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ATMOSPHERIC CONDITIONS ASSOCIATED WITH TURBULENCE ENCOUNTERED BY THE XB-70 AIRPLANE ABOVE 40,000 FEET ALTITUDE

by L. J. Ehernberger

Flight Research Center
Edwards, Calif.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • SEPTEMBER 1968

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SUMMARY

High-altitude atmospheric turbulence has been encountered by the XB-70 airplane during flight tests over the Western United States. The encounters from 36 flights were used to obtain a preliminary assessment of the meteorological features associated with high-altitude turbulence. This study used data from an NACA VGH recorder carried on the airplane and from rawinsonde observations made near turbulence encounters at altitudes above 40,000 feet (12,200 meters). These data showed that turbulence of significant intensity at high altitudes is related to wind velocity, vertical wind shear, and the vertical temperature gradient. These findings are in general agreement with various turbulence-generating disturbances suggested previously in the literature. It is also indicated that the disturbances causing high-altitude turbulence can originate in both the lower atmosphere and the stratosphere.

INTRODUCTION

Atmospheric turbulence is of concern to operators of subsonic jet transport aircraft because of both flight safety and passenger-comfort considerations (ref. 1). With the anticipated introduction of supersonic transport (SST) aircraft, questions arise concerning the meteorological conditions related to high-altitude turbulence and its subsequent effects during cruise at speeds three times those of subsonic jet transports and at altitudes more than 20,000 feet (6100 meters) higher. Several investigators (refs. 2 to 6) have suggested that high-altitude turbulence (in the lower stratosphere) may be related to wave motion and mixing resulting from wind shear acting across thin atmospheric layers of differing stability. If true, such relationships could form the basis for predicting the presence of turbulence at SST flight altitudes. However, the validity of these relationships has not been established because of the lack of data with which to correlate the aircraft turbulence encounters at high altitudes with the associated meteorological features.

In order to partially eliminate this lack of data, high-altitude turbulence recently encountered by the XB-70 airplane, which is similar in configuration and performance to the planned SST, has been identified for correlation with meteorological information. The study, made at the NASA Flight Research Center, Edwards, Calif., covers data obtained from 36 flights of the XB-70 airplane over the Western United States between February 1965 and March 1966. This paper discusses the preliminary findings of the atmospheric features associated with the more intense clear-air turbulence encountered at altitudes above 40,000 feet (12,200 meters). The date, time of day, altitude, and geographical location of the turbulence encounters for each flight are presented in the appendix.

SYMBOLS

Measurements for this investigation were made in U.S. Customary Units; equivalent values in the International System of Units are indicated parenthetically.

$\Delta a_{n_{max}}$	maximum peak-to-peak increment in normal acceleration at the airplane center of gravity, g units
g	acceleration of gravity, 32.2 ft/sec^2 (9.8 m/sec^2)
h_p	pressure altitude, ft (m)
V_{max}	wind velocity at the altitude of the maximum wind level, knots (m/sec)
V_{100}	wind velocity at the 100-millibar level (approximately 53,000 ft or 16,200 m altitude), knots (m/sec)
$\left(\frac{\partial V}{\partial z}\right)_{low}$	vertical wind shear for a shear layer below the flight altitude, sec^{-1}
$\left(\frac{\partial V}{\partial z}\right)_{flt}$	vertical wind shear for a shear layer at the flight altitude, sec^{-1}
γ_{flt}	lapse rate for a layer of low static stability at the flight altitude, C°/km
$-\gamma_{flt}$	inversion rate for a layer of high static stability at the flight altitude, C°/km

DATA COLLECTION

The data presented in this study include an estimate of the turbulence intensity, altitude, location, flight distance in turbulence, time of day, and the upper-air wind and temperature soundings for turbulence encountered at altitudes above 40,000 feet (12,200 meters). An NACA VGH recorder (ref. 7) carried in the XB-70 airplane provided a time-history trace for the values of airspeed, normal acceleration at the airplane center of gravity, and pressure altitude. In flight through turbulence, rapid fluctuations appeared on the normal-acceleration trace and irregular disturbances were noted on the airspeed trace, as shown in figure 1. The maximum peak-to-peak increment in normal acceleration at the airplane center of gravity $\Delta a_{n_{max}}$, which is also illustrated in figure 1, was determined for each turbulence encounter. Since instrumentation for a direct measure of gust velocity was not available, $\Delta a_{n_{max}}$ was used as an estimate of the turbulence intensity.

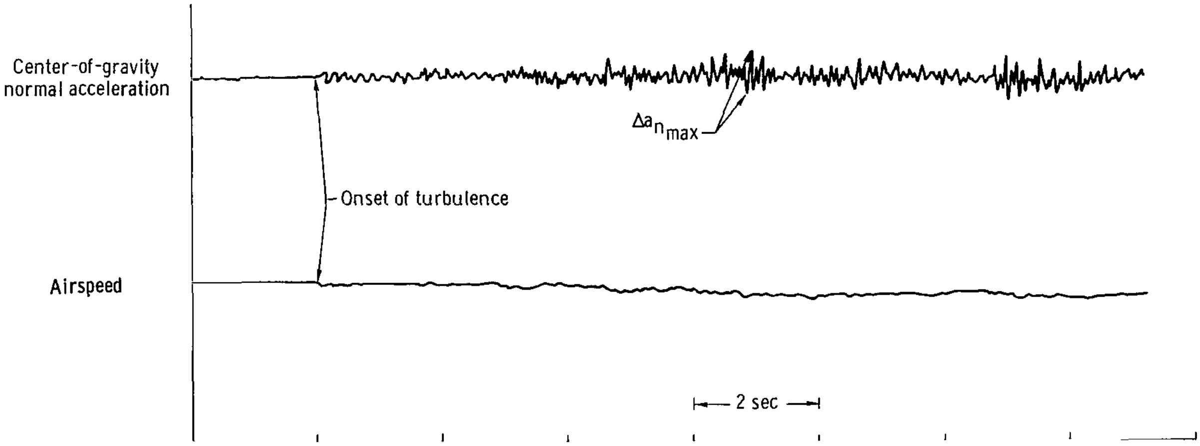


Figure 1.— VGH time history of normal acceleration and airspeed for an XB–70 turbulence encounter.

The particular VGH recorder used in the XB-70 airplane was modified in two ways. First, the recorder was set up to operate at a film speed of 14 inches per minute (5.93 millimeters/second) to provide improved resolution. Second, the accelerometer and galvanometer each had a natural frequency of 16 cycles per second and 20 cycles per second, and their damping was 0.65 critical. With these characteristics, the frequency response of the normal-acceleration measurement was essentially flat to 10 cycles per second.

Flight tests of the XB-70 airplane were made over the Western United States, as shown by the shaded area in figure 2. Nearly all of this area is characterized by irregular or mountainous terrain. The geographical location of the airplane when high-altitude turbulence was indicated by the VGH recorder data was obtained from the ground track recorded on a radar plotting-board map for each flight.

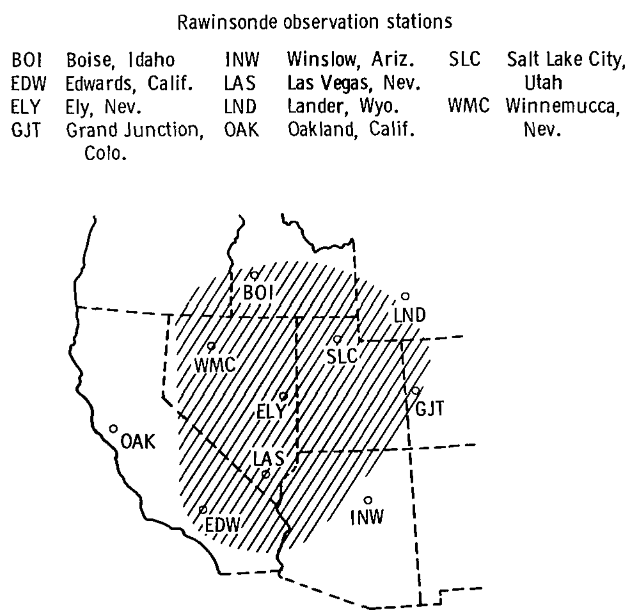


Figure 2.— Geographic area of XB–70 flights and locations of rawinsonde observation stations.

The upper-air stations near the XB-70 flight path from which rawinsonde observations near the turbulence encounters were obtained are also shown in figure 2. For the soundings made at civilian rawinsonde stations, copies of adiabatic charts WBAN-31A, B, and C and copies of the coded data for transmission on the winds aloft computation sheet, WBAN-20, were obtained from the National Weather Records Center, Environmental Science Services Administration, Asheville, N. C. Data for turbulence encounters near Edwards Air Force Base, Calif., were provided by Detachment 21, 6th Weather Wing, Air Weather Service, in the tabulated form produced by a digital-computer data-reduction program.

ANALYSIS PROCEDURE

In examining the association between high-altitude turbulence and meteorological features, three steps were followed: (1) review of VGH data for turbulence encounters; (2) separation of the encounters into two intensity categories; and (3) selection of specific meteorological parameters for evaluation from the rawinsonde data. In order to limit this initial study to the more intense turbulence, VGH data for 36 flights were reviewed for encounters having $\Delta a_{n_{max}}$ equal to 0.25g or greater. Encounters of this magnitude were found on 21 of the 36 flights at altitudes above 40,000 feet (12,200 meters). It may be of interest to note that VGH data were also available for six flights on which no high-altitude turbulence was encountered. An additional 21 flights, which either did not exceed 40,000 feet (12,200 meters) altitude or did not have VGH data, were made during the period covered by this study.

The XB-70 turbulence encounters were separated into two intensity categories on the basis of $\Delta a_{n_{max}}$. Encounters for which $0.2\ g \leq \Delta a_{n_{max}} < 0.40g$ were categorized as T1 and those with $\Delta a_{n_{max}} \geq 0.40g$ were categorized as T2. Pilots of the XB-70 airplane frequently referred to the turbulence intensity in these categories as "light" and "moderate," respectively. The arbitrary intensity categorization, T1 and T2, was used because uncertainties introduced by flexibility in the aircraft structure (ref. 8) preclude the calculation of derived gust velocities.

Selection of the meteorological parameters was made with consideration of the relevance to clear-air turbulence and the ease of obtaining the parameters directly from rawinsonde data. The six meteorological parameters selected were: (1) the wind speed at the altitude of the maximum wind level, (2) the wind speed at the 100-millibar level (approximately 53,000 feet or 16,200 meters pressure altitude), (3) vertical wind shear at lower altitude, (4) vertical wind shear at the flight altitude, (5) a pronounced temperature lapse at the flight altitude, and (6) a pronounced temperature inversion at the flight altitude. Flight-altitude wind shear, lapse, or inversion layers having values less than 0.005 sec^{-1}, 4.0 C°/km, or 5.0 C°/km, respectively, were not considered to be pronounced and were not included in this evaluation.

Lower-altitude wind shear was selected for evaluation in an attempt to include disturbances that could propagate upward, indirectly causing turbulence at the flight altitude, and to include shear layers that may belong to a deep atmospheric disturbance. These shear layers were considered to be at lower altitude when they were 5000 feet (1500 meters) or more below the flight level. The vertical wind shear, lapse, and inversion layers at the flight altitude may be expected to be directly associated with the turbulence encountered by the XB-70 airplane. In order to allow for differences in time and/or location between the rawinsonde observation and the turbulence encounter, these layers were considered to be at the flight altitude when they were within 2000 feet (600 meters) of the flight level.

The selected meteorological parameters were tabulated for the high-altitude turbulence encounters. Frequently, on a given flight, repeated encounters were experienced near the same rawinsonde observation and essentially in the same atmospheric layer. This repetition was avoided in the tabulation of the meteorological parameters by selecting only the encounter with the largest value of $\Delta a_{n_{max}}$. That is, when more than one encounter was within the area of a given rawinsonde observation and within 2000 feet (600 meters) in altitude or within the same meteorological layer, only the encounter with the largest $\Delta a_{n_{max}}$ was tabulated. A total of 43 samples, 27 in category T1 and 16 in category T2, was obtained by using this procedure.

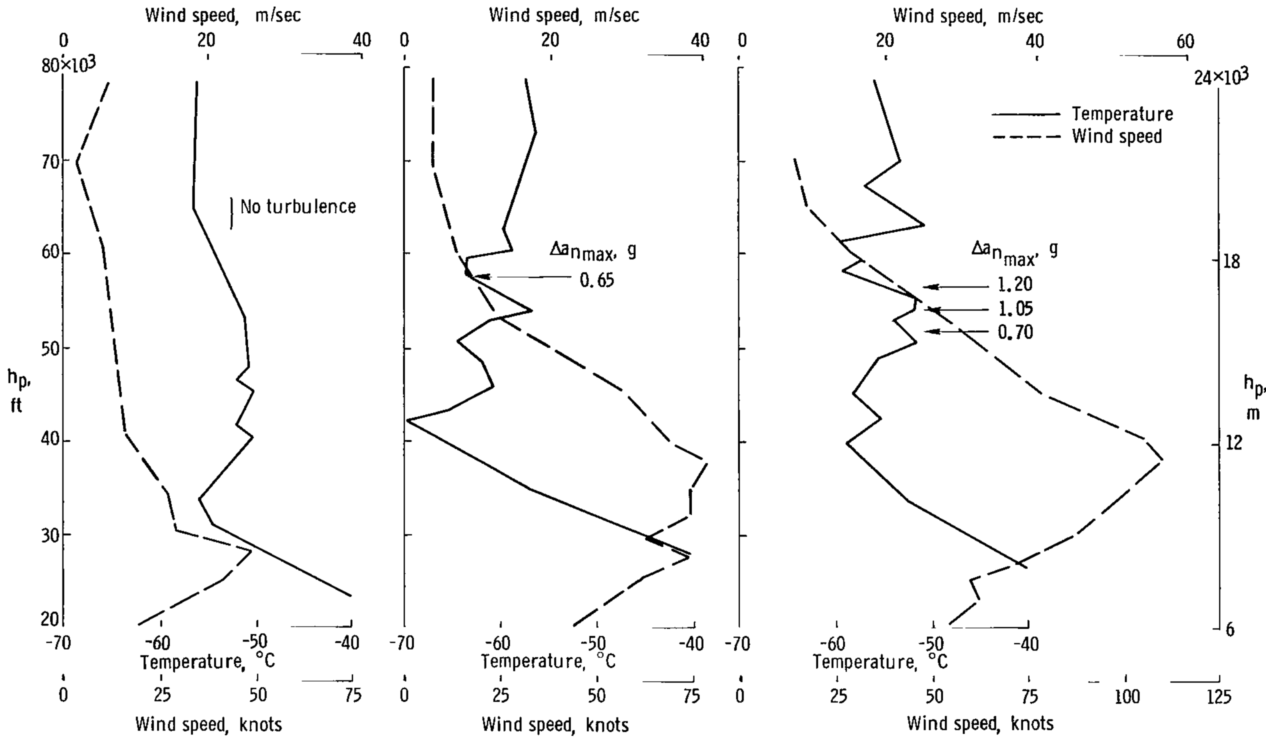
RESULTS AND DISCUSSION

The values of the meteorological parameters and the associated flight information, including the date, airplane number and flight number, encounter number, $\Delta a_{n_{max}}$, distance in turbulence, and the pressure altitude, are presented in table I. A general observation of these data indicates that the meteorological conditions accompanying the more intense turbulence, T2, tend to have larger values for wind speed, wind shear, lapse, and inversion layers than the T1 conditions. Typical illustrations of these features based on data taken from several flights are shown by the wind and temperature profiles in figures 3(a) to 3(c). While flying across the area covered by the profile in figure 3(a), the XB-70 airplane was gradually changing altitude from 63,000 feet (19,200 meters) to 65,000 feet (19,800 meters). No turbulence was encountered during this portion of the flight through relatively quiet atmospheric conditions. As shown, the wind speed reached a maximum of less than 50 knots (26 meters/second) below 30,000 feet (9100 meters) altitude and decreased to low values at the higher altitudes. Also, there were no appreciable wind shear, lapse, or inversion layers near the flight altitude. Figure 3(b) shows the profile for turbulence encountered during cruise at an altitude of 57,700 feet (17,600 meters) in which $\Delta a_{n_{max}}$ reached 0.65g. Here, the wind speed gradually decreased from more than 75 knots (39 meters/second) below 40,000 feet (12,200 meters) to lower speeds above 55,000 feet (16,700 meters). The temperature profile shows the flight altitude to be at the top of a pronounced lapse layer, with strong inversion layers both above and below. Figure 3(c) shows the profile for a deep layer of turbulence that was encountered during a climb between 52,000 feet (15,800 meters) and 59,000 feet (18,000 meters) altitude. The wind speed reached a maximum of greater than 100 knots (51 meters/second) at 40,000 feet (12,200 meters) and was also notably high at the altitudes at which turbulence was encountered. Several alternate layers of lapse and inversion are shown in the temperature profile. Again, for this example, the largest value of $\Delta a_{n_{max}}$ appeared in a layer of pronounced lapse.

TABLE I.– TURBULENCE SAMPLES

Flight date	Airplane and flight number	Encounter number	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)	V_{max}, knots (m/sec)	V_{100}, knots (m/sec)	$\left(\frac{\partial V}{\partial z}\right)_{low}$, sec^{-1}	$\left(\frac{\partial V}{\partial z}\right)_{flt}$, sec^{-1} (a)	γ_{flt}, C°/km (a)	$-\gamma_{flt}$, C°/km (a)
Category T1											
4/20/65	1-10	10	0.30	3.8 (6.1)	57.0×10^3 (17.4×10^3)	73 (37.6)	14 (7.2)	0.014	-----	----	6.0
4/28/65	1-11	1	.25	4.5 (8.3)	55.7 (17.0)	52 (26.8)	16 (8.2)	.016	-----	----	---
5/7/65	1-12	7	.25	3.6 (6.7)	47.3 (14.4)	66 (34.0)	6 (3.1)	.037	-----	4.0	---
		9	.25	1.5 (2.8)	56.2 (17.1)	66 (34.0)	6 (3.1)	.037	-----	----	---
		12	.30	3.6 (6.7)	58.8 (17.9)	43 (22.1)	18 (9.3)	.009	-----	5.2	---
		14	.35	12.5 (23.2)	51.8 (15.8)	43 (22.1)	18 (9.3)	.009	0.005	4.0	---
6/16/65	1-13	6	.25	7.0 (13.0)	55.2 (16.8)	91 (46.8)	24 (12.3)	.015	-----	----	---
		16	.30	5.2 (9.6)	56.9 (17.3)	68 (35.0)	11 (5.7)	.011	.006	----	7.6
		18	.25	2.3 (4.3)	47.0 (14.3)	68 (35.0)	11 (5.7)	.011	.007	5.2	---
7/1/65	1-14	2	.30	7.1 (13.1)	50.3 (15.3)	48 (24.7)	14 (7.2)	.007	.010	4.5	---
9/17/65	2-5	4	.35	42.6 (78.9)	47.1 (14.4)	43 (22.1)	35 (18.0)	.010	-----	----	---
		5	.25	4.8 (8.9)	51.0 (15.5)	43 (22.1)	35 (18.0)	.010	.005	----	7.1
		12	.25	1.6 (3.0)	45.8 (14.0)	67 (34.5)	37 (19.0)	.011	.006	5.7	---
9/22/65	1-16	2	.25	6.5 (12.0)	53.7 (16.4)	40 (20.6)	17 (8.7)	.008	.005	----	---
		8	.25	21.9 (40.6)	65.3 (19.9)	50 (25.7)	27 (13.9)	.010	-----	----	---
9/29/65	2-6	5	.30	4.7 (8.7)	45.7 (13.9)	88 (45.3)	27 (13.9)	.010	.010	----	---
10/14/65	1-17	4	.25	11.3 (20.9)	53.7 (16.4)	27 (13.9)	14 (7.2)	.010	-----	----	---
11/2/65	2-11	3	.35	6.8 (12.6)	56.0 (17.1)	56 (28.8)	25 (12.9)	.011	-----	----	---
1/12/66	2-18	5	.25	2.6 (4.8)	63.7 (19.4)	70 (36.0)	35 (18.0)	.014	.007	----	---
		6	.30	7.2 (13.3)	67.4 (20.5)	57 (29.3)	33 (17.0)	.009	-----	----	---
		14	.25	10.3 (19.1)	53.0 (16.2)	64 (32.9)	56 (28.8)	.013	.015	6.8	6.8
2/9/66	2-20	1	.25	15.7 (29.1)	46.4 (14.1)	84 (43.2)	15 (7.7)	.010	-----	----	---
		4	.30	19.1 (35.4)	49.5 (15.1)	76 (39.1)	16 (8.2)	.015	.005	----	5.2
		10	.30	1.9 (3.5)	55.9 (17.0)	85 (43.7)	20 (10.3)	.023	-----	----	---
3/10/66	2-23	1	.35	6.5 (12.0)	41.3 (12.6)	82 (42.2)	33 (17.0)	.018	.007	----	---
		11	.25	18.4 (34.1)	65.4 (19.9)	72 (37.0)	30 (15.4)	.026	.005	----	---
3/17/66	2-25	14	.25	5.3 (9.8)	66.0 (20.1)	105 (54.0)	42 (21.6)	.024	-----	----	---
Category T2											
4/20/65	1-10	14	0.65	6.3 (11.7)	57.7×10^3 (17.6×10^3)	79 (40.6)	26 (13.4)	0.010	-----	6.2	24.0
		22	.70	16.4 (30.4)	46.6 (14.2)	58 (29.8)	39 (20.1)	.012	0.008	----	14.5
9/22/65	1-16	1	.45	4.9 (9.1)	43.0 (13.1)	25 (12.9)	19 (9.8)	.014	-----	5.9	----
		5	.40	16.9 (31.3)	60.3 (18.4)	49 (25.2)	33 (17.0)	.021	.009	----	11.0
12/2/65	1-23	4	.40	6.1 (11.3)	45.2 (13.8)	113 (58.1)	41 (21.1)	.032	.013	----	----
		9	.40	4.7 (8.7)	50.2 (15.3)	136 (70.0)	54 (27.8)	.035	.007	5.2	----
		13	.40	2.6 (4.8)	46.8 (14.3)	136 (70.0)	54 (27.8)	.035	.005	----	----
		15	.45	1.0 (1.9)	49.5 (15.1)	122 (62.8)	41 (21.1)	.020	-----	4.7	----
12/7/65	1-24	2	.40	5.9 (10.9)	61.6 (18.8)	72 (37.0)	36 (18.5)	.017	.005	6.6	----
1/3/66	2-17	5	.55	14.9 (27.6)	51.2 (15.6)	56 (28.8)	30 (15.4)	.015	-----	----	----
		10	.55	68.9 (127.6)	60.0 (18.3)	65 (33.4)	27 (13.9)	.017	.010	----	5.0
3/15/66	2-24	6	.55	39.8 (73.7)	58.1 (17.7)	72 (37.0)	40 (20.6)	.017	-----	6.5	5.8
3/19/66	2-26	2	.70	20.4 (37.8)	52.0 (15.8)	122 (62.8)	47 (24.2)	.022	.007	----	27.0
		4	1.05	242.9 (449.9)	54.8 (16.7)	122 (62.8)	47 (24.2)	.022	.007	8.0	7.5
		4	1.20	242.9 (449.9)	57.0 (17.4)	122 (62.8)	47 (24.2)	.022	.005	8.0	7.5
		4	.50	242.9 (449.9)	60.1 (18.3)	120 (61.7)	40 (20.6)	.021	.005	8.0	6.6

[a]Values not given for $\left(\frac{\partial V}{\partial z}\right)_{flt}$, γ_{flt}, and $-\gamma_{flt}$ were less than 0.005 sec^{-1}, 4.0 C°/km, and 5.0 C°/km, respectively.



(a) No turbulence.

(b) Turbulence during constant-altitude cruise.

(c) Turbulence during climb.

Figure 3.— Examples of wind and temperature profiles for various turbulence conditions encountered by the XB–70 airplane.

A more direct comparison between the meteorological parameters for the turbulence-intensity categories T1 and T2 was attempted on the basis of the percentage of encounters in each category that equals or exceeds specified values for each parameter. For this purpose, values were selected for the parameters that appeared to discriminate well between the T1 and T2 samples. This comparison, including the percentages and the specified values, is presented in table II. As shown, the specified values for the

TABLE II.– PERCENT OF SAMPLES MEETING THE SPECIFIED VALUES OF THE METEOROLOGICAL PARAMETERS FOR CATEGORIES T1 AND T2

Parameter	Specified value	Turbulence-intensity category	
		T1, percent	T2, percent
V_{max}	≥70 knots (36 m/sec)	37	69
V_{100}	≥40 knots (20.6 m/sec)	7	56
$\left(\frac{\partial V}{\partial z}\right)_{low}$	≥0.020 sec^{-1}	9	56
$\left(\frac{\partial V}{\partial z}\right)_{flt}$	≥0.005 sec^{-1}	48	69
γ_{flt}	≥4.0 C°/km	26	56
$-\gamma_{flt}$	≥5.0 C°/km	18	56

meteorological parameters are met by a greater percentage of the samples in category T2 than in category T1. The percentage meeting the specified value for vertical wind shear at the flight altitude shows the least contrast of all the parameters. However, this low contrast is assumed to reflect the reduced sensitivity and an increase in error of the wind measurement at high altitude, rather than the actual significance of wind shear to the turbulence encounters at these altitudes.

The trend shown for all the meteorological parameters in table II and the absence of any single outstanding parameter indicate that a variety of disturbance mechanisms can generate significant high-altitude turbulence. It is conceivable that these disturbances may include strong frontal systems, sharp pressure troughs, and lee wave activity developed in the troposphere, as well as strong stability deviations and wind-shear layers generated within the stratosphere. Additional data and studies for each of these disturbances are needed to develop high-altitude-turbulence forecasting procedures.

In general, the results shown in table II verify previous work and theoretical expectations regarding the atmospheric disturbances significant to high-altitude turbulence. In particular, the higher maximum wind velocity and stronger vertical wind shear at lower altitudes frequently accompany strong frontal systems and lee wave conditions. These features associated with category T2 turbulence give support to suggestions by Hildreth et al. (ref. 2) and Reiter (ref. 3) that the turbulence at SST cruise altitudes will be related to flow over rough terrain and mountain wave activity. The flight-level wind shear and pronounced temperature inversions may often characterize wave motion in a shearing current and conditions favoring the growth of small-amplitude perturbations, which are also discussed in references 2 and 4 as being important to high-altitude turbulence. In several of the T2 samples, there were both pronounced lapse layers and vertical wind shear at flight altitude. These features agree qualitatively with the index of clear-air-turbulence intensity derived by Colson and Panofsky (ref. 5), since they decrease the Richardson number and increase the magnitude of the velocity-vector difference across the layer. The pronounced lapse layers associated with some of the turbulence encounters appear to support the hypothesis discussed in reference 6. According to this hypothesis, the adiabatic layers characterize zones of mixing between two air masses in which much of the clear-air turbulence is generated.

The importance of considering several parameters rather than a single parameter (such as wind shear, lapse, or inversion rate) can be demonstrated by comparing categories T1 and T2 on the basis of the number of samples in each category that meet the specified values for three or more of the meteorological parameters. As shown in the following tabulation, few samples from category T1 but most of the samples from category T2 meet the specified values for three or more of the meteorological parameters. In addition to indicating the variety of parameters involved, the contrast shown by this comparison is also interpreted as illustrating the usefulness of rawinsonde data for describing atmospheric conditions associated with high-altitude turbulence.

Category	Cases meeting less than three specified values	Cases meeting three or more specified values
T1	23	4
T2	4	12

CONCLUDING REMARKS

A study of turbulence encountered by the XB-70 airplane has shown that turbulence of significant intensity at SST cruise altitudes is related to wind velocity, vertical wind shear, and temperature parameters obtained from rawinsonde measurements. The data illustrate that high-altitude turbulence is found in several situations characterized by various combinations of meteorological parameters. Some of the turbulence situations encountered exemplify particular disturbances that previous investigators have suggested could cause high-altitude turbulence. As mentioned in the literature, these disturbances can originate in the lower atmosphere as well as within the stratosphere itself. Additional data and meteorological analyses are needed for the development of high-altitude-turbulence forecasting procedures.

Flight Research Center,
National Aeronautics and Space Administration,
Edwards, Calif., January 5, 1968,
126-16-06-01-24.

APPENDIX

TABULATION OF XB-70 TURBULENCE-ENCOUNTER DATA

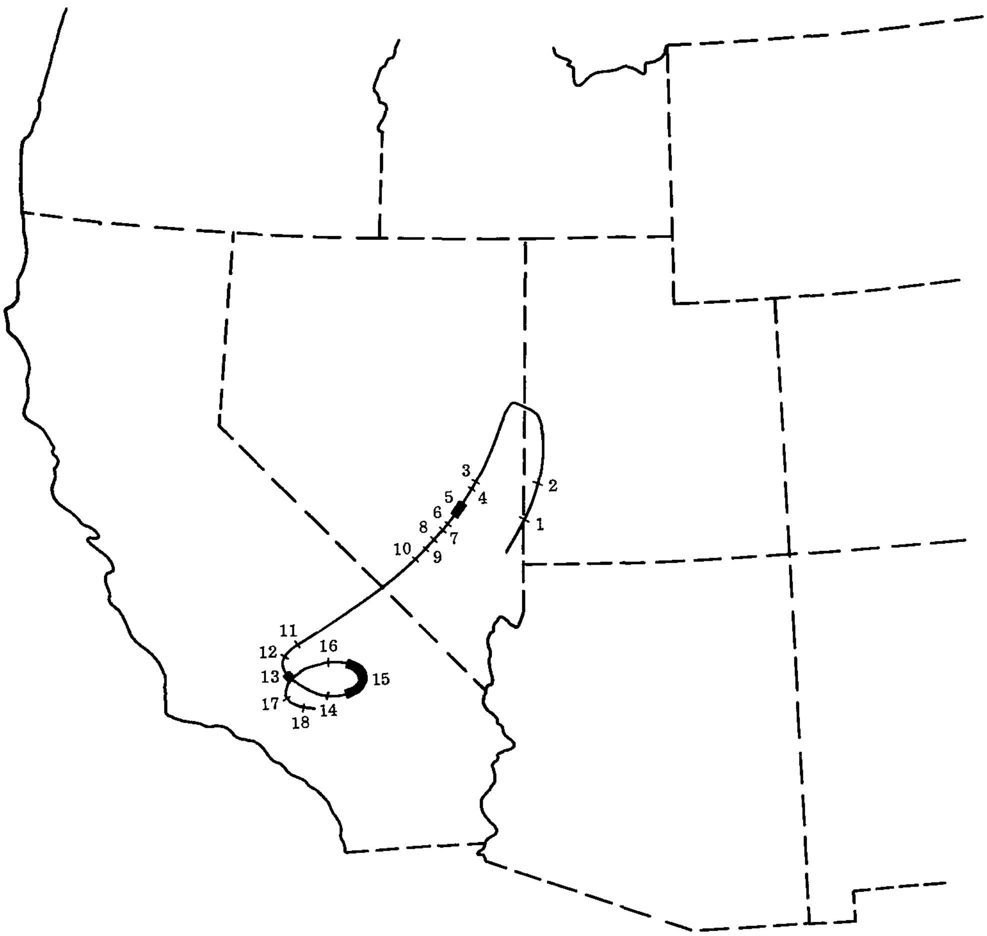
Turbulence-encounter data are tabulated in this appendix for 36 flights of the XB-70 airplane over the Western United States between February 1965 and March 1966. The basic VGH data for turbulence encountered at altitudes above 40,000 feet (12,200 meters) have a threshold value for the maximum peak-to-peak increment in normal acceleration at the airplane center of gravity $\Delta a_{n_{max}}$ of 0.10g. A higher threshold, 0.25g, was selected for the study reported in this paper, in order to exclude turbulence of very light intensity. Also, a number of encounters in this appendix were not used in the study because they were separated from the nearest rawinsonde data by excessive distances (typically more than 120 nautical miles or 62 kilometers). Although 63 flights were made during the period covered, only 36 flights on which turbulence data were obtained at altitudes above 40,000 feet (12,200 meters) are included.

The data are presented in tables (pages 11 to 46) which give the number, time of day, $\Delta a_{n_{max}}$, length, and altitude of each turbulence encounter. A map showing the encounter locations accompanies the data table for each flight. A solid line on the maps shows the flight track for the portion of the flight above 40,000 feet (12,200 meters) altitude. A short line across the flight track denotes turbulence encounters that were less than 5 nautical miles long; a square denotes encounters 5 to 10 nautical miles long. For encounters longer than 10 nautical miles, a thick line along the flight track, representative of the distance in turbulence, is used. The adjoining numbers provide a cross-reference between the encounter locations on the map and the accompanying table.

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1850Z	0.10	0.5 (0.9)	40.2×10^3 (12.3×10^3)

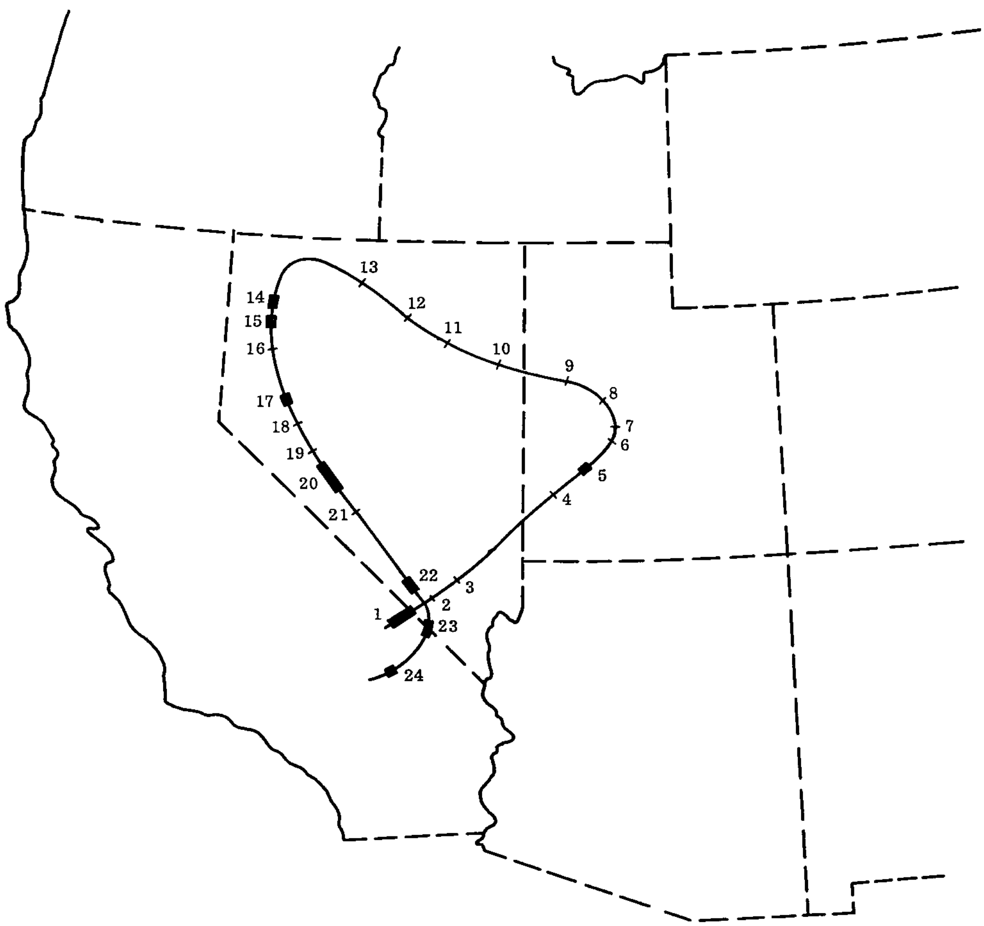
XB-70-1-5 February 16, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1845Z	0.25	2.1 (3.9)	40.7× 10³ (12.4× 10³)
2	1849Z	.15	4.9 (9.1)	43.1 (13.1)
3	1901Z	.15	4.1 (7.6)	43.8 (13.4)
4	1901Z	.20	2.5 (4.6)	44.5 (13.6)
5	1902Z	.20	14.8 (27.4)	45.1 (13.7)
6	1903Z	.20	2.1 (3.9)	45.3 (13.8)
7	1903Z	.15	.8 (1.5)	45.5 (13.9)
8	1904Z	.15	4.7 (8.7)	45.2 (13.8)
9	1906Z	.15	1.9 (3.5)	44.2 (13.5)
10	1907Z	.20	2.2 (4.1)	46.0 (14.0)
11	1915Z	.15	2.9 (5.4)	49.8 (15.2)
12	1915Z	.20	1.4 (2.6)	49.8 (15.2)
13	1919Z	.20	5.1 (9.4)	49.8 (15.2)
14	1920Z	.15	2.7 (5.0)	49.6 (15.1)
15	1926Z	.45	56.2 (104.1)	42.0 (12.8)
16	1928Z	.15	1.5 (2.8)	41.3 (12.6)
17	1931Z	.15	1.4 (2.6)	40.3 (12.3)
18	1933Z	.15	1.8 (3.3)	41.0 (12.5)



XB-70-1-7 March 4, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1933Z	0.30	23.9 (44.3)	37.5×10^3 (11.4×10^3)
2	1935Z	.20	2.3 (4.3)	42.9 (13.1)
3	1938Z	.20	1.9 (3.5)	46.0 (14.0)
4	1943Z	.20	4.0 (7.4)	54.9 (16.7)
5	1944Z	.20	8.8 (16.3)	56.7 (17.3)
6	1945Z	.15	2.1 (3.9)	57.0 (17.4)
7	1946Z	.15	.7 (1.3)	56.6 (17.3)
8	1947Z	.20	2.1 (3.9)	57.4 (17.5)
9	1952Z	.20	2.4 (4.4)	57.3 (17.5)
10	1953Z	.30	3.8 (7.0)	57.0 (17.4)
11	1959Z	.30	3.1 (5.7)	56.8 (17.3)
12	2000Z	.25	4.2 (7.8)	56.9 (17.3)
13	2004Z	.20	2.8 (5.2)	57.0 (17.4)
14	2007Z	.65	6.3 (11.7)	57.7 (17.6)
15	2009Z	.30	8.5 (15.7)	57.1 (17.4)
16	2010Z	.20	1.1 (2.0)	56.6 (17.3)
17	2014Z	.55	9.7 (18.0)	57.3 (17.5)
18	2016Z	.40	2.5 (4.6)	55.0 (16.8)
19	2017Z	.40	4.5 (8.3)	52.5 (16.0)
20	2018Z	.65	29.5 (54.6)	52.6 (16.0)
21	2021Z	.15	3.8 (7.0)	53.5 (16.3)
22	2030Z	.70	16.4 (30.4)	46.6 (14.2)
23	2031Z	.45	15.6 (28.9)	46.3 (14.1)
24	2039Z	.15	5.6 (10.4)	41.2 (12.6)

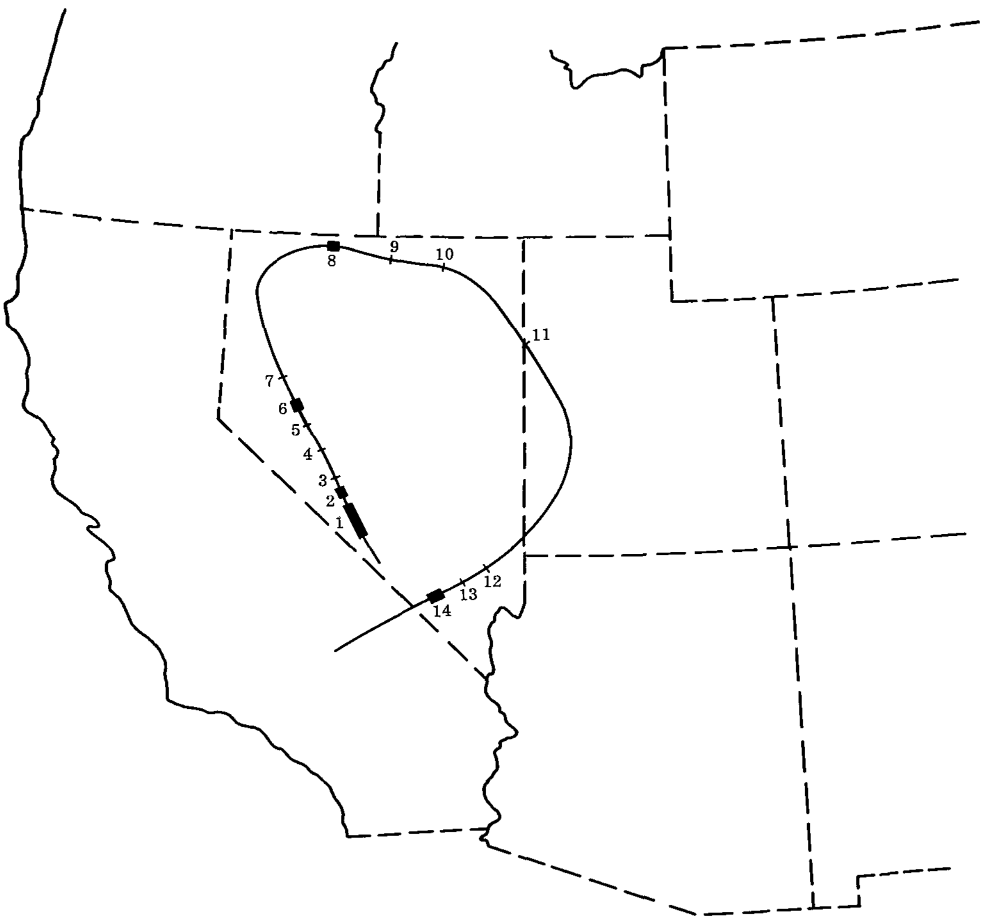


XB-70-1-10 April 20, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1650Z	0.25	4.5 (8.3)	55.7×10^3 (17.0×10^3)
2	1652Z	.25	3.1 (5.7)	56.2 (17.1)

XB-70-1-11 April 28, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1832Z	0.40	33.2 (61.5)	40.8×10^3 (12.4×10^3)
2	1834Z	.20	5.8 (10.7)	42.2 (12.9)
3	1835Z	.25	2.0 (3.7)	43.5 (13.3)
4	1835Z	.20	3.4 (6.3)	43.8 (13.3)
5	1836Z	.20	.6 (1.1)	43.5 (13.3)
6	1836Z	.20	5.1 (9.4)	45.5 (13.9)
7	1837Z	.25	3.6 (6.7)	47.3 (14.4)
8	1845Z	.15	9.2 (17.0)	54.2 (16.5)
9	1850Z	.25	1.5 (2.8)	56.2 (17.1)
10	1852Z	.20	3.8 (7.0)	58.2 (17.7)
11	1856Z	.20	4.9 (9.1)	58.4 (17.8)
12	2010Z	.30	3.6 (6.7)	58.8 (17.9)
13	2011Z	.20	3.1 (5.7)	55.5 (16.9)
14	2012Z	.35	12.5 (23.2)	51.8 (15.8)

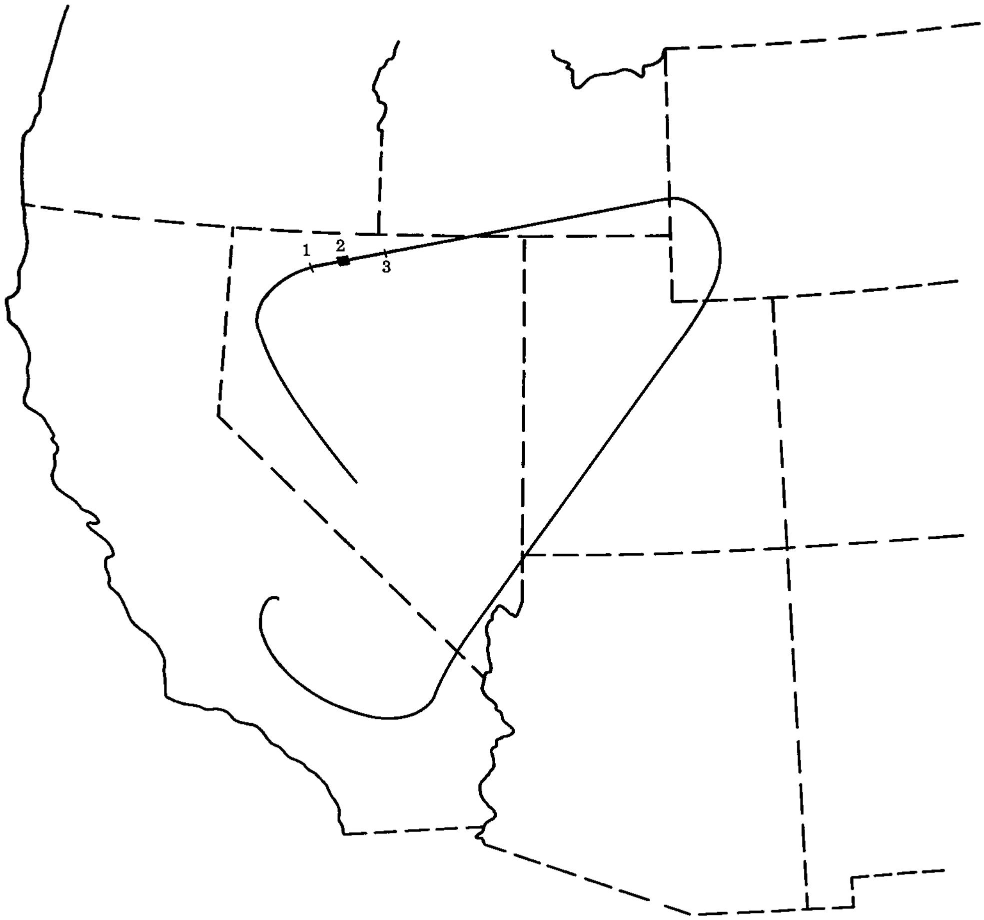


XB-70-1-12 May 7, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1429Z	0.20	2.8 (5.2)	43.6× 10^3 (13.3× 10^3)
2	1432Z	.15	1.5 (2.8)	46.2 (14.1)
3	1437Z	.20	5.3 (9.8)	53.2 (16.2)
4	1439Z	.15	.7 (1.3)	54.8 (16.7)
5	1440Z	.25	3.5 (6.5)	55.4 (16.9)
6	1442Z	.25	7.0 (13.0)	55.2 (16.8)
7	1443Z	.20	4.3 (8.0)	57.2 (17.4)
8	1445Z	.25	10.5 (19.4)	57.5 (17.5)
9	1449Z	.15	7.6 (14.1)	59.4 (18.1)
10	1458Z	.15	2.8 (5.2)	62.2 (19.0)
11	1500Z	.15	1.2 (2.2)	62.6 (19.1)
12	1501Z	.15	13.4 (24.8)	63.0 (19.2)
13	1502Z	.20	1.6 (3.0)	63.5 (19.4)
14	1503Z	.15	2.0 (3.7)	63.8 (19.4)
15	1516Z	.25	23.0 (42.6)	58.0 (17.7)
16	1522Z	.30	5.2 (9.6)	56.9 (17.3)
17	1523Z	.15	1.1 (2.0)	56.2 (17.1)
18	1525Z	.25	2.3 (4.3)	47.0 (14.3)

XB-70-1-13 June 16, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1422Z	0.20	0.7 (1.3)	47.9×10^3 (14.6×10^3)
2	1423Z	.30	7.1 (13.1)	50.3 (15.3)
3	1424Z	.20	1.4 (2.6)	53.4 (16.3)



XB-70-1-14 July 1, 1965

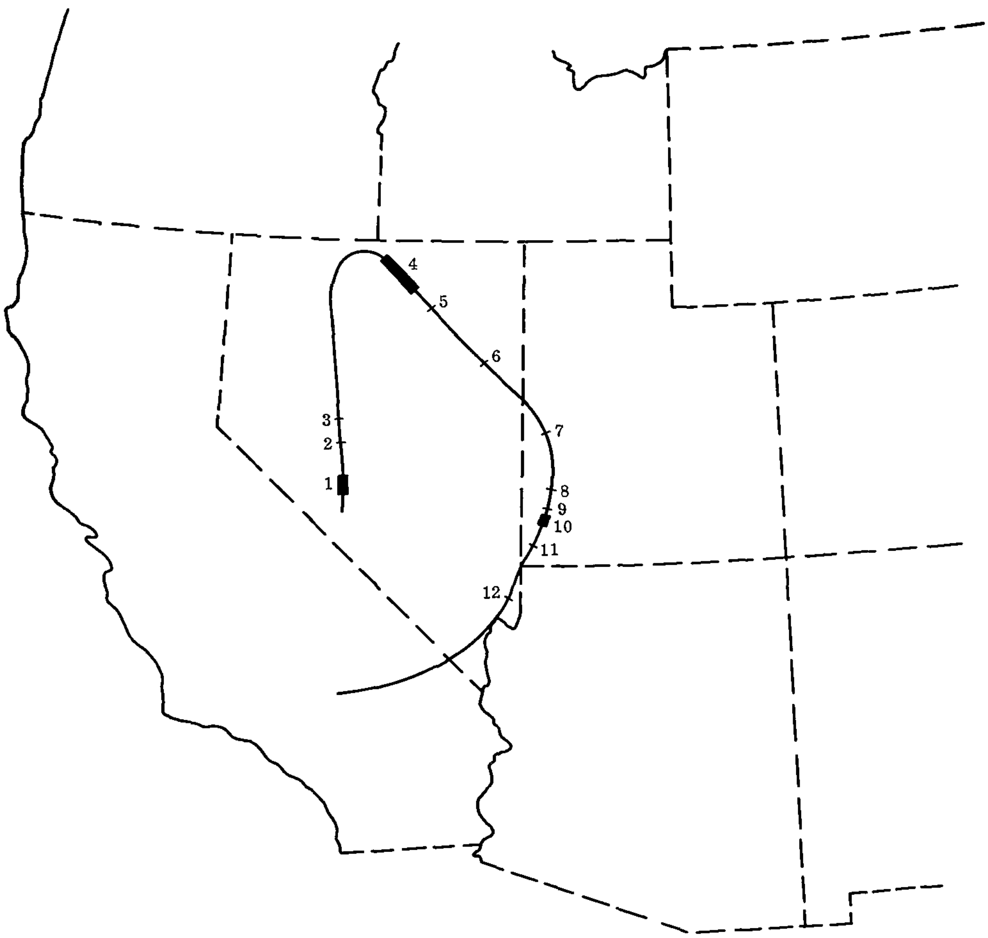
Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1456Z	0.15	2.2 (4.1)	65.0×10^3 (19.8×10^3)

XB-70-1-15 July 27, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1958Z	0.40	16.2 (30.0)	43.7× 10^3 (13.3× 10^3)
2	2000Z	.30	22.7 (42.0)	43.0 (13.1)
3	2001Z	.25	1.9 (3.5)	43.2 (13.2)
4	2002Z	.35	18.3 (33.9)	43.5 (13.3)
5	2005Z	.10	.7 (1.3)	45.8 (14.0)
6	2006Z	.10	4.9 (9.1)	45.6 (13.9)
7	2008Z	.15	15.0 (27.8)	45.6 (13.9)
8	2016Z	.20	10.2 (18.9)	45.0 (13.7)
9	2020Z	.25	54.1 (100.2)	43.5 (13.3)
10	2026Z	.20	20.7 (38.3)	44.6 (13.6)
11	2028Z	.25	11.2 (20.7)	43.6 (13.3)

XB-70-2-3 August 18, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1918Z	0.25	15.6 (28.9)	42.2× 10^3 (12.9× 10^3)
2	1920Z	.20	4.2 (7.8)	42.0 (12.8)
3	1921Z	.15	3.7 (6.9)	42.5 (13.0)
4	1935Z	.35	42.6 (78.9)	47.1 (14.4)
5	1938Z	.25	4.8 (8.9)	51.0 (15.5)
6	1942Z	.20	1.9 (3.5)	52.0 (15.8)
7	1946Z	.20	1.2 (2.2)	50.0 (15.2)
8	1950Z	.15	1.0 (1.9)	47.0 (14.3)
9	1951Z	.10	1.8 (3.3)	47.0 (14.3)
10	1951Z	.20	6.7 (12.4)	47.0 (14.3)
11	1952Z	.10	1.8 (3.3)	47.0 (14.3)
12	1955Z	.25	1.6 (3.0)	45.8 (14.0)



XB-70-2-5 September 17, 1965

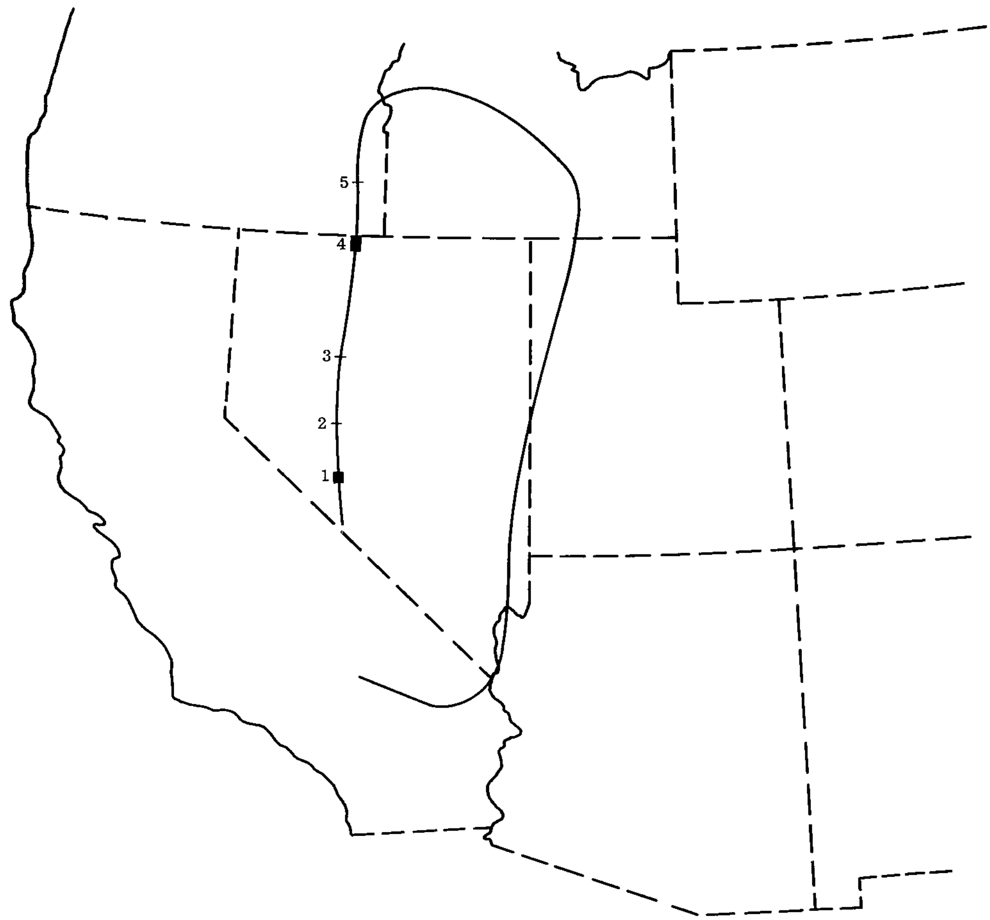
Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	hp, ft (m)
1	1920Z	0.45	4.9 (9.1)	43.0×10^3 (13.1×10^3)
2	1923Z	.25	6.5 (12.0)	53.7 (16.4)
3	1925Z	.20	9.2 (17.0)	56.0 (17.1)
4	1941Z	.15	.9 (1.7)	61.9 (18.9)
5	1946Z	.40	16.9 (31.3)	60.3 (18.4)
6	1948Z	.20	3.0 (5.6)	62.0 (18.9)
7	1953Z	.20	6.3 (11.7)	65.5 (20.0)
8	1958Z	.25	21.9 (40.6)	65.3 (19.9)

XB-70-1-16 September 22, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1915Z	0.20	4.4 (8.1)	41.5×10^3 (12.6×10^3)
2	1916Z	.20	5.8 (10.7)	42.1 (12.8)
3	1917Z	.15	1.2 (2.2)	43.1 (13.1)
4	1920Z	.15	1.7 (3.1)	51.3 (15.6)
5	1925Z	.30	4.7 (8.7)	45.7 (13.9)

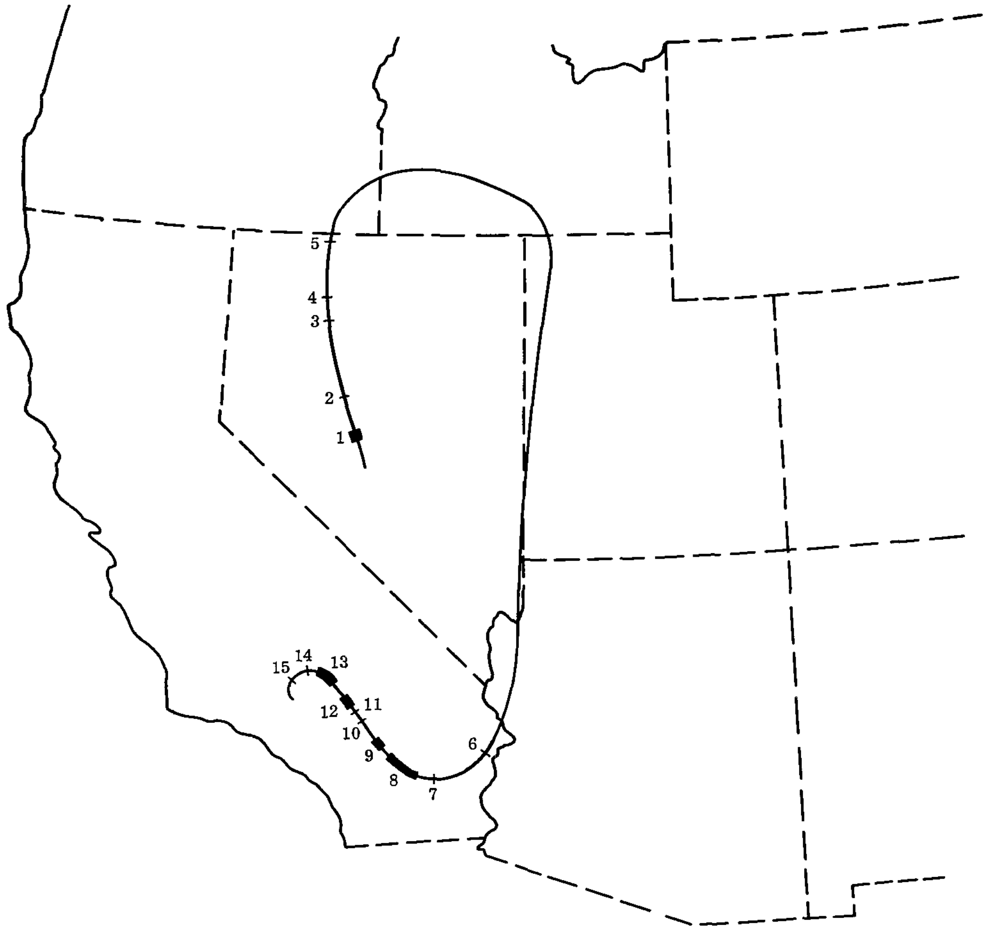
XB-70-2-6 September 29, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1628Z	0.20	5.1 (9.4)	49.8×10^3 (15.2×10^3)
2	1628Z	.15	3.0 (5.6)	50.0 (15.2)
3	1633Z	.15	2.1 (3.9)	54.3 (16.6)
4	1635Z	.25	11.3 (20.9)	53.7 (16.4)
5	1641Z	.20	1.5 (2.8)	56.4 (17.2)



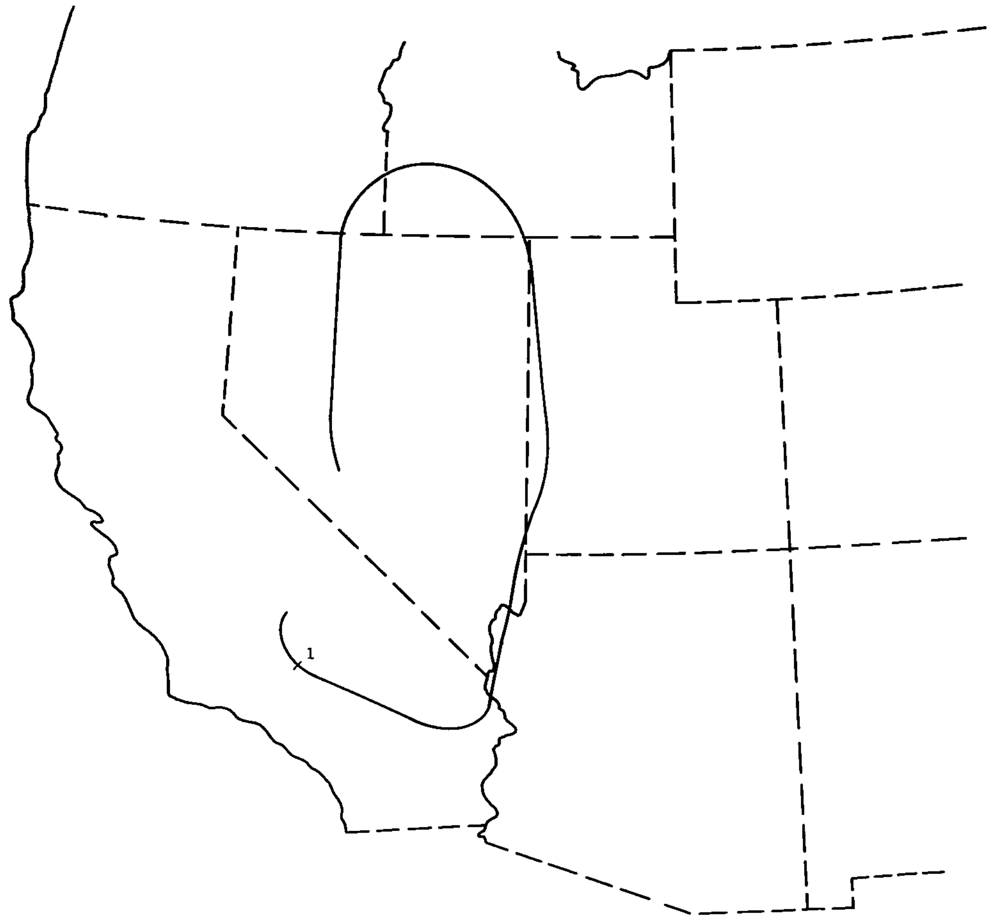
XB-70-1-17 October 14, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1638Z	0.15	8.5 (15.7)	42.0×10^3 (12.8×10^3)
2	1641Z	.25	1.1 (2.0)	48.0 (14.6)
3	1645Z	.10	.7 (1.3)	55.7 (17.0)
4	1645Z	.20	.7 (1.3)	56.0 (17.1)
5	1648Z	.10	2.9 (5.4)	58.6 (17.9)
6	1723Z	.10	1.6 (3.0)	58.1 (17.7)
7	1724Z	.25	1.2 (2.2)	58.7 (17.9)
8	1727Z	.20	34.7 (64.3)	57.4 (17.5)
9	1729Z	.20	9.3 (17.2)	56.0 (17.1)
10	1730Z	.10	1.8 (3.3)	56.4 (17.2)
11	1731Z	.15	4.9 (9.1)	55.9 (17.0)
12	1731Z	.15	5.0 (9.3)	54.0 (16.5)
13	1733Z	.35	24.5 (45.4)	52.0 (15.8)
14	1734Z	.25	3.6 (6.7)	50.2 (15.3)
15	1735Z	.10	4.5 (8.3)	42.4 (12.9)



XB-70-2-9 October 16, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1812Z	0.10	0.9 (1.7)	46.0×10^3 (14.0×10^3)



XB-70-2-10 **October 26, 1965**

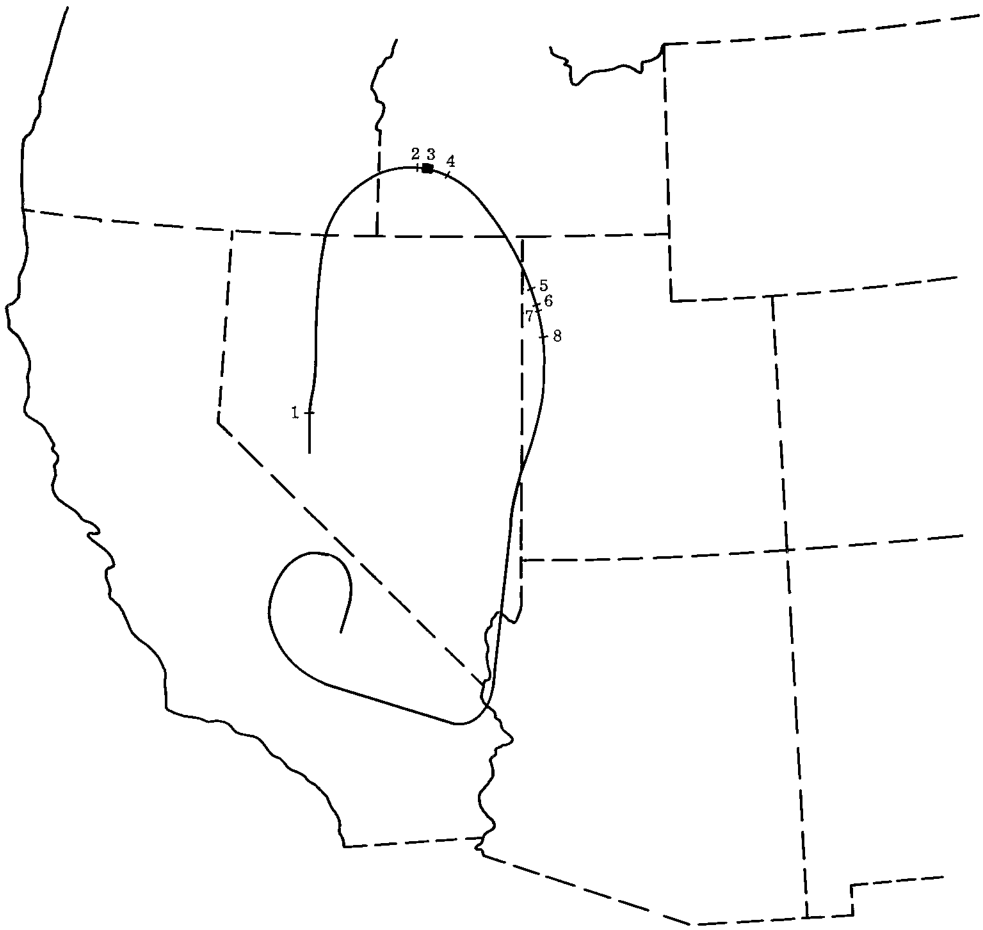
Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1801Z	0.15	2.3 (4.3)	45.4×10^3 (13.8×10^3)
2	1817Z	.20	3.8 (7.0)	43.1 (13.1)
3	1820Z	.20	2.2 (4.1)	40.3 (12.3)

XB-70-1-20 November 12, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1855Z	0.15	2.3 (4.3)	45.4×10^3 (13.8×10^3)
2	1952Z	.15	1.1 (2.0)	40.4 (12.3)

XB-70-1-18 November 4, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1950Z	0.15	1.2 (2.2)	47.2×10^3 (14.4×10^3)
2	2003Z	.10	1.1 (2.0)	56.0 (17.1)
3	2003Z	.35	6.8 (12.6)	56.0 (17.1)
4	2004Z	.10	.8 (1.5)	55.7 (17.0)
5	2010Z	.10	.8 (1.5)	56.0 (17.1)
6	2011Z	.10	.7 (1.3)	55.9 (17.0)
7	2011Z	.20	3.8 (7.0)	56.0 (17.1)
8	2012Z	.15	.4 (.7)	56.7 (17.3)

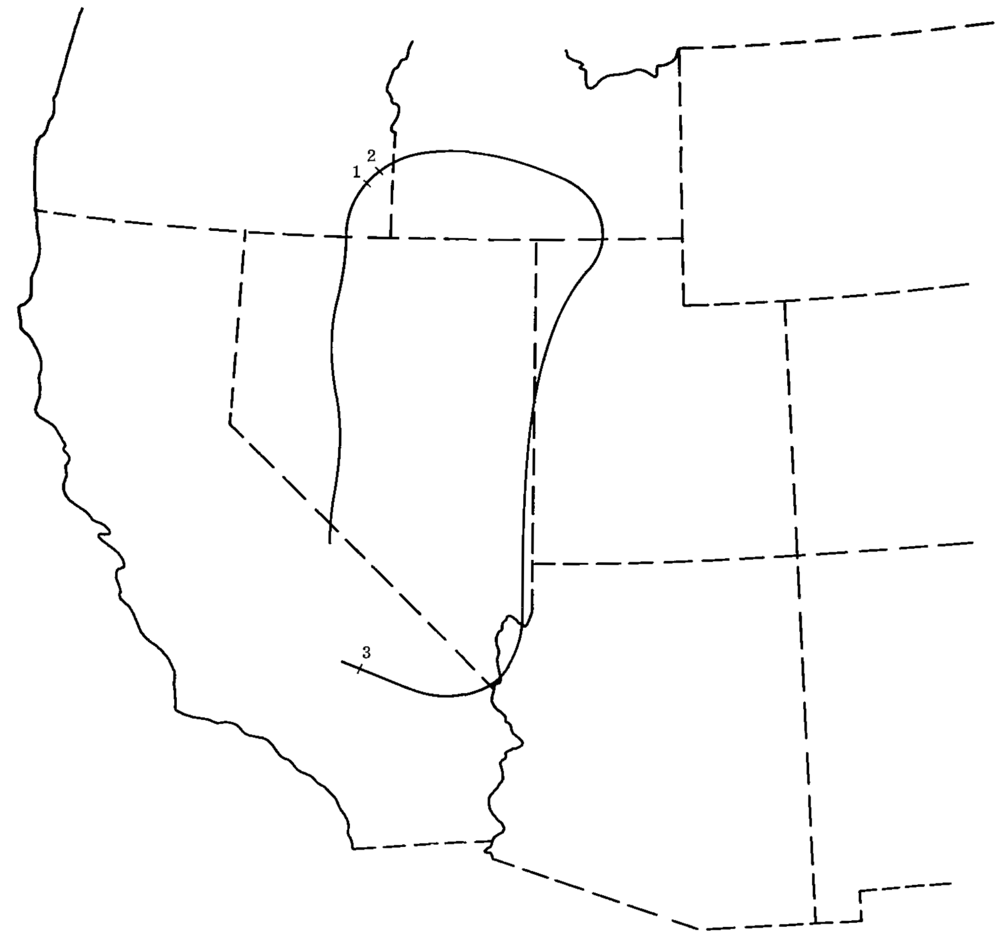


XB-70-2-11 November 2, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	2121Z	0.15	2.1 (3.9)	45.0×10^3 (13.7×10^3)
2	2121Z	.15	.8 (1.5)	44.8 (13.7)

XB-70-1-21 November 18, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	hp, ft (m)
1	1735Z	0.15	0.7 (1.3)	50.8×10^3 (15.5×10^3)
2	1736Z	.20	.7 (1.3)	50.8 (15.5)
3	1817Z	.20	.6 (1.1)	45.8 (14.0)

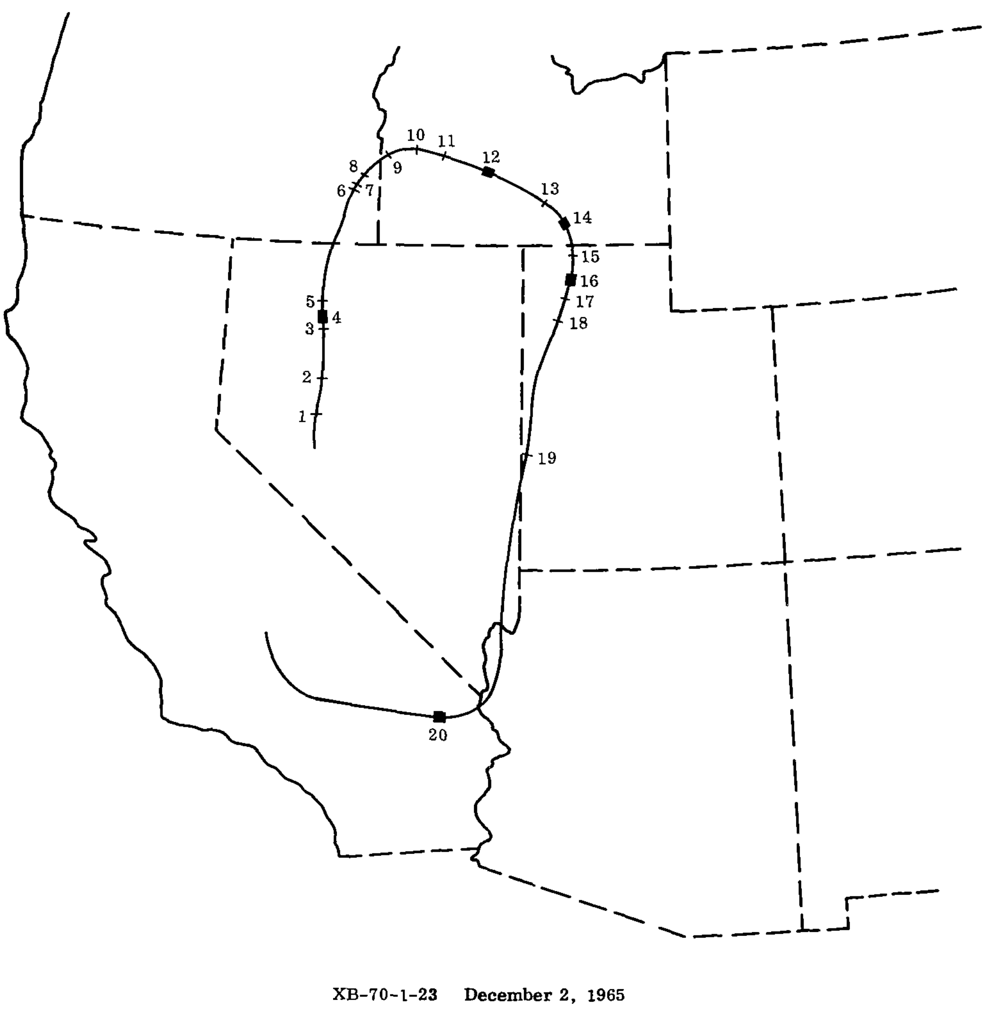


XB-70-1-22 November 30, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	hp, ft (m)
1	1726Z	0.10	1.5 (2.8)	44.5× 10^3 (13.6× 10^3)
2	1817Z	.15	1.8 (3.3)	58.0 (17.7)
3	1819Z	.20	1.7 (3.1)	58.0 (17.7)
4	1827Z	.15	2.8 (5.2)	48.2 (14.7)

XB-70-2-13 December 1, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1750Z	0.20	0.9 (1.7)	45.7×10³ (13.9×10³)
2	1752Z	.15	.9 (1.7)	45.5 (13.9)
3	1755Z	.25	1.2 (2.2)	45.0 (13.7)
4	1755Z	.40	6.1 (11.3)	45.2 (13.8)
5	1756Z	.20	3.2 (5.9)	45.6 (13.9)
6	1803Z	.25	2.3 (4.3)	46.6 (14.2)
7	1803Z	.15	2.3 (4.3)	46.2 (14.1)
8	1804Z	.25	1.2 (2.2)	46.3 (14.1)
9	1807Z	.40	4.7 (8.7)	50.2 (15.3)
10	1808Z	.25	2.5 (4.6)	49.8 (15.2)
11	1809Z	.25	2.9 (5.4)	49.4 (15.1)
12	1813Z	.20	5.7 (10.6)	48.7 (14.8)
13	1815Z	.40	2.6 (4.8)	46.8 (14.3)
14	1817Z	.30	5.2 (9.6)	52.1 (15.9)
15	1817Z	.45	1.0 (1.9)	49.5 (15.1)
16	1818Z	.30	7.2 (13.3)	49.0 (14.9)
17	1819Z	.15	2.3 (4.3)	49.5 (15.1)
18	1822Z	.30	4.1 (7.6)	50.0 (15.2)
19	1828Z	.20	1.1 (2.0)	59.6 (18.2)
20	1838Z	.20	5.5 (10.2)	57.8 (17.6)



XB-70-1-23 December 2, 1965

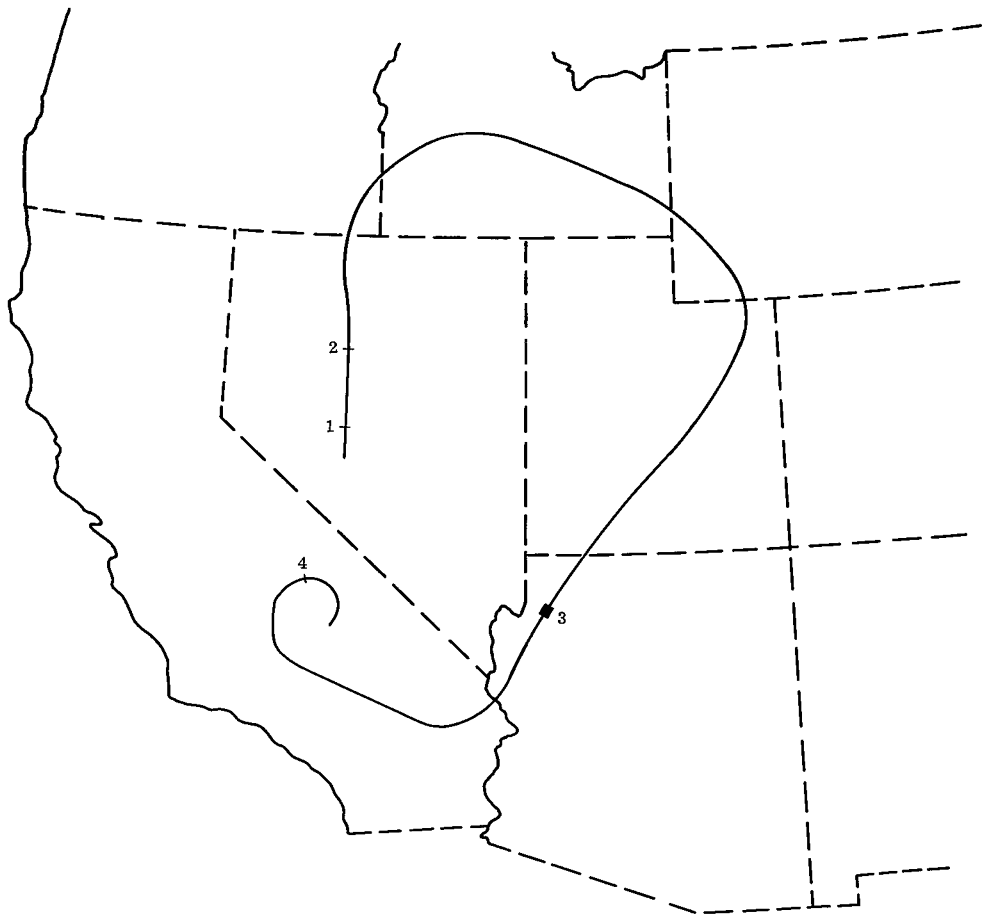
Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1745Z	0.20	1.9 (3.5)	54.4×10^3 (16.6×10^3)
2	1747Z	.40	5.9 (10.9)	61.6 (18.8)
3	1748Z	.30	4.8 (8.9)	60.2 (18.3)

XB-70-1-24 December 7, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	2056Z	0.20	1.8 (3.3)	41.2× 10^3 (12.6× 10^3)
2	2101Z	.20	1.4 (2.6)	49.6 (15.1)
3	2117Z	.15	.9 (1.7)	40.5 (12.3)

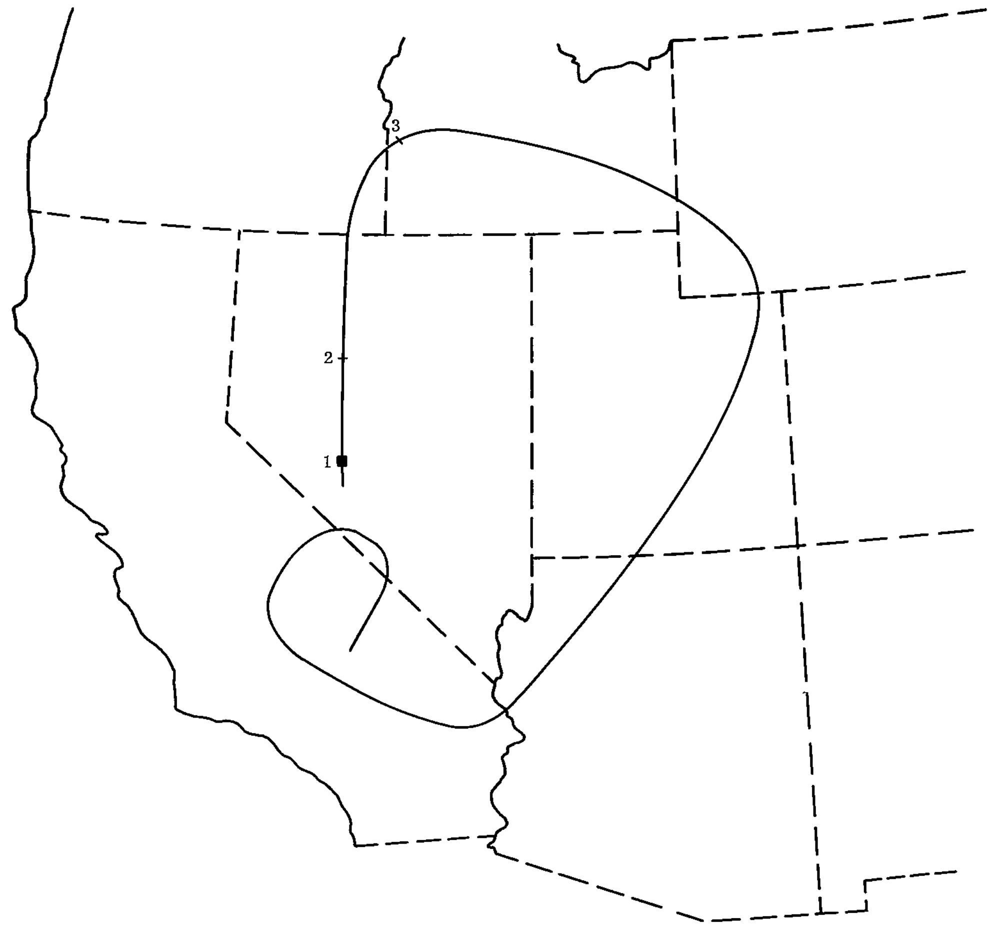
XB-70-1-25 December 10, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1722Z	0.20	2.6 (4.8)	42.1×10^3 (12.8×10^3)
2	1726Z	.20	1.0 (1.9)	48.0 (14.6)
3	1803Z	.15	7.1 (13.1)	64.8 (19.8)
4	1819Z	.10	2.6 (4.8)	57.2 (17.4)



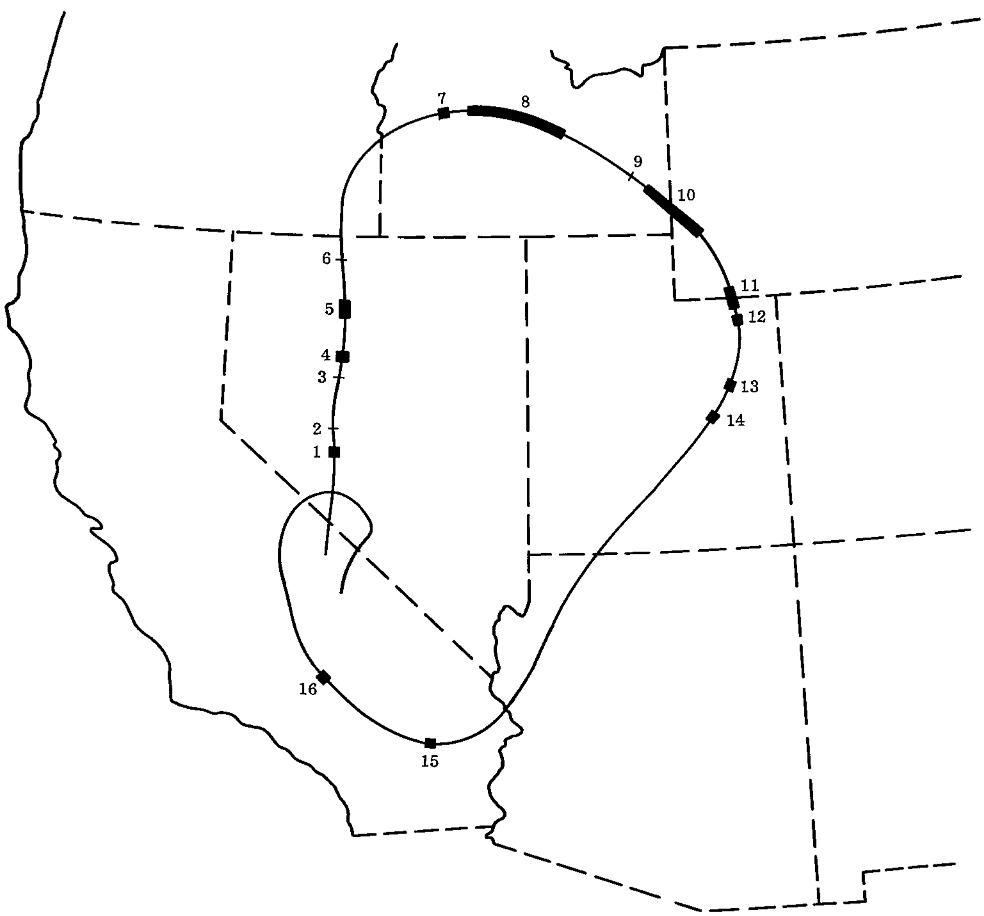
XB-70-2-15 December 11, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	2125Z	0.25	9.2 (17.0)	42.4×10^3 (12.9×10^3)
2	2132Z	.10	1.1 (2.0)	53.7 (16.4)
3	2140Z	.15	1.6 (3.0)	60.4 (18.4)



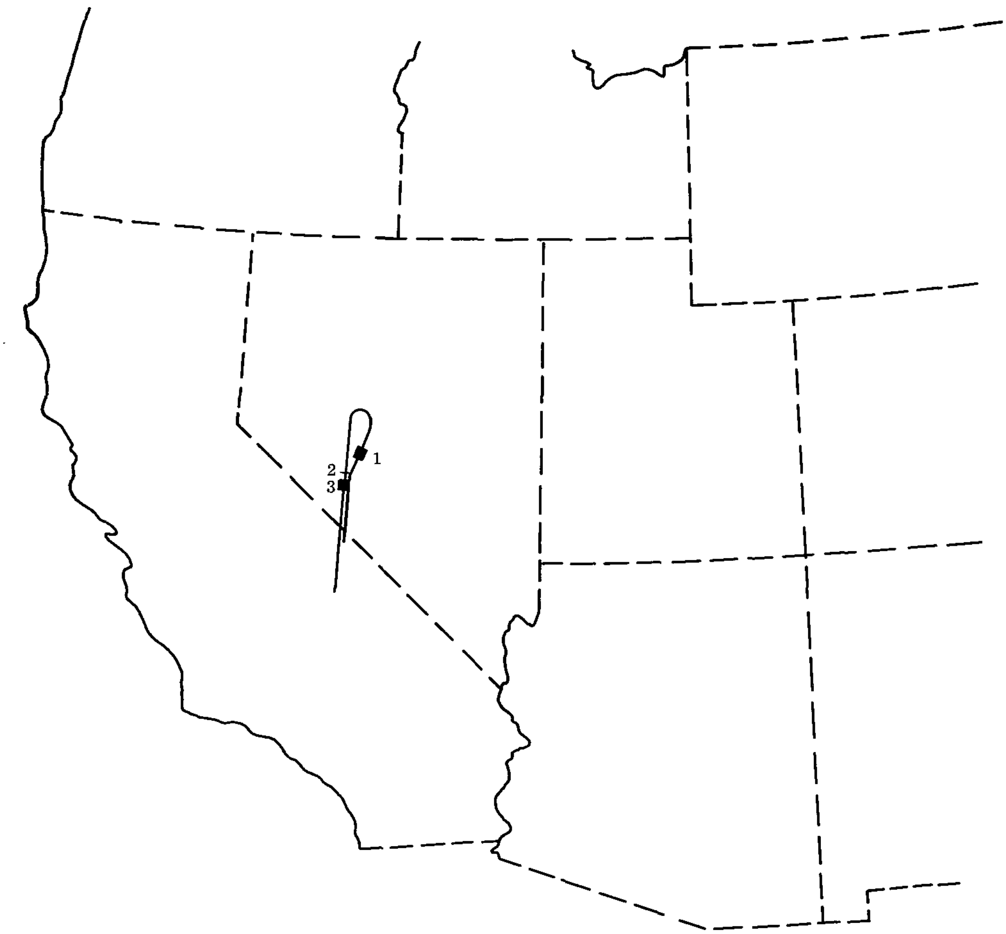
XB-70-2-16 December 21, 1965

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1721Z	0.35	5.4 (10.0)	47.4×10^3 (14.4×10^3)
2	1722Z	.20	1.3 (2.4)	47.4 (14.4)
3	1724Z	.15	3.4 (6.3)	49.4 (15.1)
4	1725Z	.20	5.5 (10.2)	50.8 (15.5)
5	1726Z	.55	14.9 (27.6)	51.2 (15.6)
6	1728Z	.15	1.5 (2.8)	53.0 (16.1)
7	1738Z	.45	5.2 (9.6)	57.4 (17.5)
8	1741Z	.55	93.5 (173.2)	56.7 (17.3)
9	1746Z	.15	11.4 (21.1)	59.4 (18.1)
10	1747Z	.55	68.9 (127.6)	60.0 (18.3)
11	1751Z	.25	18.8 (34.8)	59.1 (18.0)
12	1752Z	.30	6.0 (11.1)	59.2 (18.0)
13	1754Z	.25	6.5 (12.0)	60.0 (18.3)
14	1755Z	.20	7.0 (13.0)	60.0 (18.3)
15	1811Z	.35	7.2 (13.3)	66.3 (20.2)
16	1815Z	.20	7.9 (14.6)	66.0 (20.1)



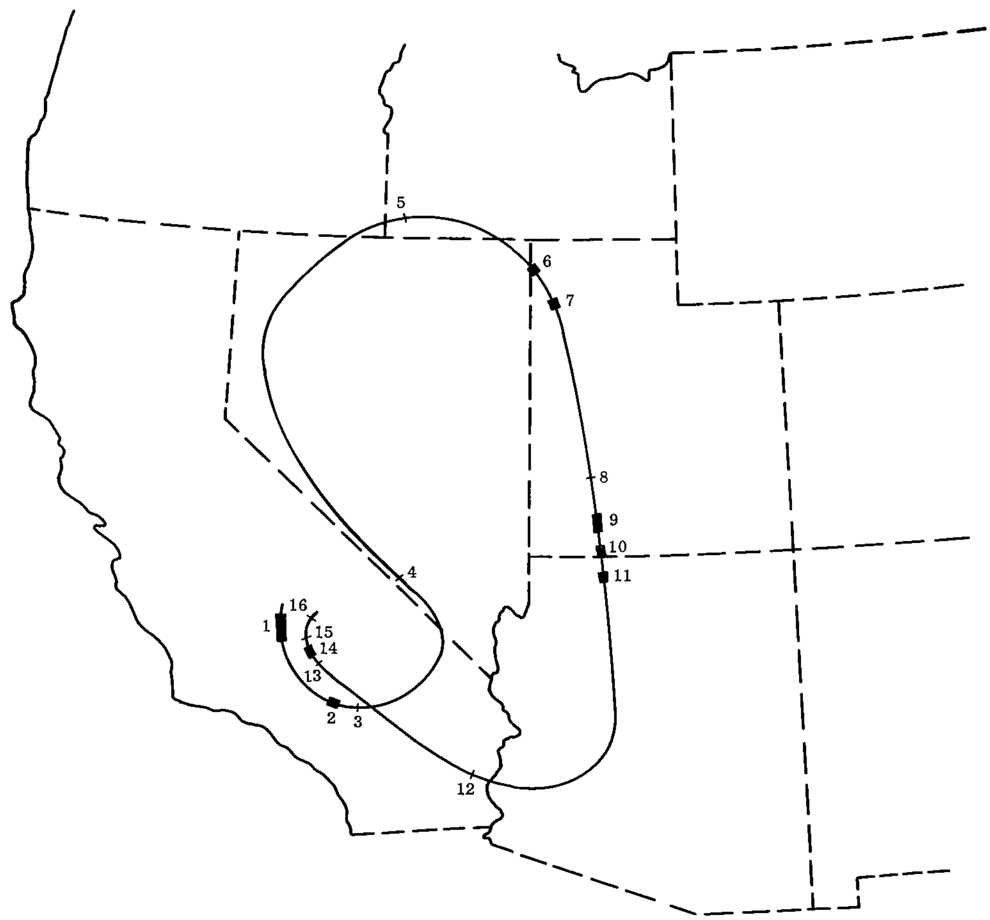
XB-70-2-17 January 3, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1552Z	0.25	5.9 (10.9)	41.5×10^3 (12.6×10^3)
2	1600Z	.20	4.5 (8.3)	40.8 (12.4)
3	1600Z	.35	10.5 (19.4)	40.7 (12.4)



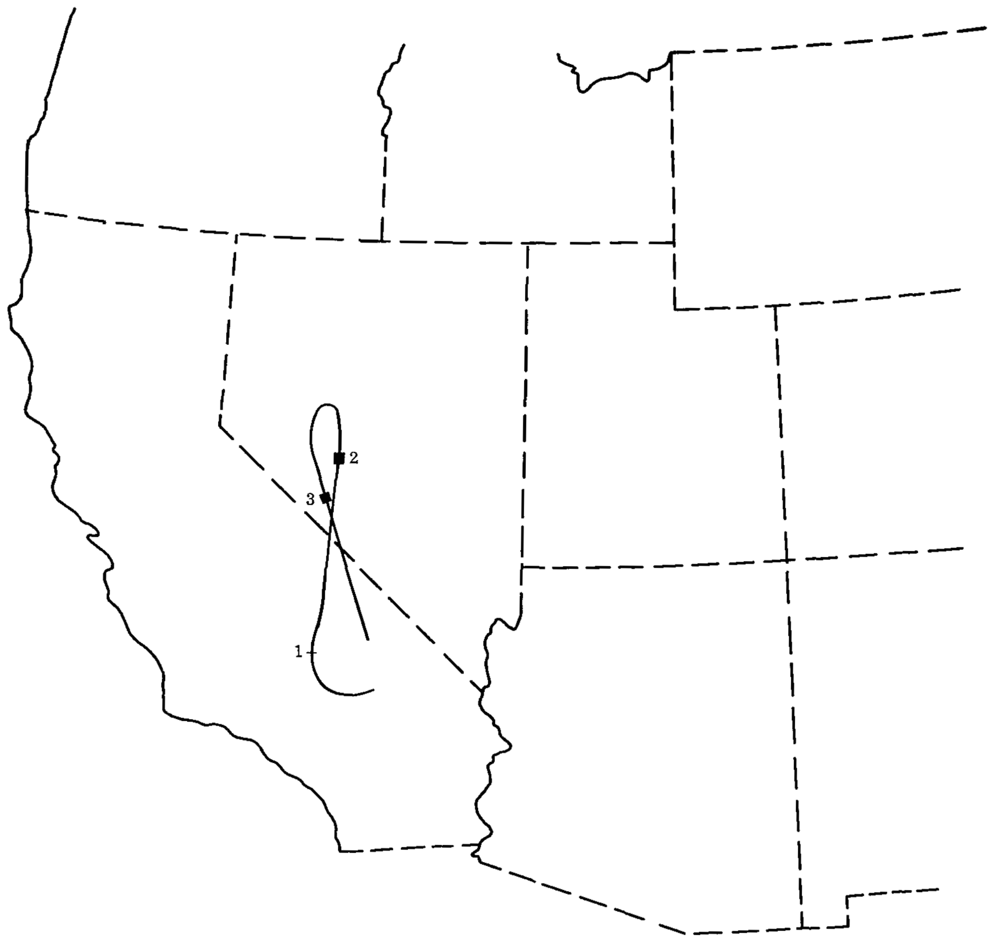
XB-70-1-31 January 11, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1715Z	0.15	22.1 (40.9)	43.0×10^3 (13.1×10^3)
2	1719Z	.10	8.2 (15.2)	52.2 (15.9)
3	1720Z	.10	4.8 (8.9)	54.0 (16.5)
4	1729Z	.10	2.0 (3.7)	59.8 (18.2)
5	1746Z	.25	2.6 (4.8)	63.7 (19.4)
6	1751Z	.30	7.2 (13.3)	67.4 (20.5)
7	1752Z	.15	8.1 (15.0)	67.3 (20.5)
8	1758Z	.10	2.2 (4.1)	67.1 (20.5)
9	1800Z	.20	16.8 (31.1)	66.0 (20.1)
10	1801Z	.10	5.0 (9.3)	66.6 (20.3)
11	1802Z	.15	11.9 (22.0)	66.7 (20.3)
12	1803Z	.10	4.6 (8.5)	69.0 (21.0)
13	1822Z	.10	1.2 (2.2)	57.8 (17.6)
14	1823Z	.25	10.3 (19.1)	53.0 (16.2)
15	1824Z	.10	2.2 (4.1)	48.6 (14.8)
16	1826Z	.10	1.5 (2.8)	41.8 (12.7)



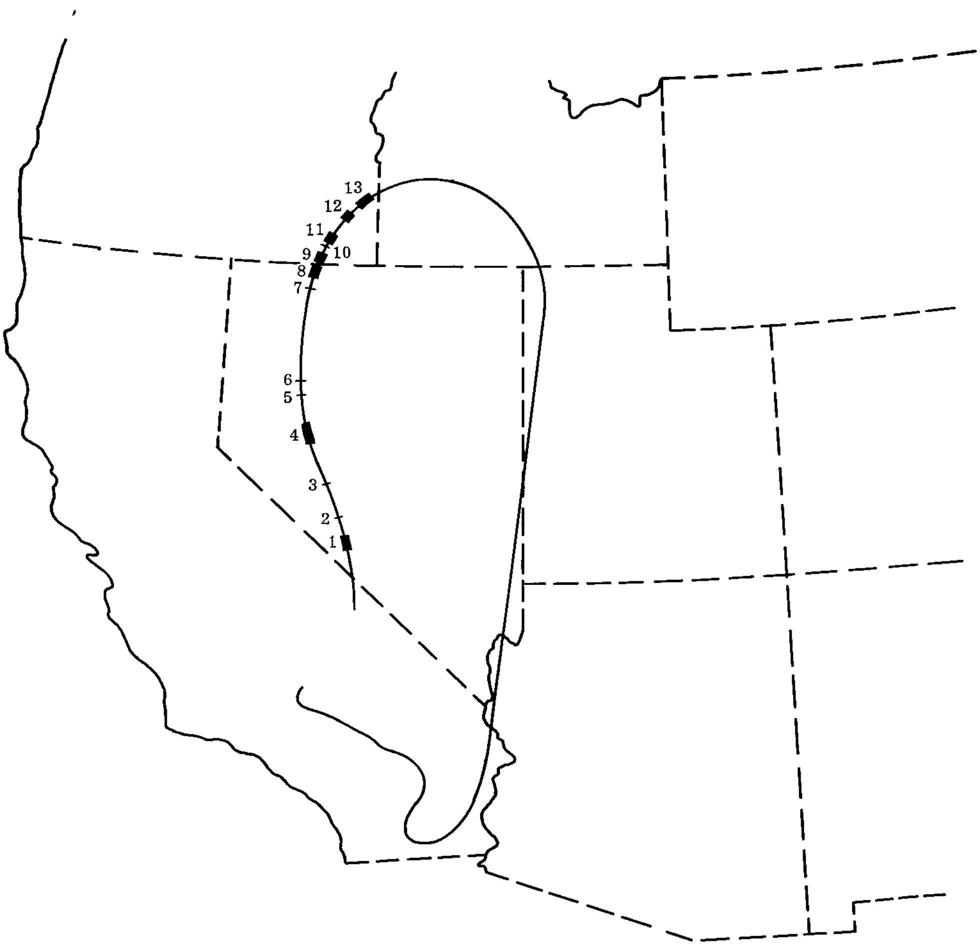
XB-70-2-18 January 12, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1942Z	0.20	2.9 (5.4)	46.6× 10^3 (14.2× 10^3)
2	1951Z	.15	7.5 (13.9)	45.6 (13.9)
3	2001Z	.20	9.7 (18.0)	44.8 (13.7)



XB-70-1-33 January 15, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1813Z	0.25	15.7 (29.1)	46.4×10^3 (14.1×10^3)
2	1814Z	.15	1.6 (3.0)	47.2 (14.4)
3	1815Z	.15	3.2 (5.9)	48.6 (14.8)
4	1817Z	.30	19.1 (35.4)	49.5 (15.1)
5	1820Z	.15	1.1 (2.0)	52.7 (16.1)
6	1820Z	.10	1.8 (3.3)	52.9 (16.1)
7	1824Z	.25	4.5 (8.3)	55.1 (16.8)
8	1825Z	.10	10.3 (19.1)	55.5 (16.9)
9	1825Z	.25	7.6 (14.1)	55.8 (17.0)
10	1826Z	.30	1.9 (3.5)	55.9 (17.0)
11	1826Z	.20	5.8 (10.7)	56.0 (17.1)
12	1828Z	.25	6.6 (12.2)	56.9 (17.3)
13	1828Z	.25	13.3 (24.6)	56.7 (17.3)

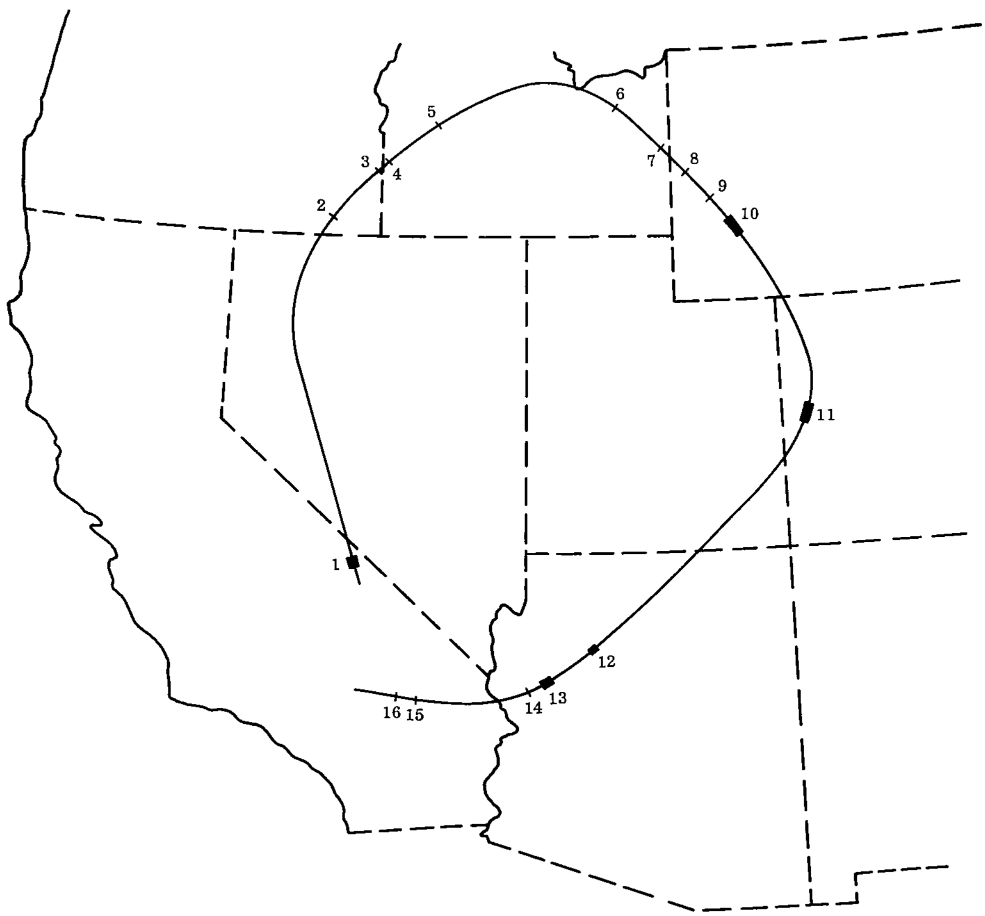


XB-70-2-20 February 9, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	2053Z	0.10	0.6 (1.1)	46.7×10^3 (14.2×10^3)
2	2145Z	.20	13.5 (25.0)	70.6 (21.5)

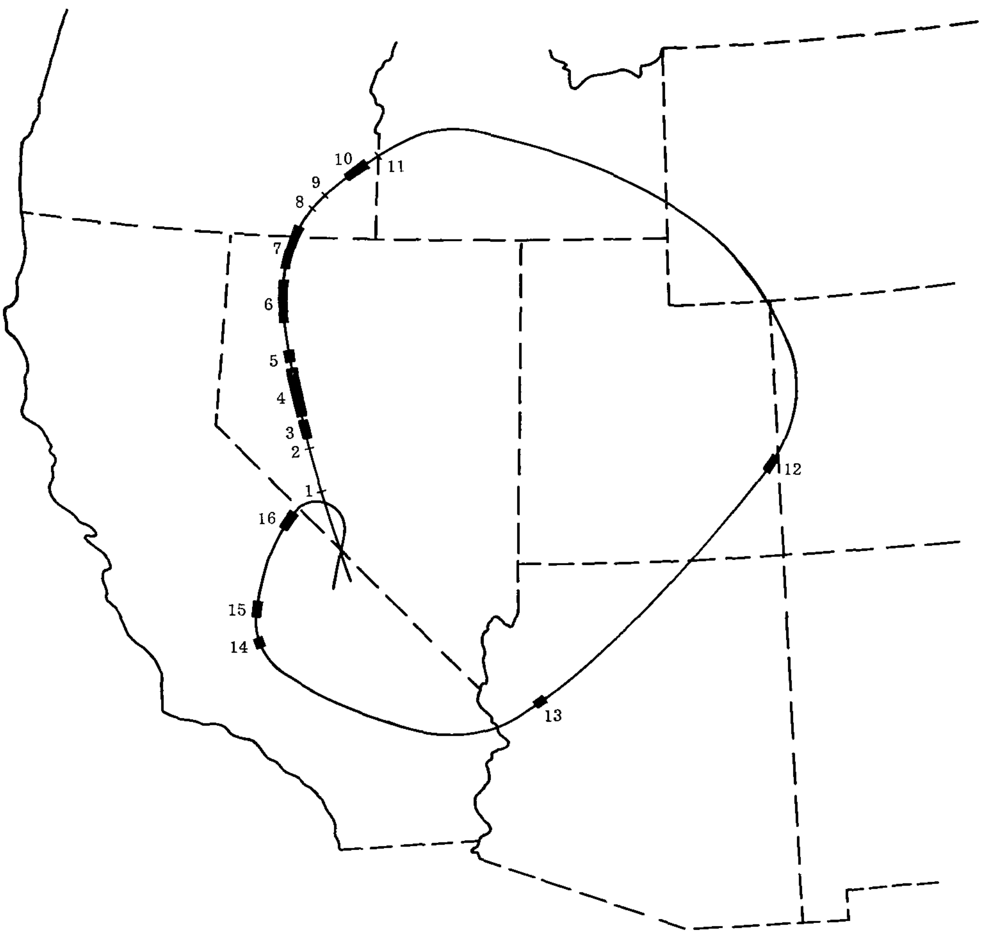
XB-70-2-22 February 17, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1713Z	0.35	6.5 (12.0)	41.3× 10^3 (12.6× 10^3)
2	1731Z	.10	1.8 (3.3)	60.1 (18.3)
3	1735Z	.10	3.3 (6.1)	62.4 (19.0)
4	1735Z	.10	3.3 (6.1)	62.0 (18.9)
5	1738Z	.10	2.9 (5.4)	63.9 (19.5)
6	1745Z	.10	2.2 (4.1)	64.5 (19.7)
7	1747Z	.15	2.1 (3.9)	68.8 (21.0)
8	1748Z	.10	2.6 (4.8)	64.7 (19.7)
9	1749Z	.10	2.1 (3.9)	64.2 (19.6)
10	1750Z	.20	19.4 (35.9)	65.4 (19.9)
11	1800Z	.25	18.4 (34.1)	65.4 (19.9)
12	1813Z	.10	5.8 (10.7)	55.0 (16.8)
13	1816Z	.15	6.7 (12.4)	47.5 (14.5)
14	1817Z	.10	1.0 (1.9)	46.9 (14.3)
15	1826Z	.10	.8 (1.5)	43.5 (13.3)
16	1826Z	.10	2.9 (5.4)	43.1 (13.1)



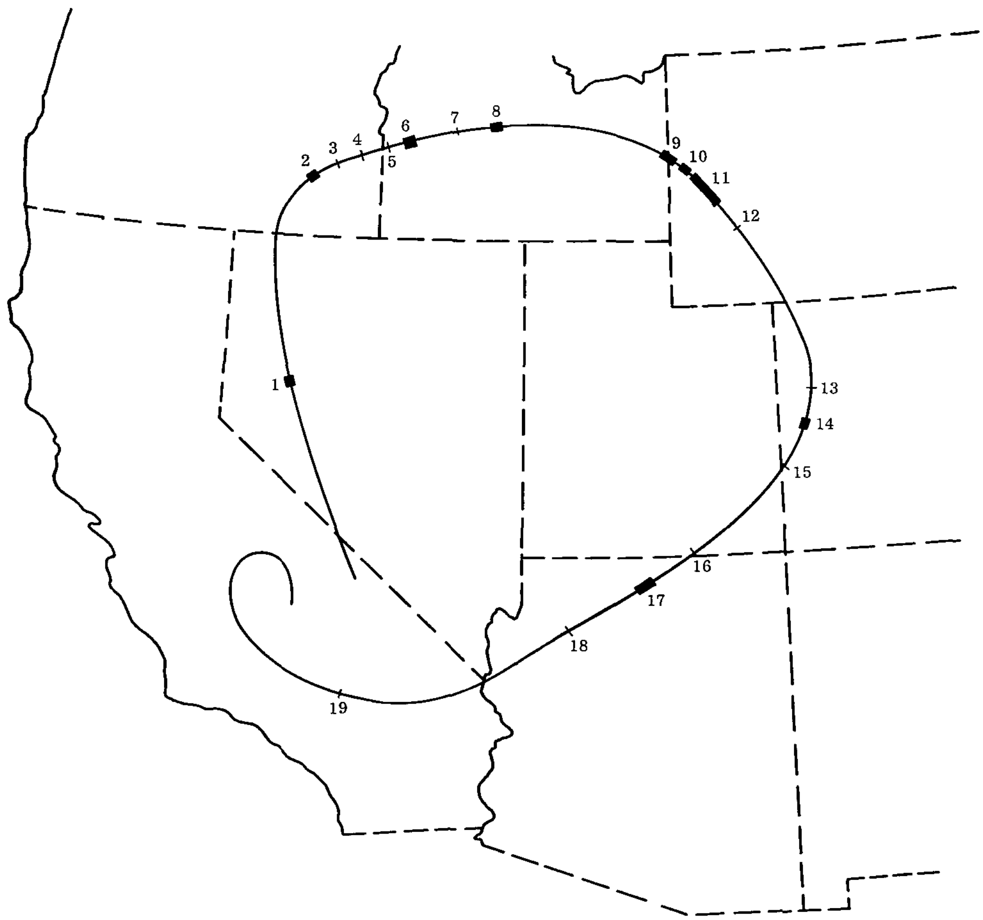
XB-70-2-23 March 10, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1730Z	0.10	2.2 (4.1)	47.3×10^3 (14.4×10^3)
2	1732Z	.10	1.0 (1.9)	48.5 (14.8)
3	1733Z	.35	18.4 (34.1)	51.4 (15.7)
4	1735Z	.20	46.8 (86.7)	54.0 (16.5)
5	1737Z	.10	10.2 (18.9)	55.2 (16.8)
6	1739Z	.55	39.8 (73.7)	58.1 (17.7)
7	1741Z	.25	39.0 (72.2)	58.8 (17.9)
8	1743Z	.15	1.5 (2.8)	60.6 (18.5)
9	1743Z	.10	1.2 (2.2)	60.1 (18.3)
10	1745Z	.15	23.8 (44.1)	60.5 (18.4)
11	1746Z	.10	4.9 (9.1)	60.5 (18.4)
12	1812Z	.15	16.2 (30.0)	66.1 (20.1)
13	1824Z	.15	6.7 (12.4)	65.4 (19.9)
14	1836Z	.20	6.6 (12.2)	67.0 (20.4)
15	1837Z	.20	16.7 (30.9)	67.2 (20.5)
16	1840Z	.20	17.5 (32.4)	65.1 (19.8)



XB-70-2-24 March 15, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1715Z	0.10	5.2 (9.6)	54.0×10^3 (16.5×10^3)
2	1724Z	.20	5.7 (10.6)	59.2 (18.0)
3	1725Z	.15	.8 (1.5)	59.3 (18.1)
4	1726Z	.20	1.6 (3.0)	58.8 (17.9)
5	1727Z	.10	3.7 (6.9)	59.4 (18.1)
6	1728Z	.20	5.7 (10.6)	59.9 (18.3)
7	1730Z	.10	3.4 (6.3)	61.8 (18.8)
8	1731Z	.20	5.6 (10.4)	62.7 (19.1)
9	1738Z	.20	14.5 (26.9)	63.6 (19.4)
10	1739Z	.20	6.4 (11.9)	63.1 (19.2)
11	1740Z	.20	37.8 (70.0)	64.2 (19.6)
12	1742Z	.20	4.8 (8.9)	64.2 (19.6)
13	1748Z	.20	4.4 (8.1)	65.9 (20.1)
14	1750Z	.25	5.3 (9.8)	66.0 (20.1)
15	1751Z	.20	1.3 (2.4)	65.7 (20.0)
16	1755Z	.20	.9 (1.7)	65.7 (20.0)
17	1758Z	.35	28.1 (52.0)	65.9 (20.1)
18	1801Z	.15	2.2 (4.1)	66.2 (20.2)
19	1809Z	.10	1.3 (2.4)	66.2 (20.2)



XB-70-2-25 March 17, 1966

Encounter number	Greenwich time	$\Delta a_{n_{max}}$, g units	Distance in turbulence, n. mi. (km)	h_p, ft (m)
1	1905Z	0.10	3.4 (6.3)	51.0×10^3 (15.5×10^3)
2	1906Z	.70	20.4 (37.8)	52.0 (15.8)
3	1908Z	.45	13.9 (25.7)	53.6 (16.3)
4	1913Z	1.20	242.9 (449.9)	57.0 (17.4)
5	1919Z	.25	12.1 (22.4)	62.2 (19.0)
6	1921Z	.30	17.2 (31.9)	62.8 (19.1)
7	1923Z	.20	10.2 (18.9)	64.3 (19.6)
8	1925Z	.15	10.7 (19.8)	65.0 (19.8)
9	1930Z	.15	10.0 (18.5)	65.6 (20.0)
10	1931Z	.10	3.1 (5.7)	65.8 (20.1)
11	1958Z	.20	19.7 (36.5)	69.4 (21.2)
12	2000Z	.10	4.2 (7.8)	70.4 (21.5)
13	2001Z	.20	6.9 (12.8)	70.0 (21.3)
14	2003Z	.20	4.5 (8.3)	69.4 (21.2)
15	2015Z	.10	5.6 (10.4)	53.2 (16.2)

XB-70-2-26 March 19, 1966

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