AVIATION WEEK

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SEPT. 10, 1951

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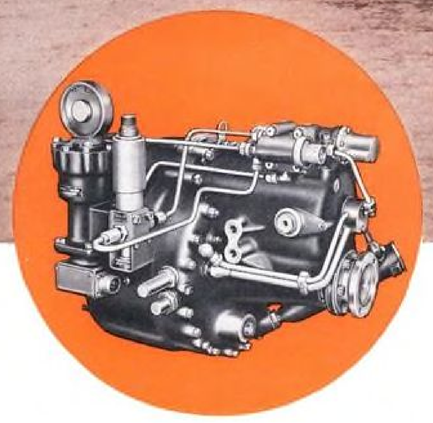
New Martin "Flying Boat" equipped with SUNDSTRAND Alternator Drives



Proved performance of precision-built transmission leads to new application!

Due to the tremendous amount of electrical equipment required in this new, radar-loaded Martin P5M-1 Anti-Submarine Patrol Bomber, the availability of constant frequency AC current became a "must". This called for installation of Sundstrand Constant Speed Alternator Drives — a tried and proved method of providing weight-saving AC power in the air.

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B.F.Goodrich

Overhead and underfoot, Avtrim cuts costs

KEEPING UP the good looks of an airliner's head lining and floor can be expensive. Head linings get scuffed and smudged. And rugs take a beating from muddy shoes, spilled foods, scraping feet, the pounding of high heels.

Like many other airlines, Pioneer solved the problem with Avtrim, the B. F. Goodrich flexible material. (See photos above.) Used for head lining, it resists scuffs. Dirt can be swished off with a damp cloth. And an occasional once-over with soap and water makes the Avtrim sparkle like new.

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Aviation Week

ABP Member ABC

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NEWS DIGEST

DOMESTIC

First Medal of Honor for air action in Korea was presented posthumously to son and widow of Maj. Louis J. Sebille at a formal review at March AFB, Riverside, Calif. by USAF Chief of Staff, Gen. Hoyt S. Vandenberg. Maj. Sebille was commander of the 67th Fighter Bomber Group and was killed while flying an F-51 Mustang against a ground concentration of troops, artillery and armored vehicles.

Personal and executive type aircraft shipments during July totaled 199, worth $1,327,000, according to Joseph T. Geuting, Jr., of the Personal Aircraft Council of the AIA. Four-place craft accounted for 146 of the total; 51 were two-place and 2 were one-place.

CIO United Auto Workers struck Wednesday at Douglas Aircraft Co.'s 13,000-employe Long Beach plant. Negotiations over wages and working conditions had broken down. The union's executive board represents about 10,000 of the workers at the Long Beach plant.

Air Force was scheduled to take over Bechtel-McCone modification center in Birmingham Aug. 29. Hayes Aircraft Corp. will modify B-25 Mitchell bombers there under a $5.6-million contract. Hayes employment will start at 3,000, may rise to 8,000 when company starts reconditioning Douglas C-124 cargo craft.

Gen. George C. Kenney, Air Force's second-ranking officer in point of service, retired with top honors last week after 35 years of service. During retirement ceremonies, Kenney, whose serial number is A2, was decorated with his third Distinguished Service Medal and the Legion of Merit by Gen. Hoyt S. Vandenberg. The entire air staff turned out to honor General Kenney.

War surplus transports, sold by CAA from storage, brought the agency $826,053. TWA paid $320,001 for an old-type Constellation; EAL bought a C-54 for $355,001, and Transocean Air Lines bought a C-54 for $151,051.

Maj. Gen. E. J. Timberlake, Jr. has been named commanding general of Tactical Air Command's Ninth Air Force, succeeding Maj. Gen. W. R. Wolfinbarger. Gen Timberlake recently returned from the Far East where he has been serving since 1948.

FINANCIAL

Lockheed Aircraft Service, Inc. has a $19.4-million backlog in maintenance, overhaul and modification work. Contracts include reconditioning of Lockheed F-80 jets and North American F-51 Mustangs for the USAF, Lockheed C-121 Constellations and Boeing C-97 Stratofreighters for MATS.

First atomic aircraft airframe development contract has been awarded to Consolidated Vultee Aircraft Corp.'s Ft. Worth division. General Electric has the engine development contract. Development will be joint Convair-GE project.

California Eastern Airways, Inc. reports operating revenues of $3,717,891 for the six months ending June 30, 1951. After provision for taxes and depreciation, net profit for the period was $82,064. Company says these figures reflect the cumulative effect of transport services, inauguration of contract flight training operations at Columbus, Miss., and equipment installation under government contract at CEA's Oakland, Calif., base.

INTERNATIONAL

Bendix-Tecnico Proprietary Limited is a new Bendix affiliate formed in Australia to manufacture and distribute equipment for the aircraft and electronics fields. The new firm will be jointly owned by Bendix and Tecnico Limited, of Marrickville, Australia, on a 40-60% basis.

Four new climb records were claimed by the British for a special Gloster Meteor 8 with Armstrong Siddeley Sapphire jet engines. Marks set were 1 min. 16 sec. to 9,850 ft. (3,000 meters); 1 min. 50 sec. to 19,700 ft.; 2 min. 25 sec. to 29,500 ft.; 3 min. 7 sec. to 39,400 ft.

Napier Nomad, a British Diesel piston engine plus a gas turbine, is currently flying in a modified Avro Lincoln test-bed. The Nomad uses the Diesel to drive one of two contra-rotating propellers and the exhaust gases from the engine to drive a turbine which turns the other prop.

English Electric Canberra set new east-west trans-Atlantic record of 4 hr. 15 min. from Aldergrove, Northern Ireland to Gander, Newfoundland. Average speed for the 2,073-mi. trip was 480.2 mph. Wing Cmdr. Roland P. Beamont, English Electric's chief test pilot, flew the crossing. Canberra completed flight Tuesday, arriving at Glenn L. Martin Co., Baltimore.

AVIATION CALENDAR

Sept. 10-14—Sixth national instrument conference and exhibit sponsored by the Instrument Society of America, Sam Houston Coliseum, Houston, Tex.

Sept. 10-16—Seventh annual general meeting of the International Air Transport Assn., Westminster School, London, England. Program includes one-day visit to SBAC Farnborough show.

Sept. 11-16—Twelfth flying display and exhibition of the Society of British Aircraft Constructors, Farnborough, England.

Sept. 15—Air tour to Nantucket Island, Mass., sponsored by the Nantucket Flying Club, Nantucket Memorial Airport, Mass.

Sept. 17-19—15th annual convention of the International Northwest Aviation Council, Jasper National Park, Alberta, Canada.

Sept. 18-20—Meeting of the meteorology committee of the Air Transport Assn., Greystone Lodge, Denver.

Sept. 20—Aviation Writers Assn., luncheon, with featured guest speakers. Wings Club, Hotel Biltmore, N. Y. C.

Sept. 26-28—Fall meeting of the American Society of Mechanical Engineers, Hotel Radisson, Minneapolis.

Oct. 2-4—Seventh annual aircraft spark plug and ignition conference sponsored by the Champion Spark Plug Co. of Toledo.

Oct. 3-6—Annual national aeronautical and engineering display and aircraft production forum, sponsored by Society of Automotive Engineers, Biltmore Hotel, Los Angeles.

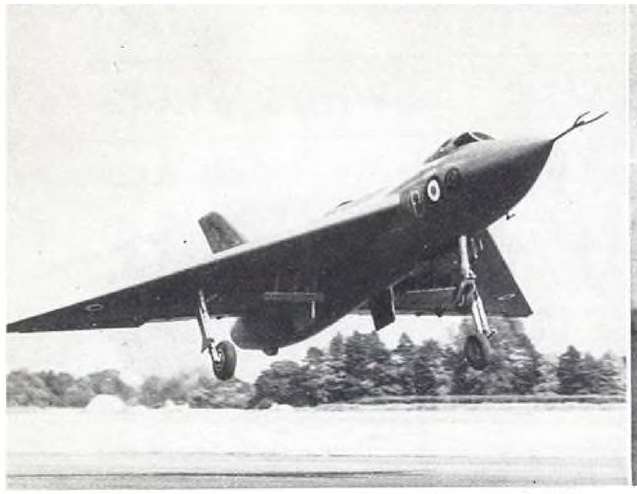
Oct. 8-10—Special conference on aircraft electrical applications, sponsored by the air transportation committee of the American Institute of Electrical Engineers and the Los Angeles section of the Institute, Hollywood Roosevelt Hotel, Hollywood.

Oct. 9—Air transport section, National Safety Council, Palmer House, Chicago.

Oct. 11-12—1951 conference on airport management and operation, University of Oklahoma, Norman, Okla.

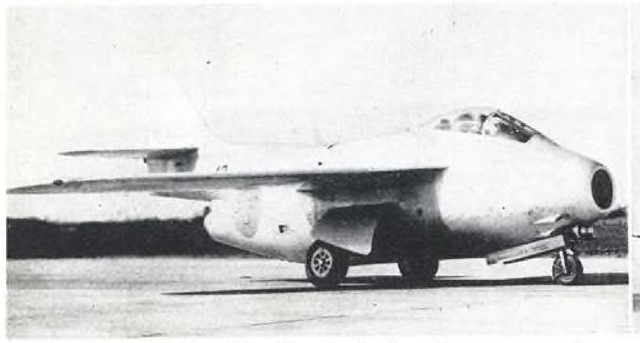
PICTURE CREDITS

9—(Avro 707B) McGraw-Hill World News; (Russian copters) Sovfoto; (SAAB-29, Safir 91B) Howard Levy; (F-94s) Lockheed; 14—INP; 17—USAF; 66—Dorothy Douglas.



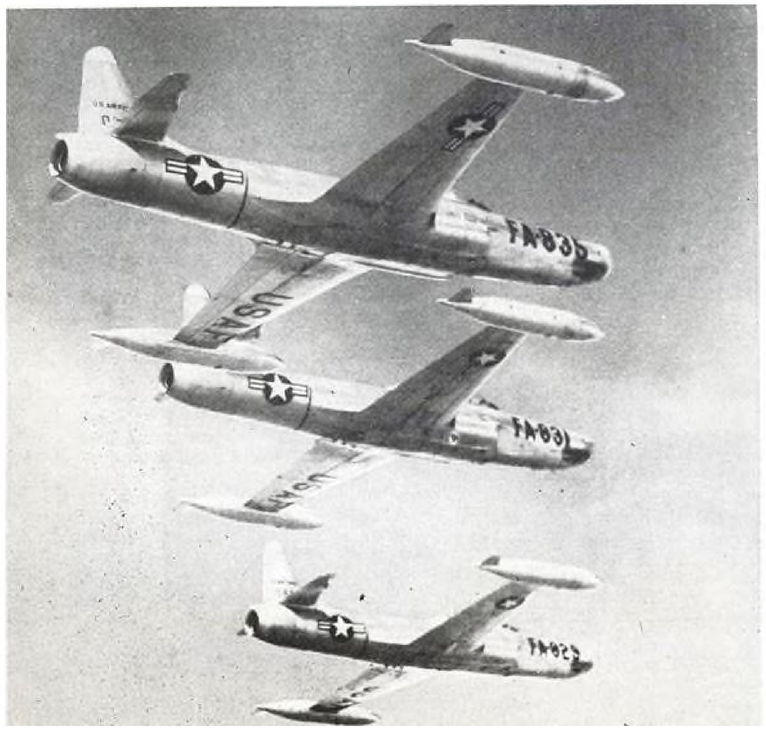
AVRO 707B, feeling for the ground, uses wing-mounted picket-fence air brakes to increase drag in landing attitude.

RUSSIAN COPTERS credited to designer N. Mil were displayed at Tushino airdrome near Moscow on Aviation Day, July 8.



SWEDISH SAAB-29, 600-mph.-plus jet fighter was recently placed in squadron service. First production craft is shown.

SPECIAL SAFIR 91B mounts half-scale swept wing for studies of configuration. Leading-edge slots and special flaps are fitted.



Picture Highlights Of the Week

LOCKHEED F-94 flight of FEAF 35th Fighter Interceptor Wing cruises high over Japan. Assigned to the 314th Air Division, mission is Japan's defense.

INDUSTRY OBSERVER

► Now that Douglas is well along with its first C-124B turboprop heavy transport, it is trying for a USAF production order for more of the turboprop cargo planes. Availability of Pratt & Whitney T-34s, which power plane, may decide how soon a quantity order is arranged.

► **The 90-ft. diameter test capacity of the Wright Air Development Center helicopter rotor test tower at Dayton is just about filled by the big 85-ft. diameter rotors of the Piasecki XH-16 transport helicopter, with DC-4 size fuselage. A 4,000-hp. electric motor whirls the rotor at the top of the 50-ft. high test tower to avoid ground cushion effect. Plans call for installation of a television camera in the tower to observe the blades.**

► The reconnaissance version of the Boeing B-47 has been delayed as a result of the switch in production programs, shelving the B-47C and putting immediate emphasis on the less powerful but more immediately available B-47B. It had been planned to deliver the RB-47s out of the B-47C order, so the switch necessitated a considerable modification in plans for the photo plane to make it adaptable to the B-47B program. The RB-47B version, although slower than the contemplated RB-47C, will be considerably faster than any recon plane now available to the USAF, and probably the only one able to keep up with the B-47 bombers, over a several thousand-mile mission.

► **New type rubberized-nylon pneumatic lifting bags, to hoist planes that have made belly landings or have damaged landing gear, have been developed for USAF by U. S. Rubber Co. Bags are capable of operations at temperatures as low as minus 65 deg. F. Older F-1 type cotton lifting bags were useless at temperatures below minus 20 degrees. New F-2 design is only a few inches high when not inflated, but inflates to 6 ft. height, and at a pressure of 3.5 psi. will lift 12 tons.**

► New possibilities for free-fall aerial delivery techniques are being opened by an experimental development of General Tire & Rubber Co. and the Army. This is a liquid container, made of synthetic rubber, which bounces when it hits. Size currently tested holds five gal. of gasoline, has been dropped repeatedly from altitudes up to 2,000 ft. for a free fall without damage to contents or to the disc-shaped container.

► **The Sacred Cow, first presidential airplane, was one of the first Douglas C-54s to get a cycle reconditioning at the newly opened Texas Engineering and Manufacturing overhaul base at Majors Field, Greenville, Tex., under a large new contract for continuing cycle overhauls on C-54s. The plane is still used to transport very important people (VIP) by Military Air Transport Service.**

► Fairchild has modified the tail booms and tail surfaces of its XC-120 Pack Plane, to correspond with the vertical dorsal fins on the booms and beefed-up tail surfaces of its later C-119C Packet combat transports.

► **Saunders-Roe Ltd. which has taken over the development contract for the Cierva Air Horse helicopter from the original Cierva Autogiro Co., has completed a thorough dis-assembly and examination of the No. 2 Air Horse WA-555. This was done because of the crash of the original machine, which was attributed to the fatigue failure of a small link in one of the rotor heads. The WA-555 has been reassembled and preliminary engine runs have been completed. Ground runs and flight tests are expected later this fall.**

► Boeing's first 8-jet XB-52 is expected to meet its schedule for rollout at Seattle in October, and first flight before year's end, now that it appears that sufficient Pratt & Whitney J-57 engines will be delivered on schedule. Meanwhile Convair's XB-60 (sweptwing development of the B-36) is not due to get any J-57s, probably until early next year.

► **Results of experiments with the 60-degree delta wing XF-92A Convair jet plane are going into Convair's continuing Navy program to develop high speed water-based aircraft, with blended wing-hull designs. Tests indicate the feasibility of developing a water-based fighter-bomber, carrying pilot and radar operator, and capable of speeds up to Mach 0.95, it has been disclosed.**

WHO'S WHERE

In the Front Office

Benjamin A. Main, Jr., has been named vice president-engineering for Aeroquip Corp., Jackson, Mich., and **H. L. Schrock, Jr.,** has been designated vice president-treasurer. Main has been with the company since 1942 as chief development engineer; Schrock joined Aeroquip in 1947.

W. Gordon Wood has been designated vice president-traffic for Trans-Canada Airlines and will also represent the carrier on traffic matters in the International Air Transport Assn. He succeeds **Anson C. McKim,** who recently resigned. Wood has been TCA's general traffic manager since 1948.

Changes

R. M. Combes has been made chief engineer of the development laboratories, Pacific division, Bendix Aviation Corp. and will head up the newly acquired Plant 3 in Burbank.

N. W. Bouley has been designated assistant chief engineer-executive for Convair's San Diego division and **Harold W. Pope** has been named assistant chief engineer of the firm's Guided Missile division.

Charles T. McKinnie has been appointed assistant sales manager of Pratt & Whitney Aircraft to direct all military and commercial sales activities. **John Craig, Jr.,** succeeds him as the company's West Coast representative.

Named to the Board

William E. Boeing, Jr., has been named a director of Pacific Northern Airlines.

Joseph V. Shields has been elected a director of Colonial Airlines.

Capt. Max Welborn, USNR (Ret.), has been appointed manager of personal relations, contracts and sales by Bellanca Aircraft Corp. Since May he had been with Bellanca on a consultant basis. Until his retirement after 30 years with the Navy in July, 1950, he had been on almost continual flight status.

Charles C. Buckland, a newly elected vice president of Minneapolis-Honeywell Aeronautical division, will head a new group correlating and expanding subcontracting activities of the aeronautical and ordnance divisions. Other M-H changes: **M. P. Fedders** is new manager of aeronautical operation; **E. H. Salzman** is director of aeronautical administration; **Howard J. Stoops** is director of aero manufacturing.

Revere Corp. of America announces the following appointments: **Robert R. Allen,** formerly a consultant for management engineering problems, has been named assistant general manager; **Joseph V. Fox,** formerly with Manning, Maxwell & Moore, has been named manufacturing manager; **Francis D. Costello,** formerly with Fairchild Guided Missiles div., is production control superintendent; **Rear Adm. Henry G. Williams,** USN (Ret.), is director of customer relations.

AVIATION WEEK

VOL. 55, NO. 11

SEPTEMBER 10, 1951

Not Enough Steel, Say AF and Industry

But NPA officials claim that structural allotments meet 'most urgent' demands.

By William Kroger

A fourth-quarter structural steel allotment announced by the National Production Authority last week was supposed to iron the kinks out of the facilities expansion program. Instead, it put kinks in the brows of air planners and brought indignant protests from aircraft industry and military officials.

In releasing the allotments of scarce steel needed to construct buildings and other facilities to build, test or equip defense items, Defense Production Administrator Manly Fleischmann said that "all of the required structural steel for the most urgent" Air Force, Army and Navy programs was made available to manufacturers supplying the three services.

According to one Air Force officer, that just isn't so. According to a Munitions Board representative, that is a "very misleading" statement. According to an Aircraft Production Board spokesman, it is silly. According to aircraft industry representatives in Washington, the allotment doesn't come near meeting needs.

►**NPA Rebuttal**—NPA officials who monitored the allotment can't share the alarm, and point out that, as Fleischmann said, the allotments are for the "most urgent" programs. The test was whether deferring a project until the first quarter of 1952 or later would harm the defense effort. Any applicant turned down now can apply by Sept. 20 for an allotment for the first quarter of 1952 for the same project. NPA planners think the fourth-quarter allotment does no harm to the defense effort.

They are getting plenty of argument.

Air Force won't say officially how much structural steel would be required to meet the needs of its contractors. But fairly reliable estimates range between 100,000 and 150,000 tons.

The fourth-quarter allotment for Air Force contractors totals 31,273 tons.

►**One-Third Equals 100%?**—This, says NPA, is 100% of AF's stated requirements. In contrast, AF officials say that applications for allotments sent to NPA with Air Force endorsement totaled considerably above that. A Munitions Board official estimates that the allotment to Air Force contractors is about one-third of the total the Air Force sponsored.

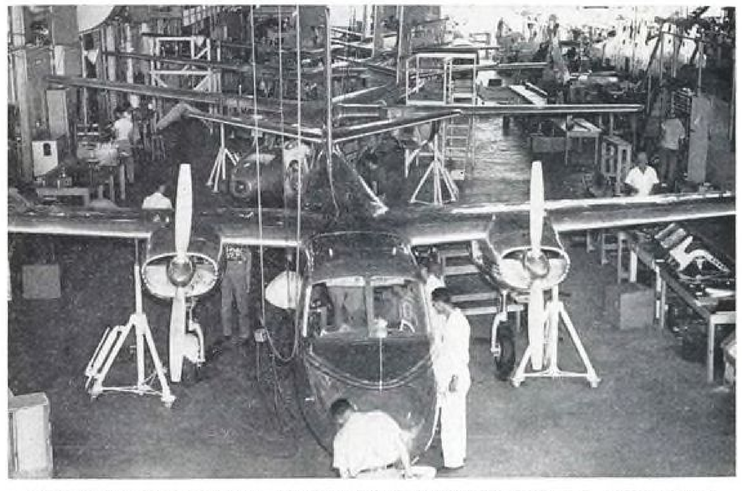
The gulf between NPA and other government agencies and the industry apparently lies in a favorite government word "screened." What actually happened, it seems, is that an intra-agency committee took requests from all those wanting structural steel, measured them against a set of criteria, and said in effect, "here, now ask us for steel for only projects meeting these criteria." So, the Air Force got steel for 100% of the projects meeting the criteria. But the services and the industry might argue that the criteria were too strictly applied. Here is the measuring stick used:

- **Facilities under construction** to make products urgently and directly required by the Department of Defense and the Atomic Energy Commission.
- **Blast furnaces** that are scheduled to be completed before or in 1952.
- **Steel producing** or finishing facilities scheduled to be completed this year.
- **Important steel producing** or finishing facilities owned by small business concerns, generally scheduled to be completed during 1952.

In the Air Force view, the word "urgently" in the first criterion certainly must have been too strictly applied, because the AF has endorsed about 9,000 applications, and NPA has turned down more than 4,000. But probably, in the NPA view, the Air Force was a bit liberal in its endorsement. One automotive company has AF endorsement for about 62,000 tons. And yet fourth quarter total to all AF contractors was 31,273.

►**Research Not Urgent**—That is some measure of the bind industry feels it is in because of the structural steel shortage. A case in point might be Boeing, which got no allotment in the fourth-quarter listings released last week. It already has started expanding its wind-tunnel facilities at Seattle for research on the B-52. And at Wichita, Boeing needs an electronics building in connection with B-47 production. Both of those projects will have to be suspended unless a revision is made in the fourth-quarter allotments, or Boeing manages some other way out. As it stands now, both B-52 and B-47 work is subject to delay.

This had to be overlooked by NPA in drawing up the allotments. That



FIRST PRODUCTION AERO COMMANDER ROLLS OFF LINE

Production rate of two Aero Commanders a week by November is expected at Tulakes Airport, Oklahoma City, plant by Aero Design & Engineering Co. First production model recently came off the line, with five more in the works behind it. Company took over an empty aircraft hangar at Tulakes in January, 1951, to set up this plant and says it now has orders, with deposits, for 45 Commanders.

agency's explanation is simple. The fourth-quarter allotments are in the nature of a "crash" program—it has to be done right away. Research work can always wait, in the NPA view, and that takes care of the windtunnel. As for Wichita, work has been done out-of-doors at Wichita before, and a few months more isn't going to make a lot of difference, NPA feels.

▶**Little Now, More Later**—NPA is in somewhat of the position of the man juggling a hot potato from hand to hand until it cools. NPA defers some construction the military says is vital in favor of construction that NPA insists in the long run is going to help ease all problems. So the largest allotment of structural steel in the fourth quarter—89,468 tons—goes to iron and steel companies because by speeding the expansion of their facilities you speed the day when there won't be any structural steel shortage.

By following this philosophy, NPA hopes that there will be more structural steel available next year.

Of course, the other result of that philosophy is to delay the day when the Air Force will get the planes and equipment it says it needs. It pushes just so much farther into the future the date when the Air Force (particularly in reference to the B-52 and the Strategic Air Command) will be in a position to meet all its commitments.

▶**More And More**—All of NPA's actions are pitched on the policy of expanding the production base so that at some future date—if the country did not become involved in all-out war in the meantime—there could be a tremendous outpouring of materiel. To most military and industry people in Washington who are impatient to get volume production quickly, this seems a "guns plus butter" policy.

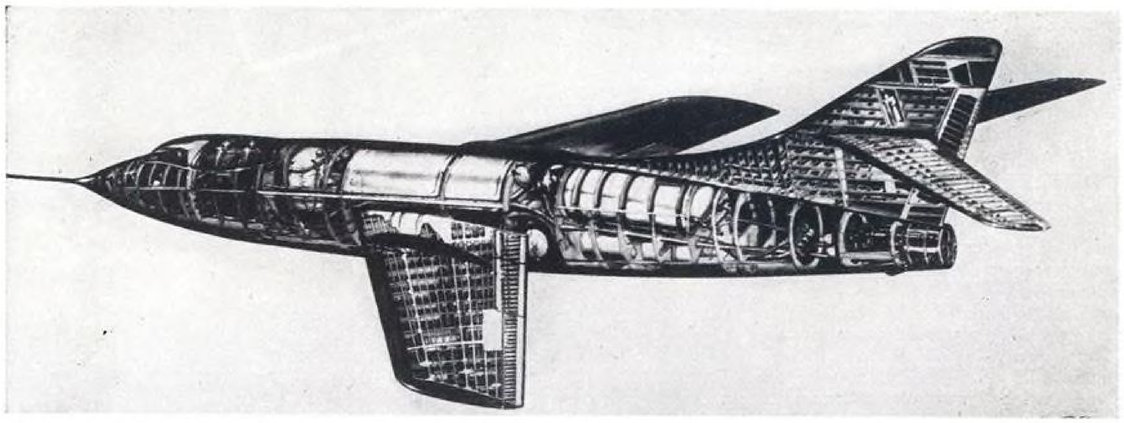
The feeling is growing among military and industry people in Washington that the Defense Production Administration is more interested in having the curve of civilian output rise parallel to the curve of defense production than it is in speeding defense production alone.

So, while it's true that greater structural steel allotments now to steel manufacturers will yield more structural steel later on, that additional steel capacity also will make possible a continuing high level of civilian production. Without the additional steel productive capacity, civilian requirements might have to be trimmed down.

But as if to confound critics of its present policy, NPA's fourth-quarter structural steel allotments dealt roughly with general commercial construction. Stated requirements in this category were 106,574 tons. Allotment is 12,055 tons, 11% of requirements. "Other industrial expansion"—defined as industrial machine equipment, textiles, chemicals, electronics and electrical equipment, pulp and paper, etc.—fared somewhat better. Rrequirements were listed as 121,723 tons, and allotments total 32,515 tons, 26%.

This allotment shades that of the Air Force and is considerably better than the 4,059 tons allotted to Army contrac-

(Continued on page 15)



SKYROCKET D-558-2, Navy-Douglas research craft which set new altitude record for man-carrying craft in Aug. 15 flight.

Details of Douglas Skyrocket's New Record Flight

Recent flight of the Douglas Skyrocket piloted by Bill Bridgeman shattered every existing altitude record for occupied aircraft or balloons, the Navy has announced. Navy refused to give exact altitude attained but it is generally believed to have been 77,500 feet—over 14 miles. This is more than a mile higher than the officially recognized record of 72,394 set by a man-carrying balloon in 1935. Douglas, it is understood, set this "mile higher" goal as the last test of the Skyrocket before turning it over to NACA.

The 45-foot research plane was launched at 35,000 ft. after its rocket fuel tanks were "topped off" from the mother ship B-29. In three seconds Bridgeman had all four rockets going and started up at a 65-deg. angle. Within ten seconds the plane had broken thru the sonic barrier (662 mph.) and was climbing away from the earth at a speed of about 1,000 miles an hour. Almost immediately Bridgeman had to pull the plane into steeper angle of climb to save power for climb rather than speed. When the Skyrocket reached its planned altitude, Bridgeman leveled off to obtain high speed performance data. After burnout, Bridgeman glided down and proceeded to make a perfect dead-stick landing.

Douglas engineers said the plane could have gone higher on its Aug. 15 record-setting test had the pilot flown a "missile-like trajectory" or straight up. But Navy and Douglas spokesmen said they were content to break records gradually while providing maximum safety for pilot and plane.

Adm T. F. Combs, Chief of BuAer, said at conclusion of tests that much credit for Skyrocket's success was due directly to the personal effort given the program by E. H. Heinemann, chief engineer of the Douglas El Segundo division.

(Continued from page 14)

tors and the 7,306 tons approved for Navy construction. Both the Army and the Navy allotments are claimed by NPA to be 100% of "stated requirements"—again on the same basis of making requests meet the criteria.

NPA adds that additional tonnage will boost the Army-Navy-Air Force allotments to 60,000 tons, but that projects which will get the additional tonnage have not been determined.

Included among aircraft producers allotted fourth-quarter structural steel:

Pratt and Whitney Aircraft; North American Aviation; Fairchild Engine and Airplane, for a guided missiles plant; Goodyear Aircraft; Ford Motor Co., for an engine plant; Piasecki Helicopter; American Brake Shoe Corp., for jet engine facilities; Dresser Mfg. Co., for jet engine parts facilities; Lockheed; Eaton Mfg. Co. for parts facilities; Thompson Products, Inc.; Ford Motor Co. for an airplane parts plant; Harris-Seybold Co., for airplane parts facilities; American Machine and Metals, Inc., for aircraft instruments facilities; B. G. Corp., for aircraft engine components facilities; ;Gentral Electric Co., for engine facilities; Creamery Package Mfg. Co., for jet engine parts facilities; Standard Pressed Steel Co., for aircraft fasteners facilities; Monroe Calculating Machine Co., for instrument facilities; Wright Aero; Republic Aviation; Roots-Connersville Blower Corp., for supersonic windtunnel construction facilities; Bendix Aviation; Ex-Cello Corp., for aircraft parts facilities; Hughes Aircraft; Solar Aircraft, for jet engine components facilities; Nash Kelvinator, for an engine plant; Northrop Aircraft, for guided missiles facilities; Fairchild, for aircraft facilities; Hartman Electrical Mfg. Co., for aircraft electronic controls facilities; Houdaille-Hersey Corp., for aircraft components facilities, Douglas Aircraft; and Whirlpool Corp., for facilities to produce aircraft wings.

Wolfinbarger Named To Air Support Unit

Maj. Gen. W. B. Wolfinbarger has been named Air Force representative on the Joint Tactical Air Support Board at Pope AFB, Ft. Bragg, N. C. He will act as chairman of the board.

This is the outgrowth of an Army plan to establish a joint airborne test center which would be responsible for development of requirements for tactical aircraft, airborne equipment and tactics and techniques for support of ground troops.

The center, established two years ago by the Army was an adjunct of the field forces. As originally proposed three years ago, the center would have been a joint project designed to iron out and coordinate tri-service tactical air-ground support matters. Air Force at that time refused coordination and thus Navy remained out.

▶**Initial Move**—Last year, Air Force, becoming aware of the increased pressure for tactical air support in view of the international situation, finally set up a "field office" at Ft. Bragg's nearby Pope AFB, which was supposed to coordinate Army-Air Force tactical matters. The field office was manned by representatives of the Eglin air proving ground and Ninth Tactical Air Force and cooperated with Army, but actually accomplished very little by way of working out joint airborne problems. The primary reason: It had no authority.

Army representative on the new Joint Tactical Air Support Board is Maj. Gen. William M. Miley, director of Army's airborne center. Navy has thus far not named its representative but is expected to do so shortly, a Naval spokesman said.

While the Joint Tactical Air Support Board probably will not exercise command authority as such, decisions reached by the board and forwarded to Defense Department staff agencies as "recommendations" will be tantamount to decisions, an Army spokesman said.

As a result, he added, the board is likely to become the focal point of procurement planning not only for troop and cargo carriers, but in many cases will also be the agency responsible for formulating requirements for virtually all tactical support aircraft.

▶**End to Friction?**—This will go far, it was explained, towards eliminating much cause for disparity between what Army wants for tactical air and what it gets after the Army requirement passes through Air Force agencies to evolve aircraft specifications and procurement of the end product.

In announcing Wolfinbarger's appointment as chairman of the new board, Air Force said he would be succeeded as commander of the Ninth Tactical Air Force by Maj. Gen. Edward J. Timberlake. Previously, Timberlake was Deputy Commander of Far East Air Forces. His successor has not as yet been named.

In other Air Force transfers, Maj. Gen. Francis L. Ankenbrandt, former Director of Communications, Deputy Chief of Staff for Operations, was named Assistant Chief of Staff, Communications, Allied Air Forces, Central Europe. He will be succeeded by Maj. Gen. Raymond C. Maude, who has been commanding general of the 1009th Special Weapons Squadron.

Brig. Gen. Donald J. Kiern, who has been Director of Research, Air Research and Development Command, Baltimore, Md., replaces Maude in command of the 1009th. His successor has not been announced.

NACA Test Program Slashed by Congress

National Advisory Committee for Aeronautics' 1952 program for new construction on test facilities has been cut 50% by Congress.

NACA requested $13,300,000 for new projects for the '52 fiscal year, which started July 1. The budget approved by Congress and signed by the President allows only $6,650,000.

The committee has discretion as to how to apply cuts to its planned $13,300,000 program, which was to include:

- **Langley Laboratory,** $5,522,000 for modernization of the 7-ft. by 10-ft. tunnel and building additions to the 16-ft. tunnel laboratory.
- **Ames Laboratory,** $1,550,000 for modernization of the 6-ft. by 6-ft. tunnel and heat transfer and low-density apparatus.
- **Lewis Laboratory,** $1,805,000 for hydrogen liquefaction plant and high altitude fuels facilities.
- **Wallops Island,** $100,000 for service facilities.
- **Edwards Station,** $4,323,000 for flight test facility.

During the year, NACA will also move forward with development of its phase of the unitary wind-tunnel program: two supersonic aero-dynamic tunnels—an 8-ft. tunnel at Ames Laboratory and a 4-ft. tunnel at Langley; and an 8-ft. supersonic engine test tunnel at Lewis. Congress has made $75 million available to NACA to move full-steam ahead with this program, of which NACA has obligated $30 million. The prospect is that the tunnels will be completed in about two years.

In addition to the $6,650,000 for new construction work, NACA's '52 fiscal year budget, as approved by Congress, allows:

- **For liquidation** of construction contracts already let, $11,700,000.
- **For salaries and expenses,** $49,250,000. NACA requested $55 million to provide for 1,200 additional personnel to step up its activities to keep pace with the expanded military research and development programs.

NACA's total appropriation for the '52 fiscal year of $67,600,000 all cash, compares with the $74,068,000 appropriated the agency for the '51 fiscal year—$63,068,000 cash and $11 million contract authorization.

Qantas Airways Gets Plymouths

Melbourne—The first two of four Short Plymouths on order have recently been delivered to Qantas Empire Airways, which will use the four-engine flying boats on Pacific Islands services.

EAL-Pilot Pact Based on Mileage

Revolutionary agreement marks ALPA's first success in attempt to break away from hourly pay formula.

Eastern Air Lines has signed a revolutionary contract with its pilots, providing pay for miles rather than hours flown. The contract may set the pace for the airline industry.

The new agreement also marks the first success for the Air Line Pilots Assn. in its attempt to break away from the old pay formula based on hours which has existed since 1934 (AVIATION WEEK, Aug. 27, p. 63).

Highlights of the new contract, which is retroactive to Jan. 1, 1951.

• **Co-pilot pay** after the first two years' service is put on the same increment formula as captain pay, at lower rates.

• **Captain pay gains** are typified by a jump from $1,220 a month to $1,361 for an eight-year man flying a Constellation.

• **Co-pilot pay gains** are typified by a jump from $286 a month to $350 for the beginner and by a jump from $565 a month to $767 for the eight-year co-pilot.

• **Mileage formula** puts a premium pay rate on pilot hours scheduled over 66 hours a month on a Super Constellation, over 68 hours on a Constellation, over 75¼ hours on a Martin 4-0-4 and over 83 hours on a DC-4. This is the amount of time, it is calculated, it would take this plane to fly 17,000 miles.

The Eastern mileage formula provides one cent a mile flown by captains the first 17,000 miles a month, 2 cents to 22,000 miles, and 3 cents beyond. Co-pilot mileage pay is half that. But only the Super Constellation—just going into production—could fly 22,000 miles a month based on the agreed-to pegged block speed for it of 260 mph.

The new Eastern contract sets a precedent by providing mileage pay, with increasing penalty costs to the airline for flying more than set maximums. But it is not a complete ALPA victory on that score—just the first successful battle.

Says the Air Line Pilots Assn. about the new mileage formula: "This is not a mileage limitation by any means—but it is recognition of the problem of the fast airplane and it is the first step, and a big one, too, in the right direction—it reverses the old trend in the mileage pay concept that a pilot should (A) fly 'free' miles, (B) fly farther and farther for less and less. . . . It is not all we wanted nor all we will eventually need, either, but we are on our way."

▶**Pay Formulas**—except for co-pilots their first two years, pilot pay is figured by a series of base pay, hourly pay, gross weight, and mileage. Here is a summary of how Eastern's pilots are paid now under the new contract, retroactive to the first of this year.

• **Captain's pay.** First of all, captains get base pay ranging from $250 a month for a third-year man to $350 a month his eighth year—$50 a month more base pay than before. Then comes straight hourly pay, unchanged in the new contract. Next come gross weight pay and mileage pay. Captain's gross weight pay is now 2 cents per 1,000 lb. per hour flown, compared with 1¾ cents before. Mileage pay—the new ingredient—is one cent a mile to 17,000 miles per month, two cents to 22,000 miles and three cents over.

• **Co-pilot's pay.** The co-pilots under the new contract are paid by the same kind of increment pay formulas as the captains, but at lower rates. Before, the co-pilot stayed as he started—on straight base pay, starting at $286 a month and ending at $565 a month the sixth year.

Now the co-pilot stays on base pay only two years—$350 a month the first year and $400 the second. Then he cuts in on the increment pay.

Starting his third year, co-pilot now first gets his monthly base pay; that starts at $250 a month his third year and increases $20 a month each year; it is the same base pay scale as the captain's. Second comes the straight hourly pay based on the pegged speed of the plane flown, with allowance for day or night time higher rates for night, as with captains.

Then there's gross weight pay of ¼ cent per 1,000 lb. per hour flown. And the new mileage pay on top of that—at half the captain's rate; co-pilot straight mileage pay is ½ cent a mile the first 17,000 miles, 1 cent to 22,000 miles, and 1½ cents beyond 22,000.

▶**Comparative Rates**—Here is how the new Eastern agreement affects the eight-year EAL pilot's pay, compared with the American emergency board recommendation and the EAL pilot pay rate in 1950. These monthly pay figures are for a pilot flying 85 hours, half day-half night.

DC-3

	Captain	Co-pilot
AA board	$ 897	$628
1950 pay	897	565
New contract	1,013	622

DC-4

AA board	$1,084	$731
1950 pay	1,080	565
New contract	1,184	693

Martin 4-0-4 or Convair-Liner

AA board	$1,048	$711
1950 pay	1,060	565
New contract	1,188	708

Lockheed 749 or Douglas DC-6

AA board	$1,204	$777
1950 pay	1,220	565
New contract	1,361	767

Lockheed 1049 or Douglas DC-6B

AA board	$1,263	$848
1950 pay	1,261	565
New contract	1,401	783

The DC-3 co-pilot is a special case in the Eastern contract. He gets base pay plus an hourly rate instead of the increment formulas. This rate is: third year $2.35 an hour; fourth $2.75, fifth $3.15, sixth $3.50, seventh $3.40 and eighth $3.20. Eastern expects to retire its DC-3s by replacement.

▶**Other Pay Provisions**—Also provided in the contract are liberalized minimum pay guarantees and expense allowances.

Co-pilot minimum guarantee on all planes is: first year $350 a month, second $400, third $398, fourth $450, fifth $503, sixth $553, seventh and eighth $565.

Reserve captain minimum guarantee is $400 flight pay in addition to regular co-pilot base pay.

Expense allowance is increased to 35 cents per hour effective Sept. 1.

School pay is to be based on the average of the last three months' earnings during which no time was lost.

Vacation period is two weeks up to a pilot's tenth year or service; then it increases two days per year of service.

Working overseas or in foreign countries, captains will get an extra dollar an hour, and co-pilots 50 cents, for flight time.

Battle Seen on Control of NAL

A stockholders' contest for control of National Airlines appears likely at the company's scheduled annual meeting Sept. 27.

The insurgents are led by William K. Jacobs, Jr., now a director of the company but removed from the proposed management slate.

Jacobs is opposing President G. T. Baker's proposal to eliminate cumulative voting by stockholders. Jacobs contends that such elimination would strengthen the "dictatorial powers" of Baker. The struggle centers around Baker's alleged actions taken without consultation of the board of directors.

From the literature issued by Jacobs, it appears the insurgents do not plan Baker's removal, but to surround him with an independent directors' board.

MEDIUM BOMBERS—Korea raises the question: Tactical ace or tactical waste?

Flexibility Seen As Air Power Key

Claim is made that B-29 tactical bombing, properly applied, would provide effective results.

By Alpheus W. Jessup

(*McGraw-Hill World News*)

Bomber Command, Far East Air Force—One big revelation of the Korean war is the flexibility of air power. And one of the most important lessons drawn from the Korean experience is that flexibility should become a primary doctrine for the USAF.

Flexibility was first demonstrated by the successful use of jet fighters for close support bombing missions. Another demonstration is here in Bomber Command. Having wiped out its two or three strategic targets in North Korea months ago, Bomber Command directs its B-29s exclusively on tactical bombing missions.

▶**The Best Medium**—It has proved medium bombers can carry large bomb loads and distribute them on worthwhile targets within the tactical zone. In the opinion of many Air Force officers, it has proved the need, and probably the absolute necessity, for medium bombers in many tactical air operations. One Strategic Air Command general went so far as to tell this correspondent that medium bombers pretty well outmode fighter bombing for many tactical targets. New sights and bombing techniques provide an accuracy which in his opinion makes the medium bomber the most efficient of the air weapons.

Not all of SAC shares this view. To a large extent SAC, whose B-29 groups make up Bomber Command, considers tactical use of medium bombers in Korea a waste of effort.

Maj. Gen. Emmett O'Donnell, who headed Bomber Command for several months, summed up SAC's views recently: "In the future they (big bombers) should be utilized by one command, the command that has studied their utilization and knows everything about it and they should not be given out piecemeal to theaters where they might be used improperly. I think they might be sent against unworthy targets."

▶**The Debate**—Careful analysis of the record tends to support this contention. Ignoring the publicity given "effective bomb tonnage" (defined as bomb tonnage dropped north of the 38th Parallel regardless of what it hit), it appears that much of Bomber Command's effort was wasted. Operations analysts from USAF, however, estimate that Bomber Command's effectiveness was only a fraction of what it might have been. Using the record in Korea to claim that medium bombers are inefficient tactical aircraft is "nonsense." Limited as the data is, they claim that it indicates that the medium bomber is here to stay as an important part of tactical air support.

The fault in Korea has not been the medium bomber. It has been the inadequate development of methods for attacking tactical targets. Bombing attacks are successful only when the bombs hit the target and explode in such a way as to destroy the target or render it unuseable to the enemy for the maximum amount of time. Air Force preoccupation with headline hunting obscures this aim under a mass of tonnage figures, the weight of bombs released over enemy area, supporters of the mediums say.

▶**Target Analysis**—Until very recently, little research and development has gone into target analysis and target attacks. By the end of World War II, just such research and development was a primary requisite throughout the Air Force. As one analyst with broad World War II experience put it, Bomber Command has forgotten how it used to attain efficiency. Many bomber officers haven't read either the basic studies on operations analysis or the United States Strategic Bombing Survey.

B-29 officers and O'Donnell bitterly complained their attacks on bridges during the early stages of the Korean war were wasted effort. They were. They knocked down few bridges. But they assumed that bridge-busting couldn't be done, because it wasn't in the SAC concept. They did not try to find out if it were possible to hit bridges effectively with bombs from B-29s.

Recently, Bomber Command began "clobbering hell out of bridges." Research and development of attack methods resulted in a drastic change in the angle of attack against bridges. For nine months, bombers had been attacking at an angle of 20 deg. to the axis with hardly ever a hit. But they kept right on following the same method. Now, they attack at a considerably different angle with consistently good results.

▶**Fuse Settings**—Operations analysts also think the bomb fuse settings had a good deal to do with the ineffectiveness of bridge bombing. They point out that 1/10 second error in fuse setting can mean the difference between a successful bomb and an unsuccessful bomb.

Major tactical targets for medium bombers are rail marshaling yards, bridges—now that they can destroy them—and airfields. As to efficiency, one B-29 can do the work of six B-26s on a marshaling yard. Here too, research and development of attack method is essential.

For a long time, Air Force was puzzled why yards weren't kept out of action longer. Besides blasting the yards, they usually dropped several

variable-delay fused bombs, which should have kept bombing off for 24 hours, preventing repair work. The heavy bombs penetrated deeply into the yard and were self-buried. When they exploded, all the blast and shock effect was absorbed in the ground and debris with no effect on reconstruction overhead.

► **Avionic Aids**—A new major use for medium bombers are attacks in all-weather and at night against enemy troop concentrations. Radar and other new navigational aids and Shoran accurately guide medium bombers to the bomb-dropping point. Against troops, the B-29s drop 100- and 500-lb. bombs, with proximity fuses, which burst in the air with devastating effects on enemy troops. The accuracy of the navigation is so great that these bombs are dropped at night within 400 yards of our own front lines.

Chinese prisoners have been terrified by this weapon. They believe our radar actually picks out troop concentrations. Infantry commanders credit one B-29 dropping proximity-fused bombs with routing a full enemy regimental attack.

The B-29 is not considered the ideal aircraft for the job, but it is available in large numbers and it can do the job in the opinion of qualified airmen here. It is believed that the B-47 would be excellent for tactical bombardment.

► **Unify the Air Force**—What observers believe is necessary now is unification in the Air Force. Strategic Air and Tactical Air must work together on the development of medium bombardment which can be switched from one mission to the other as required by the military situation. The alternative is the utilization of air power by dogma.

There also is a need to swing America's military publicity from the big figures concept to the target destruction concept. The number of airplanes airborne, the number of sorties flown and the tons of bombs released are meaningless figures in war. Analysis of the great B-29 raids on Japan revealed that the first 25% of the planes over the target area accounted for 90 to 95% of the damage. Maximum efficiency would have been attained by sending 200-plane attacks rather than 800-plane missions.

But in its battle for publicity with the Navy, the Air Force couldn't get the big play unless it sent large numbers of B-29s winging toward Tokyo. The big figures concept in the long run has a blinding effect on officers in all services.

Finally, the Air Force, as well as all the services, needs to develop its maximum potential through open-minded research and development of its methods of attack. One of the great examples of this was Lt. Gen. Curtis Le May's decision to send the B-29s over Tokyo at 5,000-ft. altitude. Through late 1944 and early 1945 the B-29s dropped their bombs from high altitude with generally unsuccessful results. Pilots and crews were disturbed when the briefing officer announced the altitude of 5,000 ft. for the Tokyo attacks of Mar. 9, 1945. But the results were tremendous and began the great fire raids which destroyed so much of Japan's principal industrial centers.

See Supersonic Jet Delta Flying Boat

Research and design details of a new flying boat configuration, blending aerodynamic and hydrodynamic refinements, were disclosed last week by Ernest R. Stout, assistant to Convair's chief engineer, in a paper presented before the joint conference of the Institute of the Aeronautical Sciences and the Royal Aeronautical Society, at Brighton, England.

Stout's paper, "A Review of High-Speed Hydrodynamic Development," described to the third joint conference of this Anglo-American group the results of Convair's hydrodynamic experimentation in Project Skate and its delta wing experience with the XF-92.

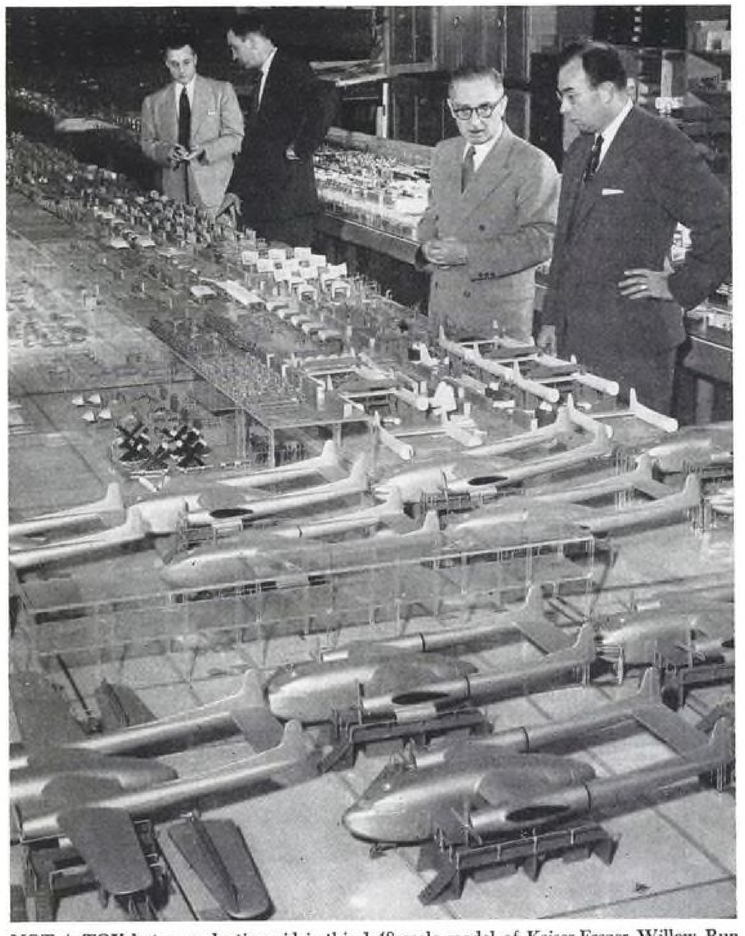
Drawing on this work, Convair's engineers have produced data indicating that the aerodynamic advantages of the delta wing coupled with a new hydrodynamic concept of blanded wing-and-hull design can lead to jet-powered, supersonic, water-based aircraft.

(Aviation Week will present further details of Stout's paper later.)

B-50 TAKES ON RESEARCH 'BOMB LOAD'

Trundled under the belly of Boeing B-50 mother ship, the tiny rocket-propelled Bell X-1D (top photo) is prepared for flight. Just prior to recent launching, X-1D suffered mishap and had to be jettisoned, exploding in mid-air (Aviation Week Sept. 3, p. 15). Pilot had scrambled to safety before drop. Instead of taxiing mother ship over pit containing X-1D for attachment as heretofore, B-50 is shown jacked above ground level here. Lower photo shows X-1D bundled into modified bomb-bay of B-50, where it is carried to altitude and released. Differences from X-1 include protruding canopy.

PRODUCTION



NOT A TOY but a production aid is this 1:48 scale model of Kaiser-Frazer Willow Run plant, with replicas of Fairchiid C-119 on assembly line. K-F President Edgar Kaiser (right) inspects 70 x 35-ft. layout with other K-F executives.

Willow Run Getting Ready to Roll

Kaiser-Frazer expects to finish first C-119 this fall, with a 3-a-day C-123 peak rate after Packet phase-out.

By Alexander McSurely

Willow Run Airport, Mich.—In one of the best laid-out aircraft manufacturing facilities in the world, Kaiser-Frazer Corp. is getting ready here to build twin-engine transports at a rate which may eventually reach three planes a day, under present plans.

About one-third of the huge aircraft plant is at present assigned for plane manufacture, while the rest of the 3.5-million sq. ft. facility remains for continuing automobile production.

Schedules call for the first Fairchild C-119 combat cargo transport to be completed at Willow Run this fall, probably in November. As usual, the first several of the licensee's planes will be assembled from parts largely supplied by the parent company, Fairchild Engine and Airplane Corp., from its Hagerstown, Md., plant.

► **Later Plans**—But as soon as its own production gets rolling, Kaiser-Frazer hopes to increase production of the Packets gradually up to beyond the 20-a-month figure at the peak, before production is phased out for the C-119, and phased in for the second plane to be built at Willow Run—the Chase C-123 assault transport.

Plan is for the Willow Run phase-out on C-119s to be coordinated with the phase-in of the Packet's production by Fairchild, in the plant operated by Douglas in World War II at Chicago's O'Hare Airport.

Kaiser-Frazer will build the C-119 fuselage and center wing sections out to the nacelles at Willow Run, and is subcontracting production of the outer wing panels, booms, and tails to Gibson Refrigerator Corp., Greenville, Mich., Whirlpool Corp., LaPorte, Ind., and Murray Corp. of America, Detroit.

On a percentage basis it figures out that Kaiser-Frazer is building 65% of the airplane, after the first few units, and that some 700 companies in 26 states are being used as suppliers of the remaining parts and the materials.

► **Plenty of Room**—Actually the Packet production at Willow Run will be "small potatoes" compared to what was done in the same facility in World War II. The C-123 production scheduled to follow will be a more complete utilization of the big plant's output potential.

Kaiser-Frazer plans to start one C-123 line paralleling the C-119 line as soon as necessary tooling and fixtures can be prepared, and after, as the C-119 line is phased out, will switch that line to a second C-123 assembly setup.

With C-123 orders calling for approximately 380 airplanes to be built at Willow Run, and with two lines on which to build them, it is estimated that peak production of as many as three airplanes a day may be achieved.

This is still considerably short of what was done at Willow Run by the Ford Motor Co., its original owner, during World War II. Ford built a total of 8,809 Convair-designed four-engined B-24 Liberator bombers and cranked out 4,600 of these in one year (1944).

This breaks down to over 10 planes a working day. At the peak, attained only for a short period, Ford was completing one Liberator an hour.

Probably the best gauge for comparing the new planned production at Willow Run with that of World War II is in airframe pounds. The C-119 airframe weight is about 27,000 lb. and that of the Ford-built Liberators was similar. The C-123 is somewhat lighter, probably around 20,000 lb.

(Airframe weight is defined as the weight of the empty airplane minus powerplants, wheels, tires, brakes, superchargers, auxiliary powerplants, removable radio and electronic units, armament, starters, generators and batteries.)

► **Machine Tools**—Kaiser-Frazer is in relatively good shape to start plane production as far as general purpose machine tools are concerned, but still needs special purpose tools. Soon after the automobile company knew it had

the C-119 licensing agreement firmed up with Fairchild and AMC, its tooling engineers were sent down to Marietta, Ga., to select large quantities of general purpose tools from the Air Force reserve storage. They got in early enough to get excellent tools. These have already been transferred to Willow Run, and are being placed according to a very elaborate scale model production layout which Kaiser-Frazer has laid out on a balcony overlooking the production area.

Edgar Kaiser, president of Kaiser-Frazer, says that his company is now turning out 200 automobiles a day at Willow Run, a considerable drop from the peak production of 1,200 cars a day. But he expects the aircraft production to about equal his auto production, in dollars, by about May of 1952, when the peak under present schedules will be reached.

OUR EXPANDING INDUSTRY

AC Spark Plug division of General Motors is preparing to tool up at Flint, Mich., for production of gyroscopic gunsights for the USAF. . . .

AiResearch Mfg. Co. of Arizona has started assembly operations of electronic analogue computers and cabin pressure regulators in its new 70,000 sq. ft. plant at Sky Harbor Airport, Phoenix. The plant now employs 170. . . .

American Brake Shoe Co. will build a foundry at Medina, N. Y., to produce parts for Wright Aeronautical Corp.'s J-65 Sapphire turbojet engine. The foundry will be ready in the spring of next year and will be operated by the company's Engineered Castings division. . . .

Baldwin-Lima-Hamilton Corp., Eddystone, Pa., has gotten a contract from Wright Aeronautical Corp. to manufacture turbines for the J-65 Sapphire jet engine. . . .

Collins Radio Co. will lease a 50,000-sq. ft. new plant to be built in the Trinity industrial district of Dallas, Tex., located near the firm's present 20,000-sq. ft. factory in that area. Collins is working on a backlog of over $150 million. . . .

Convair's Guided Missile division is expanding its Pomona annex facilities by 15,000 sq. ft. Division is also leasing nearby vacant storage lot to provide temporary additional engineering laboratory activities. . . .

Fox Edge Co., Inc., Lowell, Mass., has recently completed an expansion of its parachute cord productive capacity which will boost output 100%. . . .

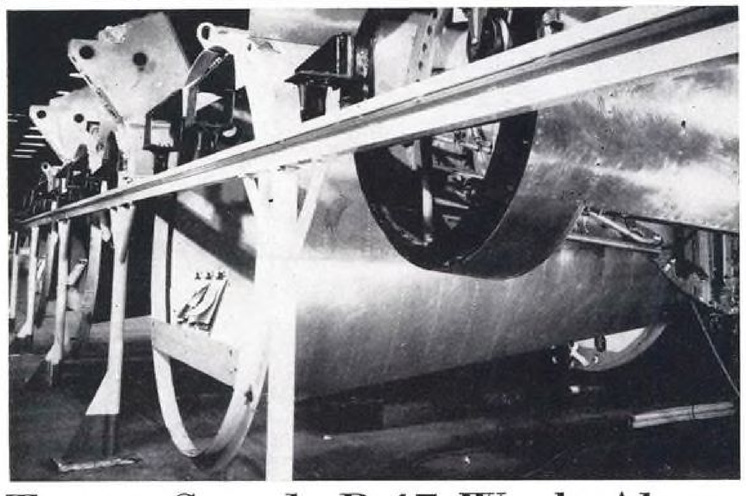
Humphrey, Inc., San Diego, has become affiliated with Pacific Scientific Instrument Co. to take over the design, development and production of aeronautical guidance and control units of Humphrey-Watson Co. . . .

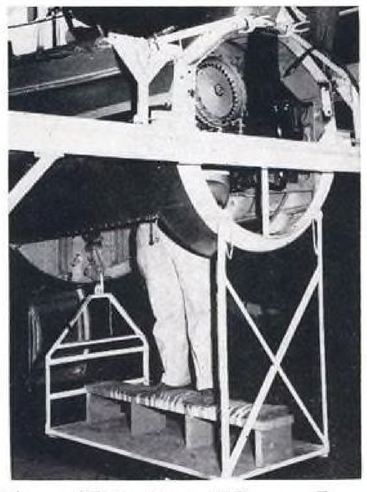
Lockheed Aircraft Corp., will open a 48,000-sq. ft. feeder plant in Bakersfield, Calif., for subassemblies of military or commercial planes. The plant, which will be in operation in 60 days, will employ 250-300, mostly women. . . .

Metals Processing division of Curtiss-Wright Corp., has acquired the Otis Elevator Co. works in Buffalo, N. Y., having 144,000 sq. ft. of building area. Division will work on advanced metallurgical techniques to be used in the production of jet engines. . . .

Neomatic, Inc., Los Angeles, has doubled capacity to produce electronics components by moving to larger quarters at 11632 San Vicente Blvd., Los Angeles 49. . . .

Majestic Aircraft division, Metal Specialties, Inc., Moosup, Conn., has contracted with Glenn L. Martin Co. to build ailerons for the P5M-1 Marlin flying boat. . . .





Temco Speeds B-47 Work Along the Right Track

More production speed and conservation of vitally needed floor space stem from an elevated track arrangement to facilitate equipment installation in Boeing B-47 rear fuselage sections being built by Texas Engineering and Mfg. Co.

Temco engineers designed this production facility as a substitute for carrying each fuselage section in its own jig consisting of two scaffold-like stands attached to each end by support rings, then mounting the entire jig on wheels in order to facilitate movement on floor tracks.

In the new arrangement, the scaffold stands have been eliminated and the wheels have been welded directly to the jig support rings to support the section on the double elevated track, allowing closer grouping of units.

Platforms also were introduced which could be suspended from the support rings and major fittings or mounted on the track along which the fuselage section moves. This eliminates bulky floor work stands.

USAF CONTRACTS

Air Force contracts announced by Air Materiel Command for the week ended July 27 included 120 valued at "over $250,000." In this issue, AVIATION WEEK completes the listing begun last week.

Aircraft Tools, Inc., Los Angeles, dimpling unit-pneumatic portable, Cl. 17A, over $250,000.

AiResearch Mfg. Co., div., of Garrett Corp., Los Angeles, spare parts for actuators, motors, thermostats, Cl. 03C, 155 items, $63,489; airplane coolers, steel, Cl. 03F, 310 ea., $78,035.

Airequipment Co., Burbank, crash truck, foam care funnel, Cl. 12, 850 ea., $43,214.

Air Products, Inc., Emmons, Pa., maintenance parts for the A-1 generator, Cl. 19C, 57 items, $121,575.

American Coleman Co., Omaha, incorporating of engineering changes to vehicles, Cl. 19B, $109,073.

American Pipe & Steel Corp., Alhambra, Calif., hydrant refueling systems for servicing aircraft from tank car sidings, Cl. 12, over $250,000.

American Pneumatic Tool Co., Los Angeles, riveting hammers, Cl. 17A, 607 ea., $34,902.

American Type Founders, Cincinnati, repair of Weberdorf presses, 1 job, $35,000.

Ansonia Electrical Co., Ansonia, Conn., telephone cable, Cl. 08F, over $250,000.

Antenna Research Laboratories, Inc., Columbus, O., dummy load, Cl. 16J, 213 ea., $36,750.

Apex Machine & Tool Co., Dayton, aircraft hardware, Cl. 04A, 15,000 ea., $67,500.

Aro Equipment Corp., Bryan, O., wrench, pneumatic & data, Cl. 17A, 756 ea., $77,406.

Atlantic Parachutes Corp., Lowell, Mass., parachutes, Cl. 20, over $250,000.

Bendix Products div., Bendix Aviation Corp., South Bend, test stand assembly, direct injection, fuel, nozzle, Cl. 17C, over $250,000.

Bill Jack Scientific Instrument Corp., Solana Beach, Calif., S-11 cameras, related equipment, spare parts and data, Cl. AF 10A, over $250,000.

Board of Regents, University of Calif., Berkley, to subcontract with Linfield College, for development of a field emission type cathode, $50,000.

Boeing Airplane Co., Seattle, engine ground test program, $210,000.

Bolsey Research & Development Corp., New York, cameras, 12 ea., $72,000.

Brown-Brackmeyer Co., Dayton, buffer & polisher bench type, Cl. 17A, 191 ea., $28,521.

Brunswick, Balke, Collender, Chicago, components of aerial delivery kits, platform assembly, crash frames, barrel bars 7 etc., Cl. 20, over $250,000.

S. Buchsbaum & Co., Chicago, additional emergency sustenance kits, Cl. 13C, 1,250 ea., $70,425, recreation kits, Cl. 37, 600 ea., $193,800.

Butler Mfg. Co., Kansas City, trailer, Cl. 19B, over $250,000; mockup, drawing; trailer, engineering data; spare parts, Cl. 19B, over $250,000.

Berlin & Jones Co., Inc., New York, correspondence envelopes.

Cal-Aero Technical Institute, Glendale, Calif., training of 300 AF personnel as airplane and engine mechanics, over $250,000.

Cameo Curtains, Inc., New York, cargo parachute, Cl. 20, over $250,000.

Cappel, MacDonald & Co., Dayton, kits, emergency sustenance, Cl. 13, over $250,000.

Central Missouri State College, Warrenburg, Mo., furnishing of necessary facilities and training for 575 AF personnel as clerk-typists for 12 weeks, $231,210.

Century Engineers, Inc., Burbank, fuel tanks, 12 items, $59,653.

Century Sportswear, Philadelphia, trousers, Cl. 13A, over $250,000.

Cessna Aircraft Co., Wichita, spare parts, Cl. 014, over $250,000.

Cincinnati Electronics Co., Cincinnati, radio receivers, R-77A/ARC-3, Cl. 16A, over $250,000.

Cincinnati Lathe & Tool Co., Cincinnati, drill presses; lathes, Cl. 17A, over $250,000; drill press, Cl. 17A, 60 ea., $77,370.

Clark, David Co., Worcester, Mass., suits, flying, Cl. 13A, over $250,000.

Cleveland Pneumatic Tool Co., Cleveland, gruss air springs maintenance parts, Cl. 19C, over $250,000.

Cleveland Steel Barrel Co., Cleveland, metal shipping containers, Cl. 43, 2 items, $79,600.

Colorado Agricultural & Mechanical College, Fort Collins, Colo., furnishing of necessary facilities and training for 250 AF personnel as meat and dairy inspectors for 15 wks, $142,816.

Columbus Flyers, Englewood, Calif., training of 300 AF personnel in 36 week course and A & E mechanics, over $250,000.

Consolidated Vultee Aircraft Corp., Ft. Worth, repair, rework, modification and overhaul of government furnished parts, $175,000.

Continental Motors Corp., Muskegon, Mich., PC-30 Packette type engines, Cl. 19C, over $250,000.

Cranecr Posture Chair Co., Kansas City, Mo., typist & clerical chair, Cl. 40A, 3,750 ea., $70,762.

Crawford Mfg. Co., Richmond, cotton muslin parachute, Cl. 20, over $250,000.

Curtis Laboratories, Inc., Los Angeles, lenses, 133 ea., $52,400.

Helene Curtis Industries, Chicago, A-10A dryers, Cl. AF 10B, 80 ea., $78,127.

Dana Corp., Toledo, spare parts, Cl. 19C, 59 items, $42,017.

Douglas Aircraft Co., Santa Monica, services and materials necessary to perform structural repair of aircraft, Cl. O1D, $101,-025.

Drybak Corp., Binghamton, N. Y., jackets, flying type N-2A, Cl. 13A, 6,589 ea., $221,-851; suits, flying, Cl. 13A, 2,000 ea., $127,-900; jackets, Cl. 13A, over $250,000.

Eastern Stainless Steel Corp., Baltimore, stainless sheet for supply & maintenance program, over $250,000.

Sigmund Eisner, Red Bank, N. J., trousers, Cl. 13A, over $250,000.

Elastic Stop Nut Corp. of America, Union, aircraft nuts, Cl. 04A, $5,341,300 ea., $237,-648.

Emerson Electric Mfg. Co., St. Louis, air circulating fan, Cl. 34B, over $250,000.

Fairchild Camera & Instrument Corp., Jamaica, L. I., photo equipment, spare parts & maintenance data, Cl. 10A, over $250,000; photographic cameras & equipment, spare parts and data, over $250,000; development of experimental shutters manuals and drawings, 1 shutter, 6 manuals, 1 set drawing, $89,605; camera, spare parts & data, Cl. AF 10A, over $250,000; camera, magazine, spare parts, data, Cl. AF 10A, over $250,000.

Farrand Optical Co., New York, design and development lens, Cl. 10A, $82,847.

Fashion Frocks, Inc., Cincinnati, parachutes, harnesses, Cl. 20B, over $250,000; parachute packs, Cl. 20B, 2,449 ea., $213,-205.

Federal Mfg. & Engineering Corp., Brooklyn, radio set AN/GRC-32, Cl. 16B, over $250,000.

Federal Motor Truck Co., Detroit, spare parts for C-2 truck tractor, Cl. 19C, 22 items, $40,549.

Gallagher & Sons, E. A., Philadelphia, storage of AF general purpose vehicles, over $250,000.

Garden City Plating & Mfg. Co., Chicago, floodlight, Cl. 08A, over $250,000; floodlight, Cl. 08A, over $250,000.

General Electric Co., Schenectady, stand-test, aluminum, Cl. 17C, 24 ea., $35,376; parts for motor assemblies, Cl. 03C, 45 items, $75,000; tube electron RMA, Cl. 16E, over $250,000.

General Fireproofing Co., Youngstown, O., steel, flat-top desk, Cl. 40A, over $250,000; steel, flat-top desks, over $250,000.

Gibbs Mfg. & Research Corp., Janesville, Wis., radar indicator group, Cl. 16A, 9 items, $39,005; components of a complete system of Doppler Drift attachment, Cl. 16A, 13 items, $214,586.

Goodall Fabrics, Inc., New York, cloth, cotton duck, Cl. 21, over $250,000.

Goodyear Tire & Rubber Co., Akron, wheel assemblies and brake assemblies, Cl. 03B, 2,213 ea., $156,654.

C. H. Gossinger Machinery Co., Dayton, shapers, Cl. 17A, 28 ea., $161,402.

Granberg Corp., Oakland, aircraft fuel meters, spare parts, & data, Cl. 19C, over $250,000.

Greer Stop Nut Co., Chicago, aircraft nuts, Cl. 04A, 15,174,200 ea., $158,083.

Griffith Ladder Mfg. Co., Malden, Mass., wooden ladder 8 ft., Cl. 19A, 3,678 ea., $90,846.

Guardian Electric Mfg. Co., Chicago, relays, Cl. 16E.

Guardite Corp., Chicago, modification of existing Guardite compression chambers, over $250,000.

Hammond Mfg. Corp., Pasadena, trailer, type K-1, Cl. 19A, 166 ea., $65,525.

Harmon Equipment Co., Los Angeles, trailer-oil servicing, Cl. 19B, 3 ea., $37,105.

Brad Harrison Co., Oak Park, Ill., cable assembly, Cl. 08B, 2,300 ea., $82,472.

Heag Knitting Mills, Inc., Yonkers, N. Y., glove inserts, 74,120 pr., mitten inserts, Cl. 13A, 24,996, $136,892.

Heil Co., Milwaukee, F-6 refueling trailers for refueling B-36 & other large aircraft, Cl. 19B, over $250,000.

Hercules Motors Corp., Canton, O., spare parts for Hercules engines, Cl. 19C, 197 items, $219,941.

H & E Distributing Co., Inc., Oklahoma City, aircraft parts, Cl. 01D, 1-22 items, $56,626.

Hewitt Rubber div., Hewitt Robins, Inc., gasoline hose, Cl. 12, over $250,000.

Hinson Mfg. Co., Waterloo, Iowa, flyers clothing bag, Cl. 13C, over $250,000.

Hirsch, Gustav Org., Inc., Columbus, furnish services of telephone construction crews, cable splicing crews, and one installer crew, $28,000.

House of Swansdown, Inc., New York, WAF patterns, Cl. 13, 86 ea., $27,250.

Houston Fearless Corp., Los Angeles, magazines, spare parts, special tooling, 200 ea., 10%, $201,720; processing machine, 1 spray, sensitized materials and drawings, 1 set, $35,066.

Hubbard, Dilley & Hamilton, New York, architect, engineering service, $46,848.

Hunter Fan & Ventilating Co., Memphis, air circulating fan, Cl. 34B, over $250,000.

Illinois Institute of Technology, Chicago, research for design of cantilever hangar and hose hangar, $56,000.

Independent Pneumatic Tool Co., Aurora, Ill., air hammers, electric drills, sanders & impact wrenches, Cl. 17A, over $250,000.

Ingersoll-Rand Co., Cincinnati, compressors, Cl. 17A, over $250,000.

Institute of Applied Arts & Sciences, Brooklyn, furnishing of necessary facilities and training for 180 AF personnel as dental lab technicians for 26 weeks, over $250,000.

International Latex Corp., Dover, Del., helmets, type K-1, Cl. 13A, 106 ea., $66,664.

Irving Air Chute Co., Inc., Buffalo, parachute equipment, Cl. 20B, over $250,000.

Jackson Electrical Equipment Co., Dayton, tester, variable capacitance, Cl. 17C, 86 ea., $50,699.

Jackson, Keene S., Glendale, gun sight parts, Cl. 11B, 101 items, $176,460.

Kansas State Teachers College, Emporia, Kan., furnishing of necessary facilities and

training for 675 clerk-typists for 12 weeks, over $250,000.

Kearfott Co., Inc., Little Falls, N. J., master indicators, Cl. 05A, 100 ea., $245,000.

Kearney & Trecher Corp., Milwaukee, #3 universal milling machine, Cl. 17A, 3 ea., $54,595.

Kindred Aviation Corp., Burbank, generator type R-1, s/n, 4224-200-3, Cl. 03, 330 ea., $51,150.

Kollsman Instrument Corp., Elmhurst, L. I., N. Y., pilot's standard compass, spare parts and data, 3,543 ea., $59,437.

Kops Brothers, Inc., New York, flying suits, over $250,000.

Kuehne Mfg. Co., Mattoon, Ill., steel chair, Cl. 40A, over $250,000.

Lambert Engineering Co., St. Louis, ejector type B-5, 24 ea., ejector type B-4, 24 ea., $192,078.

Lear Inc., Grand Rapids, components of autopilot for Navy, Cl. 05F, 17 items, $25,261.

Le Tourneau Technical Institute, Longview, Tex., furnishing of necessary facilities and training for 884 AF personnel in basic automotive preventive maintenance for 9 weeks, $156,697.

Lincoln Metal Products Corp., Brooklyn, metal shipping containers, Cl. 43, 4 items, $151,985; metal shipping containers, Cl. 43, over $250,000.

Lindberg Engineering Co., Chicago, electric heat treating, furnace & generator, Cl. 17A, 10 ea., $35,573.

Lion Uniform Co., Dayton, shirts and trousers, Cl. 13A, over $250,000.

Lockheed Aircraft Corp., Burbank, kits and assemblies, sub-assemblies, Cl. O1L, 210 ea., $114,240.

Louisiana Polytechnic Institute, Ruston, La., furnishing of necessary facilities and training for 575 AF personnel as clerk-typists for 12 weeks, over $250,000.

Lowther, Harry A. Co., Shelbyville, Ind., 333 towing vehicles, engineering data, maintenance data, spare parts, Cl. 19B, over $250,000.

Lyon Metal Products, Inc., Aurora, Ill., work benches, Cl. 17A, over $250,000.

Mallory, P. R. & Co., Inc., Indianapolis, rectifiers, Cl. 17A, 248 ea., $103,850.

Marlow Pumps, Ridgewood, N. J., pump kits, maintenance data, spare parts; engineering data, Cl. 19C, 292 ea., $150,000.

Marmon-Herrington Co., Indianapolis, type 0-10 crash fire trucks, Cl. 19B & C, over $250,000.

McInerney Spring & Wire Co., Grand Rapids, cargo parachute, Cl. 20, over $250,000.

McKay Products Corp., Sayre Pa., cargo parachutes, Cl. 20, over $250,000.

C. H. Masland & Sons, Carlisle, Pa., trousers & jackets, Cl. 13A, over $250,000; jackets, air, Cl. 13A, over $250,000; cotton duck cloth, Cl. 21, over $250,000.

Meier Mfg. & Dist. Co., Tucker, Ga., table, wood, dining hall, Cl. 40A, over $250,000.

Metal Industries, Inc., Indianapolis, metal shipping containers, Cl. 43, 4 ea., $200,250; metal shipping containers, Cl. 43, 5 items, $84,345.

Miller Equipment Co., Franklin, Pa., parachute harnesses, Cl. 20B, over $250,000.

I. Miller & Sons, Inc., Long Island City, cargo parachute, Cl. 20, over $250,000.

Miller G. William & Assoc., Montgomery, Ala., services, overhaul Marines engines, $123,000.

Mine Safety Appliances Co., Pittsburgh, oxygen pressure masks, Cl. 13C, 4,958 ea., $93,329; mask-oxygen pressure, Cl. 13C, over $250,000.

Mirax Chemical Products Corp., St. Louis, metal shipping containers, Cl. 43, 60,000 ea., $131,010; metal shipping containers, Cl. 43, 2 items, $54,483.

Motch & Merryweather Machine Co., Cleveland, metal shapers, Cl. 17A, over $250,000.

National Automotive Fibres, Detroit, cargo parachutes, Cl. 20, over $250,000.

National Products Co., Grand Haven, Mich., work benches, wood tops, Cl. 17A, 505 ea., $65,490.

National Store Fixture Co., Baltimore, table, wood, dining hall, Cl. 40A, over $250,000.

Niles Tool Works div., Baldwin-Lima-Hamilton, Corp., Hamilton, wing turret lathe, Cl. 17A, over $250,000.

Norcor Mfg. Co., Green Bay, Wis., tablet arm chairs, Cl. 40A, 15,000 ea., $127,980.

Northrop Aeronautical Institute, Northrop A/C Inc., Hawthorne, Calif., furnishing of necessary facilities & training for 710 AF personnel in airframe repair man training for 16 weeks, over $250,000.

Northrop Aircraft Inc., Hawthorne, technical data, Cl. 30B, $35,517.

Northwest Missouri State College, Marysville, Mo., furnishing of necessary facilities and training for 575 AF personnel as clerk-typists for 12 weeks, over $250,000.

Nuare Co., Chicago, light spare parts, Cl. AF 10B, 238 ea., 5%, $172,306; photo tanks, Cl. AF 10B, 1,938 ea., $21,095.

Ohio Chemicals & Surgical Equipment Co., Madison, oxygen equipment, Cl. 13C, 30,789 ea., $125,580.

Olympic Radio & Television, Inc., Long Island, radio set ACR-574A, Cl. 16B, over $250,000.

Oklahoma A & M College, Stillwater, Okla., furnishing of necessary facilities and training of 275 AF personnel as stenos for 26 weeks, over $250,000.

Osborne Coinage Co., Cincinnati, plunger, parachute harness, Cl. 13C, 222,518, $195,-815.

Panellit, Inc., Chicago, complete instrumentation for AEDC, over $250,000.

Parks College, St. Louis University, E. St. Louis, training of 300 AF personnel as airplane and engine mechanics, over $250,000.

Pennsylvania Transformer Co., Canonsburg, Pa., power transformer, over $250,000.

Perkins Elmer Corp., Glenbrook, Conn., cone assembly, engineer data, Cl. AF 10A, 77 ea., $224,080.

Perney Equipment Co., Columbus, heat treating furnace, Cl. 17A, 13 ea., $30,241.

Pesco Products, Borg-Warner Corp., Bedford, fuel booster pumps, Cl. O31, 700 ea., $98,188.

Philco Corp., Philadelphia, training of

200 AF personnel in radar mechanics for 30 weeks, over $250,000.

Phoenix Tinware Co., Brooklyn, metal shipping containers, Cl. 43, over $250,000.

Pratt & Whitney div., Niles-Bement-Pond Co., West Hartford, shapers, Cl. 17A, 4 ea., $54,356; lathes, Cl. 17A, 4 ea., $30,808.

Radioplane Co., Van Nuys, Calif., study of & proof operation of USAF parachute test facility, $25,000.

Radio Receptor Co., Brooklyn, radio transmitter T-282/GR, Cl. 16B, over $250,000.

Randall Mfg. Co., Inc., New York, vapor-type degreaser, Cl. 17A, 46 ea., $35,742.

Ranier Co., Inc., Brooklyn, parachute equipment, Cl. 20B, over $250,000.

Reed Products, Inc., Milwaukee, N-3A jackets, Cl. 13A, over $250,000.

Reliance Mfg. Co., Chicago, ripcord assembly, Cl. 13C, 94,158, $233,511.

Rem-Cru Titanium, Inc., Bridgeport, Conn., research on mechanical properties of various titanium alloys, $41,376.

Republic Aviation Corp., Farmingdale, L. I., F-84G mobile training units, Cl. 01N, over $250,000; bar & cable assembly, sling assembly, 1,282 ea., sling assembly, Cl. 19A, 49 ea., 42 ea., $145,324.

Revere Camera Co., Chicago, camera, spare parts, Cl. AF 10D, over $250,000.

Reynolds Metals Co., Richmond, operation & maintenance of mfg. methods of pilot plant plancor, over $250,000.

Robbins & Meyers, Inc., Springfield, O., assembly, type A-1 for type J-1 engine hoist, Cl. 19A, over $250,000.

Romec div., Lear, Inc., Elyria, O., pressurizing kits, Cl. 16A, 530 ea., $92,812.

Roth Office Equipment Co., Dayton, typist chair, Cl. 40A, 3,750 ea., $94,875.

Salsbury Corp., Los Angeles, tire changer set, Cl. 17A, 100 ea., $42,450.

Scintilla Magneto div., Bendix Aviation Corp., Sidney, N. Y., manifold ring P/N4704, Cl. 03H, magneto assembly, lead (rt), lead (lt), harness assembly, ignition Co. 1, over $250,000.

Singer Sewing Machine Co., New York, sewing machines, Cl. 17A, 91 ea., $24,540.

Skinner Purefiers div., Bendix Aviation Corp., Detroit, F-2A fuel filter kit, Cl. 08B, over $250,000.

Skyline Mills, Inc., Chattanooga, nylon & cotton webbing for parachute repair, Cl. 21, over $250,000.

Smith, A. O., Corp., Milwaukee, providing industrial facilities for producing of steel weldments for B-52 aircraft, over $250,000.

Smith, Henchman & Grylls, Inc., Detroit, provide a transportation to the Mount Washington Icing Research Facility, $55,000.

Spartan School of Aeronautics, Tulsa, training of 300 AF personnel in airplane maintenance fundamentals for 36 weeks, over $250,000.

Sperry Gyroscope Co., div., Sperry Corp., Great Neck, L. I., N. Y., components of J-2 compass system, Cl. 05A, over $250,000; misc. tools, Cl. 18, $191,435.

Springfield Machine Tool Co., Springfield, O., geared head engine lathe, Cl. 17A, $239,474.

Springfield Tent & Awning Co., Springfield, O., field maintenance shelters, type A-1A, Cl. 19A, 80 ea., $58,569; cloth-cotton duck, Cl. 21, 135,524 yds., $233,227.

Stamford Electronics Co., Stamford, Conn., pulse generator, Cl. 16J, over $250,000.

Standard Molding Corp., Dayton, emergency sea rescue, lamp assembly, Cl. 08A, 50,000 ea., $128,250.

Standard Steel Works, Kansas City, F-6 trailers, refueling for refueling aircraft, also spare parts, Cl. 19B, over $250,000.

St. Louis Univ., St. Louis, furnishing of necessary facilities and training for 150 AF personnel in arm. electronics for 19 weeks, 1 set drawing, $89,605.

Stewart-Warner Corp., Indianapolis, hand operator heaters, Cl. 19A, 532 ea., $120,217.

Superior Sleeprite Corp., Chicago, desk-typist, steel, Cl. 40A, over $250,000.

Superior Togs Corp., Elizabeth, mens flying type jackets, Cl. 13A, over $250,000.

Surface Combustion Corp., Toledo, F-4 heater, Cl. 19A, over $250,000.

Switlik Parachute Co., Trenton, parachutes, harnesses, Cl. 20B, over $250,000.

Tarleton State College, Stephenville, Tex., furnishing of necessary facilities and training for 575 AF personnel as clerk-typists for 12 weeks, $238,100.

Technicraft Corp., Kansas City, aircraft covers, Cl. 20, 2,367 ea., $161,805; cover, aircraft, Cl. 20, over $250,000.

Tenn. Polytechnic Institute, Cookeville, furnishing of necessary facilities and training of AF personnel for 12 weeks, over $250,000.

Thiokol Corp., Trenton, development of a basis new polymer for use in integral fuel tank sealing compounds, $40,000.

Tracerlab, Inc., Boston, radiac sets, spare parts and data, 57 ea., $66,051.

Turk, Joseph, Mfg. Co., Bradley, Ill., typist steel desks, over $250,000; desk-typist, steel, Cl. 40A, over $250,000.

Turner, Albert, & Co., New York, K-2A flying suits, Cl. 13A, over $250,000; jackets, flying, Cl. 13A, over $250,000.

Union Twist Drill Co., Athol, Mass., cutter, milling gear, Cl. 17B, 2,910 ea., $28,164.

U. S. Rubber Co., New York, hose-nonmetallic, Cl. 12, 15 ft. lengths, $53,598.

Unity Industries, Inc., Guthrie, Center, Iowa, delivery kits, aerial, Cl. 20, over $250,000.

University of Alabama, Alabama, furnishing of necessary facilities and training for 475 AF personnel as clerk typists, $190,540.

University of Denver, Denver, furnishing of necessary facilities & training of 500 AF personnel as sanitary technicians for 16 weeks, over $250,000.

University of Minnesota, Minneapolis, research study on free air temperature, over $250,000.

Van Norman Co., Springfield, Mass., milling machines, Cl. 17A, 24 ea., $172,620; milling machines, Cl. 18, 4 ea., $40,940.

Victoria Instrument Co., Cleveland, chamber, pocket charger, reader, Cl. 39C, 4,724 ea., 47 ea., $81,500.

Video Products Corp., Red Bank, N. J., panel assembly, 40 ea., $56,641.

Waltz Furnace Co., Cincinnati, furnace, electric heat treating, Cl. 17A, 30 ea., $97,500.

Waukesha Motors Corp., Waukesha, Wis., engine assembly & spare parts, Cl. 19C, $80,540.

Webster-Chicago, Inc., Chicago, AN/APR-4 radar set, Cl. 16A, over $250,000.

Westinghouse Electric Corp., Dayton, transformers, Cl. 16E, 200 ea., $98,718; conduit elbow assemblies, Cl. 08D, misc., $66,915.

Weston Electrical Instrument Corp., Newark, clamp-on ammeter development, cl. 16A, 8 ea., $30,000.

New Rolling Mill For Magnesium

A new jobbing-type mill for rolling magnesium sheet is being added to Brooks and Perkins, Inc.'s facilities in this metal field.

The company reports, in its Magazine of Magnesium, that the new plant will afford its users important economies and control-factors—ability to roll exact sizes and gages needed for fabrication, rather than being dependent on limited stock sizes available. This frequently involves as much as 50% waste in cutting the required blanks.

Operation of this company-owned facility will largely eliminate delay resulting from short supply of magnesium sheet. This has been so serious, B&P says, that current deliveries of certain fabricated parts are held back several months.

The new plant will be located on a 10½-acre site in the northwest suburban area of Detroit. Contracts for the first building already have been awarded. Most of the heavy equipment is on hand and initial installations will include a hot mill and two cold mills, with ovens and auxiliary equipment.

Rolling operations in this facility are expected to begin next January. Plans call for integration of all B&P operations on this site, but meanwhile, fabricating will continue in the main plant near downtown Detroit.

Impact-Extrusion For Thin-Wall Parts

A team of Lockheed Aircraft researchers have come up with a scheme for impact-extruding tough aluminum alloys, a process widely used with soft metals.

Experiments and actual production in the study of adapting the process to aircraft materials have already brought on the design of a 1,000-ton impact-extrusion punch press. It is now being built by E. W. Bliss Co., and will be installed at Lockheed this summer.

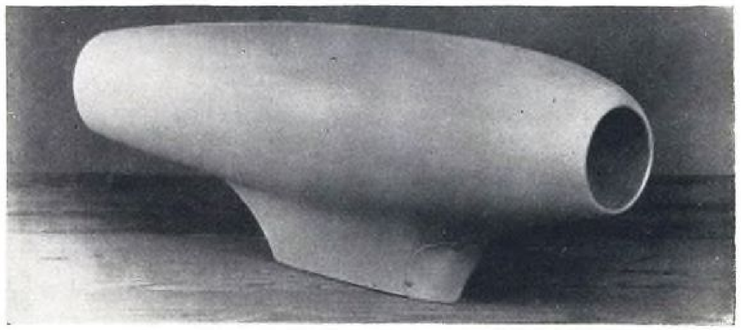
Already earmarked for processing by the method are 15 parts, whose transfer from conventional machining is expected to show a saving of more than $52,000 yearly. Four of these parts now are in production on a smaller press. Engineers predict that the process, most practical on a minimum quantity production of 1,000 parts, can be extended to 177 different items for huge economy.

Lockheed fabrication engineers feel that extrusions open new design fields, making practical shapes that previously were prohibitive cost-wise, with an increase in tensile strength over machined parts because of the cold working that the impact imparts to the metal. And thinner-walled parts can be produced, with consequent weight saving. Saving of material also will be effected in those parts ordinarily made by boring, drilling or cutting.

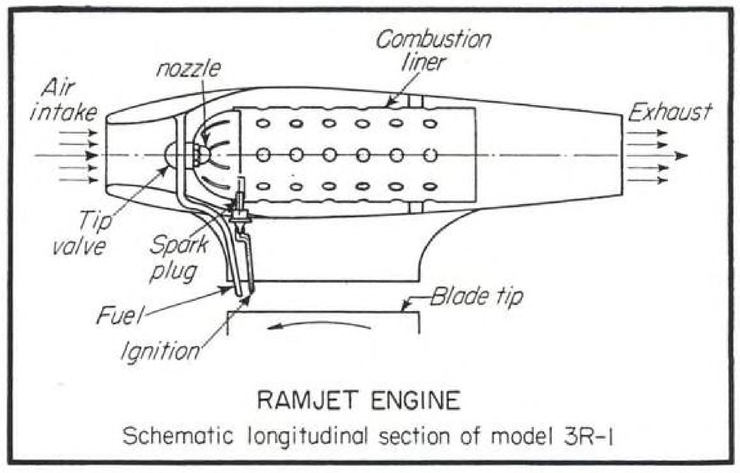
On the new Lockheed press, flow rate will be two parts per minute with hand-feeding, 12 per minute with automatic feeding.

How GE Tested Ramjet for Helicopters

Data gathered proves important in light of increasing interest.



Late model of GE 3R-1 ramjet.



RAMJET ENGINE

Schematic longitudinal section of model 3R-1

Emphasis on the ramjet and pulsejet seemingly has been soft-pedaled, publicity-wise, in comparison with the mass of data published on the top-priority turbojet.

These propulsion engines were brought into the practical realm by World War II. The turbojet immediately found widespread application in the fixed-wing field, while the ramjet and pulsejet were applied only on a limited scale to the propulsion of guided missiles.

But helicopter engineers soon saw the potential for the ramjet and pulsejet in the rotary wing field. Definite advantages were reported shown for the former in McDonnell's Little Henry (XH-20) and the Hiller Hornet and for the latter in American Helicopter Co.'s Top Sergeant (XA-5). The turbojet, too, has invaded the copter field. It is being evaluated in the Hughes XH-17 and the French tipjet S. O. 1120 (Ariel III).

►**Pioneer Ramjet**—One of the pioneers in ramjet studies was General Electric's general engineering and consulting lab. This facility, as far back as 1945 designed and built the 3R-1—a 6-in. subsonic ramjet, which was tested on the tip of a helicopter blade. The investigation in its major part was under the auspices of U. S. Army Ordnance's Project Hermes.

This engine's makeup and its performance data were presented last year at the Sixth Annual Forum of the American Helicopter Society by Igor B. Benson, now chief of research at Kaman Aircraft Corp., and formerly with General Electric Co.

Benson's paper has not been previously published, but the data is as timely now as when presented—particularly in view of the accelerated interest in jet power for helicopters, an era that is just beginning.

Investigation with the 3R-1 engine proved that a subsonic ramjet engine is a realistic and attractive thermal powerplant. Although no production model was planned, enough was learned to pass safely to larger models and higher speeds.

►**Prospects Good**—Benson holds that there is little doubt that a self-contained powerplant of ramjet type will gain widespread popularity in the rotary wing field in the not-too-distant future because of its basic simplicity and low cost.

This will come to pass as soon as more knowledge on ramjet mechanics is disseminated to enterprising groups of experimenters and investors.

In view of the ramjet's fuel consumption, it appears that it is most suitable for short-haul operations, cargo or passenger, as well as for personal flights of about one hour duration. On this basis, Benson says, it will out-perform in economy the conventionally powered copter by a long margin, both in initial cost and in operational expenses.

But there is still much room for improvement for the ramjet engine. It may be compounded with the pulsejet feature which will make the rotor self-starting. Cheaper fuels, such as fuel oil and coal, are very much in the picture, for there is no theoretical limitation in their use.

►**General Characteristics**—The 3R-1 ramjet was originally built entirely of stainless steel. It consisted of a thin outer shell housing a domed, perforated cylinder with fuel nozzle and sparkplug in its head, similar to the combustion chamber used in the turbojet.

The engine was originally designed for operation at 800 fps., when it would deliver approximately 50 hp. at a specific fuel consumption of 3.3 lb./hp.-hr. Latest aluminum model weighed just under 5.0 lb., giving a specific weight of 0.1 lb./hp.

Commercial grade kerosene was used for fuel throughout the tests, although on some occasions ordinary automotive gasoline was substituted, with only a slight gain in performance. Diesel oil

and light-grade fuel oil also were burned with good results.

► **Performance, Operation**—Benson reports that one of the main purposes of the development program was to develop a satisfactory thermodynamic theory of ramjet power cycle which would be verified by tests and measurements of actual engine behavior.

This goal was substantially accomplished, for the agreement between theoretical and measured performance figures was within 8% or better, throughout the range of tests. An accompanying chart is a cross-plot of engine gross thrust and specific fuel consumption vs. tip speed. Thrust in these curves is actual force available for acceleration and, therefore, work. It may be plotted as rotor horsepower vs. tip speed, as also shown—a more convenient form for rotary wing engineers.

These curves disclose that high tip speeds offer the most favorable regime for ramjet operation, for its thrust output varies nearly as a square of relative free stream velocity. Thus, for a given rotor, the margin of power available for thrust is always greater at higher tip speeds, other factors being equal.

This must be balanced by an engineering compromise against higher blade parasite drag, heavier blades designed to withstand greater centrifugal forces, poorer rotor controllability and, perhaps, the encounter of compressibility effects at high tip speed ratios.

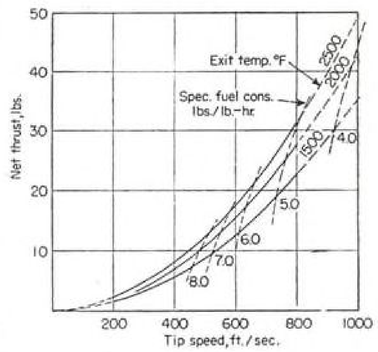
Of further interest is the apparent passing of the thrust curve through the origin. So does the drag of the rotor at standstill, but it is always less than the jet thrust. Why then, poses Benson, couldn't the ramjet-driven rotor be started without auxiliary power? The graph suggests the answer: (1) Margin of thrust over drag is infinitesimal near zero speeds; and (2) sfc. approaches infinity in this region.

On the practical side, at low tip speeds combustion temperatures should be kept low (thereby reducing available thrust) because insufficient external cooling increases the danger of overheating the tailcone. Thus, it is generally necessary to accelerate the rotor up to 100-200 fps. by external power before the ramjets fully take over.

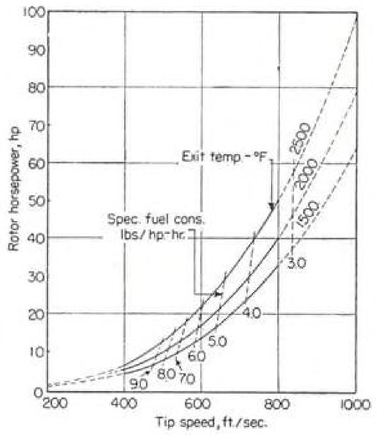
► **Exit Temperatures**—A typical curve of thrust coefficient vs. fuel flow at 300 fps. tip speed is shown plotted for several exit areas. A cross-plot of exit temperatures is superimposed for a more complete picture of performance.

Importance of proper choice of exit area can be seen from this diagram, knowing that exit temperatures will be limited by the fuel used and attainable combustion efficiencies. There is a definite optimum exit area which will yield maximum thrust coefficient and lowest fuel flow for a given exit temperature.

However, here, too, a compromise must be taken, for normally, the ramjet engine will operate through a range of exit temperatures, depending on power demand. Thus, a selected design point may be 2200F with a spread of ± 800 deg. to accommodate normal power variation.



Jet thrust vs. tip speed.

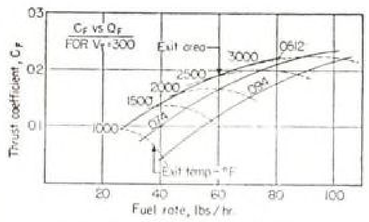


Rotor hp. vs. tip speed.

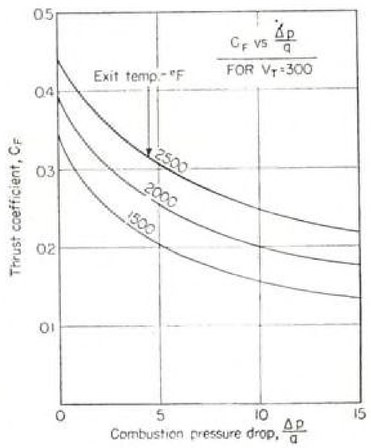
The thrust coefficient curve is convex upward, leveling off at stoichiometric air-fuel ratio and reversing its slope beyond this point. This suggests an interesting way to another compromise—that which must be taken to accommodate for varying tip speeds. While it is relatively simple to find optimum power setting for any given rotor rpm., an altogether different problem is presented by the variation of tip speed due to forward flight.

Relative free stream velocity oscillates cyclically once per revolution whenever the rotor possesses translational speed. It seems fairly hopeless, says Benson, to attempt to vary the fuel flow in unison with the rapidly changing ram velocity—because of "water hammer" and many other resonant effects in fuel lines—hence, a more fundamental method of compensation must be sought.

► **Engine Size**—The convexity of the thrust coefficient curve suggests a solu-



Thrust coefficient vs. fuel rate.



Thrust coefficient vs. pressure drop.

tion to this problem. In selecting engine size for a particular rotor with design tip speed of, say, V_T, a certain maximum forward speed, V_F, must be contemplated. Maximum ram velocity on the advancing blade will then be $V_T + V_F$, while minimum of $V_T = V_F$ will occur on the retreating blade.

Engine size then should be so chosen to deliver rated thrust at fuel flow just short of stoichiometric, at tip speed of $V_T = V_F$. With this observed, the advancing blade will be operating on a lean mixture and, therefore, at a reduced thrust coefficient. But, since its ram velocity is $V_T + V_F$, and it enters into the expression of thrust in square form, its effect may be greater than that of lower C_F.

In fact, Benson holds, with proper care it is not difficult to design a ramjet engine for a given rotor which will have greater thrust on the advancing blade than on the retreating side. This is something new in the rotary wing art. Of course, such a rotor may not require lag hinges and will be very smooth in forward flight.

▶ **Pressure Drop**—Another plot shows influence of pressure drop, $\Delta p/q$, in the combustion chamber, on the gross thrust coefficient. This, Benson advances, is a very important criterion of overall combustion chamber efficiency in ramjet design. It is usually referred to as drop in "velocity heads" at maximum diameter, caused entirely by the

overall drag of the burner during the combustion process.

Momentum loss, due to temperature rise of gas within the chamber, is not included in this term, because it is small, readily calculable and is the same for all burners, regardless of design, so long as they reach equal combustion temperatures.

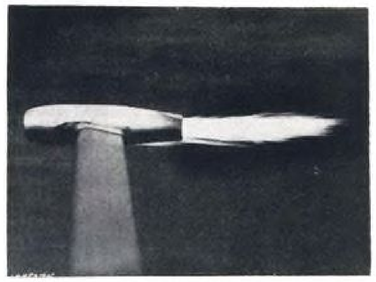
It can be seen that the thrust of an engine may be doubled by reducing combustion pressure drop from 12 to 1 velocity heads at 1500F, for example. In making this step, some sacrifice in combustion efficiency may be inevitable—say, from 95 to 80%—but it may more than pay for itself in reduction of parasite drag by permitting the use of smaller size engine. Arriving at an optimum balance in this choice, says Benson, may well be regarded as the the heart of ramjet development and, indeed, presents the greatest challenge to engineering skill.

► **Fuel Control**—There are a number of other pertinent problems which must be solved before the ramjet engine will successfully operate. First among them is fuel control. A little reflection will bring out the realization that the rotor acts as a centrifugal pump, increasing fuel pressure at the tip to as high as 2000 psi., depending on rotor rpm. The higher the rpm., the higher the pressure, which in turn tends to increase fuel flow, therefore increasing rpm.—a divergent function, threatening to cause rotor run-away. Something must be done, contends Benson, either to make fuel control immune to changes of rotor rpm., or actually to reverse the response to provide automatic governing action.

This was successfully done by means of a "tip valve" which in effect is a pressure relief valve so located that the weight of its plunger under centrifugal force opposes the hydrostatic pressure of fuel by a controlled margin. Care must be exercised to prevent valve chattering, hunting, etc., throughout full range of tip speeds and fuel flows. A fair amount of high grade engineering skill is required to carry this development to flawless operation.

► **Weight Factor**—High centrifugal forces comprise Enemy No. 1 not only to fuel control, but to most everything in the ramjet engine. At 600 fps., for example, centrifugal loading is 1000G on a 22-ft. rotor. Thus, rubber insulation of the ignition cable extrudes itself along the blade if supported only at the hub or even at every 1-ft. of length. It must be taped or glued along its full length. Reduction of engine weight becomes an all-out offensive of engineering effort.

While early models of 3R-1 engine, entirely of stainless steel, weighed 13.4 lb., the latest version weighed only 4.9 lb. Except for its 18-8 liner, it was all-aluminum. In spite of intense combustion temperatures, the aluminum tailcone stood up well under all normal operating conditions, unusual as it may seem. The accompanying photo reveals how it was done. This picture deliberately was taken at excessive fuel flow to show the effect of "film cooling" to protect the aluminum skin with a thin layer of cool air. Normally, flame cannot be seen outside the exit nozzle.



ROTASCOPE view shows annular air film separating flame from tailcone.

Performance of the ramjet was observed by four methods:

• **Static Bench Tests.** These were primarily useful in combustion chamber development and qualitative observation of ignition characteristics, flame blowout, etc. Exit temperatures vs. air-fuel ratios were conveniently measured. Only internal air flow was supplied to the engine, which simulated free air velocities up to 800 fps. Later, the engine was mounted on knife-edge scales, which permitted measurements of drag and thrust.

• **Windtunnel Tests.** These were conducted to measure accurately external skin friction, which cannot be well accounted for in stationary burning tests. No combustion tests were possible at that time, for there were no windtunnels available with separate exhaust systems. In a recirculating system, oxygen content in the air would soon drop down to a prohibitive level, and thermodynamic observations would be of little value. Hence, no attempt was made to burn in the windtunnel.

Of great interest were drag and lift measurements, says Benson, when the jet unit was given positive incidence into the air stream to simulate effects of changing blade pitch.

A value for L/D as high as 7.0 was measured in these tests, indicating that considerable lift would be produced by the jet body itself. The "cold" drag coefficient at zero incidence was 0.11, while "hot" external C_D was 0.06. The latter figure was obtained by fairing out the nose and tail to simulate essentially laminar external flow. With no boundary layer separation, it represents primarily the friction drag.

Drag produced by internal flow when

"hot" could not be well measured in the windtunnel without some complex addition of separate air jet into the combustion chamber. Instead, its presence was accounted for as a negative component in the thrust coefficient when measurements were conducted on jet thrust with burner actually firing.

• **Electric Dynamometer.** This setup served two major purposes—to measure actual power output of jets under whirling conditions, and to check various factors of safety by overspeeding the rotor. The dynamometer, capable of delivering and absorbing 250 hp. up to 600 rpm., was mounted inside a 45-ft.-dia. pit, with its shaft vertical, so that ramjet engines were whirled on blade tips in the horizontal plane.

Fuel was fed and controlled from the top of the cover which enclosed the pit. Although jet power output measurements were not very accurate with this setup because of stirred air circulation within the pit, which decreased relative ram velocity by some uncertain amount, the value of this arrangement was considerable.

Effects of centrifugal force on fuel control, flame symmetry, ignition and blowout characteristics under actual whirling conditions were studied with ease and speed because of the setup's excellent flexibility. Comparative figures on thrust output were available at all times on the dynamometer instruments.

A thorough strain-gage instrumentation was installed, making possible confirmation of stress analysis studies and serving as a safety control in overspeed tests.

A very useful optical device, the Rotascope, was installed and tested here for the first time. By means of a system of revolving mirrors, it permitted continuous observation of blade tips. Flame shape and color could be watched regardless of rotor rpm. and brightness of illumination of the field.

• **Outdoor Trials.** As a final step, the ramjet engines were mounted on blade tips of an actual aircraft and whirled outdoors through the range of tip speeds. An old Kellett YO-60 autogiro served as an early test rig for this purpose. Power input and output could be measured within 1% by an electronic torquemeter mounted on the rotorshaft. Fuel, ignition, thermocouples, etc., originally were fed from above, by means of an overhang beam. A sealed 24-ring slipring assembly served this purpose faultlessly throughout the program. Later, fuel and ignition lines were fed from below and through the hollow hub as in an aircraft installation.

► **Overall Characteristics**—A large number of observations were made. Some of these are:

Initial cost of a ramjet is, obviously,

(*Continued on page 145*)

precise ILS approach flying greatly simplified!

Collins
Approach Horizon

Collins
Course Indicator

COLLINS Radio Company is now giving demonstrations of a revolutionary new Flight Instrument System to airline pilots and technical personnel from coast to coast.

The purpose of the System, which has been under development and flight test for many months, is to give the pilot a clear *pictorial* presentation, on fewer instruments, of all the information he needs for precise ILS approach flying and en route navigation. Only four instruments are required in the basic flight group diagrammed above . . . the new Collins Approach Horizon, the Course Indicator, conventional altimeter and conventional air speed indicator.

Although complete VHF navigation and instrument letdown information is supplied the pilot on only two instruments, there is no possible source of confusion. Rather, there is a quicker, easier perception of the aircraft's exact position with respect to the selected course, and easily followed steering directions for making good the course.

Strong approval of the Collins Flight Instrument System has come from pilots to whom it has been demonstrated. For example, one said the System seemed " . . . logical, easy to follow, and instilled confidence." Another said, "You don't have to keep looking back and forth between the ILS indicator and a separate gyro horizon." Almost without exception the pilots feel that integration of more information on fewer instruments is less confusing, more readable.

The Approach Horizon, pictured above, in addition to showing attitude, is an "anticipator" instrument. It tells the pilot (1) he is steering the plane correctly or incorrectly to arrive smoothly on course, or (2) he is on course and steering correctly, or (3) he is on course but flying in a manner that won't keep him there. Thus on final approach this single instrument presents all information necessary for making an accurate ILS letdown without bracketing the localizer course or maneuvering violently to get on the runway after breakthrough.

The horizontal bar of the Approach Horizon operates much the same as a standard artificial horizon. Pitch information is shown by the stylized wings and fin of the airplane in the center of the instrument, which move up or down as the attitude of the aircraft is changed.

Displacement information with respect to the glideslope is obtained by noting the position of the pointer on the left in relation to the G. S. scale.

Electrorically computed steering information for making good the localizer course is presented to the pilot by left or right deflection of the vertical pointer. To make good the course it is only necessary for the pilot to maneuver the airplane to keep the pointer centered. Drift is automatically compensated for by forcing the pilot to "crab" in order to keep the pointer centered.

The Approach Horizon may also be used to good advantage in flying compass leadings.

The Course Indicator provides the pilot with a clear picture of his position with respect to his chosen course, just as though he could see his course as a broad white line marked on the ground below.

This single instrument presents to the pilot at a glance all the information which ordinarily must be assimilated by evaluating the readings of several other instruments, which the Course Indicator makes unnecessary.

The aircraft's compass heading is displayed continuously against the lubber line at the top of the instrument.

Displacement information with respect to a selected omnirange or localizer course is shown by the relative position of the small white airplane to the broad white bar which represents the course.

To-From information with respect to an omnirange station appears as small white flags on the appropriate side of the indicator center.

Thus, the Collins Flight Instrument System displays on these two instruments alone all necessary information for precise ILS approach flying: attitude, position and steering instruction.

Adoption of the Collins Flight Instrument System will replace two of the instruments in the conventional flight panel and eliminate several others. This simplification of the panel reduces expense and maintenance, of course, but more important, presents to the pilot all the necessary information, more clearly, on fewer instruments, and in a manner that requires a minimum of interpretation.

A booklet illustrating and describing the operation of the Collins Flight System is now available. We will be glad to mail you a copy on request.

FOR BETTER INSTRUMENT LANDINGS, IT'S . . .

COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 West 42nd Street
NEW YORK 18

1937 Irving Boulevard
DALLAS 2

2700 West Olive Avenue
BURBANK

(Continued from page 40)

very low compared to a reciprocating engine, disregarding even the auxiliary gearing the latter requires. There are very few close tolerances to be kept, if any.

Maintenance, Benson says is almost non-existent—there is no lubrication system to attend and no moving parts to wear.

Every 25 hours or so the burner may be inspected for carbon deposit, and may need occasional cleaning in the zone of rich mixture. Carbon is usually soft and can be wiped off clean with a rag without removing the engine from the blade.

Noise level of the ramjet is considerably lower than that of an equivalent piston engine. In fact, it may be described as a low frequency hiss of 65-70db. if, by proper design, no flame pulsation is permitted to occur.

On numerous occasions during the development program, flame pulsation did occur, relates Benson, with various degrees of modulation. Invariably this was accompanied by an increase of thrust output and the rise of noise level.

The powerplant then behaved, in part, at least, as a resojet, but its operation was erratic. Several "overtones" could be obtained, by varying tip speed and air-fuel ratios, each having its own specific performance pattern. Until more is known about the control of this phenomenon, it is deemed advisable to steer clear of pulsation altogether for the sake of uniformity of engine performance.

►**Power Failure**—There is some concern among design engineers as to what happens when power fails. Autorotation is considerably impaired by the drag of a "cold" engine, and this increases the sinking speed of the rotor, which already is likely to have fairly high disk loading.

This looks bad at first, says Benson, but, it should be remembered that there is an engine on each blade—two for two-bladed, three for three-bladed rotors. The craft actually has multi-engine performance. Chances are that level flight can be maintained on the remaining power, at moderate speeds, and safe landing may be accomplished with a slight flareout.

The rotor goes out of balance somewhat, due to dissymmetry of driving torque, but the amount of actual pylon vibration is surprisingly slight, particularly if lag hinges are not used. Restarting of an engine is done merely by pushing the ignition button.

►**Starting Problem**—Starting the rotor from standstill must be done by auxiliary power. This is the second major drawback of a ramjet, although not an insurmountable one. Either a small gasoline engine or an electric starter

may be used; and their power capacity should be between 1 and 2% of the total rotor horsepower, with an operating cycle of not less than 1 min. in duration.

One idea is to use auxiliary pulsejets at the tips to eliminate gearing and weight of conventional starters. This may be the answer, says Benson, but at present these don't start very reliably either. The future will show which method will receive the greatest recognition.

Engineering Groups Plan to Join Forces

Plans are underway to bring 40,000-50,000 engineering employes in the U. S. under a single national organization which would speak for them on matters of labor legislation, wages and hours, and various professional and welfare issues.

Many of the engineers who would be affected are employed in the aircraft industry.

In an initial move towards such a national representation, officials of 16 groups, who a spokesman said covered about 25,000 professional engineers, held a meeting Aug. 25-26, in Newark, N. J.

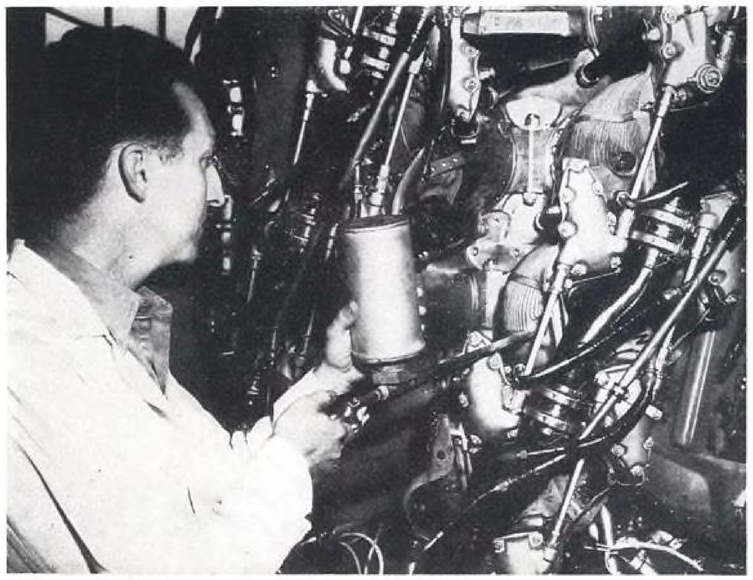
Those represented were reported to have included the Minneapolis Federation of Honeywell Engineers, Engineers Assn. (Sperry Gyroscope group), Council of Western Electrical Technical Employes, Engineers and Architects Assn. (Lockheed and Convair), Assn. of Professional Engineering Personnel (RCA), and the National Professional Association of Engineers, Architects and Scientists.

The last named was described as one of the major forces in the consolidation move. It is said to represent about 8,000 West Coast engineering employes at Boeing, Douglas and other industrial establishments, and in civil service positions.

At the Newark meeting, the purpose of the national organization was projected: to promote the professional and economic welfare of the engineering employe.

Plans were advanced for makeup of membership, procedures before the Wage Stabilization Board were discussed, wage data correlated between the 16 groups, and professional qualification of engineering college curricula (for higher standards) was also considered.

The spokesman said a second meeting of the 16 groups, plus additional units, is scheduled for Feb. 22-24 at Chicago, when it is expected that a constitution will be presented for the projected national organization of engineering employes.



SPECIAL APPLICATOR blows VPI into PAA engine for long-term preservation.

VPI Joins Fight Against Rust

Anti-corrosion powder reaches market after extensive airline tests point to savings in time and money.

By Scott H. Reiniger

Large savings in time, labor and costs and reduction in the number of parts lost yearly in the fight against metal corrosion are predicted for VPI 260, recently placed on the market by Shell Oil Co. after extensive service tests.

The product is a volatile powder that produces corrosion-inhibiting vapors. Gaining increased attention in the aviation industry, it already is used as a standard preservative throughout all three divisions of Pan American World Airways for protection of engines (inside and out) and components in storage or shipment. Other airlines that Shell says have adopted it for similar use are United, All-American, Colonial and Capital.

► **Properties**—VPI 260 powder is a synthetic organic chemical compounded by Shell Development Corp. Its active ingredient is dicyclohexylammonium nitrite. The vapors of VPI are carried by convection and diffusion to all surfaces of the part to be protected, where they condense to give a thin layer of crystals which dissolve in any water film present.

The important thing with use of VPI is that the surface does not have to be coated to be protected. Unlike grease and other coatings, VPI does not erect a protective wall of defense against corrosive atmospheres. It counterattacks corrosion at the source, treating the atmosphere, in effect, to render the combination of water and oxygen non-corrosive.

VPI can be applied in many different ways, Shell says. The powder can be blown inside an engine to give off long-lasting vapors which do not affect operation or have to be removed when the engine goes into service. Parts to be exposed to the elements can be wrapped in special paper impregnated with VPI, instead of being coated with grease and then laboriously degreased. All that is needed to ready them for service is to unwrap them. The VPI vapors will prevent corrosion, Shell says, even if the package breathes.

VPI will not seal in a corrosive deposit on a metal surface as grease might. In addition to preventing corrosion, the product is said to have the capacity to completely arrest corrosion at any stage.

► **Long-Term Protection**—Where some methods of protecting engines are effective in terms of weeks or a few months, Shell claims that VPI can give protection for years. And the protection given during the longer period is more effective, the firm stresses. Further, VPI will penetrate to surfaces of assemblies that cannot be protected by other means. An important limitation: the product does not offer protection at temperatures above 140F.

VPI has been under service tests by various companies since 1946 but only recently was offered on a nationwide basis by Shell. Pioneer in these early tests in the aviation industry was PanAm's Pacific-Alaska division. PAD has developed standard procedures for preserving its engines and other parts with VPI. So far it has treated about 120 Pratt & Whitney R-4360s and 180 R-2000s and stored them with successful results in such highly corrosive atmospheres as surround Wake Is., Guam, Manila, Noumea, and Bangkok.

► **PanAm Experience**—PAD said that, before using VPI, it "had to perform overhauls on five R-2000 engines that had rusted while being stored at bases along the company's routes in the Pacific. Approximately eight P&W 1830s needed to be overhauled without ever being placed in use, as a result of corrosive action." Since using VPI, the company commented, it has not had a similar experience.

Before VPI came into use, PAD treated the internal engine with AN-VV. –C-576b, Type 2 corrosion-proof oil. The outside of the engine was sprayed with hard-setting AN-C-52 compound.

Now the outside of the engine simply is wrapped in VPI paper. The inside is treated both by corrosion-proof oil and VPI. The powder is blown into each cylinder, the nose, power, blower and rear sections. For added protection, the cylinders are fitted with "Protek" plugs filled with VPI impregnated paper. Strips of this paper also are placed between cylinders and pushrods. PanAm has developed a special applicator for blowing VPI into the engine.

► **First Tests**—PAD first became impressed with VPI's potential in 1946 when it put small quantities of the powder in plastic bags containing various engine parts and instruments and left them on the roof of a hangar at the division's headquarters base for 14 months. This test led to a full-scale evaluation.

Experiments were carried out to determine optimum procedures for preserving engines with VPI. Other tests conducted in the laboratories of Shell Development Corp. proved VPI disintegrated sufficiently at engine operating temperatures to preclude any wear or scuffing of parts. It also was found that VPI had no bad effect on magnesium engine parts.

In 1948, full-scale engine service tests were ordered and engines were preserved with VPI and shipped to island stations for spares. The favorable results of this test culminated in the issuance of a procedure publication for VPI preservation of P&W R-2000 engines.

► **Other Uses**—Finally, tests were conducted to see how VPI protective measures for engines in shipment stood up. A P&W R-4360 powerplant package wrapped in VPI paper, then simply covered by tarpaulins, was carried to Hawaii on the open deck of a ship. Now all shipments go this way, says PAD.

VPI 260 has other uses besides the job of preserving parts in storage or shipment. An outstanding example is its application by R. M. Hollingshead Corp. This firm employs VPI as an additive to inhibit corrosion in its water-base, non-flammable H-2 hydraulic fluid, used extensively by the Navy.

COMFORT ALOFT

These newly designed seats will be installed in DC-6Bs now on order by Swissair, KLM, SAS, and Philippine Air Lines, according to the manufacturer, Hardman Tool & Engineering Co. They will also go into KLM's 1049 Super-Constellations. The Los Angeles concern points to these features of the seats: track mounting provisions for variations in seat spacing; full 70-deg. recline with limit stops for day spacing; inclusion of leg rests, service tables and two position foot rests; scientifically contoured airfoam cushioning throughout; stressed for loads up to 9Gs; maximum under-seat leg clearance.

Sierracin Used In Edge-Lighted Panels

Edge-lighting of instrument panels is a new and practical application recently developed for Sierracin, a polyester plastic well known for its use for cabin windows and canopies in pressurized aircraft.

The panels, cast in one piece, consist of a transparent core coated on both sides with thin layers first of white then non-reflecting black-pigmented Sierracin. Panel markings are produced by engraving through the black and white layers to a depth of .004 in. The letters are spray-filled with Sierracin W7C translucent white plastic and allowed to cure. Then the entire panel is washed with lacquer thinner.

Small bulbs are placed in strategically located holes throughout the panel and transmit their light (usually red, but any color may be used) through the transparent inner core to emerge uniformly at the lettering. Intensity may be controlled by rheostats. The bulbs, removable from the front of the panel, are covered with caps sealed with rubber grommets to make the joint absolutely light-proof. Surfaces of the panel are scratch and puncture resistant to prevent light leakage through normal use.

Edges are generally coated with the same materials used for surface coating. Air drying catalysts are used to permit fast drying and an opaque white is used to give added protection against light leaks at edges, corners and hole rims.

► **Craze-resistant Panel**—The non-crazing, thermosetting plastic panels, designated number 5005, coming under Army-Navy spec AN-P-89, resists alcohol, lacquer thinner, methyl, ethyl ketone, standard commercial cleaners, aviation gasoline, Skydrol and AN-O-366 hydraulic fluid. Temperature range is −70 to +260 deg. and it resists salt spray and salt laden moisture. Being integrally moulded in one sheet eliminates the possibility of delamination

Some Physical and Chemical Properties of Sierracin #5005 Panels

Tensile Strength—over 9,000 psi.
Flexural Strength—16,000-18,000 psi.
Resistance to continuous heat—240 deg. F.
Heat distortion point—170 deg. F.
Thermal conductivity—4.5-5.
Thermal expansion (deg. F.)—5.5-7.
Compressive strength—30,000 psi.
Luminous light transmission—90%.
Electrical properties—Excellent.

according to M. R. Crossman, vice president, sales, of the manufacturer, Sierra Products Co., Compton, California.

Engraving (much of which is done by the Miller Dial & Name Plate Co., Los Angeles) to only a depth of .004 in. reduces parallax to the point where markings are readable from angles up to 80 deg., a highly desirable feature in modern aircraft where precise readings are important.

The dull black finish reduces glare and reflection to a minimum and also provides extreme contrast to the white markings during the day and red illmuinated markings at night. The almost complete absence of light leakage cuts eye strain during night flying and allows for maximum adjustment between interior and exterior cockpit vision.

When sufficiently heated, Serracin may be formed to almost any desired radius for uses such as throttle quadrant arcs. The material may also be readily machined, drilled or ground. Present cost of the plastic with both sides coated is about $10 sq. ft. Current sizes available are 20 x 20 in. and 24 x 24 in. It will soon be made in sizes up to 36 x 48 in.

Crossman says his company has a large backlog of orders for edge lighting instrument panels to go into such aircraft as the T-29 and B-36.

Glass Trim Going Into Capital Fleet

Capital Airlines, a new convert to glass interior trim for aircraft, is equipping its entire fleet of 56 planes with Dura-Trim, a vinyl-coated Fiberglas fabric.

John B. Schneller, president of Duracote Corp., Ravenna, O., manufacturer of the material, says that Capital is the first airline to use Dura-Trim for such applications as overhead, side wall and wainscotting covering.

Schneller claims for the fabric good dimensional stability, long life, light weight, and resistance to fire, wear and scuffing.

NEW AVIATION PRODUCTS

Helicopter Part

The tapering steel tube shown above has been compression-formed into the backbone for a helicopter rotor by the Tube Reducing Corp.

The seven-ft. unit is split lengthwise to illustrate changes in diameter and wall thickness. Progressing from hub to tip of rotor, diameter and thickness decrease in size through five successive steps.

A big advantage is gained by forming this part by the compression process, the firm says. It reduces machining, providing a tube that is "near perfect with respect to bore, weight distribution and finish," the company claims.

Tube Reducing Corp., Wallington, N. J.

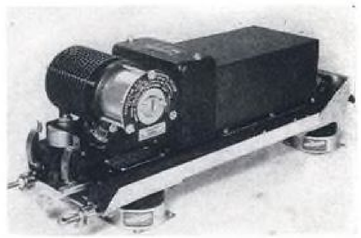
4,000-psi. Air Valve

A lightweight check valve for pneumatic systems, designed to operate efficiently at air pressures up to 4,000 psi., has been developed by Bobrick Mfg. Co.

The new unit is believed by its maker to be the only 4,000-psi. check valve for pneumatic systems now on the market. It also is suitable for hydraulic pressures up to 5,000 psi., the company adds. Proof pressure of the new check valve is 9,200 lb.

The unit, a free flow type, is made of stainless steel, weighs 3.4 oz. The outer cylinder is a standard AN 6249-6 envelope, while both ends of the unit have fittings for ⅜-in. tubing, in accordance with AND 10056.

Other performance data listed by the firm: Maximum free flow—7.0 lb./min.; maximum pressure drop through valve —100 psig. at 7.0 lb./min. air flow with an air inlet flow of 150 psig. maximum; leakage in reverse flow direction—does not exceed 200 cu. in. of free air/min. at 4,000 psi.



B-47 Volt Control

A compact d.c. electrical control system, featuring a number of new wrinkles aimed at giving better high-altitude operation, is being produced for the B-47 Stratojet bomber by Jack & Heintz.

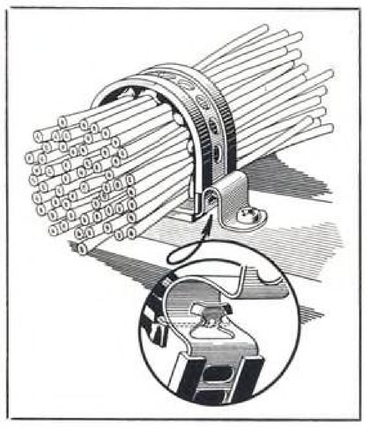
It includes an improved carbon pile voltage regulator and assorted relays, all neatly packaged into a single lightweight control panel. The panel, a plug-in type, can be rapidly slipped on

or off a standard radio rack. The unit can be interchanged between the B-47B and B-47C. Only parts not included on the panel are the main line contactor and a current relay. The unit is adaptable to any military or commercial plane, J&H says.

In the regulator, special attention has been given to heat transfer, creep and friction problems. The fin area has been increased. The regulator will dissipate 90 watts continuously at 50,000 ft. altitude without blast cooling, says the firm. A "frictionless" spring reportedly has shown excellent results in matching the magnetic force curve, permitting the regulator to operate long periods without change in voltage setting.

Among other points highlighted by the firm: An equalizer relay shortens the equalizer circuit between regulators to reduce circuit resistance; overvoltage protection is provided by two relays, one an overvoltage generator selector relay; differential voltage and reverse current control is provided by a double-duty relay (eliminates one relay) that has coils capable of handling both full line voltage and voltage of reversed generator; a 400-ohm booster resistor is energized from the bus to prevent generator reversals. It adds to normal residual voltage of the generator.

Jack & Heintz, Inc., 17600 Broadway, Cleveland 1.



"Toolless" Clamp

A new clamp for securing bundles of wire in aircraft electrical systems, which can be opened or closed without use of tools, has been announced by Tinnerman Products, Inc.

The clamp terminates into a T-shaped tongue. To secure the clamp and the bundle it embraces to the plane, the tongue is inserted (by hand pressure) into a slot in a mounting clip screwed to the aircraft structure. The clamp locks to the clip in a way that insures against accidental release, says Tinnerman.

The clamp holds bundles of 5/16

to 1¾-in. diameter. It can be used singly or in tandem. Tinnerman says it meets maximum loading requirements for size as set forth by the Electrical Groups in Military Aircraft.

Tinnerman Products, Inc., Box 6688, Dept. 14, Cleveland 1.

ALSO ON THE MARKET

Non-rusting "Chemalloy" can be sawed, cast or machined, needs no coolant while being lathe-turned; can be used without flux for welding aluminum or can be fabricated into dry bearings, among many other uses. Chemalloy Associates, Gillespie Airport, Calif.

Tens-O-Trol dynamometer, for measuring tension, weight or tractive loads, reads remotely. Selsyn transmitter, on which loads are imposed, signals through cable up to 400 ft. to repeater indicator motor. W. C. Dillon & Co., Inc., 1421 S. Circle Ave., Forest Park, Ill.

Hydraulic power units combine reservoir, pump and motor in compact package. Line (224 models) embraces low pressure units 1,750 psi.), Hi-Low units with dual pressure source and Hi-pressure units (10,000 psi.). Haskel Engineering and Supply Co., 721 W. Broadway, Glendale 4, Calif.

"Vibrotest" Model 264 insulation resistance tester has range from 0 to 100 megohms at 500v. d.c. plus low range 0-to-10,000-ohm scale; will detect deteriorating or faulty insulation; also can be used for circuit continuity testing. Associated Research, Inc., 3758 W. Belmont Ave., Chicago 18.

Tumb-L-Matic wet-process tumbling compound suspends grease and cuttings, permits greater abrasive action by keeping parts free of action-retarding accumulations, resulting in fast, high finish. Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70.

Link-Lock fingertwist lock for military transit cases, instrument cases, etc., has no springs, is designed for satisfactory operation at extreme low temperatures and to safely carry loads up to 1,000 lb. in tension. Simmons Fastener Corp., N. Broadway, Albany 1, N. Y.

Aluminum solder rod (lead-free) melts at 400F, flows at 450F, can be applied with ordinary soldering iron. For soldering all aluminum alloys (except 24ST) or aluminum to dissimilar metals and particularly for work on electronic units and instruments. All-State Welding Alloys Co., Inc., White Plains, N. Y.

FINANCIAL

Aircraft Dividend Record

(Per Share)

	TOTAL PAID 1950	CURRENT MARKET	ESTIMATED – 1951 TOTAL	YIELD%
Beech	$0.80	13	$0.80	6.2
Bell	1.75	27	2.00	7.4
Bendix	5.00	52	5.00	9.6
Boeing	3.00	46	3.00	6.5
Cessna	0.20	6	0.20	3.3
Consolidated Vultee	1.00	17	1.00	5.9
Curtiss-Wright, "A"	2.00	25	2.00	8.0
Curtiss-Wright, Common	1.00	10	1.00	10.0
Douglas	6.25*	52	4.00	7.7
Fairchild	0.60	7	0.60	8.5
Grumman	4.00*	23	2.00	8.7
Lockheed	3.00*	20	2.00	10.0
Martin	None	16	None	None
McDonnell	2.00*	18	1.00	5.6
No. American	1.25	15	1.25	8.4
Northrop	None	15	0.50	3.3
Republic	0.50	14	0.50	3.6
Ryan	0.20	9	0.40	4.5
Sperry	2.00	32	2.00	6.3
United, Common	2.00*	31	2.00	6.5
United, Preferred	5.00	105	5.00	4.8

* *Paid on old stock before split-ups.*

Stability Means Regular Dividends

Huge procurement program puts emphasis on income rather than speculative aspects of aircraft shares.

The aircraft group has assumed the characteristics of an industry from which stable, regular dividend income may now be anticipated.

Until recently, regular dividend income was not the strongest investment characteristic of aircraft equities. Considered as growth situations, aircraft companies for a long period of time felt the necessity of husbanding all available resources. This led to the "ploughing back" of earnings, where present, and dictated only token or nominal dividends to shareholders.

After World War II, cutbacks and reconversions made for extensive upheavals in the corporate affairs of most aircraft units. After this process was completed, a change in national policy took place calling for a reversal of the downward rate of aircraft procurement. This program was soon sharply accelerated by the Korean war. These conditions hardly made for stability.

▶ **Transformed Outlook**—Aircraft equities found their greatest investor support from those seeking capital appreciation. This gave the group a highly speculative tinge. Long-range views were required which meant evaluating a company's ability to keep ahead of current technological aeronautical advances, obtain orders, and convert such business into a profit.

While very much of the same approach underlies investment thinking toward the aircraft industry today, constantly mounting airplane procurement programs have transformed the immediate outlook for the group. Sustained operations at relatively high levels appear likely for some time to come.

▶ **Uncertainties**—There is no irrevocable finality to current earnings reports until definite steps have been completed. To begin with, contract deliveries do not always fall into neat patterns where they conform to fiscal periods. A number of aircraft companies include some estimate for current earnings in their work-in-process accounts. This remains to be substantiated at a later date. Even then, there is no assurance that the transaction is accurately presented. There remains the renegotiation hurdle. It may take at least a year and frequently longer after a specific contract is completed for the renegotiation processes to run their course.

Under the stated circumstances, it is a rare management that can positively assert that seemingly high earnings currently being reported are real and irrevocably in the bank. A too liberal

dividend policy premised on this assumption may later turn out to be a distribution of capital rather than of earnings.

It is this condition which has led many aircraft companies to follow irregular dividend policies. In the past, the inclination was to make the bulk of disbursements to stockholders at the year-end when results for the past period were more fully known. Semi-annual payments were also common practice in preference to the established quarterly distributions common to most other publicly held corporate enterprises.

► **Dividend Change**—This past pattern of earnings distribution to stockholders by aircraft companies has now changed. An increasing number of builders have now adopted quarterly dividend policies. Among the latest to do so are United Aircraft, McDonnell, Sperry and Ryan.

Northrop's 25-cents-a-share payment to be made Sept. 14, is the first for that company since October, 1948. This leaves the Glenn L. Martin Co. as the only major aircraft company unlikely to pay a dividend to stockholders during 1951. The Martin Co. recently sustained an adjusted net loss of $4,490,140 for the first six months of this year. The company's loans from the Reconstruction Finance Corp. further militate against an early resumption of dividends. The last Martin payment was 75 cents per share in March, 1947.

► **Stock Split-Ups**—During the past year or so no less than five aircraft companies have declared stock split-ups. Frequently, in addition to creating a broader market interest for the equity, the stock split also serves as a device to increase cash disbursements. For example, early this year United Aircraft declared a 20% stock dividend on its common shares. It previously had been paying $1.00 per share semi-annually, or a total of $2.00 for the year. Following the 20% stock dividend, it switched to a quarterly dividend disbursement of 50 cents a share—maintaining the old rate on the increased number of shares.

At indicated current dividend rates, aircraft equities yielding 6% and better are not uncommon. This compares very favorably with most other industrial equities. In almost every instance, current earnings are materially in excess of dividend payments. It is interesting that liberal aircraft income yields have prevailed over a period of years for a number of companies. This is particularly true for Grumman, Douglas and Curtiss-Wright "A."

Improved aircraft dividend yields are bound to attract the attention of staid, conservative investors who in the past have considered the aircraft industry too erratic and uncertain for income possibilities. —Selig Altschul

New Push Given All-Weather Plans

Instrument flight factor in recent airline mishaps brings re-examination of equipment and training.

By F. Lee Moore

The airline industry and government agencies are starting a new drive to increase all-weather flight safety.

Spurred by the grim realization that ten of the last 12 fatal airline accidents took place in weather requiring instrument flight, here is what the industry and government are doing to remedy the situation:

• **Airlines are re-studying** their training, maintenance and equipment programs in an attempt to bring avionic performance up to the reliability level of engines and airplanes.

• **More money and effort** is being expended by the airlines to hasten full operational use of new devices.

• **Civil Aeronautics Administration** is re-evaluating its present programs in the light of recent accidents and plans to ask Congress for a supplemental appropriation to step up its navigational aids program.

• **Both industry and government** are mulling over means of improving the existing situation right now, without waiting for avionic equipment that, while a laboratory success, may be years away from operational use.

The recent United DC-6B crash near Oakland, Calif., during an instrument let-down was the latest in the series of ten accidents which would tend to indicate that the biggest safety problem today is efficiency of avionic equipment and its use.

While improved modern equipment installation is the long-range goal now, as it has been for years, the airlines say that if they started using right now an untried "improvement," the end result might be less satisfactory than the existing equipment and procedures.

▶ **Speed-up Planned**—But in light of recent operational experience and high earnings, many are going to put more money into hastening procurement, test, and evaluation of the newer devices.

More airline money and effort will shorten the time to full operational use of new improved equipment like symbolic instruments and automatic approach, the airlines point out.

A complicating feature in the planned all-weather safety programs is the lagging delivery of avionic equipment, because of military orders. Long lead times mean there can be no quick rise in new avionics equipment programs for civil aviation. But much can be done with more effort and money put into existing and presently available equipment. It is there that airlines and CAA are looking first before taking any other steps.

Position location, course accuracy and flight proficiency are the chief problems of all-weather flight. According to airlines and CAA, here are some important aids available now or will be ready soon:

• **Position location.** Orientation aids include: omnirange (VOR); terminal omnirange (TVOR); voice instead of code identificatnon of ground stations; radar.

• **Course accuracy.** Experts agree that ILS and VOR are accurate and reasonably reliable now—and far better than their predecessor aids. But pilots and airline operations men believe more precise monitoring is needed to catch the deviations that still do occur.

• **Flight proficiency.** Aids to relieve the pilot of nervous and physical burden of instrument flight include automatic pilot, automatic approach coupler, and the new "picture" instruments.

▶ **Airborne Equipment Needs**—Airlines may speed up their testing and utilization of available modern avionic equipment, the experts agree, even through new equipment takes time to get. Right now, pilots have a great variety of equipment to watch during instrument navigation.

Many modern devices to simplify the pilot's job can be ordered now. Among these are:

• **Automatic approach.** Automatic pilot and approach beam coupler relieve the pilot from manual flying duty. He becomes free to monitor all instruments and to check radio signals more effectively. Most airlines are using automatic pilots now, and United and American are going in for flight installation of auto approach couplers; some other leading airlines may follow United and American.

• **Symbolic display instruments.** Symbolic display instruments give the pilot a visual presentation of where he is or where to fly or both. And they combine the functions of two or three different instruments, simplifying the pilot's job. Among these new type instruments are

Analysis of Fatal Crashes

Inadequate all-weather flight equipment may have contributed largely to many of the recent fatal U.S. airline crashes, AVIATION WEEK is told by leaders of the Air Transport Assn., Air Line Pilots Assn., Civil Aeronautics Board and Civil Aeronautics Administration.

Here is the record on which they based their comment:

• **Washington, instrument approach,** Dec. 12, 1949, Capital Airlines DC-3, six fatalities. Instrument approach possibly complicated by engine trouble.

• **Minneapolis, instrument approach,** Mar. 3, 1950, Northwest Airlines 2-0-2, 13 fatalities. Judged by CAB as pilot error in instrument approach.

• **Benton Harbor, Mich., frontal weather,** June 23, 1950, Northwest Airlines DC-4, 58 fatalities. Cause undetermined by CAB; plane vanished ut the time it hit a violent storm.

• **Utica, N. Y., engine failure,** Sept. 4, 1950, Robinson Airlines DC-3, 16 fatalities. Engine failed on takeoff.

• **Butte, Mont., instrument approach,** Nov. 7, 1950, Northwest Airlines 2-0-2, 22 fatalities. Judged by CAB as pilot error in instrument approach.

• **Philadelphia, instrument approach,** Jan. 14, 1951, National Airlines DC-4, six fatalities. Plane overshot runway on instrument approach.

• **Reardon, Wash., instrument, weather,** Jan. 16, 1951, Northwest Airlines 2-0-2, 10 fatalities. Plane crashed out of cloudy weather.

• **Sioux City, instrument approach,** Mar. 2, 1951, Mid-Continent Airlines DC-3, 15 fatalities. Plane crashed maneuvering for second instrument approach to field after missing first instrument approach.

• **Santa Barbara, instrument, weather,** Apr. 6, 1951, Southwest Airlines DC-3, 22 fatalities. Plane, navigating on instruments, struck mountain peak.

• **Ft. Wayne, frontal storm,** Apr. 28, 1951, United Air Lines DC-3, 11 fatalities. Plane spun in while pulling out of approach to field through the edge of violent front storm.

• **Ft. Collins, Colo., instrument, navigation,** June 30, 1951, United Air Lines DC-6, 50 fatalities. Plane navigating on instruments, hit mountain peak far off course.

• **Oakland, Calif., instrument approach,** Aug. 24, 1951, United Air Lines DC-6B, 50 fatalities. Plane hit 20 ft. below peak of 1,500-ft. hill on instrument approach. A 600-ft.-thick cloud layer reached from 1,400 ft. altitude up to 2,000 ft.

the Sperry Zero Reader, the Bendix ID-249 Omnimag, and the Collins Approach Horizon and Course Line Indicator.

• **Omnirange receivers.** About 90% of scheduled airlines will have VOR receivers installed by the end of this year. But most of the installations are single, not dual. There's a question whether the modern VOR can be made the primary means of navigation before a plane has two receivers (one as standby). Until that is decided, or airlines can get delivery of dual receivers, the old low-frequency L/MF four-course range may remain the primary navigation instrument.

• **Terrain clearance indicator.** CAB required use of a terrain clearance or proximity indicator such as the radio altimeter some years ago. This was to warn the pilot of approaching mountains, hills or ground level. But many airlines had such difficulty with maintenance, misinformation and failures that the CAB order was rescinded. Reports are that many airlines still consider the instrument inadequate so far, although the military have used it since early in World War II.

These are some of the main airborne equipment programs that both airline and government experts consider important to all-weather safety progress, although some may not be quite ready for fleet operation. Many of those instruments are dependent on ground installations.

► **Airways Establishment**—CAA's federal airways equipment budget this fiscal year will be between $8 million and $13 million—depending on House-Senate conference results.

That's much less than the $25 million CAA requested from Congress, but CAA may be able to step up some ground equipment projects for more navigation safety, at the expense of other planned projects aimed more at convenience than safety. Aids nominated for more CAA emphasis last week by pilots and airline spokesmen were: voice identification of ground equipment instead of code; more monitor efficiency on ILS and VOR.

VOR omnirange is to be the standard navigation aid. It may be that CAA can defer some other aids while it gets the VOR system foolproof.

All presently installed ground aids identify themselves by coded dot-dash-dot signals. The unwary or distracted pilot sometimes misreads the code, or just assumes he tuned in the right frequency and doesn't check it. Misidentification of a range has caused some near-misses on airliner navigation, and some observers are guessing mis-identification of a range station might have caused the crash June 30 of a UAL DC-6 in Colorado.

CAA plans ultimately to change all range and marker identities to voice.

But the present program is for a gradual shift to voice, although installation of a voice recorder at a station is not considered an expensive modification.

► **Airline Operation**—CAA urges airlines to speed their transition from low-medium frequency aids to full utilization of the new very high frequency VOR, GCA and other modern aids and controls. But many airlines and their pilots want to move into that carefully. They are using the VHF equipment and radar ground control often where available. But they don't put full trust in them yet. There are still some unexplained failures of ground and airborne equipment. Nevertheless, maintenance of both is improving at a rapid rate.

By late next year, the airlines will mostly be using the new very high frequency aids as the primary navigation system.

Airlines, pilots and government men agree that stepped-up procurement, test and utilization of modern proven equipment is the fastest way to all-weather flight safety. Pilots are human beings, with most of the weaknesses that implies. There is more room for improvement in equipment than pilots, all observers seem to agree. They urge equipment to make the pilot's job simpler and more efficient. They want simple, sure equipment monitored by other equipment, as well as intensified pilot training in all-weather flight technique and discipline.

VERSATILE CARGO LIFTER

This hydraulic truck lift, with a platform 9 ft. x 15 ft., capable of handling 8,000-lb. loads, is being used by Flying Tiger air freight stations in Chicago and Cleveland to speed loads to and from the plane. It's expected to cut usual loading time in half, since freight loads may be loaded on the platform in advance and then quickly unloaded when the plane arrives. Here it's used by a C-46.

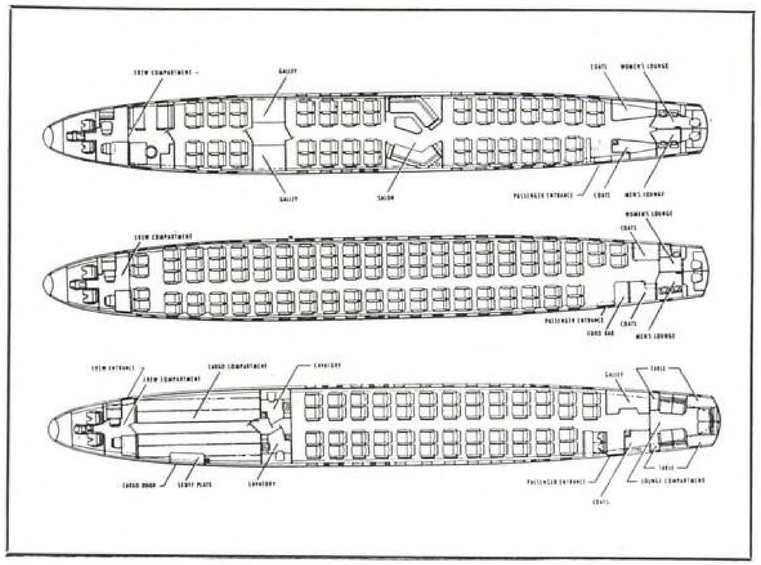
Try New System of Settling Accounts

Three major trans-Atlantic carriers are conducting a joint trial-run in the use of distance instead of currencies for settling accounts between them through the International Air Transport Assn.'s Clearing House. The new scheme promises to achieve decided time and cost savings over the previous method used.

For the latter half of this year, Air France, British Overseas Airways Corp. and Pan American Airways will bill each other for space sold on the other's behalf in terms of distances involved, automatically weighted by coefficients to allow for rebates, discounts and surcharges. At the end of each month, single balances for each company will be struck by an offset of credits and debits and the result rendered into terms of cash by the use of daily rate figures.

Up to now, the practice has been for the selling airline to compute the value of the space sold in terms of currency and convert the results into the currency used by the companies who actually carried the traffic. The checking and rechecking by all companies concerned required thousands of man-hours yearly and created a considerable time lag in the ultimate settlement of accounts.

An initial test of the new system was made by British European Airways, Danish DDL, Dutch KLM, Belgian Sabena and Swissair on intra-European journeys, and it was found that that there was a difference of only one-eighth of one percent between the results obtained by the new method and the older system, with the latter still subject to at least several weeks of checking.



SUPERCONNIE VERSIONS

Lockheed Aircraft Corp. offers several interior arrangements of its Super Constellation for air carrier needs. The "Inter-Continental," at top, is a 54-seat luxury version, with salon in the center of the craft. On overland flights, the relief crew quarters up front could be replaced by eight more passenger seats. The "Interurban," center, would carry 103 passengers in five-abreast seats at 39-in. intervals. The bottom floor plan shows combination passenger-cargo version, with room for 50 passengers and 1,140-cu. ft. cargo space up forward. A 60x72-in. cargo door facilitates handling.

CAB Estimates LAA Mail Pay

Metropolitan helicopter operator Los Angeles Airways has a Civil Aeronautics Board show-cause order setting final mail pay. CAB proposes to pay LAA $1,351,190 or $1.36 a plane mile for Oct. 1, 1947-Dec. 31, 1950; and current rate of $1.30 a plane mile for the first 30,000 mi. a month and 60 cents for additional mileage.

The 1947-50 rate is figured by CAB to give Los Angeles Airways "a fair return on the recognized investment computed at 7% in accordance with established Board policy. . . ." This comes out to $67,406 on investment of $296,293, with allowance for $17,098 federal and $1,123 state income taxes.

The new current rate of $1.30 is figured to give an estimated operating profit margin of 9.94 cents per plane mile to provide a fair return and "continued development of the helicopter experiment." The rate is set on estimated operating margin instead of investment return because investment is too small to make it a reliable yardstick for measuring future mail pay need. Estimates are the company's own, which CAB agreed looked reasonable.

CAB allows LAA President Clarence M. Belinn a salary of $15,000 a year starting this January "because of the general change in economic conditions." But CAB cut his salary down $3,737 to $12,000 a year for 1947-50. The basis for this was stated in the Trans-Texas Airways mail rate case: "Where a carrier relies so heavily on mail pay support it is believed that the maximum salary for chief executive officers that should be underwritten by the government in cases of local service carriers is $12,000 a year."

TAA Traffic Up

(*McGraw-Hill World News*)

Melbourne—Sharp traffic gains marked Trans-Australia Airlines' first half of the current fiscal year. Revenue passenger miles were up to 289,371,000 (an 18.4% increase over the same period last year). The number of revenue passengers was 609,974, a 15% increase.

Revenue freight increased 27.3%, to 32,590,000 lb., and mail was up 10.3% to 5,695,182 lb. The number of unduplicated route miles went up to 21,917 from the previous 18,361. Ports of call were increased from 56 to 93.

TAA has sent an engineer to London to recruit technicians to take care of its steadily rising business. A newly bought DC-4 will fly some to Melbourne.

CAB Takes Over Housekeeping Job

The Civil Aeronautics Board will henceforth do all its own administrative housekeeping. CAB takes over from CAA its own accounting services, payroll preparation and necessary procurement.

CAB's budget and fiscal section will do CAB accounting and payroll work. The CAB general service section will be in charge of the procurement operation.

This administrative change was recommended by the Congressional Aviation Policy Board and the Hoover Commission. The step is also in line with provisions of the Budget and Accounting Procedures Act of 1950, the Board says.

The Board has also announced that it has renamed its Bureau of Administration as the Office of Administration.

TACA Inaugurates New Service to U.S.

San Jose, Costa Rica—A new daily flight connecting the capitals of five Central American republics and New Orleans with "same day" service has been opened by Transportes Aeros Centro Americanos (TACA).

The DC-3 flight leaves San Jose at 4 a.m. every day but Sunday, and goes to Managua (Nicaragua), Tegucigalpa (Honduras), San Salvador—where passengers transfer to a DC-4—and Guatemala City, landing at New Orleans at 2:15 p.m.

The before-dawn takeoff from San Jose sets a night-flying precedent in Costa Rica, since the little, mountain-ringed Sabana Airport has hitherto been restricted to daylight operations. Prior to inaugurating the service, TACA made extensive night takeoff tests from the field, using flare paths.

Brazilian 1950 Air Travel Marks

(*McGraw-Hill World News*)

Rio de Janeiro—Panair do Brazil and Cruseiro do Sol share the spotlight as Brazil's leading airlines in official summaries of their 1950 transport operations.

Panair carried 250,180 passengers, 4,046 metric tons of baggage, 5,018 metric tons of freight, while Cruzeiro do Sol flew 280,229 passengers, 3,365 metric tons of baggage and 6,524 metric tons of freight last year.

CAB Findings on EAL Florida Accident

Civil Aeronautics Board findings about the probable cause of Eastern Air Lines' Constellation 749A landing accident at Jacksonville last year "was the unsuccessful attempt of the crew to lock the landing gear manually due to lack of training in the operation of the emergency hydraulic system."

Warning lights in cockpit indicated that the landing gear was not locked down. Immediately following touchdown the left main landing gear retracted. The plane swerved to the left off the runway. No one was hurt, but the plane was substantially damaged. Accident took place on Oct. 10, 1950.

Among CAB's findings: the regular down lock hydraulic line failed due to excessive torquing of the coupling nut; Eastern had not specified a torque value for the nut, though one was specified for it by the manufacturer; crew did not lock the left main landing gear manually, although this could have been done; "the unfamiliarity with the emergency system was due to a lack of adequate training by the airline."

Air France Profits

(McGraw-Hill World News)

Paris—Air France earned a net profit of $29,502 last year compared with a net profit of only $209 for the 16 months from Sept. 1, 1948 through 1949, according to the latest annual report issued by the carrier.

Gross income for 1950 was $75,430,000, compared with $73,714,300 for the previous 16 months. Part of the improvement in earnings was effected by reducing number of employes from 15,060 at the end of 1949 to 14,603 at the end of last year.

The French carrier transported 775,000 passengers last year as against 650,000 in 1949 and flew 23,917 across the Atlantic in 1950 compared with 21,674 in 1949. Passenger mileage went up 15% last year over 1949; freight mileage was up 21%, and postal mileage was 27% higher.

DME in Australia

(McGraw-Hill World News)

Melbourne—An extensive distance measuring equipment program is underway at Australian airports and along flying routes to provide an additional means of navigational assistance to pilots.

Initial work on installations and aerial transmitters has begun and plans call for 89 DME stations along the country's air routes.

Australia Speeds Ocean Radio Links

Melbourne—To facilitate communication with aircraft on Indian Ocean routes, the government has decided to develop a site ten miles from Guildford, West Australia, as an international airport.

Because of the speeding up of the start of South Africa-Australia services through the Cocos Islands, authorities will provide temporary international radio transmitting and receiving equipment in Belgravia Park for communicating with international planes and to provide point-to-point contact with Cocos Islands and meteorological services.

Brazil Strengthens Training Program

(McGraw-Hill World News)

Rio de Janeiro—Brazil's civil aviation training program has been substantially strengthened with distribution by the government of 80 new Piper PA-18 Super Cub 105s to government-subsidized flying clubs. The mass dedication ceremonies were attended by President Vargas.

The Super Cubs, together with spare parts, were purchased by the Brazilian government with a $300,000 credit opened last year.

ANA Record

Melbourne—Australian National Airways has carried over 650,000 passengers for the year ended June 30, 6.5% increase over the corresponding period last year. Freight went up some 26%, reaching 72.9 million pounds. These figures would have been still higher, the carrier estimates, if delivery of new Douglas Skymasters had not been canceled with start of Korean hostilities.

In 15 years of operations, ANA, largest privately owned air carrier in Australia, has lifted 4,330,000 passengers over 2 billion passenger miles and has hauled 241 million pounds of air freight.

TWA European Plan Is Scored by PanAm

Reacting to a Trans World Airlines request that CAB eliminate Pan American competition from France, Italy and Spain, a PanAm spokesman said last week: "What TWA wants is to have CAB throw out President Truman's policy of overseas competition at main traffic points and substitute TWA's own plan for no competition."

Both TWA and PanAm have filed

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: "OPPORTUNITIES" :EQUIPMENT
BUSINESS: :USED OR RESALE

SEARCHLIGHT SECTION CONTINUED ON PAGE 75

applications requesting either new permanent certificates or renewal of their temporary international route certificates expiring next July 4. PanAm asks no change in the present international route structure. But TWA asks CAB to eliminate PanAm from Central and Southern Europe, especially Paris and Rome; TWA asks a return to what it calls "area competition"—meaning competition to the London and Lisbon gateways to Europe but no competition between the two carriers within Europe and the Near East. TWA says this was the CAB policy until the President changed it in his decision last year overruling the Board's denial of the PanAm-American overseas merger.

SHORTLINES

► **Air France**—Reports a profit of 10,325,595 francs on its worldwide operations in 1950, figuring equipment amortization "very much on the same lines as that practiced by other airlines." Subsidy was reduced to 8% of total revenues, Air France says. Passenger load factor remained "superior to 65%." Passenger kilometers increased 14% to 1,134,923,830. Ton miles gained 16%.

► **Air Transport Assn.**—Airline Finance and Accounting Conference has published "origination and destination airline traffic survey of revenue passengers for September, 1949." This survey is made twice a year, based on CAB figures. CAB formerly issued the reports, but ATA now offers them at $25 per set.

► **BOAC and BEA**—Britain's two government-owned international airlines report a total operating loss of $15,524,398 in the fiscal year ended Mar. 31, compared with a loss of $25,648,000 a year ago. British Overseas Airways reduced its losses 41% to $12,783,198; British European Airways reduced its losses 28% to $2,741,200. Both BOAC and BEA report they are planning air coach type operations, with "the possibility of extending the benefits of air travel more widely."

► **Eastern Air Lines**—Has extended low-fare summer excursion rates New York-Miami to Oct. 31. This off-season first-class excursion rate is $114, compared with standard round trip fare of $144 and night air coach round trip rate of $107.

► **California Eastern Airways**—Is still scheduling more than 14 hours per day utilization of its DC-4s on the Pacific airlift. In the first year of the

(Continued on p. 75)

(*Continued from p. 72*)

Korea war, CEA reports it flew nearly 34,500,000 passenger miles carrying over 7,000 passengers including over 500 litter patients. Using two to four DC-4s at all times, utilization averaged 13 hours, 19 minutes per plane per day.

► **International Civil Aviation Organization**—Legal committee meeting starting at Madrid this week will work for revision of existing international law limiting airline liability for passenger injuries. Present regulations accepted by more than 41 nations were made in 1929. Maximum liability of an airborne for passengers injury on international flight is now $8,291. Some nations want the limit raised.

► **KLM Royal Dutch Airlines**—Reports sales the first six months of this year up 26% over a year ago.

► **New York International Airport**—Idlewild reports a new one-day record for trans-Atlantic rivals—1,426 passengers.

► **Northwest Airlines**—President Croil Hunter reports to his directors that no airline mergers with NWA are imminent. "Although Northwest has been approached in recent months by several airlines . . . none of these conversations was initiated by Northwest and none has been anything more than exploratory."

► **Philippine Air Lines**—Reports net profit of $636,482 for the first half of 1951 compared with only $19,473 a year ago. Load factor was 79%, compared with 63% a year ago.

► **Robinson Airlines**—New York local service airline has put its sixth Douglas DC-3 in operation and says "more planes will be acquired soon." All Robinson DC-3s now, seat 24 passengers.

► **Seaboard & Western Airlines**—Reports a record 1,063,869 pounds of air freight carried in July.

► **Trans World Airlines**—Reports a record 52,000 air coach passengers carried June-August this year. TWA adds a fifth daily coach flight the end of this month. This will be New York to San Francisco via Chicago. . . . . has opened sales offices in Nice, France, and Llanes, Spain.

► **United Air Lines**—Starts its big quarter-century anniversary celebration and promotion campaign this week in 32 cities. UAL in 25 years has carried 7 million passengers, 42,974,000 pounds of mail, 35,076,000 pounds of air express and 58,702,000 pounds of air freight.

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390	48461	Gear
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1178	84289	Bearing
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88	727TY73Z2	Weston	Right Wing Anti-icing
83	727TY74Z2	Weston	Tail Anti-icing
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22	8DJ-29-AAY	G. E.	Indicator (Cowl Flap)
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174	450-0	Skinner	Gasoline Filter
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22	0655-D	Aro	Oxygen Regulator
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A 32-page engineering manual 53-A detailing General Controls' line of Hi-G automatic controls for aircraft can be obtained by writing the firm at Glendale, Calif. . . . 12-page catalog giving engineering data on **aircraft hose assemblies**, is offered by Resistoflex Corp., Belleville 9, N. J. . . . **Catalog 51b** giving complete specifications on more than 70 types and sizes of miniature ball bearings is available from Miniature Precision Bearings, Inc., Keene, N. H.

Folder lists all of E. F. Drew & Co.'s products for the aviation industry including carbon and parts cleaner, corrosion preventives, emulsion cleaners, paint strippers, polishes, solvent cleaners, steam cleaners and special compounds. Write Aviation Products department, E. F. Drew & Co., Inc., New York 10. . . . **Electroshield, the New Copper Clad Metal** is a folder which shows how manufacturers can stretch critical copper supplies up to four times using this process. Write American Cladmetals Co., Carnegie, Pa.

Cerromatrix method of punch and die setting is detailed in 20-page manual being distributed by Cerro de Pasco Corp., 40 Wall St., New York 5. . . . **Catalog 72** gives listings of Micro switches conforming to MIL-S-6743 and MIL-S-6744 and listings of switches conforming to JAN-S-63. Write Micro Switch division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Descriptions of Townsend Nylock and Tufflok locknuts are carried in new folder available from Townsend Co., New Brighton, Pa. . . . **Assembly Suggestions** is 24-page booklet covering new fastening developments as an aid to designers and product engineers. Write Shakeproof, Inc., 2501 No. Keeler Ave., Chicago 39, Ill. The company also makes available a new booklet on advantages and application of power screw drivers, showing detailed features of the Shakeproof unit.

New Addresses

William C. Wold Associates, Inc., has moved to larger offices at 516 Fifth Ave., New York, 18. Phone is MUrray Hill 7-2050.

Harry M. Chase, Inc., operators of Dallas Aero Service at Love Field since 1945, has moved its plant and organization to Dallas-Garland Rd. & Loop 12, Dallas. Phones are FAirdale 2675 and 2676.

Cannon Electric Co. is the new name of former Cannon Electric Development Co., division of Cannon Manufacturing Corp., 3209 Humboldt St., Los Angeles 31. Phone number is CApitol 5-1251.

Personal Airplane Sales Corp. has moved facilities to Hangars A and C at Westchester County Airport, White Plains, N. Y., from its previous location at Roosevelt Field, N. Y. New phones are WHite Plains 6-8585 and 6-9000.

WESTLAND-SIKORSKY S-55 ROTORESCUE

Demonstration of sea rescue by helicopter is made near Lee-on-Solent, England, by Westland-Sikorsky S-55 of 705 Squadron R.N., Safety Equipment and Survival Training School. Roomy interior permits special operator to control hook (right).

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Washington Roundup

New Secretary of Defense?

Secretary George Marshall is expected to retire shortly after the 1953 fiscal year defense program is worked out by the Defense Department early in October. He has long wanted to.

Washington speculation on the new defense chief favors RFC Administrator Stuart Symington.

►**Eisenhower: More Air Power**—Reports from Gen. Dwight Eisenhower's headquarters focus on two basic points:

• Air power holds the key to defense of Europe. Lt. Gen. Alfred M. Gruenther, chief of staff, Supreme Headquarters Allied Powers in Europe, stated to the Senate: "We speak a great deal of ground divisions, but I would like to make it extremely clear that as far as Gen. Eisenhower is concerned and as far as our headquarters are concerned—and I would say as far as most military men are concerned—air power will be the dominant factor in the defense posture. It is of over-riding importance to us. Gen. Eisenhower has the staff working in every possible way to improve the air picture.

• The three-year European defense build-up program falls far short in air power of the force military men mark down as "must" to meet Russian aggression.

This seems to be the picture:

• Russia has an estimated 9,000 tactical aircraft available for operations in Europe. It's likely this force will continually be increased.

• SHAPE leaders want a two-to-one superiority in air power to counteract Russia's more than two-to-one advantage in ground troops. SHAPE's target of about 60 European-based divisions compares with Russia's 175. This would mean a tactical air force in Europe of 18,000 planes—250 wings.

• But under the approved program, by the June 30, 1954 target date, SHAPE's tactical air power will fall short of matching Russia's even one-for-one.

Mobilization Timetable

This is the new schedule the Administration's mobilization planners are going by:

• Target date for readiness for a major war: June 30, 1954.

• Peak in military contract letting: it will be reached next spring.

• Peak in military spending, reflecting deliveries: it will be reached a year later, in the spring of '53.

►**More Aircraft Business**—Added to the $13 billion in planes and parts that'll be ordered during the '52 fiscal year for the U. S. armed services, the U. S. industry's load will be increased by:

• **Planes for Europe.** Air Force and Navy will spend $1,425 million on aircraft for Western European countries, $325 million on aircraft for other non-Communist countries.

Since Mutual Defense Assistance Program started in October, 1949, U. S. has spent $1,125 million in aeronautical equipment for Europe; $125 million in planes and parts for other countries.

• **More Canadian Orders.** Prospect is that there will be an avalanche of Canadian orders for planes and parts soon.

Up to now there has been a ceiling of $100 million on the amount of outstanding foreign orders for defense equipment the U. S. could finance. This is going to be boosted to $500 million. Foreign nations pay when they get delivery.

Canada has indicated it will place orders up to the $500 million between now and next July—mostly for aircraft.

But 40 other countries are interested in getting the U. S. financing.

►**Airline Subsidy Outlook**—Opposition to legislation approved by the Senate Commerce Committee taking the subsidy out of airmail pay is developing on Capitol Hill:

• Delaware's Sen. John Williams, a crusader against all varieties of subsidy, will try to tighten up or eliminate provisions for grants to scheduled airlines and freight carriers for "commerce" and "defense" interests.

• Massachusett's Rep. John Kennedy will take up Postmaster Jesse Donaldson's case against paying universal postal union rates for foreign airmail. Donaldson's position: UPU rates are negotiated, don't relate to the cost of service, and would mean a slice of subsidy in a purportedly "compensatory" rate.

Meanwhile, industry factions are aiming for changes:

• Scheduled airlines want freight carriers—Slick Airways and Flying Tiger Line—cut off from subsidy grants. Their main apprehension: nonskeds will obtain some type of CAB certificate and claim eligibility for government support, too.

• Nonskeds want it written into the law that they are eligible for subsidy in "commerce" and "defense" interests.

Things to Watch for

• **Nonsked's best friend.** Watch for Senate Small Business Committee to bring pressure on CAB to keep the nonskeds in business.

Committee's chairman, Sen. John Sparkman launched the campaign with a Senate speech. He charged: In lieu of a blanket "death edict," the Board's new tactic is to kill off the nonskeds one by one. His comment: "It may be a slower death, it may be less painful, but it is just as certain and it is just as harmful and just as destructive to the economy and security of the country."

• **More airlift?** Watch for nonskeds to push for legislation authorizing the services to build up airlift by purchasing planes for lease to operators with 75% of their personnel in the reserve.

They will open campaign in the new January session of Congress.

• **Commercial jets.** Watch for airlines to seek tax-exempt reserves to finance development and purchase of jet passenger liners.

They are thinking it over. The plan would parallel the merchant marine program to encourage an up-to-date fleet. Airlines hesitate, though, at the prospect that depreciation for tax purposes wouldn't be allowed on planes bought with tax-exempt funds. Their question: Would high taxes on planes cancel out the tax savings on the reserve pool?

But legislation authorizing the government to finance prototypes is out—for the forseeable future. The reserve plan is the airlines' only hope now on the horizon of stimulating development of new commercial passenger liners.

—Katherine Johnsen

(Editor Robert H. Wood, whose editorials usually appear on this page, is on vacation.)

FOUR MORE RECORDS FALL TO G-E JETS

Thompson Trophy: A North American F-86 smashed the world's speed record for the 100-kilometer closed-course with a speed of 628.698. In warming up for the event, the jet also broke the closed-course record with a speed of 635.411.

Bendix Trophy: Another Sabrejet beat existing Muroc-to-Detroit records in winning the Bendix race with a speed of 553.761—averaging better than 25 mph faster than the previous record. The F-86 finished the race in a dive at sonic speed, after sustaining speeds of better than 650 mph over much of the course.

Chicago to Detroit: Four F-86s, averaging 672.189 mph, etched a new record in the skies from Chicago to Detroit, finishing the 237-mile course in less than 21 minutes.

Thompson Trophy: 628.698 MPH

Closed-course Record: 635.411 MPH

Bendix Race: 553.61 MPH

Chicago to Detroit: 21 minutes

Shattering existing records in every event in which they were entered, North American F-86 Sabrejets, powered by General Electric J47 jet engines, tallied a clean sweep at the National Air Races in Detroit.

Jet engines designed and developed by General Electric have set more records, powered more planes and flown more hours than all other jet engines combined. G-E leadership in the development and production of engineered systems and precision products for aircraft is available to you by contacting your nearby G-E office. *General Electric Company, Schenectady 5, New York.*

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