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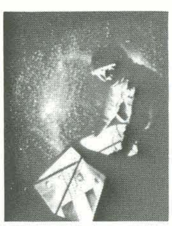
In This Issue



ON OUR COVER—The road to the stars is surely long and may be lumpy, but one thing is certain—Boeing is doing some ingenious things to help speed the astronauts on their way and get them back alive. For details, see page 15.

PHOTO CREDITS—Richard Stefanich (cover, 15); Paul Wagner (3, 4, 5, 10); United States Air Force (5); National Aeronautics and Space Administration (6, 7); Byron Wingett (8, 9, 14); Jack Barkus (11, 12, 13); Glen Kaufman (12); Boeing Vertol Division (14).

THE BOEING COMPANY

HEADQUARTERS OFFICES

7755 East Marginal Way Seattle, Washington

THE BRIEFING

Thomas R. Wilcox was elected a director of The Boeing Company last month, succeeding D. A. Forward, who resigned. Forward, retired vice-chairman of the First National City Bank of New York City, had served as a Boeing director since September, 1946.

Wilcox is an executive vice-president of the First National City Bank. He started with the bank in 1934 as a page, became a teller in 1937 and completed his education under a National City Foundation award, graduating from Princeton University in 1940. He joined the Navy the day after Pearl Harbor and was discharged in 1945 with the grade of lieutenant. Wilcox is a director of the Colgate-Palmolive Company, trustee of Mutual Life Insurance Company of New York, director of the Greater New York Fund and chairman of the board of the Visiting Nurse Service of New York.

N. D. Showalter, a Boeing vice-president and an old-timer in the airplane business, resigned last month and is now making his home at Pacific Palisades, California. Showalter joined Boeing in 1928 following engineering training at the University of Washington. In 1940 he became assistant to Eddie Allen, Boeing's famous pioneer in engineering-oriented flight test. Later in that year Showalter was named chief military project engineer for the famous B-17 and B-29 Fortress bombers. Showalter later spent several years in Kansas as manager of the Boeing Wichita Division. In his most recent assignment he helped organize and served as director and vice-president of the Boeing International Corporation, a wholly owned subsidiary. He left that post a year ago on leave of absence for health reasons.

Sales of five more jetliners recently were entered in the Boeing order book. Air India announced that it would purchase a second 707-320B Intercontinental for delivery in the spring of 1965, bringing the airline's total of Boeing jets to eight. American Airlines announced that it was ordering four more jetliners—two 727s and two 707-120Bs—for delivery in the first quarter of 1965. The orders bring to 573 the total number of jetliner sales. Of this number, 170 are Model 727s.

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Just-caught crabs taste best—

and so do fresh pineapples.

Going to the dogs is good business.

AIR CARGO JETS AHEAD

By ROBERT NEPRUD and PAUL WAGNER

HAVE YOU noticed that the pineapple on your dinner table tastes better and sweeter than pineapple used to? You'd almost think it was picked dead ripe by a husky Hawaiian and chopped into succulent chunks while you waited. It wasn't — but it didn't miss by much.

And what about those tempting, king-size strawberries, the first of the season from California? You'd swear they were straight out of the patch. The truth is, they were still ripening on the vine just yesterday.

And have you ever tasted better salmon or king crab than you've been getting at your local fish store or supermarket lately? Not many hours before, that salmon was swimming in Puget Sound and that long-legged, tasty crab was strolling on the bottom under frigid waters off Kodiak, Alaska.

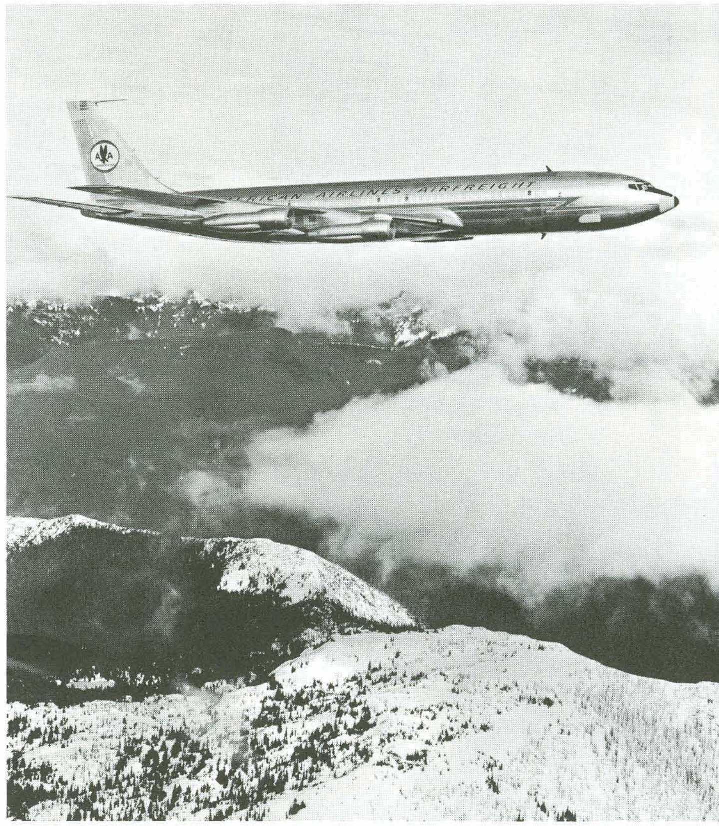
And what's with those eye-catching blossoms in the florist's window, including the delicately beautiful orchids that used to be so prohibitively expensive? You'd think they'd come from a tropical clime to the florist instantaneously via some copyrighted miracle. And you'd be very nearly correct, give or take a few hours.

There appears to be no limit to the kinds of things being shipped by air these days, thanks largely to the speed, handling efficiency, greater capacity and lower freight rates made possible by today's big new jet aircraft. For instance, 10 Volkswagen sedans and a saucy Karmann Ghia were flown by Trans World Airlines cargo-jet from Germany to the United States on a recent trip. This is becoming standard procedure.

Two tons of live crayfish made

First California strawberries bring 59¢ per box in Seattle.

Baby chicks fly and stay spry.



American flies four all-cargo 320Cs.

the long trip all the way from Cape Town to Europe via a South African Airways 707.

Then there is the enterprising Parisian baker who finds it both practical and profitable to ship his French bread to New York City at the rate of 3,000 baguettes a week. The crisp loaves are sealed in polyethylene bags while still warm, then are rushed to Orly Field each morning in time to connect with an Air France 707 Intercontinental. It's still morning, Eastern Standard Time, when the baguettes are snapped up by smart restaurants and appreciative housewives on the American side of the Atlantic.

Speaking of variety, the 74,000-pound payload carried by the first TWA C-Jet on its inaugural hop from California to the East Coast early in December just about ran the gamut. The big jet with the candy-red speed stripes carried fresh strawberries, Pacific crab, Japanese textiles, Christmas toys, wine, bread and a batch of computer units.

Rapid jet transit with luxury trimming has helped to step up the air shipment of family pets and miscellaneous fauna. There are times, judging by the activity around a typical air freight terminal, when you'd think the jets were being turned into flying Noah's Arks. In addition to the usual run of cats and dogs, you'll find guinea pigs, rats and mice (for scientific experiments), baby chicks, parakeets and tropical fish, to mention only a few of the finned, feathered and four-footed travelers encountered in the air these days.

Air freight is the fastest-growing sector of the total freight transportation business, both domestic and international. Last year, United States domestic scheduled air-cargo figures reached 650,000,000 ton-miles — up about 12 per cent from 1962. World wide, the 1963 total was in excess of 2,250,000,000 ton-miles, up from 2,000,000,000 ton-miles the previous year.

In 1964, say the analysts, the air-cargo upsurge is even stronger, promising to record a 15- to 20-per cent increase both in the U. S. do-

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New equipment, big door, speed cargo loading.

Clothing shipped from Japan in one day is style-fresh, on time for seasonal demand.

mestic and the international fronts.

While the bulk of air cargo still is carried in the holds of passenger jets or in converted piston-engine aircraft, the new Boeing 707-320C convertible cargo-jets delivered in the past year already are having an impact on the air cargo industry.

Designed to exploit the growth in the world-wide market, the 600-mile-an-hour, turbofan-powered, cargo-passenger jets are proving to be a powerful catalyst. Not only are they delivering goods over long distances at a lower operating cost than their piston-engine predecessors, but their overall performance, coupled with their 40-46-ton capacity, has helped to spark a series of specific cargo rate reductions. These cheaper rates, in turn, are attracting still more traffic to the airways.

Thirty-four Boeing 707-320Cs have been ordered to date by seven major airlines, and a number of other carriers are displaying strong interest. Approximately half of the C-jets have been delivered from the Boeing Renton plant and are hauling freight for Pan American World Airways, American Airlines, Trans World Airlines and World Airways. In addition, Northwest Orient Airlines is flying a specially designed 707-320B equipped with an extra above-decks cargo hold and a big door.

Northwest Orient Airlines, Qantas Empire Airways and Irish International Airlines are slated to receive cargo-passenger convertibles during 1964.

Shipment by air is particularly suitable for high-value items, for articles slated for timely delivery and for choice perishables. Air shipment helps companies keep inventories down, is useful for replenishing specialized clothing and other retail stocks in a hurry and can be useful in hedging against such faddish items as hula hoops, Beatle records and other specialties with unpredictable appeal.

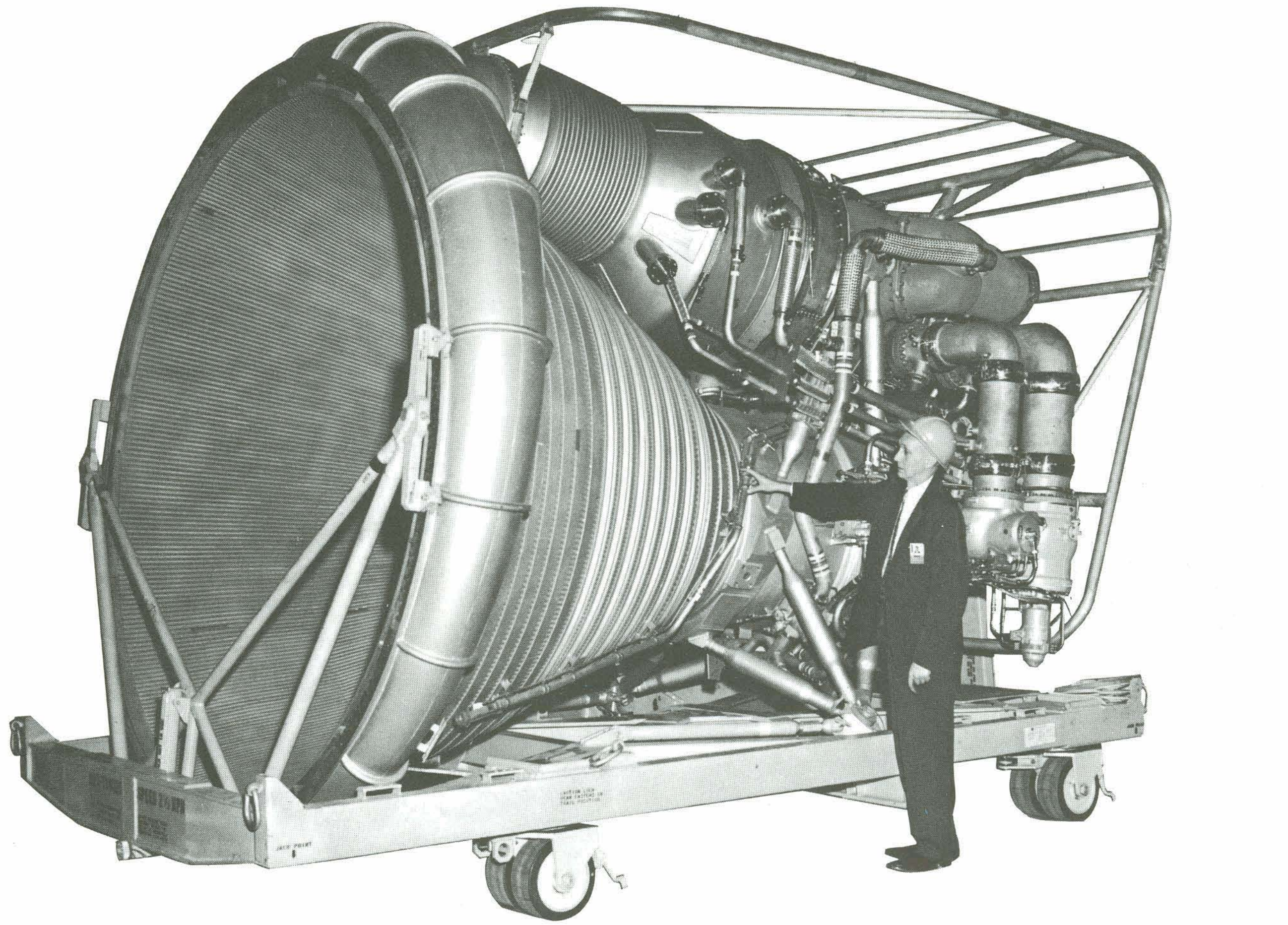
There's plenty of growth potential for air cargo. In fact, one well-known market expert, Professor Stanley Brewer of the University of Washington, foresees an annual increase rate of about 30 per cent through 1970 in the North America-Asia market.

Improvements are being made in handling systems, with Pan American, TWA, American and United in the forefront of airlines which have set up new jet loading and freight-handling methods which are streamlined, efficient and highly automated. In many places, notably at O'Hare and J. F. Kennedy airports in the U. S., beautifully designed new cargo terminals are partly completed and in use.

The present outstanding air-freight facility is in the industrial park which adjoins Shannon International Airport in Ireland. Here, cargo aircraft roll up alongside factories and take aboard many types of manufactured items, even including a folding piano built by a Dutch firm, without having to depend on a middle man.

Early this year a Pan American C-jet took off from San Francisco International Airport with a sizable cargo — 92,945 pounds, to be exact. The big plane made its turn, then headed out over the Pacific Ocean toward Honolulu, Tokyo and Saigon with a world-record payload aboard.

Chances are that another Boeing cargo-jet has bettered that mark by now. The way the air-freight business is jumping, records of one kind or another are being smashed every few days.



H. C. "Chart" Andrews, factory manager, Boeing Saturn Booster Branch, inspects mock-up of F-1 engine.

SATURN STANDS UP

By WILLIAM SHEIL

THE Boeing Company's Launch Systems Branch and the National Aeronautics and Space Administration will make good use of the law of gravity when assembling America's newest space vehicle, the Saturn V/Apollo moon rocket.

Until now, different stages of various space vehicles usually have been assembled horizontally before being shipped to the launch pad at Cape Kennedy, Florida. The sheer hugeness of the Saturn V/Apollo makes a different assembly system more practical.

The S-1C first-stage booster, which Boeing is building at NASA's Michoud Operations in New Orleans, will stand 138.5 feet tall and measure 33 feet in diameter. Consisting of five major assemblies—tail section, fuel tank, intertank, liquid oxygen tank and forward skirt—the S-1C will house five F-1 Rocketdyne engines which will produce a total thrust of 7,500,000 pounds at liftoff.

Determining the best way to assemble such a huge booster required study of a number of possible methods. A decision finally was made to put the S-1C together in a vertical position, with gravity supplying the force to hold the parts in place while they are being fastened. This time-tested system was devised by the first man who piled one stone on top of another.

A specially built 215-foot-tall Vertical Assembly, Hydrostatic Testing and Cleaning Building is nearing completion at Michoud. After the five S-1C sections have been assembled in the building, the booster will be laid down horizontally on a gigantic cart and moved to another building, where engines and miscellaneous equipment will be installed.

Following checkout and test at Michoud, the booster will be barged, in a horizontal position, to Huntsville, Alabama, or the Mississippi Test Operation for static firing. When the static firings have been completed, the booster will be returned to Michoud for refurbishing and then barged to Cape Kennedy, where it will be stood upright again and joined with the other booster stages and the spacecraft, to make an entire vehicle.

NASA's Vertical Assembly Building at Cape Kennedy will be some two miles from the launch pad. Standing 524 feet high, about as tall as the Washington Monument, the building will have a volume of 128,000,000 cubic feet, almost 1½ times the cubic volume of the Pentagon, the world's largest office building.

The stages will be assembled on a movable platform bigger than a baseball diamond, on which a 425-foot tower for umbilical connections will be mounted.

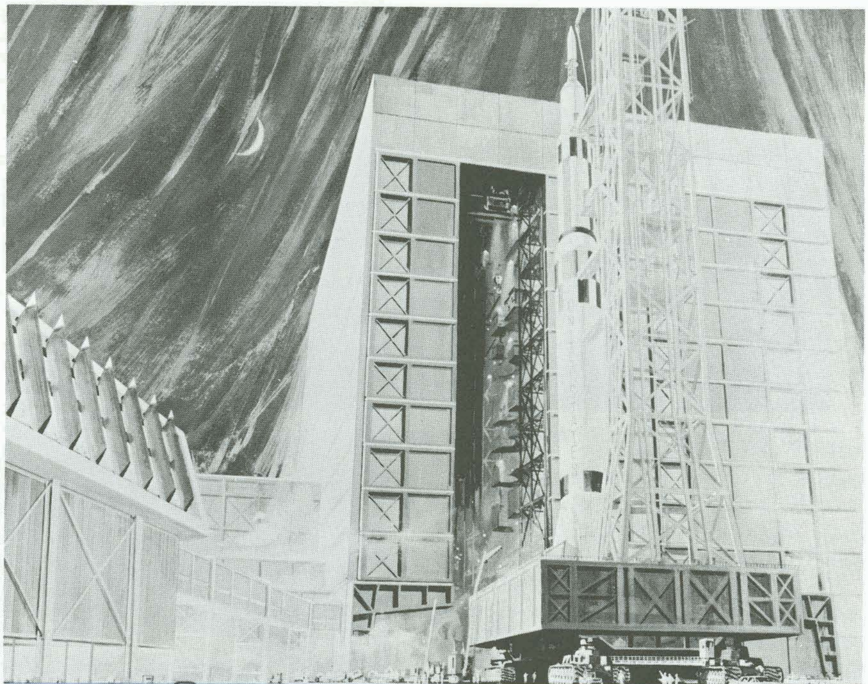
When the assembly is completed, a crawler-type vehicle will move to the building on eight tank-type treads. Driven by electric motors powered by diesel-driven generators, the crawler will pick up the platform with the Saturn V and the umbilical tower and carry them over special roadways to the launch pad, stopping en route at the arming tower.

The launch vehicle and spacecraft system include small and medium-sized solid-propellant rockets and pyrotechnic devices in the launch escape system, for retrograde propulsion on return from earth orbit and for stage separation. For safety reasons, these devices must be installed outdoors.

At the pad, the crawler will lower the platform, vehicle and tower to support blocks. The final step in preparing the rocket for launch will be to pump fuels into the tanks.

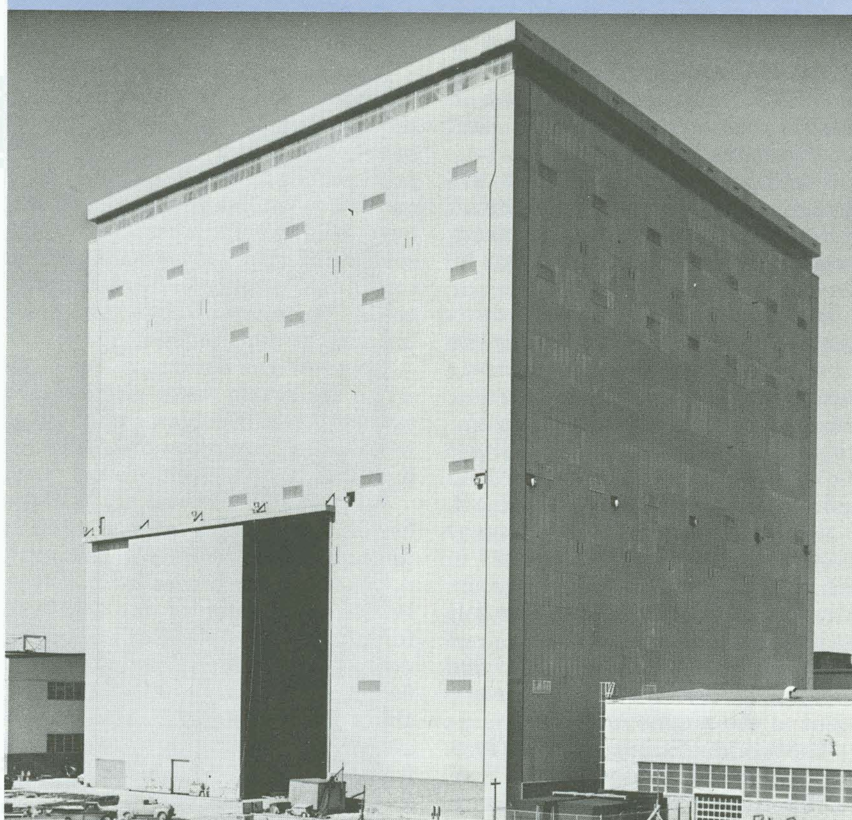
As the 364-foot Saturn V stands poised on the pad, its three astronauts will ride an elevator up to the Apollo spacecraft, enter, make last minute instrument checks and await ignition at the conclusion of the countdown. The hold-down arm will release the 6,000,000-pound vehicle and the S-1C first-stage booster will generate 7,500,000 pounds of thrust at liftoff.

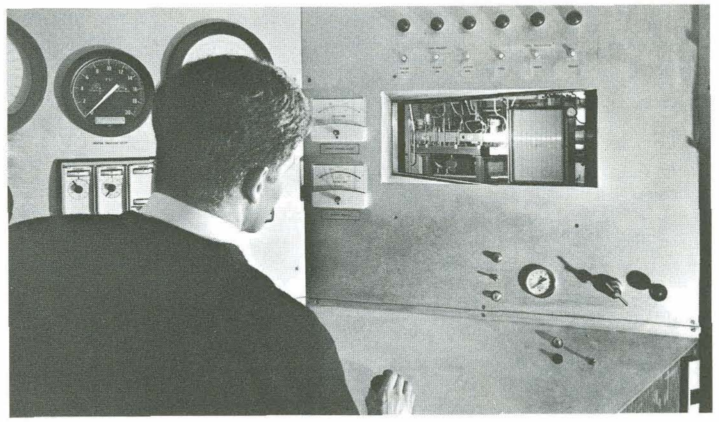
Steadily accelerating, the spacecraft will reach escape velocity of more than 25,000 miles per hour in about 15 minutes, after the three booster stages successively burn out and drop away. The astronauts will be on their way to the moon.



Drawing depicts Saturn V/Apollo at Cape Kennedy.

New vertical assembly building at Michoud is 215 feet tall.





Gas dynamics facility can be seen in control-room mirror.

TUNNEL OF FLAME

By WILLIAM CLARKE

NO ONE KNOWS the speed limit of a jet engine. But a basic-research facility designed to look into the nature of combustion as it occurs in a supersonic flow of air is being completed at the Boeing Scientific Research Laboratories in Seattle and may throw some light on the subject.

The installation is called a gas dynamics facility—a tunnel through which a high-speed, high-temperature blast of air and flame can be driven.

BSRL is devoted to basic research and is not interested in jet engines as such, but is interested in finding out what happens when burning takes place in a supersonic blast of air. J. K. Richmond of BSRL's flight sciences laboratory expects to spend several years on the subject.

A turbojet engine, at its present stage of development, is limited in speed by how fast its parts can spin. More promising in many respects is a ramjet engine, which has no moving parts. Air is crammed in and compressed by the forward movement of the engine.

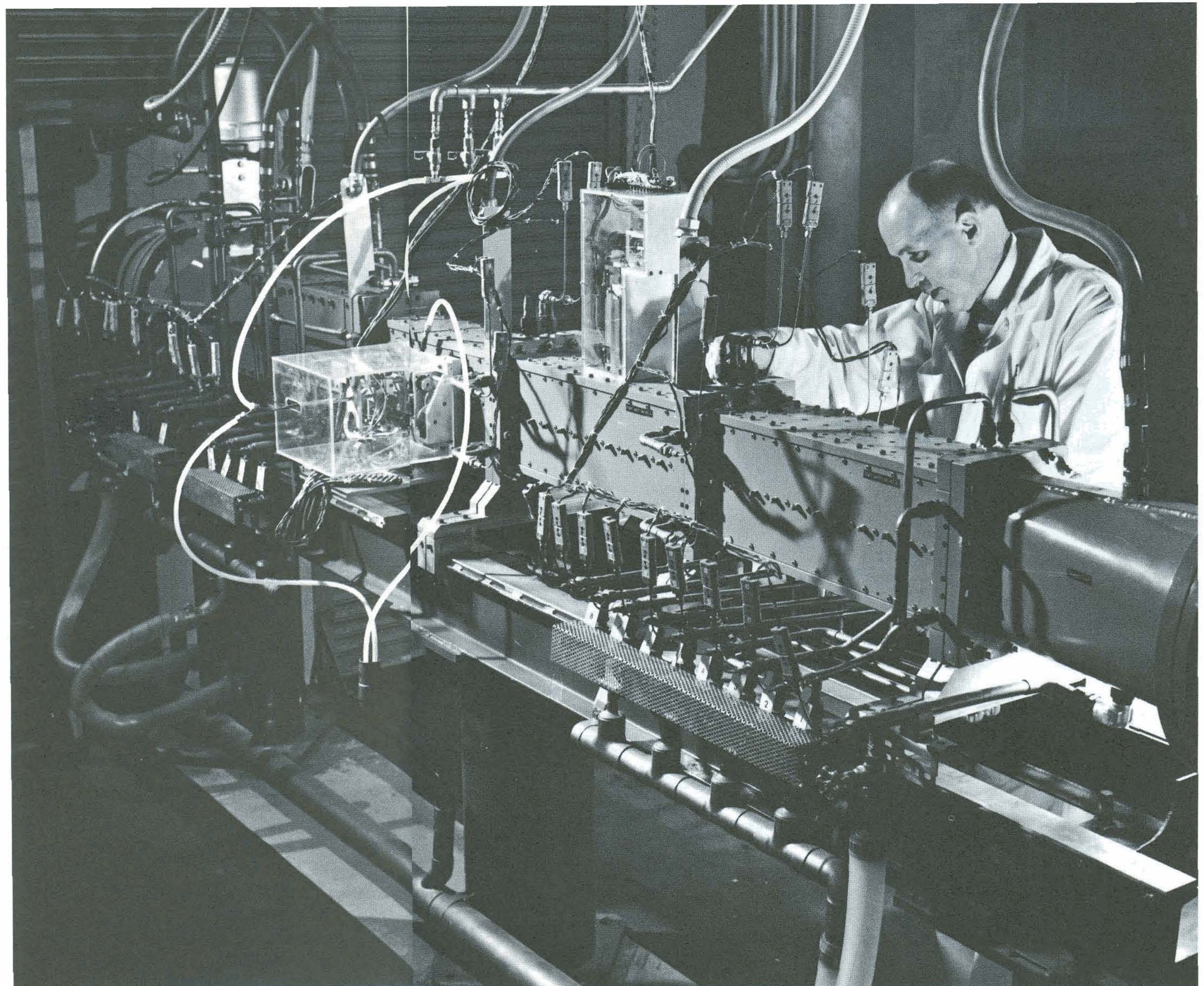
The world of transportation foresees a number of uses for the ramjet in the Mach 5 to 10 category. An aerospace plane, which could take off from a landing field on earth and fly into space is one. A booster which would be recoverable and which would not require that oxygen be carried would be another. An airliner which would cruise at super-high speed is also a possibility.

Ramjets now in use have a comparatively low-speed air flow in the combustion chamber. They also have a number of built-in operating problems, such as high heat and control. Solutions to these problems have been found in specific cases, such as the Boeing Bomarc missile, but such problems presumably could be relieved by supersonic burning in the ramjet.

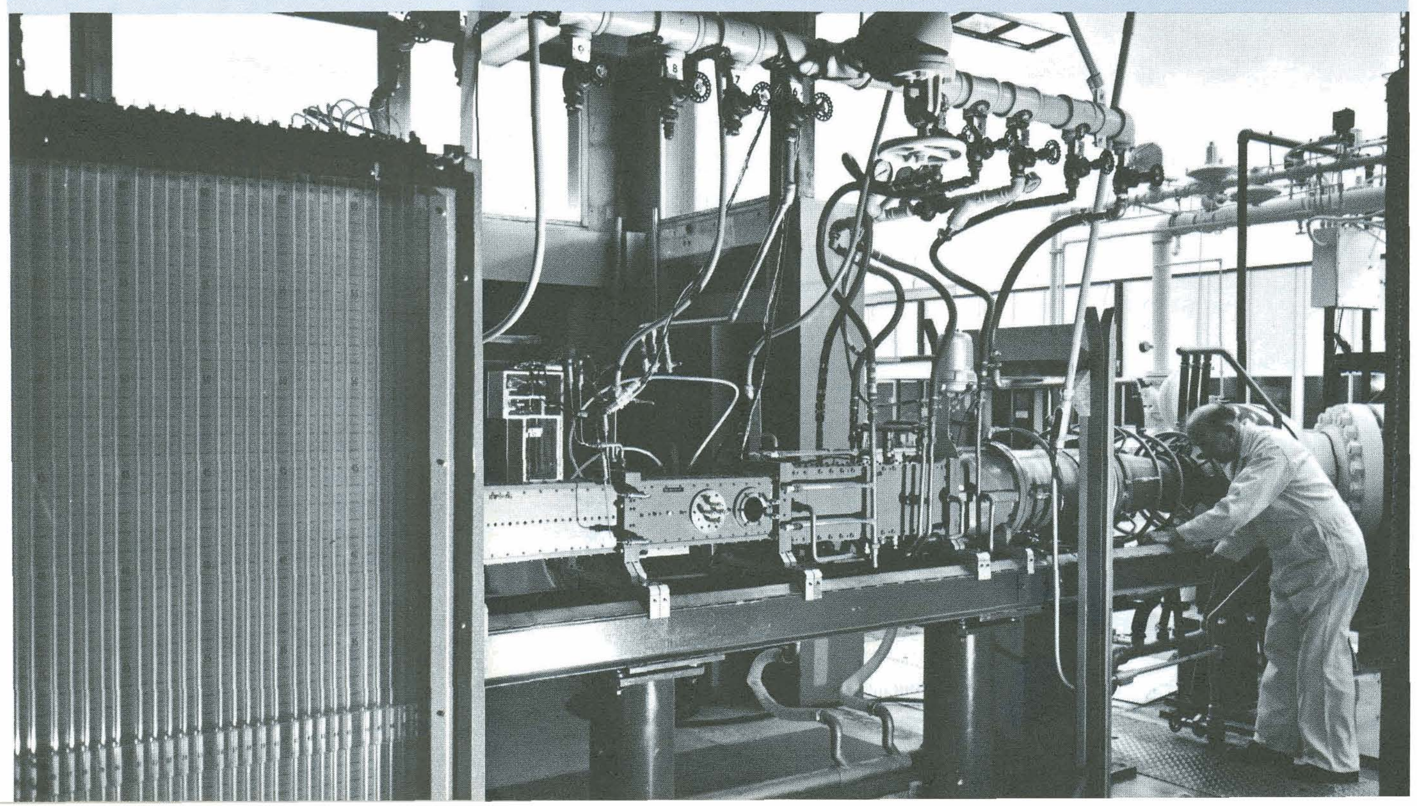
The new gas dynamics test facility is in certain ways similar to a ramjet engine. Such an engine takes in air at high speed and compresses it, which heats the air.

Air for the new tunnel will be heated by a stack of hot pebbles through which the air will be forced. A container, 28 inches by 9½ feet, lies in the center of the facility's furnace. It is filled with alumina pebbles and will be heated by gas flame. When the pebbles reach about 2,500 degrees F, compressed air will be blasted through the stack from bottom to top and then into the wind tunnel proper.

The air temperature will be raised further—to about 3,500 degrees F—by flame introduced into the tunnel upstream from the test section.



Views (above, below) show opposite sides of new tunnel which will be used to study supersonic combustion.



This heat has dictated some of the features designed into the tunnel, such as a water-cooling system in the nozzles. A water spray has been placed near the tunnel exit so that the gases leaving the test section can be cooled and made inert. A maximum spray of 60 gallons a minute is possible. A four-inch main, with a head of 125 pounds per square inch, will supply the water.

The tunnel is surrounded by a jungle of cold-water pipes, hydrogen pipes and instrumentation wires. "It is not," says Ray Shreve, the BSRL scientist who supervised the design of construction, "very aesthetic."

Air for each blow down will come from a number of steel tanks, a total of 500 cubic feet at 1,600 pounds per square inch.

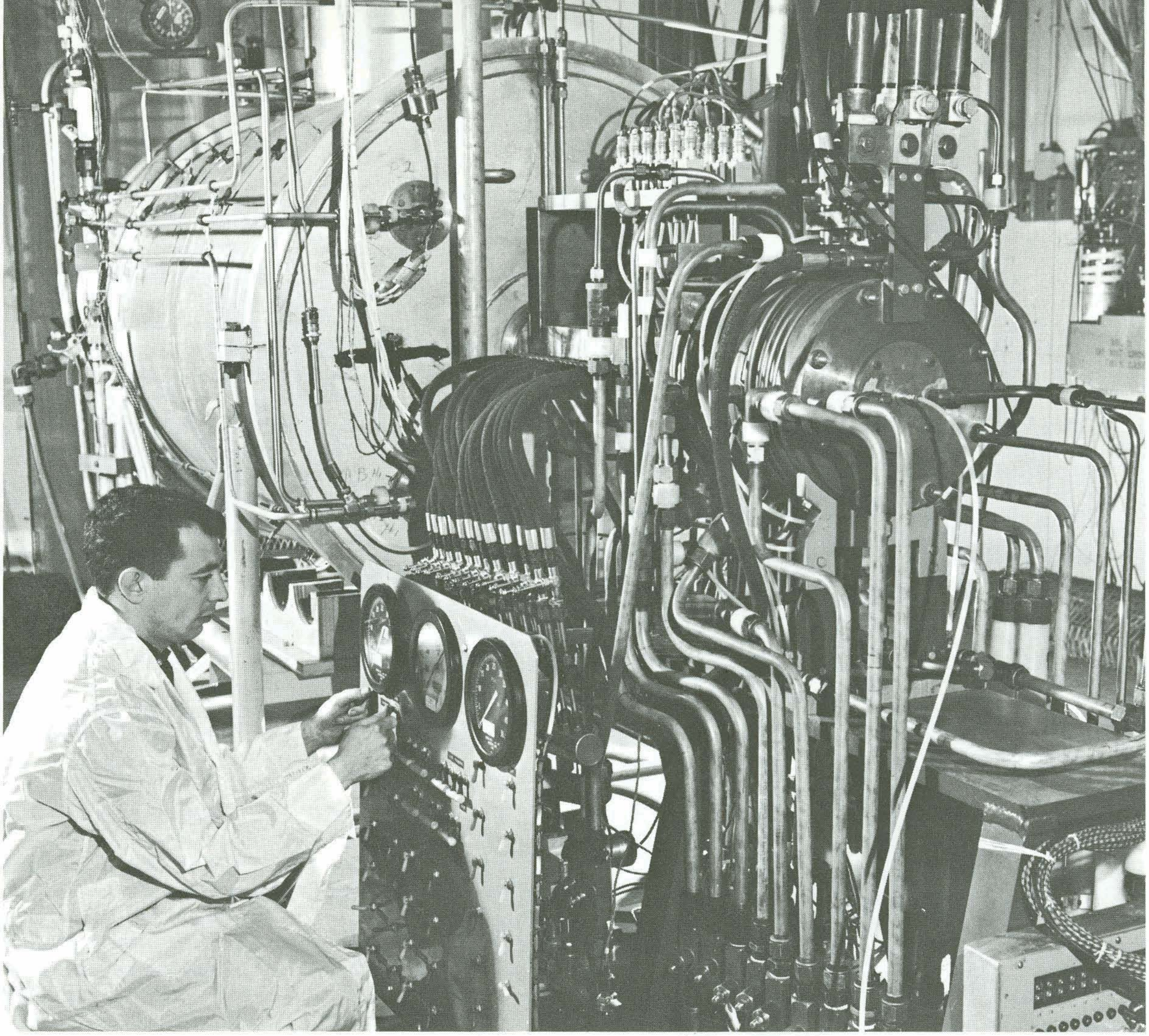
Air speed will be controlled by two nozzles in the wind tunnel section. The slow nozzle provides Mach 2.5 speeds. The second nozzle, still under construction, will increase the speed to Mach 4.5.

An unusually long test section—six feet long by four inches by six inches—has been provided for a variety of experiments in mixing and burning of hydrogen and air. Two windows, downstream from the nozzle, will be film cooled by injecting cold gas into the boundary layer immediately upstream from the windows.

Experiments in the gas dynamics facility will be of two basic types. One will be to introduce hydrogen gas into a stream of super-heated air going through the test section. The hydrogen will burn as a supersonic flame as it is mixed with the hot air along the length of the test section.

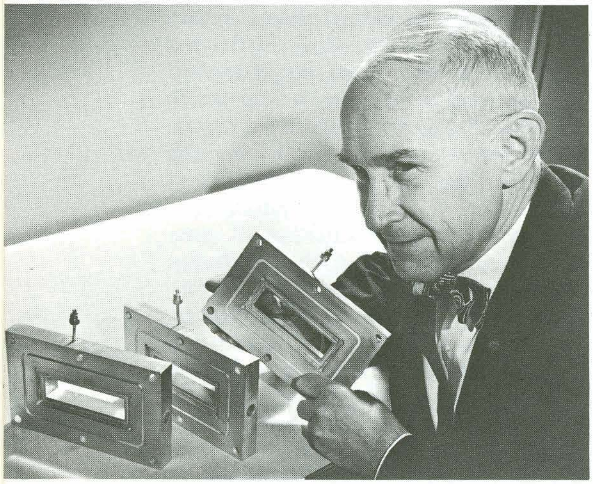
The other experiment will consist of mixing fuel with air in the nozzle at a temperature too low to ignite the mixture. Ignition will be caused by a shock wave set up in the tunnel. The result is called a standing detonation.

What will the results be? The men at BSRL don't know, but they expect to run down the answers to a lot of questions.



Supply and metering lines make plasma device look like plumber's nightmare.

WHERE THE AIR IS REALLY HOT



Duct segments measure plasma temperature.

By DONALD BRANNON

A DRAWBACK in the search for suitable spacecraft materials has been the difficulty in simulating a condition encountered during re-entry. The problem has been solved by an unique new facility in the arc plasma laboratories of the Boeing Aero-Space Division's flight technology organization in Seattle.

In the arc plasma laboratory, materials are subjected to blasts of fiery air whose temperatures, velocities and pressures can be regulated to simulate re-entry conditions. The problem has been to place test specimens precisely at the right location in the blast stream and to measure accurately the conditions at this point. Until the new facility was built, engineers were not sure they had achieved the required conditions.

A typical arc plasma device employs a pair of water-cooled copper electrodes to heat pressurized air to temperatures as high as 20,000 degrees F. The air expands, disintegrates into an ionized state called a plasma, and streaks through a nozzle into a rectangular duct, where it slams into a sample of test material. The duct has vacuum capability to simulate altitudes up to 200,000 feet.

As the plasma leaves the nozzle throat, it flows smoothly, like water over the lip of a dam. Aerodynamicists call this laminar flow. But the plasma quickly assumes the character of a rushing river, swirling, tumbling and eddying. This is the turbulent flow which attacks spacecraft and is of concern to designers.

Finding the turbulent portion of the plasma stream has been a major headache. Visual methods are ineffective and recording instruments within the duct melt away.

Arc plasma researchers tackling the problem knew that turbulent flow against a material transmits more heat than laminar flow. They reasoned that points on the duct wall experiencing greatest rates of temperature increase would reveal where the stream flow changed from laminar to turbulent.

The engineers built a special two-foot-long section in the duct. The section looks something like a conduit composed of hollow rectangular doughnuts, joined side by side. It is made of 24 of these doughnuts, or segments, each an inch across.

Every segment contains openings through which water is pumped and metered. When the plasma blasts down the duct, it heats the water circulating through the segments forming the duct. Temperatures of each segment are measured.

Those segments indicating greatest heating rate reveal where in the duct the plasma is turbulent. The areas of steady turbulence then are charted for various operating conditions. Researchers can place test panels where conditions correctly simulate actual re-entry.

In this way designers get the answers to questions such as how fast materials will burn away, the effectiveness of protective coatings, how a vehicle interior is best insulated and what happens to joints and protuberances during re-entry.

Most materials being tested are composites of metals and ceramics. Some have been continuously plasma-blasted as long as four hours.

Currently, the turbulent arc plasma facility is involved with Boeing problems. Since it is the only facility of its kind, other companies may bring some of their problems to Boeing for answers.

SPAGHETTI TO THE RESCUE

By LES SOURBEER

IF SOMEONE tells you that spaghetti, of all things, plays a role in the production of parts for a space capsule booster and a helicopter, you can believe him.

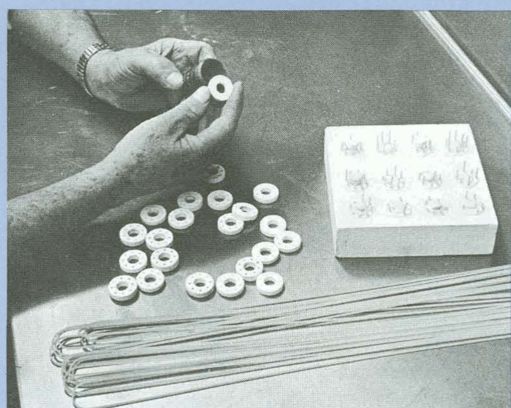
Production men at Boeing's Wichita Branch needed an insulator to go in the head of an electric welding torch. This particular torch is used to weld steel tools which make parts for the Saturn S-1C booster and Boeing Vertol helicopters.

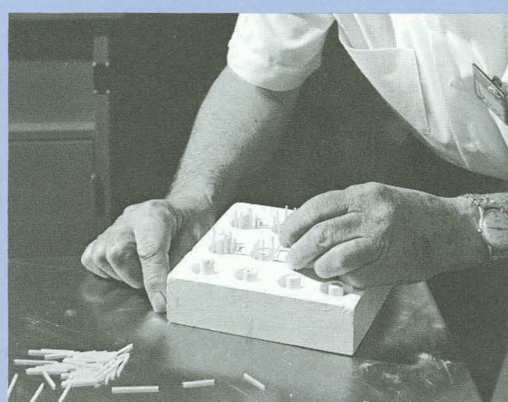
The insulator not only had to withstand very high temperatures, but also to serve as a shield against the splatter of molten metal. In addition it had to have holes to accommodate a flow of gas.

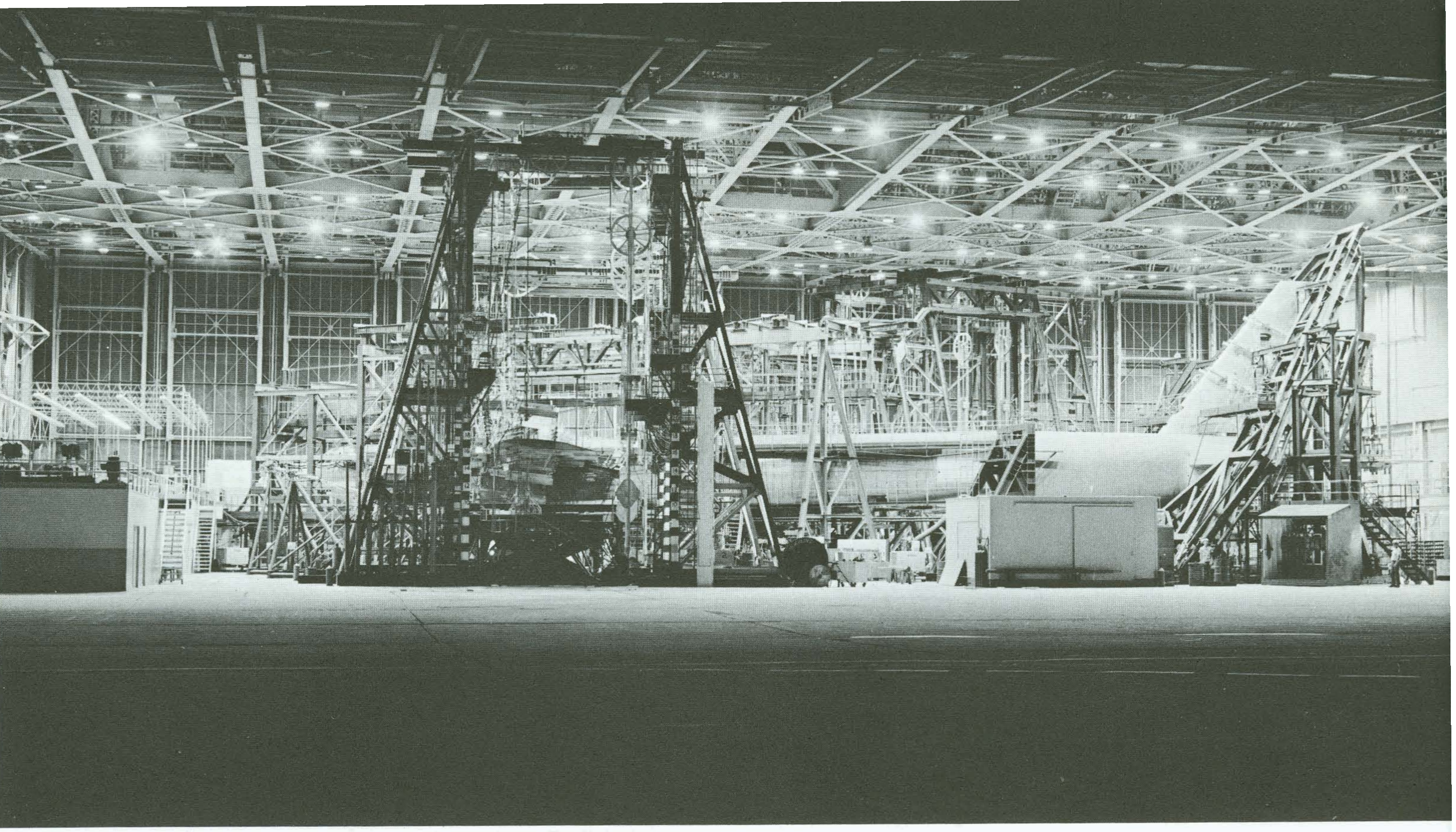
Making a ceramic insulator—which resembles a washer about an inch wide with evenly spaced small round holes through the band—was easy up to a point. A plaster mold was formed which could be crumbled after the ceramic compound had been hardened in a firing oven. The hole in the center also could be formed of breakaway plaster.

But forming the small holes was a problem. Several possible methods were rejected because they were too slow or too costly. Finally ceramist O. W. Thrailkill came up with the answer: use spaghetti.

Tiny dry sticks of the tasty food, just as they came from the grocery store, were inserted in holes drilled in the plaster mold. The ceramic material was poured in the mold and baked. During this process the spaghetti went up in smoke, leaving nothing but the holes, exactly where they should be and exactly the right size. As a considerable number of the ceramic shields were needed, low cost was important.

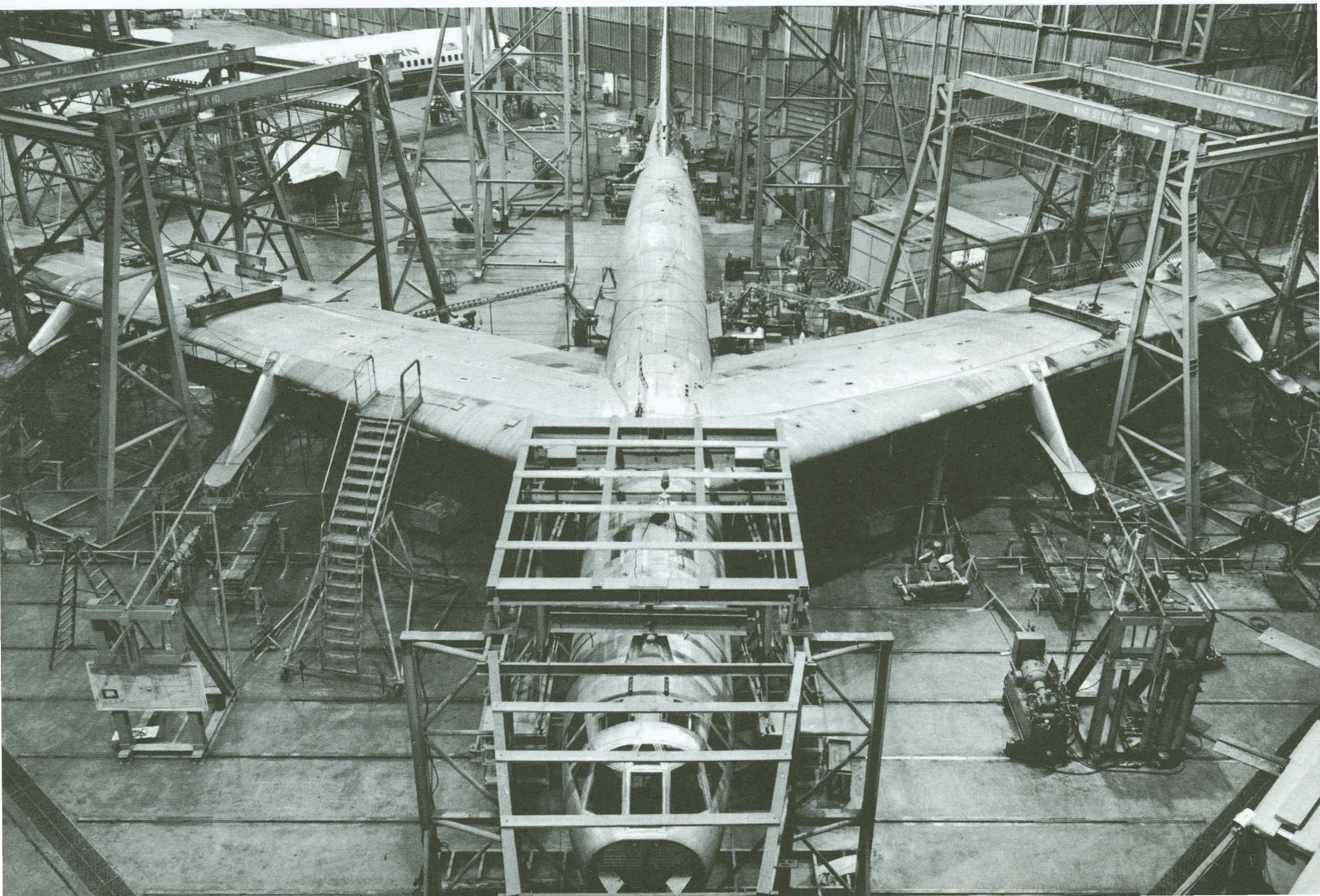


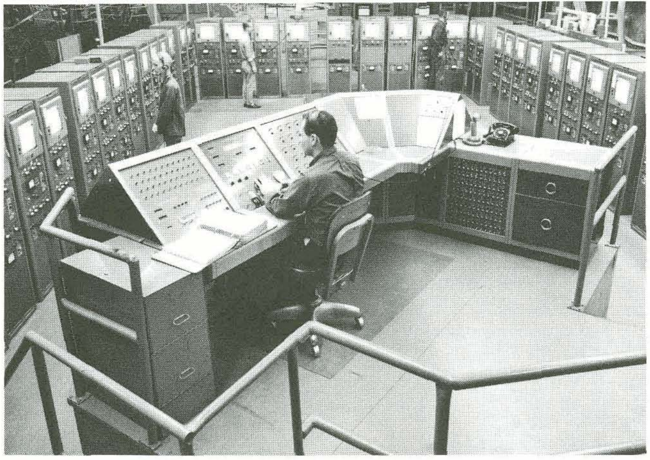




Cyclic test equipment surrounds B-52H in Wichita hangar.

A B-52F is tested in Seattle hangar.





Wichita console is circled by 35 load controllers.

B-52 BOMBERS UNDERGO TESTS

By DARRELL BARTEE

CREWS of technicians of Boeing's Airplane Division working at Seattle recently "landed" a B-52F after "flying" it about eight times as many hours as the total flown by any other Stratofortress now in use.

The technician's kind of flying took place inside a hangar on Boeing Field. It was one of those tests in which the stresses and strains of flight are simulated and applied to an airplane on the ground. Such tests help to determine how much of what kind of flying an airplane safely can endure. They help predict where more structural improvement will be needed, well ahead of customer usage. They chart a future of performance and safety.

Boeing has become a specialist in testing for tomorrow because of the exceptional number of its airplanes in the air, and because of its traditional interest in the long-term reliability of its products.

The tests are called cyclic because stresses are applied in cycles. They differ from static tests, which deal in design strength, in that they evaluate the cumulative effects of structural wear and tear over a period of time. Boeing conducts both types of tests on military aircraft and on commercial planes.

In the B-52F project, the cyclic testers put parts of the bomber through several normal lifetimes of simulated use. When a crack was found in a component, it was inspected and repaired, and the test continued. Five phases of test were applied progressively to the wing, tail fin, stabilizer, body and crew compartment.

As many as 23 hydraulically powered and automatically controlled load systems, or rams, were used to simulate the forces felt in B-52 flight. To exert these forces and to measure and record the results, the test technicians used more than 725 instrumentation and loading locations on the airplane. These included 451 attachments for strain gages, 245 for crack detection and 31 for load application.

Surrounded as it was by support structures for this maze of instrumentation, laced with hydraulic and electrical lines and hemmed in by power supplies and recording equipment, the B-52F movements were barely visible. But a steady flow of vital information came out, from December, 1958, to February, 1964. The endurance data was fed into the B-52 engineering center at the Wichita Branch and then into the up-dating plans for the fleet of the Strategic Air Command.

The B-52F project is one of nine such tests on Boeing airplanes. Three have been completed on B-47 Stratojets and a fourth test is still in progress. Two have been finished on B-52s, with a third in progress and a fourth planned, covering all models in the SAC fleet. The KC-135 and the commercial 727 have been through the trials. For economy's sake, all tests are run with stripped-down airplanes or sections.

From this massive experience, Boeing has been able to pioneer in techniques of the cyclic art. For example, in the first B-47 test there were seven load systems operated by semi-automatic methods at four cycles per minute. In a new B-52H test being planned at Wichita there will be more than 60 load systems. These will be automatically programmed by means of photoelectric devices following curves on rotating drums. The speed has been hiked to 12 cycles per minute.

In early tests, endurance data was processed by hand. Today, computers have taken over.

Total load cycles have increased from 100,000 on the B-47 to 1,400,000 in current tests. Improvements have been made in the use of fail-safe circuitry, advanced servo control consoles and automatic readout.

A 24-hour SAC flight now can be simulated in 50 minutes. The current B-52 cyclic tests represent actual SAC mission profiles, complete with high-altitude and low-level flight, and aerial refueling. Results are invaluable in figuring service life.

The ground-bound pilots and co-pilots in the B-52F hangar on Boeing Field have a tired-out, patched-up bomber on their hands. But plans are afoot for still another phase, a complete tear-down and inspection of the bomber parts.

ADVENTURES IN MANAGEMENT

SPORTS-MINDED MAGICIAN

A CHARACTER who gets his kicks by beating his company's customers at golf could be a dangerous man to have around. Tom Peppler, Chinook helicopter program manager at Boeing's Vertol Division, not only does this, but also strains mightily—and usually successfully—to beat his boss at the same game. The fact that Peppler still holds an executive job is sterling evidence that he has something going for him besides diplomacy.

Peppler is more than a little touched on the subject of sports. He's a watcher, reader, doer and coach. In the last capacity he employed witchcraft (that's what it takes) to guide his baseball team to the Little League championship of Pennsylvania. Peppler, his wife and daughter live in Rose Valley, about 15 minutes from the Boeing Vertol plant in Morton, Pennsylvania.

Using the same sort of magic, Peppler infects the people around him with the urge to excel.

As a result, the organization behind the Chinook is a pusher. The Chinook program has been described by Gen. Frank Besson, Commanding General of the Army Materiel Command, as "unprecedented in the history of Army aviation." He referred to the fact that first deliveries were made to operational units less than four years from go-ahead.

Peppler was chief of preliminary design when Chinook was born. It has been his baby ever since.

Born in Baltimore in 1920, Peppler attended high school in that city. He took an accelerated course and entered Purdue as a sophomore in 1937. He also was probably the only college student in the country with four signed blank checks in his pocket.

His father, obviously a man of great faith, told Peppler to write in on the checks whatever amounts of money he needed and to manage his finances wisely. Tom Peppler did manage well and was graduated with an aeronautical engineering degree in 1941. He has been managing well ever since. That includes winning—from anybody.

SKIPPER REGAN

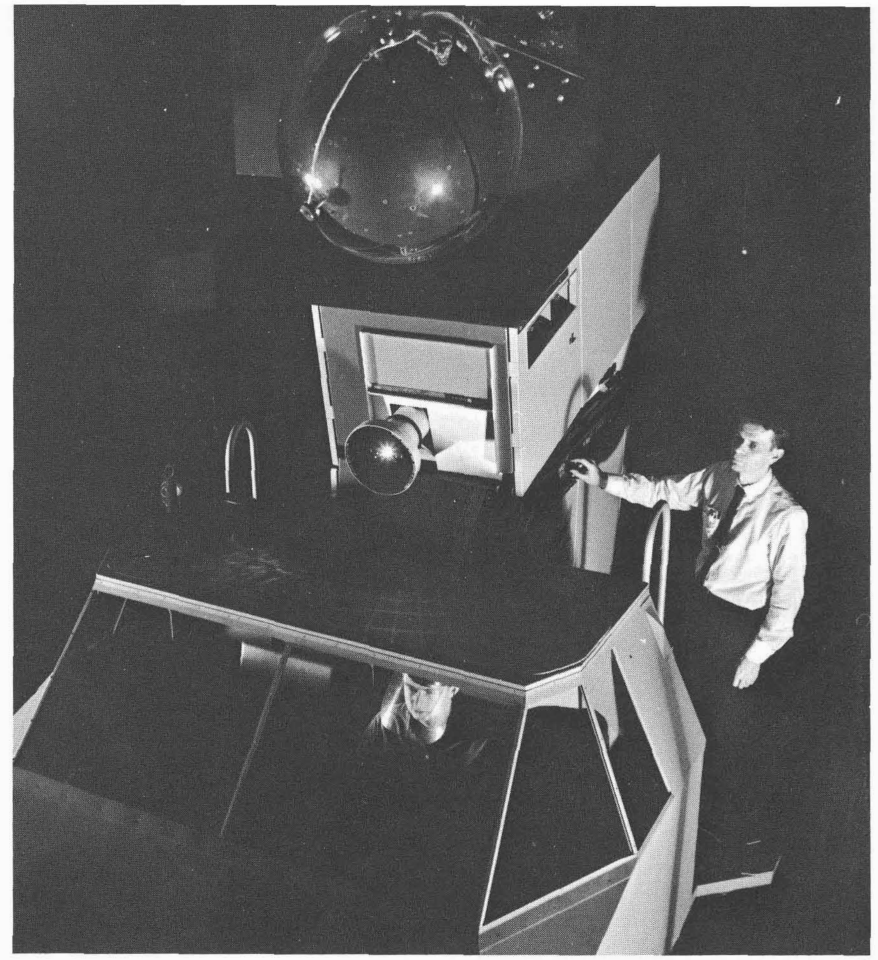
IN 1960 a 40-foot K-40 masthead sloop, fresh from a San Diego boatyard, made her debut in Northwest sailboat racing circles. Within two years the *Thetis*—for the Greek goddess of the sea—had been named Boat of the Year by Seattle's Corinthian Yacht Club and had established herself as a boat-to-beat in competitive racing. This came as no surprise—the owner and his crew had worked and trained together to put her there.

Thetis belongs to Robert L. Regan (or maybe it's the other way around), director of manufacturing for the Boeing Airplane Division, who applies to boat handling the same concentration he gives to heading a work force of approximately 15,000 persons engaged in the production of 707s, 720s and 727s for the airlines, and KC-135 tanker transports for the U. S. Air Force.

Regan joined the company's manufacturing department when, as he puts it, "there wasn't such a word." The year was 1928 and he began as a metal fitter, filing tubes for the F3B1 Navy fighter plane. Ten years and a large pile of filings later he was foreman of the body shop. These were thin years for the company, but those who stayed through the great depression formed the team that led Boeing through the wars and into the jet age.

As the company's manufacturing program grew, so did Regan's responsibilities. He served in a variety of supervisory positions. In 1956 he was named manufacturing manager of the newly formed Transport Division, at the crucial time when the jet transport production programs were being established. The tough goals set have been met and sometimes bettered.

"It's like sailing," Regan explains. "You get the right crew and give them the right equipment and nothing is impossible—either now or in the future."



ROAD TO THE STARS

HOW WELL can a man perform in a spacecraft? Can he steer to a landing on the moon? Take off? Guide through earth re-entry? Rendezvous in space?

The answers to these questions and a number of others in the same general area are subjects of inquiry of a new Boeing space-flight simulator.

Already in partial operation in Seattle, the unusual facility employs a closed-circuit television system of the type used in sports events to project realistic pictures of space missions on a screen in front of a spacecraft cockpit. The cockpit holds an operator, usually an experienced pilot. A set of controls which he manipulates operates the simulator so that the spacecraft cockpit seems to maneuver in compliance with his commands.

The cockpit actually is firmly fixed to the floor. Moving images are projected on a large curved screen in front of the cockpit. For example, the surface of the moon as it would look from a spacecraft approaching for a landing may be shown. At the same time a field of stars as they would appear to an astronaut are projected on the screen.

When the pilot moves his controls to direct his spacecraft down, the images on the screen move up, correspondingly. The effect, to the man looking out the cockpit window, is a realistic dive.

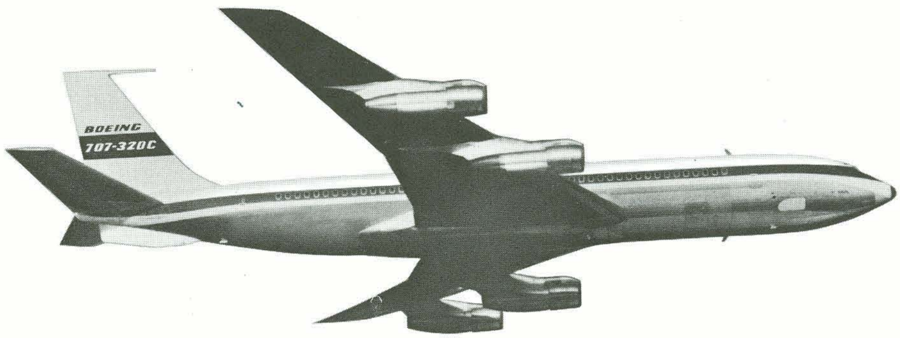
The images—the moon, a spacecraft, earth—are photographed by TV cameras in another room, from scale models, and projected on the screen. A planetarium provides accurate stars for the background. A computer controls the whole operation.

AMERICAN

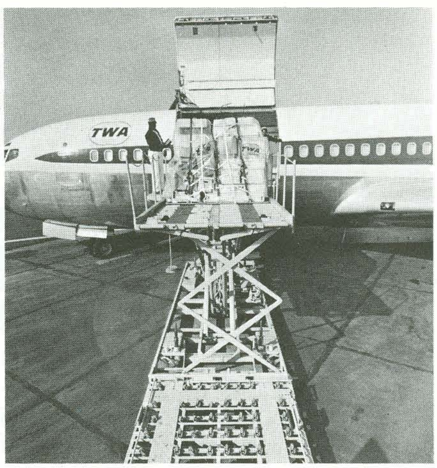
IRISH*

NORTHWEST ORIENT

PAN AMERICAN



QANTAS*



TWA

WORLD

These airlines have ordered Boeing cargo jets

These are the famous airlines that have already ordered Boeing cargo jets.

Many are in service now, setting distance, speed and payload records. But more important, Boeing cargo jets are operating at the world's lowest ton-mile cost. They bring operators the largest cargo door, and a time-saving system that can unload and load 90,000 pounds of palletized payload in less than an hour. Cruising at 575 mph with full payload, new Boeing cargo jets can provide next-morning delivery of volume cargo — across a continent or an ocean.

Boeing cargo jets are a development of the Boeing 707-320B turbofan Intercontinental — the largest, longest-range commercial jet in existence. They incorporate the same major systems and components, offering airline operators substantial savings through standardized spare parts, ground handling equipment and training.

**Irish and Qantas cargo jets in service later*

BOEING CARGO JET