

R. T. P. FILE COPY

9th Part of Report No. A. & A. E. E. /783.

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AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT. Avia 18/734

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BOSCOMBE DOWN.

Kittyhawk A. L. 229.
(Allison V-1710 F. 3.R)

Fuel Consumption trials and range flight
with a long range

jettisonable ventral tank fitted.

A. & A. E. E. Ref:- 4484/1-A. S. 76
M. A. P. Ref:- R. A. 1871/D. N. A. 1.

DATE 4/1/53
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REDUCE TO 99 AUTHORIZED
Progress of issue of report.

This report deals with the aircraft (or equipment) as tested. Action to remedy defects or decisions to accept items not in strict compliance with the specification are matters for decision and action by the Ministry of Aircraft Production.

Report No.	DATE	Title.
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5th do.		A. K. 572 - Weights, Loading data and Leading particulars.
6th do.		A. K. 572 - Fuel consumption trials.
7th do.		A. K. 572 & A. L. 229 - Radio trials - Communication sets.
8th do.		A. K. 572 - Rate of climb and position error measurements.

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SUMMARY.

The maximum still air range of the aeroplane is 1060 miles at an airspeed of 162-165 m.p.h. A. S. I. with corresponding engine conditions of 1900 R.P.M. and 21" Hg. boost. at 15,000 ft.

The difference in air miles per gallon between external tank jettisoned and external tank on but empty is very small. Because of this it is recommended that the external tank be left on throughout a range flight.

1. Introduction:

Tests were required to determine the range of Kittyhawk aircraft fitted with an under fuselage long range fuel tank capable of being jettisoned in flight.

2. Tests made.

Level speeds were done at the engine conditions at which fuel consumptions had previously been measured on Kittyhawk A. K. 572 (see 6th Part of Report A. & A. E. E. /783.) From these figures the air miles per gallon were calculated. Using the most economical cruising conditions determined in this manner a range flight was made to determine the maximum range. In this flight the external fuel tank was not jettisoned.

3. Condition of aeroplane relative to tests.

Six 0.50" calibre machine guns were fitted in the wings with the gun ports sealed and the ejector chutes unsealed. A rear view mirror was fitted above the windscreen. The jettisonable fuel tank of 43 gallons capacity was carried on a bomb rack beneath the fuselage.

R/T aerials extended from each wing tip to the tail fin. A V.H.F.

/aerial

ast was fitted on the fuselage behind the pilot's cockpit. I.F.F. s were also installed. Underneath the starboard wing, just outboard of undercarriage fairing the streamlined housing for a G.45 camera gun was fitted. The engine had individual stub exhausts fitted.

The tests were done at an all-up weight of 8840 lb. with the centre of gravity 26.2" aft of the datum, undercarriage down.

The tests were done during April and May, 1942.

4. Results of tests:

4.1. Determination of optimum air miles per gallon. The results are given in Table I and Fig. I. From these it will be seen that the maximum air miles per gallon is 7.36 obtained at a speed of 162-3 m.p.h. A.S.I. The engine conditions that gave this speed were 1900 r.p.m. and 21" of Hg. boost. The air miles per gallon compare favourably with 7.40 air miles per gallon obtained on a Kittyhawk without an external tank (See 6th Part of Report A.A.E.E./783). Full throttle level speed measurements obtained on A.L.229 have shown a decrease in level speed of 10 m.p.h. obtained with the tank on. Of this about 1 m.p.h. is accounted for by the greater weight, leaving 9 m.p.h. as due to the drag of the external tank. Thus, at the engine conditions for maximum range, the speed would be increased by jettisoning the tank by about 4 m.p.h. A.S.I., and the air miles per gallon by $2\frac{1}{2}\%$. Thus the improvement in range due to jettisoning the tank will be only 15-20 miles. In Service, therefore, the pilot can either jettison his tank for maximum range, or retain it throughout the flight, in which latter case he will lose about 20 miles in still air.

TABLE I.
FUEL CONSUMPTION TESTS IN CRUISING FLIGHT.

Sp. gravity of fuel = 0.72
Mean weight of aeroplane = 8270 lb.
during test.

Height Feet.	Air Speed		R. P. M.	Boost lb/sq. in.	Mixture Control	Consumption		Air miles per gallon.
	True m. p. h.	A. S. I. m. p. h.				lb/hr.	gall/hr.	
I. C. A. N.	283.5	219.5	2300	30 $\frac{1}{2}$	Weak	422	58.5	4.85
15,000	267.5	207.5	↓	28	↓	343	47.6	5.62
	260.5	202.5		27		317	44.0	5.92
Standard	245	190.5	↓	25	↓	274	38.0	6.45
15,000	230.5	180		23		246	34.1	6.75
	↓	224.0	175	22	235	32.7	6.85	
↓	265	205	2100	28	317	44.0	6.02	
↓	258	200	↓	27	297	41.0	6.29	
↓	243.5	189.5	↓	25	261	36.2	6.73	
↓	225.5	176	↓	22 $\frac{1}{2}$	231	32.0	7.04	
↓	247	192	1900	26	263	36.5	6.75	
↓	240	187	↓	25	249	34.5	6.96	
↓	220	171.5	↓	22 $\frac{1}{2}$	216	30.0	7.32	
↓	206.5	162.5	↓	21	202	28.0	7.36	
↓	196	154	↓	20	193	26.8	7.30	

Lowest comfortable speed for continuous cruising = 150 m.p.h. A.S.I.

4.2. Range flight: A range flight was done with all tanks full, the total fuel capacity being 166 gallons. The aeroplane was climbed to 15,000 feet in weak mixture at 2300 r.p.m. and 30" boost. The pilot then used the most economical cruising conditions as stated above, and continued the flight until the overload and main tanks were drained. Flight, i.e. landing, subsequent to the range flight proper, was made using fuel from the reserve tank. On landing, the aeroplane was refuelled to determine the amount of fuel used. All but 7 gallons were used during the range flight. The tanks were then drained to find out how much fuel cannot be used. All the fuel in the external tank can be used, but it was found that 3 gallons remained in the main wing and fuselage tanks.

The results of the range flight are tabulated below:

/TABLE II.

TAKE TO CARBURETTOR -
(CLEANERS, NO SNOWGUARD)

TABLE II.
Range Flight at 15,000 ft.

Time from take-off.	Tank used.	A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Boost	Fuel used (gallons)	Miles covered
Take-off and climb (18 mins)	Main	-	-	3000	+44½"	17	53
1 hr. 31 mins.	External	163	207	1900	+21"	43	316
3 hrs. 11 mins.	Main	165	209	1900	+21"	99	662
Fuel left in main tanks (cannot be used)						3	-
Fuel left in reserve tank available for further flying (allowing 7.36 air miles per gallon).						4	29
Total						166	1060

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4.3. Comparison of estimated and actual values of range:

Before the range flight was done the following estimation of the maximum attainable range was made.

Total available fuel = 123 in main tanks + 43 in overload tank.
 Fuel used for taxiing, take-off, and climb in weak mixture at 2300 r.p.m. and 30" of boost = 20 gallons.
 Fuel estimated to remain in tanks after they had been drained = 5 gallons.
 This leaves 123-20-5 = 98 gallons for cruising at 15,000 ft. on main tanks.

Estimated distance covered on climb = 35 miles
 " " " using 43 gallons.
 in overload tank at 7.36 air miles per gallon = 316 miles
 Estimated distance covered using 98 gallons available in main tanks at 7.36 air miles per gallon. = 720 miles
 Total = 1071 miles

From the above it can be seen that there was fair agreement between the actual flight and the estimated maximum range.

5. Conclusions:

With a total of 166 gallons of fuel available, the aeroplane has a still air range of 1060 miles when flown at 15,000 feet at an airspeed of about 165 m.p.h. with corresponding engine conditions of 1900 R.P.M. and 21 inches Hg. boost.

The range will be increased by about 15-20 miles if the external tank is jettisoned after the fuel has been used, so that, unless the absolute maximum range is required, it is recommended that the tank be left on throughout a long flight.

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W. J. Jones
Air Commodore,
Commanding A. & A.E.E.
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KITTYHAWK AL-229

(ALLISON V-1710 F.3.R.)

AIR RANGE PER GALLON

ATMOSPHERIC CONDITIONS ~ STANDARD

WEAK MIXTURE.

AIR INTAKE TO CARBURETTOR ~ CL
(NO CLEANERS, NO SNOWGUARD)

BOOST IS INDICATED IN INCHES OF MERCURY

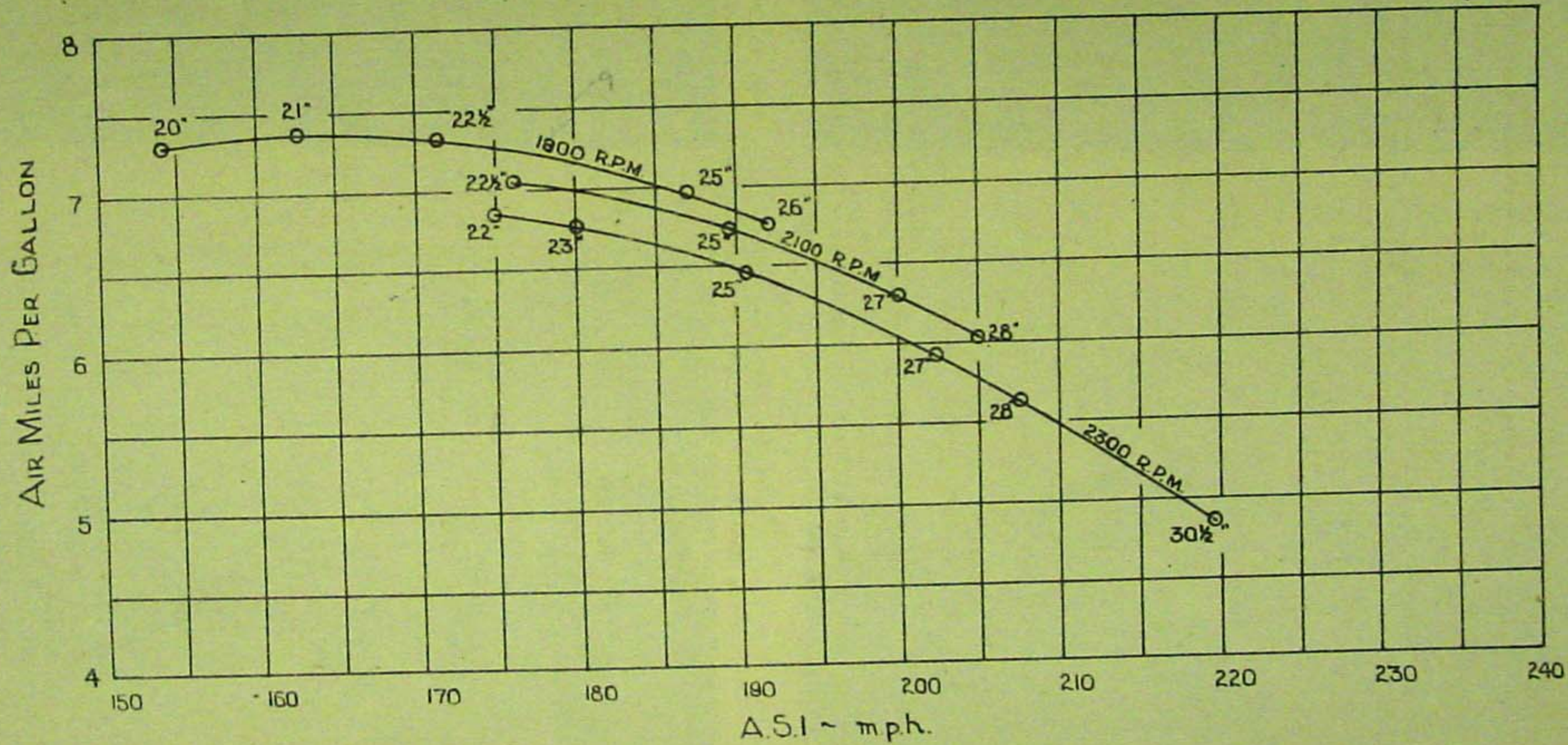


FIG 1

299	66
316	43
53	17
Miles covered	Fuel used (gallons)

