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④ TECHNICAL NOTE, NO. WCT 54-62

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⑭ WADC-TN-WCT-54-62

⑥ BASIS OF REPUBLIC 329-AL TYP TANKS  
ON JAN 8-54

⑩ [Redacted]

Directorate of Flight and All-Weather Testing

This document may require specific prior approval

APFDL/FDP with  
W.H. APPS, Ohio 45437

⑪ 7 OCT 54

⑫ 33 p.

Wright Air Development Center  
Air Research and Development Command  
United States Air Force  
Wright-Patterson Air Force Base, Ohio

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D-152<sup>2</sup>

DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



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JUNE 67

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(A)

WRIGHT AIR DEVELOPMENT CENTER  
RESEARCH AND DEVELOPMENT COMMAND  
CHINA SPRING AIR FORCE  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

Technical Note  
WAF 64-62  
7 October 1964  
Author: W. R. Miller

Evaluation Branch  
Directorate of Flight and  
All-Weather Testing  
~~S-324-571(b)~~

TESTS OF REPUBLIC 320-GAL TIP TANKS  
ON AN F-84G

SUMMARY

Flight tests were conducted on an F-84G to evaluate the drag and the maneuvering flight characteristics of the aircraft with modified Republic 320-gal experimental tip tanks installed. Drag and g-forces experienced by the 320-gal tanks and the tank center-of-gravity shift with attitude change and time were also measured. Compared with Republic standard 230-gal tip tanks, the modified 320-gal tanks were found to indicate (1) an additional loss at 10,000 ft of some 3 to 7 knots calibrated air speed in the ram range max continuous to 64, (2) the same or slightly higher stick forces in maneuvering flight.



*[Signature]*  
Approved by: ROBERT W. SCULLIE  
Colonel, USAF  
Director of Flight and All-Weather Testing  
Wright Air Development Center

Method 1110

1. Flight tests were conducted on the No. 41-756, under  
300 lb. 300-571(5) for evaluation of the drag and the maneuver. Flight  
characteristics of the aircraft were determined with the aircraft  
installed with the wing, and the engine extended by the 300-571  
tanks. Ground tests were conducted to determine the effect of the  
gravity position of the aircraft, the effect of the aircraft  
of fuel, and the effect of the aircraft.

2. The tests, the flight tests, and the ground tests, were  
conducted, were requested by the Aircraft Laboratory, and were  
conducted during the period of 1951 through 1952. The project  
was interrupted at one point for an extended period of time, the aircraft  
was assigned exclusively to another program (Jet engines).

3. The aircraft was modified (serviced) and applied to the ground  
laboratory at the time of the flight tests. The aircraft was  
"Condition of all instruments and equipment - all instruments of 1-10."

Method 1111

4. The test item was the aircraft with the engine at centrally-  
mounted 300-571 tip tanks, specific sketch No. 300-571, modified by  
installation of internal tanks. The aircraft was modified as  
as compared to the aircraft of the aircraft of 1-10.

Method 1112

5. The test aircraft was the aircraft of the aircraft of 1-10, serial  
number 4-808997. The elevator control system was standard (standard  
of the aircraft of 1-10 for the aircraft of 1-10, standard  
of 1-10).

6. All speed-rpm and air-speed system calibrations were checked  
at a gross weight at the start of approximately 1,000 lb. The gross  
weights to which the aircraft was loaded for the stability tests varied  
necessarily according to the tip-tank fuel load and the engine, rpm,  
and were as specified on the flight test sheets, and were as follows:  
the desired position for the stability tests were obtained by  
the forward fuel tank during the flight to the test altitude, which  
permitted an insignificant change in weight during the test, as the  
wing tanks and main tank was used.

Method 1113

7. The drag, stick-force, and elevator-position instrumentation  
consisted of the following calibrated instruments, not panel-mounted:  
C-12 altimeter, 2-1a air-speed indicator, sensitive tachometer, C-10  
free-air-temperature indicator and probe, fuel counter and core flowmeter,  
2-4 accelerometer, stick-force indicator (a strain-gauge and a differ-  
type system), and autosyn elevator-position indicator.

8. A Dillon Model 5-4 oscillograph was installed for the vibration-measuring phase, using accelerometer pick-ups for vibratory accelerations in the y plane only. A pick-up was installed in the tail of each 320-gal tank, in the nose of one tank, and in the aircraft fuselage at the cg position.

9. The test equipment used to measure tank cg shift consisted of a counterbalancing straps supporting a 320-gal tank at the fore and aft assembly stations, with a Dillon dynamometer in series with an overhead cable attached to each strap.

#### RESULTS AND DISCUSSION

##### 1). Tests:

a. Speed-power calibrations at 10,000 feet for three configurations: empty Republic 320-gal tanks installed, empty Republic 230-gal tanks installed, and no external tanks. The data were reduced to std rpm vs air calibrated air speed and corrected rpm vs Mach number for a std gross weight of 17,000 lbs, and are presented in Figures 1 and 2.

b. Stick force and elevator deflection vs  $\beta$  at 30,000 ft for three trim speeds (231, 250, and 277 knots calibrated air speed) and two  $\alpha$ 's (nominally 27.5 and 27.9%  $\alpha$ ) for the following configurations and the tank fuel loadings:

(1) Republic 320-gal tanks installed, tanks empty and with 120 gal of fuel in each tank.

(2) Republic 230-gal tanks installed, tanks empty and with 120 gal of fuel in each tank.

(3) No external tanks.

The data are presented in Figures 4-7 as a comparison of the stick-force moments obtained at the three trim speeds and in Figures 8 and 9 as stick-force and elevator-deflection moments plotted against  $\alpha$  for each trim speed.

c. Vibratory accelerations of the 320-gal tanks, recorded at 10,000 and 15,000 ft with 50, 100, and 150 gal of J2-4 fuel in each tank and at 10,000 ft with 120 gal of fuel in each tank. Vibrations were recorded both in stabilized level flight and during abrupt aileron and elevator movements, at various Mach numbers from .50 to .82. The Aircraft Laboratory accomplished the data reduction and analysis.

d. Air-speed-system calibrations at 10,000 ft in the 320-gal-tank configuration, the results of which are plotted in Fig 3. AF Technical Note WADC 52-10 established that the calibration of the std system is the same for the clean aircraft as for the tip-tank configuration; hence

only one configuration was flown. A second calibration of the one configuration was found necessary when a fuselage skin patch was placed near one of the two static sources.

e. Tank cg shift with attitude change and time, for fuel quantities of 50, 100, and 160 gal. A photographic time history was taken of the readings of one of the dynamometers (see par 9), immediately following a change in tank attitude from level to approximately 40° nose up. When the cg change with time became relatively small and constant, the tank was moved to level position and another time history taken. This was repeated for changes in attitude from level to approximately 40° nose down and conversely (The hoist required 9 seconds to accomplish each attitude change). The results are presented in Figures 10-12.

11. Test Results:

a. The following tabular comparison is obtained from Fig 1:

<u>max continuous rpm at 10,000 ft (95%)</u>	
	V <sub>c</sub> * (Knots)
320-gal experimental tanks installed	436
230-gal std tanks installed	441
No external tanks	448
<u>Cruise rpm for max range at 10,000 ft (84%)</u>	
	V <sub>c</sub> * (Knots)
320-gal experimental tanks installed	306
230-gal std tanks installed	313
no external tanks	327

\*Calibrated Air Speed

b. Figures 4 and 5 show for the forward cg position little or no separation in stick force per g data with configuration and tank fuel loading at the two lower trim speeds; at the highest trim speed, the 320-gal-tank configuration indicated a slightly higher gradient than was obtained with the 230-gal tanks installed. Figures 6 and 7, in general, show for the rear cg position a measurable difference in stick-force gradient for the 320- and 230-gal-tank configurations only with a partial fuel load in the tanks, at the two higher trim speeds.

c. The following tabulation of maneuvering stick-free neutral points is obtained from Figures 3 and 4.

	cg (% M.A.C.)	
	<u>1.5g</u>	<u>3.5g</u>
Empty 320-gal tanks	77-1/2	38-1/4
" 230-gal tanks	78-1/4	36
320-gal tanks with partial fuel load	74-1/2	34
230-gal " " " " "	75	36
No external tanks	74-1/2	37-1/2

#### CONCLUSIONS

12. Through the rpm range 95 to 84% at 10,000 ft, the aircraft with modified Republic experimental 320-gal tip tanks installed was 3 to 7 knots slower than with Republic standard 230-gal tanks. Through the same rpm range, the 320-gal-tank configuration was 11 to 21 knots slower than the clean aircraft.

13. Stick forces per g were essentially the same for the 230-gal- and 320-gal-tank configurations at the lower trim speeds except for the rear cg position with partial fuel load in the tip tanks; in this instance, and also at the highest test trim speed for both cg positions, the stick forces were in general slightly higher with the 320-gal tanks installed.

#### RECOMMENDATIONS

14. None.

Technical Note No. 54-67  
**FLIGHT DATA SHEET**

F-84G (S/N) 51-768 FLIGHT NO. \_\_\_\_\_ DATE \_\_\_\_\_

CAMERA COUNTER NO.	IAS (KNOTS)	A. ALTITUDE (FT)	FUEL COUNTER (GAL)	PACER % (KNOTS)
<p>FLIGHT 1 - Air speed system calibration by F-86E pacer, AF No 50-599. 320 gal. lip tanks installed. Fuel specific wt 6.22 lbs/gal. Gross weight at engine start 15218 lbs. 18 Sept 53. Fuel counter reading at engine start 11008.5 gal.</p>				
2	425.7	10,650	11091	418.6
3	398.0	10,940		390.4
4	372.5	10,950		360.3
5	351.2	11,260		344.1
6	332.7	11,560		328.0
7	307.0	11,250		302.7
8	292.7	11,340		288.2
9	276.1	11,540		272.3
10	251.5	11,865		249.2
11	230.5	12,160		229.3
12	208.1	12,055		206.2
13	190.5	11,990		189.2
14	169.8	11,710		169.8
15	153.9	11,165		154.9
16	133.7	10,760		135.4
17	126.3	10,220		128.5
18	117.9	9,655	10846	120.2

Table 1

Technical Data Sheet  
**FLIGHT DATA SHEET**

10896 Alt 31760 FLIGHT NO DATE

CAMERA COUNTER NO	IAS (KNOTS)	ALTITUDE (FT)	FUEL COUNTER (GAL)	PASSENGER (KNOTS)
<p>FLIGHT 10 Air speed system calibration by C-28A pacer, AF No. 991511. 320 gal tip tanks installed. Fuel specific wt 6.18 lb/gal. Gross weight at engine start is 210 lb. 320 gal</p>				
2	199.5	5010		198.5
3	190.3	5040		189.7
5	178.4	4850		178.8
6	168.5	4910		169.4
7	158.5	5020		160.3
10	136.7	4770		139.5
11	128.6	4850		131.3
12	120.0	4820		122.7
<p>FLIGHT 22 Air speed system calibration by C-28A pacer, AF No. 19110. 320 gal tip tanks installed. Fuel specific wt 6.35 lb/gal. Fuel counter housing at engine start 9990 gal. Gross weight at engine start is 210 lb. 28 Jan 59.</p>				
2	451.0	10,000		447.5
3	436.7	10,240		427.5
4	419.8	10,240		411.0
5	400.5	9,940		391.9
6	375.5	11,340		366.6
7	359.2	10,190		353.1
8	337.2	10,200		331.2
9	320.7	10,150		314.4
10	301.5	10,150		295.9
11	280.0	10,220		274.2
12	259.7	10,230		256.8
13	238.4	10,150		235.7
14	218.0	10,120		216.0
15	199.0	10,000		196.5
16	181.5	10,110		182.0
17	161.0	10,320	745.0	162.1

# FLIGHT DATA SHEET

1046 Alt 51769 FLIGHT NO DATE

CAMERA COUNTER NO	FAT (DEG C)	RPM	FUEL COUNTER (GAL)	ALTITUDE (FT)	IAS (KNOTS)
<p>FLIGHT 13 Speed: RPM calibration. 320 gal Republic tip tanks installed. Fuel specific wt 6.35 lbs/gal. Fuel counter reading at engine start 999.9 gal. Gross weight at engine start 15210 lbs. 22 Jan 52</p>					
3.	27.5	7593	827.1	10,050	454.7
4.	26.5	7399	806.1	10,000	439.5
5.	22.5	7184	777.9	10,000	405.2
6.	17.5	6958	728.7	10,020	352.2
7.	13.0	6728	705.5	10,040	314.6
8.	9.5	6588	678.5	10,070	284.4
9.	5.5	6359	665.6	10,110	245.0
10.	4.0	6202	650.5	10,080	218.5
11.	3.0	5982	644.3	10,050	187.5
<p>FLIGHT 14 Speed: RPM calibration. No external tanks installed. Fuel specific wt 6.35 lbs/gal. Fuel counter reading at engine start 999.9 gal. Gross weight at engine start 15205 lbs. 22 Jan 52</p>					
3.	28.0	7726	915.6	10,100	464.5
4.	29.5	7574	895.2	10,100	464.5
5.	28.0	7389	879.3	10,090	456.8
6.	25.5	7152	840.9	10,070	428.7
7.	21.0	6998	805.9	10,080	385.7
8.	16.5	6768	786.4	10,120	337.7
9.	12.0	6548	760.9	10,050	296.6
10.	7.5	6359	746.0	10,070	259.7
11.	5.0	6182	731.3	10,080	228.5

FLIGHT DATA SHEET

F-016 AI NO. 51-268

FLIGHT NO.

DATE

CAMERA COUNTER NO.	FAT (DEG. C)	RPM	FUEL COUNTER (GAL)	ALTITUDE (FT)	IAS (KNOTS)
<p>FLIGHT 21 - Speed-RPM calibration. 230-gal Republic lip tanks installed. Fuel specific wt. 6.31 lbs/gal. Fuel counter reading at engine start 499.9 gal. Gross weight at engine start 15,210 lbs. 28 Jan 52.</p>					
1	21.5	7727	906.5	10,000	160.0
2	20.5	7574	896.6	10,050	156.3
3	19.5	7409	876.1	10,080	150.5
4	16.5	7204	861.2	10,000	147.7
5	12.5	6978	840.4	10,060	132.5
6	7.0	6758	807.9	10,060	133.2
7	3.0	6538	780.7	10,080	121.0
8	1.0	6358	779.0	10,060	127.7
9	-0.5	6177	767.0	10,060	135.3
10	-4.0	5962	752.0	10,070	98.0
11	-6.0	5862	735.8	10,090	96.8
12	-7.5	5842	718.6	10,100	137.7

FLIGHT DATA SHEET

F549 Alt 51-763 FLIGHT NO DATE

CAMERA COUNTER I.D.	IAS (KNOTS)	ALTITUDE (FT)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (G)	FUEL COUNTER (GAL)
<p>FLIGHT 2 - Stick force &amp; elev position vs g. No external tanks.                      c.g. 22.8% MAC Gr. Wt. at engine start 15300 lbs. Fuel counter                      reading at engine start 792.8 gal. Fuel capacity 1062.8                      lbs/gal. 20 Sept 53.</p>						
2	201	30,970	3.4	0.0	1.00	824
8	201	29,650	4.8	4.5	1.50	
4	200	30,680	7.4	7.8	2.05	
7	200	29,840	6.4	6.4	1.95	777
9	259	31,480	7.1	0.0	1.00	776
22	259	30,780	3.2	4.9	1.45	
15	258	30,240	3.7	7.5	2.00	
14	258	30,430	4.1	8.9	2.47	
18	258	30,560	4.2	7.7	2.71	
23	258	30,280	4.8	11.6	3.10	
25	258	30,250	4.8	13.2	3.10	653
<p>FLIGHT 3 - Stick force &amp; elev position vs g. Same configuration,                      c.g., etc as Flt 2 above except fuel counter reading at                      engine start 603.6 gal. 20 Sept 53.</p>						
26	280	31,450	1.8	0.0	1.00	430
27	280	30,690	2.4	2.8	1.55	
28	280	30,670	3.0	4.9	2.05	
29	181	30,370	3.4	7.4	2.47	
36	280	30,900	3.5	7.9	2.31	
38	280	30,530	4.4	11.4	3.03	
30	280	28,720	5.6	16.3	3.76	
39	280	28,930	5.4	15.5	3.70	336

FLIGHT DATA SHEET

F-84G 51-768 FLIGHT NO. DATE

CAMERA COUNTER NO.	IAS (KNOTS)	ALTITUDE (FT.)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL)
<p>FLIGHT 4. Stick force &amp; elev. position vs g. No external tanks c.g. 23.0% MAC. Gr. Acc. at engine start 15320 lbs. Fuel counter reading at engine start 040. Fuel specific wt. 6.21 lbs/gal. 29 Sept 53.</p>						
2	201	28430	1.9	0.0	1.00	339
3	200	24140	2.2	1.2	1.50	
5	200	31440	2.8	2.8	2.00	
7	200	27800	2.4	4.2	1.44	196
11	259	31170	1.1	0.0	1.00	700
12	259	31450	1.4	1.6	1.50	
15	258	32120	1.1	0.0	1.00	
17	258	30140	1.0	0.0	1.00	624
<p>FLIGHT 5. Stick force &amp; elev. position vs g. Same configuration, c.g., etc. as 4. Fuel counter reading at engine start 612.6 gal. 30 Sept 53.</p>						
32	254	30010	1.2	0.5	1.45	453
33	258	28950	1.5	3.7	2.14	
36	200	28900	1.5	2.6	1.93	420
38	281	31850	1.0	0.0	1.00	381
42	281	31510	1.3	2.1	1.40	
43	281	31450	1.4	3.1	1.93	
40	281	30930	1.2	3.1	1.26	
45	281	29680	1.5	6.1	2.15	
47	280	27310	1.6	7.1	2.40	
46	280	29380	1.7	7.1	3.00	
48	280	27640	1.6	5.5	1.50	308

FLIGHT DATA SHEET

F84G AT NO. 51-768 FLIGHT NO. DATE

CAMERA COUNTER NO.	IAS (KNOTS)	ALTITUDE (FT)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS.)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL)
<p>FLIGHT 8 Stick force &amp; elev positions vs g. Empty 320 gal Republic tip tanks installed. c.g. 22.8% MAC. Gr. Wt. at engine start 15620 lbs. Fuel counter reading at engine start 999.8 gal. Fuel specific wt 6.22 lbs/gal. 2 Oct 53.</p>						
2	201	29190	4.1	0.0	1.00	833
8	200	30350	9.1	9.8	2.21	
9	200	30570	5.8	4.2	1.50	
10	201	30410	9.0	9.3	2.30	792
11	259	29750	2.4	0.0	1.00	765
12	260	30230	3.0	3.6	1.40	
13	259	30310	4.6	7.4	2.05	
16	260	29270	5.5	10.3	2.36	
21	259	29830	5.6	10.6	2.47	
22	259	31060	6.0	12.9	3.00	
24	258	29060	7.1	17.0	3.68	
26	258	28280	7.3	18.1	3.72	676
<p>FLIGHT 9 Stick force &amp; elev positions vs g. Same configuration, c.g., etc as flight 8 above except fuel counter reading at engine start 640.0 gal. 2 Oct 53.</p>						
24	280	30850	2.3	2.0	1.05	441
30	280	30770	3.2	4.0	1.45	
37	280	31510	3.5	5.7	1.50	
39	280	31520	4.2	8.4	1.97	
39	280	31420	5.1	12.3	2.42	
40	280	31130	6.2	17.2	3.00	
41	281	30840	7.5	23.2	3.53	
56	290	28740	8.2	24.7	4.10	
42	280	28890	7.7	23.4	3.05	328

FLIGHT DATA SHEET

F.84G AI NO. 51-768

FLIGHT NO.

DATE

CAMERA COUNTER NO.	I A S (KNOTS)	ALTITUDE (FT.)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL.)
<p>FLIGHT 6 - Stick force &amp; elev position vs g. Empty 320-gal Republic 1/2 tanks installed. c.g. 27.9% MAC. Gr. Wt. at engine start 15475 lbs. Fuel counter reading at engine start 899.8 gal. Fuel specific wt. 6.21 lbs/gal. 1 Oct 53.</p>						
2	201	29970	2.6	0.0	1.00	837
3	200	32,560	3.1	3.3	1.50	
7	200	28,530	3.3	1.7	1.45	
8	200	31,320	4.6	5.4	2.21	
9	201	30,080	4.2	4.6	1.97	784
10	258	31,130	1.7	0.0	1.00	765
19	259	31,130	2.2	2.0	1.50	
18	259	31,120	2.7	4.7	2.00	
13	259	30,760	2.9	6.5	2.57	
20	258	31,040	3.0	6.9	2.52	
14	258	30,890	3.3	7.5	3.05	
21	258	30,740	3.2	8.3	3.13	
16	259	30,410	3.7	10.6	3.63	
23	259	29,620	3.3	9.2	3.30	639
<p>FLIGHT 7 - Stick force &amp; elev position vs g. Same configuration c.g., etc as Flt 6 above except fuel counter reading at engine start 592.7 gal. 1 Oct 53</p>						
25	280	30,630	1.5	0.0	1.00	416
26	280	30,880	2.0	2.5	1.35	
35	280	31,050	2.1	2.6	1.45	
36	280	31,010	2.5	5.0	2.01	
29	280	29,720	2.5	6.4	2.42	
31	280	29,540	3.5	9.3	3.10	
38	280	30,600	3.4	8.8	3.03	
39	231	30,630	3.8	10.6	3.50	
34	250	27,850	3.6	11.2	3.74	
40	279	28,120	3.3	14.0	4.00	300

FLIGHT DATA SHEET

F-84G AF 51-765 FLIGHT NO. DATE

CAMERA COUNTER NO	IAS (KNOTS)	ALTITUDE (FT.)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (G)	FUEL COUNTER (GAL)
<p>FLIGHT 11 - Stick force &amp; elev position vs 9,320 gal Republic 1p tanks with 100 gal fuel in each tank. cg 220%MAC. Gr. Wt at engine start 17775 lbs. fuel counter reading at engine start 9930.2 gal. fuel specific wt 6.22 lbs/gal. 14 Oct 53.</p>						
3	201	30,040	4.2	0.0	1.00	712
4	201	29,400	7.3	7.0	1.95	
5	201	31,590	5.6	3.4	1.45	681
8	260	30,680	2.6	0.0	1.00	645
9	260	31,040	4.1	4.7	1.55	
14	258	29,990	4.7	7.1	1.92	
18	258	30,140	6.0	12.0	3.05	
19	258	29,620	6.3	13.0	3.10	
21	258	29,700	5.3	8.8	2.47	578
<p>FLIGHT 12 - Stick force &amp; elev position vs 9. Same configuration, cg, etc as flt 11. above except fuel counter reading at engine start 9529.2 gal. 14 Oct 53.</p>						
23	280	32,710	2.5	0.0	1.00	329
25	280	31,070	2.7	5.1	1.55	
27	281	32,600	5.4	11.3	2.47	
29	280	30,740	4.5	9.5	1.95	
34	279	28,740	6.2	14.8	3.10	
35	281	30,620	7.3	19.2	3.00	
36	280	30,190	7.3	18.6	3.30	
37	280	30,430	4.4	5.4	2.01	
42	279	29,430	7.9	20.5	3.55	200

FLIGHT DATA SHEET

FLIGHT NO. 51768 DATE

CHECK NUMBER	IAS (KNOTS)	ALTITUDE (FEET)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	THROW LEVER (IN)	FUEL COUNTER (GAL.)
<p>FLIGHT 13 Stick force &amp; elev position vs g. 320-gal Republic. Tip tanks with 166 gal fuel in each tank. C.G. 27.6% MAC. Gr. Wt. at engine start 17,335 lbs fuel counter reading at engine start 858.1 gal. Fuel specific wt. 5.22 lbs/gal. 7 Oct 53</p>						
4	201	30860	2.2	0.0	1.00	971
5	200	30860	2.7	2.8	1.50	
6	201	30580	3.0	3.2	2.00	
7	200	30420	3.4	3.9	1.94	961
11	258	30860	1.7	0.0	1.00	911
12	258	31130	2.4	3.0	1.53	
13	258	31030	2.4	4.6	1.71	
15	258	27440	2.7	9.1	3.04	
16	258	29830	2.6	7.2	3.02	
17	258	23240	3.4	9.5	3.24	
20	258	29130	2.5	6.5	2.76	
21	258	22720	2.6	4.4	2.05	872
<p>FLIGHT 10 Stick force &amp; elev position vs g. Same configuration, c.g. etc as flt 13 above except fuel counter reading at engine start 586.1 gal. 7 Oct 53.</p>						
20	281	30112	1.5	0.0	1.00	419
22	220	30440	2.9	8.0	2.63	
24	200	32520	2.5	5.7	2.02	
25	280	29230	2.7	6.5	2.42	
27	250	28300	3.2	9.0	3.25	
28	281	29140	4.2	12.6	3.87	
30	260	31090	2.1	3.6	1.48	
31	281	30940	2.5	6.1	2.13	
33	280	28090	3.6	12.1	3.09	
34	280	28720	3.1	8.8	2.89	327

FLIGHT DATA SHEET

F-34G AF 51-768 FLIGHT NO. DATE

CAMERA COUNTER NO.	MAS (KNOTS)	ALTITUDE (FT.)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS.)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL.)
FLIGHT 1A - Stick force & elev position is g. Empty 230-gal. Republic 12 tanks installed at 72.8% MAC. Gr. WL at engine start 15600 lbs. Fuel counter reading at engine start 998.8 gal. Fuel specific wt. 6.23 lbs/gal. 19 Oct 53.						
2	200	29,860	4.2	0.0	1.00	847
3	201	30,240	5.7	3.6	1.40	
4	200	29,230	7.5	6.9	1.93	
5	200	28,720	8.7	10.3	2.16	
6	200	30,010	5.8	2.6	1.50	
7	200	29,790	7.3	6.3	2.03	844
8	259	30,400	2.5	0.0	1.00	795
9	258	31,030	3.6	4.0	1.50	
11	258	30,570	5.2	9.9	2.57	
13	259	31,130	4.6	6.9	2.04	
14	259	30,220	5.8	13.0	3.05	
16	258	28,030	6.7	10.5	3.53	
20	259	30,740	5.1	9.3	2.36	
22	259	29,520	6.3	15.0	3.25	750
23	280	30,600	2.2	0.0	1.00	737
24	280	30,990	3.4	5.1	1.50	
25	280	30,980	4.1	9.0	2.02	
27	280	30,710	4.8	11.5	2.45	
29	280	29,910	5.6	14.5	3.05	
32	280	30,370	3.6	5.4	1.65	
34	280	30,670	4.1	8.1	1.95	
38	279	28,490	6.0	16.8	3.57	
39	280	27,870	6.6	20.5	4.10	761

FLIGHT DATA SHEET

F-84G AIRCRAFT NO. 51-768

FLIGHT NO.

DATE

CAMERA COUNTER NO.	IAS (KNOTS)	ALTITUDE (FT.)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL.)
<p>FLIGHT 15: Stick force &amp; elev position vs g. Empty 230 gal. Republic 1/4 tanks installed. c.g. 27.9% MAC. G.Wt. at engine start 15375 lbs. Fuel counter reading at engine start 999.8 gal. Fuel spec. for ml 620 lbs/gal. 20 Oct 55.</p>						
2	201	29910	2.5	0.0	1.00	833
3	201	29830	4.3	5.5	2.05	
4	201	29170	3.3	1.7	1.37	
5	201	29180	5.0	6.0	2.26	
6	201	29090	3.7	3.6	1.50	620
8	259	30750	1.6	0.0	1.00	801
9	260	31150	2.2	2.5	1.55	
10	260	31130	2.5	4.6	2.03	
11	260	30820	2.6	6.3	2.71	
12	259	30140	2.8	7.5	3.02	
14	258	28790	2.7	9.0	3.50	
20	260	28830	2.6	3.3	1.87	768
21	280	31470	1.5	0.0	1.00	749
22	280	31740	2.1	2.4	1.70	
23	280	31660	2.4	4.0	2.13	
25	280	31650	2.5	10.6	3.26	
26	280	30590	2.3	5.2	2.04	
27	280	30570	2.5	6.9	2.42	
28	280	29730	2.8	8.6	3.02	
29	281	29130	3.1	11.2	3.55	
31	280	27550	2.2	4.0	1.53	
33	279	29010	3.7	13.3	4.10	
34	277	28200	3.3	11.8	3.94	692

FLIGHT DATA SHEET

F-84G 51-768 FLIGHT NO. DATE

CAMERA COUNTER NO	IAS (KNOTS)	ALTITUDE (FT)	ELEVATOR POSITION (DEG)	STICK FORCE (LBS)	NORMAL ACCELERATION (g)	FUEL COUNTER (GAL)
<p>FLIGHT 16 Stick force &amp; elev position vs 9,230-gal Republic top tanks with 160 gal fuel in each. Tank c.g. 22.9% MAC. Gr. Wt at engine start 17675 lbs. Fuel counter reading at engine start 0000.0 gal. Fuel specific wt. 6.20 lbs/gal. 20 Oct 53.</p>						
2	201	29510	4.0	0	1.05	836
3	201	30670	5.5	3.9	1.45	
6	201	31182	7.5	7.0	1.96	799
8	259	30960	2.5	0	1.05	790
9	259	31420	3.8	5.0	1.59	
10	259	31340	4.5	8.0	2.09	
12	257	29580	5.4	11.5	2.87	
15	258	31390	5.2	9.9	2.49	
16	259	29790	5.9	13.1	3.08	749
17	280	30150	2.3	0	1.05	738
22	280	29620	5.9	15.7	3.27	
25	280	27970	5.6	15.9	3.41	
27	280	30880	3.5	5.4	1.67	
28	280	30810	3.85	7.1	1.98	
29	280	30660	4.5	9.9	2.40	
30	280	32370	5.5	13.9	2.93	
31	280	29460	6.0	17.0	3.47	691

FLIGHT DATA SHEET

F84G AIRCRAFT 51-768 FLIGHT NO. DATE

CAMERA COUNTER NO	IAS (KNOTS)	ALTITUDE (FT)	ELEVATOR POSITION (DEGREES)	STICK FORCE (LBS)	NORMAL ACCELERATION (G)	FUEL COUNTER (GAL)
<p>FLIGHT 18 Stick force &amp; elev. position vs g 230 gal Republic 1st                  Annas with 160 gal fuel in each tank. c.g. 27.6% MAC. 50% HP at                  engine start. 1305 lbs. Fuel counter reading at engine start                  680.7 gal. Fuel specific wt. 6.22 lbs/gal 27 Oct 58</p>						
1	200	20,100	2.3	0.0	1.20	684
2	201	22,770	2.0	2.7	1.61	
3	200	24,770	4.2	3.7	2.05	
4	201	26,070	5.1	2.7	1.61	
5	200	30,280	5.1	4.1	2.02	800
6	260	29,740	1.5	5.0	1.00	787
9	259	30,500	2.3	3.2	1.63	
11	258	30,280	2.3	5.3	2.50	
12	259	30,880	1.9	1.5	1.39	
14	259	30,880	2.1	4.2	1.89	
15	259	30,750	2.2	4.7	2.63	
17	257	29,740	2.2	6.1	3.03	751
18	281	31,190	1.4	0.0	1.05	733
21	281	31,740	2.1	5.0	1.95	
22	280	31,160	2.5	7.4	2.45	
24	280	30,540	1.9	3.3	1.64	
25	280	30,460	1.9	4.5	2.10	
26	280	30,290	2.2	6.1	2.41	
27	280	29,620	2.6	9.0	3.10	
28	279	28,520	2.6	10.2	3.68	711

FIG NO. 1  
 STD RPM VS CALIBRATED AIR SPEED  
 F-046 USAF NO 51-768  
 FLAPS AND GEAR UP  
 ALTITUDE 10,000 FT  
 STD GROSS WEIGHT 13,900 LBS

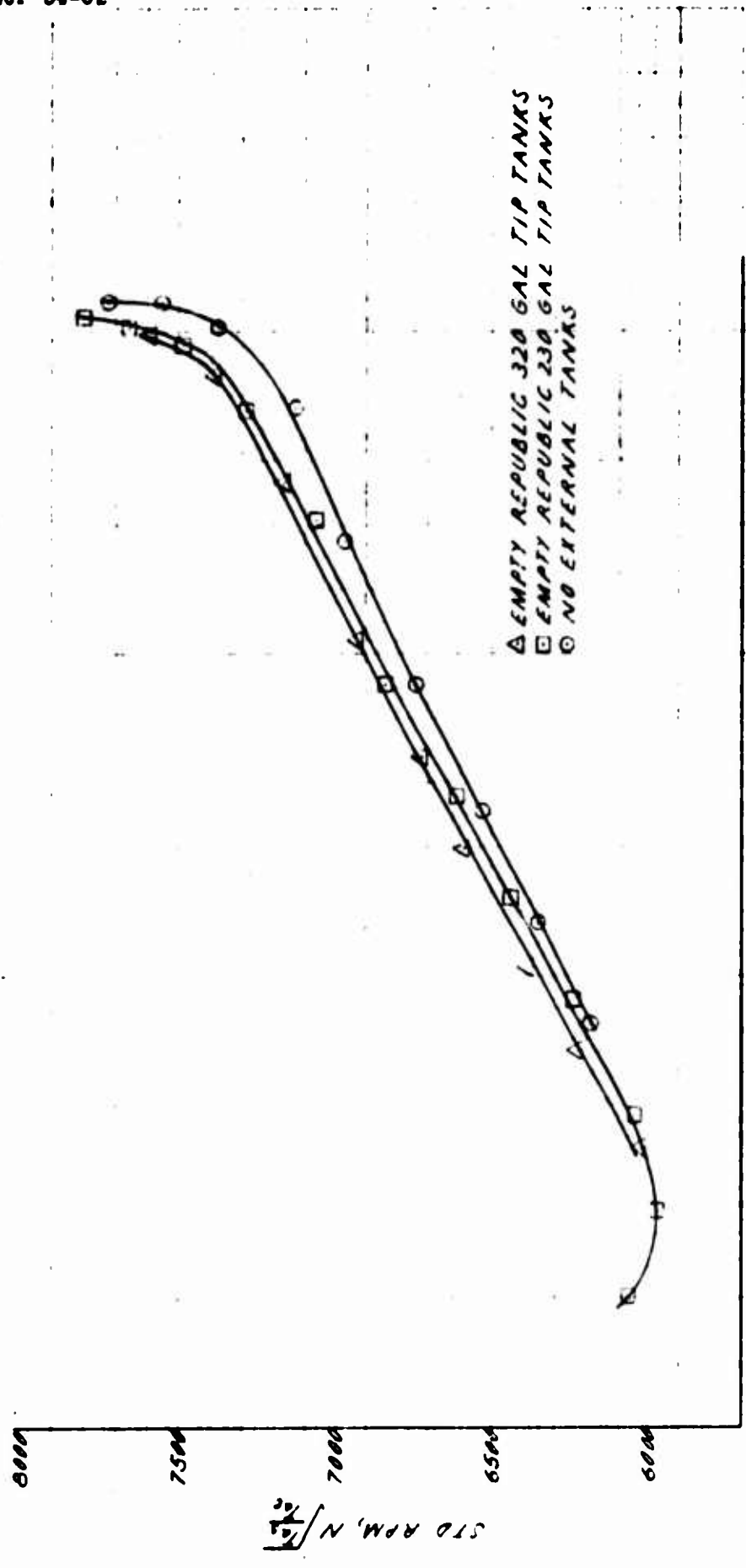


Figure 1

CALIBRATED AIR SPEED,  $V_C$  ~ KNOTS

FIG. NO. 2  
CORRECTED RPM VS MACH NUMBER  
F-84G USAF NV 51-768  
FLAPS AND GEAR UP  
ALTITUDE 10,000 FT  
STD GROSS WEIGHT 13,900 LBS

- △ EMPTY REPUBLIC 320 GAL TIP TANKS
- EMPTY REPUBLIC 230 GAL TIP TANKS
- NO EXTERNAL TANKS

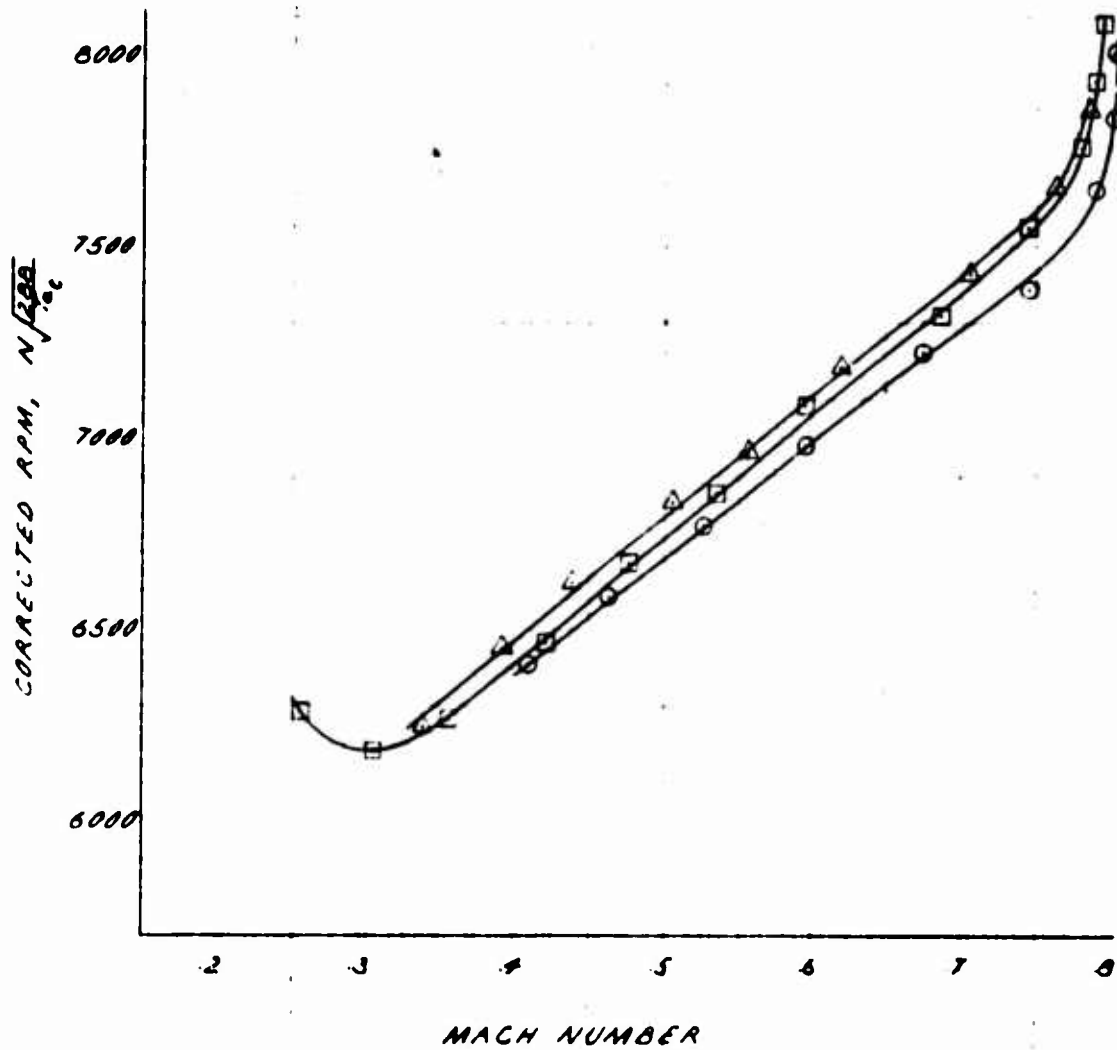


Figure 2

HRM

FIG NO 3  
 AIR SPEED SYSTEM POSITION CORRECTION  
 F-84G USAF NO 51-768  
 AVG GROSS WEIGHT 14,030 LBS  
 EMPTY 320 GAL TIP TANKS INSTALLED  
 FLAPS AND GEAR UP

PLACED BY:  $\Delta$  F-86E, USAF NO 50-599. 10,000 FT  
 $\circ$  F-86A, USAF NO 48-170. 10,000 FT  
 $\square$  T-28A, USAF NO 49-571. 5,000 FT

NOTE: THE STD PRODUCTION PITOT-STATIC SYSTEM WAS USED. CONSISTED OF FLUSAR STATIC INLETS, ONE EACH SIDE OF FUSELAGE AT STA 578, AND TYPE AN5013-1 PITOT HEAD LOCATED IN NOSE DUCT DIVIDER.

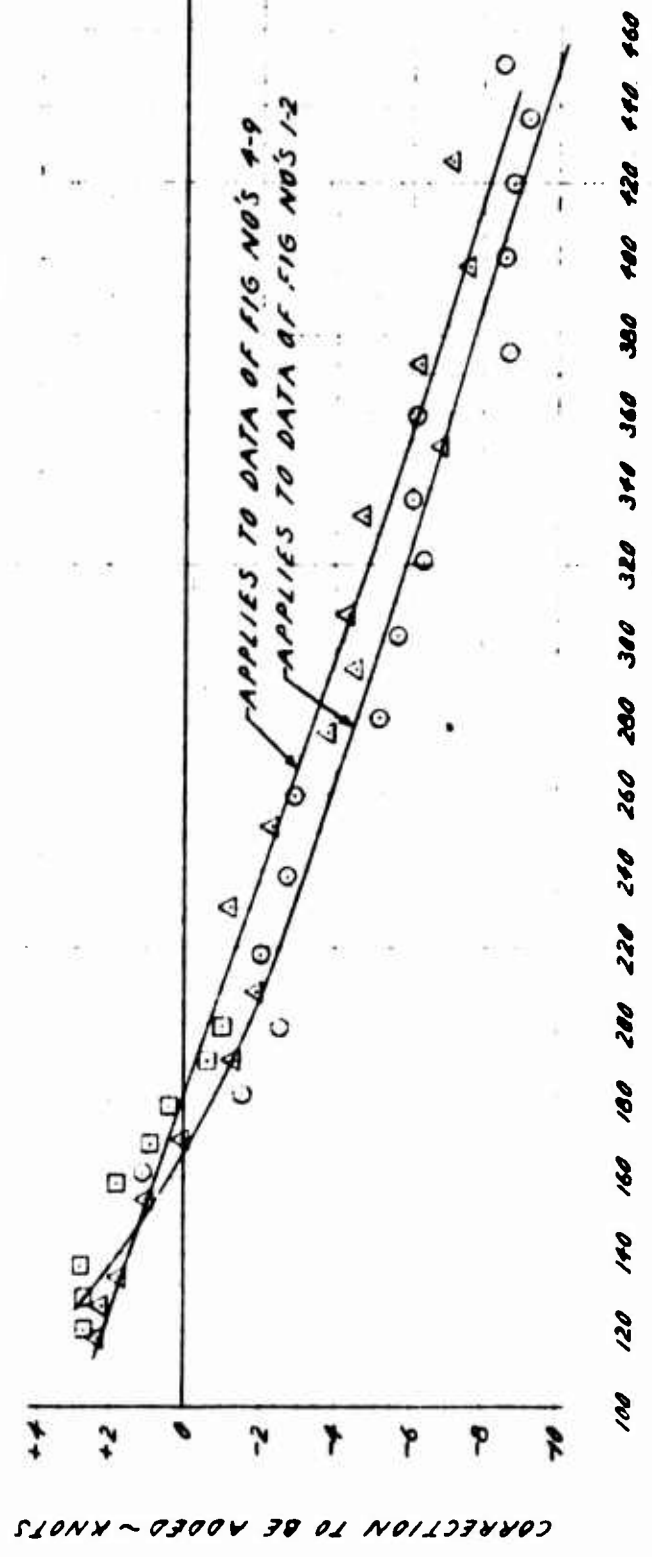


Figure 3

INDICATED AIR SPEED CORRECTED FOR INSTRUMENT ERROR ~ KNOTS

FIG. NO. 4  
 MANEUVERING FLIGHT CHARACTERISTICS  
 F-89B USAF NO. 51-760  
 FLAPS AND GEAR UP  
 ALTITUDE 30,000 FT

- △ EMPTY REPUBLIC 320 GAL TIP TANKS
- EMPTY REPUBLIC 230 GAL TIP TANKS
- NO EXTERNAL TANKS

CG POSITION	AVG TEST GROSS WEIGHT
22.0 %MAC	14,060 LBS
22.0	14,190
22.0	13,845

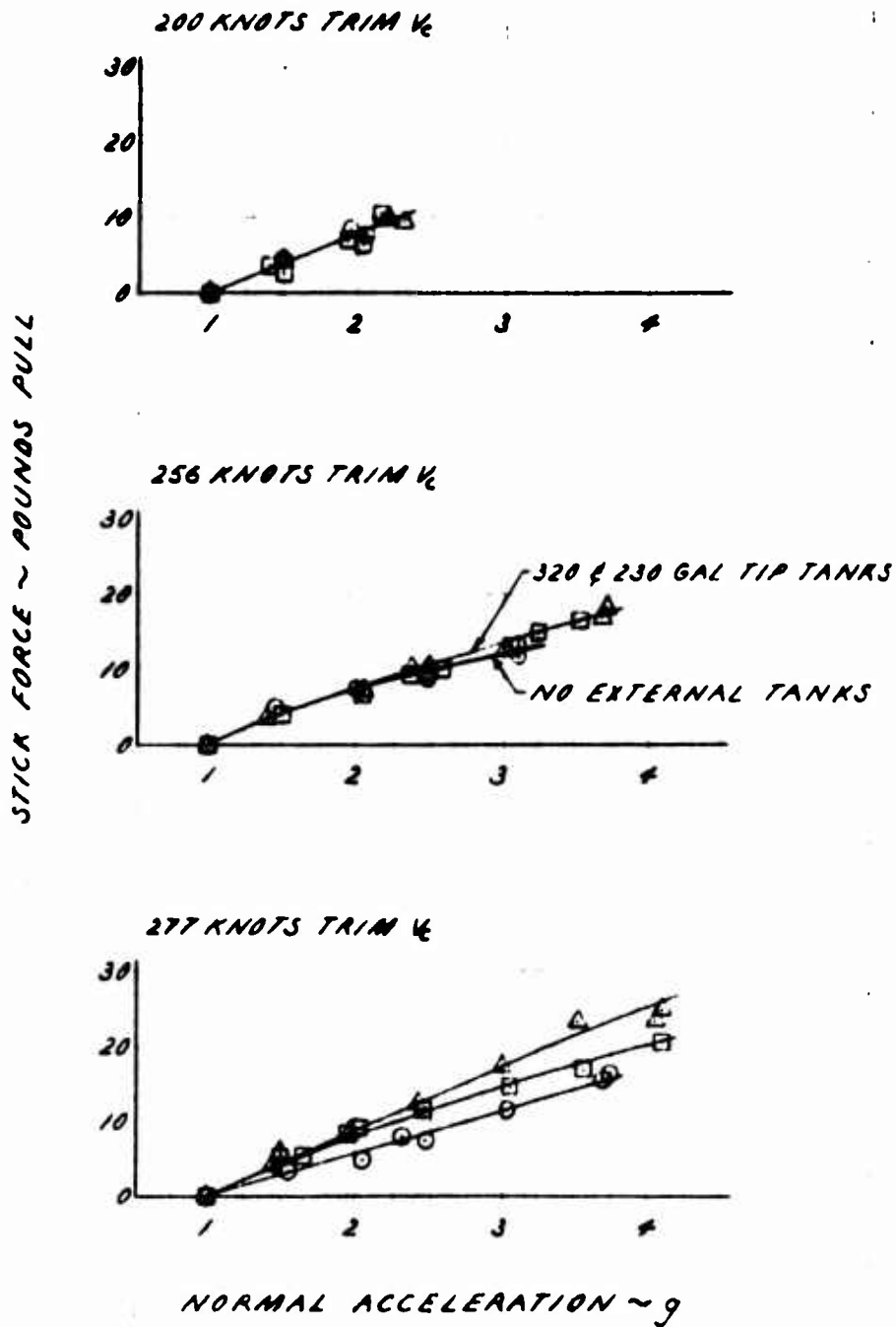


Figure 4

HRM

FIG NO. 3  
 MANEUVERING FLIGHT CHARACTERISTICS  
 F-89B USAF NO 51-760  
 FLAPS AND GEAR UP  
 ALTITUDE 30,000 FT

	CG POSITION	AVG TEST GROSS WEIGHT
△ REPUBLIC 320 GAL TIP TANKS, 160 GAL FUEL IN EACH TANK	22.8 % MAC	16,130 LBS
□ REPUBLIC 230 GAL TIP TANKS, 160 GAL FUEL IN EACH TANK	22.9	16,210
○ NO EXTERNAL TANKS	22.8	13,845

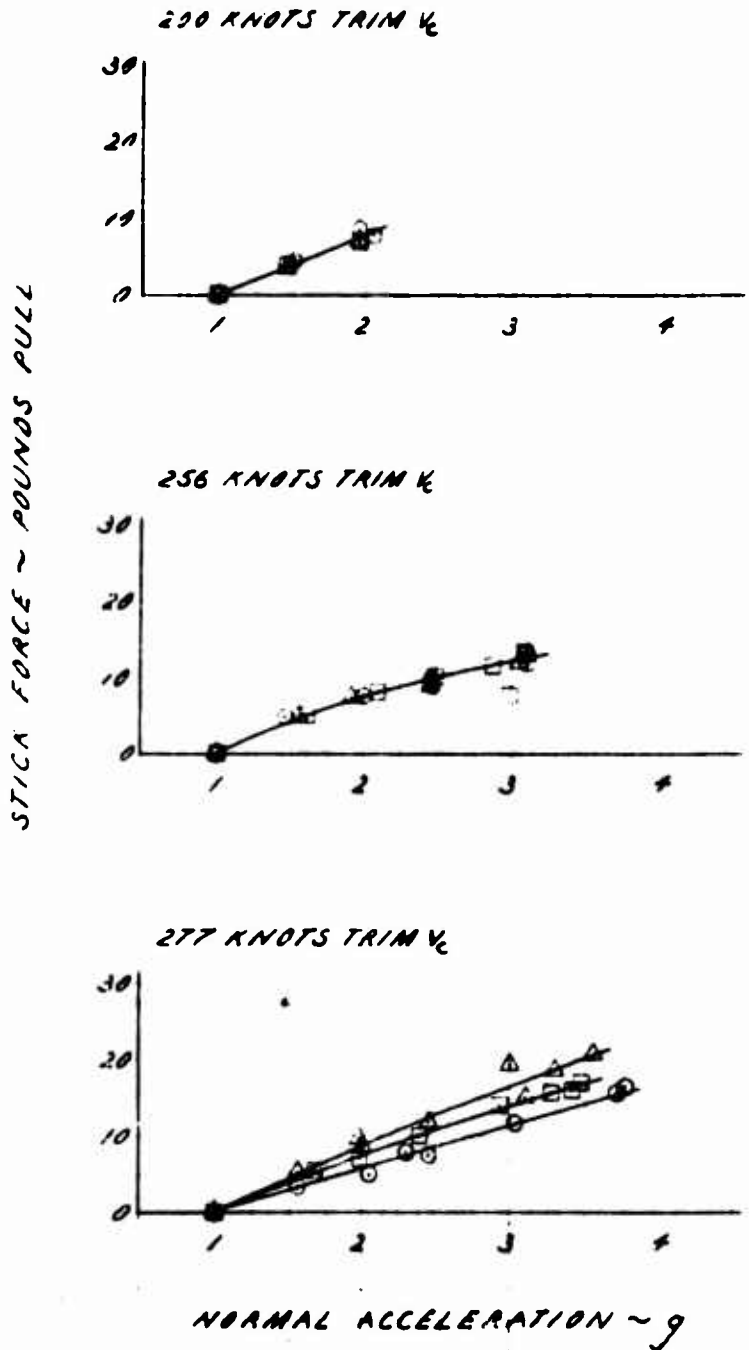


Figure 6

HRM

**FIG. NO. 6**  
**MANEUVERING FLIGHT CHARACTERISTICS**  
**F-84B USAF NO. 51-768**  
**FLAPS AND GEAR UP**  
**ALTITUDE 30,000 FT**

	<u>CG POSITION</u>	<u>AVG TEST GROSS WEIGHT</u>
△ EMPTY REPUBLIC 320 GAL TIP TANKS	27.9% MAC	13,935 LBS
□ EMPTY REPUBLIC 230 GAL TIP TANKS	27.9	13,900
○ NO EXTERNAL TANKS	28.0	13,870

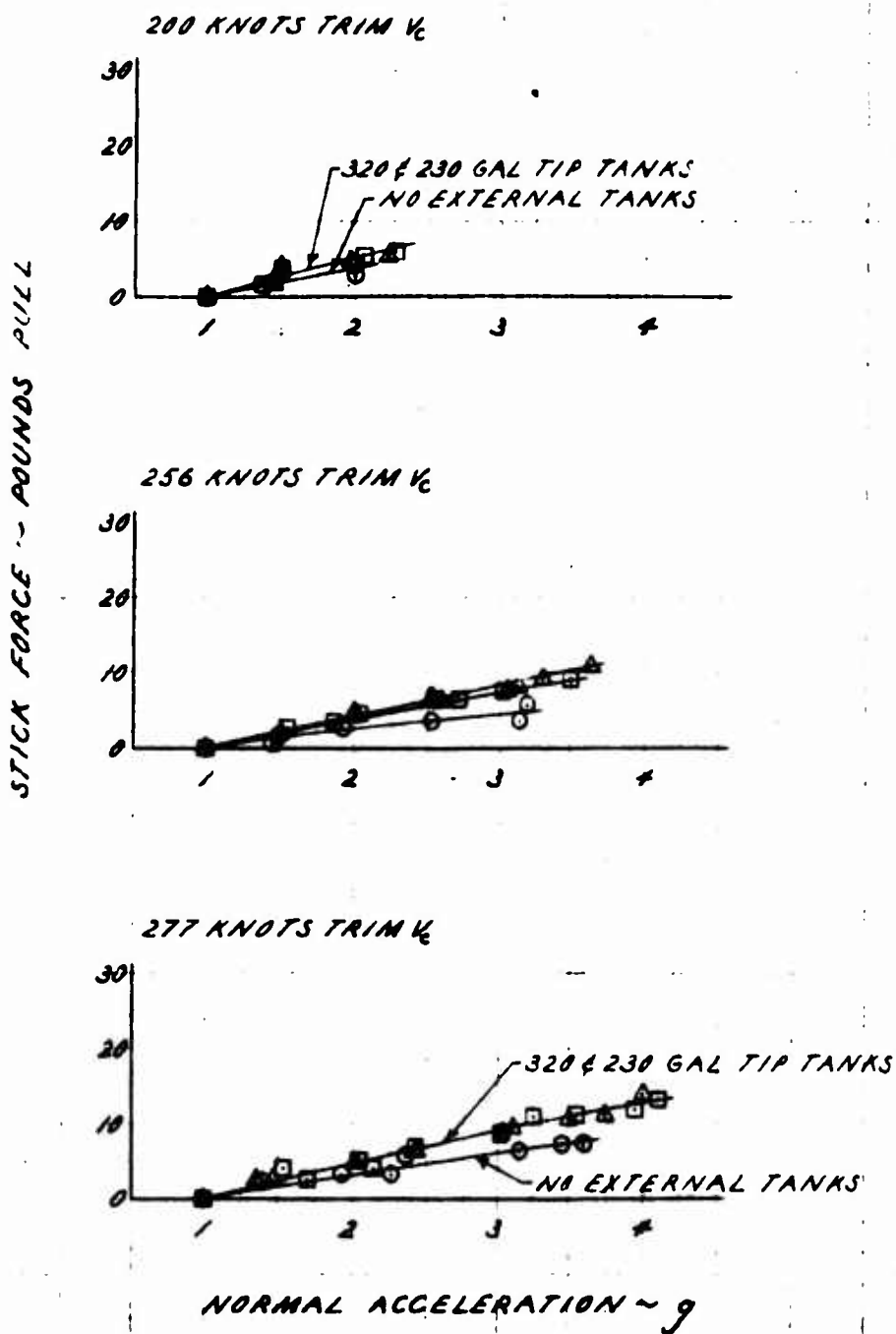
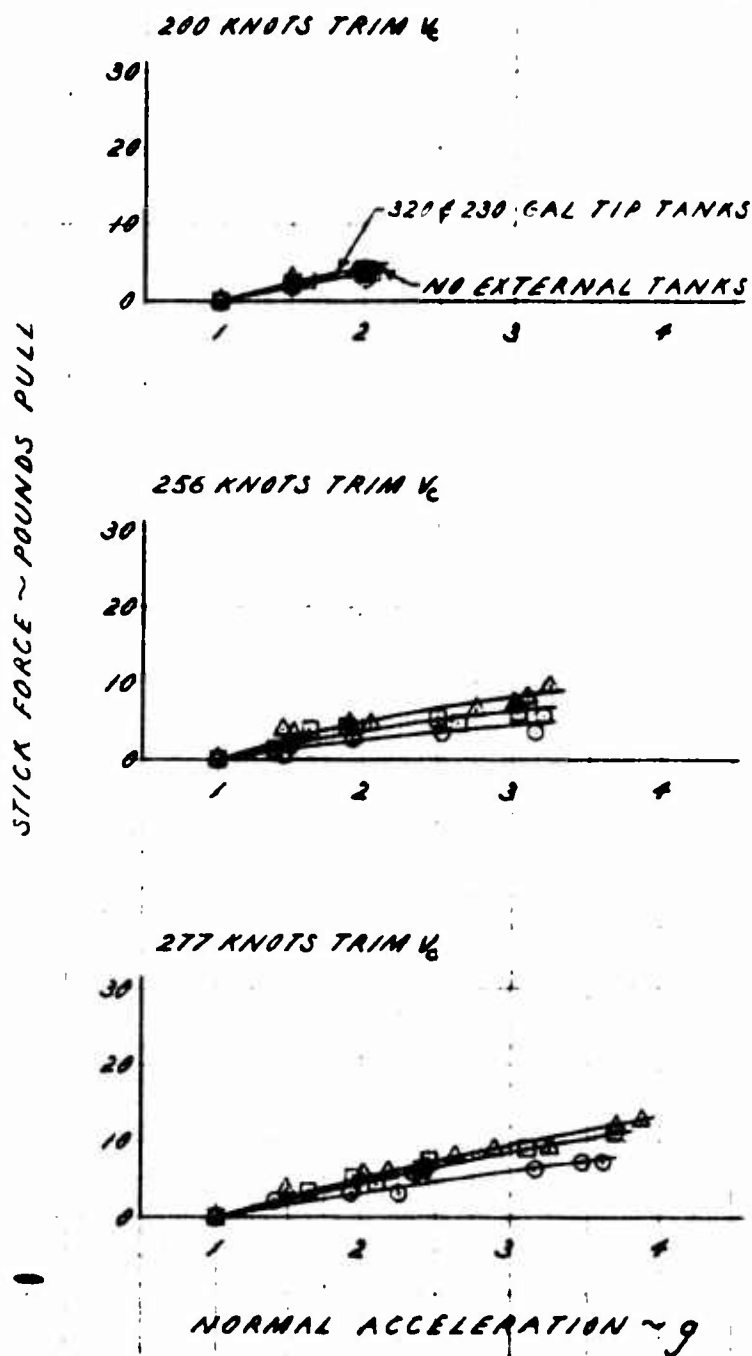


Figure 6

HRM

FIG. NO. 7  
 MANEUVERING FLIGHT CHARACTERISTICS  
 F-84G USAF NO. 54768  
 FLAPS AND GEAR UP  
 ALTITUDE 30,000 FT

	CG POSITION	AVG TEST GROSS WEIGHT
△ REPUBLIC 320 GAL TIP TANKS, 160 GAL FUEL IN EACH TANK	27.8 % MAC	15,915 LBS
□ REPUBLIC 230 GAL TIP TANKS, 160 GAL FUEL IN EACH TANK	27.8	15,890
○ NO EXTERNAL TANKS	28.0	13,870



HRM

Figure 7

FIG. NO. 8  
 MANEUVERING FLIGHT CHARACTERISTICS  
 F-84G USAF NO. 51-768  
 FLAPS AND GEAR UP  
 ALTITUDE 30,000 FT TRIM & 277 KNOTS  
 AVG TEST GROSS WEIGHT 13,050 LBS

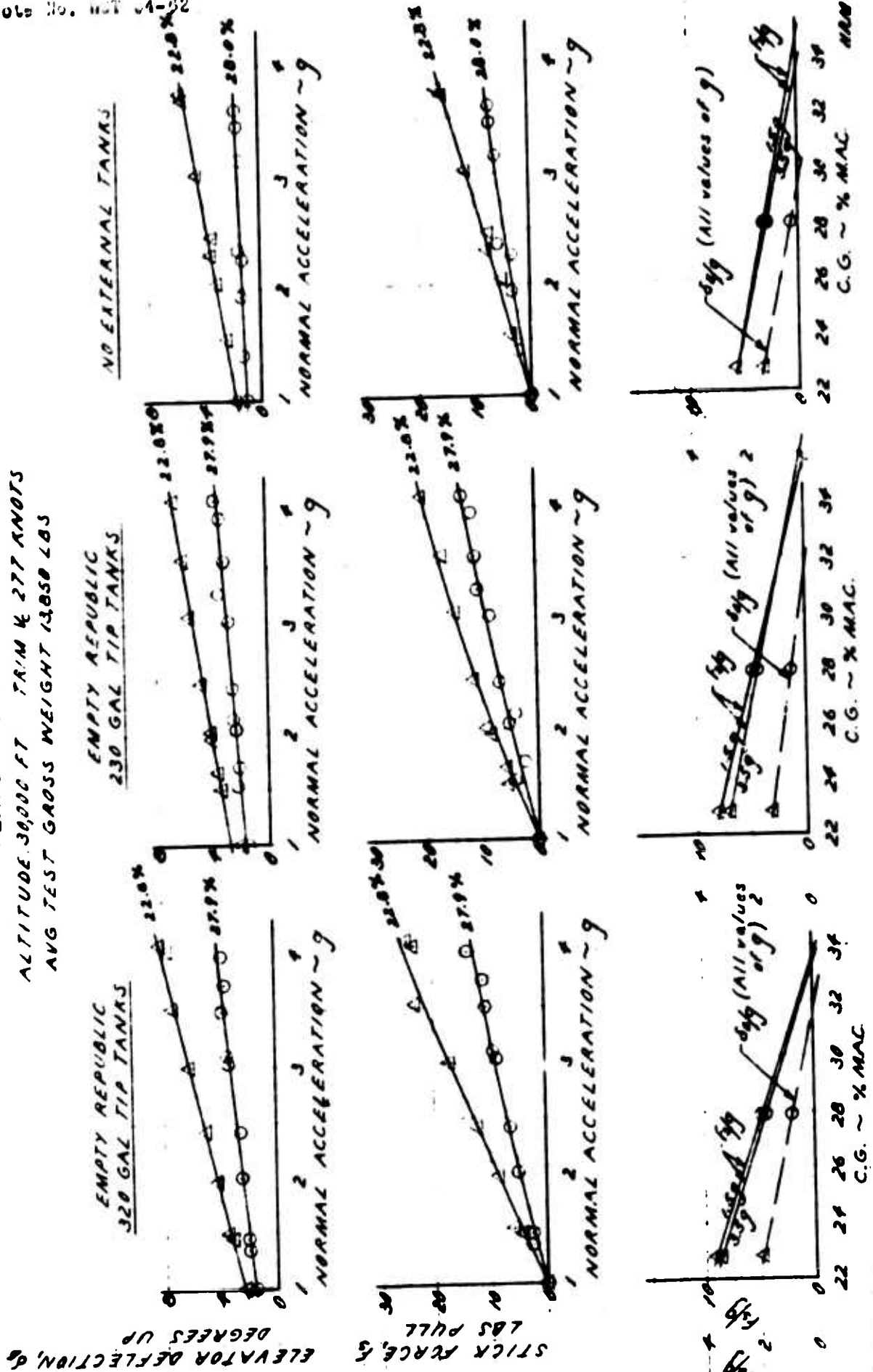


Figure 8

FIG. NO 9  
 MANEUVERING FLIGHT CHARACTERISTICS  
 F-046 USAF NO 51-768  
 FLAPS AND GEAR UP  
 ALTITUDE 30,000 FT TRIM 1/2 277 KNOTS  
 AVG TEST GROSS WEIGHT 15,000 LBS

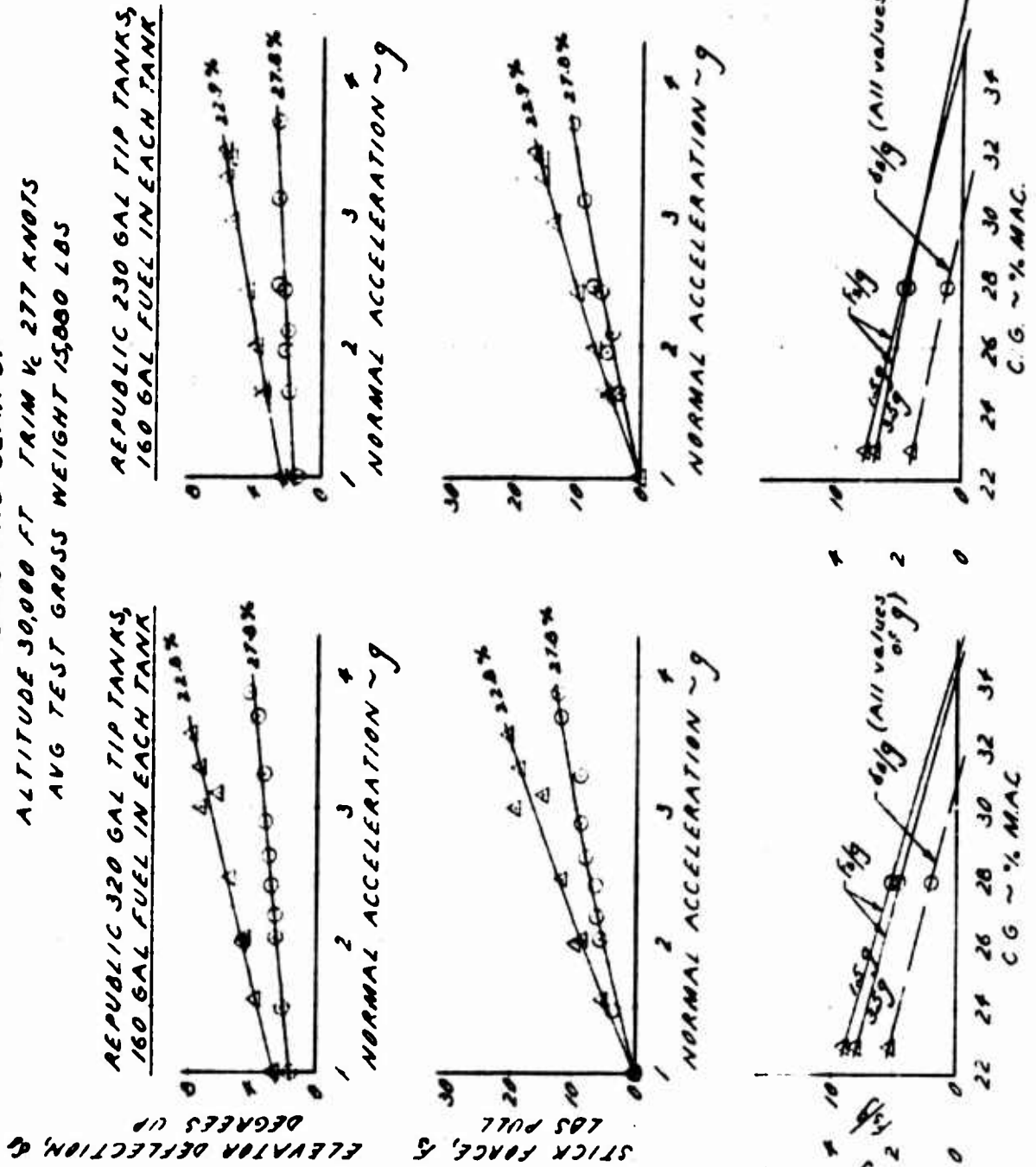
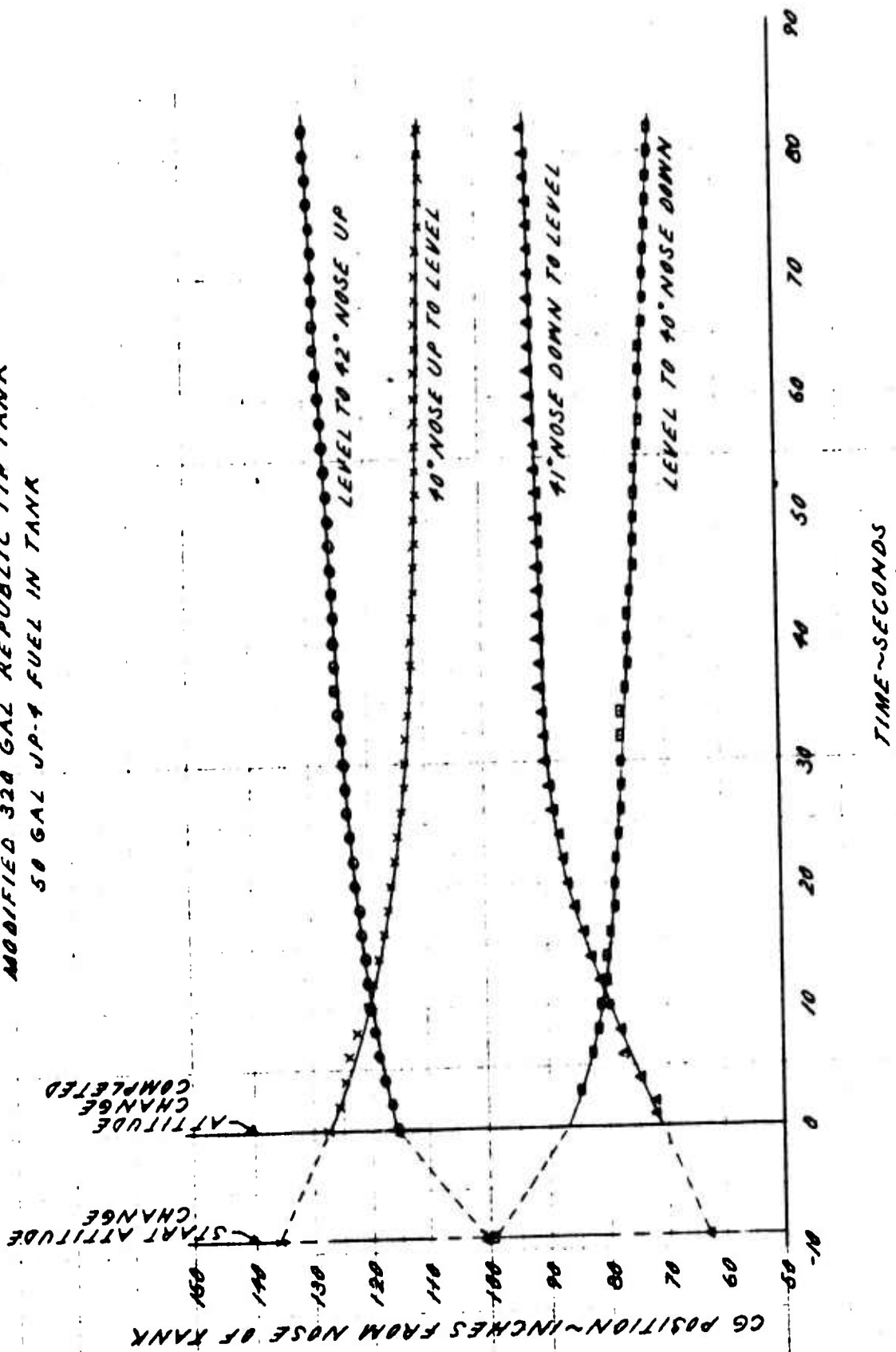


Figure 9

FIG. NO 10  
 CG SHIFT OF TANK WITH TIME, FOLLOWING ATTITUDE CHANGE  
 MODIFIED 320 GAL REPUBLIC TIP TANK  
 50 GAL JP-4 FUEL IN TANK



DIRM

Figure 10

FIG. NO. 11  
 CG SHIFT OF TANK WITH TIME, FOLLOWING ATTITUDE CHANGE  
 MODIFIED 320 GAL REPUBLIC TIA TANK  
 100 GAL JP-4 FUEL IN TANK

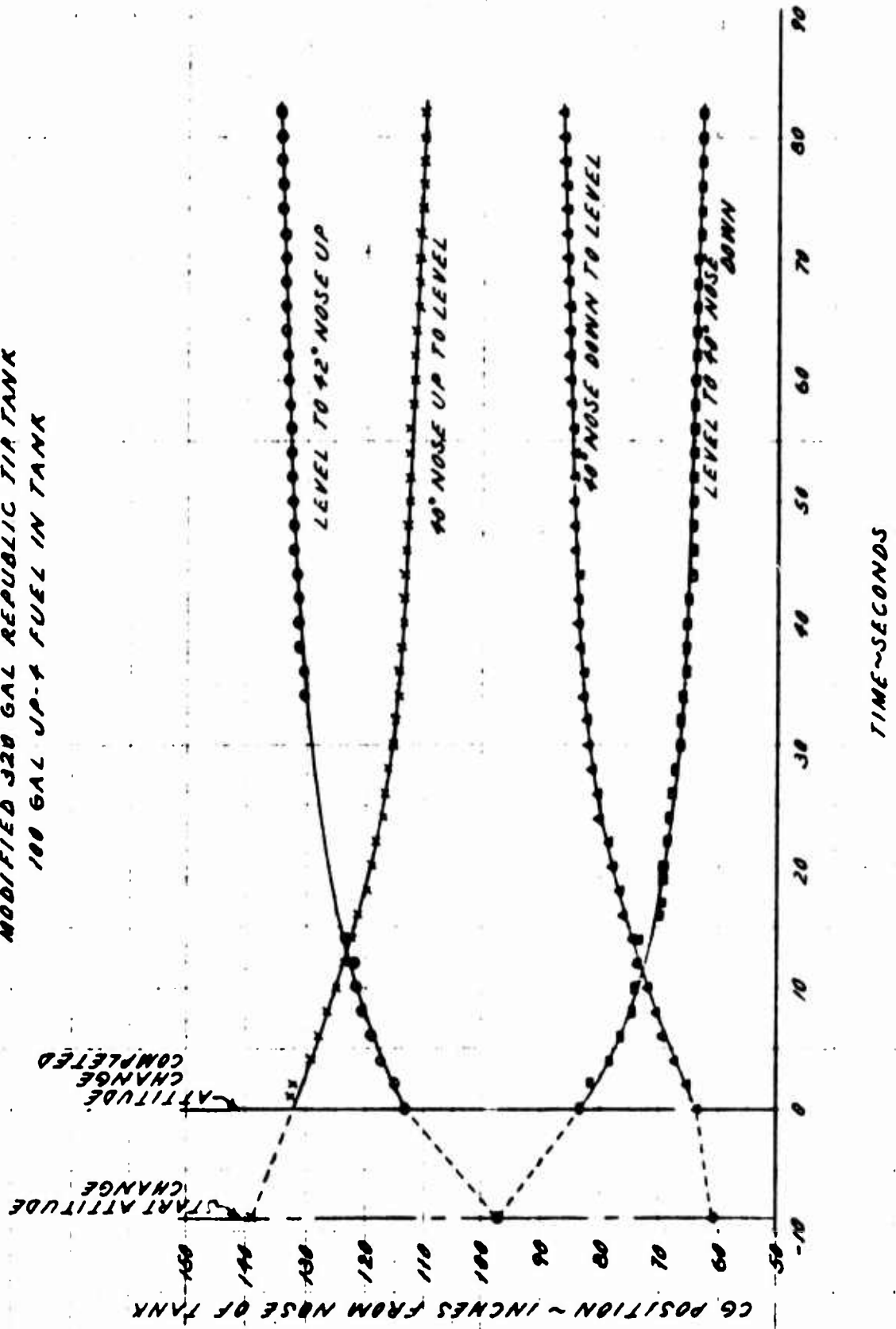


Figure 11

FIG. NO. 12  
CG SHIFT OF TANK WITH TIME, FOLLOWING ATTITUDE CHANGE  
MODIFIED 320 GAL REPUBLIC TIP TANK  
160 GAL JP-4 FUEL IN TANK

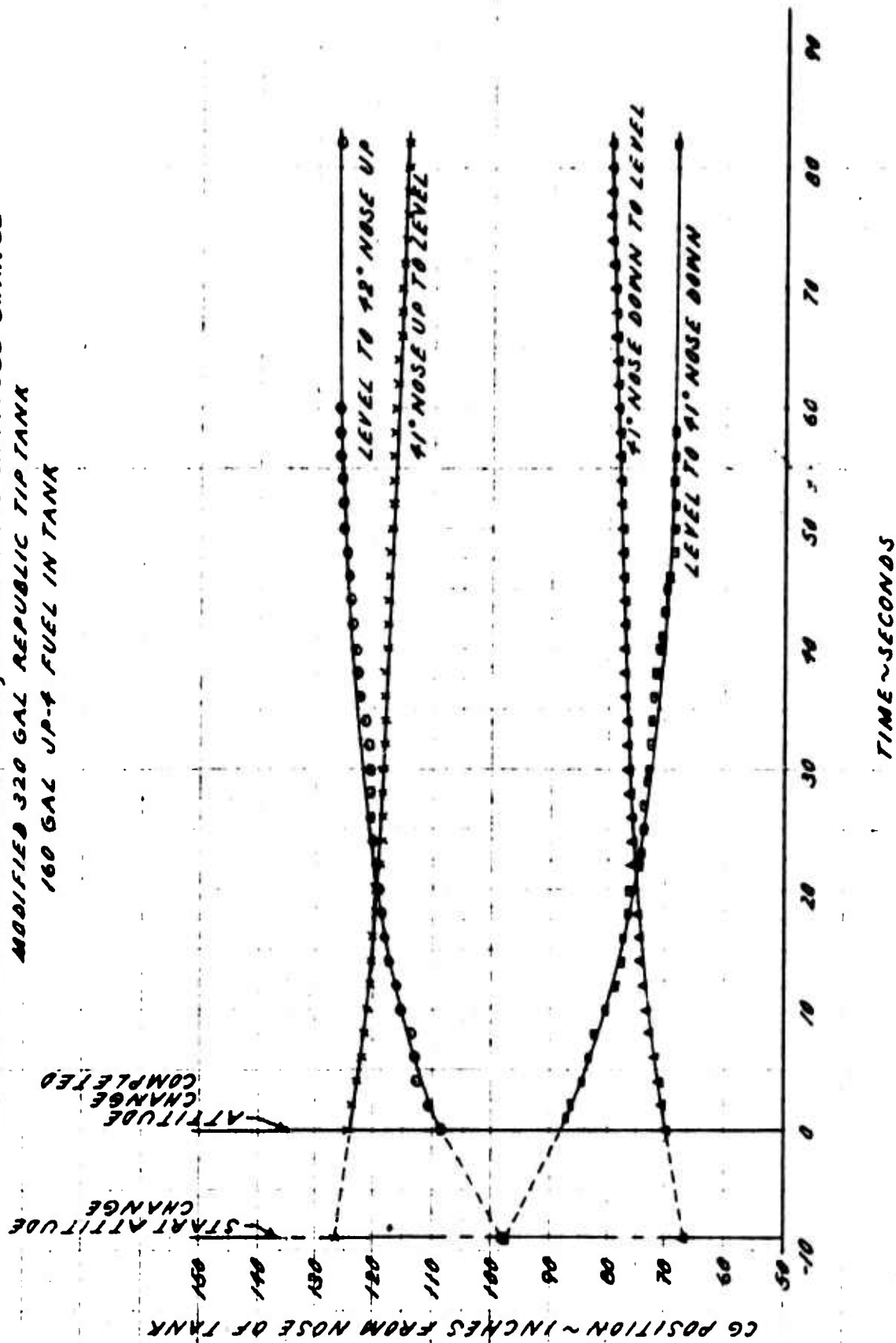


Figure 12