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TECHNICAL MEMORANDUM SD-10-82   30 JUNE 1982

VP FUEL CONSERVATION FOURTH QUARTERLY REPORT

(FEBRUARY 1982 - MAY 1982)

SUPPLEMENT

DEPARTMENT OF THE NAVY
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA. 18974

Systems Directorate

TECHNICAL MEMORANDUM SD-10-82 30 June 1982

VP FUEL CONSERVATION FOURTH QUARTERLY REPORT
(February 1982 - May 1982)

Supplement

This effort is being conducted for:

NAVAL MATERIAL COMMAND
Department of the Navy
Washington, DC 20360

Program Element	64710N
Project Number	Z0371
Task Area	Z0371-0000
Work Unit	GH420

With assistance from Keystone Computer Associates, Inc. under
Contract No. N62269-81-C-0115 Task Order No. 0005

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EXECUTIVE SUMMARY

Naval Air Development Center (NAVAIRDEVCEN) has been tasked by Naval Material Command (NAVMAT-08E) to examine changes in operational concepts, payloads, equipment and tactics that reduce fuel consumption. As part of this task NAVAIRDEVCEN has developed a data base to track fuel consumption for the VP community. The data base is used as a means of documenting fuel saving techniques. WING ELEVEN is currently participating in this endeavor.

This report contains detailed analysis on fuel consumption for participating VP squadrons (Patrol Squadrons Forty-Nine, Five, Twenty-Four, Fifty-Six and Sixteen in the VP Fuel Conservation Study.

Background material outlining overall approach and data collection procedures is provided in NADC-81319-20, "VP Fuel Conservation Report (May-October 1981 Data)", 31 December 1981. Quarterly report supplements are provided to update this report. In keeping with the formats of previous reports, the supplement starts with section 3.0, Quarterly Data Summary.

Conclusion:

On an average for all missions the squadrons are carrying excess fuel (freighting fuel) as follows (K lbs):

Month	Feb	Mar	April	May
Squadron A	5.2	5.5	4.8	6.8
B	4.1	6.7	5.5	4.9
C	3.0	2.9	3.5	3.5
D	3.4	2.1	3.4	3.8
E	-	-	4.3	4.0

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3.0 QUARTERLY DATA SUMMARY

3.1 FIRST QUARTER DATA SUMMARY

The first reporting period of the VP Fuel Conservation effort commenced in June 1981 with the data from June through August 1981. The squadron involved in the data collection and reporting during this period was PATRON FOUR NINE (VP-49) stationed at NAS Jacksonville, Florida. During the first quarter, VP-49 completed its pre-deployment preparation at NAS Jacksonville and deployed to Naval Air Facility (NAF) Sigonella, Sicily in mid July 1981. While deployed at NAF Sigonella, VP-49 operated flights from NAF Sigonella, Naples, Rome and Suda Bay. The results of the first quarter data are contained in Reference 1.

3.2 SECOND QUARTER DATA SUMMARY

The second reporting period of the VP Fuel Conservation effort included data from September through October 1981. VP-49 continued to provide the data collection cards during the deployment to NAF Sigonella. PATRON FIVE (VP-5) also joined in the data collection starting in August. VP-5 is located at NAS Jacksonville, Florida and was just returning from a deployment prior to partaking in this effort. Therefore, the majority of the data cards received from VP-5 during the second quarter were from missions originating from NAS Jacksonville. However, some of the flights were from the deployment to NAS Rota, Spain, the Azores and NAS Bermuda. The results of the Second quarter data are contained in Reference 2.

3.3 THIRD QUARTER DATA SUMMARY

The third reporting period of the VP Fuel Conservation effort included data from November 1981 through January 1982. VP-49 and VP-5 continued to provide the data collection cards during the reporting period. VP-49 was on deployment at NAF Sigonella during November and returned to NAS Jacksonville in the middle of December. VP-5 was at NAS Jacksonville the entire reporting period. PATRON TWO-FOUR (VP-24) joined the data collection effort in January 1982. VP-24 is currently operating from NAS Jacksonville. The results of the third quarter data are contained in Reference 3.

3.4 FOURTH QUARTER DATA SUMMARY

The fourth reporting period of the VP Fuel Conservation effort included data from February through May 1982. VP-49, 5 and 24 continued to provide the data collection cards during the reporting period. VP-49 and 24 were at NAS Jacksonville the entire reporting period. VP-5 deployed to NAF Sigonella in the middle of May. VP-56, currently deployed to NAS Bermuda began data collection in mid February. Additionally, VP-16 which is currently located at NAS Jacksonville began data collection in April.

A comparison of the total number of flights by month and squadron, made available from the yellow sheets, and the number of usable data base cards is contained in Table 3-1.

This reveals that 68.2% of all flights are completing and submitting the Fuel Mission Summary Form. This percentage of usage includes both VP-56 and VP-16 who started the data collection midway through a month. Therefore data cards were not completed for every flight reported by the yellow sheets. By eleminating those two months the card submission rate would increase overall to 75%. This is an improvement from last quarter which had an overall of 61.5% cards submitted.

SQUADRON	MARCH			APRIL			MAY			TOTAL		
	FLIGHTS	CARDS	%	FLIGHTS	CARDS	%	FLIGHTS	CARDS	%	FLIGHTS	CARDS	%
49	93	71	76.3	83	65	78.3	90	70	77.8	266	206	77.4
5	82	61	74.4	91	54	59.3	107	62	57.9	280	177	63.0
24	113	109	96.5	104	104	100.0	124	108	87.1	341	321	94.1
56	152	25	16.4	128	82	64.1	129	56	43.4	409	163	39.9
16				67	51	76.1	99	80	80.8	166	131	78.9
Total	440	266	60.5	473	356	75.3	549	376	68.5	1462	998	68.2

Table 3-1 Total Flights vs Flight Cards Received

4.0 QUARTERLY DATA ANALYSIS

During this reporting period (February through May 1982) the analysis continued to be performed in the areas of excess fuel on board the aircraft, actual versus planned flight time, and fuel flow as a function of both mission phase and mission type. Additionally, three new areas of analysis have been undertaken. They deal with the use of Auxiliary Power Units (APU) versus Ground Support Equipment (GSE) on non-operational (FAM, XCTY, OTHER) flights; engines loitered on station, and engine mode during taxi out.

The six areas of analysis and their relationship to fuel conservation are summarized as follows:

- Excess fueling - to demonstrate the direct relationship between the aircraft weight and fuel flow that exists (e.g., the heavier the aircraft, the higher the fuel flow).
- Planned versus actual flight time - to determine if the aircraft are being overfueled for the planned flight times or if the planned flight times are in excess of required time and therefore resulting in excess fuel loading.
- Fuel flow - to determine if fuel flow is a function of mission type and to determine if aircrews are adjusting and modifying procedures during mission phases which will result in a decrease of fuel usage.
- APU vs. GSE - to determine the potential savings gained by utilizing GSE on all non-operational (FAM, XCTY, OTHER) flights.
- Engine loiter - to determine to what extent aircrews are loitering engines.
- Engine mode during taxi - to demonstrate potential savings of fuel consumption by utilizing two-engine taxi to the runway.

The remainder of this section discusses the analysis of these six areas.

4.1 EXCESS FUEL

There are several ways to look at excess fuel loads. An overview is shown in Figure 4-1. This figure demonstrates a mean excess fuel at engine shutdown on a per flight per month per squadron basis. These values were obtained as follows (it should be noted that carrying extra fuel results in an increased aircraft gross weight and increased fuel consumption):

- Obtain fuel remaining at engine start and at engine shutdown.
- Determine fuel used for each data collection card by subtracting the fuel remaining at engine shutdown from the fuel remaining at engine start.

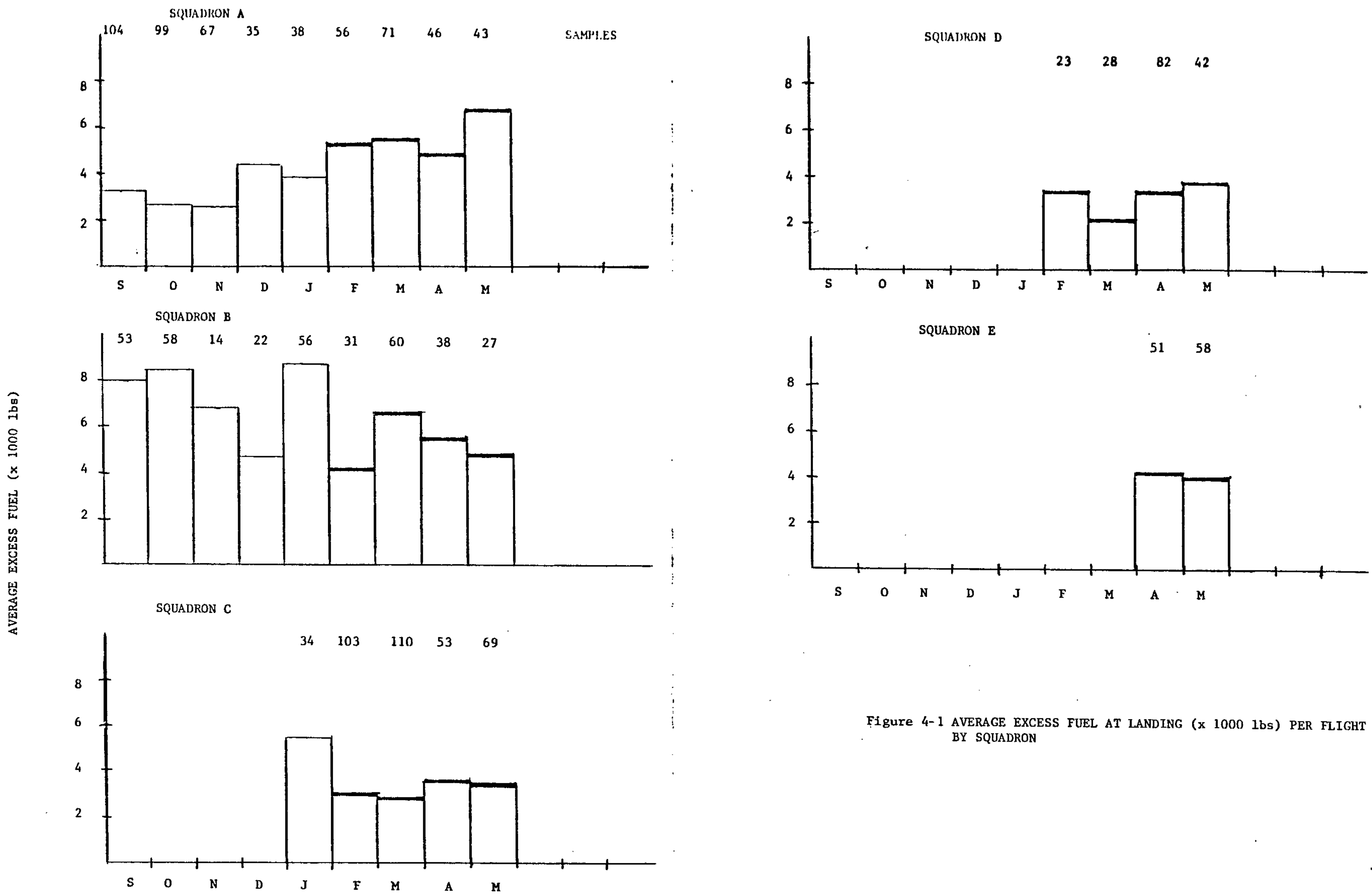


Figure 4-1 AVERAGE EXCESS FUEL AT LANDING (x 1000 lbs) PER FLIGHT BY SQUADRON

- Add the specific on top fuel requirement for each of the bases to the fuel used and use this value as the "adjusted fuel load."

- To determine the excess fuel load, subtract the adjusted fuel load from the fuel remaining at engine start.

- Determine the mean value of the excess fuel loaded for the individual squadron per month and plot on Figure 4-1.

Prior to review of the subsequent figures, it is important to note that flights which returned earlier than scheduled (due to aborts or cancellations), flights fueled for PLE and flights which were extended were not included in this analysis, provided the data collection cards were annotated accordingly. Also, it is possible to obtain an approximation of the excess fuel being carried on the flights by multiplying the monthly excess fuel value by the sample size for that month.

A second way to examine fuel freighting is to sort the data into expected flight duration. Figures 4-2 through 4-19 summarize the overall excessive fuel freighted by each flight each squadron each month sorted into expected flight duration. The lower charts on Figures 4-2 through 4-19 depict by month and by squadron the mean excessive fuel load for each half hour increment of time. The symbology used on Figures 4-2 through 4-19 is as follows:

- A circle (o) indicates the mean fuel load at engine shutdown for the specified time increment of planned flight time.

- A triangle ($\triangle$) indicates the minimum and maximum fuel loads at engine shutdown for the specified time increment of planned flight time.

- The rectangular shape at the far right hand side indicates the mean fuel load at engine shutdown and the 1 sigma, standard deviation, of all flights about that mean.

- The dashed line (---) represents the on top fuel reserve requirement for the specified base location.

Review of these Figures shows that aircraft have been carrying fuel loads in excess of the amount needed for the individual flights. The amount of fuel used, as depicted in Figures 4-2 to 4-19, is actually higher than it would be if no excess fuel were carried. By carrying extra fuel, the aircraft gross weight is increased which results in an increased fuel consumption.

4.2 PLANNED VS ACTUAL FLIGHT TIME

Analysis of planned vs actual flight time was performed by extracting the entry contained in the Expected Flight Hours data element (card 2 columns 25-27) and comparing that with the actual flight times. Actual flight time was determined as the difference between the take-off time entry (card 3 columns 1-4) and

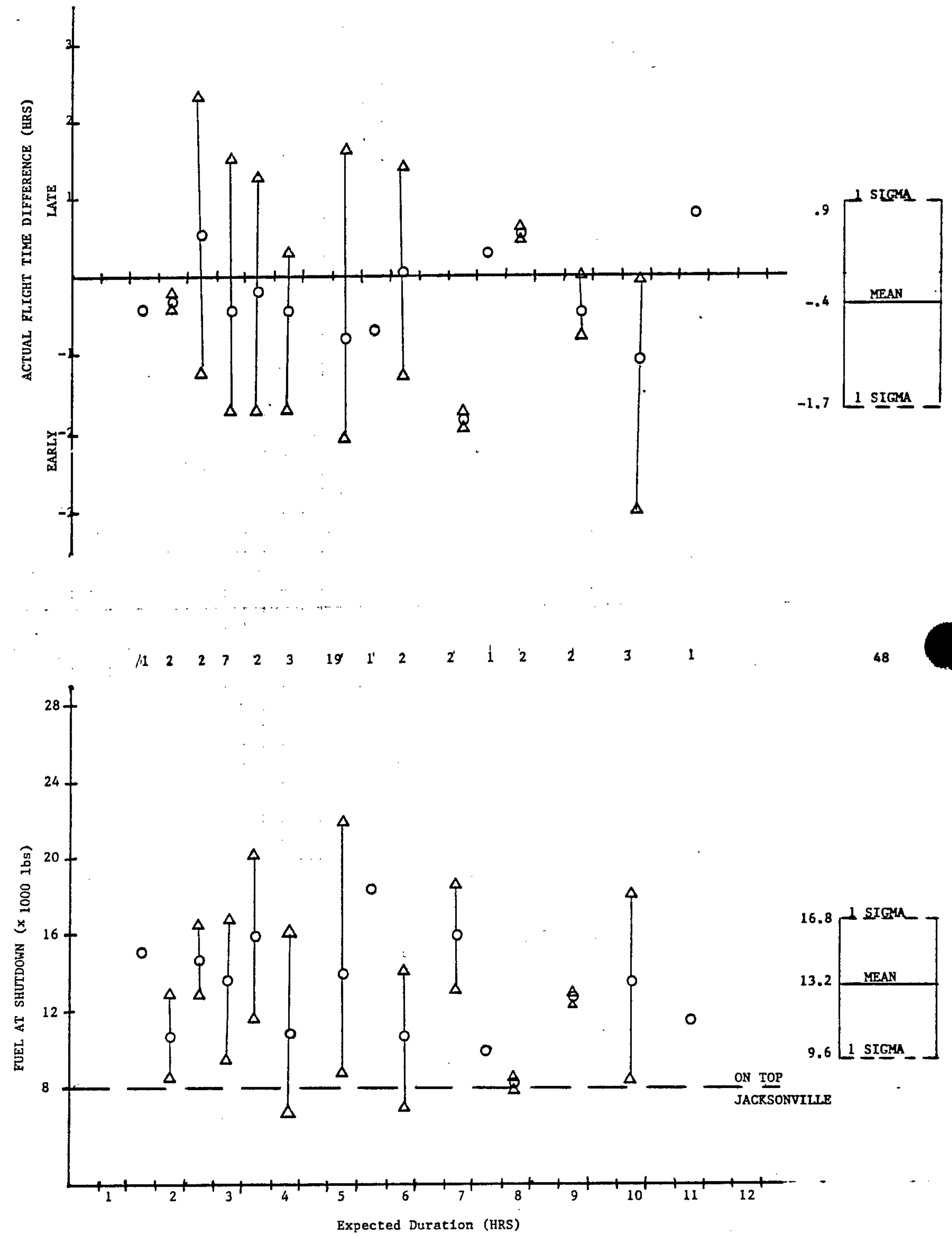


Figure 4-2 SQUADRON A FEBRUARY FUEL AT SHUTDOWN AND FLIGHT DURATION

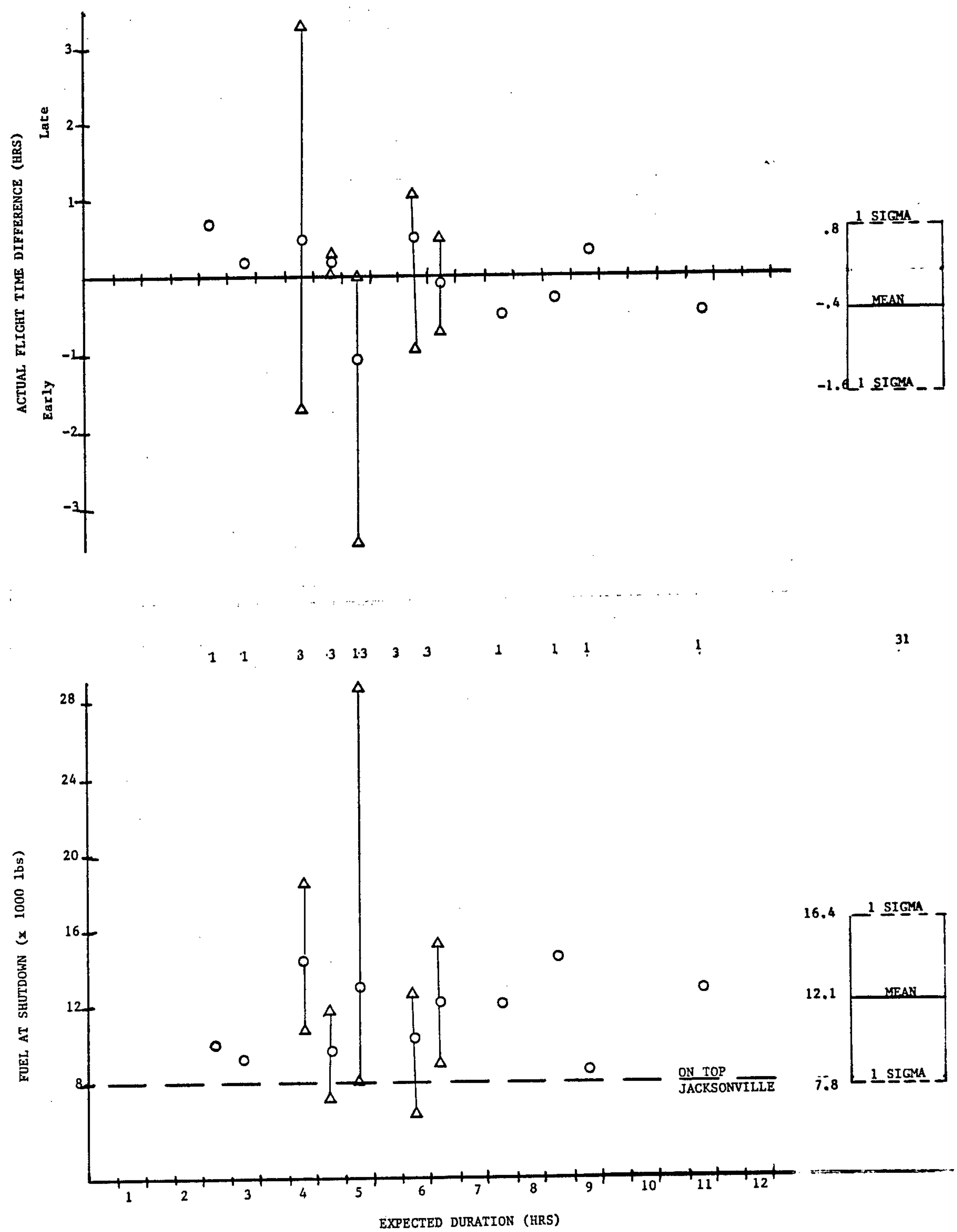


Figure 4-3 SQUADRON B FEBRUARY FUEL AT SHUTDOWN AND FLIGHT TIME

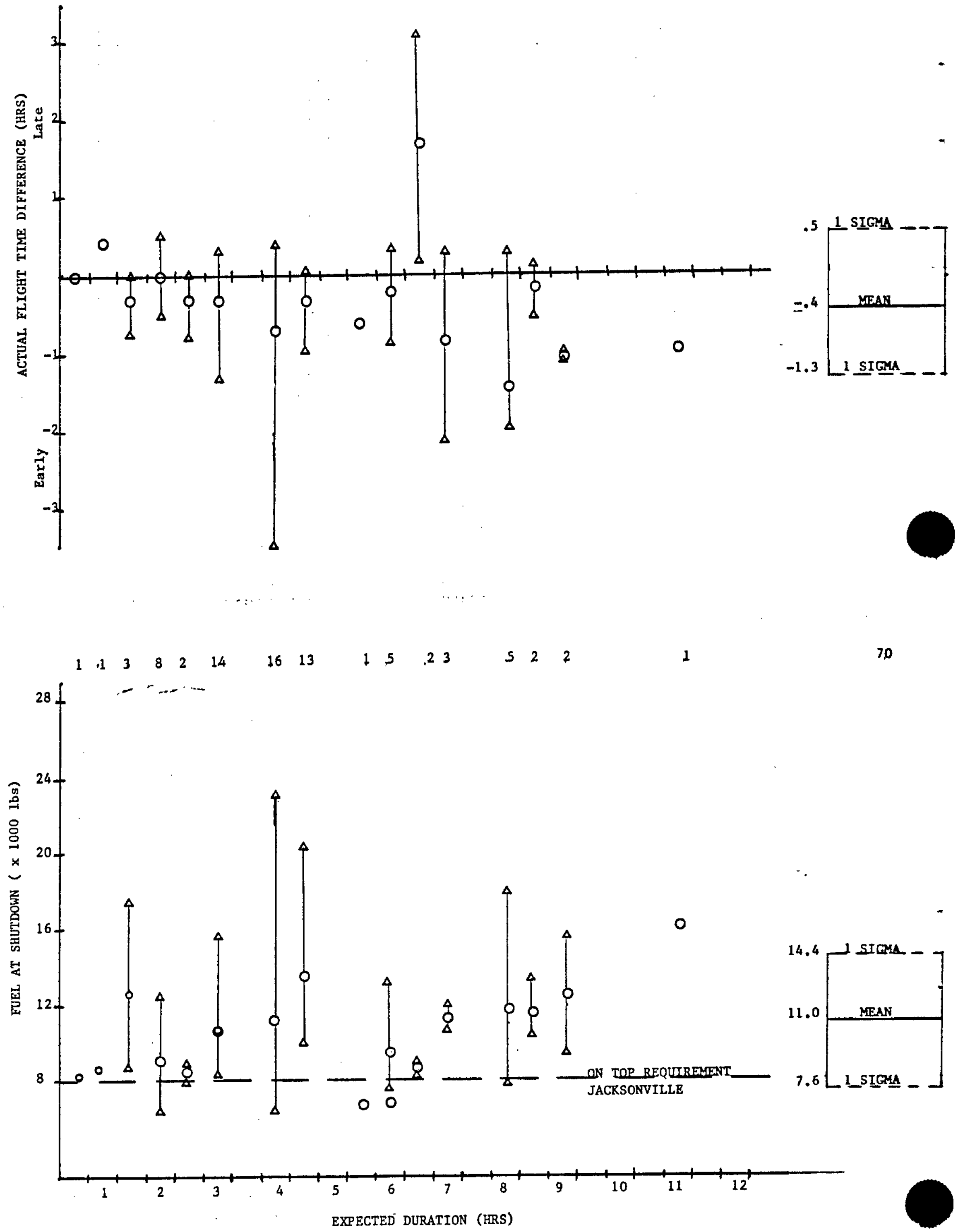


Figure 4-4 Squadron C February Fuel At Shutdown and Flight Time

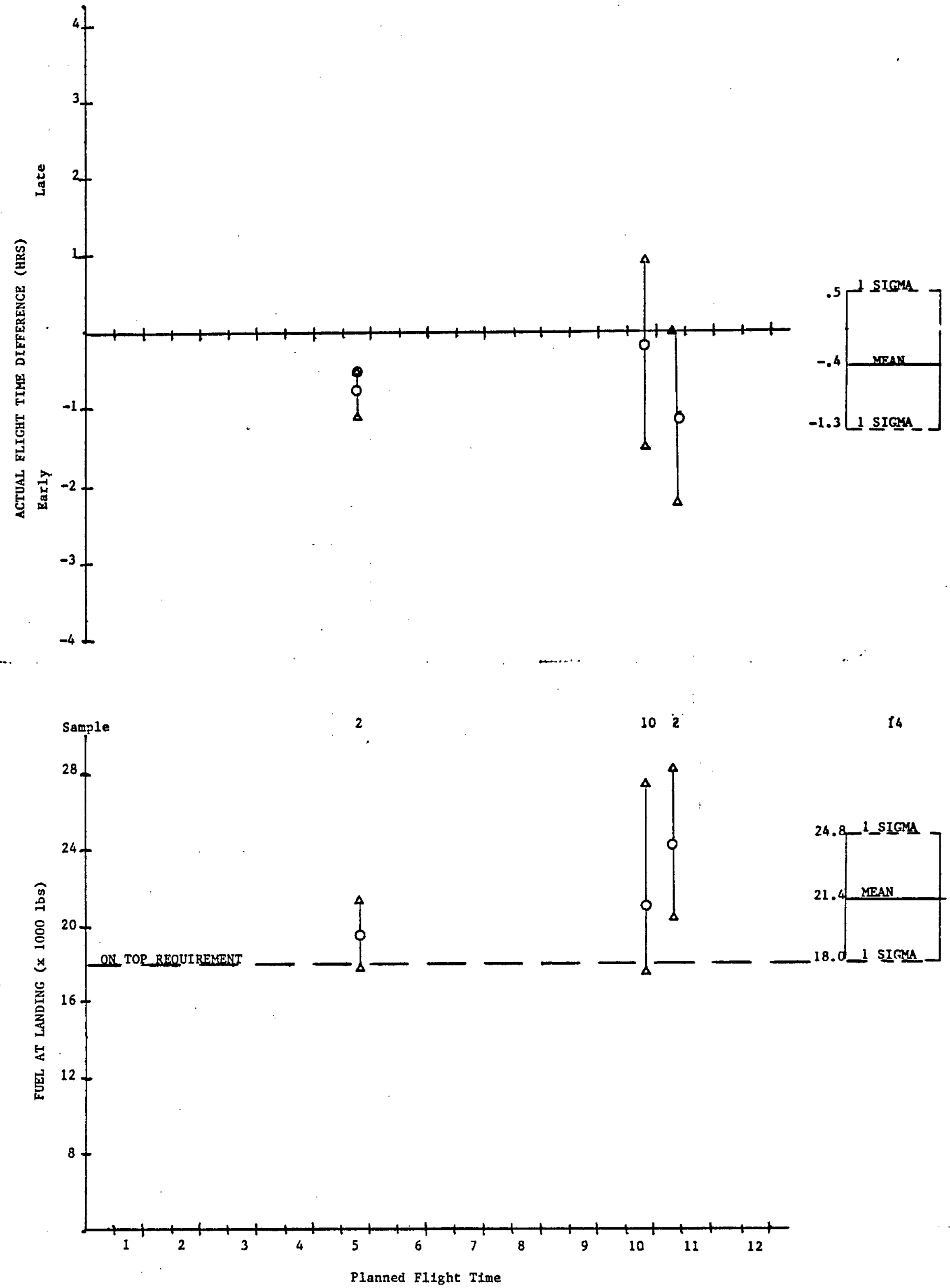


FIGURE 4-5 SQUADRON D FEBRUARY FUEL AT SHUTDOWN AND FLIGHT TIME

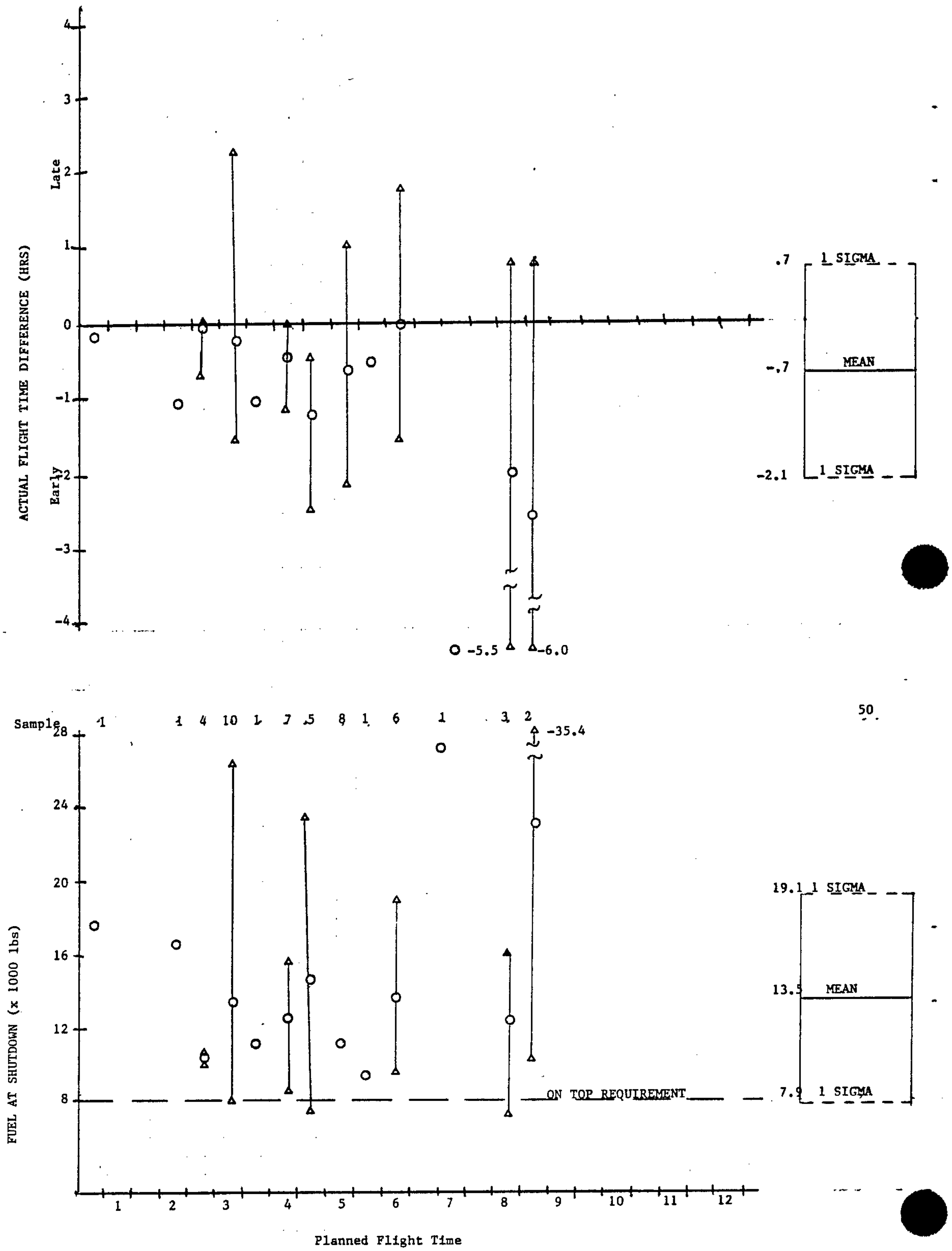


Figure 4-6 SQUADRON A MARCH FUEL AT SHUTDOWN AND FLIGHT TIME

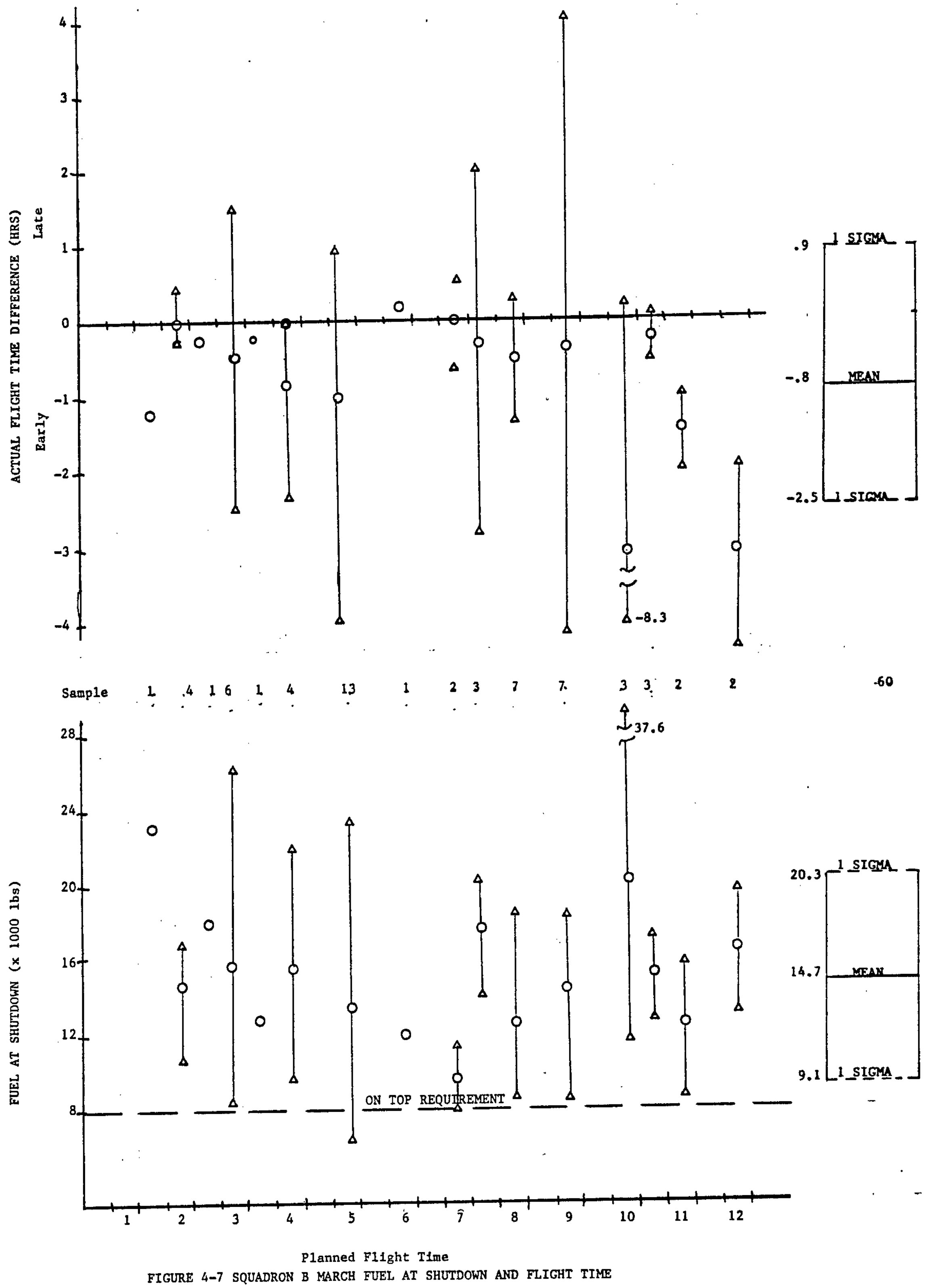


FIGURE 4-7 SQUADRON B MARCH FUEL AT SHUTDOWN AND FLIGHT TIME

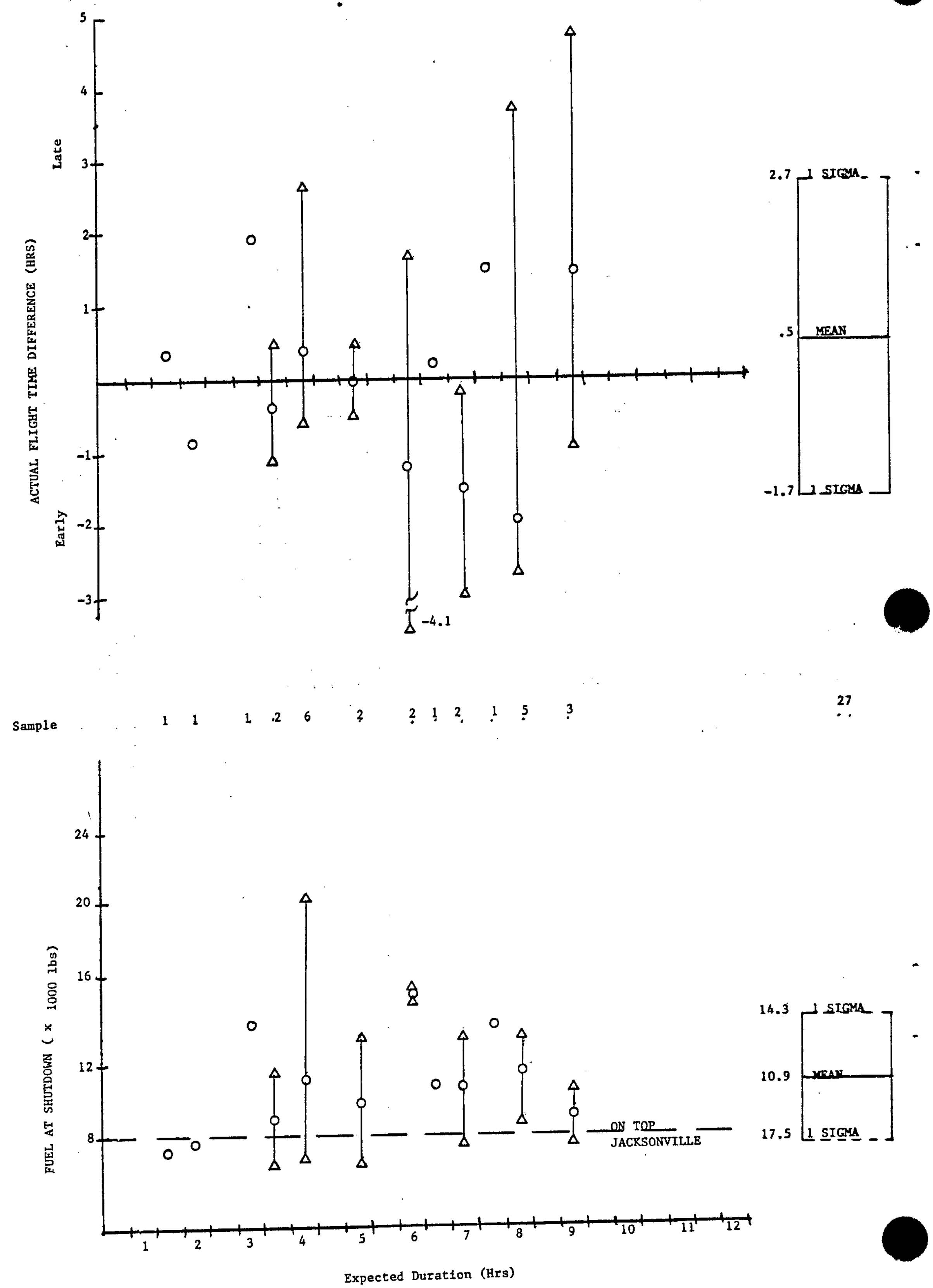


FIGURE 4-8 SQUADRON C MARCH FUEL AT SHUTDOWN AND FLIGHT DURATION

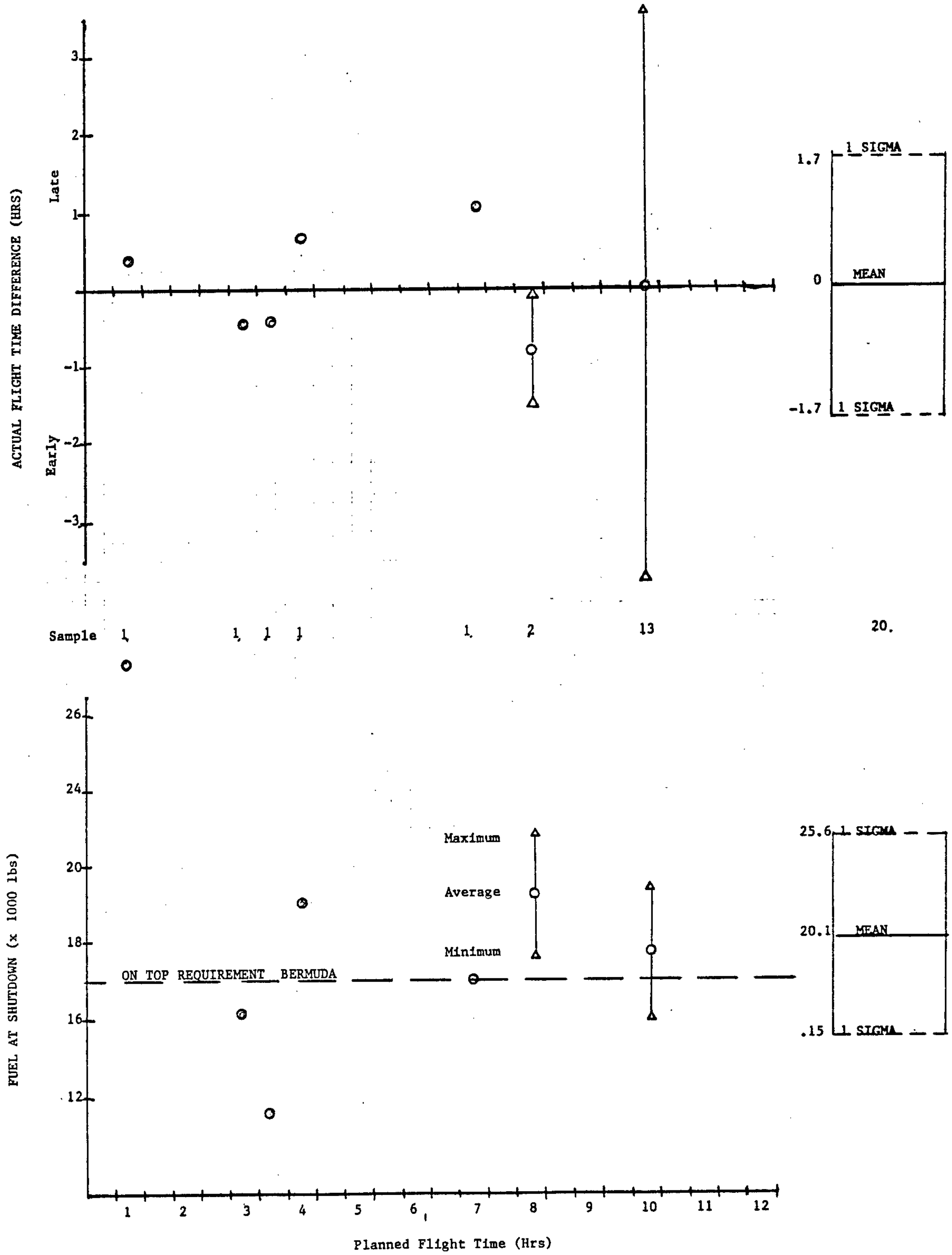


FIGURE 4-9 SQUADRON D MARCH FUEL AT SHUTDOWN AND FLIGHT DURATION

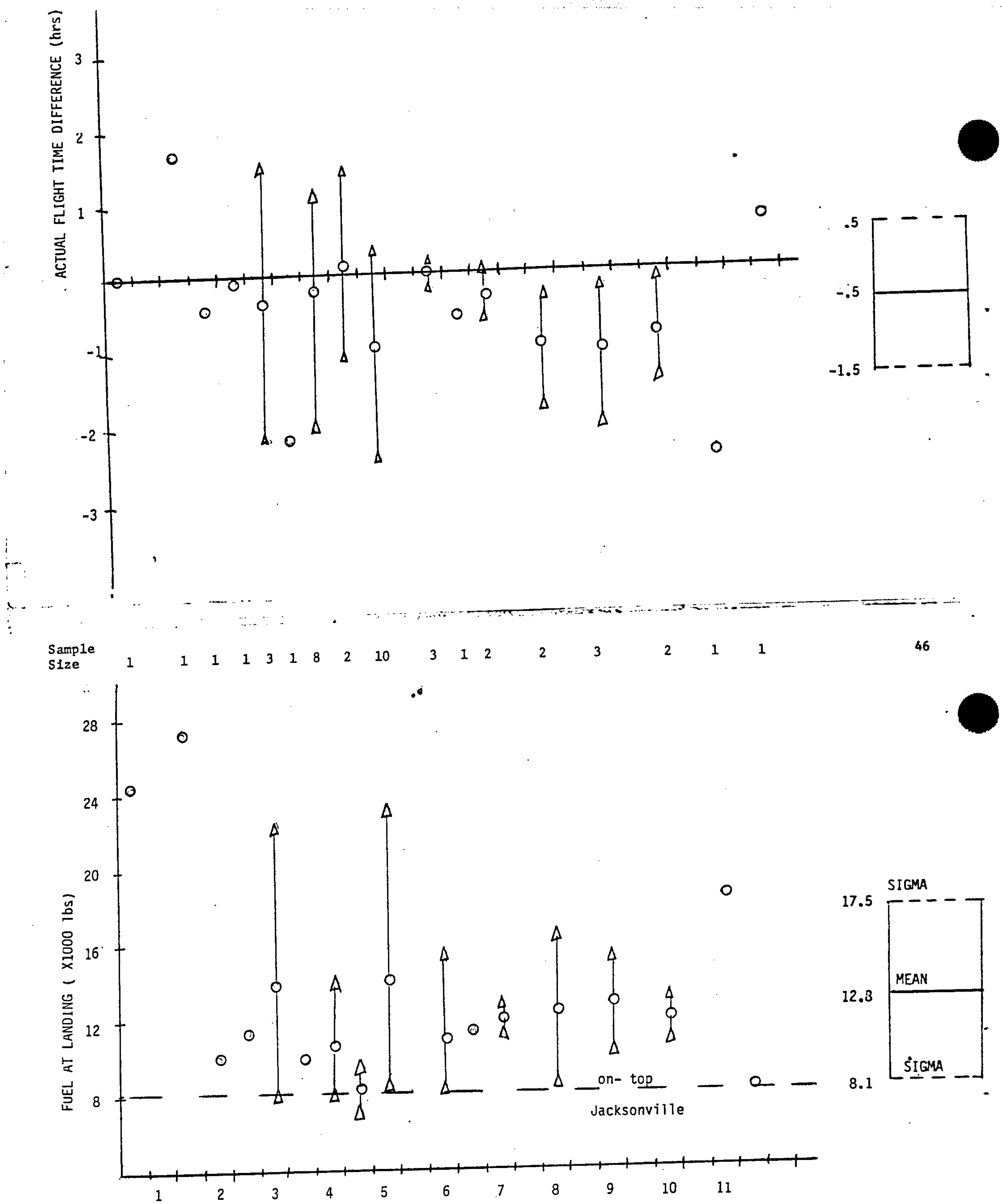


FIGURE 4-12 SQUADRON A APRIL FUEL AT SHUTDOWN AND FLIGHT DURATION

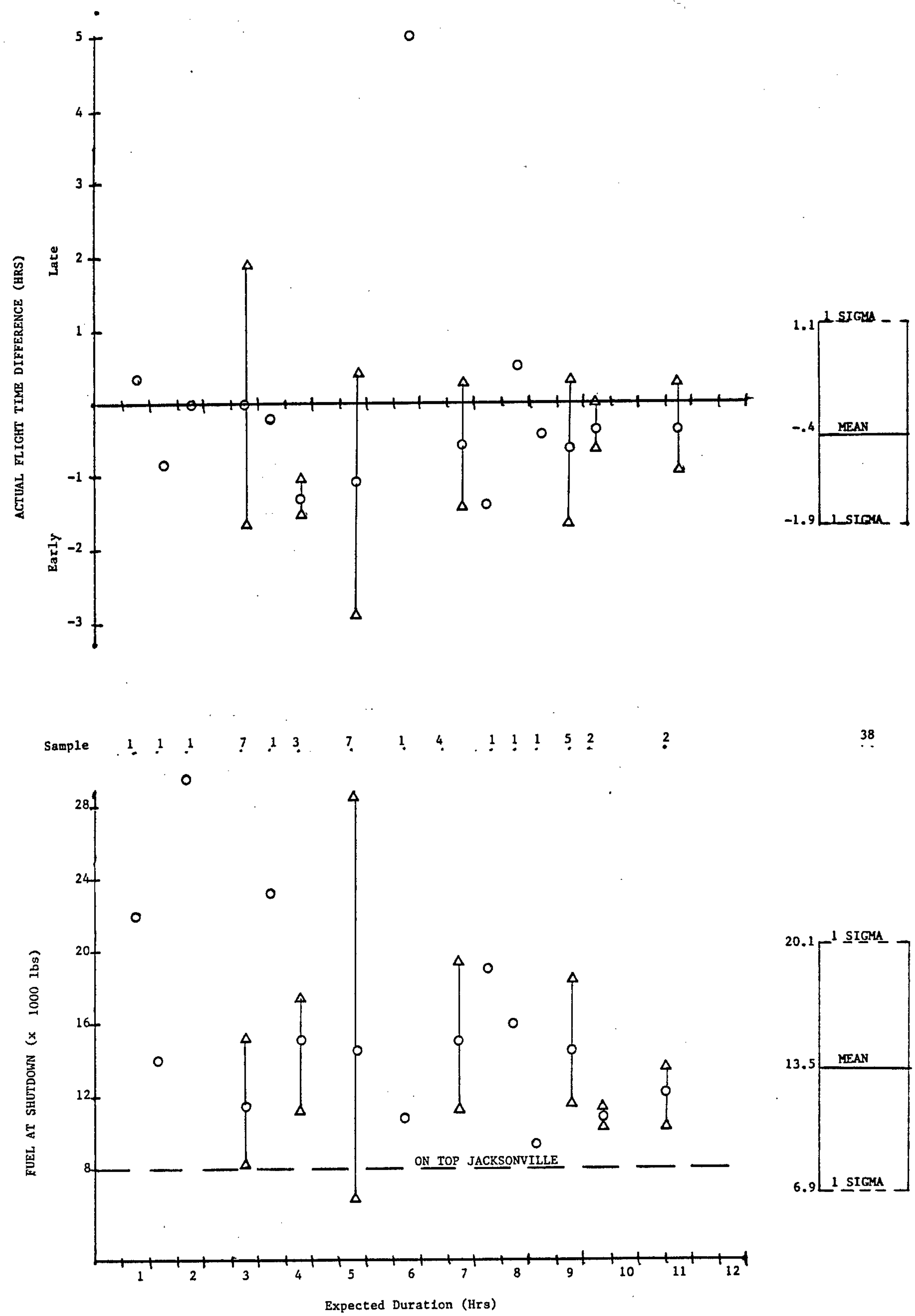


FIGURE 4-11 SQUADRON B APRIL FUEL AT SHUTDOWN AND FLIGHT DURATION

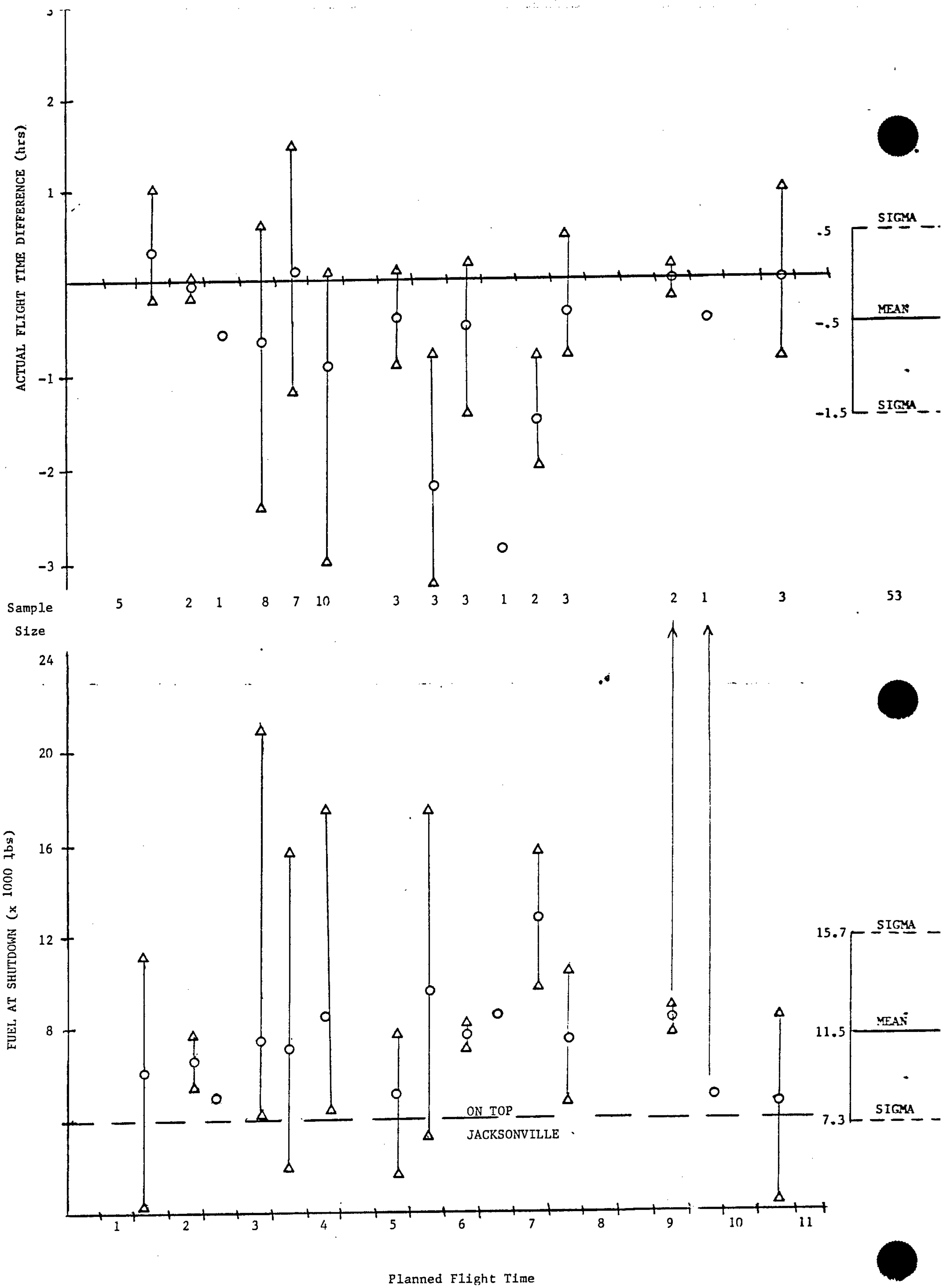


FIGURE 4-12 SQUADRON C APRIL FUEL AT SHUTDOWN AND FLIGHT DURATION

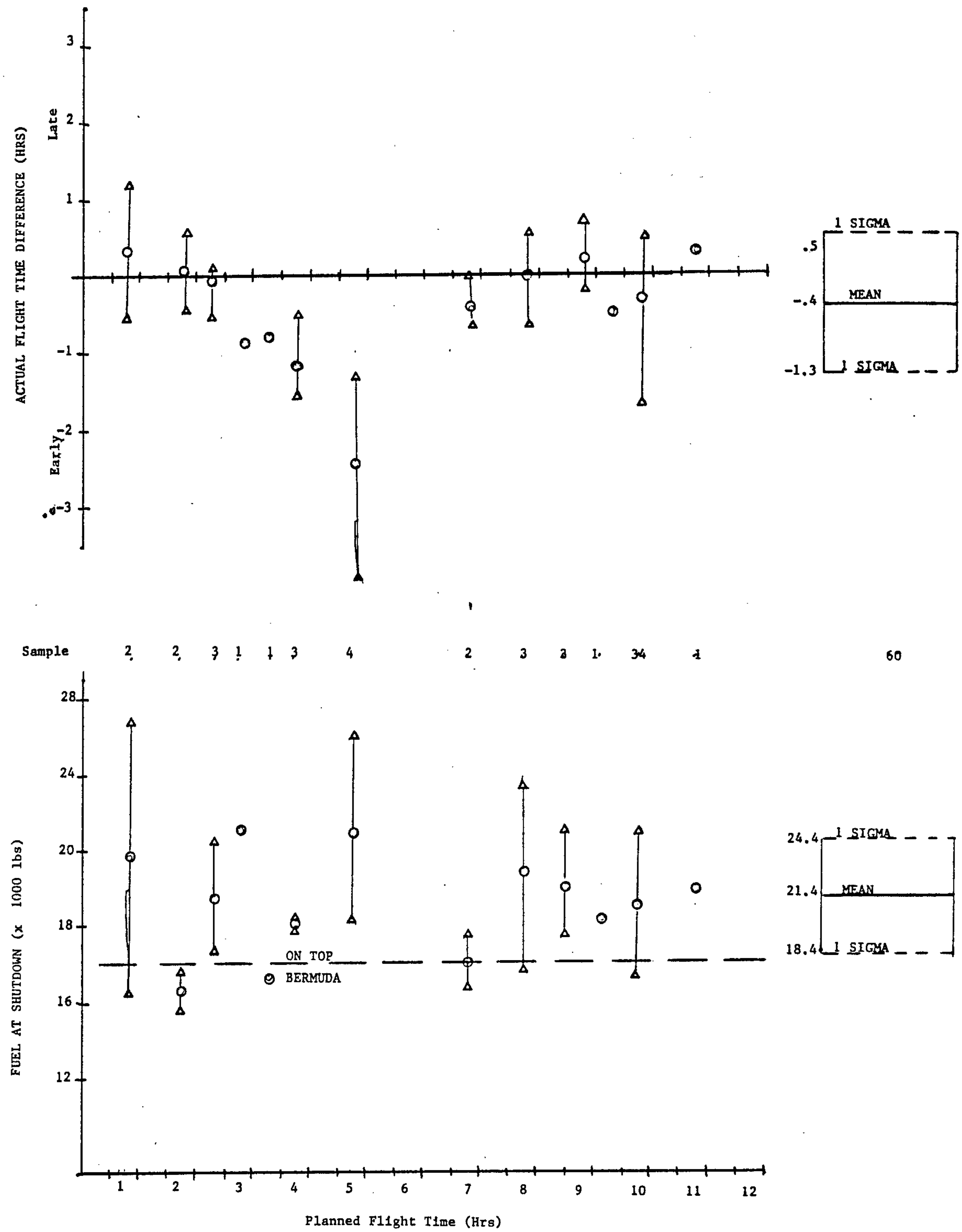


FIGURE 4-13 SQUADRON D APRIL FUEL AT SHUTDOWN AND FLIGHT DURATION

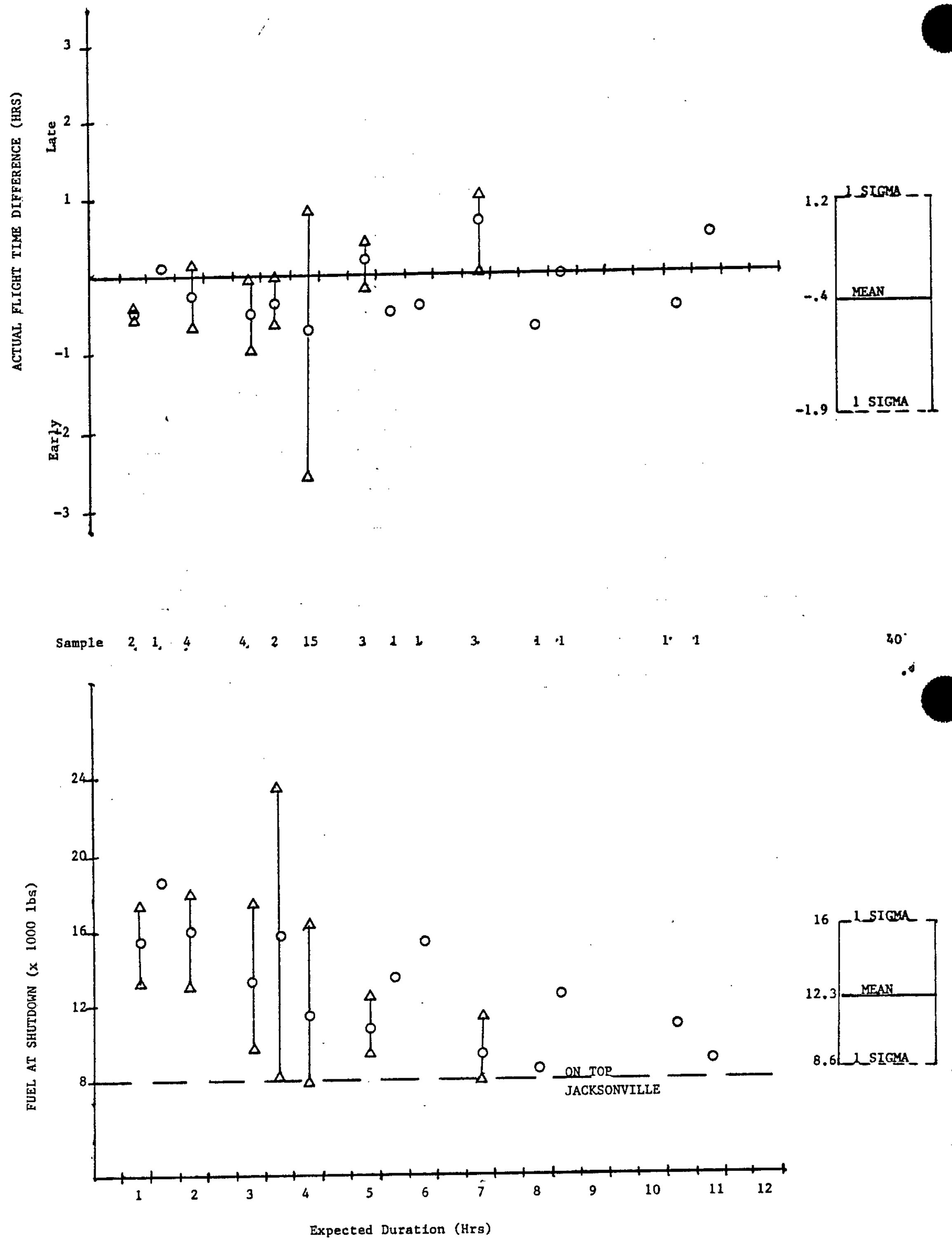


FIGURE 4-14 SQUADRON E APRIL FUEL AT SHUTDOWN AND FLIGHT DURATION

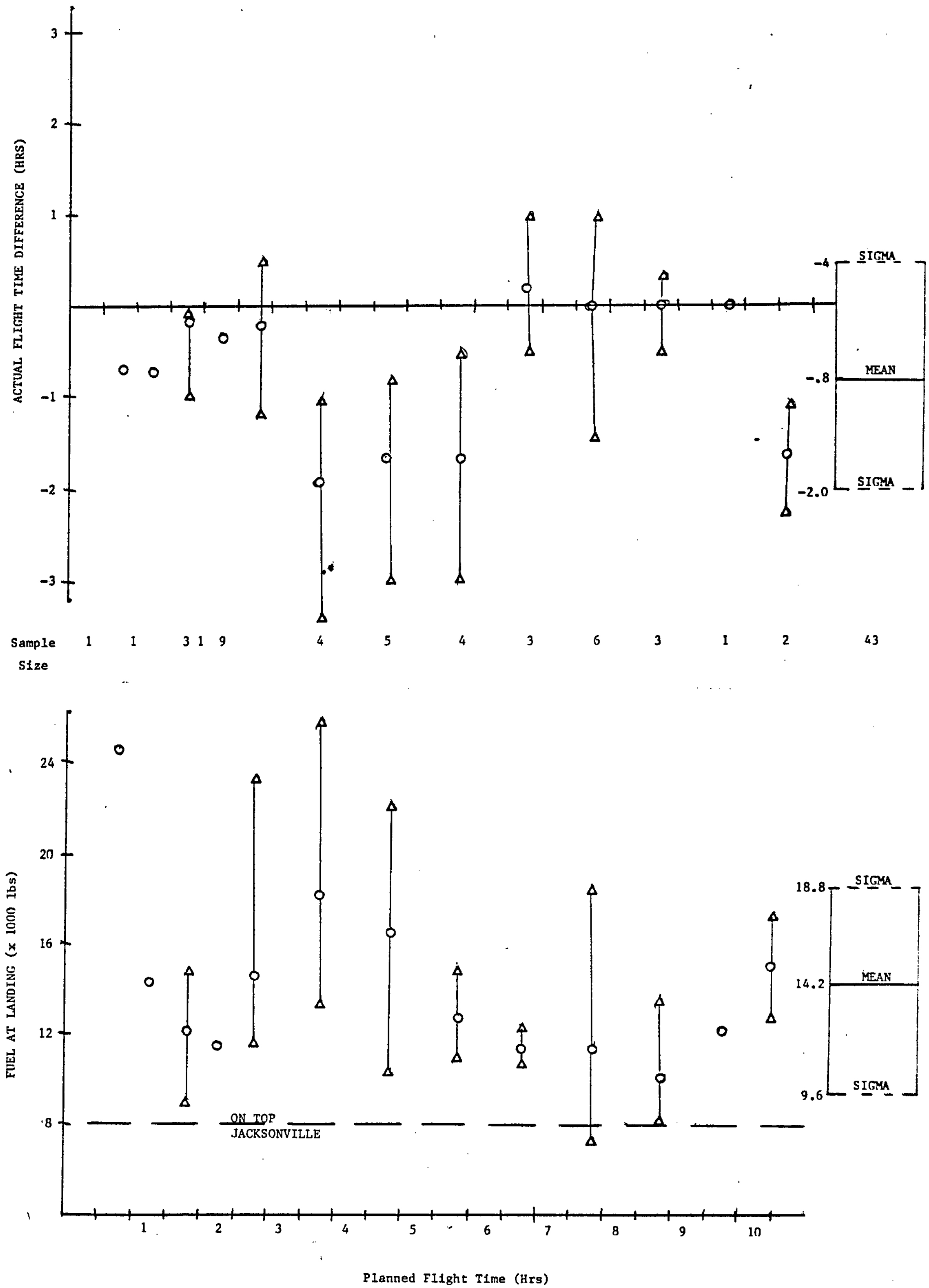


FIGURE 4-15 SQUADRON A MAY FUEL AT SHUTDOWN AND FLIGHT DURATION

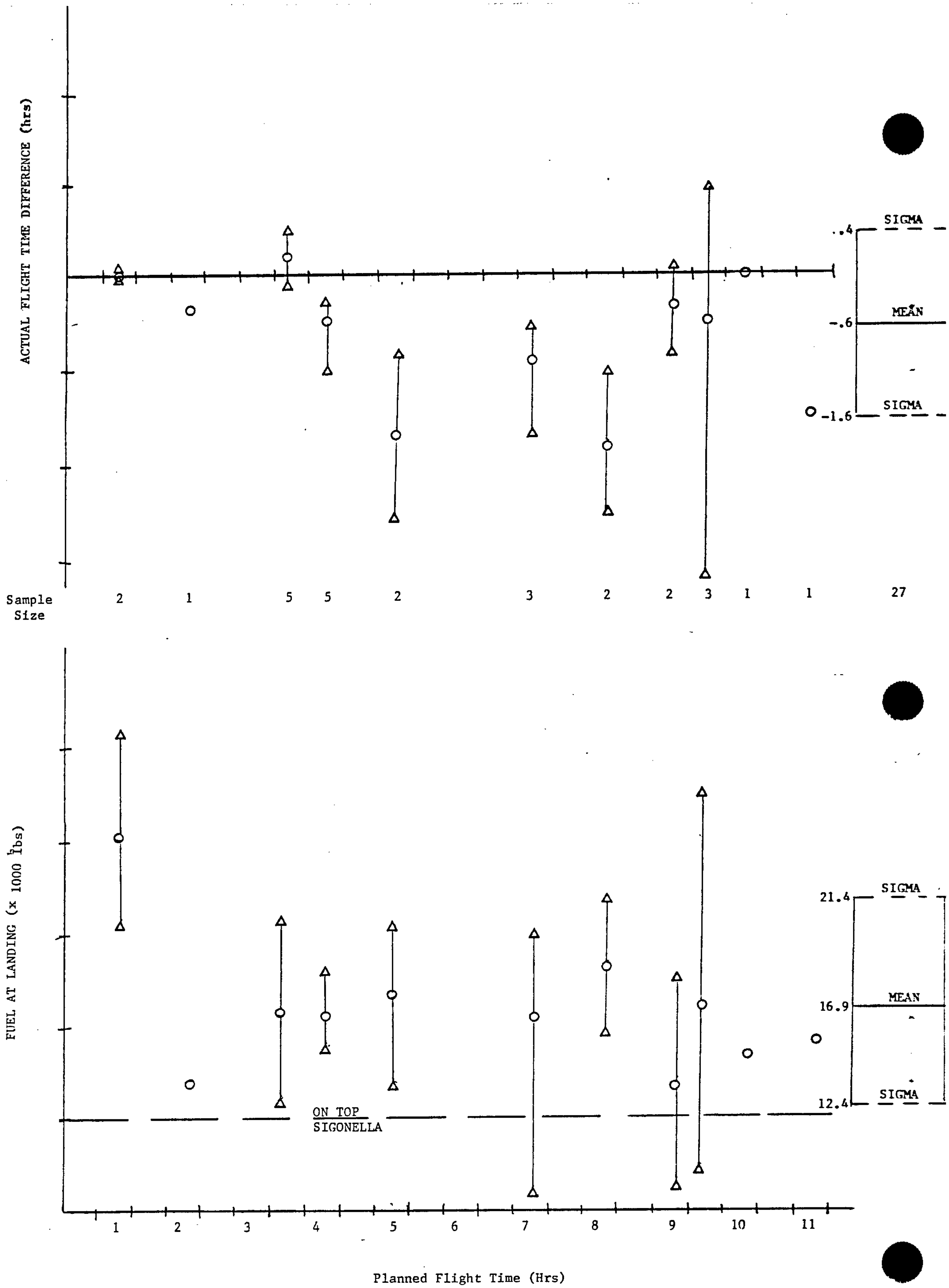
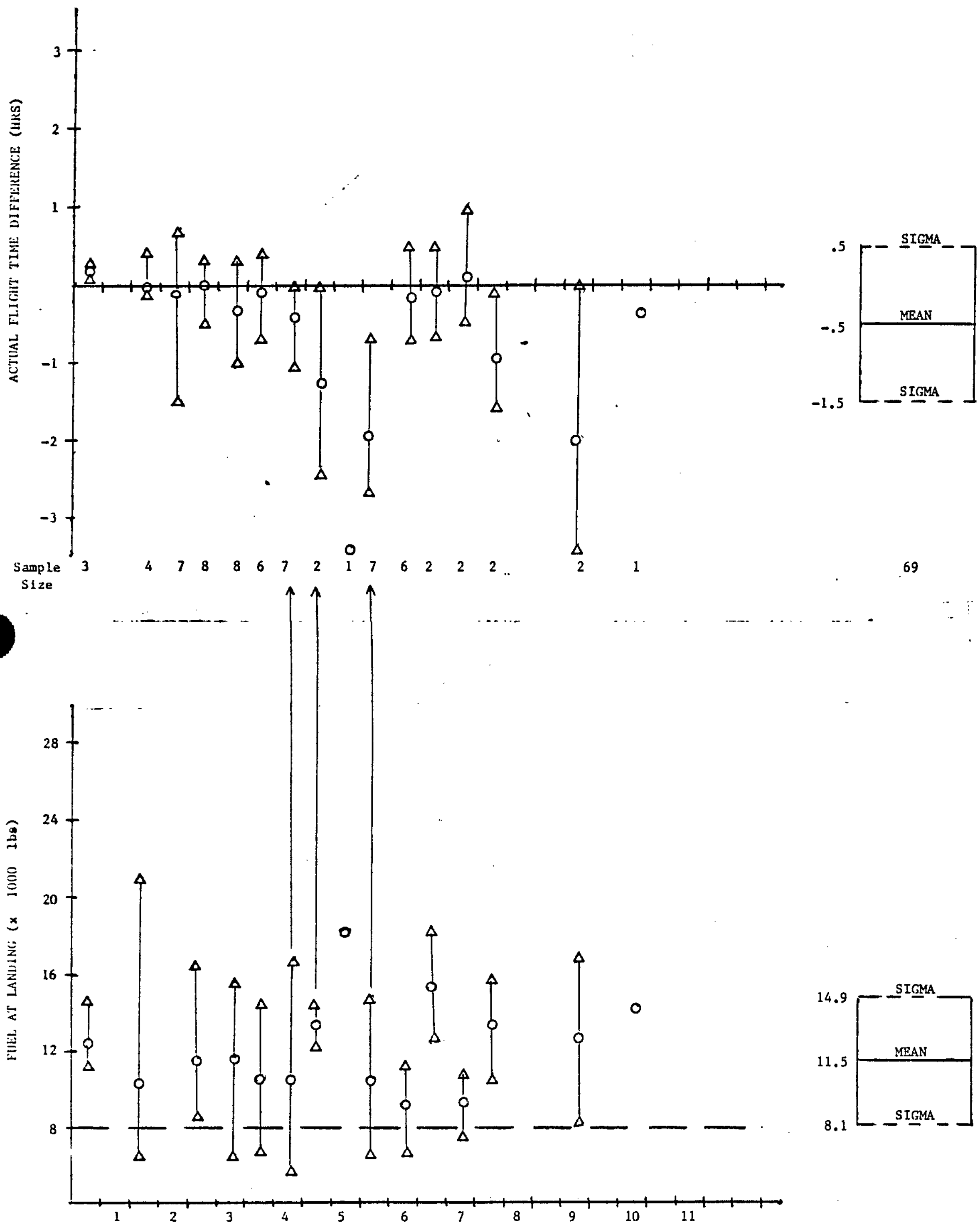


FIGURE 4-16 SQUADRON B MAY FUEL AT SHUTDOWN AND FLIGHT TIME



Planned Flight Time (Hrs)
FIGURE 4-17 SQUADRON C MAY FUEL AT LANDING AND FLIGHT TIME

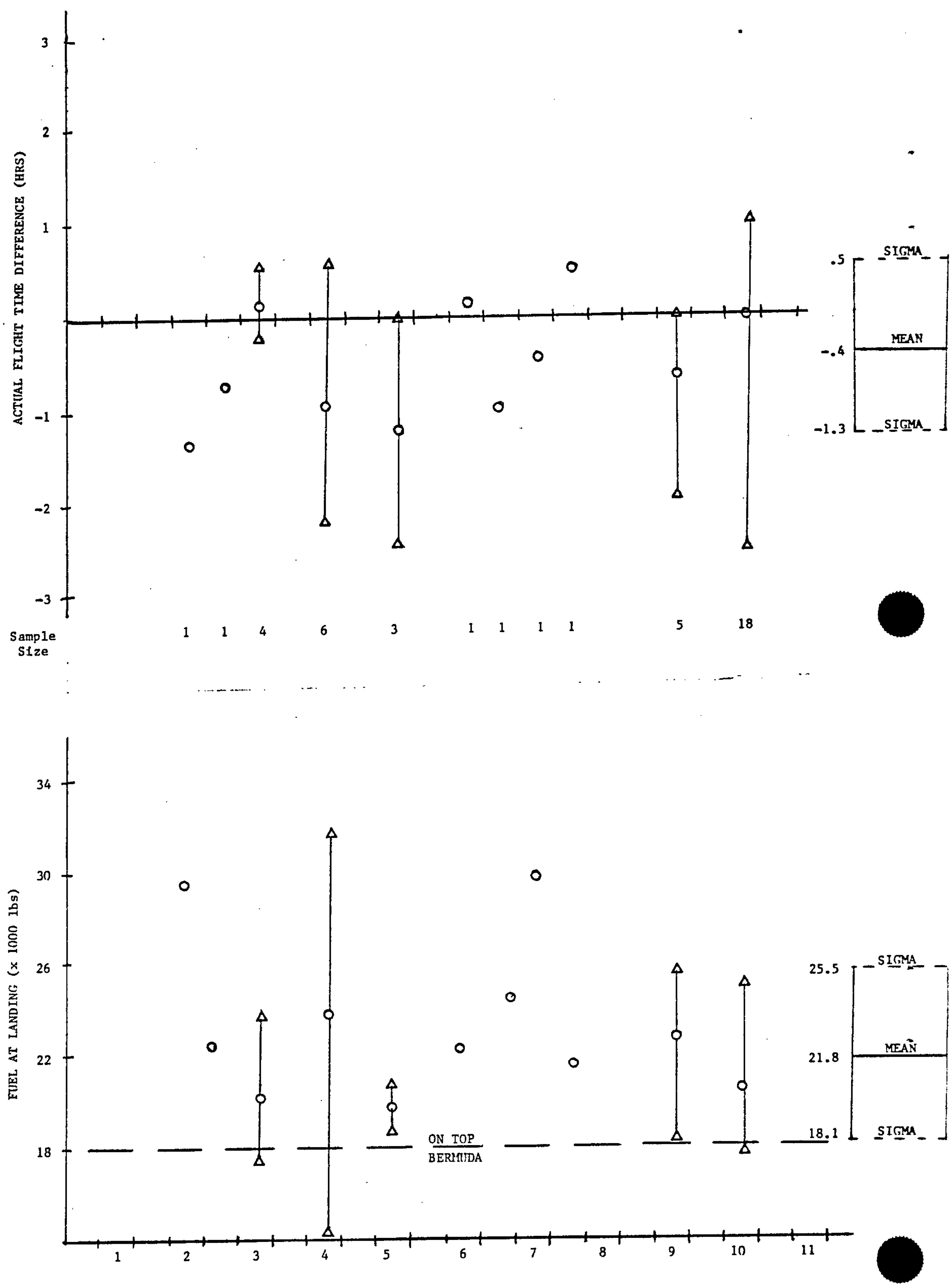


FIGURE 4-18 SQUADRON D MAY FUEL AT SHUTDOWN AND FLIGHT DURATION

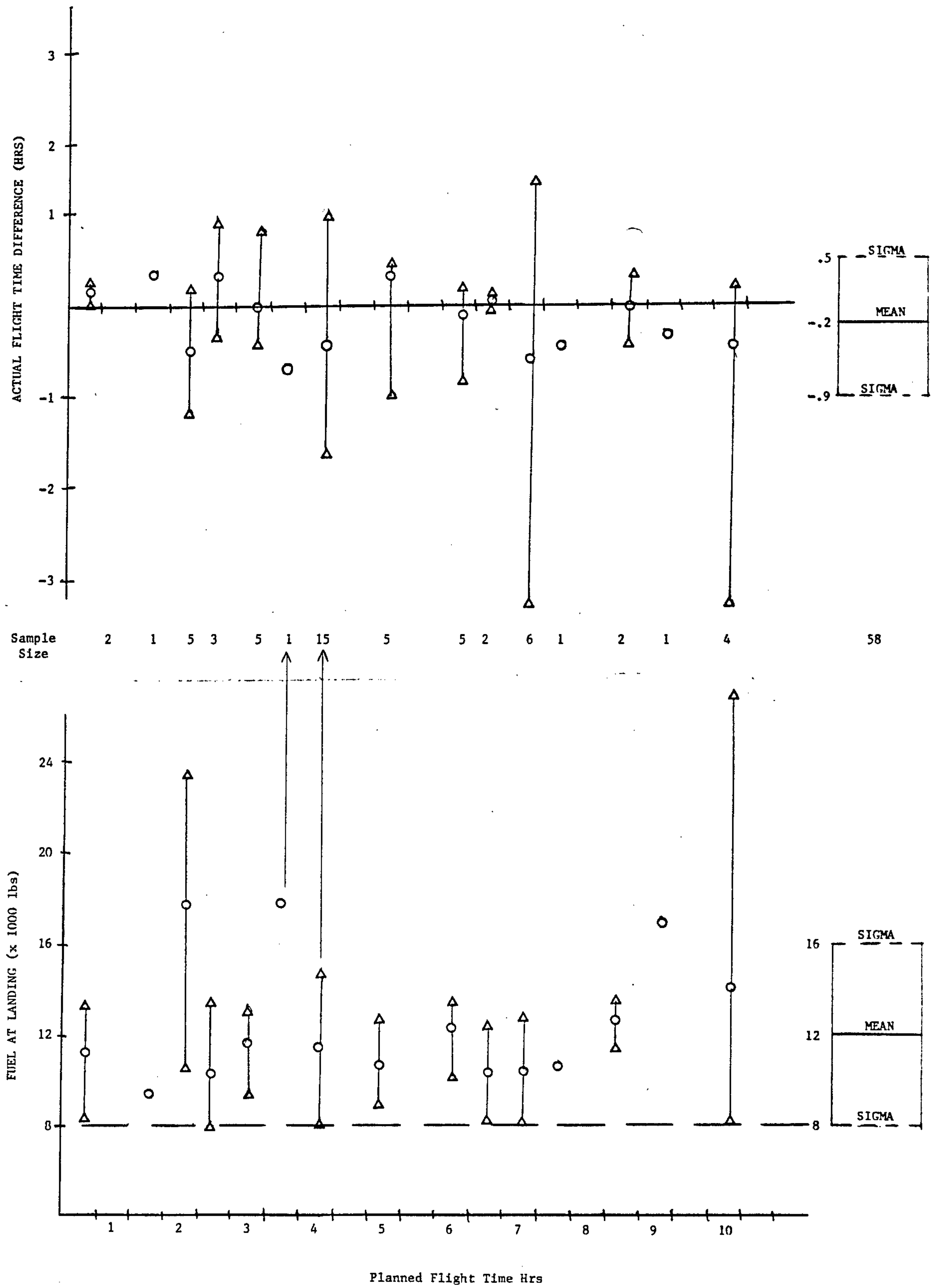


FIGURE 4-19 SQUADRON E MAY FUEL AT SHUTDOWN AND FLIGHT DURATION

land time entry (card 6 columns 1-4). All flight data cards that recorded comments reflecting extended flights or aborted flights were eliminated from this analysis.

The upper charts on Figures 4-2 through 4-19 depict the results of this analysis. For each one half hour increment of planned flight time, the mean actual flight time is plotted. Additionally, the largest variants for each increment have been displayed (dashed lines). The block at the extreme right of each graphic display contains the mean and 1 sigma, standard deviation, for all flights in that month. The sample size for each increment and total is displayed across the middle of each display.

As can be observed in these charts on Figures 4-2 through 4-19 all squadrons involved in the VP Fuel conservation effort are flying less than the planned time on the average. It must be noted however, that a few flights have been returning 4-5 hours prior to scheduled time and these flights may be influencing the findings. Since no comments are included on the data cards, these flights must be used in the analysis.

4.3 FUEL FLOW

Table 4-2 and Figures 4-20 through 4-24 depict the fuel flow by mission stage and month for each of the squadrons. As mentioned previously in this technical memorandum, fuel flow is being considered to determine variation within mission types and to observe trends on aircrew involvement to see where conservative measurements are being applied. Fuel flow by mission phase will be analyzed in the future. Fuel flow by mission phase has shown that the cruise-in appears to be greater than the cruise-out. Fuel flow is obtained by dividing the duration from take-off to land into the fuel consumed during the duration. These numbers are from overall display 4 "Summary By Pilot" (Ref 2). Tables 4-1 and 4-2 summarize the results of the fuel flow analysis. All tables are the results of the OVERALL 01 display - Fuel Consumed by Stage of Flight. Table 4-1 depicts the fuel flow by mission type for each squadron during this reporting period.

4.4 APU VS GSE DURING PREFLIGHT

COMPATWING ELEVEN Fuel Conservation Conference, Report of 3 April 1981 OPS Memo 7-81, proposed a series of 43 fuel conservative measures which could result in the reduction of fuel consumption. Two such proposed measures, #2 and #5, were concerned with the use of GSE as opposed to APU during preflights for operational flights. Table 4-3 and Figure 4-25 were developed utilizing the data received during this reporting period and demonstrate the potential fuel savings available by utilizing GSE on all non-operational (FAM, XCTY, OTHER) flights. These tables and Figures were developed utilizing the following considerations: an APU burns fuel at a rate of 300 lb/hr, while GSE fuel rate is 50 lb/hr or a savings of 250 lb/hr; GSE is utilized only on non-operational flight; GSE would be available for all non-operational flight; and fuel costs are $1.42 per gallon.

SQUADRON	MISSION TYPE	AVERAGE FUEL FLOW SAMPLE/SIZE			
		FEB	MARCH	APRIL	MAY
A	ASW	4061/15	3826/12	3882/14	4107/17
	SS	4105/3	4236/3	4269/1	4428/6
	DS	4165/1	-	-	-
	FAM	3848/11	4117/26	4128/20	4174/16
	XCTY	3364/13	2690/18	3381/15	2869/17
	OTHER	3839/9	4204/9	4378/5	4211/9
B	ASW	4420/13	42261/24	4248/12	4176/18
	SS	4115/3	4433/1	4224/1	4268/2
	DS	-	3805/3	4440/1	-
	FAM	4361/8	4186/11	4328/8	4474/8
	XCTY	3868/13	4232/6	4604/19	4399/30
	OTHER	4090/9	5111/14	3574/12	4190/1
C	ASW	4163/18	4095/19	4297/11	4583/24
	SS	4230/1	4486/3	4641/4	4241/2
	DS	-	3889/1	4257/1	-
	FAM	4267/10	4260/31	4474/12	4007/4
	XCTY	4168/30	4359/36	4103/44	4391/28
	OTHER	4285/32	4033/14	4193/33	4406/47
D	ASW	4083/11	4313/13	4068/31	4383/14
	SS	4436/2	4336/1	4813/2	3956/1
	DS	4158/1	-	4248/1	-
	FAM	4043/2	5447/1	4034/10	4423/2
	XCTY	-	4442/4	4034/10	4971/4
	OTHER	4194/1	4240/1	4337/15	4385/21
E	ASW	*	*	4180/6	4363/21
	SS			4376/2	4418/2
	DS			4154/6	-
	FAM			4674/19	4252/15
	XCTY			4360/8	4174/20
	OTHER			4249/7	4291/18

*Data not available since squadron was not involved in fuel conservation experiment.

Table 4-1 Flight Fuel Flow By Mission Type

SQUADRON	MISSION PHASE	AVERAGE FUEL FLOW SAMPLE/SIZE			
		FEB	MARCH	APRIL	MAY
A	Pre-Flight	276/47	185/52	162/43	250/50
	Climb	7456/40	8524/45	7766/44	6649/45
	Cruise-Out	5171/21	5430/24	4587/33	4760/27
	On-Station	3774/19	3836/15	4080/19	3974/21
	Cruise-In	5480/3	*	6060/4	5237/7
	Descent	3435/28	3736/34	4191/35	3274/30
	Post-Flight	2770/42	2130/50	2148/46	2056/55
B	Pre-Flight	401/35	286/51	*	243/40
	Climb	8298/49	7420/50	7156/46	7413/52
	Cruise-Out	4298/32	4703/47	4631/34	5154/37
	On-Station	4096/19	4342/35	4064/19	4172/17
	Cruise-In	5991/7	5829/7	5250/2	7116/5
	Descent	3037/31	3302/33	2962/30	3504/27
	Post-Flight	2702/31	2153/45	2059/40	1960/52
C	Pre-Flight	*	*	477/64	270/80
	Climb	7386/80	8574/93	7237/93	6748/92
	Cruise-Out	5489/39	4593/44	4554/43	5102/56
	On-Station	4028/31	3908/32	4714/32	5041/4[illegible]
	Cruise-In	5743/7	5780/3	5740/6	6780/12
	Descent	3716/71	3461/79	3666/75	3626/77
	Post-Flight	2151/68	2132/77	2359/74	2404/88
D	Pre-Flight	168/5	225/16	*	180/36
	Climb	7120/15	7797/19	6745/51	7494/47
	Cruise-Out	5371/21	4869 19	5705/50	5521/43
	On-Station	4128/20	3799/16	4736/47	4651/37
	Cruise-In	6420/4	8940/3	5743/7	5656/11
	Descent	2646/19	5978/19	4116/48	2676/38
	Post-Flight	2122/19	2109/19	3211/46	2386/35
E	Pre-Flight			*	233/58
	Climb			7835/29	7830/60
	Cruise-Out			4823/21	4809/48
	On-Station	N/A	N/A	4061/16	4133/25
	Cruise-In			4920/1	5843/5
	Descent			3788/24	3448/32
	Post-Flight			1971/42	2269/62

Table 4-2 Fuel Flow By Mission Phase - All Missions

*Fuel Flows in excess of aircraft capabilities

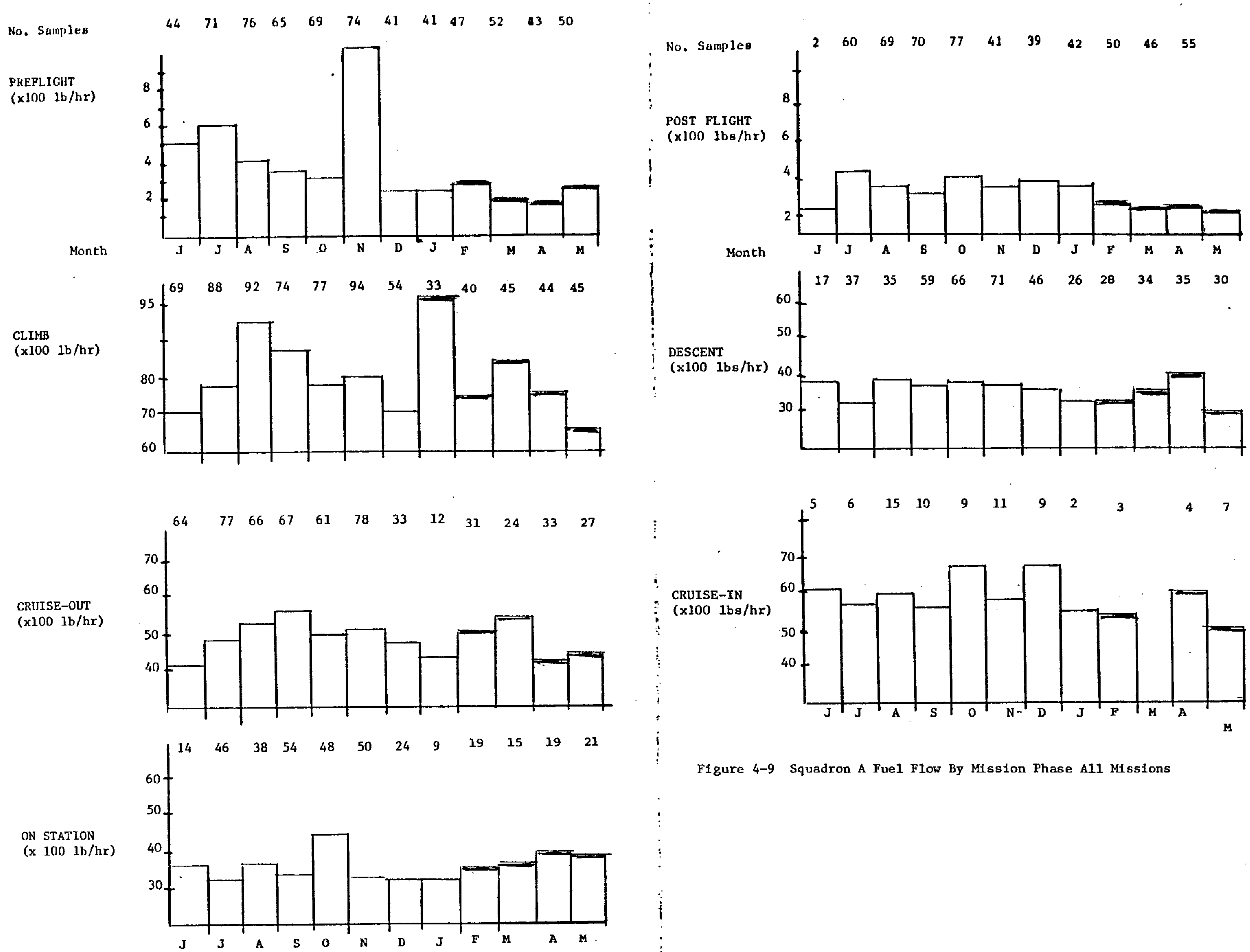


Figure 4-9 Squadron A Fuel Flow By Mission Phase All Missions

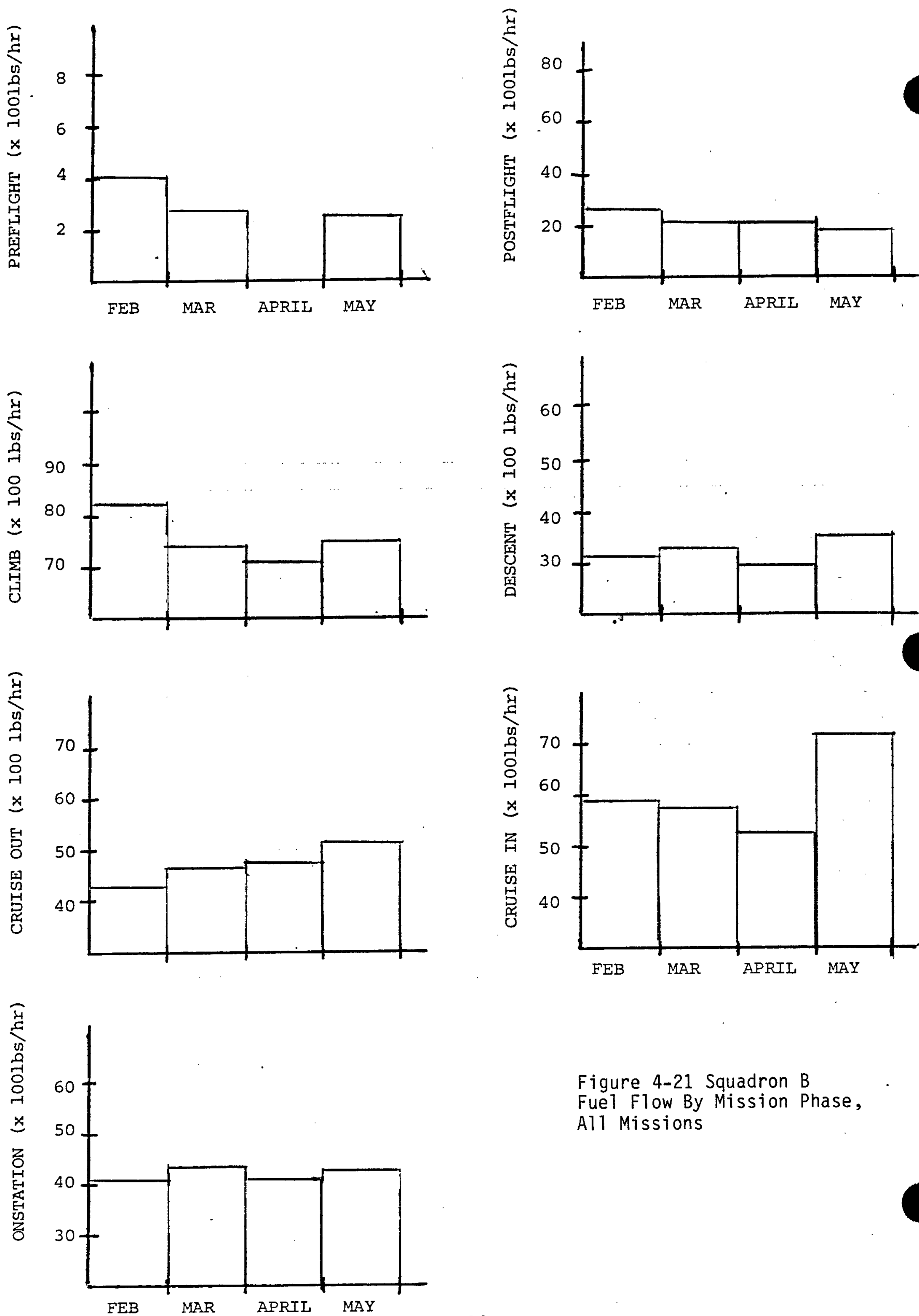


Figure 4-21 Squadron B Fuel Flow By Mission Phase, All Missions

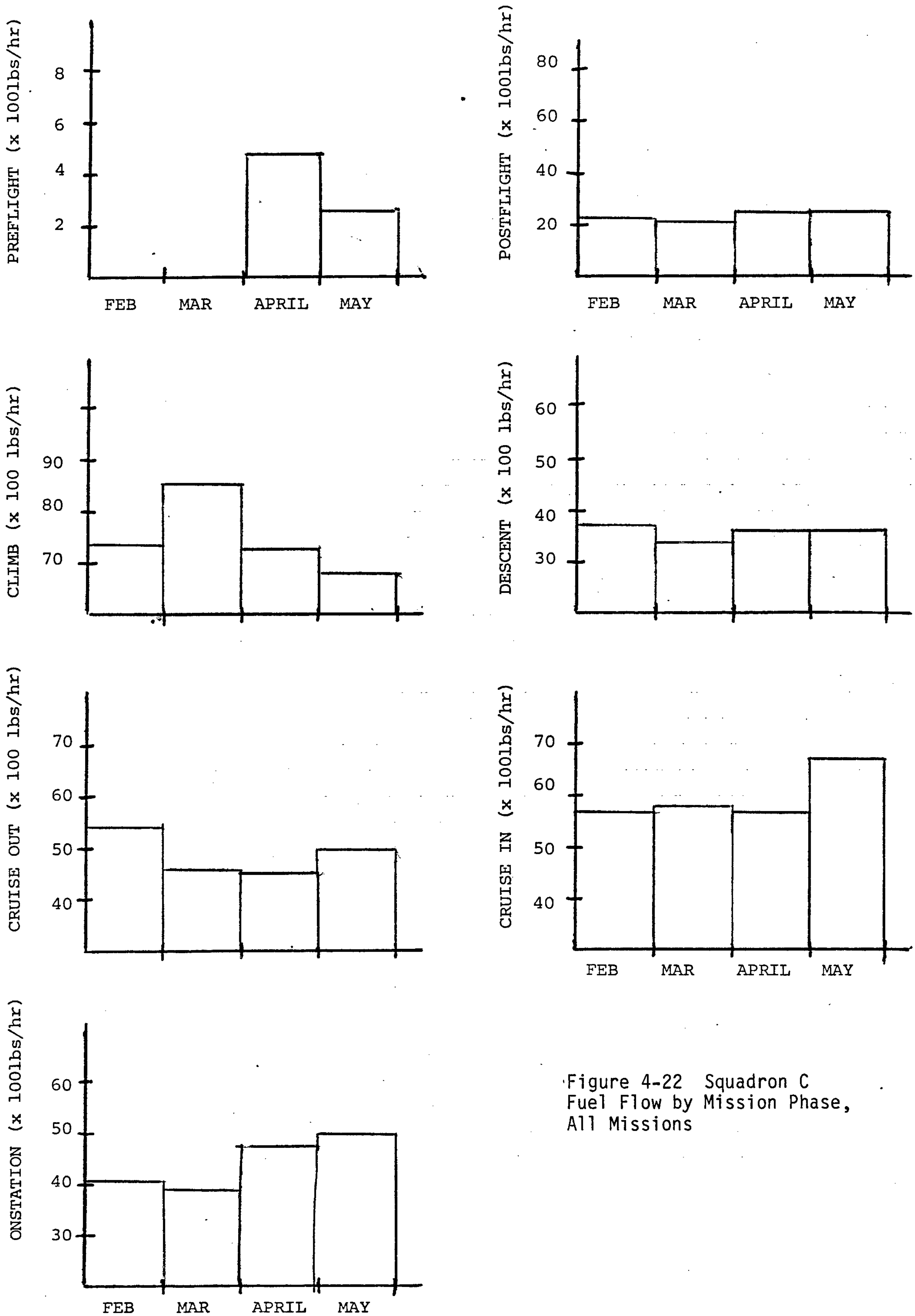


Figure 4-22 Squadron C Fuel Flow by Mission Phase, All Missions

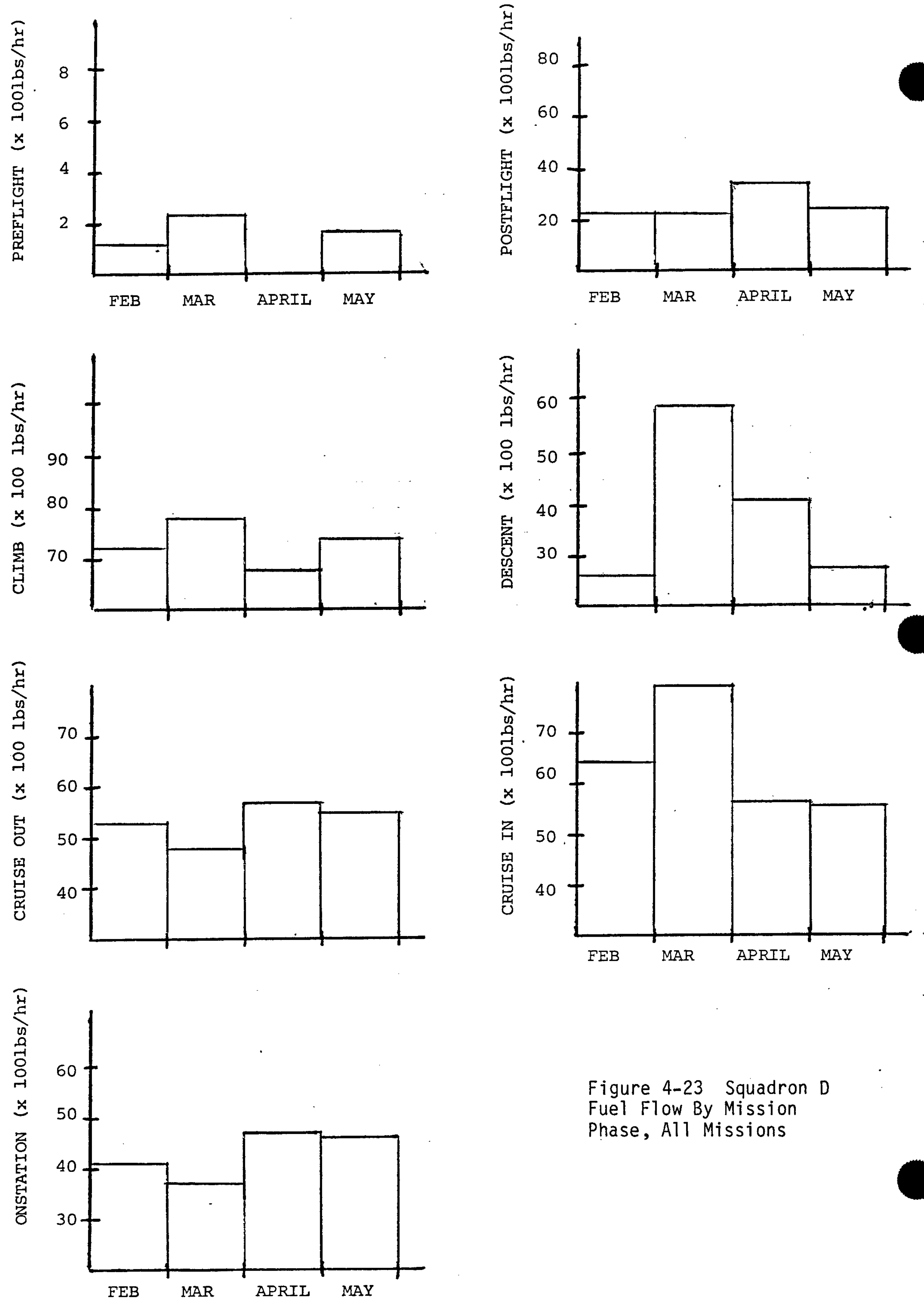
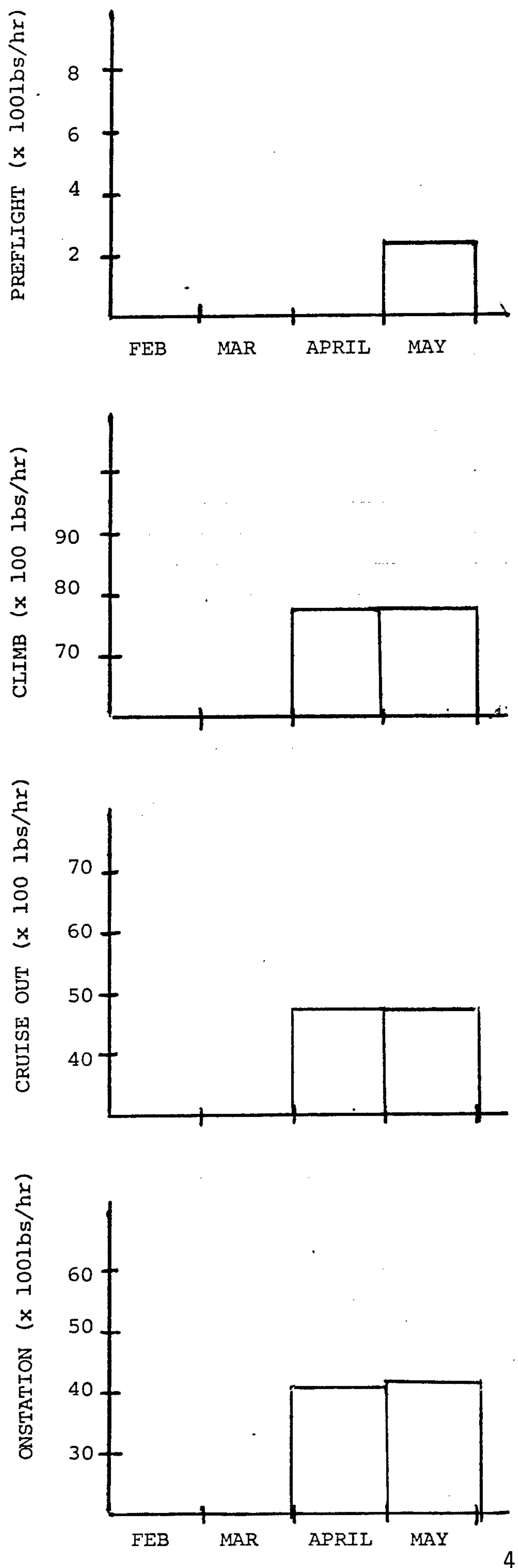


Figure 4-23 Squadron D Fuel Flow By Mission Phase, All Missions



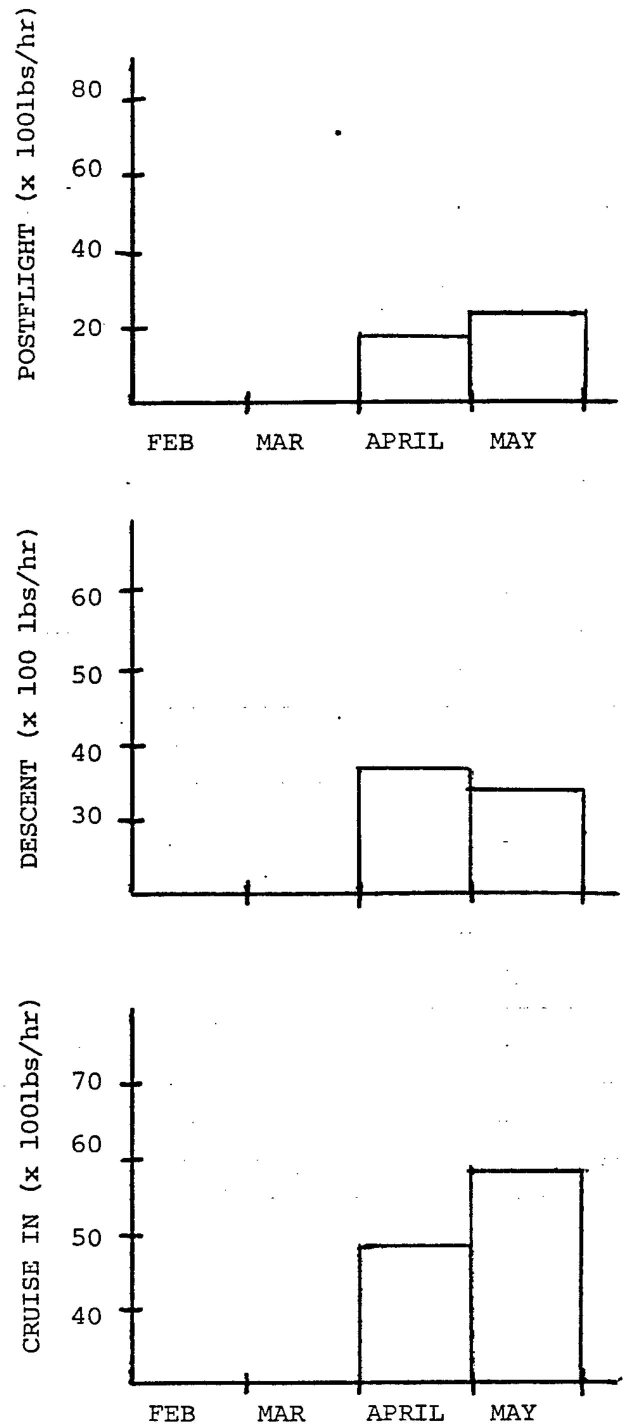


Figure 4-24 Squadron E
Fuel Flow By Mission Phase,
All Missions

Table 4-3 depicts the total fuel consumed during preflight (non-operational flights), the ratio of non-operational flights to all flights. The average non-operational flight preflight time, and the projected cost difference of using the APU over the GSE for the non-operational flights. Figure 4-25 is a graphic depiction of the relationship of operational and non-operational flights fuel used for preflight to the total preflight fuel consumed.

Two issues which must be addressed in the APU vs GSE preflight analysis are the availability of operable GSE and the cost to operate the GSE. GSE is assumed to be available and fully operable for this analysis. In fact this is not always true, which results in the high usage of APU for non-operational flights. However, the projected cost savings may warrant an investigation into obtaining more GSE. This analysis also assumes that the squadrons will be responsible for supplying fuel for the GSE. Again this is not a totally correct assumption, but it may be a viable way to defer the base expenses of the additional GSE.

4.5 ENGINE LOITER

Proposed fuel conservation measures numbers 27 and 28 of reference 4 pertain to maximizing the loitering of engines while performing highwork. Table 4-4 and Figure 4-26 demonstrate the squadrons adherence to these proposed conservation measures. These tables and Figures show that the majority of the flights will shut down at least one engine for a portion of the operating flight. However, there appears to be somewhat of a reluctance at loitering two engines. However, what is not determined from this analysis is the number of flights which could have loitered two engines but did not. The data required to perform this analysis is not currently available.

4.6 ENGINE MODE DURING TAXI

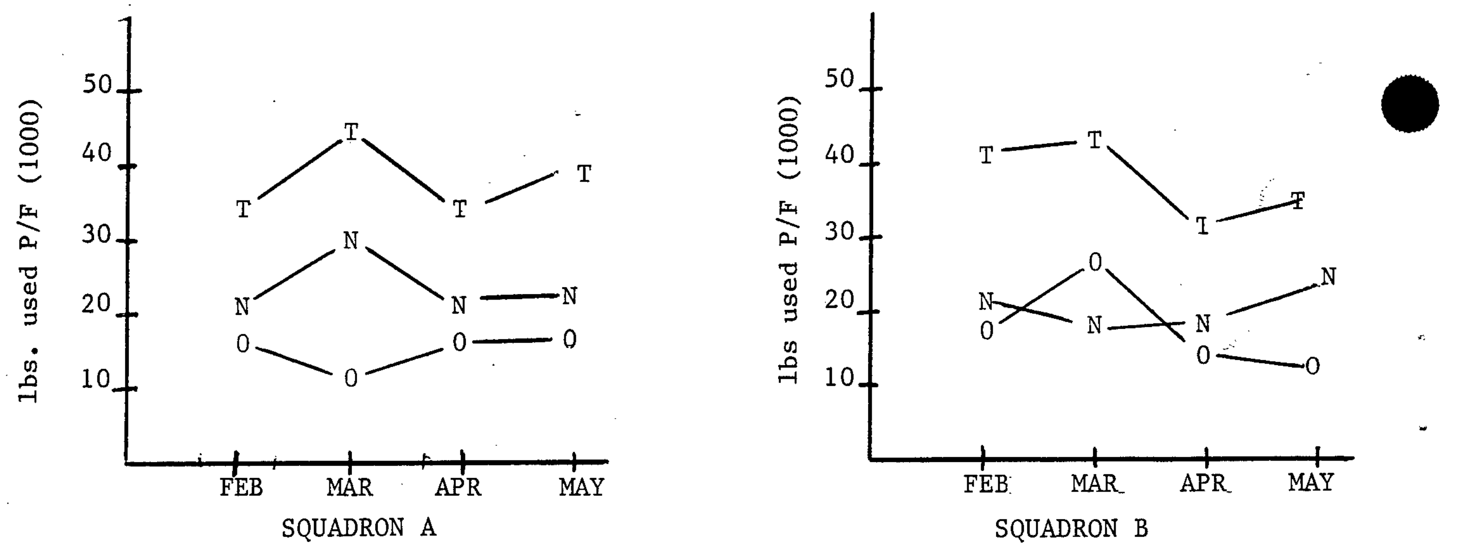
Investigation into the maneuver in which flight crews operated the engines during taxi for take-off revealed that fuel consumption could be reduced by stricter adherence to the two engine taxi proposed fuel conservation measure. This analysis does not take into account environmental factors such as snow and ice, however all the squadrons analyzed have been operating from bases where environmental factors are of no major significance (NAS Jacksonville, NAS Bermuda and NAF Sigonella). Figure 4-27 depicts by squadron the percentage of flights that taxi with 2, 3 and 4 engines operating. Table 4-5 summarizes the projected fuel usage by utilizing more than 2 engines for taxi to take-off. The projected savings in Table 4-5 demonstrates the magnitude of the fuel consumed by utilization of 2 engine taxi.

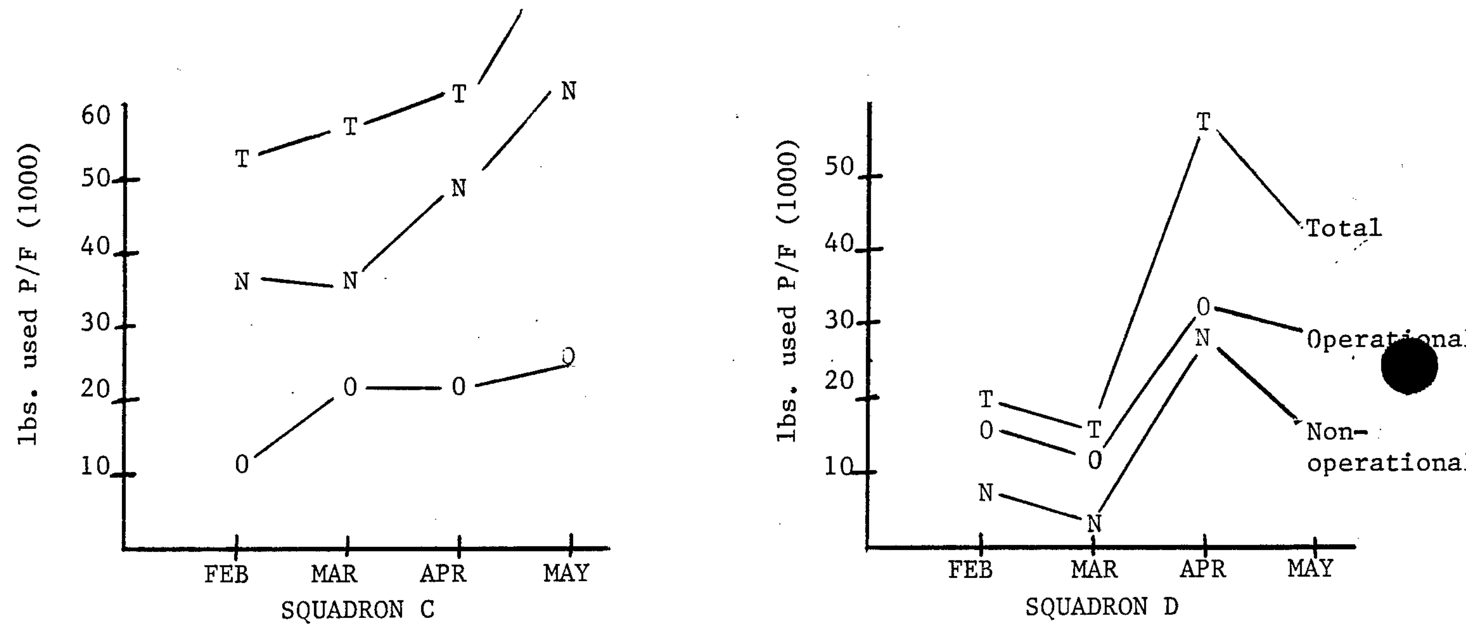
SQUADRON	MONTH	NON-OP/ TOTAL FLIGHTS	PROJECTED LBS FUEL USED NON-OP / OP PREFLIGHT	PROJECTED COST OF NON-OP PREFLIGHTS
A	FEB	32/56	18,920 / 15,876	$ 3,950
	MARCH	53/71	31,950 / 12,869	$ 6,672
	APRIL	36/75	21,600 / 15,120	$ 4,511
	MAY	42/65	23,000 / 17,250	$ 4,803
	TOTAL	163/267	95,470 / 61,115	$19,936
B	FEB	34/57	21,888 / 18,240	$ 4,571
	MARCH	28/62	17,647 / 27,280	$ 3,685
	APRIL	28/53	15,000 / 17,760	$ 3,132
	MAY	39/59	23,100 / 13,500	$ 4,824
	TOTAL	129/231	77,635 / 76,780	$16,212
C	FEB	82/103	37,286 / 14,729	$ 7,786
	MARCH	78/110	35,926 / 20,735	$ 7,502
	APRIL	85/103	48,875 / 20,910	$10,206
	MAY	82/108	60,750 / 24,180	$12,686
	TOTAL	327/424	182,837 / 80,554	$38,180
D	FEB	9/23	6,440 / 14,700	$ 1,345
	MARCH	8/25	4,456 / 13,283	$ 930
	APRIL	46/82	28,700 / 29,766	$ 5,993
	MAY	29/59	16,100 / 27,350	$ 3,362
	TOTAL	92/189	55,696 / 85,099	$11,630
E	FEB	*	*	*
	MARCH	*	*	*
	APRIL	33/51	8,925 / 14,850	$ 1,864
	MAY	56/80	32,400 / 22,320	$ 6,766
	TOTAL	89/131	41,325 / 37,170	8,630

*Squadron not involved in data collection program.

Table 4-3 Projected APU Fuel Consumption During Preflight

*Assumes that squadron provides 50 lbs fuel per hour for GSE





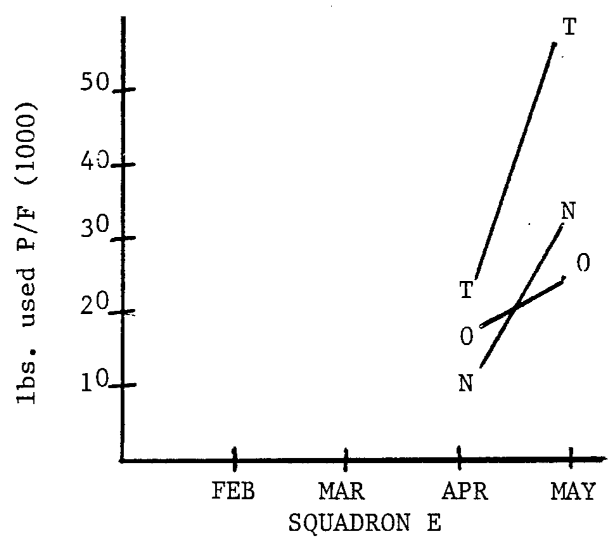
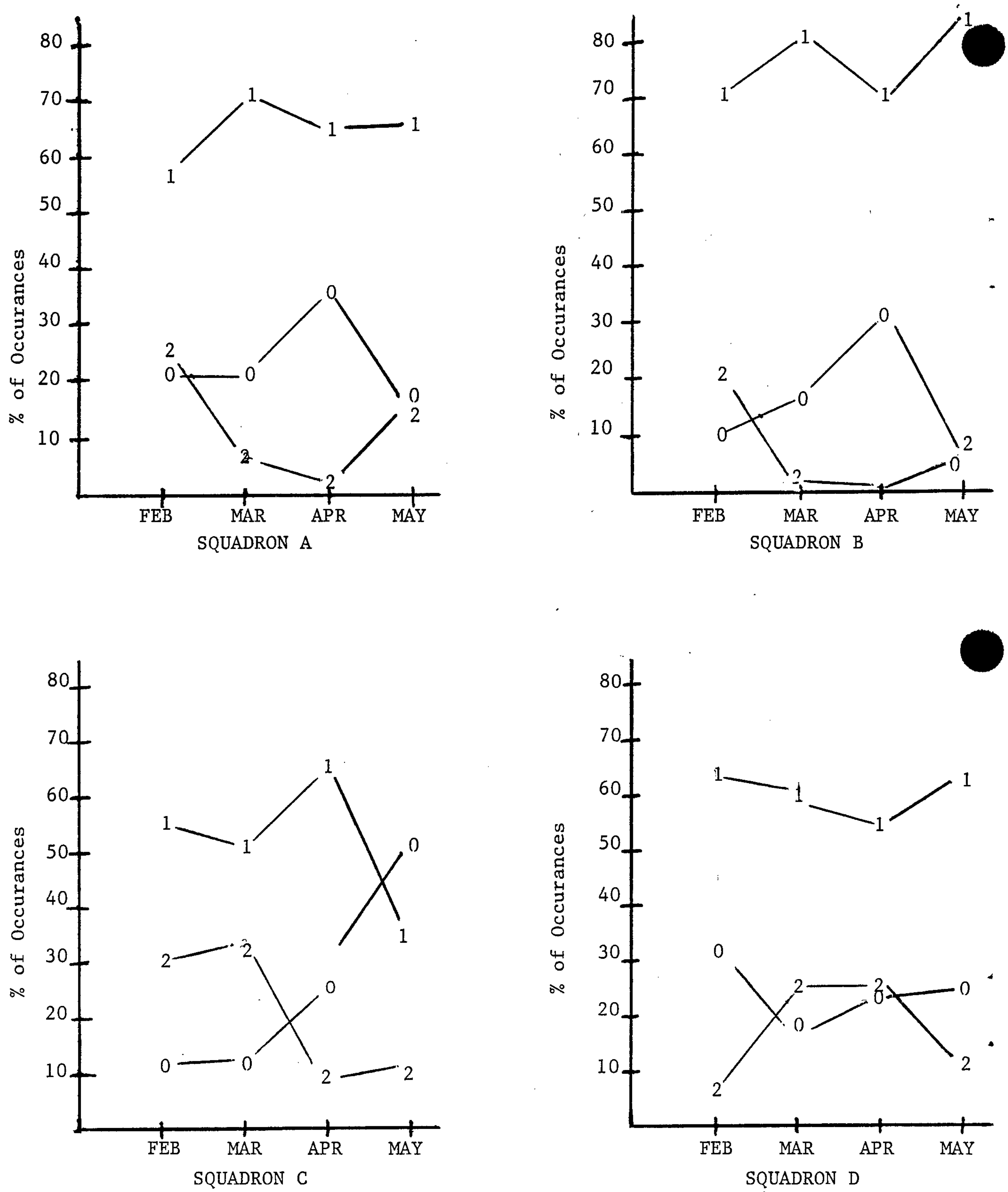


Figure 4-25 Projected Fuel Consumed During Preflight

SQUADRON	FEB			MAR			APR			MAY		
	0 LOITER	1 LOITER	2 LOITER	0 LOITER	1 LOITER	2 LOITER	0 LOITER	1 LOITER	2 LOITER	0 LOITER	1 LOITER	2 LOITER
A	4 20%	11 55%	5 25%	3 20%	11 73%	1 7%	8 35%	15 65%	0 0%	4 17%	15 65%	4 17%
B	2 10%	15 71%	4 19%	6 17%	28 80%	1 3%	6 30%	14 70%	0 0%	1 6%	16 89%	1 6%
C	4 13%	17 55%	10 32%	5 14%	18 51%	12 34%	9 27%	21 64%	3 9%	21 50%	16 38%	5 12%
D	7 32%	14 64%	1 4%	3 17%	11 61%	4 22%	11 22%	29 56%	11 22%	9 24%	24 63%	5 13%
E	-	-	-	-	-	-	1 6%	17 94%	0 0%	3 10%	25 86%	1 4%

Table 4-4 Number of Occurrences and Percentage Engines Loitered on Station (operational flight)

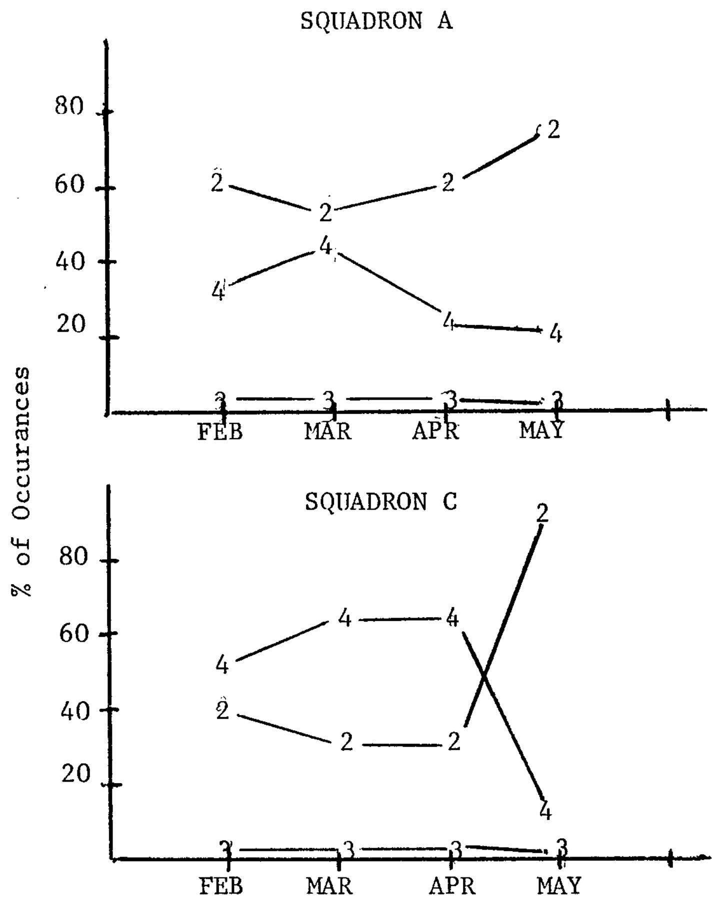


Legend: 0 - no engine loiter
1 - 1 engine loiter
2 - 2 engine loiter

Figure 4-26 On Station Engine Loiter Percentage (operational flight)

SQUADRON	MONTH	AVER. TAXI TIME (MIN)	PROJECTED LBS USED ALL TAXI	PROJECTED LBS USED 2 ENGINE	PROJECTED LBS FUEL USED (EXCESS)	PROJECTED DOLLAR SAVINGS
A	FEB	12	24,960	20,160	4800	$1,002
	MAR	14	38,500	29,820	8680	$1,813
	APR	12	28,200	23,400	4800	$1,002
	MAY	12	29,520	25,200	4320	$ 902
	TOTAL		121,180	98,580	22600	$4,719
B	FEB	11	26,180	18,810	7370	$1,539
	MAR	11	29,700	20,460	9240	$1,930
	APR	12	23,690	19,440	4200	$ 877
	MAY	10	26,800	18,600	8200	$1,712
	TOTAL		106,370	77,310	29010	$6,058
C	FEB	10	34,000	30,900	3100	$ 647
	MAR	10	36,300	33,000	3300	$ 689
	APR	9	27,450	25,920	1530	$ 320
	MAY	9	27,630	25,650	1980	$ 413
	TOTAL		125,380	115,470	9110	$2,069
D	FEB	9	6,480	6,210	270	$ 56
	MAR	7	6,300	5,250	1050	$ 219
	APR	10	28,200	24,600	3600	$ 752
	MAY	7	15,260	12,390	2870	$ 599
	TOTAL		56,240	48,450	7790	$1,626
E	FEB	-	-	-	-	-
	MAR	-	-	-	-	-
	APR	11	21,770	16,830	4940	$1,032
	MAY	7	11,970	2,730	9240	$1,930
	TOTAL		33,740	19,560	14180	$2,962

Table 4-5 Projected Fuel Usage During Taxi



Legend: 2= 2 engine on prior to Taxi
3= 3 engine on prior to Taxi
4= 4 engine on prior to Taxi

Note: desirable to have high 2 engine and low 4 engine

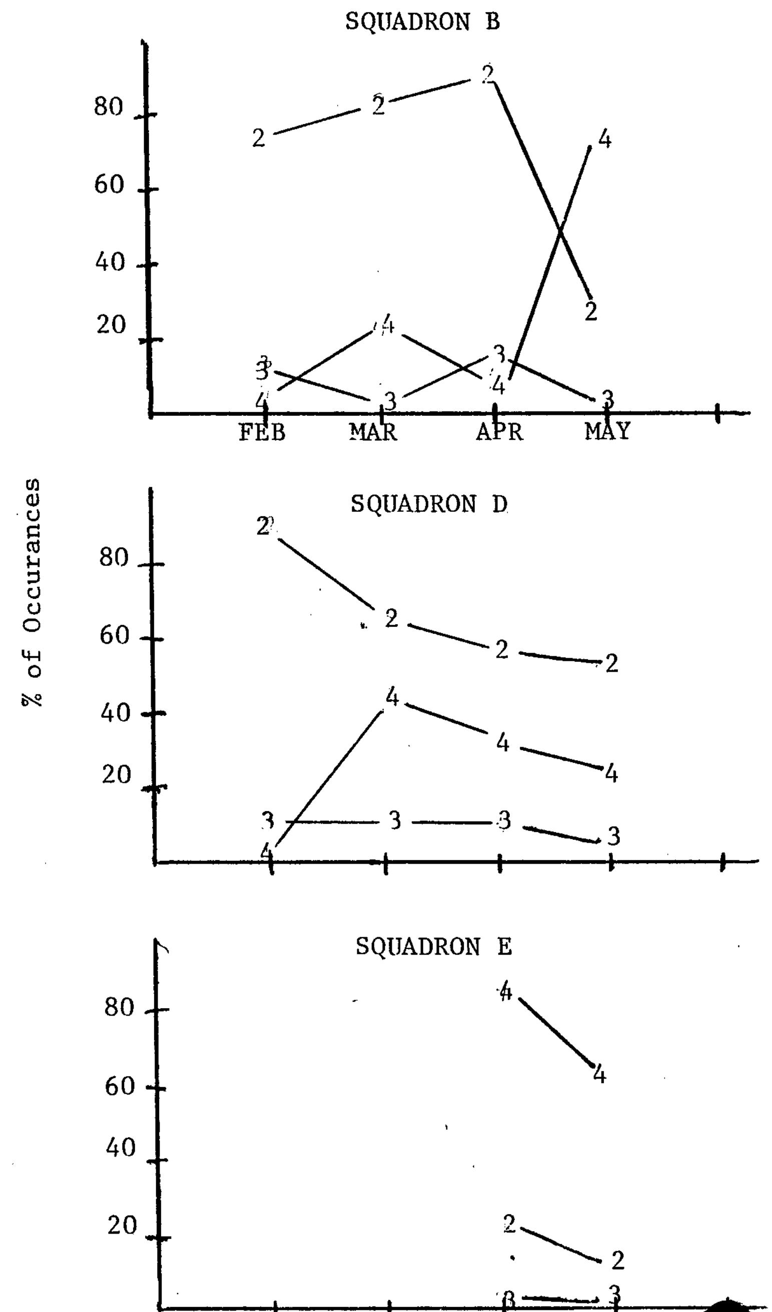


Figure 4-27 Engines on Prior to Taxi

5.0 CONCLUSIONS

1. The assistance of participating squadron and COMPATWING-11 personnel continues to be exceptional. This is exemplified by the continuous increase of data cards received over the reporting period.

2. Fuel Freighting (Figures 4-1 through 4-19) still appears to be a problem area and causing high fuel consumption. No consistent trends of reduction of excess fuel loads have been established. The following summarizes the average excessive freighted fuel (lbs) per flight per squadron over this reporting period.

SQUADRON/MONTH	FEB	MARCH	APRIL	MAY	AVER
A	5200	5500	4800	6800	5600
B	4100 *	6700	5500	4900	5300
C	3000	2900	3500	3500	3300
D	3400 *	2100 *	3400 *	3800 *	3200
E	-	-	4300	4000	4200

* Squadron On Deployment

3. As reported in previous Quarterly Reports, the greater portion of flights which carry excess fuel appears to still be those flights of 5 hour planned flight time or less. Probable causes of this excess fueling include excessive ramp load requirements, scheduling flights (primarily training) for larger duration than needed, potential airborne maintenance problems on aircraft assigned training missions, and fueling multiple stop cross-countries with fuel for final destination and not intermediate stops.

4. Fuel flow by mission phase for all missions (Table 4-2 and Figure 4-24) demonstrate trends in the fuel flow of the mission. However, it continues that the fuel flow during the cruise in mission phase is higher than cruise out. Investigation into this area should continue.

5. Utilization of GSE during preflight of all non-operational flights (FAM, XCTY, OTHER) could result in a substantial amount of fuel savings as depicted in Table 4-3 and Figure 4-25. This analysis assumes adequate availability of GSE.

6. Aircrews are relizing the fuel savings potential gained by flying 3 engine loiter as depicted by percentage of operational flights that do shut down at least one engine while on station. (Table 4-4 and Figure 4-26).

7. Fuel savings potentials obtained by taxi on two engines can be improved as depicted in Table 4-5 and Figure 4-27. More fuel can be saved, and a resultant decrease in cost per flight hour, by crews who use two engine taxi.

6.0 RECOMMENDATIONS

1. All participants in the VP Fuel Conservation Experiment should be commended for their diligence and willingness to partake in the experiment. The quality and quantity of data cards has improved for all squadrons during this reporting period. The continuous interest shown by these participants demonstrates a concern for fuel conservation and their interest to evaluate their own proficiency.

2. A detailed investigation of time required to perform various training evolutions, standard ramp loads, aircraft availability and cross-country fuel loading requirements should be conducted to reduce the fuel freighting and actual vs. planned flight time deviation variations.

3. The cruise-in fuel flow should be investigated at the squadron level in an effort to determine why it is continuously higher than the cruise-out fuel flow.

4. Maximize the use of GSE for all non-operational preflights as a fuel conservation method and investigate at the wing and base level the potential for obtaining adequate GSE to support non-operational flights.

5. Re-emphasize at the squadron level the utilization of 2 engine loiter while on station weather and time permitting.

6. Stress the fuel savings attainable by maximizing two engine taxi to the runway when weather and operational constraints permit.

REFERENCES

1. NAVAIRDEVCEN Technical Memorandum 31-81, "VP Fuel Conservation Quarterly Repot (June-August 1981), D. Bellis, G. Katz, A. McCarty, 30 September 1981.

2. NAVAIRDEVCEN Report No. NADC-81319-20, "Vp Fuel Conservation Report (May-October 1981 Data), D. Bellis, G. Katz, A. McCarty, Interim Report, 31 December 1981.

3. NAVAIRDEVCEN Technical Memorandum 9-82, "VP Fuel Conservation Quarterly Report (November 1981-January 1982) Supplement", G. Katz, A. McCarty, 30 March 1982.

4. COMPATWING ELEVEN OPSMEMO 7-81, "Fuel Conservation Conference, Report Of", 03 April 1981.