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CONFIDENTIAL

DETAIL No. 521/W/169

R.A.A.F. HEADQUARTERS

DIRECTORATE OF TECHNICAL SERVICES

No. 1 AIRCRAFT PERFORMANCE UNIT

REPORT

ON

"ALTITUDE TRIALS - 1 KITTAWAKE P40N - 20"

BY

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AND

Flying Officer R. R. SHAY.

DATE OF ISSUE: January, 1945

AERONAUTICAL SYMBOLS

I. FUNDAMENTAL AND DERIVED UNITS

	Symbol	Metric		English	
		Unit	Abbreviation	Unit	Abbreviation
Length	l	meter	m	foot (or mile)	ft (or mi)
Time	t	second	s	second (or hour)	sec (or hr)
Force	F	weight of 1 kilogram	kg	weight of 1 pound	lb
Power	P	horsepower (metric)	kph	horsepower	hp
Speed	V	kilometers per hour meters per second	mps	miles per hour feet per second	mph fps

2. GENERAL SYMBOLS

- | | |
|---|---|
| <p>W Weight = mg</p> <p>g Standard acceleration of gravity 9.80665 m/s²
or 32.1740 ft/sec²</p> <p>m Mass = $\frac{W}{g}$</p> <p>I Moment of inertia = mk^2. (Indicate axis of radius of gyration k by proper subscript.)</p> <p>μ Coefficient of viscosity</p> | <p>ν Kinematic viscosity</p> <p>ρ Density (mass per unit volume)
Standard density of dry air, 0.12497 kg·m⁻³·s² at 15° C and 760 mm; or 0.002378 lb·ft⁻³·sec²
Specific weight of "standard" air, 1.2255 kg/m³ or 0.07651 lb/cu ft</p> |
|---|---|

3. AERODYNAMIC SYMBOLS

- | | |
|---|---|
| <p>S Area</p> <p>S_w Area of Wing</p> <p>G Gap</p> <p>b Span</p> <p>c Chord</p> <p>A Aspect ratio, $\frac{b}{c}$</p> <p>V True air speed</p> <p>q Dynamic pressure, $\frac{1}{2}\rho V^2$</p> <p>L Lift, absolute coefficient $C_L = \frac{L}{qS}$</p> <p>D Drag, absolute coefficient, $C_D = \frac{D}{qS}$</p> <p>D_b Profile drag, absolute coefficient $C_{D_b} = \frac{D_b}{qS}$</p> <p>D_i Induced drag, absolute coefficient $C_{D_i} = \frac{D_i}{qS}$</p> <p>D_p Parasite drag, absolute coefficient $C_{D_p} = \frac{D_p}{qS}$</p> <p>C Cross-wind force, absolute coefficient $C_C = \frac{C}{qS}$</p> | <p>i_w Angle of setting of wings (relative to thrust line)</p> <p>i_t Angle of stabilizer setting (relative to thrust line)</p> <p>Q Resultant moment</p> <p>Ω Resultant angular velocity</p> <p>R Reynolds number $\rho \frac{Vl}{\mu}$ where l is a linear dimension (e.g., for an aerofoil of 1.0 ft chord, 100 mph, standard pressure at 15° C, the corresponding Reynolds number is 935,400; or for an aerofoil of 1.0 m chord, 100 mps, the corresponding Reynolds number is 6,865,000)</p> <p>α Angle of attack</p> <p>ϵ Angle of downwash</p> <p>α_∞ Angle of attack, infinite aspect ratio</p> <p>α_i Angle of attack, induced</p> <p>α_a Angle of attack, absolute (measured from zero-lift position)</p> <p>γ Flight-path angle</p> |
|---|---|

NO. 1 AIRCRAFT PERFORMANCE DATA

LEVEL

ATTITUDE TRIALS - I
KT. TRACK INCH - 20

Detail No: 521/A-182
R.A.A.F. R/O. CHS. Es: 5/503/17
No. 1 A.C.U. File No: 1/4/29

SUMMARY

The following table gives a summary of the results of attitude trials on this aircraft.

The table gives the angle of attack of the aircraft datum for various conditions.

HEIGHT FT. (Lbs.) A.C.U. (W.G.H.)	LEVEL				
	5000	7000	8000	9000	10,000
140	1025'	1020'	1010'	995'	985'
180	1010'	1000'	990'	975'	965'
220	- 0910'	- 0920'	- 0925'	- 1010'	- 1035'
260	- 1000'	- 0940'	- 0920'	- 0900'	- 0925'
300	- 1020'	- 1010'	- 1000'	- 0915'	- 0930'
360	-	- 1000'	- 1025'	- 1010'	- 1005'
		200	DIV.		
140	1025'	1000'	990'	985'	980'
180	0955'	1010'	1005'	1000'	1010'
220	- 0920'	- 0910'	- 0930'	- 0955'	- 1020'
260	- 1005'	- 0945'	- 0930'	- 0910'	- 0910'
300	- 1035'	- 1020'	- 1005'	- 0955'	- 0935'
360	-	- 1050'	- 1010'	- 1020'	- 1010'

1. INTRODUCTION.

Attitude Trials on a number of aircraft are required by Arm. 7 (D.Arm.) for gun harmonization purposes. This report covers position error observation and attitude trials on a BONE aircraft.

2. CONDITION OF AIRCRAFT EQUIPMENT TO TRIALS.

2.1 Aircraft

Type - Kittyhawk BONE - 2000
Aircraft Identification No: 429 - 650
Wing Area: 236 sq. ft.
Aerial: - From dorsal Mast to fin
"Spike" dorsal Aerial
Guns: - Sealed dust lube filter
to 6 0.50" calibre wing
machine guns
Exhaust Stubs - Hantz Injector type.

Bomb Rack: - 2 Wing bomb racks, with away
bracket.
Paint: - The aircraft was unpainted
except for the standard white
tail assembly and wing leading
edge, and black "anti-collision"
nose section.

A photo of the aircraft is attached to this report.

2.2 Aircraft:

Type: Curtiss Electric
Description: 3-bladed V.P.
Diameter: 11 ft. 0 in.
Pitch Range: 24.5° - 29.5°

2.3 Engine:

Type: Allison V-3710 - 99

2.4 Weight:

The aircraft was weighed at No. 1 A.B. Inverton. It was flown at a take-off weight of 2250 lbs.

3. TESTS CARRIED OUT:

3-1 Position Error: The position error of the aircraft was determined by the traversing method.

3-2 Attitude Trials: A set of 20 runs were made at 6700 lbs., using a small liquid demand pendulum altimeter read by the pilot.

This altimeter, which had not been previously used, proved quite satisfactory. It operates in a bath of synthetic paraffin containing a small percentage of kerosene. This latter component was added to eliminate a slight stickiness which was observed with pure paraffin.

4. RESULTS OF TESTS:

4.1 Position Error Trial: The Position Error correction to the A.B.I. at 2250 lbs. is shown in Figure 1. Figure 2 gives the correction as a correction to the lift coefficient based on the A.B.I. to give the true lift coefficient. Figure 3 gives details of the pilot head.

4.2 Attitude Trials: The results of the trials were reduced to the standard attitude - lift coefficient curve, which is given in Figure 4. The lift coefficient is based on the gross wing area of 236 sq. ft. Curves for attitude vs. Gross weight have been calculated for a number of indicated Air Speeds for level flight, and for a 20° dive, and are given in Figures 5 and 6 respectively.

4. REVERSE DEVELOPMENTS.

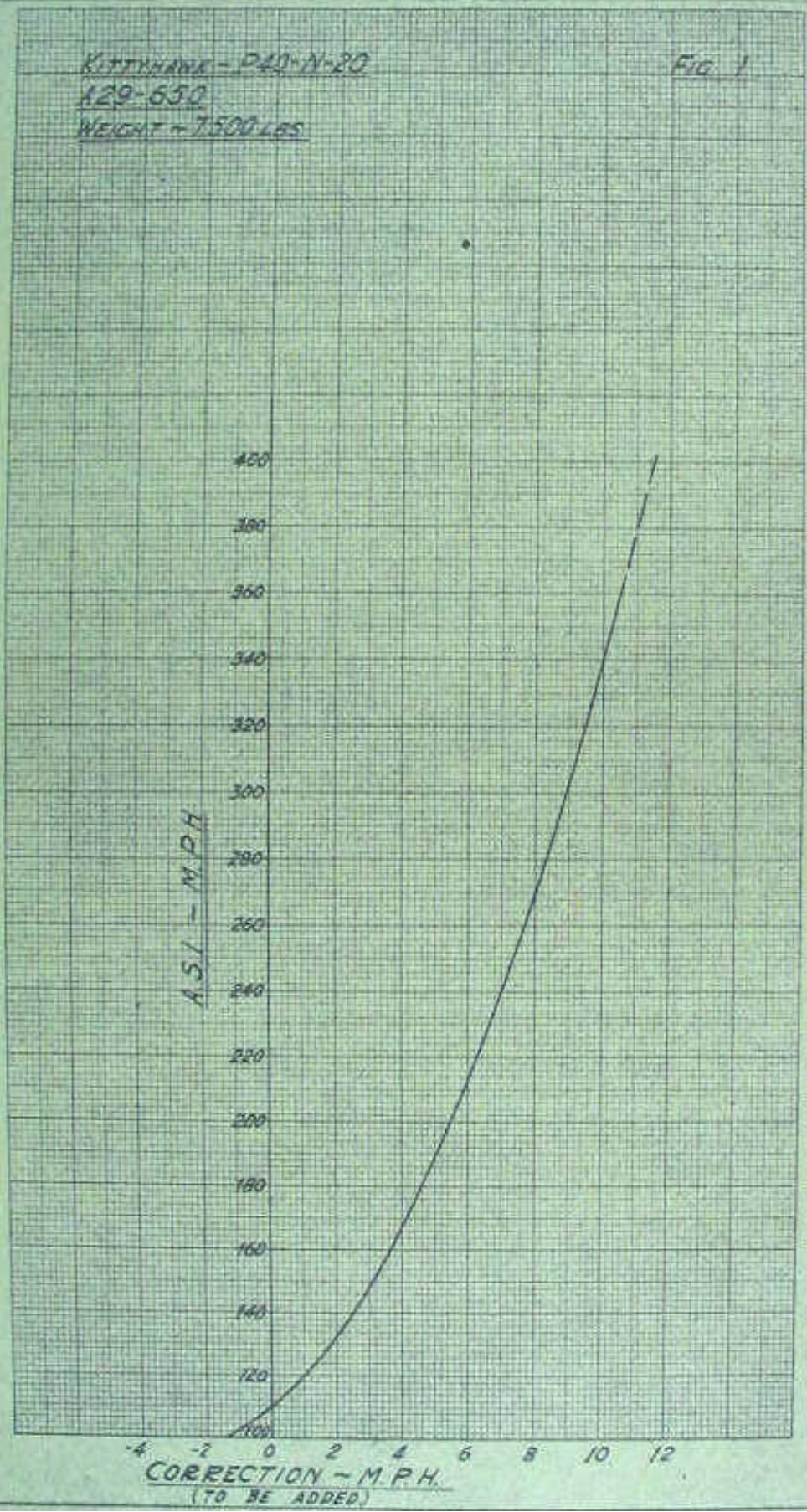
The DEVELOPMENTS are being filed to a Division T.P.
All. VII and trials in this subject will be carried out shortly.

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KITTYHAWK - P-40-N-20
129-650
WEIGHT - 7,500 LBS.

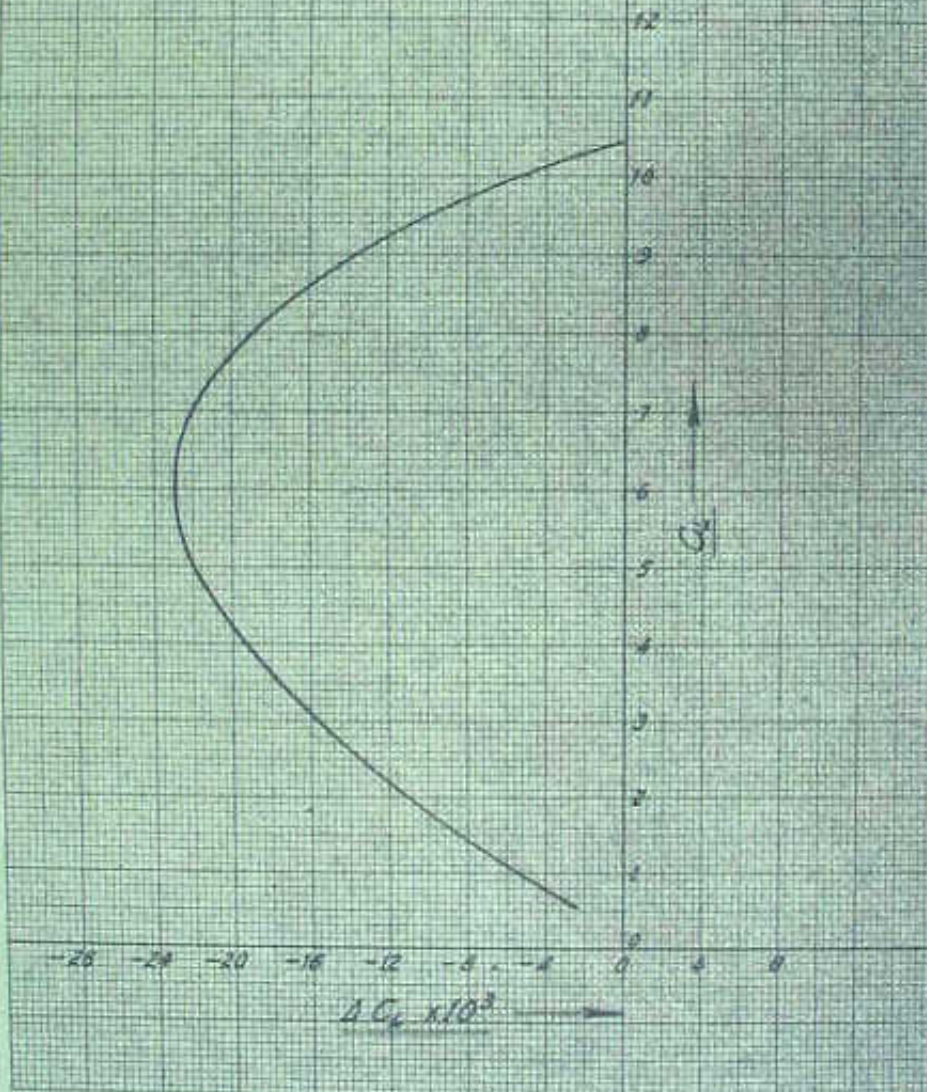
FIG. 1



KITTIBANK - PAD-N-20
129-650

FIG 2

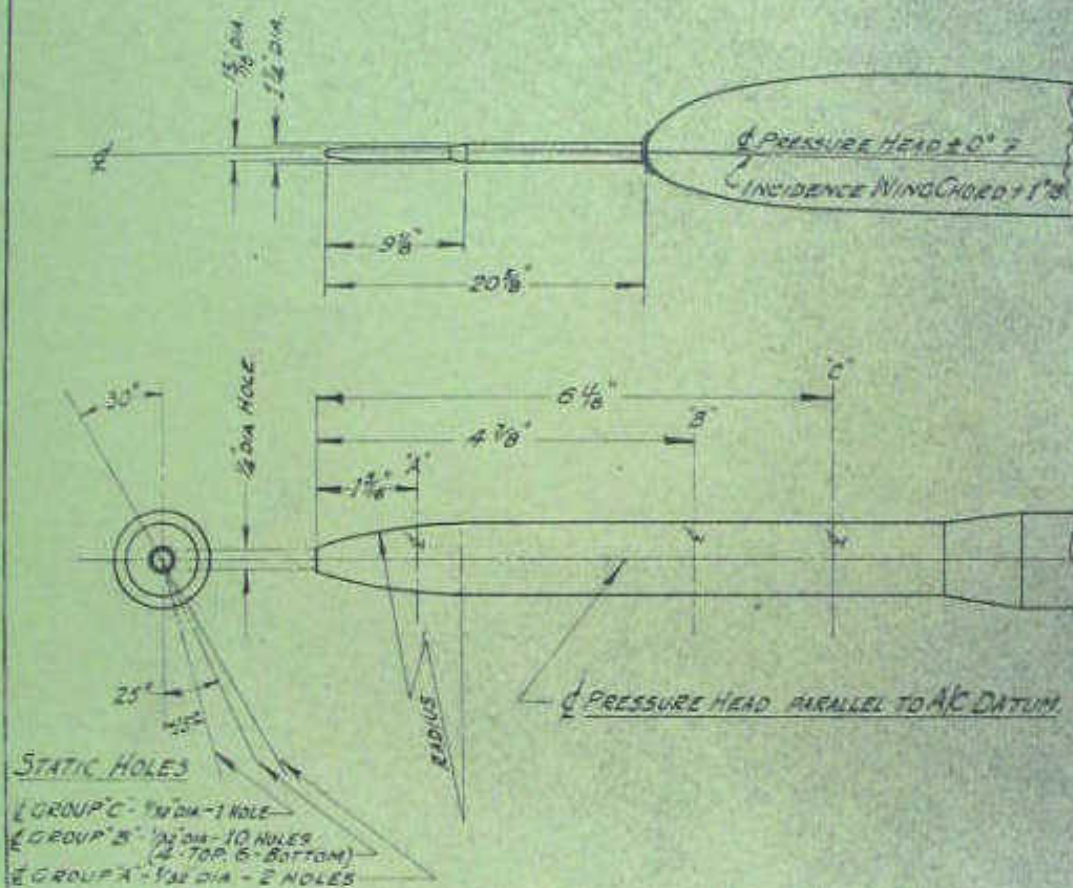
CORRECTION TO LIFT COEFFICIENT BASED ON THE A.S.I.
TO GIVE THE TRUE LIFT COEFFICIENT



PREPARED BY	KASE	R.A.A.F. H.Q. NO. 1 AIRCRAFT PERFORMANCE UNIT	521-A-169
CHECKED BY	RS	PRESSURE HEAD DETAILS.	DATE 7-12-44

KITTYHAWK PAO-N-20
A 29-650

FIG. 3.



TYPE OF PRESSURE HEAD	WESTINGHOUSE AN5816-2, 24V DC
RATIO OF APERTURE OF TUBE TO EXTERNAL DIA OF STATIC	SEE SKETCH
INCIDENCE OF MAIN PLANE	1° 18'
ANGLE OF STATIC TUBE TO CHORD OF MAIN PLANE	1° 18'
LENGTH OF CHORD AT SECTION	51 1/4"
DISTANCE FROM PLANE OF SYMMETRY	16 10 1/4"
POSITION	LE PORT M.P.
SEMI-SPAN	18 7 3/4"
RATIO OF THICKNESS TO CHORD OF AEROFOIL SECTION ADJACENT TO PRESSURE HEAD	9%

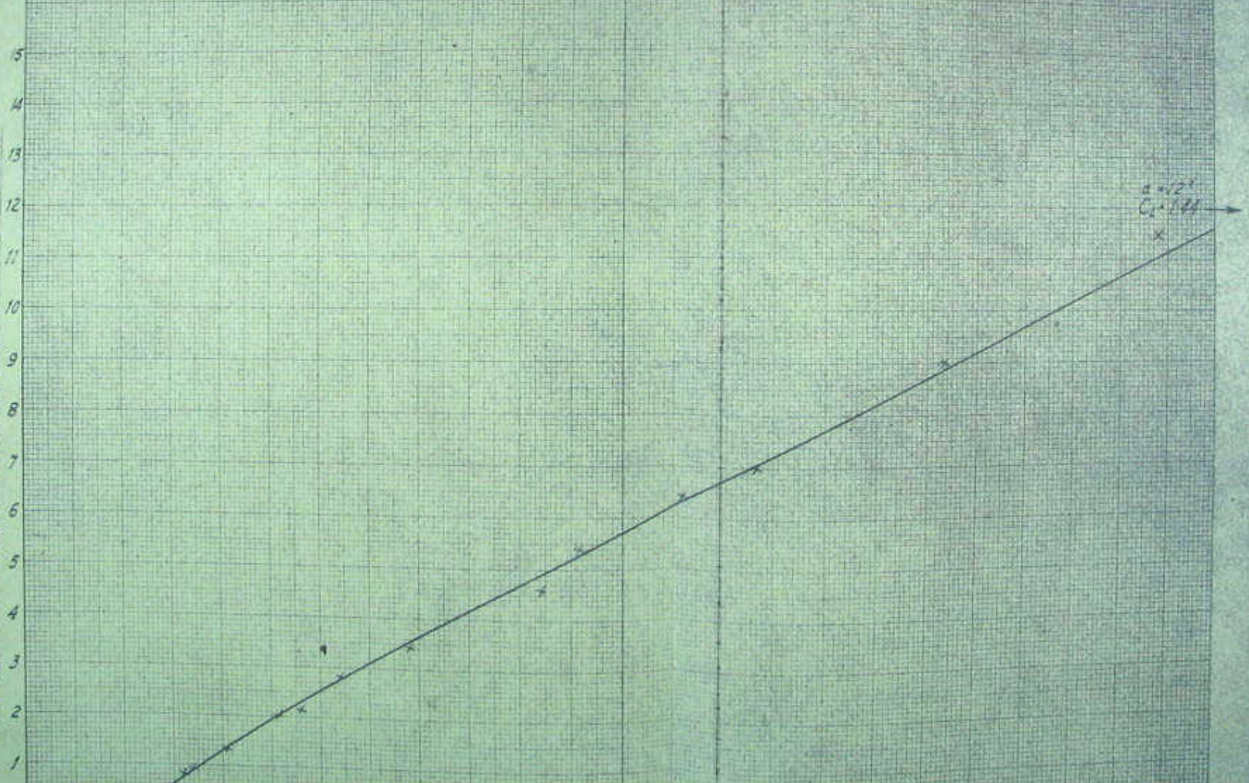
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KITTIFHANK-P40-N-20
A29-650

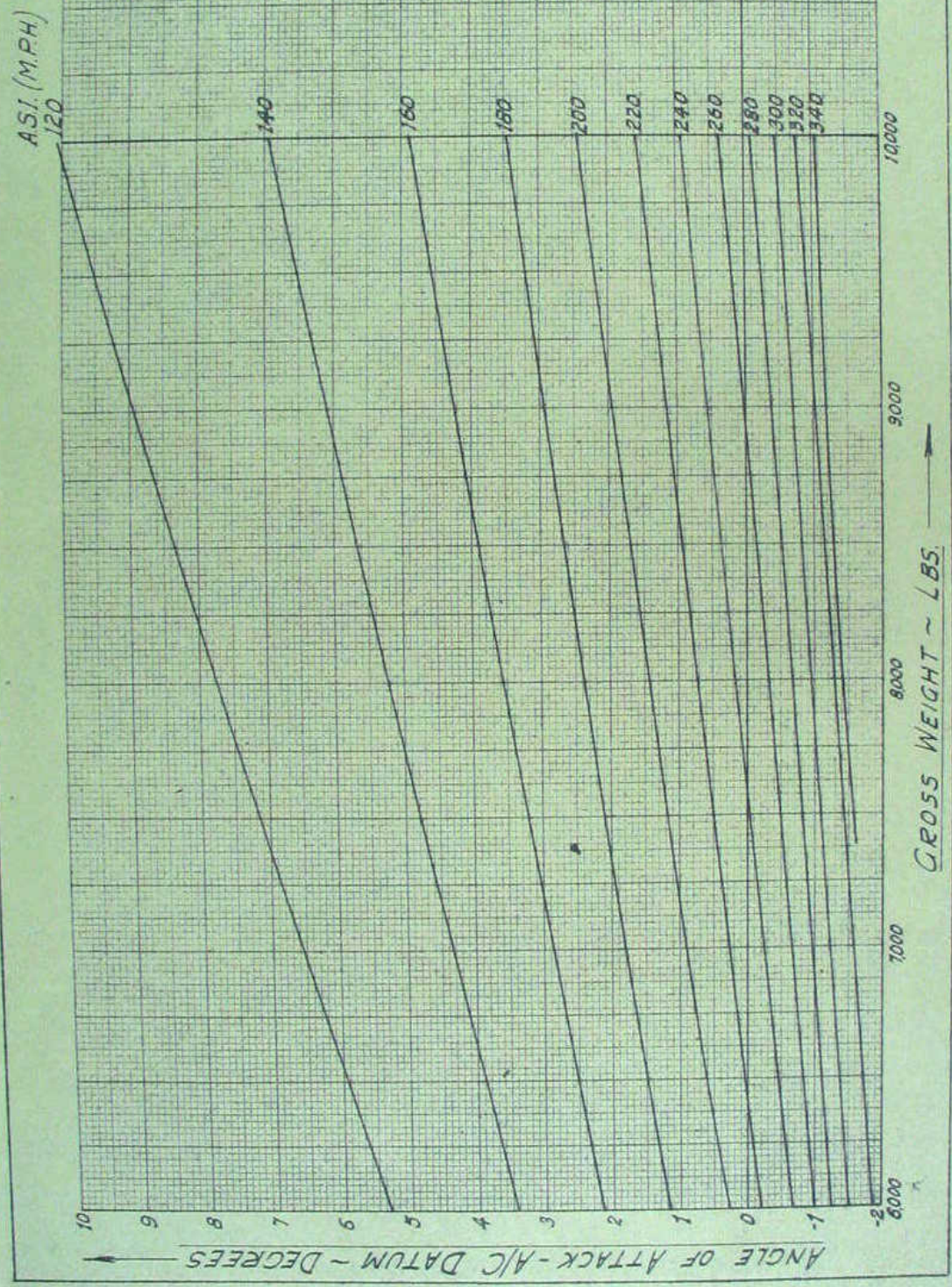
FIG. 1

ATTITUDE - LIFT COEFFICIENT CURVE

ANGLE OF ATTACK - AIRCRAFT DATUM - DEGREES



KITTYHAWK - PAO - N-20 *FIG. 5*
129-650
 LEVEL FLIGHT
 LINES OF CONSTANT A.S.I.



PREPARED BY *RJ/HAB* D.T.S. R.A.A.F. H.Q. T.S.7
SPECIAL DUTIES AND PERFORMANCE FLIGHT

521-A-169

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