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RESEARCH MEMORANDUM

EVALUATION OF GUST AND DRAFT VELOCITIES FROM FLIGHTS OF

P-61C AIRPLANES WITHIN THUNDERSTORMS

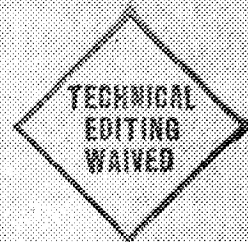
JULY 24, 1946 TO AUGUST 6, 1946

AT ORLANDO, FLORIDA

By

H. B. Tolefson

Langley Memorial Aeronautical Laboratory
Langley Field, Va.



NATIONAL ADVISORY COMMITTEE
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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

RESEARCH MEMORANDUM

EVALUATION OF GUST AND DRAFT VELOCITIES FROM FLIGHTS OF

P-61C AIRPLANES WITHIN THUNDERSTORMS

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The results obtained from gust and draft velocity measurements within thunderstorms for the period July 24, 1946 to August 6, 1946 at Orlando, Florida are presented herein. These data are summarized in tables I and II and are of the type presented in reference 1 for previous flights.

In two thunderstorm traverses, indications of ambient-air temperature were obtained from photo-observer records. These data are summarized in table III.

Langley Memorial Aeronautical Laboratory
National Advisory Committee for Aeronautics
Langley Field, Va.

Harold B. Tolefson

Harold B. Tolefson
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Approved: *Richard V. Rhode*

Richard V. Rhode
Chief of Aircraft Loads Division

BUB

REFERENCE

1. Tolefson, H. B.: Evaluation of Gust and Draft Velocities from Flights of P-61C Airplanes within Thunderstorms July 22, 1946 to July 23, 1946 at Orlando, Florida. NACA RM No. L7C19, 1947.

TABLE I.- SUMMARY OF GUST MEASUREMENTS FROM FLIGHTS
OF P-61C AIRPLANES WITHIN THUNDERSTORMS

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e_{max}}$ (fps)	Maximum true gust velocity $U_{t_{max}}$ (fps)	Gust gradient distance (ft)	No. of gusts	
July 24, 1946 - Flight 16						
Airplane 327 Traverse 1		Time (EST) 154138 - 154419 Length of traverse 112.5 sec, 50,141 ft Initial heading (deg) 360				
0 - 3	21,000	----	-2.5	----	----	2
3 - 6		4.5	-2.9	7.9	448	3
6 - 9		4.1	-----	-----	-----	1
9 - 12		4.1	-2.9	-----	-5.4	138
12 - 15		5.7	-2.9	5.8	370	5
15 - 18		4.5	-3.5	-----	-----	2
18 - 21		-----	-2.2	-----	-5.4	185
21 - 24		4.1	-2.9	-----	-7.4	321
24 - 27	20,500	4.1	-----	5.4	183	1
27 - 30		11.5	-3.2	-----	-----	2
30 - 33		10.8	-2.9	-----	-----	4
33 - 36		4.1	-----	-----	-----	5
36 - 39	21,000	13.1	-6.1	-----	-----	4
39 - 42		5.1	-4.5	-----	-----	5
42 - 45		13.7	-2.5	-----	-----	4
45 - 48		6.7	-7.0	-----	-----	3
48 - 51		2.5	-2.5	-----	-----	2
Airplane 327 Traverse 2		Time (EST) 154958 - 155125 Length of traverse 105.0 sec, 37,653 ft Initial heading (deg) 190				
0 - 3	21,000	12.7	-6.0	-----	-----	6
3 - 6		10.1	-5.1	-----	-----	5
6 - 9		10.1	-9.5	10.7	200	6
9 - 12	21,500	10.5	-8.2	-----	-----	4
12 - 15	22,000	12.4	-10.8	-----	-----	3
15 - 18	22,500	13.3	-9.8	-----	-----	6
18 - 21		17.4	-9.2	-----	-----	5
21 - 24	23,000	15.2	-13.3	-----	-----	6
24 - 27		16.8	-9.5	-----	-----	6
27 - 30		3.2	-----	-----	-----	2
30 - 33		4.4	-4.1	-----	-7.9	143

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e\max}$ (fps)		Maximum true gust velocity $U_{t\max}$ (fps)		Gust gradient distance (ft)		No. of gusts
July 24, 1946 - Flight 16								
Airplane 327 Traverse 3		{ Time (EST) 155728 - 160100 Length of traverse 231.5 sec, 89,788 ft Initial heading (deg) 270						
84 - 87	21,500	----	----	----	----	----	----	0
87 - 90		4.7	----	----	----	----	----	1
Airplane 327 Traverse 4		{ Time (EST) 160623 - 161020 Length of traverse 257.5 sec, 90,570 ft Initial heading (deg) 80						
0 - 3	21,000	8.8	-4.1	13.4	-10.9	191	90	5
3 - 6		6.6	-6.3	----	----	----	----	4
6 - 9		9.4	-5.6	----	----	----	----	5
9 - 12		8.5	-9.1	----	----	----	----	3
12 - 15	21,500	2.5	-3.1	6.6	----	300	----	3
15 - 18		----	----	----	----	----	----	0
18 - 21		4.1	-2.5	----	----	----	----	2
21 - 24		8.5	----	9.5	----	135	----	1
24 - 27		6.9	-2.5	----	----	----	----	4
27 - 30		8.1	-4.4	----	-8.5	----	290	4
30 - 33		8.5	-8.8	----	----	----	----	5
33 - 36		6.6	-3.1	9.4	-8.5	204	68	3
36 - 39		4.1	-4.1	----	----	----	----	2
39 - 42		6.3	-2.5	----	----	----	----	3
42 - 45		4.1	----	9.4	----	358	----	2
45 - 48		6.3	-3.1	----	----	----	----	3
48 - 51		3.8	-3.1	7.6	----	364	----	3
51 - 54		4.1	----	----	----	----	----	1
54 - 57		7.2	-10.0	----	----	----	----	3
57 - 60		8.8	-3.8	----	----	----	----	2
60 - 63		7.2	-2.8	----	----	----	----	2
63 - 66		11.0	-2.2	----	----	----	----	2
66 - 69		7.2	----	----	----	----	----	2
69 - 72		7.2	-4.7	----	----	----	----	3
72 - 75		7.2	-3.4	----	----	----	----	3
75 - 78		----	-3.8	----	-10.8	----	481	1
78 - 81		5.3	----	----	----	----	----	2
81 - 84		2.5	-3.1	----	-7.7	----	387	2

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pleasure altitude (ft)	Maximum effective gust velocity $U_{e\max}$ (fps)		Maximum true gust velocity $U_{t\max}$ (fps)		Gust gradient distance (ft)		No. of gusts	
July 24, 1946 - Flight 16									
Airplane 327 Traverse 4	{ Time (EST) 160623 - 161020 Length of traverse 257.5 sec, 90,570 ft Initial heading (deg) 80								
84 - 87	21,500	----	-----	----	-----	----	-----	0	
87 - 90		----	-----	----	-----	----	-----	0	
90 - 93		----	-----	----	-----	----	-----	0	
Airplane 327 Traverse 5	{ Time (EST) 162245 - 162354 Length of traverse 80.5 sec, 26,329 ft Initial heading (deg) 160								
0 - 3	21,000	----	-4.3	----	-----	----	-----	1	
3 - 6	20,500	2.5	-----	----	-----	----	-----	1	
6 - 9	21,000	----	-----	----	-----	----	-----	0	
9 - 12		4.0	-----	----	-----	----	-----	2	
12 - 15		4.7	-----	4.8	-----	105	----	2	
15 - 18		4.7	-----	----	-----	----	-----	2	
18 - 21		----	-3.4	----	-----	----	-----	1	
21 - 24		----	-3.7	----	-8.7	----	178	----	1
24 - 27		----	----	-----	----	-----	----	-----	0
Airplane 331 Traverse 1	{ Time (EST) (a) Length of traverse 170.2 sec, 53,946 ft Initial heading (deg) (a)								
0 - 3	16,000	6.3	-8.6	9.0	-----	124	----	2	
3 - 6		5.1	-9.2	----	-----	----	----	2	
6 - 9		7.6	-12.1	----	-----	----	----	8	
9 - 12		6.0	-2.9	8.4	-----	64	----	4	
12 - 15		----	-3.2	----	-----	----	----	2	
15 - 18		----	-4.8	----	-7.2	----	186	----	2
18 - 21		1.9	-3.2	----	-5.6	----	124	----	4
21 - 24		----	-3.2	----	----	----	----	----	1
24 - 27		3.2	-----	5.6	-----	183	----	----	1
27 - 30		----	----	----	-----	----	----	----	0
30 - 33	6.3	-8.9	----	-----	----	----	----	4	

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e max (fps)		Maximum true gust velocity U _t max (fps)		Gust gradient distance (ft)		No. of gusts
July 24, 1946 - Flight 16								
Airplane 331 traverse 1		{ Time (EST) (a) Length of traverse 170.2 sec, 53,946 ft Initial heading (deg) (a)						
33 - 36	16,000	14.9	-9.2	----	-----	----	----	9
36 - 39		12.1	-14.3	----	-----	----	----	6
39 - 42		15.5	-6.0	----	-----	----	----	9
42 - 45	16,500	12.4	-10.2	----	-15.3	----	344	9
45 - 48		16.2	-8.9	29.6	-----	63	----	5
48 - 51	17,000	6.3	-19.4	----	-----	----	----	7
51 - 54		4.4	-8.9	----	-----	----	----	9
Airplane 331 Traverse 2		{ Time (EST) (a) Length of traverse 129.5 sec, 41,269 ft Initial heading (deg) (a)						
0 - 3	16,500	15.2	-18.3	----	-----	----	----	11
3 - 6		9.5	-13.9	16.2	-----	166	----	10
6 - 9		20.8	-14.8	----	-----	----	----	7
9 - 12	17,000	9.8	-8.5	----	-----	----	----	7
12 - 15		9.8	-18.6	----	-15.8	----	66	7
15 - 18		6.9	-11.1	----	-----	----	----	6
18 - 21		8.8	-12.6	----	-----	----	----	3
21 - 24		----	-----	----	-----	----	----	0
24 - 27		6.6	-5.7	----	-----	----	----	2
27 - 30	16,500	10.4	-6.6	----	-----	----	----	9
30 - 33		19.9	-6.6	----	-----	----	----	7
33 - 36		13.9	-11.4	----	-----	----	----	7
36 - 39		9.5	-7.9	----	-----	----	----	9
39 - 42		8.5	-9.2	----	-----	----	----	4
Airplane 331 Traverse 3		{ Time (EST) (a) Length of traverse 183.2 sec, 55,958 ft Initial heading (deg) (a)						
0 - 3	16,000	6.0	-9.4	----	-----	----	----	5
3 - 6		6.3	-7.5	----	-----	----	----	6
6 - 9		5.6	-10.4	----	-----	----	----	3

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft $\times 10^3$	Pressure altitude (ft)	Maximum effective gust velocity $U_{e \max}$ (fps)		Maximum true gust velocity $U_{t \max}$ (fps)		Gust gradient distance (ft)		No. of gusts
July 24, 1946 - Flight 16								
Airplane 331 Traverse 3		Time (EST) (a) Length of traverse 183.2 sec, 55,958 ft Initial heading (deg) (a)						
9 - 12	16,000	15.4	-15.4	----	-----	----	----	8
12 - 15		18.2	-17.3	----	-----	----	----	6
15 - 18		6.6	-4.1	12.1	-----	154	----	7
18 - 21		6.6	-4.7	6.1	-9.6	149	467	5
21 - 24	16,500	----	-5.3	----	-----	----	----	1
24 - 27		----	-6.0	----	-6.2	----	143	1
27 - 30	16,000	4.1	-4.7	----	-----	----	----	4
30 - 33		----	-6.0	----	-11.6	----	63	3
33 - 36		3.8	-2.8	----	-----	----	----	2
36 - 39		11.0	-----	----	-----	----	----	1
39 - 42		4.4	-2.8	----	-----	----	----	2
42 - 45		3.8	-2.8	----	-----	----	----	3
45 - 48		4.4	-2.8	----	-----	----	----	2
48 - 51		----	-3.1	----	-----	----	----	2
51 - 54		----	-----	----	-----	----	----	0
54 - 57		----	-----	----	-----	----	----	0
Airplane 331 Traverse 4		Time (EST) (a) Length of traverse 416.7 sec, 128,640 ft Initial heading (deg) (a)						
0 - 3	16,000	6.9	-5.6	----	-----	----	----	3
3 - 6		6.9	-13.7	----	-----	----	----	8
6 - 9		6.9	-5.3	----	-----	----	----	10
9 - 12		11.2	-2.5	----	-----	----	----	4
12 - 15		3.1	-8.7	7.8	-----	128	----	5
15 - 18		8.7	-8.7	----	-----	----	----	4
18 - 21		----	-3.4	----	-----	----	----	1
21 - 24		2.5	-----	----	-----	----	----	1
24 - 27		----	-3.1	----	-----	----	----	1
27 - 30		----	-3.1	----	-----	----	----	2
30 - 33		5.0	-4.1	----	-----	----	----	5
33 - 36	15,500	7.5	-5.6	----	-----	----	----	7
36 - 39		6.6	-5.9	----	-6.1	----	97	6

^a No records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e_{max}}$ (fps)	Maximum true gust velocity $U_{t_{max}}$ (fps)	Gust gradient distance (ft)	No. of gusts	
July 24, 1946 - Flight 16						
Airplane 331 Traverse 4		Time (EST) (a) Length of traverse 416.7 sec, 128,640 ft Initial heading (deg) (a)				
39 - 42	15,500	9.0	-----	-----	-----	3
42 - 45	16,000	9.4	-4.4	6.0	62	4
45 - 48		3.1	-3.7	-----	182	3
48 - 51		-----	-4.4	-----	59	3
51 - 54		4.1	-----	-----	-----	1
54 - 57		-----	-3.4	-----	-----	1
57 - 60		-----	-----	-----	-----	0
60 - 63		7.2	-5.9	7.9	251	5
63 - 66		6.9	-9.7	-----	-----	4
66 - 69		3.4	-4.4	6.2	88	2
69 - 72		-----	-5.9	-----	-----	1
72 - 75		7.8	-----	-----	-----	1
75 - 78		6.2	-4.4	-----	-----	2
78 - 81		9.0	-9.0	9.8	157	4
81 - 84		5.9	-8.7	-----	-----	4
84 - 87	15,500	9.0	-2.8	-----	100	4
87 - 90		7.8	-6.9	-----	-----	3
90 - 93	16,000	-----	-2.8	-----	320	2
93 - 96		8.4	-8.1	-----	212	3
96 - 99		-----	-5.9	-----	-----	1
99 - 102		10.3	-5.9	-----	-----	5
102 - 105		8.4	-9.7	24.6	182	5
105 - 108		14.7	-11.2	-----	-----	6
108 - 111		14.0	-10.3	-----	-----	3
111 - 114		10.9	-8.1	-----	-----	5
114 - 117		5.6	-11.9	-----	-----	8
117 - 120		12.8	-8.7	-----	-----	10
120 - 123		12.5	-2.8	-----	-----	4
123 - 126		-----	-8.1	-----	-----	2
126 - 129	16,500	4.1	-3.1	-----	61	4

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft $\times 10^3$	Pressure altitude (ft)	Maximum effective gust velocity $U_{e\max}$ (fps)		Maximum true gust velocity $U_{t\max}$ (fps)		Gust gradient distance (ft)	No. of gusts	
July 24, 1946 - Flight 16								
Airplane 331 Traverse 5		Time (EST) (a) Length of traverse 347.0 sec, 106,603 ft Initial heading (deg) (a)						
0 - 3	15,500	3.1	-5.3	9.6	-11.1	90	241	4
3 - 6		9.6	-2.5	-----	-----	-----	-----	3
6 - 9		5.9	-5.0	-----	-----	-----	-----	5
9 - 12		5.0	-----	11.5	-----	223	-----	3
12 - 15		6.5	-7.1	-----	-----	-----	-----	8
15 - 18		6.5	-5.9	14.6	-----	153	-----	6
18 - 21		4.6	-4.6	-----	-----	-----	-----	5
21 - 24	16,000	4.3	-6.2	-----	-9.8	-----	180	6
24 - 27		7.4	-10.5	-----	-6.2	-----	87	5
27 - 30		18.0	-7.7	-----	-----	-----	-----	7
30 - 33		12.4	-9.0	-----	-----	-----	-----	6
33 - 36	16,500	9.3	-9.0	-----	-----	-----	-----	6
36 - 39		15.2	-7.4	18.3	-----	117	-----	4
39 - 42	17,000	9.3	-19.8	-----	-----	-----	-----	4
42 - 45		10.2	-13.6	15.1	-----	30	-----	6
45 - 48		15.8	-5.6	-----	-----	-----	-----	6
48 - 51		9.0	-5.6	-----	-----	-----	-----	5
51 - 54		5.6	-10.8	10.2	-----	242	-----	3
54 - 57		5.9	-6.8	-----	-----	-----	-----	3
57 - 60		-----	-----	-----	-----	-----	-----	0
60 - 63		-----	-----	-----	-----	-----	-----	0
63 - 66		-----	-----	-----	-----	-----	-----	0
66 - 69		3.4	-----	6.3	-----	90	-----	1
69 - 72		6.2	-----	13.2	-----	159	-----	1
72 - 75		3.7	-4.3	-----	-----	-----	-----	2
75 - 78		-----	-----	-----	-----	-----	-----	0
78 - 81		2.5	-4.3	-----	-----	-----	-----	2
81 - 84		-----	-3.1	-----	-----	-----	-----	1
84 - 87		3.4	-4.3	-----	-----	-----	-----	2
87 - 90		3.4	-3.7	-----	-----	-----	-----	2
90 - 93		4.0	-3.7	-----	-----	-----	-----	2
93 - 96		6.8	-4.6	13.3	-----	379	-----	3

^aNo record obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e\max}$ (fps)		Maximum true gust velocity $U_{t\max}$ (fps)		Gust gradient distance (ft)		No. of gusts
July 24, 1946 - Flight 16								
Airplane 331 Traverse 5		Time (EST) (a) Length of traverse 347.0 sec, 106,603 ft Initial heading (deg) (a)						
96 - 99	17,000	4.0	-5.0	----	----	----	----	3
99 - 102	16,500	4.6	-6.5	----	----	----	----	2
102 - 105		4.0	-3.1	----	----	----	----	2
105 - 108		----	----	----	----	----	----	0
Airplane 347 Traverse 1		Time (EST) (b) Length of traverse 106.9 sec, 25,791 ft Initial heading (deg) 200						
0 - 3	6,000	2.2	-2.6	----	----	----	----	6
3 - 6		3.5	-6.1	5.1	-5.4	47	142	10
6 - 9		8.3	----	----	----	----	----	7
9 - 12		5.7	-3.8	----	----	----	----	4
12 - 15		2.6	-3.2	4.0	----	135	----	2
15 - 18		2.6	----	----	----	----	----	3
18 - 21		4.5	-3.5	----	----	----	----	3
21 - 24	5,500	5.7	-3.5	9.0	----	45	----	8
24 - 27		2.2	-3.5	----	----	----	----	3
Airplane 347 Traverse 2		Time (EST) (b) Length of traverse 37.3 sec, 9,326 ft Initial heading (deg) 140						
0 - 3	5,500	12.7	----	19.8	----	175	----	2
3 - 6		6.7	-3.5	----	-17.0	----	25	10
6 - 9		3.5	-6.4	3.5	----	99	----	3
9 - 12		----	----	----	----	----	----	0
Airplane 347 Traverse 3		Time (EST) (b) Length of traverse 88.6 sec, 20,944 ft Initial heading (deg) 270						
0 - 3	6,000	2.2	-4.1	----	-7.5	----	94	5
3 - 6		5.0	-3.8	----	----	----	----	6

^aNo record obtained.

^bClock not in field of view of motion-picture camera.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e _{max} (fps)	Maximum true gust velocity U _t _{max} (fps)	Gust gradient distance (ft)	No. of gusts		
July 24, 1946 - Flight 16							
Airplane 347 Traverse 3	{ Time (EST) (b) Length of traverse 88.6 sec, 20,944 ft Initial heading (deg) 270						
6 - 9	6,000	2.2	-----	-----	-----	2	
9 - 12		7.2	-7.9	7.8	70	7	
12 - 15		4.1	-6.0	-----	-----	8	
15 - 18		2.5	-3.8	-----	-5.9	114	3
18 - 21		2.5	-2.5	-----	-----	-----	2
Airplane 347 Traverse 4	{ Time (EST) (b) Length of traverse 80.5 sec, 20,352 ft Initial heading (deg) 180						
0 - 3	6,000	3.4	-3.4	-----	-----	3	
3 - 6		3.4	-3.1	-----	-----	5	
6 - 9		2.7	-6.3	-----	-8.7	122	4
9 - 12		2.2	-3.4	-----	-----	-----	2
12 - 15		4.7	-5.6	-----	-----	-----	4
15 - 18		3.1	-----	-----	-----	-----	1
18 - 21		-----	-----	-----	-----	-----	0
August 6, 1946 - Flight 17							
Airplane 327 Traverse 1	{ Time (EST) (c) Length of traverse 318.4 sec, 123,482 ft Initial heading (deg) 30						
0 - 3	26,000	2.2	-----	-----	-----	1	
3 - 6		-----	-----	-----	-----	0	
6 - 9		2.8	-----	-----	-----	1	
9 - 12		-----	-----	-----	-----	0	
12 - 15		10.8	-4.7	11.4	227	4	
15 - 18		10.1	-3.8	-----	-----	5	
18 - 21		12.0	-7.3	-----	-----	3	
21 - 24		7.6	-8.9	-----	-----	5	
24 - 27		6.3	-3.8	-----	-----	5	

^bClock not in field of view of motion-picture camera.

^cClock inoperative.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e\max}$ (fps)	Maximum true gust velocity $U_{t\max}$ (fps)	Gust gradient distance (ft)	No. of gusts
August 6, 1946 - Flight 17					
Airplane 327 Traverse 1	{ Time (EST) (c) Length of traverse 318.4 sec, 123,482 ft Initial heading (deg) 30				
27 - 30	26,000	----	----	----	0
30 - 33		----	----	----	0
33 - 36		----	----	----	0
36 - 39		----	----	----	0
39 - 42		----	----	----	0
42 - 45		----	----	----	0
45 - 48		----	----	----	0
48 - 51		----	----	----	0
51 - 54		----	----	----	0
54 - 57		----	----	----	0
57 - 60		----	----	----	0
60 - 63		----	----	----	0
63 - 66		----	----	----	0
66 - 69		----	----	----	0
69 - 72		----	----	----	0
72 - 75		----	----	----	0
75 - 78		----	----	----	0
78 - 81		----	----	----	0
81 - 84		----	----	----	0
84 - 87		----	----	----	0
87 - 90		----	----	----	0
90 - 93		----	----	----	0
93 - 96		----	----	----	0
96 - 99	----	----	----	0	
99 - 102	----	----	----	0	
102 - 105	----	----	----	0	
105 - 108	----	2.8	----	----	1
108 - 111	----	----	----	----	0
111 - 114	----	2.8	----	----	1
114 - 117	----	2.8	----	----	1
117 - 120	----	----	----	----	0
120 - 123	----	----	----	----	0
123 - 126	----	----	----	----	0

Clock inoperative.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e max (fps)	Maximum true gust velocity U _t max (fps)	Gust gradient distance (ft)	No. of gusts
August 6, 1946 - Flight 17					
Airplane 327 Traverse 2		Time (EST) (c) Length of traverse 208.3 sec, 80,402 ft Initial heading (deg) 30			
0 - 3	26,000	6.9	-----	-----	2
3 - 6		9.7	-7.9	-----	8
6 - 9		5.3	-----	10.7	3
9 - 12		-----	-4.4	-----	3
12 - 15	25,500	-----	-----	-----	0
15 - 18	26,000	-----	-----	-----	0
18 - 21		-----	-----	-----	0
21 - 24		4.7	-----	-----	1
24 - 27		-----	-4.1	-----	1
27 - 30		3.1	-----	6.2	1
30 - 33		-----	-----	-----	0
33 - 36		-----	-----	-----	0
36 - 39		-----	-----	-----	0
39 - 42		-----	-----	-----	0
42 - 45		-----	-----	-----	0
45 - 48		-----	-----	-----	0
48 - 51		-----	-----	-----	0
51 - 54		-----	-----	-----	0
54 - 57		-----	-----	-----	0
57 - 60		-----	-----	-----	0
60 - 63		-----	-----	-----	0
63 - 66		-----	-----	-----	0
66 - 69		-----	-----	-----	0
69 - 72		-----	-----	-----	0
72 - 75		-----	-----	-----	0
75 - 78		-----	-----	-----	0
78 - 81		-----	-----	-----	0
Airplane 327 Traverse 3		Time (EST) (a) Length of traverse 162.4 sec, 60,097 ft Initial heading (deg) (a)			
0 - 3	26,000	4.1	-----	8.3	2
3 - 6		5.3	-4.1	-----	3

^aNo record obtained.

^cClock inoperative.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e max (fps)		Maximum true gust velocity U _t max (fps)		Gust gradient distance (ft)		No. of gusts
August 6, 1946 - Flight 17								
Airplane 327 Traverse 3		{ Time (EST) (a) Length of traverse 162.4 sec, 60,097 ft Initial heading (deg) (a)						
6 - 9	26,000	4.4	-5.9	6.8	-----	177	-----	5
9 - 12		7.8	-----	16.0	-----	105	-----	4
12 - 15		7.5	-----	13.2	-----	145	-----	1
15 - 18		3.4	-----	6.8	-----	180	-----	1
18 - 21		-----	-----	-----	-----	-----	-----	0
21 - 24	25,500	5.0	-3.1	-----	-----	-----	-----	3
24 - 27		6.9	-4.7	-----	-----	-----	-----	3
27 - 30		5.0	-4.7	11.1	-----	187	-----	3
30 - 33		11.3	-7.5	-----	-----	-----	-----	6
33 - 36		7.2	-4.4	-----	-----	-----	-----	3
36 - 39		4.7	-3.8	-----	-----	-----	-----	2
39 - 42		5.3	-----	-----	-----	-----	-----	1
42 - 45	26,000	4.7	-----	-----	-----	-----	-----	1
45 - 48		-----	-4.7	-----	-----	-----	-----	1
48 - 51		-----	-----	-----	-----	-----	-----	0
51 - 54		-----	-----	-----	-----	-----	-----	0
54 - 57		-----	-----	-----	-----	-----	-----	0
57 - 60		-----	-----	-----	-----	-----	-----	0
60 - 63		-----	-----	-----	-----	-----	-----	0
Airplane 327 Traverse 4		{ Time (EST) (a) Length of traverse 143.9 sec, 58,527 ft Initial heading (deg) (a)						
0 - 3	26,000	13.7	-----	-----	-----	-----	-----	1
3 - 6	25,500	-----	-----	-----	-----	-----	-----	0
6 - 9		-----	-----	-----	-----	-----	-----	0
9 - 12	25,000	-----	-----	-----	-----	-----	-----	0
12 - 15	25,500	5.6	-----	-----	-----	-----	-----	1
15 - 18		2.2	-----	-----	-----	-----	-----	1
18 - 21	26,000	7.2	-8.4	6.1	-----	154	-----	4
21 - 24		22.1	-12.8	-----	-----	-----	-----	3
24 - 27		11.2	-8.4	22.5	+25.0	259	399	4
27 - 30		10.3	-4.7	-----	-----	-----	-----	5

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft $\times 10^3$	Pressure altitude (ft)	Maximum effective gust velocity $U_{e \max}$ (fps)	Maximum true gust velocity $U_{t \max}$ (fps)	Gust gradient distance (ft)	No. of gusts
August 6, 1946 - Flight 17					
Airplane 327 Traverse 4		Time (EST) (a) Length of traverse 143.9 sec, 58,527 ft Initial heading (deg) (a)			
30 - 33	25,500	11.2	-5.9	-----	6
33 - 36	26,000	6.2	-----	-----	1
36 - 39		6.5	-8.1	----- -31.3	6
39 - 42		2.8	-----	4.4	2
42 - 45		4.4	-4.4	7.7	2
45 - 48		3.7	-3.4	-----	2
48 - 51		2.8	-3.4	-----	2
51 - 54		5.0	-----	-----	2
54 - 57		-----	-3.4	----- -8.0	1
57 - 60		2.8	-----	-----	2
Airplane 347 Traverse 1		Time (EST) (b) Length of traverse 36.1 sec, 12,190 ft Initial heading (deg) 30			
0 - 3	21,000	7.9	-8.2	----- -17.3	8
3 - 6		13.6	-7.0	33.1	6
6 - 9		13.3	-12.3	26.8 -21.8	7
9 - 12		4.7	-9.2	18.9 -5.3	7
12 - 15	20,500	-----	-----	-----	0
Airplane 347 Traverse 2		Time (EST) (b) Length of traverse 65.5 sec, 22,143 ft Initial heading (deg) 30			
0 - 3	21,000	4.7	-5.7	8.9	4
3 - 6		2.5	-5.7	-----	4
6 - 9		1.9	-6.6	----- -6.0	5
9 - 12	20,500	5.7	-5.7	-----	5
12 - 15	21,000	7.2	-3.1	15.2	7
15 - 18		2.8	-5.7	11.4	5
18 - 21		6.9	-9.1	----- -16.7	7
21 - 24		6.9	-----	12.5	1

^aNo records obtained.^bClock not in field of view of motion-picture camera.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e _{max} (fps)		Maximum true gust velocity U _t _{max} (fps)		Gust gradient distance (ft)		No. of gusts
August 6, 1946 - Flight 17								
Airplane 347 Traverse 3		Time (EST) (b) Length of traverse 68.5 sec, 23,143 ft Initial heading (deg) 60						
0 - 3	21,000	4.7	-6.9	----	-8.8	----	374	4
3 - 6		8.1	-1.9	3.9	-5.2	69	139	3
6 - 9		4.1	-2.8	----	----	----	----	2
9 - 12		1.9	-5.6	----	-11.0	----	340	4
12 - 15		4.7	-3.1	9.6	-6.0	67	100	4
15 - 18		2.5	-3.1	9.3	-6.0	202	101	5
18 - 21		2.2	----	----	----	----	----	1
21 - 24		----	-3.1	----	----	----	----	1
Airplane 347 Traverse 4		Time (EST) (b) Length of traverse 163.4 sec, 35,342 ft Initial heading (deg) 350						
0 - 3	21,000	8.7	-6.2	8.9	-10.5	33	134	5
3 - 6		5.9	-7.2	----	-11.5	----	68	6
6 - 9		7.2	-7.2	----	----	----	----	6
9 - 12		3.1	-4.7	4.7	-6.0	135	101	4
12 - 15		----	-3.1	----	----	----	----	1
15 - 18		1.9	----	----	----	----	----	1
18 - 21		----	----	----	----	----	----	0
21 - 24		2.5	-3.1	6.2	----	372	----	4
24 - 27		21.8	-14.7	51.8	----	107	----	9
27 - 30		11.5	-6.2	----	----	----	----	4
30 - 33	5.0	-16.2	----	----	----	----	7	
33 - 36	21,500	1.9	-2.8	----	----	----	4	
Airplane 345 Traverse 1		Time (EST) (a) Length of traverse 197.1 sec, 58,657 ft Initial heading (deg) (a)						
0 - 3	15,500	6.3	-5.7	----	----	----	----	3
3 - 6		7.0	-3.5	----	----	----	----	4
6 - 9		7.9	-7.9	9.5	----	110	----	10

^aNo records obtained.

^bClock not in field of view of motion-picture camera.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity $U_{e_{max}}$ (fps)		Maximum true gust velocity $U_{t_{max}}$ (fps)		Gust gradient distance (ft)		No. of gusts
August 6, 1946 - Flight 17								
Airplane 345 Traverse 1		{ Time (EST) (a) Length of traverse 197.1 sec, 58,657 ft Initial heading (deg) (a)						
9 - 12	15,500	7.0	-6.0	----	----	----	----	9
12 - 15		3.5	-4.8	----	----	----	----	6
15 - 18		5.1	-2.9	----	----	----	----	2
18 - 21		----	----	----	----	----	----	0
21 - 24		----	----	----	----	----	----	0
24 - 27		----	----	----	----	----	----	0
27 - 30		----	----	----	----	----	----	0
30 - 33		----	----	----	----	----	----	0
33 - 36		----	-2.9	----	-5.6	----	421	1
36 - 39		3.5	----	----	----	----	----	1
39 - 42		12.7	-10.8	----	----	----	----	5
42 - 45		16.2	-5.4	----	----	----	----	5
45 - 48	16,000	12.4	-18.7	----	----	----	----	7
48 - 51		6.7	-9.8	----	----	----	----	6
51 - 54		9.8	-9.2	7.0	----	81	----	8
54 - 57	15,500	6.7	-9.2	----	----	----	----	4
57 - 60		----	----	----	----	----	----	0
Airplane 345 Traverse 2		{ Time (EST) (a) Length of traverse 14.8 sec, 4,371 ft Initial heading (deg) (a)						
0 - 3	15,500	4.4	-8.2	----	-5.4	----	58	15
3 - 6		7.0	-7.3	----	----	----	----	4
Airplane 345 Traverse 3		{ Time (EST) (a) Length of traverse 70.7 sec, 21,096 ft Initial heading (deg) (a)						
0 - 3	15,500	----	-2.8	----	----	----	----	1
3 - 6		3.5	-2.8	----	----	----	----	4
6 - 9		3.5	-2.8	----	----	----	----	3
9 - 12		3.5	-2.8	----	----	----	----	4

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Continued

Space interval ft x 10 ³	Pressure altitude (ft)	Maximum effective gust velocity U _e max (fps)		Maximum true gust velocity U _t max (fps)		Gust gradient distance (ft)		No. of gusts
August 6, 1946 - Flight 17								
Airplane 345 Traverse 3		{ Time (EST) (a) Length of traverse 70.7 sec, 21,096 ft Initial heading (deg) (a)						
12 - 15	15,500	3.5	-2.8	6.1	-----	179	----	2
15 - 18		-----	-----	-----	-----	-----	-----	0
18 - 21		-----	-----	-----	-----	-----	-----	0
21 - 24		-----	-----	-----	-----	-----	-----	0
Airplane 345 Traverse 4		{ Time (EST) (a) Length of traverse 106.1 sec, 30,952 ft Initial heading (deg) (a)						
0 - 3	15,500	----	----	----	----	----	----	0
3 - 6		----	----	----	----	----	----	0
6 - 9		----	----	----	----	----	----	0
9 - 12		----	----	----	----	----	----	0
12 - 15		6.9	-2.5	13.4	-----	58	----	4
15 - 18		-----	-----	-----	-----	-----	-----	0
18 - 21		-----	-----	-----	-----	-----	-----	0
21 - 24		8.8	-4.1	15.3	-----	176	----	2
24 - 27		4.1	-9.1	-----	-----	-----	-----	7
27 - 30		-----	-----	-----	-----	-----	-----	0
30 - 33	-----	-----	-----	-----	-----	-----	0	
Airplane 345 Traverse 5		{ Time (EST) (a) Length of traverse 151.2 sec, 43,511 ft Initial heading (deg) (a)						
0 - 3	15,500	----	----	----	----	----	----	0
3 - 6		----	----	----	----	----	----	0
6 - 9		----	----	----	----	----	----	0
9 - 12		----	----	----	----	----	----	0
12 - 15		-----	-3.1	-----	-----	-----	-----	1
15 - 18		-----	-3.1	-----	-5.5	-----	106	2
18 - 21		6.9	-6.6	-----	-----	-----	-----	5
21 - 24		5.9	-6.9	7.4	-----	55	----	6
24 - 27		10.9	-6.6	-----	-----	-----	-----	9

^aNo records obtained.

TABLE I.- SUMMARY OF GUST MEASUREMENTS - Concluded

Space interval ft $\times 10^3$	Pressure altitude (ft)	Maximum effective gust velocity $U_{e_{max}}$ (fps)		Maximum true gust velocity $U_{t_{max}}$ (fps)		Gust gradient distance (ft)	No. of gusts	
August 6, 1946 - Flight 17								
Airplane 345 Traverse 5		{ Time (EST) (a) Length of traverse 151.2 sec, 43,511 ft Initial heading (deg) (a)						
27 - 30	15,500	3.8	-4.7	----	-7.3	----	234	6
30 - 33		5.6	-4.1	----	-9.2	----	31	8
33 - 36		5.3	-2.8	6.6	-----	59	-----	4
36 - 39		4.1	-4.1	----	-7.2	----	120	6
39 - 42		3.4	-2.8	----	-----	-----	-----	2
42 - 45		2.8	-----	5.1	-----	90	-----	1
Airplane 351 ^a								

^aNo records obtained.

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TABLE II.- SUMMARY OF DRAFT VELOCITY MEASUREMENTS FROM FLIGHTS
OF P-61C AIRPLANES WITHIN THUNDERSTORMS

Date	Flight no.	Air-plane no.	Assigned altitude	Tra-verse no.	Draft location from cloud entry (ft)		Draft extent (ft)	Average draft velocity (fps)	
					Start	End			
7-24-46	16	327	21,000	1	31,811	41,774	9,963	44.1	
				2	2,462	25,411	22,949	37.5	
				3	49,913	78,253	28,340	14.4	
				a ₄					
		a ₅							
		331	16,000	1	31,145	34,396	3,251	-25.1	
					37,148	52,966	15,818	32.0	
					2	12,871	17,498	4,627	34.3
					a ₃				
					4	4,760	9,734	4,974	-31.1
					82,489	87,857	5,368	-31.5	
		109,820	114,728	4,908	31.2				
		5	10,872	40,832	29,960	16.0			
					50,069	59,847	9,778	13.3	
347	6,000	a ₁							
		a ₂							
		a ₃							
		a ₄							
8-6-46	17	327	26,000	a ₁					
				a ₂					
				a ₃					
				4	10,360	20,242	9,882	29.8	
23,651	31,850	8,199	-28.0						

aNo draft velocities indicated by records.

TABLE II.- SUMMARY OF DRAFT VELOCITY MEASUREMENTS - Concluded

Date	Flight	Air- plane no.	Assigned altitude (ft)	Tra- verse no.	Draft location from cloud entry (ft)		Draft extent (ft)	Average draft velocity (fps)	
					Start	End			
8-6-46	17	347	21,000	^a 1					
				2	10,312	15,487	5,175	16.2	
				^a 3					
				4	24,800	32,555	7,755	32.7	
				1	41,533	49,987	8,454	16.5	
		345	16,000	^a 2					
				^a 3					
				^a 4					
				^a 5					
				^b 351	11,000				

^aNo draft velocities indicated by records.

^bNo records obtained.

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TABLE III.- SUMMARY OF INDICATIONS OF AMBIENT

AIR TEMPERATURE WITHIN THUNDERSTORMS

Date	Flight no.	Airplane no.	Traverse no.	Time (EST)	Distance from cloud entry (ft)	Milliammeter reading
7-24-46	16	327	2	154958	0	150
				155015	6,900	100
				155030	12,900	100
				155045	18,000	130
				155100	22,800	120
				155115	27,500	150
				3	155728	0
			155815		18,200	150
			155830		24,300	140
			155845		30,500	140
			155900		36,600	130
			155915		42,600	130
			155930		48,600	120
			155945		54,900	105
			160000		60,600	120
			160015		66,100	120
			160030		71,500	130
			160045		76,800	150
			160100		81,900	160

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