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A.R.C. Technical Report

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**Turbulence Encountered
by Comet I Aircraft**

By

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ROYAL AIRCRAFT ESTABLISHMENT

Turbulence Encountered by Comet 1 Aircraft

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SUMMARY

Acceleration records have been obtained of the turbulence encountered by B.O.A.C. Comet aircraft in 680,000 miles of operational flying on routes connecting London with South Africa and the Far East. It is shown that turbulence decreases with increasing altitude. Of all gusts greater than 10 ft/sec E.A.S. 91% were encountered below 27,500. Above 27,500 ft, about 75% of gusts greater than 10 ft/sec E.A.S. occur in cumuliform cloud. In flight sectors where conditions favour the formation of cumuliform cloud, gusts may be several times more numerous on average than over widespread routes.



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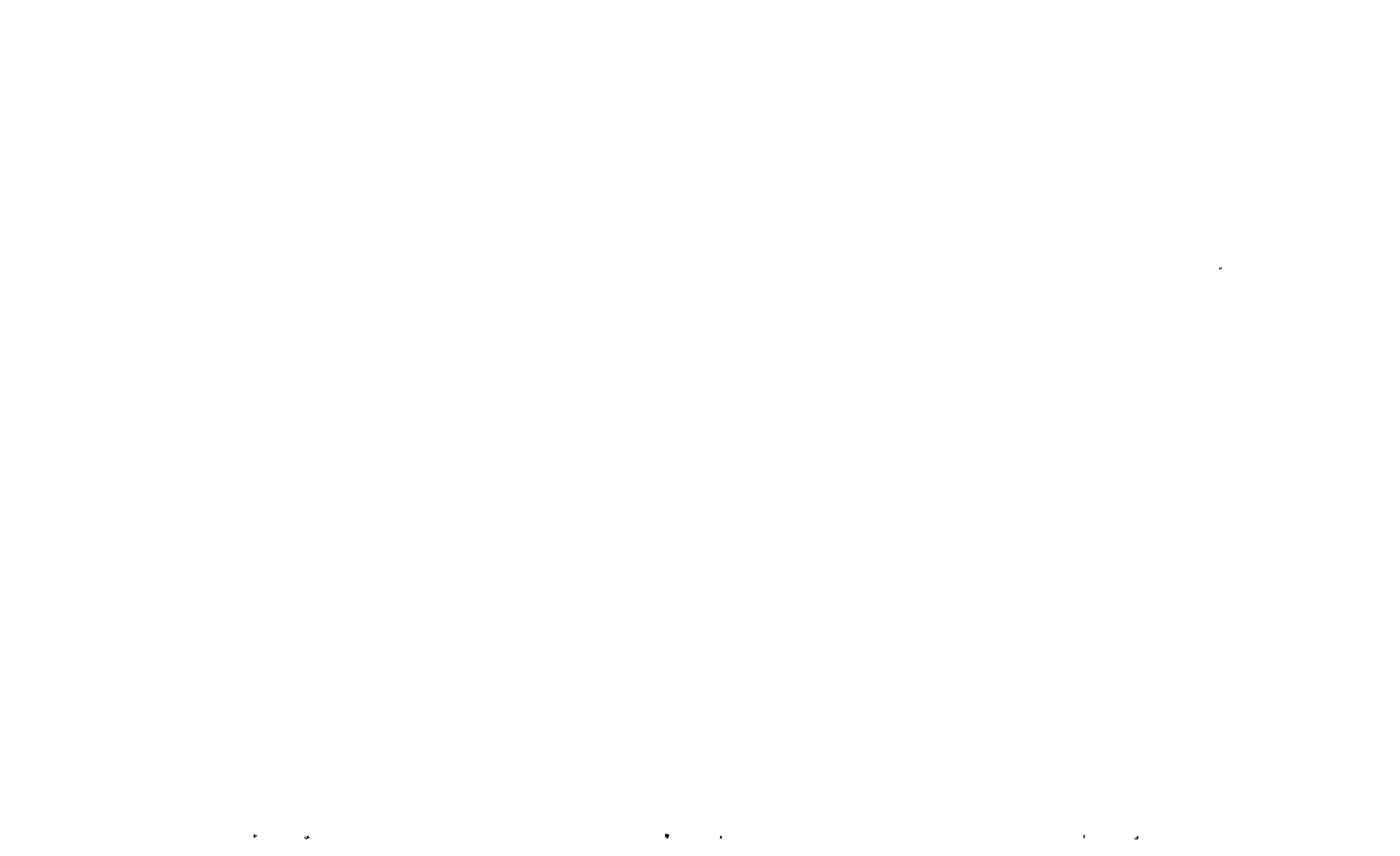
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1 Introduction

From May 1952 to January 1954 Counting Accelerometers were carried in B.O.A.C. Comet aircraft and acceleration records were obtained of the turbulence encountered in 680,000 miles of operational route flying.

The data are examined to determine the variation of turbulence with altitude and the relative importance of the turbulence occurring in clear air and in cumuloform cloud in the altitude band 27,500 feet to 42,500 feet, i.e. at cruising altitudes. A comparison is drawn between the high-altitude turbulence in different geographical locations.

2 Description of Equipment and Flying

2.1 Instrument and Installation

The Counting Accelerometer¹ responds to the accelerations imposed on it in a vertical direction and records the number of times each of a series of acceleration levels has been exceeded. Successive counters represent levels at intervals of 0.1g and readings are given for a range of 1.2g to 2.9g for upward accelerations and from 0.8g to -0.9g for downward. The above values are nominal and have been corrected in the report except where it is stated otherwise. An altimeter, airspeed indicator and spring-driven clock are grouped around the counter dial and the whole assembly is photographed at regular intervals of approximately 10 minutes duration.

For these experiments the Counting Accelerometer was rigidly attached to the airframe approximately 8 feet aft of the centre of gravity of the aircraft at the forward end of the luggage compartment.

2.2 The flying covered by the records

The records were made between May 1952 and January 1954 on 700 flights covering 680,000 miles of operational flying on routes connecting London with Johannesburg, Colombo, Singapore and Tokyo. Details of the routes are shown in Fig.1 and the distances flown in individual sectors are given in Table I. The distribution of recording time between months of the year is shown in Fig.2. Between London and Johannesburg records were obtained in all months of the year, but on routes to the east from Cairo nearly all the recording time lay between May and November.

3 Data

3.1 Accelerometer data

The accelerometer data consist of a series of consecutive records of average duration 9.4 minutes. Each record contains the number of times each acceleration level was exceeded and the speed and altitude of the aircraft.

In the sample sequence of records given in Table II each line records the time, airspeed and altitude at the end of an interval and the counts of accelerations exceeded during the interval. The values of aircraft weight were calculated on the basis of the take-off and landing weights recorded by the aircraft captain. In the records made during climb and descent the altitude reading is corrected for change of altitude during the preceding interval with due regard to the probable variation of gust frequency with altitude. Records which include the effects of ground loads are discarded. On an average, the first and last five minutes of each flight are, therefore, not included in the data. The altitudes affected are below about 12,500 feet.

Details of the time spent at each speed and altitude during climb, cruise and descent are given in Tables IX, X and XI.

A summary of the Counts of Acceleration is given in Appendix II.

3.2 Weather reports

For some flights B.O.A.C. provided copies of weather reports made by aircrews during flight. Fig.3 illustrates the weather report which corresponds with the records of Table II. Such reports provide valuable information on cloud conditions at the altitude of the aircraft. The weather reports were available for 98% of the high altitude turbulence encountered.

4 Variation in turbulence with altitude

Using the methods of Appendix I the acceleration data were expressed in terms of the magnitudes and distribution of the gusts encountered². Alleviation factors were obtained in terms of the mass parameter of the aircraft³. The gust counts calculated by this method are given in Table III. If the numbers of gusts in the two lowest altitude bands are increased in proportion to the lost recording time referred to in section 3.1 it is found that 91% of gusts greater than 10 ft/sec E.A.S. were below 27,500 ft. Fig.4 shows the gust spectrum for each altitude band from sea level to 42,500 ft. Fig.5 shows the variation with altitude of the average distance between gusts greater than 10, 20, and 30 ft/sec E.A.S. respectively. The upper portion of the 30 ft/sec curve is extrapolated from the spectrum in Fig.4 and may require to be altered when more information is obtained.

As upward and downward gusts were found in about equal numbers, Figs. 4 and 5 are based on the sum of the two.

Fig.5 shows a rapid decrease in turbulence from sea level upwards. From sea level to about 27,500 ft the distance between gusts of a given magnitude approximately doubles during every 3,500 ft rise. Above 27,500 ft the variation is probably small and is insignificant in the present data. The most reliable estimate of the turbulence at the high altitudes is that for the band centred on 35,000 ft in which most of the cruise was flown.

5 Turbulence at high altitude

At altitudes greater than 27,500 feet, i.e. cruising conditions, the data consist of 8,080 records, of average duration 9.4 minutes, representing a distance of 527,000 statute miles.

5.1 Location of turbulence of specific intensity

Table IV shows the distribution of all records according to their content of acceleration increments numerically greater than 0.23g. Accelerations of this magnitude, which are the smallest recorded by the instrument used, correspond to an average gust speed of 5.75 f.p.s. E.A.S. and occur on only 6.9% of the records. In 1.4% of the records $\pm 0.23g$ is exceeded at least 10 times.

Examination of the records in chronological sequence shows the bulk of the turbulence as isolated well-defined occurrences. Selections were made of all records containing 10 or more counts of acceleration increments numerically greater than 0.23g, and of all records containing accelerations greater than 0.52g; more than half the records obtained in this way satisfied both conditions.

The selected records were found to represent 81 separate occurrences of turbulence. The total counts of the accelerations which were experienced on these occasions are shown in Table V to comprise a large proportion of the total counts made above 27,500 feet.

5.2 The influence of weather conditions

E.O.A.C. crew weather reports are available for flights which contain 75 of the selected occasions of turbulence. These weather reports cover 98% of all gusts greater than 10 ft/sec E.A.S. at high altitude. The cloud descriptions given in Table VI were derived from these reports at the appropriate location along the flight path.

A distinction is drawn between the turbulence associated with cumuli-form cloud that may be anticipated by the pilot on visual evidence and avoided to some extent, and the turbulence that is unexpectedly encountered in clear air or in non-convective cloud such as cirrus and stratus. The counts of acceleration made under these two conditions are compared in Table VII. In all cases of turbulence for which weather reports are available, cumuli-form cloud was associated with about 75% of the gusts with speeds greater than 10 ft/sec E.A.S. and with all gusts greater than 20 ft/sec E.A.S.

5.3 Horizontal range of the turbulence

The horizontal extent of the turbulence along the path of the aircraft on the occasions selected is represented approximately by the number of consecutive records containing acceleration counts. The average distance covered by a record is 65 miles. The extents were determined approximately in 77 cases and their estimated relative frequency is shown in Fig.6.

5.4 The influence of geographical location

A comparison was made of the turbulence over different route sectors on the basis of the acceleration counts in Table VI. The $\pm 0.43g$ increment level is the most suitable as significant counts were made in most sectors and Table VI contains 97% of all counts made at this level. Similar results were obtained, however, when the $\pm 0.23g$ and $\pm 0.33g$ levels were used for the comparison.

Table VIII lists the sectors in descending order of turbulence. The turbulence is expressed in terms of the average distance to exceed $\pm 0.43g$ once and also as a ratio to the average turbulence over all routes. It is apparent from the table that in 5 sectors the turbulence exceeded the average value appreciably. Of these sectors, 4 lie to the east from Cairo and the relatively strong turbulence may, to some extent reflect the uneven seasonal distribution of the recording time on these routes (section 2.2). The turbulence on the remaining sector, Livingstone to Entebbe, is a more reliable estimate as the records were more evenly distributed through the year and the mileage and acceleration counts were much greater. This sector contrasts with the adjoining sectors, Livingstone to Johannesburg and Khartoum to Entebbe, both of which are below average. The weather reports show that the predominant cause of turbulence in this sector is cumulonimbus cloud which is probably associated with Lake Tanganyika, an extensive ground feature.

At the other extreme the sectors Cairo to Khartoum, Cairo to Bahrein and Bahrein to Karachi are significantly lacking in turbulence. These sectors all lie over desert.

6 Conclusions

The acceleration records obtained from Comet aircraft during 685,000 miles of operational flying on routes connecting London with South Africa and the Far East establish the following conclusions.

- (i) With increasing altitude there is a continuous decrease in the number of gusts. Above 30,000 ft no significant variation is shown by the present data.
- (ii) 91% of all gusts greater than 10 ft/sec E.A.S. were encountered below 27,500 feet.
- (iii) Weather conditions are known for 98% of the gusts greater than 10 ft/sec E.A.S. encountered above 27,500 ft. Cumuliform cloud was associated with 75% of these gusts and all those greater than 20 ft/sec E.A.S.
- (iv) In flight sectors where conditions favour the formation of cumuliform cloud gusts are more numerous on the average than over all routes.

Acknowledgements

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| <u>No.</u> | <u>Author</u> | <u>Title, etc.</u> |
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| 2 | - | Air Publication 970, Chapter 203. |
| 3 | J.K. Zbrczek | Gust Alleviation Factors. R & M 2970, August, 1953. |

TABLE I

Distances Flown in Flight Sectors

| Flight Sector | Number of Flights | Length of Sector Miles | Average Distance Flown Above 28,000 Ft. Miles | Total Distance Flown Above 28,000 Ft. 1000 Miles |
|---------------------------------|-------------------|------------------------|---|--|
| London - Rome | 98 | 925 | 640 | 62.7 |
| Rome - Cairo* | 103 | 1385 | 1095 | 112.8 |
| Cairo - Khartoum | 59 | 992 | 710 | 41.9 |
| Khartoum - Entebbe | 60 | 1090 | 810 | 48.6 |
| Entebbe - Livingstone | 57 | 1320 | 1030 | 58.7 |
| Livingstone - Johannesburg | 46 | 610 | 330 | 15.2 |
| Cairo - Bahrein | 44 | 1175 | 885 | 38.9 |
| Bahrein - Karachi | 48 | 1045 | 760 | 36.5 |
| Karachi - Calcutta ^Ø | 34 | 1425 | 1135 | 38.6 |
| Karachi - Bombay | 13 | 550 | 275 | 3.6 |
| Bombay - Colombo | 8 | 970 | 680 | 5.4 |
| Calcutta - Bangkok ⁺ | 34 | 1005 | 720 | 24.5 |
| Bangkok - Singapore | 14 | 900 | 620 | 8.7 |
| Bangkok - Manila | 14 | 1375 | 1090 | 15.3 |
| Manila - Okinawa | 11 | 960 | 680 | 7.5 |
| Okinawa - Tokyo | 11 | 1035 | 755 | 8.5 |
| Totals | 654 | | | 527.4 |

* alternatively Beirut

^Ø via Delhi

+ sometimes via Rangoon

Note: The above information relates to 712 flights. The combination of certain short sectors for the purposes of this report, as indicated, accounts for the above total of 654.

TABLE II
Specimen Acceleration Record Sequence

| Card Number | Time G.M.T. | Indicated Airspeed (10 kts) | Corrected Altitude I.C.A.N. (1000 ft) | Altitude I.C.A.N. (1000 ft) | Aircraft Weight (1000 lb) | Number of times each acceleration (g) was exceeded (1.0g is level flight) | | | | | | | | | | | | | | | | Remarks | | |
|-------------|-------------|-----------------------------|---------------------------------------|-----------------------------|---------------------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|---------|---|--|
| | | | | | | 0.08 | 0.10 | 0.28 | 0.58 | 0.48 | 0.57 | 0.67 | 0.77 | 1.25 | 1.35 | 1.43 | 1.52 | 1.62 | 1.72 | 1.82 | 1.92 | | | |
| 0717 | 1038 | 00 | | 03 | 97.4 | | | | | | | | | | | | | | | | | | On the ground at Livingstone. These accelerations are due to ground loads during taxiing and take-off and air loads during first stages of the climb. | |
| 0718 | 1048 | 23 | | 13 | 96.3 | | | 1 | 1 | 1 | 2 | 20 | 30 | 26 | 9 | 3 | 2 | 1 | | | | | | |
| 0719 | 1059 | 20 | 17 | 21 | 95.2 | | | | | | | | | | | | | | | | | | | |
| 0720 | 1109 | 20 | 24 | 27 | 94.1 | | | | | | | | | | | | | | | | | | | |
| 0721 | 1109 | 19 | 29 | 31 | 93.0 | | | | | | | | | | | | | | | | | | | |
| 0721 | 1118 | 22 | | 31 | 91.9 | | | | | | | | | | | | | | | | | | | |
| 0722 | 1128 | 22 | | 31 | 90.8 | | | | | | | | | | | | | | | | | | | |
| 0723 | 1138 | 22 | | 32 | 89.7 | | | | | | | | | | | | | | | | | | | |
| 0724 | 1148 | 22 | | 32 | 88.6 | | | | | | | | | | | | | | | | | | | |
| 0725 | 1158 | 22 | | 33 | 87.5 | | | | | | | | | | | | | | | | | | | |
| 0726 | 1208 | 22 | | 33 | 85.4 | | | | | | | | | | | | | | | | | | | |
| 0727 | 1218 | 22 | | 33 | 85.3 | | | | | | | | | | | | | | | | | | | |
| 0728 | 1228 | 21 | | 34 | 84.1 | | | | | | | | | | | | | | | | | | | |
| 0729 | 1238 | 21 | | 34 | 83.0 | | | | | | | | | | | | | | | | | | | |
| 0730 | 1248 | 21 | | 35 | 81.9 | | | | | | | | | | | | | | | | | | | |
| 0731 | 1258 | 21 | | 35 | 80.8 | | | | | | | | | | | | | | | | | | | |
| 0732 | 1308 | 21 | | 36 | 79.7 | | | | | | | | | | | | | | | | | | | |
| 0733 | 1318 | 21 | | 37 | 78.6 | | | | 4 | 9 | 28 | 42 | 52 | 36 | 18 | 11 | 5 | 4 | 3 | 3 | | | Gust accelerations in cumulonimbus | |
| 0734 | 1328 | 20 | | 37 | 77.5 | 1 | 1 | 3 | 6 | 13 | 12 | 25 | 42 | 60 | 29 | 20 | 11 | 5 | 4 | 2 | | | | |
| 0735 | 1338 | 22 | 31 | 25 | 76.4 | | | | | | | | | | | | | | | | | | | |
| 0736 | 1349 | 21 | 20 | 17 | 75.3 | | | | | | | | | | | | | | | | | | | |
| 0737 | 1359 | 21 | 11 | 07 | 74.2 | | | | | | | | | | | | | | | | | | | |
| 0738 | 1409 | 00 | | 04 | 73.1 | | | | | | | 2 | 9 | 16 | 21 | 9 | 4 | | | | | | | On the ground at Entebbe. Ground loads during landing and taxiing and air loads in last stages of descent. |
| | | | | | | | | | | | | | | | | | | | | | | | | |

These records were made on a flight from Livingstone to Entebbe on 16.4.53. The corresponding Weather Report is given in Fig.3.

TABLE III

Summary of Gust Speeds Encountered

| Altitude Above Sea Level I.C.A.N. | Flying Time Recorded | Flying Distance Recorded | Estimated Distance Flown | Estimated Number of Times a Given Gust Speed was Exceeded in the Recorded Distance Flown | | | | | | | | | | | | | | | | |
|-----------------------------------|----------------------|--------------------------|--------------------------|--|-----|-----|-----|-----|-----|-----|-----|------|------|-----|-----|----|----|----|----|----|
| | | | | Vertical Gust Speed ft/sec E.A.S. (+Up, -Down) | | | | | | | | | | | | | | | | |
| X 1000 ft | Hours | Stat. Miles | Stat. Miles | -45 | -40 | -35 | -30 | -25 | -20 | -15 | -10 | -7.5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| 0-2.5 | 5 | 860 | 10835 | | | | 2 | 5 | 8 | 18 | 48 | 72 | 315 | 145 | 31 | 11 | 2 | | | |
| 2.5-7.5 | 61 | 13615 | 22980 | | | | | 5 | 14 | 70 | 450 | 1090 | 1840 | 870 | 208 | 50 | 14 | 4 | | |
| 7.5-12.5 | 104 | 28280 | 28280 | 1 | 1 | 2 | 3 | 7 | 17 | 72 | 455 | 1090 | 1070 | 780 | 119 | 23 | 7 | | | |
| 12.5-17.5 | 87 | 28765 | 28765 | | | | | 2 | 7 | 20 | 100 | 272 | 360 | 140 | 23 | 3 | | | | |
| 17.5-22.5 | 109 | 36235 | 36235 | | | | 1 | 1 | 6 | 17 | 86 | 198 | 275 | 132 | 33 | 8 | 2 | 1 | | |
| 22.5-27.5 | 142 | 49015 | 49015 | | | | | 1 | 1 | 3 | 27 | 97 | 115 | 31 | 5 | 1 | 1 | | | |
| 27.5-32.5 | 334 | 128800 | 128800 | | | | | | 1 | 8 | 61 | 160 | 230 | 79 | 12 | 2 | | | | |
| 32.5-37.5 | 803 | 341200 | 341200 | | | | | 4 | 11 | 40 | 217 | 575 | 730 | 270 | 58 | 18 | 3 | 2 | | |
| 37.5-42.5 | 129 | 57090 | 57090 | | | | | | | 1 | 15 | 45 | 96 | 28 | 3 | 1 | | | | |
| Totals | 1774 | 683860 | 703200 | | | | | | | | | | | | | | | | | |

1
6
1

TABLE IV

Frequency of Occurrence of Acceleration Increments
Exceeding 0.23g between 27,500 ft and 42,500 ft

| Sum of the number of upward and downward acceleration increments greater than 0.23g | Number of Records Containing at least this number |
|---|---|
| 0 | 8080 |
| 1 | 558 |
| 2 | 335 |
| 3 | 247 |
| 4 | 204 |
| 5 | 182 |
| 10 | 112 |
| 15 | 77 |
| 20 | 57 |
| 25 | 43 |
| 30 | 38 |
| 35 | 30 |
| 40 | 24 |
| 45 | 16 |
| 50 | 13 |
| 60 | 9 |
| 70 | 7 |
| 80 | 5 |
| 90 | 4 |
| 100 | 1 |

TABLE V

Proportion of Acceleration Counts on Turbulent Occasions
between 27,500 ft and 42,500 ft

| Accel. Increment g | Number of Times each Acceleration Increment was Exceeded | | | | | | | | | |
|---|--|------|------|------|------|------|------|------|------|------|
| | 0.23 | 0.33 | 0.43 | 0.52 | 0.62 | 0.72 | 0.82 | 0.92 | 1.02 | 1.12 |
| Total Counts | 4185 | 1515 | 495 | 230 | 107 | 64 | 32 | 17 | 5 | 2 |
| Counts occurring on selected occasions | 3282 | 1369 | 481 | 230 | 107 | 64 | 32 | 17 | 5 | 2 |
| Not accounted for on selected occasions | 903 | 146 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ditto as percentage of total | 22 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE VI

Details of Turbulent Occasions Between 27,500 ft and 42,500 ft

| Date of Flight | Flight Sector | Location of Peak Turbulence | | | | Horizontal Extent of Turbulence | Maximum Upward and Downward Accelerations and Corresponding Gust Speeds | | | | Combined Number of Upward and Downward Accelerations Greater than Stated Increments | | | | | | | | | | Cloud at the Aircraft Position | | |
|----------------|----------------------------|-----------------------------|-----|------|---------|---------------------------------|---|------|---------------|----|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------|------|--|
| | | Time G.M.T. | Lat | Long | Alt | | g | | ft/sec E.A.S. | | 0.23g | 0.33g | 0.43g | 0.52g | 0.62g | 0.72g | 0.82g | 0.92g | 1.02g | 1.12g | | | |
| | | | Deg | Deg | 1000 ft | | X65 Miles | Up | Down | Up | | | | | | | | | | | | Down | |
| 2 4.52 | Khartoum - Entebbe | 0403 | 7N | 32E | 39 | 0-1 | 1.23 | 0.57 | 5 | 10 | 16 | 10 | 3 | | | | | | | | | | Alto cumulus |
| 2 4.52 | Khartoum - Entebbe | 0423 | 5N | 32E | 39 | 0-1 | 1.23 | 0.67 | 5 | 7 | 16 | 3 | | | | | | | | | | | Alto cumulus |
| 6 6.52 | London - Rome | 1600 | 46N | 8E | 42 | 0-2 | 1.33 | 0.77 | 8 | 5 | 12 | 2 | | | | | | | | | | | None (Cb tops at 20,000 ft) |
| 11 7.52 | Entebbe - Khartoum | 1445 | 3N | 32E | 30 | 0-2 | 1.33 | 0.67 | 10 | 10 | 14 | 5 | | | | | | | | | | | Cumulo nimbus |
| 3 11.52 | Livingstone - Entebbe | 1221 | 8S | 29E | 35 | 0-1 | 1.92 | 0.67 | 19 | 7 | 13 | 9 | 4 | 2 | 2 | 2 | 1 | 1 | | | | | Cumulo nimbus |
| 21.11.52 | Rome - Beirut | 1919 | 38N | 25E | 38 | 0-1 | 1.33 | 0.67 | 7 | 7 | 15 | 8 | 1 | | | | | | | | | | Cumulo nimbus |
| 13. 1 53 | Bombay - Colombo | 0345 | 17N | 74E | 34 | 0-2 | 1.43 | 0.77 | 12 | 7 | 27 | 16 | 3 | | | | | | | | | | None |
| 22 1.53 | Colombo - Bombay | 0324 | 12N | 77E | 38 | 2-4 | 1.33 | 0.67 | 7 | 7 | 32 | 6 | | | | | | | | | | | None |
| 22 1.53 | Colombo - Bombay | 0424 | 16N | 75E | 36 | 0-2 | 1.33 | 0.67 | 7 | 7 | 17 | 4 | | | | | | | | | | | None |
| 28. 1.53 | Karachi - Calcutta | 0115 | 24N | 73E | 31 | 4-6 | 1.43 | 0.48 | 13 | 16 | 158 | 34 | 4 | 1 | | | | | | | | | None |
| 28. 1.53 | Bangkok - Singapore | 1119 | 5N | 103E | 34 | 0-2 | 1.33 | 0.67 | 7 | 7 | 12 | 4 | | | | | | | | | | | Cumulo nimbus |
| 5. 2.53 | Livingstone - Entebbe | 1152 | 12S | 28E | 34 | 2-4 | 1.82 | 0.48 | 21 | 14 | 74 | 29 | 9 | 4 | 1 | 1 | 1 | | | | | | Cumulo nimbus |
| 5. 2.53 | Livingstone - Entebbe | 1302 | 6S | 30E | 36 | 1-3 | 1.52 | 0.48 | 10 | 10 | 48 | 36 | 13 | 6 | | | | | | | | | Cumulo nimbus |
| 7. 3.53 | Rome - Cairo | 1903 | 35N | 25E | 38 | 0-1 | 1.33 | 0.77 | 6 | 6 | 10 | 3 | | | | | | | | | | | None |
| 9. 3.53 | Livingstone - Entebbe | 1308 | 3S | 31E | 36 | 0-1 | 2.02 | 0.08 | 21 | 18 | 95 | 62 | 25 | 16 | 6 | 6 | 4 | 2 | 1 | | | | Cumulo nimbus |
| 31. 3 53 | Cairo - Khartoum | 2259 | 27N | 32E | 32 | 0-2 | 1.43 | 0.67 | 13 | 10 | 38 | 13 | 2 | | | | | | | | | | 7/8 Cirrostratus + Altostratus |
| 6. 4.53 | Livingstone - Entebbe | 1349 | 8S | 29E | 35 | 0-2 | 2.12 | 0.08 | 30 | 23 | 109 | 58 | 32 | 22 | 19 | 10 | 6 | 4 | 2 | 2 | | | Cumulo nimbus + cirrus |
| 6. 4.53 | Livingstone - Entebbe | 1419 | 6S | 30E | 36 | 1-3 | 1.43 | 0.67 | 11 | 8 | 99 | 58 | 14 | 5 | 3 | 3 | 1 | | | | | | Cumulo nimbus + cirrus |
| 16. 4.53 | Livingstone - Entebbe | 1318 | 3S | 31E | 37 | 0-2 | 1.82 | 0.08 | 17 | 19 | 196 | 118 | 59 | 39 | 16 | 11 | 6 | 4 | | | | | Cumulo nimbus |
| 20. 4.53 | Rome - Cairo | 1342 | 34N | 18E | 36 | 0-2 | 1.72 | 0.38 | 16 | 14 | 21 | 11 | 7 | 6 | 4 | 2 | | | | | | | 8/8 Cirrostratus |
| 21. 4.53 | Calcutta - Bangkok | 1013 | 16N | 96E | 36 | 0-1 | 1.33 | 0.67 | 7 | 7 | 15 | 3 | | | | | | | | | | | Cumulo nimbus |
| 21. 4.53 | Manila - Itazuka | 1851 | 27N | 127E | 30 | - | 1.52 | 0.57 | 12 | 10 | 12 | 6 | 3 | 1 | | | | | | | | | None |
| 13. 5.53 | Bangkok - Manila | 1252 | 15N | 111E | 39 | 0-1 | 1.23 | 0.67 | 3 | 5 | 16 | 1 | | | | | | | | | | | Cumulo nimbus |
| 15. 5.53 | Delhi - Karachi | 0323 | 27N | 72E | 35 | 0-1 | 1.52 | 0.57 | 12 | 11 | 24 | 11 | 4 | 1 | | | | | | | | | Not known |
| 19. 5.53 | Manila - Okinawa | 1804 | 21N | 124E | 34 | 0-1 | 1.82 | 0.48 | 20 | 12 | 67 | 48 | 20 | 7 | 2 | 1 | 1 | | | | | | Cumulo nimbus |
| 26 5.53 | London - Rome | 1809 | 48N | 5E | 37 | 0-2 | 1.33 | 0.57 | 8 | 10 | 50 | 26 | 2 | | | | | | | | | | Cumulo nimbus |
| 15. 6 53 | Manila - Bangkok | 2307 | 15N | 103E | 34 | 5-7 | 1.72 | 0.48 | 21 | 15 | 118 | 32 | 6 | 2 | 1 | 1 | | | | | | | Cumulo nimbus in 8/8 Alto stratus |
| 19. 6.53 | Calcutta - Bangkok | 0707 | 17N | 96E | 33 | 1-3 | 1.72 | 0.38 | 15 | 13 | 85 | 38 | 19 | 8 | 5 | 2 | | | | | | | 6/8 Stratus |
| 20 6.53 | Singapore - Bangkok | 0302 | 10N | 102E | 34 | 0-1 | 1.82 | 0.38 | 18 | 14 | 72 | 44 | 16 | 5 | 2 | 1 | 1 | | | | | | 8/8 Stratus |
| 24. 6.53 | Rome - Cairo | 2010 | 37N | 23E | 35 | 0-1 | 1.33 | 0.67 | 7 | 7 | 14 | 2 | | | | | | | | | | | None |
| 24. 6.53 | Rome - Cairo | 2040 | 34N | 26E | 34 | 0-2 | 1.33 | 0.67 | 8 | 8 | 26 | 8 | | | | | | | | | | | None |
| 30. 6.53 | Livingstone - Johannesburg | 1308 | 22S | 27E | 36 | 0-1 | 1.23 | 0.67 | 6 | 8 | 10 | 1 | | | | | | | | | | | None |
| 1. 7.53 | Entebbe - Khartoum | 1555 | 4N | 32E | 35 | 0-2 | 1.43 | 0.48 | 12 | 15 | 70 | 24 | 8 | 2 | | | | | | | | | Cumulo nimbus in Altostratus |
| 8. 7.53 | Khartoum - Entebbe | 0242 | 11N | 32E | 33 | 1-3 | 1.43 | 0.57 | 11 | 11 | 51 | 12 | 2 | | | | | | | | | | Cumulo nimbus |
| 5. 8.53 | Rangoon - Calcutta | 0530 | 19N | 93E | 37 | 0-2 | 1.52 | 0.57 | 12 | 11 | 70 | 27 | 11 | 3 | | | | | | | | | Cumulo nimbus in Altostratus |
| 5. 8.53 | Calcutta - Delhi | 0845 | 27N | 83E | 36 | 0-1 | 1.23 | 0.67 | 5 | 8 | 10 | 1 | | | | | | | | | | | Not known |
| 8. 8.53 | Tokyo - Okinawa | 2220 | 32N | 134E | 33 | 0-2 | 1.33 | 0.77 | 10 | 7 | 24 | 5 | 1 | | | | | | | | | | Cumulo nimbus |
| 10. 8.53 | Manila - Bangkok | 0606 | 15N | 110E | 35 | 4-6 | 1.23 | 0.67 | 6 | 9 | 89 | 13 | 1 | | | | | | | | | | Cumulo nimbus in thin Stratus |
| 27. 8 53 | Johannesburg - Livingstone | 0915 | 22S | 27E | 36 | 1-3 | 1.43 | 0.67 | 10 | 8 | 75 | 16 | 1 | | | | | | | | | | None |
| 6. 9.53 | Calcutta - Rangoon | 0606 | 22N | 90E | 28 | 0-1 | 1.62 | 0.57 | 18 | 13 | 20 | 12 | 4 | 1 | 1 | | | | | | | | Alto cumulus |
| 9 9 53 | Rangoon - Calcutta | 0532 | 20N | 92E | 35 | - | 1.43 | 0.57 | 10 | 10 | 45 | 12 | 2 | | | | | | | | | | Alto cumulus |
| 9 9 53 | Calcutta - Delhi | 0748 | 24N | 86E | 29 | 0-1 | 1.52 | 0.38 | 15 | 18 | 17 | 13 | 4 | 2 | 1 | | | | | | | | Alto cumulus |
| 14. 9.53 | Bangkok - Singapore | 0750 | 9N | 102E | 35 | 0-1 | 1.43 | 0.67 | 11 | 8 | 38 | 11 | 1 | | | | | | | | | | 3/8 Altostratus |
| 14. 9.53 | Bangkok - Singapore | 0900 | 4N | 103E | 34 | 2-4 | 1.62 | 0.08 | 12 | 18 | 82 | 35 | 15 | 6 | 3 | 1 | 1 | 1 | | | | | Cumulo nimbus + 6/8 Cumulus |
| 19. 9.53 | London - Rome | 1711 | 44N | 10E | 28 | - | 1.33 | 0.77 | 8 | 6 | 26 | 3 | | | | | | | | | | | Cumulo nimbus |
| 22. 9.53 | Tokyo - Okinawa | 1559 | 32N | 134E | 34 | 3-5 | 1.23 | 0.57 | 6 | 11 | 24 | 3 | 1 | | | | | | | | | | 8/8 Cirrus |
| 23. 9.53 | Manila - Bangkok | 2345 | 15N | 112E | 35 | 0-1 | 1.33 | 0.67 | 9 | 9 | 13 | 4 | | | | | | | | | | | 7/8 Cirrus, (cumulo nimbus 5000' below) |

TABLE VI (Contd.)

| Date of Flight | Flight Sector | Location of Peak Turbulence | | | | Horizontal Extent of Turbulence | Maximum Upward and Downward Accelerations and Corresponding Gust Speeds | | | | Combined Number of Upward and Downward Accelerations Greater than Stated Increments | | | | | | | | | | Cloud at the Aircraft Position | |
|------------------------------|----------------------------|-----------------------------|-----|------|-----|---------------------------------|---|-------|---------------|------|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------|------------------------------------|
| | | Time G.M.T | Lat | Long | Alt | | g | | ft/sec L.A.S. | | 0.23g | 0.33g | 0.43g | 0.52g | 0.62g | 0.72g | 0.82g | 0.92g | 1.02g | 1.12g | | |
| | | | | | | | Up | Down | Up | Down | | | | | | | | | | | | |
| 24. 9 53 | Rome - London | 0338 | 47N | 8E | 35 | 0-1 | 1.52 | 0.57 | 11 | 9 | 20 | 5 | 2 | 1 | | | | | | | | 8/8 Stratus below |
| 26. 9.53 | London - Rome | 1040 | 48N | 5E | 39 | 2-4 | 1.52 | 0.57 | 12 | 8 | 66 | 14 | 3 | 1 | | | | | | | | None |
| 29. 9.53 | Okinawa - Manila | 2043 | 22N | 125E | 37 | 0-2 | 1.33 | 0.67 | 8 | 6 | 23 | 4 | | | | | | | | | | Cumulo nimbus |
| 29. 9.53 | Okinawa - Manila | 2123 | 19N | 123E | 39 | 0-1 | 1.52 | 0.67 | 12 | 8 | 10 | 7 | 5 | 1 | | | | | | | | Cumulo nimbus |
| 4.10.53 | London - Rome | 0958 | 44N | 10E | 39 | 0-2 | 1.43 | 0.48 | 9 | 10 | 36 | 13 | 6 | 3 | 1 | 1 | | | | | | 8/8 Altostratus |
| 6.10.53 | London - Rome | 1919 | 47N | 8E | 39 | 0-1 | 1.33 | 0.38 | 7 | 13 | 17 | 7 | 1 | 1 | 1 | | | | | | | None |
| 6.10.53 | Rome - Beirut | 2200 | 41N | 17E | 34 | 0-2 | 1.33 | 0.38 | 9 | 15 | 17 | 5 | 1 | 1 | 1 | | | | | | | Not known |
| 8.10.53 | London - Rome | 1123 | 45N | 9E | 38 | 0-1 | 1.33 | 0.67 | 8 | 6 | 25 | 6 | | | | | | | | | | None |
| 9.10.53 | Beirut - Rome | 0313 | 40N | 22E | 36 | 0-1 | 1.33 | 0.57 | 8 | 10 | 14 | 6 | 1 | | | | | | | | | Cumulo nimbus |
| 12.10.53 | Khartoum - Entebbe | 0455 | 5N | 32E | 33 | 0-1 | 1.33 | 0.57 | 6 | 10 | 14 | 4 | 2 | | | | | | | | | None (8/8 Cirrostratus above) |
| 13.10.53 | Livingstone - Entebbe | 1233 | 7S | 30E | 35 | 0-1 | 1.52 | 0.57 | 11 | 10 | 15 | 13 | 5 | 2 | | | | | | | | Cumulo nimbus in 1/8 Cumulus |
| 14.10.53 | Cairo - Rome | 0150 | 41N | 15E | 30 | 0-1 | 1.43 | 0.67 | 10 | 8 | 29 | 6 | 1 | | | | | | | | | Not known |
| 14.10.53 | Rome - London | 0438 | 45N | 9E | 36 | 0-1 | 1.43 | 0.57 | 10 | 9 | 13 | 5 | 2 | | | | | | | | | Not known |
| 16.10.53 | Livingstone - Entebbe | 1215 | 8S | 29E | 38 | 0-1 | 1.33 | 0.38 | 10 | 18 | 12 | 6 | 1 | 1 | 1 | | | | | | | Cumulo nimbus in 8/8 Cirrostratus |
| 18.10.53 | London - Rome | 1613 | 47N | 8E | 37 | 1-3 | 1.33 | 0.48 | 8 | 11 | 35 | 9 | 2 | 1 | | | | | | | | Not known |
| 21.10.53 | Khartoum - Entebbe | 0419 | 8N | 32E | 35 | 0-1 | 1.72 | 0.38 | 19 | 16 | 89 | 50 | 24 | 14 | 9 | 1 | | | | | | Alto cumulus |
| 21.10.53 | Entebbe - Livingstone | 0930 | 13S | 27E | 36 | - | 1.33 | 0.48 | 5 | 9 | 20 | 2 | 1 | 1 | | | | | | | | 6/8 Cirrus |
| 24.10.53 | Rome - Cairo | 1314 | 39N | 18E | 32 | 0-1 | 1.82 | 0.28 | 20 | 19 | 50 | 40 | 17 | 12 | 7 | 5 | 1 | | | | | Cirrostratus (cumulo nimbus below) |
| 25.10.53 | Bangkok - Manila | 1212 | 14N | 106E | 35 | 0-2 | 1.43 | 0.28 | 14 | 23 | 76 | 34 | 6 | 2 | 1 | 1 | | | | | | Cumulo nimbus |
| 26.10.53 | Cairo - Elmas | 0416 | 41N | 15E | 30 | 0-2 | 1.92 | 0.53 | 22 | 15 | 52 | 31 | 16 | 9 | 4 | 3 | 1 | 1 | | | | Cumulo nimbus |
| 27.10.53 | Tokyo - Okinawa | 1550 | 33N | 135E | 31 | 1-3 | 1.43 | 0.67 | 11 | 9 | 59 | 14 | 3 | | | | | | | | | Stratus |
| 27.10.53 | Tokyo - Okinawa | 1710 | 29N | 137E | 35 | 0-2 | 1.82 | -0.02 | 23 | 28 | 89 | 43 | 22 | 13 | 6 | 4 | 2 | 1 | 1 | | | Cumulo nimbus |
| 31.10.53 | Entebbe - Livingstone | 0717 | 7S | 30E | 33 | 0-1 | 1.92 | 0.08 | 22 | 22 | 44 | 19 | 6 | 4 | 3 | 3 | 3 | 2 | 1 | | | Cumulo nimbus |
| 5.11.53 | Bombay - Colombo | 0840 | 12N | 77E | 40 | 0-1 | 1.43 | - | 8 | - | 11 | 1 | 1 | | | | | | | | | 6/8 Cirrus |
| 11.11.53 | Beirut - Rome | 0322 | 37N | 28E | 34 | 0-1 | 1.82 | 0.43 | 20 | 14 | 19 | 15 | 11 | 6 | 2 | 2 | 1 | | | | | Cumulo nimbus |
| 24.11.53 | Singapore - Bangkok | 0736 | 8N | 102E | 35 | 2-4 | 1.52 | 0.57 | 12 | 11 | 33 | 15 | 6 | 2 | | | | | | | | Stratus |
| 30.11.53 | Entebbe - Livingstone | 0900 | 9S | 29E | 34 | 0-1 | 1.52 | 0.77 | 12 | 6 | 16 | 6 | 4 | 1 | | | | | | | | Cumulo nimbus |
| 1.12.53 | Johannesburg - Livingstone | 0915 | 20S | 27E | 31 | 0-2 | 1.43 | 0.57 | 10 | 10 | 39 | 15 | 7 | | | | | | | | | Stratus |
| 1.12.53 | Livingstone - Entebbe | 1150 | 12S | 28E | 35 | 0-1 | 1.92 | 0.38 | 19 | 13 | 8 | 6 | 4 | 2 | 2 | 1 | 1 | 1 | | | | Cumulus |
| 1.12.53 | Livingstone - Entebbe | 1240 | 7S | 30E | 37 | 0-1 | 1.82 | 0.57 | 17 | 10 | 33 | 13 | 5 | 3 | 1 | 1 | 1 | | | | | Cumulus |
| 4.12.53 | Livingstone - Entebbe | 1255 | 6S | 30E | 39 | 0-1 | 1.72 | 0.38 | 15 | 13 | 61 | 39 | 18 | 10 | 2 | 1 | | | | | | Cumulo nimbus + 4/8 Cumulus |
| 8.12.53 | Livingstone - Entebbe | 1245 | 5S | 30E | 38 | 0-1 | 1.43 | 0.67 | 11 | 6 | 21 | 7 | 1 | | | | | | | | | 8/8 Cirrostratus |
| 29.12.53 | Livingstone - Entebbe | 1300 | 8S | 29E | 39 | 0-2 | 1.33 | 0.67 | 8 | 8 | 18 | 4 | | | | | | | | | | Cumulo nimbus |
| 3.1.54 | Khartoum - Cairo | 2054 | 18N | 32E | 36 | 0-2 | 1.33 | 0.67 | 7 | 7 | 13 | 5 | | | | | | | | | | None |
| Total Counts on 81 Occasions | | | | | | | | | | | 3282 | 1369 | 481 | 230 | 107 | 64 | 32 | 17 | 5 | 2 | | |

TABLE VII

Accelerations in Clear Air and Cumuliform Cloud on Turbulent Occasions between 27,500 ft and 42,500 ft

| Cloud Condition | Number of Times each Acceleration Increment was exceeded | | | | | | | | | | |
|--------------------------------------|---|------|------|-------|------|------|------|------|------|------|------|
| | Accel. increment g | 0.23 | 0.33 | 0.43 | 0.52 | 0.62 | 0.72 | 0.82 | 0.92 | 1.02 | 1.12 |
| | Average gust speed ft/sec | 5.75 | 8.25 | 10.75 | 13.0 | 15.5 | 18.0 | 20.5 | 23.0 | 25.5 | 28.0 |
| Cumuliform | | 2046 | 962 | 364 | 185 | 86 | 53 | 30 | 17 | 5 | 2 |
| Clear air } Cirrus } Stratus } | | 1108 | 370 | 107 | 42 | 20 | 11 | 2 | | | |
| Not known | | 128 | 37 | 10 | 3 | 1 | | | | | |
| | Total | 3282 | 1369 | 481 | 230 | 107 | 64 | 32 | 17 | 5 | 2 |
| | Counts occurring in cumuliform cloud and clear air as a % of those occurring under known conditions | | | | | | | | | | |
| Cumuliform | | 65 | 72 | 77 | 82 | 81 | 83 | 94 | 100 | 100 | 100 |
| Clear air } Cirrus } Stratus } | % | 35 | 28 | 23 | 18 | 19 | 17 | 6 | 0 | 0 | 0 |

TABLE VIII

Turbulence in Flight Sectors Between 27,500 ft and 42,500 ft

| Sector | Distance Flown X1000 Miles | Number of Accelerations Exceeding $\pm 0.43g$ | Average Distance to Exceed $+0.43g$ once. Miles | Turbulence Ratio <u>Overall Miles/Count</u> Sector Miles/Count |
|----------------------------|----------------------------|---|---|--|
| Bangkok - Singapore | 8.7 | 38 | 230 | 4.7 |
| Manila - Okinawa | 7.5 | 28 | 270 | 4.0 |
| Entebbe - Livingstone | 58.7 | 201 | 290 | 3.8 |
| Okinawa - Tokyo | 8.5 | 27 | 310 | 3.5 |
| Calcutta - Bangkok | 24.5 | 36 | 680 | 1.6 |
| Bangkok - Manila | 15.3 | 13 | 1200 | 0.91 |
| Khartoum - Entebbe | 48.6 | 39 | 1200 | 0.91 |
| Bombay - Colombo | 5.4 | 4 | 1400 | 0.77 |
| Livingstone - Johannesburg | 15.2 | 8 | 1900 | 0.59 |
| Rome - Cairo | 112.8 | 55 | 2100 | 0.53 |
| Karachi - Calcutta | 38.6 | 12 | 3200 | 0.34 |
| London - Rome | 62.7 | 18 | 3500 | 0.31 |
| Cairo - Khartoum | 41.9 | 2 | 21000 | } < 0.1 |
| Cairo - Bahrain | 38.9 | 0 | - | |
| Bahrain - Karachi | 36.5 | 0 | - | |
| Karachi - Bombay | 3.6 | 0 | - | * |
| All routes | 527.4 | 481 | 1090 | |

* No significance.

TABLE IX

Estimated Time in Minutes Spent at Each Speed and Altitude During Climb

| | | Altitude Above Sea Level, I.C.A.N. (X 1000 ft) | | | | | | | | | | | | | | | | | | | | | | | | | Totals | | | |
|--------------------------|-----|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--------|------|------|-------|
| | | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | 25 | 26 | 27 |
| Indicated Airspeed Knots | 110 | 15 | 5 | 10 | | | | | 10 | | 10 | | | | | | | | | | | | | | | | | | 50 | |
| | 120 | 80 | 25 | 25 | | | | | 20 | | | | | | | | | | | | | | | | | | | | 150 | |
| | 130 | 135 | 25 | 40 | 25 | | 10 | | | | | | | | | | | | | | | | | | | | | | 235 | |
| | 140 | 130 | 115 | 60 | 20 | 20 | | | | 10 | | | | | | | | | | | | | | | | | | | 355 | |
| | 150 | 65 | 130 | 130 | 95 | 50 | 65 | 40 | 15 | 10 | | 5 | | | | | | | | | | 10 | | | | | | | 615 | |
| | 160 | 35 | 120 | 160 | 60 | 40 | 120 | 75 | 35 | 35 | 5 | 10 | | 10 | | | | | | | | | | | | | | | 705 | |
| | 170 | 5 | 65 | 110 | 230 | 325 | 255 | 170 | 40 | 65 | 10 | | 10 | | | | | | | | | | | | | | | | 1285 | |
| | 180 | | 35 | 65 | 70 | 45 | 90 | 105 | 30 | 10 | 10 | | 20 | | | | | | | | 10 | | | | 10 | 20 | | 10 | 530 | |
| | 190 | | | | 10 | | 75 | 115 | 75 | 95 | 20 | 30 | 10 | 20 | 20 | 20 | | 10 | | 10 | 65 | 10 | 30 | 10 | 55 | 65 | 65 | 170 | 255 | 1235 |
| | 200 | | | | 10 | | 85 | 140 | 130 | 185 | 120 | 55 | 65 | 30 | 30 | 20 | 65 | 65 | 65 | 105 | 65 | 105 | 140 | 245 | 365 | 665 | 675 | 735 | 960 | 5125 |
| | 210 | | | 10 | | 10 | | 45 | 95 | 105 | 45 | 160 | 65 | 55 | 65 | 85 | 140 | 120 | 300 | 235 | 375 | 450 | 500 | 590 | 440 | 320 | 355 | 180 | 65 | 4810 |
| | 220 | | | | | 10 | 20 | 95 | 75 | 130 | 235 | 170 | 130 | 235 | 245 | 280 | 205 | 320 | 355 | 255 | 245 | 235 | 130 | 30 | 40 | 20 | 10 | 10 | | 3480 |
| | 230 | | | 20 | | 10 | 10 | 20 | 55 | 85 | 85 | 205 | 190 | 130 | 160 | 140 | 105 | 45 | 75 | 30 | 20 | | 10 | | | | | | | 1395 |
| | 240 | | | | | | 10 | | 20 | 40 | 30 | 65 | 30 | 20 | 20 | | 10 | | 10 | | | | | | | | | | | 255 |
| 250 | | | | | | | | 10 | | | | | | 10 | | | | | | | | | | | | | | | 20 | |
| 260 | | | | | | | | 10 | | | | | | | | | | | | | | | | | | | | | 10 | |
| Totals | | 465 | 530 | 630 | 520 | 510 | 740 | 805 | 620 | 770 | 570 | 695 | 525 | 510 | 540 | 545 | 525 | 560 | 805 | 635 | 780 | 810 | 810 | 875 | 910 | 1090 | 1105 | 1105 | 1280 | 20265 |

This table represents 710 climbs

TABLE X

Estimated Time in Minutes Spent at Each Speed and Altitude During Cruise

| | | Altitude Above Sea Level, I.C.A.N. (X 1000 ft) | | | | | | | | | | | | | | Totals | |
|--------------------------|-----|--|------|------|------|------|------|-------|-------|------|------|------|------|-----|-----|--------|-------|
| | | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | | 42 |
| Indicated Airspeed Knots | 170 | 10 | 10 | 20 | 10 | 20 | 20 | 20 | 20 | 30 | 20 | 20 | | 10 | | | 210 |
| | 180 | 75 | 55 | 150 | 95 | 245 | 255 | 140 | 170 | 130 | 75 | 95 | 30 | 45 | 40 | 10 | 1610 |
| | 190 | 590 | 900 | 885 | 745 | 760 | 535 | 40 | 280 | 190 | 215 | 205 | 130 | 85 | 10 | | 5570 |
| | 200 | 780 | 425 | 535 | 245 | 225 | 355 | 620 | 845 | 845 | 1045 | 980 | 620 | 265 | 30 | 30 | 7845 |
| | 210 | 320 | 290 | 470 | 780 | 1855 | 3555 | 4880 | 4495 | 4905 | 4025 | 2395 | 1080 | 375 | 40 | | 29465 |
| | 220 | 340 | 430 | 1155 | 2245 | 3150 | 4250 | 4265 | 4110 | 3150 | 1945 | 790 | 365 | 45 | | | 26240 |
| | 230 | 160 | 190 | 330 | 660 | 725 | 590 | 760 | 565 | 310 | 95 | 20 | | | | | 4405 |
| | 240 | 20 | 10 | 40 | 10 | 45 | 20 | 45 | 20 | 10 | | 10 | | | | | 230 |
| | 250 | 10 | | 10 | 10 | | | | | | | | | | | | 30 |
| | 260 | | | | 10 | | | | 10 | | | | | | | | 20 |
| 270 | | | 10 | | | | | | | | | | | | | 10 | |
| Totals | | 2305 | 2310 | 3605 | 4810 | 7025 | 9580 | 10780 | 10505 | 9570 | 7420 | 4515 | 2225 | 825 | 120 | 40 | 75635 |

This table represents 712 cruises

TABLE XI

Estimated Time in Minutes Spent at Each Speed and Altitude During Descent

| | | Altitude Above Sea Level, I.C.A.N. (X 1000 ft) | | | | | | | | | | | | | | | | | | | | | | | | | | Totals | | |
|--------------------------|-----|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|-------|------|
| | | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | 26 | 27 |
| Indicated Airspeed Knots | 110 | 310 | 115 | 40 | | | 10 | 20 | | | | | | | | | | | | | | | | | | | | | 495 | |
| | 120 | 205 | 300 | 125 | 30 | 35 | 20 | 5 | 10 | | | | | | | | | | | | | | | | | | | | 730 | |
| | 130 | 30 | 265 | 125 | 75 | 40 | 20 | | | 5 | | | | | | | | | | | | | | | | | | | 560 | |
| | 140 | 5 | 175 | 105 | 65 | 70 | 35 | 40 | 10 | 20 | 15 | | | | 10 | | | | | | | | | | | | | | 550 | |
| | 150 | 5 | 95 | 115 | 65 | 100 | 130 | 75 | 40 | 60 | 20 | 20 | 10 | | | | | | | | | | | | | | | | 735 | |
| | 160 | | 65 | 160 | 115 | 195 | 100 | 170 | 155 | 130 | 85 | 45 | 20 | 10 | | | 10 | | | | | | | | | | | | 1260 | |
| | 170 | | 15 | 45 | 110 | 65 | 105 | 200 | 165 | 155 | 120 | 85 | 30 | 20 | | | 10 | 10 | | | | 10 | | 10 | | | | 10 | 1165 | |
| | 180 | | | 15 | 25 | 50 | 125 | 110 | 130 | 75 | 195 | 65 | 105 | 75 | | 10 | 10 | | 40 | | 10 | 10 | 20 | | | 10 | | | 1080 | |
| | 190 | | | | | 40 | 20 | 55 | 65 | 75 | 130 | 130 | 95 | 30 | 40 | 20 | 30 | 10 | 85 | 20 | 20 | 30 | | 40 | 10 | 30 | | 30 | 10 | 1015 |
| | 200 | | | | 20 | 10 | | 55 | 20 | 95 | 55 | 95 | 120 | 75 | 75 | 65 | 85 | 115 | 75 | 45 | 45 | 75 | 55 | 75 | 65 | 65 | 40 | 75 | 85 | 1585 |
| | 210 | | | | | | | 20 | 30 | 85 | 95 | 140 | 115 | 95 | 115 | 85 | 115 | 120 | 190 | 160 | 180 | 130 | 205 | 195 | 205 | 170 | 190 | 140 | 160 | 2940 |
| | 220 | | | | | | | | 20 | 40 | 85 | 40 | 75 | 130 | 120 | 105 | 95 | 95 | 195 | 150 | 130 | 275 | 275 | 180 | 235 | 340 | 255 | 310 | 215 | 3365 |
| | 230 | | | | | | 10 | | | | 40 | 10 | 65 | 40 | 20 | 45 | 45 | 45 | 115 | 45 | 40 | 40 | 75 | 30 | 45 | 85 | 75 | 30 | 45 | 945 |
| | 240 | | | | | | | | | 10 | | | | | 10 | | 20 | 20 | 40 | | 20 | 30 | | 10 | 10 | 20 | 30 | | 10 | 250 |
| | 250 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 260 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Totals | 555 | 1030 | 730 | 505 | 605 | 565 | 740 | 665 | 750 | 840 | 630 | 635 | 475 | 380 | 360 | 420 | 435 | 700 | 440 | 455 | 570 | 640 | 540 | 580 | 730 | 580 | 595 | 525 | 16520 | |

This table represents 686 descents

APPENDIX I

Method of translating acceleration into gust speed

It is assumed that the normal acceleration at the instrument position is that at the centre of gravity of the aircraft. The recorded accelerations are translated into vertical gust speeds by the following method.

Aircraft weight is divided into bands of width 10,000 lb centred on mean weights of 104,500 lb, 94,500 lb, 84,500 lb, 74,500 lb, 64,500 lb.

Indicated airspeed is corrected for pitot head position error and compressibility. The airspeed range is divided into 10 knot bands.

The altitude range is divided into a sea level band from 0 to 2500 ft and bands of 5000 ft width centred on 5, 10, 15, 20, 25, 30, 35 and 40,000 feet.

The counts of acceleration are grouped according to the weight, airspeed and altitude of the aircraft and the gust speed corresponding to each group is found from the formula:

$$U = \frac{\delta n w}{F \frac{1}{2} \rho_0 a V}$$

- U equivalent vertical gust speed
 δn normal acceleration increment in g units
w wing loading
F gust alleviation factor* (Zbrozek)
 ρ_0 air density at sea level (I.C.A.O.)
a slope of the lift curve at appropriate Mach No.
V indicated airspeed

By simple graphical interpolation the counts are referred to gust speeds of $7\frac{1}{2}$, 10, 15, 20 ft/sec and a gust distribution is obtained for each altitude band. The mileage flown in each band is calculated and gust spectra are obtained in terms of the average distance between gusts exceeding different magnitudes.

* The gust is assumed to increase linearly to its maximum value in a horizontal distance of 100 feet. The alleviating factor is calculated as a function of the mass parameter $U_g = \frac{2w}{g \rho \bar{c} a}$ where ρ is air density and \bar{c} is the mean wing chord. Allowance is made for the effect of wing aspect ratio on the rate of growth of lift and for the effect of compressibility on the unsteady lift function.

APPENDIX II

Summary of Acceleration Data from Comet Aircraft (April 1952 to January 1954)

| Indicated Airspeed (10 knots units) | Altitude Above Sea Level (1000 ft units) | Aircraft Weight (10,000 lb units) | Recording Time (9.4 min units) | Number of Times Each Level of Acceleration was Exceeded | | | | | | | | | | | | | | | | | |
|--|--|--|---|---|----------|----------|----------|----------|------------|------------|--------------|--------------|------------|------------|----------|----------|----------|----------|----------|----------|----|
| | | | | Nominal Acceleration (see footnote) | | | | | | | | | | | | | | | | | |
| | | | | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g | | |
| 14 | 00 | 06 | 001 001 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 000 | 000 000 | 0000 0000 | 0008 0008 | 004 004 | 000 000 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | | |
| 12 | 00 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 13 | 00 | 07 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0003 | 002 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 14 | 00 | 07 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 005 | 0013 | 0030 | 005 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 15 | 00 | 07 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0011 | 001 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 16 | 00 | 07 | 005 | 00 | 02 | 06 | 05 | 07 | 009 | 018 | 0020 | 0055 | 031 | 009 | 09 | 02 | 02 | 02 | 00 | 00 | 00 |
| 17 | 00 | 07 | 003 022 | 00 00 | 00 02 | 00 06 | 00 05 | 00 07 | 000 009 | 000 023 | 0000 0034 | 0003 0102 | 000 039 | 000 009 | 00 09 | 00 02 | 00 02 | 00 02 | 00 00 | 00 00 | |
| 16 | 00 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 17 | 00 | 08 | 001 002 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 000 | 000 000 | 0000 0000 | 0000 0000 | 000 000 | 000 000 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | |
| 15 | 00 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 001 | 003 | 0011 | 0013 | 006 | 001 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 18 | 00 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 21 | 00 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 23 | 00 | 09 | 002 005 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 001 | 000 003 | 0000 0011 | 0000 0013 | 000 006 | 000 001 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | |
| 12 | 00 | 10 | 001 001 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 000 | 001 001 | 0001 0001 | 0005 0005 | 002 002 | 000 000 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | |
| | | | 031 | 00 | 02 | 06 | 05 | 07 | 010 | 027 | 0046 | 0128 | 051 | 010 | 09 | 02 | 02 | 00 | 00 | | |

The necessary corrections for instrument error to the nominal acceleration levels are

- 1.2g, 1.3g, 1.4g +0.03g
- 1.5g and greater +0.02g
- 0.8g, 0.7g, 0.6g -0.03g
- 0.5g and smaller -0.02g

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 13 | 05 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0007 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 14 | 05 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0010 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 15 | 05 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0009 | 0029 | 010 | 002 | 00 | 00 | 00 | 00 | 00 |
| 16 | 05 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0005 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 05 | 06 | 005 | 00 | 00 | 00 | 00 | 00 | 001 | 003 | 0007 | 0032 | 011 | 005 | 02 | 00 | 00 | 00 | 00 |
| 18 | 05 | 06 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0013 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 014 | 00 | 00 | 00 | 00 | 00 | 001 | 004 | 0017 | 0096 | 031 | 007 | 02 | 00 | 00 | 00 | 00 |
| 11 | 05 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 005 | 0017 | 0027 | 013 | 008 | 00 | 00 | 00 | 00 | 00 |
| 12 | 05 | 07 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0014 | 008 | 005 | 02 | 00 | 00 | 00 | 00 |
| 13 | 05 | 07 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0017 | 0050 | 017 | 008 | 03 | 03 | 02 | 00 | 00 |
| 14 | 05 | 07 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0003 | 0034 | 013 | 003 | 02 | 00 | 00 | 00 | 00 |
| 15 | 05 | 07 | 016 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0005 | 0043 | 007 | 000 | 00 | 00 | 00 | 00 | 00 |
| 16 | 05 | 07 | 040 | 00 | 00 | 00 | 00 | 00 | 001 | 016 | 0060 | 0175 | 051 | 019 | 06 | 04 | 02 | 01 | 00 |
| 17 | 05 | 07 | 045 | 00 | 00 | 00 | 01 | 02 | 008 | 049 | 0131 | 0288 | 097 | 028 | 06 | 01 | 00 | 00 | 00 |
| 18 | 05 | 07 | 033 | 00 | 00 | 00 | 00 | 00 | 004 | 013 | 0048 | 0107 | 045 | 015 | 06 | 02 | 02 | 01 | 01 |
| 19 | 05 | 07 | 018 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0007 | 0047 | 015 | 002 | 02 | 00 | 00 | 00 | 00 |
| 20 | 05 | 07 | 008 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0007 | 0021 | 009 | 002 | 02 | 01 | 00 | 00 | 00 |
| 21 | 05 | 07 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 05 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 05 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 188 | 00 | 00 | 00 | 01 | 02 | 013 | 092 | 0298 | 0809 | 275 | 090 | 29 | 11 | 06 | 02 | 01 |
| 11 | 05 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 002 | 007 | 0030 | 0052 | 019 | 001 | 00 | 00 | 00 | 00 | 00 |
| 12 | 05 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 001 | 005 | 0010 | 0011 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 14 | 05 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 15 | 05 | 08 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0017 | 0022 | 007 | 000 | 00 | 00 | 00 | 00 | 00 |
| 16 | 05 | 08 | 006 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0008 | 0008 | 004 | 001 | 00 | 00 | 00 | 00 | 00 |
| 17 | 05 | 08 | 007 | 00 | 00 | 00 | 00 | 01 | 004 | 014 | 0028 | 0045 | 021 | 005 | 02 | 00 | 00 | 00 | 00 |
| 18 | 05 | 08 | 012 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0006 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 05 | 08 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0004 | 0012 | 008 | 004 | 02 | 01 | 00 | 00 | 00 |
| 20 | 05 | 08 | 010 | 00 | 00 | 00 | 00 | 00 | 001 | 009 | 0026 | 0025 | 010 | 001 | 00 | 00 | 00 | 00 | 00 |
| 21 | 05 | 08 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 05 | 08 | 002 | 00 | 00 | 00 | 00 | 00 | 001 | 006 | 0011 | 0020 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 05 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 05 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0008 | 0012 | 004 | 001 | 00 | 00 | 00 | 00 | 00 |
| | | | 055 | 00 | 00 | 00 | 00 | 01 | 009 | 050 | 0143 | 0213 | 078 | 013 | 04 | 01 | 00 | 00 | 00 |
| 11 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0003 | 0002 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 12 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0003 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 13 | 05 | 09 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0004 | 0002 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 15 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0003 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 16 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0006 | 0012 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 05 | 09 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0010 | 0011 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 05 | 09 | 019 | 00 | 00 | 01 | 01 | 02 | 003 | 011 | 0036 | 0085 | 032 | 009 | 02 | 01 | 01 | 01 | 00 |
| 19 | 05 | 09 | 024 | 00 | 00 | 00 | 00 | 01 | 003 | 013 | 0036 | 0069 | 021 | 006 | 01 | 00 | 00 | 00 | 00 |
| 20 | 05 | 09 | 025 | 00 | 00 | 00 | 00 | 02 | 003 | 011 | 0033 | 0061 | 017 | 006 | 02 | 00 | 00 | 00 | 00 |
| 21 | 05 | 09 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 05 | 09 | 015 | 00 | 01 | 01 | 01 | 01 | 001 | 005 | 0016 | 0022 | 006 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 05 | 09 | 008 | 00 | 00 | 00 | 00 | 00 | 000 | 004 | 0014 | 0021 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 05 | 09 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 25 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 26 | 05 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 115 | 00 | 01 | 02 | 02 | 06 | 010 | 046 | 0162 | 0294 | 088 | 021 | 05 | 01 | 01 | 01 | 00 |
| 17 | 05 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 05 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 05 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 05 | 10 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0001 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 05 | 10 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0001 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 05 | 10 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0004 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 05 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 001 | 002 | 0004 | 0005 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 017 | 00 | 00 | 00 | 00 | 00 | 001 | 004 | 0007 | 0013 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 389 | 00 | 01 | 02 | 03 | 09 | 034 | 196 | 0627 | 1425 | 475 | 131 | 40 | 13 | 07 | 03 | 01 |

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------------|-----------|----------|----------|----------|----------|------------|------------|--------------|--------------|------------|------------|----------|----------|----------|----------|----------|
| 21 | 10 | 05 | 001 001 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 000 | 000 000 | 0001 0001 | 0000 0000 | 000 000 | 000 000 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 |
| 14 | 10 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0008 | 0012 | 005 | 000 | 00 | 00 | 00 | 00 | 00 |
| 15 | 10 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0006 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 16 | 10 | 06 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0045 | 0024 | 011 | 004 | 00 | 00 | 00 | 00 | 00 |
| 17 | 10 | 06 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0010 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 10 | 06 | 005 | 00 | 00 | 00 | 00 | 00 | 006 | 023 | 0039 | 0068 | 031 | 010 | 05 | 01 | 00 | 00 | 00 |
| 19 | 10 | 06 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0004 | 0010 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 10 | 06 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0015 | 006 | 002 | 02 | 00 | 00 | 00 | 00 |
| 21 | 10 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0007 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 10 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 10 | 06 | 001 030 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 006 | 000 028 | 0000 0100 | 0000 0152 | 000 059 | 000 016 | 00 07 | 00 01 | 00 00 | 00 00 | 00 00 |
| 14 | 10 | 07 | 002 | 01 | 01 | 02 | 02 | 03 | 006 | 027 | 0047 | 0073 | 032 | 010 | 01 | 00 | 00 | 00 | 00 |
| 15 | 10 | 07 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0009 | 0008 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 16 | 10 | 07 | 025 | 00 | 00 | 00 | 00 | 00 | 002 | 012 | 0040 | 0102 | 035 | 007 | 02 | 00 | 00 | 00 | 00 |
| 17 | 10 | 07 | 035 | 00 | 00 | 00 | 00 | 03 | 010 | 038 | 0128 | 0291 | 105 | 033 | 08 | 02 | 02 | 00 | 00 |
| 18 | 10 | 07 | 046 | 00 | 00 | 00 | 01 | 01 | 011 | 055 | 0135 | 0240 | 096 | 028 | 09 | 03 | 02 | 01 | 00 |
| 19 | 10 | 07 | 036 | 00 | 00 | 00 | 01 | 02 | 006 | 030 | 0062 | 0120 | 040 | 012 | 05 | 04 | 03 | 01 | 00 |
| 20 | 10 | 07 | 042 | 00 | 00 | 00 | 00 | 00 | 000 | 010 | 0043 | 0082 | 031 | 008 | 01 | 00 | 00 | 00 | 00 |
| 21 | 10 | 07 | 045 | 00 | 00 | 00 | 00 | 03 | 005 | 022 | 0058 | 0108 | 034 | 015 | 05 | 01 | 00 | 00 | 00 |
| 22 | 10 | 07 | 034 | 00 | 00 | 00 | 00 | 00 | 000 | 006 | 0016 | 0050 | 015 | 002 | 01 | 01 | 00 | 00 | 00 |
| 23 | 10 | 07 | 015 | 00 | 00 | 00 | 00 | 00 | 001 | 002 | 0004 | 0012 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 10 | 07 | 001 288 | 00 01 | 00 01 | 00 02 | 00 04 | 00 12 | 000 041 | 000 202 | 0000 0542 | 0000 1086 | 000 392 | 000 115 | 00 32 | 00 11 | 00 07 | 00 02 | 00 00 |
| 11 | 10 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0007 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 14 | 10 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 003 | 017 | 0028 | 0034 | 016 | 008 | 02 | 00 | 00 | 00 | 00 |
| 16 | 10 | 08 | 003 | 00 | 00 | 02 | 03 | 04 | 008 | 018 | 0036 | 0057 | 028 | 009 | 05 | 03 | 02 | 00 | 00 |
| 17 | 10 | 08 | 006 | 00 | 00 | 00 | 00 | 00 | 004 | 013 | 0050 | 0081 | 027 | 007 | 01 | 00 | 00 | 00 | 00 |
| 18 | 10 | 08 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0011 | 0028 | 011 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 10 | 08 | 013 | 00 | 00 | 00 | 00 | 03 | 004 | 011 | 0027 | 0045 | 016 | 004 | 01 | 01 | 00 | 00 | 00 |
| 20 | 10 | 08 | 013 | 00 | 00 | 01 | 01 | 03 | 006 | 021 | 0047 | 0061 | 031 | 011 | 03 | 00 | 00 | 00 | 00 |
| 21 | 10 | 08 | 023 | 00 | 00 | 00 | 00 | 01 | 002 | 007 | 0031 | 0050 | 011 | 003 | 01 | 00 | 00 | 00 | 00 |
| 22 | 10 | 08 | 019 | 00 | 00 | 00 | 00 | 00 | 003 | 013 | 0039 | 0033 | 014 | 003 | 00 | 00 | 00 | 00 | 00 |
| 23 | 10 | 08 | 018 | 00 | 00 | 00 | 00 | 00 | 000 | 004 | 0017 | 0020 | 004 | 002 | 01 | 00 | 00 | 00 | 00 |
| 24 | 10 | 08 | 001 103 | 00 00 | 00 00 | 00 03 | 00 04 | 00 11 | 000 030 | 000 108 | 0000 0293 | 0000 0411 | 000 158 | 000 047 | 00 14 | 00 04 | 00 02 | 00 00 | 00 00 |
| 16 | 10 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 10 | 09 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 009 | 0015 | 0015 | 006 | 001 | 00 | 00 | 00 | 00 | 00 |
| 18 | 10 | 09 | 002 | 00 | 00 | 00 | 00 | 01 | 002 | 004 | 0012 | 0033 | 010 | 002 | 01 | 00 | 00 | 00 | 00 |
| 19 | 10 | 09 | 013 | 01 | 01 | 01 | 01 | 01 | 002 | 010 | 0028 | 0025 | 010 | 001 | 01 | 00 | 00 | 00 | 00 |
| 20 | 10 | 09 | 033 | 01* | 01 | 02 | 03 | 05 | 006 | 019 | 0048 | 0048 | 021 | 005 | 04 | 01 | 01 | 00 | 00 |
| 21 | 10 | 09 | 028 | 00 | 00 | 00 | 00 | 00 | 001 | 007 | 0025 | 0028 | 006 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 10 | 09 | 069 | 00 | 00 | 00 | 00 | 01 | 001 | 002 | 0009 | 0042 | 007 | 001 | 00 | 00 | 00 | 00 | 00 |
| 23 | 10 | 09 | 047 | 00 | 00 | 00 | 00 | 01 | 003 | 009 | 0020 | 0033 | 011 | 002 | 02 | 02 | 00 | 00 | 00 |
| 24 | 10 | 09 | 015 | 00 | 00 | 00 | 00 | 01 | 002 | 004 | 0010 | 0014 | 011 | 004 | 03 | 02 | 01 | 01 | 00 |
| 25 | 10 | 09 | 001 213 | 00 02* | 00 02 | 00 03 | 00 04 | 00 10 | 000 017 | 000 064 | 0000 0168 | 0000 0238 | 000 082 | 000 016 | 00 11 | 00 05 | 00 02 | 00 01 | 00 00 |
| 20 | 10 | 10 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0005 | 0005 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 10 | 10 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0003 | 0008 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 10 | 10 | 011 | 00 | 00 | 00 | 01 | 01 | 001 | 002 | 0003 | 0007 | 004 | 003 | 03 | 01 | 00 | 00 | 00 |
| 23 | 10 | 10 | 009 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 10 | 10 | 003 029 | 00 00 | 00 00 | 00 00 | 00 01 | 00 01 | 000 001 | 000 005 | 0001 0012 | 0004 0024 | 002 009 | 000 003 | 00 03 | 00 01 | 00 00 | 00 00 | 00 00 |
| | | | 664 | 03* | 03 | 08 | 13 | 34 | 095 | 407 | 1116 | 1911 | 700 | 197 | 67 | 22 | 11 | 03 | 00 |

* 1 count continues to -0 3g

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------------|----------|----------|----------|----------|----------|------------|------------|--------------|--------------|------------|------------|----------|----------|----------|----------|----------|
| 20 | 15 | 05 | 001 001 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 | 000 000 | 000 000 | 0001 0001 | 0000 0000 | 000 000 | 000 000 | 00 00 | 00 00 | 00 00 | 00 00 | 00 00 |
| 18 | 15 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0006 | 002 | 001 | 00 | 00 | 00 | 00 | 00 |
| 19 | 15 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 15 | 06 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 15 | 06 | 004 | 00 | 00 | 00 | 01 | 02 | 003 | 008 | 0016 | 0017 | 010 | 005 | 02 | 00 | 00 | 00 | 00 |
| 22 | 15 | 06 | 005 016 | 00 00 | 00 00 | 00 00 | 00 01 | 00 02 | 000 003 | 000 008 | 0000 0016 | 0000 0027 | 000 012 | 000 006 | 00 02 | 00 00 | 00 00 | 00 00 | 00 00 |
| 16 | 15 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 15 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0003 | 0010 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 15 | 07 | 003 | 00 | 00 | 00 | 00 | 02 | 005 | 014 | 0018 | 0032 | 015 | 006 | 02 | 02 | 01 | 00 | 00 |
| 19 | 15 | 07 | 016 | 00 | 01 | 02 | 02 | 05 | 007 | 035 | 0052 | 0077 | 042 | 021 | 11 | 04 | 02 | 00 | 00 |
| 20 | 15 | 07 | 034 | 00 | 00 | 00 | 00 | 01 | 001 | 004 | 0014 | 0028 | 007 | 001 | 00 | 00 | 00 | 00 | 00 |
| 21 | 15 | 07 | 057 | 00 | 00 | 00 | 00 | 00 | 001 | 009 | 0017 | 0021 | 012 | 004 | 00 | 00 | 00 | 00 | 00 |
| 22 | 15 | 07 | 055 | 00 | 00 | 00 | 00 | 00 | 006 | 025 | 0034 | 0054 | 021 | 009 | 01 | 00 | 00 | 00 | 00 |
| 23 | 15 | 07 | 030 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0005 | 0008 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 15 | 07 | 006 204 | 00 00 | 00 01 | 00 02 | 00 02 | 00 08 | 000 020 | 000 089 | 0003 0146 | 0002 0232 | 001 102 | 000 041 | 00 14 | 00 06 | 00 03 | 00 00 | 00 00 |
| 14 | 15 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0009 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 15 | 08 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 15 | 08 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0009 | 0009 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 15 | 08 | 013 | 00 | 01 | 01 | 02 | 02 | 006 | 005 | 0013 | 0026 | 016 | 005 | 04 | 01 | 00 | 00 | 00 |
| 21 | 15 | 08 | 029 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0015 | 0009 | 001 | 001 | 00 | 00 | 00 | 00 | 00 |
| 22 | 15 | 08 | 040 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0002 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 15 | 08 | 013 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 15 | 08 | 004 106 | 00 00 | 00 01 | 00 01 | 00 02 | 00 02 | 000 006 | 000 009 | 0001 0042 | 0001 0057 | 001 023 | 000 006 | 00 04 | 00 01 | 00 00 | 00 00 | 00 00 |
| 19 | 15 | 09 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 15 | 09 | 017 | 00 | 00 | 02 | 02 | 03 | 007 | 018 | 0055 | 0063 | 019 | 006 | 01 | 00 | 00 | 00 | 00 |
| 21 | 15 | 09 | 048 | 00 | 00 | 01 | 01 | 03 | 005 | 021 | 0057 | 0074 | 021 | 004 | 02 | 01 | 00 | 00 | 00 |
| 22 | 15 | 09 | 097 | 00 | 00 | 00 | 00 | 00 | 002 | 004 | 0010 | 0008 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 15 | 09 | 035 199 | 00 00 | 00 00 | 00 03 | 00 03 | 00 06 | 000 014 | 000 043 | 0007 0129 | 0012 0157 | 002 046 | 000 010 | 00 03 | 00 01 | 00 00 | 00 00 | 00 00 |
| 20 | 15 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0002 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 15 | 10 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 15 | 10 | 018 | 01 | 01 | 01 | 01 | 02 | 002 | 005 | 0007 | 0008 | 005 | 003 | 02 | 00 | 00 | 00 | 00 |
| 23 | 15 | 10 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 15 | 10 | 002 032 | 00 01 | 00 01 | 00 01 | 00 01 | 00 02 | 000 002 | 000 005 | 0000 0008 | 0000 0011 | 000 006 | 000 003 | 00 02 | 00 00 | 00 00 | 00 00 | 00 00 |
| | | | 558 | 01 | 03 | 07 | 09 | 20 | 045 | 154 | 0342 | 0484 | 189 | 066 | 25 | 08 | 03 | 00 | 00 |

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 17 | 20 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 20 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 20 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 20 | 06 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 20 | 06 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 20 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 016 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 20 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 001 | 002 | 0005 | 0019 | 006 | 001 | 01 | 00 | 00 | 00 | 00 |
| 18 | 20 | 07 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 006 | 0006 | 0049 | 019 | 013 | 08 | 05 | 02 | 00 | 00 |
| 19 | 20 | 07 | 009 | 01* | 02 | 05 | 07 | 15 | 025 | 059 | 0092 | 0107 | 061 | 034 | 19 | 10 | 07 | 03 | 01** |
| 20 | 20 | 07 | 034 | 00 | 00 | 00 | 00 | 04 | 006 | 013 | 0031 | 0057 | 022 | 008 | 03 | 02 | 01 | 00 | 00 |
| 21 | 20 | 07 | 080 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0012 | 0019 | 004 | 001 | 00 | 00 | 00 | 00 | 00 |
| 22 | 20 | 07 | 083 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0018 | 0026 | 007 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 20 | 07 | 018 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0001 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 20 | 07 | 006 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0004 | 0003 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 234 | 01* | 02 | 05 | 07 | 19 | 032 | 086 | 0169 | 0282 | 121 | 057 | 31 | 17 | 10 | 03 | 01** |
| 18 | 20 | 08 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 20 | 08 | 007 | 00 | 00 | 00 | 00 | 00 | 001 | 007 | 0013 | 0019 | 008 | 003 | 02 | 01 | 00 | 00 | 00 |
| 20 | 20 | 08 | 019 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0005 | 0003 | 001 | 001 | 00 | 00 | 00 | 00 | 00 |
| 21 | 20 | 08 | 074 | 00 | 00 | 01 | 01 | 01 | 003 | 003 | 0009 | 0031 | 009 | 002 | 00 | 00 | 00 | 00 | 00 |
| 22 | 20 | 08 | 040 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0004 | 0008 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 20 | 08 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 20 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 148 | 00 | 00 | 01 | 01 | 01 | 004 | 015 | 0031 | 0063 | 020 | 006 | 02 | 01 | 00 | 00 | 00 |
| 15 | 20 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 20 | 09 | 007 | 00 | 00 | 00 | 02 | 02 | 006 | 014 | 0024 | 0029 | 013 | 004 | 03 | 01 | 01 | 01 | 00 |
| 20 | 20 | 09 | 042 | 00 | 00 | 00 | 00 | 01 | 002 | 008 | 0018 | 0026 | 010 | 005 | 01 | 00 | 00 | 00 | 00 |
| 21 | 20 | 09 | 155 | 00 | 00 | 00 | 00 | 00 | 001 | 010 | 0023 | 0036 | 014 | 004 | 01 | 00 | 00 | 00 | 00 |
| 22 | 20 | 09 | 062 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 20 | 09 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 272 | 00 | 00 | 00 | 02 | 03 | 009 | 032 | 0065 | 0094 | 037 | 013 | 05 | 01 | 01 | 01 | 00 |
| 20 | 20 | 10 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0004 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 20 | 10 | 009 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 20 | 10 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 20 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 025 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0005 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 695 | 01* | 02 | 06 | 10 | 23 | 045 | 133 | 0267 | 0446 | 178 | 076 | 38 | 19 | 11 | 04 | 01** |

* 1 count continues to -0.1g.

** 1 count continues to 2.1g.

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 22 | 25 | 05 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 25 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 25 | 06 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 25 | 06 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0002 | 0012 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 25 | 06 | 009 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 25 | 06 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 022 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0002 | 0013 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 25 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0005 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 25 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 25 | 07 | 008 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0004 | 0011 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 25 | 07 | 037 | 00 | 00 | 00 | 00 | 01 | 002 | 013 | 0026 | 0029 | 014 | 004 | 02 | 01 | 01 | 01 | 01* |
| 21 | 25 | 07 | 066 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0006 | 0004 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 25 | 07 | 106 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0029 | 0026 | 005 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 25 | 07 | 022 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0004 | 0005 | 003 | 001 | 00 | 00 | 00 | 00 | 00 |
| 24 | 25 | 07 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 249 | 00 | 00 | 00 | 00 | 01 | 002 | 018 | 0074 | 0078 | 024 | 005 | 02 | 01 | 01 | 01 | 01* |
| 18 | 25 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 25 | 08 | 027 | 00 | 00 | 00 | 00 | 00 | 000 | 004 | 0024 | 0022 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 25 | 08 | 110 | 01 | 02 | 02 | 02 | 02 | 007 | 011 | 0021 | 0047 | 015 | 003 | 02 | 00 | 00 | 00 | 00 |
| 21 | 25 | 08 | 069 | 00 | 00 | 00 | 00 | 01 | 001 | 008 | 0016 | 0022 | 006 | 003 | 01 | 00 | 00 | 00 | 00 |
| 22 | 25 | 08 | 032 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0005 | 0005 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 25 | 08 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 25 | 08 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 245 | 01 | 02 | 02 | 02 | 03 | 008 | 024 | 0066 | 0096 | 026 | 006 | 03 | 00 | 00 | 00 | 00 |
| 18 | 25 | 09 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 25 | 09 | 035 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0005 | 0004 | 002 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 25 | 09 | 232 | 00 | 00 | 00 | 01 | 01 | 001 | 007 | 0025 | 0038 | 006 | 003 | 03 | 01 | 00 | 00 | 00 |
| 21 | 25 | 09 | 087 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0003 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 25 | 09 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 25 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 361 | 00 | 00 | 00 | 01 | 01 | 001 | 008 | 0034 | 0042 | 008 | 003 | 03 | 01 | 00 | 00 | 00 |
| 19 | 25 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 25 | 10 | 015 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 25 | 10 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 026 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 904 | 01 | 02 | 02 | 03 | 05 | 011 | 052 | 0176 | 0229 | 061 | 014 | 08 | 02 | 01 | 01 | 01* |

* 1 count continues to 2.0g.

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 17 | 30 | 06 | 001 | 00 | 00 | 00 | 01 | 03 | 005 | 009 | 0013 | 0031 | 019 | 011 | 06 | 03 | 03 | 01 | 01 |
| 20 | 30 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 30 | 06 | 006 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 30 | 06 | 009 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 30 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 019 | 00 | 00 | 00 | 01 | 03 | 005 | 009 | 0013 | 0031 | 019 | 011 | 06 | 03 | 03 | 01 | 01 |
| 17 | 30 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 30 | 07 | 008 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 30 | 07 | 022 | 00 | 00 | 00 | 00 | 00 | 004 | 008 | 0016 | 0029 | 014 | 010 | 05 | 02 | 01 | 00 | 00 |
| 20 | 30 | 07 | 023 | 00 | 00 | 00 | 00 | 00 | 001 | 002 | 0013 | 0027 | 010 | 004 | 01 | 00 | 00 | 00 | 00 |
| 21 | 30 | 07 | 124 | 00 | 00 | 00 | 00 | 00 | 003 | 007 | 0033 | 0058 | 020 | 006 | 00 | 00 | 00 | 00 | 00 |
| 22 | 30 | 07 | 144 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0016 | 0013 | 002 | 001 | 00 | 00 | 00 | 00 | 00 |
| 23 | 30 | 07 | 034 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 30 | 07 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 25 | 30 | 07 | 003 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 26 | 30 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 27 | 30 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 365 | 00 | 00 | 00 | 00 | 00 | 008 | 020 | 0021 | 0130 | 046 | 021 | 06 | 02 | 01 | 00 | 00 |
| 17 | 30 | 08 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 30 | 08 | 031 | 00 | 00 | 00 | 00 | 00 | 002 | 008 | 0014 | 0017 | 005 | 002 | 01 | 01 | 00 | 00 | 00 |
| 19 | 30 | 08 | 194 | 00 | 00 | 00 | 01 | 02 | 003 | 012 | 0020 | 0022 | 008 | 002 | 01 | 00 | 00 | 00 | 00 |
| 20 | 30 | 08 | 085 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0002 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 30 | 08 | 211 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0012 | 0026 | 006 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 30 | 08 | 320 | 00 | 00 | 00 | 00 | 00 | 001 | 004 | 0022 | 0020 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 30 | 08 | 044 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0023 | 0010 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 30 | 08 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 891 | 00 | 00 | 00 | 01 | 02 | 006 | 030 | 0091 | 0097 | 023 | 004 | 02 | 01 | 00 | 00 | 00 |
| 17 | 30 | 09 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 30 | 09 | 026 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 30 | 09 | 193 | 00 | 00 | 00 | 00 | 01 | 002 | 011 | 0041 | 0057 | 014 | 002 | 00 | 00 | 00 | 00 | 00 |
| 20 | 30 | 09 | 118 | 00 | 00 | 00 | 00 | 00 | 001 | 005 | 0023 | 0019 | 008 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 30 | 09 | 054 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0005 | 0005 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 30 | 09 | 306 | 00 | 00 | 02 | 03 | 07 | 010 | 027 | 0066 | 0099 | 035 | 010 | 05 | 04 | 03 | 01 | 00 |
| 23 | 30 | 09 | 139 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0015 | 0021 | 001 | 001 | 00 | 00 | 00 | 00 | 00 |
| 24 | 30 | 09 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 843 | 00 | 00 | 02 | 03 | 08 | 013 | 046 | 0151 | 0201 | 058 | 013 | 05 | 04 | 03 | 01 | 00 |
| 18 | 30 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 30 | 10 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 30 | 10 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 30 | 10 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 015 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 2133 | 00 | 00 | 02 | 05 | 13 | 032 | 105 | 0356 | 0459 | 146 | 049 | 19 | 10 | 07 | 02 | 01 |

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 18 | 35 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 35 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 35 | 06 | 007 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 35 | 06 | 019 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0001 | 0003 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 35 | 06 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0001 | 0001 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 35 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 041 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0002 | 0007 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 35 | 07 | 006 | 00 | 01 | 02 | 02 | 02 | 004 | 010 | 0007 | 0021 | 011 | 002 | 02 | 02 | 02 | 01 | 00 |
| 18 | 35 | 07 | 017 | 00 | 00 | 00 | 00 | 00 | 001 | 018 | 0047 | 0050 | 022 | 008 | 02 | 00 | 00 | 00 | 00 |
| 19 | 35 | 07 | 029 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0004 | 0004 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 35 | 07 | 206 | 01 | 01 | 03 | 08 | 12 | 019 | 059 | 0141 | 0189 | 060 | 034 | 14 | 07 | 06 | 03 | 00 |
| 21 | 35 | 07 | 572 | 02 | 03 | 05 | 06 | 17 | 034 | 105 | 0171 | 0220 | 106 | 042 | 21 | 08 | 06 | 05 | 04* |
| 22 | 35 | 07 | 195 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0008 | 0012 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 35 | 07 | 022 | 00 | 00 | 00 | 00 | 01 | 001 | 002 | 0010 | 0022 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 35 | 07 | 004 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 26 | 35 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 1052 | 03 | 05 | 10 | 16 | 32 | 059 | 196 | 0388 | 0519 | 201 | 086 | 39 | 17 | 14 | 09 | 04* |
| 17 | 35 | 08 | 004 | 00 | 00 | 00 | 00 | 01 | 002 | 004 | 0012 | 0021 | 004 | 001 | 00 | 00 | 00 | 00 | 00 |
| 18 | 35 | 08 | 050 | 01/ | 01 | 01 | 02 | 06 | 026 | 042 | 0121 | 0156 | 051 | 017 | 10 | 05 | 04 | 01 | 00 |
| 19 | 35 | 08 | 112 | 03 | 04 | 06 | 15 | 22 | 042 | 092 | 0219 | 0299 | 114 | 037 | 19 | 14 | 09 | 05 | 03** |
| 20 | 35 | 08 | 166 | 00 | 00 | 00 | 00 | 03 | 013 | 050 | 0092 | 0110 | 041 | 018 | 11 | 05 | 01 | 01 | 00 |
| 21 | 35 | 08 | 1657 | 00 | 00 | 00 | 02 | 04 | 021 | 079 | 0214 | 0270 | 094 | 023 | 14 | 04 | 03 | 01 | 00 |
| 22 | 35 | 08 | 1329 | 00 | 00 | 00 | 01 | 01 | 005 | 025 | 0096 | 0151 | 036 | 014 | 05 | 03 | 03 | 02 | 02 |
| 23 | 35 | 08 | 096 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0006 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 35 | 08 | 005 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 3419 | 04/ | 05 | 07 | 20 | 37 | 109 | 292 | 0756 | 1013 | 341 | 110 | 59 | 31 | 20 | 10 | 05** |
| 17 | 35 | 09 | 001 | 00 | 00 | 01 | 01 | 01 | 001 | 010 | 0020 | 0024 | 009 | 001 | 00 | 00 | 00 | 00 | 00 |
| 18 | 35 | 09 | 014 | 00 | 00 | 00 | 00 | 00 | 000 | 007 | 0017 | 0018 | 008 | 004 | 01 | 00 | 00 | 00 | 00 |
| 19 | 35 | 09 | 026 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0007 | 0007 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 35 | 09 | 016 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0003 | 0007 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 35 | 09 | 077 | 00 | 00 | 00 | 01 | 04 | 005 | 007 | 0017 | 0025 | 014 | 007 | 03 | 02 | 02 | 01 | 00 |
| 22 | 35 | 09 | 351 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0018 | 0023 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 23 | 35 | 09 | 127 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0002 | 0008 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 35 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 613 | 00 | 00 | 01 | 02 | 05 | 006 | 027 | 0084 | 0112 | 039 | 012 | 04 | 02 | 02 | 01 | 00 |
| 19 | 35 | 10 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 5126 | 07/ | 10 | 18 | 38 | 74 | 174 | 516 | 1230 | 1651 | 582 | 208 | 102 | 50 | 36 | 20 | 09*** |

/ 1 count continues to 0.0g.

* 1 count continues to 2.0g.

** 2 counts continue to 2.1g

*** 3 counts at 2.0g, 2 counts at 2.1g

| Speed | Altitude | Weight | Time | 0.1g | 0.2g | 0.3g | 0.4g | 0.5g | 0.6g | 0.7g | 0.8g | 1.2g | 1.3g | 1.4g | 1.5g | 1.6g | 1.7g | 1.8g | 1.9g |
|-------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 19 | 40 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 20 | 40 | 06 | 010 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 21 | 40 | 06 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 40 | 06 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 015 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0001 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 17 | 40 | 07 | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 40 | 07 | 015 | 00 | 00 | 00 | 00 | 00 | 000 | 002 | 0004 | 0017 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 40 | 07 | 021 | 00 | 00 | 00 | 01 | 06 | 008 | 020 | 0032 | 0062 | 030 | 011 | 04 | 01 | 01 | 00 | 00 |
| 20 | 40 | 07 | 153 | 00 | 00 | 00 | 00 | 00 | 000 | 006 | 0019 | 0045 | 012 | 002 | 00 | 00 | 00 | 00 | 00 |
| 21 | 40 | 07 | 194 | 00 | 00 | 00 | 00 | 00 | 000 | 008 | 0044 | 0025 | 003 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 40 | 07 | 032 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0009 | 0008 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 24 | 40 | 07 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 418 | 00 | 00 | 00 | 01 | 06 | 008 | 037 | 0108 | 0157 | 048 | 013 | 04 | 01 | 01 | 00 | 00 |
| 17 | 40 | 08 | 001 | 00 | 00 | 00 | 01 | 01 | 001 | 002 | 0005 | 0007 | 004 | 000 | 00 | 00 | 00 | 00 | 00 |
| 18 | 40 | 08 | 008 | 00 | 00 | 00 | 00 | 00 | 000 | 001 | 0003 | 0007 | 001 | 000 | 00 | 00 | 00 | 00 | 00 |
| 19 | 40 | 08 | 023 | 00 | 00 | 00 | 00 | 00 | 000 | 003 | 0013 | 0033 | 008 | 001 | 01 | 00 | 00 | 00 | 00 |
| 20 | 40 | 08 | 039 | 00 | 00 | 00 | 00 | 01 | 001 | 007 | 0024 | 0064 | 017 | 008 | 04 | 02 | 02 | 01 | 01 |
| 21 | 40 | 08 | 219 | 00 | 00 | 00 | 01 | 01 | 002 | 004 | 0016 | 0035 | 022 | 004 | 02 | 01 | 00 | 00 | 00 |
| 22 | 40 | 08 | 094 | 00 | 00 | 00 | 00 | 01 | 001 | 004 | 0012 | 0024 | 008 | 003 | 00 | 00 | 00 | 00 | 00 |
| 23 | 40 | 08 | 022 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 406 | 00 | 00 | 00 | 02 | 04 | 005 | 021 | 0073 | 0170 | 060 | 016 | 07 | 03 | 02 | 01 | 01 |
| 20 | 40 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| 22 | 40 | 09 | 001 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 002 | 00 | 00 | 00 | 00 | 00 | 000 | 000 | 0000 | 0000 | 000 | 000 | 00 | 00 | 00 | 00 | 00 |
| | | | 841 | 00 | 00 | 00 | 03 | 10 | 013 | 058 | 0181 | 0328 | 108 | 029 | 11 | 04 | 03 | 01 | 01 |

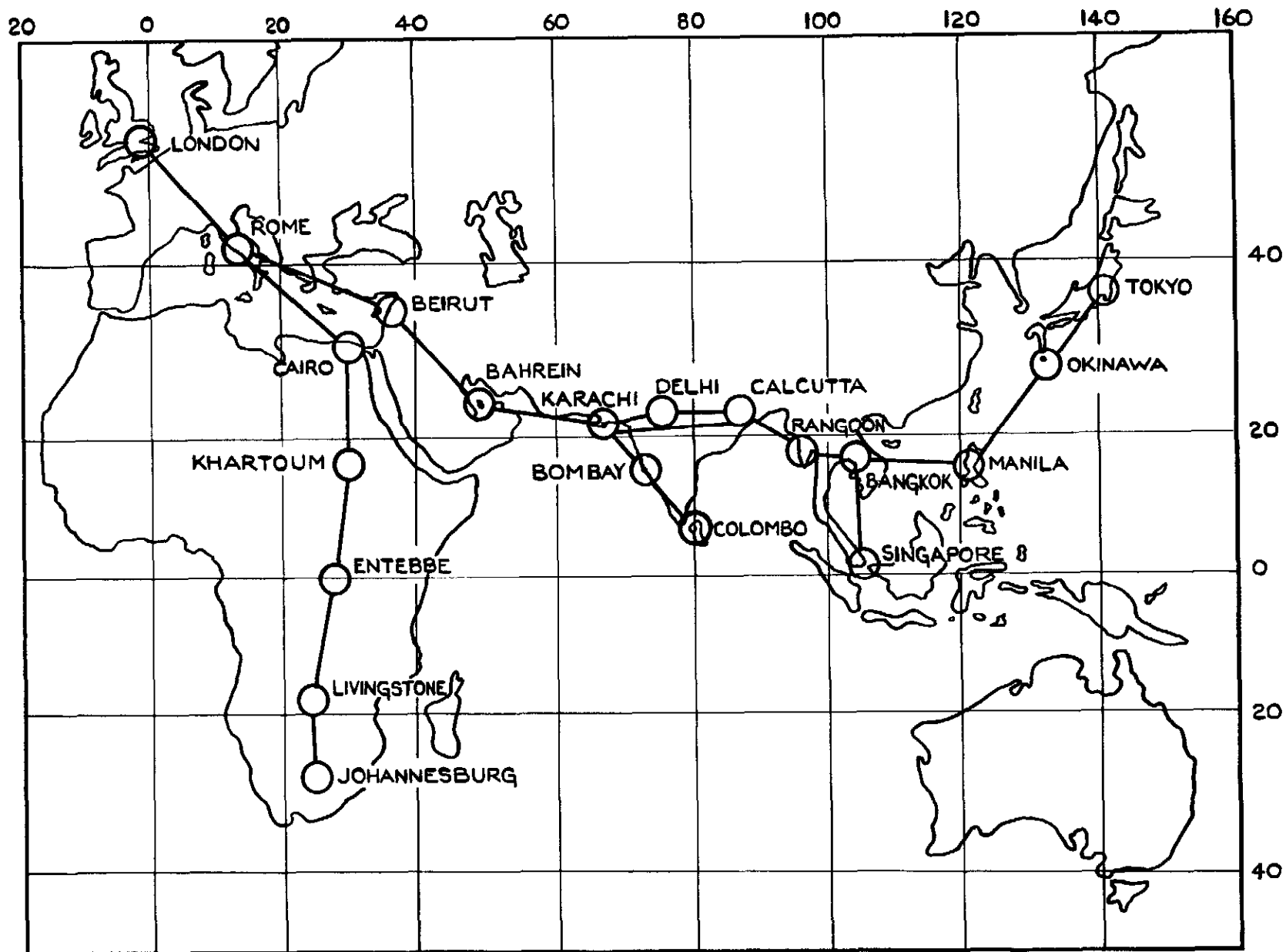


FIG.1. MAP OF THE ROUTES FLOWN.

FIG.2.

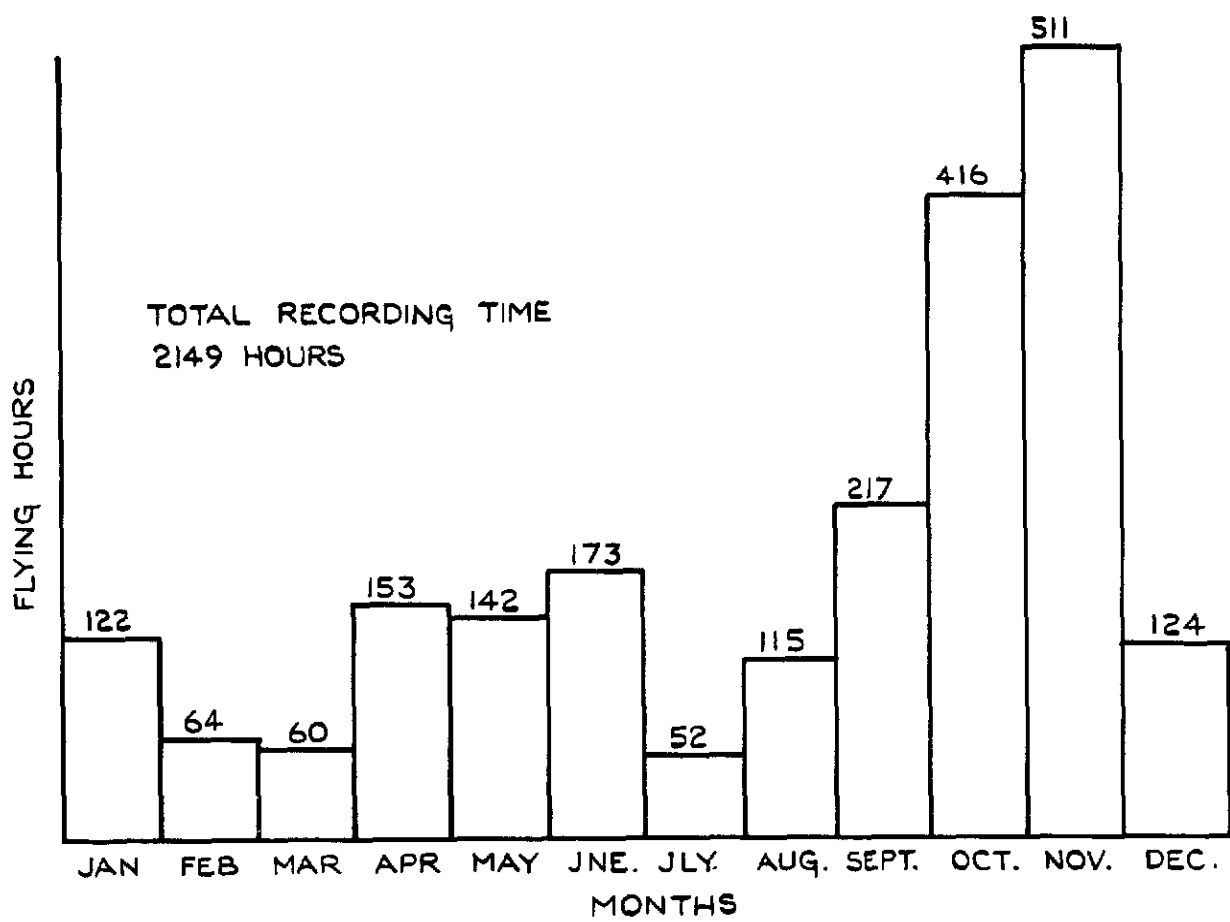


FIG.2. MONTHLY DISTRIBUTION OF THE RECORDED FLYING TIME.

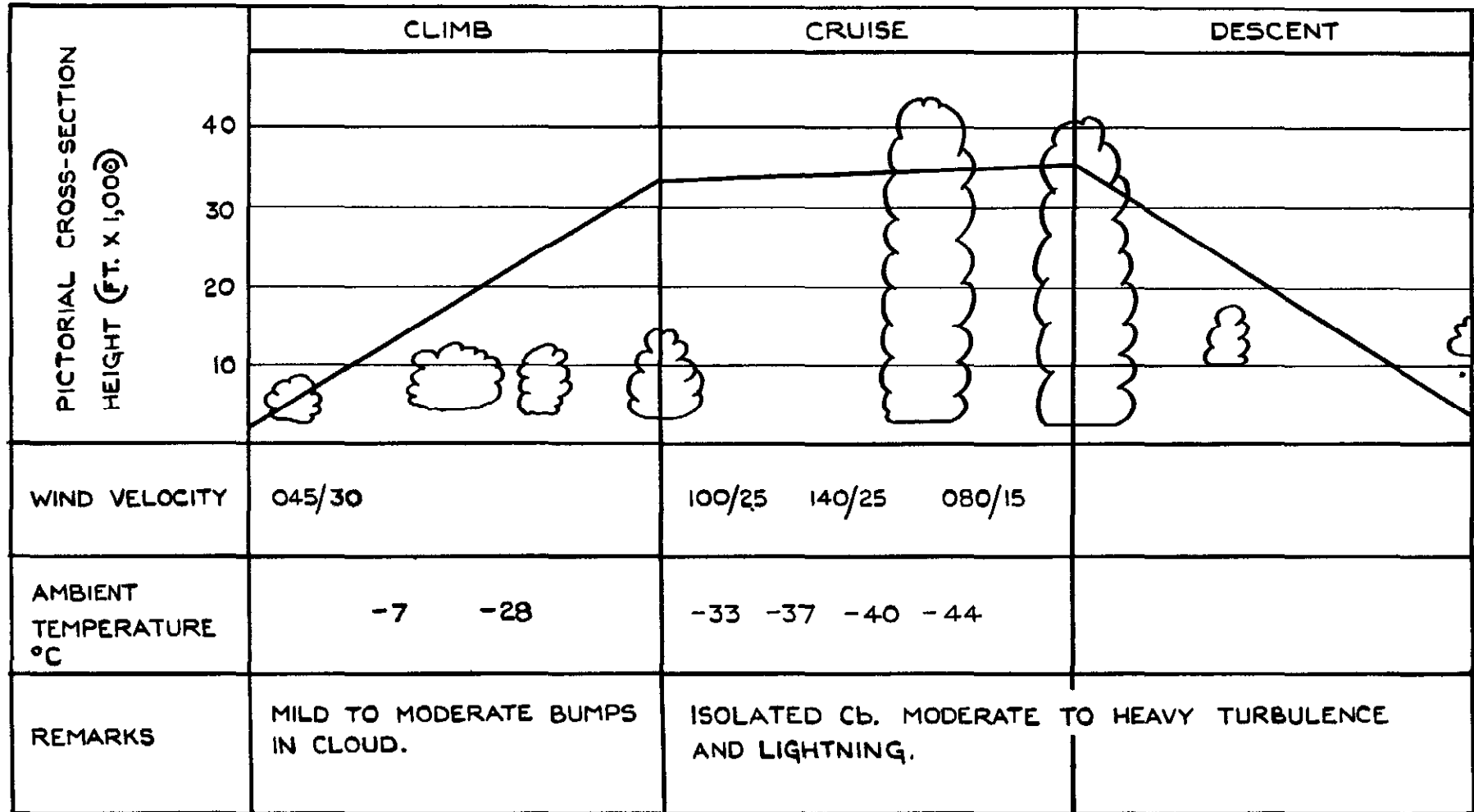
B.O.A.C.
WEATHER REPORT.

DATE: 16.4.53

AIRCRAFT: G-ALYS

FROM: LIVINGSTONE

TO: ENTEBBE



CAPTAIN

FIG. 3. SPECIMEN WEATHER REPORT.

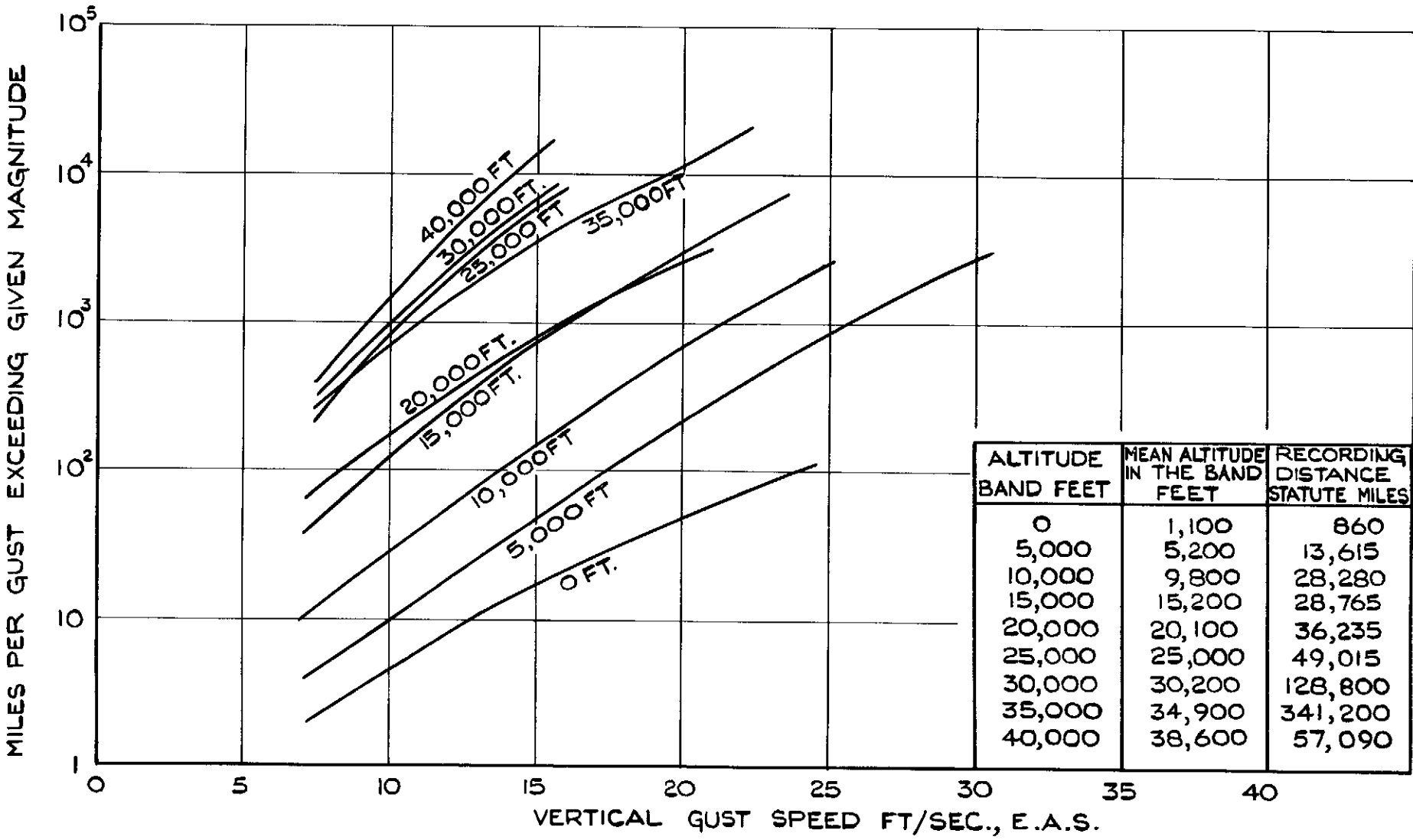


FIG. 4. GUST SPECTRA AT DIFFERENT ALTITUDES.

FIG. 5.

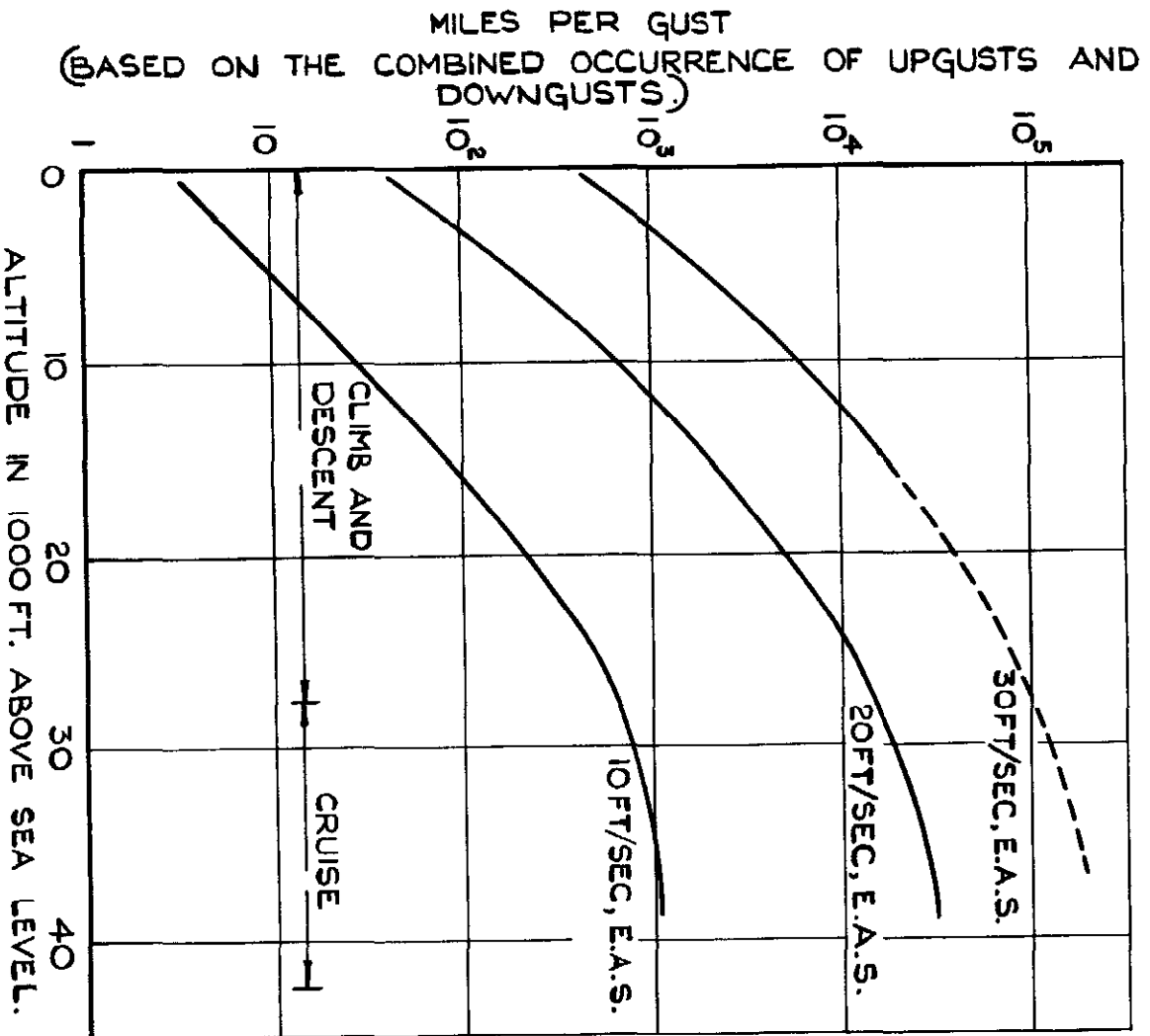


FIG. 5. VARIATION OF TURBULENCE WITH
ALTITUDE IN TERMS OF GUSTS EXCEEDING
10 FT/SEC, 20 FT/SEC. AND 30 FT/SEC.

FIG.6.

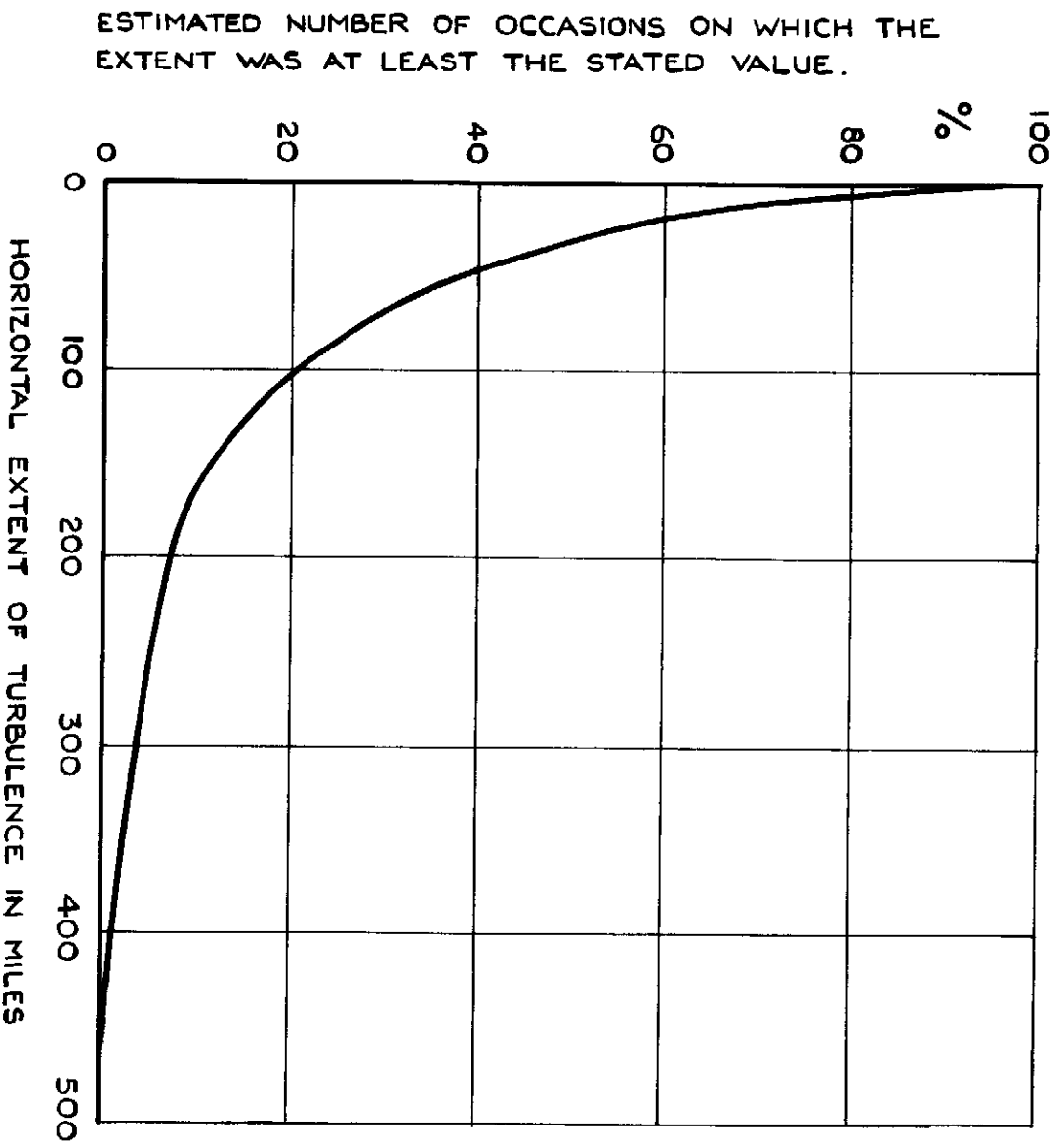


FIG.6. HORIZONTAL EXTENT OF TURBULENCE.

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