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RESEARCH MEMORANDUM

EVALUATION OF GUST AND DRAFT VELOCITIES FROM FLIGHTS OF

P-61c AIRPLANES WITHIN THUNDERSTORMS

IV - JULY 19, 1946 TO JULY 20, 1946

AT ORLANDO, FLORIDA

By

H. B. Tolefson

Langley Memorial Aeronautical Laboratory
Langley Field, Va.

Oct. 29, 1946



**NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
WASHINGTON**

NACA RM No. L6J16b

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Summaries of the gust and draft velocities evaluated from acceleration and airspeed-altitude records taken by NACA instruments installed in P-61c airplanes participating in thunderstorm flights 12 and 13 of July 19, 1946, and July 20, 1946, respectively, are presented in tables I and II herein. These data are of the type presented in reference 1 for previous flights.

Inspection of the motion picture records of the pilots' instrument panels for the present flights indicated that the milliammeter connected to equipment for measuring ambient air temperature read zero throughout all traverses.

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

Harold B. Tolefson
Harold B. Tolefson
Aeronautical Engineer

Approved:

Richard V. Rhode
Richard V. Rhode
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CME

REFERENCE

1. Tolefson, H. B.: Evaluation of Gust and Draft Velocities from Flights of P-61c Airplanes within Thunderstorms. III - July 12, 1946 to July 18, 1946 at Orlando, Florida. NACA RM No. L6I24, 1946.

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

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 19, 1946 - Flight 12					
Airplane 347 { Time (EST) - (a) Traverse 1 { Length of traverse 122.2 sec, 46,416 ft Initial heading (deg) - (a)					
0 - 3	22,000	14.8	-13.5	----	7
3 - 6		9.1	-8.8	----	14
6 - 9	22,500	5.3	-7.5	---- -32.2	9
9 - 12		7.5	-12.9	----	7
12 - 15		9.4	-7.2	----	5
15 - 18		8.5	-6.6	11.5 -21.4	7
18 - 21		11.9	-2.5	17.7 -12.1	7
21 - 24		9.7	-11.9	27.8	8
24 - 27		10.4	-5.3	24.5	6
27 - 30	23,000	6.0	-4.7	12.8 -5.4	6
30 - 33		4.1	-10.1	9.9	4
33 - 36		7.5	-2.5	9.1 -8.3	7
36 - 39		7.2	-4.1	8.3 -8.3	10
39 - 42		6.6	-11.9	7.3	9
42 - 45		6.0	-2.2	6.7	9
45 - 48		----	-1.9	----	1
Airplane 347 { Time (EST) - (a) Traverse 2 { Length of traverse 173.6 sec, 66,041 ft Initial heading (deg) - (a)					
0 - 3	21,000	5.6	----	7.8	2
3 - 6		3.4	-3.1	---- -5.2	6
6 - 9		10.6	-3.1	---- -5.2	8
9 - 12		7.5	-2.2	8.8	5
12 - 15		9.7	-2.2	7.7 -5.8	5
15 - 18		3.4	-3.1	5.7 -7.7	5
18 - 21		4.7	-5.6	12.5 -7.1	7
21 - 24		4.4	-3.4	8.2 -4.5	6
24 - 27		6.9	-7.5	11.3 -25.6	3
27 - 30		3.7	-6.9	----	6

^aNo motion-picture camera installed in airplane.

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 19, 1946 - Flight 12								
Airplane 347 Traverse 2		{ Time (EST) - (a) Length of traverse 173.6 sec, 66,041 ft Initial heading (deg) - (a)						
30 - 33	21,000	11.9	-9.4	----	----	9		
33 - 36		12.8	-19.1	----	-39.2	7		
36 - 39		16.6	-10.9	----	----	8		
39 - 42		15.3	-9.4	24.9	44	8		
42 - 45		9.7	-20.3	10.3	38	8		
45 - 48		11.2	-10.9	----	----	7		
48 - 51		11.2	-7.5	----	----	11		
51 - 54		8.7	-14.1	16.5	-3.2	118	81	
54 - 57		4.7	-7.8	8.5	-11.2	39	117	
57 - 60		6.9	-3.7	4.8	-7.0	116	116	
60 - 63		9.1	-8.7	----	----	----	7	
63 - 66		13.1	-5.9	----	-7.7	241	6	
66 - 69	----	----	----	----	----	0		
Airplane 347 Traverse 3		{ Time (EST) - (a) Length of traverse 236.6 sec, 76,313 ft Initial heading (deg) - (a)						
0 - 3	20,500	6.2	-6.2	6.9	-13.5	67	100	7
3 - 6		13.7	-8.4	16.1	----	165	----	7
6 - 9		8.4	-7.4	----	-6.3	----	67	8
9 - 12		7.1	-5.0	----	-11.4	----	67	8
12 - 15		5.0	-3.4	----	-4.6	----	164	5
15 - 18		2.8	-5.0	7.5	-4.2	32	97	8
18 - 21		4.7	-5.0	----	-5.5	----	91	3
21 - 24	21,000	5.6	-6.5	13.0	-5.5	60	91	6
24 - 27		8.1	-6.8	22.7	----	32	----	7
27 - 30		8.4	-8.7	----	----	----	----	6
30 - 33		12.1	----	----	----	----	----	3
33 - 36		----	-8.4	----	----	----	----	3
36 - 39		2.8	-2.8	6.9	----	31	----	6
39 - 42		2.8	-2.8	6.4	----	216	----	3
42 - 45		2.8	----	----	----	----	----	1

^aNo motion-picture camera installed in airplane.

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 19, 1946 - Flight 12								
Airplane 347 Traverse 3		{ Time (EST) - (a) Length of traverse 236.6 sec, 76,313 ft Initial heading (deg) - (a)						
45 - 48	21,000	2.2	-3.1	----	----	----	----	4
48 - 51		4.3	-----	----	-5.3	----	33	4
51 - 54	20,500	4.7	-10.5	6.6	-19.7	100	100	6
54 - 57		----	-----	----	-12.3	----	451	1
57 - 60		2.5	-2.5	6.6	----	35	----	3
60 - 63		2.5	-----	----	-3.6	----	102	2
63 - 66		4.7	-2.5	11.4	----	32	----	2
66 - 69		----	-3.7	----	----	----	----	2
69 - 72		3.7	-4.7	6.0	-11.4	33	96	4
72 - 75		7.8	-4.7	----	-5.8	----	223	9
75 - 78		4.7	-4.0	----	----	----	----	4
Airplane 347 Traverse 4		{ Time (EST) - (a) Length of traverse 251.5 sec, 85,870 ft Initial heading (deg) - (a)						
0 - 3	20,500	----	-2.5	----	----	----	----	1
3 - 6		2.8	-4.6	10.9	----	59	----	4
6 - 9		5.6	-5.6	17.3	-5.2	150	180	5
9 - 12		14.2	-5.9	10.2	-8.9	61	62	10
12 - 15		12.0	-18.5	----	----	----	----	8
15 - 18	21,000	16.1	-10.5	----	-8.1	----	35	9
18 - 21		22.2	-9.6	22.9	-21.4	159	39	7
21 - 24		9.0	-12.7	----	----	----	----	8
24 - 27		5.6	-9.9	----	----	----	----	5
27 - 30		19.4	-5.6	----	----	----	----	9
30 - 33	21,500	13.3	-9.6	----	----	----	----	8
33 - 36		15.1	-9.3	----	----	----	----	9
36 - 39		11.7	-26.2	20.7	----	64	----	9
39 - 42		4.9	-8.0	----	----	----	----	10
42 - 45		6.5	-6.2	15.1	----	164	----	9
45 - 48		6.8	-8.0	16.1	----	36	----	8
48 - 51		13.9	-6.8	----	----	----	----	7

^aNo motion-picture camera installed in airplane.

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 19, 1946 - Flight 12					
Airplane 347 { Time (EST) - (a) Traverse 4 { Length of traverse 251.5 sec, 85,870 ft Initial heading (deg) - (a)					
51 - 54	21,500	4.9	-10.2	-----	10
54 - 57		7.7	-8.0	9.3	12
57 - 60	21,000	11.1	-8.6	-----	10
60 - 63		15.7	-3.7	-----	6
63 - 66	21,500	7.1	-8.6	9.4	6
66 - 69		10.8	-7.7	14.6	8
69 - 72		13.0	-5.9	-----	6
72 - 75	22,000	5.9	-4.9	9.5	7
75 - 78		21.3	-10.5	-----	6
78 - 81		13.9	-13.0	31.6	5
81 - 84		9.0	-12.0	-----	6
84 - 87		-----	-9.3	-----	2
Airplane 333 { Time (EST) 155300 - 155530 Traverse 1 { Length of traverse 173.1 sec, 53,477 ft Initial heading (deg) 110					
0 - 3	16,000	8.2	-19.9	-----	10
3 - 6		14.2	-10.1	-----	7
6 - 9	15,500	7.3	-12.9	-----	6
9 - 12		15.2	-8.8	-----	10
12 - 15		10.1	-6.9	-----	7
15 - 18	16,000	5.4	-7.9	8.3	8
18 - 21		3.5	-7.3	-----	8
21 - 24	15,500	18.6	-18.9	-----	6
24 - 27	15,000	14.5	-8.5	22.2	7
27 - 30		18.6	-13.3	-----	9
30 - 33	15,500	20.5	-7.6	22.4	7
33 - 36	16,000	8.2	-18.9	5.5	9
36 - 39		4.7	-7.3	8.0	10
39 - 42		-----	-9.2	-----	2
42 - 45	15,000	16.4	-2.2	11.4	3
45 - 48	16,000	3.8	-4.1	5.6	8

^aNo motion-picture camera installed in airplane.

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 19, 1946 - Flight 12					
Airplane 333 Traverse 1		{ Time (EST) 155300 - 155530 Length of traverse 173.1 sec, 53,477 ft Initial heading (deg) 110			
48 - 51 51 - 54	16,000	---- 2.2	-3.2 -1.6	---- ----	1 2
Airplane 327 Traverse 1		{ Time (EST) 155600 - 155930 Length of traverse 229.1 sec, 84,000 ft Initial heading (deg) 120			
0 - 3 3 - 6 6 - 9 9 - 12 12 - 15 15 - 18 18 - 21 21 - 24 24 - 27 27 - 30 30 - 33 33 - 36 36 - 39 39 - 42 42 - 45 45 - 48 48 - 51 51 - 54 54 - 57 57 - 60 60 - 63 63 - 66 66 - 69 69 - 72 72 - 75 75 - 78 78 - 81 81 - 84	10,500 11,000 10,500 11,000 <				

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 19, 1946 - Flight 12					
Airplane 327 { Time (EST) - (b) Traverse 2 { Length of traverse 194.5 sec, 74,577 ft Initial heading (deg) - (b)					
0 - 3	11,000	----	-----	-----	0
3 - 6		-----	-5.0	-----	3
6 - 9	10,500	6.3	-5.0	-----	5
9 - 12		7.6	-8.8	-----	3
12 - 15	11,000	2.8	-13.2	-----	5
15 - 18		11.7	-8.8	16.2	5
18 - 21		14.2	-5.0	-----	7
21 - 24		7.2	-10.1	-----	6
24 - 27		4.7	-5.0	-----	3
27 - 30	11,500	4.7	-9.1	-----	6
30 - 33		8.2	-6.0	-----	4
33 - 36		6.3	-5.7	-----	8
36 - 39		7.6	-6.9	-----	6
39 - 42		7.2	-6.9	-----	8
42 - 45		7.2	-7.9	-----	5
45 - 48	11,000	7.9	-9.4	-----	5
48 - 51		6.3	-----	-----	3
51 - 54		6.3	-9.8	-----	4
54 - 57		6.0	-2.8	-----	4
57 - 60	11,500	6.3	-8.5	-----	5
60 - 63		6.9	-5.7	-----	3
63 - 66		11.7	-6.3	-----	3
66 - 69		12.0	-8.2	-----	6
69 - 72	12,000	4.7	-7.6	-----	8
72 - 75	11,500	3.1	-13.2	-----	2
Airplane 327 { Time (EST) 161336 - 161747 Traverse 3 { Length of traverse 274.6 sec, 93,866 ft Initial heading (deg) 90					
0 - 3	10,500	2.5	-5.0	-----	2
3 - 6		5.0	-2.5	-----	3
6 - 9		7.5	-8.1	-----	7

^bNo motion-picture 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 19, 1946 - Flight 12					
Airplane 327 { Time (EST) 161336 - 161747 Traverse 3 { Length of traverse 274.6 sec, 93,866 ft Initial heading (deg) 90					
9 - 12	10,500	8.1	-10.3	-----	6
12 - 15	11,000	11.3	-4.4	8.3	7
15 - 18		10.3	-6.0	-----	4
18 - 21		6.0	-11.0	-18.0	6
21 - 24		66.6	-7.8	-----	6
24 - 27		7.5	-4.4	12.2	6
27 - 30		6.0	-4.4	-15.3	6
30 - 33		4.7	-4.7	-7.7	4
33 - 36		7.2	-3.1	12.6	8
36 - 39		4.4	-2.5	-----	4
39 - 42		4.7	-4.4	11.3	5
42 - 45		6.3	-4.4	6.7	6
45 - 48		6.9	-6.0	11.9	2
48 - 51		5.3	-4.7	-----	5
51 - 54		10.0	-4.4	-10.0	6
54 - 57		4.7	-2.5	6.7	7
57 - 60	11,500	10.0	-5.0	5.6	5
60 - 63		12.2	-11.0	-----	6
63 - 66	12,000	14.7	-12.2	30.5	5
66 - 69		12.5	-6.6	-----	5
69 - 72		14.4	-9.4	-----	2
72 - 75		-----	-6.6	-----	2
75 - 78		7.5	-6.0	-----	5
78 - 81	11,500	9.4	-6.3	5.0	4
81 - 84	12,000	10.0	-3.4	-----	5
84 - 87		9.4	-11.0	-18.2	5
87 - 90		11.0	-26.6	-20.4	7
90 - 93		6.9	-10.3	9.5	4
93 - 96		-----	-----	-----	0
Airplane 327 { Time (EST) 162457 - 162912 Traverse 4 { Length of traverse 282.6 sec, 102,217 ft Initial heading (deg) 270					
0 - 3	10,500	6.5	-6.8	-21.9	4
3 - 6	11,000	5.9	-3.1	-----	3

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 19, 1946 - Flight 12								
Airplane 327 Traverse 4		{ Time (EST) 162457 - 162912 Length of traverse 282.6 sec, 102,217 ft Initial heading (deg) 270						
6 - 9	11,000	2.2	-5.3	7.4	-6.5	421	178	4
9 - 12		2.5	-----	-----	-----	-----	-----	1
12 - 15		-----	-----	-----	-----	-----	-----	2
15 - 18		-----	-3.4	-----	-----	-----	-----	2
18 - 21		3.4	-2.5	-----	-----	-----	-----	2
21 - 24		-----	-1.9	-----	-----	-----	-----	1
24 - 27		-----	-----	-----	-----	-----	-----	1
27 - 30		5.9	-4.0	-----	-----	-----	-----	5
30 - 33		7.1	-9.3	-----	-----	-----	-----	6
33 - 36		4.6	-3.1	-----	-----	-----	-----	5
36 - 39		-----	-2.8	-----	-----	-----	-----	4
39 - 42		8.0	-2.7	-----	-----	-----	-----	8
42 - 45	10,500	16.1	-10.2	-----	-----	-----	-----	6
45 - 48		8.0	-9.6	-----	-----	-----	-----	7
48 - 51		10.2	-14.5	-----	-----	-----	-----	4
51 - 54	11,000	7.4	-4.6	-----	-----	-----	-----	3
54 - 57		9.3	-8.0	-----	-15.3	-----	116	6
57 - 60	11,500	6.5	-9.0	-----	-----	-----	-----	7
60 - 63		4.9	-6.2	-----	-----	-----	-----	5
63 - 66		8.7	-5.3	-----	-----	-----	-----	5
66 - 69		4.9	-7.4	-----	-16.9	-----	202	5
69 - 72		6.5	-7.7	-----	-----	-----	-----	8
72 - 75		13.0	-9.3	-----	-----	-----	-----	5
75 - 78		9.9	-4.0	-----	-----	-----	-----	6
78 - 81	12,000	6.8	-9.6	15.2	-----	105	-----	8
81 - 84		4.0	-4.6	-----	-7.7	-----	105	4
84 - 87		2.2	-2.5	-----	-----	-----	-----	3
87 - 90		2.2	-4.6	8.8	-----	351	-----	3
90 - 93	11,500	1.9	-4.3	-----	-----	-----	-----	5
93 - 96		5.9	-3.1	-----	-----	-----	-----	3
96 - 99		9.6	-5.6	-----	-15.4	-----	185	5
99 - 102	11,500	9.0	-5.9	19.1	-----	38	-----	5
102 - 105		-----	-----	-----	-----	-----	-----	0

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 19, 1946 - Flight 12							
Airplane 344 Traverse 1		{ Time (EST) 155120 - 155310 Length of traverse 120.2 sec, 41,791 ft Initial heading (deg) 130					
0 - 3	5,500	8.4	-15.8	----	----	----	11
3 - 6	6,000	9.0	-8.4	----	-19.1	291	11
6 - 9		10.3	-9.4	----	----	----	10
9 - 12		12.9	-15.2	----	-8.7	221	6
12 - 15		7.4	-10.6	----	-18.6	373	7
15 - 18		6.8	-13.9	----	-25.7	100	7
18 - 21		4.8	-8.1	14.3	-13.5	225 66	6
21 - 24		8.7	-4.8	----	-9.0	35	3
24 - 27		7.1	-6.4	----	-6.8	74	5
27 - 30		2.9	----	----	----	----	2
30 - 33	6,500	2.9	-2.6	----	-7.1	38	4
33 - 36		6.4	-6.8	----	----	----	8
36 - 39		8.1	-11.3	----	-19.7	110	8
39 - 42		----	-6.4	----	----	----	1
Airplane 344 Traverse 2		{ Time (EST) 160053 - 160220 Length of traverse 115.2 sec, 30,888 ft Initial heading (deg) 300					
0 - 3	5,500	6.8	-2.3	----	----	----	3
3 - 6		8.4	-6.4	----	----	----	3
6 - 9		4.8	-13.2	----	----	----	4
9 - 12		11.6	-12.9	----	-26.2	96	5
12 - 15		17.0	-8.4	----	----	----	7
15 - 18		8.7	-5.5	9.9	----	111	6
18 - 21		8.0	-3.9	13.6	----	56	5
21 - 24		14.1	-4.5	16.0	----	105	4
24 - 27		6.8	-6.1	17.6	----	26	6
27 - 30		8.7	-5.8	12.4	----	260	4
30 - 33		6.4	----	----	----	----	1

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 19, 1946 - Flight 12					
Airplane 344 { Time (EST) 160930 - 161615 Traverse 3 { Length of traverse 389.5 sec, 114,320 ft Initial heading (deg) 100					
0 - 3	6,000	9.9	-7.3	----	7
3 - 6		11.8	-11.5	----	3
6 - 9		----	-8.9	----	6
9 - 12		16.9	-10.2	----	7
12 - 15		10.2	-15.0	---- -8.7	5
15 - 18		5.8	-8.0	8.6 ----	3
18 - 21		7.0	-5.8	----	5
21 - 24		7.3	-8.6	---- -11.8	5
24 - 27		17.9	-7.7	----	5
27 - 30		15.0	-9.9	----	4
30 - 33		7.3	-10.2	----	6
33 - 36		9.9	-16.3	---- -21.0	9
36 - 39		----	-8.9	---- -15.6	3
39 - 42		5.1	-3.2	----	3
42 - 45		8.3	-4.2	----	2
45 - 48		7.7	-6.1	----	4
48 - 51		10.2	-9.9	---- -17.1	5
51 - 54		8.9	-7.7	14.4 ----	3
54 - 57		3.2	-5.8	---- -20.4	3
57 - 60		9.6	-9.9	----	7
60 - 63		8.3	-14.1	14.1 ----	10
63 - 66		8.3	-12.5	----	5
66 - 69		12.8	-8.0	----	4
69 - 72		15.0	-12.8	----	8
72 - 75		13.1	-7.7	----	5
75 - 78		7.7	-8.0	----	5
78 - 81		7.7	-4.8	----	4
81 - 84		----	-3.5	----	3
84 - 87		7.7	-6.1	----	3
87 - 90		4.2	-4.8	8.1 -9.3	3
90 - 93		4.5	----	6.9 ----	1
93 - 96		----	-2.9	----	3
96 - 99		----	-2.9	----	3
99 - 102		4.5	-3.5	----	4
102 - 105		----	----	----	0

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 19, 1946 - Flight 12								
Airplane 344 Traverse 3		{ Time (EST) 160930 - 161615 Length of traverse 389.5 sec, 114,320 ft Initial heading (deg) 100						
105 - 108	6,000	3.5	-3.5	7.5	-----	185	-----	3
108 - 111		3.5	-----	-----	-----	-----	-----	2
111 - 114		-----	-----	-----	-----	-----	-----	0
114 - 117		-----	-----	-----	-----	-----	-----	0
Airplane 344 Traverse 4		{ Time (EST) 162510 - 162825 Length of traverse 219.1 sec, 60,725 ft Initial heading (deg) 280						
0 - 3	6,500	8.2	-3.8	-----	-----	-----	-----	4
3 - 6	6,000	10.5	-13.0	25.1	-----	139	-----	4
6 - 9		24.7	-16.5	22.5	-----	82	-----	8
9 - 12		7.6	-8.9	-----	-----	-----	-----	8
12 - 15		22.2	-14.9	24.6	-29.8	61	61	15
15 - 18	6,500	8.2	-9.5	-----	-----	-----	-----	8
18 - 21		7.0	-5.1	-----	-----	-----	-----	6
21 - 24		11.1	-5.7	-----	-----	-----	-----	7
24 - 27		6.3	-1.3	-----	-----	-----	-----	5
27 - 30		7.6	-1.0	-----	-----	-----	-----	5
30 - 33		9.2	-14.9	-----	-----	-----	-----	6
33 - 36		17.7	-9.2	-----	-13.6	-----	99	6
36 - 39		24.7	-8.2	-----	-----	-----	-----	7
39 - 42		8.6	-18.4	-----	-----	-----	-----	11
42 - 45		7.9	-15.2	-----	-36.4	-----	31	3
45 - 48		13.0	-6.0	22.9	-----	31	-----	7
48 - 51		15.2	-12.4	-----	-14.9	-----	64	6
51 - 54		9.2	-4.8	-----	-----	-----	-----	7
54 - 57		17.1	-20.6	-----	-----	-----	-----	8
57 - 60		9.5	-1.0	-----	-----	-----	-----	3
60 - 63		-----	-----	-----	-----	-----	-----	0

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 20, 1946 - Flight 13						
Airplane 327 Traverse 1		{ Time (EST) - (b) Length of traverse 151.4 sec, 48,105 ft Initial heading (deg) - (b)				
0 - 3	16,000	----	-5.3	13.1	89	4
3 - 6		5.3	-7.2	10.3	60	6
6 - 9		3.4	-----	6.1	93	4
9 - 12		4.7	-----	4.8	64	3
12 - 15		5.6	-4.7	-----	261	2
15 - 18		11.9	-10.3	3.1	65	8
18 - 21		6.9	-10.3	-----	372	5
21 - 24		4.4	-14.1	14.6	418	2
24 - 27		-----	-----	-----	-----	0
27 - 30		4.1	-----	-----	65	3
30 - 33		-----	-----	-----	285	2
33 - 36		-----	-----	-----	95	1
36 - 39	16,500	15.3	-19.7	26.5	170	5
39 - 42		8.8	-4.1	-----	-----	5
42 - 45		10.0	-8.8	-----	257	5
45 - 48		3.8	-6.3	-----	-----	2
48 - 51		-----	-----	-----	-----	0
Airplane 327 Traverse 2		{ Time (EST) - (b) Length of traverse 268.8 sec, 90,569 ft Initial heading (deg) - (b)				
0 - 3	16,000	-----	-----	-----	-----	3
3 - 6		-----	-----	-----	-----	1
6 - 9		3.7	-----	12.8	503	3
9 - 12		-----	-----	2.9	99	2
12 - 15		-----	-----	-----	-----	2
15 - 18		-----	-----	-----	-----	1
18 - 21		4.7	-6.6	10.9	510	3
21 - 24		5.0	-4.4	8.0	35	6
24 - 27		4.1	-----	7.2	188	5
27 - 30		5.6	-7.2	-----	251	6
30 - 33		7.2	-10.6	10.0	71	7
				-26.3	315	

^bNo motion-picture 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 20, 1946 - Flight 13					
Airplane 327 { Time (EST) - (b) Traverse 2 { Length of traverse 268.8 sec, 90,569 ft Initial heading (deg) - (b)					
33 - 36	16,000	7.2	-7.2	----	9
36 - 39		12.2	-5.9	22.7	4
39 - 42		15.6	-7.8	----	4
42 - 45		9.7	-13.1	----	4
45 - 48		11.2	-5.9	----	5
48 - 51		3.7	----	6.6	1
51 - 54		----	----	----	0
54 - 57		----	-3.7	----	3
57 - 60		6.6	----	-9.7	3
60 - 63		3.7	-4.7	8.2	4
63 - 66	16,500	8.7	-3.7	----	3
66 - 69		6.6	-3.7	11.5	5
69 - 72		5.6	-13.7	19.0	5
72 - 75		11.2	-4.1	----	6
75 - 78		6.6	----	-2.9	5
78 - 81		7.5	-10.3	-18.8	6
81 - 84		6.6	----	10.9	1
84 - 87		----	----	----	1
87 - 90		----	----	----	0
90 - 93		----	----	----	0
Airplane 327 { Time (EST) - (b) Traverse 3 { Length of traverse 127.4 sec, 34,966 ft Initial heading (deg) - (b)					
0 - 3	16,500	10.5	-9.0	15.4	7
3 - 6	17,000	19.2	-8.4	13.9	4
6 - 9		15.8	----	21.8	4
9 - 12		17.3	-8.7	----	4
12 - 15	18,000	13.3	-23.5	20.6	4
15 - 18	18,000	17.0	-21.4	29.9	6
18 - 21		12.7	-19.2	----	5
21 - 24		11.8	-9.0	----	5

^bNo motion-picture 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			
July 20, 1946 - Flight 13								
Airplane 327 Traverse 3		{ Time (EST) - (b) Length of traverse 127.4 sec, 34,966 ft Initial heading (deg) - (b)						
24 - 27	18,000	11.4	-----	-----	4			
27 - 30	18,500	-----	6.7	-6.7	3			
30 - 33		-----	-----	-----	1			
33 - 36		-----	-----	-----	1			
Airplane 327 Traverse 4		{ Time (EST) - (b) Length of traverse 96.5 sec, 33,207 ft Initial heading (deg) - (b)						
0 - 3	18,000	6.5	-2.8	10.9	-7.9	374	110	4
3 - 6		6.2	-----	6.7	-----	180	-----	5
6 - 9		-----	-4.6	9.1	-----	97	-----	4
9 - 12		4.0	-----	-----	-----	-----	-----	4
12 - 15		5.9	-6.5	9.1	-----	93	-----	2
15 - 18		8.6	-7.4	13.5	-----	335	-----	4
18 - 21		9.0	-7.1	22.3	-9.0	380	68	6
21 - 24		10.2	-9.9	-----	-----	-----	-----	7
24 - 27		7.1	-5.9	7.2	-12.5	204	101	5
27 - 30		-----	-----	-----	-8.4	-----	34	4
30 - 33		-----	-----	10.4	-----	387	-----	2
33 - 36		-----	-----	-----	-----	-----	-----	0

^bNo motion-picture records obtained.

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

Date	Flight no.	Air-plane no.	Assigned altitude (ft)	Tra-verse no.	Draft location from cloud entry (ft)		Draft extent (ft)	Average draft velocity (fps)
					Start	End		
7-19-46	12	347	21,000	a ₁				
				2	51,307 8,494	60,205 12,220	8,898 3,726	-19.2 -28.0
				3	26,753	32,717	5,964	-29.3
				4	33,461 45,502 51,062 69,985	39,020 50,396 58,132 78,871	5,559 4,894 7,070 8,886	36.3 20.9 -39.4 16.4
		333	16,000	a ₁				
		327	11,000	1	41,697 53,933	46,785 55,560	5,088 1,627	17.5 55.7
				2	19,808 65,588	29,505 72,273	9,697 6,685	21.8 24.3
				3	16,709	21,652	4,943	20.2
				4	63,614	69,182	5,568	26.1
		344	6,000	a ₁				
				a ₂				
				3	47,693	58,439	10,746	10.3
				a ₄				
7-20-46	13	327	16,000	1	17,649 33,434	20,028 37,549	2,379 4,115	43.8 13.4
				2	72,724 76,181	75,139 79,311	2,415 3,130	31.6 33.9

^aNo draft velocities indicated by records.

TABLE II.- SUMMARY OF DRAFT MEASUREMENTS - Concluded

Date	Flight no.	Air- plane no.	Assigned altitude (ft) -	Tra- verse no.	Draft location from cloud entry (ft)		Draft extent (ft)	Average draft velocity (fps)
					Start	End		
7-20-46	13	327	16,000	3	24,986	26,901	1,915	33.4
				4	12,457	14,065	1,608	37.6

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