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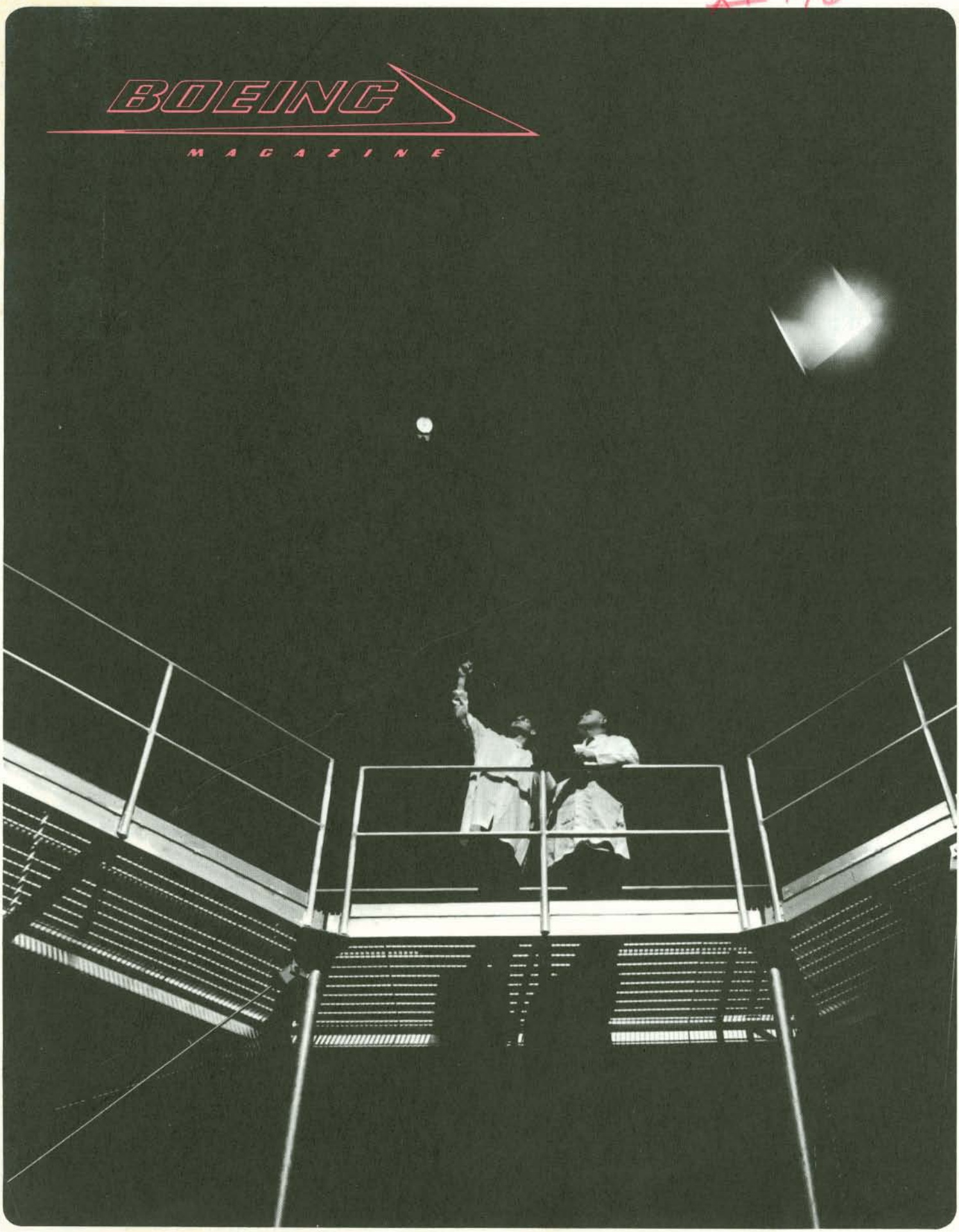
BOEING MAGAZINE



Bread Board.

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In This Issue

PHOTO CREDITS—Richard Stefanich (cover, 3,4,5); Washington State Democratic Committee (3); Vernon Rutledge (5,13,15); Fabian Bachrach (7); Paul Wagner (7,8, 12,13); Byron Wingett (8,14); NASA Marshall Space Flight Center, Robert Walters (10,11); Thomas Cusick (14).

ON OUR COVER—Engineers stand on walkway which circles interior of space-environment simulation chamber at new Boeing Space Center. Full-size spacecraft, such as Lunar Orbiter, will be tested in this super-cold vacuum chamber. See next page.

THE BOEING COMPANY
HEADQUARTERS OFFICES
7755 East Marginal Way, Seattle, Washington 98124

BRIEFING

The United States Air Force recently awarded a $6.5-million contract to Boeing to develop a reliable, low-cost upper-stage rocket for placing small- and medium-size payloads in orbit. The solid-fuel stage—nicknamed Burner II — will go atop Thor standard launch vehicles and will be used to orbit unmanned satellites. The stage also will be adaptable for use with Atlas and Titan boosters. One ground-test model and three flight-test vehicles will be built by Boeing in Seattle.

Air pollution is a major problem confronting future space travelers, said Dr. J. E. Cotton of Boeing's Space Division at a meeting of the American Chemical Society in Atlantic City last month. In small, air-tight areas such as spacecraft cabins, the atmosphere can be contaminated by tiny amounts of gas vaporizing from construction materials. Methods of control are being studied.

Several new Boeing facilities are under construction in the Seattle area. Included are a $3 million engineering laboratory at the Commercial Airplane Division's Renton complex, a Space Center on 320 acres at Kent (see article on next page) and a central fabrication plant on 263 acres at Auburn. The Boeing Vertol Division recently purchased 112 acres and more than 1,000,000 square feet of factory area in suburban Philadelphia.

Airlines placing orders for Boeing jetliners in recent weeks included Continental Airlines, two 707-320Cs; Aerolineas Argentinas, four 707-320Bs; Pacific Air Lines, four 737-100s plus lease of two standard 727s; Pacific Northern Airlines, four 727Cs, and Trans World Airlines, nine 707-120Bs, four 707-320Bs, three 707-320Cs, one standard 727 and six 727QCs.

An unusual book, *Aeronautics 1815-1891*, by G. Brewer and P. Y. Alexander, is an unchanged reprint of the original edition published in London in 1893. The book lists aeronautical patents from 1815 to 1891. One 1842 patent describes with fair accuracy the stick-and-wire airplanes built 70 years later. Other patents were taken on jet propulsion and parachutes. The book has 160 pages, 59 illustrations, paperback, costs Guilders 17.50 and is printed in English by B. M. Israel, Singel 379, Amsterdam, Netherlands.

Mt. Rainier is neighbor of new laboratories.

Hubert H. Humphrey

New Space Center sharpens the

FORWARD EDGE OF RESEARCH

By WILLIAM CLOTHIER

THE ROAD to the planets winds along precise, narrow flight paths, pot-holed with solar radiation and meteoroids and exposed to a potentially deadly mixture of extreme heat, cold and vacuum. To find out what protection is required by spacecraft and astronauts, small areas of space are simulated in laboratories for testing.

The Boeing Space Center near Kent, Washington, is the newest

and most advanced space laboratory complex in private industry offering spaceflight and space-environment simulation capability. Later this month (October, 1965) the Space Center will be dedicated. Hubert H. Humphrey, Vice-President of the United States, is scheduled to be the featured speaker. The Vice-President is chairman of the National Aeronautics and Space Council and advises the President regarding policies, plans, programs, and accomplishments of U. S. agencies engaged in aeronautical and space activities.

Four major laboratories are in operation at the 320-acre Kent site and a new office building for the Space Division is under construction. Other facilities will be added as necessary.

Equipment has been developed by Boeing to simulate earth-atmosphere re-entry, rocket takeoffs and orbital-flight maneuvers. These facilities will serve as test-beds, helping engineers design better spacecraft systems. They can also be used to train space pilots for future missions. This human-engineering approach helps determine how equipment should be designed to take full advantage of man's capabilities in space.

Two space flight simulators are in operation. One is a rendezvous and docking simulator which enables pilots to "fly" a spacecraft into docking position with another satellite in orbit. A different device, the space flight simulator, produces visual simulation of space flights, orbital re-entry and controlled landings on the surface of the earth or moon.

Both simulators are controlled by computers, making it possible to simulate trajectories, velocities and approach angles characteristic of orbital mechanics.

The space flight simulator projects images of sky, stars, planets and moon on a hemispherical screen 30 feet in diameter located in a special room which is blacked out during simulated space flights. The pilot's cockpit is positioned at the center of the screen, placing him in the center of a tiny universe.

Scale models of the earth, moon and selected landing sites are located in a model room near the projection room. Television cameras in the model room are mounted on carriages which move back and forth on 90-foot tracks. As the pilot moves cockpit controls during a simulated flight, commands are fed through a computer system which tells a particular camera how to approach the target (either an earth or lunar landing area), shifting the scene on the projection room screen. The illusion of flying through space is highly realistic.

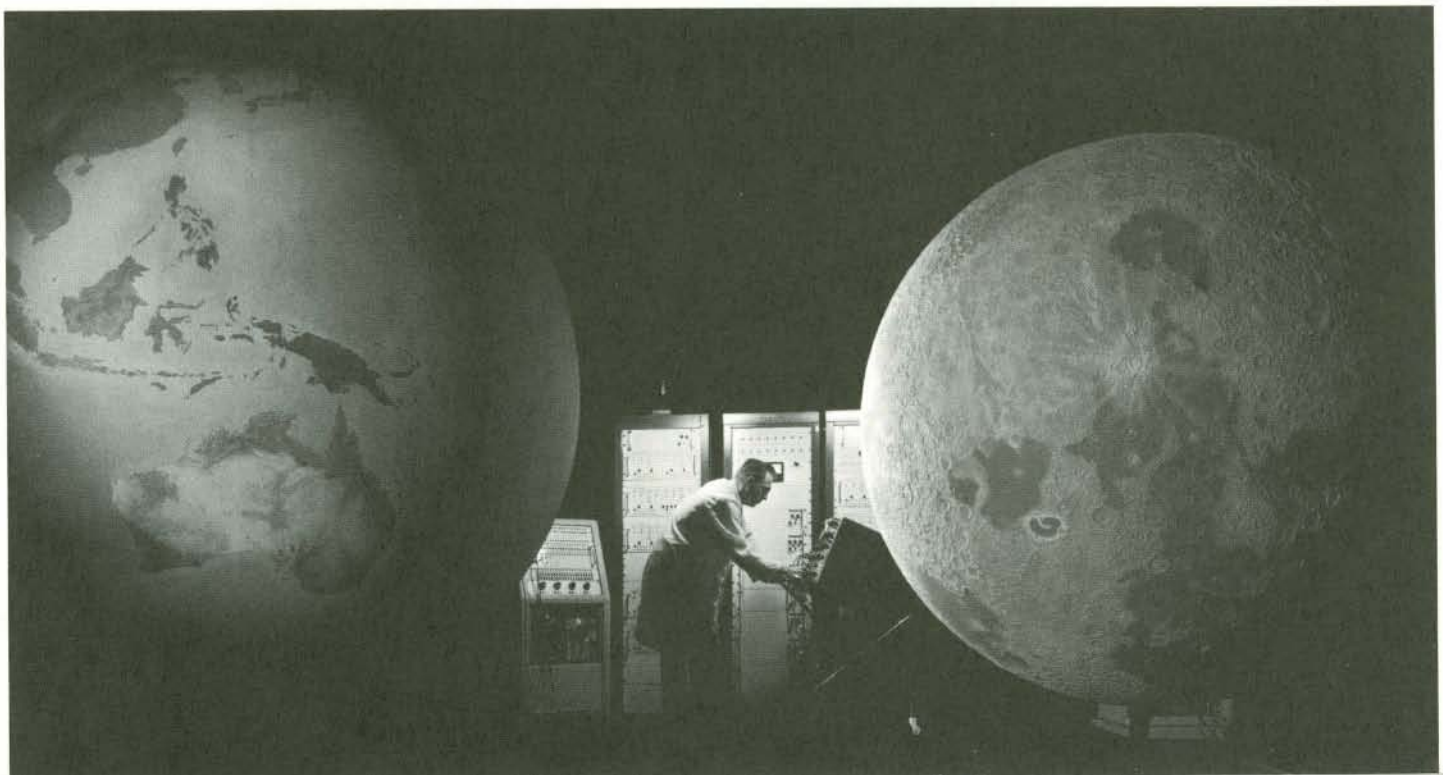
Four different cameras can be operated simultaneously to provide sequenced camera shots from orbital altitudes down to near-surface approaches. Space vehicles can be superimposed on the screen and moved through a prescribed trajectory.

Star fields are projected on the screen by a star projector. Stars also can be generated electronically and projected through the television system. More than 2,300 identifiable stars can be represented over the complete celestial sphere.

The rendezvous and docking simulator is located in a high bay at the Space Center. The room measures 100 by 150 feet and 70 feet high. The pilot sits in a cockpit mounted on the forward end of a 12-foot-long frame supported on an air-bearing. Small reaction jets are used to rock the cockpit up and down (pitch), swivel it left and right (yaw), and rotate it 45 degrees to either side (roll).

Walls, floor and ceiling of the huge room are covered with a light-absorbing black paint which simulates the darkness of space. The target vehicle is painted white and hangs from an overhead crane. It moves back and forth, up and down, right or left as commanded by the pilot. Pilot movement of cockpit controls sends signals through the computer system which

Globes of earth and moon are used by flight simulator.



coordinates the attitude of the cockpit and the movement of the target vehicle.

Engineers feed mathematical equations into the computer, which translates them into precise movements for simulated trajectories, approach velocities and orbital maneuvers. The pilot feels as if he were moving through the void of space as he tries to complete a rendezvous.

Spacecraft and space-flight hardware must be tested before leaving earth. Eleven simulation chambers at the Space Center can produce conditions similar to those found in space.

A number of chambers are necessary to handle tests being run concurrently and individual chambers are designed for specific needs. Some tests require solar radiation or extremely high vacuum, others have less demanding requirements.

The largest chamber measures 50 feet high and 39 feet in diameter. Complete vehicles, such as the Lunar Orbiter spacecraft which Boeing is building for the National Aeronautics and Space Administration, can be placed inside the chamber and subjected to most of the conditions expected in space.

A vacuum equivalent to that at an altitude of 400 miles — approximately one trillionth of the earth's atmospheric pressure at sea level— can be achieved in the big chamber. Temperatures of minus 320 degrees can be produced.

Other simulation chambers are capable of producing pressures equivalent to those at an altitude of 600 miles. One 10-foot-diameter chamber is equipped with a special sunlight simulator to produce the heat and solar radiation found hundreds of miles above the earth's surface.

Research engineers are investigating effects of radiation, vacuum and extreme temperatures on materials. Other efforts are directed toward cryogenics research — the science of the very cold — which is considered basic to development of advanced propulsion systems for future space exploration. Cryogenic fluids, such as liquid hydrogen, pose tough problems in handling and use in space. Extremely efficient insulation is necessary to avoid excessive loss of fluid during storage on extended space missions.

Many earth-bound materials will not function in the severe environment of space and new materials or processes must be developed to cope with the extremes of space flight. Temperature extremes in space vary from about 250 degrees F (in direct sunlight) to 250 degrees below zero (in shadow).

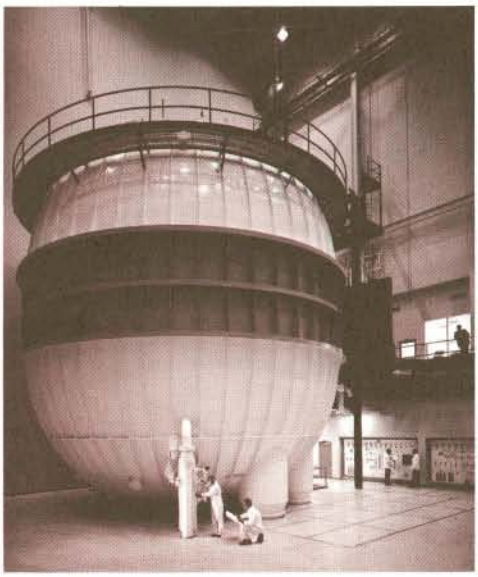
Space missions with today's limited rocket power would be impossible without microelectronics. The Microelectronics Laboratory at the Space Center is equipped for advanced research, engineering, testing and analysis of electronic equipment to meet or exceed critical requirements for maximum reliability and efficiency, minimum weight and cost.

Ultra-clean areas are used to fabricate silicon integrated circuits and vapor-deposited, thin-film devices. An analytical facility housed in a central area supports a development and improvement program as a continuous activity. Test equipment, much of it Boeing-developed, allows short- and long-term operational testing of circuit devices.

New methods for assembling or packaging new types of electronic circuits have been developed, including techniques to fasten tiny wires with diameters less than 1/1000 of an inch to microscopic-sized electronic parts. Researchers also have developed ways to assemble "microelectronic sandwiches" with dozens of layers of wires laminated together.

Acquiring knowledge to support the nation's space exploration programs is the prime function of the laboratories at the new Space Center.

Ultrasonic bonder attaches small leads to circuits.



This is exterior of vacuum chamber shown on cover.

Simulator enables pilot to dock spacecraft on satellite.

This 1933 photo shows Boeing 247 airliner and (from left) Eric Nelson, Amelia Earhart and Mrs. W. E. Boeing.

Northeast Airlines will fly

727S TO FLORIDA

By THOMAS COLE

A WHITE TRIJET with a long dark-blue band along the windows and the big initials "NE" on the tail rotated off the mile-long Renton Field runway September 2, 1965, and sped northward.

A first flight is never routine, but this one rated as exceptional to Capt. Robert Francis of Northeast Airlines. The airplane, a 727, was the first pure jet his company could call its own.

A few weeks later the same airplane took off from Boeing Field in Seattle and headed for Logan International at Boston, its new home, in what is probably the shortest ordered-to-delivered time on record in the jet age. The plane was one of 12 Boeing 727s ordered by Northeast on its 32nd birthday, August 10, 1965. Options on two more 727s were taken at the same time.

Captain Francis went with the delivery flight, back to his job as manager of crew scheduling. A Northeast man for 24 years, most of it as a pilot, he was the airline's first resident representative at Boeing, supervising the first delivery.

That 727, which went from Boston to Miami a short time after delivery to be used for pilot training, and another, to be delivered early in December, will help the airline pick up a big share of the booming Florida winter traffic.

By the time the 1966-7 winter season rolls around, Northeast will have six standard 727s to feed into the routes carrying sun seekers south from the northeast part of the United States and from Canada. This Florida route is one of the largest air-travel markets in the world.

By the last month of 1967 Northeast's entire 12-plane Boeing order will be off the delivery line. Six will be standard 727s and six will be extended-body (by 20 feet) 727s, the latter each having a capacity of 170 passengers. Northeast is the first carrier to order this extended-body jet, which Boeing announced August 5, 1965.

The order was placed just 11 days after the Storer Broadcasting Company of Miami acquired control of the airline, although arrangements had been under negotiation for some time.

The broadcasting company, headed by George B. Storer and his son, George Jr., now controls about 87 per cent of the common stock. On August 27 at a special meeting held in lieu of the annual meeting of Northeast's stockholders, seven new directors were seated on the board, including George Storer Jr., who became chairman of the board and chief executive officer.

The Northeast's 727s will be a little different from most domestic-

carrier airplanes in that they will be outfitted for overwater service. This means they will carry five 25-man life rafts and one 10-man life raft plus an emergency transmitter fitted into the forward ceiling. Flying south from Boston and New York to Miami takes the 727s over the Atlantic Ocean. Northeast's standard 727s are being outfitted to carry 98 passengers each, 20 first class and 78 tourist.

The economical, reliable, short-to-medium range jets seem made to order for Northeast's routes, which stretch from Montreal to Miami, with segments connecting Boston (the headquarters), New York, Philadelphia, Washington, D.C., Miami and Fort Lauderdale. The New England segments average out shorter than those of any other of the 11 major trunklines.

While the 727s are the first jets that Northeast can call its own (technically they are purchased by the Storer company and leased to the airline), jet service is not new to the carrier.

Its first jet service began December 17, 1959, between New York and Miami with a 138-passenger Boeing 707 leased from Trans World Airlines. The airplane went to work just in time to help Northeast celebrate 1959 as its first million-passenger year. For the first four months of its service, the 707 averaged a load factor of better than 80 per cent and 100 per cent reliability. On January 30, 1960, it set a speed record of 1 hour 45 minutes from Miami to New York and on the same flight set a record for having the greatest number of people ever carried on a commercial transport flight up to that time — 152 including a crew of eight and six infants.

Northeast's President James W. Austin

Board Chairman George B. Storer, Jr.

In the summer of 1960 Northeast added leased Convair 880s to its fleet and has operated this type of airplane on the Florida routes since. Its other aircraft are 17 DC-6s and 6 DC-3s.

Modern jetliners were unheard of in 1931 when Amelia Earhart helped found the predecessor of Northeast, Boston-Maine Airways, Inc. The company began with three second-hand tri-motor Stinsons. Scheduled service, however, did not start until August 11, 1933, when the first roundtrip flight was made between Boston and Bangor, Maine. The present company name was adopted in November, 1940.

In 1944 the Civil Aeronautics Board extended Northeast's system from Boston to New York and in late 1956, the CAB authorized a five-year temporary certificate for Northeast to take on the Florida routes in what was probably the most significant development in the airline's history. The airline inaugurated Florida service in January 1957. Northeast is seeking permanent renewal of the certificate.

As 1965 draws to a close, Northeast's President James W. Austin looks forward with optimism to the future with the operation of the new Boeing 727s.

Northeast's first standard 727 will work Boston- Miami route.

Long-body 727s will go into same assembly line as standard 727s.

New long-body 727 jetliner will carry

39 MORE PASSENGERS

The 727-200 will be 20 feet longer than the standard 727 jetliner.

Artist's drawing shows how 727-200 will look.

Illustration by Warren McCallister

By JAMES BOYNTON

IF YOU TAKE a standard 133-foot-long Boeing Model 727 trijet and add a 10-foot section of cabin forward of the wing and another 10-foot section aft of the wing you will, naturally, have a long-body 727.

Which is precisely what Boeing is doing.

Although this at first might seem rather a light-hearted and superficial approach to airplane design it is, in fact, the result of exacting engineering and market studies directed at the development of an airplane to meet the growth in air traffic on short, high-density routes.

For example, the standard 727s (which from now on will carry the designation of 727-100) are capable of carrying up to 131 passengers in their high density configuration. The 727-200 will carry 126 passengers in combination first class and economy seating, or 160 to 170 passengers in high-density configuration. This increased capacity is ideally suited to provide seats necessary to meet the increase in air travel — especially evident in the short-range commuter market.

The 727-200 will offer the same high degree of economy and profit potential as experienced by standard 727 operators. In fact, the -200 will have seat-mile costs some 20 per cent lower than present 727 airplanes.

Performance, too, will be basically the same as in the 727-100 series. Because of the 727-200's higher gross weight — 170,000 pounds compared with 161,000 pounds in the -100 airplanes — the long-body 727 will require slightly longer runway lengths for takeoff, 6,000 to 7,000 feet. The same handling characteristics and very low approach and landing speeds of the standard 727s will be retained in the new airplane. The wing span and area of the -200 will remain unchanged from the present airplane. With a full payload the 727-200 will have a range of 1,400 miles.

The new airplane will be powered by Pratt & Whitney JT8D-7 turbofan engines — improved versions of the JT8D-1 engines installed on the standard 727 airplanes.

The standard 727 has achieved an in-service departure reliability rate of 98 per cent in its more than 18 months of airline operation. This means that only two per cent of all scheduled flights have been delayed for more than five minutes for mechanical reasons. This outstanding reliability will be retained in the -200 airplane, since the new model will have components and systems in common with its predecessor as well as with the new twin-engine Model 737 short-range jetliner.

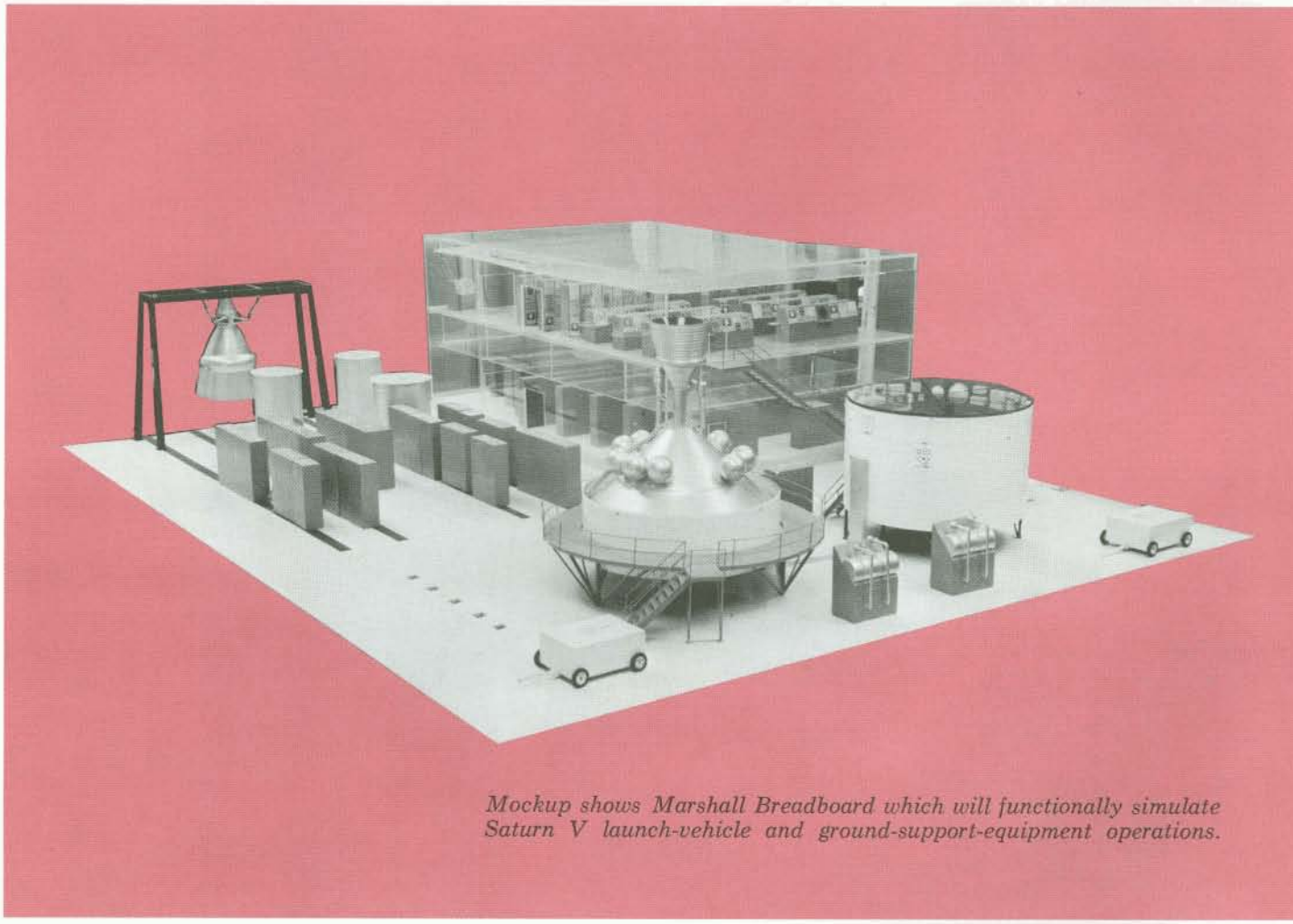
A major difference between the -100 and -200 series trijets is the addition of a second door to service the enlarged forward lower-deck cargo compartment in the long-body airplane. The -200 will have a forward lower-deck cargo-space capacity of 754 cubic feet compared with 425 cubic feet in the -100.

The aft-cargo-compartment volume in the -200 also has been enlarged, to 910 cubic feet from the 463 cubic feet carried in the standard model. To facilitate loading the -200, a new type of cargo-compartment door will be installed. These open by swinging out and under the fuselage in contrast to the inward opening doors of the standard 727.

In announcing the company's decision to put the -200 into production, John O. Yeasting, Boeing vice-president and Commercial Airplane Division general manager, said, "The standard 727 has proved itself to be the most economical and profitable airplane in service today on short-to-medium-range routes.

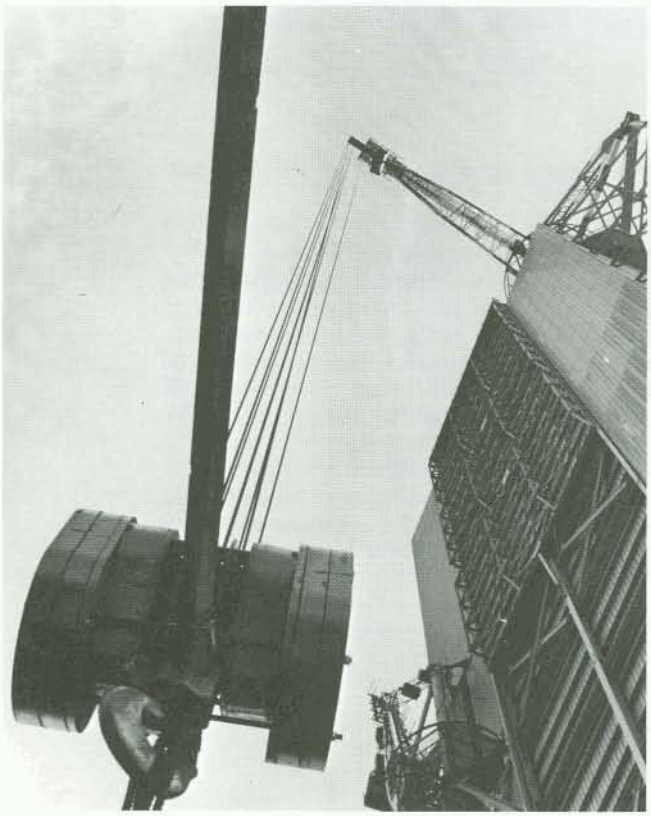
"The 727-200 will extend these economies to an even greater degree as well as provide improved service to the air traveler."

Northeast Airlines, the first carrier to order the new jet, will take delivery of its first 727-200 in October, 1967.



Mockup shows Marshall Breadboard which will functionally simulate Saturn V launch-vehicle and ground-support-equipment operations.

Apollo/Saturn V will be tested in this 36-story tower.



Boeing Vertol helicopter delivers part to test tower.

Preparation for flight to moon requires such devices as

BREADBOARDS AND D-BIRDS

Breadboard models are reviewed by (from left) Arthur L. Scholz, Don H. Atherly and F. B. Williams.

By WILLIAM B. SHEIL

THE National Aeronautics and Space Administration's Apollo/Saturn V Project is the largest single industrial program in America today. More than 300,000 persons representing 20,000 companies in 47 states are working toward a common goal: to land Americans on the moon in this decade.

Tying this widespread activity together and making sure that everything works is one of the most intricate jobs ever attempted by American government and industry. The operational capacity of the system and the ability of the various NASA centers to operate and maintain the system depends largely upon how well the integration program is defined.

A major part of the overall program is the development of launch vehicles, the main one being the Saturn V S-IC booster for which Boeing is prime contractor. In addition, Boeing is performing certain systems engineering and systems integration functions in support of NASA's Marshall Space Flight Center, the organization responsible for Saturn V development at Huntsville, Alabama.

Dr. Arthur L. Rudolph, Marshall's Saturn V program manager, is responsible for all phases of the task through planning, coordination and contractor technical direction. Boeing's Saturn V systems mission support work is managed by Don H. Atherly.

A significant portion of Boeing's effort is devoted to assisting Marshall install and operate the Saturn V Systems Breadboard, a test facility for developing automatic checkout and launch-control equipment to be used at the Kennedy Space Center, Florida.

This electronic-mechanical simulator will help verify procedures to be followed before various systems are incorporated into the launch operation at Cape Kennedy. The Breadboard will functionally simulate the entire launching and ground-support procedure from countdown to liftoff by means of mechanical automation and electronic simulation in real time—that is, in the same time frame as under actual launch conditions.

Selected Kennedy Space Center personnel will train for the Saturn V launches at the Marshall Breadboard.

Another essential job preliminary to man's first trip to the moon is the testing of a complete flight vehicle. The Saturn V Dynamic Test Vehicle program marks the first time that a rocket as large as Saturn V (364 feet tall and 33 feet in diameter) will be tested in a restrained environment to provide flight-control design data. This will be the first assembly of a complete Apollo/Saturn V.

"The S-IC-D will go into the giant test stand, which is the largest building in Alabama, in mid-November," says Atherly. "The D-Bird's first stage recently was completed by Boeing at Marshall's Michoud Assembly Facility in New Orleans, and will be delivered in Huntsville shortly. North American will ship the S-II second stage and Douglas will send the S-IV-B third stage to Huntsville from California. International Business Machines is responsible for the instrument unit and the NASA Manned Spacecraft Center at Houston will furnish the payload, a simulated Apollo Capsule. We'll put the stack together and begin the test program next February. The tests are scheduled to run through November, 1966.

"The purpose of these tests is to determine the bending and vibration characteristics of the complete Apollo/Saturn V dynamic vehicle. In these particular tests, no engines will be ignited nor will there be any fuel aboard.

"This huge test setup will enable us to obtain data needed by Marshall to prove the flight-control system to be used in guiding the Saturn V in its normal anticipated flight trajectory. When you consider that our first Saturn V manned launch is scheduled for 1968, the quicker we get programs such as the Dynamic Test Vehicle and the Breadboard under way, the closer we will be to the moon."

Mockups of 737 jetliners speed production

THE ARTFUL IMITATORS

By BARNEY SCOFIELD

NURTURED on a steady diet of blueprints and cared for by many skilled technicians, the newest member of the Boeing jetliner family — the twin-jet 737 — is rapidly coming to life.

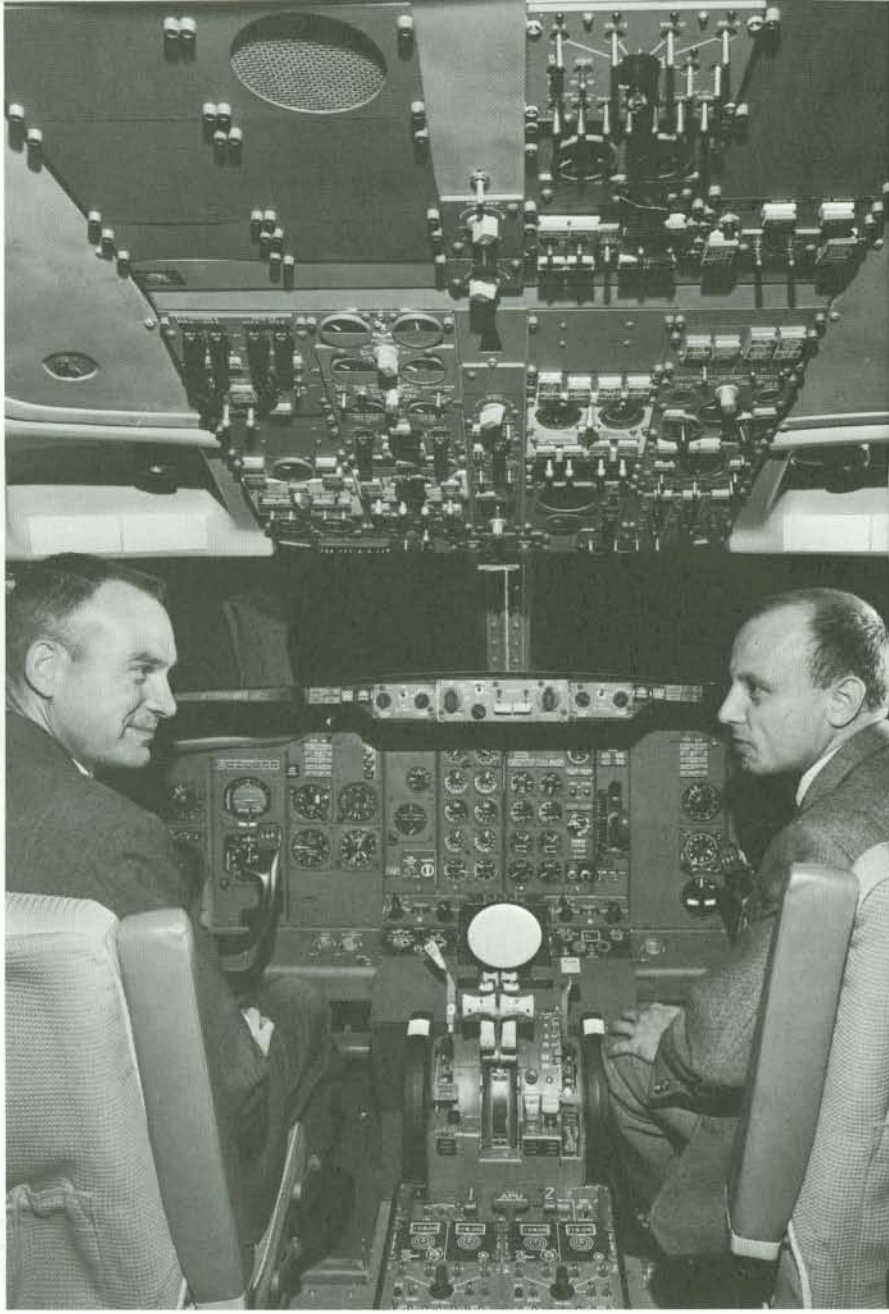
Cabin interiors are being laid out, instrument locations selected and numerous components are being fitted into full-scale mockups of the new short-range jetliner before it is assembled.

Several wood and aluminum mockups of the airplane already are complete and others are being hammered and riveted together at the Commercial Airplane Division's plant in Renton, Washington.

Built at considerable expense, the mockups are expected to pay for themselves many times over by enabling Boeing and airline personnel to work out detailed design without costly engineering and manufacturing delays.

The mockups, like those used extensively in other Boeing jetliner development programs, fall into three categories: quickly assembled mockups for early configuration review, detailed mockups for final system configuration verification and release of complete engineering information, and refined mockups for final manufacturing development.

A preliminary 737 mockup al-



Harald Josenhans (right) of Lufthansa views 737 cockpit mockup with Boeing pilot Brien Wygle.

Josenhans and Wygle examine 1/10-scale model of 737.

Neil Stewart of Western Airlines studies 737 seating arrangements.

A. M. Salmon (on right) of United Air Lines is briefed on detailed systems mockup by Earl White.

Passenger-cabin mockup is complete even to lights and piped-in music.

ready has been built of the entire lefthand portion of the airliner including one wing, engine pod, complete body and landing gear. It now is being converted into a systems configuration development vehicle. A similar manufacturing development mockup is under construction.

Inside they are being fitted with instruments, control cables, hydraulic lines and other components to make sure everything fits and to determine the simplest and most efficient assembly methods.

Other mockups built or under construction include cockpit sections, a landing gear and wing section, engine pod and strut, wings and passenger cabins.

One of the cockpits is being used to determine optimum lighting and instrument location. The passenger cabins — complete with seats, galleys, washrooms, carpets, air-conditioning and piped-in music — are being used to determine customer interior arrangements and color schemes.

More than 200 technicians are working two shifts to have all the mockups complete and in use before the 737 goes into final assembly. Even after the new airplane is rolled out, test flown and certificated, the mockups will be of use in incorporating design improvements.

Lufthansa German Airlines, United Air Lines, Western Airlines and Pacific Air Lines have announced the purchase of 81 of the new jetliners and have optioned 43 more. Initial airline deliveries are set for late 1967.

With engineering manpower at its peak, the 737 production program is on schedule and headed toward a November, 1966, rollout of the first of the new jetliners.

Besides progress on the mockups, other program milestones include completion of the first master models for parts tooling, release of more than 30 per cent of final engineering drawings and completion of more than 3,000 hours of wind-tunnel testing.

The 737 — with its two engines mounted beneath its wings to afford considerable weight saving and provide additional passenger space— is the smallest member of the Boeing jetliner family.

Two versions of the airplane, the 737-100 and 737-200, are in production. Each will have a maximum gross weight of 93,500 pounds and will cruise at speeds of 575 miles an hour.

Major differences between the two will be in overall length and passenger-carrying capacity. The 737-100 will be 94 feet long and carry 76 to 100 passengers. The 737-200 will be 100 feet long and carry 90 to 115 passengers.

ADVENTURES IN MANAGEMENT

INSTINCT FOR ACHIEVEMENT

A MAN who could write a book or two about what makes business firms flourish or flop is F. E. (Gene) Akin. For years he has cast an X-ray eye on the production abilities of hundreds of companies which are, or would like to be, on Boeing's list of suppliers. He will continue this scrutinizing as part of his new job as director of materiel for the company's recently-formed Aerospace Group.

Anything the 44-year-old Akin wrote would be done in eye-catching language; he is known for an effective choice of words. His wide-swinging vocabulary has served him well since youthful days in Coffeyville, Kansas, where he was a star softball pitcher. Upon occasion he addressed the umpire, they say, in language which was very explicit.

The place where Gene wanted to score, however, was in the airplane business. He started at age 18 and worked some 16 years with Beech and with Swallow. He joined Boeing at Wichita in 1955, as a staff assistant in materiel, and now has a record of 26 years in what he calls "the science of source selection."

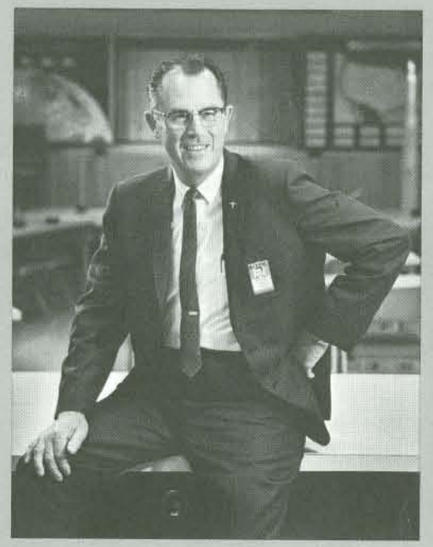
Wearing a bow tie and a built-in badge of personal integrity, Akin went to Seattle in 1959 as an outside production manager, later became materiel manager for Bomarc. This was followed by the same assignment on Minuteman, before he was named materiel manager at Wichita. He was president of the Purchasing Agents Association of Wichita.

Cars are one of Akin's current interests, along with motor trips (with his wife and daughter), music, sports and dogs (poodles only).

Akin believes that people have special strengths. "You prove it when you put a manager in business for himself," he says, "and let him act as if he owned his project. Most people have an instinct for achievement."

While at Wichita, Akin got the materiel section interested in a lively competition for the best ideas in cost improvement. Instead of prizes, monthly citations were presented. Expensive awards were not needed, he said, because most people, when properly invited, are just naturally interested in accomplishment for its own sake.

POINTER



AS an imaginative six-year-old, Bob Plath decided to invent a machine which would spot an airplane passing overhead. He rigged a wooden pointer to a porch pillar of his home and attached a string to it. When an airplane flew over, young Bob rushed from the house, pulled the string, activated the pointer, and thus notified the world of the aircraft's presence—or so it seemed to a boy his age.

Robert Plath has come a long way since, in aerospace design, engineering and management. As assistant general manager of Boeing's Missile Division, Plath has a direct responsibility for the division's missile programs. He is credited with a key role in success of the Air Force Minuteman intercontinental ballistic missile.

With an aeronautical engineering degree from Tri-State College in Indiana and post-graduate work at the University of Michigan in hand, Plath joined Boeing in 1936. He worked on major company programs such as the XB-15, B-17 Flying Fortress, Model 307 Stratoliner, Model 314 Clipper, B-47 bomber, Bomarc interceptor missile system; served as chief engineer for the Pilotless Aircraft Division; as assistant Minuteman program manager and engineering manager and was named chief engineer for the Aero-Space Division before his present position.

In these 29 years with Boeing, Plath has earned a reputation as an inventive, meticulous engineer and manager with a quiet sense of humor. He has had numerous opportunities to point the way for others. Sometimes the string he pulls is a perfectly-timed injection of humor and logic which brings a meeting discussion back to a single line. Matters that come under his review pen always receive careful attention — and are improved.

"Bob is interested in perfection," says a close associate. "He once spent 60 hours grinding a six-inch telescopic mirror. The thing worked perfectly, so he forgot about it and went to something else."

Another long-time co-worker says, "Plath insists on knowing how any machine works — particularly one that flies. He is the only man I know who learned to fly (at age 16) by reading a flight-instruction book."

Plath admits being happiest when those who work for him achieve success with a difficult system or technical problem. And since that early experience in Spokane he has continued to do an expert job of pointing the way.

New instrument measures, but obeys order

DON'T TOUCH

A LABEL, "Handle carefully, but do not touch," would apply to many aerospace parts which are so fine of finish that contact of inspection instruments could cause damage.

To solve this problem a Boeing quality control research engineer, Bruce Keller, has devised an instrument which measures surface contours to an accuracy of 1/10,000 inch, without contact.

The instrument projects a pinpoint of light onto an object to be measured. The light is reflected into a sensor unit.

As the instrument moves over the object, any dimensional change in the surface changes the position of the reflected spot. The sensor unit, compensating to keep the spot centered in a prism, sends this contour information to readout and recording equipment.

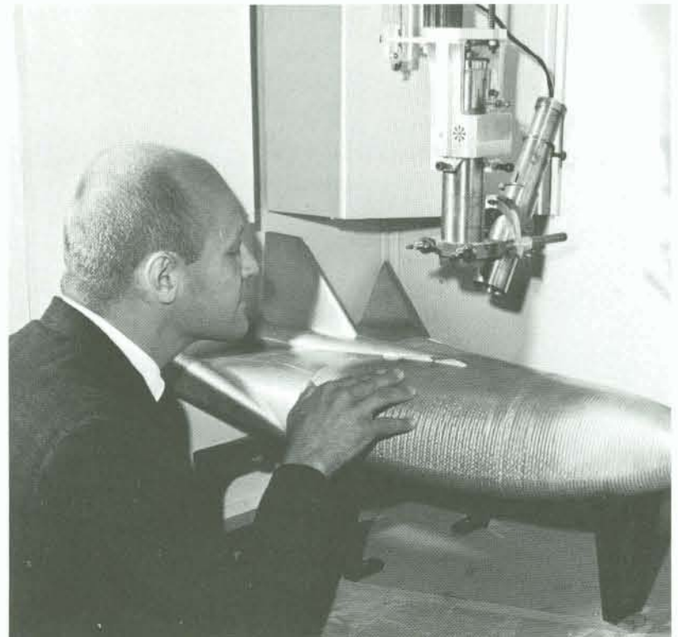
The data can be processed by computer for mathematical analysis and programmed for other machines which deliver engineering drawings. Direct readout is by digital display — columns of numbers representing coordinate points — or by computer tape. A graph recording may be made representing a cross-section view of the test surface.

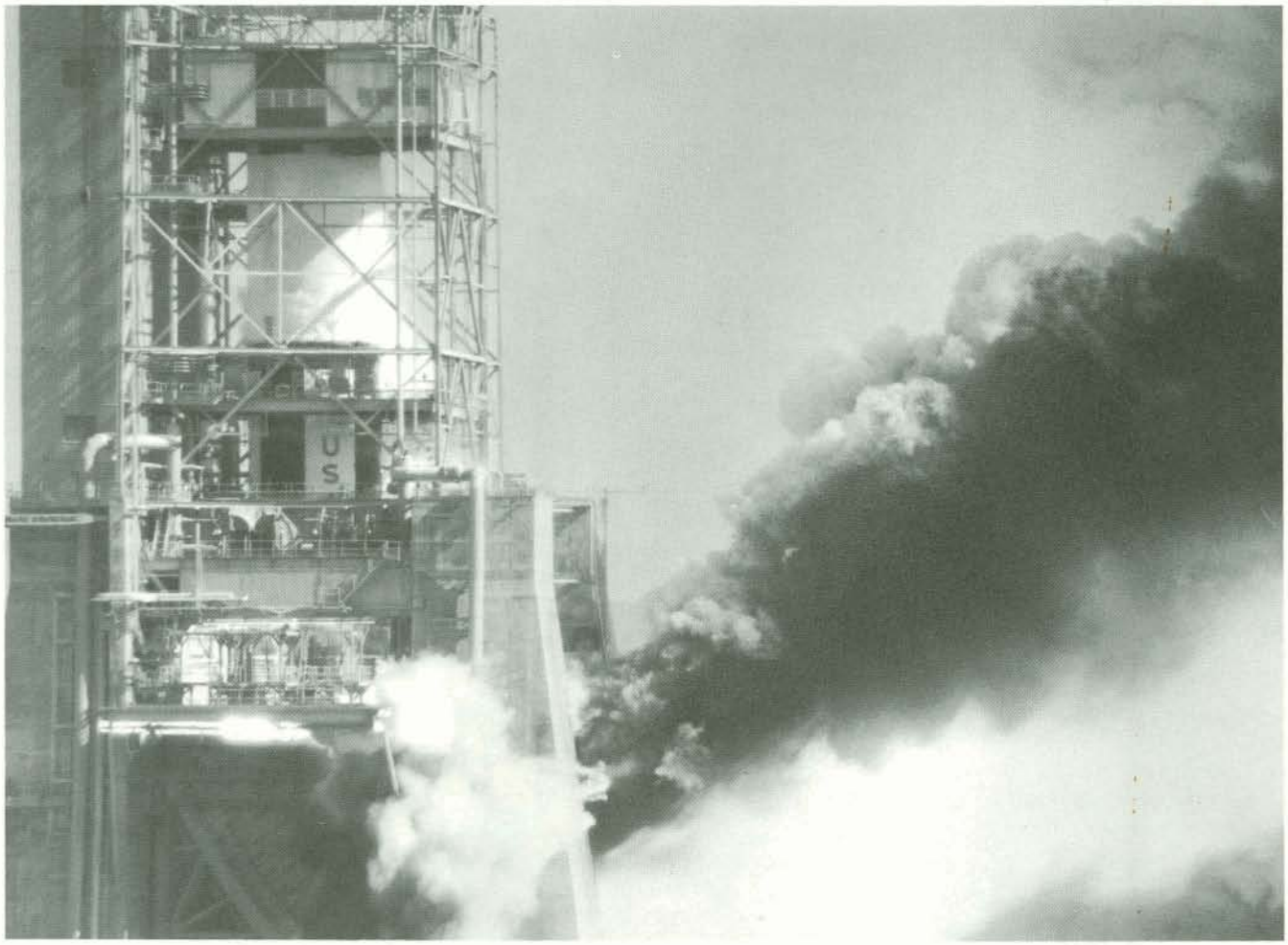
Keller's system is being considered for many uses, including the monitoring of vibration, coating thickness and surface flatness. Lasar technology is being applied to the system to increase sensitivity, and the scanning technique is being improved to speed the recording of data.

The system is flexible, adapting equally well to wind tunnel models and small machined parts as to large aircraft or missile assemblies. Measurements are made in a fraction of the time required for conventional techniques.

Patents are being sought on the system and Boeing Associated Products is studying its market potential outside the company.

Instrument uses a beam of light to measure contours of any surface with great accuracy.

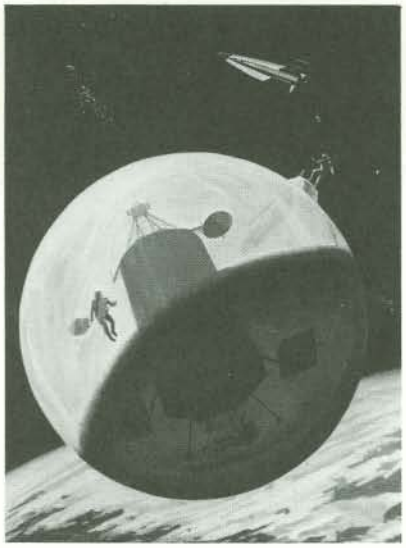




FIRST full-duration test firing of Saturn V's S-1C booster marked a major milestone on the way to America's first manned lunar landing. The test, conducted at NASA's Marshall Space Flight Center, generated the most force ever produced by a rocket—sufficient to create 160 million hp in flight. The Saturn V vehicle, tall as a 30-story building and weighing 3,000 tons, will launch American astronauts to the moon this decade. It will be able to put 100 tons into earth orbit, or propel several tons of instruments to Mars. Boeing holds a NASA contract to develop, build and test the S-1C booster.

Capability has many faces at Boeing

TWIN TURBINE Sea Knight, built by Boeing's Vertol Division, is U.S. Marine Corps assault transport helicopter. Tandem rotors fold in less than one minute for storage on carrier hangar decks.



SPACE BUBBLE, an inflatable balloon, suggested by U.S. Air Force and Boeing scientists, would protect astronauts while assembling platforms or repairing craft in space.

NEWEST jetliner, Boeing 737 Twinjet, will carry up to 115 passengers at 550 to 600 mph, over routes of 100 to 1100 miles. New 737 will offer more head room, more shoulder room than any other short-range jet. It has been ordered by Lufthansa, Pacific, United and Western.

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