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Editor: CHESTER CHATFIELD
Managing Editor: KENNETH L. CALKINS
Associate Editor: DARRELL BARTEE (Wichita)
Art and Production Mgr.: KEITH KINSMAN
Staff Artists: ALDEN METCALF, BILL HARCUS

In This Issue

CONTRIBUTORS—Photo: U.S. Air Force (2); Jack Barkus (6, 7); National Aeronautics and Space Administration (8); Byron Wingett (10, 12); Paul Wagner (11); Vern Manion (13); Vern Rutledge (14); Art: Alden Metcalf (cover, 3, 4, 5, 12 and 15).

ON OUR COVER — The 71-foot *Tucumcari,* Boeing-designed Navy gunboat, cuts through an Asian sea in this artist's concept by Alden Metcalf. The boat, to be launched this summer, was named by the Navy for the town of Tucumcari, New Mexico.

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BRIEFING

He has experience in the Pentagon and is a command pilot; he has seen duty in Morocco, the Philippines, England and Okinawa. In short, Gen. Joseph J. Nazzaro, the new commander in chief of the Strategic Air Command, has Air Force know-how as he becomes the key figure in U.S. deterrent power. The new SAC chief has been quietly compiling an eventful military record since he graduated from the U.S. Military Academy in 1936. He is now 53, has been honored by six of the top decorations in the U.S. and Europe, and can recall 39 combat missions in World War 2. A native New Yorker, he has served at Air Force installations in 11 different states. Nazzaro learned to fly at Kelly Field, has served as deputy director of operations, U.S. Strategic Forces in Europe; successively commanded two bomb wings and two air divisions; became deputy commander of the 15th Air Force, and then commander of the 8th Air Force. After graduation from the Air Command and Staff school, Nazzaro was promptly named to the instructor staff. He went from that post to Washington, D.C. for duty in the war plans division, USAF headquarters. General Nazzaro has been at SAC headquarters since December, 1964, when he was named vice commander in chief.

When letters arrive here, those written on the letterhead of a customer or potential customer, get perhaps a little quicker reaction than notes scrawled on the backs of envelopes. (No offense, Abe.) All letters receive response but perhaps with a little more zip when the stationery reads, as a recent letterhead did, "Pacific International Airlines — USA, Tokyo, London, Paris, Hawaii. Headquarters: Albuquerque, New Mexico." The writer wanted a copy of *Boeing Magazine* and added this postscript: "Pacific International is not a real airline. I am a 17-year-old student and PIA is my hobby." The letter was signed by Dodd Gladden, PIA's president and chairman of the board. His request was filled and went out in the next mail. An airline is an airline. We don't differentiate.

A Missouri schoolteacher collects

CLASSICS FROM THE CLASSROOM

By HAROLD DUNN

DID YOU KNOW that the first lady aviator was Kitty Hawk? That Roger Wilco invented the "language of communication"? Or that one of the chief by-products of the aviation industry is going places?

This information has been gleaned from test papers and essays during the 11 years that I've taught elementary school youngsters.

Kitty Hawk and Roger Wilco may have their admirers but Baron von Richthofen, the German ace of World War 1, has also come in for his share of adulation. A 10-year-old girl summed up her feelings like this: "In a uniform or not, Baron von Richthofen was a dashing figure."

If history repeats itself, it usually does it with some unexpected twists when grade-school pupils tell the story:

"Spinning jennies were flying jennies that did not work."

"People talked about flying in balloons for centuries. Finally there was enough hot air to get them off the ground."

QUESTION: On his first flight, how long was Wilbur Wright in the air? ANSWER: I'm not sure. Five feet something with his shoes on.

One of the fringe benefits of being an elementary school teacher is the possibility that the next paper I correct will contain a wrong answer that is twice as witty and delightful as the right one. When members of the grade school set turn their attention to men notable

in aeronautics, youngsterisms seem to come as thick as chalkdust. Three examples:

"Euclid thought out how to make geometry help people to fly. He was born in the 300s and died in the 200s. That is another thing he thought out how to do. He thought out how to do it by using B.C.s."

"Charles Lindbergh is the most famous person in flying history and so are the Wright Brothers."

"The Wright Brothers made their first flight in 1903. 1903 was really in the 20nd. century but everybody was behind the times in those days."

The elementary school youngster's mind is a vast storehouse of information—half true, half false and wholly delightful. Sometimes he isn't wrong at all. It's just the way he puts it:

"During the Twenties, people started walking on airplane wings and things like that. I know it is crazy but this was before television or anything so what else was there to do?"

"Back in 1924, eight men tried to fly around the world but they only ended up where they started."

"Floyd Bennett comes from the year 1926. He is a famous aviator few people have ever heard of."

Ever heard of the word "pecally"? I hadn't until I came across this in a paper: "When I first started studying about airplanes, pecally things began to happen. First I was heightened by their vast hugeness. By and by I put on my thinker and thought how important they really are. I then heaved a sigh at how it would be fun visiting at where they are made."

Much of the juvenalia that I've collected through the years has been devoted to comments about Charles Lindbergh's historic first solo flight over the Atlantic. Here are three of my favorites:

"Charles Lindberg was the first to fly to Paris. He did it by the airplane method."

"When they asked him if he would like to fly to Paris, he rolled his eyes and flashed his teeth and said Sure."

"A straight line is the shortest distance between two points unless

you are going with Lindberg to Paris. Things are different there."

In commenting on the duties of the navigator, a girl who claimed she was one of aviation's "starchest supporters" wrote: "The navigator figures out the latitude and longitude. Latitude tells him where he is and longitude tells him how long he can stay there."

Her best friend once concluded: "The three main crewmen on a plane are the pilot, navigator and percolator."

If any of these definitions have caused Webster to turn over in his grave, he would have to do it with a smile. Here's what I mean:

"Drone is a spare name for when people cannot think how to say pilotless airplane."

"When anybody says plane, what he is saying depends on whether he is saying it to a pilot or a carpenter."

"I know what a sextant is but I had rather not say."

"A visa is a passport permitting an airplane to leave the country. For round trips you need a visa versa."

One chap absorbed the information regarding the many uses for airplanes in our modern world, but his skepticism showed: "How many uses they have for airplanes these days is more for saying than believing."

Three years later his younger sister wrote: "The number of aircraft in the world today is an adsurbly large fact of a number."

Ramjets have certainly come in for their share of comments recently. The remarks have proved to be unexpected, unconventional and undeniably true:

"Until it is decided whether ramjets are rockets or jets, we must continue to call them ramjets."

"The way ramjets work, as I understand it, is not very well understood."

"In ramjets the air rushes out when the fuel is ignited. So would anybody."

A couple of years ago there was a tiny moppet in my class who had a delightful way of expressing her thoughts. Here's how she summed up her feelings: "From now on I will put both gladness and wonder in my same thought about airplanes."

More than one eager young scholar has started out with a discussion of air travel and ended up in outer space. The following astronomical observations are fresh from the minds of four fourth graders:

"The North Star is, as a mattery fact, almost straight north. This is quite a coincidents."

"Our Mother Earth has small poles and a large equator because of the termendious speed as she hurdles through the space. Since we are along for the ride, we too tend to be flat at our poles and round at our equators."

"Some people can tell what time it is by looking at the sun but I have never been able to make out the numbers."

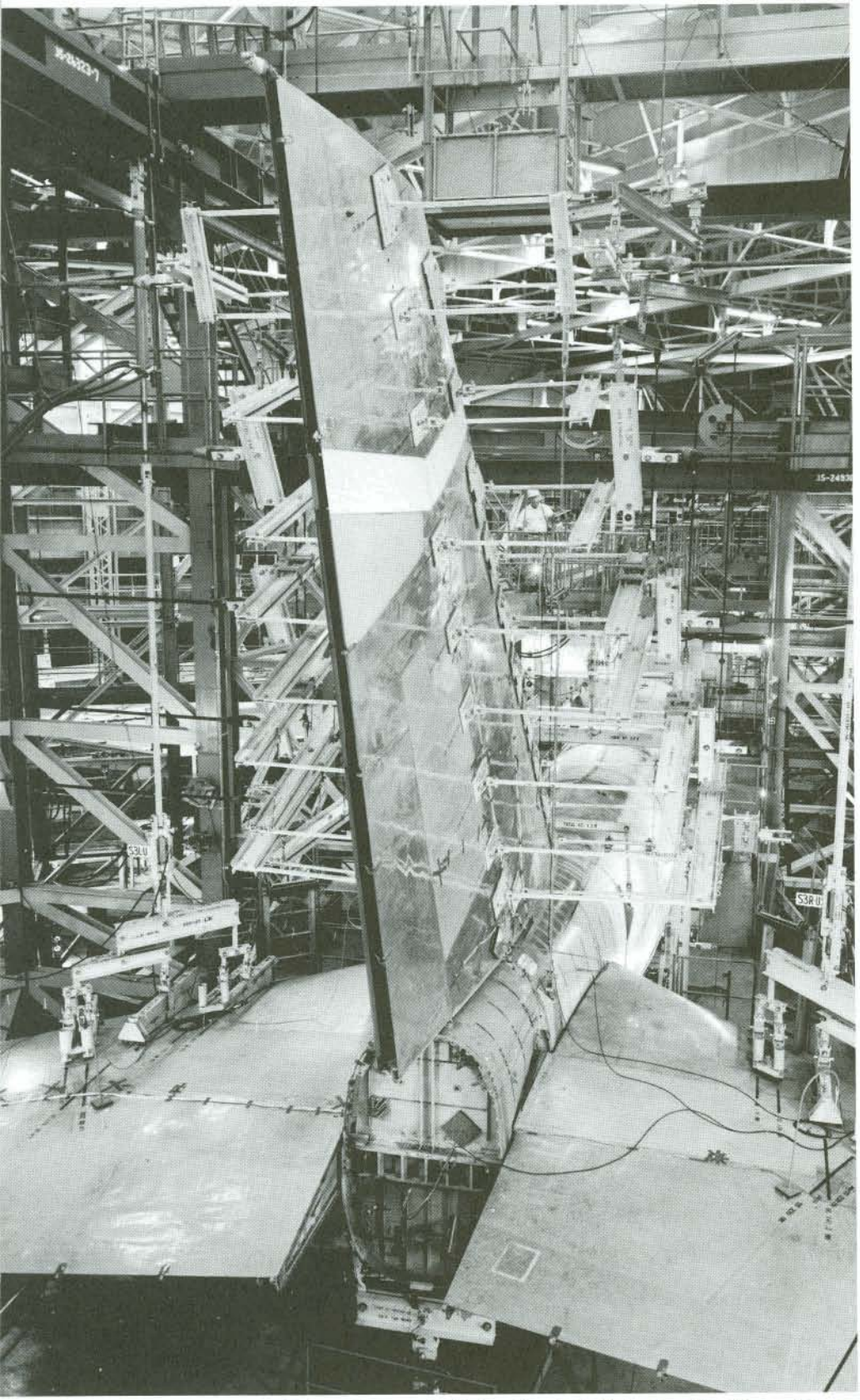
"Through the years people have guessed that Venus might be inhabited by women, dragons, or other strange creatures."

No one looks to the future as eagerly as youngsters do. Last year I received these two predictions about future air travel:

"Thanks to what we are learning from aviation, we should soon be able to look forward to having ceilings made out of fog."

"So far planes have only been able to fly in circles of no more than 360 degrees. This could be the next big breakthrough in air travel."

Harold Dunn has taught school in Ballwin, Missouri, for seven years. Before that he taught in Gallup, New Mexico, and Jefferson City, Missouri. In that time he has read a lot of themes written by grade school children and found therein some of the most creative writing being done in America today. He has collected portions of those themes that deal with aviation for the readers of Boeing Magazine.



Stripped-down B-52 bomber is buffeted by 71 different loads.

At Wichita, a B-52 is trapped in

THE IRON MAIDEN

By DARRELL BARTEE

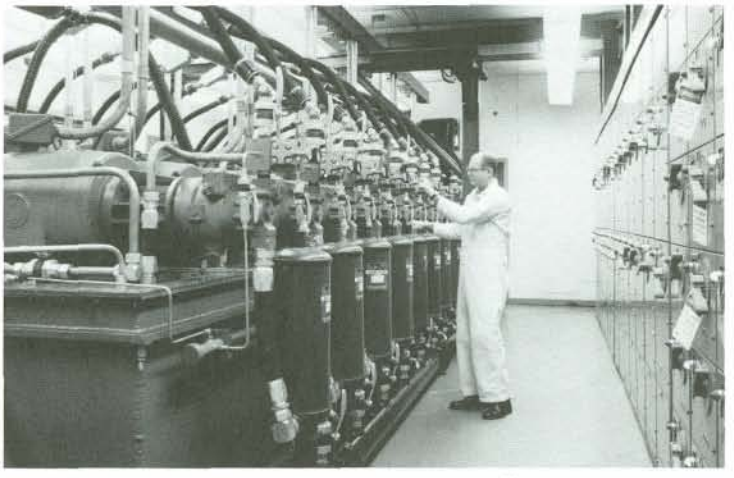
IN a hangar at Boeing's Wichita, Kansas, Division, engineers wearing headphones plugged into a system can hear the groans of a trapped giant.

The sounds come from the structural muscles of a B-52H jet bomber, reacting to the rigors of a new-style cyclic test. Microphones, inertia-triggered cameras and detection circuits are also a part of the action.

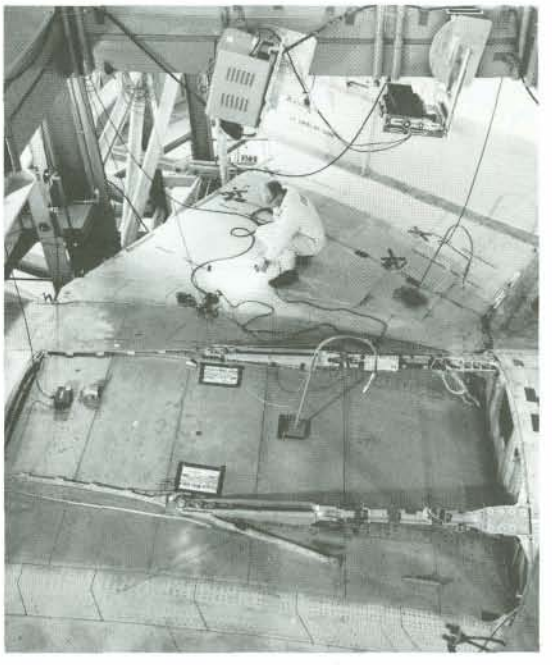
The torture is concentrated on body and tail sections of the plane, to determine the long-range ruggedness of modifications to those sections. It is one of those tests (conducted regularly by Boeing on both military and commercial planes) in which stresses of flight are simulated on the ground.

The test, which will be collecting and recording vital structural-strength data until November, 1968, has the advantage of two new techniques. One is a method for supporting the test aircraft in a "floating" position, with no tie-down to the floor. The other is a system for programming cyclic loads through magnetic tape controls and computers. Both are important improvements in the familiar drama which plays periodically at Boeing plants.

The "torture" is taking place in an auditorium-like hangar, with the



Oil pumps supply pressure for hydraulic torture rams.



Cameras, microphones, crack detectors check on wing.

B-52 almost hidden amid an "iron maiden" of steel beams (500 tons of them) towering up 68 feet. A series of 94 hydraulic rams and load-eveners, responding to the electronic signals from 71 load and position controllers, provide the "blows and buffets" to the bomber's body and tail.

By causing the airplane to suffer these strains well ahead of the time they might occur in line of duty, Boeing engineers can make informed predictions about structural strength needed at future points in the life of the plane. The test techniques are directed at extending that service life. The project is conducted under an Air Force contract administered by the Oklahoma City Air Materiel Area, the support agency for the B-52s of the Strategic Air Command.

This is the fifth such test to be conducted by Wichita structural test engineers and technicians on varied versions of B-47 and B-52 jets. Skills gained from past tests have built until the present procedure can, according to Wichita specialists, "apply more loads to a larger specimen in a more realistic manner than any other cyclic test facility in existence."

In the new procedure, the airplane is freely supported as though in flight. Its location in space is held constant by 12 position-control systems which respond automatically to its movement. The suspension technique makes test loading more realistic; it is a more scientific simulation of flight.

Wichita test personnel have successfully developed a way to control over 100 per cent more load systems than were required in their last B-52 test. Formerly, load signals were generated by photoelectric pickups following the instructions of graphs traced on rotating drums. Today, rolls of magnetic tape do the job better. The improvement allows more flexibility, more control of loads and more results reported in a more useful form.

During the cyclic action, movement and the effect of stress on the body or tail section under test are plainly visible and sometimes loudly audible. This B-52 has no secrets. It is thoroughly "bugged." Reactions of the airplane are reported in detail by 312 strain gauges, 78 crack detection circuits, 18 cameras and 20 sound-detection microphones installed at strategic locations on the bomber. Hydraulic power to apply this crunching action comes from a bank of 26 oil pumps enclosed in a nearby room.

To simulate stresses and fatigue experienced by the B-52 on actual Strategic Air Command missions, two patterns of signals are first programmed on the magnetic tapes. One represents the strains of an airborne alert mission; the other simulates combat crew training flights.

These signals feed through a processor-controller, through a series of digital-analog converters, and then to control and recording racks. Each rack controls its own set of hydraulic rams around the airplane and records the load data.

The action is monitored by an engineer at a master control console. But he is not alone. Some 25 others are watching, listening and checking for test progress. Most of them are stationed in the balconies surrounding the test, or on catwalks around the airplane. They are busily working in a complex and massive array of measuring instruments, recording devices, servo mechanisms, electrical cables, hydraulic lines, rams, eveners, and fail-safe systems.

The test will put the stripped-down B-52 Stratofort through the equivalent of four normal lifetimes of Air Force operation. The new exactness and versatility of the test process, developed at Wichita, may well be a factor in the improved lifetimes of future jets.

Floor levels give Boeing test crew access to Apollo/Saturn 5 stack.

Booster stage is hoisted into dynamic test tower in Huntsville.

Dynamic test of the Apollo-Saturn means

SHAKE WELL BEFORE USING

By RAY THOMAS

MARSHALL Space Flight Center, where it takes a lot to impress a space-oriented work force, had a real traffic-stopper recently. Looming through the Huntsville, Alabama morning mist was an argosy of the future: Apollo/Saturn 5, completely assembled and jutting high into the sky.

Soon a massive door eased into place; all that remained on view was the tallest building in Alabama.

This is the Apollo/Saturn 5 dynamic test tower, a structure housing control centers, electronic and machine shops, and an elevator which rises so high above the countryside that you can see company coming for three days. Here and in a nearby instrumentation center, Boeing and National Aeronautics and Space Administration engineers are dynamic-testing the entire moon rocket to determine how it will behave in flight.

The payoff from these activities will come at Cape Kennedy, where, sometime before 1970, Apollo astronauts will embark on a round-trip journey to the moon. What is learned at Huntsville will be applied to design of the moon rocket's structural, guidance and flight control systems.

Don H. Atherly, Saturn 5 program executive for Boeing, explained, "What we're doing in this dynamic testing program is obtaining information to compare with predicted results. Where differences appear, NASA can take specific measures."

The Apollo/Saturn 5 at Huntsville will be the only complete assembly of the space vehicle other than at Cape Kennedy. Stages and assemblies have been brought together, stacked in the test tower and instrumented throughout the vehicle's 365-foot length. There are 795 measurement points where sensors are attached to record what happens as tests are conducted.

"There's nothing small about this vehicle, and you can't get to any place on it easily," says Ed Foster, Boeing systems test manager. "When a test is in progress, five closed-circuit television cameras help us monitor what is going on."

To house such a bird, the tower itself had to be massive. It was designed and constructed to NASA specifications by the Army Corps of Engineers. Built with structural steel and sided with corregated metal sheets, the tower measures 100 feet on each side, rises 360 feet and is topped by a 120-foot crane. Perhaps attracted by the crane's bright paint, Alabama wasps find the upper reaches of the tower irresistible during the hot summer months. These wee beasties, however, have not been any problem, since schedules dictated the winter months as the time for the dynamic test program.

Basic to the tower is a Martin-designed four point "wetfoot" suspension system which virtually "floats" the Apollo/Saturn 5 on cushions of oil to simulate the freedom of flight. The vehicle rests upon four supports which in turn fit into individual pressure chambers. Nitrogen is pumped into the chambers and forces oil to circulate through a system which can lift the Apollo/Saturn 5 as much as four inches. Less than half of this, about 1¾ inches, is required for testing.

Once afloat and free of upper-level restraints, the vehicle is subjected to a shaker system which induces pitch, yaw and roll motions—forces that rocket stages and spacecraft will encounter in actual flight. When a vehicle weighs six million pounds and is 365 feet long the results can be startling.

"During testing at certain frequencies, the top of the Apollo/Saturn stack sways as much as 21 inches," commented Foster. "Our instruments show that under some conditions the booster-spaceship combination actually assumes the shape of an elongated 'S'."

What effect these and other conditions could have upon, say, the vehicle's guidance and control system, or the various interstage connections, is what the dynamic test program is all about.

Ten basic time-points are being dynamic tested for the complete Apollo/Saturn 5. These begin with the full-weight condition at liftoff and end with the lesser weight condition at first-stage burnout—146.3 seconds later. Eight in-between time-weight data points are analyzed.

The test vehicle's fuel weight is simulated by a solution of water with sodium dichromate added to inhibit rust and corrosion. Gaseous nitrogen pressurizes the tanks to simulate flight conditions.

While all of this is going on, Boeing engineers monitor and record the test data in a nearby instrumentation center. A steady stream of stress, strain and acceleration information is recorded for computer analysis at Boeing's Huntsville simulation center. In addition to observing the test results by instruments, Boeing test engineers find the closed-circuit television system helpful. Thus, if instruments indicate that interesting things are happening in the first-stage booster interstage areas, to pick a spot, the

cameras can be placed to cover this section. The cameras can be panned and zoomed by remote control.

Boeing-Huntsville has been in charge of Apollo/Saturn 5 dynamic tests since February of 1966. At that time, NASA assigned Boeing mission responsibility for defining, planning and conducting the program. The test booster, however, has been on hand since October of 1965, and underwent dynamic testing in the fall of 1966 while engineers awaited arrival of the other Apollo/Saturn 5 elements. Assembly of the entire vehicle was completed last December 3 and final test preparations were made during the Christmas season. Testing of the stack began December 29.

The company's work on the dynamic test program is a capstone for other Apollo/Saturn 5 efforts by Boeing-Huntsville. Items:

*Engineers simulate flights of the entire Apollo/Saturn 5 by using the largest known hybrid computer system in the world—the $10 million Boeing-Huntsville simulation center. The hybrid combines digital and analog computers and has "flown" hundreds of paper flights of the moon rocket.

*The "breadboard," a term given to an electro-mechanical set-up at Marshall Space Flight Center, is verifying ground-control computer programs destined for use at Cape Kennedy during vehicle check-out, countdown and launch.

*A two-year program of first-stage booster static firings concluded at Huntsville in November with a 127-second firing of the No. 3 flight booster. Boeing and NASA teams conducted 19 captive firings of Saturn 5 boosters. Huntsville systems test crews now have moved to NASA's Mississippi Test Facility to continue static-firing programs.

*Tests of the Apollo/Saturn 5 launch-service arms at Marshall are being supported by Boeing. These "arms," nine in number, are launch tower extensions supplying power, fuel and ground-control communications links to the booster and spaceship before launch. This work at Marshall is done at the fittingly named "arm farm."

*Full scale structural tests of the Saturn 5 booster and other components are conducted by Boeing-Huntsville at Marshall. Tests-to-destruction determine ultimate strength of these structures.

*Boeing-Huntsville engineering laboratories are cycle testing electronic components for the NASA Jet Propulsion Laboratory.

"What all of this means," commented Ed Foster, "is that Boeing-Huntsville has built a systems test organization here that is capable of any job from the smallest to the largest. We are proud of that."

Boeing engineers monitor "nerve center" for dynamic test.

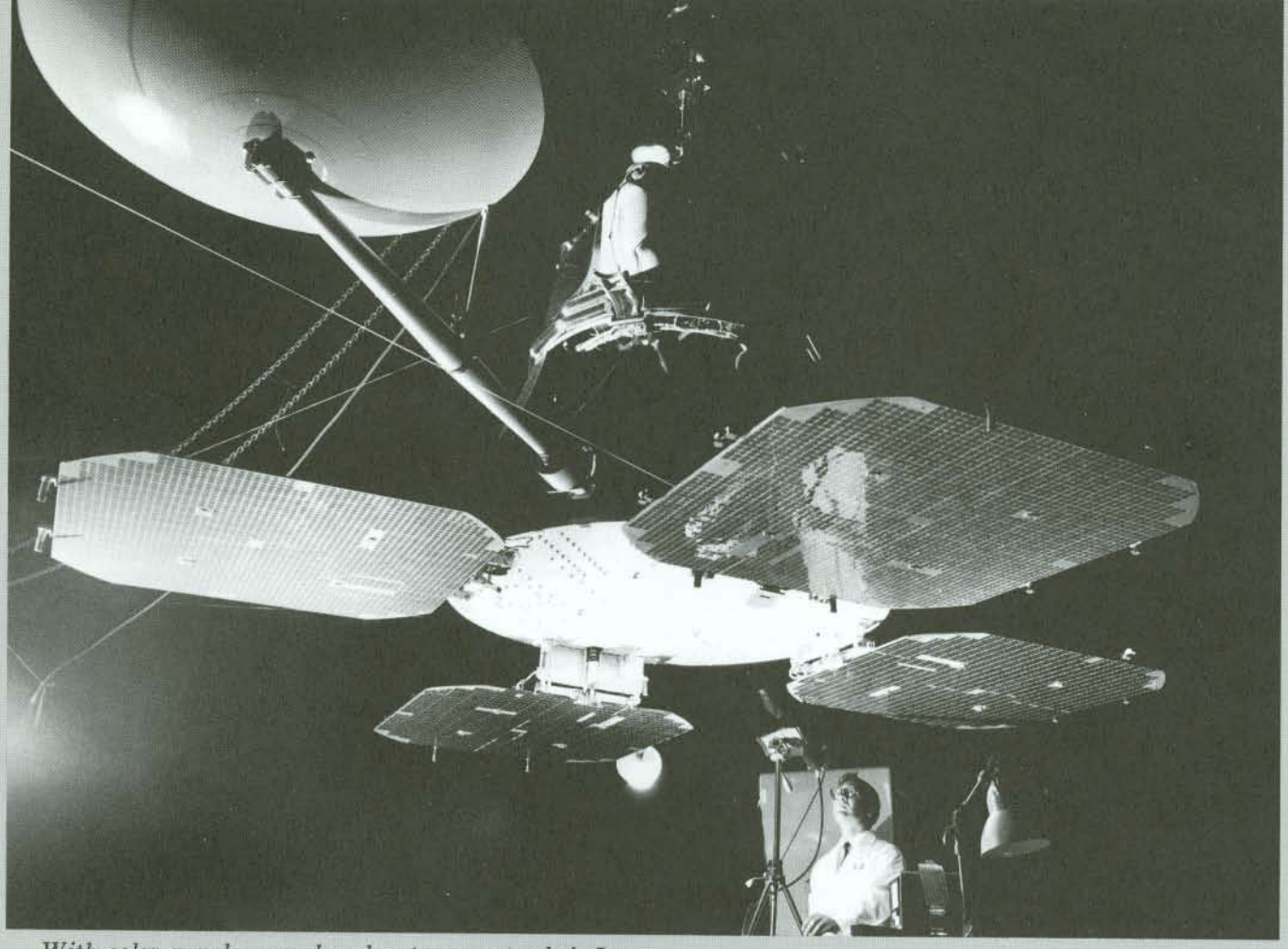
By WES ROBINSON

FLYING down to get a tan in the warm sunshine of Maracaibo or Antigua may be great, but when you're flying to the moon, sunshine is an occupational hazard. Outside the protective shield of the Earth's atmosphere, cheerful sunbeams turn into raw, intense ultraviolet radiation. Heat produced by this radiation could be harmful to a spaceman and could damage a space vehicle's delicate sensing and guidance instruments.

Insulation may be used to protect astronauts and critical operating parts of a space vehicle from ultraviolet rays, but shrouding the entire craft in insulation is impractical. Most spacecraft must fly to the moon with their chassis clad only in a thin coat of paint. The paint is designed to reflect away the heat of the sun and radiate out into space a large portion of the heat generated by spacecraft equipment. However, scientists found the traditional reflective quality of white silicone paint did a strange flip-flop in space: It yellowed, causing a severe increase in solar heat absorption. Once it was re-exposed to air, the paint changed back, chameleon-like, to an obediently reflective white.

Such unpredictable coatings will not do for long-term space flights, so Boeing has developed its own special space paint. In space-chamber tests, the new paint has stayed white and has rejected ultraviolet rays extremely well compared with other spacecraft paint coatings. To see how it performs on an actual space mission, Lunar Orbiter 3 carried a sample of the Boeing paint to the moon in February, along with two non-Boeing paint samples, each instrumented with a thermistor to measure temperature changes. The results of that test were radioed to Earth and are now under study.

The search for a suitable coating led Boeing researchers to examine how paint is applied, the temperature of application, the temperature of paint during simulated space flight, and even the effects of air molecules trapped inside a paint film. However, it was chemistry and

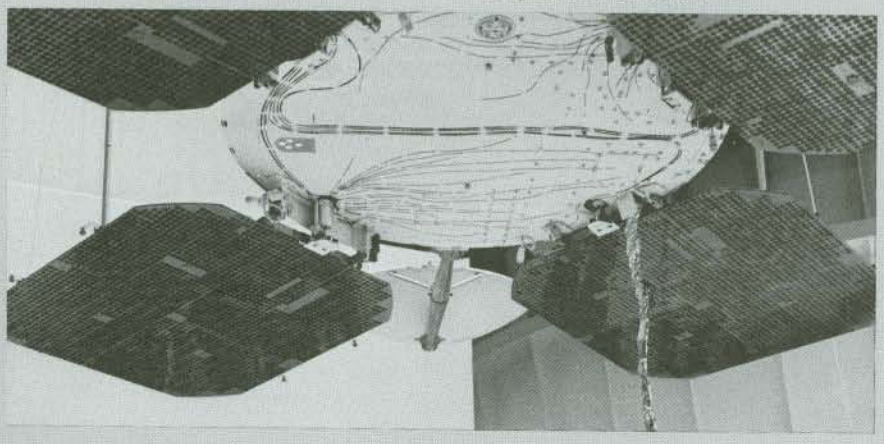


With solar panels spread and antenna extended, Lunar Orbiter may look ungraceful but has proved very useful.

Space paint once got yellow but

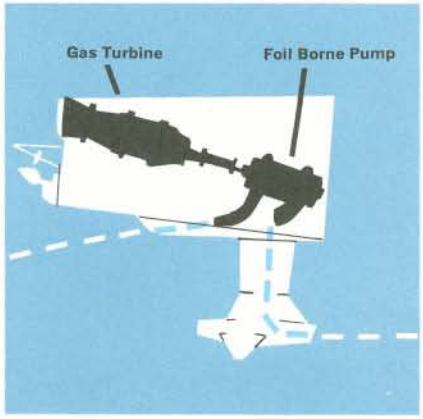
OLD YALLER IS WHITE AGAIN

Four white paint chips rode on bottom of Lunar Orbiter.



not painting technique that made the big difference. Part of the yellowing effect was suspected to be caused by the paint catalyst—a chemical reactive agent. Boeing began searching for a silicone paint catalyst that would virtually disappear after the paint film had cured, and eventually zeroed in on a relatively obscure member of the amine family of chemicals. The amine catalyst produced a startling improvement in making paint impervious to ultraviolet bombardment. Still better results were obtained by treating paint with potassium silicate—based on findings by Illinois Institute of Technology—and then mixing it with the catalyst.

It's still too early to know how well the new paint mixture will perform in all cases, but indications are the compound should keep white paint white and help both spacemen and spacecraft stay in space for longer periods of time without suffering an ultraviolet "sunburn."



There's a word for sea-going simplicity —

TUCUMCARI

By ALLEN HOBBS

LATER this year, a formidable craft, its guns as yet untried, will test its sea legs for the first time in the narrow channels and deep waters of Puget Sound.

If freighter skippers, fishermen and ferry boat passengers do classic vaudeville doubletakes, it will not be surprising since they will be seeing a new breed of boat.

The doubletake may be followed by a third stare when onlookers note that the boat, traveling at more than 40 knots, is trailing two water fountains from its stern.

"Harry, look at that boat on stilts. Look at all the water coming out of it."

"The boat probably leaks and they're pumpin' it out, Gladys."

No leaks, Harry, but plenty of pumpin'. In fact, it pumps 100 tons of water a minute.

The boat, designed and being built by Boeing, is the United States Navy's *Tucumcari* hydrofoil gunboat, a revolutionary craft that may be the forerunner of a fleet of swift, special-mission Navy craft. It is swift because it rides on foils —underwater wings that lift the hull out of the water greatly reducing resistance to forward motion.

It has no conventional propeller. The streams of water at the stern are the tell-tale evidence of a water jet propulsion system, one of the newest ideas in the marine field.

How does it work? A gas turbine-driven centrifugal pump sucks sea water in through two ports in the base of the aft foil struts. The water rushes up the hollow struts and jets out under the stern of the craft. Water jet propulsion works on the same principle of thrust as that of an airliner's jet engine. With the explosive force of a super fire hose, the pump jet is a perfect example of "every action has an opposite and equal reaction."

Water jet propulsion is up to the minute, dramatic and really works. But why use it?

The answer, especially for a hydrofoil, lies in simplicity. A water jet system eliminates the complex gearing and shafting and lubrication and maintenance required to swing a propeller buried far under a boat at the end of a foil strut—some 12 feet below the engine. Also eliminated is the propeller itself and its vulnerability to damage from underwater debris.

In addition, a propeller turning at high speed often encounters the water vapor bubbles of cavitation. Vapor pockets form near a fast-moving, underwater surface, such as a propeller or foil, robbing it of efficiency.

The hydrofoil designer finds a real plus in being able to eliminate an underwater complexity such as the propeller.

The 60-ton aluminum craft now under construction in Seattle, Washington, is 71 feet long and has a 20-foot beam. Its speed will be in excess of 40 knots. For coastal maneuvers, the boat's rough-water performance is an advantage.

The 3,100 horsepower Bristol Siddeley *Proteus* gas turbine engine is coupled directly to the Byron Jackson pump for compactness. The pump has dual entry and dual exit water ports and will spew out about 27,000 gallons of water per minute. The typical household's consumption of water at the rate of about 4,500 gallons per month seems like a drought contrasted to the hydrofoil's pump capacity. The pump pressure is also considerable —enough to fight a fire at the top of the Washington Monument.

When cruising on its hull, the gunboat uses a second water jet propulsion system—a smaller pump driven by a diesel engine.

Water jet boats have been under study for five years at Boeing. Dur-

Little Squirt proved the pump jet was a going power plant.

ing this time a company-designed research hydrofoil, appropriately named *Little Squirt,* has been smoothly pumping its way over the waters of Puget Sound and Lake Washington at speeds of up to 50 miles an hour. Loaded with data recording equipment, the craft has gathered information used for the design of the Navy's new gunboat.

This was the starting place for the scale and full-scale model tests, computer studies and design work that led to the *Tucumcari.*

The automatic electronic control system that will be used to guide foilborne operation of the *Tucumcari* is an advanced version of the system developed on the *Little Squirt* and *Fresh 1,* a high-speed research hydrofoil built for the Navy by Boeing in 1963.

The new gunboat is now cradled on a barge moored in the Duwamish River, Seattle, Washington, while work on interior machinery and the superstructure is completed. In a separate area, workers are putting the finishing touches on the stainless steel foil struts. Sometime this summer the new hydrofoil will get its first taste of water in this river which flows to Seattle's Elliott Bay on Puget Sound.

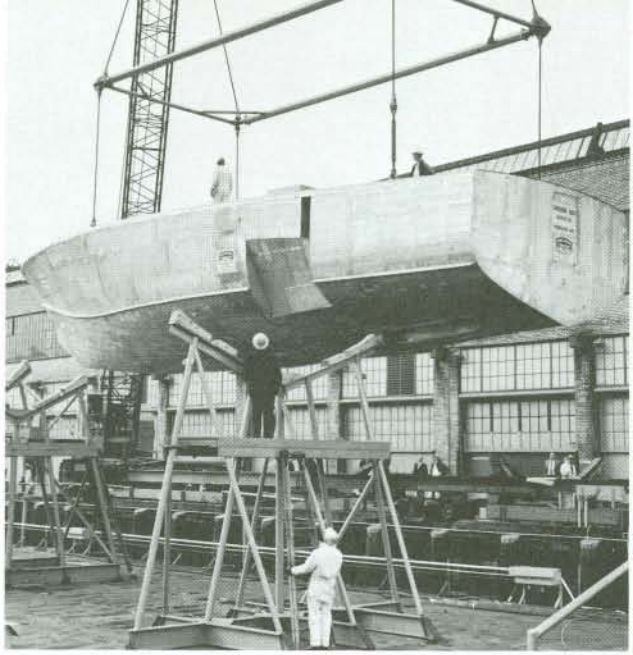
Within the *Tucumcari's* hull are two engine compartments, one containing the turbine for foilborne power and the other the hullborne diesel. This enables the gunboat to operate even with one engine damaged or flooded. The retractable foils allow shallow-water maneuvering.

Other features of the new craft include air cooling of "lube" oil and hydraulic fluid. Air cooling rather than the more conventional seawater cooling is used to eliminate any possible contamination of systems from salt-water leakage caused by battle damage.

The *Tucumcari* will be armed with a 40mm gun forward, an 81mm mortar aft and twin 50-caliber machine guns on each side of the bridge.

When this new breed of boat takes to the water for Boeing and Navy tests later this year, mariners will be seeing the prototype of things to come—a fast, maneuverable craft for almost any sea.

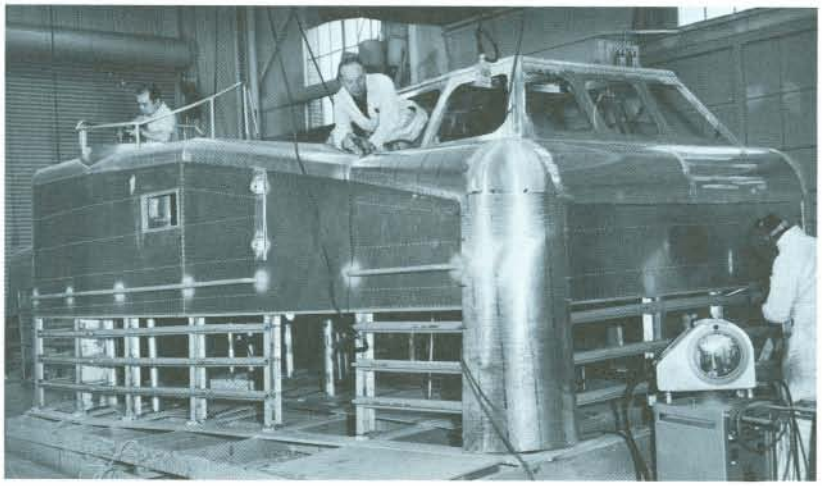
But no propeller.



Hull is lowered to cradle on barge below dockside. Slots in side and in bow (below) are for foil struts.

Gunboat's aluminum hull was built by Gunderson Bros. Engineering Co. in Portland and hauled to Seattle.

Gunboat cabin is remindful of airplane fuselage.



IN THE FAMILY TRADITION

IN 1923 Alf Olsen and his family emigrated from Torget Island, a wind-swept dot on the North Sea off the coast of Norway, 100 miles south of the Arctic Circle.

He left his home because he felt that his children—including a 4-year-old boy named Sofus—would have greater opportunities in the United States than he could ever provide them through fishing and farming on the island.

Upon arrival in the Scandinavian Ballard community of Seattle, already well-populated with Olsens, the family changed its name. As was sometimes the custom, they took the name of their former home. By this act, Sofus Olsen became Sofus Torget.

For Sofus, his father's willingness to change, to adapt, to take on new and bigger responsibilities became a part of his own way of life. This is an ideal attitude to have when you consider that Torget, the younger, is director of manufacturing for Boeing's Everett Branch. As such, he has the task of building the world's biggest airplane in a yet-to-be-completed factory against a production schedule that calls for completion of the first unit in less than two years.

Each airplane will require more than 270,000 parts having a total weight of 340,000 pounds. Under presently planned schedules, Boeing shop personnel will assemble these parts into Model 747 jetliners at the rate of one airplane every 2½ working days. It is a production effort which dwarfs any other program in the industry. And Sofus, son of Alf, is the man to handle it.

Torget came to Boeing by way of Ballard High School and the Balcom Payne Fisheries, a salmon cannery at Ketchikan, Alaska.

Working summers in the cannery paid his way through three years at the University of Washington.

"I was," he recalls, "the cannery machinist. I kept the equipment going during the canning runs which, when the fish were coming in, operated up to 22 hours a day. Then the crews knocked off for two hours of sleep, leaving 'guess who' to do the machine work."

In 1941, he started at Boeing in tool design and went into production engineering after three years. He stayed until 1946 when he took a cinch on his belt, a leave of absence, his life's savings and went back to school. After the University granted him a degree in mechanical engineering, he returned to Boeing and went into production engineering until his present assignment in April, 1966. He has been associated with every Boeing aircraft since the B-17 Flying Fortress.

The family lives in the North Beach area of Seattle and Torget, who enjoys the outdoors ("Salmon fishing is a lot more fun than salmon canning.") is building a summer home on Hood Canal.

It might be pointed out that the completion schedule on the Hood Canal project has been set back as a result of the time he devotes to another schedule in Everett. Despite the size of his Everett task, he isn't worried. He's depending on a 1,000-man work force especially picked to start production.

"They're not underestimating the 747 job," he said. "I'm lucky. They're good, and they're dedicated and they're qualified."

Then, in case there were any doubt, he added, "We'll be out on schedule."

A new development in weather control,

FLYING CLOUD

By KEN CALKINS

IF laboratory experiments conducted by Boeing meteorologists prove out in the field, it may be possible to protect crops from frost by covering them with a cloud.

The key is in the development of an evaporation-resistant water fog — a flying cloud shield which may insulate orchards against sudden temperature changes.

Chemical fogs and oil fogs hang heavy in the air, lasting for hours. But water fogs fade out in seconds except when moisture saturation of the air approaches 100 per cent. Chemical fogs either smell bad, are poisonous or explosive. Water fog, however, is safe for plants and odorless. Boeing researchers estimate that a warm blanket of mist laid over a field of crops could hold in 80 per cent of the heat the ground now radiates into the air. Such a blanket could ward off a killing frost, could foster the growth of new buds on cool nights. The problem, then, was to develop a water fog with the stability of a chemical fog.

In seeking a way to slow water-evaporation, the meteorologists "searched the literature." They found that evaporation from many water supply reservoirs had been retarded with a one-molecule-thick coating of cetyl alcohol.

Cetyl alcohol is one of the "long-chain" alcohols, a so-called associated compound just as water is. When cetyl alcohol and water touch, they react to complete a molecular structure, "lining up like soldiers along the surface, thereby forming a barrier to evaporation," according to Thomas Y. Palmer, a meteorologist on Boeing's atmospheric sciences staff.

In an experiment in the Boeing laboratory the researchers boiled flasks of alcohol, mixing the vapor with water spray. Palmer, who reported on the work to a meeting of the Western Washington Horticultural Society in January, said that in the laboratory, "Such large quantities of fog were produced that the experiment could never run more than 30 seconds. After that, the large room that the experiments were conducted in was so filled with fog that we could literally not see our hands in front of our faces. We experienced all the effects of the 'arctic white-out' including disorientation and walking into a wall."

Computer studies indicate that about 10 gallons of water and as little as one one-hundredth pound of cetyl alcohol could produce a "flying cloud" large enough to cover an acre of crops with an insulating blanket of stable fog.

"Another potential use of the process is as a carrier for chemicals," Palmer said. "Proper design of the range of water drop sizes could achieve uniform deposit of fertilizers or insecticides over large distances downwind."

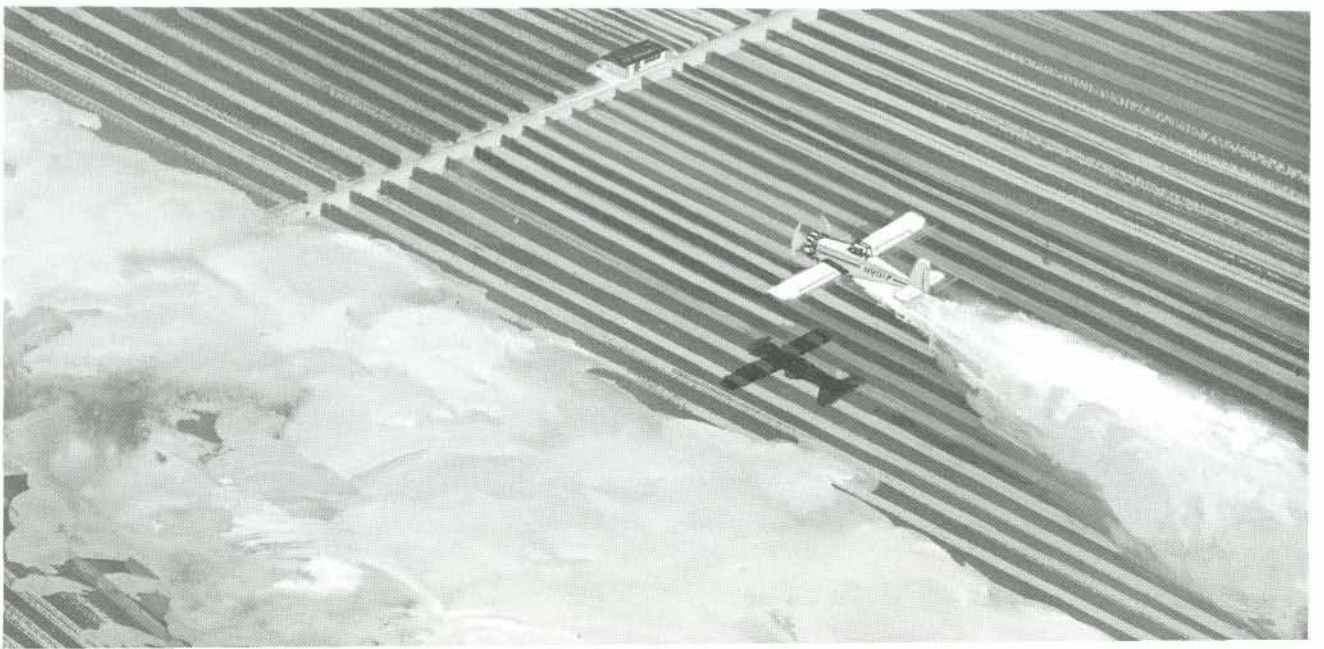
Thus, when the wind was right, a farmer could dust his own crops from a portable tower. For larger areas, the familiar crop-dusting aircraft could fill a valley with clouds in hours.

Field tests of the Boeing process are yet to be conducted. Boeing Associated Products, the company agency responsible for pursuing potential applications of the process, is investigating the interest of agricultural groups, research institutes and universities in possible cooperative programs and field tests.

The potential uses of the "flying cloud" process are hypothetical until more experimental work has been done. But such uses might include retarding wilting in newly transplanted crops.

One of the more exciting if more distant applications might be the control of rain and hail.

In retarding rainfall, the procedure would work as the inverse of rain making. Where rain-makers seed clouds with silver iodide, rain-stoppers would seed it with hexadecanol — cetyl alcohol. The alcohol would coat the cloud particles, impair their natural seeding process and impede the formation of rain and hail. In the laboratory, a coated, supercooled cloud was found to be non-seedable—it would not condense into rain drops.

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Northern Consolidated (Alaska)


Pacific Air Lines


Pacific Southwest Airlines


Pacific Western Airlines


Piedmont Airlines


South African Airways


United Air Lines


Western Airlines


Wien Air Alaska

17 airlines christen the Boeing 737 Twinjet

Since the christening, Canadian Pacific has ordered Boeing 737s.

Airline stewardesses from around the world recently came to Seattle for the christening. They represent the 17 airlines which have already ordered the new 737 Twinjet, world's most advanced short-range jetliner. When the 737 Twinjet goes into airline service next year, it will be the first to bring the roomy comfort of big jets to short-range routes.

BOEING 737