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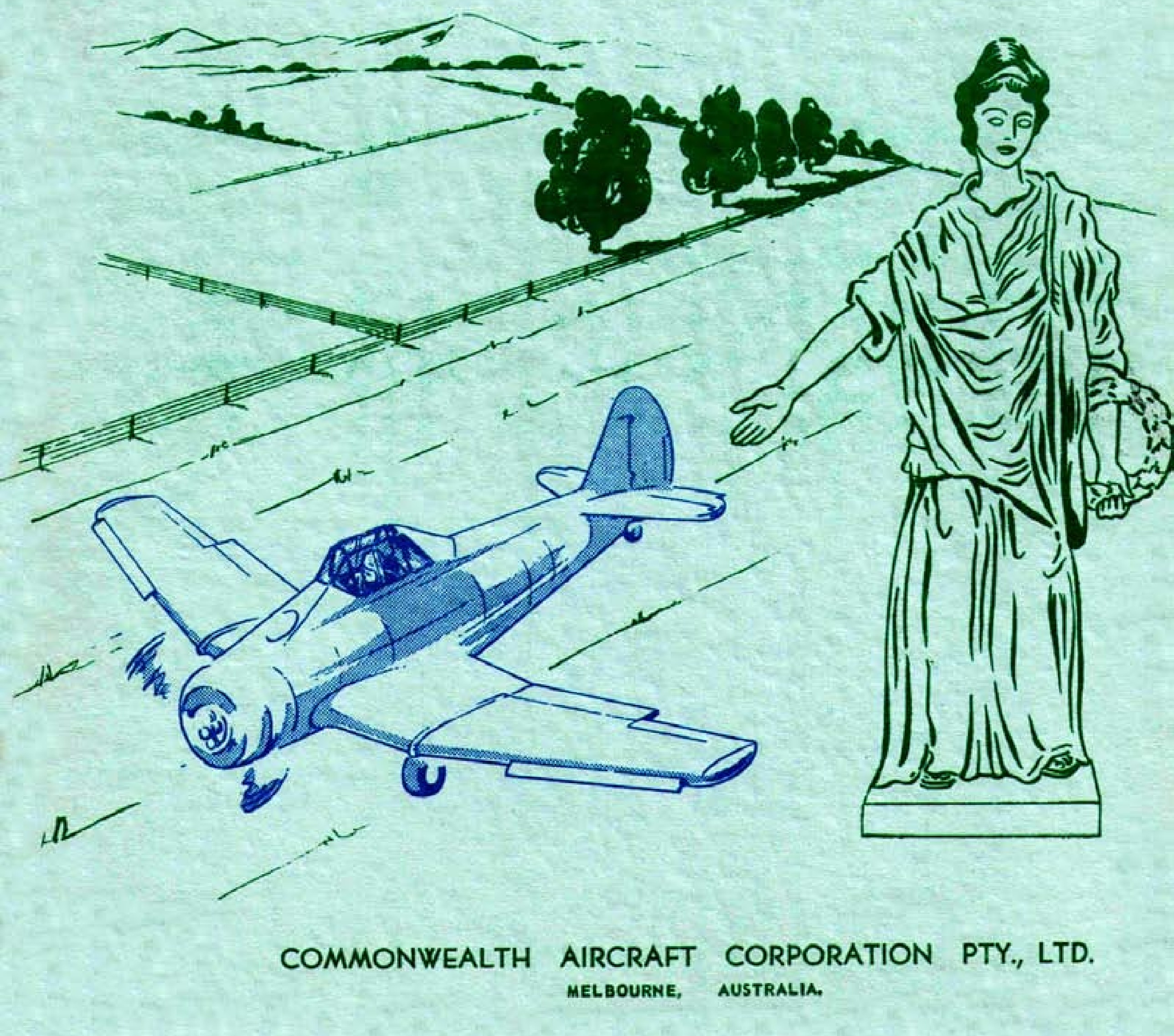
The CERES AGRICULTURAL AEROPLANE



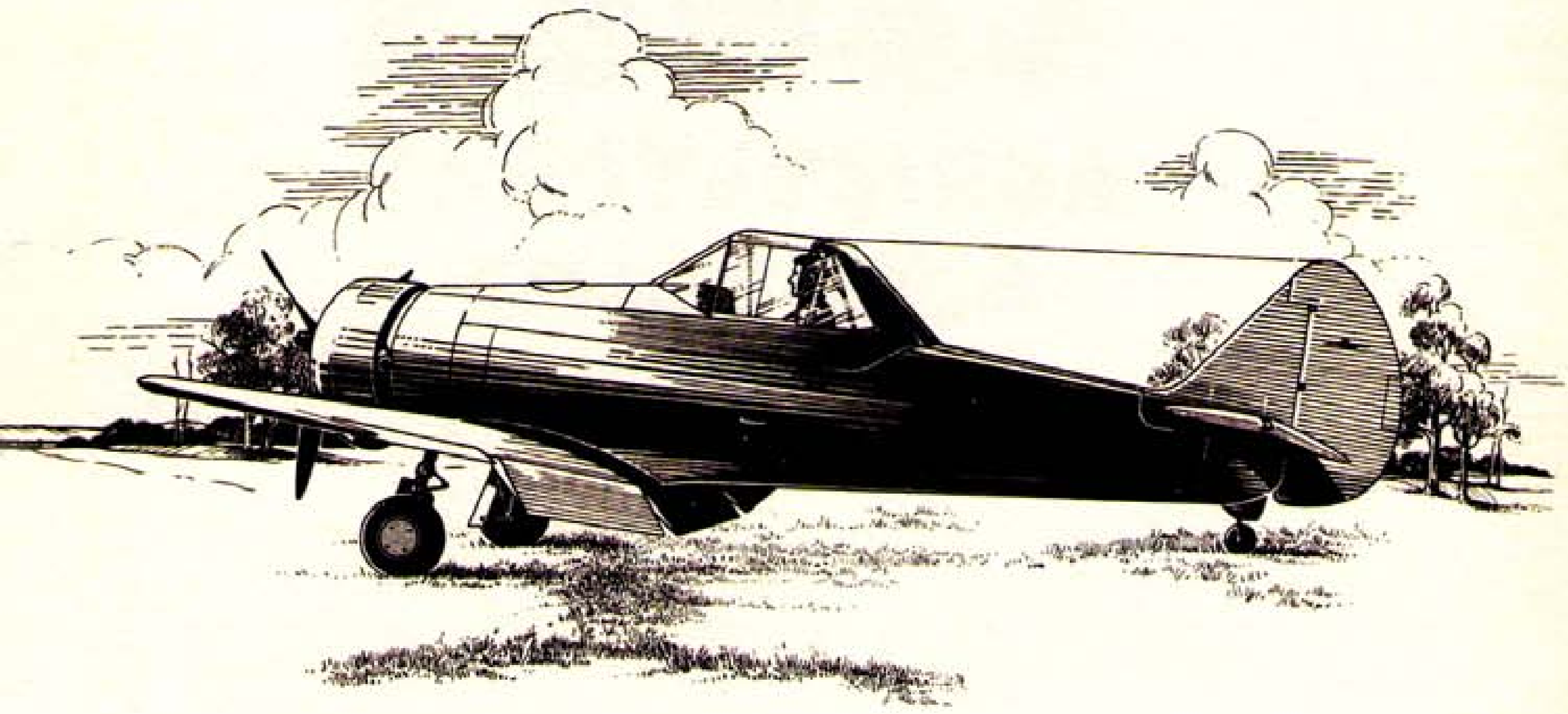
COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.
MELBOURNE, AUSTRALIA.

The CERES AGRICULTURAL AEROPLANE

CERES

The ancient Romans made offerings to Ceres, the goddess of corn and fertility, for the success of their harvest.

Modern man is likely to be more certain of results by resort to aerial crop dusting. To give Australia a unique advantage, Commonwealth Aircraft Corporation Pty. Ltd. has developed a new design for all agricultural purposes. This is the CERES Agricultural Aeroplane.



FOREWORD

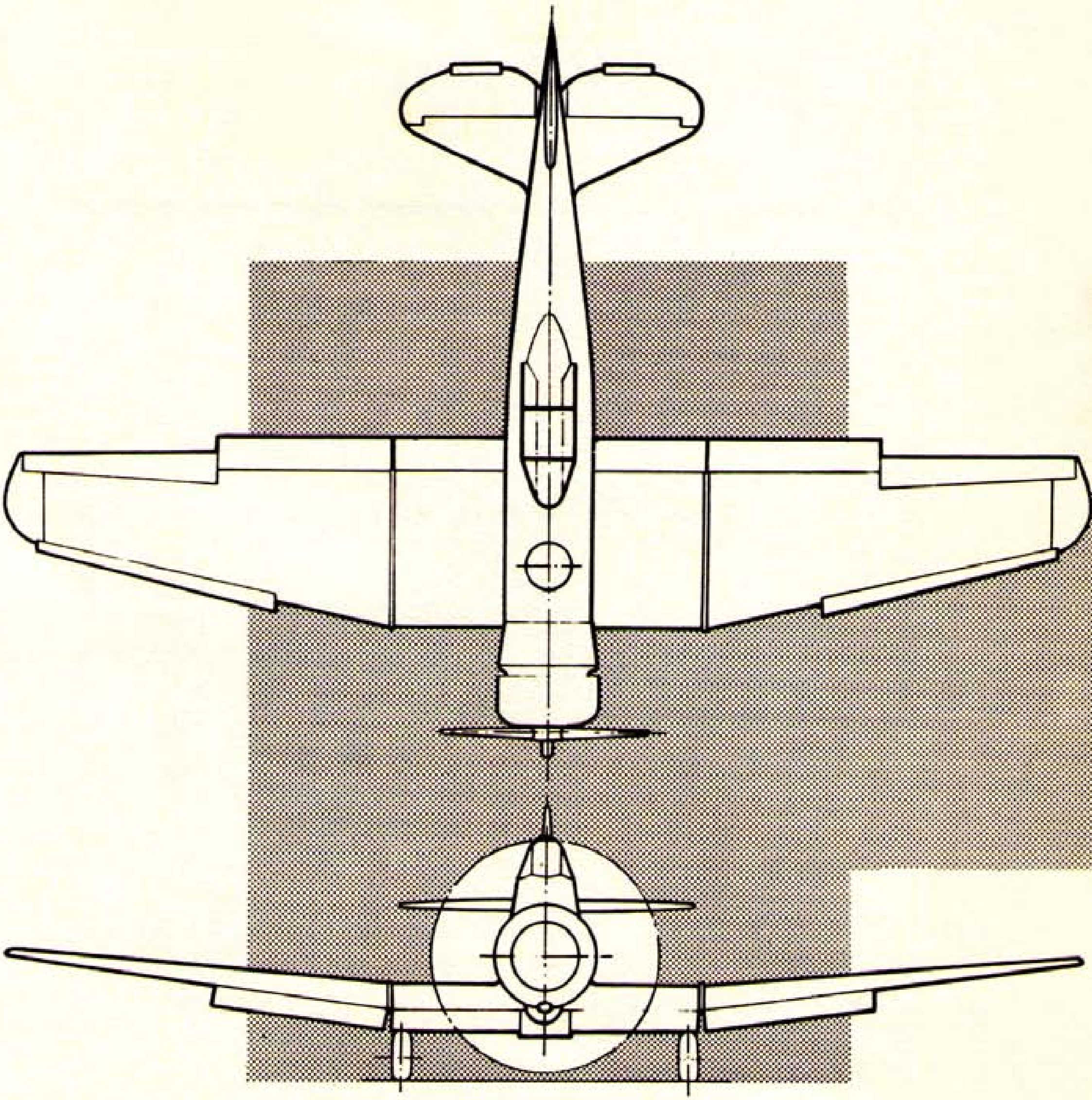
It has been demonstrated in U.S.A. and more particularly in New Zealand that there is a great advantage to be derived by using aeroplanes for the spreading of fertilizer and for spraying with exterminator and insecticides.

Until recently the only aeroplanes available have been adaptations of existing types. There is a growing and, as yet, unsatisfied demand for specialized aeroplanes of a type most suitable for this work.

Over the nine months ending in March, 1957, three quarters of a million acres were treated by agricultural aeroplanes, carrying, for the most part, a very small load and, therefore, operating under conditions which are not only difficult for the operator but expensive to the farmer.

In spite of this, however, the growth of this industry has been most encouraging and the time is undoubtedly opportune for the presentation of an up to date conception which can be offered at a reasonable first cost and which will assist very materially in the proper fulfilment of this nationally important work.

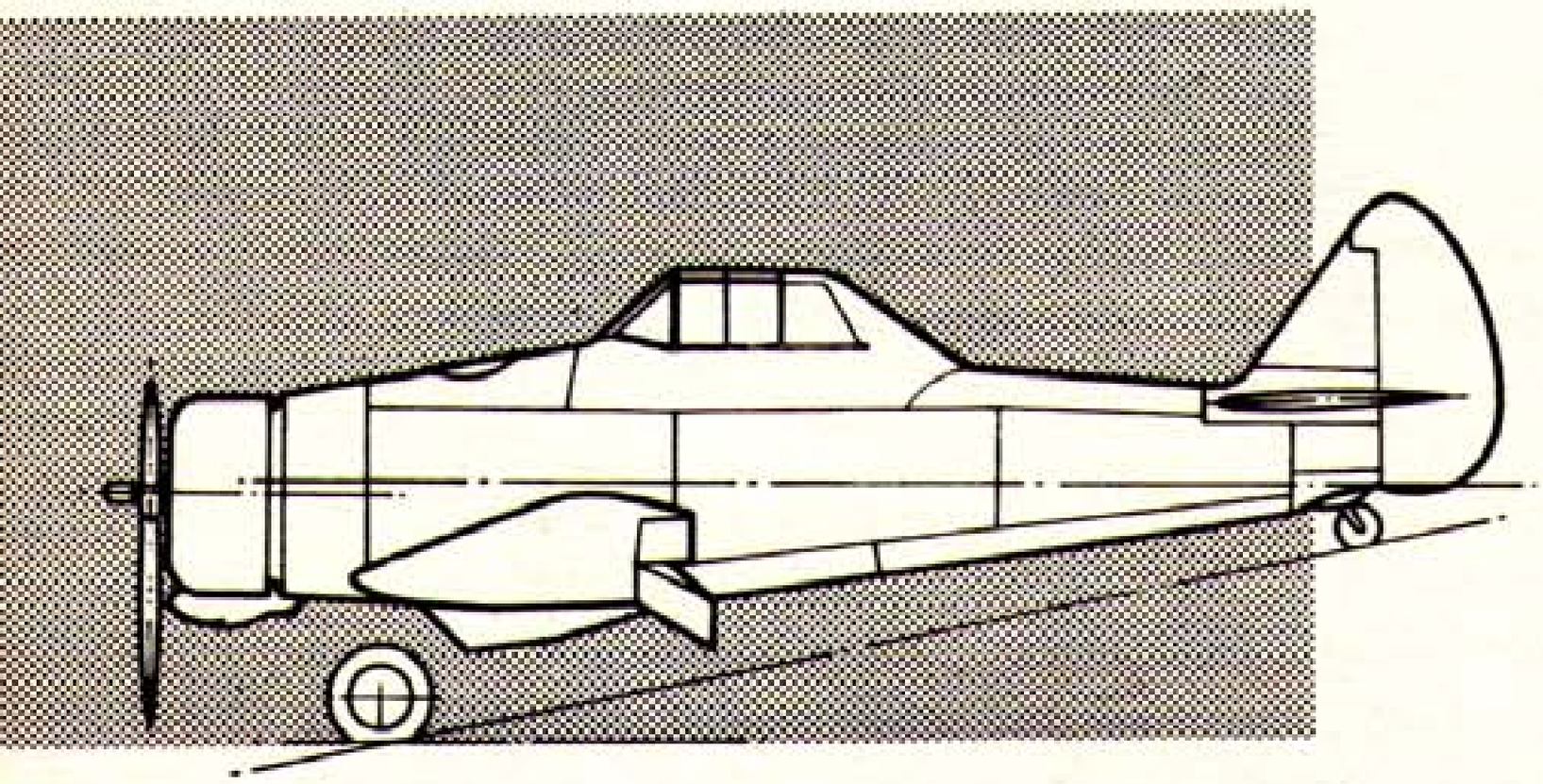
This brochure presents the CERES Agricultural Aeroplane, which, through good design, has enabled the utilization of the power plant and some major components of the basic Wirraway aeroplane to provide just such a combination of low cost, good performance, and payload.



CERES AGRICULTURAL AEROPLANE

1 2 3 4 5 6 7 8 9 10

SCALE FEET



FEATURES

It was obvious that the cost of an aeroplane for agricultural work could be greatly reduced if some components from surplus disposal aeroplanes could be used. Certain structural components and the undercarriage of the well-proven Wirraway were therefore utilized, together with the complete Pratt & Whitney Wasp engine installation.

The robust construction of the Wirraway, which gave 20 years of almost complete freedom from technical trouble, is evident in the CERES and is essential for the rough service which is required of an agricultural aeroplane.

It was realized that it was necessary to design a fundamentally different aeroplane, aerodynamically, to achieve the flying characteristics essential for an agricultural role. The requirements include: short take-off run with full load; excellent rate of climb, even from elevated airstrips and in high temperatures; good control at low speeds when manoeuvring close to the ground; and a very short landing run.

A new wing was designed with increased span and 25% greater area than the Wirraway. By the fitting of leading edge slots and incorporation of slotted flaps, this wing achieves all the features associated with low wing loading.

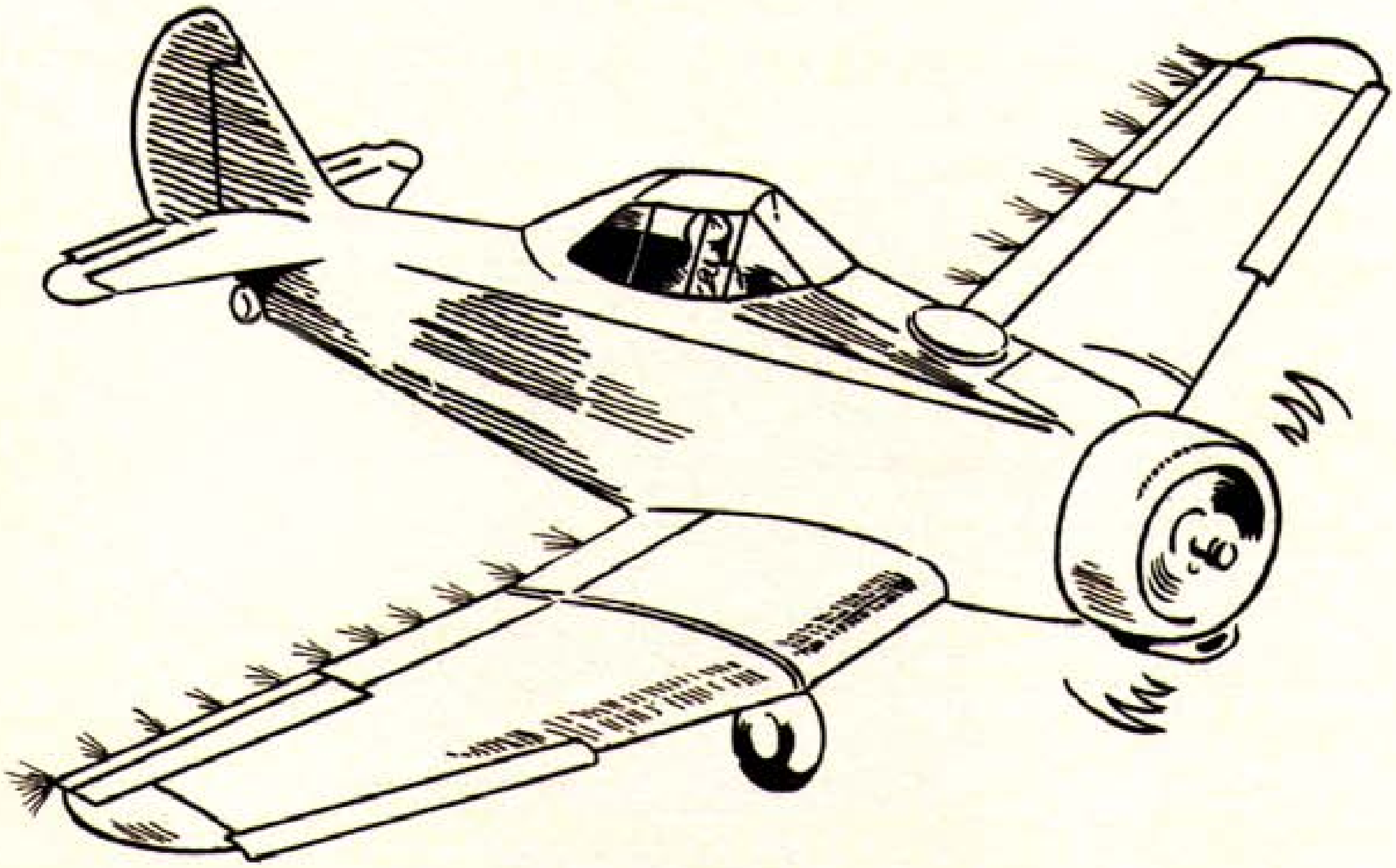
A considerably longer fuselage gives greater control moments from the tail unit, and the location of the hopper on the C.G. ensures a negligible variation of fore-and-aft trim with change of gross weight.

The Wasp engine has been converted from geared to direct drive with an increase of static thrust of 50% over that normal with the Wirraway.

All the complexity of hydraulics and electrics have been eliminated and bare essentials only are provided in the interests of simplicity and low cost of maintenance.

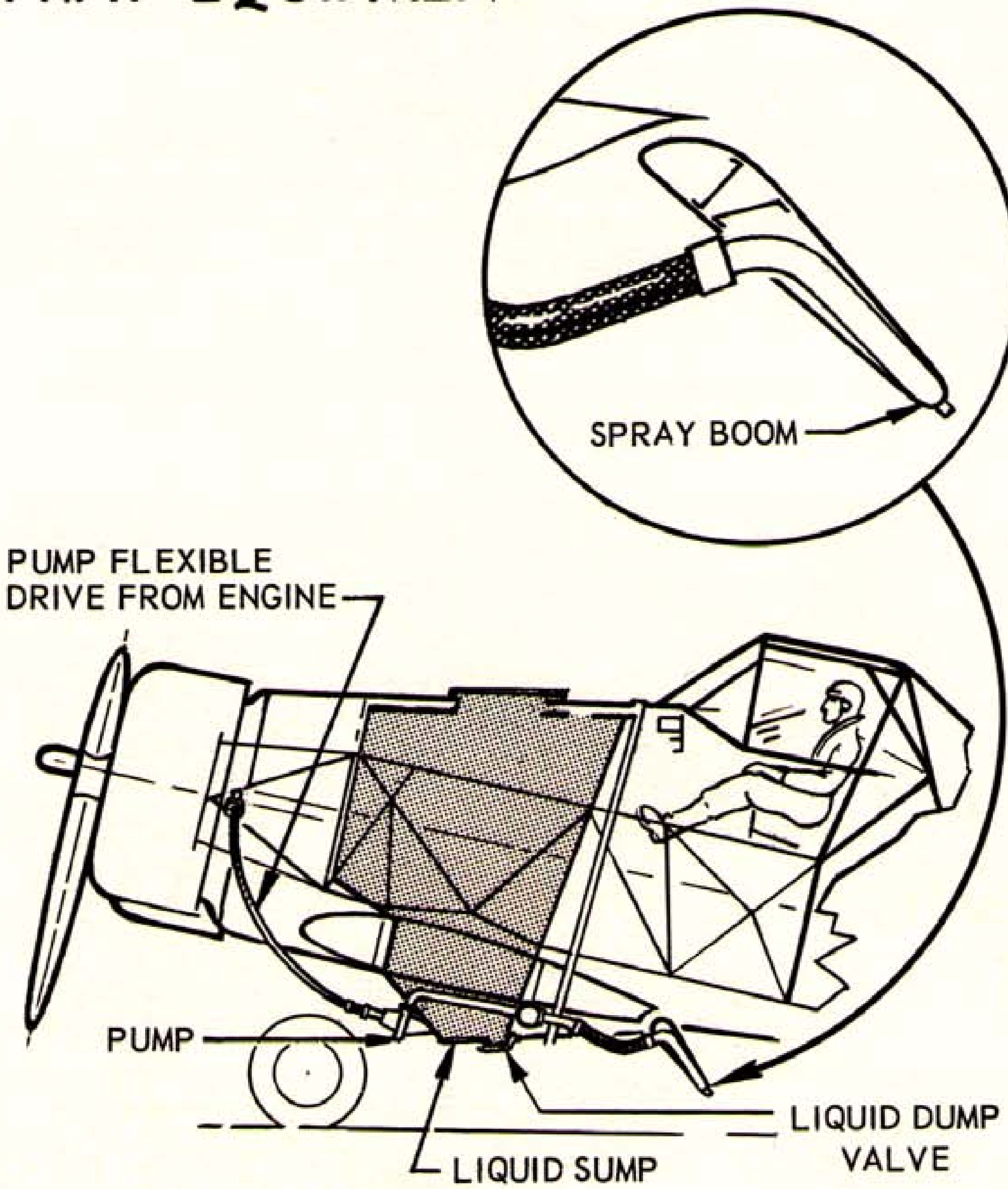
The above features have involved much new construction, and such items as have been incorporated from the Wirraway have been chosen only after careful inspection as being in virtually "unworn" condition. The result is a first class metal aeroplane of the soundest mechanical construction with a proven engine of ample power, and available at a cost which is relatively very much below any other of comparable capacity.

The CERES has been designed in close collaboration with the Department of Civil Aviation, which will issue a Certificate of Airworthiness for the special role for which this aeroplane has been developed, with full confidence that it has the performance needed for safe and efficient operation.

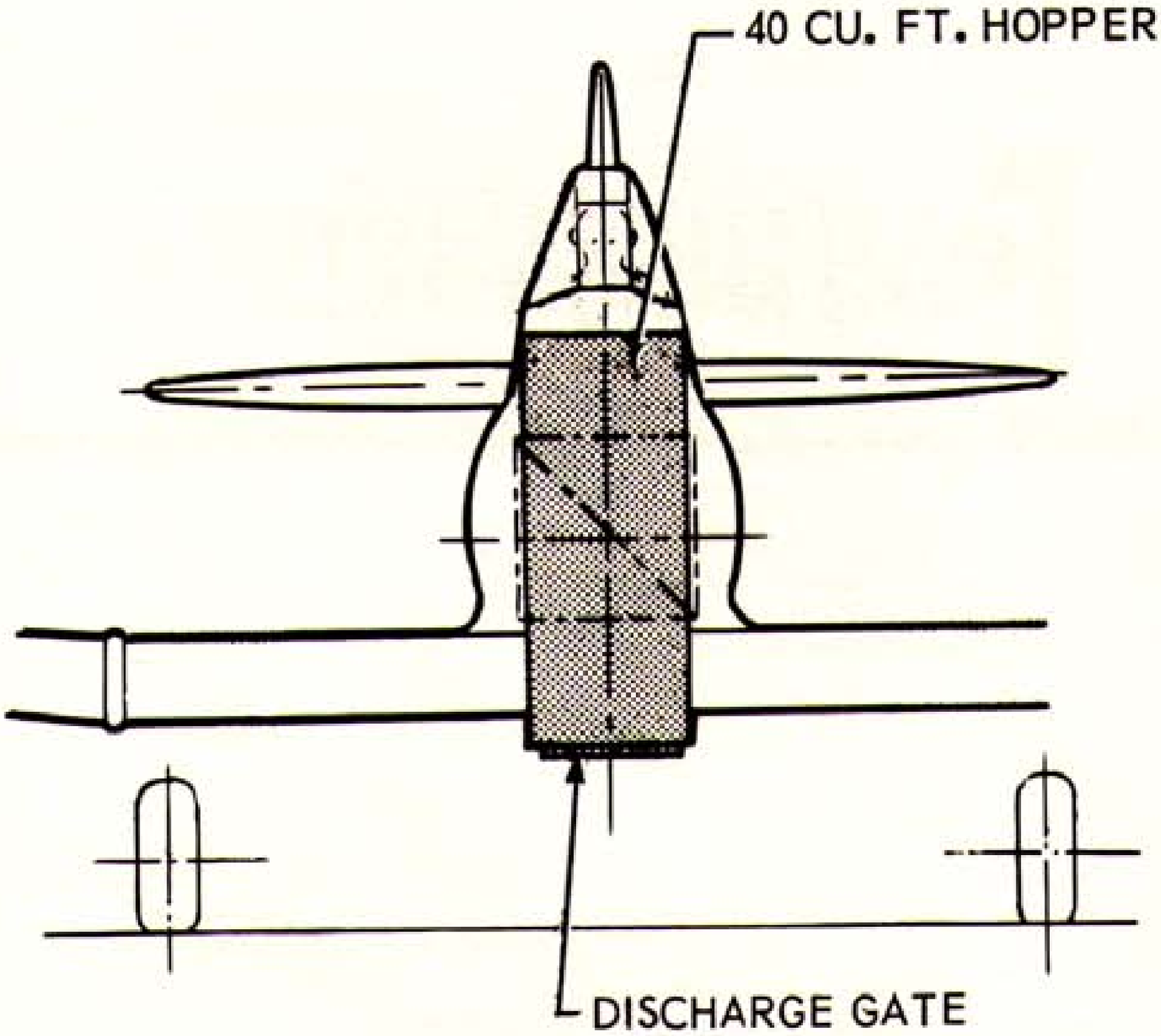


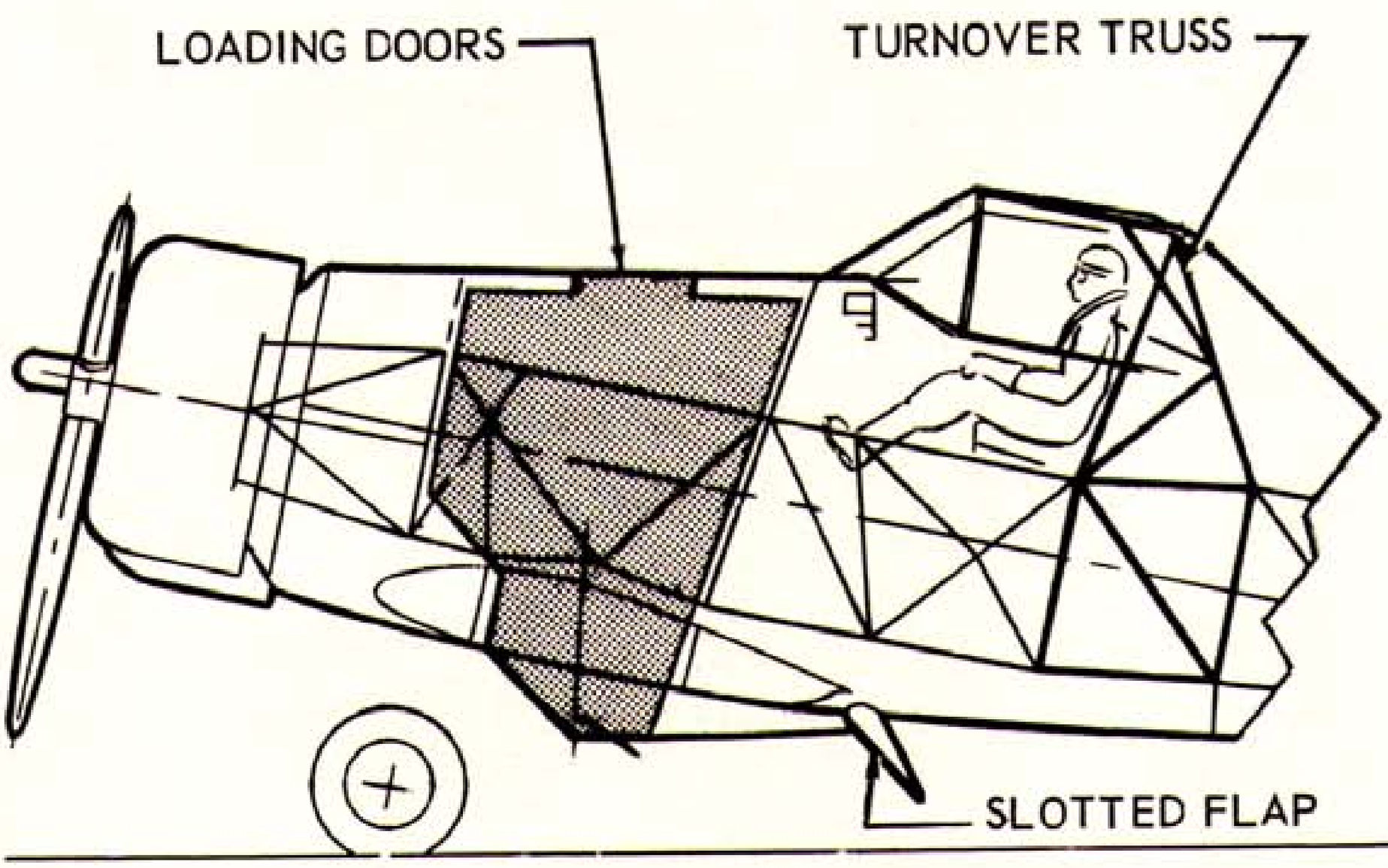
BASIC LAYOUTS

SPRAY EQUIPMENT



DUSTING LAYOUT





PERFORMANCE

WEIGHTS

TARE WEIGHT			3940 LB.
SERVICE LOAD			2560
PILOT		170	
FUEL 34 GAL.		245	
OIL	5 GAL.	45	
PAYLOAD		2100	
NORMAL GROSS WEIGHT			6500
OVERLOAD GROSS WEIGHT (PAYLOAD 2500 LB.)			6900
FERRY WEIGHT (69 G. FUEL)			4650
LANDING WEIGHT (MEAN)			4275
WING LOADING (NORMAL GROSS)			20.9 LB./SQ.FT.
T.O. POWER LOADING (NORMAL GROSS)			10.9 LB./HP.
C.G. RANGE		24.7 –	25.5%

ENGINE - PRATT & WHITNEY WASP S3HI-G

CONDITION	HEIGHT	R.P.M.	HORSEPOWER
TAKE OFF	S.L.	2250	600
RATED POWER	S.L.	2200	525
	5000 FT.	2200	550
MAX. CONTINUOUS CRUISE	S.L.	2100	400
	9000 FT.	2100	460

NORMAL GROSS WEIGHT 6500 LB. (PAYLOAD 2100 LB.)

TAKE OFF		
GROUND RUN		295 YDS.
TOTAL OVER 20 FT.		360 YDS.
RATE OF CLIMB		
AT TAKE-OFF POWER	FLAPS DOWN	750 FT./MIN. AT 75 M.P.H.
	FLAPS UP	950 FT./MIN. AT 89 M.P.H.
STALLING SPEED		
SEA LEVEL		61 M.P.H.
ENDURANCE		
34 GALLONS FUEL		1.5 HOURS

LANDING WEIGHT 4275 LB.

LANDING	
GROUND RUN	150 YDS.
TOTAL OVER 50 FT.	390 YDS.
STALLING SPEED	
SEA LEVEL	50 M.P.H.

FERRY WEIGHT 4650 LB.

CRUISE SPEED	
5000 FT.	110 M.P.H.
RATE OF CLIMB	
AT TAKE OFF POWER	1700 FT./MIN.
RANGE	
69 GALL. FUEL. NO RESERVE	350 S. MILES

OPERATION

A stainless steel hopper with a capacity of 41 cubic feet holds a normal load of 2100 pounds of light material or an overload of 2500 pounds of the denser materials such as superphosphate and gypsum. These loadings permit an operating load factor of 3.5g. and 3.25g. respectively.

Loading is carried out through a hinged lid at the top of the fuselage. As the rate of application may vary over a wide range, provision is made for adjustable vanes in the hopper discharge chute, while emergency dumping of the whole load can be completed in a few seconds.

A changeover from solid to liquid load can be readily effected by replacement of the dust gate at the hopper chute by a combination of sump and pump discharging at a rate to suit the operator, and varying from 4 to 150 gallons per minute.

The liquid is pumped through booms located behind the rear spar to nozzles equally spaced over the whole span and giving an effective swath width of 50 feet.

Penetration of the spray into the foliage is assisted by the low wing layout and in particular by the large chord flaps.

These flaps have a range of travel from 15 to 40 degrees. For cross country flights the upper setting is used. At the commencement of dusting or spraying, the flaps are mechanically set at the lower position, in which they remain for all operations, including take-off and landing.

The use of a supercharged engine which maintains sea level take-off power up to 3000 feet means that operations can be carried out in mountainous terrain or on high plateaus.

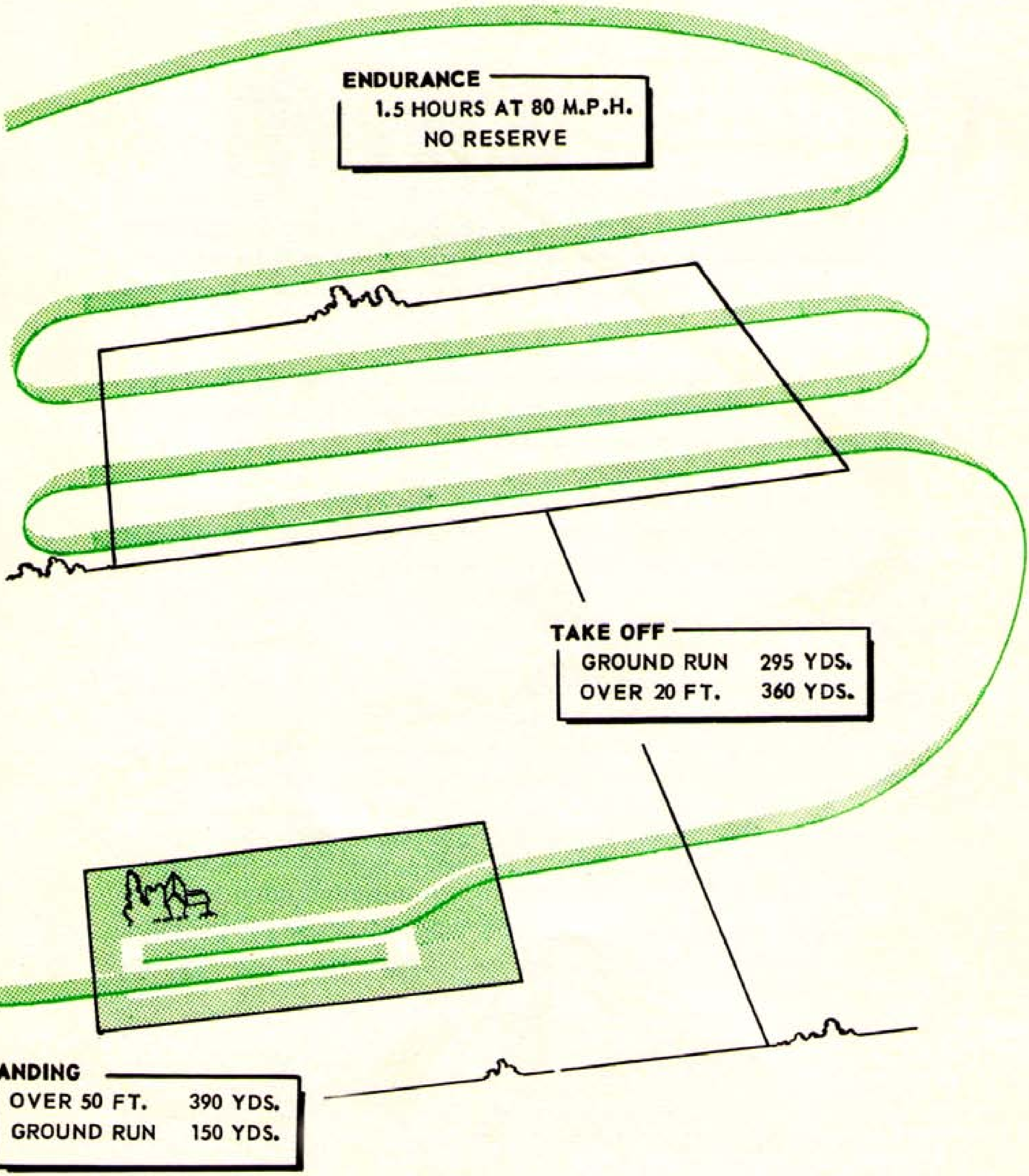
With full load the take-off run with full flap is 295 yards on take-off power and the initial rate of climb is 750 feet per minute. Subsequent flight at desired cruise power gives an operating speed of 80 m.p.h. at full load, this speed giving a sufficient margin over the stall to enable reasonable turns to be made at each pass.

With full load and the flaps in the up position the initial rate of climb is 950 feet per minute. However, the take-off distance over 50 feet is somewhat greater with the flaps in this position and for this reason the flaps are set down during dusting or spraying operations.

At the reduced flying weight with the hopper empty, the stalling speed is 50 m.p.h. and the landing run is 150 yards.

To give the maximum hopper load, only one of the two 34 gallon fuel tanks is filled and with this, one hour of operation is possible with an ample reserve.

For cross country flights at the lighter weight of 4650 pounds, the initial rate of climb is much higher at 1700 feet per minute and with a cruising speed of 110 m.p.h., a still air range, without reserve, of 350 miles is attainable.

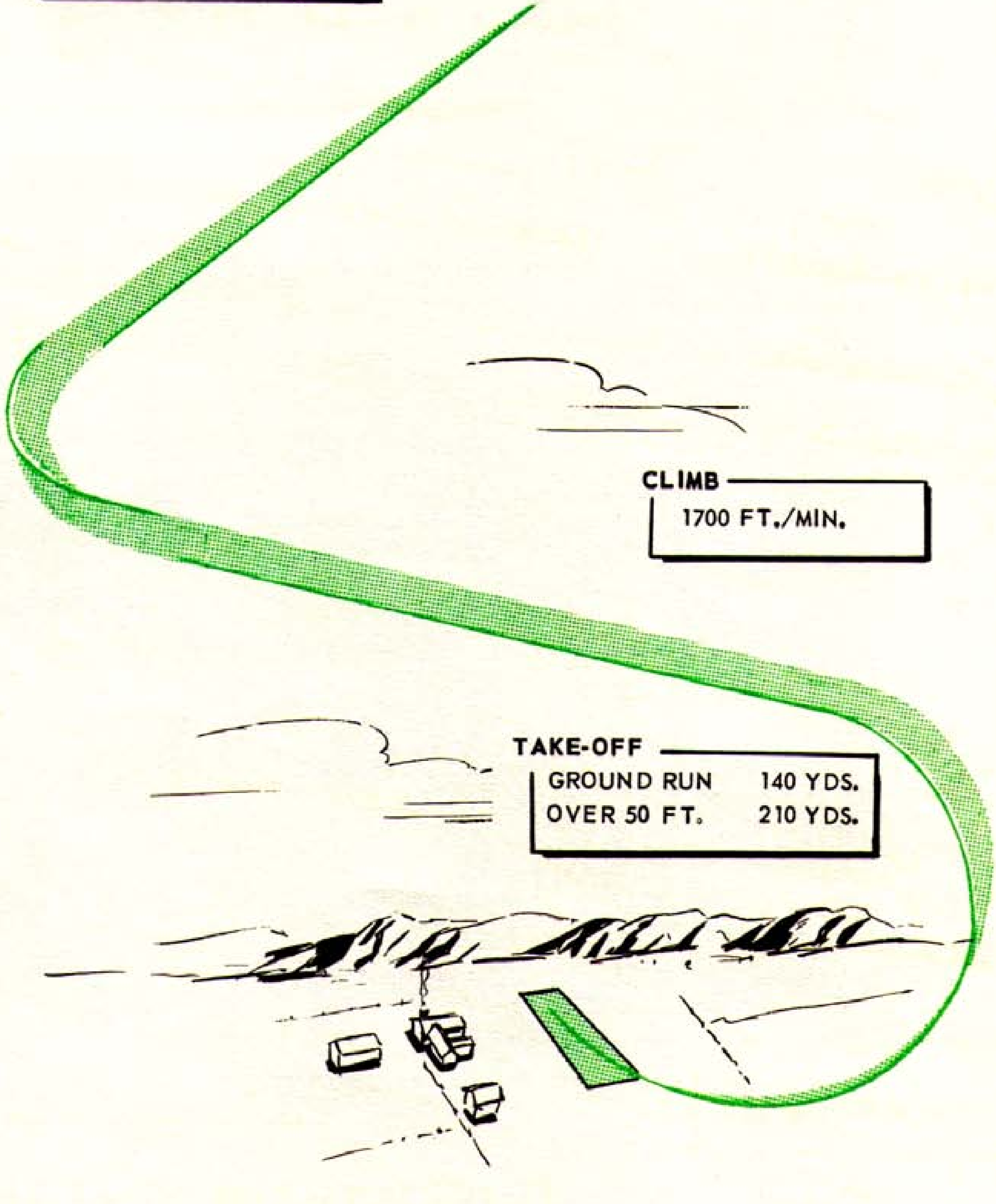


DUSTING OR SPRAYING

CROSS COUNTRY

RANGE

375 MILES AT 120 M.P.H.
NO RESERVE



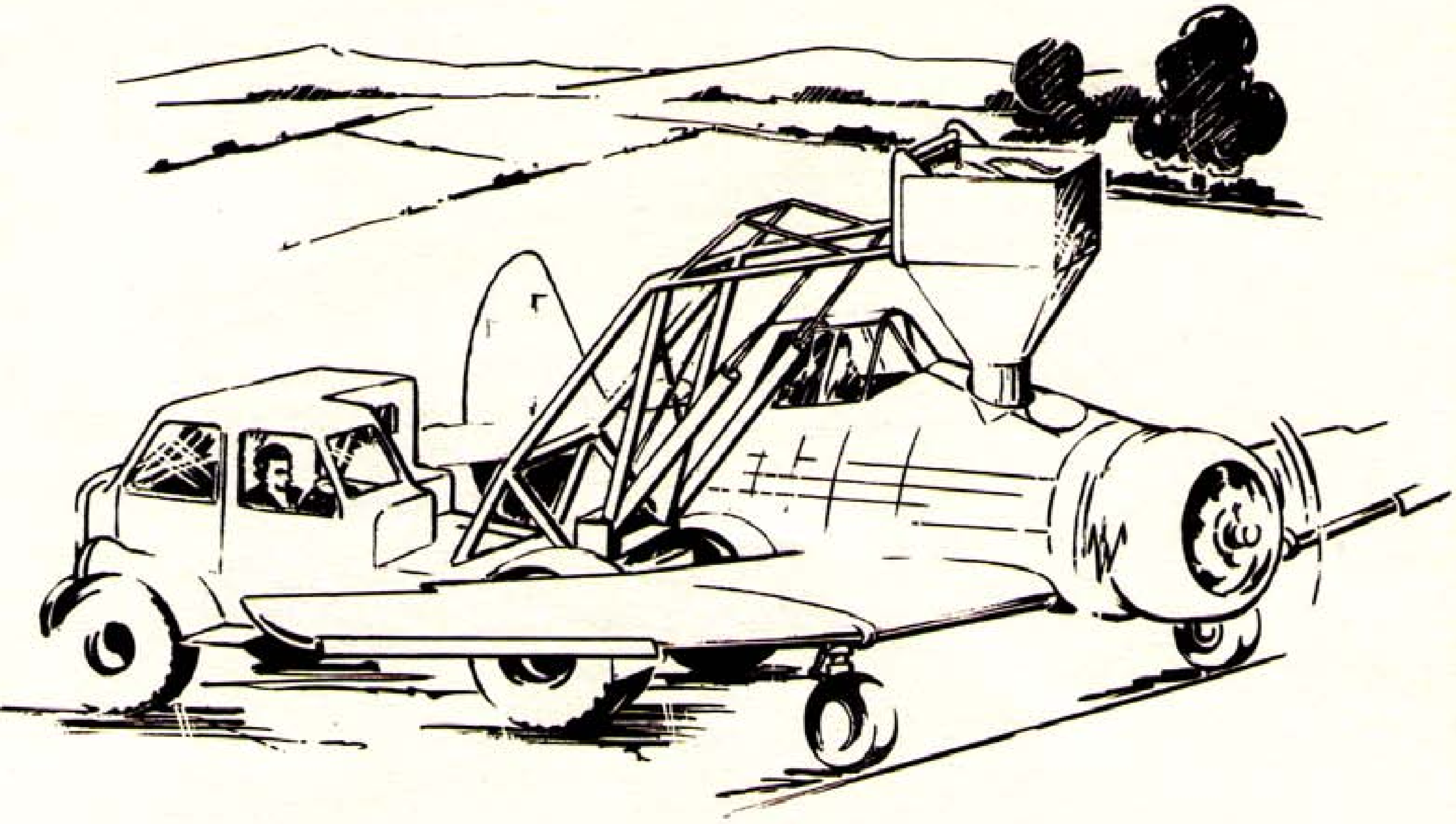
CLIMB

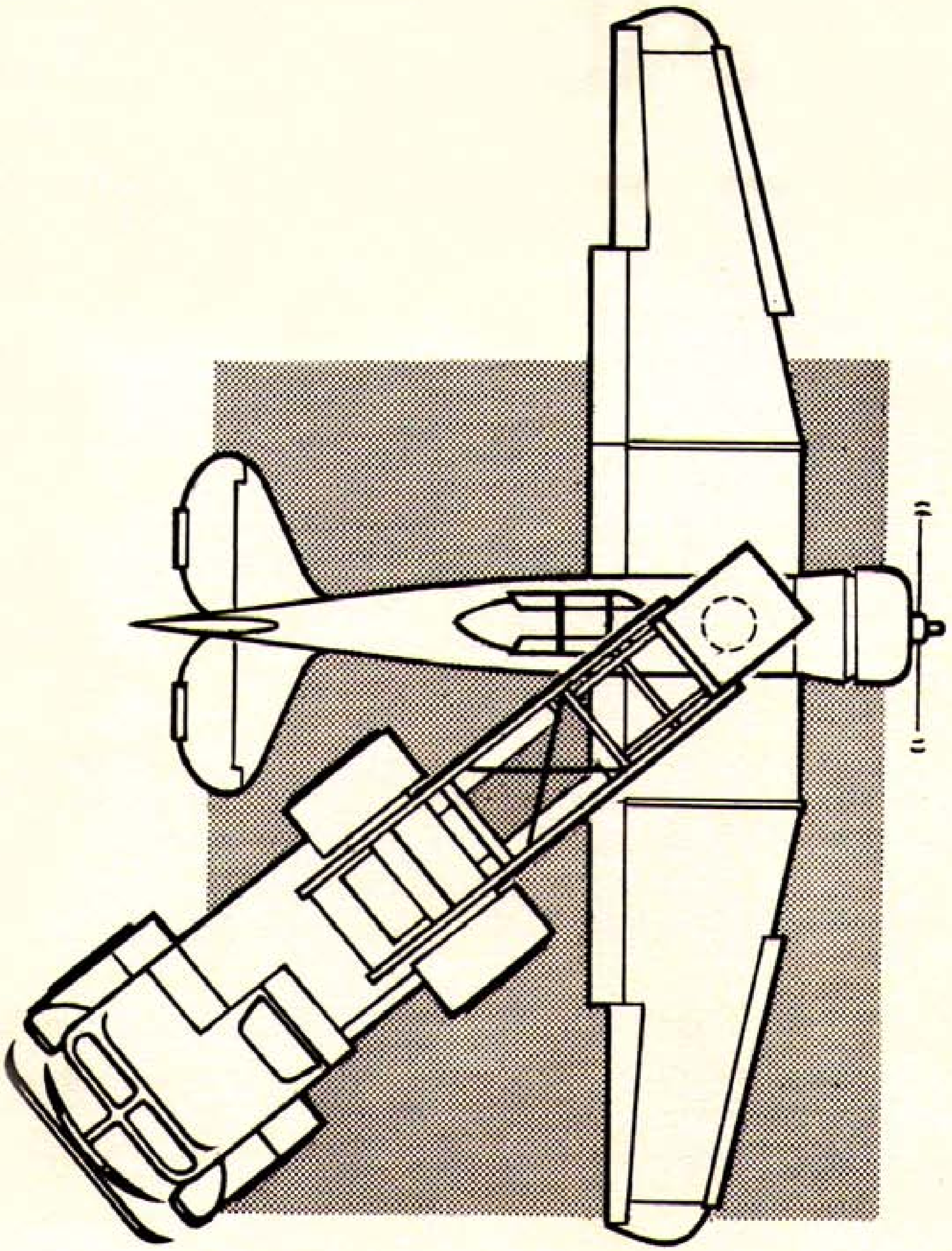
1700 FT./MIN.

TAKE-OFF

GROUND RUN	140 YDS.
OVER 50 FT.	210 YDS.

HANDLING





OPERATING COST

ESTIMATED ANNUAL OPERATING COST —

ONE AEROPLANE WITH LOADING TRUCK

UTILISATION) AEROPLANE		400 HOURS
PER ANNUM) TRUCK		500 HOURS
FERTILIZER LOAD PER FLIGHT		ONE TON

	MAX.		MIN.
APPLICATION RATE TONS/YEAR	4000	–	2400
FUEL USAGE GALLS/HOUR		24	
FUEL USAGE GALLS/YEAR	9600	–	5750

			MAX.		MIN.
AEROPLANE DEPRECIATION ALLOWANCE				£2000	
TRUCK DEPRECIATION ALLOWANCE				£ 700	
INTEREST ON AEROPLANE & TRUCK				£ 750	
INSURANCES	AEROPLANE	£1700			
	TRUCK	£ 80			
	THIRD PARTY	£ 100			
	PILOT	£ 160			
	DRIVER	£ 15			
		£2055		£2055	
SALARIES	PILOT			£2100	
	DRIVER			£1000	
FUEL COST	AEROPLANE		£2090	–	£1255
	TRUCK			£ 100	
MAINTENANCE	AEROPLANE			£ 850	
	TRUCK			£ 200	
AIRSTRIP CHARGE				£ 500	
HANGAR CHARGE				£ 80	
TOTAL OPERATING COST) OF AEROPLANE & TRUCK)			£12425	–	£11590
OPERATING COST PER TON			£3.11		£4.83
REVENUE AT £6.15.0 PER TON			£27000		£16700
REVENUE AT £5. 0. 0 PER TON			£20000		£12000

NOTE: *All figures quoted are approximate only and allowance should be made to compensate for variation due to place, time, and circumstance.*

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