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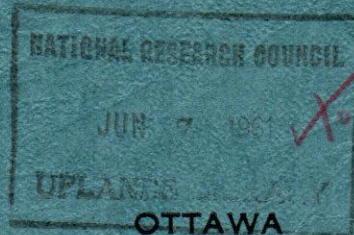
LR - 304

VERTICAL ACCELERATIONS ENCOUNTERED BY AIRCRAFT
ON AGRICULTURAL OPERATIONS

BY

R. T. SEWELL

NATIONAL AERONAUTICAL ESTABLISHMENT



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REPORT

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Structures Laboratory

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ON AGRICULTURAL OPERATIONS

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Director

SUMMARY

Three Boeing A-75N-1 aircraft (Stearman), operated by Wheeler Airlines, were fitted with NRC Registering G-Meters in order to obtain data on vertical accelerations encountered during agricultural operations.

Records were obtained from two aircraft only, covering a period of 60 flying hours, the aircraft being engaged in forest-spraying operations in New Brunswick. Maximum acceleration increments recorded did not exceed 1.9g negative and 2.5g positive.

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VERTICAL ACCELERATIONS ENCOUNTERED BY AIRCRAFT ON AGRICULTURAL OPERATIONS

1. INTRODUCTION

The work described in this report was undertaken at the request of the Commonwealth Advisory Aeronautical Research Council as part of a cooperative research programme to obtain data on the loads encountered by aircraft engaged in agricultural operations.

Counting accelerometers were installed in three Stearman aircraft owned and operated by Wheeler Airlines, St. Jovite, Quebec. Approval of the installation was granted by Department of Transport, Air Services, Civil Aviation Branch (letter dated 4 April 1960, reference 5258-192).

The Stearman is a two-seat biplane, manufactured by the Boeing Airplane Company, Type A. 75N-1, modified to make it suitable for crop dusting and spraying operations. The gross modifications involve removal of the forward cockpit and installation of a dust hopper or spray tank, and the installation of a larger engine. Normal maximum gross take-off weight is 3600 lb. Figure 1 shows one of the aircraft used.

2. INSTALLATION

The three aircraft selected for the installation carried registration letters CF-EQT, CF-EQU and CF-EQY. The first was fitted for dusting, and the others for spraying.

Since the aircraft had no electrical system, 24-volt batteries were provided in each, and a pilot-operated switch was fitted to enable the meters to be energised after take-off and to be de-energised before landing.

The G-meter and battery box were mounted on an aluminum plate secured transversely across the fuselage longerons immediately behind the engine firewall, with the centre line of the plate 11 inches forward of the leading edge of the lower plane, and 3 inches forward of the normal centre of gravity. The control switch was mounted on the starboard side of the cockpit.

Each meter provided acceleration counts at six threshold levels between limits of -1.0g and 4.0g nominal. The meters were calibrated before installation,

with the following results:

Meter Serial No. 13. Installed in CF-EQT

Counter Number	1	2	3	4	5	6
Counting Level	-1.0	0	2.0	2.4	2.9	3.8

Meter Serial No. 9. Installed in CF-EQU

Counter Number	1	2	3	4	5	6
Counting Level	-1.0	0	2.0	2.5	3.0	3.5

Meter Serial No. 12. Installed in CF-EQY

Counter Number	1	2	3	4	5	6
Counting Level	-0.9	0	2.0	2.5	3.0	3.9

The installation in the three aircraft was carried out by staff of the Structures Laboratory at St. Jovite on 7 April 1960.

3. RESULTS

No results were obtained from the installation in CF-EQT. It was subsequently found that the system had been rendered inoperative due to the ingress of DDT powder in the battery box.

The remaining aircraft were employed on forest-spraying operations in Quebec and New Brunswick between May 21 and June 16.

Spraying was carried out at an altitude of 75 to 100 feet above the local terrain at an average speed of 100 m.p.h.

The results obtained are given in Table I and plotted in Figure 2.

It is known that the result from CF-EQY on June 9 includes landing accelerations. However, it is impossible to determine the proportion of flight accelerations to landing accelerations.

Making no allowance for included landing accelerations, the hours to reach or exceed a given acceleration level are:

Zero g	-	15.25 hours
2.0g	-	0.61 hours
2.5g	-	12.20 hours
3.0g	-	61.00 hours

4. DISCUSSION OF RESULTS

Since spraying operations are carried out only in calm weather conditions when the wind speed at ground level does not exceed 5 m.p.h., it appears reasonable to assume that the accelerations recorded are largely due to manoeuvres at the end of each run rather than to atmospheric turbulence.

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TABLE I

ACCELERATION COUNTS OBTAINED

AIRCRAFT CF-EQU

Date	Meter Counts (Non-cumulative)						Flight Time		Base
	-1.0	0	2.0	2.5	3.0	3.5	Hr.	Min.	
May 21	0	0	0	0	0	0	1	30	St. Jean, Que. Kesnac, N. B. Kesnac, N. B.
May 23	0	3	12	1	0	0	4	00	
May 29	0	1	16	0	0	0	6	00	
TOTALS	0	4	28	1	0	0	11	30	

AIRCRAFT CF-EQY

Date	Meter Counts (Non-cumulative)						Flight Time		Base
	-0.9	0	2.0	2.5	3.0	3.9	Hr.	Min.	
May 21	0	0	1	1	0	0	1	30	St. Jean, Que. Kesnac, N. B. Kesnac, N. B. Horns Gulch, N. B.
May 26	0	0	9	1	0	0	10	00	
June 9	0	0	49	0	0	0	23	00	
June 16	0	0	13	2	1	0	15	00	
TOTALS	0	0	72	4	1	0	49	30	

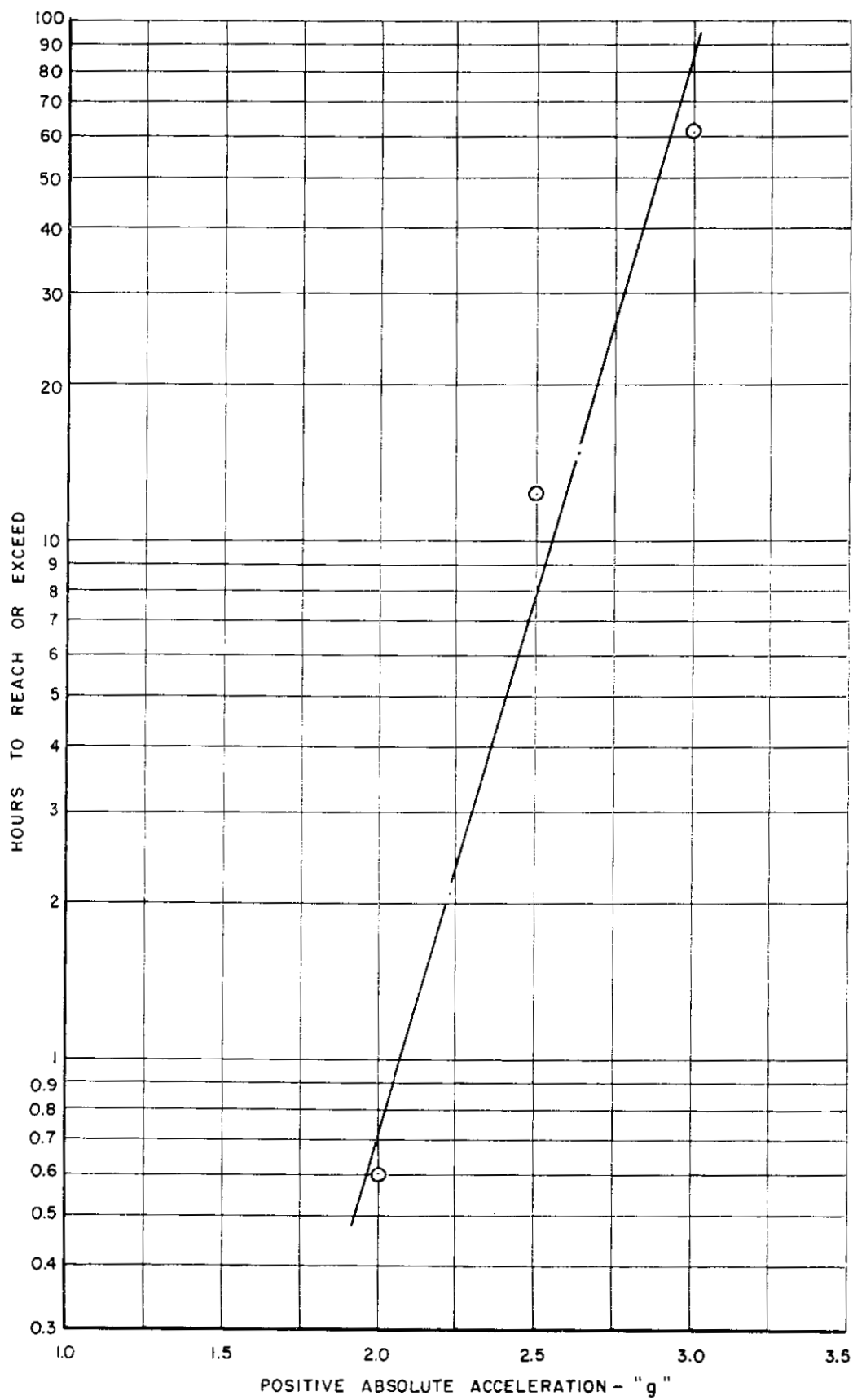
Total Effective Counts - Both Aircraft

Threshold counting level:	0	2.0	2.5	3.0
Number of counts:	4	100	5	1
Total hours:	61			



AIRCRAFT USED FOR CROP DUSTING AND SPRAYING OPERATIONS

FIG. 2
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PLOT OF ACCELERATION COUNTS OBTAINED
STEARMAN AIRCRAFT AGRICULTURAL OPERATIONS