QC Avro CF105 P-AD-82

DERIVATIVES.

V. Baddeley Nov. 1956

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### TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: CF-105

REPORT No P/Aero Data/82

FILE NO

NO OF SHEETS \_\_\_

TITLE:

FLASTIC LONGITUDINAL

DERIVATIVES.

PREPARED BY V. Baddeley DATE Nov. 1956

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ISSUE No. REVISION NO

AVRO AIRCRAFT LIMITED

# TECHNICAL DEPARTMENT

AIRCRAFT

CF-105

REPORT No P/Aero Data/82 SHEET NO \_\_ PREPARED BY V. Baddeley Nov. 1956 CHECKED BY DATE

- ELASTIC LONGITUDINAL DERIVATIVES CONTROL

Derivatives Modified Due To Flastics

## CONTENTS

1.	Stal	bility Derivatives	Section Reference	No. of Sheets
	*	Aerodynamic Centre	1.1	1
	*	$c_{L_{lpha}}$	1.2	2
		$c_{L_q}$	1.3	1
		c <sub>Lå</sub>	1.4	1
		$c_{M_{\odot}}$	1.5	2
		α.	1.6	1
	*	$c_{M\alpha}$	1.7	2
,		$c_{M_{\mathbf{q}}}$	1.8	1
		C <sub>Mq</sub>	1.9	1
	ŕ	Δ CL(CMo)CMo	1.10	2
	*	C.P.(C <sub>Mo</sub> )	1.11	2

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CF-105

REPORT No P/Aero Data/82

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2.	Cont	rol Derivatives	Section Reference	No. Of Sheets
	*	$c_{L_{\delta_R}}$ , $c_{L_{\delta_E}/c_{L_{\delta_R}}}$ , and $c_{L_{\delta_E}}$ for		
		l 'g', c.g. at .31 A.M.C. Weight = 47,000 lb.	2.1	5
	¥	$c_{P_R}$ , $\triangle CP(C_L)$ , $\triangle CP(\propto)$	2.2	6
	*	$C_{M\delta(C_L)}$ , l'g' c.g. at .31 A.M.C.		
		Weight = 47,000 lb.	2.3	1
	*	$C_{M\delta}(\propto)$ 1 'g' c.g. at .31 A.M.C.		
		Weight = 47,000 lb.	2.4	1
		c <sub>h∞</sub>	2.5	1
		$c_{h_{\delta_e}}$	2.6	1
		c <sub>ho</sub>	2.7	1
3.	Appe	ndix		
		α <sub>TR</sub> , l 'g', c.g. at .31 A.M.C. Weight = 47,000 lb.	. 3.1	1
		δ <sub>TR</sub> , l 'g', c.g. at.31 A.M.C. Weight = 47,000 lb.	3.2	1

N.B. 
$$c_{M_{\delta}(c_L)} = c_{L_{\delta_{Rigid}}}$$
 (a.c.  $-c_{P_E}$ )  
 $c_{M_{\delta}(\alpha)} = c_{L_{\delta_{Rigid}}}$  (h  $-c_{P_E}$ ( $\alpha$ )

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REMARK.

One general remark, it is assumed that the effects of elasticity, on all derivatives are felt immediately some small disturbance is made. This is obviously not correct for high frequency oscillations, but corrections for this are beyond the scope of this report.

Apart from this  $\underline{\text{Section 1}}$  is self explanatory with the following minor comments.

(a)  $\Delta$   $C_{\mbox{\scriptsize $L_{\mbox{\scriptsize $C_{M}$}}$}\mbox{\scriptsize $O$}}$  could have been expressed as a change in O  $_{\mbox{\scriptsize $O$}}$ 

viz. 
$$\Delta O(_{\circ} = \frac{-\Delta C_{L_{CM_{o}}}}{c_{M_{o}}}$$

(b) Similarlly a change in  $C_{M_{\odot}}$  due to  $C_{M_{\odot}}$  with the revised ( o could have been given

viz. 
$$\Delta C_{M_0} = C_{L_{CM_0}} (a.c. - c.p._{CM_0})$$

However the more fundamental treatment of figs. 1.10,  $\not\in$  1.11 was considered more desirable, but it should be remembered that basically all the effects are, is a change in 0  $\not\in$  C<sub>M.</sub>

(c) The change in C<sub>M</sub> shown in fig. 1.5.2 is for c.g. at .31 A.M.C. However since most of this change is due to the vertical shift of c.g., from test model to aircraft the curve could be used for other c.g.'s with very little loss of accuracy.

#### Section 2

that the RIGID values of  $C_{L_\delta}$  be used since the changes in c.p. due to elastics are based on the rigid values of  $C_{L_\delta}$ .

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Section 2 (Continued)

(b) In obtaining c.p. elastic from figs 2:2.1 - 2.2.6, it will be noted that  $\triangle$  c.p. due to elastics is shown positive forwards, and hence c.p. = c.p. from (2.2.1, 2.2.2)

- Δ c.p. from 2.2.3 - 2.2.6.

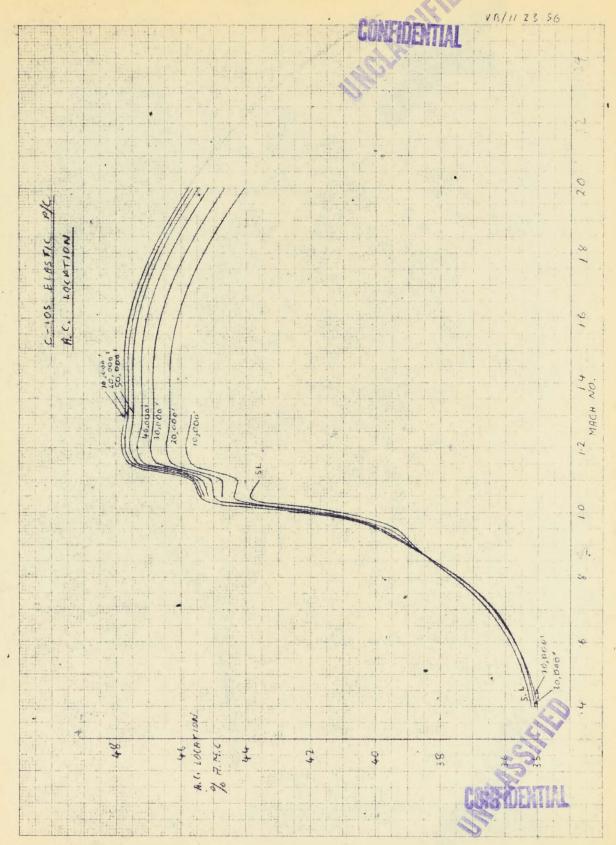
#### Section 3

The values of Q  $_{TR}$ , and  $\delta_{TR}$  for l 'g', were obtained by adding the increments due to elastics, from calculations using the derivatives, to the rigid values obtained directly from  $C_M \sim C_L \sim \delta$  plots.

In this manner errors due to linearization were minimized. However this does mean, that calculations using the derivatives of the report will not agree exactly with the values of C(  $_{\rm TR}$  and  $\delta_{\rm TR}$  quoted.

It will also be noted, that the  $\mathcal{Q}_{TR}$  curve is for the rigid aircraft. This is because the change is  $\mathcal{Q}$  due to elastics at 1 'g' is so small as to be not significant, hence the rigid curve.

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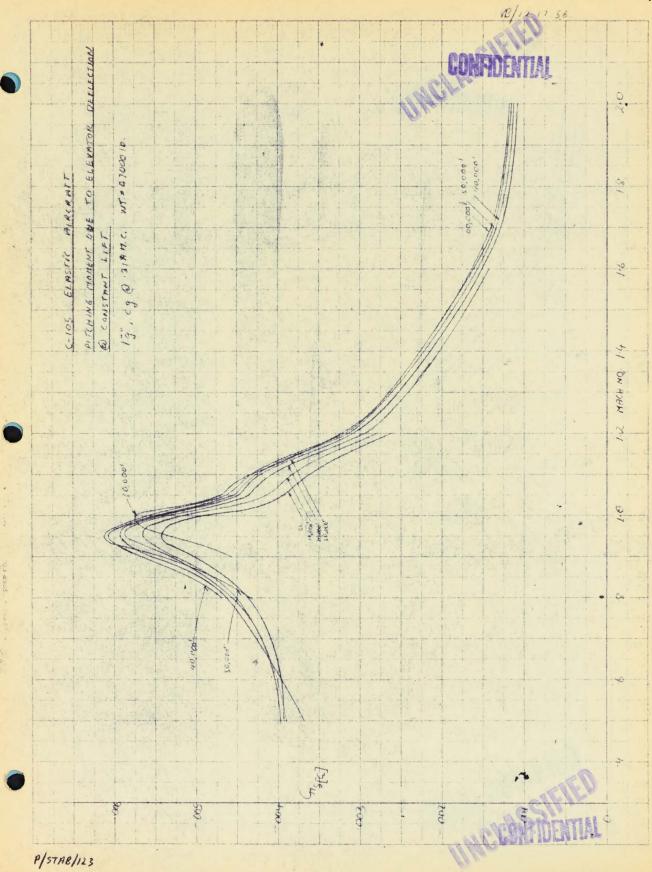
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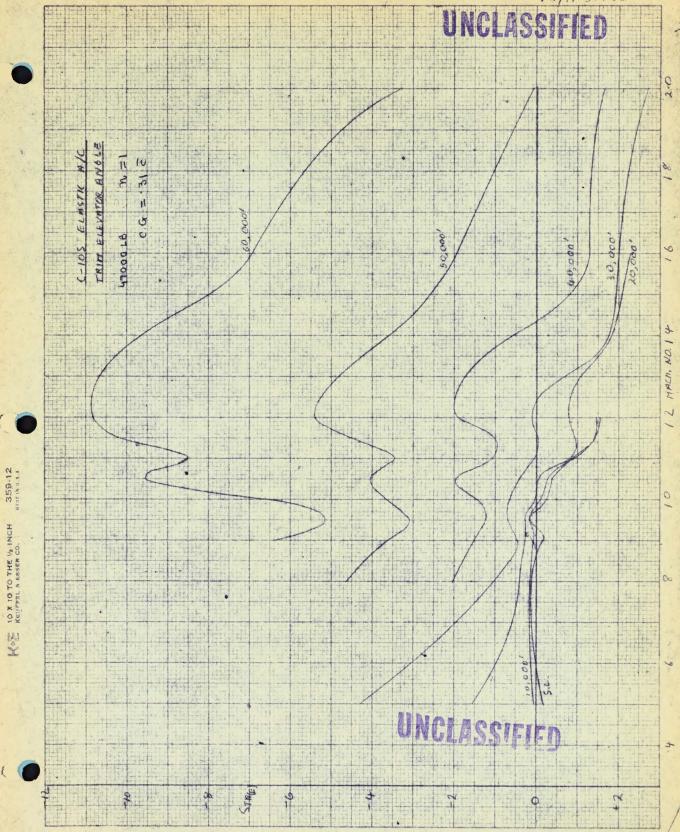
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