

TWINS MEAN BUSINESS

*American Light Twin-engined
Executive Aircraft Reviewed*



TWO recent *Flight* assessments of typical American light twin-engined executive aircraft (Beech B50 Twin Bonanza, December 31st; Aero Commander, December 24th) serve as reminders of the advanced state of development of such aircraft for executive transport in the U.S.A. In fact the majority of American light aircraft are used for business purposes, and many very much larger machines have been specially converted.

A key factor in the selection of such aircraft, quite obviously, is their availability for use when business calls rather than when weather permits, and for this reason something approaching full-scale airline radio and radio navigation equipment is essential. Though even Piper Pacers often carry fairly comprehensive aids of this kind they do not offer quite the amenities and cruising/range performance of, for example, the light twin, and it is the latter type which in recent years has emerged as one of the basic executive air-transport vehicles in the U.S.A.

American business-aircraft owners have formed themselves into a body called the National Business Aircraft Association, and at Love Field, Dallas, Texas, last October, the association held its seventh annual convention. This was attended by 435 delegates, almost twice as many as last year, and some \$5 million worth of new executive aircraft were exhibited for their benefit by manufacturers and dealers.

Steadily increasing use is being made of "corporate aircraft," i.e., aeroplanes owned by companies for executive transport purposes, and the N.B.A.A. aims to supervise and co-ordinate the operation of such machines, and to protect their status in aviation law. During the various meetings at Love Field a variety of subjects was dealt with, and suggestions were exchanged between Civil Aeronautics Authority and N.B.A.A. representatives. Forms of insurance for pilots, training schemes and piloting standards, navigation aids and traffic facilities were all discussed, especially with a view to maintaining the recognition of executive aircraft as *bona fide* airways users. It was particularly suggested that all operators should install VOR/DME equipment, since the coverage in the U.S.A. was now complete except for four small blind patches at 20,000ft. The scope of these executive aircraft operations is considerable, and their value to the companies concerned was amply demonstrated at the convention.

The great variety of types of aircraft currently used for

The Cessna 310, in the air, shows the generous proportions of its tail surfaces. Tailplane span is no less than 17ft.

business ranges from the modest Piper-type light aircraft to the "super-de-luxe" pressurized conversions of World War 2 bombers, brand-new executive Martin 202s, and such aircraft as DC-3s re-engined with P. and W. R2000 or P. and W. 1830-94-M1. At least two variants of these latter conversions were on show. Also to be seen were various Lockheed Lodestars, Beech 18 and Super 18 and the compound Learstar. Three foreign products were shown. One was the de Havilland Heron, which sells at \$195,000 (about £69,500) and is very popular. Another was the de Havilland Dove which, though not dealt with in detail here, since it is not of American origin, holds an important position in the light twin field, and is well liked. More than 80 Doves have now been sold in the U.S.A. The third was the Piaggio P.136L amphibian, *alias* Royal Gull, which is assembled in America by the Royal Aircraft Corporation, Milwaukee, and sells for \$65,000 (about £2,330). It was briefly described in *Flight* on November 19th. Another amphibian on show was the Grumman Super Widgeon; considerable interest has been shown in these amphibians by oil companies who would find them useful for personnel and light freight transport between the shore and oil-drilling rigs erected at sea.

In a class of its own, however, is the series of light twins selling at between \$35,000 and \$69,000*, with seating capacities from four to eight, offering good cruising speeds and ranges often over 1,000 miles. They are, in order of price, the Piper Apache (170 m.p.h., \$35,075), the Riley '55 Twin Navion (180 m.p.h., \$36,500), the Cessna 310 (205 m.p.h., \$50,000), the Aero Commander 560 (197 m.p.h., \$69,500), and the Beech Twin Bonanza C50 (200 m.p.h., \$69,950). All these have metal construction, tricycle undercarriages, variable-pitch airscrews, horizontally opposed engines, comprehensive radio-navigation equipment, a smart appearance, and a long and varied list of comfort and safety features.

Only one of them is in the direct sense a conversion of its single-engined predecessor, namely the Riley '55, which was originally the Ryan Navion. Its production was taken over

*Approximate sterling equivalents for dollar amounts quoted in this paragraph are: \$35,000, £12,000; \$69,000, £24,700; \$35,075, £12,527; \$36,500, £13,050; \$50,000, £17,800; \$69,500 £24,800; \$69,950, £24,960.



The only high-wing light twin, the Aero Commander sits very low on the ground. The under-fuselage is specially strengthened to take an emergency belly landing with the minimum damage.

"Flight" photograph

With one airscrew feathered (note also large rudder-trim tab) the Piper Apache, fully loaded, has a 5,000ft plus ceiling.

vania. Pipers have, of course, built a long series of successful light aircraft of the Cub type, leading up to the Tri-Pacer and the Cruiser series. Their venture in the light-twin field is called the Apache, and it is the lightest and most compact of all the twins here described.

Incidentally, the company recently held a convention of their own, attended by over 200 distributors, at which the work of the company was reviewed. From a series of customer surveys, carried out in the last four years, they have been able to draw some interesting conclusions; for instance, that the percentage of buyers who had never owned Pipers before is steadily increasing and that, whereas in 1951 90 per cent of Piper aircraft sold were used for business purposes, in 1954 the figure is 97 per cent. Each owner flies an average 320 hours per year. The block-to-block speed of the aircraft in service has increased from 114.9 to 119 m.p.h., while fuel consumption in gallons per hour has decreased from 8.9 to 8.1. The company have even established that the average r.p.m. used by their customers has decreased from 2,410 to 2,375.

The most significant figures, however, are those concerned with navigation aids and blind-flying instruments. For instance, in 1951, 46 per cent of Piper aircraft owners used standard instrument-panels, and only 8 per cent full blind-flying panels. In 1954, only 14 per cent retained standard panels, 74 per cent ordering full panels. Similarly, radio navigation equipment of the compound "omni" type was fitted by only 17 per cent in 1951, and is now used by 85 per cent. On the other hand, use of A.D.F. has remained constant at approximately 8.3 per cent.

From this can be gained some idea of the increasingly efficient use of business aircraft. The navigation-aid coverage is there; the airborne equipment is available in quantity at prices owners are prepared to pay; and the installation of both this equipment and full blind-flying panels shows that more and more of these light aircraft are being used, airliner-fashion, for journeys in I.F.R. conditions which were previously the prerogative of the fully equipped scheduled airliner.

Further surveys have shown that, of the types of people using Piper aircraft for business purposes in 1954, 18.2 per cent were farmers or ranchers, 27.5 per cent manufacturers, 12.2 per cent construction companies, 9.2 per cent physicians, 15.8 per cent wholesalers and distributors, and 6.2 per cent engineers and architects (the remainder are classed as "miscellaneous"). These proportions fluctuate slightly from year to year but remain substantially constant. To support their figures, Pipers announced at the convention that they had a backlog of orders—for Apaches, Tri-Pacers, Super Cubs and PA-18-A agricultural machines—worth \$6 million, with firm deposits on hand.

The Piper Apache was described in *Flight* on May 7th last year. It has a cruising speed of 160 m.p.h., an all-up weight of 3,500 lb and is powered by two Lycoming 0-320 engines with Hartzell constant-speed, fully feathering, two-bladed airscrews. It seats four and can, of course, be equipped for night and instrument flying. More than 100 have been delivered since production began last May.

Pipers found that it was cheaper to fly their aircraft to foreign customers than to crate them and ship them, and the most remarkable venture in this respect has been Max Conrad's delivery flight of an Apache direct from New York to Paris last November. The aircraft was destined as a sales representative's demonstrator for the European area. It was a standard airframe with its two 36-gallon wing tanks supplemented by three tanks in the cabin, bringing the total fuel load up to 360 gallons. Max Conrad also installed his own system for adding engine oil in flight. Endurance was reckoned at 25 to 26 hours. Radio equipment consisted of the standard

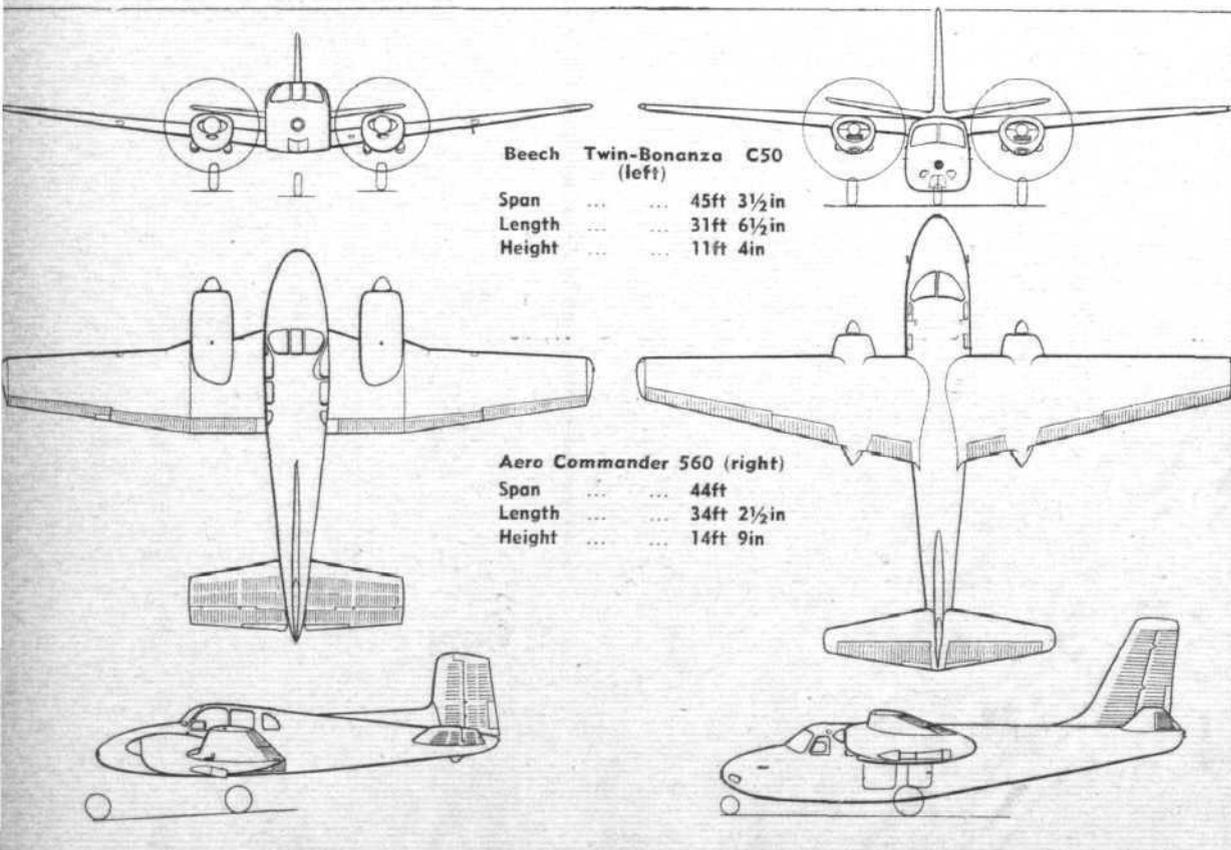
The largest of the light twins approximately to scale with each other and with those on the opposite page.

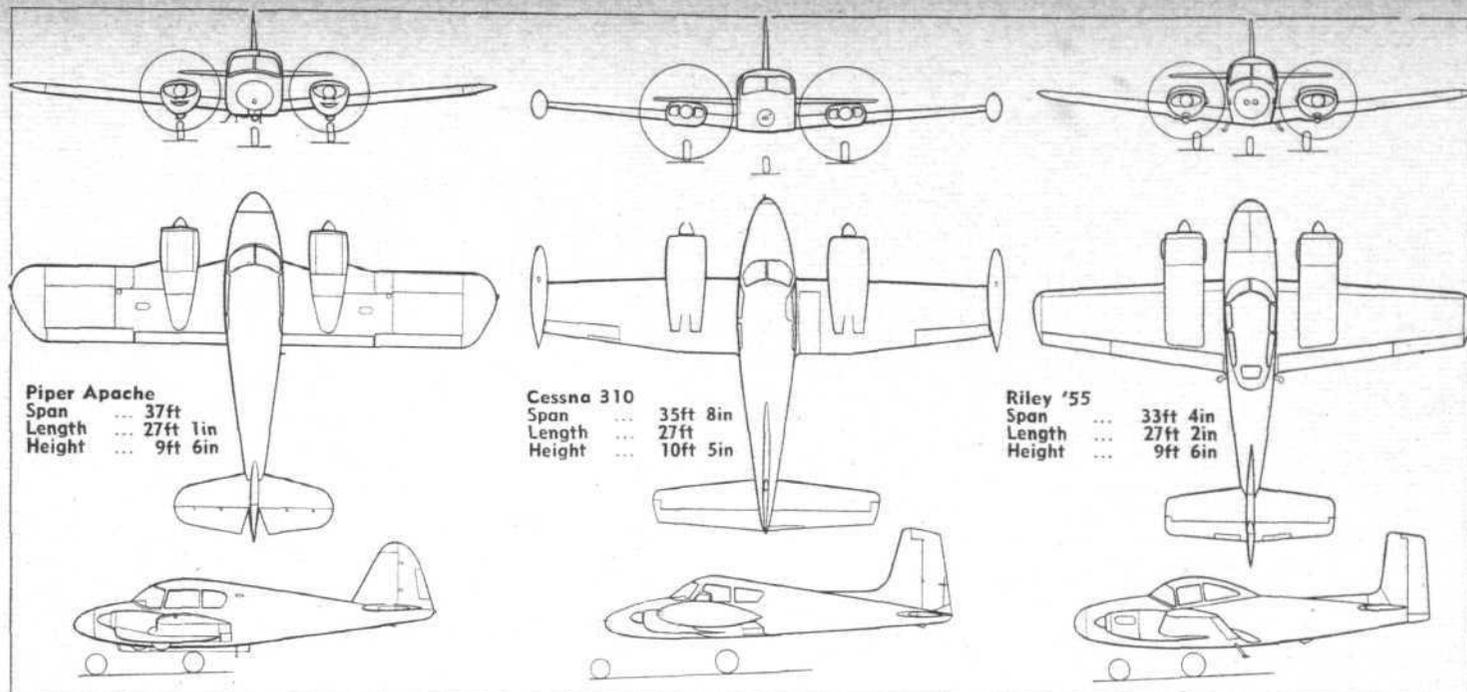
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successively by a number of companies, the latest of which is Temco. This concern has developed a production-line conversion system for which the customer furnishes a Navion airframe and Temco convert it to the full Riley '55 standard. Under an agreement concluded this year, the Temco-converted Navion is marketed by the Riley Twin Aircraft Sales Corporation; hence the name.

Conversion was originally suggested by a Los Angeles businessman in 1951. Riley took up the idea, converted a Navion, and obtained a C. of A. The actual conversion work was then delegated to Temco, who redesigned it in August 1953, incorporating 150-h.p. Lycomings. The Riley '55 is the new model of this aircraft. If the engines become available in time, the '55 is to be powered with newly developed 170 h.p. Lycoming 0340s, which will give it a top speed of 180 m.p.h. and allow an increase of gross weight to 3,600 lb. The fuel system is improved, and the addition of wing tanks will allow a range of up to 1,200 miles. In view of the longer endurance the front seats have been redesigned for greater comfort. The instrument panel, almost inevitably for a new model, has also been redesigned. Take-off and landing distance in standard atmosphere over 50ft obstacles are respectively 1,150ft and 1,050ft. Rate of climb is 1,400 ft/min and range on internal tanks at 70 per cent power 900 miles. Fuel consumption is 8-10 gal/hr/engine, and the single engine ceiling is 6,000-8,000ft.

One of the latest producers of light twins in the U.S.A. is Piper Aircraft Corp., whose factory is at Lock Haven, Pennsyl-





Piper Apache
Span ... 37ft
Length ... 27ft 1in
Height ... 9ft 6in

Cessna 310
Span ... 35ft 8in
Length ... 27ft
Height ... 10ft 5in

Riley '55
Span ... 33ft 4in
Length ... 27ft 2in
Height ... 9ft 6in

The three smaller twins approximately to scale. The sharply kinked leading edges of the Apache's wings are noteworthy.

production model's Narco Omnigator with I.L.S. localizer and eight-channel transmitter, Narco Simplex 12-channel V.H.F. transceiver, and Lear A.D.F. 12. The only non-standard equipment was a Sunny South M.F. transmitter.

Conrad wore a U.S.A.F. exposure suit and Mae West; and carried with him an inflatable life-raft and a suitcase of normal clothing. Provisions consisted of a box of biscuits, two bottles of Coca-Cola and a fresh grapefruit. The Apache is reported to have reached Paris—after 22 hr 23 min in the air—with 70 gallons of fuel remaining in the tanks. Calculations showed that for the total distance, which is officially 3,625 miles, the average speed was 161 m.p.h., and the average fuel consumption 12.88 gal/hr. At take-off from New York (Idlewild) the Apache weighed 5,000 lb—1,500 lb overload—and the take-off was measured as 2,500ft in a 6-8 m.p.h. cross-wind. This flight alone gives some measure of the capabilities of the Apache—and at least one other of the light twins here described has put up similar performances.

Among them is the Aero Commander, made by Aero Design and Engineering Company, Bethany, Oklahoma. One of these aircraft actually flew non-stop from Oklahoma City to Washington, D.C., over 1,100 miles, with one of its airscrews removed. Moreover, normal cruising power was used and the "live" engine did not suffer unduly. The Aero Commander has also flown over the 19,000ft Mount Popocatepetl in Mexico and, utilizing its normal range of 1,050 miles, it has made delivery flights all over the world, one in particular from Oklahoma City eastwards to Tokyo.

The latest Aero Commander, the model 560, has swept vertical tail surfaces, to compensate for three- instead of two-bladed airscrews and more powerful engines, but the allure of a swept surface is well exploited as a sales attraction. In its standard production form it has two individual seats in front and a three-place bench seat in the rear of the cabin. The space between them is sufficient for the addition of a third row of two seats, these being supplied at extra cost. Various arrangements of ice-boxes and cocktail cabinets can also be located here. A full-length bunk can be made up with collapsible back-

Bearing some resemblance to the Navion, the Riley '55 twin is in fact a direct conversion by Temco.

rests, or the seating so arranged that the passengers can sit round a table. Conversely, all seating can be removed to allow the carriage of freight.

The standard instrument layout provides for full blind-flying panel and engine instruments, and basic radio communications equipment, but "custom" arrangements of I.L.S., V.O.R., D.M.E. and omni-navigation aids can easily be added, and usually are.

Its Lycoming GO-480-B six-cylinder geared 270-h.p. engines make the Aero Commander one of the largest of all the light twins. At a maximum gross weight of 6,000 lb, it takes off over a 50ft obstacle in 1,100ft, and climbs at 1,400 ft/min on two engines, or with one airscrew feathered at 340 ft/min. Single-engine ceiling is 9,800ft. Cruising speed at 70 per cent rated power at 10,000ft is 197 m.p.h., stalling speed 59 m.p.h. and landing distance over a 50ft obstacle 1,050ft. The lowest stalling speed at 75 per cent rated power, and with 40 deg flap, is 45 m.p.h. at full load. Maximum range with the full 145 gallons usable fuel load is 1,050 miles, with 30 min reserve. All these figures are for the maximum a.u.w.; in the optimum configuration, at an all-up weight of 5,500 lb, performance all round is improved. The Aero Commander is one of the most popular of the light twin executive aircraft on the market and is used by a large number of companies on the American continent and elsewhere.

Probably the most ambitious of the five light twins, and claimed to be the fastest and farthest-flying, is the latest Beech Twin-Bonanza Model C50. It is, in fact, in very much the same speed, weight and range bracket as the Aero Commander. Its maximum range with no reserve, at 10,000ft, is 1,100 miles, similar to that for the Aero Commander with 30 minutes' reserve. Maximum all-up weight is 6,000 lb and cruising speed at 66 per cent power is 200 m.p.h. at 10,000ft. Other figures are very similar to those for the Aero Commander; service ceiling 20,000ft on both engines and 8,500ft single engine, take-off over 50ft obstacle 1,260ft, and landing distance over a similar obstacle 1,375ft. In its standard layout it is a six-seater.

Last year's Twin-Bonanza,* which was in production from January to October—99 were built—had 260 h.p. Lycomings, whereas the C50 has 15 h.p. more each side. Among detail improvements is a more effective and simpler airscrew control, and redesigned cabin heating whereby the blower and automatic control system can also operate when the 50,000 B.Th.U. heating unit is switched off. Exterior finish is offered in 17 different colours, and the interior incorporates "luxurious new fabrics and genuine leather trim." Inevitably, the instrument panel has been redesigned, and radio navigation equipment is now placed within easy reach of the pilot. Optional extras include an airscrew anti-icing system, a rotating navigation light atop the cabin, a nose-mounted taxiing light, an evaporative air conditioner and an engine pre-heating system for cold-weather operation.

In their brochures on the Twin-Bonanza, Beech Aircraft make a particular point of safety features. They state, for instance, that the low-wing layout permits 65 per cent of the weight to be located below and forward of the passengers. Shoulder harness is provided as standard equipment and the airframe has been stressed to 8 g maximum load—i.e., considerably higher than the 5.7 g required by the C.A.A. for this type of aircraft. It is, in fact, a very tough aircraft well suited for rough work.

The latest arrival in the field is the Cessna 310, which can boast many distinctive design features. A low-wing five-seat monoplane with single fin and rudder, it is powered by two

*Subject of an "In the Air" report by the Editor in our December 31st, 1954, issue.





The new Cessna 310, in characteristic American paint finish, is probably the cleanest of all the twins.

The biggest of the group is the Beech B50 Twin-Bonanza, here seen over England while being tried by the Editor of "Flight."

"Flight" photograph

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Continental O-470-B engines giving 240 h.p. each at 2,600 r.p.m. The main undercarriage retracts inwards into the wing centre section and all fuel, normally carried here, is accommodated in permanently attached wing-tip tanks; this means that the engine nacelles do not have to house wheels and can be extremely small, giving minimum drag, and that the efficiency of the wing over its whole span is maintained at the highest level, partly because the tip-mounted fuel tanks provide "end-plate" effect. The positioning of the fuel load also constitutes an obvious safety factor. The nosewheel, which retracts rearwards, can carry an optional swivelling taxiing light, is steerable through 15 deg either side and casters freely up to 55 deg. The turning radius on the ground is said to be little more than the track of the main undercarriage. The engine cowlings are accessible at waist-height on the ground and, though so small, are said to provide ample space for the addition of optional ancillaries. No cooling gills are required, since the exhausts are led through augments tubes which entrain cooling air and provide some extra thrust. This system is also used in several of the other light twins.

All these features have contributed to a cruising speed of 205 m.p.h. and a maximum speed of 220 m.p.h. Span, length and height of the aircraft are respectively 36ft, 27ft and 10ft 5in; empty weight is 2,850 lb, fuel capacity 100 U.S. gallons, and oil capacity 6 U.S. gallons. The list price is \$49,950 (£17,900) for the standard aircraft, which includes full blind-flying instrumentation, a 20,000 B.Th.U. thermostatically controlled cabin heater, windshield de-misters, two cigar-lighters, four ashtrays, one red instrument light and two ultra-violet lights, one map-reading light, a baggage compartment light, adjustable reclining seats, cabin radio loudspeaker, a gyro test valve, four ventilators, a coat-hanger, and a clear-vision panel, to name only a few items. Other standard equipment includes electric engine primers, electric fuel-boost pumps, and engine-driven fuel and vacuum pumps, two generators, electrically operated flaps, electrically operated undercarriage (with independent mechanical stand-by), hydraulic toe-operated brakes, parking brake and a landing light in the port wing. Considering the price of the aircraft this equipment is elaborate, but no mention is made of radios. Comprehensive radio equipment of the type usually fitted in executive aircraft is liable to add anything up to \$20,000 (£7,150) to the first cost. Even these additions, however, would not bring the Cessna 310 into the Twin-Bonanza's price bracket, where additional radio equipment will cause an equal increase in the basic price.

All-up weights for the 310 vary between 4,000 and 4,600 lb, and the figures that follow are for the representative 4,300 lb a.u.w. which allows for four passengers, full fuel load, and 125 lb of baggage and/or optional equipment. In this configuration, sea-level top speed is 220 m.p.h. and cruising speed at 70 per cent power at 8,000ft, 205 m.p.h.; maximum sea level rate of climb is 1,850 ft/min, and single-engine rate of climb 470 ft/min, increasing by 425 ft/min for every 30 min airborne. Single-engine service ceiling is 9,300ft. Incidentally, wing loading is 24.6 lb/sq ft (typical of the light twins) and power loading 8.9 lb/h.p. Twin-engine service ceiling is 22,000ft and maximum range on internal tankage, at 50 per cent power at 10,000ft, is 1,000 miles. As on most aircraft of this type, the airscrews are metal two-bladed, constant-speed, fully feathering and fitted with spinners. Hartzell is the principal supplier of these airscrews.

The instrument panel is neatly arranged, leaving adequate space for the installation of radio and navigation equipment. Engine instruments are grouped to starboard and all engine and trim controls are located on the central control pedestal; there is provision for dual control.

Following car-industry practice, the light twin manufacturers annually bring out a "new and improved" model, whose basic features inevitably include more engine power, higher cruising speeds and better general performance. Reading between the lines, it is evident that many of the selling-points are, in fact, normal rectifications of minor shortcomings in the original design. Each type, nevertheless, is unquestionably developed to provide



better performance, more comfort and better operational characteristics, particularly for all-weather flying and radio navigation.

As engine power is progressively increased the twins encroach more and more on the domain of the larger and not over-economical "custom" conversions, while these in their turn will sooner or later have to be replaced. Some idea of what the replacements will be can already be gained from such projects as the Cessna 620. This is a low-wing monoplane with tricycle undercarriage and seating for eight to ten. It will be powered by four Continental GSO526 six-cylinder geared and supercharged 320 h.p. engines, which will confer a cruising speed of 250 m.p.h., and there will be cabin pressurization. The first prototype of this strictly "corporate" or executive aircraft is due to fly early this year. Going a step further still, one might mention Martin's proposed executive version of the licence-built B-57 Canberra, some details of which appeared in *Flight* on October 15th. Described by the company as a "combat personnel transport," it could seat up to 12 passengers in a pressurized cabin and, as indicated at the time, may well find a number of buyers amongst the larger commercial concerns.

American experience has shown that, in order to provide the type of utilization which would be demanded of it, a successful executive aircraft must be equipped as fully as an airliner. Though a market for such aircraft must exist in Europe, few have so far found homes this side of the Atlantic. The type of equipment which could fill the bill for Europe would be, for example, Decca Navigator, V.H.F. R/T., I.L.S., and radio compass. Equivalent American equipment has been reduced in both size and weight to a point where it can well be accommodated in small aircraft. The requirements basically are for a 4-6 seater, with baggage space, full night and I.F.R. equipment, and preferably twin-engined with real single-engined performance, a cruising speed approaching 200 m.p.h. and a range of up to 1,000 miles. Comfort and reliability would, as always, be essential. Though the American light twins would be useful in Europe, their importation on any scale is difficult mainly because of their high cost; but even this, for many business concerns, would not be excessive in view of the undoubted advantages to be gained from ownership.

C.M.L.

GERMAN SAILPLANE DESIGNS

DETAILS of existing German and Austrian designs of sailplanes and gliders are given in *Deutsche Segelflugzeuge*, recently published at DM5 by Aero-Verlag Hubert Zuerl, Hermann-Lingg-Strasse 9, München 15. Three-view drawings and a short description are given for each of the 43 types listed, many of which are illustrated in addition by photographs. Among the machines described are the HKS-1, the Zugvogel, the Horten Ho-15c Urubu and Ho-33, and the auxiliary-powered Fibo-2a.