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PHOTO CREDITS—U.S. Air Force (cover, 8,9); Frontier Airlines (7); Vernon Rutledge (10,14); Jack Barkus (11); Illinois National Guard (12,13); A. B. Bofors (15).



ON OUR COVER—Men of the 454th Bomb Wing who won the Fairchild Trophy in the 1965 bombing and navigation competition are champions of the entire Strategic Air Command. Their plane was *Miss Magnolia* and her story may be read on pages 8 and 9.

THE BOEING COMPANY

HEADQUARTERS OFFICES

7755 East Marginal Way, Seattle, Washington 98124



The recently announced 737E, corporate version of the new Model 737 short-range jetliner, will bring jet efficiency and economy to corporate business travel. The 737E is designed to serve business and industry in a variety of roles, including: a business jet for executive travel worldwide; a trouble-shooting airplane to carry teams of specialists and equipment to meet emergency situations, and a jet-speed meetinghouse or showroom in which business discussions may be conducted or displays or sales shows held. The 737E has 600 cubic feet of cargo space for passenger baggage and for display or show material stowage.

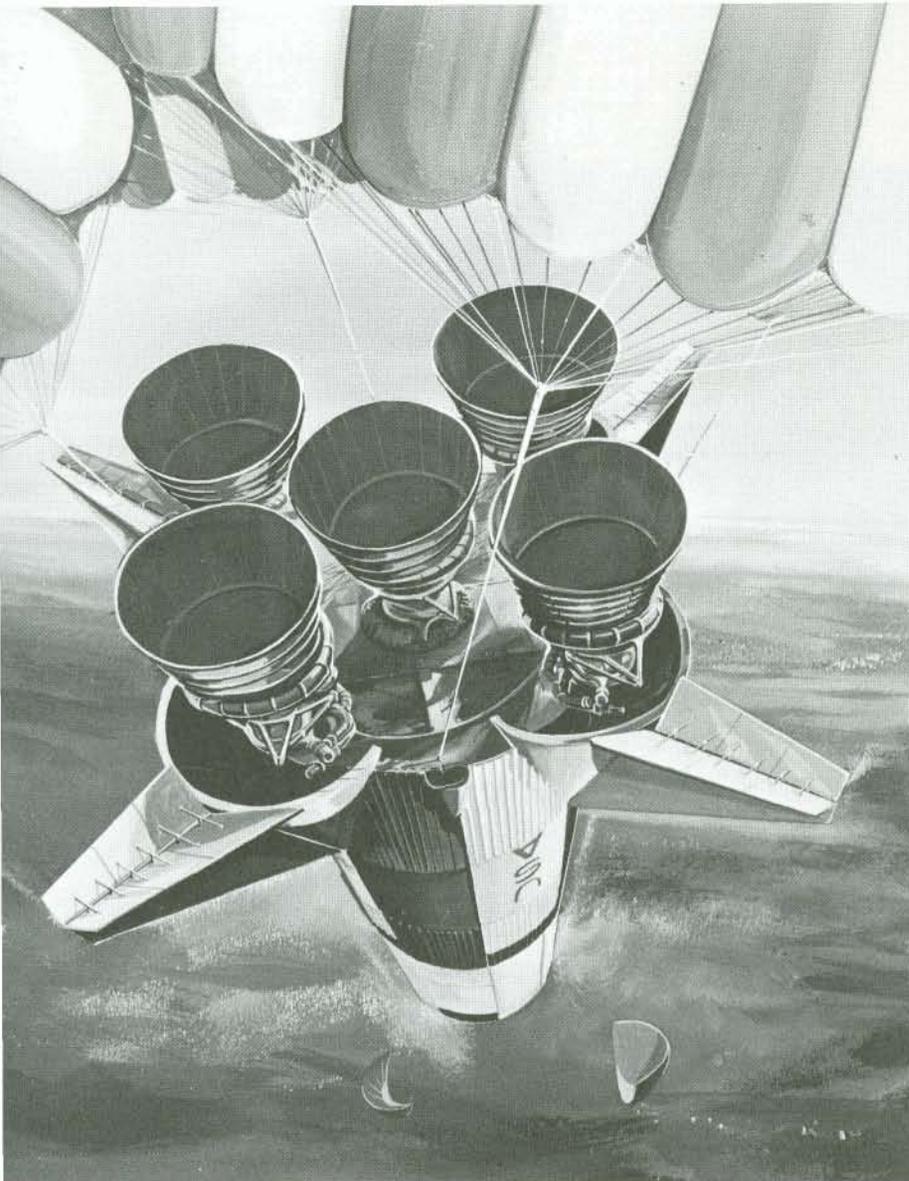
The Department of Defense has notified the Boeing Vertol Division to accelerate the U. S. Marine Corps CH-46A Sea Knight helicopter production schedule by 100 per cent over the previously planned production rate.

Airlines placing orders for Boeing jetliners in recent weeks included Eastern Air Lines, five 727QCs; American Airlines, twenty-seven 707-120Bs, eight -320Cs, five 727-100s and twenty-two 727-200s; Wardair Canada Ltd., one 727-100; Flying Tiger Line, one -320C; Mexicana Airlines, two 727-100s and two 737-100s, and Pan American World Airways, six -320Bs and six 727-100s.

The 727 jetliner with new automatic or manual approach systems has received United States Federal Aviation Agency approval to make landing approaches in Category II conditions, which are defined as 100-foot ceiling and 1,300-foot forward visibility. Category I limits, under which the airlines currently operate, are 200-foot ceiling and one-half-mile visibility. Earlier this year a Boeing-Bendix automatic approach and landing system received certification for use in the Boeing 720B for Category II approaches—the first such system to be granted FAA approval.

Certification of the 727 approves this airplane's ability to operate at these new minimums. Operation in regular airline service is contingent upon airline flight crews demonstrating proficiency in use of the systems. In addition, airport ground facilities where the new minimums will apply must meet certain FAA requirements.





Drawing shows a burned-out first-stage booster.

By WILLIAM CLOTHIER

CAPE KENNEDY, Fla.—It is 1967 and launch time for the first complete system test of Saturn V, the mammoth three-stage National Aeronautics and Space Administration's rocket designed to place man on the moon.

As the countdown reaches zero, instruments in the blockhouse control room confirm a successful lift-off as the five engines on the S-1C booster thunderously ignite and the 35-story-high rocket blazes from the starting blocks, driven by 7½ million pounds of thrust.

Some 2½ minutes later, at an altitude of about 40 miles, the first stage—the S-1C portion of the three-stage space cruiser—finishes gulping the last of 2,200 tons of fuel and is separated from the rest of the rocket as the second stage fires and continues driving the payload into orbit.

The burned-out first stage, 33 feet in diameter and 140 feet long, is still coasting toward apogee, but at this point the huge tube is finished—a dehydrated derelict fit only for junk unless some means is found to bring it back to earth in a reusable condition.

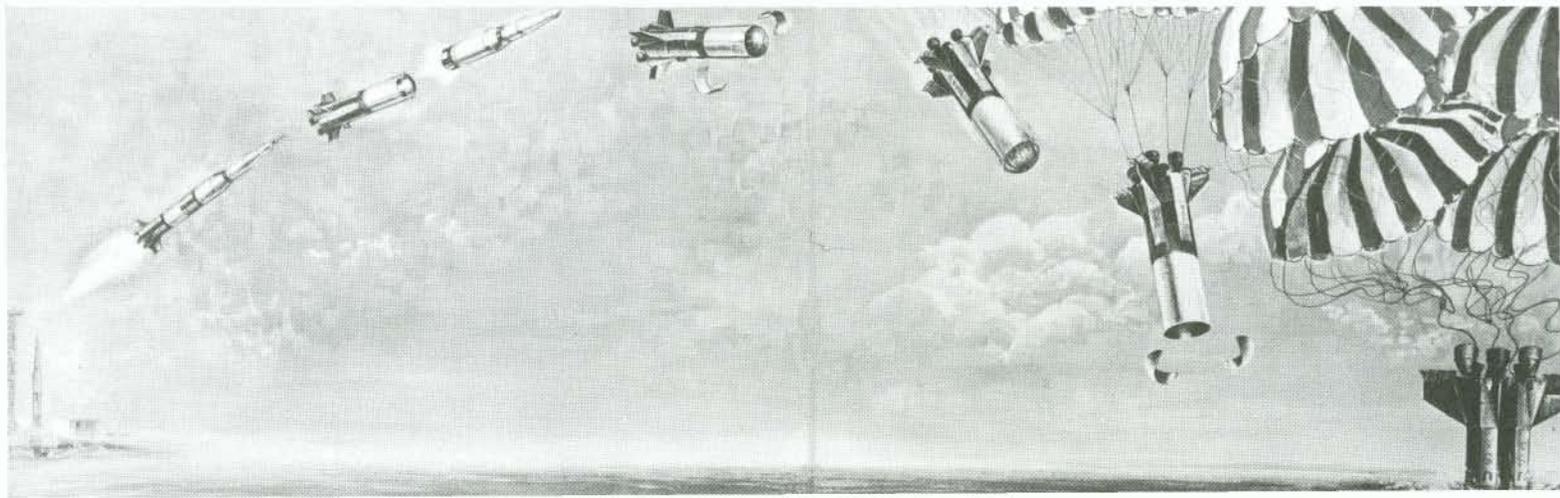
Though the heavy load of fuel is gone the booster still weighs nearly 175 tons and is streaking along at more than a mile and a half per second. It will drop into the Atlantic ocean.

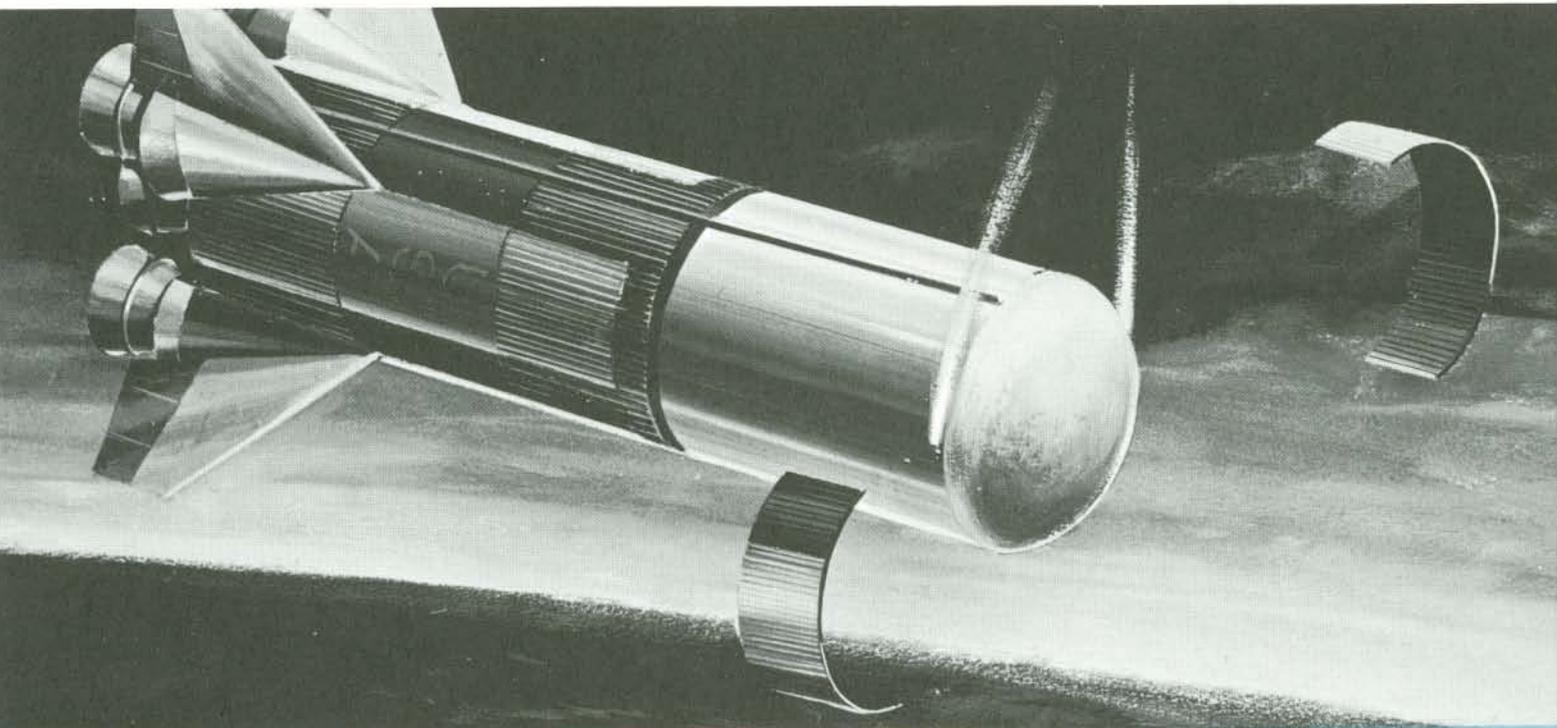
This launch sequence could be the story for the first ten Saturn V firings, but things may change after that. Boeing's Space Division has just completed a \$200,000 study of S-1C recovery and reusability

Big rockets can be saved by

THE SOFT SPLASH

At 31,000 feet altitude four six-foot pilot parachutes open, followed by four 45-foot parachutes at 29,600 feet and four 120-foot parachutes at 15,000 feet.





As booster descends into atmosphere, oxygen-tank pressure is increased to improve rigidity, forward skirt is jettisoned and reaction controls orient booster.

for the National Aeronautics and Space Administration's Marshall Space Flight Center. According to Benson Hamlin, Boeing's Project Manager for the study, recovery is possible and economically feasible.

Data obtained during the first phase of the study indicated that very few of the several types of reusable launch systems analyzed were feasible. A number of concepts were investigated, including a fixed-wing system, parachutes, hydrogen balloons, drag brakes, ballutes (part balloons and part parachutes), para vulcoons and flexirotors (parachute-like devices which spin like helicopter blades).

The first phase weeded out many of the concepts and indicated that detailed feasibility and cost effectiveness studies should be made of two systems — aerial retrieval and water impact.

The concept which was the sim-

plest, lightest, with less development risk and offering the greatest savings with the least investment of time and money was the water-impact system. Certain technological aspects of some of the other systems would require significant advancements in the present state-of-the-art, says Hamlin.

"It's like the old saw about learning to crawl before you walk, learning to walk before you run, and so forth," Hamlin points out. "Some day the fixed-wing concept probably will take over for booster recovery systems, but that day is a long way off. Our studies showed that it would take 228 fixed-wing launches before a break-even point on costs, and at present usage rates there's no market for such a sophisticated system.

"Meanwhile, we have a very real need for an economical method to recover and reuse our big boosters.

Right now they're expended but they are too expensive to keep throwing away."

During a 10-year period of 60 launches, the total savings available by recovering the S-1C by the water-impact method would amount to more than half a billion dollars.

Recovery of the S-1C stage as proposed by Boeing would begin immediately after separation. A nose-first attitude for hypersonic re-entry is provided for by reaction control units from stage separation until aerodynamic forces are sufficient to provide stability.

Dive brakes would open at apogee and lock in a fixed 45-degree angle, providing increased drag and improved stability during re-entry. Deceleration during re-entry is provided for by the stabilized booster itself. The forward liquid oxygen tank dome would be thermally protected with ablative material and

would act as a protective heat shield for re-entry.

A launching and recovery would proceed like this:

At 32,000 feet the booster reaches sonic velocity. At 31,000 feet and a velocity of 928 feet per second, four pilot chutes, six feet in diameter, are deployed. At 29,600 feet, four drogue chutes, 45 feet in diameter, are deployed by the pilot chutes. At 15,000 feet, four main parachutes, 120 feet in diameter, are deployed.

At about 500 feet, the liquid-oxygen tank dome is jettisoned by explosive means and vent holes are blown in the rear of the tank. The booster impacts the water at about 100 feet per second. With the dome gone and the vent holes open, the tank acts as a pneumatic shock absorber on impact, reducing impact load and booster tumbling problems. The booster floats vertically with the nose up. The booster is picked up by a ship (Landing Ship Dock) standing by in the impact area.

Special epoxy paint and resin may be used to protect the booster from corrosion in the salt water for 15 days after impact. The Boeing study assumes that the booster will

be retrieved from the water in less than 15 hours.

Some booster components such as switches or gages will require replacement, but most of the electrical and electronic gear can be satisfactorily refurbished by flushing with fresh water and drying with alcohol, according to the Boeing study. Damage from salt water corrosion will be minimal with the recommended environmental protection measures.

If the water-impact recovery system were adopted for a 10-year firing schedule with a launch every two months, 14 boosters would be required instead of 60. The study shows that the average number of firings per booster would be slightly more than four.

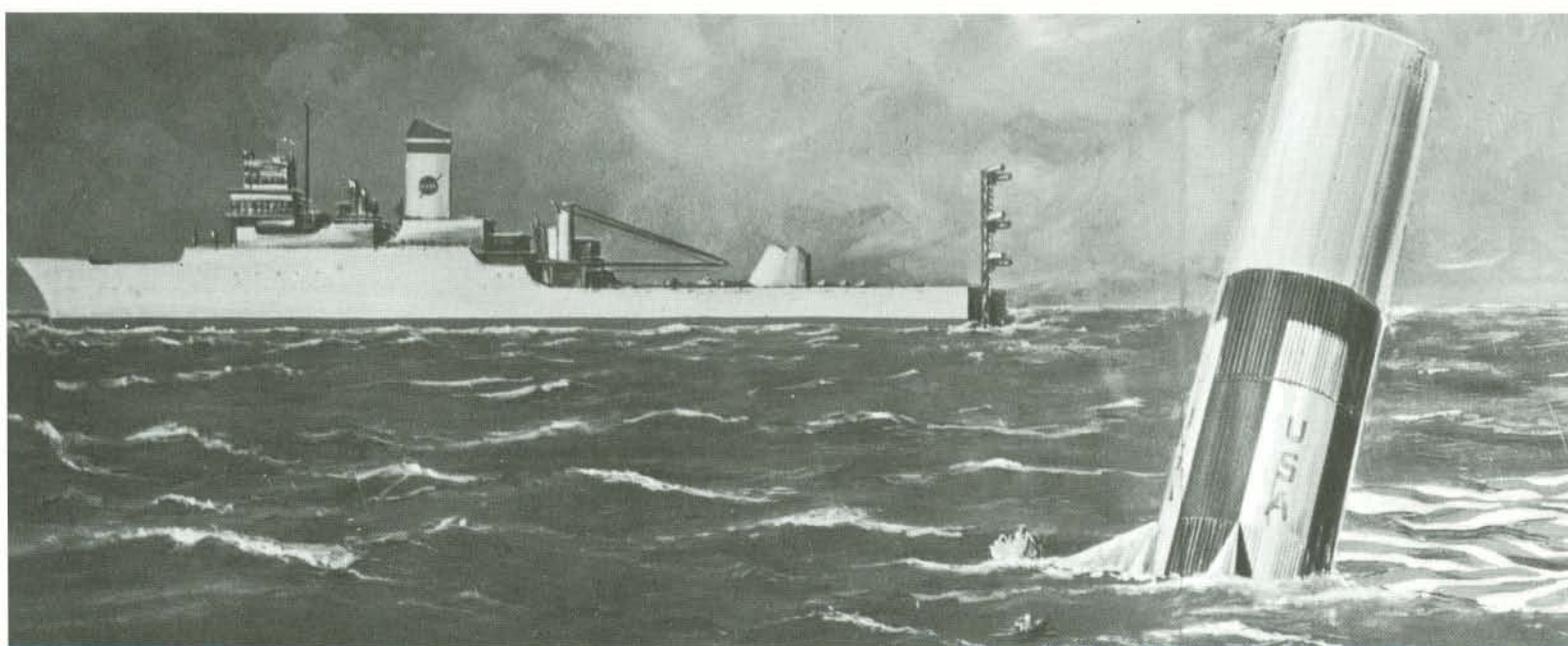
Hamlin points out that the conclusions of the study are ultra-conservative. "For example," he says, "our study assumed that each booster recovered would be refurbished and put on a five-month test program, including static firing — the same as for a brand new booster — at an expense of about 2½ million dollars. We also assumed each booster would be on the pad for three months being readied for launch. Realistically, we would ex-

pect considerable reduction in these time schedules — perhaps down to six to eight weeks — since the booster already would have proved it could fly."

The water-impact recovery system requires minimal changes in the booster. Total weight of the booster recovery system is 48,700 pounds, including four enlarged fins, a reaction control unit and four parachute systems.

The economics for adoption of a reusable launch system are compelling. A cheap, throwaway booster might be the answer, but the very nature of the mighty machines makes this a remote possibility. The technology is demanding and expensive. Economic shortcuts of the magnitude needed for big booster throwaways are not expected in design or fabrication.

"At this point in time the water-impact recovery system is the best buy among the several recovery systems studied," says Hamlin. "It is the least expensive, the most reliable and is well within our technical capabilities. Research and development costs are very low and approximately 40 per cent of S-1C costs can be saved during a 60-launch, 10-year program." ←



After water halts descent, the booster rotates slowly to engine-down position, attains stable buoyancy and is picked up by ship.

New 727s will provide jet speed in

FRONTIERLAND, U.S.A.

By ROBERT NEPRUD

THE 11-state western area criss-crossed by Frontier Airlines routes and known unofficially as "Frontierland" still is cowboy-and-Indian country, liberally seasoned with such urbane centers as Denver and Salt Lake City.

The Denver-based regional carrier, one of the country's largest and liveliest, rides herd over a territory that takes in the Rocky Mountain states, most of the Southwest and much of the Plains Region. Eastern terminus of the airline is Kansas City, Missouri, famous for steaks and stockyards.

Quick-on-the-draw Frontier rates as one of the fastest-growing airlines in the business. Because the 30 per cent of the United States it serves contains a scant two per cent

of the nation's population, the airline must be aggressive, efficient and friendly to fill the seats of the prop-jets and piston aircraft it currently operates.

The task will grow larger in the spring of 1967 when the first of five recently-ordered Boeing 727s goes to work in the gold and green colors of the Frontier stable. But if the airline's traffic growth continues, there's an excellent possibility that the carrier will pick up its option on five additional aircraft.

In a bid to attract more passengers, Frontier reaches far beyond its home area. The airline has been especially active since the summer of 1962 and has come up with a variety of low-cost air fares and special travel plans.

One of the favorites is a youth

fare, whereby a traveler under 22 can flash a Frontier Airlines identification card and pick up his ticket at a 40 per cent discount.

Then there's the liberal Frontier family plan that enables a man to purchase his wife's ticket for half-fare and allows all accompanying small-fry to be ticketed at one-quarter of the regular tab. Good seven days a week the year around, the family fare has proved popular.

More recently, the airline came up with a \$100 special that provides 30 days of unlimited first-class travel anywhere in Frontierland. There's just one catch. To be eligible, a traveler must reside in a West Coast state, east of the Mississippi River or outside the Continental United States.

The usual discounts for members

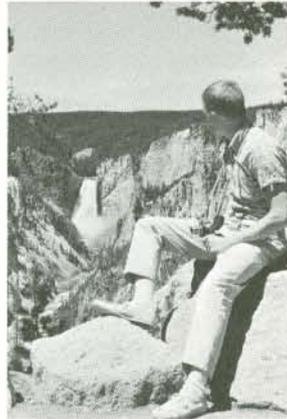
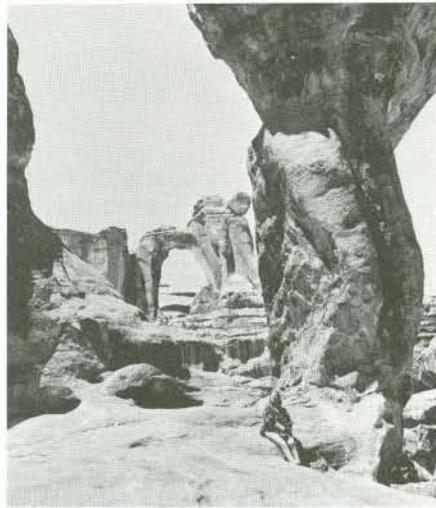
John MacDonald

Drawing shows how 727 will look in Frontier markings.



Right: Canyonlands and Yellowstone national parks are two of many tourist areas served by Frontier.

Below: Lewis W. Dymond, Frontier's president, also has a captain's rating.



of the military forces and clergymen also are offered.

End result of these special fares and promotions, including low-cost, all-expense tour packages to such places as Yellowstone Park, Mount Rushmore, Carlsbad Caverns and the Grand Canyon, has been a spectacular jump in passenger traffic.

In 1963, Frontier Airlines led the entire industry with a 51 per cent increase in passenger miles flown, with 153,602,000 counted. It also registered a 44 per cent growth in the number of passengers carried—up to 540,774. In 1964, passenger miles climbed to 187,575,000 and passengers to 635,370. So far in 1965, the traffic trend is continuing upward and the airline is reporting record profits.

Frontier's cargo traffic has set new marks in recent years. Between 1961 and 1964, air freight ton-miles increased by 82 per cent to 1,444,068. An innovation that is catching on with businessmen is the new

courier service. Under the plan, packages weighing up to five pounds are flown to any city on the carrier's 11-state system for a flat charge of \$3.

Frontier is a comparatively young airline. It dates back to the spring of 1950 when three small companies—Monarch Airlines, Arizona Airways and Challenger Airlines—were merged to provide one-carrier through service, north-south between Canada and the Mexican border. The system served seven states in the Southwest and Rocky Mountain regions.

Steady growth in Stateside tourism, along with extensive oil, natural gas and uranium development and considerable activity in the construction of military missile sites and reclamation dam projects, have combined to keep the airline on the move since its inception. Route increases in 1954 and 1958 added four new states and many more cities.

The airline has kept pace with progress in the matter of equipment. It added Convair 340s to its twin-engine fleet in 1959 and purchased 52-passenger Convair 580 turbo-prop airliners in 1964.

Close on the heels of its recent 727 purchase, Frontier announced plans to expand hangar, maintenance, training, general office and reservations facilities at Denver's Stapleton International Airport. Biggest single project is a six-bay hangar tailored specifically for the Boeing trijets.

Top man at Frontier is Lewis W. Dymond, a dynamic and intensely human person who plays to win and seems to have a fine time.

"He even enjoys crises," marveled the late G. T. Baker, his former boss at National Airlines, where Dymond headed operations and maintenance before taking over the reins at Frontier in 1962.

Dymond got into the airline business fresh out of high school in St. Petersburg, Florida, taking a \$50-a-month job as an airplane cleaner for National. He studied on the side and climbed rapidly, moving to stock clerk, to flight dispatcher and to station manager.

He also earned a commercial-pilot rating, qualified as a co-pilot on test hops, and went on to get his captain's rating. Then, at the ripe age of 32, Dymond decided to go to college. He worked by day and attended classes at the University of Miami by night, graduating with honors and a law degree. He stayed with National and in 1957 became a vice-president.

As Frontier's president and chairman of the board, Dymond has become an integral part of Frontierland. Not only does he know every route-foot covered by the airline; he is personally acquainted with just about every employee.

Dymond also is very much at home on horseback, on skis, angling for trout or—according to unconfirmed reports—milking a cow. Among his many civic and business affiliations, he especially prizes an honorary membership in the Crow Indian tribe. That's understandable—the chief of Frontierland certainly should be entitled to wear a feather in his hat. ←

By JACK WECKER

EARLY one Saturday morning in September, 33-year-old Maj. Max Mihura throttled back the eight turbojet engines on his B-52 and whistled into Fairchild Air Force Base, Washington, scene of the 1965 Strategic Air Command Bombing-Navigation Competition. On the left side of the big global bomber's fuselage was a map of the sovereign state of Mississippi with a star designating the location of Columbus AFB. As the 454th Bombardment Wing entry taxied into its parking position, a rival crewman nearby (obviously a northerner) mumbled, "Now, isn't that original! That B-52 from Mississippi is named *Miss Magnolia*." What this Yankee competitor didn't (and couldn't) know then was that this B-52F from the deep,

deep south was destined to ride roughshod over his entry and all 42 others in this four-day competition that pits SAC's best-against-the-best in men and equipment.

As the contest unfolded, events came to light which showed that the *Miss Magnolia* outfit had a number of things working in its favor:

—the six-man crew, Capt. Richard Helmer, co-pilot; Maj. Chester Godsy, radar navigator; Capt. William King, electronics warfare officer; Maj. Richard Agolia, navigator; M/Sgt. Samuel Taulbee, gunner; and Major Mihura, aircraft commander, are career Air Force men and have a total of some 16,000 hours B-52 time

—their work week averaged 74 hours, plenty of time to get familiar with the equipment

—the 454th is part of Second Air

Force which has won the coveted Fairchild Trophy (symbolic of outstanding unit skill in bombing and navigation) six times—more than any other of SAC's numbered Air Forces

—their global bomber was christened only nine days before by Miss Mississippi (Patsy Puckett) who, that very night (September 11), was named first runner-up in the annual Miss America pageant; the southern beauty personally bade them to "do well, you all"

—the men aboard had developed a camaraderie stemming from bombing raids in South Vietnam and from having flown together five years.

—the 454th was flying Boeing bombers which have been in the winner's circle 10 of 13 times during previous competitions

—they were carrying a Confed-

erate flag as a good luck charm —their wing commander, Col. William T. Cumiskey, had instilled firmly these words in the minds of the crew: "Victory begins with a man's will to win."

In all, approximately 1,500 SAC-men participated in the 1965 competition—flying and maintaining a total of thirty-seven B-52s, five B-47s and two B-58s (since aerial refueling was not a part of this year's meet, tanker aircraft were not involved). Each bomber was to fly two identical sorties on separate nights over a 2,500-mile route at low and extremely high altitudes.

They were taking part in an event referred to as the World Series of bombing and navigation. An air of urgency permeated the entire meet.

Even the weather—complete with rain, unseasonal temperature drops and an unforecast line of

thunderstorms—added realism to the 1965 competition. The elements brought particular headaches for the maintenance crews, such as the 454's S/Sgt. Clifton Johnson, crew chief; T/Sgt. Ted Burton, armament and electronics crew chief—and 86 of their counterparts in other wings—who were responsible for keeping airplanes and equipment operating at top efficiency.

Miss Magnolia built a score of 1,226 points which, broken down, meant 1,006.5 for bombing, 119.5 for high-altitude navigation and 100 (perfect score) for low-altitude navigation. The effort, eclipsing runner-up Wurtsmith AFB's 379th Bombardment Wing, was good enough to win the Fairchild Trophy, best bombing and navigation by a B-52 wing, best overall organization in bombing and best B-52 crew on bombing for both

missions.

Trophies for the best combined bombing and navigation by a B-47 unit, best B-47 crew in bombing for both missions and best B-47 crew in bombing for one sortie went to the 380th Strategic Aerospace Wing's *Pride of Adirondacks*, Plattsburgh AFB, New York. The 305th Bombardment Wing, Bunker Hill AFB, Indiana, won awards for the best bombing and navigation by a B-58 unit, for the best overall wing in navigation, best B-58 crew in bombing and navigation for one mission and best crew in bombing and in navigation on both flights.

Others sharing the winners' spotlight were the 509th Bombardment Wing, Pease AFB, New Hampshire, for best B-47 crew in navigation for both sorties and the 379th Bombardment Wing, Wurtsmith AFB, Michigan, for best B-52 crew in navigation for the two missions.

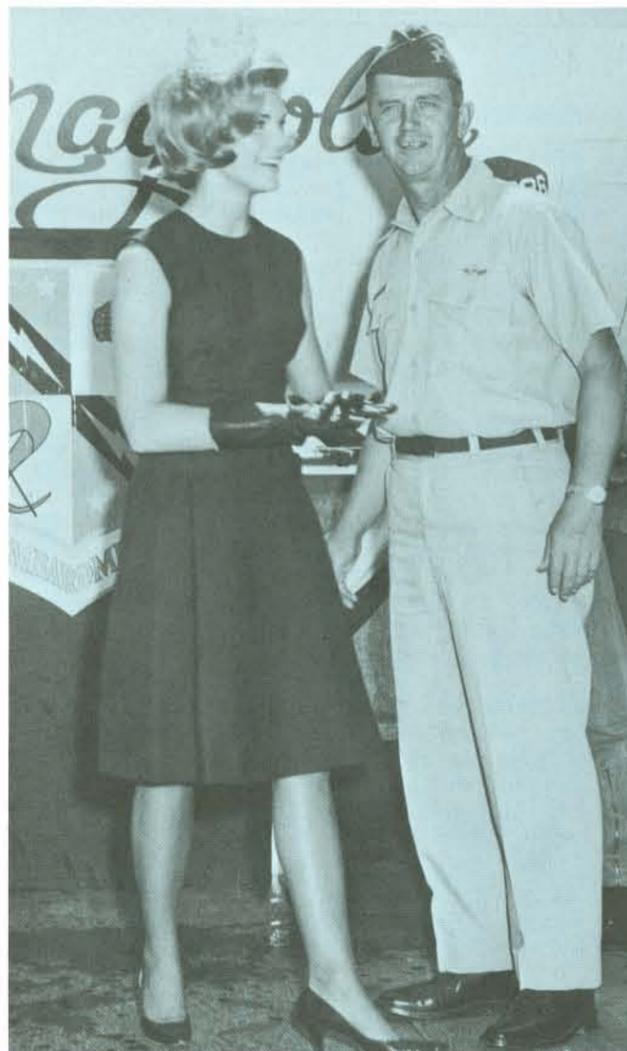
A heart-winning performance came from the 28th Bombardment Wing of Ellsworth AFB, South Dakota, which scored a near-perfect single mission of 698.5 points out of a possible 750, making two direct hits. Their contribution was good enough to take top honors for the best B-52 crew in bombing and navigation for a single mission.

Awards to the winners were handed out personally by smiling Gen. John D. Ryan, SAC's commander-in-chief, during an impressive ceremony in the competition auditorium. If any man enjoyed his work more than General Ryan that Friday afternoon, it was not apparent.

In brief remarks to a standing-room crowd, General Ryan lauded the efforts of all competitors in the meet. He said scores in the 1965 event were the best ever recorded. He singled out especially the ground-maintenance crews for their contributions to success of SAC's operations generally and the competition in particular.

After the meet was ended and *Miss Magnolia* carried the winners back to their home base in Mississippi, they were greeted by a sign surrounded by grinning friends. The sign read, "Can do. Will do. Have Done." ←

Patsy Puckett (Miss Mississippi) and Colonel Cumiskey officiate at christening of Miss Magnolia.



Strategic Air Command holds its 14th bombing competition.

HER NAME IS MISS MAGNOLIA

SAC generals at competition included (from left) W. K. Martin, David Wade, John D. Ryan and Horace M. Wade.



This competition aircraft had been in action over Vietnam.



Lt. Col. Earl W. Spencer (left) accepts trophy for 922nd Air Refueling Squadron. Col. Mason A. Dula is in center. Gen. John D. Ryan stands at right.



New system provides

ALIGNMENT FOR TALL TOOLS

By WESLEY ROBINSON

A UNIQUE vertical alignment system which allows the top of a structure to be easily and precisely aligned with all points at its base has been developed by Boeing engineers.

The new system eliminates disadvantages of conventional vertical alignment methods, which require scaffolding to hold a man and a level at the top of the structure.

Boeing's new system permits a single operator on the ground to sight across the top of a vertical structure. The Boeing system does not depend on a level base plane and is not sensitive to vibration. It has been tested successfully at heights up to 20 feet and should perform equally well for taller structures.

Heart of the new system is a specially-ground pentaprism which is propelled up and down on a vertical beam by remote control. When the five-sided prism reaches the desired height, the operator at ground level sights through a two-directional telescope to which is attached a movable right angle prism. The operator can see along the top of the structure as if he were looking through a periscope.

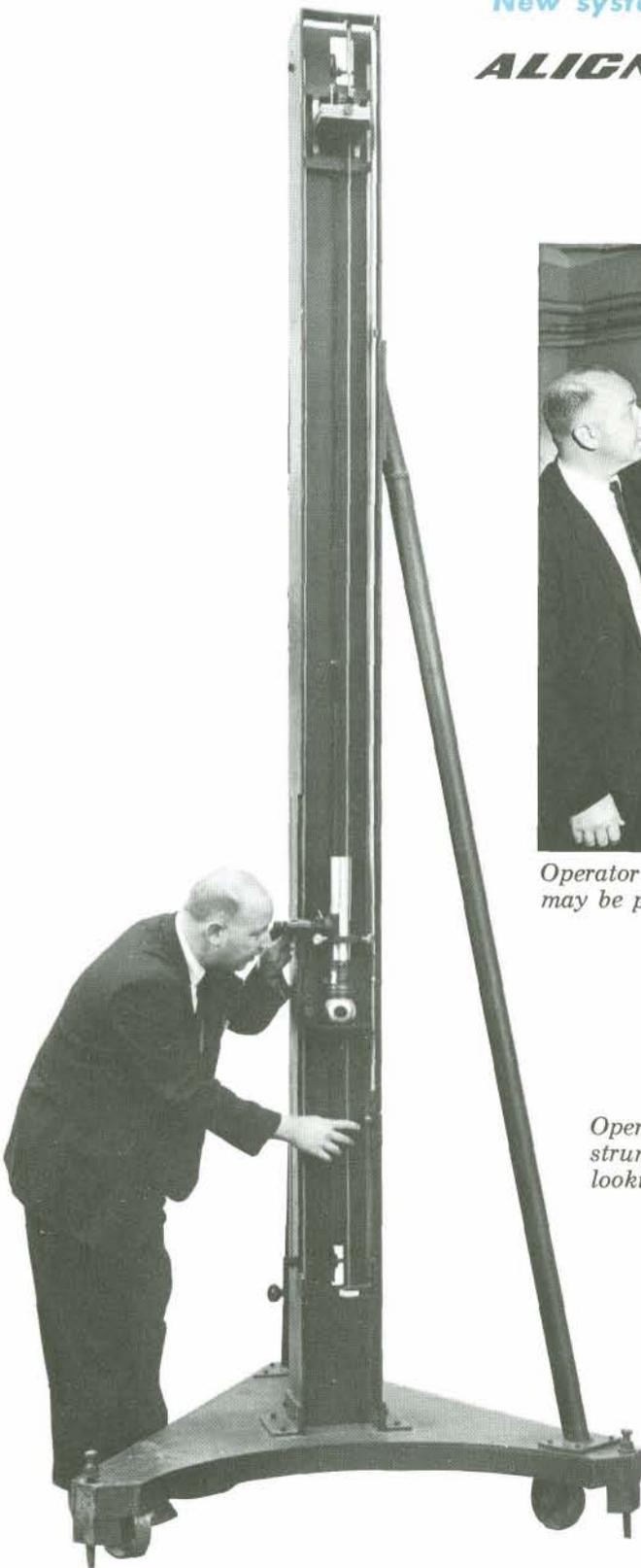
The angle of the pentaprism may be changed by remote control if the operator wishes, and the pentaprism may be rotated to obtain a reading completely around the structure.

Other optical tooling instruments developed by Boeing include an optical square which gives three simultaneous perpendicular lines of sight, a transverse planizer which can establish perpendicular lines to a horizontal plane and a long-distance horizontal alignment system.

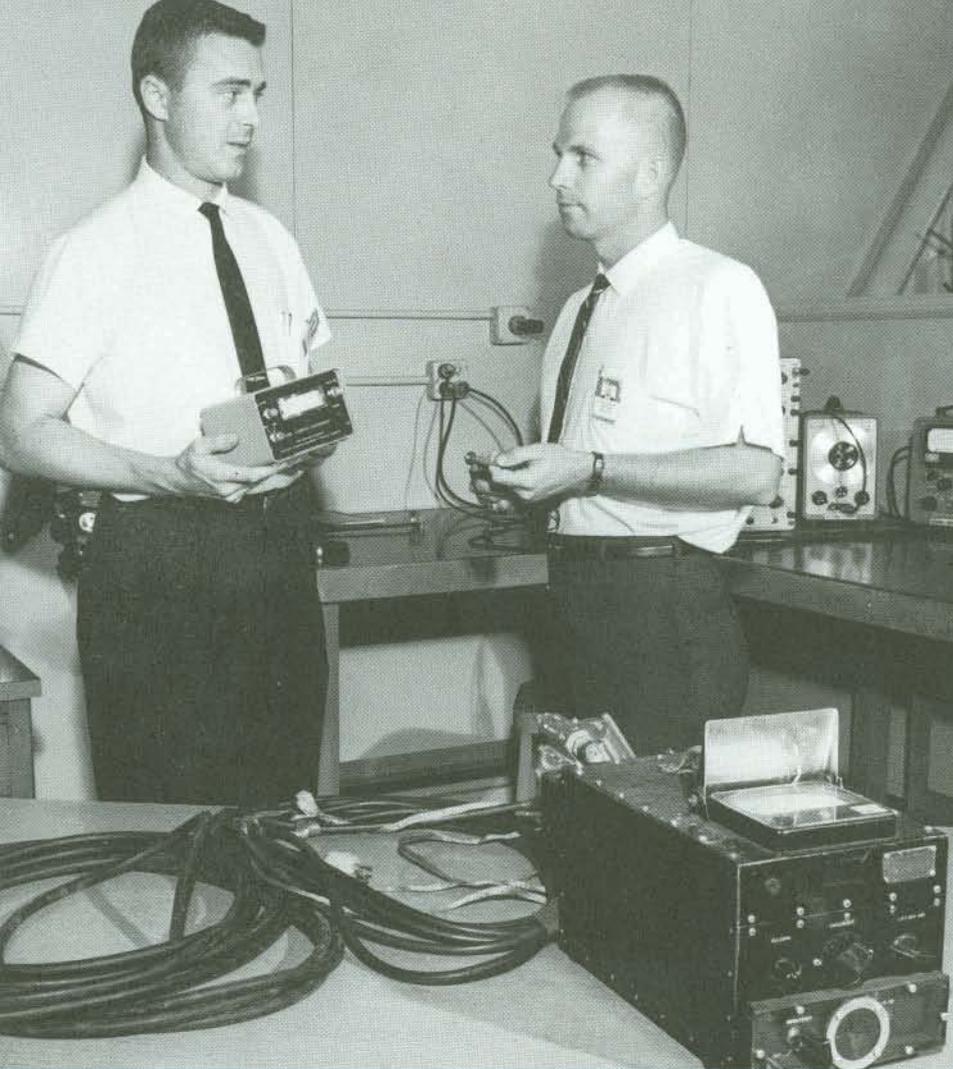
Tolerances are getting slimmer while aircraft and missiles grow bigger. Advanced optical alignment is one way of ensuring that tighter tolerances will be achieved. 



Operator adjusts instrument which may be propelled up and down beam.



Operator can see through instrument at top as if he were looking through a periscope.



Small hand-held instrument does more jobs than large instrument on table.

Eddy current tester is

BETTER AND 9 TIMES SMALLER

By DARRELL BARTEE

AN aerospace test instrument approximately 100 times more sensitive than the unit it replaces has been invented at the Wichita Branch of Boeing's Military Airplane Division.

The device, an eddy-current tester, is one of the most widely used electrical instruments in aircraft in-

spection work, both in production and maintenance. It helps to determine the soundness of aircraft metals as well as the condition of components and surfaces after they have been in service. It can measure the thickness of paint, film and plating, and can gauge hardness as well as conductivity.

Often an eddy-current tester must be taken into small places. The

ideal instrument would be mobile, compact, lightweight, safe, accurate, and capable of a wide range of measurements. These are exactly the specifications of the new device. It is transistorized, self-contained, battery-operated, measures four by five by seven inches and weighs about four pounds. It is approximately 17 times lighter and one-ninth the size of previous units.

Eddy-current testing employs the familiar principle of measuring resistance in a magnetic field. A powered coil adjacent to material being tested is subject to a secondary or induced (eddy) current. The nature of the eddy current can indicate characteristics of the material.

The new instrument has capacity sufficient to replace six old-style models. Frequency ranges from 100 to 100,000 cycles are available via plug-in modules stored within. Quick changes of these modules are made in the quality-control laboratory. An expanded read-out dial has been added.

Old-model eddy-current testers weighed up to 70 pounds and were trailed by long lengths of power cable. They also required compressed air lines because the high voltages, in situations where airplane fuel vapors were present, created fire hazards and the testers needed their own supply of vapor-free air.

Almost all this inconvenience now can be eliminated. The improved tester has only a few feet of light wire attached, with a coil probe at the end. Bolt-hole probes can be attached with adapters.

Wichita designers used only standard types of electrical circuits and elements, but combined them to achieve maximum usefulness. Measurements of less than .001 inches can be made.

In quantity, the new testers can be produced for about \$300 each. Old-type models cost up to \$750. Designers of the new device believe that its all-purpose, self-contained features offer advantages to the whole field of eddy-current testing. Possibilities are being evaluated by Boeing's Associated Products unit.

Air National Guards call their hybrid KC-97s

INSTANT JET TANKERS

By MAJ. PHILIP E. GUNBY

THEY pretty much are used to it, but Air National Guard crews of the 126th Air Refueling Wing still exchange knowing smiles when air route traffic control centers ask confirmation that their aircraft is, indeed, a Boeing KC-97 Stratotanker.

"The reason," explains Brig. Gen. Howard T. Markey, wing commander, "is that it seems to be moving along too fast for a '97."

The increased speed results from addition of two jet engines which are helping to write new performance chapters in the long service record of the tried-and-true Boeing '97 series.

KC-97s and Air Guardsmen first got together in 1961. The 126th Wing traces its history in some respects at least to World War I, and its Guardsmen have served in single and multi-engine aircraft. But in-flight refueling was a new mission for them—and for the entire Air National Guard.

On September 6, 1961, just 29 days after receiving the first stripped-down Stratotanker, the wing's 108th Air Refueling Squadron from O'Hare International Airport near Chicago made the first all-Air National Guard in-flight wet refueling hook-up with an F-84F Thunderstreak jet fighter-bomber from Peoria, Illinois.

Since then, the wing has off-loaded more than 22,000,000 pounds of fuel without an accident.

Wing headquarters and its 126th Air Refueling Group are at O'Hare International. The 128th Air Refueling Group is at Gen. Billy Mitchell Field, Milwaukee, and the 160th Air Refueling Group is at Clinton County Air Force Base near Wilmington in southwest Ohio.

From these bases, Air Guardsmen of the 126th Wing have ranged over both Atlantic and Pacific,

much of the continental United States, Canada, Puerto Rico and Alaska, to do their refueling job.

Subsequently, a second Air National Guard refueling wing, with headquarters at Dallas, Texas, has been formed.

During this time, it became obvious to Maj. Gen. Donald J. Smith, Illinois Air Guard chief of staff, and others that the standard KC-97G, 11th and final model of the series, had speed and altitude limitations when refueling newer Century Series jet fighters.

Tobogganing (putting the KC-97G in a slight dive) frequently was required to gain required refueling speeds. This could result in descent into weather, limiting hook-ups and requiring additional fuel for jets being refueled to climb back to cruise altitude. Reduced takeoff fuel weights were required at times, so that more tankers were needed to meet mission demands.

Maj. Gen. Donald J. Smith



Learning that a KC-97G had been fitted with a wing from a Boeing KB-50J tanker after an accident, General Smith reasoned that, with wings so interchangeable, it might be possible to add GE J47-25 and 25A jet engines to the KC-97G. This had been done earlier on the KB-50.

With support from the National Guard Bureau and Tactical Air Command of the United States Air Force, the jet-augmented KC-97L was born.

Fuel tank pylons of the KC-97G were replaced with jet-engine pylons made for the KB-50J, which was being phased-out, using the same outboard wing mounting points. The KB-50 radar rendezvous equipment also was added to the jet-modified KC-97. Hayes International Corp., Birmingham, Alabama, performed the modifications under contract with Oklahoma City Air Materiel Area. Cost averaged less than \$38,000 per plane.

The last of the 126th Wing's Stratotankers was modified in the fall of 1965. The KC-97L holds more fuel, even without its pylon tanks, than the KB-50, and the installed pylons and jet engines are 2,400 pounds lighter than full pylon fuel tanks.

"Reduced reciprocating engine power requirements because of the added jet thrust will extend reciprocating engine life, reduce overhauls and more than amortize the cost of this complete modification within the remaining life of the aircraft," General Smith says. "Labor is the only major cost item in this modification."

General Smith also notes these performance data: air refueling altitude increase of up to 10,000 feet over the standard KC-97G for any given takeoff weight; indicated airspeed increase of 50 knots over the standard KC-97G for any given takeoff weight and altitude in level



KC-97L has speed and altitude needed to refuel fighters.

Jet engines replace fuel tanks at same positions.

Brig. Gen. Howard T. Markey



flight; standard day takeoff roll decreased approximately one-half over standard KC-97G requirement for any given weight up to maximum gross; safety factor increased, especially in case of loss of a reciprocating engine on takeoff at maximum gross weight of 175,000 pounds, and critical high cylinder head temperature time to climb cut to 72 per cent of that required by a standard KC-97G.

"Lack of sufficient airspeed and airborne radar rendezvous equipment had limited the Stratotanker

for our mission, but now we are giving proper support in deployment of jets, including overseas," the general says.

General Markey has been briefing Air Force officials on the wing's resultant Flexible Air Refueling concept. This includes high and low level in-flight refueling, fly-in ground refueling for trucks and other equipment and supplementary missions such as air medical evacuation, transport of troops, carrying cargo and possibly even assistance in rescue operations by

circling and dropping equipment.

Involved in this, in addition to the KC-97L's short takeoff and landing capacity, is its ability to loiter at low level using just the four reciprocating engines, or to climb quickly and refuel high performance aircraft by using its two jets-four reciprocating configuration.

This versatility has earned the KC-97L a nickname in the 126th Air Refueling Wing. Air Guardsmen call it "The Instant Jet Tanker." 

ADVENTURES IN MANAGEMENT

BROAD-FIELD MAN

IN THIS DAY of specialization, Bill Cook is a nonconformist. Whether briefing an airline president on the sonic boom or reviewing the latest supersonic transport design, Cook can cross the lines of technology in a manner reminiscent of the days when men single-handedly designed, built and flew their own aircraft.

"For years Bill has stayed ahead in technology," says Maynard Pen-

nell, Boeing vice-president and supersonic transport program director. "He has played a major role in the development of numerous aircraft, including the B-17, B-29 and B-47 bombers, and the entire family of Boeing jetliners."

As assistant program director, Cook reports directly to Pennell and is in charge of technical development of the supersonic transport. Cook is a pilot and has a first-hand

understanding of piloting problems. This helps make Boeing airplanes easy to fly. His own plane is a Grumman Widgeon amphibian.

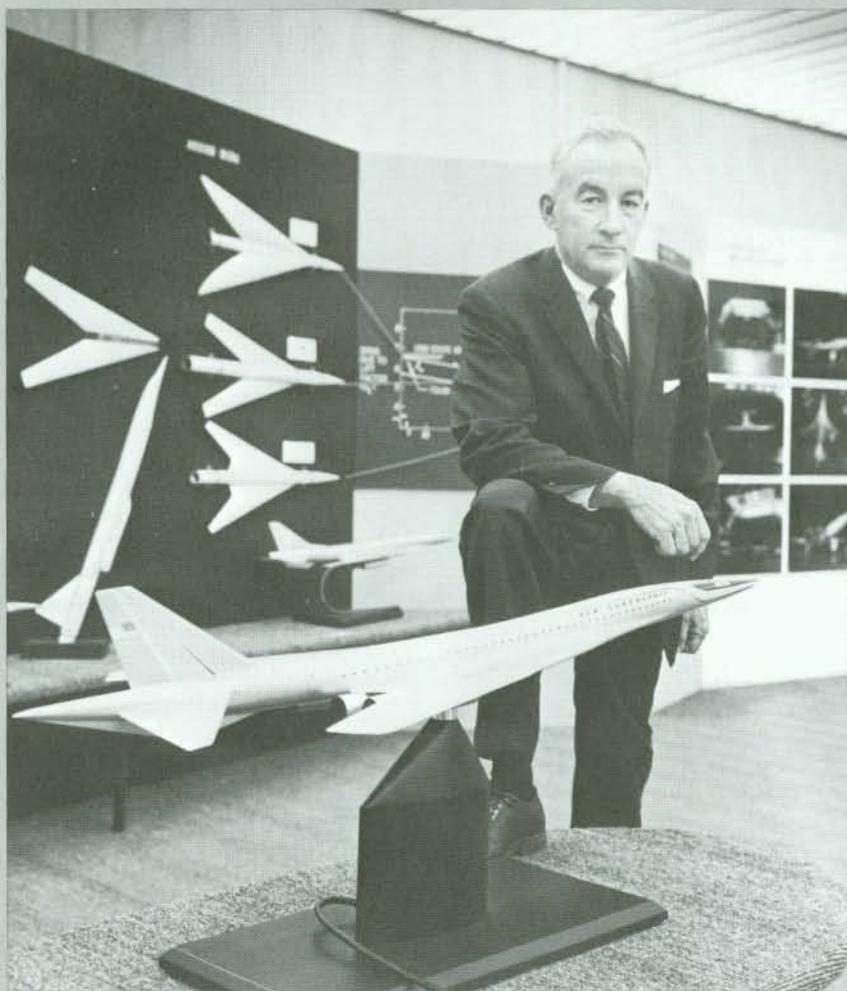
Cook is inventive and can be quiet and withdrawn when studying a problem or enthusiastically vocal when describing a solution. Although he constantly demands results, he gives those who work for him plenty of latitude.

Once during a flap over the B-17 someone asked, "How come everyone but Bill Cook is working?" Cook was sitting in his office staring at the ceiling. He wasn't interested in the B-17 problem because he knew it would be solved. He was thinking about the B-29, a new airplane, which was destined to play a major role in bringing World War II to an end.

Before joining the supersonic transport program, Cook was assistant director of engineering for the former Transport Division. He was one of those largely responsible for the idea of the 727 flap configuration, one of the outstanding features of this highly successful jetliner.

Born William Hough Cook Jr. in Plainview, Texas, on October 10, 1913, he spent his childhood years in Mexico, where his father was employed as a land scout for the Gulf Oil Company. The family later settled in New Jersey. Cook is married to the former Priscilla Osler, sister of the late Boeing test pilot, Scott Osler. They have three children, Tandy, Wyatt and Carrie.

Cook received a mechanical engineering degree from Rensselaer Polytechnic Institute and a master of science degree from the Massachusetts Institute of Technology before joining Boeing in 1938. He says that he came to Boeing for two reasons—he wanted to get back to the wide-open spaces and no one else offered him a job. 



Swedish Army announces two

NEW TURBINE-POWERED VEHICLES

By ALLEN HOBBS

THE Royal Swedish Army has announced the development of two new military vehicles which use Boeing gas turbine engines as boost power. The vehicles are a self-propelled 155mm gun and a fast-reacting, self-propelled anti-aircraft weapon equipped with two automatic 40mm guns.

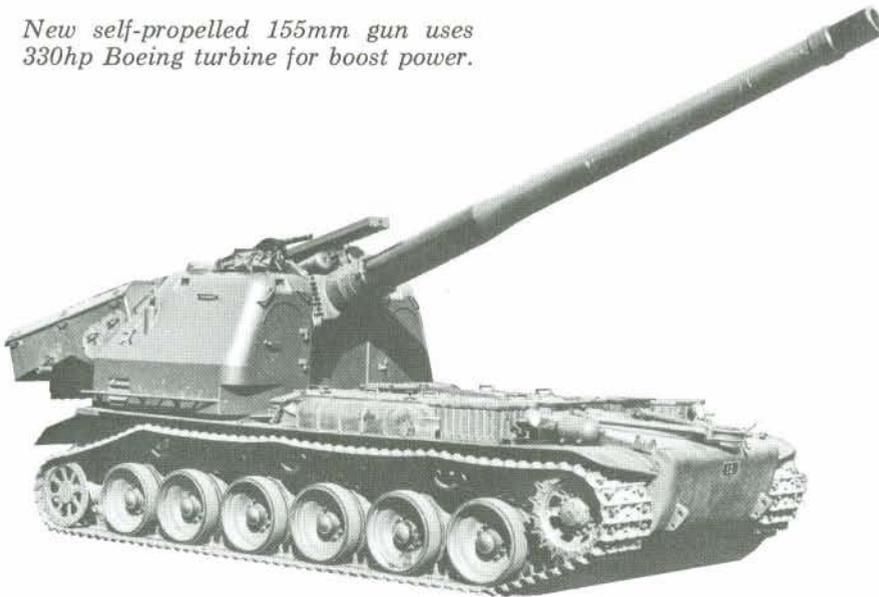
The Swedish Army already has in production a 37-ton tank that has dual powerplants—a 240-horsepower Rolls Royce multi-fuel reciprocating engine for cruise power and a 330-horsepower Boeing turbine engine to provide boost power for high-speed operation. This Swedish tank is an unique turret-

less design carrying a 105mm gun.

All three vehicles use the same twin powerplant package. Prime contractor for the three vehicles is AB Bofors, the leading Swedish armament manufacturer. AB Volvo is producing the powerplant and transmission package.

The new 155mm gun is a tracked vehicle that has entered production.

New self-propelled 155mm gun uses 330hp Boeing turbine for boost power.



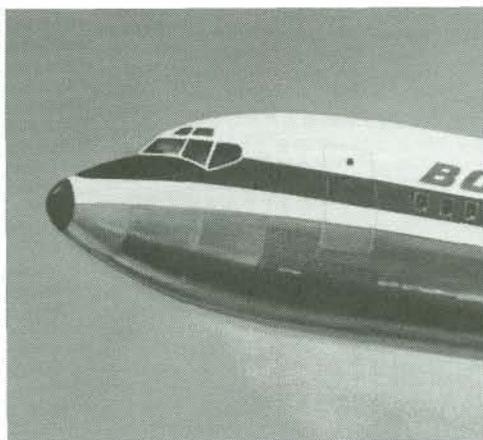
Anti-aircraft weapon has 40mm guns.

It weighs 48 tons and has good cross-country mobility, rapid-fire capability and can hurl 14 rounds in 45 seconds a distance of more than 13 miles (25 km). The vehicle is manned by a crew of four to seven men.

The 40mm anti-aircraft weapon is a tracked vehicle that has great mobility and high fire power and is equipped with radar and automatic tracking equipment. The vehicle's turret can rotate 360 degrees in 1.5 seconds. The 40mm guns can be used against targets on the ground as well as in the air.

The Boeing Company Turbine Division is producing Model 502 turbine engines for the three Swedish vehicles under a contract awarded in 1964. The Boeing engine was selected because of its high power-to-weight ratio, ability to start readily in sub-zero weather, compact size, reliability and ability to burn a variety of fuels.

In the drive package for all three vehicles, power from the reciprocating engine and Boeing gas turbine is fed into a single gear box through a combining gear. This allows the reciprocating engine alone, the turbine alone, or both engines together to power the vehicle. In cold weather the turbine can be used to start the reciprocating engine. ←



**This could be
a Boeing 707, 720, 727
or the new
Boeing 737 Twinjet.**



(Passengers on the 737 will notice the similarity in comfort, too.)

The newest member of the Boeing family of jetliners will be the smallest. Yet the 737's cabin will actually be as wide and as high as that of the biggest Boeing. It will offer passengers more shoulder room, more head room than any other short-range jet.

The 737 is designed to replace the turboprop and piston-type aircraft now serving smaller cities. A quiet,

quick-climbing jet, the 737 will be able to operate from smaller airports. It is, in addition, the only jetliner that will give passengers on short, smaller-city routes the same spacious cabin comfort enjoyed by passengers on long-range jets.

The 737 will cruise from 550 to 600 miles an hour. It will bring travelers the advantages of the unequalled flight

experience of Boeing jetliners: five and one-half million hours (627 years) in the air.

The first Boeing 737 is scheduled to roll out next year. Orders have already been placed by Caribair, Lufthansa, Mexicana, Pacific, United and Western.

BOEING 737