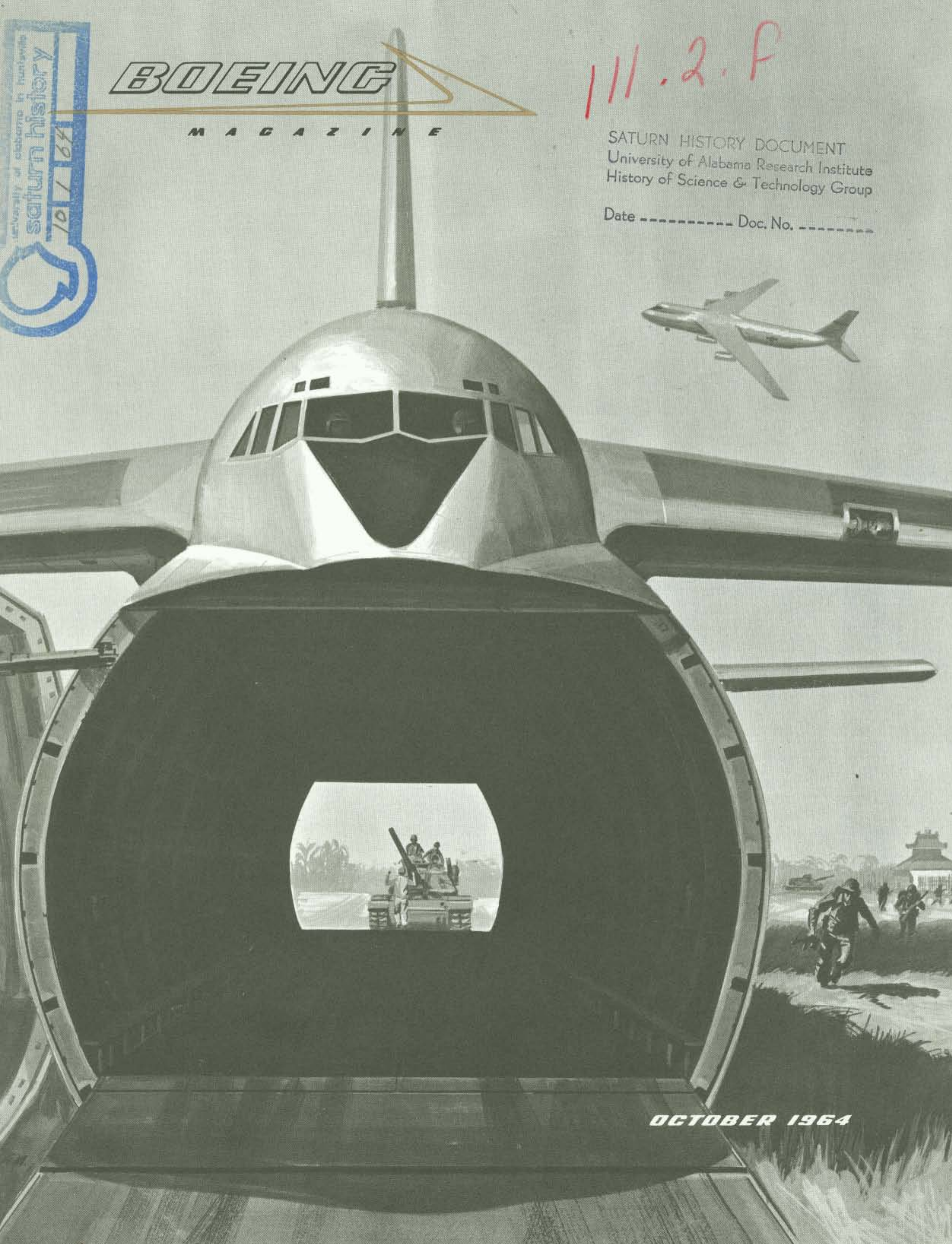
BOEING MAGAZINE



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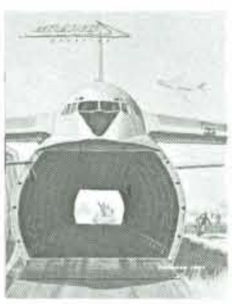
In This Issue



ON OUR COVER—A Boeing logistics transport airplane is pictured by artist Alden Metcalf as it might look in a tactical situation. Articles in this issue discuss the company's work on design of large, economical transports of extraordinary capability.

PHOTO CREDITS—Paul Wagner (6, 10, 12, 13); Byron Wingett (6, 7, 10); National Aeronautics and Space Administration, by Russ Hopkins (8, 9); Richard Stefanich (11); Jack Barkus (15).

THE BOEING COMPANY

HEADQUARTERS OFFICES

7755 East Marginal Way Seattle, Washington

THE BRIEFING

On September 14, 1964, Boeing submitted to the U. S. Air Force a 4,272-page study for a new military jet transport which could exceed by far any existing aircraft in capacity, operational abilities and economy. The study, carried out under an Air Force contract, represents one part of several year's work by Boeing to develop an aerial logistics system capable of moving military personnel and massive equipment swiftly to any part of the world, including combat areas with only primitive airfields. The company assigned a 500-man team for several months to this specific contracted study of the CX-HLS (Cargo Experimental-Heavy Logistics System). The team is headed by H. W. Withington as program director, under Edward C. Wells, vice president—product development.

An aeronautical engineer and former B-17 combat pilot, Donald G. Sachs, has been appointed Boeing's CX-HLS assistant program manager in the company's Dayton, Ohio, office. Sachs will coordinate activities between the Boeing CX-HLS team in Seattle and the CX-HLS group in the U. S. Air Force Systems Command's program office at Wright-Patterson Air Force Base, near Dayton.

Both major political parties are using Boeing airplanes to carry their presidential candidates to the people this fall. The Democratic National Committee will pay to the U. S. Air Force the standard charge for use of Air Force One and any of the other three Boeing VC-137 transport planes employed to carry President Johnson and members of his party on the campaign trail. The Republican National Committee has leased an American Airlines Boeing 727 to fly Senator Goldwater and party.

Fifteen long-range Boeing Intecontinental jetliners and six 727 short-to-medium-range jets recently were added to the Airplane Division's order list. Qantas Empire Airways will take deliveries of three convertible cargo-passenger -320Cs late in 1965 and early in 1966. Northwest Airlines is acquiring two additional C-Jets for 1965 delivery and El Al Israel Airlines will receive a -320B in January, 1966. All Nippon Airways purchased two additional 727s for delivery in September and October, 1965, and Lufthansa German Airlines has ordered nine 707 Intercontinentals and four 727s. Lufthansa will turn over two tri-jets to Condor Flugdienst, a subsidiary.

Large logistics transport may look like this.

Four-year study results in advanced cargo plane.

LONG STRIDE FOR LOGISTICS

By JOHN NEWLAND

FOR YEARS Boeing has been designing and building large jet transports. But in mid-1962, two years before the U. S. Air Force awarded study contracts for the CX-HLS (Cargo Experimental—Heavy Logistics System), Boeing designers came up with something that made even the most erudite airlift experts wipe their glasses and take another look.

It was a concept of a military cargo transport. It looked big even at Boeing which built 744 B-52 eight-jet, 488,000-pound bombers, the largest aircraft in service. Longer than an ice hockey rink, the floor of the new airplane was wider than two moving vans. And related to its size was its effectiveness which, detailed studies showed, would save billions of dollars over the long haul.

The concept came into being this way:

Maynard L. Pennell, project engineer on the Boeing 707 prototype in 1952 and now a company vice-president, in 1961 was director of engineering for the division which builds the famous jet transports. Looking to the future as airplane designers must, Pennell one day called in William L. Hamilton, a young electronics engineer and operations analyst, and directed him to analyze the factors involved in the transportation of Army divisions by air.

Hamilton and a dozen helpers went to work loading small-scale cutouts of army vehicles onto a floor plan of an advanced heavy aircraft concept. At about the same time, Boeing's Project SLAM (a program for Simulating the Loading of Aircraft with Military cargo) was programmed for an IBM 7094 computer and was used to check the manual loading. These were basic studies, to determine the relationship between payload and cargo compartment floor area in moving general purpose armed forces.

As the analysis went on, it became increasingly apparent that floor area was among the most important factors in the design of an efficient airlift aircraft. In addition, study verified that army vehicles aren't as dense in terms of pounds per square foot as might be thought. This broadened the airlift possibilities beyond the transport of lightweight airborne divisions.

Then in mid-1962, a Congressional group was scheduled to visit Boeing's Airplane Division to be brought up to date on Boeing's products and studies. Analysis had shown that large jet transports with greater floor width could do a better job of accommodating Army vehicles. But this fact had to be applied in operations analysis to the overall U. S. airlift requirement.

To brief the Congressmen, Hamilton was asked to provide answers to a challenging list of questions:

What is the total U.S. airlift requirement? How many troops and how much equipment is there in the United States to be moved? How fast would it have to be moved? How far? To where would it have to be moved? In short: *What are America's airlift needs?*

A start-from-scratch analysis was begun, based on the best data that could be obtained from the Department of Defense and the military services.

Applied to the payload-to-floor-area conclusions of the first analysis, the results of the requirements study helped Boeing engineers come up with a fresh approach, and the concept of a new aircraft that could do a better job while saving a great deal of money in the long run.

What the analysis showed was this: for greatest efficiency and cost effectiveness, what is needed is a fleet of very large aircraft capable of carrying any type of Army division and its equipment, and landing on unpaved support-type airfields.

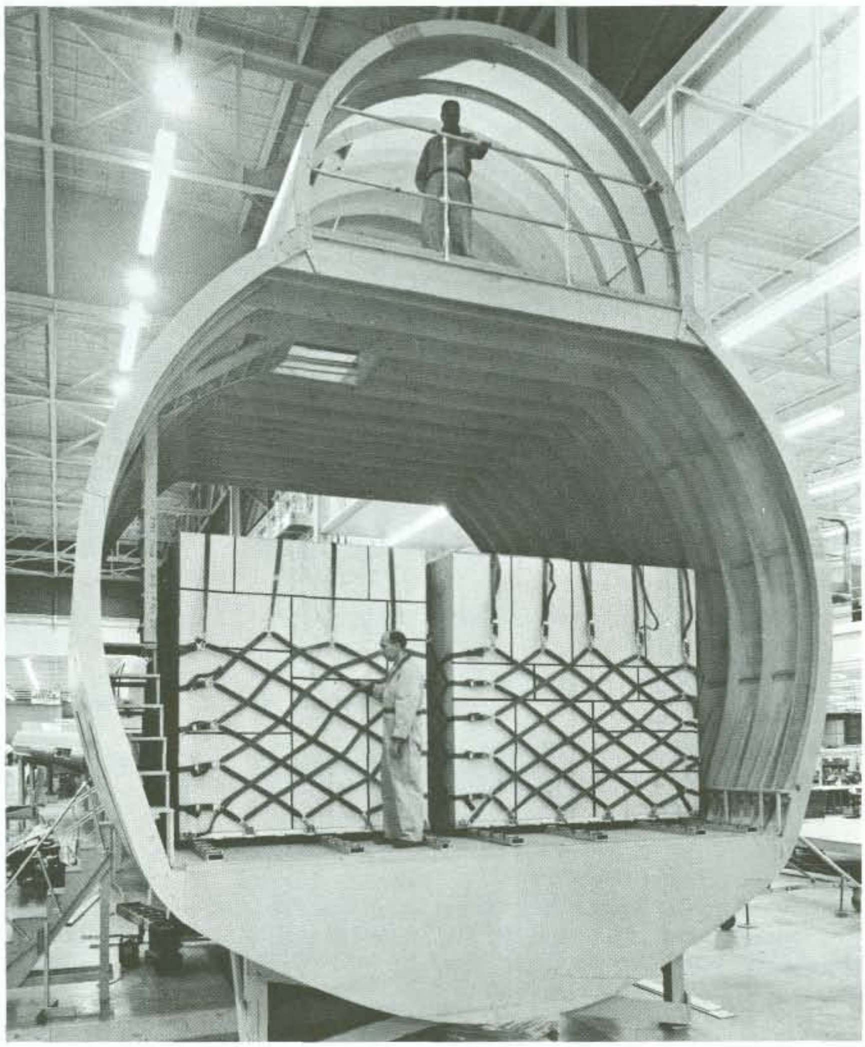
Surprisingly, it was found that such a fleet could, over a ten-year period, not only provide vastly more efficient airlift, but could do it at a saving of billions of dollars over presently programmed airlift.

With that information at hand, the next question was directed to Kenneth Holtby, an engineer recently returned from a year's graduate study at Massachusetts Institute of Technology as a Sloan Fellow.

The question: *Can Boeing fill the airlift need?*

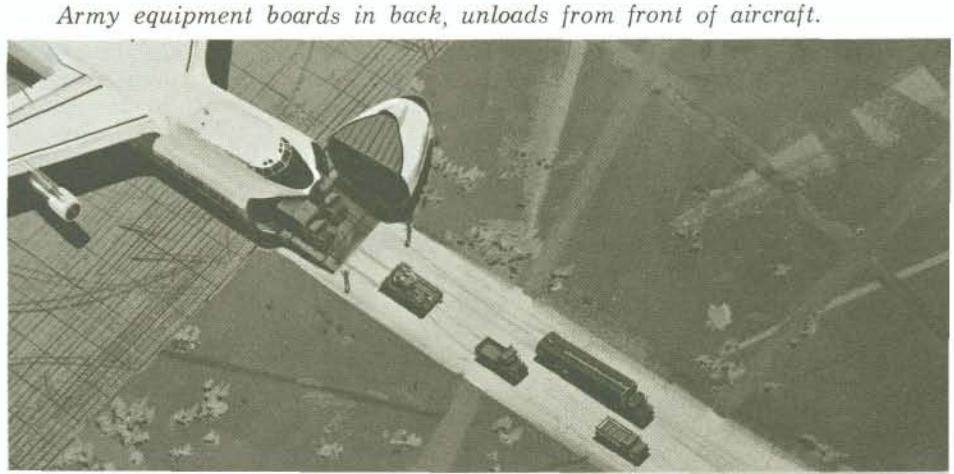
Boeing has traditionally tried to fill U. S. military needs with products that have more total capability than the minimum specified. The company views the government-defense industry team as intensely inter-dependent, with the manufacturer providing a technical element the government is less likely to provide.

Boeing's continuing study of cus-



Logistics transport mockups were used in early Boeing studies.

Army equipment boards in back, unloads from front of aircraft.



tomer needs also has a purely practical basis in the company's desire to be ready to share in any new business that comes along. Developments or inventions growing out of such studies are considered advantageous to both members of the government-defense industry team.

Holtby and his fellow engineers in the product development department, along with Hamilton and his operations analysis team, began working from general conclusions to specific concepts. Project SLAM was intensified.

With programming accomplished, the computer could do a hundred-year job of loading vehicles and combinations of vehicles into cargo compartments of various sizes in a matter of weeks. The optimum cabin width was determined. Studies to determine the best cabin length and height were also carried out.

Aircraft concepts ranging from 400,000 pounds to over one million pounds were studied.

"We approached it this way," Holtby recalls. "If we could start from scratch, what kind of an airplane would we like to have to match payload to floor area?"

The design would have to have a high wing and as low a floor level as possible in order to provide practical loading and off-loading under tactical conditions. It would have to be large to accommodate the optimum floor size, but there are advantages of efficiency in a large aircraft so long as its designers are unhampered by powerplant limitations. In earlier days, when propellers were standard, such limitations were severe.

The design arrived at in September and October, 1962, was an aircraft with gross weight over 500,000 pounds and capable of carrying 180,000 pounds payload over practical ranges, figures that now seem conservative.

In the past, massive long-range airlift has been limited by the requirement for long, strong runways. There are only a certain number of such runways in the world, and they aren't necessarily near where the U.S. might be called upon to halt aggression with force or the threat of force.

But if a massive airlift transport could use austere, support airfields close to the point of need, it could overfly a lot of problems, including bad roads, guerrilla activity and congested transhipment points.

Boeing had experience in developing high-lift devices for the 727 jetliner, so high-lift devices were included in its 1962 massive airlift transport concept. So was the high-flotation landing gear necessary for operation on relatively unimproved airfields.

The basic concept at which Boeing designers arrived in 1962 has, of course, been refined as time has gone by. High-lift flaps were developed in wind-tunnel tests, and high-speed drag of the wing-body intersection, aft body, landing-gear housing and pilot's cabin were determined.

Wind-tunnel tests of high-lift flaps were followed by flight-testing of the devices on the company's jet prototype airplane. Development of the high-lift devices, including blown-flap boundary layer control, has lowered stall speeds dramatically.

High flotation landing-gear design refinements also have been made. Early designs had 40 tires and increased the gross weight of the aircraft by nearly 5 per cent. Latest designs need only twenty tires, and the gross weight penalty is under 1 per cent, an economical price for such a decided advantage.

Since 1962, too, a top-flight team has been assembled, one probably without peer in the aircraft industry. Qualified to work out all problems connected with design and production of the CX-HLS, the team is made up of about 600 persons under Program Director H. W. Withington, an engineer and executive of 23 years' experience.

Key members of his organization include Holtby and Hamilton; H. E. Hurst, a manufacturing manager who has helped produce every type of Boeing aircraft since the Model 247 transport in the early Thirties; Fred Maxam, formerly senior project engineer on the Boeing 720B and 727 jetliners; Harold J. Hayden, a structures expert whose experience encompasses all Boeing jet aircraft; former Sloan Fellow O. C. Boileau, and system engineer John B. Crosetto Jr. Both Boileau and Crosetto have had broad system management experience in the Minuteman program.

Operations analysis, engineering design work, testing and other activity applied to the massive airlift transport between 1961 and mid-1964, when the first study contract was awarded, have cost $10 million in Boeing funds.

The education of Boeing engineers in the intricacies of airlift operations and in the airlift requirements of American armed forces, gained through gathering facts, analyzing them and working with them, has further equipped the company to serve its military customers.

The 1962 design concept, an impressive airplane by any standards, represented an important step forward. Boeing's CX-HLS study, submitted to the Air Force last month, is a far stride beyond even the 1962 Boeing concept.

Boeing envisions aircraft able to use lightly prepared fields.

Large logistics airplanes could use unpaved fields.

TESTS PROVE SPECIAL LANDING GEAR

By LARRY SCANLON

THE WAY snowshoes keep an Eskimo from sinking to his neck in deep drifts is the way a new type Boeing landing gear keeps airplanes from sinking in the mud. This was proved last month on Harper Dry Lake in Southern California by three days of repeated landings, takeoffs, taxi runs and acceleration and braking tests with the new gear installed on the 90-ton Boeing jet transport prototype.

The plane is believed to be the first large jet transport to demonstrate the feasibility of operating from unpaved fields.

Significance of the airplane's performance was emphasized by test project manager A. T. Curran: "The concept of landing large logistics transports on austere unprepared soil is sound and of great military value."

Data obtained during the tests is particularly applicable to the Air Force's CX-HLS (Cargo Experimental-Heavy Logistics System). Boeing is one of three major aircraft companies competing for a contract to design and build the huge CX-HLS airplane.

The special landing gear consisted of 20 wheels instead of the usual 10. Tire pressure was 25 pounds instead of 80 or 90.

The degree of hardness of the lake bed varied from a CBR of 8 to a CBR of $1\frac{1}{2}$. CBR stands for California Bearing Ratio. It was devised by the California Highway Department and is a recognized standard for describing ground-surface firmness. The higher the number, the harder the surface. CBR numbers go to 100. Large airplanes without the new high-flotation landing gear would require at least a CBR of 18 to carry out the operations performed by the Boeing test plane in much softer terrain.

The airplane first was operated on an area of the lake bed which has a CBR of 8. As the tests continued, the plane moved to softer areas. By the final day, repeated tests had been conducted on mud with a CBR of 2 with some spots going as low as $1\frac{1}{2}$.

The lake bed is covered with a thin, sun-baked crust. Beneath this is wet silt with the consistency of modeling clay.

Although operated through a wide range of conditions, including progressive increases in gross weight up to 180,000 pounds, at no time did the test plane bog down. What was learned is expected to be of great value to the Air Force in establishing requirements for future logistics type airplanes.

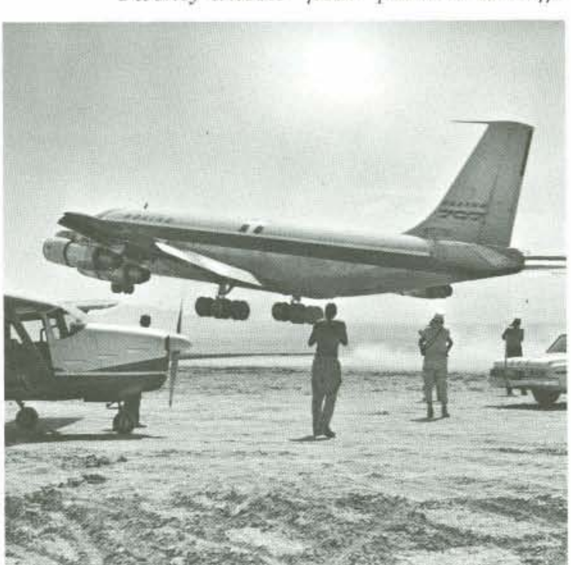
The tests demonstrated the progressive breakdown of the soil under landings, takeoffs, high-speed taxi runs and maximum braking. The airplane was towed by a tractor to test the rolling resistance in soft earth. Eight times normal power was required for this towing.

In conjunction with the National Aeronautics and Space Administration, Boeing recently demonstrated an unique high-lift system on the jet prototype, which allowed the airplane to land at speeds as low as 90 miles an hour. Jet transports of comparable size land at about 135 miles an hour.

At the conclusion of the high-flotation landing gear tests, the high-lift system, which blasts high pressure air over landing flaps to increase lift by as much as 25 per cent, was successfully demonstrated for a number of Air Force, 'Army and industry observers at Harper Dry Lake.

Temperatures of brakes and tires are checked.

Twenty wheels "float" plane to takeoff.



Dust flies from sun-baked crust on Harper Dry Lake, but beneath this is a soft wet silt which would stop most large airplanes.

Crews start work at dawn to use best conditions.

Moon-rocket men study in unique classrooms.

SCHOOL DAYS AT CAPE KENNEDY

By GREGG M. REYNOLDS

BOEING employees often have given on-the-job training to airline personnel, missile crews and other users of company products. Now there's a switch. At Cape Kennedy, Florida, more than 30 Boeing men are students instead of teachers.

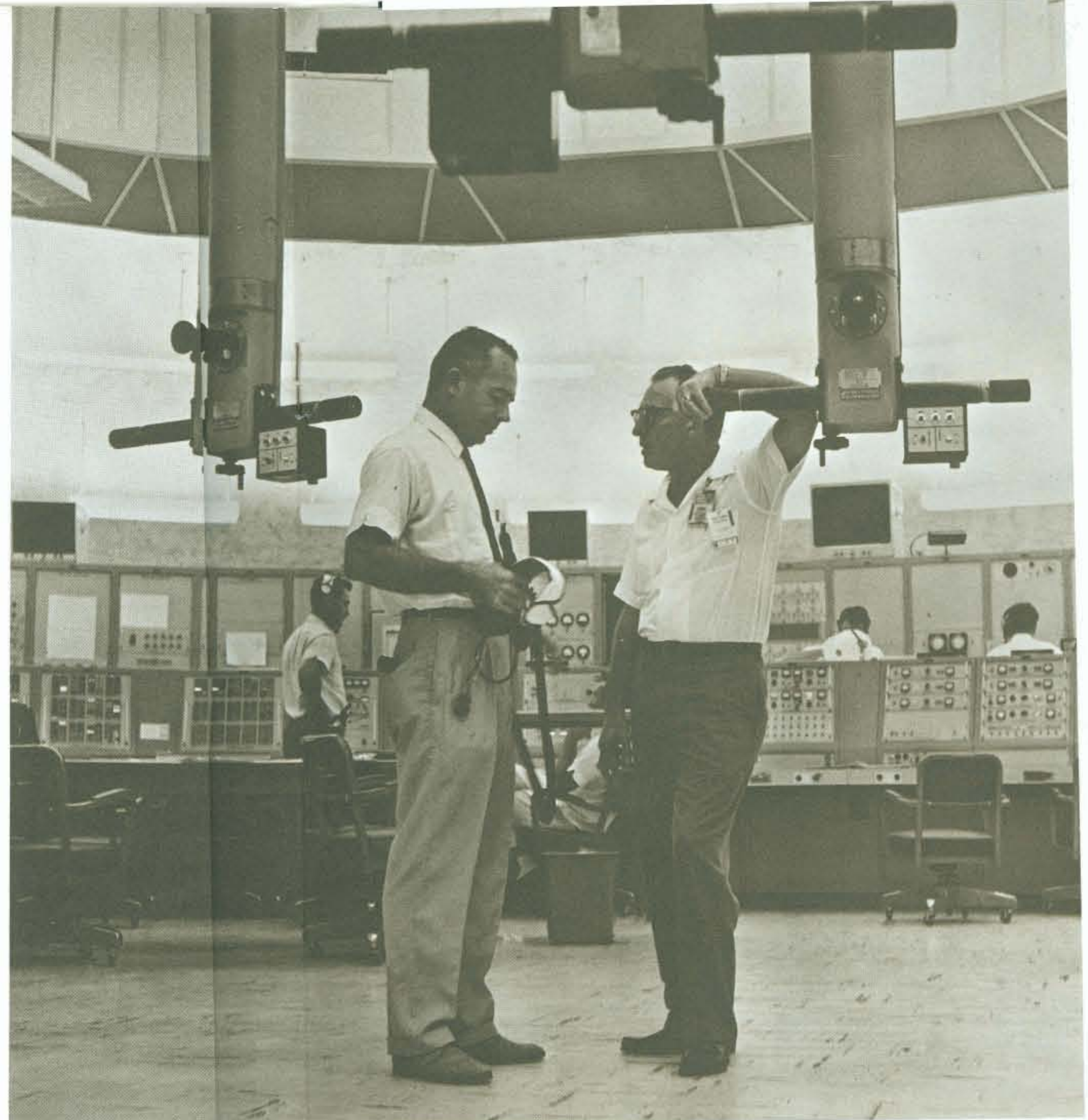
These Boeing engineers and technicians are working with the National Aeronautics and Space Administration, Kennedy Space Center, Launch Vehicle Operations, directed by Dr. Hans F. Gruene. Their classrooms are the center's Cape Kennedy launch vehicle facilities, varying from blast-proof, periscope-equipped control rooms to giant towers which service rockets.

There are numerous operational similarities between Saturn 1, current heavy-payload launch vehicle, and the Saturn 5 which will boost America's astronauts to the moon. The Boeing men are learning the whole intricate business of transporting, erecting and firing Saturn 1 rockets by observing step-by-step procedures.

Soon their knowledge will be applied to activities culminating in the first Saturn 5 launch from NASA's nearby Merritt Island Launch Area (MILA) complex 39. The training program will continue into the initial phase of Saturn 5 launch operations.

Boeing's Launch Systems Branch is building the first-stage booster for Saturn 5 at the Michoud plant near New Orleans, Louisiana, and has additional responsibilities in the program. Know-how being acquired by the students at the Kennedy Space Center will be used in training additional personnel as Boeing's Saturn 5 activities increase.

NASA administrators are pleased with the arrangement, as it enables them to pass along invaluable experience gained on the Saturn 1 program. Reaction of Boeing was well summed up by an engineer who commented, "When it comes to preparing for a complex job, nothing beats first-hand experience." It's worth noting that this man already had nine years experience on interceptor and ballistic missile programs.

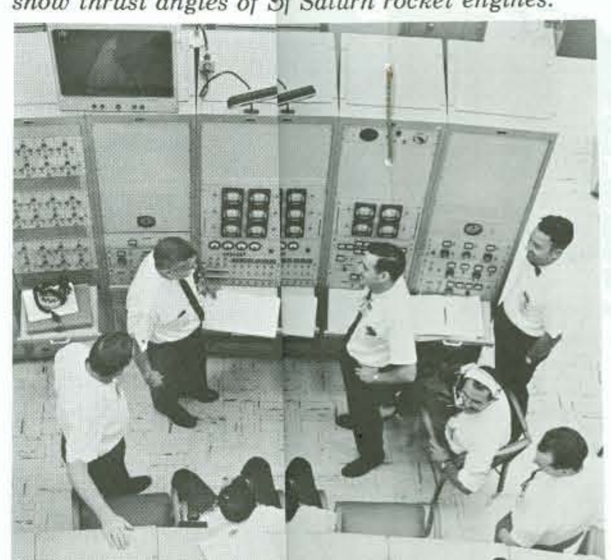


Periscope gives safe view of missile launching from Cape Kennedy blockhouse.

Boeing student gets low-down from NASA man on Saturn.

Electrical cable to Saturn 1 liquid-oxygen storage area is study subject.

"Eyeball meters," papart of this equipment, show thrust angles of Sf Saturn rocket engines.



Boeing engineer (right) learns workings of test conductors' console in blockhouse, under watchful eyes of NASA men.

Future Saturn 5 operations are subjec of discussions in Cape Kennedy office

Saturn service tower looms in backgrou beyond the men on top of blockhous

Boeing designs for future airplanes include

COST CUTS BY FIBERGLASS

By DONALD BRANNON

A NEW glass-reinforced-plastics manufacturing technique is aiding Boeing's endeavor to win contracts to build new airplanes. Details are proprietary for the present, but the method cuts costs and speeds assembly by reducing raw-material handling, tooling and the number of operations required to make fiberglass parts.

Designers involved in the study phase of the Air Force's CX-HLS (Cargo Experimental-Heavy Logistics System) program have proposed glass-reinforced plastics, generally called fiberglass, for several applications in the big cargo airplane. Fiberglass would be used for spars, ribs and skins of portions of wing trailing edge flaps, wing fixed trailing edges and some wing leading edges. The engineers also are considering fiberglass for ailerons, rudder, elevators and cowl panels.

Full-scale model CX-HLS fiberglass parts have been built for experimental purposes. They are about 3½ by 4 feet, and 15 inches deep. Actual parts would be much longer, as the CX-HLS is designed to carry cargo loads more than twice as heavy as current cargo jet airplanes.

Boeing's Airplane Division has much faith in fiberglass. Introduced successfully in the 707 and 720 jetliners, the material gained wide use in the 727. The trijet carries a fiberglass fin tip, several fiberglass radome covers, tail cone, rudder seal, wing fairings and parts of the wing leading edge. Interior applications include ducting, light shields, receptacles and covers.

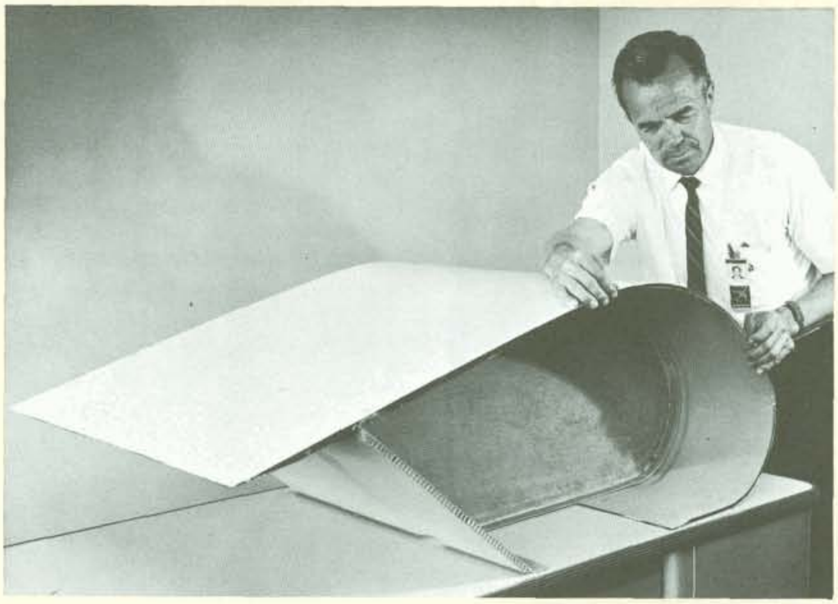
Fiberglass offers several advantages over other aircraft materials. Wing trailing edge flaps under study for the CX-HLS would cost about 37 per cent less than if made of aluminum. Only 460 tools would be needed to build the fiberglass, compared to 3,870 aluminum-working tools.

Fiberglass parts weigh 12 per cent less than comparable aluminum ones. The fiberglass can be shaped more easily, especially in compound curves. And fiberglass does a better job of resisting blows of rocks and ice during takeoff and landing. Fiberglass is quickly and easily repaired in hot or cold temperatures—an important feature in military equipment.

Resistance to corrosion is another fiberglass asset. Its performance in the sonic environment and in the aerodynamic buffeting of jet flight is another advantage. Rain erosion, static electricity buildup and sun damage are prevented by coatings.

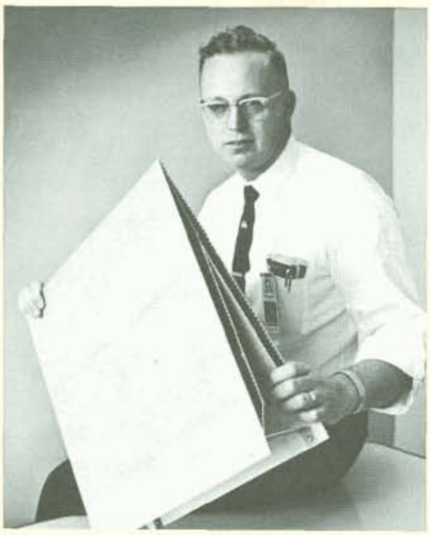
Parts such as wing flaps are composed of fiberglass skins bonded to a core of honeycomb-like fiberglass material. The core, which provides stability for the face sheets, is shaped as required, then covered with layers of the skin material. Each layer is about as thick as a blotter and made of glass fibers sealed in plastic.

Core and skin are sealed in a vacuum bag and the air is withdrawn. Air pressure outside the bag presses it tightly against the part, ensuring a smooth bond between core and skin. The part is heated in an oven, where the plastic sets and becomes hard.



CX-HLS airplane model parts built of fiberglass are proven in tests.

Model of wing trailing edge shows fiberglass skin on honeycomb core.



Fiberglass forms part of structure in 727 jetliner vertical stabilizer.

Model is of tower being built at Boardman Test Site.

New engine test stand nears completion.

ROCKETS TO FIRE SOON

By MATHEW MILETICH

BY YEAR'S END Boeing engineers and technicians will be setting up test hardware, wiring, instrumentation and control panels at the new rocket-engine test site in the desert near Boardman, Oregon. Construction men have been working hard to get basic facilities erected, chasing out a number of jackrabbits in the process.

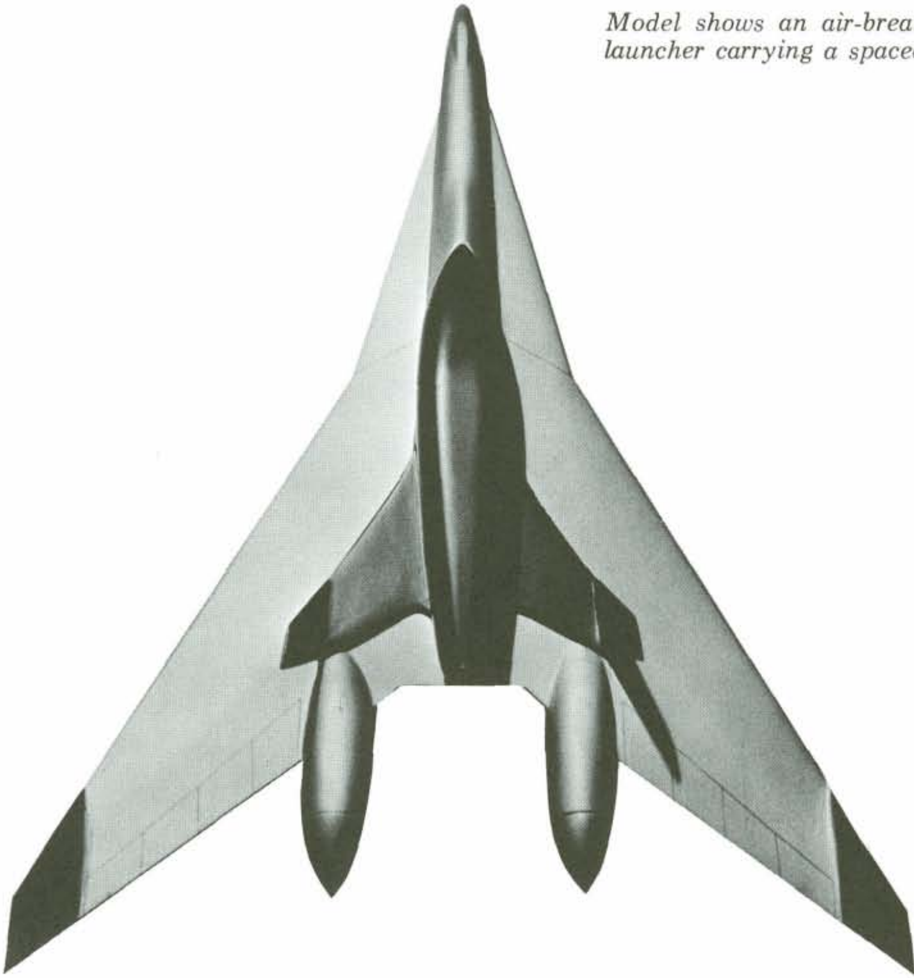
Sometime after New Year's Day testing of rocket-engine fuel systems will begin. A complex system of plumbing and wiring must be installed before testing can be done. A 24-inch main is being installed through which water will be sprayed on the tower under high pressure to protect it from the searing heat which will be generated by the tests.

A concrete pad at the base of the tower, 46 feet square and 6 feet thick, is designed to withstand high temperatures and strong blasts of air. The site also will have concrete hardstands for storage of liquid oxygen, nitrogen and other exotic rocket-engine fuels.

The 100,000-acre site's remoteness is perfectly suited for the work. No communities will be troubled by it. About 200 persons live in the town of Boardman, 3½ miles from the test site, on Highway 30 between Pendleton and The Dalles. The merchants and townspeople are happy to see this space-age industry move in as a neighbor.

Initially Boeing is investing $1.5 million in the 44-foot rocket test stand, blockhouse, 790-foot well and support facilities which soon will be ready for use. Hoffman Construction Co., general contractor, and several sub-contractors have had two or three dozen men operating bulldozers, drilling the well, erecting test-stand steel and doing other work throughout the summer months. Along with the ever-present desert wind, the construction men have made plenty of dust fly.

The stage is nearly set for the first chapter of Boardman's venture into the space age.



Model shows an air-breathing launcher carrying a spacecraft.

An expanded space program could spotlight

BOOMERANG BOOSTERS

By WILLIAM JURY

IF THE NINA, Pinta and Santa Maria had been good only for one-way trips, it is quite unlikely that Queen Isabella would have bought the ships—and even less likely that Columbus would have wanted to sail in them.

A parallel situation is developing today with respect to one-shot launch vehicles and their role in any long-range plans for exploring and exploiting space.

"Today's boosters are an economical constraint on space exploration," says Philip L. Peoples, who has been studying recoverable boosters and reusable launch systems at Boeing for more than five years. "If this country decides to go into space in a big way and often, it's going to need a cheap throwaway booster or a reusable launch system."

Within Boeing's Aero-Space Division there is a study now under way for the National Aeronautics and Space Administration to see if spent rocket boosters can be recovered, reloaded and refired economically.

Object of the study, which is being conducted for NASA's Marshall Space Flight Center at Huntsville, Alabama, is the S-1C first stage of the Saturn 5. Because it's the biggest and usually most expensive—and because it burns out at a relatively low altitude and would be the easiest to recover—the first stage has drawn most of the attention.

Being considered in the investigation are such recovery devices as parachutes, balloons, ballutes (a combination of balloon and parachute), paragliders and flexirotors (devices shaped like parachutes which spin like helicopter blades).

Recovering boosters such as the S-1C would bring savings, experts agree, but not spectacular ones. Recovery of Saturn's first stages could begin to pay off after about the 10th recovery, but the maximum savings probably never would exceed 50 per cent.

Preliminary design specialists grow wide-eyed when they talk about the bigger savings and tremendous improvements in operational flexibility which appear possible by going to a new concept entirely—the reusable launch system—designed from the ground up to be recovered and reused.

These probably would be giant, winged craft which would be piloted back to earth after they had launched their payloads. But there's a hitch. To be practical from a cost standpoint, they would have to be flown hundreds of times to amortize the high development costs of more than a billion dollars. Obviously, no payload requirement exists today to make the reusable launch system attractive from the standpoint of cost.

Cost isn't the only consideration, however. Today's boosters are operationally limited. They must be launched out over the water to avoid the danger of spent casings falling on populated areas. They are frustratingly inflexible compared with airplanes, and are exasperatingly cumbrous when being readied for launch.

For these reasons, and because sometime in the future the payload launch rate may increase several-fold, serious attention is being paid a wide range of strange craft capable of flying into space with a payload, launching it and returning.

At Boeing, a study of launch vehicle recovery and reuse has led to a consideration of a variety of craft, including vertical-takeoff, horizontal-takeoff, and airbreathing piloted launchers generally larger than the B-52 Stratofortress. Each concept has its strong points; each has certain drawbacks.

A winged booster that would take off vertically from a launch pad with its payload was a logical first step in the evolution from today's expendable boosters. The wings needed for flying back from space could be small and the landing gear — since it would not have to support the craft at launch when it was heaviest — could be light and simple. But the VTO launcher offers less chance of recovery in the event of takeoff failure, and its operational flexibility — which should be good if it is to be superior to the expendables — is limited to specially prepared takeoff sites.

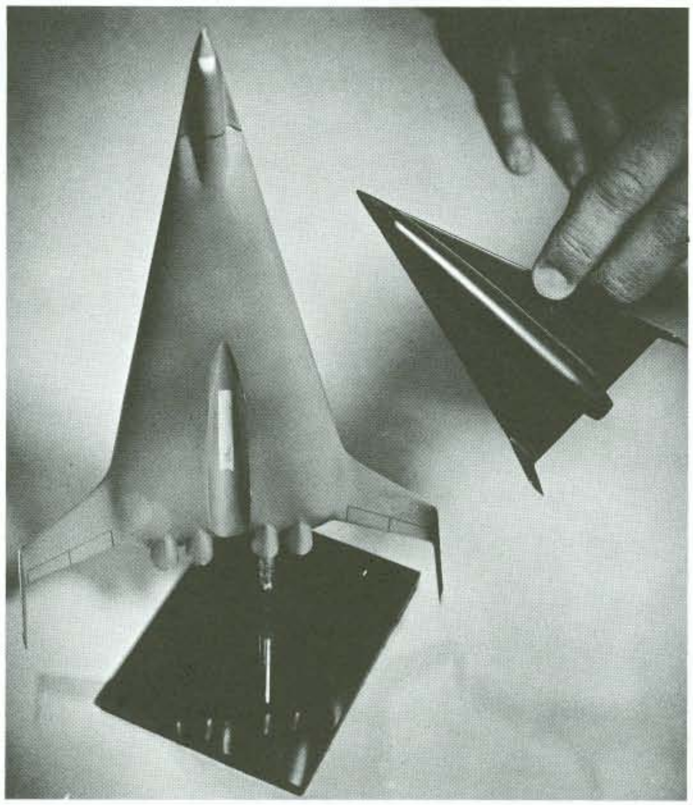
The horizontal-takeoff launcher has a tendency to be heavier because of its larger wing and bigger landing gear, but these also make it possible to fly back to an emergency landing if something goes wrong. Biggest obstacle probably is its need for long runways, and the noise of its rockets which rule out its use from existing bases.

The airbreather-launcher is a futuristic craft with a link to the past. Operating more like an airplane than the others, it would fly to staging altitude in about 30 minutes, compared with about three minutes for the rocket-propelled launchers. Because its engines would require oxygen, it would have to launch its payload at lower altitudes—about 100,000 feet. Its chief selling point: operational flexibility. It would have many of the advantages of today's airplanes. A drawback that has not yet been solved: air coming through the engine inlets would be so hot at the speeds the airbreather would fly that it would pose severe engine cooling problems.

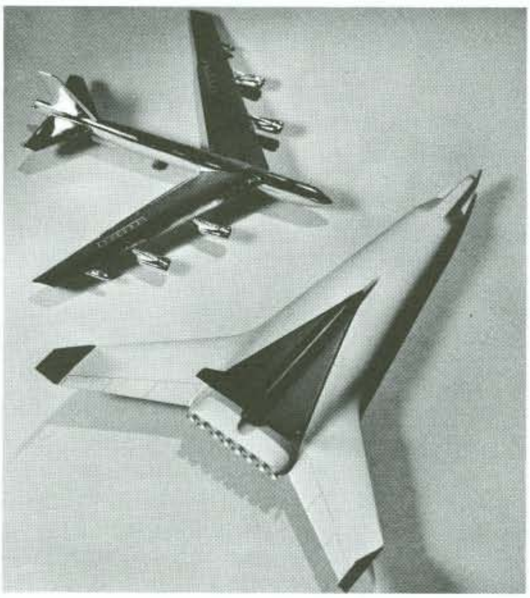
Designers also have looked at rocket-propelled sleds. A craft launched by sled would have small wings, less propellant and small landing gear — all factors which ease the re-entry problem. The limited flexibility of a system requiring railed track from which to launch, however, rules against it.

Best bet for a successful reusable launch system? Probably a hybrid system, one which combines the best of the rocket-powered boosters with the operational advantages of the airbreather. But only after considerably more research and development has ironed out the technological kinks, and our understanding of the future space mission begins to crystallize.

Vertical-takeoff rocket-propelled launch vehicle would carry spacecraft on its back.



Horizontal-takeoff launcher model is compared with same-scale model of B-52 bomber.



TESTED TESTER

A FEW YEARS AGO a reporter asked A. M. "Tex" Johnston, then chief of Boeing flight test, how he would feel if he stopped flying. "I'd feel undressed," he replied.

Today Johnston's natty attire and relaxed air give the impression that the mental nudity problem wasn't too hard to lick when the time came to swap his pilot's seat for a swivel chair. After all, while he was head of the flight test group he directed the work of some 900 men. His method of running the organization became a model of efficiency copied throughout the industry.

Johnston's appointment in February, 1964, to his present position of manager of the Boeing Atlantic Test Center, Cape Kennedy, Florida, where the first Saturn 5 moon rocket will be fired, didn't surprise his associates.

"Tex always has been in the front line," a close friend explains. "He made first flights on the YB-52 Stratofortress, on other B-52 jet bombers, on the prototype 707 jet transport and on several 707 production models. He flew America's first jet airplane, first rocket-powered aircraft and first swept-wing airplane. He was assistant manager and then manager of the X-20 space glider project. Helping to get the first manned moon ship on its way is a natural for him."

Johnston's various jobs managing large Boeing organizations have had one thing in common: each assignment was to explore some new and faster means of traveling through air or space. His approach to many of the problems in such work is summed up by a framed motto on his office wall. It reads, "One test is worth a thousand expert opinions."

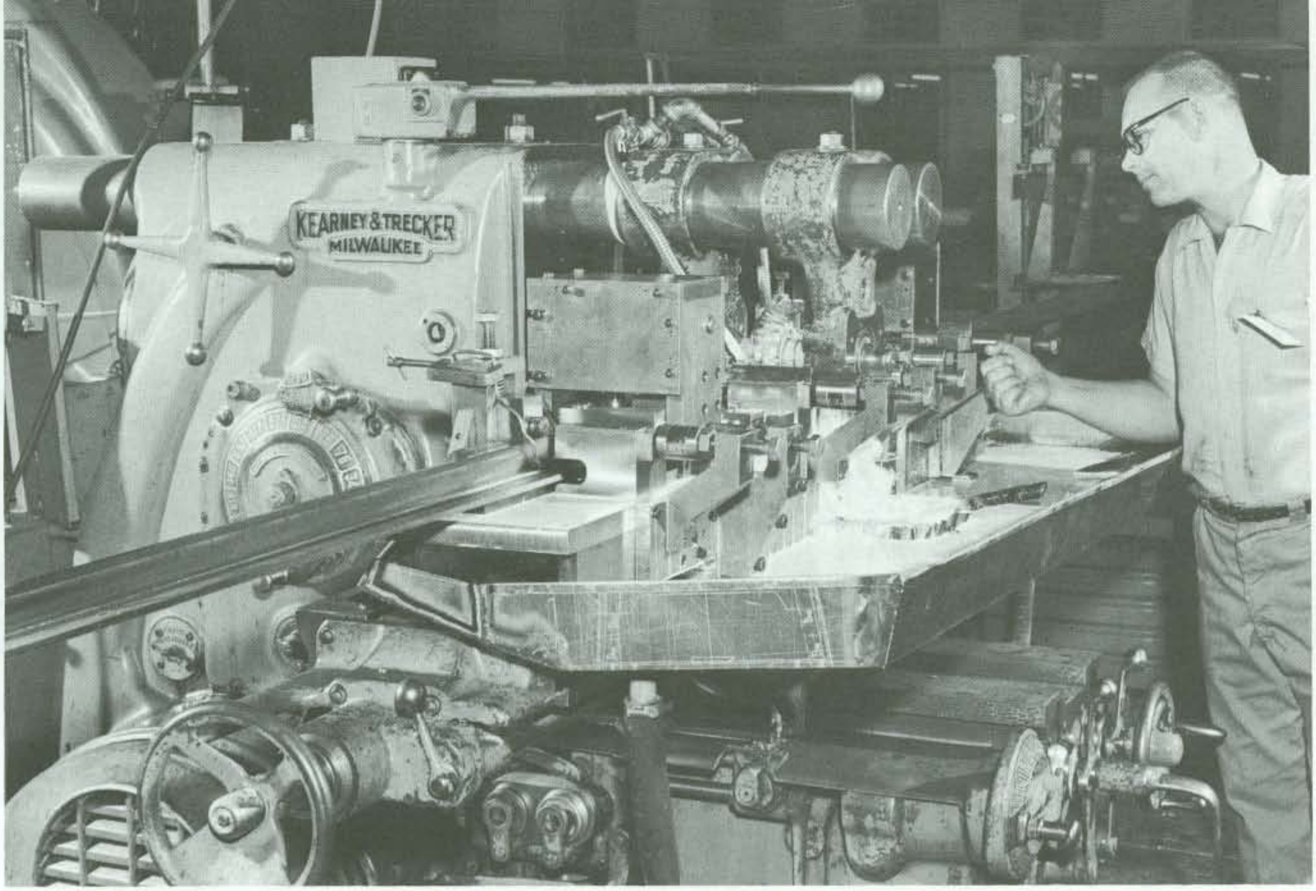
When a test pilot, Johnston planned aerial maneuvers to solve engineering and performance problems. He received the 1956 Institute of the Aeronautical Sciences Octave Chanute Award for combining science and practical experience in jet aircraft operation. In 1957 he won the Flying Tiger award for development in air transport.

Johnston's avocations pack as much excitement as did his 14,000-hour flying career. During one trip to India he bagged a 9-foot tiger, a 2,200-pound buffalo and a 520-pound wild boar. Other jaunts have produced near-record sailfish, a Dall sheep and a grizzly bear.

Stalking tigers and flying untried airplanes have helped give Johnston a bit of philosophy which he applies to management.

"You have to be free to tackle anything unexpected that turns up," he explains. "As an administrator, you get this freedom by delegating responsibility until your organization can function without you."

Johnston also keeps his eye on the till. "You can judge the efficiency of management by how well the organization meets objectives and stays within budgets," he says. "Whether you call this cost effectiveness or whatever, it is the guts of any operation."



Attachment invented by Boeing fits on conventional machine.

New device makes possible

NON-STOP TITANIUM MILLING

By DARRELL BARTEE

A SPACE-AGE attachment for a conventional milling machine is speeding production of titanium parts for the Saturn 5 moon rocket at Boeing's Wichita Branch. The new Boeing-designed device is an ingenious mechanism which both pushes and pulls long pieces of titanium past a cutter. The tough metal is thereby machined rapidly, accurately and continuously.

Hundreds of feet of extruded metal strips are needed, in various angle shapes, to build a skeleton framework for fins and fairings around engines at the base of the Saturn S-1C first-stage booster. This is one of the hot spots on the rocket, where the combined qualities of extra strength and heat resistance are required. Titanium has these qualities, but successful machining demands careful matching of feed rate and cutter speed.

Representatives from manufacturing units at Wichita got together to design and build the new continuous-feed attachment. Installed on a standard Kearney and Trecker mill with a 600-rpm vertical cutter, the device can run the titanium through faster than 12½ inches per minute.

The feat was accomplished by installing two sets of powered pinch rollers, one on each side of the cutter. The rollers ahead of the cutter push the work toward it and those on the other side pull the work away. The rollers are spring loaded and are driven by a takeoff from the mill power. Guides are installed adjacent to the rollers. The titanium strips are fed in and out of the mill from standard stand-up tables alongside the machine.

When the cutter nears the end of one piece of titanium, the mill operator butts the end of the next piece against the one being finished, so that feed is continuous. By conventional methods the process would be limited by table length and size of the machine, and each piece would have to be clamped and unclamped to the work table. This would be time consuming and could result in mismatching of cuts.

By the new method, the cuts are identical and the entire process is simplified. Setups of pinch rollers and guides can be changed quickly, according to requirements of each job. In current work on two-inch angles, the cutter mills more than 800 feet without sharpening.

Success of the prototype device indicates that the idea can be expanded and refined for applications on other mills and metals.

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