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GRUMMAN AO-1B MOHAWK

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The new S-64 Sikorsky Skycrane, now in test, is a heavy-duty helicopter capable of lifting an astonishing variety of 9-ton loads of almost any shape.

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STRATFORD, CONNECTICUT

. . . "The Mark 21 handles as well as any of its 'big three' competitors — is perfectly safe and easy for the average pilot to fly."

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. . . "Flight characteristics of the Mark 21 are excellent."

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. . . Flying Jan. '62

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. . . Aviation Week Feb. 19, '62

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. . . Flying Jan. '62

Fly the one that's got 'em talking...

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Sales Figures for Single Engine "Retractables" All Models	PIPER (2 Models)	BEECH (2 Models)	MOONEY (1 Model)	CESSNA (1 Model)
% of Sales — Jan. through Dec. 1961	39.39%	29.83%	19.26%	11.52%
% of Sales — Mar. '61 through Feb. '62	37.01%	29.10%	21.48%	12.41%

Mooney, with highest performance at lowest cost, is the one that's moving up. Fly it and see....!

MOONEY

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FLYING®

MAY, 1962

VOLUME 70, NUMBER 5

COVER: Representative of the wide range of missions assigned to the growing Army air fleet are the Grumman Mohawk AO-1BF surveillance aircraft with side-looking radar under the fuselage, and the Hiller H-23D Raven and the Bell HU-1 Iroquois utility-recon rotorcraft.

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TRAVEL BY AIR is nothing new for FLYING readers—nor for its editors/writers. It's the only way to "get things done" when time and distance are involved. A good example? Use of our own aircraft to reach key bases for this month's special report on Army Aviation. From time to time there'll be more such reports and, as a result, more FLYING.

WINGS and THINGS

CESSNA SKYMASTER, soon to be certificated, will have a gross weight approximating 4,000 pounds; useful load about 1,500 pounds. Four-place light-light twin will be powered by two six-cylinder Continental IO-360s, fuel-injected, of 210 hp each. Single-engine ceiling would be about 10,000 feet. With engines in push-pull arrangement (eliminating torque), mounted on each end of fuselage, objective is twin-engine performance with single-engine simplicity.

NEW CESSNA, *reportedly in the works at the company's Wichita, Kansas, facilities, is a low-cost, four-place utility airplane to be offered in 1963. Powerplant may be 125-140-hp category; under consideration is Franklin engine, now in test stage, which produces 125 hp at 2,800 rpm.*

HEAVY PIPER TWIN said to be in construction stage at Lock Haven, Pa. Powerplants would be in 350-hp range. Six-place twin embraces rounded fuselage (pressurization availability) and laminar-flow wing. Piper also has queried its dealers on the possibility of helicopter manufacture, pointing up rotary-wing requirements.

BOLKOW 207, *four-place, low-wing aircraft designed in Germany and powered by 180-hp Lycoming, may be marketed here by Pioneer Air Services, Burbank, Calif. Airplane embraces widespread use of fibreglas and plastics. Top speed is 158 mph; cruise speed, 145 mph; service ceiling 13,500 feet; range (55% power), 775 miles. The 207 sells for $13,700 in Europe.*

HIGH-SPEED ROTOR, aimed at increasing forward speed of helicopters, under development at Bolkow's Ottobrunn (suburb of Munich), Germany, plant. Rotor system consists of four-blade, plastic rotor, on which each blade is gear-hinged. During each rotation the blades perform a "leading and lagging" movement, which counterbalances non-uniform flow of air against the blades during forward flight. Result: increased speed plus reduction of power normally required. Rotor, in wind tunnel tests, achieved forward speeds in excess of 300 mph. Test-flight vehicle is now being built.

TURBOSUPERCHARGER, *using same basic components as in Cessna Skyknight, has been installed in Beech Model 35C Bonanza by AiResearch Aviation Service Co. (Los Angeles, Calif.). Continental 0-470 engine of 225 hp is installed in place of the original 205-hp powerplant. System includes AirResearch Industrial Products turbosupercharger and automatic altitude controller developed by AiResearch Manufacturing Co. Both are used in Skyknight, though system differs in that it is not automatically an "always-operating" type; rather can be turned on-off at pilot's discretion.*

AIR FORCE will train only 1,200 pilots and 1,000 new navigators during year beginning July 1. By contrast, nearly 8,000 pilots/navigators were trained in 1957. Flying-hour restrictions for all of USAF call for cut of 466,000 hours less than current yearly totals. There'll be 1,000 less aircraft than two years ago.

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Mail Box

TO BE A PILOT

The following letter was written by a Fifth Grader at San Mateo (Calif.) Park Grammar School and appeared in the February 1962 issue of "The Last Word" our monthly safety publication at Andrews AFB, Md. I thought you might like to use it in a future issue of FLYING.

LT. COL. C. V. GLINES, USAF
McLean, Va.

"I want to be a pilot when I grow up . . . because it's a fun job and easy to do. That's why there are so many pilots flying today. Pilots don't need much school, they just have to learn numbers so they can read instruments. I guess they should be able to read road maps so they won't be lost. Pilots should be brave so they won't be scared if it's foggy and they can't see, or if a wing or motor falls off they should stay calm so they'll know what to do. Pilots have to have good eyes to see through clouds and they can't be afraid of lightning or thunder because they're closer to them than we are. The salary pilots make is another thing I like. They make more money than they can spend. This is because most people think plane flying is dangerous except pilots don't because they know how easy it is. There isn't much I don't like except girls like pilots and all the stewardesses want to marry pilots so they always have to chase them away so they don't bother them. I hope I don't get air sick because I get car sick and if I get air sick I couldn't be a pilot and then I'd have to go to work."

STANDARDIZED LIGHTPLANE PANEL

. . . a million times Bravo!—for the direction of movement set forth on page 40 (etc.) of the January 1962 issue in the J. S. Butz Jr. article on "Project Little Guy," FAA's standardized lightplane panel!

Is there anything we, the little guys, can do to further or speed the progress in this direction? It is long overdue.

And may I add a hearty Amen to Robert J. Brush's commendation of Gill Robb Wilson in "Mailbox"—of the same issue.

Thanks . . . for your wonderful publication that does so much in the best interests of our flying fraternity.

U. OWEN WALKER
Memphis, Tenn.

ITALIAN JET TRAINER

. . . During my recent trip to Europe, I had the opportunity of visiting Aeronautica Macchi located in Varese, Italy, where they are in production on the Jet trainer MB 326. I had the pleasure of meeting the chief test pilot, Guido Carestiato, in September as they were celebrating confirmation of the new world altitude record.

I am enclosing a photograph of the test pilot in front of the plane in which he broke the record . . . I am sure FLYING's readers will appreciate seeing what type of

equipment the Italians are building at this time and especially since they exceeded the altitude mark held by the Russian pilot . . .

I have been interested in aviation and flying since 1936 and this year am president of the Condor Aero Club located at Tasa Airfield, Zelienople, Pa., where we have 133 members flying Cessna 172s and 150s. I might add I have always enjoyed reading FLYING and during my many years of flying have picked up many flying tips from your many interesting articles.

GEORGE C. STAMETS, President
Merit Machinery, Inc.,
Pittsburgh, Pa.

• *The AerMacchi MB-326 attained 49,977 feet in a Class C-1d category (aircraft weight approximately 6,000 pounds), topping the 46,852 foot existing record held by a USSR YAK-32 plane.*—ED

ENCORE, DUANE COLE

Duane Cole's "Bring Back the Kid" and Harold Stevenson's illustration (March issue) are a masterpiece in nostalgia. Probably it's these memories that make me take every kid that hangs around the hangar "up for a spin." Very few mechanics around an airport show more respect for the fabric than does the 14 year old kid. . .

R. P. FROESCHLE, M.D.
Member Flying Physicians Assn.
Hazen, N.D.

Duane Cole wants to turn aviation back twenty-five years. I am for it. We should back up—at least in our thinking, and correct the mistakes so graphically put by World Champion Aerobatic Pilot Duane Cole. . .

CHIP WESTERFIELD
Whittier, Calif.

. . . I think flying is something everybody should experience and I hope someday everybody will. . . I am that kid that the article talks about, but I don't quite have to worry about that. Where I live our airport (Wadsworth Municipal) is

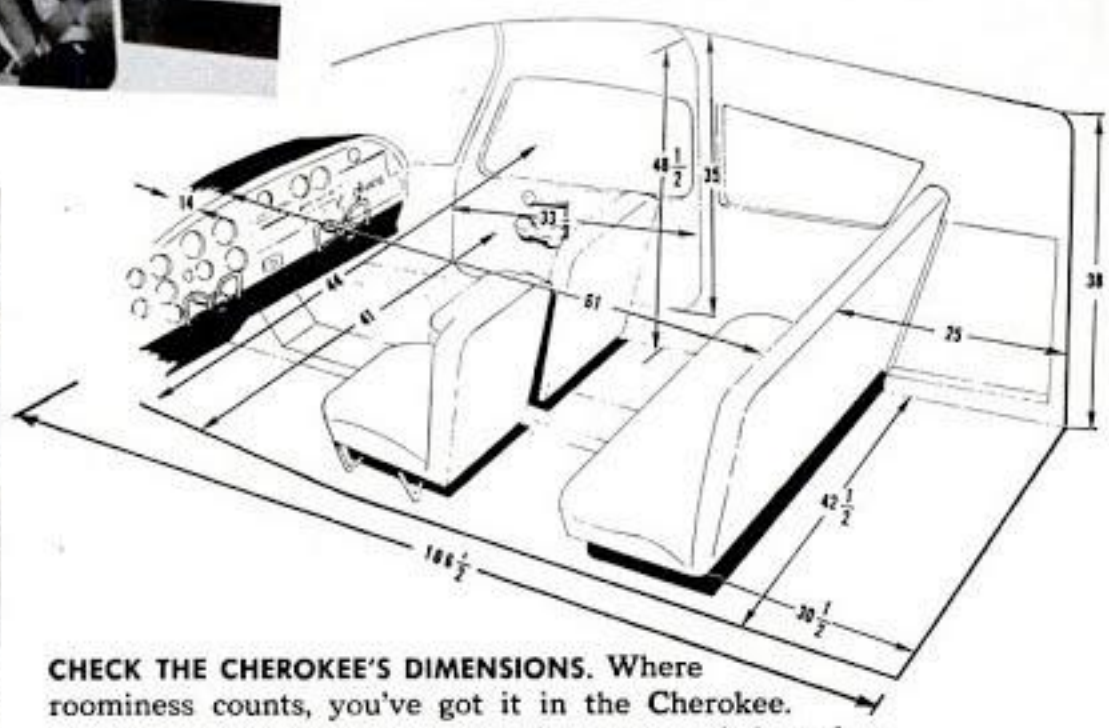
(Continued on page 6)

Here's How the Cherokee Gives You Best Comfort and Cross-Country Convenience of any Plane in its Class

BIG ROOMY CABIN

Wider, more comfortable than anything ever before offered in the thrifty 4-place class. Really comfortable seats, each individually adjustable. Soundproofed for restful travel. Big windows, unobstructed view.

JUMBO BAGGAGE SPACE. 17.7 cubic feet, biggest in its class, provides amazing amount of baggage room, all easily loaded through large outside door.



CHECK THE CHEROKEE'S DIMENSIONS. Where roominess counts, you've got it in the Cherokee. Four people can travel far and wide in uncrowded comfort. Cherokee also gives you biggest useful load—over 1000 pounds.

All this Comfort Plus

LOW-WING DESIGN SUPERIORITY

Best cabin and cross-country comfort features, best flight features, too. Wonderful flight-ease stability, amazing "air cushioned" landings, superior ground stability thanks to low CG and wide-tread tricycle landing gear.

All-metal and fiberglass construction throughout. Choice of Lycoming 150 or 160 hp engine. See your Piper dealer for a Cherokee demonstration or write for Cherokee brochure, Dept. 5-G.

MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

PIPER AIRCRAFT CORPORATION
Lock Haven, Pa. (Main Offices) — Vero Beach, Fla.

Mail Box

(Continued from page 4)

made up of a bunch of real nice men that want to give that kid a break.

But I hope that some day that "Keep Out" sign will be removed and another sign will replace it saying "Welcome Boys," and there will be airports like Wadsworth Municipal all over the country.

DARYL HIGGINS

Wadsworth, Ohio

COLLISION PREVENTION

The statement was made, in "Collision Prevention Through Color Patterns" (by J. S. Butz Jr., February issue) that: "No device was considered suitable if it added greatly to weight, complexity or cost of light aircraft." However the article keeps mentioning fluorescent paint, which they (FAA researchers) themselves admit is costly, fades quickly, and does not show up any better than enamel.

They go on to talk about collisions and near misses; and conditions under which they took place. However, I don't see any mention of the color, or colors of the aircraft involved. Did they overlook this factor?

Most of the testing seems to have been done in a laboratory. It seems to me that they could accomplish a lot more by simply flying around an airport and observing the various color combinations on aircraft being flown. As a pilot who flies out of a small field I know that on an overcast day, with three or four miles' visibility, an all aluminum or gray aircraft cannot be seen much farther than a mile. However, a red and white aircraft can be seen without difficulty. (The Cessna 210 on your February cover stands out very well against the ground, but I would hate to have to find him in a blue sky.)

In my opinion, the best coloring would be a dark bottom, light top, and a combination of both on the sides.

BOB KEINER

Oaklawn, Ill.

• *Your statement that most of the testing seems to have been done in a laboratory is not quite accurate; the article definitely states "Dozens of paint schemes were rated by pilots in the laboratory and in the field, both in the air and on the ground."*—ED

STOL ENGINEERING

Victory at last! Having battled the rush to the newsstand on campus for so many months, victory was mine today when my first subscription copy of FLYING arrived.

I would like to point out that in the March '62 issue, "Executive STOL" by Robert S. Tripp (Page 87), reference was made to the University of Mississippi Aerophysics Department . . . under the direction of the late Dr. Raspet and presently under Dr. Joseph Cornish III. These accomplishments and admired professors are an integral part of our institution at Mississippi State University, not the University of Mississippi. . .

BOBBY W. COSTILOW

State College, Miss.

AIRPORT PROBLEM

Recently there has been a resurgence of effort of a group here which is interested in moving the airport (Whitney Memorial) at St. Cloud, Minn. from its present location.

Briefly, the situation is that our airport is within the city limits and within one mile of the center of town. We who are interested in flying are most appreciative of the convenience of its location . . . The proponents of moving the airport are unimpressed by our claims that the location itself is a tremendous asset.

Those who have flown in this area probably have used our State-owned TVOR (111.6 mc STC). The voice for this facility is handled without charge by the U.S. Weather Bureau staff. There is a restaurant on the field.

The thought that prompted this letter was that we would like to request any pilot who has been here and who has appreciated the convenience of the airport's location write a short letter to Don Krause, chairman of the Airport Committee, 1317 8th Ave. N., St. Cloud, Minn.

A. K. UGGEN

St. Cloud, Minn.

AIR RACE ELIGIBILITY

Your magazine has always supported women pilots and published many interesting stories about the "Powder Puff" Derby. How about this new ruling that only commercial pilots are eligible for this air race? . . .

I have a commercial license and personally have not had the desire nor the time to compete in the Powder Puff but I know many fine women who have and think it has been a great thing for stimulating interest in aviation among women and men. As far as capabilities are concerned I think that many . . . private pilots can fly in this race as safely as many of the Commercial pilots who, like myself, are rather inactive. The whole thing looks like the Ninety-Nines are afraid of a little unprofessional competition, and I thought that women pilots were above this typical feminine trait of jealousy.

GEORGIA M. FIKE

Lander, Wyo.

TRUE AIRSPEED

I just finished reading the article "SAM for the VIP" (by Philip Warren Jr.) in the February issue of FLYING and certainly enjoyed it. However, I believe there is a slight discrepancy in the true airspeed of Air Force One. The article quotes the indicated airspeed as 280-290 knots and a mach of .85 giving a true airspeed of 450-500 mph. Considering the 30,000-foot level the TAS would be about 500 knots or 575 mph.

FLOYD L. EVANS JR.
Pilot, Trans World Airlines

Paramus, N.J.

QUICK TIP

This is just a tip on keeping track of those Control Zones on sectional charts.

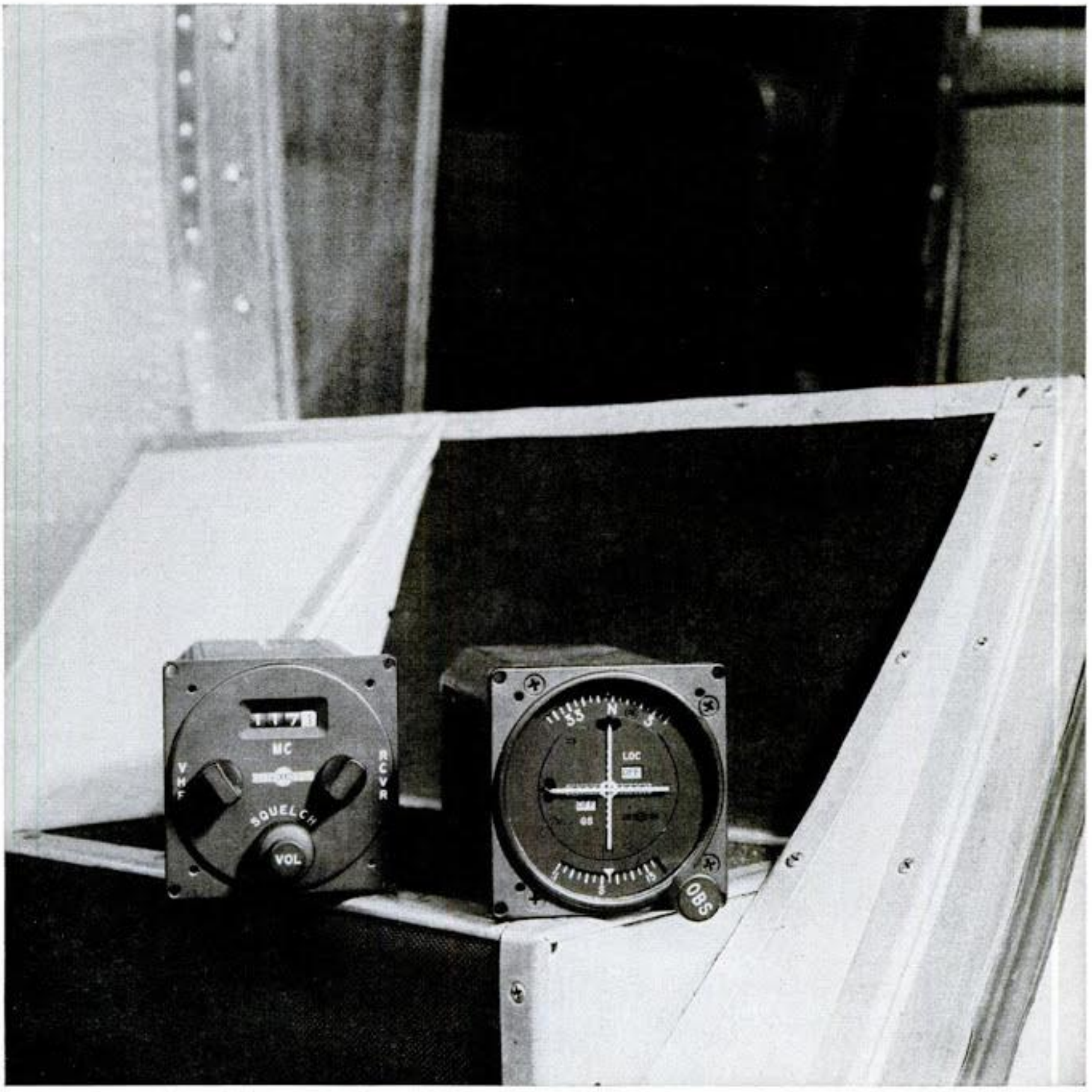
Just take an ordinary lead pencil and shade in those key-hole control zones. This makes a light grey background and the zones can be easily identified. It works for me.

CHET BALL

Clinton, Ind.

Step up to Collins and get unequaled precision and reliability in any navigational situation.

□ The 51X-3 VHF Receiver covers 190 crystal-controlled channels from 108.0 to 126.9 mc. It operates on either 12 or 24 volts and may be used as a standby communication receiver. □ The 344D-2 transistorized instrumentation unit provides complete VOR/LOC navigational information. In addition, the 344D-2 incorporates a built-in glideslope needle and warning flag so that full ILS instrumentation may be obtained by adding a glidescope receiver at the time of the installation, or at any later date. □ Both units fit standard 3" cutouts. □ For more information, contact your authorized Collins distributor, or write Collins Radio Company • Cedar Rapids • Dallas • Los Angeles • New York



COLLINS

BRIEFINGS

U. S. Army Aviation School at Ft. Rucker, Ala., recently welcomed a recruit in its Aircraft Maintenance Course who was already a student pilot. He was Private Donald B. DeWitt, 19-year-old son of Mr. and Mrs. Bernard G. DeWitt, of Palos Heights, Ill., both veteran pilots who accompanied him to Ft. Rucker out of professional interest. A flying family, his

mother is the first woman in Illinois to receive a helicopter rating. His brother, Donald, holds a private ticket and teen-age sister, Diane is a student pilot. At Ft. Rucker (above) the DeWitts (left) are shown as they look at a model H-21 helicopter with their hosts, Col. Rudolph F. Cernick (standing right) and Col. Warren R. Williams Jr.

Reporting 1961 sales of business and utility airplanes at a dollar value of $170 million and total number of units at 6,778, the Utility Airplane Council of AIA, lists the following seven manufacturers as producing the lion's share: Aero Commander $11,047,000; Beechcraft $37,072,000; Cessna $42,266,000; Champion $690,000; Mooney $5,144,000 and Piper $28,889,000. Off $30 million in dollar value and 810 in unit sales from 1960's record high, this relatively modest slump was attributed by AIA to the business recession, which still prevailed earlier in 1961.

The U.S. Supreme Court recently ruled unanimously that when airplane noises force property owners near major terminal to move, the owner is entitled to compensation. However, it was divided seven to two on who should pay. In the case decided before the high court—Thomas N. Griggs vs. Greater Pittsburgh (Pa.) Airport—Alleghany County, owner/operator of the airport, was deemed liable.

Fourteen top CAP Cadets will receive two weeks of flight training and ground instruction, courtesy of Cessna Aircraft, June 18-29, at Wichita. Cessna's agreement covers 10 hours of dual instruction and 35 hours of ground school, for male cadets only of the seven-wing North Central CAP Region, in the 16-18 year age group. Requirements include no previous in-flight instruction, a CAP Certificate of Proficiency and 18 months' CAP service. Cadets will be airlifted to Wichita and housed at McConnell AFB next door to Cessna. This is planned as an annual event.

"Project Little Guy," FAA's long talked-of program to develop a simple, more efficient cockpit layout for light aircraft (see FLYING January 1962) has been formally initiated by the agency and Colin C. Simpson named project manager. An aircraft instrumentation specialist, Simpson was formerly associated with Douglas, North American, Weber Aircraft and Guidance Technology. This project, a three-year program, calls for a flyable prototype within this period.

Hans Groenhoff, aviation photographer, whose fine work has been seen many times in FLYING and other aviation magazines for over 30 years, is to have his vast collection of photographs made a permanent display in the Smithsonian National Air Museum in Washington, D. C. The Groenhoff collection, will include some 30,000 pictures portraying three decades of growth in American civil aviation.

Eighteen years without an accident or fatality to passengers or crew has just won Panagra (Pan American-Grace Airways) a special aviation safety award from the Inter-American Safety Council. Panagra pioneered U.S. passenger service along the west coast of South America 33 years ago. It had flown a total of 2,616,847,000 passenger miles in its accident-free 18 years, a record which brought the citation.

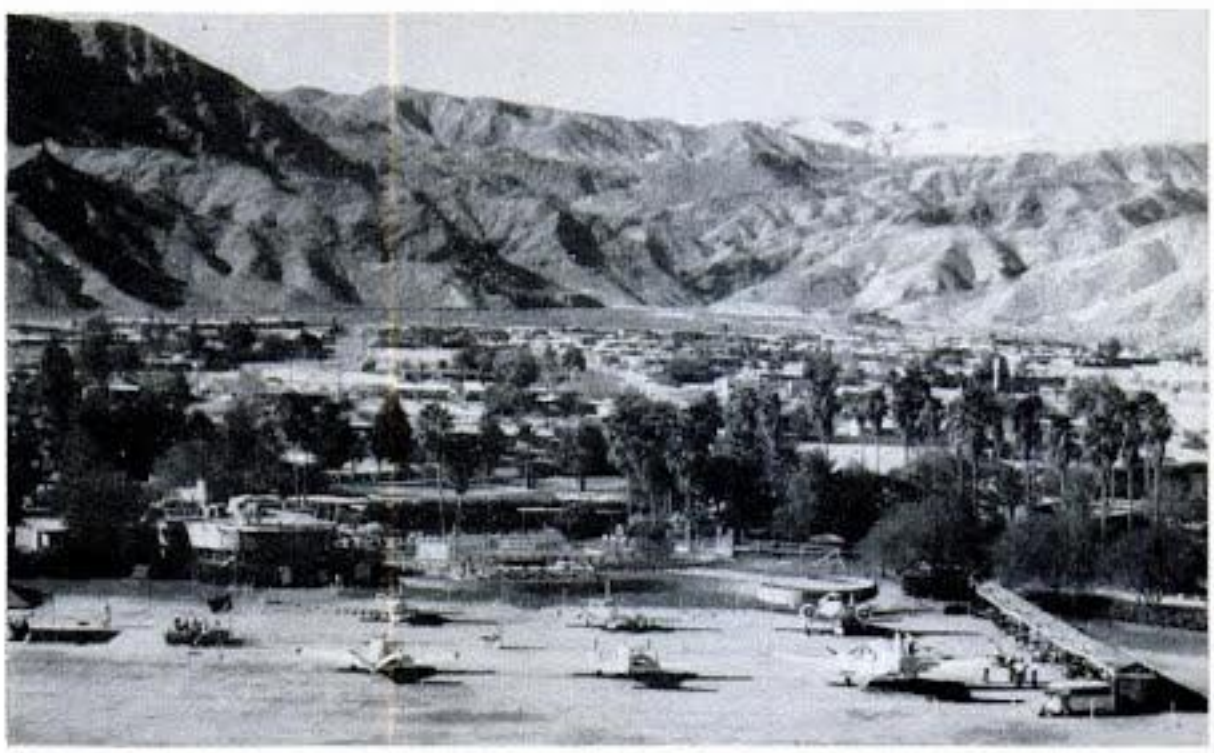
East met West in Oklahoma City recently when Squadron Leader Ayoob Kahn (right) personal pilot for the West Pakistan governor Malik Amir Mohammed Kahn, delivered a letter from his head of

state to Oklahoma's governor, J. Howard Edmondson. Squadron Leader Kahn was in Oklahoma to pick up a new Aero-Commander—a pressurized 680F-P—built for the Pakistan government. Upon his return home, he presented a letter from Governor Edmondson to Governor Kahn, along with the Aero Commander.

AIA's Utility Airplane Council has elected Mrs. A. O. Beech, president of Beech Aircraft as its 1962 chairman, to succeed Dwane L. Wallace, president of Cessna Aircraft. Mrs. Beech was simultaneously named a member of the Aerospace Industries Assn. Board of Governors, a first for any woman aircraft executive.

Periodic renewal of airmen licenses is planned by FAA when its new automatic data processing records system is launched, probably next year. Current information on all civil aircraft will also be kept in the system. The plan calls for the holder of a certificate—pilot, mechanic, dispatcher,

(Continued on page 128)



DESERT OPEN HOUSE—In a superb setting of mountain and desert, The Norman Larson Co., Beechcraft distributor of Van Nuys, Calif., this year held its annual display of new airplanes at Palm Desert Airpark in Palm Springs, along with many of industry's important support equipment suppliers. More than 1,500 visitors viewed the 1962 Beech models in warm sunshine while the San Jacinto mountains provided this majestic backdrop.

Good Everywhere

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1912

WHEN CLYDE CESSNA exhibited his 50-m.p.h. *Silver Wings*, the least of his concern was that of drag created by a fixed undercarriage. But with that plane he began the constant design advancement that has made the Cessna Aircraft Company the world's leading producer of business airplanes—as well as America's oldest.

NOW FOR 1962: To put all 50 years of aviation design experience into a line of airplanes that will remain advanced for many years to come—Cessna more than *doubled* the money usually spent for design advancement and retooling. And so successful were the results, Cessna *doubled* the warranty life on its entire Anniversary Fleet. For these reasons, when you buy a 1962 *Anniversary Model* Cessna, you'll get the world's best, most modern aircraft!

all new Anniversary Model CESSNA 210

new 360° Omni-Vision

High-Stability Wing

retractable Land-O-Matic

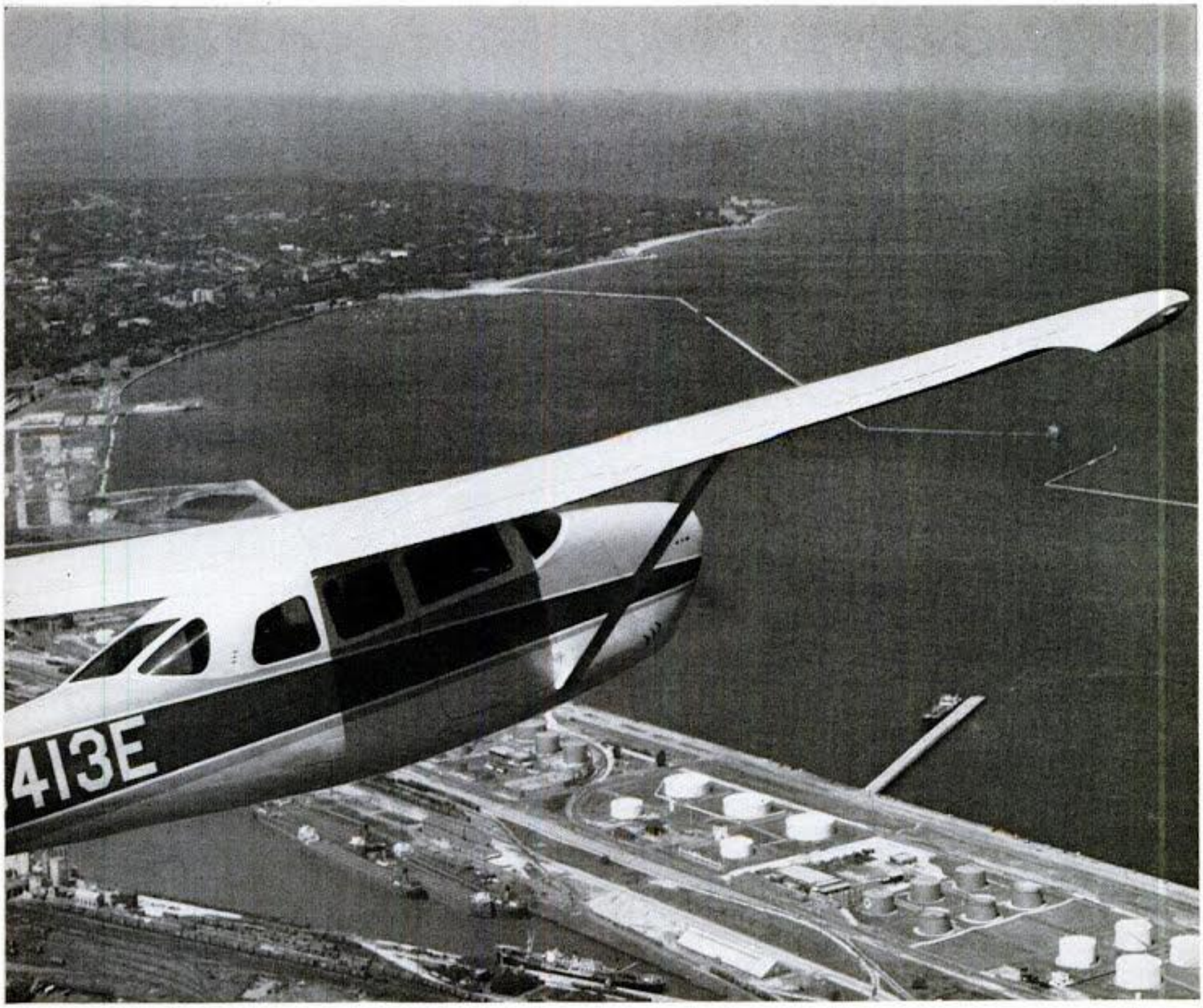
HERE'S THE WORLD'S ONLY SINGLE-ENGINE PLANE with retractable landing gear (for faster speed) and a high wing (for greater lift and stability). You get twin-engine speed with the economy and flying simplicity of a single-engine plane. Compare—and you'll choose the Cessna 210 for smoothest riding, highest performance, and easiest handling!

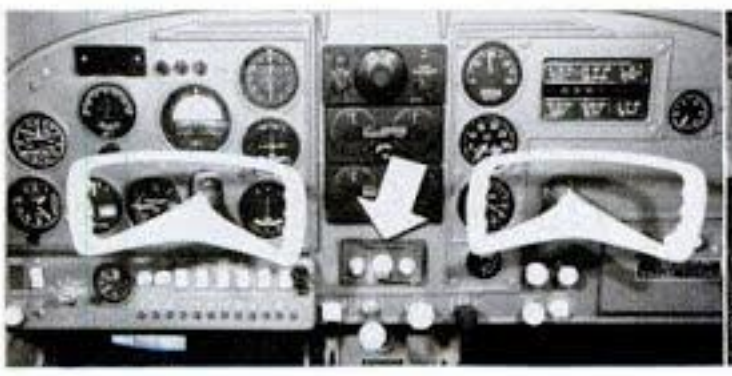
NEW 360° OMNI-VISION surrounds you with tinted picture windows. Pilots will appreciate the greater safety in flight patterns and taxiing. Passengers will enjoy the all-around sight-seeing and new feeling of spaciousness. Everyone is protected from glare and heat by the huge high wing.

THE TOTALLY NEW FUSELAGE is 4 inches wider—also longer and deeper. Center tunnel is eliminated by a new, easier-to-maintain "open-center" control system. New flat floor provides more room for easy in-flight exchange of seats. New interior stylings and foam-cushioned seats (with new optional 6-way adjustment) assure complete comfort. *No other plane in its class has a larger, more luxurious cabin.*

NEW USEFUL LOAD—increased by 90 lbs. Fuel-injection, 260-h.p. engine delivers speeds up to 198 m.p.h. New fuel system gives you longer range through more usable fuel—up to 1,218 miles.

FOR A DEMONSTRATION FLIGHT, call your Cessna dealer now (Yellow Pages). Look at all 13 new Anniversary Models . . . starting at $7,495 —*just $750 down.* Ask about this special new finance plan! Cessna 210: $23,975. Or for further information, write: Cessna Aircraft Co., Dept. F-7, Wichita, Kansas. *All prices with std. equip., f.a.f. Wichita.*





NEW CESSNA NAV-O-MATIC automatically keeps you on course and makes command turns up to 15 degrees. Makes flying easier than turnpike driving. Complete in itself! Exclusive Nav-O-Matic with simplified design and transistors needs no additional gyros for its operation . . . eliminates costly maintenance. Installed on any single-engine Cessna for just $995.

NEW INSTRUMENT PANEL has new rocker-type switches and shock-mounted flight instruments directly in front of pilot. For extra knee-room, bottom of panel has been raised 2 inches. For extra convenience: a new airliner-type control pedestal. For easier flying: a new steering system.

STATION WAGON VERSATILITY—sedan luxury. Rear seats convert in flight for full stretch-out siestas. Includes arm rests, ash trays, cigar lighter, deep pile carpets, instrument and map lights, overhead console, rear reading lights, and many more extra features. Two yard-wide doors give you convenient boarding or loading.

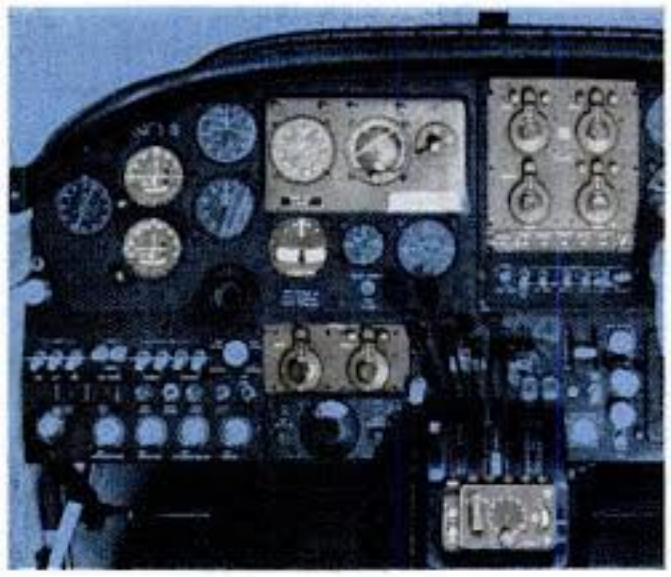
THIRTEEN BUSINESS AIRCRAFT

CESSNA

FOR EACH OF THE PAST 6 YEARS, MORE PEOPLE BOUGHT CESSNAS THAN ANY OTHER AIRCRAFT.

PILOT REPORT

A long story or a short flight documents the first major advance in flight control for general aircraft in over a decade.



MOTOROLA M-4 AUTOMATIC FLIGHT CONTROL SYSTEM

This full three-axis autopilot will not only hold attitude, heading and altitude, but will seek and follow omnirange and ILS signals.

By RICHARD L. SWEENEY

AN AUTOMATIC flight control system which is light enough in weight, small enough in volume and in a reasonable price range for general aviation has been developed by Motorola Aviation Electronics, Inc., Culver City, Calif.

The difference between an autopilot and an Automatic Flight Control System is largely a question of where the line is drawn on how many functions and operational modes are available.

There are on the market now autopilots which have additional capabilities when extra components are added. In fact, what could be termed an automatic flight control system can be put together based on one manufacturer's autopilot and other manufacturers' additional components.

However, when components from different manufacturers are assembled to make up a system, there are extra problems such as space, wiring, power supplies, installation time and labor, etc., even when the extras are basically compatible with the autopilot and each other in design. Reliability also frequently poses a problem.

Motorola's goal in the M-4 was to achieve reliability (and its inherent partner, low maintenance cost) through combining AFCS functions in overall system design and packaging.

The system was evaluated in flights totaling more than two hours, during which almost every mode of normal operation was used and several combinations of modes and functions also were investigated.

In all cases, the system performed excellently.

Cockpit elements of the M-4 system include four instruments, attitude indicator, gyrocompass, turn-bank, VOR/ILS indicator; three control switches (in addition to regular autopilot and radio master and power switches), the autopilot engage-disengage switch, course director on-off switch; course director monitor switch; and the controller unit itself.

Operational modes and functions built into the M-4 AFCS include: Normal three-axis autopilot flight with manual inputs through the controller unit. Automatic flight on a selected compass heading. Automatic flight on a selected radial of VHF omnirange. Course director operation, whereby information which would otherwise help fly the airplane automatically is used instead to guide the pilot by the vertical steering needle in the VOR/ILS indicator.

Reverse course director operation, whereby normal left-right displacement signals are given by the VOR/ILS indicator when the back course of a localizer or VOR radial is being flown. Automatic coupled flight on ILS, both on localizer and glide slope. Altitude hold, which holds the plane within 20 feet of the selected altitude. Automatic pitch trim and synchronization, which keeps the pitch condition of the airplane and the AFCS in alignment in both autopilot and manual flight so that engagement or disengagement of the autopilot at any time will not produce sharp pitch axis displacements.

Yaw damper, a feature whereby yaw stability augmentation is obtained with the rest of the autopilot dis-

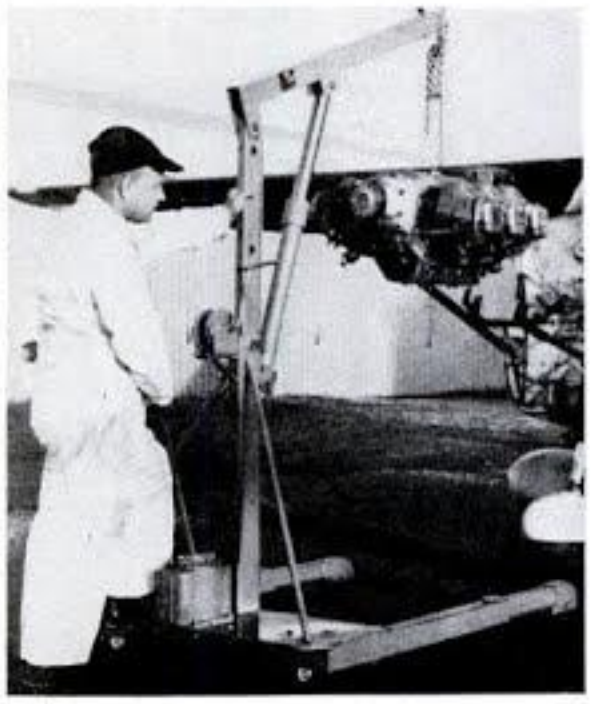
(Continued on next page)

NEW PRODUCTS

A remote indicating version of Narco's DME-UDI-2 is now available to provide arbitrary panel installation of the DME indicator and channel selector. Primarily designed to meet the dual installation requirements of DC-3 category aircraft and up, the new UDI-2R, as it is designated, consists of four separate units: the distance indicator (bottom left) and frequency

selector (bottom right) which are mounted independently on the instrument panel; the interrogator with the electromechanical motor drive at top left; and top right, the power supply, both of which are normally mounted in the aircraft electronics compartment. The blade antenna (center) is the only external installation.

Quick-lifting portable hydraulic crane trade named "Hangar Boy" has been developed by Thern Machine Co., Winona, Minn. to facilitate mounting and dismounting of aircraft engines. Mounted on full swivel ball bearing casters, this four-wheeled hoist incorporates a three-position telescoping mast and boom combination. Maximum reach is 62 inches and maximum boom height is 105 inches. Load capacity fully extended is 700 pounds; load capacity in fully retracted position is 1,500 pounds.



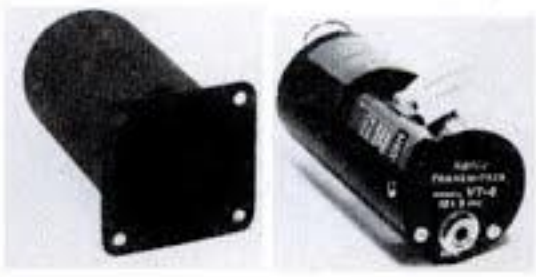
A transistorized navigation light flasher, warranted for 1,000 hours of operation, has been introduced to the general aviation market by Barber-Coleman Co., Rockford, Ill. The nine-ounce control unit provides a flash rate from 60 to 120 times per minute depending on voltage supplied, and a "fail-safe" circuit ensures that remaining bulbs will continue flashing should one or more burn out. The system can also be used to convert stationary wing tip and tail lights to a flashing system.

A simplified version of Warner Instruments' well-known E6B computer has been developed by the Chicago-based firm exclusively for the general aviation pilot. Called the Warner B-1 Vector Computer, it features a unique wind arm that simplifies the solving of wind vector problems; serves as a self-contained runway indicator; and can be used to convert ADF relative bearings to true and magnetic bearings. A knots to mph direct-reading scale is included on the vector side of the B-1 and the reverse side of the speed grid is used for a flight log and related information.

Portable VHF Multiphone, designed to meet the needs of a number of specialized communication requirements in airport operations is now available from Skycrafters, Inc., of Long Beach, Calif. Crystal-controlled Skycrafter's new Model AM-122, draws 1.0 watt current, yet its performance is said to equal 10 watt units now on the market due to a special low - powered modulator. Loudspeaker, AC and DC power cords, microphone and car-top antenna are included with the standard model. Dual-channel kit and two extra crystals (transmit and receive) are optional.

Champion Spark Plug Co. is now marketing three new "premium" spark plugs with platinum electrodes, under type designations RHM38P, REM38P and RHB36P. In addition to platinum-alloy electrodes Champion's premium plugs feature larger bore area, silver-cored nickel-alloy center electrode, copper sleeve for speedier heat dissipation, and a high-strength cartridge resistor. The company emphasizes that these plugs are designed particularly for the aircraft operators who prefer the platinum-electrode type plug, not as a replacement for its standard plugs.

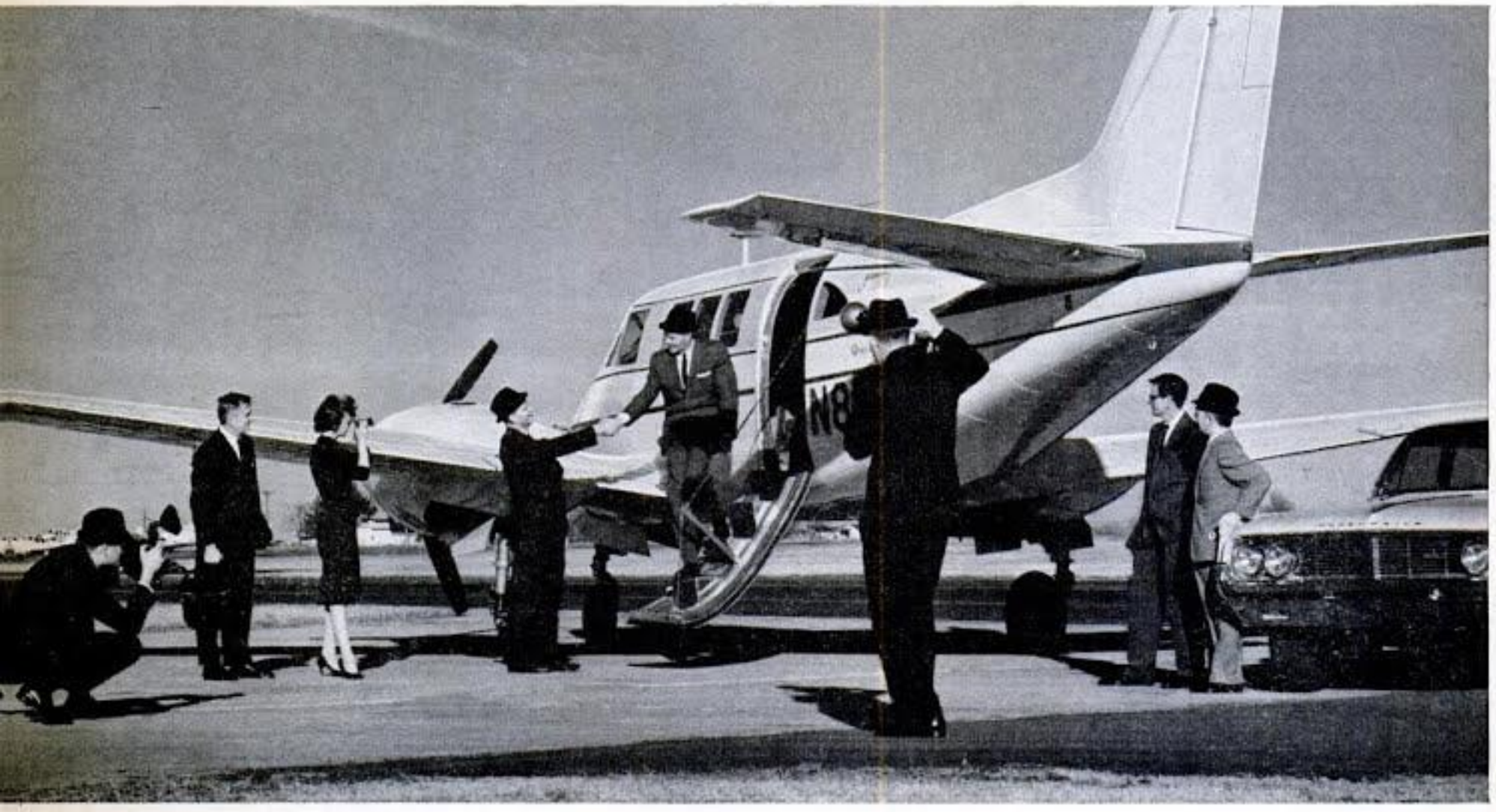
A ten-ounce VHF transmitter, self-contained and self-powered, is announced by Narco for emergency aircraft use. Called the VT-4, it is powered with two hearing aid-type batteries and can be removed from the airplane should a forced landing occur. Tag between batteries (right) is



attached to small VHF antenna which, stowed in coiled-up position, can be pulled out for operation (121.5 mc standard, others optional). A round aluminum case 2 by 4 inches, the unit mounts in standard 2¼-inch panel cutout. Standard microphone plugs into jack on face. Price $89.50.

Announcing The Beechcraft

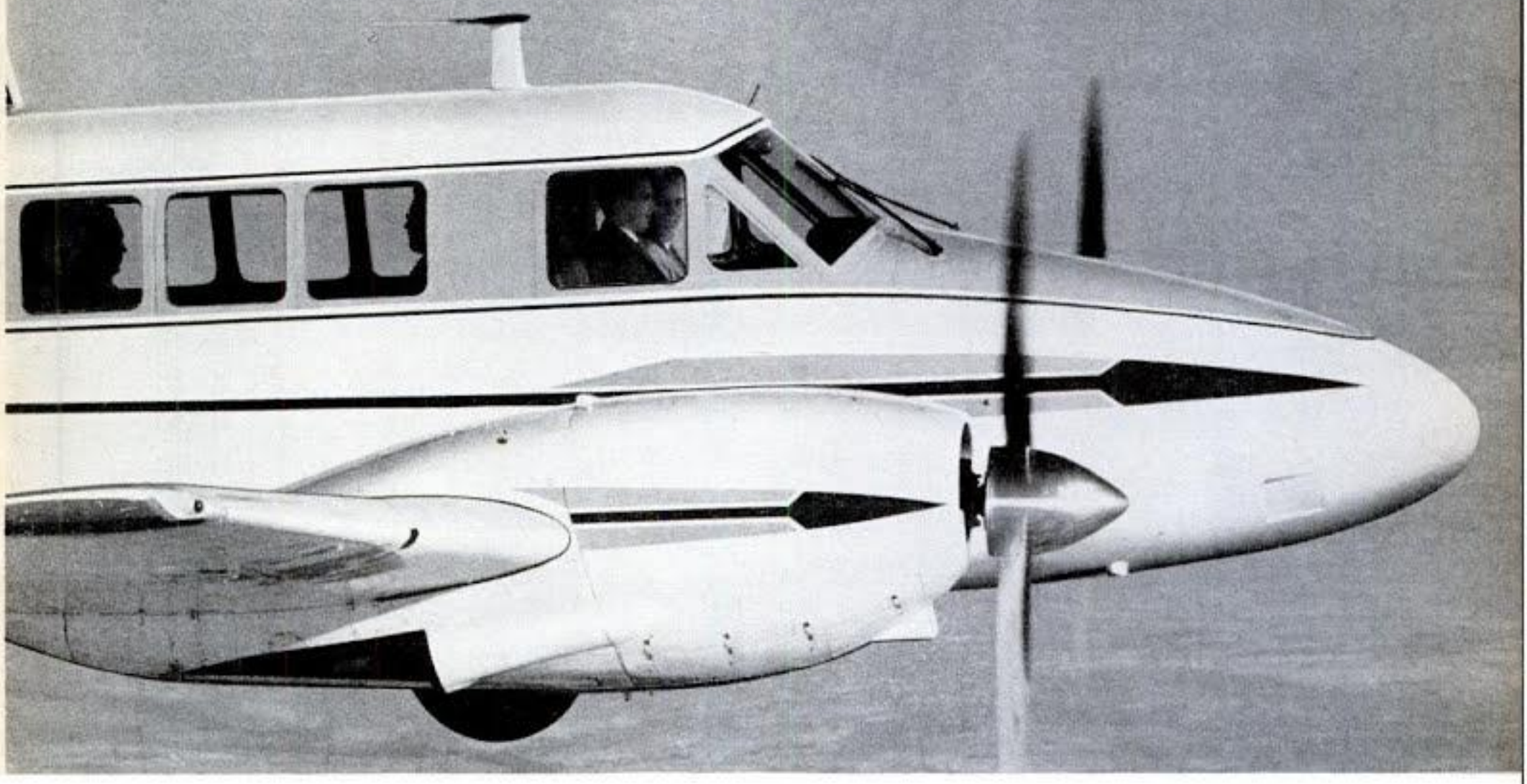
FORECAST: Here's the plane that pilots will "fight" to get! Any company pilot who flies and compares the Queen Air 80 will have a long and compelling list of reasons why the Queen Air 80 is his first choice when airplane trading time rolls around! (You may want to clip and save the ones on these pages.)



BE AMONG THE FIRST to see and compare the new Queen Air 80, the plane that's making the big airplane news in 1962. Read these "plus" reasons why:→

Sensational New

Queen Air 80



Newest addition to the fast-growing Beechcraft line, this high-performance, swept tail companion to the Queen Air 65 brings you new stepped-up speed—PLUS a host of advantages that no other plane in its size and price class can equal:

Now Beech brings you the most advanced new plane ever introduced into the 6 to 9 place field—the new Beechcraft Queen Air 80.

The new Queen Air 80 has all the famous comfort features that make the Queen Air 65 the largest-selling model in its class—all over the world. (Used even on airlines.) But — IN ADDITION—new performance characteristics give the "80" a distinctive new classification.

Here are a few of many reasons why the Queen Air 80 gives you more than any plane in its class!

NEW HIGH SPEED! Big 380 hp Lycoming supercharged fuel injection engines let the Queen Air 80 cruise 230 mph at 70% power. Top speed is 252 mph!

NEW CLIMB PERFORMANCE! 335 fpm on one engine; 1,500 fpm on both.

NEW RANGE! At 65% power, the Queen Air 80 can fly 1,070 miles, with 45 minutes reserve. (Includes warm-up, taxi, and climb.)

. . . **PLUS bigger useful load.** Big 3,200 pound allowance for passengers, baggage, fuel and optional equipment.

. . . **PLUS 81% more "liveable" area** inside cabin than its chief competitor.

. . . **PLUS 3-compartment privacy.** Separate flight deck, plus separate passenger salon, plus big separate inside baggage compartment—with private lavatory that no other in its class offers.

. . . **PLUS walkaround roominess** with wide center aisle. No scooching or crawling to reach any seat.

. . . **PLUS plenty of work space** up front, with enough panel room for dual flight instrumentation, dual nav/comm equipment and even panel-mounted radar scope.

. . . **PLUS huge safety glass** windshield that can accommodate heavy-duty wipers.

. . . **PLUS new manual mixture controls** and fuel-flow meters.

. . . **PLUS more structural strength** than any other plane in its class.

. . . **PLUS high ground clearance** that lets you land and taxi over rough terrain with confidence.

What more could you want? Now is the time to see your Beechcraft distributor or dealer. Get your name high on the list for a flight at the controls of a Queen Air 80.

FREE: Write today for ☐ New folder on amazing Beechcraft Queen Air 80. ☐ Beechcraft Leasing and Financing Plans. Address Public Relations Dept., Beech Aircraft Corp., Wichita 1, Kansas, U. S. A.

Beechcraft

AIR FLEET OF AMERICAN BUSINESS

By JAMES F. SUNDERMAN

FROM ANOTHER ISLAND: ADVENTURES AND MISADVENTURES OF AN AIRLINE STEWARDESS, by Sherry Waterman (Chilton Books, Chestnut at 56th St., Phila. 39, Pa., $3.95).

A flood of career air books of recent years has been slanted toward the young lads who might look to the sky for a rewarding and fruitful life's work.

In this book, ex-airline stewardess Sherry Waterman, after 9,000 hours on world airways, writes a travelogue of her career in the air, touching on just about every facet of a gal's life on a commercial airline.

Introduced to flying by a 20-minute ride in a Piper Cub in 1942, Sherry entered the airman's world as a meteorological aide with the U. S. Weather Bureau after high school graduation in 1945. Four years later, with service at Newark, N. J. and in Washington D. C., she applied for and began training at the American Airline's stewardess school in Chicago, and upon completion flew on American's domestic routes for about seven years. In 1956 she resigned and joined Transocean Air Lines at Oakland, California, and for three years flew the Pacific routes which opened to her the exotic places and the wide horizons of adventure of which she mainly writes in her book.

Each island in her life is another place she touched-down, the "destination" listed on the flight plan. It is these geographical settings in which she describes with frankness and realism the life, work, play, fights, romances, thoughts, wonders and perils of a stewardess.

The passengers and cargo she flew with each come in for a chapter that encompasses high points of in-flight duty. It is on layovers, at route-ends like Hawaii, Wake Island, Guam, Okinawa, Philippines, Formosa, Japan, that Sherry lifts the veil of her nine years in the air to give the reader her real-life experiences and intimate glimpses into a career that holds so much for those who would take it.

For the young ladies, for their fathers and mothers who might be doubtful of the airline stewardess vocation, we highly recommend FROM ANOTHER ISLAND.

SPEAKING OF SPACE: THE BEST FROM SPACE DIGEST, edited by Richard M. Skinner and William Leavitt (Little, Brown, 34 Beacon St., Boston 6, Mass., $5.95).

Most of us are too busy to read the millions of words that flow monthly from the periodical and book presses dealing with the technology of missile and space flight and man's conquest of the cosmos. Much of it is of dubious worth anyway since it explores scientific detail which lends little to an understanding of what it all means.

That is why a book like SPEAKING OF SPACE is a boon. For here is distilled a mountainous literature into 29 articles topically falling in seven categories: The Vastness and Mystery of the Cosmos; Man's Place in the Universe; The Impact of Technology; Man—and Machine—In Space; Economic Implications; Political-Military Significance; New Words for a New Age.

The individual pieces treat the technical specifics only as they might relate to general areas for understanding the new age in which we live. For the average layman these areas are important. The specifics are not.

The book boasts a distinguished list of authors: men like Archibald MacLeish, Arthur C. Clarke, Simon Ramo, C. P. Snow, Edward Teller, Harlow Shapley and a score more. Their works, culled from a wide selection of periodicals, speeches, books, were reprinted in SPACE DIGEST, a Department of AIR FORCE/SPACE DIGEST Magazine during its first three years of publication. The editors have well selected their material and preface each piece with a lead-in paragraph which gives perspective and identifies the author.

U. S. ARMY-AIR FORCE FIGHTER PLANES, by Edward J. Farley (Aero Publishers, 2162 Sunset Blvd., Los Angeles 26, Calif., $4.50 /standard edition, $7.50—collectors edition).

For model builders and aviation hobbyists, this new, revised edition contains specifications, information, three-view scale drawings and original paintings of 60 fighter aircraft from the Curtiss P-1 "Hawk" through the Convair B-106B.

GREAT AMERICAN FIGHTER PILOTS OF WORLD WAR II, by Robert D. Loomis (Random House, 457 Madison Ave., New York 22, N. Y., $1.95).

Here essentially for the young adults can be found the dramatic, intimate and factually authentic stories of several dozen great Army Air Force, Naval and Marine fighter pilots who wrote history in the skies of World War II in Europe and the Pacific. Some like Gabreski, Gentile, Bong, Boyington McCampbell and McGuire made fame during their heyday. Others like "Hub" Zemke, Neal Kearby, and William Shomo are not so well known but achieved brilliant combat records. Scores of photos of individuals and the aircraft they flew and of combat scenes give this Landmark book the "new look" and add to the on-the-spot flavor the author succeeds in recreating in the narrative. Drama, adventure and history are here all wrapped up in a manner that is pleasant and easy to read.

If you have trouble securing the books reviewed here, send payment in check or money order to AEROSPACE BOOK CLUB, 7801 Old Georgetown Road, Washington 14, D.C. Your books will be sent postpaid.

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Compact all transistor OMNI unit provides on-the-money, omnigation for the professional pilot, yet is simple to operate, even for the student.

Meets I.F.R. Requirements

A quality precision instrument. ■ Easily panel mounts in a standard 3 1/8" instrument hole. Small enough to mount anywhere. ■ Automatic "TO-FROM" indicator. ■ The OMNI is driven by the VHF receiver itself. No additional power supply or wiring is necessary. JUST PLUG IT IN. ■ Provides IFR accuracy from a signal as small as ½ volt. ■ Full year warranty on parts and workmanship.

NOVA/STAR OMNI $195 $30 DOWN

Nova/Star OMNI easily connects to any standard VHF receiver. Provides IFR accuracy with NARCO, KING, LEAR, ARC, COLLINS, DARE radios. Comes complete with mating plug or simple instructions. Money-back guarantee.

NOVA/STAR VHF RADIO

Provides loud and clear 2-way communications for ranges of 60 to 100 miles.

Over 5,000 Nova-Tech Radios Now In Use

You get ■ 10 crystals *($100 worth)* installed and adjusted, room for 13 more ■ Whistle-Tuning ■ Cabin Speaker with powerful amplifier ■ Built-In Intercom ■ Remote Jacks ■ Transceiver weighs 3½ lbs. Measures 3" x 5" x 6" ■ Ignition shielding not necessary. ■ PROVEN PERFORMANCE ■ Comes complete with power supply, whip antenna, wiring harness with connectors. Ready to install in your plane. ■ PERFECT PRIMARY OF SECOND RADIO.

NOVA/STAR RADIO $295 $60 DOWN

TESTIMONIALS

"There are several Nova/Star Radios and OMNIs in various arrangements on our active airport giving excellent results."
R. O. Hower, Sarasota, Florida.

"... we are now using the Nova/Star system as primary navigation and communications equipment for both IFR and VFR."
M. R. Kesby, Buena Park, Calif.

"Both the Nova/Star OMNI and the radio far out-perform my expectations ... Transmit and receive loud and clear at least 50 miles at 2,000 feet." *Dr. F. H. Sink, San Clemente, Calif.*

IRON-CLAD MONEY BACK GUARANTEE

All Nova-Tech products carry an unconditional 10-day money back return privilege with no questions asked. You must be completely satisfied!

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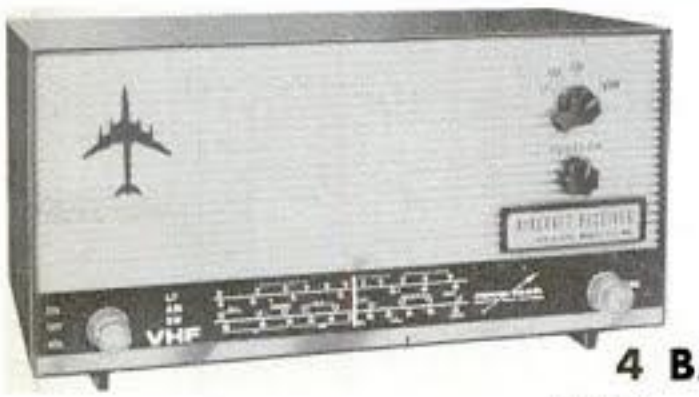

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- ☐ I enclose payment in full. ☐ Ship C.O.D. ☐ I prefer Budget Terms. I enclose $_____ Down Payment.

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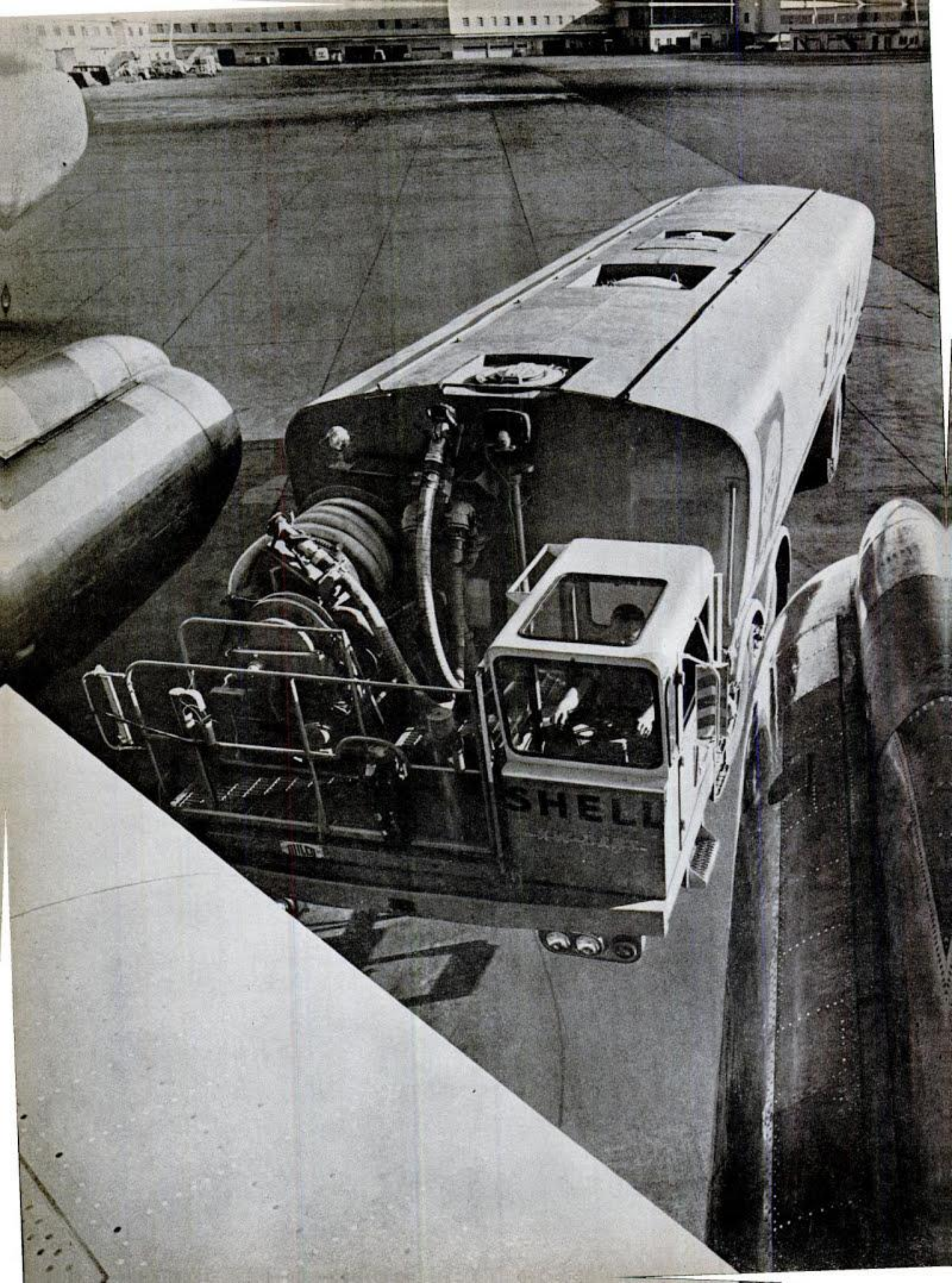

SHELL

New Shell designed refueler "inspects" every drop of fuel it delivers—can pump 600 gpm to reduce fueling time

Shell has designed a new refueler that can pump 600 gallons of fuel per minute, "inspects" it for cleanliness and can shut itself off automatically to help assure outstanding quality. It even has a "gold-fish bowl" cab (see picture) for maximum visibility.

Read how its maneuverability, front-end refueling system and built-in elevator helps make this vehicle exceptionally safe, efficient and simple to use.

THE picture on the left shows the business end of Shell's new 10,000-gallon refueling truck.

Airlines are happy with the new refueler because it helps them reduce costly ground time for their jets. Here's how: Each refueler can pump 600 gallons of jet fuel a minute. Working as a team, two units can refuel an aircraft —20,000 gallons—in 17 minutes.

The refueler's low silhouette lets it maneuver with ease into refueling position *between engine pods.*

The new Shell truck's cab even has a roof of glass, allowing the driver to position the truck swiftly and safely.

Front refueling for efficiency, safety

Refueling is done from the *front* of Shell's refueler. There is less chance of accidents.

The new truck even has an elevator (the pumping platform is hydraulically operated). This makes it easier to hook up refueling hoses to a plane. Each truck has a special filter-separator. It is designed to meet strict military specifications for fuel cleanliness—and the even stricter specifications imposed by Shell scientists themselves.

NOTE: Precautions are taken against dirt or moisture all along the line, whenever fuel is transferred from one container to another—from refinery to tank barge to storage tank to trucks to aircraft.

Checks and double checks to prevent accidents

It's highly unlikely that water could get into the new refueler. But if it should, this remarkable unit is designed to prevent it from getting into an airplane's tank. Each refueler has a highly sensitive *water slug* device. If it detects water in the fuel, a filter-water separator slug valve can stop the pump in *half a second.*

The "deadman's control" is another safety device. It allows operation by remote control, and gives the operator freedom to oversee the entire fueling operation from the best location. Should trouble occur, the "deadman's control" can also stop the pumps.

More automatic features

Pumping pressures are regulated automatically. The truck's brakes lock automatically when the pumping operation begins. They cannot release until pumping is finished and the hose is returned to its receptacle in the truck.

These are just a handful of the many features Shell has designed into this remarkable truck. They give you an idea of how much imagination and care Shell and its dealers invest to serve aviation better.

For full information on Shell's aviation products and services—including refueling developments—write: Shell Oil Company, 50 West 50th Street, New York 20, New York.

SHELL

Shell is the nation's leading supplier of commercial aviation fuel—and has been for more than a decade.

New Shell designed refueler, left, snuggles between the pods and under the wing of aircraft. Two of these refuelers operating simultaneously can refuel a jet in 17 minutes or under.

....IN THE HUMAN RACE

GILL ROBB WILSON
Publisher

WITH THE FARM chores done before summer dusk, a boy was free to trudge down the valley to where the railroad crossed the Conoquenessing. There he could sit on the creek bank to watch the immigrant trains roll west.

Sometimes one would pull into the Oneida siding to let the regular schedules go by. The immigrants would pour from the coaches to wade in the riffles of the creek, to fill jugs with water, to wash out baby diapers or undergarments.

Then I would wander among them. The broad-faced men would gravely shake hands. The women would smile. The children would gather and jabber excitedly. They would point at the hills and I would explain—Pennsylvania. They would point at the creek and I would say—Conoquenessing. Their tongues would stumble over the words. They would laugh and shout America, America! I would nod—yes, America.

After enough trains had paused at Oneida siding and enough immigrants had waded in the Conoquenessing and enough hands had been shaken, even a boy began to sense overtones of destiny.

In bed at night, I would prop my hand under an ear on the pillow so as not to miss the echoing whistles of the locomotives winding through the hills—the bugles of the countless strangers.

There must be something awesomely wonderful in the land of my fathers to call so many from the ends of the earth. I would fall asleep in a great pride even although I had no articulate explanation of this ineffable thing that the immigrants seemed to realize better than I.

Three score years are gone since then. Change has been ceaseless. The immigrants have become the people of America. America has become the mighty champion of the free.

And now another form of migration begins—to the Universe. And, once again, conflicting ideologies are locked in desperate rivalry for the key to human destiny.

Recently I sat in the TV grandstand with millions of others to watch another train go by.

But I did not think of the orbiting of Colonel Glenn as critical of who shall inhabit the Universe. Such scientific achievement is within the capability of the slave, as well as the free.

Wherein then the resurgence of that pride which touched the life of a boy long ago?

Why certainly in this—that the United States has remained so identified with the common destiny of man that we might pursue the new immigration, free of secretiveness and dark purpose!

Not that we have always been wise, or that passion and avarice have not had their way with us, but that we have never been so irretrievably dedicated to conquest and selfishness as to disfranchise us from our mission to civilization.

Thinking of the boys in uniform, the test pilot astronauts who form the sharp spearhead of migration to the stars, I reflect that the military might of the nation has never been aught but dedicated to the national aims. There must be something abidingly good in a form of government and in its citizenship to continuously command the dedication of rolling generations of soldiers and sailors and airmen—and never a Man-on-Horseback to threaten the freedom of the people! I think of those who have pioneered the aero-space age as their bounden duty in uniform and without reward beyond the encomium of "well done". . . . the penetrators of the barriers who have lived and died to maintain the capability of the American mission. Nor does their zeal diminish!

Thinking of the NASA team which labors in Project Mercury, I reflect upon the names of many who are not native born but whose genius has been critical to the national project. And I realize that the magnetism of freedom did not exhaust itself with the immigrant trains of yesterday. Still they came—those who love the greater destiny of man beyond all else.

So what shall we say as we contemplate the struggle of the ideologies for inhabiting the Universe? Where shall we place our confidence? Why, as for me and mine we shall continue to believe that the judgment of history will be with that people whose greater concern is not where they stand in the space race, but what they stand for in the human race.

Who says "GO"?

Before an American Airlines plane takes off, ten of our divisions must approve the flight. If any one says "no," the flight doesn't go.

This results in a certain number of cancelled flights, but it means that you fly only when conditions are right.

For example, the weather along your flight path is studied not only by government forecasters, but by our own meteorologists, dispatchers, pilots and co-pilots. When your plane takes off, you can rest assured that ground conditions, ceilings, cloud patterns, storm areas, winds, clear areas have all been analyzed by pros. Had there been any doubt, the flight would not have left the airport.

As for the planes you ride in—they receive over five man-hours of maintenance and inspection for every hour they spend in the air. Thousands of aircraft specialists are involved in these ground checks, and if any one of them turns thumbs down, the plane is not allowed on the line.

Finicky? You're darn right we are. It's one more reason why so many experienced travellers consistently choose American Airlines.

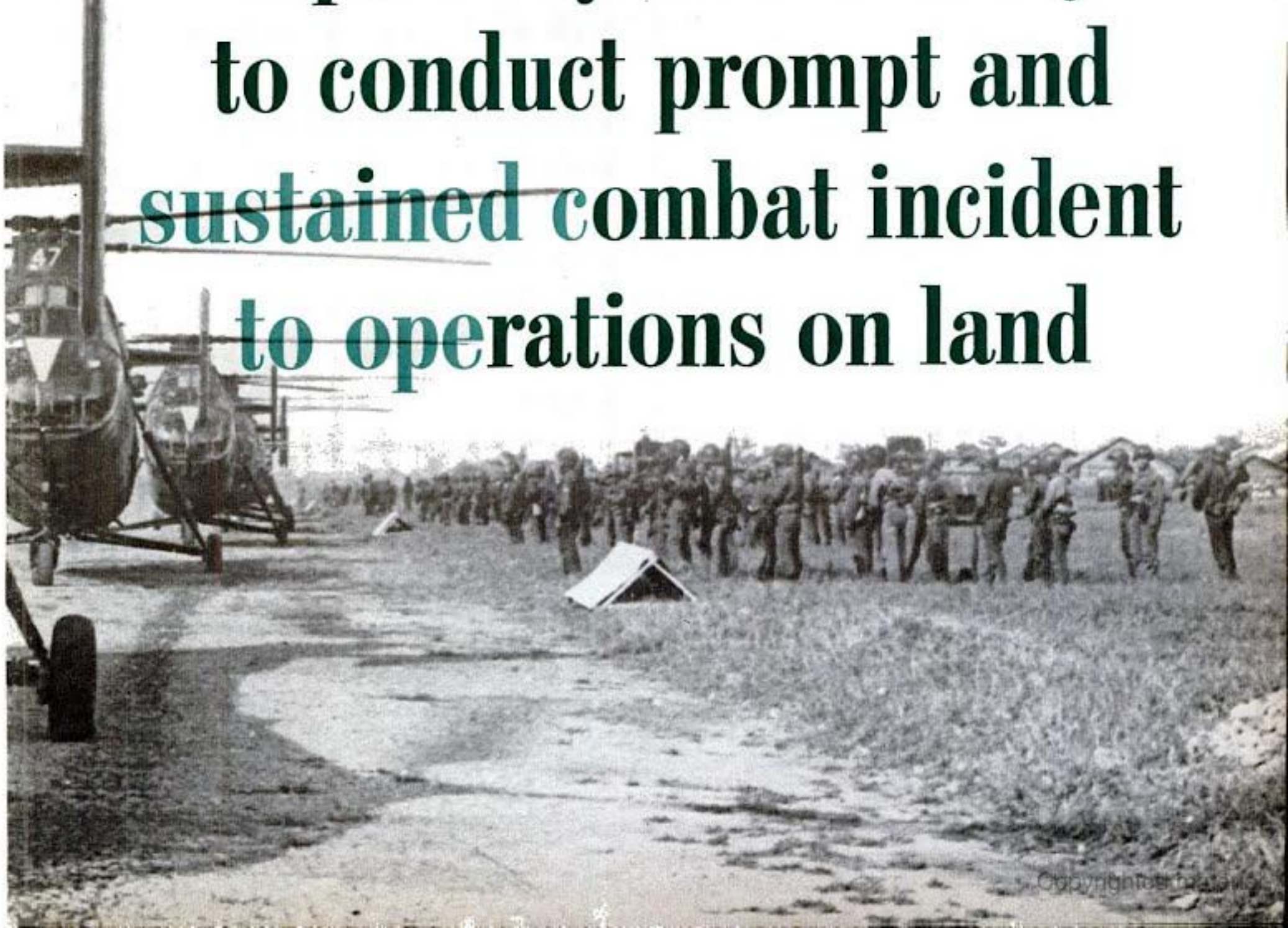
AMERICAN AMERICA'S LEADING AIRLINE

A FLYING MAGAZINE SPECIAL REPORT:

Vertol H-21C Shawnees in South Viet Nam airlift.

ARMY AVIATION

MISSION: To augment the capability of the army to conduct prompt and sustained combat incident to operations on land



Elvis J. Stahr, Jr.

Commanders throughout history have searched for a mobility advantage which could be applied decisively on the battlefield. The key to success in many instances has been the ability to appear much sooner at a critical location than the enemy thought possible. Military history is rich with examples: Napoleon's early victories in Italy; Stonewall Jackson's forced marches in the Shenandoah Valley campaigns; the German Army's blitzkrieg of 1940.

The advantage of air mobility has been apparent since man's first flight. Ground forces moved through the air to critical areas of the battlefield enjoy a decided military advantage over a foe bound to the ground.

This is the goal of Army Aviation—to provide our ground force commanders not only with vastly improved battlefield surveillance but also with the capability of moving men and firepower at speeds at least four times as fast as ever before and thus adding a new dimension to mobility. We visualize an Army that can move faster and more purposefully in any part of the spectrum of future conflict—from the guerrilla actions of unconventional war at one end of the scale to the nuclear battlefield at the other.

Army Aviation cannot be examined in isolation from the over-all mission of the Army, for it is an organic capability of the ground commander for the ground battle. Technological break-throughs of the future will add to this relatively untapped mobility potential as more advanced air vehicles are developed to suit the rugged environment of tomorrow's flying soldier.

Army Aviation will be an increasingly vital player on the Army team, doing its part to maintain the security of the United States and the entire Free World.

Elvis J. Stahr, jr.

ELVIS J. STAHR, jr.
Secretary of the Army

Mission and Objectives

Army Aviation has come of age. Major opportunity for advancing the art of subsonic flight rests upon its shoulders.

A small but capable force of 21,000 aviators, observers, officers and enlisted men, whose needs have been overshadowed by heavy emphasis upon supersonic aircraft and ICBM missiles, is now expected to develop airborne capability for the Army. Its 11-year-old aircraft inventory must be replaced by modern, more effective vehicles and weapons. Its down-to-earth doctrine, tactics and skill are paramount to successful air mobility in what Defense Secretary Robert S. McNamara terms "sublimited" or "twilight area" conflict.

Whatever it may be called, wings are essential to hard-hitting, nimble operations and to winning at tree-top level using hide-and-go-seek tactics.

This new emphasis will accomplish many things: It will hasten air mobility and versatility of U. S. ground forces.

It will cover exposed, back fence frontiers while the strategic nuclear deterrent force covers the broad

and deep frontal approach; it will accelerate technological developments in subsonic aircraft, instrumentation, and support equipment; and it will provide important fringe benefits to civil aviation.

Following weeks of intensive field research and observation of major areas of AA and its integrated role in the Army, FLYING's editorial team produced this special report on Army Aviation's doctrine, procurement, research and development, training and operational status.

On-the-spot reports and views expressed in this special Army Aviation section reveal the Army's air operations, training, research and development look of tomorrow; report on the new air soldier-pilot and the opinions of veteran aviators who have helped shape this new dimension. Overall these basic points and views paint the perspective of a big job yet to be done:

1) Considering the magnitude of its mission, Army leadership and aviation specialists need financial and moral support of all services, Department of Defense, Congress, industry and the American people.

2) Restricting policies, hangovers from less air-minded days, should be removed to place air mobility in balance with equally important peace preserving functions.

3) Army airmen are first to say that they are soldiers above everything, but less airminded battle commanders should apply unrestricted use of their air ability.

4) Army Aviation commanders say they could not accept the responsibility for Tactical Air Support if thrust upon them suddenly, but civilian leadership must recognize their right to independent development and buying and testing of air weapons and equipment devoted entirely to their task of serving and protecting the division envelope—this may eventually include their own fighter cover.

5) Current re-organization of the Army must improve AA's research and development resources and financing—intra-service roadblocks must be removed where support equipment and flight related systems are concerned.

6) Intra-service air education must dispel the ground pounder's haunting fear that AA air troops will grow into another elite corps or "Army Air Force."

7) Aerospace industry must take the challenges of Army Aviation's down-to-earth doctrine seriously.

8) In assessing the cost of air mobility of the combat division, Congress and the Nation must appreciate the dividends such development can pipeline back to civil aviation and better living for the United States. Here, all is by no means lost in expendable weapons investment.

Not since 1862, when Thaddeus S. C. Lowe became airborne in a balloon basket over Virginia to observe Confederate troop movements, has the Army needed wings more. It was vital to mass army movements in World War II and most decisive in Korea, but never as important as now on Army Aviation's 20th anniversary (June 6) and in the future.

Conventional means of moving great masses of men and equipment, via truck, train or afoot, over great areas of real estate are gone forever. Nuclear and chemical weapons can render massive areas of land contaminated and impassable. Airborne enemy forces can slaughter massive concentrations of ground troops.

Army divisions "must live and fight like Navy carrier forces," says Lt. Gen. Arthur G. Trudeau, chief of Army Research and Development. "They must be

Twin-engine Sikorsky H-37 Mojave carries up to 23 troops on combat missions. Alternate load: 24 litters. Top cruise speed loaded is 80 knots.

ever on the move, seeking targets of opportunity while using mobility and natural barriers for their own survival."

"The day of the line-plunging army is past," says Maj. Gen. Ernest F. Easterbrook, commander, Army Aviation Center at Fort Rucker, Ala. "Army divisions must be as nimble and adept at broken field running as are winning football teams." Gen. Easterbrook has been reassigned to Hawaii with the U.S. Army Pacific Command. Col. Robert R. Williams will succeed him as commanding officer of the Army Aviation Center.

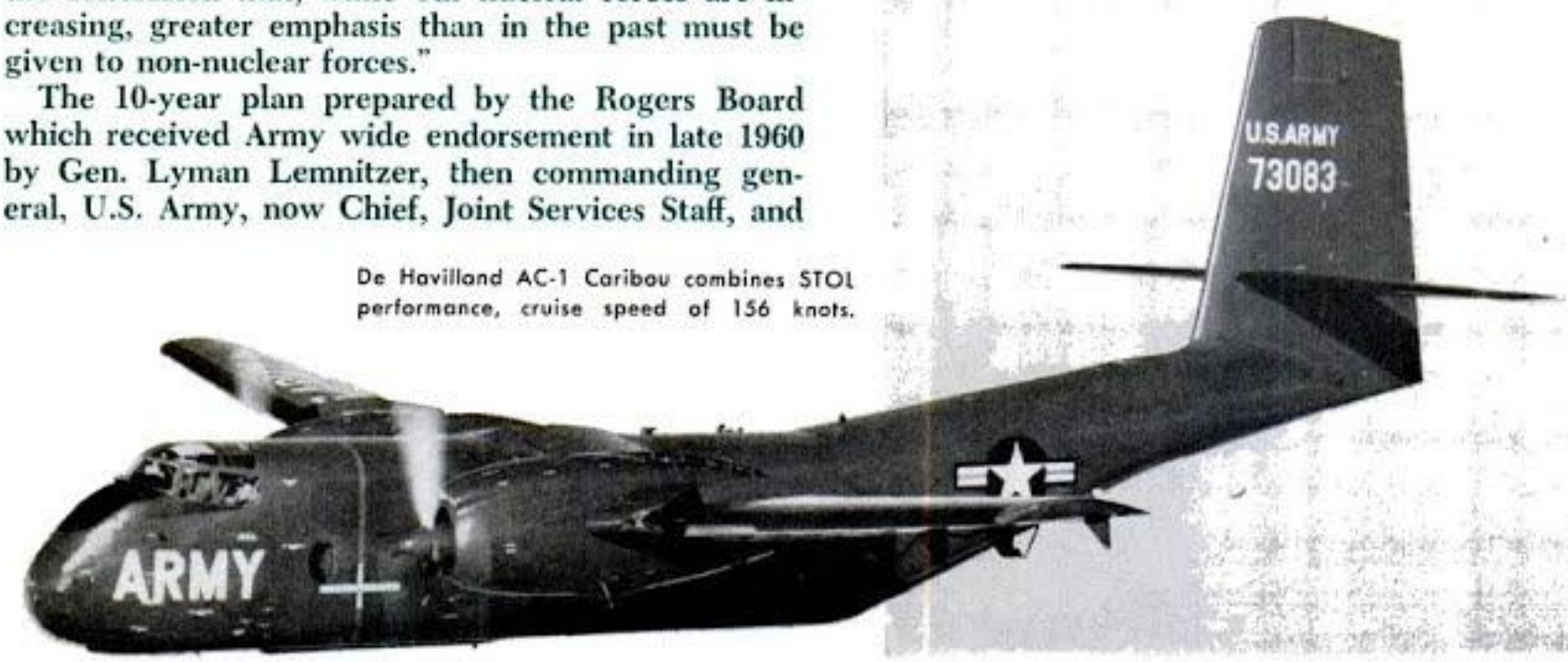
The Director of Army Aviation, at the Pentagon, Brig. Gen. Delk M. Oden, told FLYING that "air orientated commanders and AA personnel have been preparing for this mission during the last 10 years. Now that the Department of the Army and Defense Department call has come for air mobile forces, we're ready. All we need are the tools to do the job."

This new accent upon air is backed by the Kennedy Administration's attention to strong conventional forces and their role in guerrilla warfare of the kind now taking place in Viet Nam. A sizable portion of the 4,000-man force there in support of the anti-Red native troops is made up of Army airmen and air-borne troops.

This "back-to-the-soldier" movement is part of the President's "balanced force" concept. The threat of total war diminishes as U.S. nuclear war capability expands. And the prospect of total obliteration stays the hand of aggressive forces from sparking a nuclear war. However, this leaves conventional war and guerrilla operations, employed under the guise of popular political movements—called "popular revolts" or "wars of national liberation" by Khrushchev—as the most effective tools of conquest from within. Here is where the Administration sees the need for immediate strengthening of U.S. Army forces—to aid our friends and to meet the "Achilles Heel" threat of the nuclear standoff period.

Testifying before the House of Representatives' Armed Services Committee, Secretary McNamara said, "After long and intensive study we have reached the conclusion that, while our nuclear forces are increasing, greater emphasis than in the past must be given to non-nuclear forces."

The 10-year plan prepared by the Rogers Board which received Army wide endorsement in late 1960 by Gen. Lyman Lemnitzer, then commanding general, U.S. Army, now Chief, Joint Services Staff, and



De Havilland AC-1 Caribou combines STOL performance, cruise speed of 156 knots.

Left: Rear doors open in flight for paratroops. Below: capacity 32.

the aircraft and weapons procurement schedule activated in early 1961, are designed to give Army divisions 25 per cent air mobility by 1970. Now that DOD blessing has been received, there is added confidence that the doctrine will be implemented down the line.

In detailing the 1963 fiscal year budget, Secretary McNamara recommended funds for aircraft procurement in accordance with the long-range aim for 8,000 aircraft and 12,000 aviators by 1970.

The budget, beginning July 1st, if passed by Congress, includes $219,000,000 for new airplanes and equipment. This is $28 million less than the Army wanted, but $39 million more than was spent in 1961. Current actions of DOD are expected to increase '63 funds on the premise that in the '60s, the decisive struggle will take place in "sublimited war" or "twilight" conflict.

Annual expenditures for Army Aviation are expected to reach $250,000,000 annually by 1970.

Many Army leaders view the DOD-approved changes in Army management and the concentration of responsibilities with three major commands of the Army equally important to funding. The new formula will reduce overlapping effort and streamline operations, providing "more defense power for the dollar." The aim: within 18 months to consolidate responsibilities for personnel management, training, combat development, research and development and logistics functions under the smallest number of commands and agencies — an organization better aligned to changes in the general defense environment.

The third major policy development, having direct bearing upon the operational responsibilities of AA aviation, represents a mixed or "tailored" force concept and revision of the Pentomic nuclear army philosophy.

Out of this review and analysis, Secretary of the Army Elvis J. Stahr has developed the ROAD or

"tailored" division formula. Instead of a fixed armored, mechanized, infantry or airborne troop force structure, each division will have five basic command, control and support elements—such as the Army aviation battalion—then the mix of combat forces will be added, shifted or tailored to developing missions. Each division will have five to 15 battalions with an expected average of ten. The Army wants 16 regular ROAD divisions separate from training organizations. Now there are 14.

These basic moves place Army Aviation in the keystone position within the division.

Procurement philosophy guiding aircraft acquisition through 1970 calls for reduction of types from 12 to six capable of performing all missions. For example, the new LOH (Light Observation Helicopter) competition in which prototype contracts have been awarded Bell Aircraft, Hiller and Hughes, will replace the 11-year-old Cessna L-19 fixed-wing Bird Dog and the Bell H-13 Sioux and the Hiller H-23 Raven helicopters.

Bell's new HU-1 Iroquois, now coming into the inventory as a high-utility helicopter, replaces the Sikorsky H-19 Chickasaw.

In the light transport category the deHavilland AC-1 Caribou and the Boeing HC-1B Chinook twin-rotor helicopter will replace the deHavilland U-1A Otter single-engine transport and the Vertol H-21 Shawnee, Sikorsky H-34A Choctaw and eventually the Sikorsky H-37A Mojave.

A reliable, service-proved command communications aircraft, the twin-engine Beech L-23F Seminole (Military version of the Civil Queen Air) has been re-ordered and will stay in the inventory for some time to come, until a satisfactory turbine powered off-the-shelf vehicle is available. It stars as the management airlift and personnel liaison craft.

Utility surveillance has now blossomed into top priority at the division combat post. It is being filled by Grumman's AO-1 Mohawk until a heavier, more sophisticated target acquisition aircraft can be delivered to the division by 1968 or later. The Mohawk, of which 250 are programed, is now operating with divisions. It replaces the deHavilland L-20 Beaver and the Cessna L-19 Bird Dog.

On the order book—but not yet out of the study stage—is an Army requirement for heavy tactical transports (HTT) to provide mobility and logistics chores for division command and to operate from rearward USAF-TAC terminals to unprepared fields within division combat zones. In the meantime Caribous and Chinooks will share this work.

The older aircraft will be relegated to yeoman and

to Reserve-National Guard service as the newer types become available in larger quantities. As constituted in the present division structure, an Army Aviation battalion provides 103 aircraft for division command use; 25 are for airborne infantry company; 12 for air cavalry; and the remainder are for command, combat support, medical evacuation, target surveillance and photography, backup pool and general assignment within divisions. Eventually 99 will be helicopters and four will be fixed-wing aircraft, that is unless STOL vehicles demonstrate combat advantages over the rotorcraft.

Significant activity in the field is the placement of armament aboard helicopters and fixed-wing aircraft by the Army. This breaks precedent with the old-fashioned idea that helicopters and liaison aircraft were not meant to fight but to be passive resistance vehicles only. Much field study and evaluation has been accomplished with everything from missiles to napalm at Fort Rucker, Fort Bragg and elsewhere within the last 10 years. Now weapons and ammunition are being acquired and combat crews have been trained in their use. Should the emergency arise, Gen. Easterbrook says AA airplanes and rotorcraft are ready to mount modern weapons.

Timely views pertinent to the problem exhibit thorough understanding and support by Army planners of the complexities ahead:

Lt. Gen. Arthur Trudeau, R-and-D chief, told FLYING that "Army Aviation must be permitted to fight like soldiers." The division commander must be given control over the unit's envelope of air space. Whether that air space should be set at 5,000 or 10,000 feet must be decided, but they need it. Commenting on the role of USAF, he said, "the Air Force's bigger job is to keep the enemy off the backs of dispersed field forces over a large area and assume priority support assignments wherever the need requires heavyweight air strike assistance."

General Trudeau places high priority upon the development of a flying crane, one that is capable of lifting five and 10 tons and one that has far-reaching commercial application.

Brig. Gen. Ernest Easterbrook, director of AA training and a rated fixed-wing and helicopter pilot, states that "Army command has shown us better understanding and given better support than ever before. In fact, I believe the helicopter and its value as a management vehicle has done much to convert field commanders to a genuine feel for our (AA's) element and to understand what airlift capability can do for them."

The important aspects of Army air developments to future advancements in civil aviation were summarized by Brig. Gen. Delk Oden, director of Army Aviation. He viewed the future dividends this way:

"In the LOH, HU-1 and Chinook alone, it appears that the state of the art of rotary-wing aircraft has been expanded years ahead of the mark civilian effort could attain alone. Way out in the future, say 10 years or more, the Army's probing into the problems and expected practicality of VTOL or vertical flight, should provide enormous plowbacks to civil aviation.

"In our drive for simplicity, quantity buying and

Turbine-powered Bell HU-1 Iroquois helicopters with 100-knot cruise, 200-mile range, serve as utility tactical transports operating in combat zone.

our emphasis upon lightweight and low-cost new flight navigation systems, anti-collision aids, turbine engines for light aircraft, mobile all-weather airport facilities for helicopters and fixed wings, lightweight radar and new infra-red terrain clearance equipment are but a few of the many general aviation potential benefits which can accrue from Army weapons research, development and procurement."

FLYING enumerates some of the realistic state-of-the-art advancements possible in general aviation through Army R and D before the turn of the decade:

- Availability of 250-hp turboshaft engine developed for the LOH helicopter applicable to fixed-wing aircraft as well.
- Development of an automatic, visual presentation navigation system that will make all-weather flying simple and reliable.
- Proving of mobile, lightweight radar and small field landing aids, both visual and electronic, which may fall within the economic reach of "Main Street" airports or landing strips.
- Development of traffic control systems for battlefield use that can prove reliable and feasible for civil use in the control of large numbers of aircraft.
- Development of motion and directional indicators for helicopters which register accurately speeds in all directions—sideways, up or down, backwards or forward.
- Knowledge through research of pilot limitations and capabilities, training methods and techniques, that will provide for safer, more efficient use of private aircraft by pilots with minimum training and physical resources.
- Selective, "private line" communications systems.

Here is where military missions are highly compatible with civilian progress, and every dollar spent is not lost on expendable weapons and vehicles. Greater support seems like a good financial investment in public welfare as well as in peace insurance.

Rotary-Wing Operations

Skimming between the trees—banking with rotor tips inches above the ground—rushing beneath utility wires and bridges—seeking the enemy—armed for a fight. This is the U. S. Army's Aeroscout helicopter in its "nap of the earth" flight routine—and this was the experience shared by a FLYING editor as he took the controls for a firsthand account of Army Aviation's new VTOL (vertical takeoff and landing) concepts.

The ability of the helicopter to "live" in the field, using unprepared landing areas for servicing, is allowing the integration of aerial and ground combat tactics for use on the battlefield of tomorrow. With helicopters operating as an integral part of a fighting unit, the ground commander is afforded a mobility heretofore unknown.

Elements of this force were flown at the advanced helicopter training unit at Fort Rucker, Alabama, and at Fort Bragg, North Carolina, to see how the Army is utilizing rotorcraft.

The techniques applied in pilot training, in operational flights, and in field support and maintenance were found to represent a basis of operation that can lead to giant strides throughout the VTOL field.

Maj. Gen. Easterbrook has stated, "The helicopter is more than an aircraft; it is a means of improving operational management."

Toward this end unit commanders in increasing numbers will have rotorcraft made available to them. The Army estimates that by 1970 it will have 10,000 pilots and 8,000 aircraft with 75 per cent to 80 per cent helicopters—of seven different types. (Present Army airfleet totals 5,612 aircraft of 15 models.)

The most recent Army requirement is for a mass-ordered Light Observation Helicopter (LOH) with deliveries to commence in October 1963.

Specifications set by the Army in a 12 company design competition call for the LOH to exceed the performance capabilities of any helicopter in service today by 30 per cent or better in range, endurance, and passenger miles per hour. Winners—The Bell HO-4, Hiller's HO-5, and the Hughes HO-6—will undergo extensive flight test and field trials before an initial order for a prototype is decided upon.

Regardless of the model selected, the LOH will be a single-rotor, four-place craft cruising in the neighborhood of 100 mph and have a 400-pound payload. Powered by either the 250-hp Allison T63 or a back-up engine, the LOH will become an integral part of command control as well as be able to perform visual observation and target acquisition reconnaissance.

The ultimate LOH requirement is set to exceed the 4,000 mark in the next 10 years at an estimated cost of $200 million. Having been designed to satisfy FAA regulations simultaneously with those of the military (see April FLYING) this helicopter, coupled with the research for lighter, more reliable components, could well be the stepping-off place for a long sought after, low-cost utility aircraft for the commercial market.

In looking beyond the mission that individual aircraft will perform when assigned to field units, Army Aviation is embarking on a concept that includes rotorcraft of various types combined into a single front-line team. Once a proven quantity, the ground commander will have at his disposal an "Air Cavalry Troop" that contains all the essential elements to seek out an enemy and destroy him.

While radio-controlled drones and fixed-wing aircraft can relay information back to the ground unit concerning wide area coverage, the commander will rely on the use of his helicopter Aeroscouts on matters that affect his immediate security.

The observation helicopter currently working as part of the Division's Aviation Battalion, Brigade and Artillery Headquarters, and the Air Cavalry Troop is Bell's two-place H-13 Sioux.

The Aeroscout acts as the commander's eyes and ears and is armed with two .30 cal. machine guns, for

THE AIRMAN'S WORLD

Soldier, soldier, timeless image
In the memory of man,
Marching, marching down the ages
In unbroken caravan,
Tramping, tramping to the drum beat
As the nations in their day
Move to empire, flourish, falter,
Pass in spiritual decay;
What of thee oh ageless image
As the cadences of Mars
Lift beyond embattled armies
To the clashing of the stars?

Soldier, soldier, timeless image
In the history of tears,
Charging, charging in the battles
Of conflicting hopes and fears,
Falling, falling to the calling
Of eternity's tattoo
When the drumfire sweeps the columns
As the sun dispels the dew;
What of thee oh ageless image
As the thundering of Mars
Lifts beyond the twinkling campfires
To resound among the stars?

Soldier, soldier, timeless image
Of unbroken symmetry,
Marching, marching down the ages
To a changeless destiny,
Dying, dying for the causes
That the creeds and breeds profess,
In their little days of glory,
Constitute their righteousness;
Art thou less the ageless image
That the mutterings of Mars
Call thee from the tented bivouacs
To the wars among the stars?

Art thou not oh timeless image
Bright beyond the world's decay
In that duty dwells immortal
Though the soldier pass away!

GILL ROBB WILSON

self protection. To accomplish its mission, yet remain relatively safe from enemy counterfire, the Army has instituted, for both flight training and operational maneuvers, the art of "nap of the earth" flying.

A sampling of the instruction required to master the technique was undertaken by a FLYING editor with Don C. Jones, a civilian flight education specialist, from Hanchey Field, headquarters for the department of rotary-wing training at Fort Rucker. This school contains within its syllabus the most complete course of its kind in the world.

With the cooperation of Maj. Joe Hix, projects chief, there was afforded a look at the elements required of the officer or warrant officer candidates prior to assignment to an operational unit.

With basic instruction given at Camp Wolters, Texas in the Hiller H-23 Raven, the pilot who comes to Hanchey has better than 100 flight hours of helicopter experience behind him. The advanced training is designed to equip the flying soldier for work in the field. Approximately 650 officers and warrant officers are graduated every year (including Allied officers that come to five per cent of the total). Getting through the course is no small task as an average of 27 per cent of each class fails to make the grade.

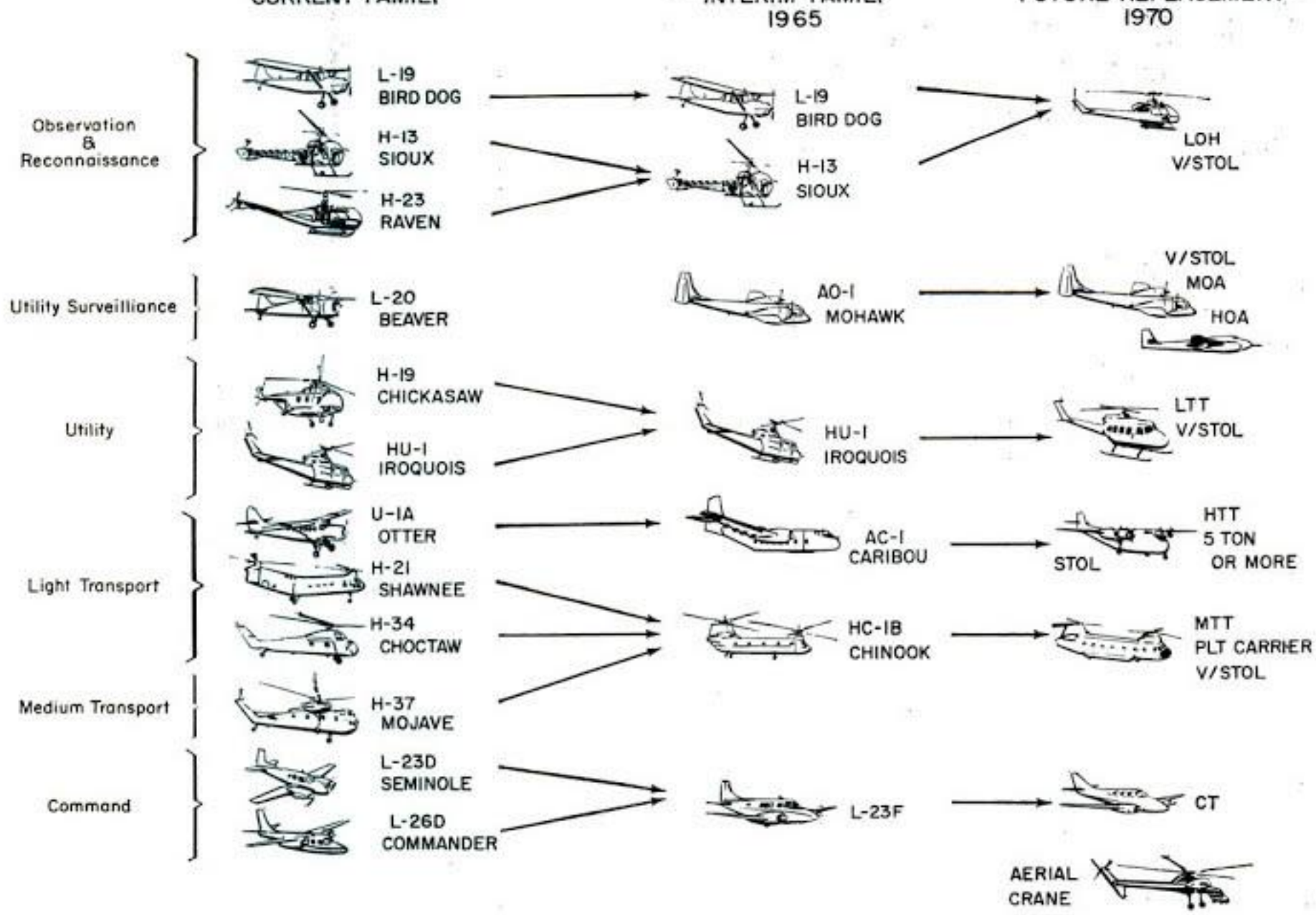
Army Aviation utilizes both military and civilian instructors at a 50/50 ratio. The permanently stationed civilians help maintain the desired continuity of technique at Hanchey while the military, with field experience, bring the current operational practices back for the new students to learn.

Flight at an altitude never exceeding 75 feet while dodging natural and man-made obstacles, seems to increase helicopter speed one hundred fold. Remaining oriented, yet observing all that the ground commander must have knowledge of, while being almost inaccessible to enemy small arms fire, takes more than "guts." It requires a great measure of skill and confidence that only excellent training standards can accomplish.

Engine failures, coupled with the other hazards of front-line maneuvering, are magnified as the aircraft flies in closer proximity to the ground. To minimize these hazards emergency techniques have been developed through experiment and experience.

At 20 feet of altitude and full forward cruising speed the Bell H-13's throttle was cut to simulate engine failure on several occasions—sometimes when least expected. Army training for this ordinarily dangerous maneuver is to sacrifice the rotor rpm momentarily, maintaining the position of the collective, until the nose starts up through the horizon for the flare.

The collective is then lowered rapidly. The flare builds up more than the sufficient rotor rpm to allow collective application for a relatively smooth touch-



PROGRAM OF EVOLUTION OF ARMY AIRCRAFT FROM THE PRESENT THROUGH 1970.

Almost hidden by trees, Bell H-13 snakes slowly down a narrow pine-bordered dirt road on Ft. Bragg confidence course designed to build pilot skill.

down. This straight-ahead approach, accomplished within seconds, was carried through into-the-wind, cross-wind, and down-wind emergencies. According to Jones, only when the wind is excessive and the aircraft is in a down-wind condition is a side flare executed to bring the aircraft partially into the wind to further dissipate airspeed.

Going low over the tree tops to otherwise inaccessible landing sites is also a part of the nap of the earth concept. While this has always been a nemesis to helicopter pilots, the Army utilizes its same autorotational techniques to bring the helicopter as close to zero airspeed as possible prior to settling into the trees. Although aircraft damage may result, danger to the pilot has proven to be minimal.

Special nap of the earth "confidence courses" have been set aside at both Fort Rucker and Fort Bragg, North Carolina to develop and maintain pilot proficiency.

To build confidence, all simulated engine failures are flown to a full stop without use of the engine for recovery. Because of the very nature of the Army's mission there is bound to be a degree of danger, but the realistic and sound approach to every phase of flight instruction cuts that danger considerably.

A definition of "nap of the earth" flying as the Army uses it would be "the technique of having the terrain and its obstacles work for the pilot rather than against him."

SKYCON TEAM

A pair of bobbing, weaving helicopters working together in a precise tactical formation forms a new reconnaissance concept known as the Skycon Team.

Skimming along at treetop level at an average 60-knot airspeed, the team provides an elusive, fast-moving scouting operation in and behind the battle zone.

Pilots at Simmons Army Air Field, Ft. Bragg, N. C., developed the technique as a way of using the natural agility of light observation helicopters in modern combat. Relying on "nap of the earth" flying for protection and maximum use of the element of surprise, the closely coordinated duo can spot enemy troop and weapon movements, note shifts in the battle area and in general probe enemy weaknesses.

But the Skycon concept also is designed to perform a variety of special missions. Pilots of the Headquarters Co., 18th Airborne Corp. STRAC (Strategic Army Corps) have developed techniques for hasty laying of mine fields; raising of roadblocks by blowing down or cutting trees; disruption of communications and setting up observation posts behind enemy lines.

Other missions aim at marking of targets, as with smoke grenades; blowing up bridges; interrogation of refugees; night reconnaissance; material analysis of enemy weapons and even radiological survey.

Plans call for equipping Skycon helicopters with

weapons such as machine guns to help in stirring up enemy reaction in scouting operations. Bomb shackles also have been devised for the rotorcraft.

Two-man Bell H-13s are modified to provide right-hand controls on one helicopter of each Skycon team and left-hand controls on the other. This permits seating of observers on the opposite side in each helicopter. Then by alternating the helicopters left and right in formation, the observers are positioned to scan either in toward each other, as when scouting along a road, or away from each other for a wider scan pattern.

Using radio communications, Skycon pilots call out pre-arranged code signals to position themselves in a series of tactical formations to meet differing mission and topographical conditions.

Spaced 30 to 60 yards apart, they fly right or left echelon, abreast, in trail, or in bobbing movement. In the bobbing maneuver each helicopter takes turns rising abruptly for a better view of the terrain and then ducking quickly back. Other signals call for one helicopter to hold while the other investigates; hurry to a rallying point; for both to land quickly; or to make a 180-degree turn.

The Skycon concept places severe demands on both equipment and men. The helicopters are subjected to maximum performance flight and redline operation for prolonged periods.

Pilots must be able to fly entire missions right at the treetops to avoid detection. Observers, who are noncoms, must be capable of instant analysis of battle conditions. To lessen exposure, the teams never double back; so the observer must spot and evaluate his objective the first time. He also doubles as navigator and is burdened with the considerable task of accurate positioning from his zig-zagging low-altitude platform.

For effective scouting missions with the Skycon concept, crews must be continuously briefed on the area intelligence situation and ready to scramble quickly. There is no time for a long briefing. As an aid in positioning teams on programed missions, reports are called in by radio at predesignated check points. A fallen helicopter as a result can be located approximately from his last reporting point.

Crews are trained for Skycon teams in three-week periods at Simmons. Every day they fly a so-called "confidence course" designed to hone to a fine degree each pilot's control of his helicopter. The first week is devoted to mastering the confidence course and to ground survival training. The second week concentrates on team maneuvers; and the third is used to integrate tactical operations.

FLYING editors flew along with a pair of crack Army pilots, First Lts. Gary W. Rauch and Gary F. Rast as a team of the Bells careened through their paces in both the confidence course and in the Skycon formations.

The confidence course started out on a strip of dusty sod road lined with a full growth of pine timber. Easing the Bells down to within a foot or two of the road, the pilots gently nudged their vehicles along at a walking pace. Surrounded by a cloud of dust, leaves and assorted flying debris, the rotorcraft creeped along between the trees. Clearance between the whirling blade tips and the trees: often less than a foot on either side.

Three sets of electric utility wires cross overhead at different points. One of these cables allows just one foot of clearance for the rotor blades of the H-13. To maneuver under this thin, low strand, the pilot simply touched the front portion of the landing skid gently to the ground and in this "stooping" posture eased the helicopter smoothly under the wire, leaving two neat little furrows in the dust as with the runners of a sleigh.

After the road-hugging portion of the course was completed, the rotorcraft were goaded along at a 60 to 75-mph clip over the tree tops, along a low-level creek bed run, and into and out of a confined clearing in the woods with a landing. Average power was 20 inches and 2,300 rpm from the Lycoming V0435-23.

Pinnacle approach was practiced at the lip of a wide earthen-walled pond, and the course ended with a high-speed low-level flat-approach autorotation.

What kind of an accident record results from operations like this? Headquarters Co. has proved they can perform rugged tactical flying and still achieve an excellent safety record.

The company received Fort Bragg's first flying safety award, from the National Safety Council, for flying 528 days with 5,999.8 hours and 2,039 missions without an accident or incident.

The company, commanded by Capt. Leyburn "Pete" Brockwell, flew an average of 11.36 hours daily in achieving the record. The award was dated 31 January 1962. The company's last incident had been in 10 August 1960. It has assigned nine aircraft and eight pilots. It flies two deHavilland L-20s, three Cessna L-19s, two Bell H-13s and two Beech L-23s.

At the contact flight division, the various types of equipment currently in operational use are available at Hanchey. As new equipment is phased into the Army concept, it is also brought to the school.

Cockpit mock-ups, which can electronically simulate procedures, are used as an inexpensive yet thorough method of orienting the pilot with the more advanced aircraft.

This indoctrination coupled with 89 hours of flight training truly readies the pilot for his mission in a specific helicopter.

Proficiency is maintained at the field unit by standardization pilots who come to Fort Rucker for a special course and then return to their units.

HELICOPTER ARMAMENT

The concept of armed helicopters in the ground support mission has definitely found a place in Army aviation. Although just six years in development, remarkable progress has been made.

The General Electric Minigun, capable of firing 3,000 rounds per minute, also .30 and .50 cal. and 7.62 mm machine guns plus airborne grenade launchers, the Emerson Kit—with turret-like weapon movement, 20 mm and 40 mm gun pods, 4.5- and 2.75-inch rockets in addition to Nord Aviation's SS-11 wire-guided missiles—all are presently included in the

aerial arsenal. As these items are either proven or discarded, new lightweight systems with the desired accuracy and fire-power will be constantly evaluated.

Helicopter armament falls into three categories—that of the light helicopter used for the aeroscout mission, the utility helicopter, and the heavier equipment whose primary mission is to destroy or neutralize larger enemy concentrations.

Careful consideration had to be given to the use of attachments of firing racks and guns. For this a good deal of credit must go to the personnel at Fort Rucker, whose enthusiasm and ingenuity have increased the potential of every weapon system mounted on air cavalry rotorcraft.

H-34s and H-21s are fitted out with 24 4.5-inch rockets in racks of 12 at each side. Sweeping in as two-aircraft sections, a leader and his wingman, firing in salvo, put out the equivalent of three artillery battalions.

The 4.5 rocket is spin stabilized, has a range of 9,000 meters and approximately the same bursting radius as a 105-mm howitzer.

It was evaluated by the Army using a MK VIII illuminated type sight in an effort to separate ballistics error from pilot error.

The 4.5 rocket development has reached a point where the Army feels a new approach is more desirable. This will be in the form of the 2.75-inch rocket, which offers greater accuracy.

In-flight loading, better sighting, and adjustable weapons are items currently under development.

The most accurate firing displays were in the form of missiles. An HU-1 Bell Iroquois, armed with six Nord SS-11 guided missiles, has the capability of destroying any known armor within the missile's range of 3,200 meters (19,850 feet or 3.75 miles).

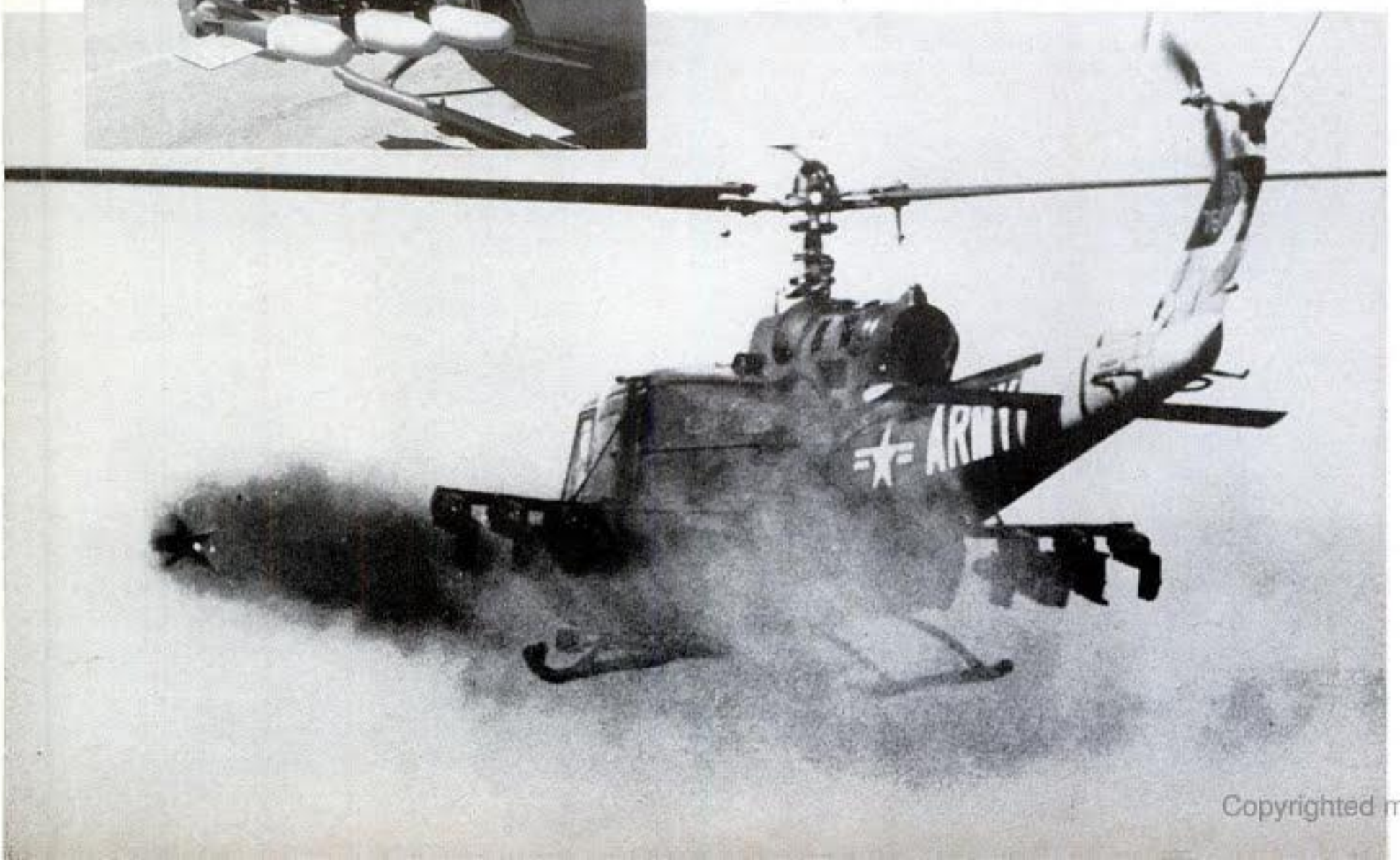
The S-11, a French design, is wire-guided by remote control from the cockpit. The controls for it are handled by either a copilot or a "gunner." He literally guides the 63-pound missile traveling at 425 mph right to the target.

Small tank-killer teams consisting of two or three helicopters, working with the infantry battalion, are envisioned.

The HU-1 series by Bell has proven its worth for a variety of missions both in the field and for training. Besides providing a stable weapons platform (a yaw damper increases firing accuracy) the Iroquois has an interior large enough to be set up as either a squad carrier or a command post complete with situation map boards and communications equipment. The latest of the HU-1s is the D model, which is the object of a 95.4 million dollar procurement program for fiscal 1963. The HU-1D retains the compact size and low silhouette of its predecessors (the 1A and 1B) but provides additional troop-carrying capability and more fuel capacity for 33 per cent greater range. Relocation of the fuel cells permits space for 12 fully equipped soldiers or a 50 per cent increase over the 1B and a 57 per cent increase in internal cargo space.

In flying the HU-1A through part of Fort Rucker's helicopter instrument course for experience with this utility aircraft, a new phase of Army aviation was brought to light. This is the training that gives the

Below: Turbine-powered Bell HU-1 fires Nord SS-11 guided wire anti-tank missile. *Left:* Three are mounted in racks on each side of rotorcraft.



pilot experience and confidence in his instruments to make all-weather flying an integral part of the helicopter mission.

In an instrument flight with Capt. John Ford, instrument school branch chief, the hood was used from takeoff as procedures were demonstrated.

The HU-1 provides stability and control that helps the pilot fly the gauges smoothly.

The complete helicopter flight training course at Fort Rucker is one that holds a high standard in every phase.

The pilots this system produces take a back seat to no one.

The Instrument Flight Division is the newest addition to the department of rotary-wing training at Fort Rucker.

Like the contact division, it contains simulators manufactured by Link and by the Trainer Corp. of America. Earlier models have been adapted to the helicopter configuration by personnel at Hanchey. The pilot is given 25 hours under the hood prior to entering the aircraft.

After 10 weeks of flight training in which 65 hours of dual and 16 hours of solo instruments are required, the graduate is fully qualified for cross-country IFR navigation in rotorcraft.

The instrument program is still in its infancy and confined to fixed-wing instruments. However, it utilizes the finest Sperry and Lear Gyros. Development of the complete instrument helicopter still has a way to go. In giving the pilot ability and confidence in existing instruments, the Army theory is that once having achieved proficiency, he can adapt to whatever system his mission calls for.

A new and far-reaching blind flying concept for helicopters (See FLYING, September 1961) is presently underway by the Army-Navy Instrument Program (ANIP) at Bell helicopter. It utilizes a grid pattern imposed on the canopy bubble. As visibility deteriorates, the pilot will be able to keep himself oriented with the ground.

Until a full all-weather system is developed for rotorcraft, ANIP has come up with what the Army calls the Interim Integrated Instrumentation and Let Down System, or as Bell has designated it, RAILS (Remote Area Landing System).

Night flying or landing under instrument visibility conditions has been difficult in helicopters due to the control complexities of the aircraft at the slower airspeeds. RAILS—under Army evaluation at Fort Watchuka, Kansas—is a complex device that uses a small battery-powered ground beacon that can be carried by hand and placed in remote or mountainous areas by Army pathfinders.

Lightweight radar, in the helicopter, activates, locates, and then tracks the landing area ground beacon. Up to 10 aircraft may operate simultaneously on any one beacon. Utilizing the beacon as a position reference in conjunction with terrain avoidance radar, in the aircraft, the system will guide the pilot around obstacles to touch down.

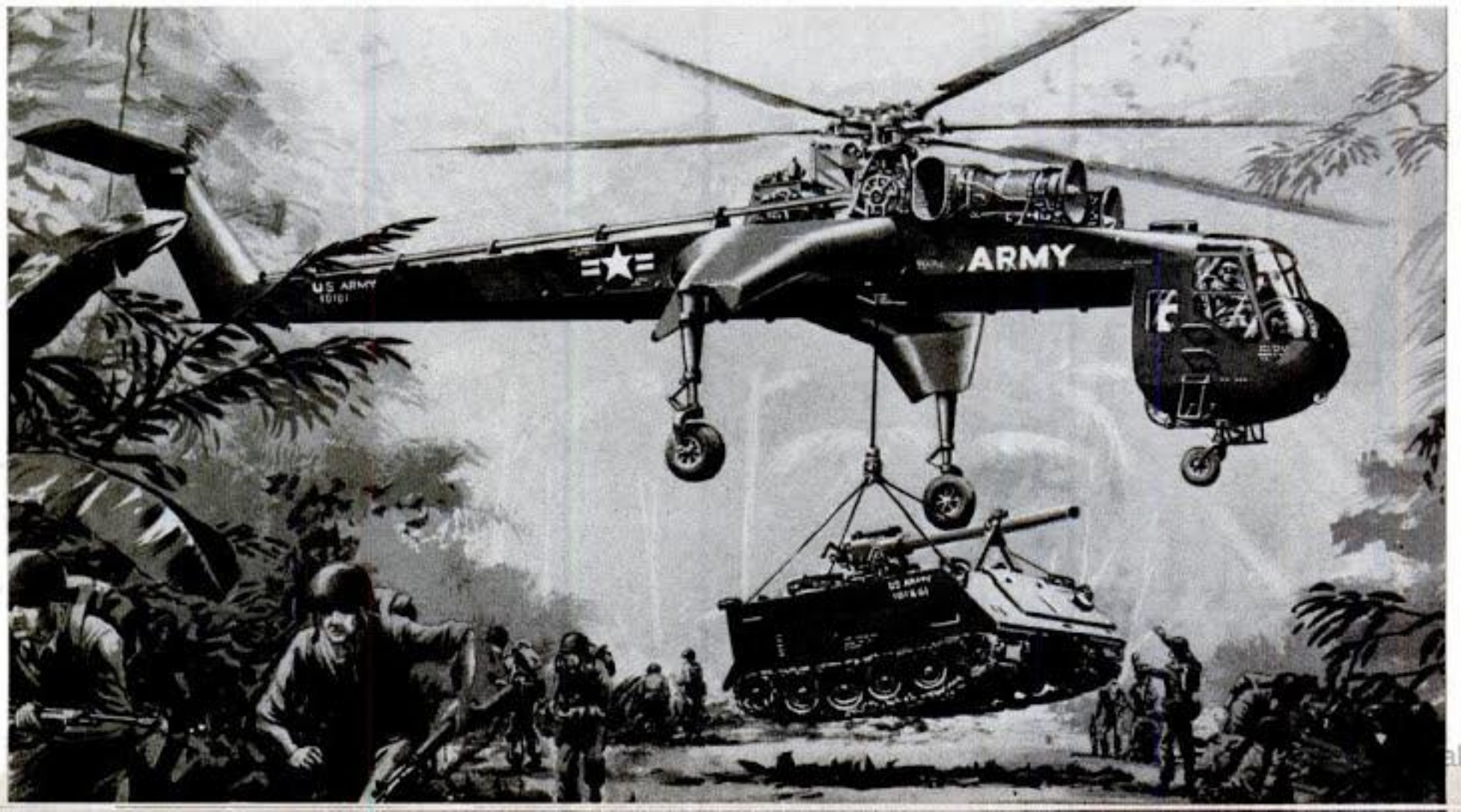
In conjunction with a system of this kind, the need for a simpler flight instrument display for helicopters is the number one item.

Other considerations such as airspeed indicators that give accurate readings between zero and 30 knots, altimeters accurate to within a foot of the ground, and a complete back-up system upon which the pilot can rely once committed to his approach must be developed before the instrument helicopter can truly come of age.

The first automatic flight control device has been developed for Army helicopters by the Sperry Phoenix Company of Phoenix, Arizona. Known as the AN/ASW-12, the 55-pound unit represents a major step for the industry and will advance the IFR helicopter in both military and civil use.

Once installed the advantages for the military pilot will be relief from control manipulation to allow

Sikorsky S-64 Skycrane with twin turbines is designed to carry an external load of up to nine tons or 60 fully equipped troops in a detachable pod.



ARMY AVIATION ROTARY-WING AIRCRAFT

Designation and Name	Crew	Passenger capacity or 240 lbs. per man	Overall length	Overall height	Rotor diameter	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Maximum cruising speed with payload (TAS)	Fuel capacity (useable)	Maximum Range (miles) with payload
Bell H-13H Sioux	1	1 or 2 litters	41'3"	9'4"	35'2"	1,777	2,350	Lyc V0435-23 Derated to 200 hp	80	41	170
Bell HU-1B Iroquois	2	5 or 2 litters	53'	14'7"	44'	4,000	6,000	Lyc T53 L-5 960 shp	120	155	210
Boeing-Vertol HC-1B Chinook	2	33 or 24 litters	98'2"	18'6"	Two 59' ea.	NA	33,000	2 Lyc T55 L-5 2,200 shp ea.	148	508	200
Hiller H-23D Raven	1	2 or 2 litters	40'8"	10'2"	35'3"	1,772	2,700	Lyc V0435-23 250 hp	80	46	135
Sikorsky H-19D Chickasaw	2	10 or 6 litters	62'3"	15'3"	53'	5,556	7,800	Wr. R1300-3 800 hp	80	153	185
Sikorsky H-34A Choctaw	2	12-18 or 8 litters	65'10"	15'10"	56'	7,900	13,900	Wr. R1820 1,425 hp	90	262	195
Sikorsky H-37A Mojave	3	23-33 or 24 litters	88'	22'4"	72'	20,717	31,000	2 P&W R2800 2,100 hp ea.	80	700	180
Vertol H-21C Shawnee	2	20 or 12 litters	86'4"	15'9"	Two 44' ea.	9,026	13,500	Wr. R1820 1,425 hp	85	300	255

aiming of missiles and rockets, combat surveillance, or precision placement of external cargo while reducing pilot fatigue factors.

The AN/ASW-12 also can provide full automatic landing approaches and en route navigation when coupled to existing instrument systems.

Coupling this unit to RAILS or other remote area systems could be the answer to night and instrument flights. This is again dependent on the research and development of adequate back-up systems.

Toward fulfillment of the present all-weather mission the Army is looking to supplement the existing cockpit installations. Negotiations are underway with NARCO for their new UDI-2 DME, the Ryan Doppler, and TACAN.

LOAD-CARRYING ROTORCRAFT

Provided with the ability to seek out the enemy in practically all weather conditions, the commander apprised of the enemy location can deploy his forces with a larger measure of flexibility. At his disposal for troop movement are two light and one medium size transport helicopters: the Vertol H-21 Shawnee capable of carrying 12 combat equipped troops or 3,480 pounds internally or a 3,000 pound sling load; the Sikorsky H-34 Choctaw with comparable capabilities; and the larger twin piston-engine Sikorsky H-37 Mojave, which carries 23 combat troops.

The light transports are expected to be phased out shortly, while the full fleet of 90 Mojaves currently is undergoing modernization at the Sikorsky overhaul and repair department. These present transports leave a good deal to be desired for a combat situation, due to their limited payloads and logistical supply problems.

Replacement for the piston-driven transports will begin late this spring when the Army is due to take delivery of its first twin-turbine Vertol HC-1B Chinook (HC-1B represents a $35.6 million program for the coming fiscal year).

Powered by two Lycoming T-55 engines rated at 2,200 military shp each, the Chinook is capable of carrying a maximum payload of more than seven tons at 150 knots (34 fully equipped troops or 24 litter patients and attendants). The 30-foot-long rear cabin offers a straight-in rear ramp to speed loading of everything from troops to vehicles to missiles.

Demonstrating what the Army is trying to achieve with aircraft having the ability to "live" in the field, the Chinook is also designed for ease of maintenance. Each HC-1B has its own built-in work platforms and portable hoists for removal of engines, transmissions, and rotor systems.

With the HC-1B in combined use with the LOH and with the Army's first turbine-driven helicopter, Bell's utility work horse the HU-1 Iroquois, all piston helicopter equipment will be phased out of the service. This will eliminate the one major difficulty involved in logistical support for the aircraft. The use of a common fuel, as well as relatively common maintenance procedures will simplify the supply function.

The use of 500-gallon sealed-bin containers has been made to transport fuel to supply points. A common fuel not only for aircraft but for the other vehicles in the field will further eliminate much of the supply difficulty facing the Army today. In action, resupply must be rapid yet careful to avoid fuel contamination. A great deal of research is going into the resupply problem since it is not felt that the sealed bin adequately answers the need for rapid and clean refueling.

Since the Korean War, during which some 21,000 front line casualties were moved to hospital areas in life-saving time, the medical air program has really come into its own. A matter of concern to every troop commander, the evacuation and care of the

wounded has grown to a full-scale operation with units having their own aircraft and full facilities.

The Korean action brought out a key problem for the medical personnel: how to cope with the large number of evacuees that helicopters are capable of bringing in every few minutes.

To help solve this, and other logistics problems and give full-scale support of any military engagement comes the latest in helicopter development—the flying crane. The Army is expressing extreme interest in this concept since movement of the support equipment must be as flexible and as mobile as the troops themselves. In this area the Army has evaluated the twin-engine Sikorsky S-60 crane.

As an interim measure, large lifting capability will be added to present rotorcraft by use of flex-wing gliders. These unmanned towed craft gain lifting potential through unique wing design. Under development for the Army by the Ryan Aeronautical Company, the flex-wing can increase the carrying capacity of current operational aircraft by 600 per cent as payloads of more than 10,000 pounds are suspended beneath.

By 1970 the Army expects to have the airborne cranes to facilitate the handling of logistics on a large scale.

Lightweight vans, designed to military specifications, will be trucked or moved by rail to terminal points to be preloaded and airlifted as required by the front line units. These vans will be constructed of rugged light materials and will be able to contain anything from troops and supplies to full operating rooms and recovery wards complete with self contained plants for lighting and air-conditioning.

This concept, while having a military basis, also has civil defense and commercial applications that are limitless.

For its mission the Army is looking into Sikorsky's

Boeing-Vertol HC-1 Chinook transport helicopter carries 33 troops.

new turbine-powered S-64 Skycrane (see FLYING March 1962) and the plans for Hiller's STORC (Self-ferrying Trans-ocean Rotary-wing Crane) with other manufacturers expected to submit designs in the near future.

The S-64, already completed and in flight test at the Sikorsky plant, offers a useful load in excess of 9 tons and is generating a good deal of interest in helicopter circles. Power for the S-64 is supplied by two Pratt & Whitney JFTD12A-2 free turbine engines maximum rated at 4,050 military shp each. The larger crane concept—Hiller's STORC, still in the development stage, may be capable of converting the huge rotors into wings for high-speed, long-range airplane flight.

With a gross weight in the area of 30 tons, it will be powered by turbo-jet engines located at the rotor blade tips to eliminate the heavy and complex shafts and gears otherwise required.

In the area of high speed VTOL, its utilization is anticipated for a fast, long-range means of bringing supplies over greater distances to put at the disposal of the ground commander.

The Tri-Service S/VTOL, a product of the design and research talents of Ling-Temco, Ryan, Vought and Hiller—is the first of its type to have gotten past the experimental stage and into prototype manufacture. First flights for five of the 18-ton prototypes are scheduled for 1964.

The state of the art of helicopter warfare is not unlike the growth pattern for fixed-wing aircraft after both World Wars I and II. The concept is good and it shall grow. Sophisticated machines, systems, and armament are already appearing on the scene. In helping to keep the peace the new mobile Army is contributing immeasurably to make VTOL aircraft realize its fullest potential.

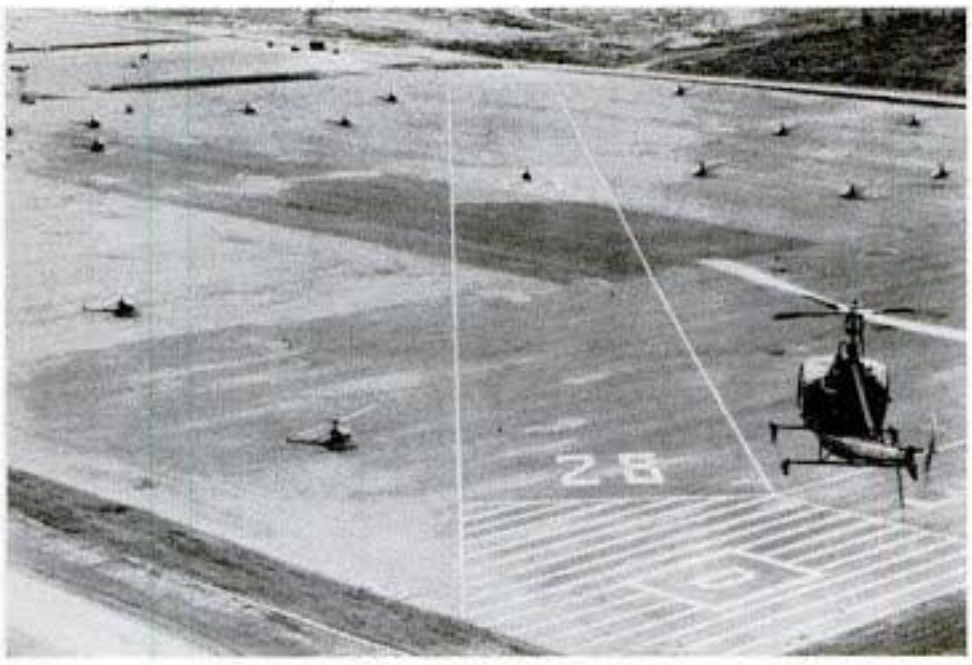
Rotary-Wing Training

An enemy emplacement is teeming with men. Trucks move in and out under the cover of tree-lined roads, accompanied by the normal sounds of a battle-front location. In the background is the steady drone of an engine. Suddenly a helicopter rises above the tree tops. It has machine guns mounted on its skid type landing gear; they chatter as they spit bullets at the men and trucks.

Before the enemy can direct return fire, the rotorcraft drops again behind the trees and is gone. Moments later, it rises again from an entirely new direction and again takes its toll. It is not bound by battle lines; its attacks are omni-directional. Between attacks, it hugs the ground while traveling at high speeds; it is the Army's new concept of "nap of the earth" flying. The pilot's duties are scouting and observation not unlike the Indian scout of the western plains, but a great deal more deadly; the helicopter has merely replaced the horse.

In the early morning, the heliport at Camp Wolters near Mineral Wells, Texas becomes a beehive of activity; a sea of helicopters comes to life. The engines and rotors start on a hundred Hiller H-23Ds as they warm up for the day's training activities. This is the U. S. Army Primary Helicopter School.

One by one, the helicopters come to a hover and



Hiller H-23D primary trainer on approach to Camp Wolters heliport.

move into an orderly sequence of departure. In double file, they leave the field. Near the boundary, they split sharply at a 45-degree angle and proceed to the stage fields and designated areas for instruction and practice.

Simultaneously, other students depart the main camp area in buses for the stage fields to take their turn, later in the morning, at flying the helicopter. Stage fields are self-sufficient, and have their own fuel, oil, tower, crash and rest facilities.

Learning to fly the helicopter is never a dull routine. The craft is capable of flying in any direction and frequently does. It appears docile in the hands of the instructor who holds it motionless in a hover, or gently nudges the stem of a weed with a skid tip to show how easy it is. All he asks of the student is to hold it over a large painted square on the ground.

Then the student takes the controls; it is no longer motionless; it moves forward as the student pulls aft on the cyclic stick to counteract it, but it doesn't stop, so he pulls more and this time it takes off rearward so fast you think it will dig its tail into the ground. Forward goes the stick and the tail goes up at an alarming angle, and some sideward motion sets in. Keep it over the square? He just wishes he could keep it pointing at the square!

But the hover is soon mastered as the student learns to lead his stick movements, to "get ahead" of the chopper, to anticipate. It finally "holds still" for him and he is able to do hovering turns, sideward, and even rearward flight—under control.

Normal takeoffs follow; the helicopter is tilted forward at just the right rate as takeoff power is applied and it moves smoothly off the "ground cushion" through "translational lift" to a 40-knot attitude.

Then come normal approaches, then steep approaches which will be used later for over-obstacle landings, shallow approaches, and the deceleration exercises of bringing the helicopter to a stop from 50 knots at 50 feet as fast as possible. Autorotations are next.

First they are made straight ahead to learn the fundamentals, then from 90 degrees, from 180 degrees with the helicopter coming down at over 1,400 feet per minute with engine idling and collective pitch full down. As the ground comes up, a sharp flair almost stops the descent. The skids are levelled then and as the ship settles toward the ground, up on the collective lets the inertia of the main rotor ease the touch-down as a full stop power off landing is made. At Camp Wolters, they have made over 1,100,000 full touch-down power-off autorotative landings since the school went into operation in 1956. They are practiced both dual and solo.

Ranchers around Camp Wolters allow the helicopters to use their land for basic maneuver practice. Areas have been established, with no monetary compensation to the owners, where operational landings can be made.

As the students progress, they learn to put the helicopter down in confined areas; areas completely surrounded by trees, down into the canyons and ravines. Careful scrutiny is required, judgement development is a by-product. This type of landing is valuable in assault, transport, and rescue operations.

Road landings are practiced, running landings, takeoffs and simulated high altitude operation. Pinnacle landings are made; here, the pilot may select a hilltop, cliff, or peak to land on. Careful selection of the spot and technique is required. Helicopters have slid off the landing area; in training this is a red mark; in combat it could be fatal.

For those who will take the Observation Pilot Course, low flying will be routine. This "nap of the earth" flying permits the pilot to skim along as low as 25 feet above the ground virtually immune from hostile fire except small arms, but it makes navigation extremely difficult. Even more dangerous is engine failure at this altitude. The pilot's reaction must be swift, precise and correct.

The collective pitch must go down to maintain rotor rpm, but it must be coordinated with back cyclic stick as the pilot is steering dangerously between div-

Student in rugged H-23D practices rough-terrain landing in clearing.

ing into the ground, dragging the tail on the ground or ballooning upward to a precarious altitude at a low airspeed—it takes skill. The student will become highly proficient in this maneuver before graduation.

Near noon, on a training day, the entire group returns to the home field. A line of homeward bound helicopters forms near the field boundary and builds outward. All are evenly spaced and traveling at an exact, predetermined airspeed. There are frequently more than 50 helicopters in the pattern at one time. From the single-file entry, they break into a double

column near the field boundary. One by one, each finds his parking place and lands with the wind quartering from the right rear to cause the main rotor blades to "lift" as they approach and pass the tail cone during shut down. The shut-down of engines and rotors is carefully supervised by the tower to prevent rotor wash of a hovering helicopter from causing flapping and possible damage to the blades of those shutting down. From the time the first helicopter enters the pattern until all engines are shut down, 100 aircraft can be landed in less than 20 minutes.

Classes are divided into two groups. While one is flying, the other attends ground school and gets its flying on the following half day.

Ground school includes 13 hours of helicopter aerodynamics, 48 hours of H-23D maintenance and three hours helicopter flying safety for qualified fixed-wing aviators. For those with no previous military pilot experience, the course is increased to 15 hours helicopter aerodynamics, 65 hours H-23D maintenance, 31 hours meterology, 34 hours navigation and nine hours of helicopter flying safety.

Since separating from the Air Force in 1956, the school has been operated through contract by Southern Airways of Atlanta, Ga. In addition to the school at Camp Wolters, Southern operates a scheduled airline covering the southeastern states and has the Beechcraft distributorship for the same area. It formerly operated the Air Force contract school at Bainbridge, Ga.

Many flight instructors at Camp Wolters are retired service helicopter pilots with considerable flight time. Present instructor pilot helicopter flight time averages near the 2,000-hour mark. Approximately 100 instructor pilots are employed, and the student-instructor ratio is three to one. Current Southern Airway policy requires new instructors to have over 200 hours of helicopter flight time, possess an FAA Commercial Helicopter Pilot certificate, and preferably be graduates of one of the service helicopter schools.

In the school structure, the military furnishes the school plant, all equipment including helicopters, buses, automobiles, etc., plant repairs and utilities. They provide student administration, military training, faculty boards and conduct a warrant officer candidate school for enlisted students. Training, maintenance, flying safety, and property accounting are supervised by the Army. Military pilots spot-check students and the contractor's flight instructors to insure quality control and standardization of instruction.

Southern Airways conducts the flight and academic training, maintains the aircraft, vehicles and equipment, operates the heliport, stage fields, ground transportation, aircraft fire and crash equipment, radio communications, weather service, maintains a flying safety program and the government property account.

Three courses are presently offered. The Officer Rotary-Wing Qualification Course is for officer grade fixed-wing aviators, who, because of their assignment have a need to be helicopter qualified. Students may be active duty Regular or Reserve officers, Army National Guard officers, or foreign national pilots from neutral or allied countries.

The course is eight weeks' duration, includes 70 hours of helicopter flying and 64 hours of ground school. Elimination rate is less than one per cent, and graduates normally return to their previous units.

The Primary Officer-Rotary Wing Course is for officers and warrant officers from the same sources as the qualification course except they lack previous military pilot training. The course is 16 weeks, has 110 flying hours and 157 academic hours.

The Warrant Officer Candidate Course is for enlisted men who attend a four-week OCS type preflight course prior to starting flight training and then follow the same curriculum as the primary officer course. Elimination rate for the latter two courses has been running from 10 to 12 per cent. Graduates presently go to Fort Rucker, Alabama for advanced training. Enlisted men will receive their warrants there. The qualification and combined primary courses classes normally have 65 students each.

When the Observation Pilot Course is started at Camp Wolters in July, 31 of the primary students will remain there for that training. The Bell H-13E and Hiller H-23D helicopters will be utilized in this course.

Camp Wolters is a natural for this type training. Local terrain is rolling with numerous ravines, valleys and hills, and covered with mesquite and scrub oak. Low-level flight requires the pilot to maintain a constant alertness and attention to flying the aircraft. He must carefully divide his attention and utilize map-reading skills to a maximum. There is a notable absence of check points for pilotage and low-level navigation. Dead reckoning becomes a prime method of maintaining orientation in order to perform planned tactical missions.

The Southern Airways organization is built around three sections under General Manager R. L. Thomas. Training and operations is headed by Joseph Shields, Wayne Schwalm is director of maintenance and Samuel Knight is director of materiel. These three sections have been developed into closely coordinated teams, each augmenting the services of the others.

The H-23D has proved to be a tough, reliable helicopter, according to Shields. The in-commission rate has consistently been over 70 per cent. Monthly flying averages between 8,000 and 9,000 hours, for an average of 50 hours per helicopter per month. Engine life average is just over 700 hours although they are approved for 1,000 hours.

Maintenance performs over 100 periodic inspections and 10 to 15 engine changes per month. Frequently, over 100 post-flight inspections are performed in a single night. The average is quite close to this figure. A former heavy-equipment overhaul building is used to permit these inspections to be made inside to alleviate any tendency to pass over items because of discomfort of the mechanic due to weather and to provide adequate illumination.

The material section is able to maintain a low out-of-commission rate for parts through the use of an IBM data machine. Constant check is kept on parts replacement frequency and planned replacement allows for a relatively low inventory of parts.

Harmonious relations between Southern Airways

and the military at Camp Wolters, which is now headed by School Commandant and Post Commander Col. Jack K. Norris and Assistant Commandant Col. Erdie O. Lansford, has led to a highly satisfactory operation. In addition to the low elimination rate, the school product has been maintained at a high level. The school was awarded the McClellan Safety Award in 1960. During the fiscal year 1962 it will graduate nearly 1,300 pilots.

Fixed-Wing Operations

In the new Army battle line stands a small but remarkable phalanx of fixed-wing aircraft. Small, as changing conditions have assigned the primary role to rotary-wing aircraft. Remarkable, because outstanding performance and versatility have enabled them to survive a rugged trial by arms. A trial by arms in competition with others of their kind as well as against the traditional adversaries of fixed-wing aircraft—rough terrain and limited access landing areas.

The prominent new members of this fixed-wing fraternity are the de Havilland Caribou AC-1 and the Grumman Mohawk AO-1.

Having performed yeoman service for over a decade as all-around observation and utility aircraft, the Cessna L-19 Birddog stands ready to retire, with honors, in deference to the upcoming light observation helicopter.

New helicopters such as the Bell HU-1 Iroquois stand to supplant the de Havilland L-20 Beaver and U-1A Otter in the utility field.

In the command category the Beech L-23 Seminole and Aero Commander L-26 retain their status as fast, economical personnel and utility transportation.

An aeronautical paradox in this Army fixed-wing lineup is the Caribou. A spread-eagled giant with a vertical stabilizer that towers almost 32 feet, it easily dominates its smaller fixed-wing brethren on the Army ramp.

Remarkably, in spite of its size it can hold its own with them in performance. Allowing for wing clearance, the Caribou can be made to shoe-horn in and out of any field the L-19 can handle, according to the men who fly her.

One of FLYING's editors flew along as they went out to prove it. The big aircraft is taxied by means of a nose wheel steering wheel on the left cockpit wall. This permits the towering stabilizer control surfaces to remain locked in gusty conditions while maneuvering on the ground.

An unusually clean cockpit layout is achieved by placing the engine controls overhead. A touch of extra luxury is the mounting of radio equipment on a sliding console between the pilots. The entire console can be shoved forward under the instrument panel out of the way. Circuit breakers are located behind the pilots.

A maximum performance takeoff in the Caribou was a revealing experience. With the 1,450-hp twin Pratt & Whitney R-2000 engines at takeoff throttle, rotation was begun at a mere 45 knots indicated, and liftoff at 55 knots as the pilot simply hauled the control wheel back in his stomach. Thirty degrees of flaps were lowered for takeoff. Flaps run the full span of the wing and the outer trailing portions operate independently as ailerons.

The aircraft, with full fuel and five aboard, climbed at 110 knots and 1,000 fpm. Normal climb power was 35 inches and 2,250 rpm. Normal cruise at 2,500 feet with 32 inches mp and 2,000 rpm gave 140 knots indicated.

The Caribou achieves outstanding short-field landing performance with full 40 degrees of flaps lowered. An airspeed of only 60 to 63 knots—low for many a light civil aircraft—was held on final approach into the stubble section of a practice strip on the Fort Rucker reservation.

A brief flare-out and then Bamm! The aircraft was down. Brakes were promptly slammed on and the big airplane shuddered to a grinding halt in an estimated 200 feet—in spite of the fact that the Caribou does not

Grumman Mohawk twin-turboprop AO-1 is fitted with flash-flares for night reconnaissance mission. Flares, fired above, automatically trigger cameras.

come equipped with reversible-pitch propellers.

How much performance is sacrificed with a full load at the aircraft's 28,500-pound gross? According to Capt. Charles Quinn: "Performance is much the same even when at gross weight."

Among other features demonstrated by Capt. Quinn was the stall warning indicator. Instead of a horn, a rapid vibration of the control wheel signals when the airspeed is seven knots above a stall. An even more vigorous vibration occurs three knots above a stall.

Another feature was automatic feathering, which on loss of fuel pressure or engine power automatically feathers the propeller of the failing engine on take-off. A safety feature, however, prevents feathering of both props.

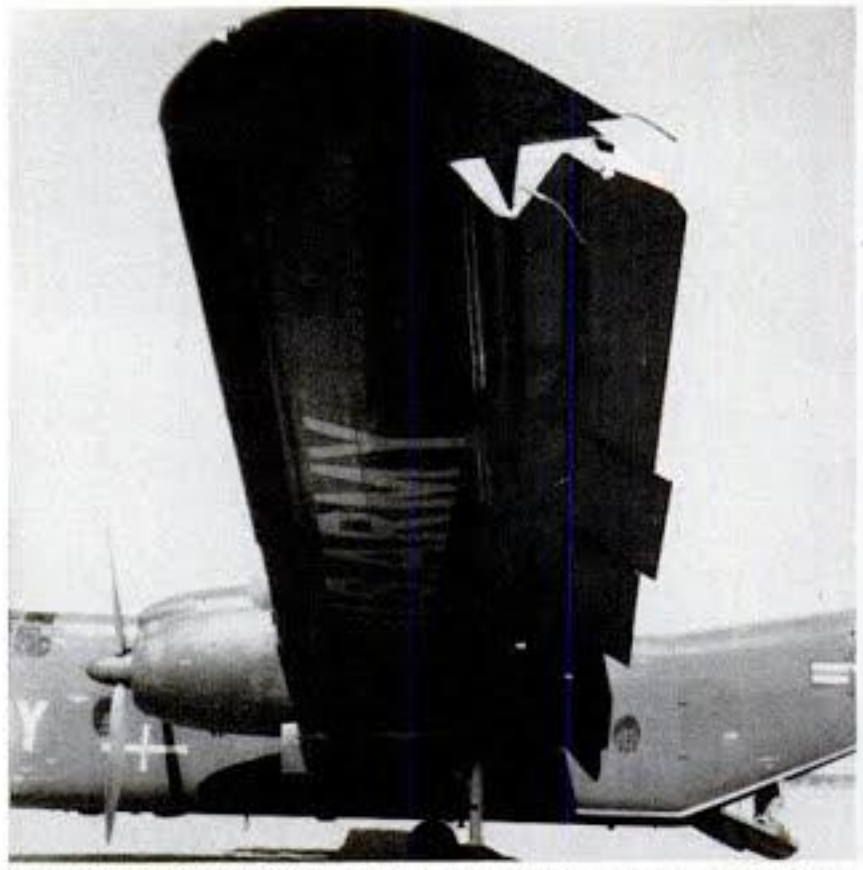
Sampling single-engine performance, Capt. Quinn feathered one engine and on the other held 42 inches and 2,500 rpm METO power. The aircraft easily managed a 1,000 fpm climb. With a single-engine cruise configuration it held 120 knots IAS with 35 inches and 2,250 rpm.

What does the Army pilot think of the Caribou and its performance? "This airplane's really made to live out in the field," commented Quinn with a glance below at the typically abbreviated landing strips dotting the Fort Rucker area. "I wouldn't be afraid to land in any of the fields around here. And one man can fly the aircraft very easily. Everything is in reach of the pilot."

The Caribou is designed to provide close support to ground forces in forward battle areas. With a 1,150-cubic-foot cabin that can be loaded from the rear at truck level, the aircraft with full fuel and 950 nautical miles' range can carry a payload of 5,562 pounds. With fuel for 200 nautical miles the payload is 8,765 pounds.

It has the load capacity for 32 armed troops, or a pair of jeeps and an ammunition carrier.

For added versatility wheel-skis have been developed and tested to permit full winter operations.



DeHavilland Caribou flaps run the full span of the wing for STOL.

As for the future, deHavilland has under consideration a military version powered by turboprop engines, probably the 2,600 shp General Electric T64. The Canadian company told FLYING the modification, if adopted, would result in a "very marked improvement in payload, speed, etc., over the present piston-engine version." The aircraft would be "refined and redimensioned" to take advantage of the additional power.

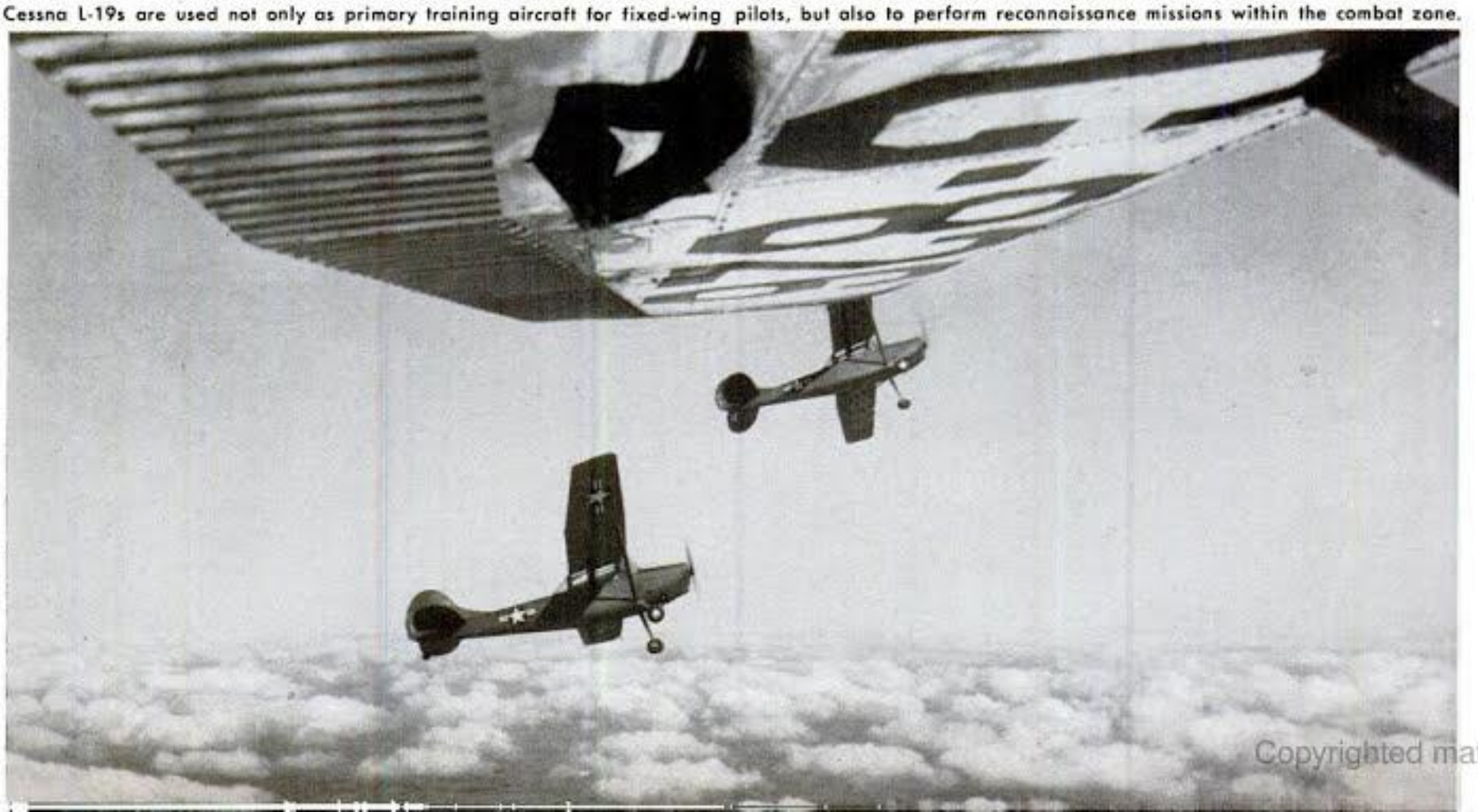
DeHavilland to date has carried the project only into the design study stage and is not firmly committed to go ahead on it.

The T64 has already been mounted in the Caribou airframe, but merely as a testbed to log flying time on the engines for certification.

The first Caribou was delivered to the U.S. Army in the fall of 1959. A total of 20 have been delivered to date, and 300 are projected by 1970.

The Grumman Mohawk AO-1 claims the distinction

Cessna L-19s are used not only as primary training aircraft for fixed-wing pilots, but also to perform reconnaissance missions within the combat zone.



ARMY AVIATION FIXED-WING AIRCRAFT

Designation and Name	Crew	Passengers (240 lbs. per man)	Span	Length	Height	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Max. cruising speed with payload (TAS)	Fuel Capacity (gallons)	Maximum range (miles) with payload
Aero Commander L-26C	1	3	49'0"	35'1"	14'6"	4,880	8,000	2 Lyc IGSO540 380 hp ea.	240	221	1,400
Beech L-23D Seminole (Twin Bonanza)	1	4	45'4"	31'6"	11'8"	4,044	7,000	2 Lyc GSO480 340 hp ea.	170	230	980
Beech L-23F Seminole (Queen Air)	1	5	45'10"	33'4"	14'2"	5,216	7,700	2 Lyc IGSO480 340 hp ea.	174	230	980
Cessna L-19 Bird Dog	1	1	36'	25'10"	7'6"	1,513	2,400	Cont.O470 213 hp	86	41	350
DeHavilland L-20 Beaver	1	4	48'	30'3"	9'	3,341	5,100	P&W R985 450 hp	110	138	575
DeHavilland U-1A Otter	2	8	58'	41'10"	12'5"	4,080	7,000	P&W R1340 600 hp	105	216	720
DeHavilland AC-1 Caribou	3	32	95'6"	72'7"	31'9"	18,000	26,000	2 P&W R2000 1,450 hp ea.	180	722	850
Grumman AO-1A Mohawk	2	0	42'	41'	12'8"	9,904	14,593	2 Lyc T53-L3 1,005 eshp ea.	258	282	410

of being the fastest and probably the most sophisticated aircraft in the Army fleet. Red-lined at 387 knots, the aircraft was urged up to 300 knots indicated for a FLYING editor after a typical Army wing-over that more closely resembled a Split-S.

At 300 feet of altitude the twin-turboprop held 260 knots IAS in a dodging, twisting run above the trees. Although unarmed, the airplane has the sensitive touch and the maneuverability of a fighter. A light pressure on the dual control stick (no wheel in this aircraft) gives a fairly fast rate of turn for a smooth, effortless aileron roll.

The automatic fuel control system permits rapid rate throttle advancement and, conversely, speed brakes can be actuated at any airspeed.

In spite of twin Lycoming T53-L3 engines of 1,005 eshp each, and a clean configuration, the Mohawk does not have a high cruise speed. Forty pounds of torque and 1,450 rpm yielded 180 knots IAS at 4,500 feet. Upping this to 60 pounds torque and 1,650 rpm edged the airspeed up a shade over 220 knots.

Typical of most Army aircraft, however, the Mohawk's forte is in the realm of short-field takeoffs and landings.

Capt. James L. Whited, flight instructor in the Mohawk program at Fort Rucker, demonstrated on an auxiliary field. He brought the aircraft down final approach at 80 knots indicated with full flaps at a 500 to 600 fpm rate of sink.

The Mohawk, incorporating a ruggedness of construction inherited from its Grumman Naval forebears, was not allowed the luxury of a gentle roundout. Instead, the aircraft was pancaked in a three-point touchdown. The gear cushioned the impact well, however, and immediately the power brakes were applied and propellers placed in reverse pitch. The airplane obligingly slammed to a halt in approximately 80 to 100 feet. The gear is built to stand a sink rate of 1,020 feet per minute.

In takeoff, the stick was pulled back at 65 knots and the aircraft flew off strongly.

The airplane's slow-flight capability is enhanced by slats that are activated in coordination with the flaps, and by inboard ailerons activated when flaps are extended.

The bulbous plexiglass cockpit and rear-mounted wing permit excellent visibility from the Mohawk. The airplane is equipped with an automatic engine synchronizing feature as well as auto-feathering. The latter automatically feathers the propeller of a failing engine on the critical takeoff period. The instrument panel is outfitted with a Collins FD 105 flight director system.

For pilot safety, a Martin-Baker automatic ejection system permitting low-level bail-outs is installed on the Mohawk. It is activated in Navy fashion by pulling down a face curtain ring from above the head.

The aircraft is designed to perform a variety of surveillance missions and has been outfitted with side-looking radar in the AO-1BF version, and with infrared detection equipment in the AO-1CF version.

The capability of the AO-1AF basic visual photographic version as a photo reconnaissance aircraft was demonstrated to FLYING editors during a low-level night mission.

Special removable flare pods are mounted on the upper wing root for night photo missions. Each pod carries 52 photo flares. The photo-flash flares are fired up above the aircraft as it passes over the target area. The flashes activate a sensor mounted on top of the fuselage, and this triggers the cameras.

Programmed to fly at 1,500-foot altitude on 10-minute departure intervals, the Mohawks took off on a planned 47-mile mission. To simulate combat conditions navigation was planned strictly on dead reckoning using visual sightings for countercheck, without use of radio facilities.

To enhance the effect of short-field operations, run-

way lights were turned on for only a portion of the available strip.

As an extra challenge to the pilots' ability to meet changing conditions, after takeoff the entire mission was changed and pilots directed by radio code to another photo objective.

Films evaluated after the flight determined the success of the mission for each pilot.

A total of 75 Mohawks have been delivered at this writing, while 250 are projected by 1970.

Fixed-Wing Training

The L-19 is a brute brother of the Cessna civilian fleet. It will stand almost straight up on its prop in a miximum angle of climb takeoff. It can be slammed onto the stubble surface of a forest clearing. Yet it can be weaseled between the trees into a narrow dirt road, in a cross-wind. FLYING editors flew in the L-19 as these maneuvers were demonstrated.

Teaching the Army pilot to handle this pocket-sized tiger with the authority that achieves results in a combat mission and with the finesse that guarantees a long life for both aircraft and pilot is what goes on at Fort Rucker, Alabama.

Use of this two-place liason aircraft for beginner pilot training is just one of several unusual aspects of the Army pilot training program.

"We're unique in the fact that our primary trainer is also one of our fighting aircraft," points out Capt. Darrel W. Basom, operations officer for primary fixed-wing training.

Another unusual aspect is the use of brand new graduates of the fixed-wing training program as instructors in the advanced phase of training.

Still a third, which puts civil operations in an interesting light, is instrument training in actual weather conditions with light single-engine aircraft.

The normal course of training for the fixed-wing pilot at Fort Rucker ends after he has completed primary and advanced training in the L-19 and instrument training in the de Havilland Beaver L-20. He then is reassigned to his home unit for training with his outfit. Later he may be returned to Fort Rucker to learn to fly either the de Havilland twin-engine Caribou transport or the twin-turboprop Mohawk surveillance aircraft built by Grumman.

There is no transition aircraft for multiengine training. The transition from the L-19 and Beaver, however, is not a difficult one, according to instructors at Fort Rucker.

The entire setup at the Army primary training area is different from its Air Force counterpart. First of all, all the student pilots are officers or warrant officers. There is no Army Aviation Cadet program with student pilots coming directly in from civilian life. Potential pilots are selected from Army units in the field, with an eye to obtaining men who first of all have acquired a solid background in combat training.

Army men are launched in their aviation career with a primary training program of simple, straightforward objectives. "We are here to turn out a student that can handle the aircraft safely and with good coordination," says Capt. Basom.

The actual flight instruction is performed by civilians of the Hawthorne School of Aviation on a civilian contract basis. Military pilots maintain uniform standards by check rides.

The primary phase, at Lowe Army Air Field on the Fort Rucker reservation, gives the student 120 hours behind a control stick and 251 hours behind a desk in academic schooling. The greatest attrition comes in the pre-solo phase of flying when some 25 per cent of the pilot candidates drop out.

This attrition rate is lowered to some seven per cent, however, in ROTC students entering with 35 hours of flight training already behind them (see box p. 46).

Solo time in the L-19 usually is between eight and 13 hours in the primary phase.

In the airplane the student learns such basic maneuvers as stalls, spins, chandelles, lazy eights, eights around a pylon, and rectangular courses, to prepare him for traffic patterns.

Because of the limitations of the aircraft, no aerobatics are taught.

About 20 hours of instrument time is given to the Army pilot in the primary phase. He flies from the rear seat of a TL-19D equipped with a variable-pitch prop and a special instrument panel mounted before him right at face level. Blinds all around the cockpit

De Havilland L-20 Beaver utility transport, long a mainstay of Army operations. There are 640 of these aircraft in the current Army inventory.

VISUAL GLIDE SLOPE INDICATOR

AN INEXPENSIVE visual glide slope indicator that can be carried around by hand is one result of the "foxhole thinking" at Simmons Army Air Field. The indicator was devised by members of Headquarters Co., 18th Airborne Corps, to guide fixed- and rotary-wing aircraft to night landings in battle terrain.

An example of what native ingenuity can do, it is paired with sets of small blinker devices (also "homebuilt") used to mark landing areas.

Both easily could be adapted for civil use at small fields lacking elaborate night lighting equipment.

The glide slope indicator is made from nothing more than a .50 cal. ammo box. A pair of dry cell batteries hooked up to an aircraft wing position light provides a beam of light aimed through an opening at one end of the ammo box, mounted on legs.

The small rectangular opening has three pieces of colored glass or plastic: yellow on top, green in the center and red below. Cost of the device: about $3 to $4.

The incoming pilot merely lines himself up with the portable "runway lights" and flies the green beam down to the landing area. If he's above the proper glide path, he sees yellow; if below, red.

How well does it work over dangerous wooded terrain? "I'll fly into any strip at night with this device," says Maj. Clifford S. Athey *(left)*, assistant aviation officer for the 18th Airborne Corps.

The runway marker and threshold lights are put together from .30 cal. ammo boxes and can be made to flash a steady or a blinking light.

give the student pilot completely hooded flight.

From this position he is taught instrument takeoffs, climbs, descents, climbing and descending turns, gyro turns, steep turns, straight and turning stalls as well as recovery from unusual positions.

Each instructor starts out with three students, although attrition may lower this number. The entire course takes 17 weeks and three days, and a class graduates every six weeks. Four classes run concurrently with 65 officers to a class. A fixed-wing program

Beech L-23F, military version of the Queen Air, is command transport.

for training helicopter-rated pilots lasts six weeks.

During academic training heaviest emphasis is placed on aircraft maintenance, and students receive 80 hours on this subject. Next comes radio communications with 34 hours; navigation, 30; and weather, 25 hours. Other courses cover principles of flight, flight planning and flight instruments. Twenty-one hours of instrument instruction is also conducted in the Link Model I-CA1-45.

On moving up to the second or advanced contact phase of training, the Army pilot learns to control his aircraft with the critical accuracy and foresight demanded by low-level flying and operations out of rugged terrain.

His classroom is some 61,000 acres of wiregrass, pine forest, narrow clearings and wood-lined sod roads.

He learns to master the short-field takeoff and landing until it becomes second nature. As his aircraft is unarmed and slow, he learns how to take advantage of its high maneuverability and to work on the deck or over the trees for protection.

Flying through a maximum performance climbout from the rear or instructor's seat of the L-19 gives a unique opportunity to evaluate both aircraft and instructor.

First of all, the man in the back seat can see nothing of the instrument panel up front. This is blocked out by the student pilot. In addition, the conventional gear configuration allows the instructor only an abbreviated glimpse of the runway by craning left and right.

Before takeoff, 20 degrees of flaps are lowered, throttle is advanced to the stop with stick full back. As brakes are released and the run begins, stick is advanced to neutral. After fly-off, the L-19 can be bent up to an angle that from the rear seat seems almost straight up. A 213-hp Continental engine holds the aircraft in this remarkable attitude, just over a stall, until the trees are cleared.

Throughout each maneuver the instructor must rely on his "feel" of the airplane and the sound of the engine as a double-check on student performance. The high degree of skill required for this type of flying makes even more remarkable the extensive use of newly trained pilots as instructors in the advanced course.

However, they are credited with making up in aggressiveness and inspiration what they lack in experience. They are given an extra 45 to 50 hours of training in methods of instruction to prepare them for their new role as flight instructors. Approximately half of the instructors in advanced fixed-wing training in L-19s are of this category and help ease the pilot shortage presently existing in the Army aviation program.

To help in navigating from low altitude, the pilot is taught to pick out prominent terrain features before moving down on the deck. If enemy fire is en-

countered, either from the ground or an attacking aircraft, the L-19 has one supreme defense—its maneuverability.

Flight instructor Capt. William Fugit demonstrated with a hard, quick wing-over that came closer to a Split-S as he rolled over inverted and racked the L-19 around to a level-off just above the trees.

During low-level flight the aircraft is trimmed slightly nose-up so that a slight forward pressure is required to hold constant altitude. If the pilot's attention is diverted and he relaxes on the controls, the aircraft then will climb away from the ground.

The Army pilot learns to evaluate his landing area from a high reconnaissance of from 400 to 600 feet and a low reconnaissance 10 to 40 feet above the trees. He checks landing area width and length, wind direction and strength and surface condition as well as possible forced landing areas. The second, low pass with 20 degrees of flaps gives a final check on surface conditions.

Approaches are made with power on and an almost level constant pitch attitude. For maximum accuracy in hitting a preselected touchdown point, the rate of descent is controlled with power. A point on the landing area is picked out to signal a go-around if a safe landing is not assured.

Again, maximum knowledge of the aircraft is demanded of the pilot, as the approach is managed by the sense of feel without reference to flight instruments. This leaves the pilot free to watch out for other aircraft as well as to properly judge his descent in areas of critical clearance.

To practice landing in restricted areas such as forest clearings, the student first is given a "barrier" approach somewhat more forgiving than those he will encounter later on. This barrier consists simply of a string stretched across the flight path and marked with ribbons. The student practices his approaches over this 50-foot-high barrier.

To aid him in evaluating his technique, the Army has devised an ingenious but simple method (see opposite page) of photographing landing aircraft with Polaroid cameras.

After completing nine weeks and two days of Phase B advanced contact training and logging another 70 hours of flight time, the Army pilot makes the plunge into advanced instrument training—in Phase C.

A large segment of previously trained Army pilots still lacking instrument flight qualifications, however, are trained by the civilian contract school, Ross Aviation, Inc. at Fort Sill, Oklahoma, in Piper Comanches (see FLYING September 1961).

The pilot going through the Fort Rucker program, already fortified with 41 hours of hood and Link time on basic instruments from his primary phase, now faces another 54 hours of hood or weather time in the de Havilland Beaver.

The course is streamlined to the extent that low frequency range procedures have been dropped. In its place the pilot studies and flies omni, ADF, ILS (both legs) and radar—both en route and GCA.

The most unique phase of training in the Army instrument program launches student pilots on cross-country flights in actual weather conditions in the single-engine L-20.

These are incorporated first of all in flights lasting a single day. Aircraft head out about 300 miles or to such points as New Orleans, La., Jackson, Miss. and Memphis, Tenn. Each instructor takes along three students. The student at the controls wears a visor for hooded flight if no actual IFR conditions exist.

In what the Army calls "multiple training" the two students awaiting their turn at the controls listen in

ARMY ROTC FLIGHT TRAINING PROGRAM

THE ARMY ROTC Flight Training Program, having proved successful for its first four years of existence, was extended for another four years in August, 1960. The purpose of the program is to motivate college students to seek a career in Army Aviation, screen applicants for Army Aviation training, act as a career incentive in the regular Army, and to create a reserve pool of qualified aviators who may be utilized in the event of national emergency.

The flight instruction is given by FAA-approved flying schools. To qualify, a flight school must meet certain standards of insurance protection, instructor personnel, and facilities, and must be in close proximity to the college being served.

In order to enroll in the Flight Training Program, an ROTC student must be in his senior year and meet academic and medical requirements set by the Army.

The flight training program is extracurricular and does not modify the primary purpose of the Army ROTC program, which is to provide qualified junior officers in sufficient quantity to meet the annual needs of the Army.

Textbooks, flying clothing, and other equipment necessary for the program are supplied to the student by either the Army or the flight school.

The object of the program is to train students in the basic ground and flight fundamentals. An FAA-approved standardized flight training program is presented, and requires 35 hours of ground instruction and 36½ hours of flight instruction. Periodic checks are required and are conducted after 12 and 20 hours of flight training. The final check flight is given by the FAA at 35 hours. Those students who qualify may apply for an FAA private pilot's license.

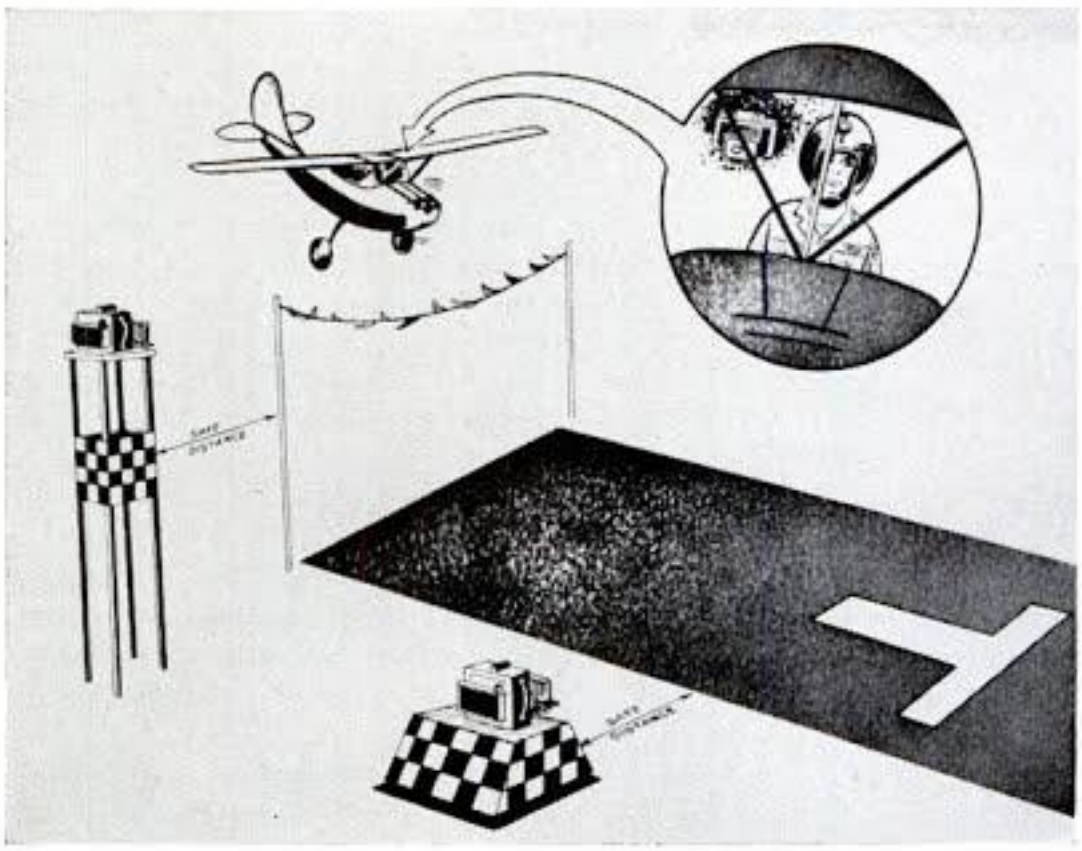
In the academic year 1960-61, 450 cadets enrolled in the program at 57 institutions. Of this number, 339 successfully completed the course for a completion rate of 75.3 per cent.

After completing the course, ROTC graduates have attended Army fixed-wing and helicopter schools. Their performance here has shown the usefulness of the Flight Training Program. The attrition rate of the former ROTC cadets was 6.6 per cent as compared with the overall primary flying school rate of 27 per cent. This reduction in attrition represented a decided savings to the Army in money, time, and effort.

Because of the low attrition rate, the Army feels that the screening of applicants for aviation training was successfully accomplished, and that the program definitely stimulated interest in Army Aviation and the regular Army as a career.

Satisfied with these results, the Army has increased the number of training spaces to 600 in the ROTC Flight Training Program for the 1962-63 school year.

POLAROID CAMERA TRAINING AID



TECHNIQUES FOR critical barrier approaches are sharpened quickly and simply by a novel Army pictorial method using Polaroid cameras.

As the student pilot passes over the string barrier and makes his touchdown, cameras mounted on the field and in the airplane record the aircraft's position and attitude.

Three cameras are used. One photographs the aircraft at the barrier; the second catches the touchdown; and a third, mounted in the cockpit and triggered by the instructor, shows the aircraft panel and approach.

The system, the idea for which was sparked by Maj. Gen. Ernest F. Easterbrook, Fort Rucker Commander, gives an instantaneous check of student progress and proficiency to aid the instructor in a fast critique.

The barrier approaches are used to simulate landings in short fields bounded by high trees.

The photographic method has obvious application for civil training.

on the radio procedures and learn from their colleague's experience.

In the later stages of their instrument training groups of students under an instructor's tutelage embark on four-day cross-country flights that range as far as 1,000 miles from home base. This gives students firsthand experience in flight planning under actual weather conditions, and in dealing with different topographical, climate and air traffic control regions.

While on cross-country, the students are taken to visit various ATC centers along their routes to gain additional perspective on the operation of the Air Traffic Control system.

"These flights contribute a great deal to building up their confidence in actual weather," notes James Morris, supervisory education specialist for flight.

How does the Army instrument pilot stack up under this program of instruction with his counterparts in the other services?

"You ask the average controller," says Morris, "and they'll give us a high rating."

Research and Development

Leadership in subsonic aeronautical research, once shared by many agencies, has come to rest on the shoulders of one organization—the United States Army. The Air Force and Navy have gone supersonic and no longer support large research efforts geared to building better low-speed subsonic aircraft.

Funds allotted the Army for aviation research and development (R&D) have increased about three times over a period of three or four years from about $20 million to a current level near $60 million. It is hoped in many quarters of the Army, in industry and at universities and non-profit institutions that this rate of funding increase will hold. The need for more "pure" or "basic" research is judged especially critical because only about $1.5 million is spent in this area. Estimates are that about $5 million is devoted to "applied" research on new aerodynamic systems, engines, etc., which are not intended to be used in specific new aircraft. The remainder of the R&D money goes for development of particular aircraft.

Technically, the opportunities in subsonic aviation have never been brighter than they are today. Present research information leaves little doubt that it is possible to build new light aircraft with greatly improved performance and utility compared to the models now in service with both military and civil operators. For instance, most engineers apparently believe that the long-heralded VTOL aircraft, of acceptable efficiency and economy, can be built in the next decade. More effort is needed to achieve such improvements, but a new era is clearly in sight.

Major advances appear possible in all phases of subsonic design. Forecasts for improved gas turbine engines have never been more optimistic in terms of higher power per pound of engine weight, lower fuel consumption, and lower price. By all indications aerodynamic design can be significantly bettered through lower drag, higher maximum lift, and improved stability and control at very low speeds. Structural weight apparently will go down as new materials, many developed for space use, are adapted to light aviation.

With the funds available now and likely to be available in the future it is clear that aerial mobility for the entire Army is 20 years or more away. Lt. Gen. Arthur Trudeau, Army Chief of Research and Devel-

opment, believes that air-mobility for 25 per cent of the combat forces by 1970 is a good minimum objective.

During the past year three major steps were taken to improve air-mobility, by taking advantage of the technology that now exists. When the Kennedy Administration took office last year, one of its first moves was to allow the Air Force to contract for the development of the C-141 turbofan-powered strategic transport to move troops and supplies over long distances. Lockheed Aircraft Corp. won the design competition for this transport.

Hiller HO-5 candidate for Army light observation helicopter (LOH).

Hughes HO-6 LOH. Army requirements call for four-place aircraft.

Bell HO-4 LOH. Testing the above three scheduled to start in 1963.

The second major step was to contract for the development of the first large VTOL aircraft. An industrial team of Ling-Temco-Vought, Ryan Aeronautical Co., and Hiller Aircraft Corp. won a competition to design and construct a four-ton payload VTOL transport powered by four General Electric T64 turboprops. Total development costs of the tri-service project is expected to be about $70 million with the Army, Navy, and Air Force sharing the expenses equally. In addition to the normal flight test program, each service plans to take this aircraft into the field and operate it under service conditions. This will be the first time that such field tests have been made.

The third major move was the initiation of development work on the Light Observation Helicopter (LOH) carrying a maximum of four men (see FLYING April 1962). Three firms, Hiller Aircraft Corp., Bell Helicopter Corp., and Hughes Tool Co., Aircraft Division, were selected as winners in a design competition among about nine companies. The winners will each develop their designs and deliver five aircraft to the Army beginning in the Fall of 1963. An extensive flight test and field trial competition will then be conducted to determine which aircraft is best suited for operational use.

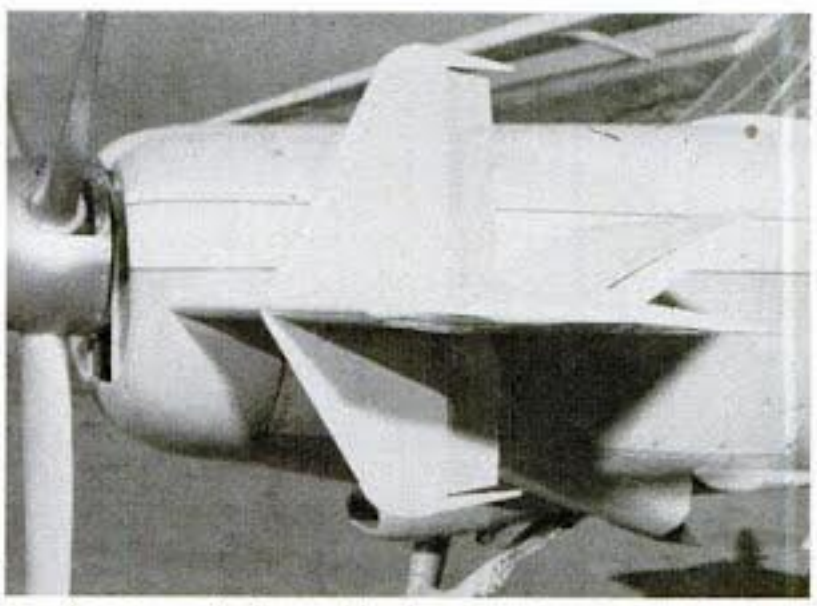
All three of the new aircraft—the C-141, the tri-service VTOL and the LOH—meet a pressing military need and are very important to the nation's future military standing. Still, they are far from sufficient, by themselves, to bring complete air mobility to the ground forces. Several other sizes of STOL and VTOL aircraft will have to be supplied in quantity. The other aircraft needed by a field Army include fairly large transports with five-ton and 10-ton payload capacities and smaller ones of up to three-tons.

Eventually the Army wants to operate primarily with VTOL aircraft which have the low speed and hovering capability of the helicopter and the high-speed performance of an airplane. This is a stringent requirement and at the present rate of development it will be well over 10 years before they appear in any numbers. Until that time the Army will operate a mixture of STOL aircraft and helicopters. A strong feeling exists that helicopters will always have a place because they are very efficient for short-range (under 100 miles) missions that require vertical take-off and landing and good hovering endurance.

From the most basic point of view there are three critical areas in which good progress must be made if the Army is ever going to replace ground transport with VTOL aircraft. These areas are:

● High thrust-to-weight-ratio engines. If VTOL aircraft are to become competitive with current aircraft in payload carrying capacity, new gas turbine engines delivering very high thrust for their weight will have to be developed. Operational gas turbines today produce up to about eight pounds of thrust per pound of engine weight. It has been estimated by many authorities that this figure must increase to 12 to one or better before VTOL aircraft will become attractive. Two years ago most engine manufacturers had hopes

The nose-mounted control surfaces are effective at low airspeeds.



They incorporate both movable elevator and rudder-type surfaces.

ROBERTSON STOL

NEW IDEAS have always come from many sources in aviation, and small companies and private inventors are still active. A good example of such activity is the STOL airplane shown here, which has a new type of control system especially designed for very low speed flight.

Skycraft, Inc. of Ft. Worth, Texas headed by James Robertson, formerly of St. Louis, Mo. has a patent on the new system. The airplane was built by the company as a first step toward commercial development. The Army has awarded Skycraft a small contract to provide flight test data on their control system.

The main idea behind the nose-mounted controls is to keep them in the direct slipstream and increase their effectiveness at low flying speeds. The airplane shown here will stay under control in level flight at 20 mph. Control effectiveness actually gets better under 40 mph. Normal gross weight is 4,200 pounds with a maximum of about 5,000 pounds. The powerplant is a modified Lycoming with water injection and rated at about 420 hp.

Stopping distance is about 25 feet. Takeoff roll can be as little as 65 feet and total distance to a 50 foot altitude is well under 400 feet.

Test pilot for Skycraft's Army tests is Paul Eddy, Chief Pilot of W. H. DuPont Airways, Miami.

Major modifications expected in the commercial version of this airplane include retractable gear and the use of a 12 per cent (chord thickness) wing in place of its 15 per cent wing.

Low-speed flight is achieved by use of slotted leading edge combined with full-span wing flaps in the 4,200-pound gross weight aircraft.

about eventually reaching this level of performance but they were not optimistic about doing it in the near future.

Today the picture has completely changed. Many engine specialists believe that the next generation of gas turbine engines can have thrust-in-weight ratios in the range of 15 or 20 to one. The change of opinion has been brought about by some very successful engine research programs, many of them privately financed.

The increased performance came about primarily through lighter construction rather than higher engine operating temperatures. It has been shown that very light construction can be tolerated, especially if an engine operates only during vertical takeoff and landing.

Since a VTOL aircraft requires about three times more thrust during takeoff and landing than it does during cruise, the use of separate relatively low-life lightweight lifting engines becomes attractive. The lightweight construction techniques also can be used to improve the thrust-to-weight ratios of the heavy-duty cruise engines which must operate during an entire flight.

● Low fuel consumption. One of the major objections to an air-mobile Army has been the high fuel consumption of current aircraft. When nothing but air transport is used in a lengthy combat operation, a very large percentage of the available aircraft must be used to carry fuel for those employed in moving troops and equipment.

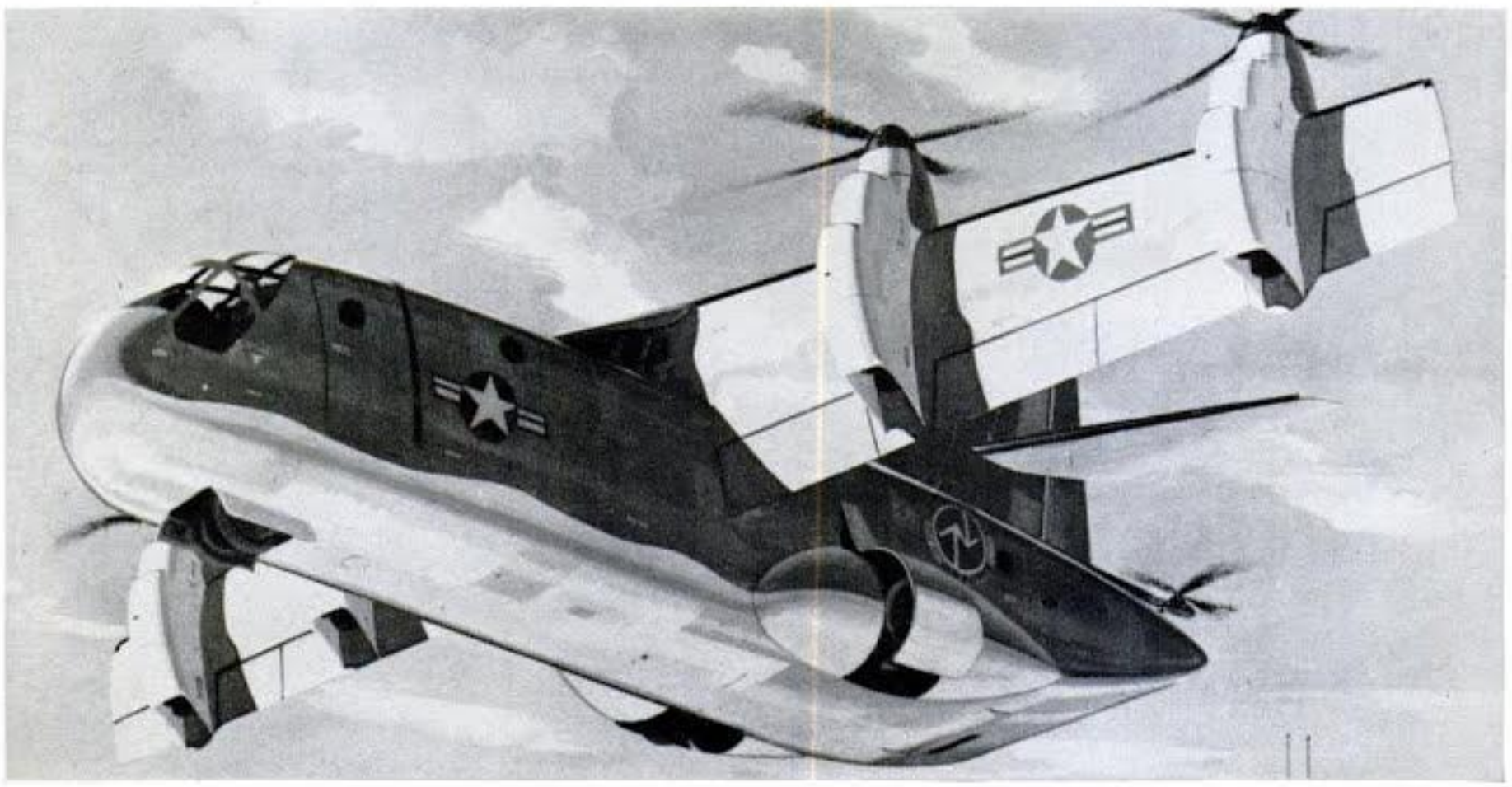
It is now believed that regenerators can be added to aircraft gas turbines to reduce their fuel consumption by 20 to 30 per cent.

This fine performance improvement is possible because a regenerator uses the hot exhaust gas to preheat the engine air before it enters the combustion chamber. This preheating means that there has to be a smaller temperature rise in the combustion chamber to bring the engine air stream up to the normal operating temperature. A smaller temperature rise in the combustion chamber in turn means that fuel may be burned at a lower rate to achieve the same power output.

As would be expected there are some disadvantages associated with regenerators. The main one is the need for a larger radiator or heat exchanger to preheat the engine air. This radiator adds weight to the engine. It also has a sizable volume and it will either increase the engine's length or diameter, depending upon how it is incorporated into the design. In either case the larger size will increase the engine's drag and fuel consumption.

However, when all factors are considered, it appears that regenerative engines are highly desirable. One study shows that the ferry range of the Chinook helicopter could be increased by more than 25 per cent if present regenerators were added to its engines. On shorter range tactical missions the fuel consumption probably would be cut about 20 per cent. On more advanced engines now in the planning stage it is believed that the reduction in fuel consumption would be in the neighborhood of 30 per cent.

Other design methods such as increasing the maximum operating temperature show promise for lowering the fuel consumption of turbine engines, although not to the extent expected from regenerators. When all of the new engine technology is considered, it appears that specific fuel consumption could be lowered 30 per cent on operational aircraft in the next 10 years. This isn't the 50 per cent called for by some Army planners but it still would make air-mobile operations much more attractive than they are today by



Artist's concept of the tri-service VTOL transport being developed by the Ling-Tempco-Vought, Ryan and Hiller team. Its design payload is four tons.

ARMY MAINTENANCE

TOP ARMY OFFICERS continually say that their goal is to buy simple, rugged aircraft requiring no maintenance that can't be performed by the average G.I. with a few hand tools in the middle of bad weather out in an open field. In recognition of the fact that such aircraft are at least several years away, the Army operates two fine schools for aviation mechanics.

One school, the Department of Maintenance of the U.S. Army Aviation School at Ft. Rucker, commanded by Lt. Col. H. J. Jern, trains mechanics for 1st and 2nd echelon, or line and operational maintenance performed in the flying units. The second training unit, headed by Lt. Col. G. A. Peyer, is part of the Transportation School at Ft. Eustis, Va. It trains 3rd and 4th echelon field maintenance specialists and 5th echelon, fixed-base depot maintenance personnel.

These schools are run in typical military fashion. Maximum use is made of training aids, cutaway models of equipment, and functioning replicas of systems to teach principles of operation as well as possible sources of trouble. Theoretical subjects are included to give the students a general understanding of aircraft and the type of systems they will maintain.

But the training is heavily oriented toward practical work on the aircraft and equipment now being used by the Army. Civil mechanic schools stress the theoretical aspect more heavily. Their graduates must be prepared to work into many different operational set-ups. The Army knows exactly what equipment it wants maintained and prepares the men to do that.

The "equipment orientation" of the curriculum doesn't seem to detract from the general effectiveness of Army mechanics. The best proof of this is the good reception industry gives to Army-trained people. The turn-over is heavy in Army maintenance ranks. A force of less than 10,000 men is now involved in the field maintenance and depot jobs.

The training school at Ft. Eustis turns out from 2,500 to 3,000 mechanics a year; so approximately that many aviation mechanics leave the Army every year and none of them have trouble staying in that field if they want to.

Eighteen separate courses are conducted at Ft. Eustis. Some are for maintenance officers and inspectors, but most are to teach young soldiers to maintain and overhaul instruments, electrical systems, hydraulic systems, powerplants, airframes etc.

The Army does not try to perform all of its own maintenance. The current policy calls for troops to perform 60 per cent of the work and civil contractors to handle 40 per cent.

significantly reducing the number of aircraft required for any given mission.

● Simplified construction and maintenance. It must be possible for relatively unskilled troops to service aircraft under the most adverse weather conditions using the simplest of tools. Sophisticated aircraft and equipment will not serve the Army's purposes, and if need be, aircraft flight performance will have to be penalized to get simplicity and ruggedness of construction. Some Army officers say the goal is to make aircraft as easy to maintain as automotive equipment. Other officers contend we must do better than that.

A major move toward a simplified aircraft fleet has been in progress for some time. This is to reduce the number of aircraft types in service.

In 1960 it became a stated part of Army policy to further reduce the numbers of models to six, one for each authorized aircraft mission.

The 1960 decision was part of a general statement of policy which set the ground rules for the development of Army Aviation during the 1960-1970 decade. The policy is based primarily on recommendations reached by a specially formed board of 10 general officers headed by Lt. Gen. Gordon B. Rogers which was known as the Army Aviation Requirements Review Board. This board was given three months from December 15, 1959 to March 15, 1960 to review the status of Army Aviation and to recommend to the then Army Chief of Staff, Gen. Lyman Lemnitzer, the course it should pursue in the next 10 years. The board reached its decisions on time and Gen. Lemnitzer approved them quickly, making them policy. The major recommendations of the Rogers Board included:

Rejection of the immediate development of VTOL aircraft for troop use. This decision was a difficult one and it met with disagreement in much of the aircraft industry and with many in the Army. Many people familiar with this field felt that the prototype development of VTOL aircraft during the 1950's had proven the concept and the Army should have moved immediately to a new generation of vehicles which could be tested in the field and used to establish definite operational requirements.

The Army's decision to go slow paralleled that of the Air Force, which postponed a VTOL fighter for the Tactical Air Command. In place of the VTOL fighter, the Air Force now plans an STOL aircraft, designated the TFX, which will have variable sweep wings. Both the Army and the Air Force consulted all industrial firms interested in VTOL, the Navy, the Marine Corps, the National Aeronautics and Space Administration, and their own scientific advisors before reaching a decision.

Brig. Gen. Clifton F. von Kann, then director of Army Aviation and a member of the Rogers Board, stated that the consensus was that the best pay-off in new aircraft development before 1965 would come if the Army stuck with helicopters and STOL airplanes. The three main reasons behind this opinion were: fuel consumption of VTOL aircraft was much higher than the helicopter and STOL; more work was needed before VTOL aircraft had the proper stability and control at low speeds for service use; and, the downwash from VTOL aircraft is much higher than that of a helicopter and more evaluation was needed to determine if their dust clouds would hamper landings and takeoffs in the field.

The Rogers Board recommended an immediate industry design competition to choose a manufacturer for a Light Observation Helicopter (LOH). It was stated that development of new transport aircraft for

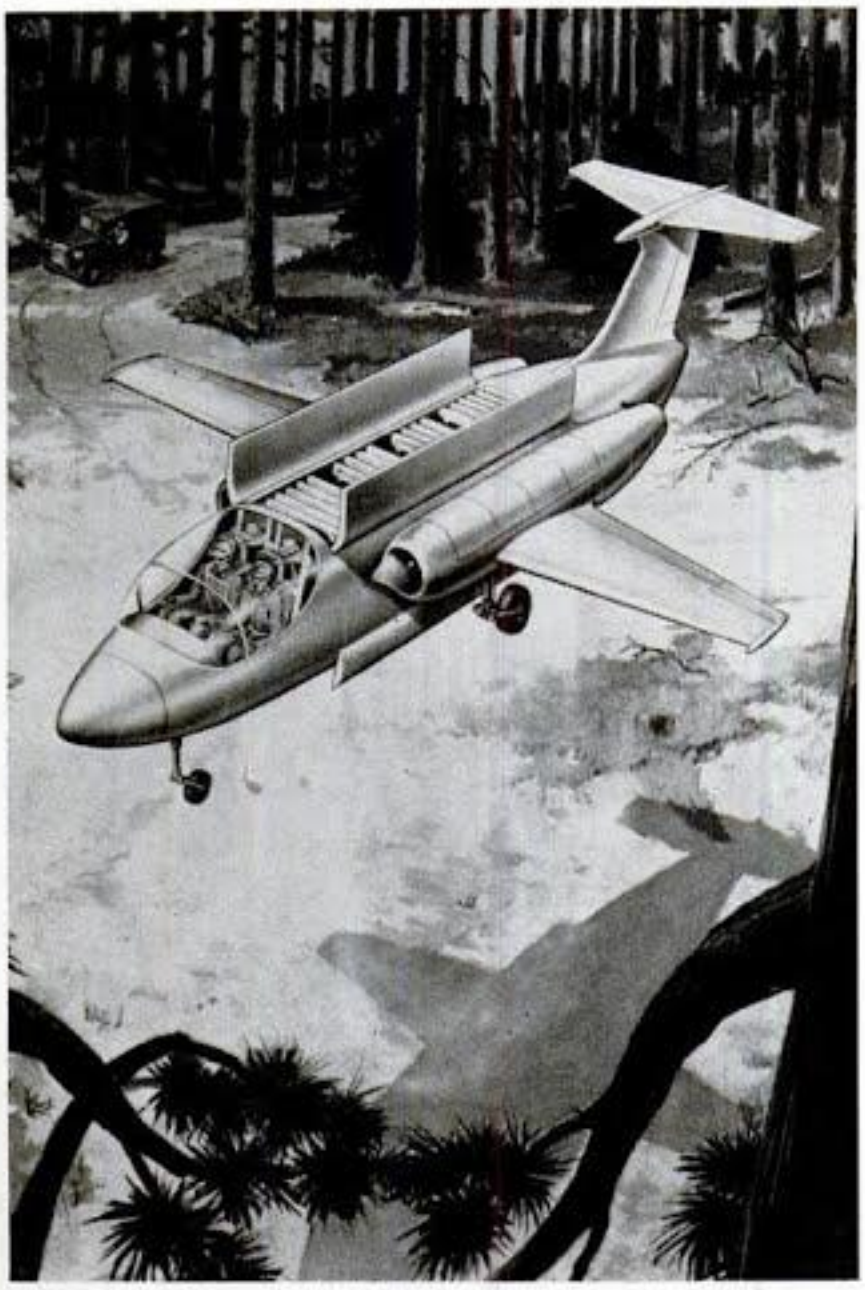
tactical use in forward areas should not commence until further technological improvements were made.

The board further recommended that such improvements should be made in conjunction with the other services. Tri-service programs are looked upon favorably by the Department of Defense as money-savers. The development of the tri-service, three-ton VTOL transport by an industrial team and its operational testing by each service is in line with this policy.

Delay was suggested in the development of a new long-range surveillance aircraft until technological improvements could be made. The desire was for this aircraft to be VTOL if possible. This recommendation has been implemented by letting two contracts for experimental VTOL aircraft. One is with an industry team of General Electric and Ryan Aeronautical for a lift-fan airplane.

The other is with Lockheed for a jet-pump or jet-augmented type VTOL airplane called the Hummingbird. It is hoped that the flight evaluation of these airplanes will be complete by 1964 so that the development of an operational surveillance aircraft can begin. The main problem is the selection of a VTOL propulsion unit and a simple stability and control system which is satisfactory at low forward speeds and in the hover.

Several other experimental VTOL aircraft are being monitored by the Army to see if they offer advantages in these areas. The Hawker P.1127, VTOL strike fighter in England, is one of the projects of special interest.



Lockheed VZ-10 Hummingbird VTOL is designed for 530-knot top speed.

The need for manned vehicles was positively stated by the Rogers Board when it recommended another round of experimental work before proceeding with the development of operational VTOL airplanes. There is to be no reliance on drones for observation tasks. Army studies and documents since the Rogers' Board report have reinforced this policy.

All of the Rogers' Board decisions and in fact any decisions about the use of aircraft over a battlefield hinge on the effectiveness of modern anti-aircraft fire and the ability of one aircraft to shoot down another when both are traveling at high speeds and low altitudes.

The all-encompassing name the Army has given this subject is "survivability."

The exact results of the survivability studies will be one of the Army's closely-guarded secrets. However, it is clear that all aircraft over the battlefield will stay at the lowest possible altitude and will move at the highest practical speed during the major portion of any mission.

In keeping with its stated policy, the Army's research and development effort with actual aircraft is directed into three major areas: close observation aircraft, long-range surveillance and transport. The highlights in the last two areas are:

Surveillance. The immediate objective of this program is to determine the feasibility of two radically new VTOL lift and propulsion systems (the General Electric lift-fan and the Lockheed augmented jet) for high subsonic surveillance aircraft.

The ultimate objective is to provide a VTOL observation, surveillance, and target acquisition system to replace the Grumman AO-1 Mohawk.

Precise military characteristics have not been determined for this system, but the following are general objectives:

1) Speed—high subsonic (approximately mach .9) at low altitude.

2) Crew—pilot plus observer.

3) Powerplants—Gas turbine engines (twin-engine desired for acceptable safety during VTOL operations and to increase mission reliability).

4) Range—200 nautical mile radius on the deck (100 nautical mile maximum speed dash plus remainder maximum velocity cruise on single engine).

5) Endurance—two hours plus 15 minutes' reserve (30 minutes at maximum velocity and remainder at speed for maximum endurance).

6) Ferry range—2,000 nautical miles minimum acceptable, 2,500 nautical miles desirable.

7) Sensors—Visual and cameras plus best state-of-the-art radar and infra-red (Required removable package type installation for radar and infra-red. Desired multi-sensor package but this not mandatory).

8) Size and weight—Minimum possible (Below 12,000 pounds normal gross weight desired).

9) Cost—Desired not more than $1 million flyaway (aircraft plus sensor package) for production run of 200 or more aircraft.

10) Operating conditions—Required to operate from unprepared surfaces within the Field Army area. (Downwash velocities and temperatures must allow

CURRENT INVENTORY ARMY AVIATION AIRCRAFT

FIXED-WING AIRCRAFT

Designation and Name	Number
Aero Commander L-26	10
Beech L-23 Seminole (Twin Bonanza)	200
Beech L-23F Seminole (Queen Air)	25
Cessna L-19 Bird Dog	1,750
De Havilland L-20 Beaver	640
De Havilland U-1A Otter	170
De Havilland AC-1 Caribou	20
Grumman AO-1 Mohawk	75
Total fixed-wing aircraft	2,890

ROTARY-WING AIRCRAFT

Designation and Name	Number
Bell H-13 Sioux	830
Bell HU-1 Iroquois (includes 5 YH-40s)	237
Hiller H-23 Raven	650
Sikorsky H-19 Chickasaw	250
Sikorsky H-34 Choctaw	375
Sikorsky H-37 Mojave	90
Vertol H-21C Shawnee	300
Total rotary-wing aircraft	2,732

TOTAL ALL AIRCRAFT 5,622

The following quantities of new aircraft are projected from the Rogers Board Plan and are based on 1970 fixed and rotary-wing requirements for Army Aviation:

Beech L-23 Seminole	200
Bell HU-1 Iroquois	2,500
Boeing-Vertol HC-1B Chinook	300
De Havilland AC-1 Caribou	300
Grumman AO-1 Mohawk	250
Light Observation Helicopter (LOH)	3,000

Aircraft planned but for which production is not presently available:
- Heavy surveillance aircraft
- Medium logistic transport
- Flying crane

AIRCRAFT TYPES ASSIGNED BY YEAR

(Aviation Battalion)

	1962	1963	1966	1968	1970
Beech L-23 Seminole	4	4	4	4	4
Bell HU-1 Iroquois	63	66	66	66	66
Boeing-Vertol HC-1 Chinook				16	16
Cessna L-19 Bird Dog	38	41	41	41	41
De Havilland L-20 Beaver	13	15	15	15	15
De Havilland U-1A Otter	2	2	2	2	2
De Havilland AC-1 Caribou	1	1	17	17	17
Grumman AO-1 Mohawk	8	12	30	30	30
North American T-28	2	2	2	2	2
Crane Helicopter					12
Observation Helicopter	67	70	70	70	70
	198	213	247	263	275

AVIATION UNIT ASSIGNMENTS

As proposed by CONARC in the Rogers Report

Airborne Division Aviation Battalion

Division Aviation Company (General Support)

AO-1	4
HU-1	4
Obser. Helicop.	10
	18

Air Cavalry Troops

HU-1	17
Obser. Helic.	10
	27

Air Mobile Company

HU-1	25

Misc. Divisional Units

Obser. Helic.	30

Corps Aviation Company (Includes HQ Flight Detachment)

L-23	3
L-20	8
L-19	9
HU-1	6
Obser. Helic.	12
	38

Corps Artillery Co. (Includes Corps Arty. Flight Sec. Arty. Group & Battalion Flight Sec.)

AO-1	4
L-20	3
L-19	15
HU-1	3
Obser. Helic.	6
	31

Surveillance Air Company

AO-1	18

Airlift Company

AC-1	16

Transportation Helicopter (Med) Co.

HC-1B	16

Aerial Crane Co.

Crane Helic.	12

Transportation Corp Field Mainten. Unit

U-1A	1

Transportation Army Aircraft Maintenance (Direct Support) Co.

U-1A	1

Miscellaneous Aviation Activities

Missile Command

AO-1	4
HU-1	2
L-19	2
	8

Airborne — Electronics Board

T-28	2
AC-1	1
L-20	1
	4

USA Garrison

L-23	1
TL-19D	12
	13

Spec'l War Center

L-20	1
L-19	1
	2

Medical Air Ambulance Co.

HU-1	7

ASA (Security) Battalion Aviation Section

L-19	1

Signal Battalion Aviation Section

L-20	2
HU-1	2
Obser. Helic.	2
	6

Tank Battalion Aviation Section

L-19	1

operations from loose dirt or sand areas with no more than rudimentary preparation such as oil, or asphalt spray stabilization or light plastic placed over the surface).

11) Operating characteristics — Maximum ruggedness and reliability.

12) Weather capability—Aircraft must be capable of all-weather operation and must have terrain avoidance radar (250 feet above terrain at maximum speed, automatic terrain-following type required). Ultimate all-weather navigation system desired which will position aircraft within about three-tenths of a mile from the destination after a 300-mile flight.

The Lockheed VZ-10 and the G.E.-Ryan VZ-11 airplanes will build the major portion of the technology on which the surveillance airplane will be based. Each of these research projects features a new type of lift system which has been highly successful in the tests made to date. The principal features of each design follow:

Lockheed VZ-10, Hummingbird. The big selling point for the Hummingbird is mechanical simplicity. Its lift propulsion system has no moving parts and could be described as some pipes and ducts fitted to the exhaust of a turbojet engine. When the aircraft flies vertically, the exhaust streams from its jet engines are turned toward the ground and their thrust is increased 40 per cent. The thrust increase is provided by a system known by various names including jet pump, jet augmentor and ejector system.

The jet pump works on the venturi principle used in carburetors. Two long venturi-shaped ducts run lengthwise down the fuselage. During vertical flight, doors on the top and the bottom of the ducts are opened and the jet engine exhaust is pumped out through a series of nozzles in the top of the ducts. The high-speed exhaust air rushing downward creates a low pressure area in the ducts. The low pressure "induces" a large quantity of the air surrounding the airplane to flow through the duct and "augment" the thrust.

Each engine powers alternate banks of nozzles in the main ducts to preclude attitude control problems in the case of asymetrical thrust or complete failure of one of the engines.

Attitude control during vertical flight is provided by four reaction jets; roll control nozzles at each wing tip, and pitch control nozzles at fore and aft ends of the fuselage. Yaw will be controlled by rotation of the pitch nozzles.

The fact that the Hummingbird lift system provides a thrust augmentation ratio of 1.4 to one with no moving parts makes it attractive for an aircraft the size of the proposed surveillance airplane. By comparison, the turbine-powered helicopter has a thrust augmentation ratio of well over five to one. Its long, relatively slow-moving blades are the most efficient augmentors by far. The helicopter's main drawbacks are mechanical complexity and a low top speed in forward flight.

With an otherwise conventional landing gear, the nose gear of the VZ-10 is unique in that it has two different extension lengths. Since the thrust ejector system is inclined slightly to the rear to facilitate optimum aircraft attitude during transition, it was found that the airplane would skid forward slightly just before lift-off. With the two-position nose gear, the nose can be raised sufficiently to direct the thrust straight down for a vertical lift-off.

Vital statistics of the Hummingbird research models include: two Pratt & Whitney JT12A-3 turbojets delivering about 3,000 pounds of thrust each; equipped empty weight—5,525 pounds; fuel weight (260 gallons)

G.E.-Ryan VTOL research aircraft. Twin General Electric J85s drive the lift-fans. Louvers give initial horizontal thrust, then close in forward flight.

PIASECKI AIRGEEPS

A NEW CONCEPT in air transportation for the Army is the wingless Piasecki Airgeep. Lift is provided by a pair of three-bladed rotors, one at the front and one at the rear. Passengers and the operator are seated in the center.

The Airgeep is not dependent on ground effect for flight, but is capable of operating at altitudes of several thousand feet.

Two models have been built. The first, called Airgeep I by Piasecki, has performed over 100 hours as a research vehicle since it began flight testing in 1958. It has also been fitted with floats for Navy testing.

The second model, Airgeep II, *(above)* entered ground tests in 1961 and began flight testing in early 1962. Its twin Artouste IIc turbines plus other design advances give it substantially improved performance, according to Piasecki. It is shown above in its first hover at Philadelphia.

Airgeep II has powered wheels for ground operations.

The Airgeeps were developed under contract with the U.S. Army.

Planned military missions include reconnaissance, supply, evacuation of wounded, command, communications and survey.

—1,675 pounds; maximum vertical takeoff weight—7,200 pounds; maximum speed—450 knots. The operational model of the Hummingbird should have an 8,000-pound gross weight and a top speed of 530 knots.

Two Hummingbirds will be constructed under the present contract and the first is due to fly in the early summer.

G.E.-Ryan Lift-Fan VZ-11. The lift-fan airplane takes a different approach to VTOL. First, its augmentation ratio is 3.0, placing it between the Hummingbird and the helicopter. In forward flight the airplane's two General Electric J85 turbojets will produce a combined 5,160 pounds of thrust.

But during vertical flight the engine exhaust is diverted through a duct to drive two fans in the wings and one small stabilizing fan in the nose. All three are "tip-turbine fans," driven by passing the high energy engine exhaust through small turbine blades located on the rim of the fan. The main fans are 76 inches in diameter and produce a large, relatively slow-moving and efficient air stream to boost the total thrust to 14,860 pounds.

The lift-fan engine system is made of light gauge steel and the total weight is about 2,500 pounds including the two turbojets and all of the necessary ducting. It has been tested on the ground for well over two years, including a full-scale wind tunnel test in a generalized airframe at the NASA's Ames Research Center. This marks the first time that an engine manufacturer has been named the prime contractor on an airplane project.

Vital statistics for the VZ-11 include: maximum VTOL weight—12,200 pounds; maximum cruise speed —over 450 mph; ferry range—1,800 miles.

Two VZ-11s will be built under the current contract and the first is scheduled to fly in 1963.

The Army has come a long way in VTOL research in the last 10 years and many specialists believe a solution to the surveillance airplane problem is in sight. However, there is no certainty that all the troubles are over. The VZ-10 and VZ-11 testbeds have complex airflow and stability problems, as do all VTOL systems. Designing airplanes which ride a vertical stream of air one minute and a nearly horizontal stream the next is never going to be easy. The tests to date are encouraging but the crucial flight programs are still ahead.

One of the major technical unknowns is the effect of the downward air streams in creating sand and dust storms around the airplanes when they are operated in the field. Helicopters provide a good starting point to rate performance in this area. Their downwash velocities are low, usually less than 100 mph or below hurricane strength. They kick up sand, small rocks, and limbs which are blown outward a short distance, then carried upward and back down through the rotor blades. The recirculation of flow leads to blade abrasion and damage. But if takeoffs and landings are made quickly and with reasonable care, it has been amply proved that helicopters give fine field service.

The VTOL airplane is a different problem. In most

cases these designs do not use any sort of rotor blade to provide a large diameter, slow moving vertical airstream. The VTOL engine systems which are good for high cruise speeds must have narrow airstreams. As the diameter is reduced, the velocity of flow must increase or the vertical thrust and lifting power quickly falls off to unusably low levels.

Consequently, the air flowing downward under most VTOL aircraft is moving at speeds of 200 mph or greater. Obviously, this is sufficient to raise dust and debris which could blind the pilot, clog the engine intakes, and mark the aircraft's position for the enemy.

Several solutions to this problem are in an advanced engineering stage. The proposed solutions include the hardening of the ground under a landing VTOL by spraying liquids and quick-drying plastics; and the dropping of light plastic membranes onto the landing area. The final answers to the downwash question won't be available until field tests have been conducted under realistic combat conditions.

In summation, the Army has some very complex technical evaluations and developments to make before an operational surveillance airplane can be designed.

The tri-service VTOL transport program is the main outgrowth of about 10 years of research in the United States. It is larger than the surveillance program both in the number of projects and the dollars to be spent. It is estimated that about $70 million will be spent on three transport aircraft developments, while about $25 million will be put into the construction and testing of the VZ-10 and VZ-11.

The three airplanes in the transport program are: 1) The tilt-wing, four-turboprop aircraft to be developed by the team of Ling-Temco-Vought, Hiller, and Ryan which will have a maximum gross weight of better than 35,000 pounds; 2) A half-scale VTOL transport with two large ducted propellers on the forward end of the fuselage and two more on the rear. This design will also have small wings, sized to provide most of the necessary lift during cruise. The ducted propellers will rotate so that their slipstreams can be directed at the ground and provide VTOL capability. 3) A half-scale aircraft very similar to the one described above except without ducts or shrouds around its propellers.

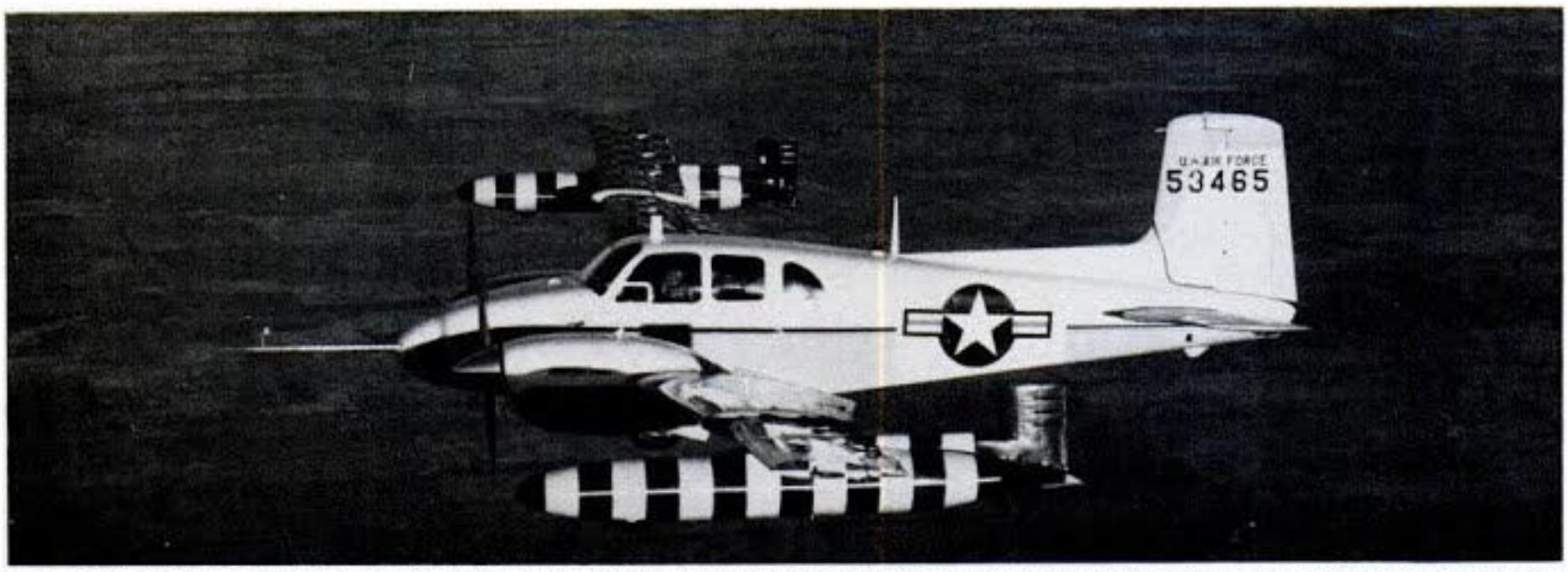
These three designs are currently considered to be the most promising of all of the VTOL ideas for transports which were investigated during the last decade. More than $100 million of research money was spent during that period but it was scattered about in a relatively uncoordinated manner by the three services and by manufacturers.

Most experts believe that the tilt-wing-plus-flap system has the greatest chance of success in the near future although other systems might prove to be more efficient in the distant future. The Vought, Hiller, Ryan team won the opportunity to build it.

This system combines the best features of two types of successful VTOL research airplanes—the simple tilt-wing and the deflected slipstream. Testing showed that tilt-wing airplanes were very efficient in vertical flight because their propellers were aimed directly at the ground. However, the wing had stalling problems as it tilted forward during transition to horizontal flight.

In contrast, the deflected slipstream airplane was not considered practical for VTOL operationals because it suffered a large thrust loss when the flaps turned the slipstream 90 degrees toward the ground. However, the large flaps on this airplane proved effective in preventing wing stall during transition. The combination of the two designs has shown up well in wind tunnel tests and apparently all of the major air flow problems have been ironed out.

Five of the tilt-wing-plus-flap airplanes will be delivered for testing. Each will be powered by four General Electric T64 turboprops with a total power output of about 11,000 eshp. Maximum payload will be about three and a half tons or 32 fully equipped soldiers. Maximum gross weight will top 35,000 pounds but the aircraft probably won't be able to operate as a VTOL at this weight. During STOL operations the aircraft will be able to carry a full payload out of a field less than 1,000 feet long. It was decided in the DOD to add two "half-scale" airplanes to the tri-service VTOL transport program to complement the tilt-wing-plus-flap project. Considerable economy is expected to result from making the new airplanes about half the size of the tilt-wing testbed. The test data from these smaller airplanes is expected



Beech L-23D of Long Tom Project, transferred from Air Force to Army. External "self-lift" fuel tanks for added range are mounted on wing extensions.

HUMAN RESOURCES RESEARCH

An Army Mohawk, traveling over 200 mph, streaks into enemy territory at an altitude not higher than 100 feet above the treetops for the entire mission. Because of the rigors of sustained high-speed flight in the dense, turbulent air close to the ground, and the strain of precise navigation over unfamiliar terrain without benefit of radio aids, the pilot will lose four pounds in one-hour of flight—more than Colonel John Glenn lost in three trips around the earth.

At this rate, how much can a man take? How often can he perform combat missions? What can be done to improve the situation?

The job of answering these questions is undertaken by the Man/Machine project of the Human Resources Research Office (HumRRO) at Fort Rucker, Alabama.

A non-government agency, HumRRO is a part of George Washington University and is supported by a contract between the University and the Department of the Army. The mission of the organization is research in training, motivation, leadership, and man-weapons system analysis.

Now in its 10th year of operation, HumRRO is an integral part of the Army's research program. Its five field units are located at military installations throughout the country. One unit is devoted to Army Aviation.

The U. S. Army Aviation Human Research Unit was activated in 1958 at Fort Rucker, Alabama, center of Army aviation activity. Here, as in other HumRRO units, the research is done in close proximity to field units and, as much as possible, under actual field conditions. One of their projects is LOW-ENTRY, a program to improve navigation techniques during low-level flight for rotary-wing and fixed-wing aircraft and to develop training methods to teach these skills to aviation personnel.

The new "nap of the earth" concept requires precise navigation while flying an entire mission at altitudes between 250 feet to practically treetop level, mostly the latter. This technique of low-altitude flying has been necessitated by the advent of more accurate air defense weapons, which have closed the middle altitudes.

Imagine flying at high speed over hostile territory without exceeding an absolute ceiling of 100 feet and hitting a target on the first pass with a lateral accuracy of 38 feet, and then returning home by an alternate route. Add combat conditions to this and you have a very demanding flight.

The Mohawk is being used for low-level penetration missions during this Man/Machine program and HumRRO has three Fiat G.91s, a Navy A4D 2N Skyhawk, and a Northrop N-156 Freedom Fighter at Fort Rucker for evaluation of optimum speed in the subsonic area.

They have found that the mission is feasible with the right planform and aircraft configuration and that the rigors of high-speed low-level flight can be minimized on the pilot.

Another training study, Project INTACT, delves into the feasability of instrument training for primary flight students. This can be compared to the FAA program which led to integrated training and the "Blue Seal" for civilian pilot ratings.

It has been found that combining instrument with contact flight training produces better VFR pilots and gives them the capability of getting safely out of accidental ventures into bad weather. Also important here is the expanding role of Army Aviation and the necessity for more fully instrument-rated pilots in the future. Research showed that early instrument training can greatly accelerate the overall training and produce better-qualified instrument pilots in a shorter period of time.

The Army is evaluating this concept for both fixed-wing and rotary-wing instruction. They feel side-by-side seating is of major importance and are leasing civilian aircraft for this purpose (see Flying, September, 1961). Regular Army tandem-seat aircraft are being used at the same time for comparison.

The object of LIFT is to develop more effective training methods for Army helicopter pilots. Located at Camp Wolters, Texas, the HumRRO unit is right in the middle of the Army Primary Helicopter school. The four phases of this program are aimed at standardization and quality control for improvement of rotary-wing training.

Aerial observation during conditions of limited visibility are being evaluated to determine present Army requirements and capabilities. Systems and devices for support of aircraft operations under these conditions also are being examined in the survey.

Aerial gunnery from armed helicopters is being studied, relating present practices with future methods of employing armed helicopters. This survey should suggest improvements in systems design and training methods.

Training devices will be studied Army-wide in order to develop their full potential. New ones will be added and unnecessary ones be weeded out. The aviation section of HumRRO will be mainly concerned with fixed- and rotary-wing pilot trainers.

HumRRO, through its freedom and flexibility as a civilian organization, is able to view the various Army programs objectively and with a broader perspective than is possible in a service organization. The findings, processed scientifically, lead to improvements in present techniques and help guide the way to future developments.

Man + Machine = Weapon

Lt. Gen. Arthur G. Trudeau
Chief, Research Development

Maj. Gen. Ernest F. Easterbrook
As commander of Ft. Rucker

Brig. Gen. Delk M. Oden
Director of Army Aviation

to be applicable to any full-scale development in the future.

The 50 per cent scale airplanes will be developed under contracts which were under negotiation at this writing. Their first flight date will be approximately the same as that of the tilt-wing-plus-flap airplane and their operational testing is scheduled to take place at the same time.

The Army has an immediate need for five and 10-ton payload transport airplanes for tactical use on the battlefield. Primarily they would be used to move large items of ordinance and equipment and to bring supplies and reinforcements into forward positions. Under the current levels of technology and funding these airplanes will have to be STOL. The VTOL concepts would come along as the following generation.

In the five-ton class many Army officers look with favor on the deHavilland Caribou fitted with turboprops instead of the reciprocating engines on the operational model today. This change will at least double the aircraft's payload without requiring major design changes. Therefore, it provides an opportunity to get a five-ton transport for an extremely low development cost. General Electric T64 turboprop engines have already been fitted to the Caribou and apparently flown with complete success.

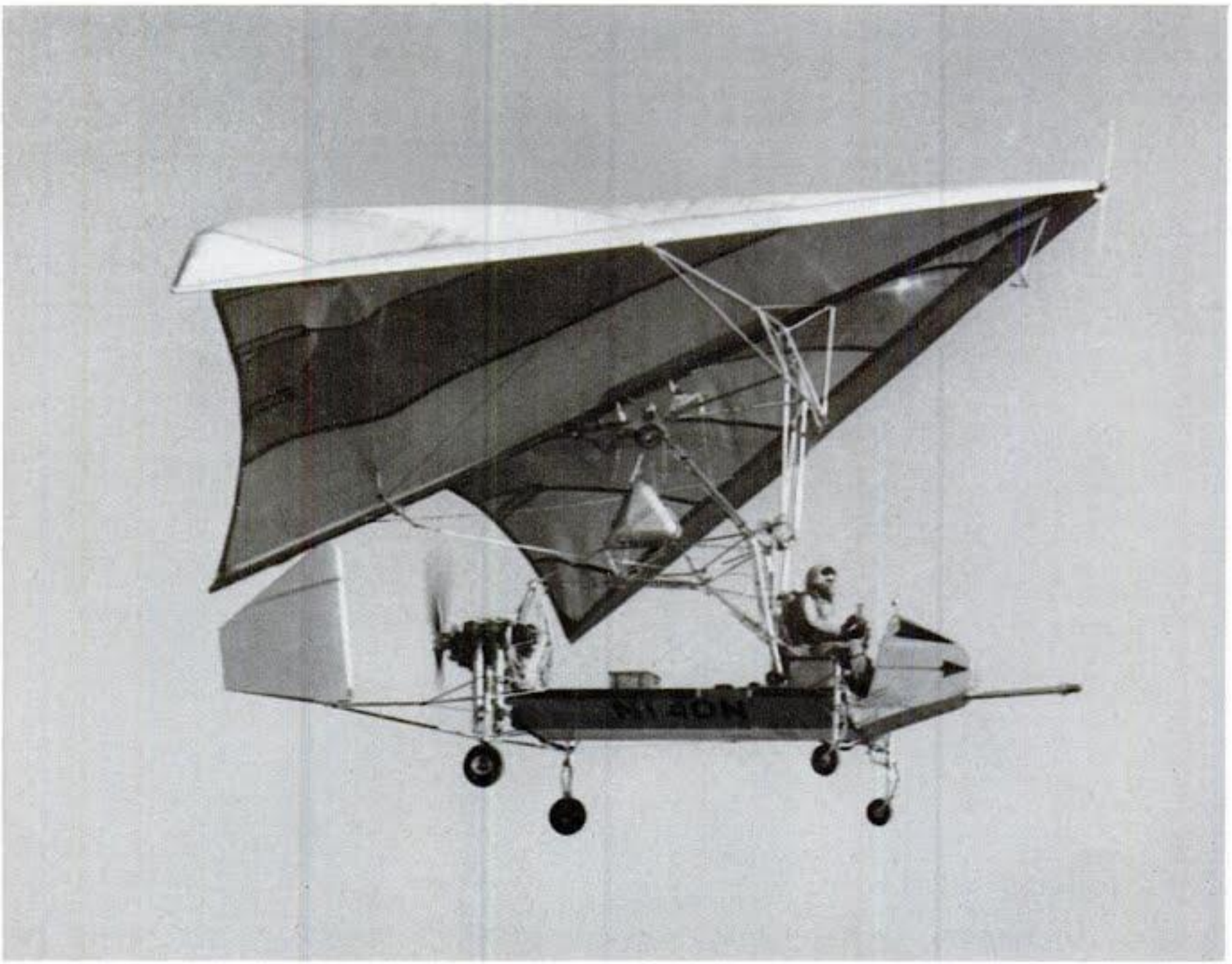
Development of a 10-ton STOL transport would not be so easy. This airplane would approach the Lockheed C-130 in size and under the DOD's current roles and missions guidelines, it is clearly in the Air Force's domain.

There is a possibility, however, that the Air Force would pass the responsibility on to the Army as it has on occasion in the past. Some sort of decision is due in the immediate future. The Army has outlined its need for the airplane to the DOD. It has stated that it is ready to pursue the project and fund it, if the Air Force does not want to do it.

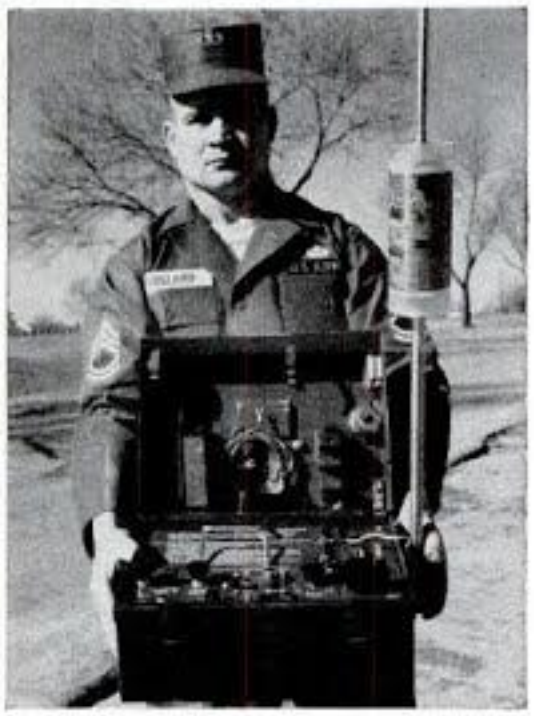
There is the possibility of a design competition in the near future.

FLEX-WING

Aviation and space authorities have only recently become interested in the "flex-wing," a wing made of cloth or plastic held in shape by three poles. This device was invented more than 15 years ago by Frances M. Rogallo of NASA's Langley Research Center. It is being studied now for several



Although self-propelled Ryan flex-wing is already flying, the Army envisions possible use of flex-wing gliders, carrying cargo, towed by rotorcraft.



MOBILE AIRPORT TRAFFIC

An important part of Army Aviation's combat effectiveness rests upon combat air traffic control systems and efficient all-weather mobile airport systems operating from unprepared field sites.

New air traffic control teams, called ATTRI, composed of 238 men, are due for activation beginning September of 1962.

They will include facilities for mobile tower, locator beacon, radar GCA unit, means for identification of aircraft (friend or foe), and radio and visual aids already included in the older Pathfinder mobile airport platoons. The latter are still in field test, and are not operational.

An important portable airport navigation and landing aid expected in the inventory at a future date is the Gilfillan TPN-8 mobile GCA radar unit, weighing 1,000 pounds, which has an effective radius of 35 miles. This equipment is being evaluated by the Navy, the prime contractor, and is being tested by AA at Fort Rucker. It is packaged for rotary-wing or fixed-wing transport.

At the present, no suitable friend or foe identification system has been developed that is satisfactory for the Army. The USAF systems are too heavy. However, Research and Development is hopeful that progress can be made in this direction soon.

Brig. Gen. Delk Oden, director, Army Aviation, told FLYING editors that the Army's work toward mobile all-weather navigation and landing aids for combat strips will match the small civil airport operator's need for lightweight, relatively inexpensive and low maintenance systems. In this area alone civil aviation benefits can be sizeable.

Pathfinder units include all or most of the following equipment:

A mobile non-directional, low-frequency beacon transmitting three signals at 30-second intervals is the ANGR-11 by Stromberg Carlson (Electronic Division of General Dynamics). It has a specification radius of 30 miles, weighs six pounds and is designed for hand carrying or use upon a jeep. Field testing has not been entirely satisfactory, but AA has hopes that the beacon (see picture) is a major step in the right direction.

Air-to-ground radio, AN/PRC-10, weighing eight pounds, built by Admiral Radio Corporation. It has 20-hour dry cell battery and its effective range is four to five miles.

Walkie-Talkie for on-ground traffic direction and communications by the Pathfinder team. They are AN/PRC-6 units built by Sentinal Radio Corporation. Range is one mile.

Runway lights, battery operated, MX290 by Delta Electronic Company, provide vertical or horizontal beams. Approximately 20 are used for fixed-wing operations.

Mobile rotating beacon light, weighing 30 pounds, is produced by Grimes. Its back-to-back lamps may be fitted with Infra-Red filters. It is a 14-volt system which can be packed in two cases, including the telescoping mast.

Crewmen use batons for direction of air crews in parking and taxiing operations.

Day runway and obstruction markers, called VS-17 day panels, made by Whitehouse Products, are used for runway and parking areas—approximately 12 for rotary-wing pads and 20 for fixed-wing strips.

Another item of field equipment used by Army includes flare pots where mobile teams are not available.

missions including the recovery of large space boosters. Ryan Aeronautical is conducting the Army's main investigations in this area. The company is flying a piloted flex-wing airplane powered by a 100-hp Continental engine (see FLYING for July, 1961).

The Army's main interest at present, however, is to tow flex-wing gliders loaded with cargo behind helicopters. Helicopters are like horses in that they can pull about six times more weight than they can carry. The flex-wing gliders could be released by the helicopters and guided by radio into small landing areas.

Another possibility is the use of the flex-wing to carry men from aircraft into very small fields on special missions. A small flex-wing with a model of a man under it was used in one of the first conceptual studies of this idea. The first drop tests of a wing with a man-sized dummy are scheduled for next fall. If all goes well, live tests will follow quickly.

Apparently most Army engineers familiar with the characteristics of the current flex-wings do not believe they can be successfully used on a piloted transport airplane. Control is a problem but apparently one which can be solved adequately. The main trouble is the low efficiency of the short span triangular wing. Its low lifting efficiency makes a powered flex-wing airplane use fuel at four or five times the rate of a conventional lightplane of the same weight. High fuel consumption does not appeal to the Army.

Ideas concerning methods of stretching out the wing and increasing its span without creating stability and control problems are being studied.

AERIAL CRANE

The Army has wanted a large aerial crane for some years but no money has been available for its development. This helicopter crane would have four stilt-like landing gear and it could straddle large loads and lift them across obstacles such as rivers, canyons, etc. The on-loading, off-loading and cargo balancing problems common to airplanes and internal loads in conventional helicopters do no exist with the crane. This large aircraft could quickly and efficiently move large quantities of materiel across natural obstacles.

The funding problem seems to be near some answers. Development costs on the crane are expected to be about $100 million and there has been some reluctance for the Army to bear them alone. The other services, except for the Marines, don't need them and there seems to be little civil market.

The Army itself would not need a large inventory of cranes.

Still it is considered a valid requirement and arguments against the expenditure are dying down. Army aviation planners are pointing toward a start on development of a 20-ton payload crane in Fiscal Year

1964. Over a 50-mile range the payload would drop to 12 tons. At the moment there seems to be no opposition to such a program.

Army engine development has concentrated on three engines in the last few years, all gas turbines. One is the Lycoming T53 developing around 1,100 hp. Its turboprop version is in the Grumman AO-1 Mohawk and its shaft model is in the Bell Iroquois helicopter. The second engine is the Lycoming T55 of 2,200 hp now flying in the Vertol Chinook. The third powerplant is the Allison T63 intended for the LOH aircraft. Its original design goals were very ambitious. For instance it was to produce 250 hp yet weigh only 95 pounds. The engine has been plagued with development troubles and is now more than 30 per cent overweight.

As an insurance move for the LOH program, Continental Aviation and Engineering Corp., Detroit, Mich., has been named by the Army to develop a "back-up" engine.

This alternate powerplant also will be designed to produce 250 hp.

In the important 500-hp class, the Army has decided to depend completely on off-the-shelf purchases. Most aircraft engine companies have financed their own development work because this size gas turbine apparently has a very large civil market. Since this source of supply is growing on its own the Army put its money elsewhere. While there are no military requirements today for such an engine, they are expected.

When it comes to larger engines, the Army is leaning on the Air Force and Navy. The best example to date is the Navy-sponsored General Electric T64, a 2,850-hp turboprop which has been flown in the Caribou and is being considered for volume purchase.

The Army also has been active in applied research with full-scale powerplants. The first major project in this area, the General Electric lift-fan, began in 1957. It passed from the study phase into the hardware stage when the construction of a full-scale engine was authorized in May 1959. This engine is being used in the lift-fan surveillance aircraft testbed. The Air Force and General Electric also have contributed financially to this project.

Today two other full-scale, advanced engines are being developed with no particular aircraft application in mind. The first of these programs is a simplified pulse jet by Hiller Aircraft Corp. This engine has shown a phenomenal ability to ingest foreign objects such as rocks, nuts, bolts, etc., and exhaust them without damage.

Since foreign object damage is a serious problem for the Army as well as other operators of gas turbine engines, this new Hiller pulse jet is attractive for aircraft which must operate in the field. The other advantages of this engine are light weight and simplicity. Its main disadvantages are noise and high fuel consumption. It appears that the disadvantages might be overcome enough to make the engine competitive.

The second research engine is a large hot-cycle helicopter rotor system being developed by Hughes Tool Co.'s Aircraft Division. In this engine the 1,700 degree F plus exhaust from jet engines is pumped through ducts up to the rotor hub, out through the hollow blades and then through nozzles on the blade tips.

This system is believed to be superior in some respects to others in which compressed air is ducted through the blades and is either exhausted "cold" (several hundred degrees F) or is combusted with fuel in blade tip burners. Several companies have experimented with tip burners and they are being used on the British Fairey Rotodyne.

Hughes has overcome some early sealing problems and apparently air-leakage in the system is now very low. There is considerable hope that the system will come through its development period successfully and can be flight tested. Its main application will be for very large aircraft such as the flying crane or a big compound helicopter. Its advantage is light weight for it eliminates all gearing, the power transmission system, and the anti-torque rotor.

RESEARCH POLICY

While it hasn't drawn much publicity, the Pentagon has been besieged in the past year by a group of university scientists who believe that subsonic aeronautical research in the U.S. is dying. They point to a host of research opportunities which are being neglected entirely or are being pursued inadequately.

Since the Army is the military group most dependent upon subsonic aviation, most of the criticism for the research lag has been aimed at it. The critics, however, understand the times and have also petitioned the DOD groups above the Army to take a greater interest in the problem.

Two major policy trends seem to have grown out of all the discussion. First, the Army is not interested in forming any large research and development complex such as the Air Force's Wright Field or the NASA's Langley Research Center. Plenty of good subsonic research facilities exist and the Army will contract with them rather than assume the financial burden of operating its own establishment. Few people argue with this decision.

The disagreement comes with the second policy trend. The Army and DOD are going to increase funding for applied and basic subsonic research, but the level apparently is going to stay below $10 million per year in the foreseeable future. There is not going to be any sudden program to stimulate activity in this area. Most of the critics do not agree with this and they believe that the necessary work is not being accomplished.

In July of 1956 the Army took a vital step toward its maturity as an aviation service. The U.S. Army Transportation Aircraft Test and Support Activity (TATSA) was activated at Ft. Rucker. This organization was the first to provide rigorous, realistic, operational testing of Army aircraft and equipment on an accelerated basis.

TATSA tests have moved so rapidly that in some cases the equivalent of more than three years of service flying have been put on new aircraft in less than

six months. The information from these tests has been vital in revealing design weaknesses so they could be corrected before equipment was placed in wide service.

In all, TATSA has performed logistical evaluations on more than 13 different aircraft. One hundred and forty-one tests have been completed on tools and equipment. More than 4,500 Unsatisfactory Reports (UR's) have been written on various parts and systems. TATSA tests have been instrumental in lengthening Time Between Overhauls (TBO) for many major systems.

TATSA tests are credited with saving millions of dollars in the purchase of spare parts alone.

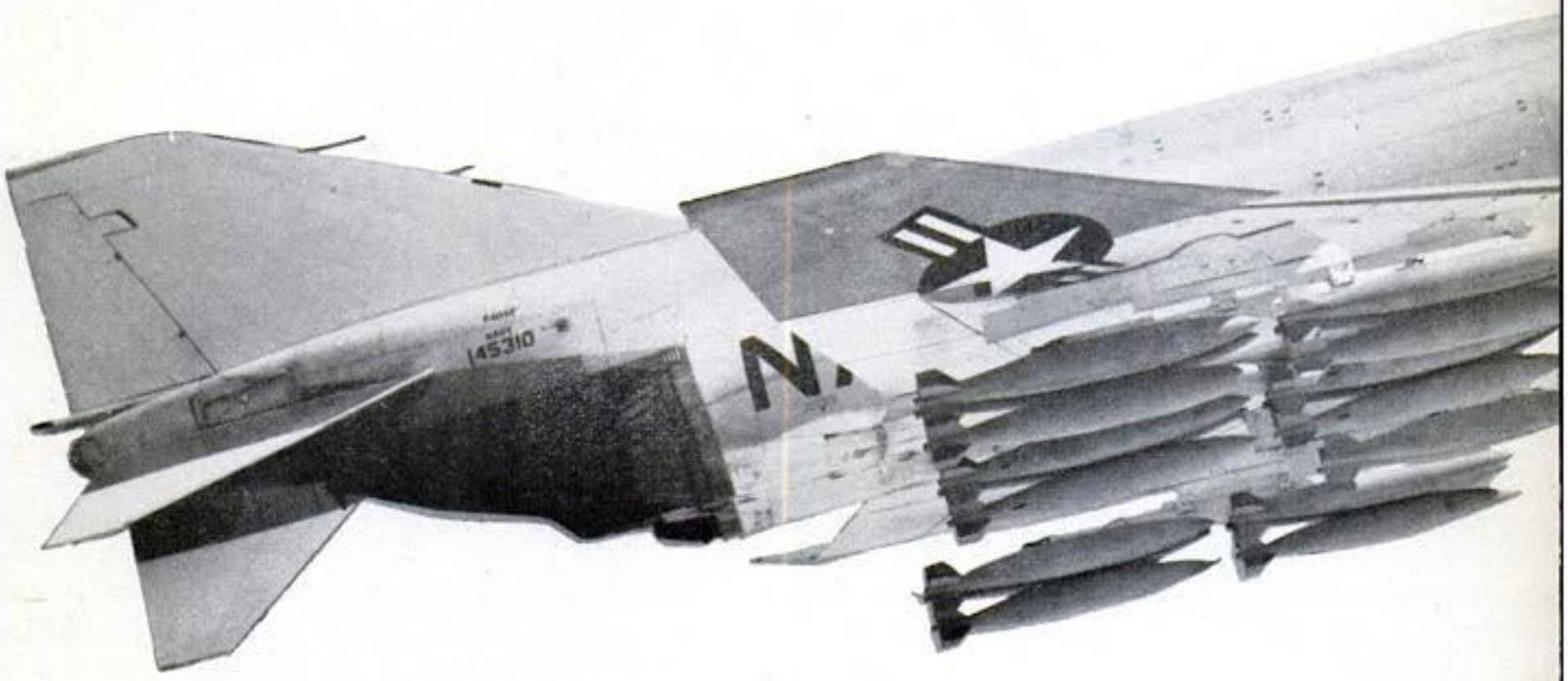
★ ★ ★

The facts are obvious. More than any other branch of the service, Army Aviation promises to contribute significant benefits to general aviation through its research and development efforts, equipment, training and operations, involving both fixed- and rotary-wing aircraft.

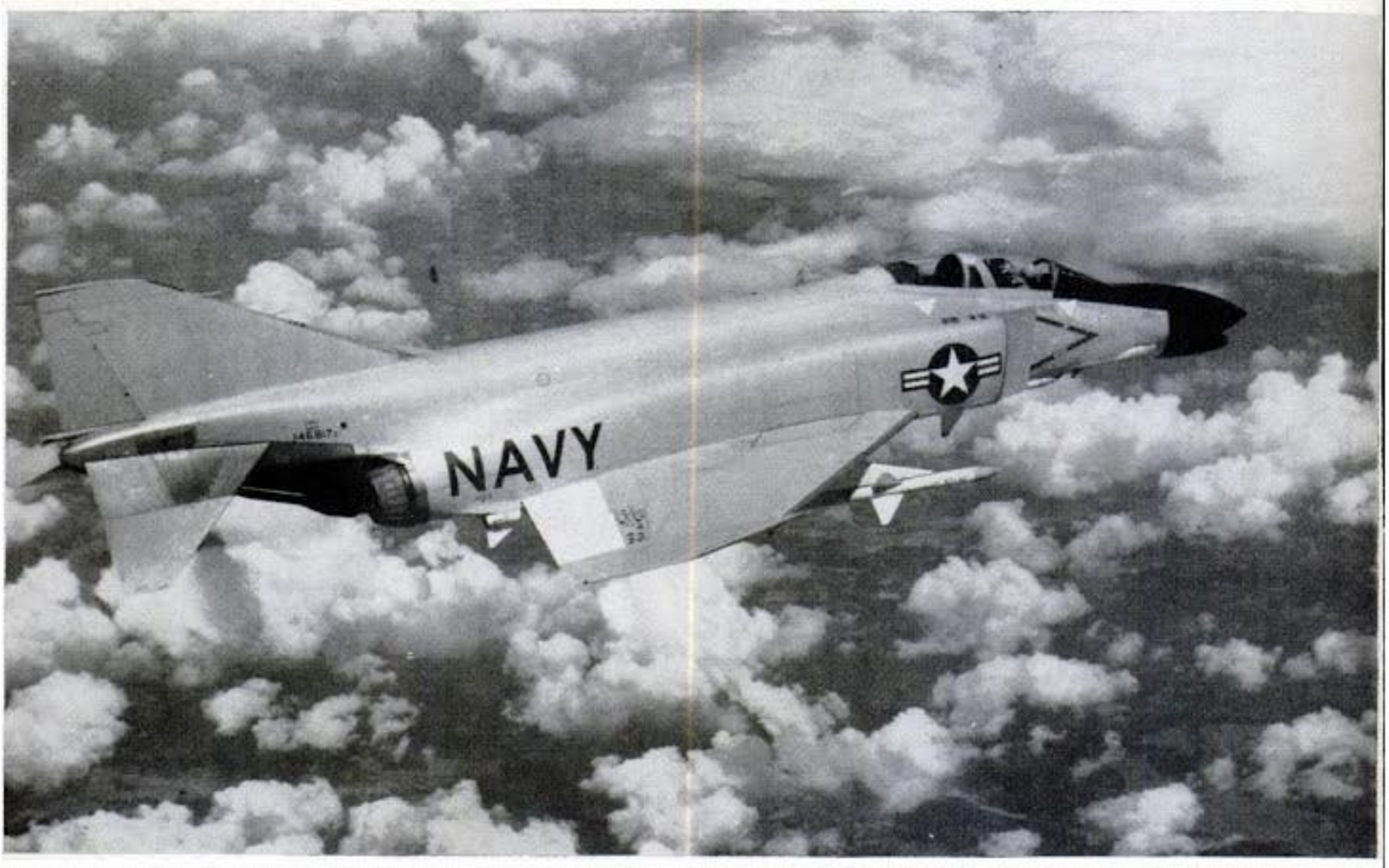
Its rapidly growing strength and versatility—coupled to its technological breakthroughs and the resourcefulness and enthusiasm of its manpower—have added new dimensions to battlefield mobility.

Army Aviation has, indeed, come of age.

Armed with a load of bombs, the F4H as a low-flying weapon suitable for brush fire wars.



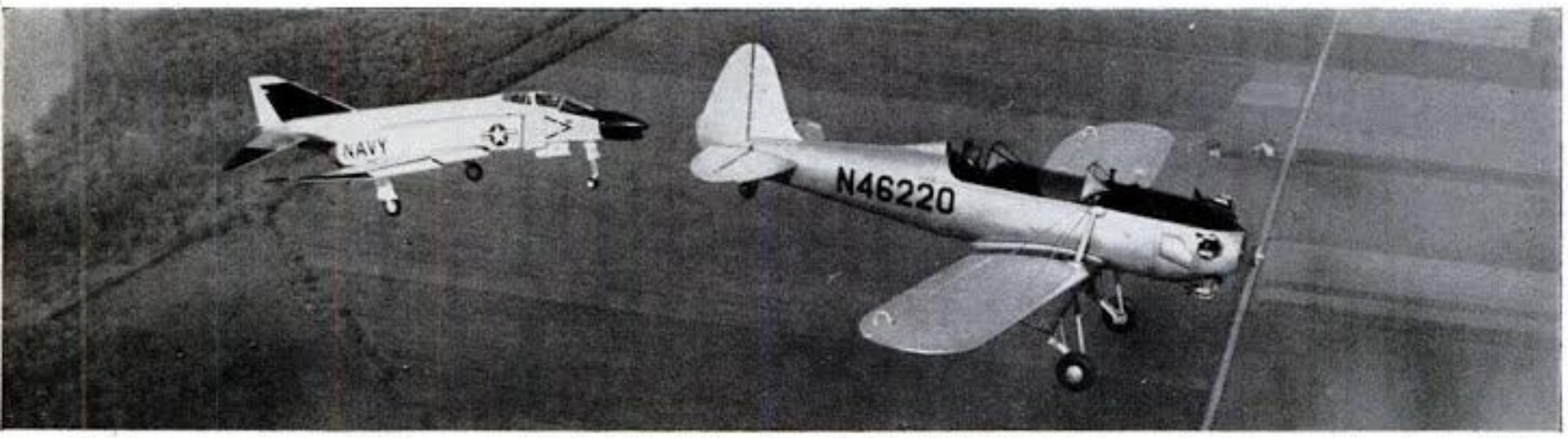
PHANTOM II-
RECORD BREAKING FIGHTER



The Phantom II carries Sidewinder missiles in its air defense role—has flown more than two and one-half times the speed of sound at 45,000 feet.

Developed for the Navy, lethal multi-mission fighter will soon join USAF as the F-110

By L. W. REITHMAIER



F4H demonstrates its remarkable low-speed ability by flying in formation with a Ryan PT-22, WW II primary trainer. Phantom easily maintained 118 kts.

IN 1939, J. S. McDonnell, founder of the company that bears his name, sent a note to the Chief of the Contract Section, Wright Field, Dayton, Ohio. This note said in part ". . . our objective is to be of maximum service possible to the United States Government in the design and manufacture of airplanes. . . ."

The McDonnell announcement, coming from the newly formed St. Louis-based company, probably caused little stir in the nation's defense establishment. The aircraft industry already doing business with the government consisted of such giants as Boeing, Douglas, Curtiss-Wright and others with long experience as producers of military aircraft.

By the time World War II ended, however, the young company had designed, built, and flown the world's first carrier-based jet fighter for the Navy, the FH-1 Phantom.

On November 22, 1961, 22 years after the founding of the company and 15 years after the first Phantom landed on a carrier, a McDonnell-built Navy F4H-1, Phantom II, lifted easily from the runway at Edwards Air Force Base, climbed to 45,000 feet and headed for the first tracking station defining the official world speed record course. After completing the required number of closely controlled passes across the course supervised by the NAA, the Phantom II officially became the fastest non-rocket aircraft in the world. Its sustained speed of 1,606.342 mph—more than two and one-half times the speed of sound (Mach 2.5)—was 81 mph faster than the previous record of 1,525.96 mph set in 1959 by an Air Force F-106. Also, it has set five world's time-to-climb records.

The Phantom II is a fitting tribute to its namesake, the original FH-1 Phantom. The FH-1 was McDonnell's first production airplane of its own design, as well as the Navy's first carrier-based fighter. The F4H-1 Phantom II is the company's, as well as the Navy's latest—and possibly the last—carrier-based fighter in this missile age.

Beside holding the world's speed record, the F4H's tremendous performance is further illustrated by its zoom ceiling of close to 100,000 feet, as well as sustained Mach 2 plus performance at altitudes in excess of 65,000 feet. At low altitudes the Phantom II is equally at home. On August 28, 1961, the McDonnell-built F4H-1 set a new world's class record for an FAI three-kilometer course at 902.768 mph (Mach 1.2) at an average altitude of 125 feet over the missile range at White Sands, New Mexico.

This unmatched high-speed performance is all the more remarkable when considering the fact that the airplane is designed to operate from an aircraft carrier! Although the Phantom II is the world's fastest airplane, it is also one of the slowest. (*Continued on page* 96)

Part of the fleet of McAlpine Aviation, one of the biggest executive operators in Britain. The firm operates from Luton Airfield, north of London.

BUSINESS FLYING

Light American executive aircraft have brought life to business flying abroad. Will high import duties force them out?

By JOHN FRICKER

TWO CHARACTERISTICS predominate in current British executive operations. The first is a steady expansion toward a large potential, as Britain takes its economic place within the European community. The second is an excess of operational restrictions resulting partly from climate and topography, but too often from a stifling web of plain, old-fashioned bureaucratic red tape.

This is because up to now, only one voice—that of the commercial airlines—has been able to make itself effectively heard in the civil allocation of Britain's crowded air space. Private and corporate pilots have been inadequately represented in the lobbying for facilities among the various ministerial committees, since, with just under 600 commercial transports registered in Britain, the Government and independent airlines have operated almost one-third of the 1,900 or so total of British civil types.

Although puny by American standards, which measure 2,000 airline transports in the 77,000 overall civil

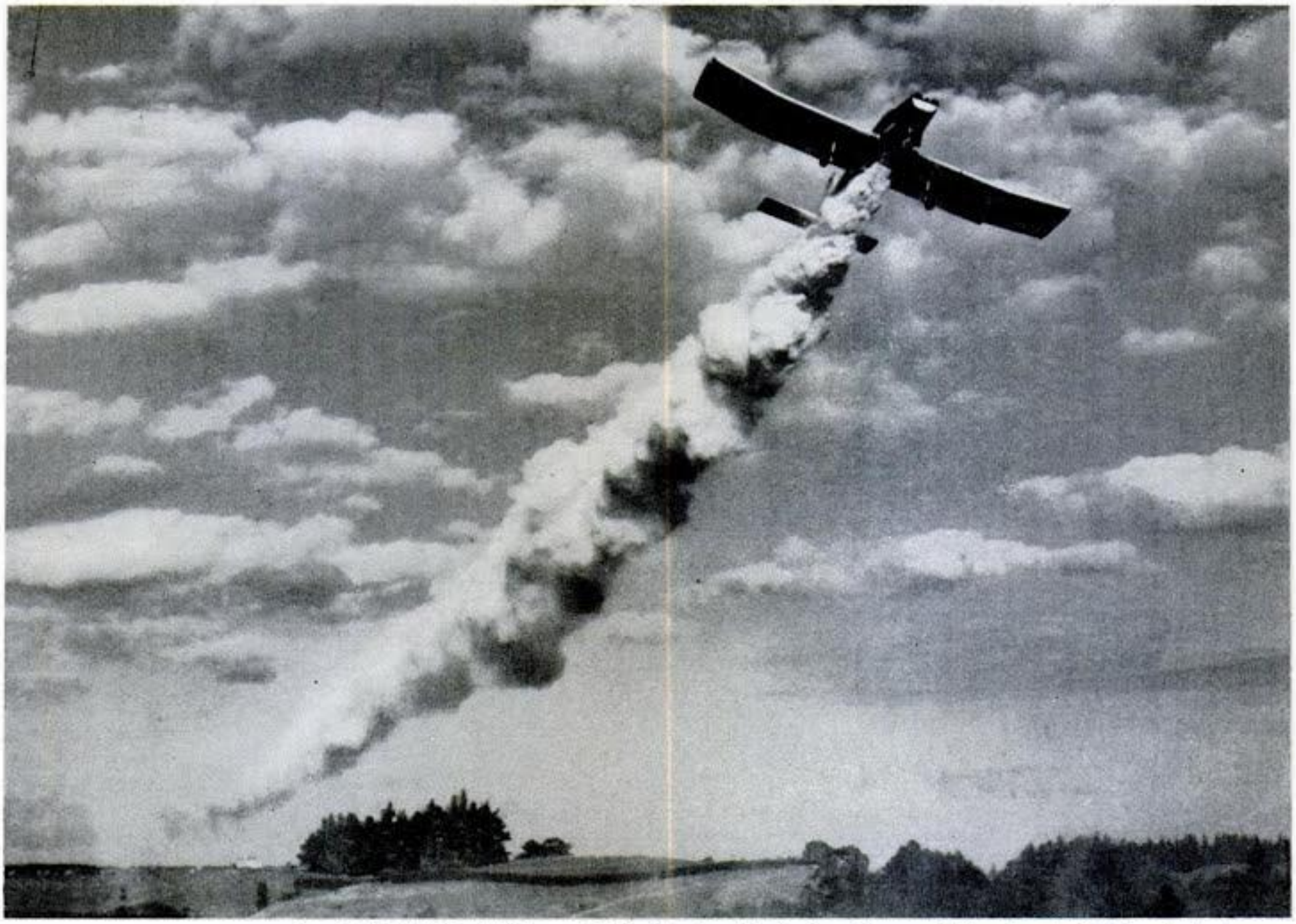
IN GREAT BRITAIN

aircraft strength, these figures show the much higher proportion of airliners in the British civil aviation pattern. Comparable totals for the British business fleet are rather more difficult to compute with any precision. While around 550 aircraft are registered in the business and private category, careful study of their ownership indicates that fewer than 150 are probably employed solely in executive flying, contrary to more optimistic estimates. Most of the older single-engine aircraft with company registrations have been excluded from this total unless known or indicated as corporately employed, and not simply run privately on a firm's books.

Of the overall total, nearly 40 belong to the aircraft industry or closely related accessory companies on more than executive use. This means that the true figure of business airplanes used by general industrial organizations is somewhere around the 100 mark in Britain. For one of the most highly industrialized countries in the world possessing a wide range of companies, this is an extremely low total. It is significant, however, that almost exactly 50 per cent of its numbers are American airplanes, which have been available for import for little more than three years.

During that time, therefore, the true British business fleet has effectively doubled, despite the fact that the impact of modern American designs has taken a while to be absorbed, and their business potential is only just beginning to be realized. As executive flying has much less background in Europe, its benefits have been correspondingly harder to sell to British businessmen, with their traditional conservatism.

There are many other reasons, too, why a really large expansion in business flying in Britain has yet to come. Although American lightplanes have proved tremendously popular, and their success has stimulated the entry of the British aircraft industry into this competitive field, they suffer an almost crippling surcharge of duty on arrival in the U.K. This amounts to nearly 20 per cent, and is charged, with a Machiavellian technique, on the delivered price. (*Continued on page* 86)



One of eight Fletcher FU-24s operated by Robertson Air Service, Ltd., spreads top dressing in New Zealand.

PILOT REPORT:

Designed expressly for agricultural jobs, duster-sprayer proves its mettle on the rugged mountainous slopes of New Zealand

FLETCHER FU-24

By RICHARD L. SWEENEY

WHEN Fletcher Aviation Corp. surveyed the agricultural aviation market prior to designing an airplane for this highly specialized operational environment, the concensus was for an airplane which had a best operational speed of about 80 mph and carried a heavy load with a low-horsepower engine.

Naturally, the primary needs were for pilot safety, low maintenance, and an airplane as easy to fly as possible in order to reduce the hard physical labor in agricultural flying.

Fletcher's answer, the FU-24, is a highly efficient aircraft in terms of power-to-payload ratio, and has several inherent safety factors in its aerodynamic design. It has a very safe cockpit and is relatively easy to fly.

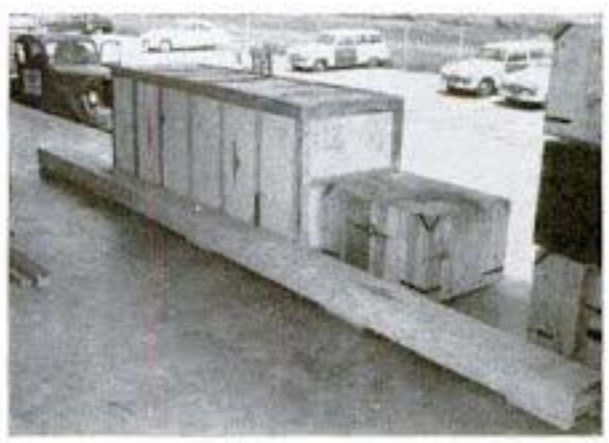
Certificated in 1955 under CAR Part 3 for export, the FU-24 (Fletcher Utility) originally used a 225-hp Continental O-470-E to carry a 1,630-pound useful load at a gross weight of 3,500 pounds.

Operating in the United States under CAR Part 8, the gross weight goes above 4,000 pounds. In New Zealand, where all FU-24s in service are located, other limits than "all you can get it in the air with" have been established.

The airplane has progressed through several models of the Continental O-470 series engine. The first advance was to the 240-hp O-470-M, then to the present 260-hp fuel injection IO-470-D. Airplane gross weight has not been increased under the Part 3 certificate.

Now in flight test, with certification expected in the near future, is the Continental GIO-470-A, rated at 310 hp for takeoff.

Above: Fletcher demonstrator shows passenger-cargo configuration. Airplane has 3,500-pound gross weight.



Left to Right: Spartan cockpit designed to stand 40 Gs. Crated kit ready for shipment to New Zealand. Simplified assembly eliminates jigs.

Configuration of this geared engine raises the propeller centerline four and one-half inches, allowing a 94-inch propeller to replace the 88-inch model now installed, while increasing ground clearance as well.

Although there have been longitudinal engine position changes, engine mounts of the first models are capable of accepting any of the O-470 series engines, with the drilling of appropriate holes. The IO-470s can be switched up or down, on any FU-24.

At first sight, the FU-24 is physically a much larger airplane than its weight or power would indicate, being 31 feet 10 inches long and having a 42-foot wing span.

The airplane's utility role is apparent at first glance. It is noisy; there are no frills like soundproofing or structural sound suppression by extra material. The flaps are manually operated by mechanical linkage through a two-position lever. Control system is matched to the mission. The FU-24, like any agricultural aircraft, cannot be evaluated in this, or any other department, in any light except that of its agricultural role. Comparisons with executive aircraft or modern lightplanes are useless—the purposes are too divergent.

Aerodynamically, the configuration is one of a medium (6:1) aspect ratio wing with a level span, except for the last seven feet of outboard section, which has eight degrees of dihedral and carries the ailerons. The wing area is large, in order to obtain lift at higher altitudes.

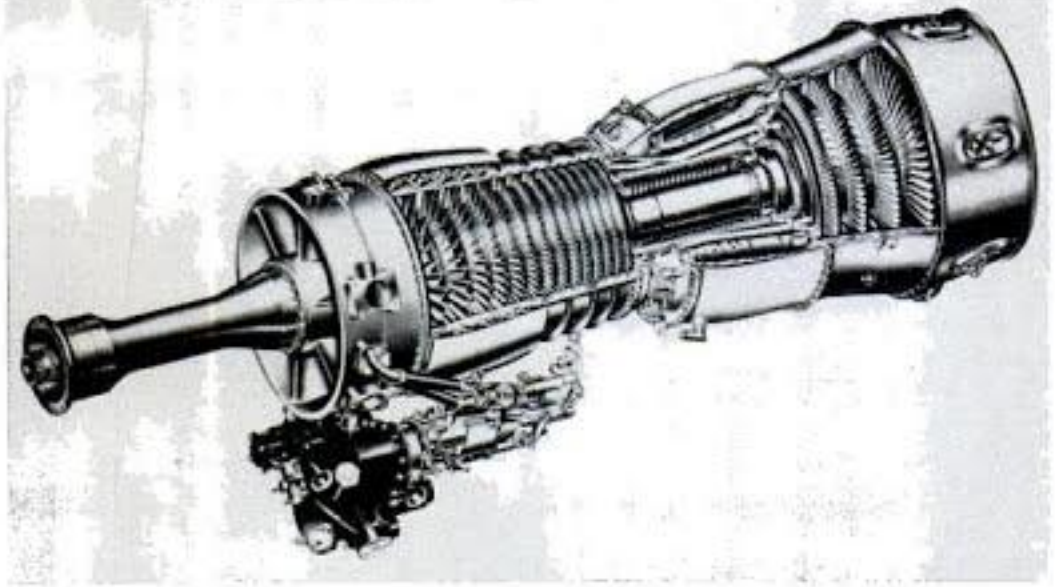
Nevertheless it still maintains the efficient characteristics of the airplane.

The FU-24 uses a stabilator, or flying tail, with a full trailing edge tab, not the (*Continued on page* 112)

NEWSREEL

VESPA JET *(Right)*. Mockup of the twin-jet executive transport designed by Douglas Aircraft Co., Santa Monica, Calif. which will be produced by Piaggio of Finale Ligure, Italy. The eight- to ten-place pressurized aircraft is to be powered by either two Bristol-Siddeley Viper 20 engines of 2,990 pounds thrust each or by two General Electric CJ610s of 2,850 pounds of thrust each. The target price is around $400,000.

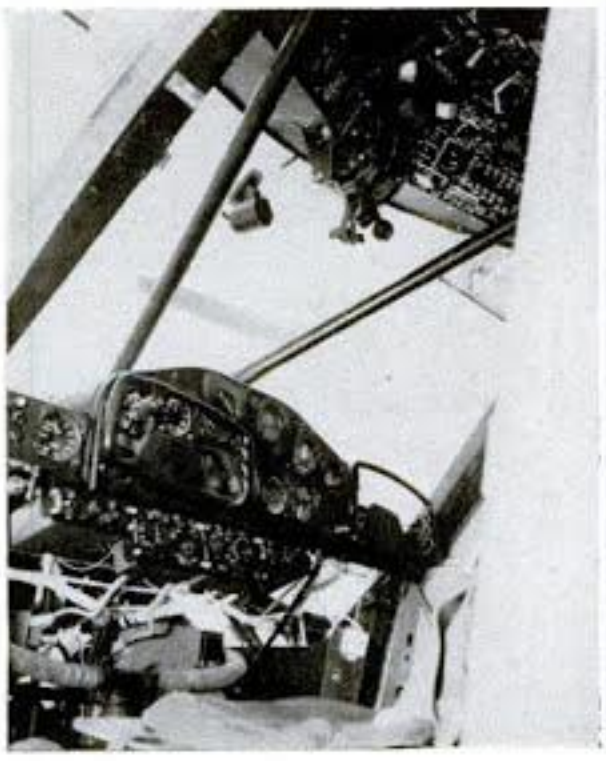
BREGUET 941 *(Left)*. STOL transport ordered by the French Air Force is powered by four Turbomeca Turmo IIID turboprop engines of 1,250 shp each. Gross weight for assault missions is 39,680 pounds. Capacity 40 troops, or 24 litters, vehicles or freight. Takeoff run, at gross weight 443 feet; landing over 50 foot obstacle, 772 feet; top cruising speed at gross weight, 271 mph.



GENERAL ELECTRIC T-64 *(Right)*. Turbine powerplant for the new generation of transport, support and tactical aircraft is available in four configurations, two as turboshaft and two as turboprop, by simple addition of reduction gearing to the basic engine. Powerplants develop from 2,810 to 2,850 shp. Direct drive turboshaft, shown here, can operate from 100-degree nose up to 45-degree nose down position, an essential feature for V/STOL aircraft. T-64-4 turboprop version has been undergoing flight test, on DH Caribou.

LONG RANGE 707 *(Above)*. Pan American's new Boeing 707-320B Intercontinental capable of 6,000 mile range with full passenger payload, is now undergoing company flight test. The aircraft is equipped with leading edge flaps over two-thirds of wing span and additional slotted inboard fillet flaps. The 320B is powered by four Pratt & Whitney JT3D-3 turbofans of 18,000 pounds thrust each. Gross weight of the airliner is 317,500 pounds.

NEWSREEL



HELIO 500 (*Above*). Twin-engine STOL aircraft designed and built by Helio Aircraft Corp., Norwood, Mass. utilizes same high lift devices as the single-engine Helio Courier. Aircraft is powered by two Lycoming O540 engines of 250 hp each. Takeoff distance over 50-foot obstacle, 530 feet. Landing distance over 50-foot obstacle, 665 feet. Maximum speed 181 mph., minimum speed is 36 mph. Note overhead throttles in photo of cockpit.

PLASTIC PROP SPINNER (*Left*). Produced by Hamilton Standard division of United Aircraft Corp., Windsor Locks, Conn., the spinner is standard equipment on the Air Force Lockheed C-130E transports, Navy P3V-1 anti-submarine aircraft and Marine GV-1 tankers. A network of embedded electric wires acts as de-icers when heated by current. Plastic spinners are 14 pounds lighter than metal ones.

POWERFUL DUSTER (*Right*). Boeing-Stearman PT-13 powered by a 650-hp Pratt & Whitney R1340 engine has near helicopter performance at takeoff, stalls at 50 mph IAS with full load. Used for agricultural work, it doubles the swath speed of same craft with 450-hp engine. Conversion was made by Sequin Aviation, Sequin, Tex. for approximately $2,000 including surplus engine and propeller. Engine mount was shortened and the oil tank relocated behind the rear cockpit.

NEW PIPER PAWNEE (*Left*). Derived from the 150-hp PA-25 Pawnee, the new version of the agricultural aircraft is powered by a 235-hp Lycoming O540-B2B5 engine, has a 1,200-pound capacity and 10-minute interchangeability of dispersal equipment. Changes include double brace wires on empennage, heavier tail wheel spring, additional set of jury struts and general beefing up of wing, fuselage and landing gear.

I learned about flying from that!

NO. 264

Why the instrument training requirements for private pilots? Here's a man who found out

By W. N. FANGIO

ALTHOUGH BAD WEATHER had been expected, it turned out to be a beautiful December Saturday in San Diego with only an occasional wisp of white to mar the otherwise blue sky. This seemed the perfect opportunity for a trip I had been planning to Porterville, California, just north of Bakersfield. I checked the weather along the route and was assured of VFR conditions. I was a brand spanking-new private pilot, but had been considerably taught by J. M. Hawn, an able and competent instructor at Lindbergh Field, and was confident I could handle myself under most conditions.

I performed all of the necessary rituals preparatory to cross-country flights and rented a Piper Tri-pacer which I had flown previously, N9618D. The plane was equipped with a fair complement of radio equipment including one omnirange receiver and one transceiver which provided standard aircraft simplex operation.

It was mid-morning and I was airborne from Lindbergh Field with my wife and three small children. I pulled the standard 45 degree right turn out of the pattern and began my climbout over Mission Bay. Contact was made with San Diego Area radio and the Flight Plan was activated. At 6,500 feet I trimmed the nose of 18 Delta over and established level flight.

My route took me directly over the Los Angeles Area and I was bothered some about crossing the control zones. I began to notice a cloud cover ahead, apparently broken, which was pushing its way up against the mountains, although peaks were still rising into view. I contacted Long Beach approach control, giving them my location, altitude, and destination, receiving permission to penetrate the control zone. The tops of the clouds ahead seemed to be getting higher. I had to quell an impulse to change frequencies and check the weather since Long Beach was tracking me and issuing instructions and traffic advisorys. I departed the Long Beach control zone and immediately checked in with Burbank approach control coming within their jurisdiction.

Now I was really beginning to worry. I was getting closer to the mountains and with my present altitude I was planning to follow U.S. 99 through the low spots, but it was becoming more and more difficult to maintain visual contact with the surface. Furthermore, it was becoming evident that the clouds ahead dictated a higher altitude. Just how much higher I couldn't be sure, but I knew peaks attaining 9,000 feet were in the vicinity and 18 Delta was not oxygen-equipped.

I had just left the Burbank control zone when I decided whatever was ahead was too formidable and began a 180-degree turn to the left. Then I learned that you can't always go where you came from. The weather had closed in behind me and I was busily engaged dodging clouds to remain VFR. To top it off the area below me was definitely overcast. Then and there I decided I needed help. Quickly, I again contacted Burbank approach control explaining that I was in a situation that would not allow VFR flight much longer and gave him my approximate location and heading. He responded by having me make an identifying turn. Once a positive identification had been made he gave me an IFR clearance, instructed me to turn to a heading of 140 degrees and proceed to the outer marker beacon.

Oh brother! He didn't know how green a pilot he had on his hands. I then told him how I appreciated the IFR clearance, but that I couldn't proceed to the outer marker beacon without an hour or two of study. He got the idea. He turned me to the 140-degree heading and I flew straight into a cloud bank. The instrument training required for the private ticket really began to pay off now, because visibility was zero and it stayed that way for the next 10 minutes. I was to make standard three-degree-per-second turns and maintain a 5,000-foot altitude until otherwise instructed. The turbulence increased in the clouds, and combined with the loss of a visual reference, it brought sickness to my wife.

The gyro compass on 18 Delta was also sick and it became increasingly difficult to hold the prescribed headings. I relayed this to Burbank and he began working a no-gyro ground-controlled approach. After turning final he set me in a descent of 450 feet per minute. At 1,500 feet I began to break out of the overcast and shortly had the end of the runway in sight. A frequency change was approved and the tower informed me that I was already (*Continued on page* 94)

They're Taking Over!

They weigh less than a ton, yet pack the working power of a bulldozer. Their ascent in the military is attested to by this remarkable fact: **by 1970 they will outnumber all other Army aircraft.*** They are penetrating the business front, expediting VIP travel, speeding critical material, impressing clients with the b-i-g look of plants and projects. This year, heads-up companies will spend $50 million with charter operators in the U.S. and Canada. To discover why the charter, lease or purchase of a helicopter is sound business for your company, contact the Hiller Commercial Division. Hiller—for two decades a pioneer in helicopter development, production and service.

*Estimated Army aircraft by 1970: 8,000.

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AIRCRAFT CORP
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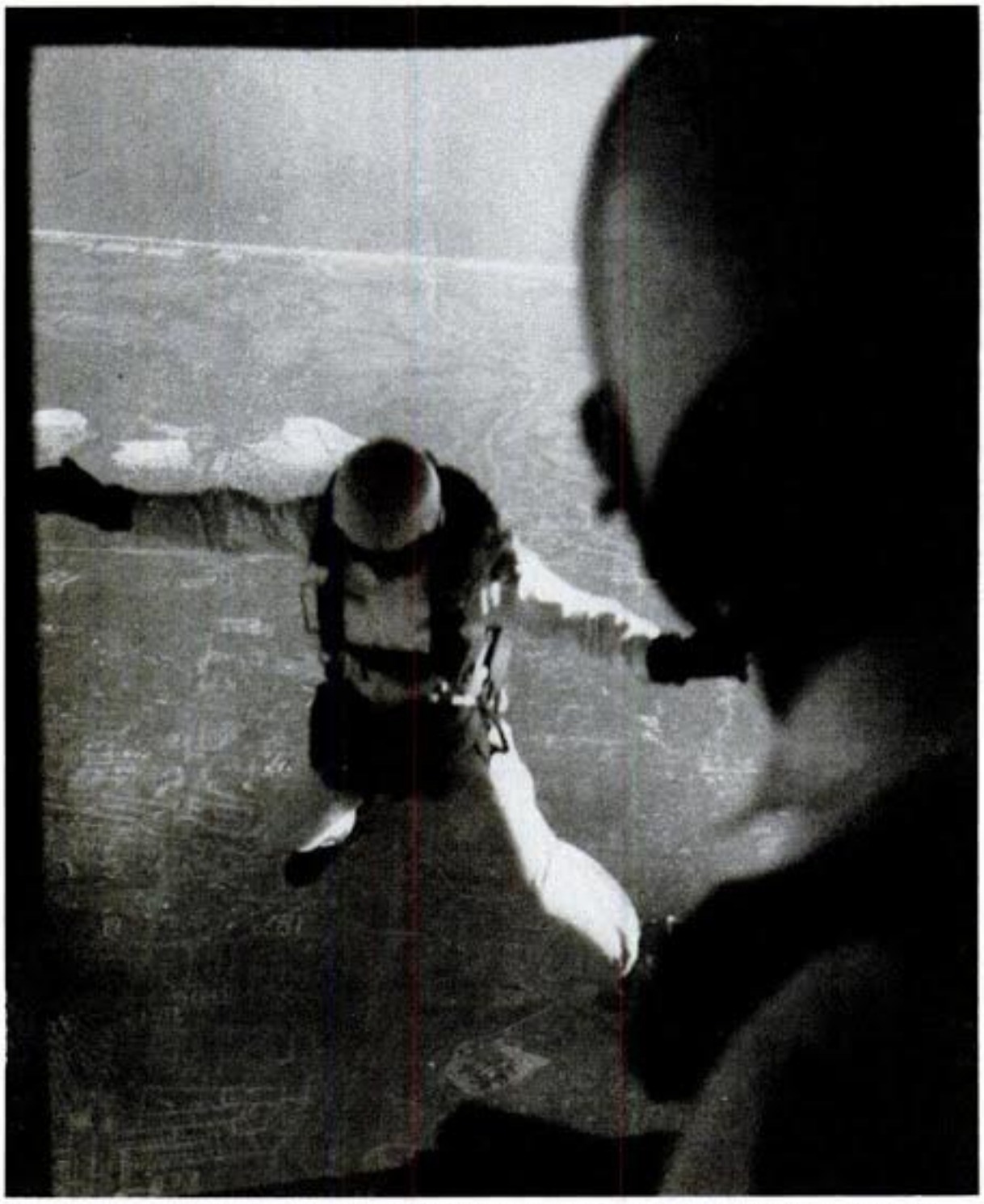
SUBSIDIARY OF THE ELECTRIC AUTOLITE COMPANY



Army team member steps out at 13,000 feet over Long Island to perform smoke-trail maneuvers.

Raceway beckons jumpers through Caribou door.

THE ARMY STEPS OUT

The U.S. Army demonstrated precision jumping and short-field operations for nine days at the Long Island Fair (N.Y.) and National Aeronautics Assn. Convention. With Mitchel Field closed, the championship parachute team and various aircraft operated from Roosevelt Raceway's parking lot.

Showing Army's versatility, Mohawk leaps off raceway parking lot, site of Lindbergh's takeoff.

The jumps were applauded by crowd of 30,000.

1,000 to 500,000 pound loads . . .
SCHENUIT can supply the aircraft tires

Schenuit specializes in aircraft tires. From the lightest private plane to the heaviest jet bomber Schenuit makes the tires. Specialization is a "must" to make the very best aircraft tires. This degree of specialization cannot be found where aircraft tires represent only a minute fraction of a manufacturer's total production.

SCHENUIT

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Wiggins Airways
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Selected franchises are available. Write:

THE SCHENUIT RUBBER COMPANY, BALTIMORE 11, MARYLAND

Sweeping the cobwebs away from community inertia,

Jaycees set a record for ambition and ingenuity

AN AIRPORT FOR A SMALL TOWN

By BASCOM NELSON

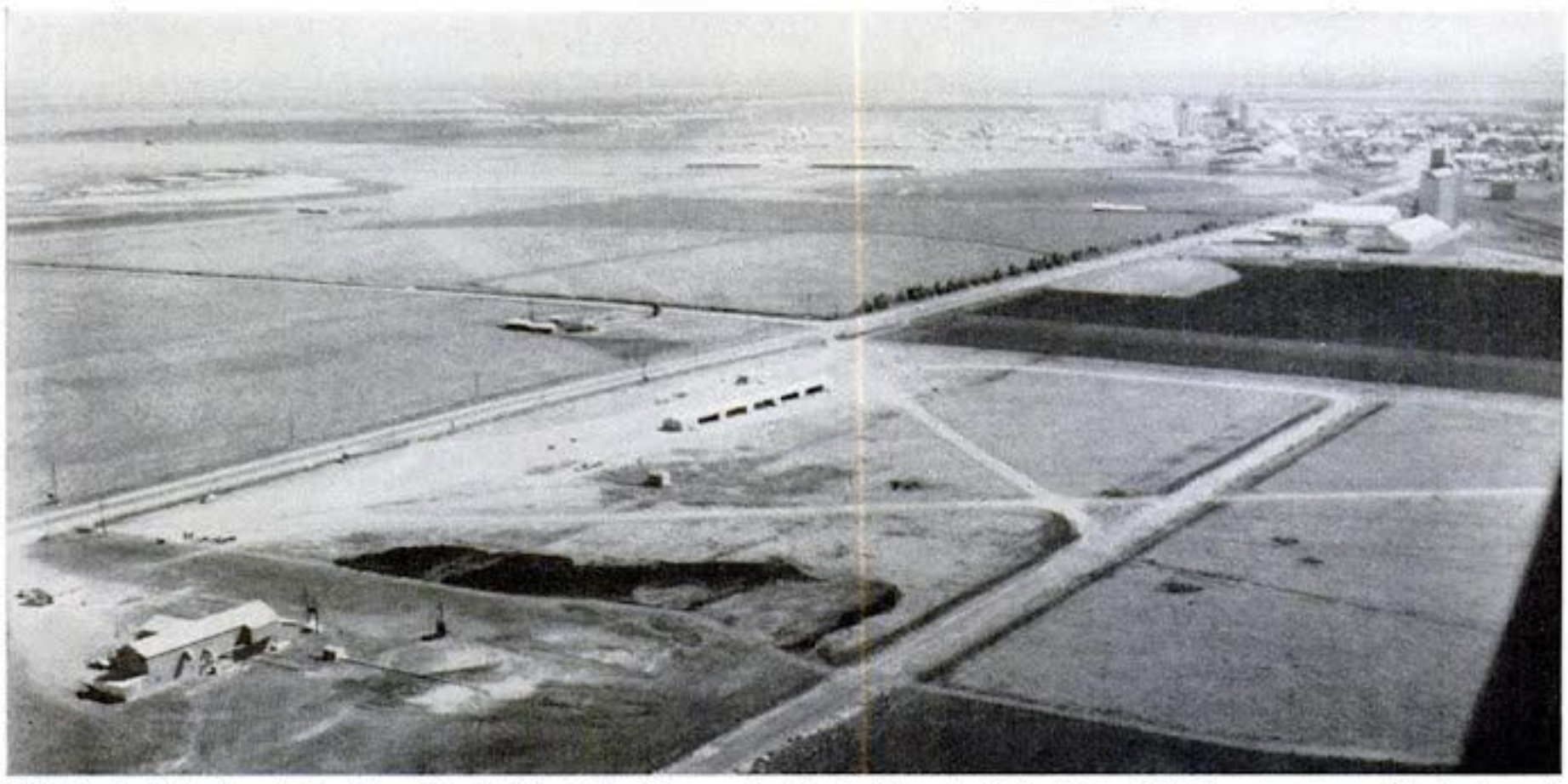
DIMMITT, TEXAS, a small town of 3,000 people, found itself on the air map, not because of a vast spending program, the securing of an abandoned air base, or a government project, but because several dozen men took the time and effort to learn that an inexpensive, satisfactory airport development project could be both possible and profitable.

It all started one day in a downtown cafe during a meeting of the board of directors of the newly-formed Dimmitt Jaycees. One man mentioned that a good project for the organization would be to build an airport, except that it would probably cost too much and the task would be too difficult. Another one mentioned that a Tri-Pacer and a Luscombe were being tied down in a pasture a mile south of town. Someone else said he had heard general aviation was on the upswing, but hastened to add that "Dimmitt is just not big enough."

The meeting adjourned; nevertheless, the thought had been planted. Members of the board noticed stories about the increased use of executive aircraft. They heard of business passing the city by for lack of an airport.

Finally one day at a regular meeting someone said, "Why don't we look into the possibility of leasing a few acres around here somewhere. The $300-an-acre land is too high for us to try to buy for an airport, but a lease or rental might work."

A committee was appointed and (*Continued on page* 80)



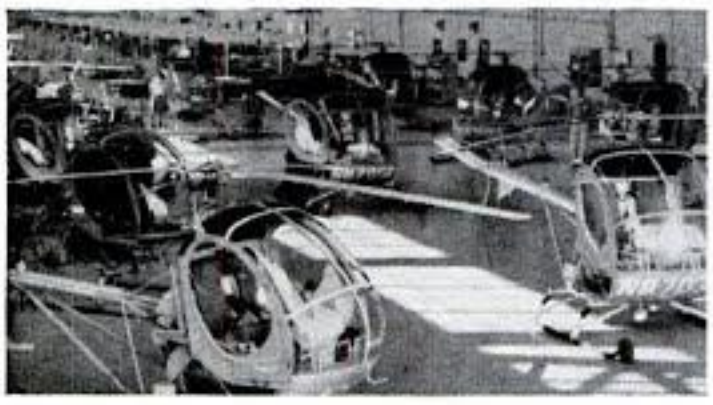
Built almost entirely by volunteer labor, Dimmitt Airport has T-hangers for 11 aircraft and a half-mile-long lighted runway. Town is in background.

LOH/HUGHES—just what the commander ordered

The Army's Light Observation Helicopter will bring the latest state of the art to front-line reality. Men who must depend on the LOH will value the advancements the Hughes HO-6 provides — reliability throughout the mission spectrum from combat recon to logistic support. Greater performance and larger useful load capacity at a lower over-all cost. ■ The HO-6 rests on sound concepts which take full advantage of Hughes modern techniques. These have been developed during the long partnership in progress between the U. S. Army and the Hughes Tool Company. ■ When deliveries are made, the Hughes HO-6 will prove itself — the optimum result of experience, imagination and outstanding production capability.

HUGHES TOOL COMPANY—Aircraft Division, Culver City, California

A salute to the 20th Anniversary of Army Aviation—June 6, 1962



Hughes has one of the industry's largest production facilities—now in volume production of the commercial 269A.

Hughes HO-6 blades quickly fold for easy concealment.

Compact size and small rotor diameter permit the Hughes HO-6 to operate from tight quarters.

THE THRUST LEVER

BY CAPTAIN DAVE KUHN

SPACE AGE

Since it was my day off between trips, I was out cutting the grass this morning. Feeling a bit abused already at the indignity being forced on a senior airline captain, being put to such a menial task, it was only natural that my reflections should center on the low status the modern pilot has sunk to.

What has happened to the glamour of flying? Kids no longer chase after a pilot for an autograph. Rarely if ever do passengers seek out the pilot and commend him on a good flight. Most often it is to advise the "driver" that: "The trip was a rough one"—"The landing bad" and that being 10 minutes late has "just lost another customer to the competition." Young maidens never tarry at the loading gate to blushingly bid us farewell anymore. The bloom is off the bush for today's fly boys. Suddenly it hit me! Commercial flying is to the Space Age as the horse and buggy is to automobiles.

Just think of it. When Orville and Wilbur Wright first flew a contraption composed of spare bicycle parts powered by a motorcycle engine, there was little or no fanfare. Only a few curious skeptics showed up in the hopes of seeing a couple of nuts break their necks.

Contrast that with Colonel Glenn's orbital flight. Two or three TV companies were set up for world-wide coverage. A vast network of tracking stations manned by hordes of experts stood by. About half of the fleet and Air Force were at ready for the pick-up. Countless numbers of reporters monopolized the air waves reporting progress of the undertaking. They even forgot to pause for station identification.

It will have to be admitted. The recovery and subsequent welcome was the best-staged spectacular ever viewed by the public. The family reunion was most heartwarming. The Russians may have made 17 orbits to our three, but we fractured them where it counts most—publicity. The TV crews did a magnificent job. There were tears, odd little Mother noises and offspring adulations. The climax was reached when the President read a prepared speech, stuck a medal on the Colonel and officially created a hero.

Nothing like it ever happens to a pilot. My kids never realize I am gone from home unless my wallet is missing from the hiding place. When I return from a three-day trip (not four and a half hours) in the dead of night cold—tired—sleepy and trying to be quiet, my reunion is less altruistic. Being quiet usually cuts down on the speeches, prepared or otherwise.

I read somewhere, or else somebody told me, about a thing called terminal velocity. It has to do with the maximum speed a falling object will reach. If I remember correctly, a man will fall no faster than 125 mph. So if he falls one mile or a hundred miles, he hits the earth with about the same impact. A space man and a jet pilot are about par in this respect. As for things whizzing past the windshield, he found nothing new—only higher up. If I should sound a bit envious, it is only that I am.

No one can take away the fact that the Colonel is a *hero* and with guts. I am sure that he would like to duck some of the publicity, but it is not allowed. Even Enos couldn't. Where the Colonel got a medal, the Wright Brothers got a summons for scaring livestock. Colonel Glenn will remain a hero for a long time until such flights are commonplace and then he will be as lackluster as airplane pilots. When other astronauts go to the moon or Mars, he will join our "has-been" club.

If the Wright boys and Lindbergh can accept back-seat status, then surely I can. Maybe one day they will find out that middle-aged fellows can adapt to weightlessness.

Without doubt our dull airplane talk will give way to the fascinating jargon used by space men. I think by-and-large, even if no one understands it, the terms and nomenclature they use have captured the ear of the public. When any system is operating, it is, "Go." "Everything Go," means ready at all quarters. "Capability" is a term meaning speed, range and altitude of a space vehicle. "Blast off" is a takeoff while "Splash Area" is a place to land.

When it was reported that the "Splash-down was effective", it merely ment there was a good landing. And so it goes. I must brush up on that stuff. It has furnished much of the glamour for the space age that the airplane once used to have a corner on.

There is one thing certain, this long "hold" on edging the flower beds is apt to create some unplanned orbits here-abouts. So I best get at it. I may never be a hero, but I can make that darn yard AOK!

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What? Bell's turbine-powered Iroquois. This U. S. Army helicopter is a leader, now being produced in quantity by Bell's turbine talent team.

Why? Bell's Iroquois supports field troops with firepower from the air . . supplies them in inaccessible areas . . searches out and evacuates combat casualties. It is *mission-balanced* . . big enough for the tough jobs . . small enough to be transportable by air. The Bell Iroquois is an *off-the-shelf* helicopter available to other U. S. services with the major costs of research and development behind it.

Where? On the production line . . lowest cost per airframe pound. On the flight line . . highest availability and performance. In the military . . greatest utility in its class.

Soon these same values will make the turbine-powered 204 the *hottest thing* in business and industry, where today, three out of four commercial helicopters are Bells. The 10-place 204 will move more people or pounds per operating dollar than any helicopter in its class.

Write: Sales Manager, Dept. 426E, P. O. Box 482, Fort Worth, Texas, for additional information about all Bell helicopters.

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Lycoming Power for the Mobile Army

A new generation of tactical aircraft keeps our Mobile Army on the move. Reconnaissance missions and rescue alerts call on advanced helicopters and VTOL aircraft to spring to action at a moment's notice. That kind of response demands quick, reliable power... Lycoming power.

More types of Army aircraft are powered by Lycoming gas turbine and reciprocating engines than those of any other manufacturer. The following are all Lycoming-powered:

- Bell H-13H Sioux
- Hiller H-23D Raven
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- Bell HU-1B Iroquois
- Bell HU-1D Iroquois
- Grumman AO-1 Mohawk
- Beech L-23D Seminole
- Beech L-23F Seminole
- Aero RL-26D Commander
- Aerojet SD-2 Drone
- Boeing-Vertol HC-1B Chinook

Lycoming

Division—Avco Corporation
Stratford, Conn., Williamsport, Pa.

Airport for a Small Town

(Continued from page 74)

the members started looking over and studying several acceptable tracts of land. One in particular they decided was outstanding. It was about 40 acres square just outside the north city limits. The land was bordered on one side by U.S. Highway 385 and lay almost flat with just enough slope for good drainage. It had not been used for anything for some time, so several members of the committee screwed up their courage and went to see Elmer Youts, owner of the property.

"Sure," he said, he'd be glad to rent it. The negotiated price for the tract was $40 per month.

Then the committee went to the owners of the two planes in the pasture. The pilots agreed to hangar their planes at the new airport at a rental fee of $15 per month. When two Jaycees said they would buy a plane together and hanger it there, the club knew they had their land lease paid, at least at the start.

Two fund-raising campaigns—a stag party and a trash-barrel lid selling drive—financed the starting of the hangar.

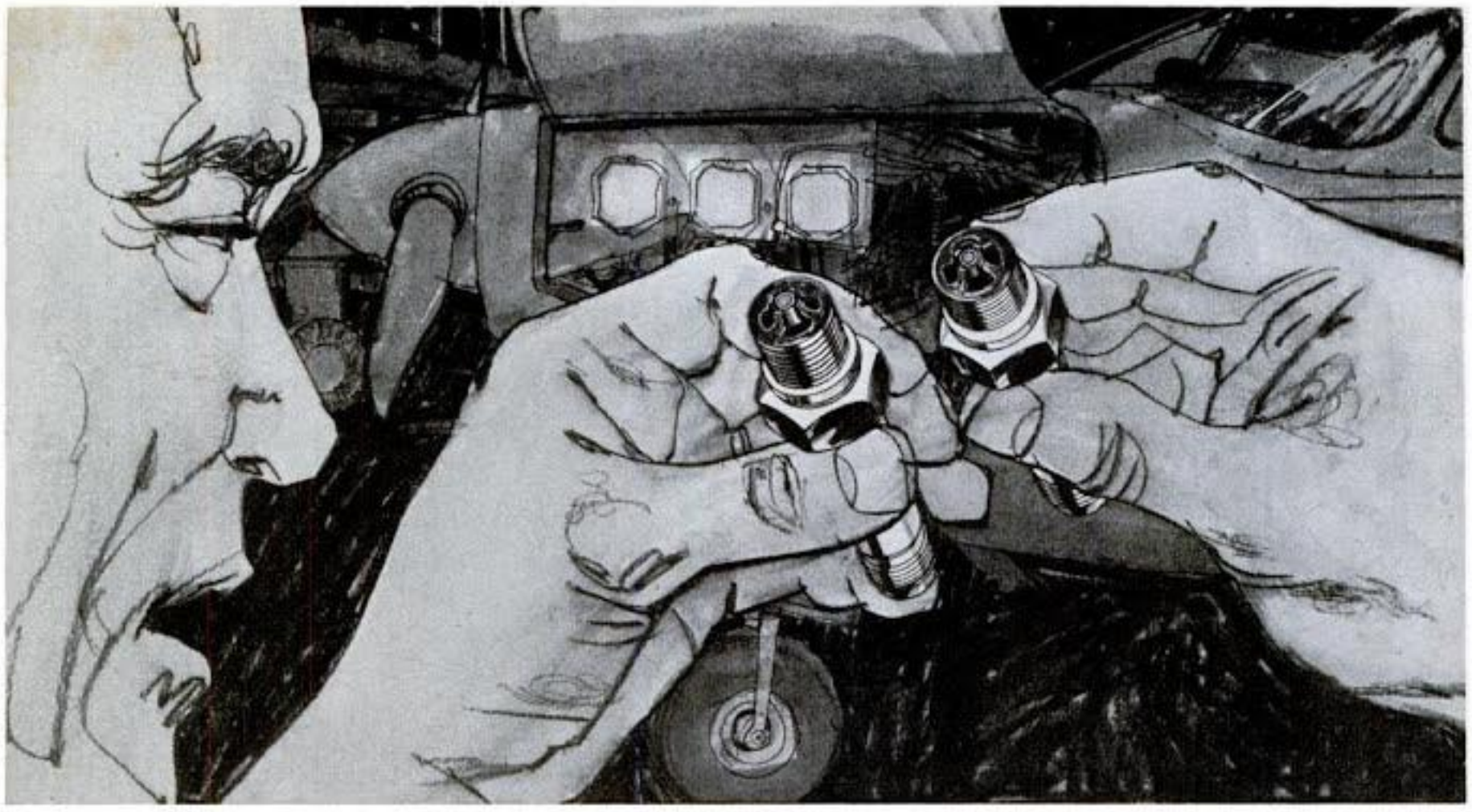
One of the Jaycees designed the interlocking T-hangars and the others started scrounging for material. The necessary used angle iron was found in one batch at a good price in nearby Tulia, Texas and the tin was dug from under barns, salvaged from burned or scrapped grain elevators, donated by a gin operator, and as a last resort bought at scrap prices.

Four runways were laid out, designed to permit into-the-wind operations under virtually all conditions. Highlines and telephone wires stretched across the east end of the east-west runway and the northeast end of the northeast-southwest runway presented the only serious obstructions. The runway boundaries were marked with old car tires painted bright orange, and from the air it looked like an ideal airport.

For several Saturdays and Sundays the entire club worked on the runways before turning their attention to the hangars. Then the fun began. With borrowed welders they fabricated the framework and had it ready for sheet metal in about three weeks of spare time work. Five hangar stalls were constructed at first, with the plan being that others would be added as needed. Eventually the project was completed and a gas pump installed by a local fuel dealer. One corner of the long hangar was walled off as a separate store room.

The Jaycees had no one to turn to for advice in building the airport, so they made some mistakes. One was that the runways weren't long enough for higher performance aircraft. A T-Craft or a J-3 could make it in and out comfortably, but on a calm day, it was marginal for the larger aircraft. Removing the barbed-wire fences across both ends of the most-used 1,100-foot north-south runway helped a lot, but it still wasn't enough, so Youts agreed to let the Jaycees extend the runway another 750 feet or so into some more of his property. Eventually the adjacent landowner agreed to let the Jaycees use some of his land for more north-south runway, so that today it is half a mile long and often used by light twins. The 3,875-

(Continued on page 84)



See what your spark plugs have to tell about your engine's performance

A simple spark plug check now can help you put your engine in top condition for increased flying time this summer. Here's what your plugs can tell you...

A spark plug inspection can reveal engine conditions as simple as plug fouling from excessive ground idling, or as serious as broken piston rings. That's why it's a good idea to take a close look at your spark plugs *now* when you're getting ready for the active flying season ahead.

Here are just a few of the common conditions spark plugs show and their possible causes:

- **LEAD FOULED**—Possibly caused by poor fuel vaporization, high lead content in fuel, or engine operating too cold. Causes power loss and poor fuel economy.
- **OIL FOULED**—In an engine past the break-in period, this condition usually means that service is required. Possible causes are broken or worn piston rings, worn valve guides, or an impeller seal leak on a supercharged engine.
- **CARBON FOULED**—Frequently caused by excessive ground idling or a too rich idle mixture. Also, plug could be too cold, and a check should be made for approval of hotter type.
- **WORN ELECTRODES**—Indicate long service, severe operation, or incorrect operating conditions. Should always be replaced.

Naturally your mechanic is the one best qualified to judge just what your spark plugs have to tell. In any case, "pulling" your spark plugs should be one of the *first* things you do to get ready for a full, pleasant flying season this summer.

And in case you need new plugs, be sure you ask for dependable *Champions*. Just look for the sign that identifies all Champion Aviation Stocking Dealers. It's your assurance of the finest in spark plugs and engine service. Make a note to have your spark plugs checked *this week!*

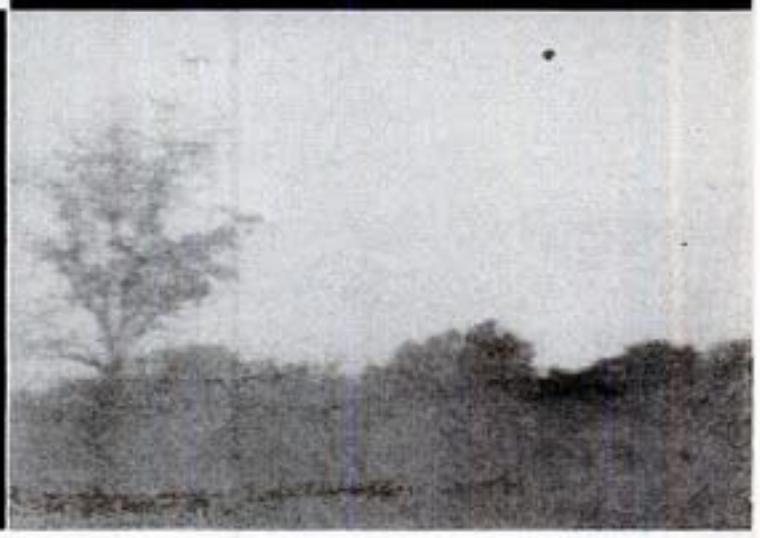
DEPENDABLE CHAMPION SPARK PLUGS

CHAMPION SPARK PLUG COMPANY TOLEDO 1, OHIO

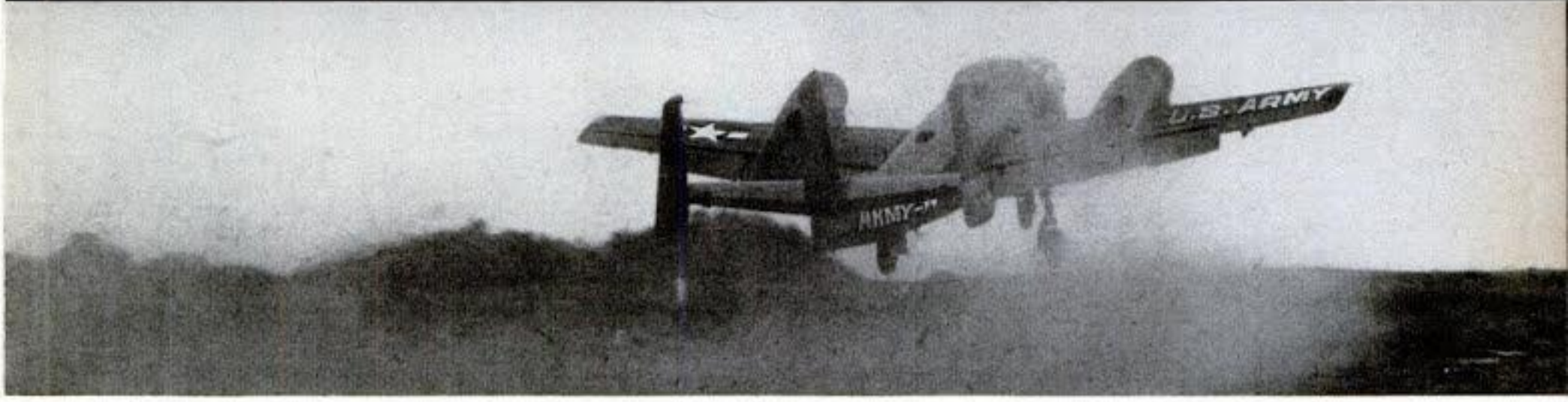
LAND...

ON ANY SURFACE...

TAKEOFF...



the ARMY MOHAWK does it all in just 600 feet of cow pasture!



The Grumman AO-1 Mohawk is a twin turbo-prop aircraft designed for electronic surveillance and observation missions. It features short-field capability for maximum operational flexibility. It's an all-weather craft—when the birds are grounded in snow, ice, or mud, the AO-1 will complete its assigned missions. The MOHAWK configuration offers: • short-field takeoff and landing • operation from unimproved areas • good low-speed control • drop tank and supply pod capabilities • adaptability to various types of photographic and electronic equipment.

Long a producer of reliable aircraft, Grumman now also develops new concepts in electronic systems integration, missiles, and space vehicles.

GRUMMAN

AIRCRAFT ENGINEERING CORPORATION

Bethpage • Long Island • New York

(Continued from page 80)

foot altitude of the Dimmitt airport makes long runways absolutely necessary.

A fly-in breakfast one cold morning in October, 1957, marked the formal opening of the new airport. A big crowd of well-wishers showed up and the Jaycees felt they had done an acceptable job as they nervously eyed the future.

The progress made by the airport has never stopped for long. Shortly after the first three planes were hangared, a fourth and fifth were purchased to fill the last stalls. Plane owners were kept on the honor system, filling their own gas tanks and signing a ticket in the storeroom.

It wasn't long before another man purchased a plane and the Jaycees called out their work force again and added two more hangars. There was now a Luscombe, T-Craft, Tri-Pacer, two Cessna 120s and a Commonwealth Sky Ranger at the airport and once it was on the Albuquerque sectional map, more and more transient aircraft began dropping in. A large sign pointed out a telephone on a hangar wall and the number to call for gasoline was written nearby.

Then a big boost came when M. A. (Buster) Tidwell, a local farmer, made a deal with the Jaycees to open a spraying and flying service at the airport. Almost immediately new pilots began showing up as Tidwell started giving flying lessons. The type of planes also began to change as owners traded their two-place planes for four-placers.

Tidwell moved an office to the airport and he had dozens of students keeping him busy when he wasn't spraying. Later two local pilots started another spraying business and the Jaycees found their airport on the most solid footing yet. More stalls were added to the long rambling hangar and the Jaycees extricated themselves from their troublesome gas sales business and turned their equipment and concession over to the spraying firms.

While they started it as a community service and agreed to a higher lease as the main north-south runway was graded and extended, the Jaycees' airport has nonetheless been a modest money-maker. Consequently they have been quick to heed pilot requests. Not long ago the north-south runway was lighted, permitting 24-hour operation so that a pilot on a long trip doesn't have to race the sun. Using surplus wire and light fixtures converted to take 15-watt bulbs, the total cost of this operation was less than $100 for about 30 lights divided down both sides of the half-mile runway.

At present there are eleven planes—six four-place, one two-place and four spray planes—in the hangar stalls and two two-placers are tied down outside. All of these planes are working machines and used about as often for business purposes as for pleasure. They are long-term investments, and every indication is that the airport will continue growing. At this writing there are two Bonanzas, one Cessna 182, a Piper Pacer and Tri-Pacer, a Stinson, a J-3, a Vagabond, an Ercoupe, two Super Cub sprayers, and two Pawnee sprayers. Remember that this airplane count is in a small town that was without an airport at all until June, 1957.

(Continued on page 86)

New, Small, 360 Channel VHF Com Receiver-Transmitter

RT-302A

COMPARE THE FEATURES — COMPARE THE SIZE!
2-9/16" HIGH, 6-3/8" WIDE, 11-3/4" DEEP

- Powerful, 7 to 10 Watts
- Designed to TSO, Cat. B
- 4 Auxiliary Amplifier Inputs
- Crystal Controlled
- Low Weight
- 95% Modulation Capacity (Automatic Limiting)
- Starflite II, Panel Mounted
- Single Channel Simplex, Concentric Knob
- 14 or 28 Volt
- Squelch Control Provided

SEE YOUR ARC DEALER or WRITE FOR FREE DESCRIPTIVE LITERATURE

Aircraft Radio Corporation
BOONTON, NEW JERSEY

RESEARCH, DESIGN, DEVELOPMENT AND PRODUCTION OF ELECTRONIC EQUIPMENT SINCE 1928.

(Continued from page 84)

This has become a profile of a successful grass roots aviation venture. The Jaycees have paid off their investment and use their small profits for civic ventures, freeing themselves from the necessity of frequent fund-raising campaigns.

With volunteer labor, secondhand and donated materials, the hangar was completed for about $300 per stall. Some hired labor was used when it became necessary to speed up completion of several of the stall additions.

A small municipal airport failed in Dimmitt about 10 years before from disuse, and it took considerable faith in small town aviation for the Jaycees to take the step. But the complexion of flying has changed. Right after World War II Sunday afternoon flying was about the only practical use for the small 65-horsepower-planes at the local strip. Now the planes in the Dimmitt hangar range all over the United States. Owners have found that the relatively low $15 per month hangar rent and the nearness of the airport to town makes flying both enjoyable and profitable.

A casual transient pilot might think the four-year-old airport is a slap at the sanctity of aviation. At present there are no rest room facilities available. But as soon as possible the Jaycees plan to rectify this situation. Another drawback is rough runways, which are nearly impossible to keep smooth in this area of West Texas winds. Also, the airport is not pretty.

But on the credit side of the ledger, it has furnished air transportation facilities where none existed before. The planes are out of the sun and protected from rain and hail. It is an informal, comfortable place for local pilots to congregate, and it has furnished a place for three families and the pilots they hire to make all or part of their livelihood. It has brought new business to the community and it has helped local firms make use of aviation. It doesn't offer a paved strip, restrooms, radio and repair facilities, but it does furnish the basic needs for flying and the Jaycees hope to make improvements in the future.

This basic airport was constructed without outside help, and with very little borrowed capital. Dimmitt is a small town and by today's standards probably shouldn't even have an airport of any kind. But the Jaycees' efforts have pointedly proven that virtually any small town can have a good working airfield with at least minimum facilities if they are willing to expend a bit of time and energy. While it is true that a regular airport operator might have starved trying to get going, a local civic club doesn't have to make a profit or pay salaries, so it would appear this is one of the best avenues for a small town to choose in acquiring an airport.

Dimmitt Jaycee Airport has been well accepted locally and has always at least broken even for its sponsors. Also there is no grumbling from non-flying taxpayers.

Without any fanfare, the Dimmitt Jaycees probably developed the most workable system possible for procuring a good, usable airport for a small town. It is a system that could be copied by anyone with a strong desire to make it work. ✚

Business Flying in Britain

(Continued from page 65)

This means that duty is paid not only on the product itself, but also on the cost of delivery.

Whatever means is employed—shipping, air freighting, or air ferrying—delivery costs across the Atlantic can never be reduced below about $1,500, and are often more. Something like $3,000 in duty and delivery is added even to the lowest-priced lightplane imported to the U.K. On the bigger aircraft, of course, the cost of duty rises proportionately as one-fifth of the f.a.f. price. Its effect is shown by a popular executive light twin such as the Piper Apache, which costs $37,990 in the United States, but retails in England at about £17,200, or the equivalent of over $48,000.

Apart from Italy, and in some categories, France, no other country in Europe has such high rates of duty, so that the British aircraft industry is protected to an almost unique degree for its internal sales. Without this protective duty, it would be hard put to begin the manufacture of lightplanes on anything like equal terms with imported products, because of the volume production and low basic cost per unit achieved by the American industry.

The sophisticated American designs have nevertheless shown that a British lightplane market exists, and although there are signs that its immediate demands have been saturated, the U.K. manufacturers and franchised distributors are girding their loins for a second-stage assault on the sales front. In this, they will undoubtedly be helped by the newly-formed Business Aircraft Users Association, which evolved after discussions between most of the leading executive operators in the U.K. and dealers in British and foreign lightplanes.

Main object of the Association, which, with its formation in May, 1961, marked the beginning of organized business flying in Britain, is not concerned with the furtherance of sales. In representing the interests of the business flying community at high levels, however, the BAUA aims to expand the size and scope of that group, and therefore increase the numbers of executive aircraft used.

While British manufacturing interests are strongly represented in the chairman of BAUA—M.A.H. Bellhouse of the Pressed Steel Company, of which the BEAGLE Group is a subsidiary—distributors of imported aircraft are also among the first council members. Kenneth McAlpine is a partner in the constructional firm of that name and founder of McAlpine Aviation, distributors for Italian Piaggio aircraft and the Helio Courier. Another Council member is Wing Cmdr. Tim Vigors, founder of the U.K. Piper agency which tops the sales for American aircraft.

With over 60 big business companies in Britain forming the BAUA, including such international names as the British Motor Corporation, Rolls-Royce, the Rootes Group, Dunlop, Imperial Chemical Industries, Unilever, Jaguar Cars, Esso, and Shell Mex and B.P., its aims and objects are wide. They range over practically every interest involved in business flying development in the United Kingdom.

The British economy is based on industrial exports, and most businessmen feel that it is not possible for England to stay out of the European Common Market. Negotiations are in hand for total European economic union, which will necessitate further expansion of British business and sales personnel activities over the Continent.

Excellent airline services exist from London to every capital in Europe, but from the provincial centers of industry in Britain such as Birmingham, Manchester, Swansea or Glasgow, it is not possible to fly directly to most major Continental cities. It is also difficult to rely on scheduled services between non-capital cities anywhere in Europe, while in Britain, only a dozen or so of the very largest towns are so connected. During the summer, when tourist cross-traffic is heavy between the U.K. and the Continent, it is often difficult to book any service at less than several days' notice, so that the common argument about the convenience of executive aircraft to match the needs of business schedules is then even more true.

One of the biggest problems facing BAUA is that of airports. During World War II, Britain became an island aircraft carrier with probably the highest density of airfields of any country on earth. Most of these abandoned bases, with hard-surfaced runways of 3-4,000 feet remain, and the land between the tarmac strips is farmed and hangars used for storage of farm vehicles or industrial goods. Even now it is rarely possible, particularly in southern England, to fly for more than five or 10 minutes without sighting some sort of airfield, but as one executive pilot commented wryly, "Britain is covered with airfields you cannot use."

In some cases, friendly farmers will agree to the use of such fields. But too often, the lease is still held by the Air Ministry, and negotiations become difficult. It has taken six weeks and a £250,000 indemnity to get permission for the use of such fields. As several pilots have found, unauthorized landings at such airfields are prosecuted with excessive zeal, and the usual fines for almost any technical offense against Air Navigation Orders are around £200 ($560). This is part of the bureaucracy which has been strangling non-commercial flying in Britain.

There are about 200 airfields open to use by business aircraft in the U.K., including a number of RAF bases available by prior arrangement—officially, 24 hours in advance. When it is realized that places like Sheffield—almost the biggest steel center in Europe—have no airfield of any sort beyond a coarse sod strip bulldozed on a hillside by one of the industrial operators, the need for air education among the civic community is readily apparent.

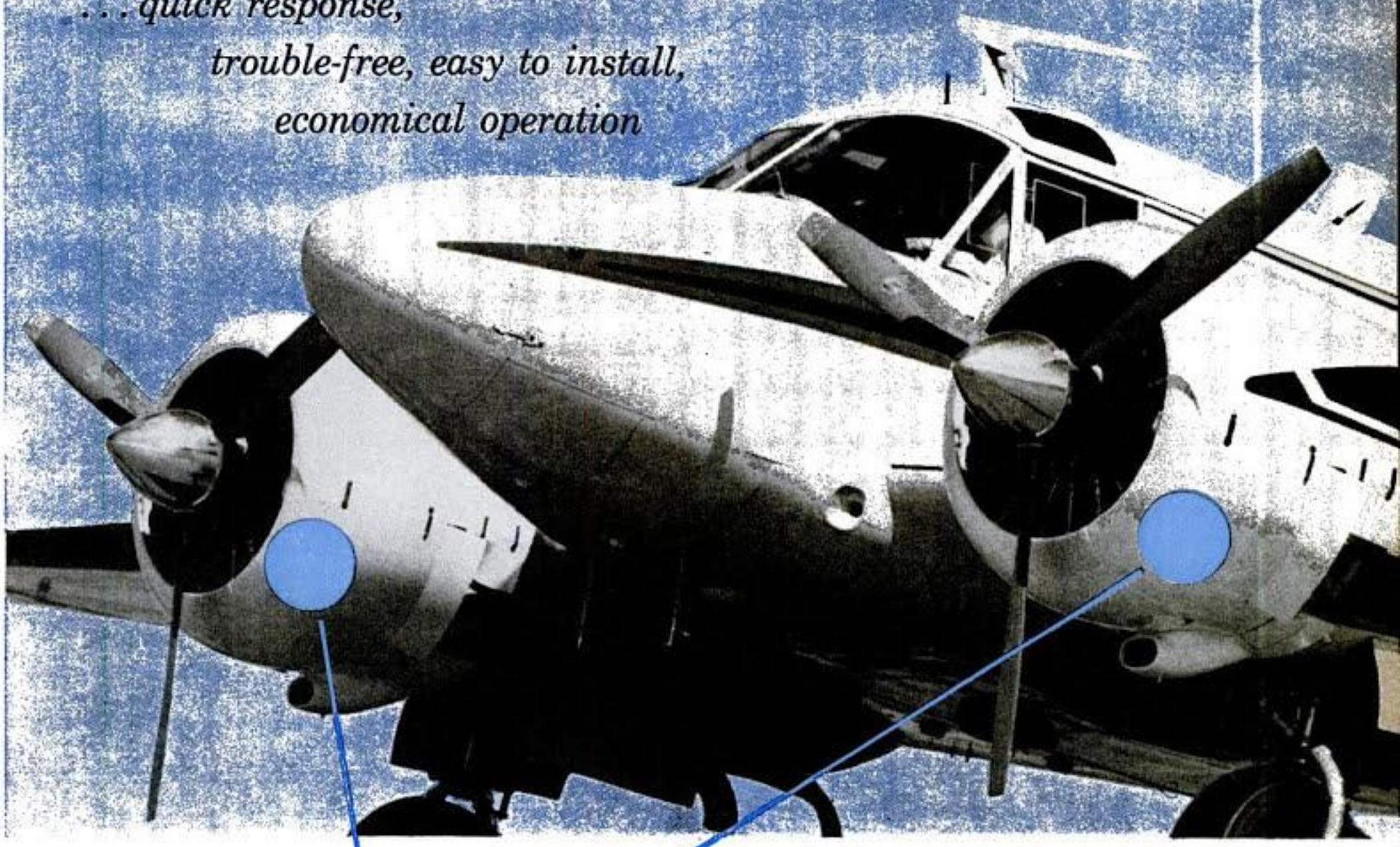
Even London has no airfields with Customs facilities for overseas travel by small business aircraft nearer than Gatwick (27 miles), Southend (40 miles) or London Airport itself. After a long battle, London Airport finally was made available

(Continued on page 90)

BENDIX FUEL INJECTION SYSTEM

Now for the "BEECH 18"

. . . quick response,
trouble-free, easy to install,
economical operation



The first effective fuel injection system for the popular Twin-Beech is now available. Tested and FAA certificated by Aviation Power Supply, Inc., and Bendix for retro-fit on all R-985 engines.

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THE WEEK-END PILOT

BY FRANK KINGSTON SMITH

YOU DON'T HAVE TO BE RICH

The arbitrary division between business aircraft used for executive transportation and sportplanes used for —you should excuse the expression— "fun-flying," is really hurting the growth of aviation. And this upsets me because it is so fallacious anyhow.

If one flies a Mooney Mark 21 to Cape Cod for a session in the surf with stripers, his trip is looked down upon as useless and annoying pleasure flying and cluckings are heard about whether this trip is really necessary. But if he flies the same airplane to the same airport to sell a ton of hacksaw blades, why then it is business flying and the stamp of approval is put on it. Now tell me, does this make sense?

There is a great potential market of would-be fun/business pilots who are grounded today because the stress on business aircraft in advertising has impressed on them the immense cost of flying new airplanes and scared them off the premises. If this is *selling* aviation, I'll turn in my typewriter.

And look at the opposition. Last week we were down in Ocean City, New Jersey, with friends, checking on their boat. The bay area was alive with boat-yards, marinas, dockspace salesmen, and everywhere were boaters hard at work scrubbing, polishing, painting, caulking, sanding, shining and paying and paying and paying. You know why? Because no one ever advertised what the cost per hour is on a boat. Because boats are sold on the sheer basis of fun and relaxation.

Flying can be sold on the same basis. But there is an essential difference. Flying is a year 'round proposition and in a short time an airplane which he flies without the bother of making schedules and confirmations becomes as necessary to a travelling salesman as a car used to be.

Take Dick Raymond, for example.

Dick used to fly night-fighters from carriers during the recent unpleasantness in the Pacific. When his time was up and he went back into civilian clothes, his heart was still up in the sky, but like too many people he figured he couldn't afford to fly his own airplane. You had to be rich to fly, he thought.

It wasn't until he read a book about a fellow who bought a nine-year-old used airplane for fifteen hundred bucks and learned to fly that Raymond realized he, too, could swing it for *that* kind of money. Within a week he shelled out $1,800 for a used Luscombe 8A and got himself back into the blue every week end.

It wasn't long before the Raymond kite had been at the sea shore for surf bathing in the late summer, and in the Pocono Mountains in the winter for skiing, and to New England in the Fall of the year with his wife alongside the pilot and the baby on the shelf back of the seat. It wasn't plush, but it was fun, and it only cost about three dollars an hour.

In time the little tin bird edged into the sancrosanct realm of "business flying." Dick found that he could cover his sales territory faster with his old Luscombe than he could in his new car, and with less fatigue. From his home near Valley Forge he could fly to the Greenbriar down in the hills of West Virginia, then to Virginia Beach on the seacoast, then up to Atlantic City and be home for dinner the same night—a three-day automobile trip, at least. And he still flew for the fun of it on week ends. I know, because I frequently went with him.

After a couple of years Dick found that he wanted a four-place plane to carry his expanding family, and he traded the Luscombe in on a used Tri-Pacer which he flies today for vocation and vacation.

Not long ago I was parking an Aero Commander on the ramp at Palm Beach Aviation when a perky little blue and white Tri-Pacer trundled up and sure enough, there was the Raymond Clan, taking a week end off to grab a little sun and surf in the middle of the cold Philadalphia winter. Dick had made calls on his customers in Georgia and the Carolinas, and knowing his route, had loaded his frau and youngsters in the little plane and arranged things for a hiatus in the Florida heat.

Flying the new singles and twins completely equipped with communications and navigation radios is admittedly costly and too expensive for the average individual for fun, only. But, the fact is that you can fly all over the United States on the Civil Airways with simple radio equipment (I just flew a Cessna 182 with three crystals in its transmitter from Raleigh-Durham to Philadelphia), and an eight- or nine-year-old airplane with a current license flies as well as, or maybe better than the day it came out of the factory. And a lot cheaper.

Flying has so much to commend it, both for business and pleasure, that I resent it when the advertisers seem to ignore the people who are not already in the five-figure income brackets—the very people who could be starting now to learn in easy steps how easy it is to fly and how much fun, and how, if you start at the bottom of the scale it doesn't break your back financially.

Take my word for it. Take up flying. You don't have to be rich.

New extra-performance ashless oil!

ESSO AVIATION OIL E

Engines stay so clean with new Esso Aviation Oil E that pilots can now consider longer inspection intervals for oil screens and propeller domes. But extra cleanliness is only part of the story. This newest ashless dispersant oil delivers the *extra performance* for which Humble aviation lubricants are famous. It reduces wear, thus reducing oil consumption and maintenance costs. And because it is *ashless*, it cannot cause plug fouling. Esso Aviation Oil E has been proven in over 15 million engine miles of flight testing . . . cleared by every major U. S. aircraft engine manufacturer. Because of multi grade characteristics, two grades, E-80 and E-120 meet *all* piston engine requirements. Ask for it wherever Esso aviation products are sold.

Esso

HUMBLE
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(Continued from page 86)

to non-scheduled operators, including business aircraft, in June, 1961.

However, the procedures involved, including restriction to non-peak traffic hours, have not made LAP easy to use by executive airplanes. This occurs at an airfield which rates about 80th in the number of annual movements throughout the World, charges some of the highest landing fees on record and complains continually about losing money. The situation is improving, however, except for single-engine airplanes, and the airport authorities have been very helpful.

As for the formalities involved in travel to the Continent, these may easily take as long as the journeys themselves. One of the first jobs of BAUA was to urge that "the present time-wasting procedures are removed." Council member Geoffrey Woods, whose company, Woods of Colchester, operates a Commander 500B and a Beech Travel Air on European flying, contends that Customs organizations still are geared to the horse and buggy days, since it is in their hands that goods and passengers spend much of their travel time.

At the moment, goods freighted from Britain by normal surface means take something like 20 days to Vienna, 15 to Brussels, 10 to Copenhagen, 16 to Paris, 17 to Milan and 28 to Lisbon. Commercial air freighting is not much quicker, because of administrative delays, besides being excessively expensive, and transport costs by air can easily amount to more than the price of the product.

Geoffrey Woods is one of many British executive operators who is interested in the growth of business air freight, and his Aero Commander was selected for its 1,500-pound cargo capacity in the rear cabin for high density loads. He is also concerned with the longer-range requirements of executive travel, and is therefore interested in the new generation of small business jets.

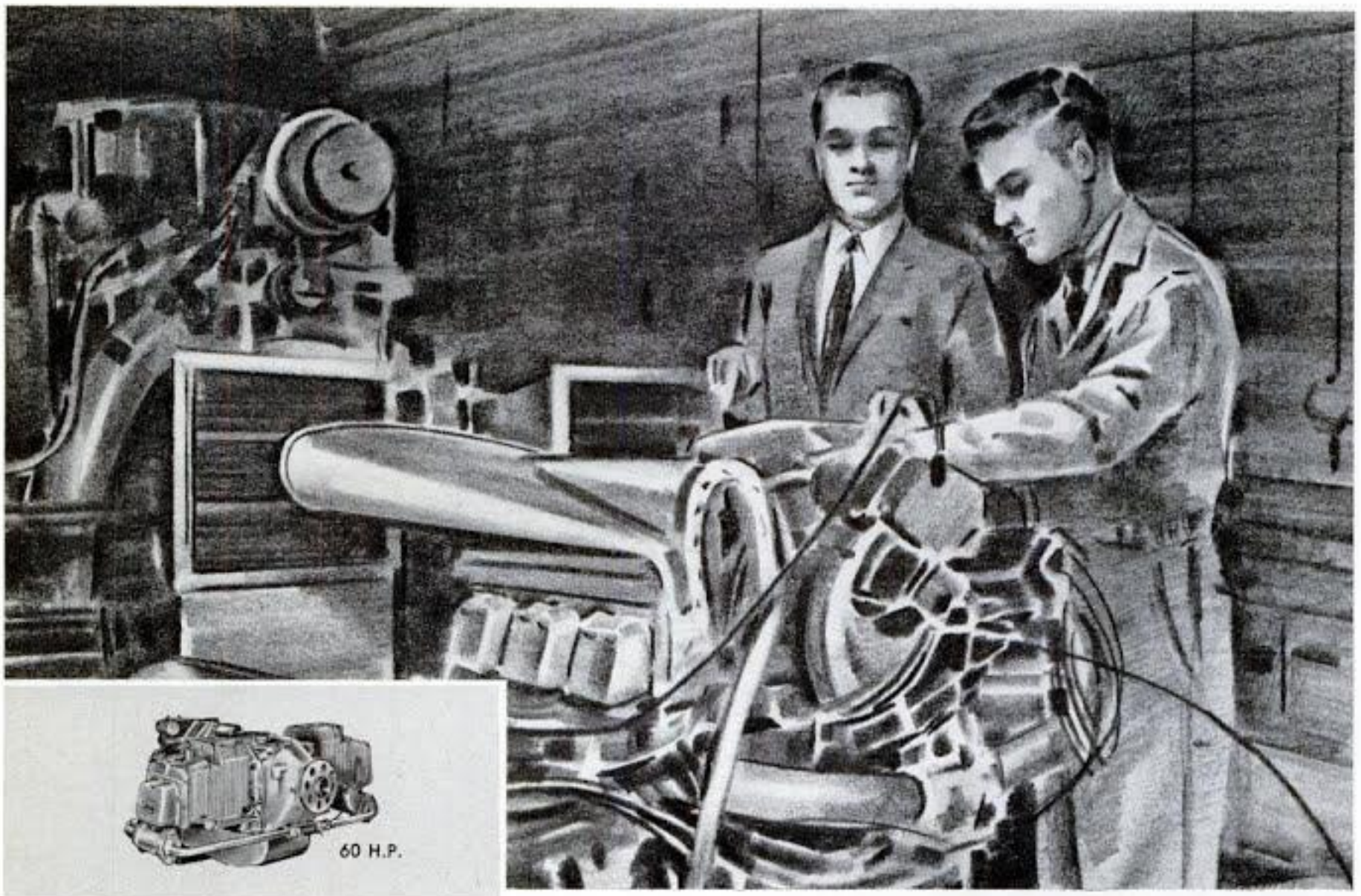
Another jet exponent is J. C. Bamford, who heads one of the leading European excavator companies, and has been using a corporate airplane since January, 1961. He surveyed the entire American and British range of light and business aircraft and visited several manufacturers on both sides of the Atlantic before deciding that de Havilland's well tried Dove, in its Mk. 8 form, was most suitable for his purposes.

A company pilot was hired for the new aircraft, which was christened "Exporter," and flights began to most of the major towns in Europe. The Dove soon lived up to its chosen name, since in the first week or so of its operation it paid for itself by its assistance in the rapid solution of a business crisis in Naples.

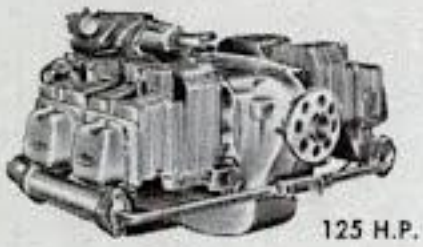
J. C. Bamford was one of the first potential customers for the D.H. 125, the Dove's jet replacement, which he foresees taking over the longer European trips while its piston-engined predecessor continues with internal U.K. operations. The Dove is ideally suited for the stage lengths involved for internal flights, which is one of the reasons why it outnumbers by a factor of three any other multiengined aircraft used in British executive flying.

This owes its post-war foundation to

(Continued on page 92)



60 H.P.



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ON THE TEST STAND TODAY
IN YOUR PLANE TOMORROW

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the Dove, which for many years was almost the only available aircraft, and with the Heron, it is particularly popular for use by the aircraft industry. de Havilland considers that it has had a reasonable production run with more than 500 Doves delivered (including many airline sales) since 1947. The Custom 800 is still being built to order, and many potential customers would like to see it with American engines.

One of the effects of the relatively short European stage lengths is fairly low annual utilization by transatlantic standards. With a planned utilization of nearly 1,000 hours per year, Woods of Colchester makes exceptional use of its Aero Commander, and the national average seems to be nearer the 500-hour mark. Most operators probably manage little more than 400 hours, which makes low first cost important if impossible-looking operating charges are not to appear on the books through massive depreciation.

Normal depreciation rate appears to be spread over eight years down to a residual value of 20 per cent, but some operators have shorter fiscal periods and smaller final book values. For high-cost business aircraft, short depreciation rates can bring these costs per hour to a greater value than any other item. The only consolation is that under the British tax laws, the relief allowed against the purchase price of a new aircraft during the first year means that an airplane as large as an Aero Commander can be operated for a net total of just $6,000 for the whole of that 12 months. For the next and following years, however, the net annual operating costs would undergo a sharp increase to around $22,000 for a 500-hour utilization.

Most users of executive airplanes say that costs do not matter in relation to the job done, and the increase in productivity could not otherwise be achieved. Public companies, however, have to account to their stockholders, and are therefore constricted to some extent in how much they can spend. High costs are among the reasons why not a single helicopter is operated by a British industrial company for executive use, despite the lack of airfields in some parts of the U.K. Several charter companies operate helicopters specifically for executives, but there is no sign of their being overwhelmed by business.

Many requirements for the ideal British business airplane are tailored to the airfield situation. Because of the primitive state of landing fields and widespread use of rough sod surfaces, particularly tough landing gear, long legs for propeller clearance and fairly large, low-pressure tires are needed. As few approach aids are available at most strips, such equipment must be carried in the aircraft. This accounts for the popularity in Britain of the Decca navigational system, which, with its flight log traces the precise position of the aircraft on a moving map, providing a continuous plot accurate enough to bring the pilot to the runway threshold.

Although Decca equipment does not occupy much room, ideally it should be

(Continued on page 94)

THE '62 COMANCHE OFFERS YOU THE BEST COMBINATION OF FEATURES YOU WANT MOST IN A CROSS-COUNTRY AIRPLANE

LOW WING, of course, 7 out of 8 pursuit chasers of "retractables" in '61 preferred low wing for cleaner design, wider, more stable landing gear, better visibility. And Comanche's laminar flow wing, exclusive all-moving stabilator give "steady as a rock" stability in flight.

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RUGGED CONSTRUCTION. Wing spar—one foot deep!—gives Comanche massive strength. You'll find added touches of quality throughout its all-metal construction—such as priming of all sheets *before* assembly to curb corrosion.

BIG CABIN. The Comanche's wide, comfortable cabin has set the standard for spaciousness in modern, high performance airplanes. There's really comfortable room for four big people.

BIG BAGGAGE SPACE. 20 cubic feet, 200-pound capacity with big 20" by 20" door means lots of baggage for four people for even the longest trip. Room for *six* big suitcases plus *more*.

SPEED. Cruise over 180 mph in the 250 hp Comanche; 160 mph in the 180 hp Comanche. And Comanche owners will tell you these figures are on the conservative side.

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LUXURY. Welcome anybody aboard your Comanche with pride. Beautiful decor and thoughtful appointments will please the most fastidious. New optional Palm Beach interior, upholstered with genuine leather and finest fabrics, adds an even finer touch of elegance.

INSTRUMENTATION. No finer panel designed. Easily accommodates full 2½ system, ADF, DME, in factory-engineered configuration for maximum performance of all electronic equipment. Most convenient location of all instruments and controls.

AUTOMATIC FLIGHT. Your choice of two fine Piper systems. The amazing AltiMatic full 3-axis autopilot with course and altitude selector you can set *before take-off*. Or the AutoControl, that makes turns automatically or holds course precisely.

TAKE A LONG . . . THOUGHTFUL LOOK at how well the Comanche gives you the really important features you want in a fast cross-country airplane, *the best combination of them all . . .* at a practical Piper price. See, fly the Comanche 180 or 250 at your Piper dealer's (listed in the Yellow Pages) or write for Comanche brochure, Dept. 5-G.

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Lock Haven, Pa. (Main Offices)
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ATTRACTIVE LEASE AND FINANCE PLANS

MORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

(Continued from page 92)

designed into the cockpit, which must also accommodate other radio and navigation aids. Southern England is well provided with more than 20 VOR stations, including USAF installations, but in the northern part of the country there are few facilities of any kind except for the occasional MF beacon. Other requirements of British executive airplanes include short takeoff and landing performance for small-field operation. In this respect, it is gratifying to see that American manufacturers are paying greater attention to improved flap effectiveness.

As in the United States, most executive operators consider aircraft toilet facilities essential, and all these factors have been considered in the design of the new BEAGLE B.206 light twin. This seats five with a toilet compartment, or seven without, and with two 320-hp Continental GIO-470 engines, will have a 200-knot cruising speed and almost STOL characteristics from its double-slotted Fowler-type flaps. In initial flight tests, it has been flown down to 47 knots, which may be reduced still further in production aircraft by a five-foot increase in span.

The other specialized executive aircraft currently under development in Britain, the D.H. 125, will cost rather more than the BEAGLE's planned equivalent of $84,000 f.a.f., but its cruising speed will be about twice as fast at over 500 mph. The first prototype of an initial production batch of 30 125s is nearing completion at de Havilland's Hatfield factory, and is due to fly in the Spring of 1962. Initially powered by two 3,000-pound Bristol-Siddeley Viper 20 turbojets, the D.H. 125 is being considered for the installation of other powerplants, including the 4,700-pound thrust GE CF-700 turbofans, for the American market.

In Britain, together with the BEAGLE types, it should make an effective contribution to the five-fold increase in business aircraft that seems probable over the next few years. ✚

"I Learned About Flying From That"

(Continued from page 70)

cleared for a straight in approach.

After refreshing ourselves I had the good fortune of speaking with the operator who had talked me down. The conversation was very rewarding. I would like to pass on my personal praise to the men everywhere who are performing this and associated services. They are doing a wonderful job.

This experience taught me among other things these three lessons: (1) Know the typical weather for the area in which you are flying. For instance, lower California has basically coastal and desert weather, and where the two meet, you can expect nearly anything. (2) Remember that no report given you by the Weather Bureau is guaranteed representative of the weather you will find while flying through the report area. (I am certainly not being critical of the fine job our weather service is doing, just pointing out the present physical incapability of monitoring every place all of the time.) (3) Keep an eye on the weather behind you as well as in front. ✚

BATTLE AREA

Mobility WITH THE CARIBOU AC-1

The STOL Caribou carries 32 combat troops . . . or 3 tons of cargo . . . or 2 army jeeps . . . Takes off in 725 ft. . . . Lands in 670 feet . . . Air drops pallets up to 6000 lbs. . . . Accommodates 22 ambulance litters plus 4 seats.

THE STOL CARIBOU
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DOWNSVIEW ONTARIO

WASHINGTON REPRESENTATIVE: J.E. McDONALD - 319 TOWER BUILDING - 14th & K STS., N.W.

Phantom II

(Continued from page 63)

This was demonstrated by flying formation with a Ryan PT-22, WW II primary trainer. At the Ryan's top speed of 118 knots, the F4H-1 had no difficulty in maintaining its wing position.

High performance, however, is only one facet of the F4H's overall capability as a balanced weapon system—a system in which airframe, fire control system, missile armament and crew are integrated into a fighting unit capable of operating in the modern aerial warfare environment.

The Phantom II can deliver Sparrow III and Sidewinder missiles against high flying targets in addition to a full range of ground strike "iron" bombs and nuclear stores. Simply varying the armament can change the F4H-1 from an air defense interceptor to a low-flying attack weapon system suitable for a "brush" war or all-out nuclear action.

This mission versatility has also interested the U.S. Air Force. Results of Project Highspeed, an evaluation held by the Air Force to compare air superiority performance of the Navy F4H and the USAF Convair F-106, have placed the F4H ahead in most categories, although final results have not yet been released by USAF.

With the present high cost and long time schedule required to develop high performance aircraft, a single, multi-mission airplane proves particularly attractive to the Defense Department. With the present emphasis on missiles, no active combat aircraft designs are in the schedule. Therefore, the F4H may well become the last great fighter used by all branches of the military services.

The development history of the F4H, typical of many high performance airplanes, covers a period of eight years. The first lines were laid down in McDonnell's preliminary design department in 1953 in response to a U.S. Navy specification for a fighter to replace the F4D and F3H series. As usual with military designs, the proposal was worked up using company funds.

A letter of intent from the Navy in 1954 gave the F4H official status. This authorized further engineering as well as production of a limited number of test airplanes. F4H production for McDonnell was not assured, however. Like most new military designs, the government has much at stake in an individual contract. After spending millions of the taxpayers' dollars, the weapon system is not always a military success. The government cannot risk the defense of the country by dumping all of its eggs in one basket. If the F4H failed to live up to its expectations, precious years of irreplaceable development time, as well as dollars, would have gone down the drain—and still no weapon system. Thus, a companion development, the Chance-Vought F8U-3, powered by one J75 engine, was also under contract, competitive with the F4H.

Since only one, either the F4H or F8U-3, would be awarded a production contract, both companies, especially the engineering departments, developed a highly competitive attitude. It was well known, however, that cost to the economy-

(Continued on page 98)

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TEXACO

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(Continued from page 96)

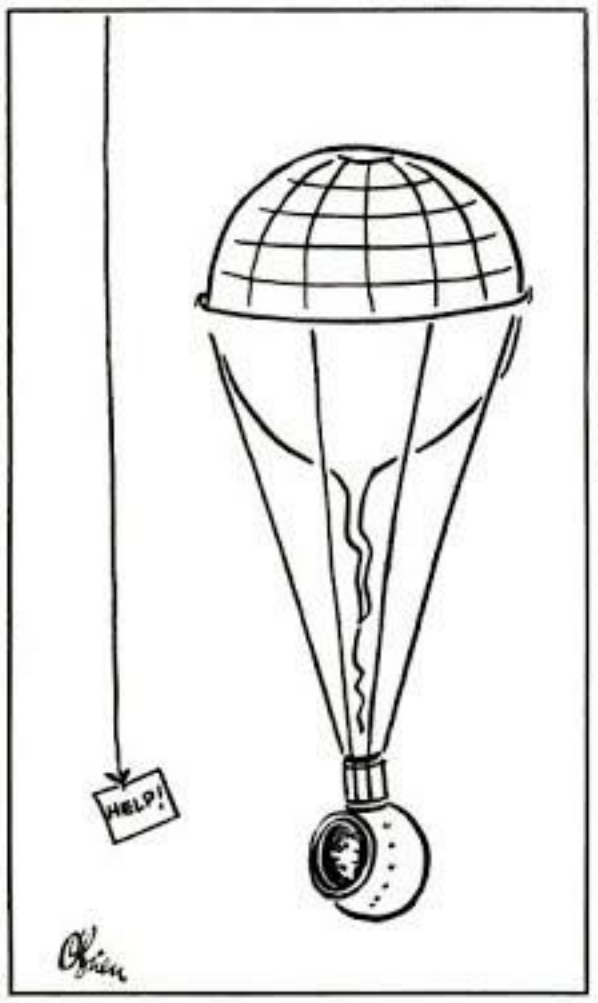
minded Defense Department would be an important item—and the F4H-1, with its two General Electric J-79 engines and two-place design vs. the F8U-3's one Pratt & Whitney J75 engine and single-place design—was definitely more expensive. The F4H-1 would have to justify its additional cost to the Navy by providing increased combat capability and growth potential over the F8U-3.

The design race between the F4H-1 and F8U-3 also became a race to see which airplane would make its first flight ahead of the other. The F4H-1 won this dubious honor by making its first flight on May 27, 1958, approximately one week ahead of the F8U-3.

It is indicative of the confidence McDonnell had in their F4H-1 that the first flight was made from Lambert Field, the St. Louis municipal airport. Most "hot" military airplanes are usually packed in a box and trucked to Edwards Air Force Base in California for their first flight. But Bob Little, then 33 years old and "Mac's" chief test pilot, knew the airplane would fly without requiring the added assurance of Edwards AFB's dry lake bed. He had been at the controls for the first flights of other MAC airplanes.

The 20-minute first flight, however, was only the beginning of a long flight test development program. A high-performance fighter is far from combat ready after its first shakedown flight. A total of 23 test airplanes were in the original contract. Each was individually instrumented to carry out a specific phase of the flight test development program. For example, separate airplanes were assigned for aerodynamics and performance development, powerplant, equipment, electronics, armament, boundary layer control, etc. These test programs were simultaneously carried out in St. Louis as well as at Edwards AFB for some of the more hazardous tests such as the spin program.

(Continued on page 104)



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KX-100

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Don't lose your Omni — just when you need it most! With the KX-100, you need not turn off your Omni or Localizer to talk to airways, approach control, departure control or tower. The KX-100 performance features cannot be equaled at twice the cost! **ASK THE MAN WHO COMMUNICATES AND NAVIGATES WITH KING!**

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Transmitter: 10 watt rf output 90 channels, crystal controlled, 118.0 to 126.9 mc, 100 kc spacing. Mike gain and sidetone adjustable. Crisp, clear speech with extra-long reach. Meets .005% transmitter frequency tolerance.

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BY J. S. BUTZ JR.

WASHINGTON CLIPBOARD

NAVCOM PROGRAM

A rundown of navigation and communication equipment needed on general aviation airplanes in the future has been given by the FAA. Joseph D. Blatt, director of the FAA's Aviation Research and Development Service, made the following points recently in describing the Air Traffic Control system the agency is now planning.

- Low-frequency radio ranges are on the way out. Automatic direction finders will be of decreasing value during the next few years as the ranges are removed from service. They probably will all be gone in five years.
- The VORTAC and ILS systems will be expanded and will become the standard instrument navigation facilities for the nation. At the beginning of this year 293 VORTAC, 216 ILS and 422 VORs were in service. Their initial investment value was $230 million. Within five years, $492 million will be spent on converting the VORs to VORTAC and in building new VORTAC and ILS facilities. VORTAC accuracy will remain at plus or minus 1.5 degrees.
- Air-ground communications will be by voice radio at least for the next eight to 10 years. Automatic data link systems to take part of the present voice load are out for the present as it appears that they cannot be produced at reasonable cost.
- High-frequency radio is on the way out, and HF transmitters used by the FAA will be decommissioned during the next five years.
- All services for civil aircraft will be provided by VHF radio. The line is going to be held at 360 channels in the 118 mc to 136 mc range with 50 kc spacing. All ground equipment will be modernized to this spacing within five years.
- Radar beacon transponders, it is hoped, will be carried on all aircraft flying in the areas of positive control. The transponder beacons greatly improve the range capability of ground radar in both horizontal and vertical planes. They also make it possible for the controler to rapidly identify the various aircraft on his radar scope. The beacons will allow greatly improved emergency techniques to be used to assist pilots in distress. They will also provide a very efficient radar hand-off technique for ground controllers.

Many of the attractive features of the new Air Traffic Control System depend upon the wide use of transponder beacons in private aircraft. FAA officials want to get the beacon price down to $500 so they will not be an undue financial burden. Many industry engineers, however, predict that the price cannot be reduced below $2,000. If this proves true, there may be some fundamental alterations in the new ATC plans.

° ° °

Project Little Guy has been taken out of the advanced planning stage and given full program status in the FAA. Colin G. Simpson, a former industry engineer associated with North American, Douglas and Weber Aircraft, has been placed in charge of the project.

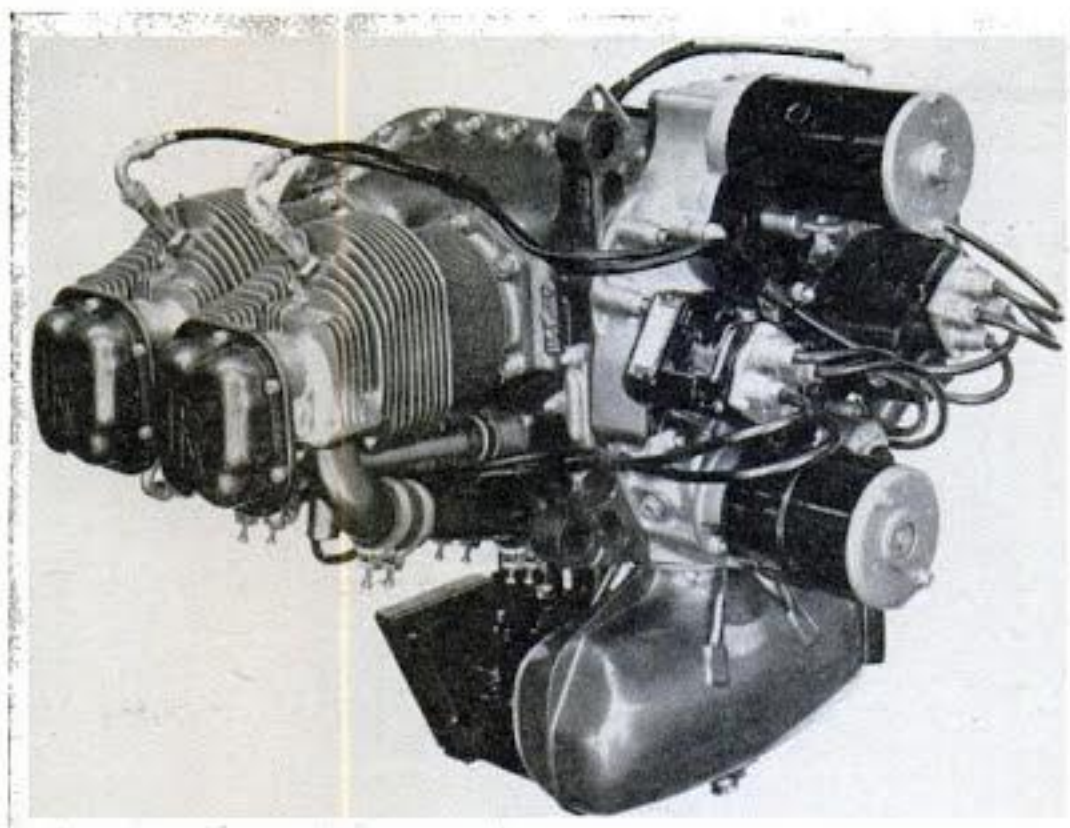
The objective of Little Guy is to assist industry in developing a simplified, low-cost, extremely reliable cockpit layout which will make instrument flying much easier than it is today (see FLYING, Jan. 1962). Ultra-modern instruments are planned for the cockpit. Many of them will be simplified versions of the latest military systems.

FAA announcements state that the Little Guy cockpit "probably will include a large pictorial display combining the functions of compass, artificial horizon, turn-and-bank indicator, altimeter, and airspeed indicator; a central navigational display showing aircraft position in relation to charts projected on the screen; auxiliary displays for status and warning; and simplified controls."

Little Guy now is scheduled to be a three-year project, and a flyable prototype of the cockpit will be produced during that time. The FAA will call upon aircraft industry firms to participate in the development of the cockpit. Interested firms will submit design proposals, and the winners of this competition will produce the major components. The FAA will integrate the components into the final system. Complete information on the prototype cockpit will be made available to all of industry.

Hopefully, the cockpit will be so superior to current equipment that industry will mass produce it.

Cost goal for the Little Guy cockpit is under $3,000 on the retail market. This includes all navigation and communication systems. Some engineers believe that electronic technology and production methods are developing that five years from now it may be possible to sell the cockpit for about $1,500.



ROLLS-ROYCE CONTINENTALS

Rolls-Royce is anticipating a market in Europe of about 2,000 light aircraft per year for its licence-built Continental engines, which include the 95-hp C-90, the 100-hp O-200 (*above*) and the 145-hp O-300. Tooling for these engines at the Crewe works has been completed, and the first complete Rolls-Royce Continentals will be delivered in the last two or three months of this year.

Initial British-built engines will be the 100-hp Continental O-200, which is the most popular of the range at the present time. Since about 90 per cent of the tooling, and many of the components are common with the O-200, the C-90 will follow soon afterwards; and the O-300 will be in British production by early 1963. Manufacture of all these engines is in hand, but an additional design in the Continental range—the 310-hp GIO-470—for which Rolls-Royce also has the licence, is not due for construction in Britain until mid-1963.

Main customers for these powerplants will be BEAGLE in the United Kingdom, and Morane-Saulnier in France, although Rolls-Royce has sales rights for the whole of Europe, for licence-built Continentals. These can also be sold in Australia and New Zealand, while Rolls has in addition exclusive rights to distribute the entire range of Continental piston engines throughout these areas.

As a start to its Continental service, the British company has laid in a stock of spares with a net value of about $150,000 and already is offering a much quicker replacement supply than was previously possible. It has also established factory repair and overhaul facilities, and can offer service exchange engines for time-expired powerplants.

Morane-Saulnier is building up to a production rate which will eventually result in the delivery of about 800 Rallye lightplanes per year, and these will use all three types of Continental currently designated by Rolls-Royce.

BEAGLE's annual production of about 800 aircraft will include something like 150 B.206 executive twins, which will be powered by the 310 hp GIO-470, initially from U.S. sources.

The remaining BEAGLE types using the Rolls/Continental will be the O-300-powered M.218 light twin, due to fly in mid-1962; the same airframe with either a single O-200 or O-300—the BEAGLE-Miles M.117—a 1963 airplane; and the re-engined Auster AOP Mk. 9, with its Bombardier powerplant replaced by an IO-470, for the British Army Air Corps. Some Airedales are also likely to have the GO-300, although production of this model will be limited to a strictly interim quantity, pending availability of the M.117.

Elsewhere in Europe, the largest production quantities of Rolls/Continentals are likely to go to Germany, where the Bölkow company is set to produce about 250 examples of the low-cost MF-1 Junior each year. The two-place Junior is powered by the O-200-A engine, and should sell in Europe for considerably less than either the Piper Colt or the Morane-Saulnier Rallye. It is also fully acrobatic.

France also will take fairly substantial quantities of engines, for the Jodel series, which are built by several manufacturers such as SAN, Wassmer, Centre-Est, etc. Some Continentals will also go to Max Holste later this year, when production starts of the Cessna 172 and perhaps the Cessna 310. Cessna is a majority shareholder in this French company.

John Fricker

MAY 2, 1923 LONG ISLAND, N. Y.

Yesterday—Overloaded, with a shuddering roar the Fokker T-2 dragged west across Long Island's treetops. For two Army fliers inside, each minute was eternity.

Crossing Dayton at dusk, they plunged on through a night of drizzling clouds and guessed a glow in the ooze was St. Louis. It was.

Down through clear dawn they saw the adobe huts of Tucumcari's Indians. Then the desert gave way to Imperial Valley's cool green. Over the last mountain, they swooped on San Diego.

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S T A N D A R D O I L C O M P A N Y O F C A L I F O R N I A

(Continued from page 98)

Although the flight development was conducted by McDonnell's civilian test pilots, Navy pilots would periodically fly the airplanes to evaluate the progress of the program. Again, results of the Navy evaluations could easily terminate the entire, expensive F4H-1 contract.

The rugged competition between the F4H-1 and its rival, the Chance-Vought F8U-3 was finally brought to a head by announcement of a direct evaluation of the two airplanes under simulated, accelerated service tests at Edwards AFB during the latter part of 1958. Each airplane was flown on grueling missions by top Navy test pilots to compare their combat capabilities.

Although both airplanes probably met the Navy's steep requirements equally well, the more expensive F4H won out. The addition of a radar operator, the fact that the plane is powered by two engines and has a greater growth potential, became decisive factors in the choice. It is suspected, however, that the Navy would like to have ordered both airplanes if the budget had permitted it.

Loss of the F4H contract would have cost about 5,000 workers their jobs. During 1960-62, a total of about 10,000 workers were involved in F4H production. The economic impact upon the local area, however, becomes even greater when considering the approximately 400 suppliers and sub-contractors in the area. So, a successful airplane affects many people in all walks of life.

What makes one airplane such an outstanding performer? How can it be the world's fastest non-rocket airplane and yet land slow enough for carrier operation? Can all this performance be achieved without sacrificing short takeoff, range, and multi-mission combat capability? And, last but not least—how can it be within the skill requirements of the average well trained military pilot?

To understand this airplane, one must understand the organization behind it—especially the creative engineering personnel responsible for the design concepts.

The Phantom II's heritage emphasizes what could be called a McDonnell tradition—the twin-engine fighter. The engineering team has been consistent with this design concept in all previous "Mac" fighters, except for one, the XP67 of 1943. The Navy series of fighters starting with the FH-1 Phantom, followed by the F2H Banshee, were all twin jet fighters. The USAF F-101 Voodoo series was also of the same basic two-engine design. The only exception was the F3H Demon powered by a single J71 turbojet engine, now in extensive service with the fleet.

If twin-engine design can be called a McDonnell tradition, it is the only "MAC" tradition, for the company's young engineering department attacks each new design with almost no regard to the past. The success of the F4H stems in part from the McDonnell philosophy of designing each new vehicle to its unique requirements rather than stretch existing designs for marginal success.

One of the secrets of the amazing performance of most McDonnell designs is extremely simple—power. The power de-

(Continued on page 106)

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(Continued from page 104)

veloped by the two G.E. J79 powerplants is almost equal to the airplane's gross weight. What this does to takeoff run and rate of climb is well known to a pilot. No "MAC" airplane was ever known as a runway hog. In fact, the F4H-1 requires less than one-third of the St. Louis Municipal Airport's 10,000 foot runway for normal takeoff.

Power, combined with variable area engine inlet ducts and wind tunnel tested aerodynamic form, provide its record breaking speed. Wing area, leading edge flaps and boundary layer control allow this Mach 2.5 airplane to slow down to less than 118 knots for easy carrier landings.

The basic design with two engines mounted side-by-side in the fuselage, provides space for more fuel than is usually possible in jet fighters. Contrary to most

(Continued on page 108)

PHANTOM II

Time-To-Climb Records

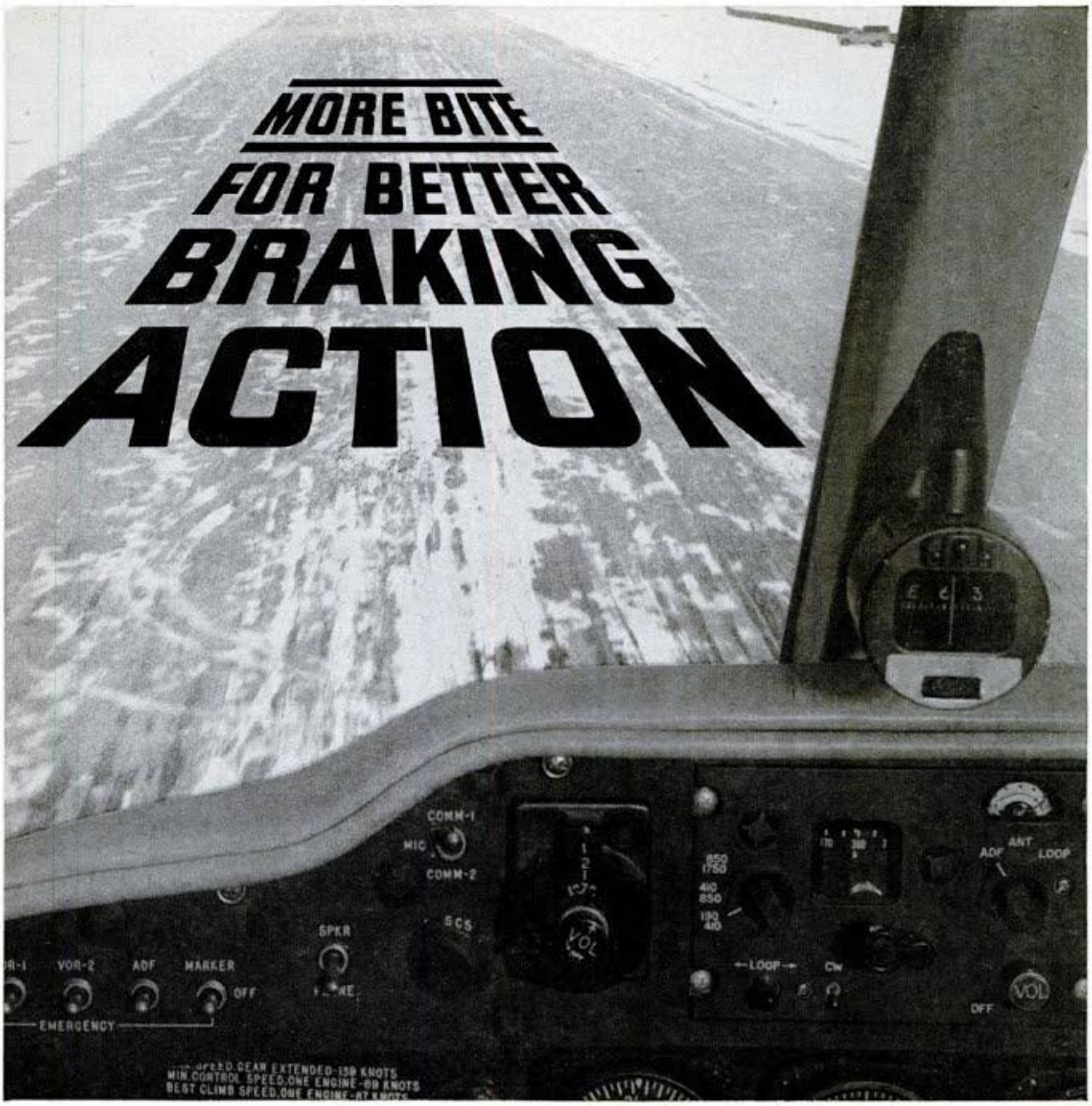
THE U.S. NAVY has claimed five world's time-to-climb records for the McDonnell F4H twin-jet fighter.

The record flights were conducted in February and March 1962 at the Naval Air Station, Brunswick, Maine, and the results submitted to the National Aeronautics Association, subject to confirmation by the Federation Aeronautique Internationale.

The records and test pilots who set them are:

3,000 meters (9,842.5 ft.): 34.523 seconds, LCDR J. W. Young, USN; 6,000 meters (19,685.0 ft.): 48.787 seconds, CDR D. M. Longton, USN; 9,000 meters (29,527.5 ft.): 61.629 seconds, LTCOL W. C. McGraw Jr., USMC; 12,000 meters (39,370.0 ft.): 77.156 seconds, LTCOL W. C. McGraw Jr., USMC; 15,000 meters (49,212.5 ft.): 114.548 seconds, LCDR D. W. Nordberg, USN.

These new marks bring to 10 the world records claimed by the F4H.



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Firestone

(Continued from page 106)

piston-engine designs, the space required by fuel is more critical than its weight. Thus, it is usually lack of available tankage that limits the range of most jet airplanes. An unbelievable quantity of fuel is contained in the F4H's six fuselage cells and one integral wing tank. In addition, fuel for long range missions and ferry purposes can be carried in external tanks.

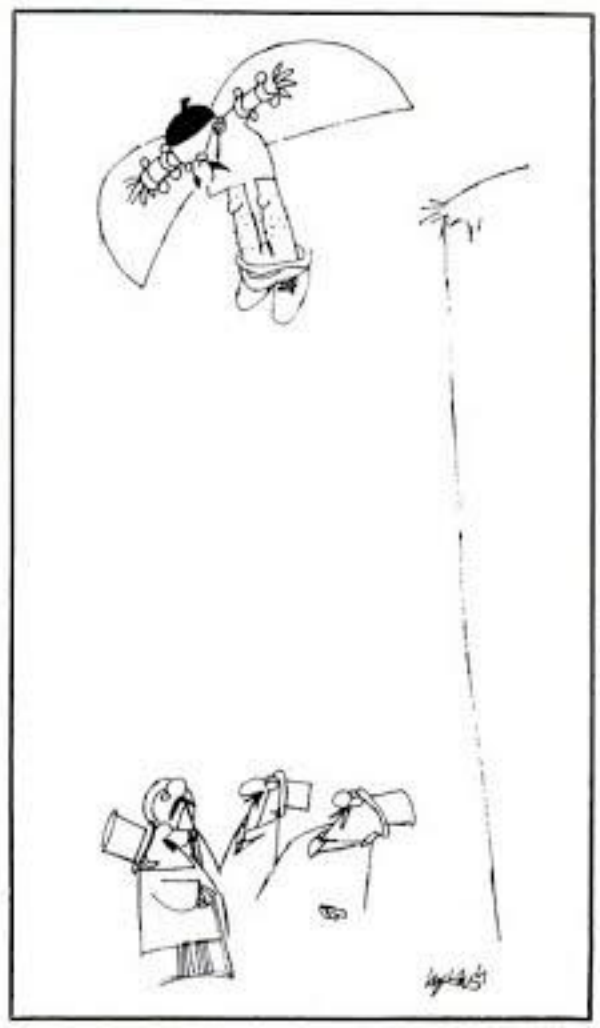
Fighter airplanes equipped with an elaborate fire control radar system, such as the F4H-1, can be operated entirely by the pilot or with a pilot-radar operator team. The military services have not decided which is the better arrangement.

A two-man crew would obviously be more satisfactory than a one-man crew, provided the performance penalty was not too great. Judging from the Phantom II's performance, the two-man crew has not appreciably affected it. The additional crew member can also double as a navigator on long-range missions. This is a decided advantage in a fighter airplane during wartime radio "blackout."

During 1963, this Navy airplane will begin to appear on U.S. Air Force bases under the Air Force designation of F-110. The Tactical Air Command will use the F-110 for air superiority and ground support missions to complement the F-105. There will be no reconnaissance version of the F-105. Instead, with a re-designed nose, the RF-110 will fulfill this mission. A pending decision may also result in procurement of the F-110 by the Air Defense Command.

In this age of specialization—and phenomenal military budgets—it is gratifying to the U.S. taxpayer that one airplane can effectively perform such a variety of missions to the satisfaction of such widely diversified services as the Navy and Air Force.

You will for certain see the Phantom II around for many years to come, wearing all kinds of hats. ✚



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SHORT-FIELD TAKEOFF, FLAPS OR NO?

ASK ANY THREE pilots about their flap technique for short-field takeoffs, and chances are you'll get three different answers.

How can you in the shortest distance loft your aircraft over the classic 50-foot obstacle—safely? Some will tell you to use partial flaps, some no flaps. Some aircraft manuals say use flaps, some say don't.

We put the question to an expert—Cal Wilson, chief of aerodynamics for Piper Aircraft Corp., Lock Haven, Pa.

He said that for most lightplanes the optimum procedure is as follows:

Hold brakes and runup to full takeoff power, using no flaps. Release brakes and wait until you have reached the no-flaps power-off stalling speed of your aircraft. Then drop about one-third flaps and fly the airplane off the ground.

This should give the maximum angle of climb for a short-field takeoff. Don't confuse this with the best rate of climb, though. Wilson says the latter is best achieved without the use of flaps.

The reason for delaying dropping partial flaps until fly-off speed is reached, is to eliminate that extra drag imposed by flaps that will lengthen the takeoff run. Wilson suggests, however, that to simplify matters beginner pilots lower the one-third flaps before they begin their takeoff roll.

If you're wondering about the cushion of airspeed you'll have over the power-off stall speed used in climbing, two factors increase your margin: the lowering of flaps and, of course, use of takeoff power. Both these lower an aircraft's stalling speed.

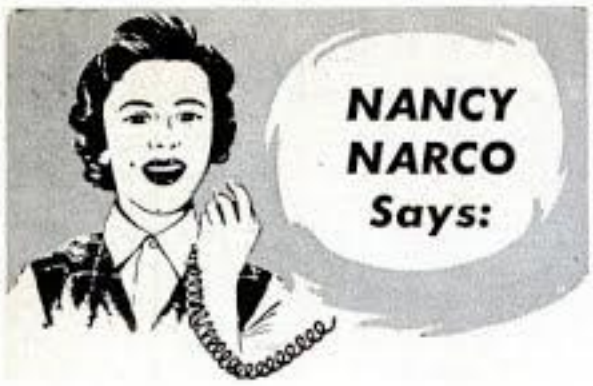
Wilson says the above technique can be expected to reduce the takeoff distance over an obstacle by 10 per cent or better on most aircraft.

For example, use of 15 degrees of flaps on the '62 Comanche 250 lowers the ground roll from 1,520 feet to 1,160, and the distance over a 50-foot obstacle from 2,050 to 1,650 feet. This represents almost a 20-per cent reduction.

As for the advice your aircraft manual will give on the use of takeoff flaps, the reason is: before a manufacturer can recommend use of takeoff flaps, the aircraft must be certificated to do just that. And the FAA requires that to qualify for certification in takeoff configuration the airplane must be able to climb at a rate equal to at least 10 times the power-off stall speed (in takeoff configuration).

So if the stalling speed is 60 mph, the rate of climb must be 10 times that or 600 feet per minute.

But of course not all aircraft that can meet these standards have necessarily been certificated by their manufacturers for takeoff with flaps.



RADIO CHARTS

If you have an Omni and ADF in your airplane, but use only Sectional or WAC charts for navigation, you're cutting down the usefulness of your radios and your ease of navigation. As you know, the Sectional Charts are designed pretty much for strictly VFR flying and they don't attempt to show the ILS localizer courses or the ADF homing facilities at the Outer and Middle Markers of an ILS System.

For instance, I was studying the Jeppesen chart for the Kansas City-Topeka area the other day and comparing the facilities shown in this with the Sectional chart for the same area.

Here's what you get on the radio chart that you can't "see" or use on the Sectional Charts: *four* ILS courses which serve as excellent cross checks or "airport finders" as much as 40-50 miles out, *seven* ADF homers and one military Omni—total of 12 valuable radio aids for the VFR pilot which aren't shown on the Sectional Chart, nor the WAC's for that matter. Any of these facilities would prove mighty handy both for routine navigation through and around a busy terminal area like Kansas City or for finding an airport in hazy conditions. For instance, if you were going to Topeka Municipal you'd see on your radio chart that you could tune your ADF to the Middle Marker—just half a mile from the end of the runway.

Now we're not maligning Sectional or WAC charts—they're a must in any airplane and a pilot who goes cross-country without such charts for the route is unwise. But it would be impossible to keep these charts up-to-date with the rapidly changing radio facilities.

Where do you get radio facility charts? You can buy individual area charts—just as you'd buy Sectionals or WACs—published by the Coast and Geodetic Survey, or you can subscribe to the service. The latter is highly recommended since radio facility charts are brought up-to-date almost every month because of new Omnis going in, frequencies being changed or other reasons.

Perhaps the most widely known radio charts are the Jepps—published by Jeppesen and Co., Denver. They offer a variety of subscription services ranging from up-to-date en route radio facility charts to full IFR service including approach charts for all airports with approach facilities. Coast and Geodetic Survey also offers the same general service and each can be subscribed to on a regional basis.

If you have any radio equipment in your airplane, it will serve you so much better if you know all the facilities (and up-to-date numbers) available to you.

Regards,

Nancy

NARCO • Fort Washington, Pa.

Fletcher FU-24

(Continued from page 67)

more conventional antibalance type.

The vertical stabilizer and rudder are standard size, yet the rudder, in all flight conditions from red-line speed to stall, is a very low force authority control. Although always sufficiently effective to keep maneuvers coordinated, and/or to retain directional control, the rudder nevertheless is not powerful enough to cause a problem.

The FU-24 evaluated by FLYING was N6507C, a company demonstrator, which has a passenger-cargo and two-pilot interior configuration. Engine controls are mounted in the center of the panel. Flap handle is located between the two front seats. The aircraft was ballasted with lead in the passenger compartment to obtain the maximum Part 3 gross weight of 3,500 pounds.

Two flights were made in N6507C. The first was with Gerry Barden, chief engineer and test pilot for Fletcher, in order to familiarize the writer with the left-hand stick control and the airplane.

The second flight, solo, at gross weight, was used to "work" the airplane in typical agricultural applicating operation over the Pacific Ocean.

During the first flight, a number of landings and takeoffs were made. Several attempts were made to induce the aircraft into high-rate responses with partially stalled wings and controls. Here, however, the rudder proved unable to produce snaps. Sudden and complete displacement of the rudder from one extreme to the other when in a very nose-high, power-on stall only yielded an uncertain wavering of the nose.

Similarly, an attempt to execute a vertical reverse also went begging. In the loading position of the ballast, the CG was toward the rear, but not at the rearmost position, and while this fact was used in trying to perform the same maneuvers as are possible with a high force authority control, the effort failed.

It also became apparent during the flight that control forces in pitch and roll axes increase uniformly with airspeed up to a point, at which they seem to jump. The sharp increase becomes noticeable first in the pitch axis, then in roll.

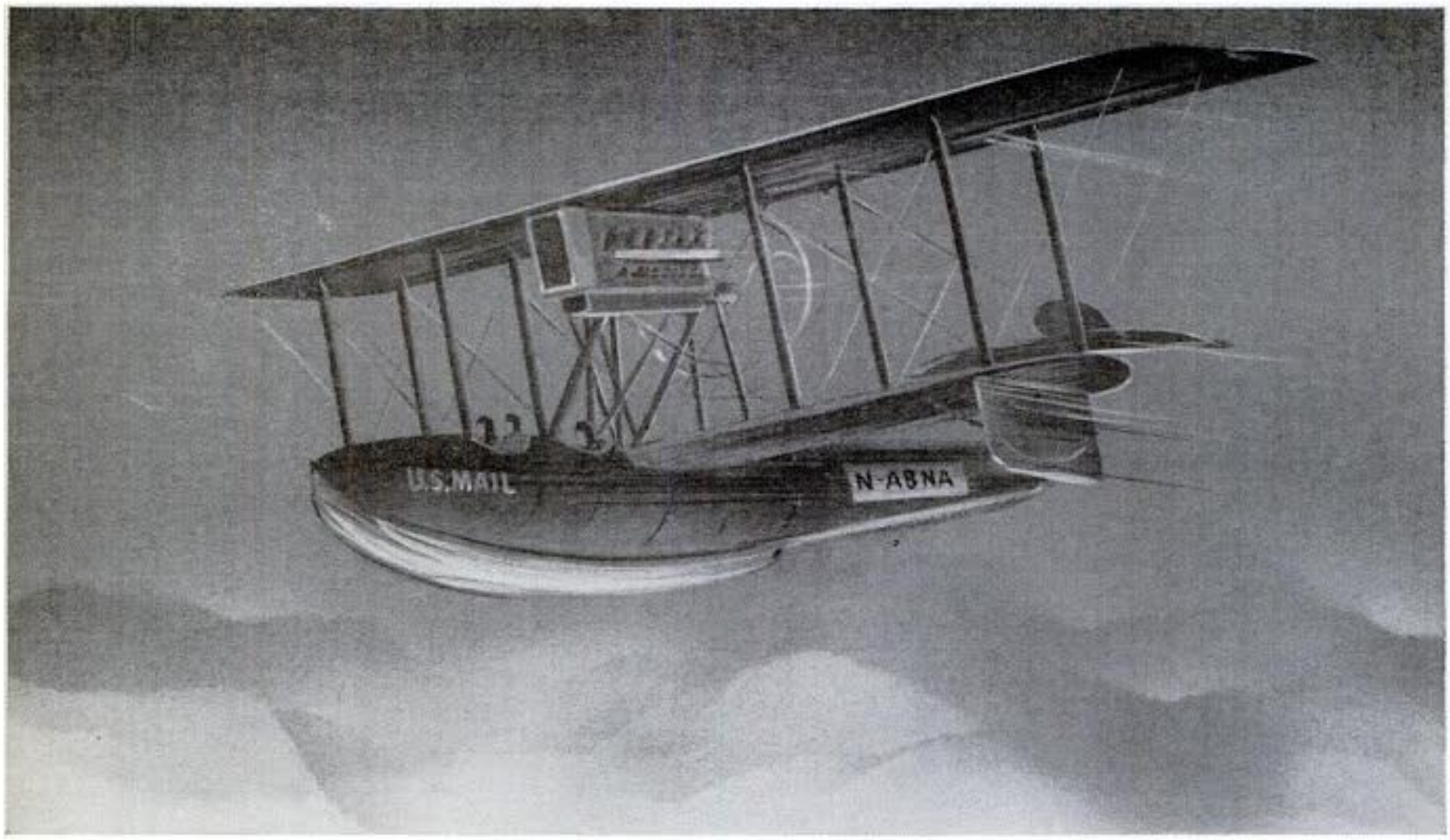
The control force gradients in the airplane obviously are matched to the mission, as are response rates. Coupled, the two add up to a very controllable and maneuverable aircraft at the working speeds, with a fairly stiff control system at higher airspeeds.

The Fletcher's lifting ability showed up well, early in the evaluation, in respectably short takeoff roll with or without flaps at maximum gross weight and a reasonably low airspeed. First notch down, or 20 degrees, is takeoff setting; full, or landing flap, is 40 degrees.

For a real leap-off, again at gross weight, full power is applied with brakes held and flaps up. At brake release, the airplane is allowed to roll about 100 feet, then flaps are dropped to takeoff setting and the FU-24 is hauled off at about 50 mph after a 500-foot ground roll or less.

When hauled into the air, the Fletcher is definitely flying, not staggering. Trim

(Continued on page 114)



Boeing 1919 B-1

The Boeing B-1, the first and only one of its kind, was piloted by Eddie Hubbard to fly the nation's first private contract international mail route. Seated in the rear cockpit, he carried the mail between Seattle and Victoria, B. C. Two passengers could be carried in the front cockpit. The plane originally was equipped with a 200 H.P. Hall-Scott engine, but was replaced by a 400 H.P. Liberty. Its top speed was 90 m.p.h. with a range of 400 miles.

In service for ten years, it is now in the Seattle Museum, displayed for visitors who are reminded of its early use in the delivery of U. S. Mail.

Just as Eddie Hubbard established one of aviation's "firsts", Parks College also continues to establish many firsts. Parks was first to be a government accredited aviation school and has graduated more students with B.S. degrees than any other aviation school in the nation. There is a place for you in aviation . . . why not write for Parks' View Book that shows how Parksmen live and learn. You have nothing to lose — and much to gain!

(Continued from page 112)

can be used to offset the required stick force to a degree, although common practice calls for a fairly neutral trim position for all takeoffs.

Landings and other maneuvers near the ground clearly demonstrate the wing's lifting ability. The comparably large area and span obtain the fullest measure from ground effect.

This shows up in go-arounds as well as landings and takeoffs, in that at airspeeds from 65 mph upwards to flap limit speed of 80 mph, the flaps can be retracted from takeoff position without noticeable sinking.

In landings, the airplane can be brought "down the chimney" at 60 mph IAS at gross weight, using full flaps; but care must be used in the flare.

An attempt was made to land the FU-24 out of a coordinated left turn from a circular overhead approach. Net result was a leveling of the wings when the lower wing entered ground effect about six feet above the surface. No attempt was made to literally sideslip the airplane onto the ground.

One fact is apparent about the Fletcher from the very first landing—all landings are good ones (based on the concept that a smooth or soft landing is a good one). In this case, the pilot has something going for him from the start. The FU-24 uses large balloon tires, with the nose wheel inflated to 11 psi and the main wheels to 18. This arrangement is made for rough field operations, but serves to boost any pilot's opinion of his landings.

For normal operations, the FU-24 is climbed at 80 mph IAS, which gives a 500 fpm climb rate.

For a maximum angle climb, leaving the flaps down and climbing at 70 mph IAS using 2,500 rpm and 26 inches mp, the Fletcher will hold a respectably steep angle, although the attitude does not seem at all severe.

(Continued on page 116)

FLETCHER FU-24
(260-hp engine)

Performance: (at gross weight)	
Speed	
Maximum at sea level	143 mph
Cruise, 75% normal rated power	127 mph
Minimum speed, power off, full flaps	48 mph
Minimum speed, power off, flaps retracted	56 mph
Service ceiling	17,000 ft.
Absolute ceiling	19,400 ft.
Takeoff over 50-ft. obstacle	950 ft.
Land over 50-ft. obstacle	less than 900 ft.
Range at cruise speed	371 miles
Rate of climb at sea level	900 fpm
Specifications:	
Gross weight	3,500 lbs.
Empty weight	2,000 lbs.
Payload	967 lbs.
Powerplant: Continental IO-470-D, 260 hp at 2,625 rpm	
Wing span	42 ft.
Overall length	31 ft. 10 inches
Height	9 ft. 4 inches
Wing area	294 sq. ft.

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(Continued from page 114)

During the climbout from the Fletcher plant at Rosemead, Calif., on the second flight, power setting of 26 inches mp and 2,500 rpm was used. Holding 80 mph IAS, the FU-24 still registered a 500 fpm climb rate at 5,000 feet at a temperature which was close to standard, 16 degrees C.

Cruise at 5,000 feet was made at 23 inches mp and 2,300 rpm. In this condition, experimentation was required to achieve the desired pitch trim setting, due to the fairly low response rate of the tab.

The Fletcher has a ground-adjustable rudder tab. In flight, to adjust trim with airspeed change, the rudder is "tromped" a couple of times. As the ball centers, the rudder apparently streamlines itself to the position required for coordinated flight.

During cruise, the FU-24 seems to be flying nose-down quite noticeably. Although the attitude in working passes is very close to that of cruise, the pilot's attention is usually busily engaged elsewhere. Therefore, if the configuration and attitude go unnoticed, everything is fine—the only time it is noticed is when the nose blocks visibility. This will be picked up very quickly by agricultural pilots.

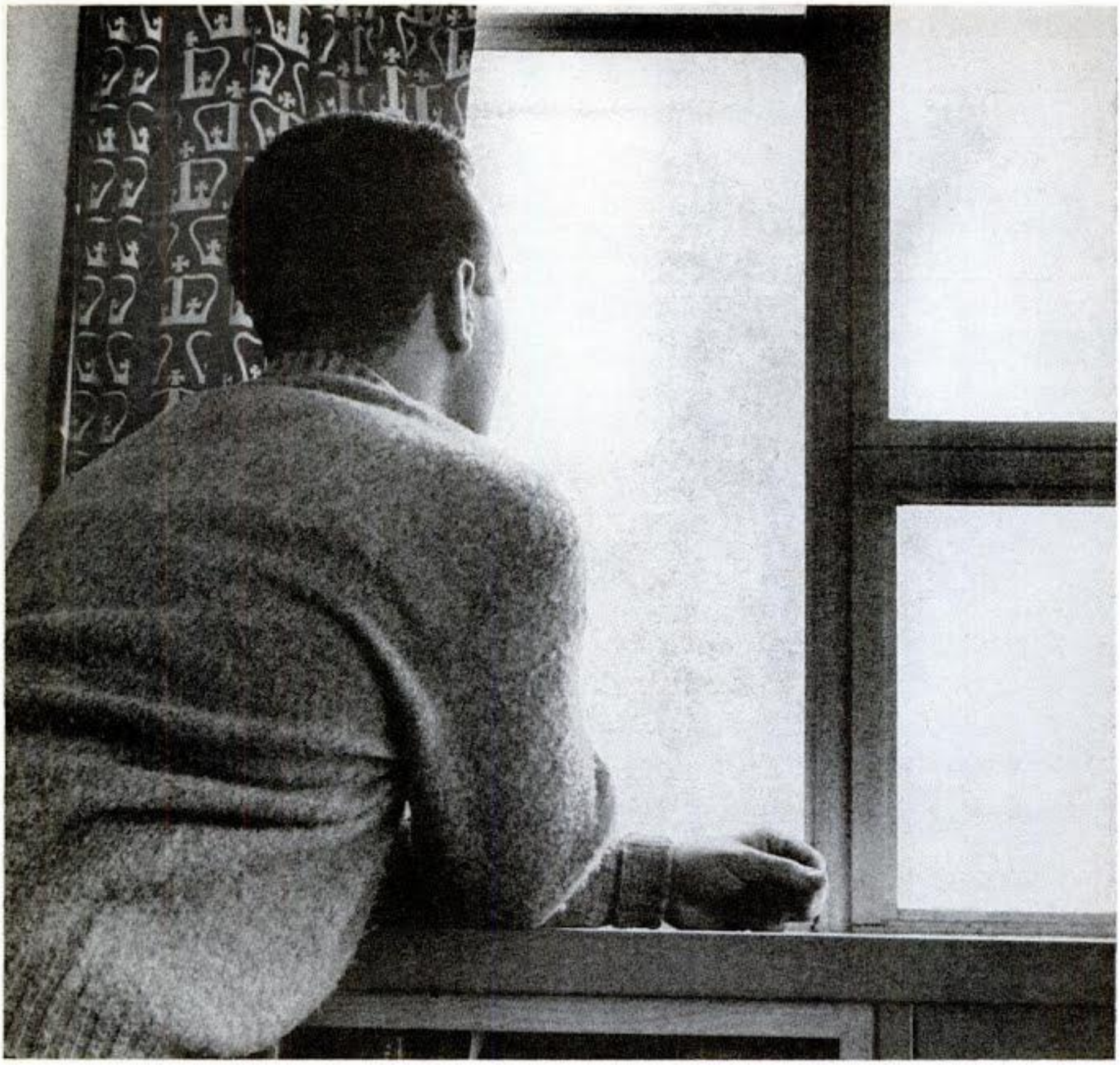
On arrival over the ocean, a full-flap, power-off descent was made at 70 mph IAS, which produced a respectable 1,000

(Continued on page 118)

1

"I DESIGNED AND BUILT IT MYSELF..."

2



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(Continued from page 116)

fpm descent rate in the aircraft.

Working passes were made as close as practicable to the water surface. Since the water was almost glassy smooth, several feet of extra altitude were held for safety.

Power setting for working runs was 2,500 rpm, with manifold pressure as required. Approximately 19 inches mp seemed best to hold 90 mph IAS in the working passes. The FU-24 handled well and flew smoothly during the passes. High inherent stability is an asset and, once the run is established, the aircraft does not tend to veer or porpoise.

An average time of 30 seconds was used for turns from start of pullup to resumption of working pass.

Cross checking time and airspeed, pull-offs to altitudes as high as 150 feet were made without airspeed dropping below 65 mph IAS or accelerated stall buffet appearing.

After several working passes, however, accelerated stalls in turns both left and right were deliberately induced at low speeds to sample characteristics and responses. Actually, it proved difficult to achieve any significant buffet in a turn without allowing the altitude to get completely out of hand in an abnormal manner, chopping power completely, or overshooting the course directionally. To complete the sampling, full rudder was applied with and against the turn, both left and right, as fast as possible. This was a significant demonstration of the low force authority rudder—the nose would slop around, but there was no tendency whatever for the airplane to snap or go into any unexpected flight attitude.

It should be emphasized that, at all times, the rudder plays a major part in keeping the airplane coordinated, indicating adequate effectiveness even though efforts to induce snap maneuvers were useless.

Stick forces are reasonably low at the airspeeds involved in agricultural operations. There were no conditions where the left-handed flying had to be abandoned for right hand control. Aileron response rate and effectiveness were high in normal airspeed operating regimes. The same is true of elevator, or stabilator control.

One investigation of low-speed flight was made, climbing and level, with gross weight approximating 3,435 pounds, at 55 mph IAS. With full flaps, 25 inches mp and 2,500 rpm, the airplane gained altitude at 300 fpm. For level flight, manifold pressure was cut to about 22 inches. In both cases, characteristics and response rates were good.

Obtaining a valid airspeed reading on the FU-24 below 55 mph IAS with power, or much below this without power, is impossible with the ordinary pitot installation. Normally, the FU-24 carries its pitot tube atop the vertical stabilizer, and turbulent airflow from the fuselage at high angles of attack tends to render the gauge useless.

One sampling of cruise speeds was made with 55 per cent power at 5,500 feet, where the Fletcher registered 105 mph IAS at 14 degrees C, giving 116 mph TAS.

A number of stalls in various conditions were done, in order to check the control

(Continued on page 120)

Jules Manger, Jr., Chairman of the Board, Manger Hotels, is seen with his wife and two of their seven children, all ardent flying enthusiasts.

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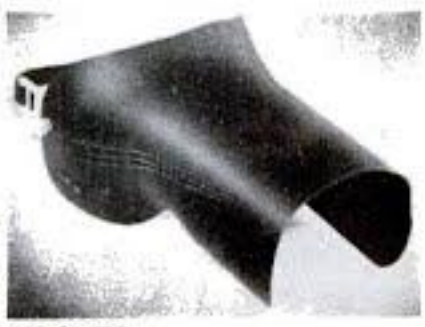

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(Continued from page 118)

system and aerodynamics as well as stall speeds and characteristics.

With any significant degree of power, the airplane does not really stall. It just sort of staggers along, nose wagging, actually not losing altitude but about holding its own from the point at which the first break comes.

At 3,000 feet, using 23 inches mp and 2,300 rpm with no flaps, the airspeed gauge became useless about 55 mph IAS, although it was quite a bit below this value that the actual stall break occurred, and after a prolonged period of buffeting and sustained full elevator displacement. At the actual break, the nose dropped to the horizon, where it stayed, and the airplane bounced along with the full up-elevator still held.

All conditions the same, with 20 degrees of flaps down, the same results were obtained except that the airspeed gauge remained readable down to 50 mph. In this condition, as well as the previous one, both aileron and rudder remained effective.

In a right climbing turn stall with 20 degrees of flaps down, the FU-24 produced a heavy buffeting prior to the stall break. At the break, the wings leveled of their own accord unless definite pressure was held against it.

With full flaps in a steep climbing left turn stall, with full rudder slammed in at the stall break, the airplane did not tend to go into any snap even at the cruise power setting used. Here again, rudder was in the low force authority condition but retained its effectiveness although response rate was fairly slow.

Using full flaps, power off, the airspeed gauge quit working very shortly before the stall break, indicating 45 mph IAS. With full rudder displacement fed in slowly, prior to the break, and holding full back stick after the break, the rolling moment is low—easily overcome by aileron.

The design group working under Wendell Fletcher which brought the FU-24 to life contained some well-known men, including Johnny Thorp, designer of a variety of light aircraft, and Walt Feller, who did the basic aerodynamic work.

Since all the major designers were pilots themselves, the goal was clear—make it an airplane you'd want to make first flight with yourself. Winner in the competition was Thorp, who got to make the first flight, but was closely followed by the other members of the design team.

All knew the history of agricultural flying—converted training planes with larger engines, which had bad visibility for the type of work, were easy to spin, and had a high fatality rate.

Some of the troubles were rooted in the aerial applicating industry itself as well as in the airplanes. Fletcher designers aimed to hurdle this barrier by making their aircraft difficult to spin by limiting the rudder travel initially. In the final analysis, no limits were needed—the low force authority situation "just happened" by itself. The visibility was to be the best, and, to top it off, a 40-g cockpit was planned since the FU-24's load is behind the pilot.

The 40-g limit was set because research indicated this was as much as a restrained

(Continued on page 122)

LIGHTPLANE MAIL SERVICE PROPOSED

USERS OF light aircraft have been taking on more responsible tasks in making the modern lightplane a dependable and efficient business machine.

Owners and operators are seeking new applications for this class of aircraft, in addition to increased utility in their present roles. With growing acceptance of light aircraft, it seems natural that the next step will be a short haul air mail system.

Such a system has been proposed by Larry Whiting of Trader Airline, Lake Geneva, Wisconsin.

Whiting has applied research experience gained in other fields of business to the thorny problem of finding a way toward, ". . . more usefulness and profit to the *Part 42 Operators* of light commercial aviation." After a detailed analysis of this segment of the industry, he came to the conclusion that these two prerequisites could best be met through the organization and operation of a fixed-base air mail service. This would extend the benefits of air mail service to any small town having access to a lightplane airport.

Citing, among other things, the decentralization of production and population to smaller communities and the inability of the major air carriers to serve these towns economically, Whiting suggests two practical applications of his project.

One would be the collection of mail from the smaller communities, delivery to the feeder and trunk lines for the long haul, and redistribution to the smaller communities at the end of the large air carrier's route.

Whiting himself is actively working on the second approach, an "orbital mail route," which would regularly collect and distribute mail to the smaller communities surrounding a large urban air mail center. Past the thinking stage, he is presently negotiating for a route of this type to operate himself. He has already established criteria concerning manpower, safety requirements, costs and charges, and others such as pilot and aircraft requirements. The scheme has brought favorable comment from the Post Office officials contacted so far, and a proposal has been made to the FAA for approval of the route.

With proper development and wise legislation, these new mail feeder routes can play an important part in speeding up the movement of our nation's growing mail load.

PICTURE CREDITS

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(lap belt, shoulder harness) human body could stand. The original design called for pilot survival if the airplane were flown into the side of a mountain at the operational speed of 80 mph.

The cockpit was designed to "keep the engine out of the pilot's lap, and the load off his back—all at the same time."

That the objective was achieved was proved by a crash in New Zealand (the only major crash of an FU-24, by the way). The airplane was almost totally demolished on a takeoff crash, but the pilot got out and walked away—while the engine stayed in front of him and the hopper load of dust was still behind.

As an example of the efficiency of the FU-24 design, the basic structure of the fuselage which survived this crash weighs just 270 pounds.

Additional features were designed into the FU-24, the predominant one being ease of production. Ease of repair and maintenance were also incorporated, along with interchangeability.

Products of this effort are such items as the gear struts. The main and nose struts are interchangeable—only the forks must be switched.

Probably the most famous aspect of the FU-24 is that it can be assembled, and all but 13 have been, without jigs. The airplane is put together on sawhorses, or on the floor.

Key to this feature is complete predrilling of every assembly hole in the airplane, on a set of master drill jigs at the factory—every rivet and bolt hole. Therefore, if a call comes in for a certain part, say a piece of fuselage skin a New Zealand ram butted and ruined, the replacement can be sent and all that needs to be done is drill out the old rivets and drive new ones.

Portions of Fletcher Aviation Corp. history which helped bring this about include a trip to New Zealand taken by Wendell Fletcher and his wife, Betty, early in the FU-24 history, with only a paper airplane to sell.

They sold it—paper though it was, and with the hopper behind the pilot, two built-in headwinds for any agricultural aircraft when it's being sold.

Gerry Barden went to New Zealand with the first 11 airplanes, which were assembled in Rosemead and shipped "Down Under." (The other two assembled at the factory for the total of 13 are the test airplane in which the 310-hp engine is being flight tested, and N6507C, the demonstrator used by FLYING.)

After the first 11 assembled ships, the remainder of the airplanes manufactured have gone to New Zealand in kit form, 112 of them. Total production has been 125 aircraft.

The New Zealand authorities, beset by dollar problems, said the applicators could spend all they wanted in New Zealand labor to assemble the airplanes, but no dollars for U.S. assembly. This edict enabled Fletcher to build and sell more airplanes than if assembly had been made in Rosemead.

Once in service in New Zealand, the FU-24 gained an excellent reputation—operating from sod fields on mountainsides more than from prepared level strips. One airplane put down 275,000 pounds of

superphosphate in a 13-hour working day. Another airplane had not one spot of brake trouble in four years. It always landed uphill, took off down, and the brakes were never used.

The FU-24 made one major change in aerial applicating in New Zealand. New loaders had to be devised in order to keep up with the airplanes.

In the U.S., the FU-24 carries a price tag of about $25,000 for the 240-hp airplane. The 260-hp model is slightly higher due to engine cost. No price has been set yet for the 310-hp model, since Continental has not yet established a price for the geared engine. But—to New Zealand, unassembled but with all the parts, the price is $14,000 on the dock at Hamilton.

Now, if you want your own FU-24, are handy with tools, have an old sawhorse or two kicking around, and some space on your garage floor. . . . . ✚

FLYING CALENDAR

April 28-29—Airshow and Fly-in sponsored by Middletown Jr. Chamber of Commerce and Middletown Aviation Club, at Middletown, Ohio airport.

May 5—Washington State Apple Blossom Festival. Fly-in breakfast Wenatchee, Wash.

May 5-6—Second Annual New Smyrna Beach Aerial Jamboree. Bevo Howard, Bob McComb & others. New Smyrna Beach, Fla. Sponsored by Civil Air Patrol.

May 18-19-20—Montana Pilots Assn. convention, Cut Bank, Montana. Registration Cut Bank Airport.

May 20-26—Aviation/Space Writers Assn. Annual Meeting, San Francisco, Calif.

May 29-June 4—All Women's International Air Race between Houston, Tex., and Nassau, Bahamas.

May 30-June 2—14th Annual Wright Memorial Glider Meet. Contact Soaring Society of Dayton, Inc., Far Hills Branch: P.O. Box 581, Dayton 19, Ohio.

June 1-3—Rotary Pilots Air Cruise with proficiency contest from Civic Memorial Airport, East Alton, Ill. to Los Angeles Rotary Intl. Convention. Open to all Rotarians East of the Miss. R. Write Pinky Opp, Rotary Club, Bethalto, Ill.

June 1-11—The Copenhagen Private Flying Club will sponsor an international aircraft fair at Skovlunde Airport, Copenhagen, Denmark.

June 3—Annual Fly-In Breakfast, Dodge County Flying Club, Dodge Center Airport, Dodge Center, Minn. Rain date June 10. Contact R. J. Nelson.

June 8-9—13th National Maintenance and Operations Meeting, Municipal Airport, Reading, Pa.

June 9—Spartan School Alumni & Employees Assn. 2nd Annual Reunion at Spartan School, Tulsa, Okla. Write Spartan Alumni, P.O. Box 15852, Tulsa.

Calendar items must be received by FLYING's editorial office, 1 Park Avenue, New York 16, N.Y., two months prior to the event.

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(Continued from page 8)

controller, etc.—to renew it within two years after the system becomes operative, by means of submitting an application. No examination is involved; and the certificate would be valid for two years. For airmen who must take periodic medical examinations, renewal would be automatic when they pass the examination.

Pilot Clara E. Livingston of San Juan, Puerto Rico airlined into Galveston, Tex., recently to pick up her new 1962 Rangemaster at the Navion plant and fly it back home. She is pictured here pointing out her return route to Navion's vice president of marketing, Currie B. Davis. Miss Livingston made her first flight to Puerto

Rico from New York in 1931 flying a three-place Rearwin Ken-Royce biplane. A charter member of the Ninety-Nines, Miss Livingston also holds the rank of Colonel in the Civil Air Patrol and is Commander of the Puerto Rico Wing.

A revolutionary step for established private camps is being taken by Camp Windham, a co-ed camp at Willimantic, Conn. with the introduction of aviation into its 1962 summer program. For the first time boys and girls of high school age are being offered a choice of two aviation programs: a 50-hour ground school course; or 50 hours of ground school and 12 hours of flight instruction. Windham's director, Marvin B. Edelman (2110 Barnes Ave., New York 62) has worked out the program with aviation consultants. The FAA-approved facilities of nearby Windham Airport will be the flight training center.

Major Alexander P. de Seversky will be presented with the General William E. Mitchell Memorial Award by Aviators' Post No. 743, American Legion, at a dinner on May 16 at the Waldorf-Astoria Hotel, N.Y. The award is presented periodically by the Post to that U. S. citizen making an outstanding contribution to aviation progress. Inventor, aircraft designer, three-time International Harmon Trophy winner, Major de Seversky needs no introduction to those within the aviation industry. He is known internationally as the author of "Victory Through Air Power"; "Air Power, Key to Survival" and, his latest, "America, Too Young to Die."

Navion Aircraft Co., Galveston, has received its charter as a Texas corporation and has absorbed its sister company, Price Engineering Corp. of Phoenix, Ariz. Navion was formerly a division of the Tusco Corp., of Houston.

Nebraska's state-owned TVOR at Beatrice is the first non-Federal VOR in the country to be approved for general public instrument approach under Federal standards, FAA's regional office, Kansas City, Mo., has announced. A number of states install and maintain navigation aids which, while they may not meet FAA criteria initially, are necessary to meet state aviation needs. Nebraska put its first one into operation in February 1955 and since that time its Aeronautics Department has continued to develop its navigational system with the technical assistance of FAA, the FCC and Wilcox Electric Co.

Outstanding alumni of the Academy of Aeronautics, LaGuardia Airport, N.Y., will be honored with merit awards at the alumni reunion in May. The awards, to be presented annually to those alumni who have made significant contributions to the aircraft/aerospace industry, were announced jointly by Charles S. (Casey) Jones, president of the Academy and Theodore DeMund, president of the Alumni Association, to mark the 30th anniversary of the school's founding.

Revised edition of Transland Aircraft's catalogue of chemical dispensing equipment for agricultural airplanes is off the press. The 1962 catalogue includes the company's standard line of equipment plus new additions such as the Swathmaster and Hopper combination for the Piper PA-18A. Address: Torrance, Calif.

Dr. John Furbay, world air commuter, lecturer and long-time director of TWA's Air World Education Department, may now be heard through a Columbia LP hi-fi recording of his popular lecture, "Four Dreams of Man." Taped before a live audience, this record presents Dr. Furbay's jet-age view of the world today. It is rich resource material for educators, students or plain citizens. All proceeds from its sales have been assigned by Dr. Furbay to the International Scholarship Fund. Price $5. Lecture Recordings, 4304 W. Fullerton, Chicago 39; or 7419 Kessel St., Forest Hills 75, N.Y.

The eighth edition of the Directory of the American Council of Independent Laboratories, containing index of members, descriptions of the individual laboratories and their services is available, without charge, to industrial and government executives. Copies, by request to 4302 East-West Highway, Washington 14, D. C.

Official certification of the Beechcraft Model 23 Musketeer—latest single-engine aircraft to enter the general aviation market—clears the way for immediate production. First deliveries are now scheduled for early next fall. The Musketeer is a four-place airplane with fixed, tricycle landing gear. In the $11,000-$12,000 price bracket, the airplane is powered with a 160-hp Lycoming engine, uses a fixed-pitch Sensenich propeller and its estimated maximum speed is 146 mph (see FLYING, January 1962 for detailed report.

Major W. F. (Bill) Long, head of W. F. Long & Associates, a firm of professional aviation consultants, has announced new offices at Love Field, Dallas, in Southwest Airmotive Co. facilities. A prominent figure in Texas aviation for over 35 years—in private flying, training and airline operation — Long founded the Dallas Aviation School at Love Field in 1926. A WW I pilot, he directed training of nearly 25,000 military and civil pilots in WW II. Only last year he disposed of his Dallas Aero Service and entered the consulting field.

Atlantic Aviation has inaugurated a "Businessman's Flight Training Program," especially tailored for the business executive who wants to learn to pilot a modern aircraft. Audio-visual aids are used in ground training to make the study more interesting and flight training from the beginning is in fully instrumented modern aircraft under normal air traffic conditions. The 50 hours of flight time takes the student through his private pilot's license. The course is available at Atlantic's Wilmington, Del. and Lynchburg, Va. bases.

The Glenn H. Curtiss Museum of Local History, will be open to the public May 21 in the Hammondsport, N. Y. school house reportedly attended by Glenn Curtiss as a boy. Several rare and history-making engines and airplanes designed by Curtiss, one of the nation's aviation greats, are featured in the collection. Otto Kohl, an associate of Curtiss from 1915 to 1924, initiated the museum project in 1953.

Flying Physician B. J. McClanahan of Hornell, N. Y. has a new DARE DR-480 radio receiver and DNCI-1 converter-indicator installed in his C-35 Beech Bonanza—a gift of the manufacturer. Dr. McClanahan won First Prize in DARE's

nation-wide contest to find a name for its new line of miniaturized navcom units. "Microstar" was the name suggested by the physician, and DARE's new line is henceforth the "Microstar" line. The firm's president, Louis Pitinsky, awarded Dr. McClanahan (right) his prize.

Some credit for Astronaut John Glenn's success is rubbing off on Harry Clever, manager of the New Philadelphia (Ohio) Airport. He taught Glenn to fly back in the Forties, the official AAAE bulletin "Read and Weep," reports.

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There are three common causes of aircraft-engine spark-plug fouling. Any of them can cause misfiring, rough running, hard starting or loss of power.

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LEAD DEPOSITS. All fuel for today's high-performing aircraft piston engines *must* contain tetraethyllead to prevent knock. When the lead has done its job, most of it is changed chemically and blown from the cylinder. No combustion process is perfect, however, and hard, shiny, ball-like deposits can build up on plug electrodes and insulators. Some of these deposits conduct electricity. So, spark gaps are altered or the voltage leaks from the center electrode to the ground electrode through the insulator deposits. The spark doesn't jump the gap and you end up with a Mag. drop and a rough engine.

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