SUMMARY AND RECOMMENDATIONS.

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The important results from the report may be summarized as follows:

(1). Best take–off distance is obtained using a 30° wing flap setting. The tail of the airplane should be lifted off the ground as soon as possible and held up through the take–off run.

(2). On a hard run–way, using 600 BHP per engine, the take-off distance is 2100 feet at sea level.

(3). Climb after take-off with a gross weight of 16,500# is 500 feet per minute with wing flaps at 30° (using take-off power).

(4). After obtaining a safe altitude (50 to 100 feet), the flaps should be retracted and the engine power reduced to 550 BHP per engine at 2200 rpm.

(5). The climb should be continued at this power to an altitude of 2000'.

(6). At 2000', the power should be reduced to 380 BHP/engine and the flight continued at the values of altitude, power, rpm and speed shown on the inclosed curve.

(7). During the maximum range flight, the following considerations apply:

a. Variation of altitude from that specified by amounts as much as 2000' (except in the heavy load condition) has very little effect on the range.

b. With headwinds or tails winds up to 20 mph, the best airspeed is wthin 5 mph of that shown on the flight procedure curve.

c. When the wind increases with altitude, the load condition, and power conditions should be carefully considered when choosing an altitude different than that shown on the curves. No strict rules can be given covering the optimum flight procedure with varying wind gradients with altitude.

d. Increase the power output when climbing from one altitude to another. Climb at an indicated speed of 120 to 130 mph.

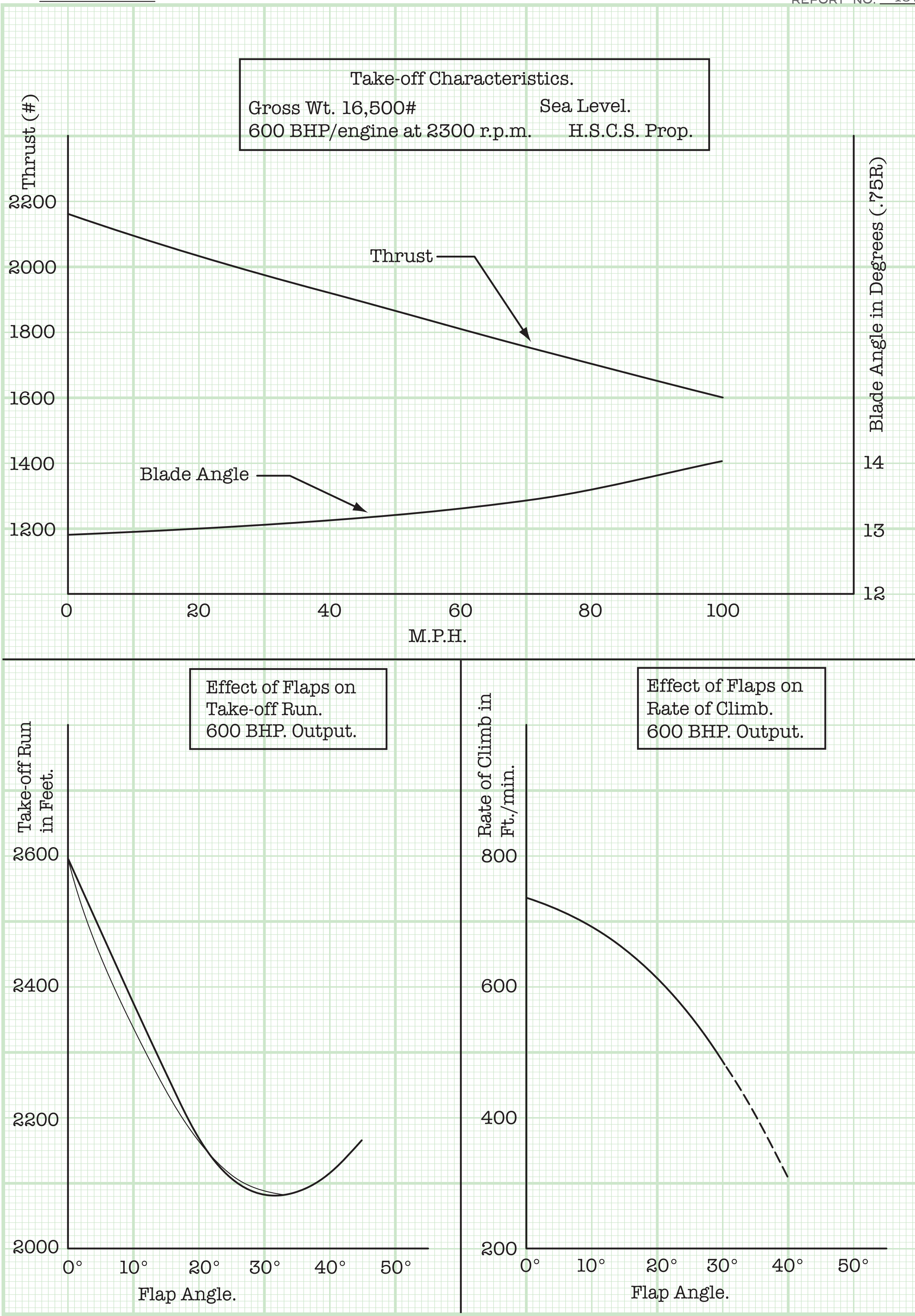
Take-off Characteristics.
Gross Wt. 16,500#
Sea Level.
600 BHP/engine at 2300 r.p.m.
H.S.C.S. Prop.
Thrust (#)
2200
2000
1800
1600
1400
1200
Thrust
Blade Angle
Blade Angle in Degrees (.75R)
14
13
12
0
20
40
60
80
100
M.P.H.
Effect of Flaps on
Take-off Run.
600 BHP. Output.
Take-off Run in Feet.
2600
2400
2200
2000
0°
10°
20°
30°
40°
50°
Flap Angle.
Effect of Flaps on
Rate of Climb.
600 BHP. Output.
Rate of Climb in Ft./min.
800
600
400
200
0°
10°
20°
30°
40°
50°
Flap Angle.

FIGURE IX.

COMPUTATIONS (continued)

Take-off will be considered with a gross weight of 16,500# and a power output of 600 BHP. per engine at 2300 r.p.m. at sea level. Schrenk's Method of analysis will be used. The following table of take-off relationships is then derived.

V	V/ND	C_P	β	C_T	Thrust	Thrust(Effective)
0 m.p.h.	0	.0418	12.9°	.102	2,320 #/prop.	2,160 #/prop.*
10	.030	.0418	12.9°	.100	2,270	2,110
20	.061	.0418	13.0°	.097	2,200	2,050
30	.091	.0418	13.1°	.093	2,120	1,970
40	.121	.0418	13.1	.090	2,090	1,950
50	.152	.0418	13.2	.090	2,050	1,910
60	.182	.0418	13.3	.086	1,960	1,820
70	.312	.0418	13.4	.082	1,860	1,730
80	.242	.0418	13.7	.080	1,820	1,690
90	.273	.0418	13.8	.078	1,770	1,650
100	.303	.0418	14.0	.075	1,710	1,590

* Effective thrust includes a 7% reduction factor due to tip losses.

Then:

$$S_1 = \frac{W}{g}\frac{q_1}{(P_o - P_1)} \log_e \frac{P_o}{P_1}$$

S_1 is the take-off run in ft.
W is the gross weight = 16,500#
g = std. air density = .0765 #/cu.ft.
q_1 = take-off impact pressure.
P_o is the initial accelerating force. P_1 the final.

$.9\ C_{L max.} = 1.31 \qquad q_1 = 27.5$ #/sq.ft. (104 m.p.h.)

$C_D = 0.148$

$P_o = T_o - \mu W = 4320 - .04 \times 16{,}500 = 3650\#$

The coefficient of friction of .04 corresponds to a good field with hard turf.

$P_1 = T_1 - D_1 = 3180 - .148 \times 458 \times 27.5 = 1317\#$

$$S_1 = \frac{16{,}500}{.0765}\frac{27.5}{(3660 - 1317)} \log_e \frac{3660}{1317} = \underline{2590 \text{ ft.}}$$

COMPUTATIONS (continued)

Investigating the effect of flaps down 20°:

$0.9\ C_{Lmax.} = 1.57 \quad o_1 = 23$ #/sq.ft. (95 m.p.h.)

$C_D = 0.183$

$P_o = 3660$#

$P_1 = 1620 \times 2 - 0.183 \times 458 \times 23 = 1310$#

$S_1 = \frac{16,500}{.0765}\ \frac{23}{2350} \log_e \frac{3660}{1310} = \underline{2180 \text{ ft.}}$

Flaps down 30°:

$0.9\ C_{Lmax.} = 0.9 \times 1.35 = 1.67 \qquad q_1 = 21.6$ #/sq.ft. (92 m.p.h.)

$C_D = 0.21$

$P_o = 3660$#

$P_1 = 2 \times 1660 - 0.21 \times 458 \times 21.6 = 1240$#

$S_1 = \frac{16,500}{.0765}\ \frac{21.6}{2420} \log_e \frac{3660}{1240} = \underline{2080 \text{ ft.}}$

Flaps down 45°:

$0.9\ C_{Lmax.} = 1.75 \qquad q_1 = 20.6$ #/sq.ft. (89.5 m.p.h.)

$C_D = 0.243$

$P_o = 3660$ #

$P_1 = 2 \times 1660 - 0.243 \times 458 \times 20.6 = 1000$#

$S_1 = \frac{16,500}{.0765}\ \frac{20.6}{2660} \log_e \frac{3660}{1040} = \underline{2165 \text{ ft.}}$

COMPUTATIONS (continued)

From the preceding calculations and graphs it is evidenct that the minimum take-off run occurs with the flaps set at approximately 30°, when it is reduced some 20% from the unflapped run.

Computations for the rate of climb curves are included in the appendix, pg.   .