NACA

RESEARCH MEMORANDUM

PRELIMINARY RESULTS FROM GUST VELOCITY MEASUREMENTS AT HIGH ALTITUDES

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NATIONAL ADVISORY COMMITTEE
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SUMMARY

The first sample of high-altitude gust data obtained from routine operations of military airplanes has been evaluated. Time-history records of airspeed, altitude, and acceleration available at this time represent about 90,000 miles of flight at altitudes up to 46,000 feet. The gust velocities are presented in tabular form.

GENERAL COMMENT

A program for collecting data on the intensity and frequency of occurrence of atmospheric gusts up to altitudes of about 45,000 feet has been initiated by the NACA to obtain gust information for use in airplane and missile design. These data are being obtained from time-history recordings of airspeed, altitude, and acceleration made during routine operations of several types of military airplanes.

In view of the interest in high-altitude gust data, the information obtained from the operations is summarized in table I to indicate the gust conditions encountered at the various altitudes. The scope of these data is indicated in table I by the total miles flown by the instrumented airplanes within altitude intervals of 5,000 feet and the miles of rough air encountered within each altitude interval. Rough air is represented herein by the portions of the record in which the accelerometer trace was disturbed and contained acceleration increments equal to or greater than 0.05g. The gust data consist of the maximum effective gust velocity and the number of gusts with velocities above a threshold of 3 feet per second encountered at each altitude. The gust velocities were evaluated on the basis of actual wing loading. As a measure of the average gust experience, the table also shows the average number of gusts (above the 3-foot-per-second threshold) encountered per mile of flight at each altitude. Insufficient data are available at this time to obtain a comparison of the gust-frequency distributions at the various altitudes.

No general conclusions are warranted from table I in view of the limited size of this initial sample of high-altitude gust data. There is an indication, however, that the maximum gust velocity and the number of gusts encountered per mile of flight decrease with increasing altitude.

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TABLE I.- SUMMARY OF GUST DATA

Altitude (ft)	Flight distance (miles)	Miles in rough air (DETECTED $a \geq .05g$)	Maximum effective gust velocity (fps)	Number of gusts ≥ 3 fps	Average number of gusts per mile of flight
0 to 5,000	4,913	1669	11	947	0.193
5,000 to 10,000	11,281	1481	12	434	.038
10,000 to 15,000	21,924	3698	13	1800	.082
15,000 to 20,000	5,412	107	11	72	.013
20,000 to 25,000	13,704	449	9	105	.008
25,000 to 30,000	13,447	443	9	93	.007
30,000 to 35,000	3,071	344	9	48	.016
35,000 to 40,000	6,492	87	7	7	.001
40,000 to 45,000	8,327	118	5	46	.006
45,000 to 50,000	455	0	—	0	0