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Rocketdyne Division
Rockwell International

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9 April 1974

SPACE SHUTTLE
ORBIT MANEUVERING ENGINE
REUSABLE THRUST CHAMBER PROGRAM

NAS9-12802

TASK XII DATA DUMP
OME INTEGRATED THRUST CHAMBER
TEST REPORT

ROCKETDYNE DIVISION OF ROCKWELL INTERNATIONAL
6633 CANOGA AVENUE, CANOGA PARK, CALIFORNIA 91304

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TASK XII DATA DUMP (PHASE I)
OME INTEGRATED THRUST CHAMBER
TEST REPORT

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CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

The Orbit Maneuvering Engine of the Space Shuttle will use a regeneratively cooled thrust chamber. Present plans call for using MMH as the fuel and coolant for the engine with NTO as the oxidizer. Under Tasks I and II of Contract NAS9-12802, Rocketdyne investigated, analytically, several thrust chamber cooling concepts and fuel coolants. Using the criteria of performance, reliability, safety, maintainability, cost, and development risk, Rocketdyne concluded that the regeneratively cooled chamber using amine fuel was a superior combination.

Under Task IV of the contract, Rocketdyne fabricated a regeneratively cooled, electroformed thrust chamber. The chamber simulated flight type hardware in all areas except the inlet and outlet manifold configurations, which were designed for test flexibility and low cost. The thrust chamber was tested with two like-doublet element injectors in Tasks V and VIII, and the results reported in Data Dump ASR73-349. The thrust chamber assembly demonstrated safe, stable operation over a wide range of operating conditions at a moderately high performance level.

Under Task X of the contract, an integrated thrust chamber was fabricated which simulated the injector-end configuration of a flight type thrust chamber assembly. This report describes the test program conducted to characterize the steady state stability, thermal, and performance characteristics of the integrated thrust chamber assembly, as well as limited tests to investigate transient characteristics. Additional tests to be performed on the engine to establish duty cycle constraints will be published under separate cover.

SUMMARY

A total of 40 tests were conducted on the integrated thrust chamber with the like-doublet No. 1 injector and 72:1 area ratio solid nozzle. The total duration accumulated during these tests was 445 seconds.

Vacuum specific impulse was 310 seconds at nominal conditions, with a 14.7 inch combustor and 2.7 percent auxiliary film coolant, which is in agreement with data obtained using the same injector in the demonstrator thrust chamber on the previous test progtam at WSTF. Performance was relatively insensitive to either saturation or temperature conditions of the propellants at the thrust chamber inlet. Performance (I_s) increased 1½ seconds when chamber pressure was increased 25 psia, and decreased 2½ seconds when chamber pressure was decreased 25 psia. The total performance variation was 5 seconds over the entire OME operating range of mixture ratio (1.45 to 1.85) and chamber pressure (110 to 140 psia).

The heat loads measured were approximately 11 percent higher than the loads measured on the demonstrator thrust chamber. However, even at these higher heat loads, the minimum safety factor was 2.4. The heat load was not significantly affected by propellant saturation or inlet temperature. The fuel injection temperature reached equilibrium in approximately 30 seconds.

Four rows of backwall temperatures were measured on the regeneratively cooled chamber. The maximum circumferential variation occurred near the injector end. The variation at this location at most severe conditions was ±20 F above the average value.

Three different valve sequences were employed resulting in oxidizer injection leads ranging from 55 to 380 msec. The thrust overshoot correlation, although weak, implied that minimum overshoots, of approximately 50 percent, would result with oxidizer injection leads of 150-250 msec. The accelerometer loads at start were less than 20 'g' except on first tests of each series where loads as high as 43 'g' were recorded.

Thirty minute soakout tests were performed after three of the test series. Two of the soakout tests were preceded by one second purges to blow most of the propellants out of the chamber in an attempt to simulate a zero 'g' condition. Maximum wall temperatures in the regeneratively cooled thrust chamber occurred near the injector-end at approximately 3 seconds after shutdown and were less than 300 F. Pressure and temperature transients indicated that the fuel downstream of the valve was depleted in approximately 30-60 seconds.

The thrust chamber assembly was stable at all conditions tested (although no bomb tests were made during this program). No instances of high or low frequency instability occurred, even though thrust overshoots in excess of 100 percent above nominal were sometimes encountered, which tend to trigger combustion instability. The thrust chamber experienced very light erosion on the acoustic cavity dams, but was otherwise in excellent condition. The injector was dye penetrant inspected and showed no signs of damage. The assembly was prepared for another test program at WSTF.

TEST HARDWARE

The hardware used for the test program consisted of a regeneratively cooled thrust chamber, a full size radiation cooled nozzle, and a like doublet injector. The injector and chamber were designed to closely simulate the thermal and dynamic characteristics of flight type hardware. All components were bolted together and sealed with either metallic or elastomeric O-rings, as appropriate.

A drawing of the thrust chamber assembly is shown in Fig. 1. Table 1 provides a summary of the regenerative cooled chamber design characteristics. The combustion chamber has a length of 14.7 inches and a contraction ratio of 2:1 with a throat diameter of 5.820. The expansion area ratio of the regeneratively cooled nozzle is 7:1. The inner wall and the lands of the chamber are 321 CRES, and the channels are closed out with electroformed nickel. The thrust chamber was designed for the heat flux profile shown in Fig. 2. Channel sizes are such that the minimum safety factor is approximately 1.5 at the most severe off design conditions, namely, the fuel inlet temperature of 100 F, the chamber pressure of 120 psia, and a propellant mixture ratio of 1.85. The coolant jacket itself is flight-weight with nickel closeout thicknesses as thin as 0.025 inches at the throat. The fuel inlet manifold is a heavy weight configuration to reduce cost, but simulates flight manifold volume. The coolant outlet manifold is more critical thermally and represents a typical flight design. The completed regeneratively cooled thrust chamber is shown in Fig. 3. The thrust chamber was extensively instrumented to measure outside wall temperatures as shown in Fig. 1.

The injector used was a like doublet (L/D No. 1), which had 186 elements arranged in nine rows. Oxidizer orifice diameters ranged from 0.032 to 0.038 inches, while fuel orifice diameters ranged from 0.028 to 0.033 inches. The injector included 68 orifices (0.020 inch diameter) to provide boundary layer coolant amounting to 2.7 percent of the total propellant flow at nominal mixture ratio. Injector characteristics are summarized in Table 2.

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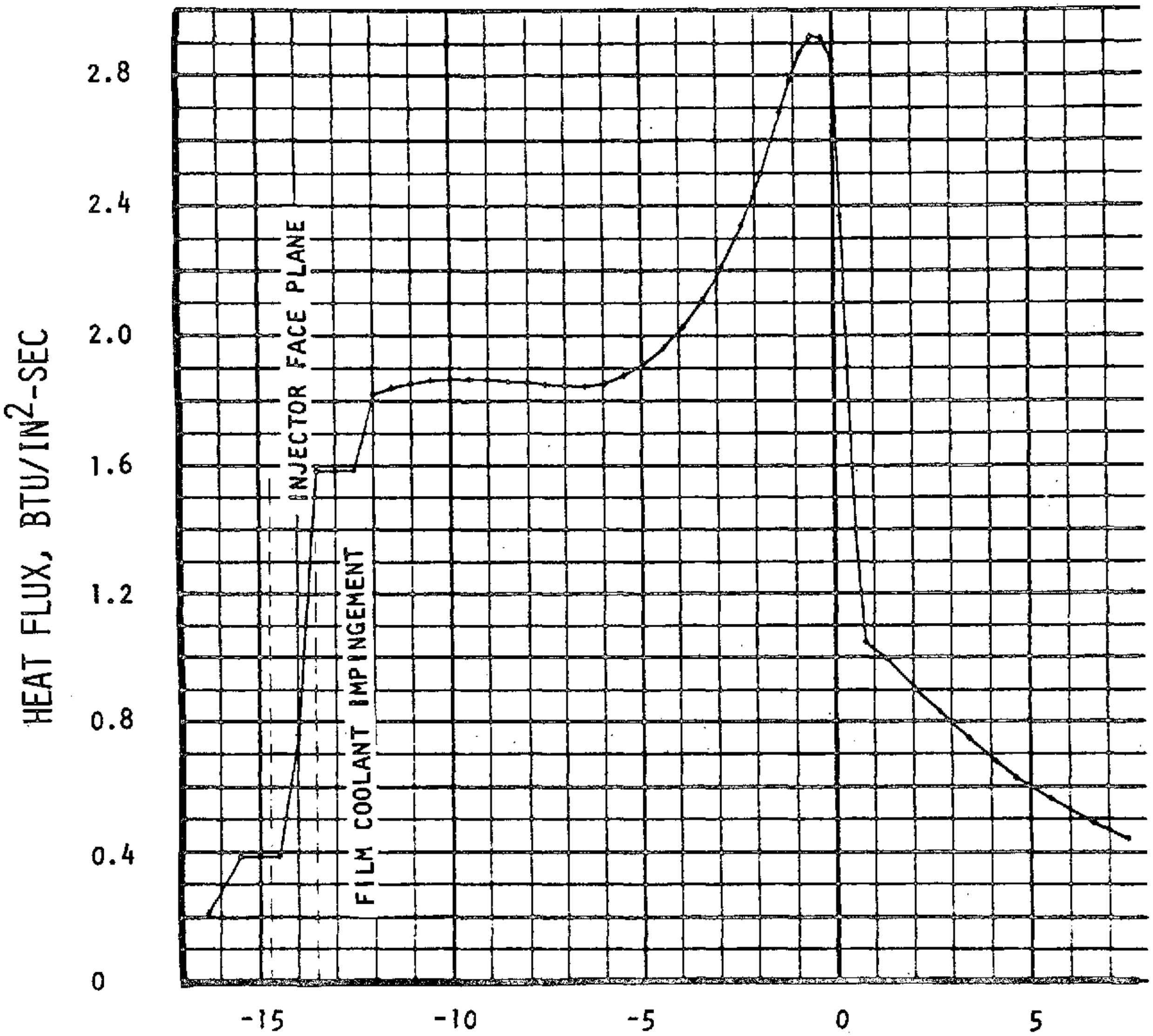
TABLE 1. Demonstrator Thrust Chamber Design Characteristics

COMBUSTOR	
Contraction Ratio	2:1
Length, in	14.7
Contour	Tapered from 7 in. upstream of throat
NOZZLE	
Regen Section Expansion Ratio	to 7:1
Nozzle Extension Expansion Ratio	7:1 to 72:1
Contour	Flight parabolic
COOLANT	
Circuit	Counterflow
Number of Regen Coolant Channels	120
Coolant Pressure Drop, psid	15
Coolant Bulk Temperature,Rise, F	178
Auxiliary Film Coolant	2.7% Total Propellant
Channel Dimensions at throat, inches	
Width, inches 0.114	
Height, inches 0.068	
Channel Dimensions near injector, inches	
Width, inches 0.114	
Length, inches 0.042	
MATERIALS	
Hot Wall (0.030 in.) and Lands	CRES 321
Cold Wall (0.030 in.)	Electroformed Nickel
Nozzle Extension	CRES

INTEGRATED THRUST CHAMBER HEAT FLUX PROFILE



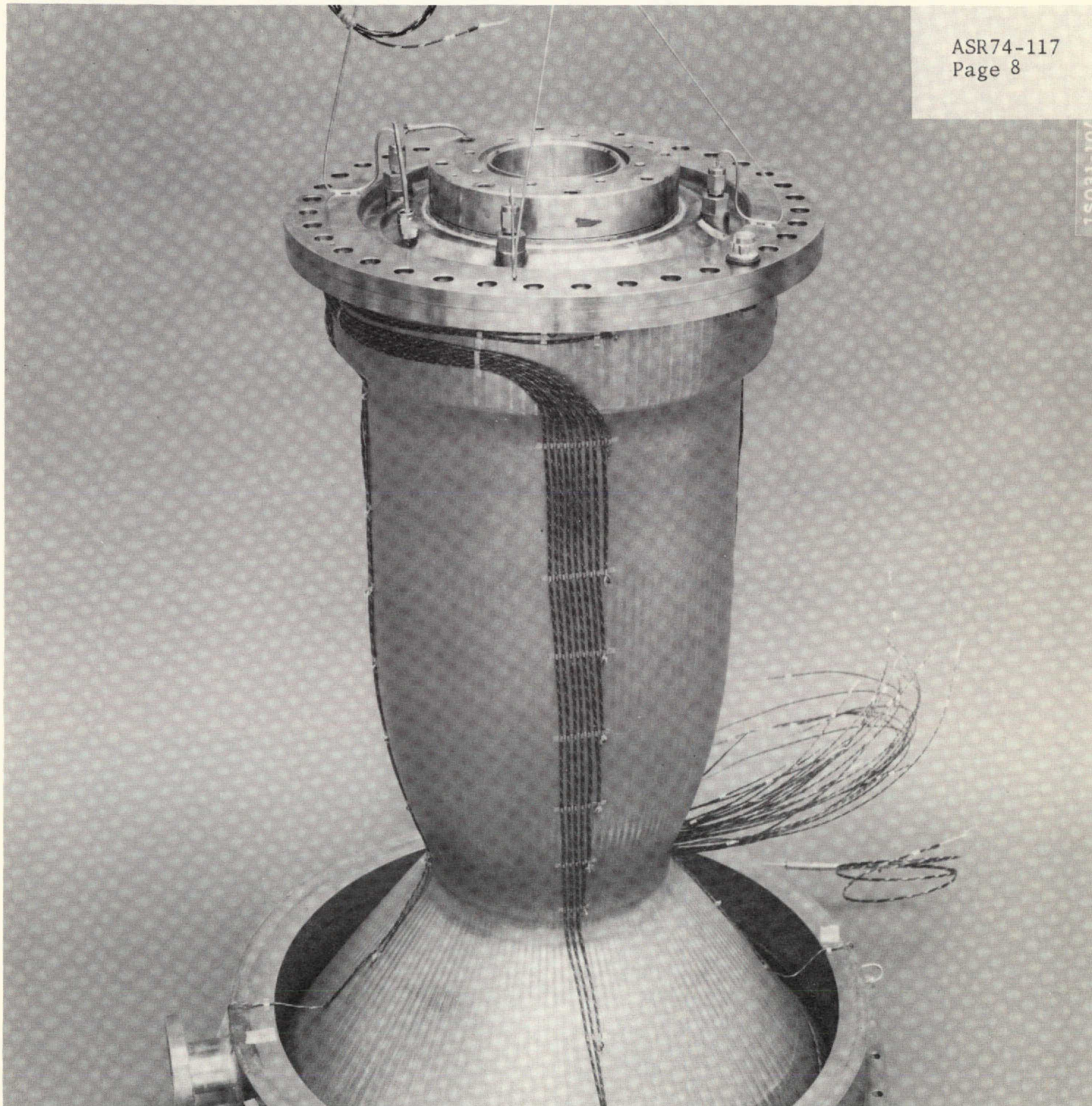


Fig. 3. Regeneratively Cooled Thrust Chamber

TABLE 2. Injector L/D No. 1 Characteristics

Diameter, in.	8.200
Number of Elements	186
Number of Rows	9
Type of Elements	Like Doublet
Oxidizer Element Diameter, in. (minimum/maximum)	0.032/ 0.038
Fuel Element Diameter, in. (minimum/maximum)	0.028/ 0.033
Pressure Drop @ Nominal Flows	
Oxidizer, psi	56
Fuel, psi	62
Number of Acoustic Cavities*	8/4
Mode Suppression	1st & 3rd Tangential, 1st Radial

*Cavities formed by chamber and injector

A flight contour radiation nozzle was used to eliminate the requirement for an analytical correction of performance measured with a nozzle having a contour other than that of a full nozzle.

TEST FACILITY

The thrust chamber assembly was tested at the NASA White Sands Test Facility at Las Cruces, New Mexico. The installation is shown schematically in Fig. 4. Figure 5 is a photograph of the installation in the White Sands Test Facility. The ducting around the solid nozzle was used for cooling between tests. Facility pressure drops under rated flow conditions were 55 psi for the oxidizer side, and 35 psi for the fuel side. Propellant tank capacities were 2000 gallons for both the fuel and oxidizer. Propellant tank pressures were limited to 372 psia on the oxidizer and fuel sides. The altitude ejector system was able to pump the capsule down to a pressure of 0.06 to 0.07 psia, equivalent to an altitude in excess of 100,000 feet.

Thrust measurements were made using a multi-axis measuring system with three axial dual bridge load cells for recording the main thrust. A complete list of facility and engine instrumentation is given in Tables 3 and 4, respectively.

The test operation at WSTF was initiated with a vacuum pump evacuation of test stand 401. This operation was performed about 2-3 hours prior to the actual test operation. The engine test stand was then readied for operation by pressurizing the propellant tanks to the required run pressures and assuring that the engine stand and the engine instrumentation were in readiness for the test. With this assurance that the engine was ready for testing, the hyperflow gas generator system was started and brought up to full operation. At this time, the altitude capsule isolation valve was opened to permit the hyperflow action to pump down the altitude cell to the final run pressure. The cell pressure was continuously monitored, and when it reached 0.1 psia, engine test activity commenced. The first event, at sequence time equals zero, was activation of the"fire switch". At this time, the electrical signal was simultaneously applied to both fuel and oxidizer main propellant valves. Valve sequencing was varied to a limited extent, by orificing the pneumatic valve which controlled the fuel valve.

FACILITY AND INSTRUMENTATION SCHEMATIC

Regeneratively Cooled Engine
with BLC

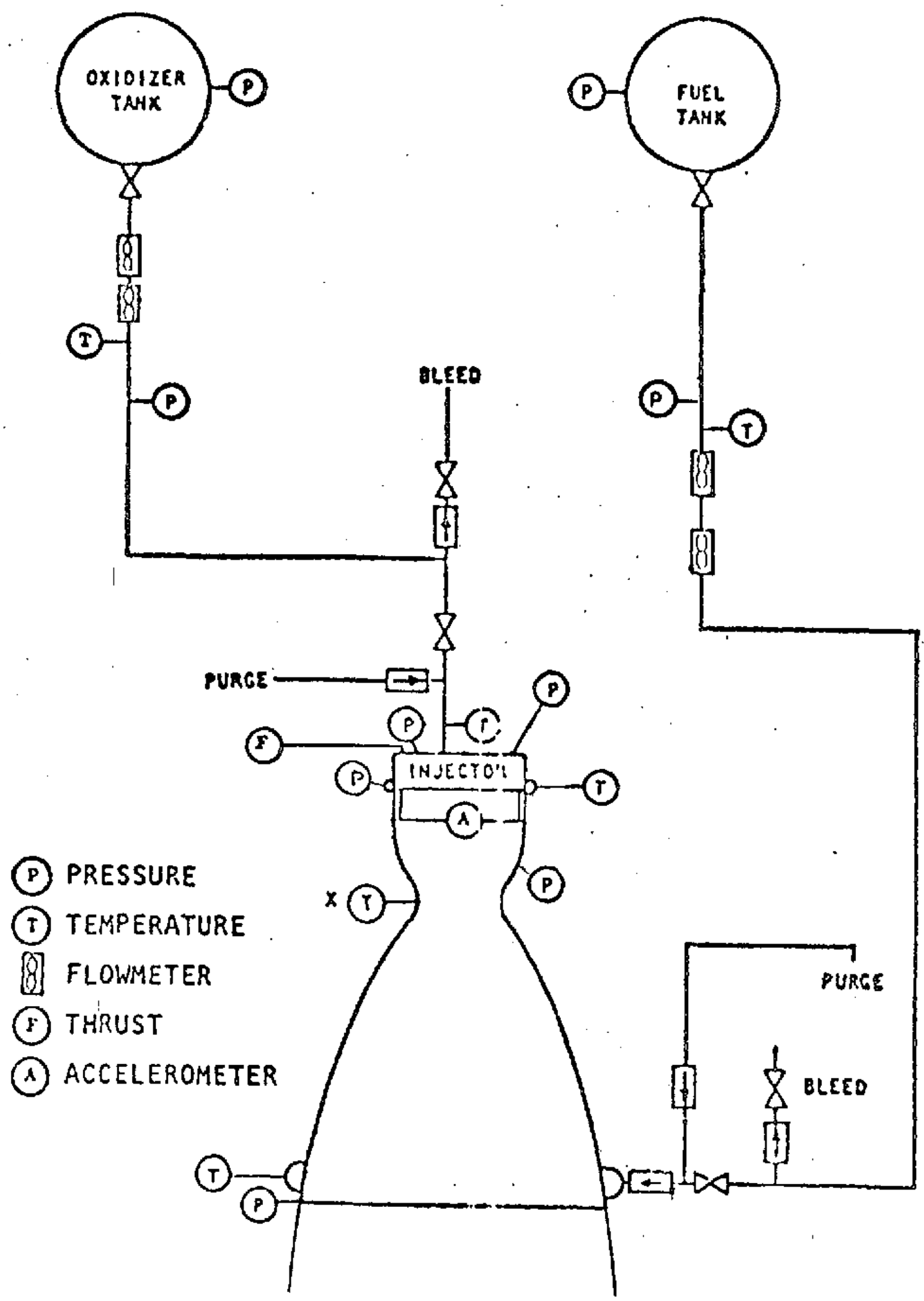


Figure 4

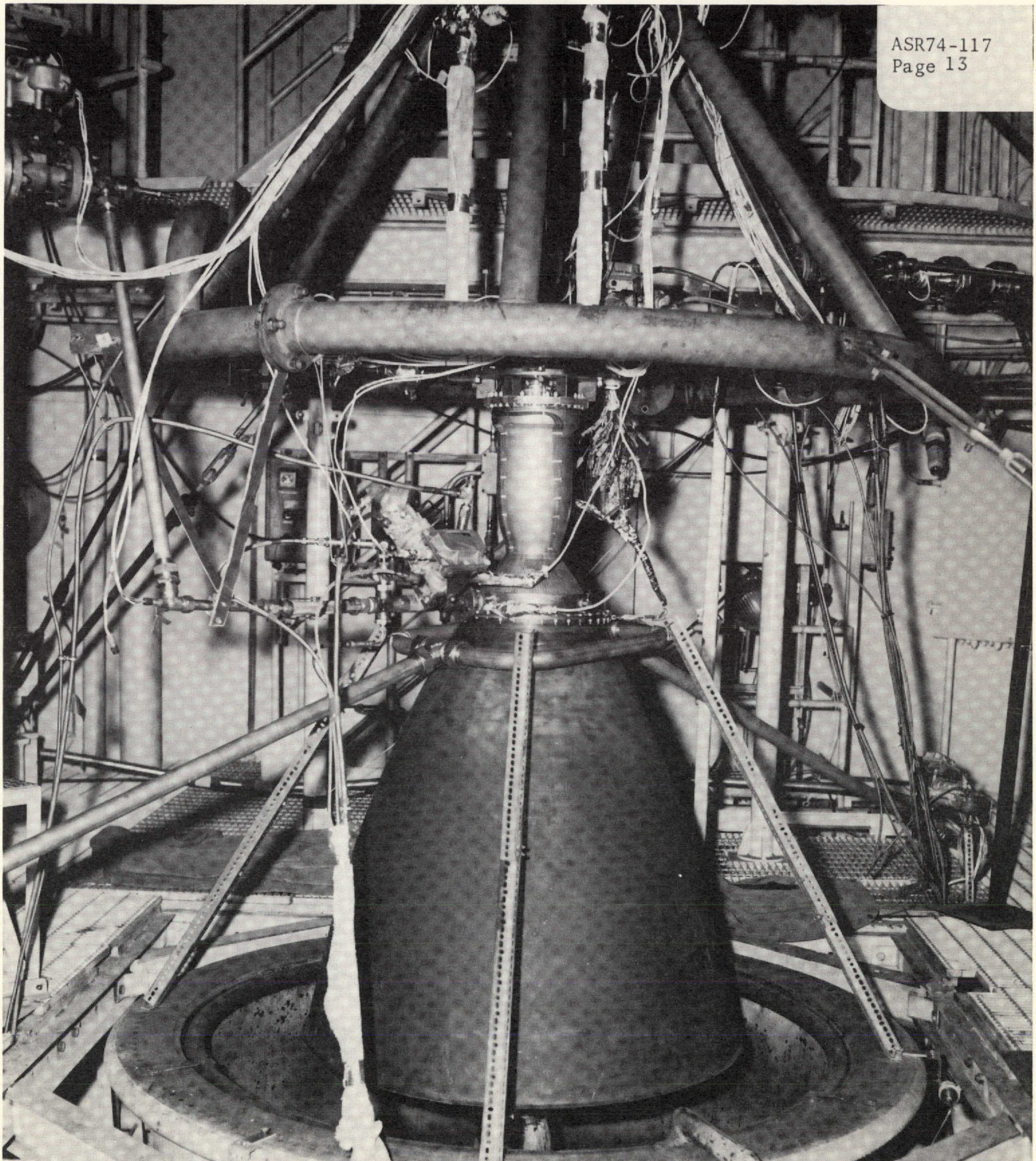


Fig. 5. Integrated Thrust Chamber
Installed at WSTF

TABLE 3

TEST INSTRUMENTATION

PARAMETER	UNITS	RANGE NOM	RANGE MAX	PRECISION	RECORDER DIGR	RECORDER OSC	RECORDER STRIP	RECORDER DIGIT	EST. RESPONS (CPS)
THRUST	LB	5100	6000	1/2	X				250
CHAMBER PRESSURE (2 EA)	PSI	125	150	1/2	X	X		X	90
OXID. INLET PRESSURE	PSI	175	225	1/2	X	X		X	90
OXID. P/V INLET PRESS	PSI	175	225	1/2	X			X	100
FUEL INLET PRESSURE	PSI	175	225	1/2	X	X		X	100
FUEL P/V INLET PRESS	PSI	175	225	1/2	X			X	100
BLC INLET PRESSURE	PSI	175	225	1/2	X	X		X	90
COOLANT INLET PRESS	PSI	200	250	1/2	X	X		X	50
COOLANT OUTLET PRESS	PSI	175	225	1/2	X	X		X	100
OXID. TANK PRESSURE	PSI	225	300	1/2	X			X	100
FUEL TANK PRESSURE	PSI	225	300	1/2	X			X	100
OXID. FLOW RATE (2 EA)	LB/SEC	11.97	14.2	1/2		X		X	
FUEL FLOW RATE									
INJECTOR (2 EA)	LB/SEC	7.2	9.0	1/2		X		X	
OXID. TEMPERATURE F/M	°F	80	100	3F	X			X	
OXID. TEMPERATURE INLET	°F	80	100	3F	X			X	
FUEL TEMPERATURE F/M	°F	80	100	3F	X			X	
FUEL TEMPERATURE INLET	°F	200	250	3F	X			X	
BLC TEMPERATURE	°F	200	250	3F	X			X	
COOLANT TEMPERATURE INLET	°F	70	150	3F	X			X	
COOLANT TEMPERATURE OUTLET	°F	200	250	3F	X			X	
CHAMBER WALL TEMPERATURES									
(SEE TABLE VII CHROMEL ALUMEL)	°F			20F	X			X	
OXID. VALVE TIMING						X	X		
FUEL VALVE TIMING						X	X		
ALTITUDE CAPSULE PRESSURE (2)	PSIA	.5	2.0	1	X			X	
ACCUMULATOR FUEL TEMP.	°F	200	275	3F	X			X	

NOTE: These values are steady-state range values only and do not take into account start transients.

TABLE 4

ENGINE INSTRUMENTATION LIST

(See Fig. 1 for Instrumentation Location on Engine)

	Temperature	Location Degrees	Recorder Range
TFBIN	Fuel Temp - Inlet Manifold Entrance*	@270	32-150F
TFB-1	Fuel Temp - T/C Outlet Manifold	@0	32-300F
TFB-2	Fuel Temp - T/C Outlet Manifold	@30	32-300F
TFB-3	Fuel Temp - T/C Outlet Manifold	@120	32-300F
TFB-4	Fuel Temp - T/C Inlet Manifold	@300	32-150F
TFB-5	Fuel Temp - T/C Inlet Manifold	@255	32-150F
TFB-6	Fuel Temp - T/C Inlet Manifild	@90	32-150F
T8	Ni Back Wall Temp @ STA-10.0	@0	32-500F
T9	Ni Back Wall Temp @ STA-10.0	@90	32-500F
T10	Ni Back Wall Temp @STA-10.0	@180	32-500F
T11	Ni Back Wall Temp @STA-10.0	@270	32-500F
T12	Ni Back Wall Temp @STA-6.0	@0	32-500F
T13	Ni Back Wall Temp @ STA-6.0	@180	32-500F
T14	Ni Back Wall Temp @ STA-.30	@0	32-500F
T15	Ni Back Wall Temp @ STA-.30	@180	32-500F
T16	Ni Back Wall Temp @STA +3.0	@0	32-500F
T17	Ni Back Wall Temp @ STA+3.0	@180	32-500F
T18	Skin Temp - T/C Inlet Manifold	@0	32-500F
T19	Skin Temp - T/C Inlet Manifold	@180	32-500F
T20	Nozzle Flange - T/C Side	@0	32-1000F
T21	Nozzle Clamp Ring	@0	32-1000F
T22	Nozzle Back Wall @ STA+8.3	@0	32-2500F
T23	Nozzle Back Wall @ STA+8.3	@90	32-2500F
T24	Nozzle Back Wall @ STA+8.3	@180	32-2500F
T25	Nozzle Back Wall @STA+8.3	@270	32-2500F
T26	Nozzle Back Wall @STA+9.0	@0	32-2500F
T27	Nozzle Back Wall @STA+9.0	@90	32-2500F
T28	Nozzle Back Wall @STA+9.0	@180	32-2500F
T29	Nozzle Back Wall @STA+9.0	@270	32-2500F
T30	Nozzle Flange - T/C Side	@180	32-1000F
T31	Nozzle Clamp Ring	@180	32-1000F
T32	Skin Temp - Nozzle Web	@90	32-2500F
T33	Skin Temp - Nozzle Web	@270	32-2500F
T34	Nickel Back Wall @STA+3.0	@90	32-500F
T35	Nickel Back Wall @STA+3.0	@270	32-500F
T36	Nickel Back Wall @STA-0.3	@90	32-500F
T37	Nickel Back Wall @STA-0.3	@270	32-500F
T38	Nickel Back Wall @STA-2.0	@0	32-500F
T39	Nickel Back Wall @STA-2.0	@90	32-500F
T40	Nickel Back Wall @STA-2.0	@180	32-500F

Table 4 (Continued)

	Temperature	Location Degrees	Recorder Range
T41	Nickel Back Wall @STA-2.0	@270	32-500F
T48	Nickel Back Wall @STA-4.0	@0	32-500F
T49	Nickel Back Wall @STA-4.0	@90	32-500F
T50	Nickel Back Wall @STA-4.0	@180	32-500F
T51	Nickel Back Wall @STA-4.0	@270	32-500F
T46	Nickel Back Wall @STA-6.0	@90	32-500F
T47	Nickel Back Wall @STA-6.0	@270	32-500F
T42	Nickel Back Wall @STA-8.0	@0	32-500F
T43	Nickel Back Wall @STA-8.0	@90	32-500F
T44	Nickel Back Wall @STA-8.0	@180	32-500F
T45	Nickel Back Wall @STA-8.0	@270	32-500F
T52	Nickel Back Wall @STA-13.0	@0	32-500F
T53	Nickel Back Wall @STA-13.0	@90	32-500F
T54	Nickel Back Wall @STA-13.0	@180	32-500F
T55	Nickel Back Wall @STA-13.0	@270	32-500F
T56	Nickel Back Wall @STA-16.0	@0	32-500F
T57	Nickel Back Wall @STA-16.0	@15	32-500F
T58	Nickel Back Wall @STA-16.0	@75	32-500F
T59	Nickel Back Wall @STA-16.0	@135	32-500F
T60	Nickel Back Wall @STA-16.0	@180	32-500F
T61	Nickel Back Wall @STA-16.0	@195	32-500F
T62	Nickel Back Wall @STA-16.0	@255	32-500F
T63	Nickel Back Wall @STA-16.0	@315	32-500F
	Pressure		
PC-1	Chamber Pressure	@75	
PC-2	Chamber Pressure	@165	
PO-1	Oxidizer Inlet Pressure, Injector		
PF-11	Fuel Pr essure - T/C Outlet Manifold	@255	
PF-12	Fuel Pressure - T/C Inlet	@210	
PFIN	Fuel Pressure - Inlet Manifold Entrance	@270	
Acc-1	Acelerometer - Axial		
Acc-2	Accelerometer - Axial		

Note: 0 degrees reference plane located 90 degrees clockwise from inlet manifold looking aft. Locations noted are clockwise from 0 degrees reference plane. STA location (±) from throat with aft (+).

* Measurement adapter at inlet manifold flange supplied by WSTF

Following each test, the engine was purged with gaseous nitrogen. At 5 seconds after shutdown, the oxidizer side purge was turned on to empty the oxidizer side of the injector. The, 5 seconds later, the fuel side purge was activated to clear residual fuel from the thrust chamber coolant passages and from the injector manifold. Then the two purges were alternately cycled on and off at 5-second intervals until no propellant vapors could be seen, usually about 20 to 25 seconds after test shutdown. During this purge cycle, the propellant tank pressures were reset to the predetermined levels for the next test. The time required for each test was between 30 and 120 seconds depending upon the extent of the pressure changes. Following the last test of a sequence, the engine was purged as before, except after series 3, when no purging was done and series 4 and 5, when a one-second purge was accomplished prior to 30-mintue vacuum soaks. The engine was purged for personnel safety after tne vacuum soaks.

TEST PROGRAMS AND RESULTS

The objectives of the test program were three-fold: 1) to evaluate performance, heat flux and operating characteristics of the OME thrust chamber assembly over the entire anticipated rangeof OMS operating conditions; 2) to provide a preliminary estimate of start characteristics of an OME thrust chamber which has been shut down after achieving thermal equilibrium conditions.

TEST PROGRAMS

To accomplish these objectives, the tests were broken down into groups of tests called test sequences, having specific detailed objectives. The first sequence consisted of three tests of increasing duration and mixed ratio. The objective of this first test series was to check out the engine facility and instrumentation. The objective of the second test series was to determine tne engine operating characteristics with ambient temperature unsaturated propellants. A relatively long oxidizer lead was used for these ten tests.

Sequence 3 consisted of ten tests conducted with ambient temperature propellants saturated with helium at 225 psia. A 30-minute vacuum soak was conducted after the last test in this series. Sequence 4 was conducted with unsaturated propellants heated to 100 F. A vacuum soak was again accomplished after the last of the ten tests in this sequence. The fifth and final sequence consisted of four tests with unsaturated ambient temperature propellants. The highest and lowest anticipated thrust levels were tested during this sequence. A vacuum soak was accomplished after the first test of this sequence. The test conditions are summarized in Table 5. A total of 40 starts and 445 seconds duration were accumulated.

The test program was conducted without any major difficulties. Minor difficulties arose during the second test series, when the extended oxidizer lead programmed on that series resulted in triggering a safety device which shut the engine down for failure to establish full chamber pressure within specified time increment. The time increment was reset commensurate with

TABLE 5

TEST PROGRAM SUMMARY

Sequence	No. of Tests*	Max. Duration Sec	Pc Range psia	O/F Range	Propellant Temp.	Propellant Condition	Oxid. Valve Lead	Post Sequence Soak
1	3	10	116-117	1.37 - 1.47	Ambient	Unsat.	Short	No
2	12	10	111-142	1.47 - 1.87	Ambient	Unsat.	Long	No
3	10	10	110-140	1.44 - 1.87	Ambient	Saturated	Intermed.	Yes
4	10	10	109-138	1.44 - 1.87	100 F	Unsat.	Intermed.	Yes
5	5	44	100-151	1.64 - 1.66	Ambient	Unsat.	Intermed.	Yes

*Includes short-duration tests with premature shutdowns (3).

the valve lead and testing proceeded. Also during the fifth test sequence, failure to reset the low-chamber-pressure safety device resulted in a premature shutdown on the test programmed for a low-chamber pressure. Again, the device was reset and testing proceeded. All steady state data appeared to be valid. However, the engine ports for measuring the fuel and oxidizer injection pressures were undersized so that the transient data obtained for these measurements is of limited value.

After the test program, the thrust chamber and injector were disassembled and inspected and found to be in good condition. The injector was dye penetrant checked to verify the structural integrity of the ring/land welds. The thrust chamber was water flowed and the emerging streams observed to provide a visual estimation of uniformity of flow feed. The flow appeared approximately uniform with a bias of approximately 5 to 10 percent higher flow in the area opposite the coolant inlet manifold. (This agreen with the circumferential variation in coolant outlet temperature observed in hot firing data.) The acoustic cavity dams were very slightly eroded at a level corresponding to just downstream of the injector face. Although the chamber was useable without modification, the eroded portions of the dams were machined clean in order to reduce the probability of future erosion and to provide a surface upon which further erosion would be more clearly visible if it occurred.

THRUST CHAMBER PERFORMANCE CHARACTERISTICS

The thrust chamber performance characteristics and operating parameters are summarized in Table 6. More detailed data are presented in Appendix A. The variation of specific impulse with chamber pressure and mixture ratio is shown in Fig. 5 for both saturated and unsaturated propellants. Performance peaks at a mixture ratio of approximately 1.8 and increases with chamber pressure. Data from the first 10-second test of each series is not presented on this plot as the performance tended to be lower than that measured on the last (repeat) test of each series. Although not as drastic as was the difference with the demonstrator thrust chamber, the lower performance is attributed to the hardware not reaching completely steady-state temperatures during the first test. The data from the first test of Series 5, which was a 44-second duration test at nominal conditions, is presented in the figure and shows good agreement with data from other tests.

The data curve from the demonstrator thrust chamber series is shown and indicates 1 to 2 seconds lower performance at the higher mixture ratios. This curve represents data taken mostly on ten-second duration tests, and it was concluded in the report summarizing that test program that the performance could be low because of the nonequilibrium temperature conditions in the hardware. In fact, based on the results of a long duration test with the demonstrator thrust chamber, using an alternate fuel, the performance under nominal conditions was predicted to be approximately 310 seconds. The data shown for the demonstrator thrust chamber were based upon analytic extrapolations to $\epsilon = 72$ of data taken with a 9:1 expansion area ratio nozzle. The good agreement affirms the validity of the analytical extrapolations.

A comparison of the performance with saturated and unsaturated propellants is shown in Fig. 5. The data indicates that there is no discernible difference in performance with the propellant in either condition. The saturated propellant tests were conducted with both the fuel and the oxidizer saturated with helium at 225 psia. Performance was only slightly improved by heating propellants to 100 F, as indicated in Fig. 6. The performance improvement appeared to be greater at the lower mixture ratios and was, at most, one second. The effect of wider variations in chamber pressure on performance were investigated during Sequence 5. Comparing the performance of the last three tests in that series on which the chamber pressures were 149, 100, and 125 psia, respectively. It appears that the higher thrust level results in a gain of approximately 1½ seconds specific impulse, while the lowest thrust level results in a loss of approximately 2½ seconds. Performance is plotted vs time for the longer duration test in Fig. 7, and compared with transient taken with the demonstrator thrust chamber. Performance is normalized to the value for each chamber at 31 seconds. The more rapid response of the integrated thrust chamber is evident from these plots.

TABLE 6. INTEGRATED THRUST CHAMBER TEST SUMMARY

TEST	NOM DUR SEC	DATA TIME SEC	$P_{C_{NS}}$ PSIA	$\dot{W}_{TOTAL}$ LB/SEC	O/F	F_{SITE} LBS	F_{VAC} LBS	$I_{S_{VAC}}$ SEC	η_{ERE} %	c^*_{SITE} FT/SEC
Checkout										
1-1	3	2-3	117	18.44	1.372	5498	5602	303.2	97.5	5421
1-2	5	4-5	117	18.46	1.464	5564	5647	305.7	97.3	5429
1-3	10	9-10	116	18.38	1.465	5563	5631	306.2	97.4	5397
Unsaturated Propellants										
2-1	10	9-10	124	19.61	1.667	5986	6053	308.7	96.2	5411
2-2	10	9-10	126	19.66	1.858	6013	6090	309.6	95.7	5469
2-3	10	9-10	141	21.90	1.466	6687	6753	308.1	97.5	5496
2-4	10	9-10	142	21.92	1.656	6747	6811	310.7	96.6	5521
2-5	10	9-10	142	21.96	1.844	6760	6839	311.4	95.8	5509
2-6	10	9-10	111	17.41	1.485	5261	5326	305.6	97.2	5462
2-7	10	9-10	112	17.47	1.670	5320	5381	308.0	96.3	5467
2-8	10	9-10	112	17.46	1.871	5307	5381	308.0	95.7	5470
2-9	10	9-10	126	19.59	1.470	5959	6017	307.0	97.4	5479
2-10	10	9-10	126	19.64	1.671	6005	6082	309.6	96.5	5474
Saturated Propellants										
3-1	10	9-10	125	19.67	1.657	6007	6081	309.1	96.4	5440
3-2	10	9-10	124	19.49	1.865	5951	6035	309.6	95.7	5461
3-3	10	9-10	140	21.82	1.452	6638	6714	307.5	97.5	5491
3-4	10	9-10	139	21.68	1.652	6648	6729	310.4	96.5	5498
3-5	10	9-10	140	21.71	1.843	6676	6757	311.2	95.8	5503
3-6	10	9-10	109	17.20	1.439	5101	5177	300.9	95.9	5402
3-7	10	9-10	110	17.23	1.682	5226	5303	307.8	96.3	5465
3-8	10	9-10	109	17.19	1.864	5214	5291	307.7	95.6	5448
3-9	10	9-10	125	19.55	1.460	5924	5997	306.6	97.4	5460
3-10*	10	9-10	126	19.72	1.654	6018	6098	309.3	96.4	5469

*Followed by ~30 minute vacuum soak

TABLE 6 . INTEGRATED THRUST CHAMBER TEST SUMMARY (Continued)

TEST	NOM DUR SEC	DATA TIME SEC	$P_{C_{NS}}$ PSIA	$\dot{W}_{TOTAL}$ LB/SEC	O/F	F_{SITE} LBS	F_{VAC} LBS	$I_{S_{VAC}}$ SEC	η_{ERE} %	c^*_{SITE} FT/SEC
Hot (100F) Propellants										
4-1	30	29-30	122	19.27	1.658	5915	5965	309.8	96.7	5408
4-2	10	9-10	138	21.59	1.449	6584	6663	308.5	97.9	5463
4-3	10	9-10	138	21.48	1.643	6589	6679	311.1	96.9	5492
4-4	10	9-10	137	21.42	1.874	6570	6658	311.0	95.9	5475
4-5	10	9-10	109	17.08	1.438	5165	5238	306.5	98.0	5473
4-6	10	9-10	110	17.05	1.595	5168	5249	308.0	97.0	5503
4-7	10	9-10	109	16.98	1.855	5160	5242	308.9	95.9	5501
4-8	10	9-10	124	19.31	1.457	5871	5947	307.9	97.9	5509
4-9	10	7-8	124	19.30	1.846	5909	5997	310.9	96.1	5475
4-10*	10	9-10	126	19.49	1.649	5960	6046	310.2	96.8	5503
Thrust Limits										
5-1	44	7-8	126	19.71	1.651	6002	6079	308.3	96.2	5474
		9-10	126	19.73	1.644	6013	6083	308.3	96.2	5450
		14-15	125	19.76	1.667	6039	6098	308.6	96.2	5417
		19-20	125	19.73	1.661	6036	6089	308.6	96.2	5403
		24-26	124	19.70	1.649	6026	6076	308.4	96.2	5392
		30-32	125	19.73	1.668	6045	6092	308.8	96.2	5394
		36-38	124	19.69	1.658	6033	6078	308.7	96.3	5395
5-2	33	9-10	151	23.50	1.643	7223	7296	310.3	96.4	5486
		14-15	150	23.52	1.644	7238	7300	310.3	96.4	5445
		19-20	149	23.53	1.650	7254	7311	310.7	96.4	5429
		30-32	149	23.53	1.648	7255	7306	310.4	96.4	5420
5-3	40	30-32	100	15.85	1.667	4813	4856	306.5	96.2	5381
5-4*	10	9-10	125	19.55	1.664	5970	6044	309.1	96.3	5473

*Followed by ~30 minute vacuum soak

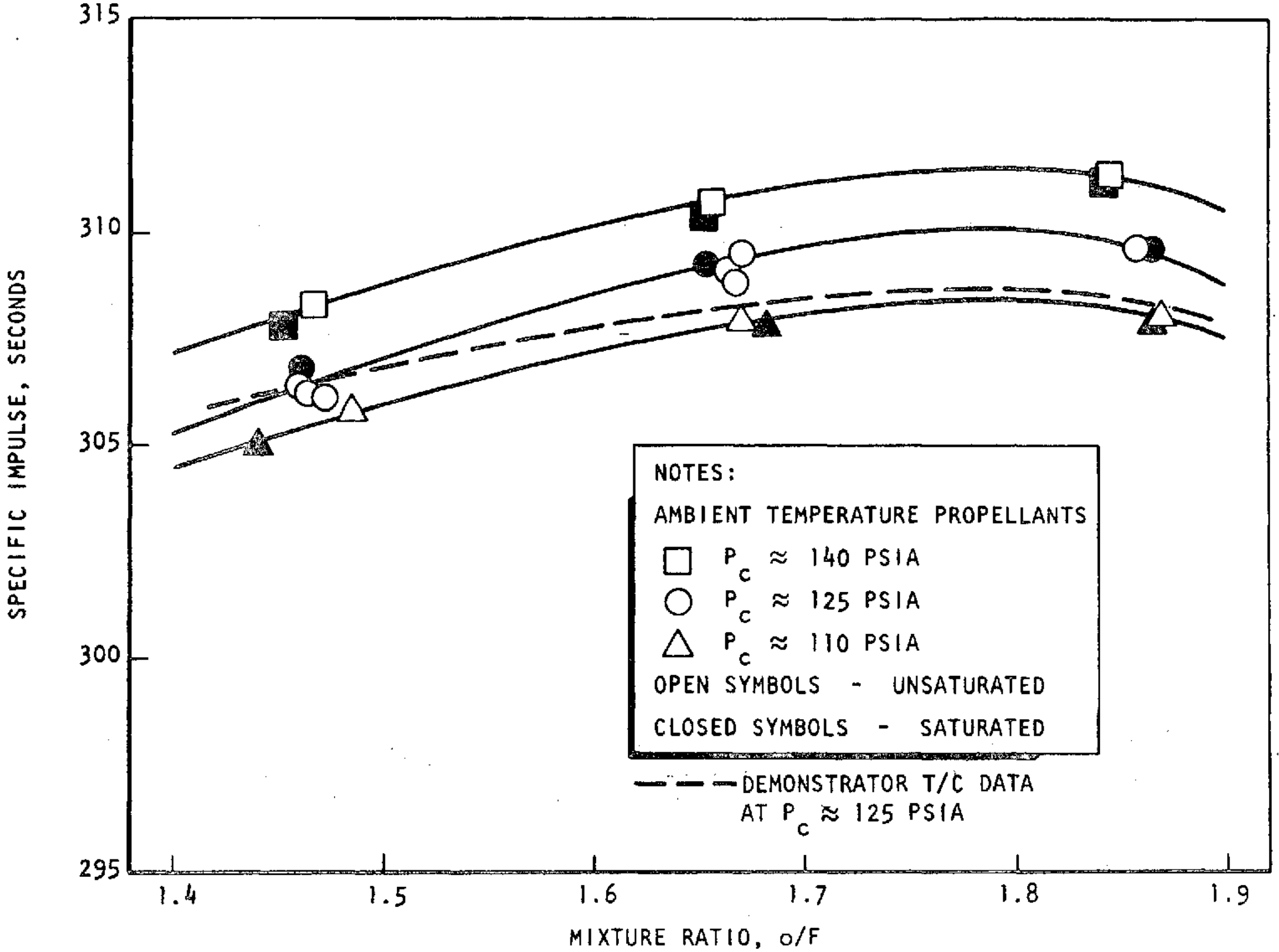


Figure 3. Integrated Chamber Performance With Ambient Temperature Propellants

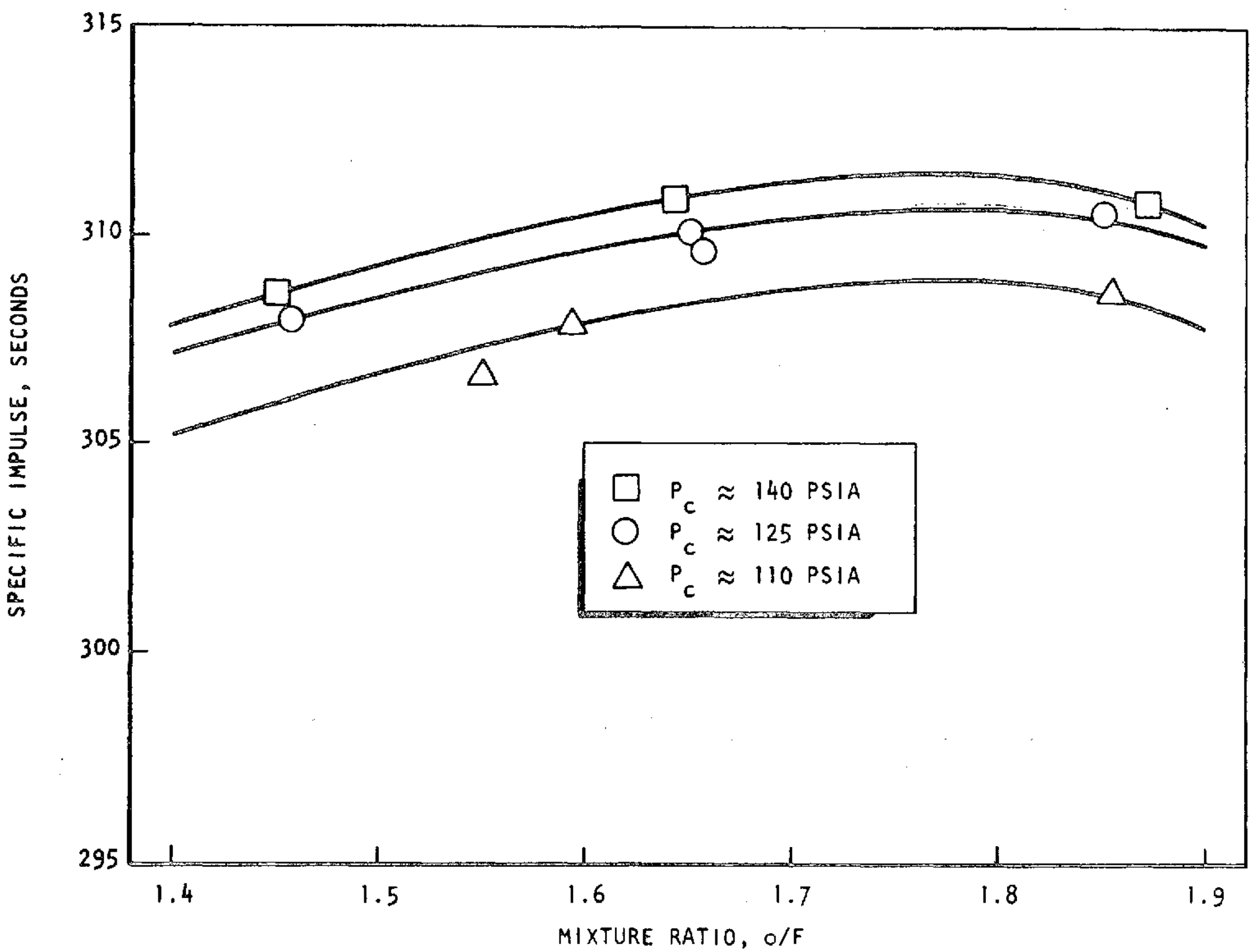


Figure 6. Integrated Chamber Performance With Unsaturated Heated Propellants

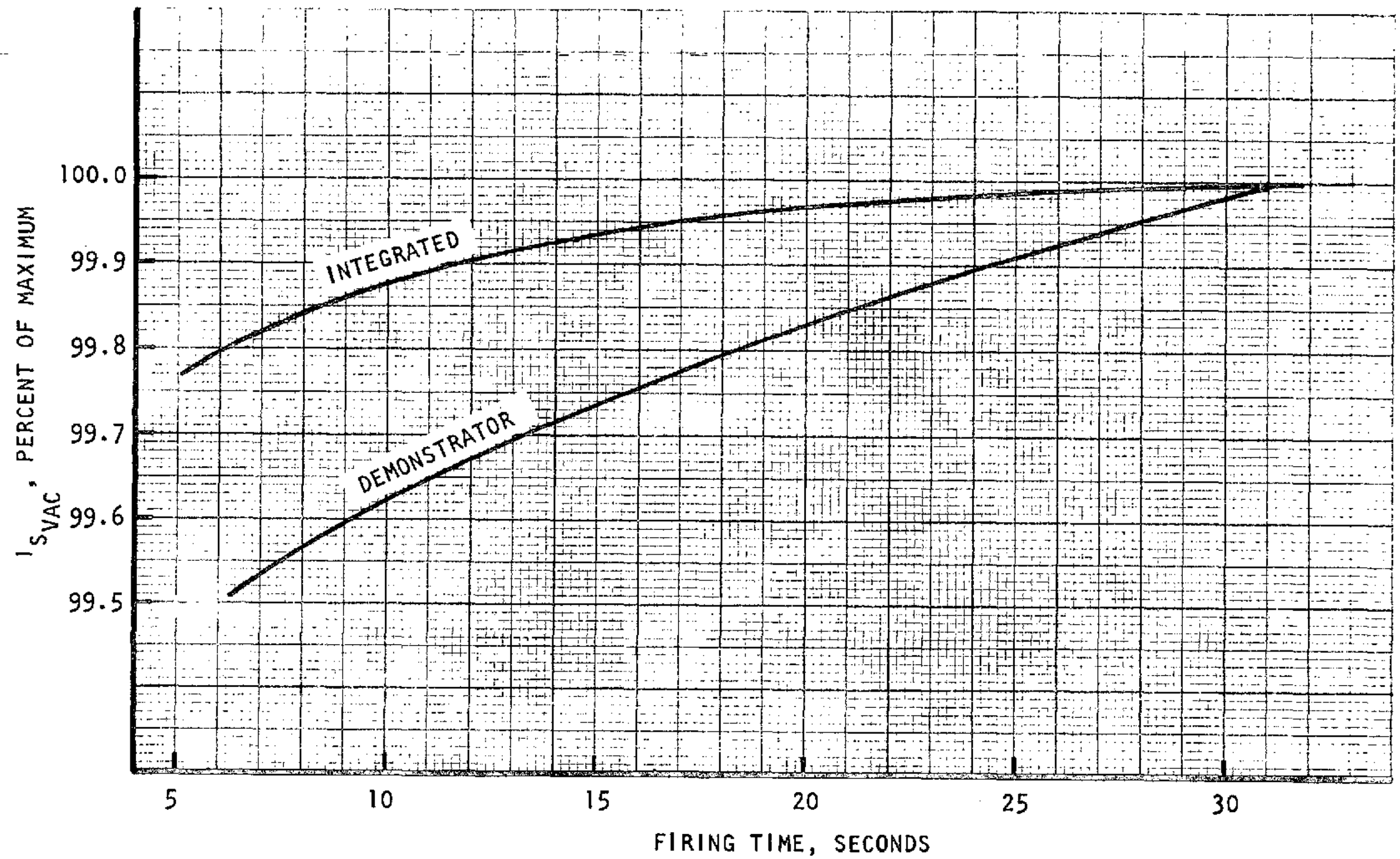


Figure 7. Comparison of Performance Transients in Demonstrator and Integrated Chambers

Injector and jacket pressure drops are plotted in Fig. 8. The pressure drops were determined by subtracting absolute pressure measurements so that accuracy in the order of 1-2 psi might be expected. Excellent correlation was shown on the oxidizer injector pressure drop clearly defining the difference between data taken with ambient and with 104 F oxidizer. The correlation on the fuel side was good, but the data had slightly more scatter probably because of the effects of variations in the fuel temperature rise in the coolant jacket. The effect of hot fuel at the chamber inlet can still be seen clearly. Fuel jacket pressure drop appeared consistent on the first test of each sequence (test 2-1B was actually the 3rd test of the sequence, preceded by 2 tests of approximately ¼-second duration), but was erratic thereafter. Oxidizer and fuel pressure drops at nominal conditions were 56 and 61 psi, respectively. Injector pressure drops for both propellants increase by approximately 4 psi when the inlet temperatures are increased to 100 F. Coolant jacket pressure drop was 15 psi at nominal conditions with no significant change at 100 F inlet temperature. A pressure drop summary for the thrust chamber assembly is shown in Fig. 9.

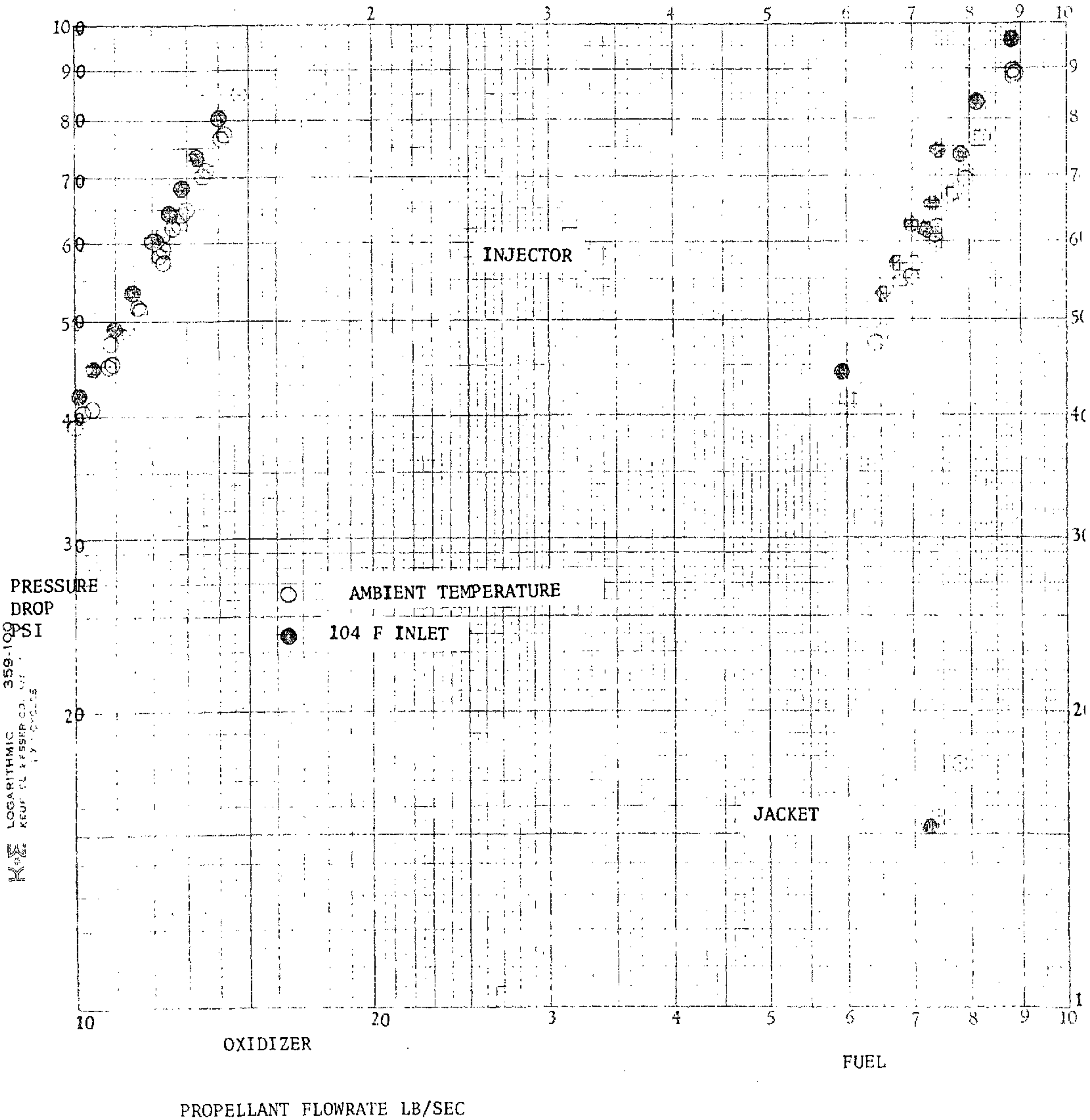


FIGURE 8. PRESSURE DROP CORRELATIONS

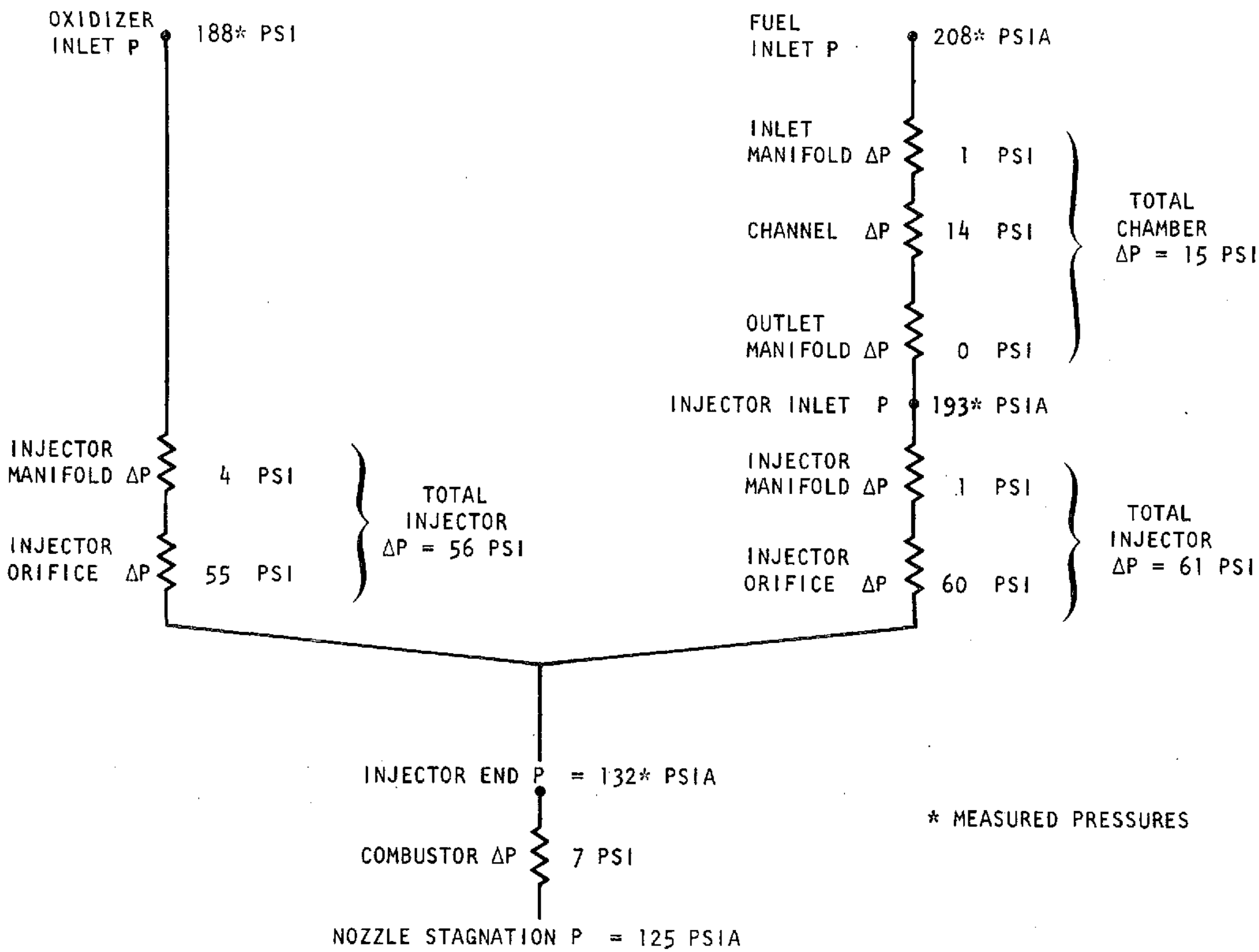


Figure 9. Integrated Thrust Chamber Assembly Pressure Drops

THERMAL DATA

Thermal data taken during the tests at WSTF consisted of fuel bulk temperature rise, regenerative chamber back wall temperature, and steel heat sink nozzle temperature transients. These data, together with the data generated during the heated tube tests under this contract, were used to provide an indication of the safety margin at which the thrust chamber was operating. Nozzle equilibrium temperatures were predicted based on the heat sink nozzle transients in conjunction with previous columbium nozzle tests with the demonstrator chamber.

Bulk Temperature Rise and Heat Load

Coolant inlet and outlet temperatures, ΔT's, and the heat load are tabulated in Table 7 for each of the 35 tests, which were of sufficient duration to obtain thermal data. The operating conditions are also noted in this table. Fuel inlet and outlet temperatures were each measured in three circumferential locations. The inlet temperature measurements were made in the coolant inlet manifold. The outlet temperatures were measured in the injector fuel distribution passages (see Fig. 1), ITC Installation Assembly Diagram).

Three bulk temperature rises were calculated based on the three outlet temperature thermocouples. The inlet temperature thermocouple TFB-6 was used as the reference temperature for all three ΔT's because of its proximity to the inlet andgeneral agreement with the fuel flowmeter temperature measurement. Temperature rises calculated in this manner generally agree within 8 percent.

The response of the coolant outlet bulk temperature and coolant ΔT for a typical cold-start test is presented in Fig. 10. The ΔT values achieve nearly steady-state conditions in about 20-25 seconds. Ninety percent of the final value is achieved in about 10 seconds. The long duration to achieve final steady-state conditions is due primarily to the time required for the massive (non-flight-weight) inlet manifold to reach equilibrium with the fuel inlet temperature. Subsequent tests achieve steady-state conditions in less than 10 seconds as noted in Fig. 11 for a typical hot-start condition.

FOLDOUT FRAME 1

TABLE 7. THERMAL DATA SUMMARY FOR SS/OME INTEGRATED CHAMBER TESTS

FOLDOUT FRAME 2

FOLDOUT FRAME 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	TEST	$P_{c_{NS}}$	MIXTURE RATIO	TEST DURATION	$\dot{W}_{FUEL}$	COOLANT OUTLET TEMPERATURE, F			INLET TEMP, F	COOLANT ΔT	COOLANT ΔQ	CHAMBER OUTER SURFACE TEMPERATURES (F), X= -16"								X = 13"				X = 10"						ASR74-117 Page 31
		psia	o/f	Seconds	(lb/sec)	TFB-1	TFB-2	TFB-3	TFB-6	F	BTU/SEC	θ, DEG/0	15	75	135	180	195	255	315	θ=0°	90°	180°	270°	0°	90°	180°	270°			
1	1-3	116	1.465	10	7.45	191	193	202	68	128	681	194	205	177	200	207	202	187	196	215	179	191	200	207	201	201	223			
2	2-1	124	1.667	10	7.35	192	200	201	67	131	688	171	214	130	208	203	208	102	191	224	184	199	201	214	207	211	222			
3	2-2	126	1.858	10	6.88	212	215	223	67	150	736	210	229	179	220	226	225	178	212	238	200	206	220	227	221	220	243			
4	2-3	141	1.466	10	8.88	190	193	200	67	127	810	190	202	172	195	202	199	184	196	206	175	179	193	197	195	192	218			
5	2-4	142	1.656	10	8.25	210	205	212	67	142	838	202	217	181	206	216	212	193	207	218	185	191	205	209	206	204	230			
6	2-5	142	1.844	10	7.72	223	215	224	67	154	849	214	227	190	218	228	223	199	216	232	196	204	213	221	216	216	237			
7	2-6	111	1.485	10	7.01	209	199	207	68	138	690	197	214	181	200	210	205	198	203	217	183	187	203	209	204	205	228			
8	2-7	112	1.670	10	6.55	219	211	219	67	149	696	209	228	186	213	221	218	202	212	229	193	194	203	220	214	214	227			
9	2-8	112	1.871	10	6.08	228	223	231	67	160	696	220	241	193	222	232	232	203	223	242	203	206	216	231	223	223	239			
10	2-9	126	1.470	10	7.93	208	197	206	67	136	773	200	210	185	196	209	204	206	203	211	179	183	199	202	201	199	226			
11	2-10	126	1.671	10	7.36	218	209	217	67	147	775	208	223	187	208	221	216	207	212	223	190	193	210	214	210	210	235			
12	3-1	125	1.657	10	7.40	194	199	205	66	133	703	171	217	135	204	200	206	108	190	220	186	184	205	212	208	206	225			
13	3-2	124	1.865	10	6.80	212	216	225	66	151	735	211	232	184	220	226	224	184	212	236	194	202	218	226	216	219	240			
14	3-3	140	1.452	10	8.90	190	192	200	67	127	809	190	204	173	193	201	197	184	195	205	174	178	194	196	195	192	220			
	3-4	139	1.652	10	8.17	202	205	214	67	140	819	204	220	189	205	216	211	196	206	218	183	189	205	209	203	204	228			
16	3-5	140	1.843	10	7.64	213	216	224	67	151	824	214	231	196	217	227	222	204	217	230	194	200	214	220	214	216	236			
17	3-6	110	1.439	10	7.08	194	197	205	67	132	666	198	208	187	197	207	202	203	201	213	180	183	201	205	202	201	226			
18	3-7	110	1.682	10	6.43	209	212	220	67	146	672	213	225	197	212	221	218	206	214	228	192	194	213	220	213	214	237			
19	3-8	109	1.864	10	6.00	220	224	232	67	158	678	225	238	206	222	234	230	214	223	242	206	205	214	232	226	224	238			
20	3-9	125	1.460	10	7.95	195	197	205	67	132	749	201	206	192	196	208	202	209	202	210	178	181	198	202	199	197	224			
21	3-10*	126	1.654	10	7.43	206	209	216	67	143	759	210	222	200	208	220	215	212	211	222	188	191	207	213	208	208	232			
22	4-1	122	1.658	30	7.25	237	241	249	104	139	721	235	253	219	243	255	245	195	240	256	223	240	239	243	238	239	261			
23	4-2	138	1.449	10	8.82	225	227	234	104	124	782	220	237	211	228	235	230	209	229	236	208	212	227	226	228	221	248			
24	4-3	138	1.643	10	8.13	237	240	247	105	136	793	234	250	230	241	249	244	219	240	249	218	231	239	238	240	234	259			
25	4-4	137	1.874	10	7.45	251	250	258	105	147	785	245	267	237	250	256	253	226	252	259	230	243	248	248	249	244	268			
26	4-5	109	1.438	10	7.01	230	233	240	106	129	646	229	242	238	233	242	238	223	234	245	214	221	232	236	232	230	251			
27	4-6	110	1.595	10	6.57	239	243	250	105	139	651	239	253	226	245	252	247	226	243	256	223	235	238	245	247	241	258			
28	4-7	109	1.855	10	5.95	253	258	265	105	153	651	249	266	233	262	264	262	235	261	270	237	261	252	259	256	258	270			
29	4-8	124	1.457	10	7.86	231	233	240	106	129	724	232	243	221	233	242	237	232	236	242	212	217	230	231	233	227	251			
30	4-9	124	1.846	10	6.80	252	255	262	106	151	731	249	267	232	258	261	260	238	257	266	233	255	250	254	249	249	276			
31	4-10*	126	1.649	10	7.36	242	245	251	106	140	739	244	256	230	244	254	250	236	247	255	224	241	242	243	243	238	262			
	5-1	124	1.658	44	7.39	204	206	216	65	142	750	205	218	205	207	217	211	202	203	222	187	191	207	214	209	208	235			
33	5-2	149	1.648	33	8.89	202	203	212	68	138	875	203	217	203	203	216	207	200	202	214	183	188	202	206	204	202	230			
34	5-3	100	1.667	40	5.94	214	216	227	68	150	637	221	231	216	215	228	221	214	216	234	196	198	214	227	217	219	243			
35	5-4*	125	1.664	10	7.34	207	210	218	69	143	750	205	225	209	208	216	216	209	209	223	190	192	209	215	211	210	233			

*Followed by ~30 mintue vacuum soak.

FORM R 79-Y-3

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FOLDOUT FRAME 1 TABLE 7. THERMAL DATA SUMMARY FOR SS/OME INTEGRATED CHAMBER TESTS (Continued) FOLDOUT FRAME 2 FOLDOUT FRAME 3

ASR74-117
Page 32

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		CHAMBER OUTER SURFACE TEMPERATURES (F)																								INLET MANIFOLD SKIN TEMPERATURE				
	TEST	X = -8"				X = -6"				X = -4"				X = -2"				X = -0.3"				X = +3"								
		θ =0°	90°	180°	270°	0°	90°	180°	270°	0°	90°	180°	270°	0°	90°	180°	270°	0°	90°	180°	270°	0°	90°	180°	270°	0°	180°			
1	1-3	190	184	189	210	178	169	169	188	160	151	157	167	142	136	142	144	139	137	145	154	124	126	128	130	78	79			
2	2-1	194	189	197	212	183	173	170	191	166	154	162	169	147	139	148	145	143	140	151	157	126	128	132	132	65	65			
3	2-2	207	201	205	228	194	183	182	205	175	164	171	182	155	148	155	156	150	147	157	166	134	136	138	140	70	69			
4	2-3	182	178	183	205	170	163	164	183	153	146	152	162	136	131	138	139	133	131	140	149	119	121	124	125	72	71			
5	2-4	192	189	193	216	180	172	174	193	162	153	160	172	144	138	146	148	140	137	147	158	126	128	131	133	72	72			
6	2-5	203	197	202	222	190	179	181	199	171	159	168	177	152	144	153	152	147	142	155	162	132	133	136	136	72	72			
7	2-6	191	187	193	214	178	171	172	192	160	151	160	170	142	137	145	146	141	137	147	156	125	127	129	131	76	75			
8	2-7	201	195	200	215	187	180	180	196	169	158	167	175	150	143	151	149	147	143	154	159	131	132	134	135	74	73			
9	2-8	212	204	209	226	197	186	186	207	177	165	173	185	157	150	158	157	154	149	160	167	137	137	139	141	74	72			
10	2-9	187	184	187	212	173	167	170	189	157	148	156	167	139	134	141	143	136	133	143	153	122	124	126	128	75	73			
11	2-10	196	192	197	220	183	175	177	197	165	155	164	174	146	141	148	150	143	139	151	160	128	131	132	134	73	73			
12	3-1	192	189	195	215	181	173	163	193	164	154	160	170	145	139	146	146	140	138	148	156	124	127	131	132	64	64			
13	3-2	206	196	205	226	193	180	180	202	174	161	171	180	155	146	154	154	149	145	156	164	134	134	138	139	70	69			
14	3-3	181	178	182	206	168	162	163	184	152	145	151	162	135	131	137	139	131	129	138	148	118	120	123	124	71	70			
	3-4	192	186	192	214	179	170	172	191	162	152	160	170	143	137	145	146	139	135	146	155	125	127	131	131	72	72			
16	3-5	201	195	202	222	188	178	180	199	170	159	169	177	151	144	152	151	146	142	154	161	131	133	136	136	74	74			
17	3-6	188	185	190	212	175	169	170	189	158	150	157	168	139	136	142	144	137	135	144	152	123	125	126	129	76	74			
18	3-7	201	195	201	222	187	178	179	199	168	158	167	176	149	143	151	151	145	142	152	160	130	131	134	135	74	73			
19	3-8	212	206	209	223	197	188	186	201	177	167	174	179	157	151	157	155	152	149	158	163	137	138	139	139	75	73			
20	3-9	185	182	186	210	172	166	168	187	156	148	156	165	137	134	140	141	135	132	142	151	121	124	125	127	76	74			
21	3-10	195	191	195	216	182	174	176	194	164	154	163	172	146	140	147	148	142	138	149	157	127	130	131	133	75	74			
22	4-1	226	221	225	246	211	204	206	223	195	187	193	203	178	172	179	180	170	168	176	184	157	157	162	162	96	98			
23	4-2	210	207	210	234	198	192	190	212	183	176	182	193	167	164	168	171	160	158	166	176	147	150	153	154	101	101			
24	4-3	220	217	220	245	207	201	199	222	192	183	190	202	175	171	176	178	167	164	173	183	154	157	170	160	105	105			
25	4-4	230	226	234	264	217	210	209	230	200	192	197	209	183	178	183	186	173	171	179	189	161	163	165	166	107	107			
26	4-5	218	214	217	238	204	198	197	216	188	181	187	197	172	169	173	176	166	163	172	181	153	156	157	159	109	110			
27	4-6	226	223	232	244	212	206	204	222	196	188	193	202	178	174	179	180	171	168	177	185	157	161	161	162	109	109			
28	4-7	238	234	246	256	224	216	219	233	206	197	204	213	187	182	188	189	180	175	185	193	165	168	169	169	108	109			
29	4-8	214	213	214	237	201	197	195	214	186	180	185	195	170	167	172	174	164	161	169	179	151	155	156	157	109	109			
30	4-9	236	230	239	270	221	213	214	234	204	194	199	212	185	180	185	188	177	172	182	191	164	166	166	167	109	109			
31	4-10	225	223	228	247	211	206	206	225	195	187	192	204	178	174	178	181	171	167	175	185	157	162	161	163	108	109			
	5-1	198	191	196	220	184	174	180	196	165	154	164	173	147	140	148	149	143	140	151	160	128	130	133	134	64	64			
33	5-2	192	187	190	215	178	170	176	191	160	152	160	169	143	138	144	146	138	136	146	155	125	127	130	131	74	72			
34	5-3	209	200	205	226	192	183	188	202	172	162	171	179	152	147	153	155	151	148	157	164	135	136	137	138	70	69			
35	5-4	197	193	198	219	184	177	177	197	166	158	165	175	147	143	149	151	144	142	152	161	130	133	135	135	80	78			

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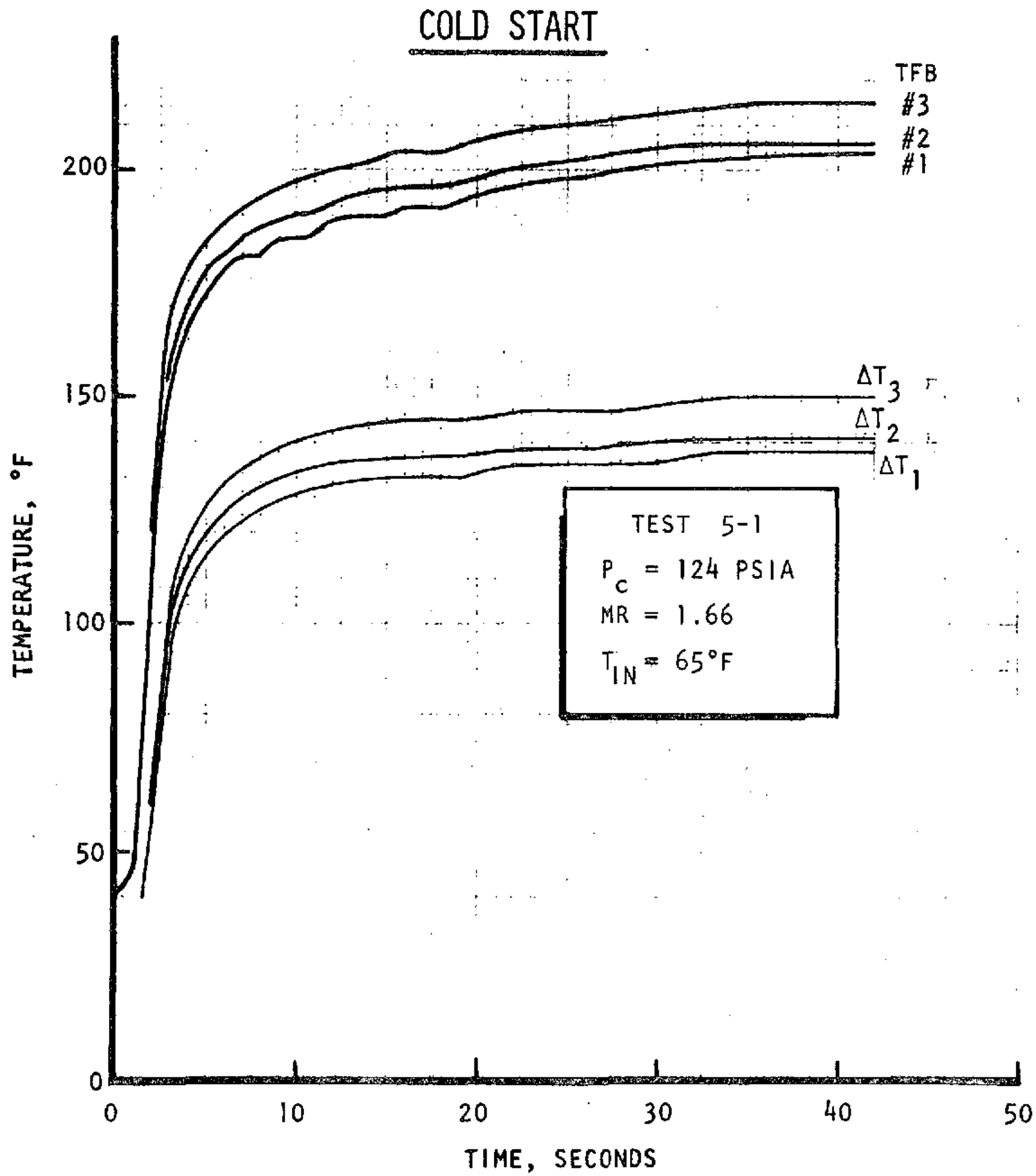

Figure 10. Typical Outlet Bulk Temperature and Temperature Rise Transients For The Integrated Thrust Chamber

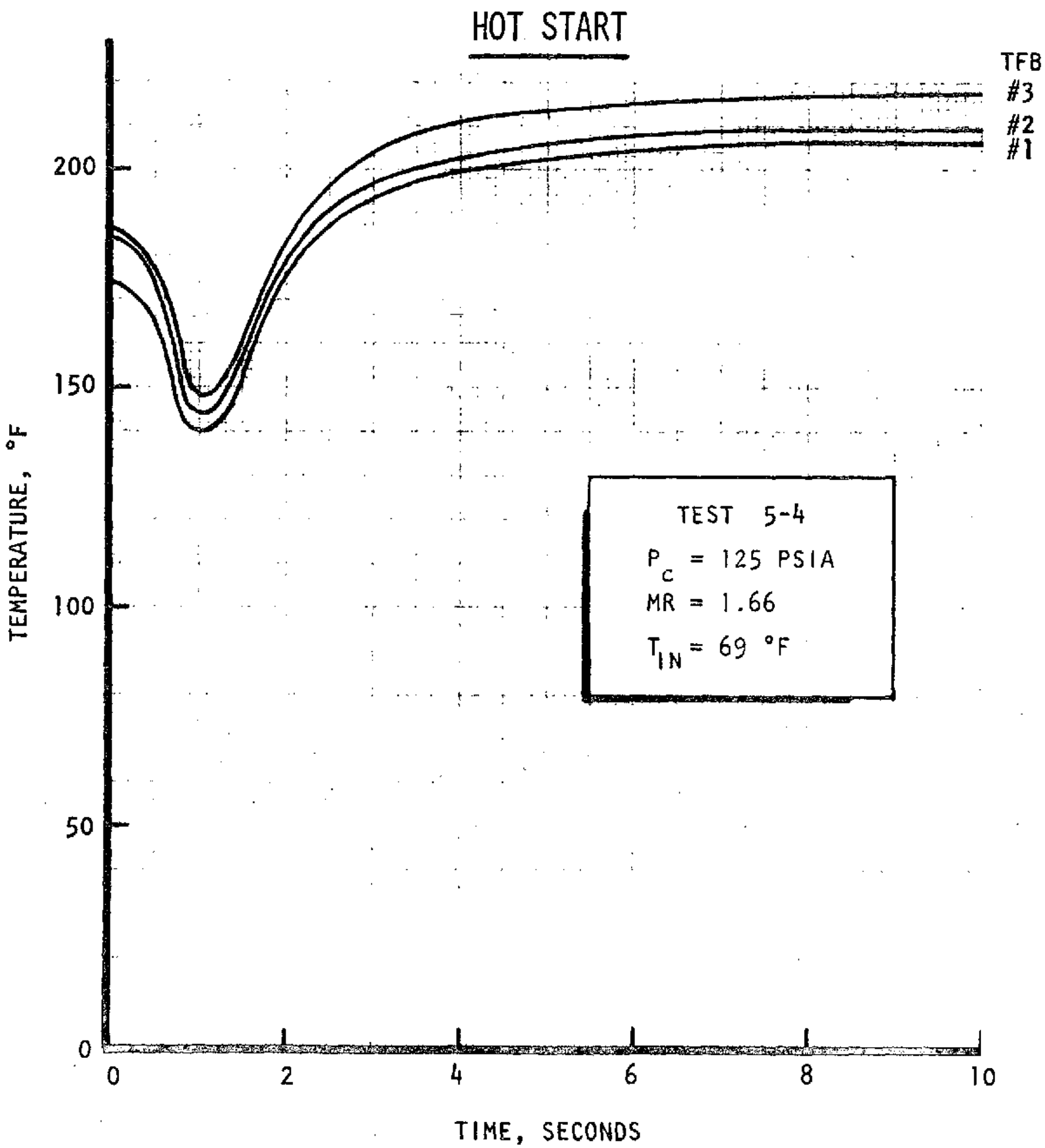

Figure 11. Typical Outlet Bulk Temperature Transient, Integrated Thrust Chamber

The majority of the tests were 10 seconds duration. The initial tests in Series 2 and 3 have about 10 percent lower outlet temperatures than similar tests later in the test series, since steady-state was not achieved for the reason discussed. These two tests were not utilized in the heat load determinations. The first tests in Series 4 and 5 were of sufficiently long duration to assure that steady-state operation was obtained.

The average values of the ΔT's were multiplied by the fuel flowrate through the jacket and the specific heat of the fuel to determine the heat absorbed by the fuel. The heat loads for ambient propellants (both saturated and unsaturated) are plotted versus chamber pressure in Fig. 12, with coded symbols to denote approximate mixture ratio. These data follow the predicted variation with Pc to the 0.8 power. The effect of mixture ratio on heat load appears negligible, which is consistent with heat transfer theory for the range of mixture ratios tested. Helium saturation also does not appear to effect chamber heat load.

The best-fit line of the demonstrator heat load test results is also presented in Fig. 12 for comparison with the ITC heat loads. The ITC heat loads are about 12 percent higher than for the demonstrator chamber, even though a slightly higher supplemental film coolant flowrate (2.7 vs 2.0 percent) was utilized in the ITC. The primary reason for the increased heat load is due to the less efficient, but much simpler, method of film coolant injection employed in the ITC design. In the ITC design, the film coolant is injected from the primary injector across the acoustic cavities onto the chamber wall. The demonstration chamber utilized a separate film coolant ring, which injected the film coolant directly along the wall without having to jump the acoustic cavities.

An additional factor in the ITC design is that the acoustic cavities are regeneratively cooled. It is estimated that about one-third of the increased ITC heat load can be attributed to regenerative cooling of the acoustic cavities.

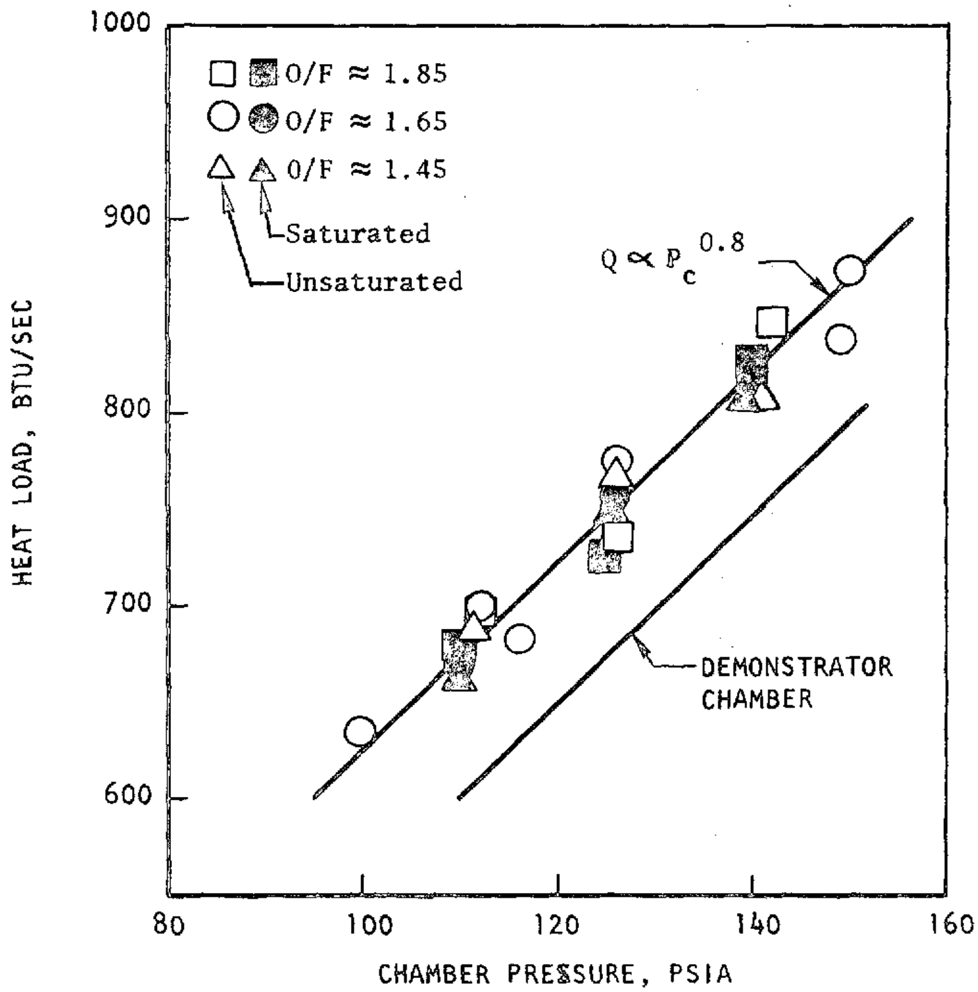

Figure 12. Integrated Chamber Heat Load With Ambient Propellants

The effect of hot propellants (≈100F) on chamber heat load is compared with the ambient propellant test results in Fig. 13. There appears to be a very slight reduction in head load, although the difference is essentially insignificant.

Back Wall Temperatures

Back (outer surface) wall temperatures were measured in numerous locations on the ITC (see Fig. 1) to indicate steady-state operating values, as well as start and soakout temperature characteristics. The steady-state back-wall temperatures are presented in Table 7 for each test of sufficient duration (≈10 seconds or longer).

Typical back wall temperature response from a cold start (i.e., first in a test series) is presented in Fig. 14. As would be expected, the response is more rapid in the higher heat flux regions, such as the throat. An initial apparent steady-state temperature level is achieved in less than ten seconds for the various back-wall temperatures depicted. The back-wall temperatures continue to rise slowly from this time as the fuel inlet temperature increases due to inlet manifold heating and a rise in the propellant inlet temperature. Final steady-state temperatures are achieved in about 30 seconds from start of test.

Typical hot start back-wall temperature transients are presented in Fig. 15. There is an initial cooling down of the back-wall as the coolant flows through the channels before combustion gas heating diffuses through the walls into the coolant and back-wall region. Steady-state back-wall temperatures are readily achieved in about 5 seconds or less under hot-start conditions. Maximum nickel back-wall temperatures after soakout and prior to restart were, in general, less than 300 F.

Steady-state back-wall temperatures are utilized primarily as an indication of circumferential heat load uniformity. These measurements are relatively insensitive to local heat flux level and tend to reflect integrated heat load along a channel in that back-wall temperatures are strongly influenced by the local bulk temperature.

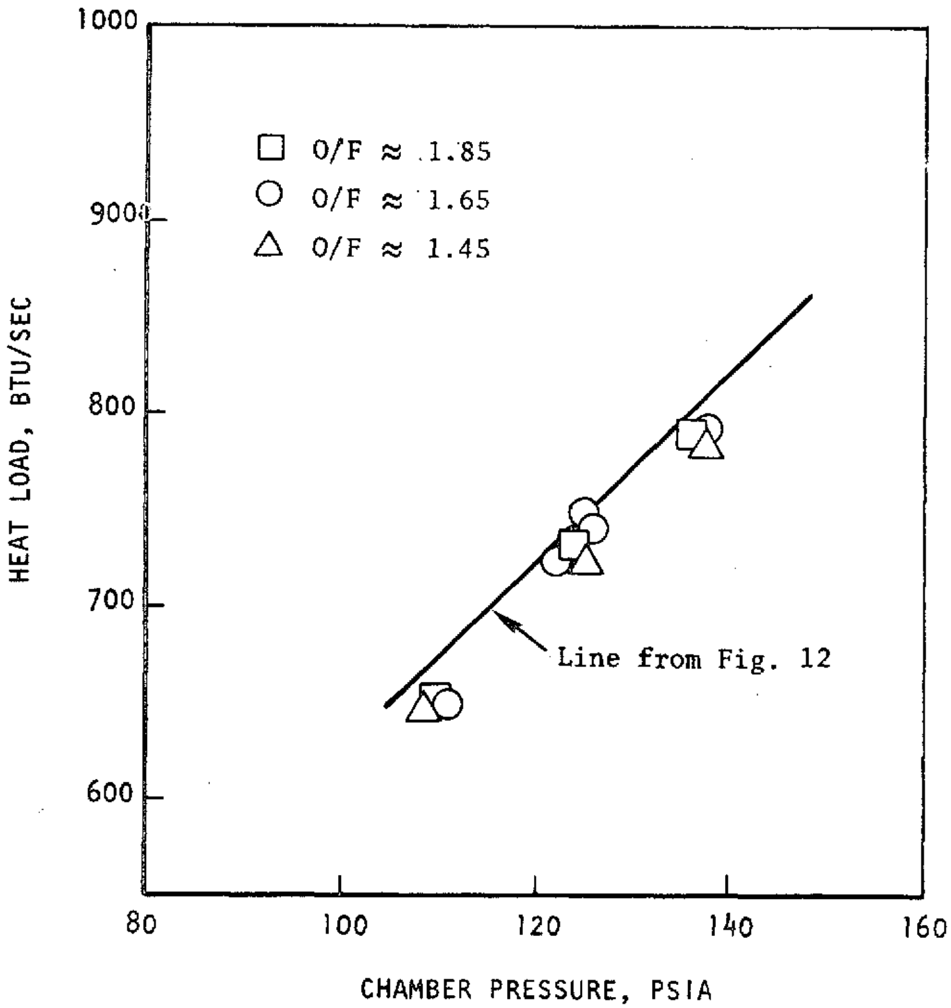

Figure 13. Integrated Chamber Heat Load With 100F Propellants

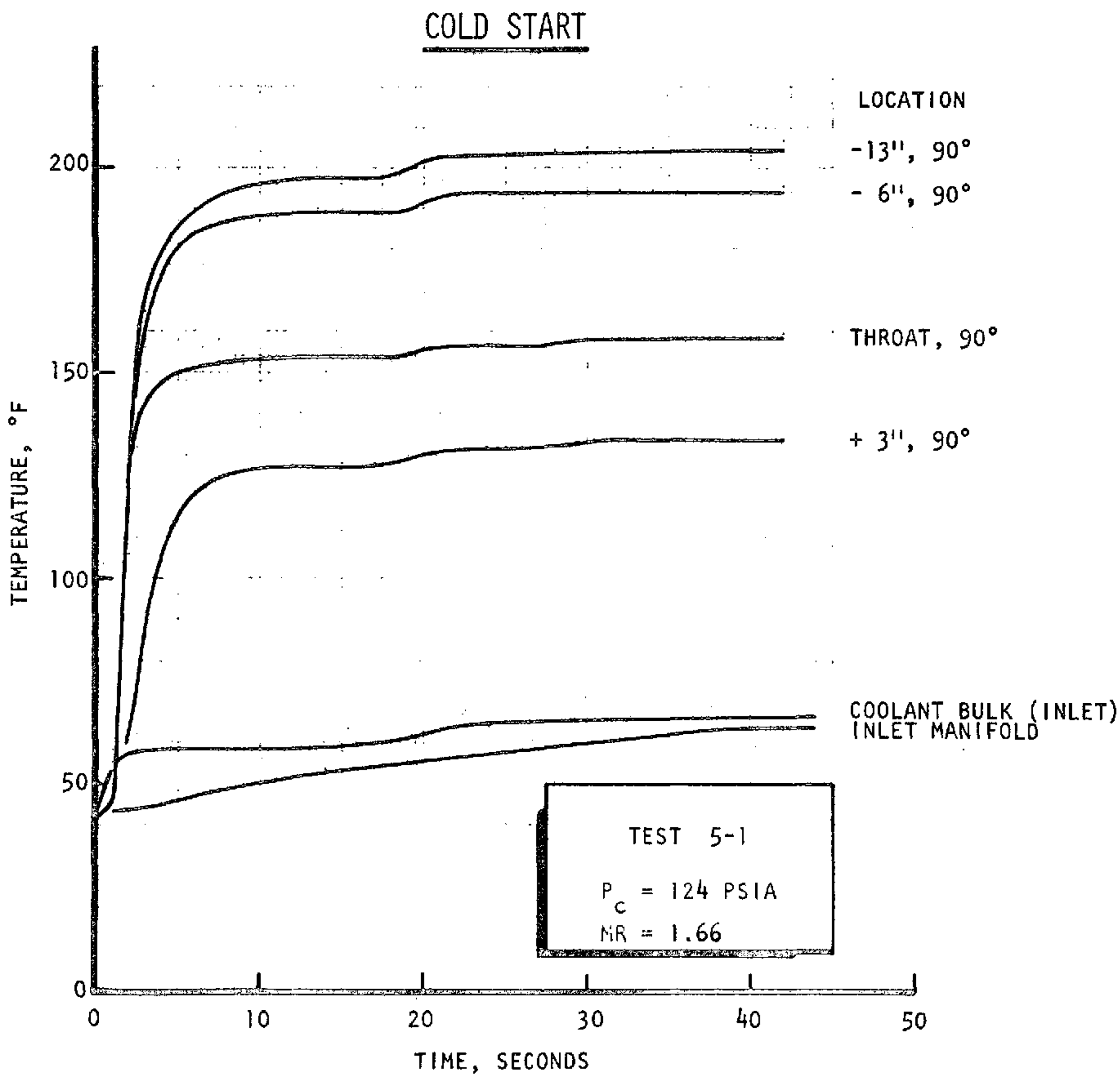

Figure 14. Typical Backwall Temperature Transients for the Integrated Thrust Chamber

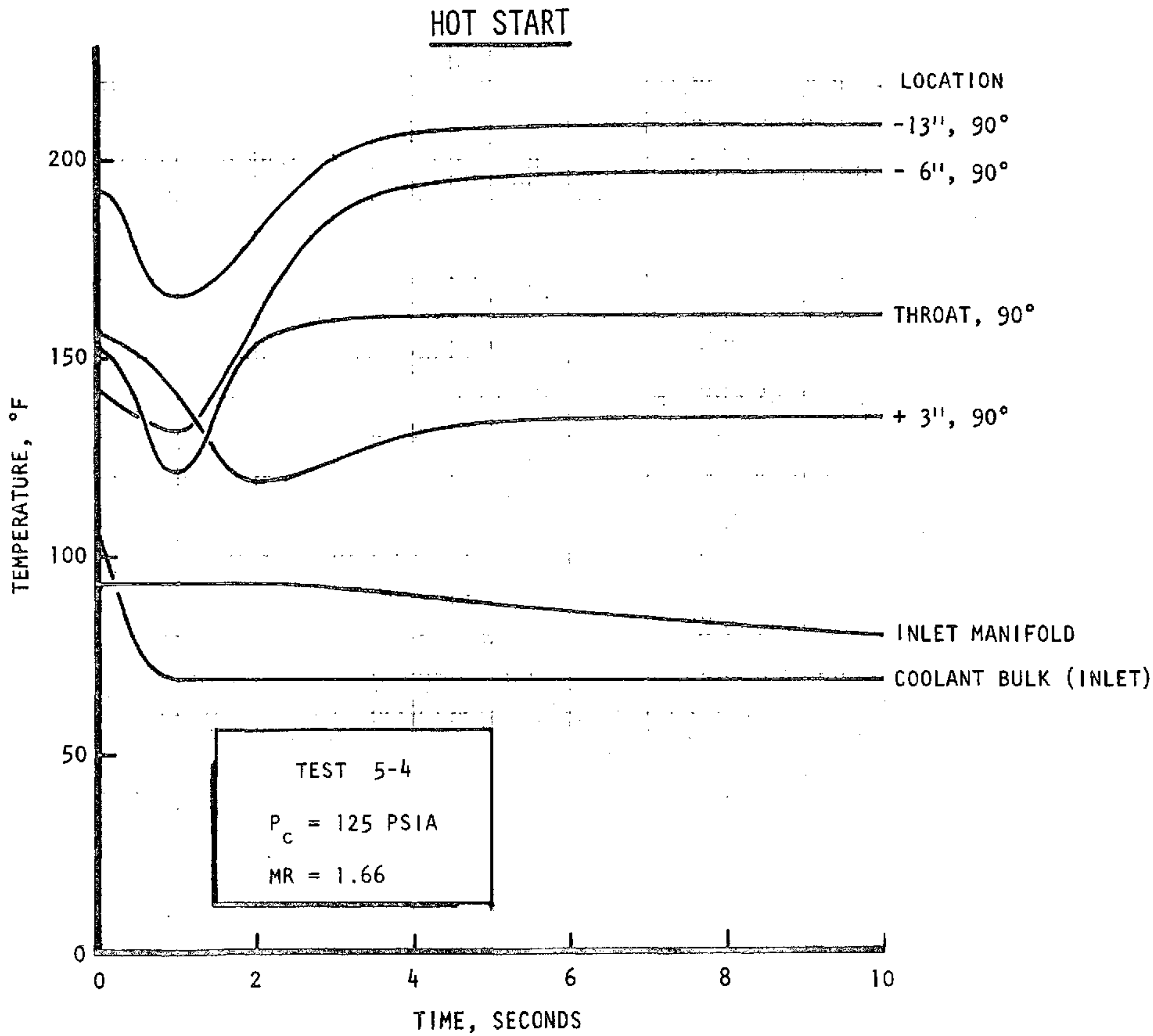

Figure 15. Typical Backwall Temperature Transients for the Integrated Thrust Chamber

In general, circumferential variation in back-wall temperatures were less than 10 F, except at the throat and injector end/acoustic cavity regions, where differentials of 15 to 20 F occurred. The injector end region is strongly affected by film cooling impingement and surface coverage, and resultant heat flux variation can affect back-wall measurements. In the case of liquid coverage, the heat flux is essentially zero, and the back-wall temperature nearly equals the local bulk temperature. At nominal heat flux levels of about 1 to 2 Btu/in^2-sec, the back-wall temperature is analytically predicted to be about 30 to 40 F above coolant bulk temperature. Acoustic cavity back-wall measurement locations varied; with 4 thermocouples located in the full length cavity regions, 2 thermocouples in the short cavity length regions, and 2 thermocouples located in the dam regions. The throat region will be discussed shortly.

Back-wall thermocouples were intended to be located at mid-channel in order to minimize the effect of land conduction on temperature measurements. A close visual post-test inspection indicated a portion (4 in. to 13 in. upstream of the throat) of one row of thermocouples located at 90^o had inadvertently been installed over mid-land rather than mid-channel. This resulted in temperature measurements about 15 to 20 F higher than for mid-channel values. These measurements were therefore not included in determining circumferential back-wall temperature variations.

A plot of back wall temperature distirbutions is presented in Fig. 16 for a typical test at nominal operating conditions. The maximum and minimum values are denoted, as well as average back-wall temperatures. It is apparent that the back-wall temperatures increase rather uniformly from slightly upstream of the throat to a point 10 inches upstream of the throat. The temperature thereafter remains essentially constant to the end of the chamber. This latter factor implies a very low rate of heat input in this region as would be accounted for by a liquid film coolant. It appears therefore that from the point of film impingement on the wall (X = 13.7 in.), the film liquid length persists to a point approximately 10 in. to 11 in. upstream of the throat. This is corroborated somewhat by visual posttest inspection, wherein bright, clean metal surfaces existed for distances of about 2 in. to 4 in.

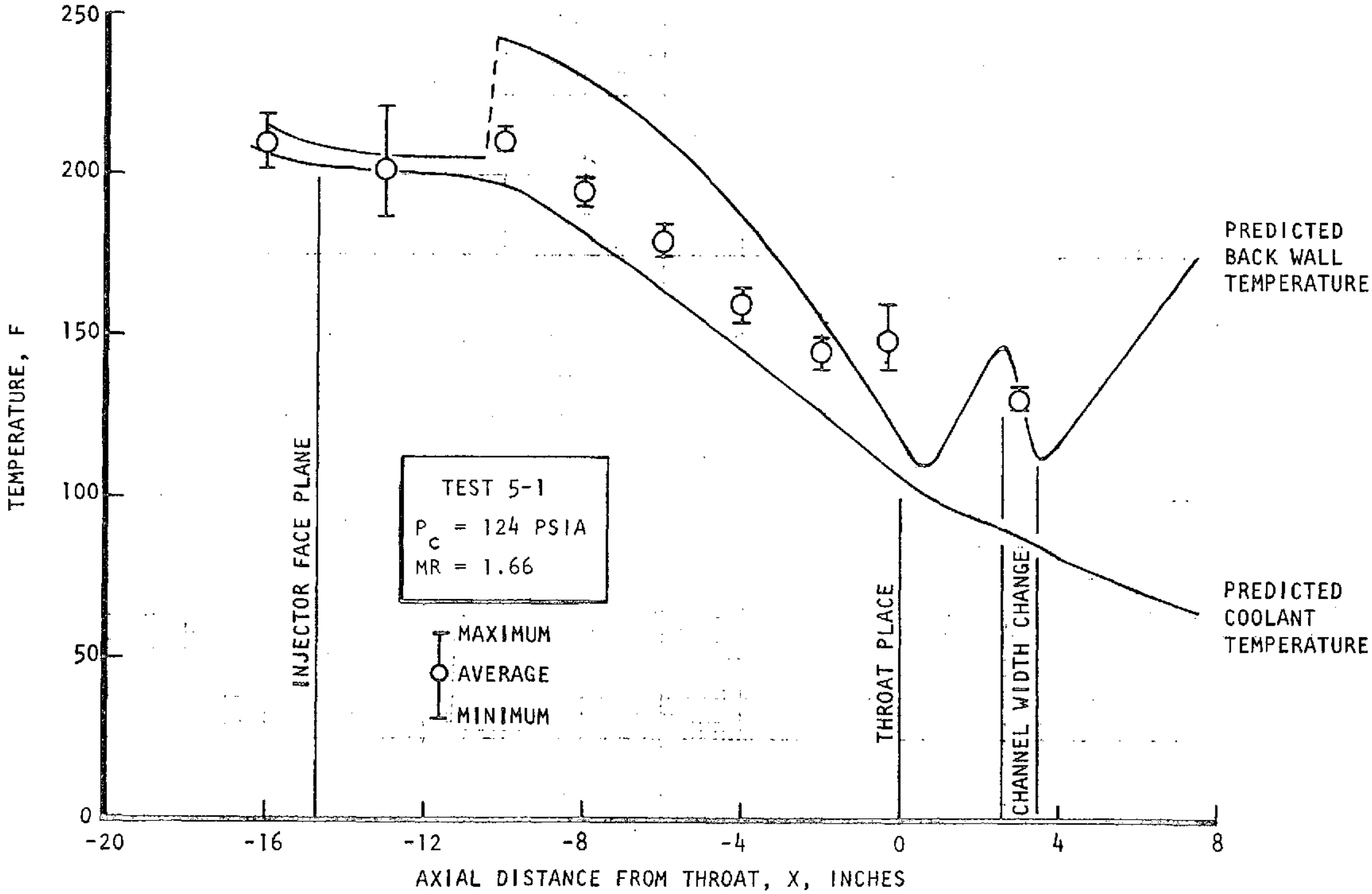

Figure 16, Integrated Thrust Chamber Back Wall Temperature Profile downstream of the point of film coolant impingement. Such surfaces indicate the likelihood of cool undecomposed liquid MMH along the wall.

The theoretical film coolant model was utilized with varying input liquid lengths in order to match the total ITC measured heat load. The heat load was matched assuming MMH decomposition at a point approximately 10.5 inches upstream of the throat, which is consistent with the above observations. The resulting analytical back wall (2-D analysis) and coolant bulk temperature profiles are included in Fig. 16 for comparison with experimental results.

In general the predicted back-wall temperatures are about 15 to 30 F higher than experimental data in the combustion zone upstream of the throat. The general slope of the experimental back-wall data and predicted bulk temperature profile agree quite well in the combustor region. In the nozzle region (X = +3 in.) the measured back-wall temperatures agree favorably with the predicted value, although the fact that the measurement was made near the region of the step change in channel width tends to complicate the results.

In the throat region of the chamber, the average measured temperatures are about 20 F higher than predicted. The data scatter of the four throat measurements is also, in general, greater than for other chamber locations, being about a 20 F maximum temperature difference, rather than 5 to 10 F. These results are similar to those noted previously for the demonstrator chamber tests. A detailed analysis of the throat region was conducted previously based on the demonstrator chamber tests to determine if a higher throat heat flux could account for this discrepancy. An increase in heat flux of 40 percent resulted in a one degree increase in the outer surface temperature (confirming the original analysis that back wall temperature is relatively insensitive to heat flux level). In order to achieve back wall temperatures similar to those measured, the projected heat flux level would have been considerably in excess of burn-out conditions. Posttest inspection of the OME demonstrator and integrated throat chamber, however, did not indicate any discoloration due to extensive overheating anywhere in the chamber.

The effect of longitudinal conduction was also determined to have a negligible (<1F) effect on outer surface temperature at the throat. The items most strongly affecting the outer surface temperature are bulk temperature and the coolant film coefficient in that order. The required increase in bulk temperature at the throat would indicate a nozzle heat load about 60 percent higher than predicted. This is in contradiction to the regeneratively cooled nozzle data and radiation nozzle results where the low nozzle temperatures indicate a lower than predicted heat flux level.

It appears at this time that the most likely reason for the higher throat outer surface temperature is a discrepancy in the coolant film coefficient distribution around the channel. The effect of the throat region curvature on a forced convection nucleate boiling liquid is not clearly understood. A degradation of the film coefficient along the outer wall (convex side of curved section) is possible. Further investigation in this area is needed to better predict back wall temperatures in the throat region. Assuming, however, that the inner wall (concave side of curved section) conditions are unaffected (i.e., T_{wg} is correct), the life of the throat region is actually increased due to a decreased temperature differential between inner and outer surfaces.

Posttest inspection of the ITC after the initial series of tests indicated a longitudinal strip along the outer surface with a slightly brighter appearance than the rest of the chamber. Prior to test series 5, an additional back wall thermocouple was installed in the center of the strip at a point 13 inches upstream of the throat. The resulting back wall temperature was determined to be about 60 F higher than the average of the four other thermocouples located at the same axial position. A 2-D thermal analysis was utilized to determine the approximate coolant bulk temperature measurement.

The results of this analysis indicate the possible existance of a hot-streak in which the heat flux level is about 20 percent above that based on the overall average coolant temperature rise. This hot-streak could result from either a plugged (or misdirected) film coolant orifice and/or outer ring primary orifice. (A maldistribution of the coolant flow could also result in a localized increased coolant temperature. Preliminary evaluation of later test data, however, in which the injector was rotated indicates that this is not the case.) The originally proposed extreme off-design operating limits were slightly exceeded in test 4-7 (P_c = 109 psia, MR = 1.86, T_{in} = 105 F), however, without hardware damage, indicating satisfactory safety margin, even with the existance of a hot-streak.

The extended operating limits of the ITC were calculated in terms of the local coolant safety factor based on the experimental heat loads and presuming the existance of a hot-streak as discussed preivously. The local coolant safety factor is defined as the ratio of coolant (MMH) burnout heat flux to the local imposed heat flux.

The resulting 2-D safety factor variation with chamber pressure at selected chamber locations is shown in Fig. 17 for nominal mixture ratio and inlet temperature. The 2-D safety factor is based on detailed two-dimensional thermal analysis indicating a concentration of heat in the corners of the channels with resultant degradation of local safety factor as compared to a one-dimensional analysis.

At reduced chamber pressure (<70 psia), the minimum safety factor occurs near the injector end (X = -13 inches) where the coolant bulk temperature is a maximum. In this region the reduced saturation temperature resulting from reduced chamber pressure has a pronounced effect on sub-cooling and, thereby, the coolant burnout heat flux level.

An operating map at nominal fuel inlet temperature (70 F) is shown in Fig. 18 for the injector end location. Using the same analytical technique, the minimum safety factor (≈1.16) achieved to date was calculated for the test conditions noted. Although the absolute value of this minimum safety factor may not be strictly correct, it represents a sound basis for selection of

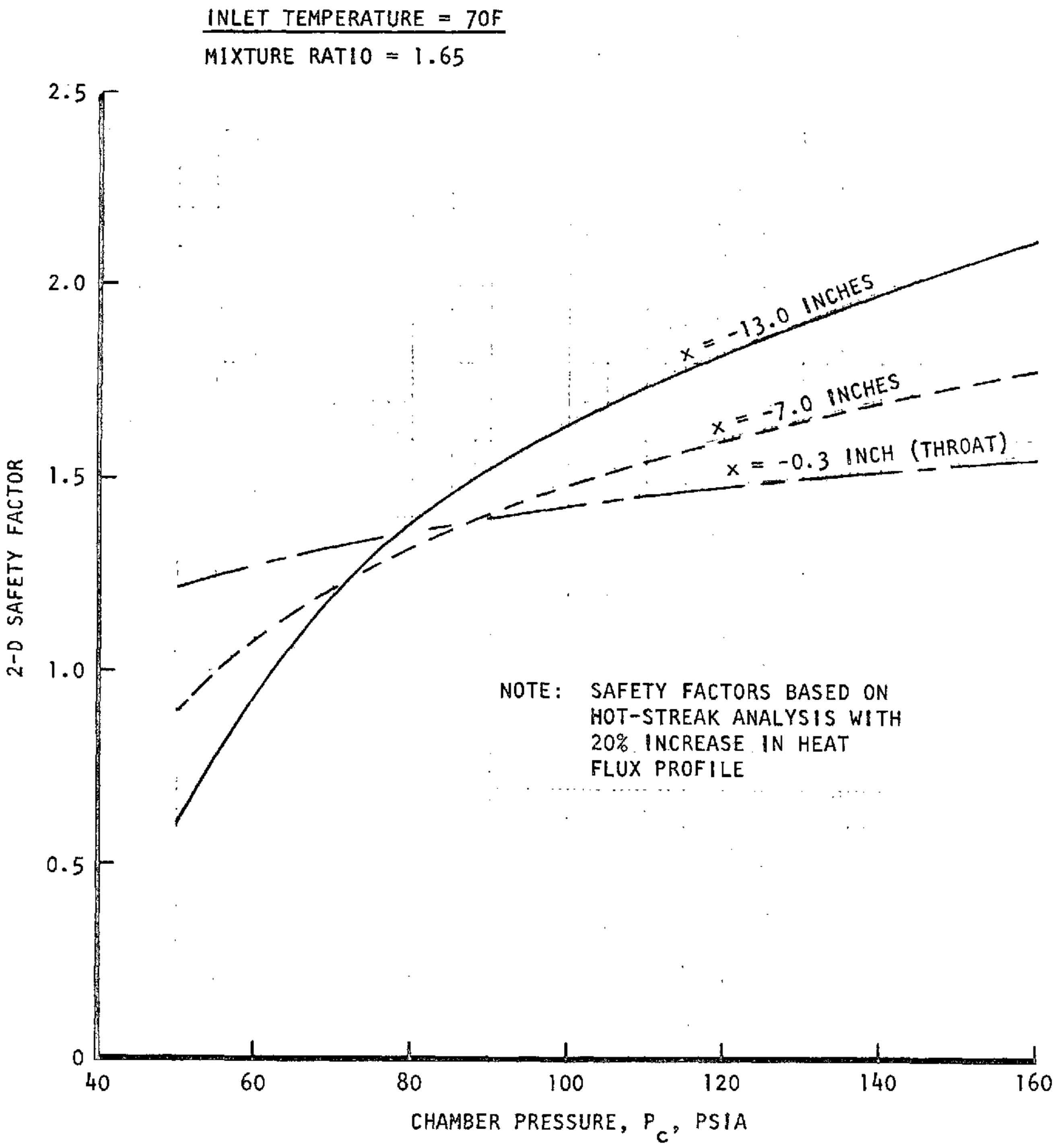

Figure 17. Cooling Safety Factor Variation at Selected Locations in the SS/OME Integrated Thrust Chamber

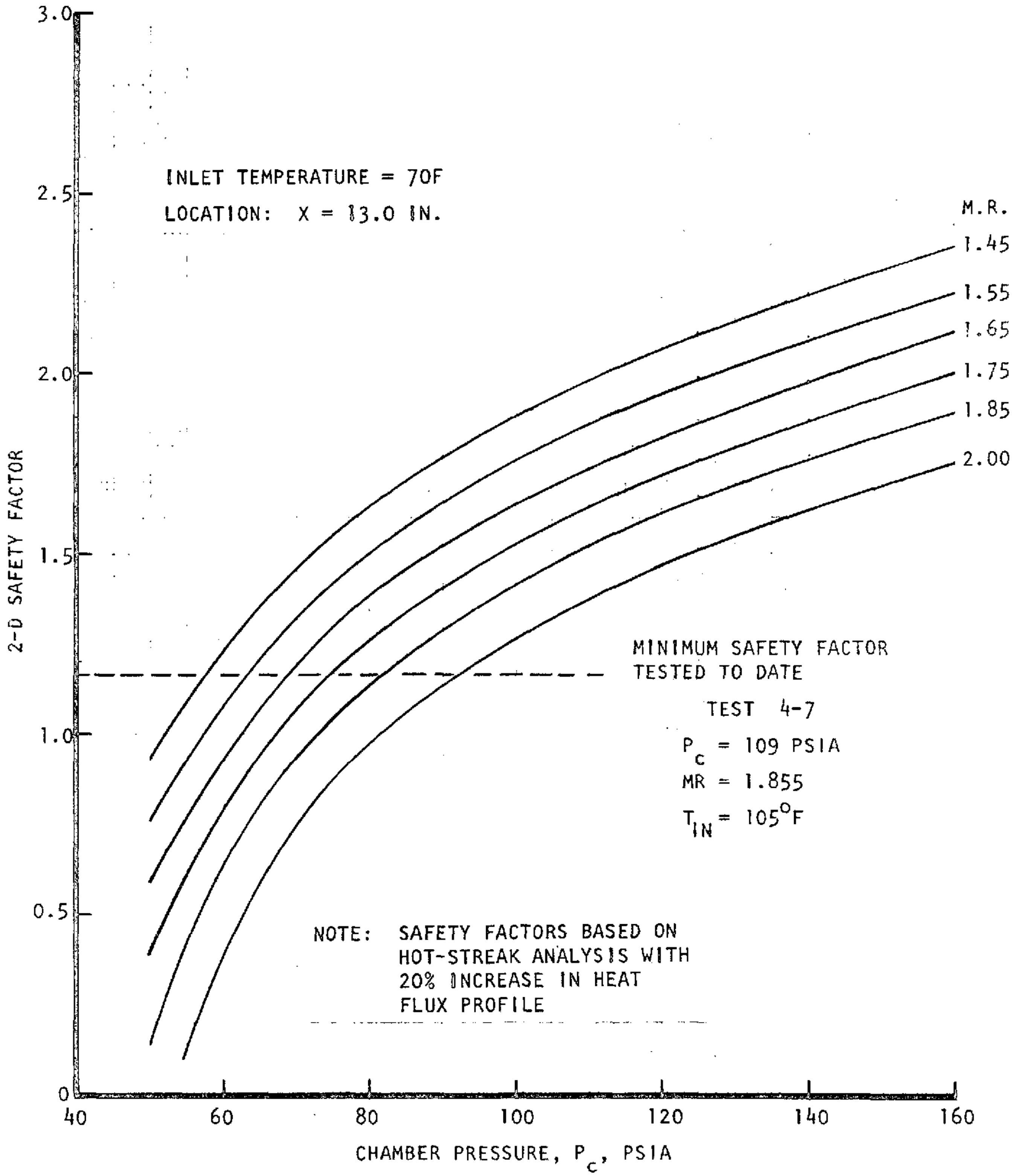

Figure 18. OME Integrated Thrust Chamber Safety Factor Operating Map

minimum chamber pressure operating limits on a comparative safety factor level. Using this approach, it is estimated that at a nominal mixture ratio (o/f = 1.65) with 70 F fuel entering the chamber, the minimum feasible chamber pressure is about 69 psia.

It should be further stressed that the foregoing analysis is conservative in that the minimum safety factor imposed is based on the worst case tested to date (Test 4-7). This test did not result in any hardware damage, and it is quite probable that more severe testing could be accomplished, since the safety factor may be in excess of the calculated value (1.16). In particular, the use of a 2-D correction on the safety factor may be conservative, since electrically heated channel test results at low heat flux levels appeared to match 1-D burnout results. If the 1-D safety factor is, indeed, the correct value, then the injector end safety factors are about 35 to 40 percent higher than shown. Furthermore, if the cause of the hot-streak is eliminated, the resultant safety factors are increased about 40 percent.

Heat Sink Nozzle

The ITC chamber tests were conducted with a full 72:1 area ratio CRES heat sink nozzle to obtain accurate performance information. Wall temperature measurements at various locations were recorded during the ITC tests. Typical temperature response data for the CRES nozzle are presented in Fig. 19. Test cut-off was based on maximum nozzle temperatures of about 1400-1500 F.

At higher area ratios (36, 53 and 70), the two circumferential measurements agree quite well. The lower area ratio positions indicate circumferential temperature differences of 100 to 150 F at cut-off with the 90° location consistently lower. With one exception, the lower the area ratio, the higher the wall temperature at cut-off, as would be expected by theory (neglecting conduction effects). At the 0° position, however, it is seen that the temperature at an area ratio of 12 is about 40 F higher than the area ratio of 10 point. The reason for this discrepancy is unclear, although it may be associated with distruption of the combustion gas flow due to a discontinuity at the attach point. In any event, the temperature differential is not particularly significant.

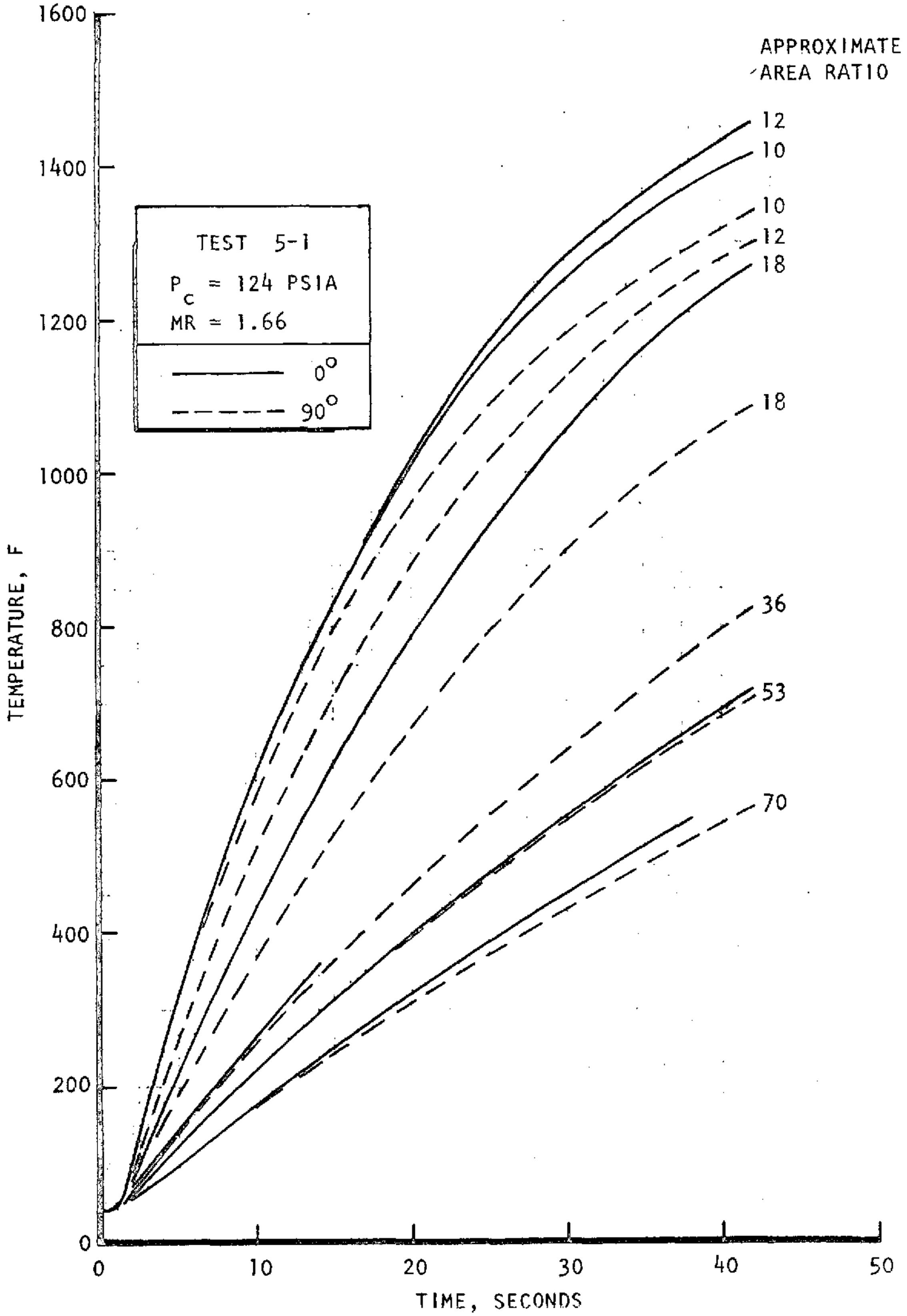

Figure 19. Steel Nozzle Temperature Response

Of primary significance, however, is the fact that the nozzle heating rate is considerably lower than initial predictions. These experimental results, combined with the columbium radiation-cooled nozzle steady-state tests on the demonstrator chamber indicate heat flux levels approximately one-half the predicted value. This implies that either the combustion gas convective film coefficient, h_g, and/or the local adiabatic wall temperature, T_{aw}, is lower than calcualted.

An attempt was made to match the heat sink nozzle temperature transient using the Differential Equation Thermal Analyzer Program (DEAP). Various constant h_g and T_{aw} values were input without satisfactory results in matching the shape of the temperature response curves. Using a variable h_g value, however, based on the Bartz type sigma correction for property effects as a function of the ratio of wall to adiabatic wall temperature gave an excellent fit of the experimental data.

The resulting comparison for the maximum temperature point is presented in Fig. 20 for the duration of Test 5-1, as well as the initial soakout period. The somewhat more rapid predicted chilldown indicates a probable slight overestimation of either the surface emittance and/or inner surface view factor. The projected equilibrium temperature based on the analytical model is also shown. The predicted value of 1700 F compares favorably with the measured columbium radiation nozzle equilibrium temperatures of 1600 F. The short coated columbium nozzle is estimated to have a higher surface emittance (≈0.9) and a higher inner surface view factor (approaching unity) than the CRES nozzle and would be expected to operate at a lower temperature than predicted for the CRES nozzle.

The projected adiabatic wall temperature of 3300 F used to achieve the desired temperature response correlation is about 1000 F lower than predicted by theory. It would appear, therefore, that there is a region of fuel rich gas adjacent to the wall which persists some distance downstream of the throat. Since the temperature of the gas is strongly affected by local mixture ratio, it may indicate the reason for the circumferential variation of the wall temperature at lower area ratios. In essence, it appears that the effect of film cooling persists longer than the theoretical model predicts. The primary defect in the film cooling model may be that it was developed for a non-regeneratively cooled system. The heat removal from the film by the regenerative coolant may account for the greater apparent efficiency of the film coolant.

The single most significant conclusion to be drawn from the heat sink nozzle tests, in conjunction with the previous radiation cooled columbium nozzle tests, is that the use of a refracting material is unnecessary at the current attach point. The use of an L-605 type nozzle extension appears quite feasible which should result in considerable cost saving to the OME engine concept. Alternatively, the columbium nozzle could be attached to a lower area ratio with an attendant reduction in engine weight.

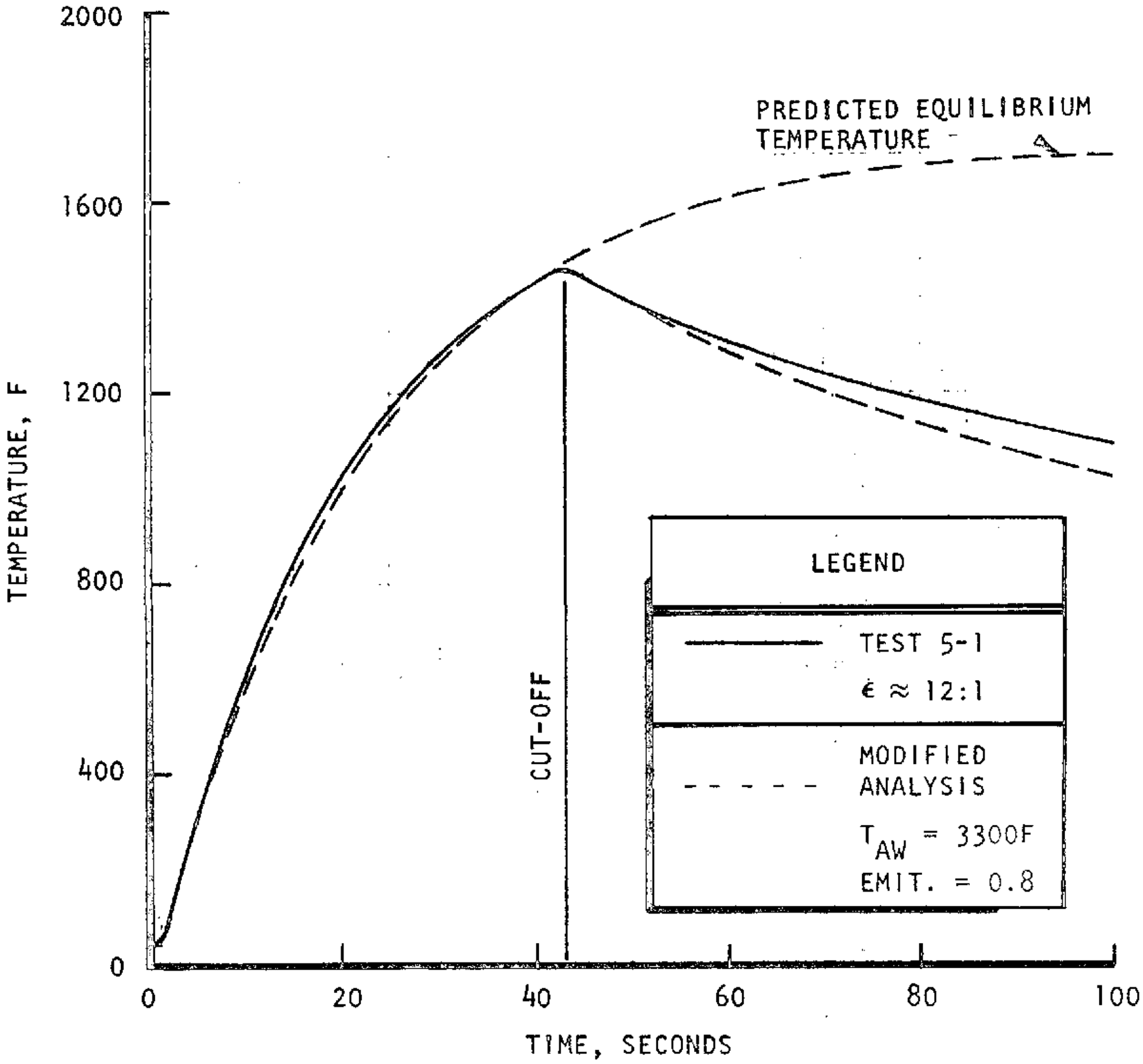

Figure 20. Comparison of Modified Analysis with the Experimental Temperature Response of the CRES Heat Sink Nozzle

START SEQUENCE VARIATIONS

Three different propellant valve opening sequences were used during the program. The propellant control valves were set so that the oxidizer propellant valve reached the full open position nominally 50 ms before the fuel valve reached its full open position for test series 1-1. The oxidizer valve lead was reset for approximately 250 ms on test series 1-2 and for 150 ms on test series 1-3, 1-4, and 1-5. Considerable variation in the oxidizer valve lead (198-307 ms) occurred from test to test on series 1-2.

Oxidizer valve lead, oxidizer injection lead, thrust and Pc overshoots, and maximum 'g' levels are summarized in Table 8. On the first two tests 1-1-1 and 1-1-2), the load cells were overloaded so that the actual value of the overshoot cannot be specified. Figure 21 and 22 show a typical start transient for the first test of a series. The fuel and oxidizer injection pressure measurements had poor response. Injector priming was inferred from the engine interface pressure measurements (upstream of the propellant valves) which were quite responsive. This procedure was also justified by the good correlation between oxidizer injection lead, determined in this manner, and oxidizer valve lead shown in Fig. 23. Chamber pressure began to rise simultaneously with thrust but the chamber pressure overshoot appears to be damped and did not correlate well with thrust overshoot or 'g' level.

Accelerometers always indicated the highest 'g' level on the first test of each series and the thrust overshoots were also the highest on these tests (except series 1-4). This phenomenon could be associated with incomplete purging between tests or with cold hardware on the first test. The cold hardware is most likely responsible because the purging procedures are quite thorough. Furthermore, tests 1-2-1A and 1-2-1B were very short duration tests (<1 sec) on which the hardware did not have an opportunity to warm up and the thrust overshoots and 'g' loads were relatively severe on tests 1-2-1B and 1-2-1, each of which was conducted within 1-3 minutes of the previous test.

TABLE 8

INTEGRATED THRUST CHAMBER TRANSIENT DATA

TEST NO.	OX VALVE LEAD, MS	F_c OVER-SHOOT,%	F OVER-SHOOT,%	ACCELER-OMETER,g	OXIDIZER INJECTION LEAD, MS
1-1-1	50	37	>110	43	132
1-1-2	44	37	>110	18	108
1-1-3	43	33	98	10	55
1-2-A	198	35	~90	37	258
1-2-B	218	23	~90	29	248
1-2-1	248	24	84	37	293
1-2-2	250	25	70	18	305
1-2-3	248	25	77	14	282
1-2-4	263	29	77	13	303
1-2-5	270	25	70	15	337
1-2-6	270	32	67	17	323
1-2-7	288	35	80	9	340
1-2-8	307	31	65	13	367
1-2-9	328	28	93	12	362
1-2-10	346	32	89	12	379
1-3-1	147	21	72	27	199
1-3-2	151	19	45	13	227
1-3-3	147	15	72	16	204
1-3-4	145	16	66	13	215
1-3-5	146	17	62	12	223
1-3-6	144	17	43	19	212
1-3-7	147	25	54	16	219
1-3-8	146	22	44	16	227
1-3-9	142	19	58	9	202
1-3-10	141	23	61	14	205

TABLE 8 (Continued)

INTEGRATED THRUST CHAMBER TRANSIENT DATA

TEST NO.	OX VALVE LEAD, MS	P_c OVER-SHOOT,%	F OVER-SHOOT,%	ACCELER-OMETER,g	OXIDIZER INJECTION LEAD, MS
1-4-1	188	19	67	28	222
1-4-2	153	9	75	17	199
1-4-3	142	16	73	9	199
1-4-4	145	19	73	10	207
1-4-5	150	22	61	9	217
1-4-6	153	20	54	9	227
1-4-7	155	24	54	13	240
1-4-8	150	28	70	14	213
1-4-9	150	29	66	10	228
1-4-10	142	18	65	12	215
1-5-1	170	37	95	36	210
1-5-2	130	42	59	13	190
1-5-3	145	42	72	6	241
1-5-4	145	26	86	12	223

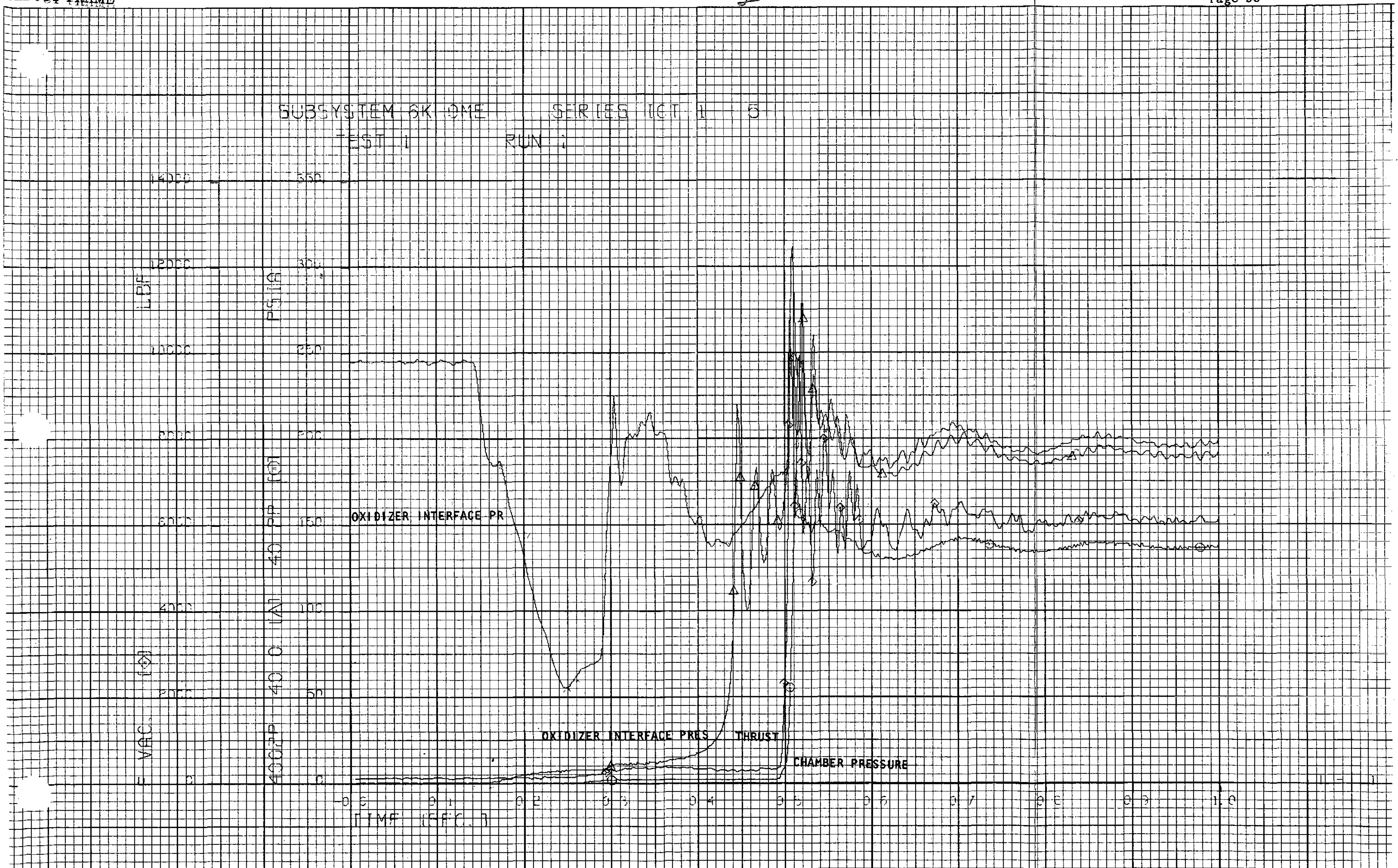

Figure 21. Oxidizer Transients on Test 1-5-1

FOLDOUT FRAME 1

FOLDOUT FRAME 2

Figure 22. Fuel Transients on Test 1-5-1

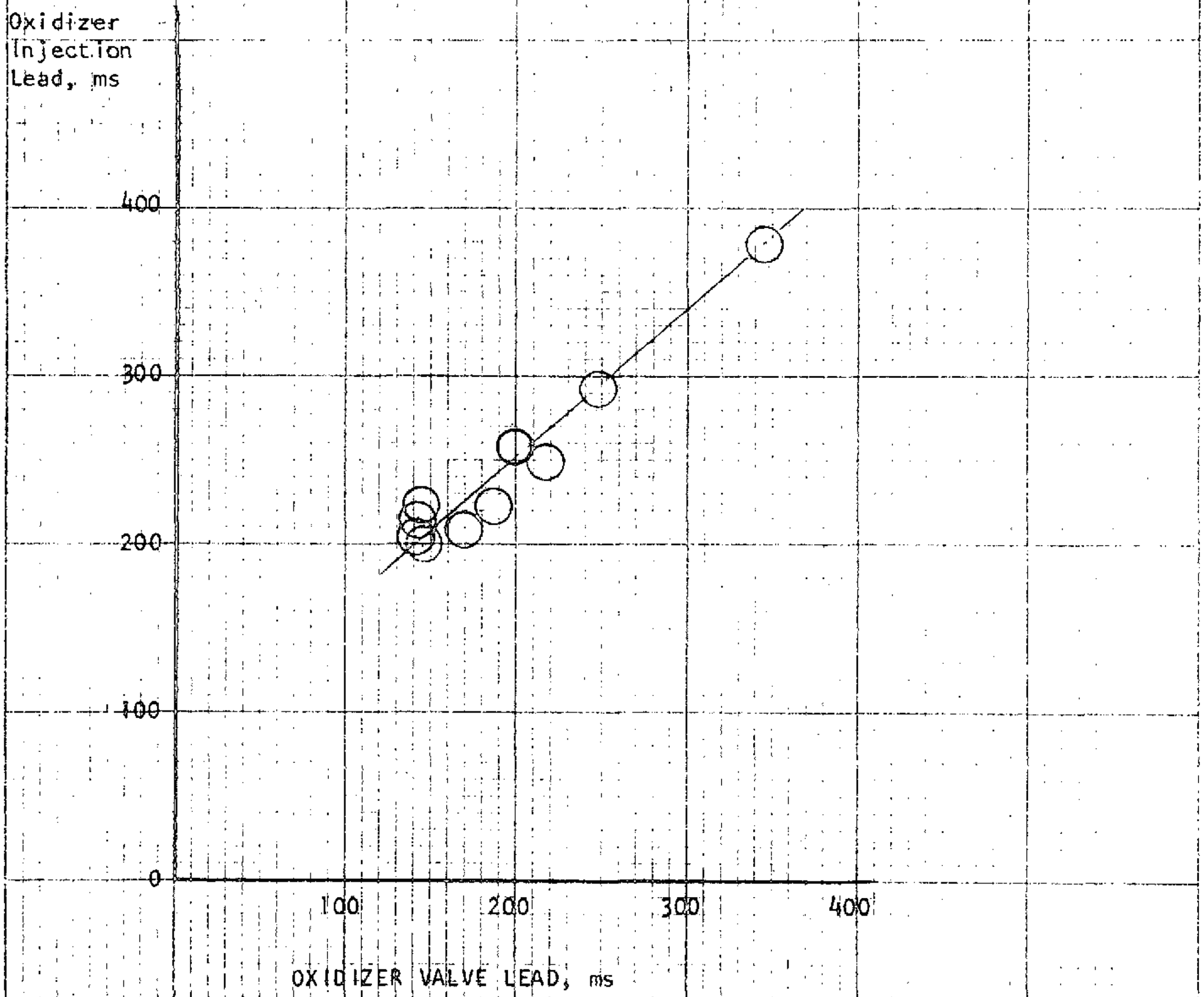

FIGURE 23. OXIDIZER INJECTION LEAD VS OXIDIZER VALVE LEAD

Start transients from test 5-4 are shown in Fig. 24 and 25 for comparison with Fig. 21 and 22 . The oxidizer valve opening times for tests 1-5-1 and 1-5-4 were 40 and 50 milliseconds respectively. The fuel valve openings for tests 1-5-1 and 1-5-4 were 140 and 95 milliseconds respectively. The fuel and oxidizer interface pressure transients reflect these valve times. The most significant differences between the traces for the first and fourth tests are that the injection pressures and chamber pressure for the last test are slightly higher than for the first tests during the low pressure part of the transient tests, implying that the warm hardware has vaporized some of the propellants entering the injector and chamber.

Thrust chamber temperatures for the first and last tests of each sequence are summarized in Table 9. The included MMH saturation data indicates that very little vapor pressure would be generated by the hardware heating the fuel to the temperatures indicated for the first tests. However, vapor pressures corresponding to the thrust chamber temperatures measured near the injector end prior to the start of the last tests could be as high as 60 psia. These pressures could reduce the fuel flowrate somewhat. But more significantly, the vaporized fuel could provide a smoother ignition with the oxidizer. Corresponding temperature data were not measured on the oxidizer side of the engine. However the higher injection pressures imply that the oxidizer also was subject to vaporization on latter tests in each sequence.

Although the correlation between the thrust overshoot and oxidizer injection lead is only loosely defined by Fig. 25A it appears that the overshoot would be minimized by an oxidizer lead of 150 to 250 ms.

POST-FIRING THERMAL TRANSIENTS

The last tests of sequences 3, 4, and the first test of series 5 were followed by thermal soakout in vacuum for a period of approximately one-half hour. On sequence 3 the soakout was initiated without any purge after the test. On sequences 4 and 5 a brief (1 second) purge of fuel and oxidizer

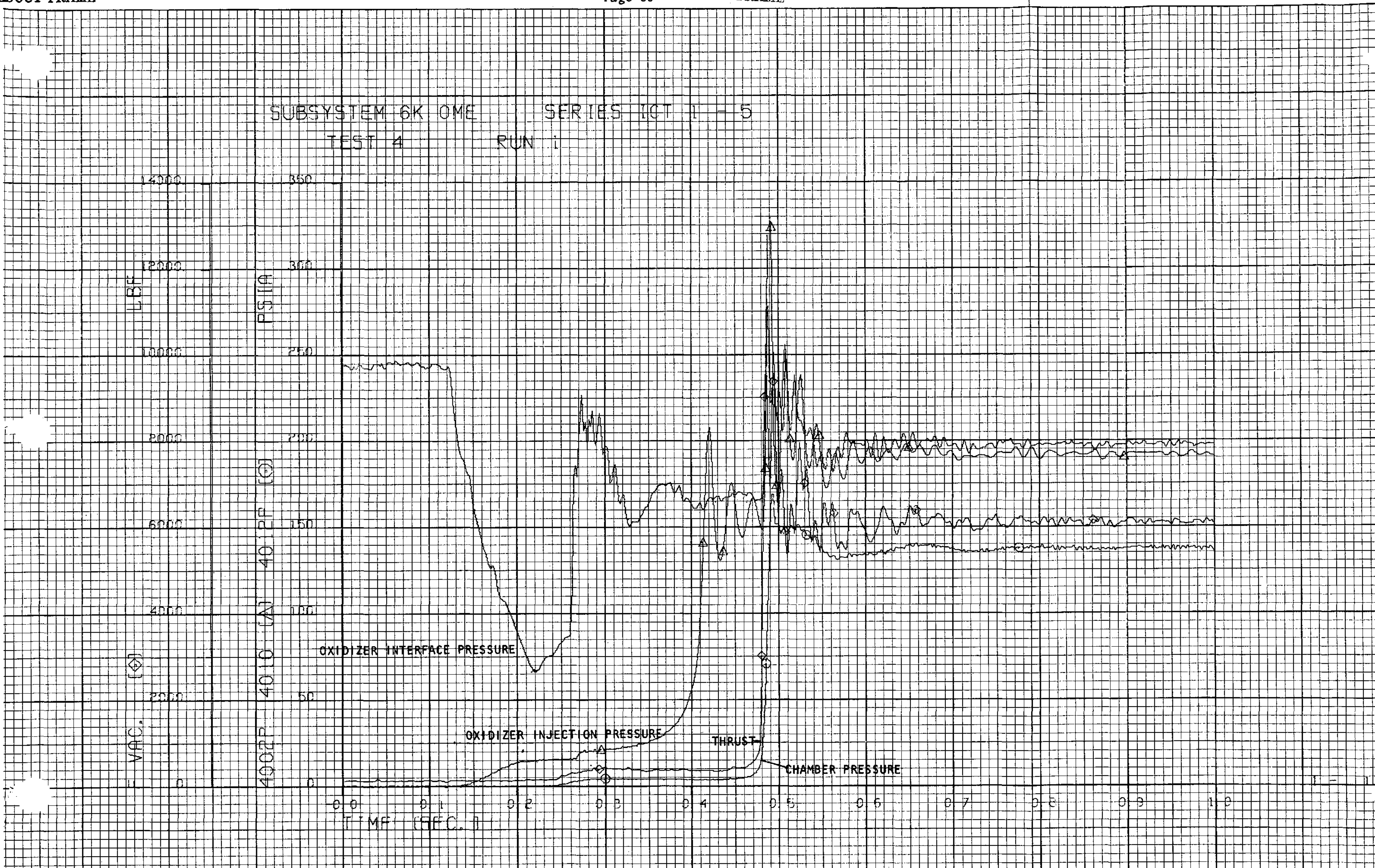

Figure 24. Oxidizer Transients on Test 1-5-4

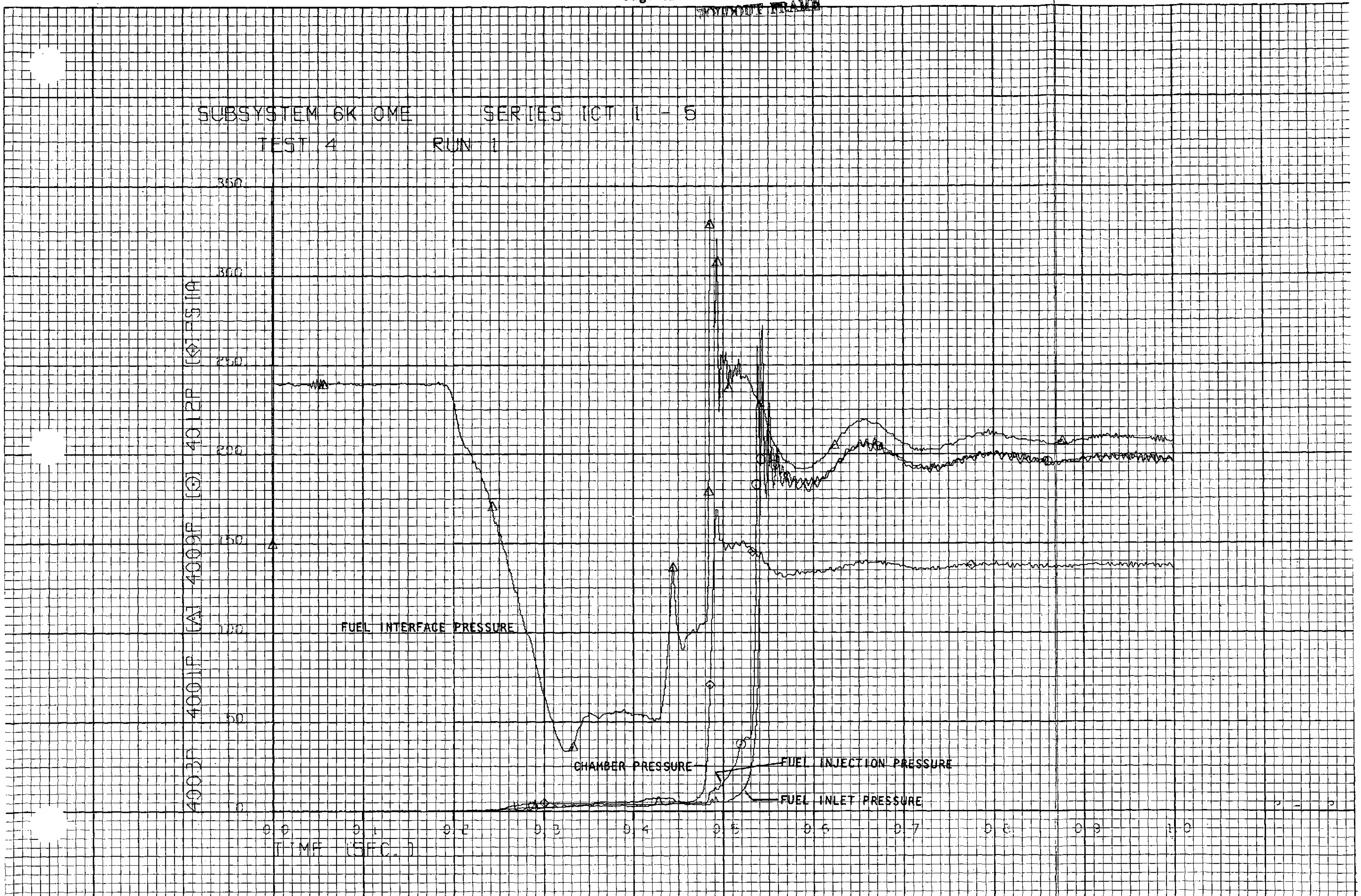

Figure 25. Fuel Transients on Test 1-5-4

TABLE 9

PRETEST THRUST CHAMBER TEMPERATURES

Test	PRETEST AVERAGE TEMPERATURES, F — Metal Temperatures Located at: -16 In	-13 In	-8 In	-4 In	0.3 In	+3 In	Nozzle Flange	Nozzle @7.2 In	Coolant @ Inlet	Coolant @ Injector
1-1	60	60	60	60	60	60	60	50	50	60
1-2	90	90	70	60	70	70	80	150	80	100
1-3	200	180	130	130	130	130	100	300	100	130
2-1B	50	50	60	60	60	60	70	70	60	50
2-10	210	140	120	120	140	130	210	780	90	130
3-1	60	60	60	60	60	60	60	60	60	60
3-10	240	160	120	120	140	130	190	1000	90	150
4-1	50	50	50	50	50	50	50	50	50	50
4-10	270	200	160	170	160	160	210	810	100	210
5-1	40	40	40	40	40	40	50	40	40	40
5-4	200	170	140	150	140	150	100	500	100	180

NOTE: MMH Saturation Data

T_{sat}, F	270	200	90	40
P_{sat}, psia	60	20	3	<1

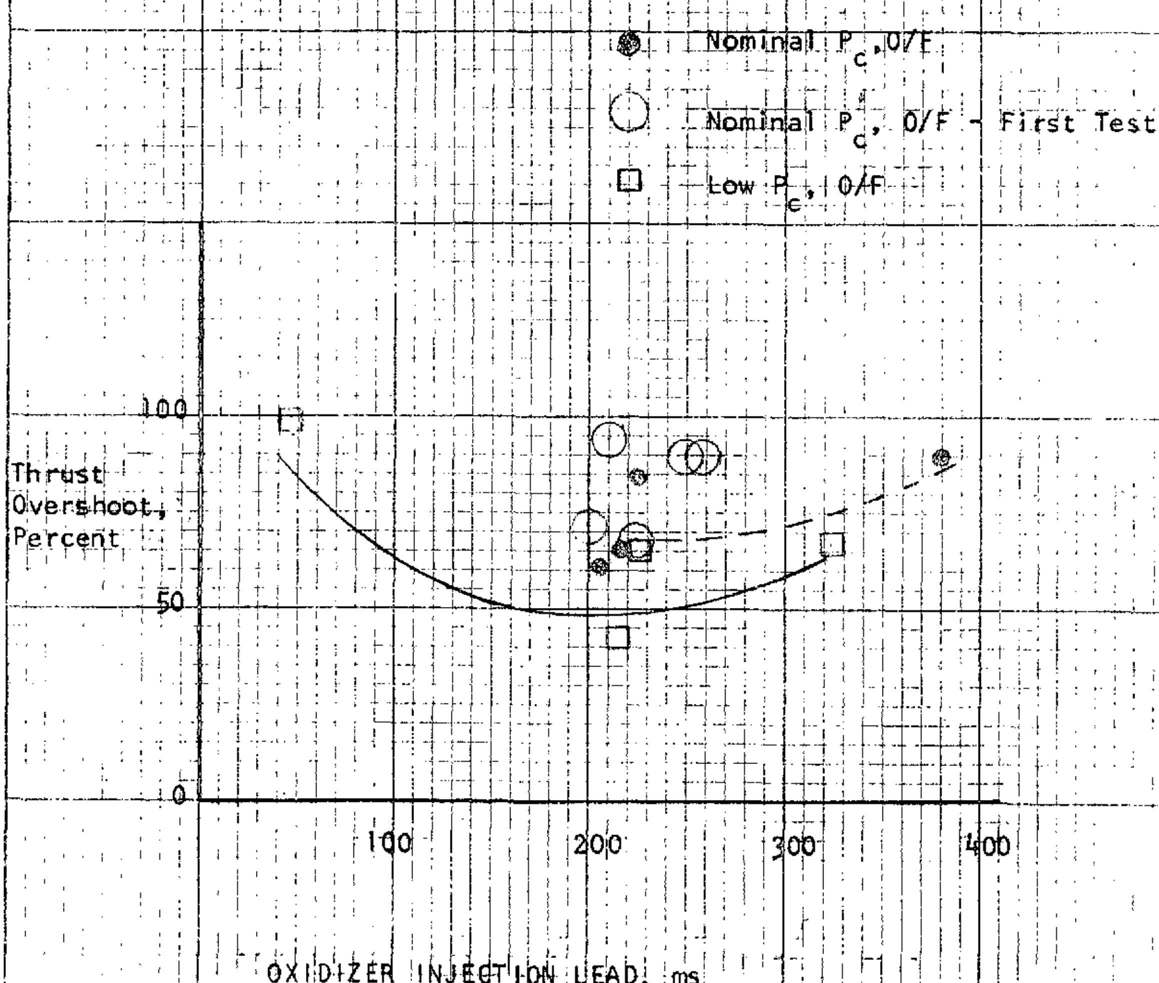

Figure 25A. Effect of Lead on Thrust Overshoot was accomplished in order to simulate the propellant depletion which would occur under zero 'g' flight conditions. Three significant events occurred during the transients. During the first two to five seconds after shutdown, inside and outside wall temperatures equilibrate with the result that certain backwall temperatures reach a maximum in this period and then decay. At about 20 to 80 seconds propellant fuel depletion in the jacket is indicated. In about 30 minutes all hardware temperatures have reached their maximum soakout values.

Nickel backwall temperatures at the zero degree circumferential location (90 degrees clockwise from the coolant inlet viewing aft) after test 1-3-10 (no purge) are shown in Fig. 26 and 27. The break in the data from 62 to 82 seconds is the result of instrumentation calibrations being taken at that time. Cut-off occurred at 10 seconds. Wall temperatures generally peak 2 to 3 seconds after cut-off as a result of the inner and outer walls reaching equilibrium. Wall temperatures at the injector-end peak more slowly because of the influence of the acoustic cavity dams and the thicker liner in this region. The maximum temperature recorded at this time period on any of the soakout tests was less than 375 F. The thrust chamber can be safely restarted at these temperatures based on the results of the electrically heated tube tests conducted under Task IX of the contract. Under this task starting conditions were simulated with tubes as hot as 1600 F with no adverse effects.

After the inner and outer walls come to equilibrium, the wall (inner and outer) is heated by soakback from the radiation-cooled nozzle and the injector and is cooled by residual fuel in the jacket, inlet manifold, and line. The volume of fuel in the injector and coolant channels is approximately 60 $inches^3$ and the volume of the inlet manifold and line to the valve is approximately the same. The shapes of the backwall temperature transients do not indicate an orderly boiling down past each axial station in the jacket. Either all the fuel in the jacket is discharged in the first few seconds or violent boiling bathes the walls with froth independent of axial location.

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The fuel inlet manifold pressure transient for test 1-3-10 and associated MMH boiling temperature are plotted in Fig. 28. The accuracy of the pressure measurement is in the order of 1 psi which corresponds to a 10 F accuracy in the boiling temperature at the lower pressures. The MMH boiling temperature curve is superimposed on Fig. 26 and 27. After the initial transient, the wall temperatures are generally 10 to 15 F above the boiling temperature implying that any fuel in the channels would be boiled at all locations. The divergence between the wall and boiling temperature curves could be the result of decreasing quantities of MMH percolating up the channels. A bias of 1 psi in the inlet manifold pressure measurement could also cause the divergence. However, at 60 seconds (50 seconds after shutdown) some of the wall temperatures reach minimum values and begin to rise indicating the onset of depletion of MMH. All wall temperatures (except at station 16, the injector end) were rising by the time calibrations were completed at 73 seconds after shutdown. This implies essentially complete propellant depletion from the channels. Wall temperature profiles at T = 83, 200, 600, and 1200 seconds plotted in Fig. 29 show the effects of thermal inputs from the injector and nozzle. The nozzle is the primary heat source during the latter period of the soakout. Regenerative chamber wall temperatures do not exceed the initial peak value at 1200 seconds all the radiation nozzle temperatures are less than 300 F and decreasing.

In Fig. 30 are plotted the temperature transients for the regenerative chamber side of the chamber/nozzle flange, the inlet manifold skin and the fuel in the inlet manifold. Comparison of the flange temperatures with the chamber wall temperature at the +3 inch station indicates that it is the flange (and nozzle) which mainly supply the heat to vaporize the fuel in the inlet manifold. The flange temperatures peak 10-20 seconds after shutdown when the heat rate from the radiation nozzle side of the flange decays to equal the heat rate to the inlet manifold and regenerative chamber wall. The inlet manifold itself is cooled quite well (75 F) during the test by the fuel. Approximately 40-50 seconds after shutdown the manifold temperatures peak at less than 110 F. Sometime during the calibration period

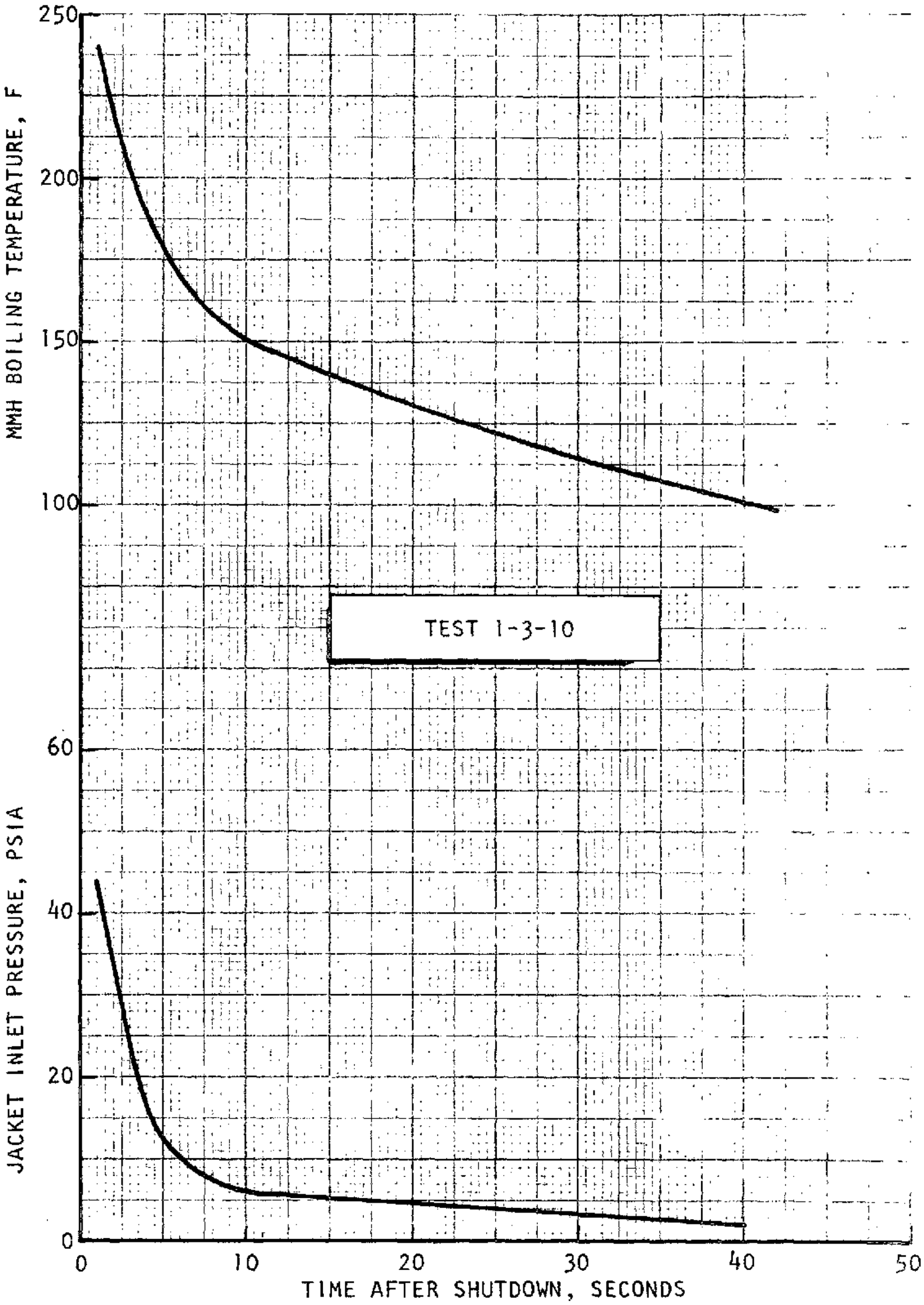

Figure 28. Inlet Pressure and Boiling Temperature Transients

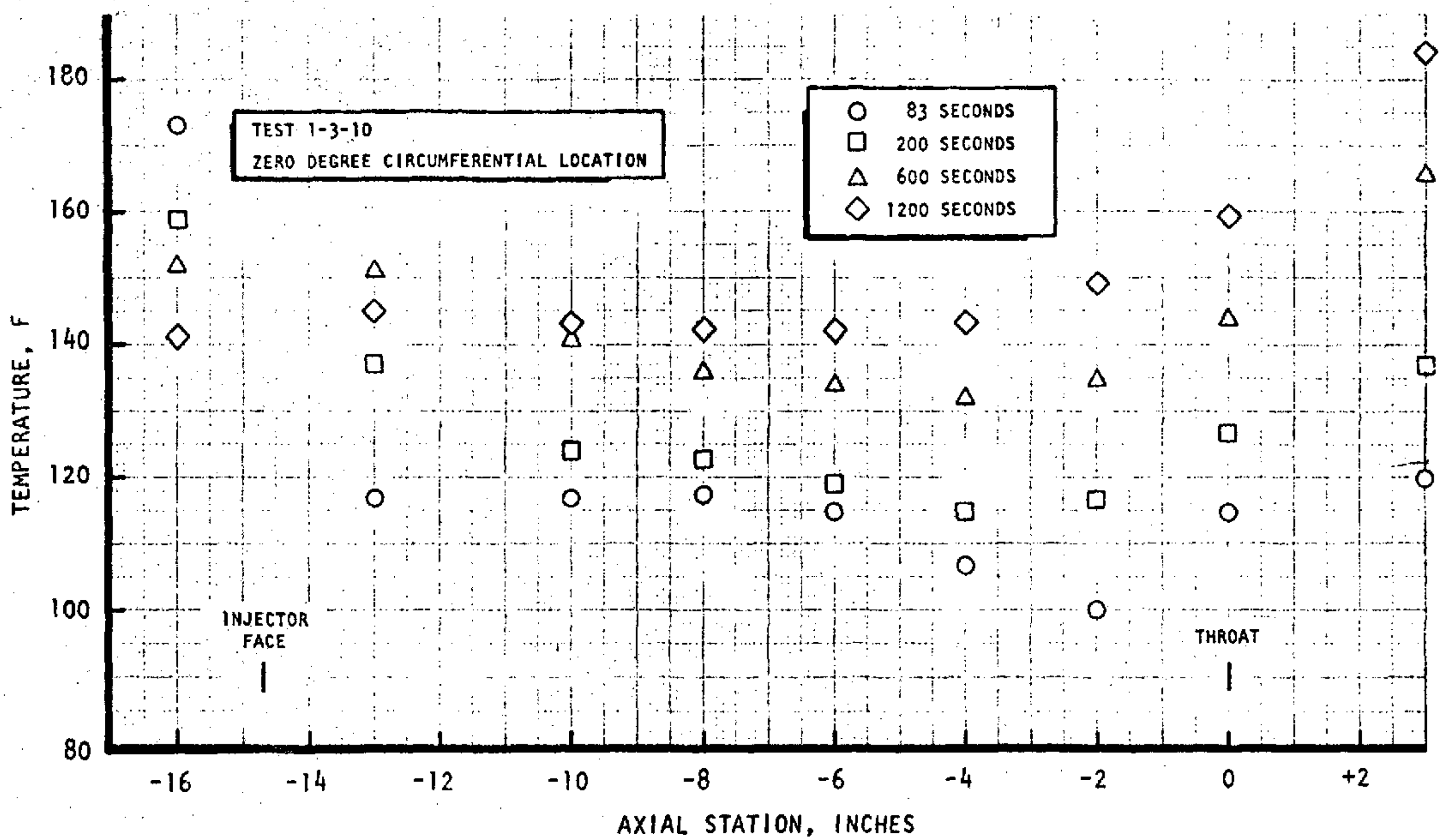

Figure 29. Regenerative Chamber Wall Temperature Profiles

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the manifold temperatures reach minimum values and begin to rise again indicating local propellant depletion.

The three fuel temperatures in the inlet manifold agree well during the firing. After shutdown, the fuel temperatures rise in response to local wall and flange temperatures. The fuel temperature near the inlet is as much as 50 F lower than at the other two locations, probably because of mixing with the fuel from the inlet line and the influence of the cool inlet duct. The MMH boiling temperature curve is again superimposed and implies that bulk boiling does not commence in the inlet manifold until some 20 seconds after shutdown. This implication, together with the alternative conclusions previously drawn from the wall temperature transient curves, lead to the conclusion that the fuel in the injector and jacket is probably blown out of the chamber by boiling in the entire jacket before boiling begins in the inlet manifold.

Propellant temperatures eventually begin to decay along with the boiling temperature curve. As the propellant boils off in the manifold, the closed tip thermocouples are uncovered and heated by the warm inlet manifold. The minimum temperature which occurred during the calibration period (50-70 seconds after shutdown) indicates fuel depletion below tht thermocouples. The exact time of depletion cannot be determined in test 1-3-10 because of the calibrations. On the soakout after test 1-4-10 all three fuel thermocouples indicated depletion within 3 seconds of each other. On test 1-5-1, two of the three thermocouples indicated simultaneous depletion (the other began on anomalous transient at that time). The inlet manifold consists of a continuous torus from which the fuel exits through 0.18 inch diameter holes into a lower torus. The simultaneous indication of minimum values by the three thermocouples, which are at different elevations above the drilled plate, implies that the boiling propellant splashes on and cools the thermocouples at least until the level falls below the drilled plate. The volume of the drilled holes and lower torus is 6-inch^3 so that fuel depletion is essentially complete when indicated by the fuel thermocouples.

Propellant temperatures eventually begin to decay along with the boiling temperature curve. As the propellant boils off in the manifold, the closed tipthermocouples are uncovered and heated by the warm inlet manifold. The minimum temperature which occurred during the calibration period (50-70 seconds after shutdown) indicates fuel depletion below the thermocouples. The exact time of depletion cannot be determined in test 1-3-10 because of the calibrations. On the soakout after test 1-4-10 all three fuel thermocouples indicated depletion within 3 seconds of each other. On test 1-5-1, two of the three thermocouples indicated simultaneous depletion (the other began on anomalous transient at that time). The inlet manifold consists of a continuous torus from which the fuel exits through 0.18 inch diameter holes into a lower torus. The simultaneous indication of minimum values by the three thermocouples, which are at different elevations above the drilled plate, implies that the boiling propellant splashes on and cools the thermocouples at least until the level falls below the drilled plate. The volume of the drilled holes and lower torus is 6-inch^3 so that fuel depletion is essentially complete when indicated by the fuel thermocouples.

Table 10 is a summary of the fuel depletion times based on the fuel inlet temperature transient data for each of the soakout tests and the associated significant conditions for each test.

TABLE 10. PROPELLANT DEPLETION SUMMARY

Test	1-3-10	1-4-10	1-5-1
Depletion Time, sec After Shutdown	~60	25	60
Fuel Inlet Temperature, F At Shutdown	65	105	65
Regen Flange Temp, F At Shutdown	190	210	50
Post-test Purge	No	Yes	Yes

The depletion time on test 1-4-10 was significantly shorter than on test 1-3-10 which can be attributed to the higher fuel temperature and the brief post-test purge. Fuel depletion times were about the same for 1-3-10 and 1-5-1 despite the post-test purge on test 1-5-1. It appears that the effect of the purge was offset by the colder regenerative chamber flange temperature. The flange temperature does not change significantly during the tests but does increase between tests because of soakback from the nozzle as indicated by the data in Table 11.

Temperatures after 20 minutes of vacuum soakout are tabulated in Table 12. All temperatures were less than 350 F at this time for all three tests. The maximum temperature difference measured on the regenerative chamber wall was 60 F. The regenerative chamber flange temperature on test 1-3-10 appears low but is based on two measurements which agree within 4 F. The highest temperature at this time was 340 F on the radiation nozzle. Although the nozzle operating temperature for the flight hardware is greater than that tested, the nozzle wall thickness of the flight hardware is significantly less (.030 vs .125 inches) so that heat transfer to the regenerative chamber should be no greater in the flight configuration.

TABLE 11. METAL TEMPS AT 0 DEGREE LOCATION

Test	Regen. Flange		Nozzle @ 7.2 In*		Nozzle @ 7.8 In.	
	-1 Sec	10.5 Sec**	-1 Sec	10.5 Sec	-1 Sec	10.5 Sec
1-3-1	60	60	60	250	60	670
-2	80	81	390	460	610	1010
-3	95	95	520	570	750	1080
-4	115	116	640	680	930	1210
-5	134	133	720	750	1030	1300
-6	137	135	650	670	890	1100
-7	152	152	690	710	970	1190
-8	170	169	740	760	1050	1250
-9	173	171	700	720	960	1180
-10	188	188	740	770	1050	1260
1-4-1	51	53	50	600	50	1200
-2	78	77	600	640	870	1160
-10	214	213	800	830	1140	1310
1-5-1	47	50	44	760	41	1360
-2***	73	74	180	830	180	1280

NOTES: *0.2" from flange of radiation nozzle
**30 sec for test 1-4-10 & 43 sec for 1-5-1
***Long delay & aborted test between 1-5-1 & 1-5-2

TABLE 12

SOAKOUT TEMPERATURES AT 1200 SECONDS

Location	Temperature*, F		
	Test 1-3-10	Test 1-4-10	Test 1-5-1
-16 In	144	184	135
-13 In	145	190	127
-10 In	142	187	154
-8 In	141	184	155
-6 In	141	182	157
-4 In	142	181	157
-2 In	147	185	160
Throat	159	193	166
+3 In	186	219	186
Inlet Manifold	208	233	187
Regen Flange	126	225	209
Near Rad. Flange (7.2 in)	254	307	246
Radiation Nozzle (7.8 in)	265	324	256
Max. Rad. Nozzle Temp.	285	340	292

*Circumferentially averaged

CONCLUSIONS

The results of the tests of the Rocketdyne integrated thrust chamber at WSTF lead to the following conclusions.

The regeneratively cooled thrust chamber, radiation cooled nozzle and like-doublet injector will operate safely over the design range of chamber pressures (110-140 psia) and mixture ratios (1.45 to 1.85) with fuel inlet temperatures up to 104 F.

Safe operation at nominal mixture ratio was also demonstrated at chamber pressures as high as 151 psia and as low as 100 psia. Although no bomb tests were conducted, the engine was stable over the operating ranges described above.

Thermal data indicates heat transfer rates are lower than predicted, although higher than measured in the demonstration chamber. The low heat load in the regenerative chamber suggests that the combustion chamber can be lengthened to improve performance. The low nozzle heat fluxes imply two alternatives: the regenerative/radiation attach point can be shifted to a lower area ratio to reduce the weight of the regenerative chamber, inlet manifold and attachment flange; or a radiation nozzle of more conventional material such as uncoated L605 can be used compared to the present design which utilizes coated columbium. The pressure drop of the integrated thrust chamber coolant jacket and manifolds is 15 psi at nominal conditions.

Chamber backwall temperature measurements indicate that a substantial safety factor exists at the circumferential location near the injector (which has the maximum temperature) even under the most adverse conditions of low-chamber pressure and high-mixture ratio and fuel-inlet temperature.

The vacuum performance (I_s) of the integrated chamber with the L/D No. 1 injector is 310 seconds at nominal conditions and is virtually unaffected by propellant inlet saturation and temperature over the range tested. Sensitivity to chamber pressure is in the order of 0.1 sec/psia. A variation of 0.11 units of mixture ratio results in a 0.1 second variation in I_s. Steady-state performance is reached more rapidly than the demonstrator chamber and agrees very well with the performance previously calculated for the demonstrator chamber. The agreement also adds confidence to the analytical extrapolation of the demonstrator performance data (taken with a 9:1 expansion nozzle) to performance with a 72:1 nozzle.

The fact that the heat loads were lower than predicted implies that performance can be increased by eliminating the boundary layer coolant, although the safety factor would be marginal at off-design conditions, or by increasing the combustor length. A specific impulse gain of approximately 2.5 seconds can be obtained by eliminating the boundary layer coolant. Based on heat sink test data, a gain of 3 seconds could be achieved by lengthening the combustion chamber to 16.2 inches. A 315 second impulse could therefore be achieved with the like-doublet injector pattern employed in a 2:1 contraction ratio chamber.

Start transient data indicated moderate starts. Thrust overshoots indicated a correlation with oxidizer injection lead while the maximum 'g' load depended only on whether the test was the first of a sequence.

Thermal soakout tests revealed that maximum soakout temperature would not be so high as to cause problems when the MMH enters the chamber for a restart, i.e. there are no high temperature restart limits. The data implies that fuel depletion of the jacket after a test occurs approximately one minute after shutdown. The depletion time is affected by the temperature of the regenerative chamber flange area (attachment to radiation nozzle) at shutdown.

The electroforming fabrication technique was demonstrated for an integrated injector/thrust chamber assembly. The present configuration was bolted together for test flexibility but can readily be modified to remove the flange and weld the components together.

APPENDIX

TEST DATA SUMMARY

Summaries of test data compiled and printed at NASA/WSTF are presented in this appendix. Data are presented for at least one slice on each test and for multiple times on a few tests. A description of the parameters is included together with the method of computing performance.

One discrepancy noted after the data was published is that the T/C surface temperatures at -4 and -8 inches are reversed.

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE
SERIES (1) SEQUENCE TEST
TEST DESCRIPTION: (2)

TEST DURATION (3)
DATA SLICE TIME (4)

PARAMETER	UNITS	AVERAGE MEASURED VALUE
FUEL TANK PRESSURE	PSIA	(5)
OXIDIZER TANK PRESSURE	PSIA	(6)
FUEL INTERFACE PRESSURE	PSIA	(7)
OXIDIZER INTERFACE PRESSURE	PSIA	(8)
T/C COOLANT INLET MAN. PRESSURE	PSIA	(9)
FUEL INJECTOR PRESSURE	PSIA	(10)
OXIDIZER INJECTOR PRESSURE	PSIA	(11)
CHAMBER PRESSURE NO. 1	PSIA	(12)
CHAMBER PRESSURE NO. 2	PSIA	(13)
AXIAL THRUST, SYSTEM A	LBF	(14)
AXIAL THRUST, SYSTEM B	LBF	(15)
Y-AXIS THRUST	LBF	(16)
Z-AXIS THRUST	LBF	(17)
AVERAGE CELL PRESSURE	PSIA	(18)
CELL PRESSURE AGREEMENT	%	(19)
AVERAGE FUEL FLOWRATE	GPM	(20)
FUEL FM AGREEMENT	%	(21)
AVERAGE OXIDIZER FLOWRATE	GPM	(22)
OXIDIZER FM AGREEMENT	%	(23)
FUEL INTERFACE TEMPERATURE	°F	(24)
OXIDIZER INTERFACE TEMPERATURE	°F	(25)
T/C COOLANT IN TEMPERATURE	°F	(26)
T/C COOLANT OUT TEMPERATURE	°F	(27)
T/C SURFACE TEMP -16 IN	°F	(28)
T/C SURFACE TEMP -13 IN	°F	(29)
T/C SURFACE TEMP -10 IN	°F	(30)
T/C SURFACE TEMP - 8 IN	°F	(31)
T/C SURFACE TEMP - 6 IN	°F	(32)
T/C SURFACE TEMP - 4 IN	°F	(33)
T/C SURFACE TEMP - 2 IN	°F	(34)
T/C SURFACE TEMP -0.3 IN	°F	(35)
T/C SURFACE TEMP + 3 IN	°F	(36)
T/C-NOZZLE FLANGE TEMP	°F	(37)

PARAMETER	UNITS	AVERAGE MEASURED VALUE
NOZZLE SURFACE TEMP +7.2 IN	°F	(38)
NOZZLE SURFACE TEMP +7.8 IN	°F	(39)
NOZZLE SURFACE TEMP +9.9 IN	°F	(40)
NOZZLE SURFACE TEMP +11.7 IN	°F	(41)
NOZZLE SURFACE TEMP +16.2 IN	°F	(42)
NOZZLE SURFACE TEMP +28.4 IN	°F	(43)
NOZZLE SURFACE TEMP +40.4 IN	°F	(44)
NOZZLE SURFACE TEMP +57.5 IN	°F	(45)

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE
SERIES SEQUENCE TEST

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	(46)
PC, NOZZLE STAGNATION	PSIA	(47)
AXIAL THRUST, SITE	LBF	(48)
AXIAL THRUST, VACUUM	LBF	(49)
NOZZLE EXIT PRESSURE	PSIA	(50)
FUEL DENSITY (MMH)	LB/FT3	(51)
OXIDIZER DENSITY	LB/FT3	(52)
FUEL FLOWRATE	LB/SEC	(53)
OXIDIZER FLOWRATE	LB/SEC	(54)
TOTAL PROPELLANT FLOWRATE	LB/SEC	(55)
MIXTURE RATIO (OVERALL)	O/F	(56)
BLC FLOWRATE	LB/SEC	(57)
BLC TOTAL PERCENT	%	(58)
CORE MIXTURE RATIO	O/F	(59)
FUEL INJECTOR DELTA-P	PSID	(60)
OXIDIZER INJECTOR DELTA-P	PSID	(61)
T/C COOLANT DELTA-P	PSID	(62)
T/C COOLANT DELTA-T	°F	(63)
THRUST CHAMBER HEAT FLUX	BTU/SEC	(64)
C*, SITE	FT/SEC	(65)
C*, UMR	FT/SEC	(66)
C* EFFICIENCY	%	(67)
CF, SITE	-----	(68)
CF SITE VACUUM	-----	(69)
CF, VAC 72 EXPECT	-----	(70)
CF CORRELATION	-----	(71)
CF, VAC 72	-----	(72)
ISP, TEST	SEC	(73)
ISP, SITE VACUUM	SEC	(74)
ISP, VAC 72, PREDICTED	SEC	(75)
ISP, ODK, TEST CONDITIONS	SEC	(76)
ISP, TDK, TEST CONDITIONS	SEC	(77)
ISP EFFICIENCY	%	(78)
ENERGY RELEASE EFFICIENCY	%	(79)

ITEM	INSTRUCTIONS
(1)(2)(4)	Series, Sequence, and Test numbers will be supplied on a data reduction input sheet by NASA TPO. This sheet will also describe the test and define data slice start-stop times.
(3)	Test duration to be read by DAG from ØIII data
(5)	GXD535P
(6)	GXD537P
(7)	4001P
(8)	4002P
(9)	4003P
(10)	4009P
(11)	4010P
(12)	4011P
(13)	4012P
(14)	XFA = (3001F + 3003F + 3005F) at data slice minus (above) at prefire -4-2 sec interval
(15)	XFB = similar to (14) above using measurements 3002F, 3004F, 3006F
(16)	YF = similar to (14) using 3011F & 3012F
(17)	$ZF = \frac{ZFA + ZFB}{2}$, where ZFA is calculated same as (14) above using measurement numbers 3007F & 3009F; ZFB uses meas. nos. 3008F & 3010F

ITEM	INSTRUCTIONS
(18)	$PCELL = \frac{EQ9511P + EQ9512P}{2}$
(19)	$CPRA = \lvert EQ9511P - EQ9512P \rvert \times 200$
(20)	$FUFLOW = \frac{1006R + 1007R}{2}$
(21)	$FUFMA = \lvert 1006R - 1007R \rvert$
(22)	$OXFLOW = \frac{2006R + 2007R}{2}$
(23)	$OXFMA = \lvert 2006R - 2007R \rvert$
(24)	$TFUINT = 1015T$
(25)	$TOXINT = 2015T$
(26)	$TCHIN = \frac{4007T + 4008T + 4013T}{3}$
(27)	$TCHOUT = \frac{4020T + 4021T + 4022T}{3}$
(28)	$TCHS\text{-}16 = \frac{4030T + 4031T + 4032T + 4033T + 4034T + 4035T + 4036T + 4037T}{8}$
(29)	$TCHS\text{-}13 = \frac{4038T + 4039T + 4040T + 4041T}{4}$
(30)	$TCHS\text{-}10 = \frac{4042T + 4043T + 4044T + 4045T}{4}$
(31)	$TCHS\text{-}8 = \frac{4046T + 4047T + 4048T + 4049T}{4}$
(32)	$TCHS\text{-}6 = \frac{4050T + 4051T + 4052T + 4053T}{4}$
(33)	$TCHS\text{-}4 = \frac{4054T + 4055T + 4056T + 4057T}{4}$
(34)	$TCHS\text{-}2 = \frac{4058T + 4059T + 4060T + 4061T}{4}$

ITEM	INSTRUCTIONS
(35)	$TCHS-0.3 = \frac{4062T + 4063T + 4064T + 4065T}{4}$
(36)	$TCHS +3 = \frac{4066T + 4067T + 4068T + 4069T}{4}$
(37)	TNOZFL = 4072T
(38)	$TNOZ7.2 = \frac{4074T + 4075T}{2}$
(39)	$TNOZ7.8 = \frac{4076T + 4077T}{2}$
(40)	$TNOZ9.9 = \frac{4078T + 4079T}{2}$
(41)	$TNOZ11.7 = \frac{4080T + 4081T}{2}$
(42)	$TNOZ16.2 = \frac{4082T + 4083T}{2}$
(43)	$TNOZ28.4 = \frac{4084T + 4085T}{2}$
(44)	$TNOZ40.4 = \frac{4086T + 4087T}{2}$
(45)	$TNOZ57.5 = \frac{4088T + 4089T}{2}$
(46)	$PCIE = \frac{(12) + (13)}{2}$
(47)	PCNS = 0.95(46)
(48)	$FSITE = \frac{(14) + (15)}{2}$
(49)	FVAC = (48) + 2005.4(18)
(50)	$PNOZEX = \frac{5001P + 5002P + 5003P}{3}$
(51)	RHOFU = 56.86 - 0.0321 (1011T)

ITEM	INSTRUCTIONS
(52)	$RHOX = 95.26 - [6.577 \times 10^{-2}(2011T)] - [1.1 \times 10^{-4}(2011T)^2] + [2.29 \times 10^{-4} \times \frac{(2010P + 2013P)}{2} + 4.94 \times 10^{-6} \times \frac{(2010P + 2013P)}{2} (2011T)]$
(53)	$WFU = \frac{(20)(51)}{448.8311689}$
(54)	$WOX = \frac{(22)(52)}{448.8311689}$
(55)	$WTOT = (53) + (54)$
(56)	$O/FTOT = \frac{(54)}{(53)}$
(57)	$WBLC = 0.0749(53)$
(58)	$BLC\% = \frac{(57)}{(55)} \times 100$
(59)	$O/FCORE = \frac{(54)}{(53) - (57)}$
(60)	$DPFINJ = (10) - (46)$
(61)	$DPOINJ = (11) - (46)$
(62)	$DPCOOL = (9) - (10)$
(63)	$DTCOOL = (27) - (26)$
(64)	$QDOTCH = 0.715 \ (53)(63)$
(65)	$C{*}SITE = \frac{(47)\ 32.174 \times 26.5291}{(55)}$
(66)	C*UMR = (65) minus correction from Table I
(67)	$C{*}EFF = \frac{(65)}{(80)} \times 100$
(68)	$CFSITE = \frac{(48)}{(47) 26.5291}$
(69)	$CFVSITE = \frac{(49)}{(47) 26.5291}$

ITEM	INSTRUCTIONS
(70)	$CFVEXP = 1.783[1.0 + 0.0023(58)] + 0.12\ [(56) - 1.65]$
(71)	$CFA = \frac{(69)}{(70)} \times 100$
(72)	$CFV72 = (69)[1.0 - 0.0023(58)]$
(73)	$ISPTEST = \frac{(48)}{(55)}$
(74)	$ISPVAC = \frac{(49)}{(55)}$
(75)	$ISPV72P = \frac{(72)(66)}{32.174}$ plus correction from Table II for test BLC%; O/F
(76)	ISPODKT = linear double interpolation from Table III
(77)	ISPTDKT = linear double interpolation from Table IV
(78)	$ISPEFF = \frac{(74)}{(81)} \times 100$
(79)	$ERE = \frac{(74) + \frac{127}{(55)}}{(77)} \times 100$
(80)	C*ODE = linear interpolation from Table V
(81)	ISPODET = linear interpolation from Table VI

TABLE I

STRATIFICATION C* LOSS, FT/SEC (MMH/NTO)

O/F ↓ (56) \ BLC% (58)	0	2%	4%
1.20	0	0	-4
1.55	0	-29	-67
1.65	0	-36	-85
1.75	0	-49	-110
1.85	0	-62	-130
2.20	0	-83	-169

TABLE II

STRATIFICATION Isp LOSS, SEC (MMH/NTO)

O/F ↓ (56) \ BLC% (58)	0	2	4
1.20	0	+0.8	+1.4
1.40	0	+0.2	+0.2
1.50	0	-0.1	-0.6
1.65	0	-0.7	-1.9
1.80	0	-1.5	-3.8
2.00	0	-3.3	-7.3
2.20	0	-4.8	-10.8

TABLE III

THEORETICAL Isp, ODK, EPS=72

TEST PCNS and O/F

O/F ↓ (56) \ PCNS → (47)	100	125	150
1.35	322.1	322.7	323.0
1.45	326.2	326.7	327.1
1.55	329.5	330.0	330.5
1.65	331.9	332.6	333.2
1.75	333.8	334.6	335.2
1.85	335.0	336.0	336.7
1.95	335.6	336.7	337.5
2.00	335.5	336.7	337.5

TABLE IV

THEORETICAL Isp, TDK, EPS=72

TEST PCNS and O/F

O/F ↓ (56) \ PCNS → (47)	100	125	150
1.35	317.5	317.9	318.2
1.45	320.9	321.4	321.8
1.65	326.6	327.3	327.8
1.85	329.7	330.6	331.4
1.95	326.3	328.5	329.9

Table V

Theoretical C-STAR, ft/sec

O/F	C-STAR (ODE)
1.20	5558
1.25	5588
1.30	5614
1.35	5638
1.40	5661
1.45	5680
1.50	5693
1.55	5701
1.60	5707
1.65	5711
1.70	5712
1.75	5709
1.80	5704
1.85	5697
1.90	5687
1.95	5676
2.00	5663
2.05	5649
2.10	2633
2.15	5616
2.20	5599

Table VI

Theoretical ISP

O/F(56)	EPS = 72 ODE
1.20	320.2
1.25	322.7
1.30	325.0
1.35	327.3
1.40	329.4
1.45	331.4
1.50	333.2
1.55	334.8
1.60	336.4
1.65	337.9
1.70	339.3
1.75	340.5
1.80	341.6
1.85	342.6
1.90	343.5
1.95	344.4
2.00	345.1
2.10	346.5
2.15	347.0
2.20	347.2

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3
SERIES RD/ICT-1 SEQUENCE 1 TEST 1
TEST DESCRIPTION
FIRST SHAKEDOWN FIRING OF ROCKETDYNE INTEGRATED CHAMBER WITH LIKE DOUBLET INJECTOR S/N1, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.45.

ACTUAL TEST DURATION 3.214 SEC
DATA SLICE TIME 2.000 SEC TO 3.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	244.495
OXIDIZER TANK PRESSURE	PSIA	210.078
FUEL INTERFACE PRESSURE	PSIA	211.683
OXIDIZER INTERFACE PRESSURE	PSIA	172.739
T/C COOLANT INLET MAN. PRESSURE	PSIA	208.940
FUEL INJECTOR PRESSURE	PSIA	191.288
OXIDIZER INJECTOR PRESSURE	PSIA	167.636
CHAMBER PRESSURE NO. 1	PSIA	124.590
CHAMBER PRESSURE NO. 2	PSIA	123.331
AXIAL THRUST, SYSTEM A	LBF	5494.815
AXIAL THRUST, SYSTEM B	LBF	5501.645
Y-AXIS THRUST	LBF	6.837
Z-AXIS THRUST	LBF	23.364
AVERAGE CELL PRESSURE	PSIA	.051
CELL PRESSURE AGREEMENT	%	.067
AVERAGE FUEL FLOWRATE	GPM	63.699
FUEL FM AGREEMENT	%	.036
AVERAGE OXIDIZER FLOWRATE	GPM	52.847
OXIDIZER FM AGREEMENT	%	.042
FUEL INTERFACE TEMPERATURE	DEG F	63.417
OXIDIZER INTERFACE TEMPERATURE	DEG F	66.302
T/C COOLANT IN TEMPERATURE	DEG F	64.379
T/C COOLANT OUT TEMPERATURE	DEG F	146.486
T/C SURFACE TEMP -16 IN	DEG F	104.739
T/C SURFACE TEMP -13 IN	DEG F	152.377
T/C SURFACE TEMP -10 IN	DEG F	162.207
T/C SURFACE TEMP - 8 IN	DEG F	124.824
T/C SURFACE TEMP - 6 IN	DEG F	132.385
T/C SURFACE TEMP - 4 IN	DEG F	152.064
T/C SURFACE TEMP - 2 IN	DEG F	118.193
T/C SURFACE TEMP -0.3 IN	DEG F	126.216
T/C SURFACE TEMP + 3 IN	DEG F	80.707
T/C NOZZLE FLANGE TEMP	DEG F	64.015
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	58.310
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	189.818
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	155.124
NOZZLE SURFACE TEMP +11.7 IN	DEG F	146.378
NOZZLE SURFACE TEMP +16.2 IN	DEG F	117.060
NOZZLE SURFACE TEMP +28.4 IN	DEG F	93.677
NOZZLE SURFACE TEMP +40.4 IN	DEG F	92.325
NOZZLE SURFACE TEMP +57.5 IN	DEG F	81.916

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3
SERIES RD/ICT-1 SEQUENCE 1 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	123.331
PC, NOZZLE STAGNATION	PSIA	117.164
AXIAL THRUST, SITE	LBF	5498.230
AXIAL THRUST, VACUUM	LBF	5600.657
NOZZLE EXIT PRESSURE	PSIA	.054
FUEL DENSITY (MMH)	LB/FT3	54.803
OXIDIZER DENSITY	LB/FT3	90.618
FUEL FLOWRATE	LB/SEC	7.778
OXIDIZER FLOWRATE	LB/SEC	10.670
TOTAL PROPELLANT FLOWRATE	LB/SEC	18.447
MIXTURE RATIO (OVERALL)	O/F	1.372
BLC FLOWRATE	LB/SEC	.583
BLC TOTAL PERCENT	%	3.158
CORE MIXTURE RATIO	O/F	1.483
FUEL INJECTOR DELTA-P	PSID	67.958
OXIDIZER INJECTOR DELTA-P	PSID	44.305
T/C COOLANT DELTA-P	PSID	17.652
T/C COOLANT DELTA-T	DEG F	82.107
THRUST CHAMBER HEAT FLUX	BTU/SEC	456.597
C-STAR, SITE	FT/SEC	5421.153
C-STAR, UMR	FT/SEC	5447.370
C-STAR EFFICIENCY	%	95.983
CF, SITE	-----	1.769
CF SITE VACUUM	-----	1.802
CF, VAC 72 EXPECT	-----	1.763
CF CORRELATION	-----	102.229
CF, VAC 72	-----	1.789
ISP, TEST	SEC	298.052
ISP, SITE VACUUM	SEC	303.604
ISP, VAC 72 PREDICTED	SEC	303.190
ISP, ODK, TEST CONDITIONS	SEC	323.392
ISP, TDK, TEST CONDITIONS	SEC	318.532
ISP EFFICIENCY	%	92.501
ENERGY RELEASE EFFICIENCY	%	97.475
C-STAR, ODE	FT/SEC	5648.043
ISP, ODE, TEST	SEC	328.217

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3

SERIES RD/ICT-1 SEQUENCE 1 TEST 2

TEST DESCRIPTION

SECOND VERIFICATION FIRING OF ROCKETDYNE INTEGRATED CHAMBER WITH LIKE DOUBLET INJECTOR S/N1, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.55.

ACTUAL TEST DURATION 5.175 SEC

DATA SLICE TIME 4.000 SEC TO 5.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	235.833
OXIDIZER TANK PRESSURE	PSIA	215.287
FUEL INTERFACE PRESSURE	PSIA	204.894
OXIDIZER INTERFACE PRESSURE	PSIA	176.553
T/C COOLANT INLET MAN. PRESSURE	PSIA	202.074
FUEL INJECTOR PRESSURE	PSIA	187.492
OXIDIZER INJECTOR PRESSURE	PSIA	171.102
CHAMBER PRESSURE NO. 1	PSIA	124.348
CHAMBER PRESSURE NO. 2	PSIA	123.582
AXIAL THRUST, SYSTEM A	LBF	5561.542
AXIAL THRUST, SYSTEM B	LBF	5568.416
Y-AXIS THRUST	LBF	5.824
Z-AXIS THRUST	LBF	22.087
AVERAGE CELL PRESSURE	PSIA	.041
CELL PRESSURE AGREEMENT	%	.022
AVERAGE FUEL FLOWRATE	GPM	61.392
FUEL FM AGREEMENT	%	.035
AVERAGE OXIDIZER FLOWRATE	GPM	54.325
OXIDIZER FM AGREEMENT	%	.040
FUEL INTERFACE TEMPERATURE	DEG F	64.436
OXIDIZER INTERFACE TEMPERATURE	DEG F	66.642
T/C COOLANT IN TEMPERATURE	DEG F	66.262
T/C COOLANT OUT TEMPERATURE	DEG F	180.036
T/C SURFACE TEMP -16 IN	DEG F	153.720
T/C SURFACE TEMP -13 IN	DEG F	182.235
T/C SURFACE TEMP -10 IN	DEG F	197.763
T/C SURFACE TEMP - 8 IN	DEG F	151.101
T/C SURFACE TEMP - 6 IN	DEG F	165.200
T/C SURFACE TEMP - 4 IN	DEG F	184.568
T/C SURFACE TEMP - 2 IN	DEG F	134.950
T/C SURFACE TEMP -0.3 IN	DEG F	139.436
T/C SURFACE TEMP + 3 IN	DEG F	112.939
T/C NOZZLE FLANGE TEMP	DEG F	83.498
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	168.032
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	397.897
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	386.918
NOZZLE SURFACE TEMP +11.7 IN	DEG F	371.359
NOZZLE SURFACE TEMP +16.2 IN	DEG F	294.213
NOZZLE SURFACE TEMP +28.4 IN	DEG F	208.627
NOZZLE SURFACE TEMP +40.4 IN	DEG F	204.626
NOZZLE SURFACE TEMP +57.5 IN	DEG F	163.765

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3
SERIES RD/ICT-1 SEQUENCE 1 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	123.582
PC, NOZZLE STAGNATION	PSIA	117.403
AXIAL THRUST, SITE	LBF	5564.979
AXIAL THRUST, VACUUM	LBF	5647.048
NOZZLE EXIT PRESSURE	PSIA	.043
FUEL DENSITY (MMH)	LB/FT3	54.773
OXIDIZER DENSITY	LB/FT3	90.594
FUEL FLOWRATE	LB/SEC	7.492
OXIDIZER FLOWRATE	LB/SEC	10.965
TOTAL PROPELLANT FLOWRATE	LB/SEC	18.457
MIXTURE RATIO (OVERALL)	O/F	1.464
BLC FLOWRATE	LB/SEC	.561
BLC TOTAL PERCENT	%	3.040
CORE MIXTURE RATIO	O/F	1.582
FUEL INJECTOR DELTA-P	PSID	63.910
OXIDIZER INJECTOR DELTA-P	PSID	47.520
T/C COOLANT DELTA-P	PSID	14.582
T/C COOLANT DELTA-T	DEG F	113.774
THRUST CHAMBER HEAT FLUX	BTU/SEC	609.456
C-STAR, SITE	FT/SEC	5429.266
C-STAR, UMR	FT/SEC	5466.507
C-STAR EFFICIENCY	%	95.526
CF, SITE	-----	1.787
CF SITE VACUUM	-----	1.813
CF, VAC 72 EXPECT	-----	1.773
CF CORRELATION	-----	102.255
CF, VAC 72	-----	1.800
ISP, TEST	SEC	301.508
ISP, SITE VACUUM	SEC	305.954
ISP, VAC 72 PREDICTED	SEC	305.742
ISP, ODK, TEST CONDITIONS	SEC	326.997
ISP, TDK, TEST CONDITIONS	SEC	321.645
ISP EFFICIENCY	%	92.185
ENERGY RELEASE EFFICIENCY	%	97.261
C-STAR, ODE	FT/SEC	5683.537
ISP, ODE, TEST	SEC	331.890

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3
SERIES RO/ICT-1 SEQUENCE 1 TEST 3
TEST DESCRIPTION
THRID CHECKOUT FIRING OF ROCKETDYNE INTEGRATED CHAMBER WITH LIKE DOUBLET INJECTOR S/N1, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.55.

ACTUAL TEST DURATION 10.158 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	233.098
OXIDIZER TANK PRESSURE	PSIA	213.867
FUEL INTERFACE PRESSURE	PSIA	202.772
OXIDIZER INTERFACE PRESSURE	PSIA	174.858
T/C COOLANT INLET MAN. PRESSURE	PSIA	200.166
FUEL INJECTOR PRESSURE	PSIA	191.668
OXIDIZER INJECTOR PRESSURE	PSIA	169.947
CHAMBER PRESSURE NO. 1	PSIA	122.899
CHAMBER PRESSURE NO. 2	PSIA	122.326
AXIAL THRUST, SYSTEM A	LBF	5558.403
AXIAL THRUST, SYSTEM B	LBF	5568.427
Y-AXIS THRUST	LBF	1.266
Z-AXIS THRUST	LBF	23.613
AVERAGE CELL PRESSURE	PSIA	.034
CELL PRESSURE AGREEMENT	%	.094
AVERAGE FUEL FLOWRATE	GPM	61.119
FUEL FM AGREEMENT	%	.066
AVERAGE OXIDIZER FLOWRATE	GPM	54.162
OXIDIZER FM AGREEMENT	%	.067
FUEL INTERFACE TEMPERATURE	DEG F	65.623
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.491
T/C COOLANT IN TEMPERATURE	DEG F	67.768
T/C COOLANT OUT TEMPERATURE	DEG F	195.557
T/C SURFACE TEMP -16 IN	DEG F	196.111
T/C SURFACE TEMP -13 IN	DEG F	196.466
T/C SURFACE TEMP -10 IN	DEG F	207.810
T/C SURFACE TEMP - 8 IN	DEG F	158.562
T/C SURFACE TEMP - 6 IN	DEG F	175.838
T/C SURFACE TEMP - 4 IN	DEG F	193.027
T/C SURFACE TEMP - 2 IN	DEG F	141.008
T/C SURFACE TEMP -0.3 IN	DEG F	143.796
T/C SURFACE TEMP + 3 IN	DEG F	126.694
T/C NOZZLE FLANGE TEMP	DEG F	105.040
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	368.171
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	743.824
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	789.485
NOZZLE SURFACE TEMP +11.7 IN	DEG F	748.422
NOZZLE SURFACE TEMP +16.2 IN	DEG F	596.970
NOZZLE SURFACE TEMP +28.4 IN	DEG F	404.990
NOZZLE SURFACE TEMP +40.4 IN	DEG F	364.760
NOZZLE SURFACE TEMP +57.5 IN	DEG F	294.633

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 13 NOV 3
SERIES RD/ICT-1 SEQUENCE 1 TEST 3

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	122.326
PC, NOZZLE STAGNATION	PSIA	116.209
AXIAL THRUST, SITE	LBF	5563.415
AXIAL THRUST, VACUUM	LBF	5631.194
NOZZLE EXIT PRESSURE	PSIA	.037
FUEL DENSITY (MMH)	LB/FT3	54.740
OXIDIZER DENSITY	LB/FT3	90.526
FUEL FLOWRATE	LB/SEC	7.454
OXIDIZER FLOWRATE	LB/SEC	10.924
TOTAL PROPELLANT FLOWRATE	LB/SEC	18.378
MIXTURE RATIO (OVERALL)	O/F	1.465
BLC FLOWRATE	LB/SEC	.558
BLC TOTAL PERCENT	%	3.038
CORE MIXTURE RATIO	O/F	1.584
FUEL INJECTOR DELTA-P	PSID	69.342
OXIDIZER INJECTOR DELTA-P	PSID	47.621
T/C COOLANT DELTA-P	PSID	8.498
T/C COOLANT DELTA-T	DEG F	127.789
THRUST CHAMBER HEAT FLUX	BTU/SEC	681.076
C-STAR, SITE	FT/SEC	5397.209
C-STAR, UMR	FT/SEC	5434.668
C-STAR EFFICIENCY	%	94.954
CF, SITE	-----	1.805
CF SITE VACUUM	-----	1.827
CF, VAC 72 EXPECT	-----	1.773
CF CORRELATION	-----	103.003
CF, VAC 72	-----	1.814
ISP, TEST	SEC	302.721
ISP, SITE VACUUM	SEC	306.409
ISP, VAC 72 PREDICTED	SEC	306.213
ISP, ODK, TEST CONDITIONS	SEC	327.036
ISP, TDK, TEST CONDITIONS	SEC	321.676
ISP EFFICIENCY	%	92.304
ENERGY RELEASE EFFICIENCY	%	97.402
C-STAR, ODE	FT/SEC	5684.029
ISP, ODE, TEST	SEC	331.958

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 1

TEST DESCRIPTION

PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.212 SEC

DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.024
OXIDIZER TANK PRESSURE	PSIA	245.593
FUEL INTERFACE PRESSURE	PSIA	209.137
OXIDIZER INTERFACE PRESSURE	PSIA	197.321
T/C COOLANT INLET MAN. PRESSURE	PSIA	206.270
FUEL INJECTOR PRESSURE	PSIA	191.427
OXIDIZER INJECTOR PRESSURE	PSIA	189.976
CHAMBER PRESSURE NO. 1	PSIA	130.872
CHAMBER PRESSURE NO. 2	PSIA	130.870
AXIAL THRUST, SYSTEM A	LBF	5984.449
AXIAL THRUST, SYSTEM B	LBF	5988.187
Y-AXIS THRUST	LBF	-1.266
Z-AXIS THRUST	LBF	25.257
AVERAGE CELL PRESSURE	PSIA	.033
CELL PRESSURE AGREEMENT	%	.091
AVERAGE FUEL FLOWRATE	GPM	60.294
FUEL FM AGREEMENT	%	.069
AVERAGE OXIDIZER FLOWRATE	GPM	60.736
OXIDIZER FM AGREEMENT	%	.189
FUEL INTERFACE TEMPERATURE	DEG F	65.326
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.151
T/C COOLANT IN TEMPERATURE	DEG F	66.639
T/C COOLANT OUT TEMPERATURE	DEG F	197.521
T/C SURFACE TEMP -16 IN	DEG F	178.454
T/C SURFACE TEMP -13 IN	DEG F	201.953
T/C SURFACE TEMP -10 IN	DEG F	213.458
T/C SURFACE TEMP - 8 IN	DEG F	162.832
T/C SURFACE TEMP - 6 IN	DEG F	179.224
T/C SURFACE TEMP - 4 IN	DEG F	197.983
T/C SURFACE TEMP - 2 IN	DEG F	144.799
T/C SURFACE TEMP -0.3 IN	DEG F	147.550
T/C SURFACE TEMP + 3 IN	DEG F	129.395
T/C NOZZLE FLANGE TEMP	DEG F	71.192
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	225.793
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	589.734
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	595.646
NOZZLE SURFACE TEMP +11.7 IN	DEG F	553.040
NOZZLE SURFACE TEMP +16.2 IN	DEG F	411.026
NOZZLE SURFACE TEMP +28.4 IN	DEG F	278.946
NOZZLE SURFACE TEMP +40.6 IN	DEG F	247.866
NOZZLE SURFACE TEMP +57.5 IN	DEG F	199.969

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	130.870
PC, NOZZLE STAGNATION	PSIA	124.326
AXIAL THRUST, SITE	LBF	5986.318
AXIAL THRUST, VACUUM	LBF	6053.115
NOZZLE EXIT PRESSURE	PSIA	.032
FUEL DENSITY (MMH)	LB/FT3	54.745
OXIDIZER DENSITY	LB/FT3	90.587
FUEL FLOWRATE	LB/SEC	7.354
OXIDIZER FLOWRATE	LB/SEC	12.258
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.612
MIXTURE RATIO (OVERALL)	O/F	1.667
BLC FLOWRATE	LB/SEC	.551
BLC TOTAL PERCENT	%	2.809
CORE MIXTURE RATIO	O/F	1.802
FUEL INJECTOR DELTA-P	PSID	60.557
OXIDIZER INJECTOR DELTA-P	PSID	59.106
T/C COOLANT DELTA-P	PSID	14.843
T/C COOLANT DELTA-T	DEG F	130.882
THRUST CHAMBER HEAT FLUX	BTU/SEC	688.216
C-STAR, SITE	FT/SEC	5410.778
C-STAR, UMR	FT/SEC	5469.590
C-STAR EFFICIENCY	%	94.738
CF, SITE	-----	1.815
CF SITE VACUUM	-----	1.835
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	102.154
CF, VAC 72	-----	1.823
ISP, TEST	SEC	305.231
ISP, SITE VACUUM	SEC	308.637
ISP, VAC 72 PREDICTED	SEC	308.651
ISP, ODK, TEST CONDITIONS	SEC	332.917
ISP, TDK, TEST CONDITIONS	SEC	327.558
ISP EFFICIENCY	%	91.213
ENERGY RELEASE EFFICIENCY	%	96.200
C-STAR, ODE	FT/SEC	5711.336
ISP, ODE, TEST	SEC	338.371

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 2

TEST DESCRIPTION

PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.85.

ACTUAL TEST DURATION 10.202 SEC

DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	225.804
OXIDIZER TANK PRESSURE	PSIA	256.010
FUEL INTERFACE PRESSURE	PSIA	199.378
OXIDIZER INTERFACE PRESSURE	PSIA	203.255
T/C COOLANT INLET MAN. PRESSURE	PSIA	197.496
FUEL INJECTOR PRESSURE	PSIA	187.635
OXIDIZER INJECTOR PRESSURE	PSIA	195.368
CHAMBER PRESSURE NO. 1	PSIA	132.556
CHAMBER PRESSURE NO. 2	PSIA	132.629
AXIAL THRUST, SYSTEM A	LBF	6009.921
AXIAL THRUST, SYSTEM B	LBF	6016.819
Y-AXIS THRUST	LBF	2.786
Z-AXIS THRUST	LBF	24.500
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.113
AVERAGE FUEL FLOWRATE	GPM	56.398
FUEL FM AGREEMENT	%	.141
AVERAGE OXIDIZER FLOWRATE	GPM	63.365
OXIDIZER FM AGREEMENT	%	.238
FUEL INTERFACE TEMPERATURE	DEG F	65.411
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.491
T/C COOLANT IN TEMPERATURE	DEG F	67.015
T/C COOLANT OUT TEMPERATURE	DEG F	216.581
T/C SURFACE TEMP -16 IN	DEG F	209.831
T/C SURFACE TEMP -13 IN	DEG F	216.089
T/C SURFACE TEMP -10 IN	DEG F	227.497
T/C SURFACE TEMP - 8 IN	DEG F	172.847
T/C SURFACE TEMP - 6 IN	DEG F	190.829
T/C SURFACE TEMP - 4 IN	DEG F	210.202
T/C SURFACE TEMP - 2 IN	DEG F	153.515
T/C SURFACE TEMP -0.3 IN	DEG F	155.293
T/C SURFACE TEMP + 3 IN	DEG F	137.170
T/C NOZZLE FLANGE TEMP	DEG F	97.859
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	445.413
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	923.388
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	971.570
NOZZLE SURFACE TEMP +11.7 IN	DEG F	906.761
NOZZLE SURFACE TEMP +16.2 IN	DEG F	727.810
NOZZLE SURFACE TEMP +28.4 IN	DEG F	486.146
NOZZLE SURFACE TEMP +40.4 IN	DEG F	421.166
NOZZLE SURFACE TEMP +57.5 IN	DEG F	338.681

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 | SEQUENCE 2 | TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	132.629
PC, NOZZLE STAGNATION	PSIA	125.998
AXIAL THRUST, SITE	LBF	6013.370
AXIAL THRUST, VACUUM	LBF	6090.010
NOZZLE EXIT PRESSURE	PSIA	.037
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.566
FUEL FLOWRATE	LB/SEC	6.880
OXIDIZER FLOWRATE	LB/SEC	12.786
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.666
MIXTURE RATIO (OVERALL)	O/F	1.858
BLC FLOWRATE	LB/SEC	.515
BLC TOTAL PERCENT	%	2.620
CORE MIXTURE RATIO	O/F	2.009
FUEL INJECTOR DELTA-P	PSID	55.006
OXIDIZER INJECTOR DELTA-P	PSID	62.739
T/C COOLANT DELTA-P	PSID	9.861
T/C COOLANT DELTA-T	DEG F	149.566
THRUST CHAMBER HEAT FLUX	BTU/SEC	735.718
C-STAR, SITE	FT/SEC	5468.670
C-STAR, UMR	FT/SEC	5552.404
C-STAR EFFICIENCY	%	96.021
CF, SITE	-----	1.799
CF SITE VACUUM	-----	1.822
CF, VAC 72 EXPECT	-----	1.819
CF CORRELATION	-----	100.174
CF, VAC 72	-----	1.811
ISP, TEST	SEC	305.781
ISP, SITE VACUUM	SEC	309.678
ISP, VAC 72 PREDICTED	SEC	309.631
ISP, ODK, TEST CONDITIONS	SEC	336.088
ISP, TDK, TEST CONDITIONS	SEC	330.456
ISP EFFICIENCY	%	90.350
ENERGY RELEASE EFFICIENCY	%	95.667
C-STAR, ODE	FT/SEC	5695.303
ISP, ODE, TEST	SEC	342.753

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 3

TEST DESCRIPTION

PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 140., O/F = 1.45.

ACTUAL TEST DURATION 10.171 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	302.847
OXIDIZER TANK PRESSURE	PSIA	275.898
FUEL INTERFACE PRESSURE	PSIA	258.357
OXIDIZER INTERFACE PRESSURE	PSIA	221.480
T/C COOLANT INLET MAN. PRESSURE	PSIA	253.955
FUEL INJECTOR PRESSURE	PSIA	236.930
OXIDIZER INJECTOR PRESSURE	PSIA	213.472
CHAMBER PRESSURE NO. 1	PSIA	147.717
CHAMBER PRESSURE NO. 2	PSIA	148.461
AXIAL THRUST, SYSTEM A	LBF	6684.113
AXIAL THRUST, SYSTEM B	LBF	6691.022
Y-AXIS THRUST	LBF	9.116
Z-AXIS THRUST	LBF	26.382
AVERAGE CELL PRESSURE	PSIA	.033
CELL PRESSURE AGREEMENT	%	.188
AVERAGE FUEL FLOWRATE	GPM	72.810
FUEL FM AGREEMENT	%	.124
AVERAGE OXIDIZER FLOWRATE	GPM	64.515
OXIDIZER FM AGREEMENT	%	.150
FUEL INTERFACE TEMPERATURE	DEG F	65.326
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.406
T/C COOLANT IN TEMPERATURE	DEG F	66.973
T/C COOLANT OUT TEMPERATURE	DEG F	194.439
T/C SURFACE TEMP -16 IN	DEG F	192.383
T/C SURFACE TEMP -13 IN	DEG F	188.182
T/C SURFACE TEMP -10 IN	DEG F	200.513
T/C SURFACE TEMP - 8 IN	DEG F	153.046
T/C SURFACE TEMP - 6 IN	DEG F	170.035
T/C SURFACE TEMP - 4 IN	DEG F	186.985
T/C SURFACE TEMP - 2 IN	DEG F	136.075
T/C SURFACE TEMP -0.3 IN	DEG F	138.223
T/C SURFACE TEMP + 3 IN	DEG F	122.221
T/C NOZZLE FLANGE TEMP	DEG F	115.301
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	570.480
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1025.497
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1051.953
NOZZLE SURFACE TEMP +11.7 IN	DEG F	976.258
NOZZLE SURFACE TEMP +16.2 IN	DEG F	880.010
NOZZLE SURFACE TEMP +28.4 IN	DEG F	641.114
NOZZLE SURFACE TEMP +60.4 IN	DEG F	559.326
NOZZLE SURFACE TEMP +57.5 IN	DEG F	451.257

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 3

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	148.461
PC, NOZZLE STAGNATION	PSIA	141.038
AXIAL THRUST, SITE	LBF	6687.567
AXIAL THRUST, VACUUM	LBF	6753.880
NOZZLE EXIT PRESSURE	PSIA	.031
FUEL DENSITY (MMH)	LB/FT3	54.753
OXIDIZER DENSITY	LB/FT3	90.590
FUEL FLOWRATE	LB/SEC	8.882
OXIDIZER FLOWRATE	LB/SEC	13.021
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.904
MIXTURE RATIO (OVERALL)	O/F	1.466
BLC FLOWRATE	LB/SEC	.665
BLC TOTAL PERCENT	%	3.037
CORE MIXTURE RATIO	O/F	1.585
FUEL INJECTOR DELTA-P	PSID	88.469
OXIDIZER INJECTOR DELTA-P	PSID	65.010
T/C COOLANT DELTA-P	PSID	17.025
T/C COOLANT DELTA-T	DEG F	127.466
THRUST CHAMBER HEAT FLUX	BTU/SEC	809.505
C-STAR, SITE	FT/SEC	5496.014
C-STAR, UMR	FT/SEC	5533.533
C-STAR EFFICIENCY	%	96.690
CF, SITE	-----	1.787
CF SITE VACUUM	-----	1.805
CF, VAC 72 EXPECT	-----	1.773
CF CORRELATION	-----	101.787
CF, VAC 72	-----	1.792
ISP, TEST	SEC	305.317
ISP, SITE VACUUM	SEC	308.345
ISP, VAC 72 PREDICTED	SEC	308.112
ISP, ODK, TEST CONDITIONS	SEC	327.496
ISP, TDK, TEST CONDITIONS	SEC	322.134
ISP EFFICIENCY	%	92.881
ENERGY RELEASE EFFICIENCY	%	97.519
C-STAR, ODE	FT/SEC	5684.165
ISP, ODE, TEST	SEC	331.977

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 4
TEST DESCRIPTION
PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 140., O/F = 1.65.

ACTUAL TEST DURATION 10.202 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	282.332
OXIDIZER TANK PRESSURE	PSIA	290.104
FUEL INTERFACE PRESSURE	PSIA	243.930
OXIDIZER INTERFACE PRESSURE	PSIA	229.533
T/C COOLANT INLET MAN. PRESSURE	PSIA	240.222
FUEL INJECTOR PRESSURE	PSIA	225.555
OXIDIZER INJECTOR PRESSURE	PSIA	220.405
CHAMBER PRESSURE NO. 1	PSIA	148.439
CHAMBER PRESSURE NO. 2	PSIA	149.215
AXIAL THRUST, SYSTEM A	LBF	6741.341
AXIAL THRUST, SYSTEM B	LBF	6754.621
Y-AXIS THRUST	LBF	7.850
Z-AXIS THRUST	LBF	25.127
AVERAGE CELL PRESSURE	PSIA	.032
CELL PRESSURE AGREEMENT	%	.279
AVERAGE FUEL FLOWRATE	GPM	67.650
FUEL FM AGREEMENT	%	.063
AVERAGE OXIDIZER FLOWRATE	GPM	67.693
OXIDIZER FM AGREEMENT	%	.209
FUEL INTERFACE TEMPERATURE	DEG F	65.411
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.406
T/C COOLANT IN TEMPERATURE	DEG F	67.099
T/C COOLANT OUT TEMPERATURE	DEG F	209.155
T/C SURFACE TEMP -16 IN	DEG F	204.108
T/C SURFACE TEMP -13 IN	DEG F	200.084
T/C SURFACE TEMP -10 IN	DEG F	212.304
T/C SURFACE TEMP - 8 IN	DEG F	161.551
T/C SURFACE TEMP - 6 IN	DEG F	179.584
T/C SURFACE TEMP - 4 IN	DEG F	197.380
T/C SURFACE TEMP - 2 IN	DEG F	143.830
T/C SURFACE TEMP -0.3 IN	DEG F	145.491
T/C SURFACE TEMP + 3 IN	DEG F	129.153
T/C NOZZLE FLANGE TEMP	DEG F	136.851
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	673.711
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1162.085
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1191.440
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1112.746
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1020.052
NOZZLE SURFACE TEMP +28.4 IN	DEG F	784.920
NOZZLE SURFACE TEMP +40.4 IN	DEG F	691.766
NOZZLE SURFACE TEMP +57.5 IN	DEG F	565.267

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 4

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	149.215
PC, NOZZLE STAGNATION	PSIA	141.754
AXIAL THRUST, SITE	LBF	6747.981
AXIAL THRUST, VACUUM	LBF	6811.850
NOZZLE EXIT PRESSURE	PSIA	.030
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.604
FUEL FLOWRATE	LB/SEC	8.252
OXIDIZER FLOWRATE	LB/SEC	13.665
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.917
MIXTURE RATIO (OVERALL)	O/F	1.656
BLC FLOWRATE	LB/SEC	.618
BLC TOTAL PERCENT	%	2.820
CORE MIXTURE RATIO	O/F	1.790
FUEL INJECTOR DELTA-P	PSID	76.339
OXIDIZER INJECTOR DELTA-P	PSID	71.190
T/C COOLANT DELTA-P	PSID	14.667
T/C COOLANT DELTA-T	DEG F	142.056
THRUST CHAMBER HEAT FLUX	BTU/SEC	838.192
C-STAR, SITE	FT/SEC	5520.500
C-STAR, UMR	FT/SEC	5577.649
C-STAR EFFICIENCY	%	96.662
CF, SITE	-----	1.794
CF SITE VACUUM	-----	1.811
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	100.896
CF, VAC 72	-----	1.800
ISP, TEST	SEC	307.885
ISP, SITE VACUUM	SEC	310.799
ISP, VAC 72 PREDICTED	SEC	310.738
ISP, ODK, TEST CONDITIONS	SEC	333.120
ISP, TDK, TEST CONDITIONS	SEC	327.738
ISP EFFICIENCY	%	91.935
ENERGY RELEASE EFFICIENCY	%	96.599
C-STAR, ODE	FT/SEC	5711.118
ISP, ODE, TEST	SEC	338.065

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 5

TEST DESCRIPTION

PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO, TARGET PCNS = 140., O/F = 1.85.

ACTUAL TEST DURATION 10.200 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	265.921
OXIDIZER TANK PRESSURE	PSIA	302.415
FUEL INTERFACE PRESSURE	PSIA	232.050
OXIDIZER INTERFACE PRESSURE	PSIA	237.162
T/C COOLANT INLET MAN. PRESSURE	PSIA	229.159
FUEL INJECTOR PRESSURE	PSIA	216.454
OXIDIZER INJECTOR PRESSURE	PSIA	226.568
CHAMBER PRESSURE NO. 1	PSIA	148.439
CHAMBER PRESSURE NO. 2	PSIA	149.215
AXIAL THRUST, SYSTEM A	LBF	6757.219
AXIAL THRUST, SYSTEM B	LBF	6764.158
Y-AXIS THRUST	LBF	4.812
Z-AXIS THRUST	LBF	24.241
AVERAGE CELL PRESSURE	PSIA	.039
CELL PRESSURE AGREEMENT	%	.215
AVERAGE FUEL FLOWRATE	GPM	63.313
FUEL FM AGREEMENT	%	.086
AVERAGE OXIDIZER FLOWRATE	GPM	70.542
OXIDIZER FM AGREEMENT	%	.262
FUEL INTERFACE TEMPERATURE	DEG F	65.495
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.406
T/C COOLANT IN TEMPERATURE	DEG F	67.224
T/C COOLANT OUT TEMPERATURE	DEG F	220.940
T/C SURFACE TEMP -16 IN	DEG F	214.560
T/C SURFACE TEMP -13 IN	DEG F	210.828
T/C SURFACE TEMP -10 IN	DEG F	222.232
T/C SURFACE TEMP - 8 IN	DEG F	168.771
T/C SURFACE TEMP - 6 IN	DEG F	187.202
T/C SURFACE TEMP - 4 IN	DEG F	206.087
T/C SURFACE TEMP - 2 IN	DEG F	150.248
T/C SURFACE TEMP -0.3 IN	DEG F	151.543
T/C SURFACE TEMP + 3 IN	DEG F	134.621
T/C NOZZLE FLANGE TEMP	DEG F	153.272
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	773.566
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1284.625
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1321.205
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1243.293
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1141.450
NOZZLE SURFACE TEMP +28.4 IN	DEG F	974.286
NOZZLE SURFACE TEMP +40.4 IN	DEG F	808.189
NOZZLE SURFACE TEMP +57.5 IN	DEG F	667.216

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 5

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	149.215
PC, NOZZLE STAGNATION	PSIA	141.754
AXIAL THRUST, SITE	LBF	6760.689
AXIAL THRUST, VACUUM	LBF	6839.800
NOZZLE EXIT PRESSURE	PSIA	.038
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.611
FUEL FLOWRATE	LB/SEC	7.723
OXIDIZER FLOWRATE	LB/SEC	14.241
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.964
MIXTURE RATIO (OVERALL)	O/F	1.844
BLC FLOWRATE	LB/SEC	.578
BLC TOTAL PERCENT	%	2.634
CORE MIXTURE RATIO	O/F	1.993
FUEL INJECTOR DELTA-P	PSID	67.239
OXIDIZER INJECTOR DELTA-P	PSID	77.353
T/C COOLANT DELTA-P	PSID	12.705
T/C COOLANT DELTA-T	DEG F	153.716
THRUST CHAMBER HEAT FLUX	BTU/SEC	848.841
C-STAR, SITE	FT/SEC	5508.662
C-STAR, UMR	FT/SEC	5591.281
C-STAR EFFICIENCY	%	96.680
CF, SITE	-----	1.798
CF SITE VACUUM	-----	1.819
CF, VAC 72 EXPECT	-----	1.817
CF CORRELATION	-----	100.095
CF, VAC 72	-----	1.808
ISP, TEST	SEC	307.803
ISP, SITE VACUUM	SEC	311.405
ISP, VAC 72 PREDICTED	SEC	311.418
ISP, ODK, TEST CONDITIONS	SEC	336.380
ISP, TDK, TEST CONDITIONS	SEC	331.030
ISP EFFICIENCY	%	90.927
ENERGY RELEASE EFFICIENCY	%	95.818
C-STAR, ODE	FT/SEC	5697.853
ISP, ODE, TEST	SEC	342.478

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3

SERIES RD/ICT-1 SEQUENCE 2 TEST 6

TEST DESCRIPTION

PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 110., O/F = 1.45.

ACTUAL TEST DURATION 10.200 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	212.128
OXIDIZER TANK PRESSURE	PSIA	198.240
FUEL INTERFACE PRESSURE	PSIA	184.951
OXIDIZER INTERFACE PRESSURE	PSIA	162.567
T/C COOLANT INLET MAN. PRESSURE	PSIA	182.237
FUEL INJECTOR PRESSURE	PSIA	172.468
OXIDIZER INJECTOR PRESSURE	PSIA	158.006
CHAMBER PRESSURE NO. 1	PSIA	117.875
CHAMBER PRESSURE NO. 2	PSIA	117.299
AXIAL THRUST, SYSTEM A	LBF	5256.231
AXIAL THRUST, SYSTEM B	LBF	5266.290
Y-AXIS THRUST	LBF	-4.305
Z-AXIS THRUST	LBF	19.710
AVERAGE CELL PRESSURE	PSIA	.032
CELL PRESSURE AGREEMENT	%	.086
AVERAGE FUEL FLOWRATE	GPM	57.441
FUEL FM AGREEMENT	%	.063
AVERAGE OXIDIZER FLOWRATE	GPM	51.586
OXIDIZER FM AGREEMENT	%	.091
FUEL INTERFACE TEMPERATURE	DEG F	65.580
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.321
T/C COOLANT IN TEMPERATURE	DEG F	67.558
T/C COOLANT OUT TEMPERATURE	DEG F	205.249
T/C SURFACE TEMP -16 IN	DEG F	200.958
T/C SURFACE TEMP -13 IN	DEG F	197.283
T/C SURFACE TEMP -10 IN	DEG F	211.368
T/C SURFACE TEMP - 8 IN	DEG F	160.270
T/C SURFACE TEMP - 6 IN	DEG F	178.134
T/C SURFACE TEMP - 4 IN	DEG F	196.412
T/C SURFACE TEMP - 2 IN	DEG F	142.498
T/C SURFACE TEMP -0.3 IN	DEG F	145.128
T/C SURFACE TEMP + 3 IN	DEG F	127.817
T/C NOZZLE FLANGE TEMP	DEG F	155.325
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	666.833
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1002.562
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1088.925
NOZZLE SURFACE TEMP +11.7 IN	DEG F	987.188
NOZZLE SURFACE TEMP +16.2 IN	DEG F	976.260
NOZZLE SURFACE TEMP +28.4 IN	DEG F	861.256
NOZZLE SURFACE TEMP +40.4 IN	DEG F	780.841
NOZZLE SURFACE TEMP +57.5 IN	DEG F	663.088

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1

SEQUENCE 2

TEST 6

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	117.299
PC, NOZZLE STAGNATION	PSIA	111.434
AXIAL THRUST, SITE	LBF	5261.261
AXIAL THRUST, VACUUM	LBF	5326.095
NOZZLE EXIT PRESSURE	PSIA	.031
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.561
FUEL FLOWRATE	LB/SEC	7.007
OXIDIZER FLOWRATE	LB/SEC	10.409
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.415
MIXTURE RATIO (OVERALL)	O/F	1.485
BLC FLOWRATE	LB/SEC	.525
BLC TOTAL PERCENT	%	3.014
CORE MIXTURE RATIO	O/F	1.606
FUEL INJECTOR DELTA-P	PSID	55.168
OXIDIZER INJECTOR DELTA-P	PSID	40.707
T/C COOLANT DELTA-P	PSID	9.769
T/C COOLANT DELTA-T	DEG F	137.691
THRUST CHAMBER HEAT FLUX	BTU/SEC	689.822
C-STAR, SITE	FT/SEC	5461.500
C-STAR, UMR	FT/SEC	5501.234
C-STAR EFFICIENCY	%	95.997
CF, SITE	-----	1.780
CF SITE VACUUM	-----	1.802
CF, VAC 72 EXPECT	-----	1.776
CF CORRELATION	-----	101.465
CF, VAC 72	-----	1.789
ISP, TEST	SEC	302.103
ISP, SITE VACUUM	SEC	305.826
ISP, VAC 72 PREDICTED	SEC	305.642
ISP, ODK, TEST CONDITIONS	SEC	327.599
ISP, TDK, TEST CONDITIONS	SEC	322.156
ISP EFFICIENCY	%	91.929
ENERGY RELEASE EFFICIENCY	%	97.195
C-STAR, ODE	FT/SEC	5689.223
ISP, ODE, TEST	SEC	332.677

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 7
TEST DESCRIPTION
PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 110., O/F = 1.65.

ACTUAL TEST DURATION 10.174 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	201.187
OXIDIZER TANK PRESSURE	PSIA	207.237
FUEL INTERFACE PRESSURE	PSIA	177.314
OXIDIZER INTERFACE PRESSURE	PSIA	168.076
T/C COOLANT INLET MAN. PRESSURE	PSIA	174.989
FUEL INJECTOR PRESSURE	PSIA	165.642
OXIDIZER INJECTOR PRESSURE	PSIA	163.014
CHAMBER PRESSURE NO. 1	PSIA	117.635
CHAMBER PRESSURE NO. 2	PSIA	117.802
AXIAL THRUST, SYSTEM A	LBF	5316.759
AXIAL THRUST, SYSTEM B	LBF	5323.560
Y-AXIS THRUST	LBF	6.331
Z-AXIS THRUST	LBF	18.564
AVERAGE CELL PRESSURE	PSIA	.031
CELL PRESSURE AGREEMENT	%	.173
AVERAGE FUEL FLOWRATE	GPM	53.653
FUEL FM AGREEMENT	%	.057
AVERAGE OXIDIZER FLOWRATE	GPM	54.162
OXIDIZER FM AGREEMENT	%	.067
FUEL INTERFACE TEMPERATURE	DEG F	65.580
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.406
T/C COOLANT IN TEMPERATURE	DEG F	67.391
T/C COOLANT OUT TEMPERATURE	DEG F	216.212
T/C SURFACE TEMP -16 IN	DEG F	211.056
T/C SURFACE TEMP -13 IN	DEG F	204.640
T/C SURFACE TEMP -10 IN	DEG F	218.599
T/C SURFACE TEMP - 8 IN	DEG F	167.258
T/C SURFACE TEMP - 6 IN	DEG F	185.388
T/C SURFACE TEMP - 4 IN	DEG F	202.941
T/C SURFACE TEMP - 2 IN	DEG F	148.189
T/C SURFACE TEMP -0.3 IN	DEG F	150.697
T/C SURFACE TEMP + 3 IN	DEG F	133.042
T/C NOZZLE FLANGE TEMP	DEG F	176.880
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	733.943
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1098.318
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1208.104
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1123.828
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1067.958
NOZZLE SURFACE TEMP +28.4 IN	DEG F	953.851
NOZZLE SURFACE TEMP +40.4 IN	DEG F	847.796
NOZZLE SURFACE TEMP +57.5 IN	DEG F	727.511

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 7

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	117.802
PC, NOZZLE STAGNATION	PSIA	111.912
AXIAL THRUST, SITE	LBF	5320.159
AXIAL THRUST, VACUUM	LBF	5381.572
NOZZLE EXIT PRESSURE	PSIA	.029
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.559
FUEL FLOWRATE	LB/SEC	6.545
OXIDIZER FLOWRATE	LB/SEC	10.928
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.473
MIXTURE RATIO (OVERALL)	O/F	1.670
BLC FLOWRATE	LB/SEC	.490
BLC TOTAL PERCENT	%	2.806
CORE MIXTURE RATIO	O/F	1.805
FUEL INJECTOR DELTA-P	PSID	47.840
OXIDIZER INJECTOR DELTA-P	PSID	45.212
T/C COOLANT DELTA-P	PSID	9.346
T/C COOLANT DELTA-T	DEG F	148.821
THRUST CHAMBER HEAT FLUX	BTU/SEC	696.416
C-STAR, SITE	FT/SEC	5466.897
C-STAR, UMR	FT/SEC	5526.148
C-STAR EFFICIENCY	%	95.719
CF, SITE	-----	1.792
CF SITE VACUUM	-----	1.813
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	100.877
CF, VAC 72	-----	1.801
ISP, TEST	SEC	304.482
ISP, SITE VACUUM	SEC	307.997
ISP, VAC 72 PREDICTED	SEC	307.979
ISP, ODK, TEST CONDITIONS	SEC	332.617
ISP, TDK, TEST CONDITIONS	SEC	327.248
ISP EFFICIENCY	%	91.002
ENERGY RELEASE EFFICIENCY	%	96.338
C-STAR, ODE	FT/SEC	5711.394
ISP, ODE, TEST	SEC	338.452

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 8
TEST DESCRIPTION
PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 110., O/F = 1.85.

ACTUAL TEST DURATION 10.196 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	189.334
OXIDIZER TANK PRESSURE	PSIA	214.340
FUEL INTERFACE PRESSURE	PSIA	168.403
OXIDIZER INTERFACE PRESSURE	PSIA	171.891
T/C COOLANT INLET MAN. PRESSURE	PSIA	166.977
FUEL INJECTOR PRESSURE	PSIA	159.196
OXIDIZER INJECTOR PRESSURE	PSIA	166.095
CHAMBER PRESSURE NO. 1	PSIA	116.912
CHAMBER PRESSURE NO. 2	PSIA	117.802
AXIAL THRUST, SYSTEM A	LBF	5304.017
AXIAL THRUST, SYSTEM B	LBF	5310.834
Y-AXIS THRUST	LBF	3.545
Z-AXIS THRUST	LBF	19.576
AVERAGE CELL PRESSURE	PSIA	.037
CELL PRESSURE AGREEMENT	%	.107
AVERAGE FUEL FLOWRATE	GPM	49.865
FUEL FM AGREEMENT	%	.050
AVERAGE OXIDIZER FLOWRATE	GPM	56.407
OXIDIZER FM AGREEMENT	%	.001
FUEL INTERFACE TEMPERATURE	DEG F	65.495
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.406
T/C COOLANT IN TEMPERATURE	DEG F	67.349
T/C COOLANT OUT TEMPERATURE	DEG F	227.421
T/C SURFACE TEMP -16 IN	DEG F	220.874
T/C SURFACE TEMP -13 IN	DEG F	216.675
T/C SURFACE TEMP -10 IN	DEG F	229.362
T/C SURFACE TEMP - 8 IN	DEG F	175.059
T/C SURFACE TEMP - 6 IN	DEG F	193.853
T/C SURFACE TEMP - 4 IN	DEG F	212.500
T/C SURFACE TEMP - 2 IN	DEG F	155.209
T/C SURFACE TEMP -0.3 IN	DEG F	157.592
T/C SURFACE TEMP + 3 IN	DEG F	138.749
T/C NOZZLE FLANGE TEMP	DEG F	194.328
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	789.936
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1170.934
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1279.671
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1203.355
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1132.525
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1019.263
NOZZLE SURFACE TEMP +40.4 IN	DEG F	902.384
NOZZLE SURFACE TEMP +57.5 IN	DEG F	783.544

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 8

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	117.802
PC, NOZZLE STAGNATION	PSIA	111.912
AXIAL THRUST, SITE	LBF	5307.425
AXIAL THRUST, VACUUM	LBF	5381.107
NOZZLE EXIT PRESSURE	PSIA	.035
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.556
FUEL FLOWRATE	LB/SEC	6.083
OXIDIZER FLOWRATE	LB/SEC	11.381
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.463
MIXTURE RATIO (OVERALL)	O/F	1.871
BLC FLOWRATE	LB/SEC	.456
BLC TOTAL PERCENT	%	2.609
CORE MIXTURE RATIO	O/F	2.022
FUEL INJECTOR DELTA-P	PSID	41.394
OXIDIZER INJECTOR DELTA-P	PSID	48.293
T/C COOLANT DELTA-P	PSID	7.781
T/C COOLANT DELTA-T	DEG F	160.072
THRUST CHAMBER HEAT FLUX	BTU/SEC	696.183
C-STAR, SITE	FT/SEC	5469.819
C-STAR, UMR	FT/SEC	5554.108
C-STAR EFFICIENCY	%	96.083
CF, SITE	-----	1.788
CF SITE VACUUM	-----	1.812
CF, VAC 72 EXPECT	-----	1.820
CF CORRELATION	-----	99.575
CF, VAC 72	-----	1.802
ISP, TEST	SEC	303.916
ISP, SITE VACUUM	SEC	308.135
ISP, VAC 72 PREDICTED	SEC	307.983
ISP, ODK, TEST CONDITIONS	SEC	335.612
ISP, TDK, TEST CONDITIONS	SEC	329.546
ISP EFFICIENCY	%	89.841
ENERGY RELEASE EFFICIENCY	%	95.710
C-STAR, ODE	FT/SEC	5692.805
ISP, ODE, TEST	SEC	342.978

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 9
TEST DESCRIPTION
PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.45.

ACTUAL TEST DURATION 10.162 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	255.436
OXIDIZER TANK PRESSURE	PSIA	234.228
FUEL INTERFACE PRESSURE	PSIA	219.320
OXIDIZER INTERFACE PRESSURE	PSIA	190.116
T/C COOLANT INLET MAN. PRESSURE	PSIA	214.663
FUEL INJECTOR PRESSURE	PSIA	202.045
OXIDIZER INJECTOR PRESSURE	PSIA	183.813
CHAMBER PRESSURE NO. 1	PSIA	131.594
CHAMBER PRESSURE NO. 2	PSIA	132.378
AXIAL THRUST, SYSTEM A	LBF	5955.913
AXIAL THRUST, SYSTEM B	LBF	5962.766
Y-AXIS THRUST	LBF	13.928
Z-AXIS THRUST	LBF	20.823
AVERAGE CELL PRESSURE	PSIA	.029
CELL PRESSURE AGREEMENT	%	.163
AVERAGE FUEL FLOWRATE	GPM	65.016
FUEL FM AGREEMENT	%	.076
AVERAGE OXIDIZER FLOWRATE	GPM	57.777
OXIDIZER FM AGREEMENT	%	.134
FUEL INTERFACE TEMPERATURE	DEG F	65.580
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.491
T/C COOLANT IN TEMPERATURE	DEG F	67.265
T/C COOLANT OUT TEMPERATURE	DEG F	203.573
T/C SURFACE TEMP -16 IN	DEG F	201.661
T/C SURFACE TEMP -13 IN	DEG F	193.082
T/C SURFACE TEMP -10 IN	DEG F	206.934
T/C SURFACE TEMP - 8 IN	DEG F	157.008
T/C SURFACE TEMP - 6 IN	DEG F	174.749
T/C SURFACE TEMP - 4 IN	DEG F	192.424
T/C SURFACE TEMP - 2 IN	DEG F	139.105
T/C SURFACE TEMP -0.3 IN	DEG F	141.252
T/C SURFACE TEMP + 3 IN	DEG F	125.020
T/C NOZZLE FLANGE TEMP	DEG F	199.460
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	766.736
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1125.707
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1223.273
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1141.614
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1097.462
NOZZLE SURFACE TEMP +28.4 IN	DEG F	994.720
NOZZLE SURFACE TEMP +40.4 IN	DEG F	899.655
NOZZLE SURFACE TEMP +57.5 IN	DEG F	791.735

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 9

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	132.378
PC, NOZZLE STAGNATION	PSIA	125.759
AXIAL THRUST, SITE	LBF	5959.340
AXIAL THRUST, VACUUM	LBF	6017.818
NOZZLE EXIT PRESSURE	PSIA	.027
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.574
FUEL FLOWRATE	LB/SEC	7.931
OXIDIZER FLOWRATE	LB/SEC	11.659
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.590
MIXTURE RATIO (OVERALL)	O/F	1.470
BLC FLOWRATE	LB/SEC	.594
BLC TOTAL PERCENT	%	3.032
CORE MIXTURE RATIO	O/F	1.589
FUEL INJECTOR DELTA-P	PSID	69.667
OXIDIZER INJECTOR DELTA-P	PSID	51.435
T/C COOLANT DELTA-P	PSID	12.618
T/C COOLANT DELTA-T	DEG F	136.308
THRUST CHAMBER HEAT FLUX	BTU/SEC	772.958
C-STAR, SITE	FT/SEC	5479.256
C-STAR, UMR	FT/SEC	5517.243
C-STAR EFFICIENCY	%	96.377
CF, SITE	-----	1.786
CF SITE VACUUM	-----	1.804
CF, VAC 72 EXPECT	-----	1.774
CF CORRELATION	-----	101.686
CF, VAC 72	-----	1.791
ISP, TEST	SEC	304.196
ISP, SITE VACUUM	SEC	307.181
ISP, VAC 72 PREDICTED	SEC	306.962
ISP, ODK, TEST CONDITIONS	SEC	327.376
ISP, TDK, TEST CONDITIONS	SEC	322.005
ISP EFFICIENCY	%	92.490
ENERGY RELEASE EFFICIENCY	%	97.409
C-STAR, ODE	FT/SEC	5685.227
ISP, ODE, TEST	SEC	332.124

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 10
TEST DESCRIPTION
PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED CHAMBER ENGINE WITH LIKE DOUBLET INJECTOR S/N2, 72 TO 1 NOZZLE, UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.197 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.024
OXIDIZER TANK PRESSURE	PSIA	246.540
FUEL INTERFACE PRESSURE	PSIA	207.864
OXIDIZER INTERFACE PRESSURE	PSIA	197.321
T/C COOLANT INLET MAN. PRESSURE	PSIA	203.981
FUEL INJECTOR PRESSURE	PSIA	192.565
OXIDIZER INJECTOR PRESSURE	PSIA	189.976
CHAMBER PRESSURE NO. 1	PSIA	132.075
CHAMBER PRESSURE NO. 2	PSIA	132.629
AXIAL THRUST, SYSTEM A	LBF	6000.381
AXIAL THRUST, SYSTEM B	LBF	6010.460
Y-AXIS THRUST	LBF	3.039
Z-AXIS THRUST	LBF	22.096
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.113
AVERAGE FUEL FLOWRATE	GPM	60.294
FUEL FM AGREEMENT	%	.069
AVERAGE OXIDIZER FLOWRATE	GPM	60.899
OXIDIZER FM AGREEMENT	%	.083
FUEL INTERFACE TEMPERATURE	DEG F	65.580
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.491
T/C COOLANT IN TEMPERATURE	DEG F	67.140
T/C COOLANT OUT TEMPERATURE	DEG F	214.448
T/C SURFACE TEMP -16 IN	DEG F	210.239
T/C SURFACE TEMP -13 IN	DEG F	203.937
T/C SURFACE TEMP -10 IN	DEG F	217.210
T/C SURFACE TEMP - 8 IN	DEG F	164.463
T/C SURFACE TEMP - 6 IN	DEG F	182.969
T/C SURFACE TEMP - 4 IN	DEG F	201.370
T/C SURFACE TEMP - 2 IN	DEG F	146.131
T/C SURFACE TEMP -0.3 IN	DEG F	148.275
T/C SURFACE TEMP + 3 IN	DEG F	131.098
T/C NOZZLE FLANGE TEMP	DEG F	213.828
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	809.025
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1208.016
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1304.660
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1235.087
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1163.770
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1061.546
NOZZLE SURFACE TEMP +40.4 IN	DEG F	946.035
NOZZLE SURFACE TEMP +57.5 IN	DEG F	835.379

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 14 NOV 3
SERIES RD/ICT-1 SEQUENCE 2 TEST 10

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	132.629
PC, NOZZLE STAGNATION	PSIA	125.998
AXIAL THRUST, SITE	LBF	6005.421
AXIAL THRUST, VACUUM	LBF	6082.060
NOZZLE EXIT PRESSURE	PSIA	.036
FUEL DENSITY (MMH)	LB/FT3	54.751
OXIDIZER DENSITY	LB/FT3	90.580
FUEL FLOWRATE	LB/SEC	7.355
OXIDIZER FLOWRATE	LB/SEC	12.290
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.645
MIXTURE RATIO (OVERALL)	O/F	1.671
BLC FLOWRATE	LB/SEC	.551
BLC TOTAL PERCENT	%	2.804
CORE MIXTURE RATIO	O/F	1.806
FUEL INJECTOR DELTA-P	PSID	59.936
OXIDIZER INJECTOR DELTA-P	PSID	57.347
T/C COOLANT DELTA-P	PSID	11.416
T/C COOLANT DELTA-T	DEG F	147.308
THRUST CHAMBER HEAT FLUX	BTU/SEC	774.667
C-STAR, SITE	FT/SEC	5474.316
C-STAR, UMR	FT/SEC	5533.766
C-STAR EFFICIENCY	%	95.849
CF, SITE	-----	1.797
CF SITE VACUUM	-----	1.820
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	101.254
CF, VAC 72	-----	1.808
ISP, TEST	SEC	305.692
ISP, SITE VACUUM	SEC	309.593
ISP, VAC 72 PREDICTED	SEC	309.580
ISP, ODK, TEST CONDITIONS	SEC	333.044
ISP, TDK, TEST CONDITIONS	SEC	327.668
ISP EFFICIENCY	%	91.463
ENERGY RELEASE EFFICIENCY	%	96.457
C-STAR, ODE	FT/SEC	5711.420
ISP, ODE, TEST	SEC	338.489

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 1
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER,
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.222 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	240.841
OXIDIZER TANK PRESSURE	PSIA	247.138
FUEL INTERFACE PRESSURE	PSIA	210.147
OXIDIZER INTERFACE PRESSURE	PSIA	198.169
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.796
FUEL INJECTOR PRESSURE	PSIA	192.186
OXIDIZER INJECTOR PRESSURE	PSIA	191.132
CHAMBER PRESSURE NO. 1	PSIA	131.835
CHAMBER PRESSURE NO. 2	PSIA	132.126
AXIAL THRUST, SYSTEM A	LBF	6001.263
AXIAL THRUST, SYSTEM B	LBF	6013.642
Y-AXIS THRUST	LBF	2.784
Z-AXIS THRUST	LBF	31.586
AVERAGE CELL PRESSURE	PSIA	.037
CELL PRESSURE AGREEMENT	%	.089
AVERAGE FUEL FLOWRATE	GPM	60.679
FUEL FM AGREEMENT	%	.053
AVERAGE OXIDIZER FLOWRATE	GPM	60.899
OXIDIZER FM AGREEMENT	%	.083
FUEL INTERFACE TEMPERATURE	DEG F	64.690
OXIDIZER INTERFACE TEMPERATURE	DEG F	68.849
T/C COOLANT IN TEMPERATURE	DEG F	66.221
T/C COOLANT OUT TEMPERATURE	DEG F	199.009
T/C SURFACE TEMP -16 IN	DEG F	197.983
T/C SURFACE TEMP -13 IN	DEG F	198.499
T/C SURFACE TEMP -10 IN	DEG F	212.709
T/C SURFACE TEMP - 8 IN	DEG F	162.017
T/C SURFACE TEMP - 6 IN	DEG F	177.288
T/C SURFACE TEMP - 4 IN	DEG F	197.742
T/C SURFACE TEMP - 2 IN	DEG F	143.865
T/C SURFACE TEMP -0.3 IN	DEG F	145.577
T/C SURFACE TEMP + 3 IN	DEG F	128.187
T/C NOZZLE FLANGE TEMP	DEG F	59.914
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	222.917
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	591.473
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	588.753
NOZZLE SURFACE TEMP +11.7 IN	DEG F	546.125
NOZZLE SURFACE TEMP +16.2 IN	DEG F	399.857
NOZZLE SURFACE TEMP +28.4 IN	DEG F	264.650
NOZZLE SURFACE TEMP +40.4 IN	DEG F	233.482
NOZZLE SURFACE TEMP +57.5 IN	DEG F	182.615

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.980
PC, NOZZLE STAGNATION	PSIA	125.381
AXIAL THRUST, SITE	LBF	6007.452
AXIAL THRUST, VACUUM	LBF	6081.125
NOZZLE EXIT PRESSURE	PSIA	.042
FUEL DENSITY (MMH)	LB/FT3	54.764
OXIDIZER DENSITY	LB/FT3	90.430
FUEL FLOWRATE	LB/SEC	7.404
OXIDIZER FLOWRATE	LB/SEC	12.270
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.674
MIXTURE RATIO (OVERALL)	O/F	1.657
BLC FLOWRATE	LB/SEC	.555
BLC TOTAL PERCENT	%	2.819
CORE MIXTURE RATIO	O/F	1.791
FUEL INJECTOR DELTA-P	PSID	60.205
OXIDIZER INJECTOR DELTA-P	PSID	59.151
T/C COOLANT DELTA-P	PSID	15.610
T/C COOLANT DELTA-T	DEG F	132.788
THRUST CHAMBER HEAT FLUX	BTU/SEC	702.945
C-STAR, SITE	FT/SEC	5439.661
C-STAR, UMR	FT/SEC	5497.018
C-STAR EFFICIENCY	%	95.246
CF, SITE	-----	1.806
CF SITE VACUUM	-----	1.828
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	101.826
CF, VAC 72	-----	1.816
ISP, TEST	SEC	305.352
ISP, SITE VACUUM	SEC	309.097
ISP, VAC 72 PREDICTED	SEC	309.080
ISP, ODK, TEST CONDITIONS	SEC	332.754
ISP, TDK, TEST CONDITIONS	SEC	327.427
ISP EFFICIENCY	%	91.421
ENERGY RELEASE EFFICIENCY	%	96.373
C-STAR, ODE	FT/SEC	5711.145
ISP, ODE, TEST	SEC	338.103

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 2
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER.
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 125., O/F = 1.85.

ACTUAL TEST DURATION 10.207 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	222.080
OXIDIZER TANK PRESSURE	PSIA	253.309
FUEL INTERFACE PRESSURE	PSIA	196.163
OXIDIZER INTERFACE PRESSURE	PSIA	201.136
T/C COOLANT INLET MAN. PRESSURE	PSIA	195.207
FUEL INJECTOR PRESSURE	PSIA	185.739
OXIDIZER INJECTOR PRESSURE	PSIA	193.443
CHAMBER PRESSURE NO. 1	PSIA	131.113
CHAMBER PRESSURE NO. 2	PSIA	131.373
AXIAL THRUST, SYSTEM A	LBF	5950.385
AXIAL THRUST, SYSTEM B	LBF	5953.220
Y-AXIS THRUST	LBF	-0.506
Z-AXIS THRUST	LBF	24.762
AVERAGE CELL PRESSURE	PSIA	.042
CELL PRESSURE AGREEMENT	%	.074
AVERAGE FUEL FLOWRATE	GPM	55.739
FUEL FM AGREEMENT	%	.121
AVERAGE OXIDIZER FLOWRATE	GPM	62.981
OXIDIZER FM AGREEMENT	%	.121
FUEL INTERFACE TEMPERATURE	DEG F	64.775
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.359
T/C COOLANT IN TEMPERATURE	DEG F	66.430
T/C COOLANT OUT TEMPERATURE	DEG F	217.508
T/C SURFACE TEMP -16 IN	DEG F	220.791
T/C SURFACE TEMP -13 IN	DEG F	212.752
T/C SURFACE TEMP -10 IN	DEG F	225.100
T/C SURFACE TEMP - 8 IN	DEG F	171.450
T/C SURFACE TEMP - 6 IN	DEG F	189.016
T/C SURFACE TEMP - 4 IN	DEG F	208.386
T/C SURFACE TEMP - 2 IN	DEG F	152.464
T/C SURFACE TEMP -0.3 IN	DEG F	153.320
T/C SURFACE TEMP + 3 IN	DEG F	136.195
T/C NOZZLE FLANGE TEMP	DEG F	80.421
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	444.015
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	918.455
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	963.404
NOZZLE SURFACE TEMP +11.7 IN	DEG F	897.225
NOZZLE SURFACE TEMP +16.2 IN	DEG F	719.678
NOZZLE SURFACE TEMP +28.4 IN	DEG F	508.283
NOZZLE SURFACE TEMP +40.4 IN	DEG F	401.466
NOZZLE SURFACE TEMP +57.5 IN	DEG F	321.657

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	131.243
PC, NOZZLE STAGNATION	PSIA	124.680
AXIAL THRUST, SITE	LBF	5951.803
AXIAL THRUST, VACUUM	LBF	6035.353
NOZZLE EXIT PRESSURE	PSIA	.047
FUEL DENSITY (MMH)	LB/FT3	54.764
OXIDIZER DENSITY	LB/FT3	90.407
FUEL FLOWRATE	LB/SEC	6.801
OXIDIZER FLOWRATE	LB/SEC	12.686
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.487
MIXTURE RATIO (OVERALL)	O/F	1.865
BLC FLOWRATE	LB/SEC	.509
BLC TOTAL PERCENT	%	2.614
CORE MIXTURE RATIO	O/F	2.016
FUEL INJECTOR DELTA-P	PSID	54.497
OXIDIZER INJECTOR DELTA-P	PSID	62.200
T/C COOLANT DELTA-P	PSID	9.468
T/C COOLANT DELTA-T	DEG F	151.078
THRUST CHAMBER HEAT FLUX	BTU/SEC	734.657
C-STAR, SITE	FT/SEC	5461.053
C-STAR, UMR	FT/SEC	5545.091
C-STAR EFFICIENCY	%	95.910
CF, SITE	-----	1.799
CF SITE VACUUM	-----	1.825
CF, VAC 72 EXPECT	-----	1.820
CF CORRELATION	-----	100.280
CF, VAC 72	-----	1.814
ISP, TEST	SEC	305.421
ISP, SITE VACUUM	SEC	309.709
ISP, VAC 72 PREDICTED	SEC	309.619
ISP, ODK, TEST CONDITIONS	SEC	336.094
ISP, TDK, TEST CONDITIONS	SEC	330.264
ISP EFFICIENCY	%	90.327
ENERGY RELEASE EFFICIENCY	%	95.749
C-STAR, ODE	FT/SEC	5693.936
ISP, ODE, TEST	SEC	342.876

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 3
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER.
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 140., O/F = 1.45.

ACTUAL TEST DURATION 10.154 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	302.158
OXIDIZER TANK PRESSURE	PSIA	273.722
FUEL INTERFACE PRESSURE	PSIA	257.187
OXIDIZER INTERFACE PRESSURE	PSIA	219.785
T/C COOLANT INLET MAN. PRESSURE	PSIA	253.574
FUEL INJECTOR PRESSURE	PSIA	237.310
OXIDIZER INJECTOR PRESSURE	PSIA	211.931
CHAMBER PRESSURE NO. 1	PSIA	147.477
CHAMBER PRESSURE NO. 2	PSIA	147.959
AXIAL THRUST, SYSTEM A	LBF	6633.841
AXIAL THRUST, SYSTEM B	LBF	6643.315
Y-AXIS THRUST	LBF	9.364
Z-AXIS THRUST	LBF	26.017
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.086
AVERAGE FUEL FLOWRATE	GPM	72.920
FUEL FM AGREEMENT	%	.121
AVERAGE OXIDIZER FLOWRATE	GPM	64.132
OXIDIZER FM AGREEMENT	%	.252
FUEL INTERFACE TEMPERATURE	DEG F	65.029
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.614
T/C COOLANT IN TEMPERATURE	DEG F	66.806
T/C COOLANT OUT TEMPERATURE	DEG F	193.972
T/C SURFACE TEMP -16 IN	DEG F	196.585
T/C SURFACE TEMP -13 IN	DEG F	187.643
T/C SURFACE TEMP -10 IN	DEG F	200.699
T/C SURFACE TEMP - 8 IN	DEG F	152.580
T/C SURFACE TEMP - 6 IN	DEG F	169.430
T/C SURFACE TEMP - 4 IN	DEG F	186.743
T/C SURFACE TEMP - 2 IN	DEG F	135.379
T/C SURFACE TEMP -0.3 IN	DEG F	136.615
T/C SURFACE TEMP + 3 IN	DEG F	121.262
T/C NOZZLE FLANGE TEMP	DEG F	94.781
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	551.120
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	990.633
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1019.239
NOZZLE SURFACE TEMP +11.7 IN	DEG F	938.107
NOZZLE SURFACE TEMP +16.2 IN	DEG F	857.442
NOZZLE SURFACE TEMP +28.6 IN	DEG F	671.192
NOZZLE SURFACE TEMP +40.4 IN	DEG F	530.172
NOZZLE SURFACE TEMP +57.5 IN	DEG F	421.844

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 3

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	147.718
PC, NOZZLE STAGNATION	PSIA	140.332
AXIAL THRUST, SITE	LBF	6638.578
AXIAL THRUST, VACUUM	LBF	6714.223
NOZZLE EXIT PRESSURE	PSIA	.043
FUEL DENSITY (MMH)	LB/FT3	54.762
OXIDIZER DENSITY	LB/FT3	90.412
FUEL FLOWRATE	LB/SEC	8.897
OXIDIZER FLOWRATE	LB/SEC	12.919
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.816
MIXTURE RATIO (OVERALL)	O/F	1.452
BLC FLOWRATE	LB/SEC	.666
BLC TOTAL PERCENT	%	3.055
CORE MIXTURE RATIO	O/F	1.570
FUEL INJECTOR DELTA-P	PSID	89.592
OXIDIZER INJECTOR DELTA-P	PSID	64.213
T/C COOLANT DELTA-P	PSID	16.264
T/C COOLANT DELTA-T	DEG F	127.166
THRUST CHAMBER HEAT FLUX	BTU/SEC	808.941
C-STAR, SITE	FT/SEC	5490.559
C-STAR, UMR	FT/SEC	5526.462
C-STAR EFFICIENCY	%	96.656
CF, SITE	-----	1.783
CF SITE VACUUM	-----	1.804
CF, VAC 72 EXPECT	-----	1.772
CF CORRELATION	-----	101.791
CF, VAC 72	-----	1.791
ISP, TEST	SEC	304.304
ISP, SITE VACUUM	SEC	307.772
ISP, VAC 72 PREDICTED	SEC	307.515
ISP, ODK, TEST CONDITIONS	SEC	327.014
ISP, TDK, TEST CONDITIONS	SEC	321.706
ISP EFFICIENCY	%	92.850
ENERGY RELEASE EFFICIENCY	%	97.478
C-STAR, ODE	FT/SEC	5680.530
ISP, ODE, TEST	SEC	331.473

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 4
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER, LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 140., O/F = 1.65.

ACTUAL TEST DURATION 10.204 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	277.906
OXIDIZER TANK PRESSURE	PSIA	285.115
FUEL INTERFACE PRESSURE	PSIA	239.812
OXIDIZER INTERFACE PRESSURE	PSIA	226.142
T/C COOLANT INLET MAN. PRESSURE	PSIA	237.170
FUEL INJECTOR PRESSURE	PSIA	223.659
OXIDIZER INJECTOR PRESSURE	PSIA	217.324
CHAMBER PRESSURE NO. 1	PSIA	146.754
CHAMBER PRESSURE NO. 2	PSIA	147.205
AXIAL THRUST, SYSTEM A	LBF	6643.338
AXIAL THRUST, SYSTEM B	LBF	6652.853
Y-AXIS THRUST	LBF	4.555
Z-AXIS THRUST	LBF	25.267
AVERAGE CELL PRESSURE	PSIA	.041
CELL PRESSURE AGREEMENT	%	.077
AVERAGE FUEL FLOWRATE	GPM	66.991
FUEL FM AGREEMENT	%	.083
AVERAGE OXIDIZER FLOWRATE	GPM	67.035
OXIDIZER FM AGREEMENT	%	.197
FUEL INTERFACE TEMPERATURE	DEG F	65.114
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.699
T/C COOLANT IN TEMPERATURE	DEG F	66.974
T/C COOLANT OUT TEMPERATURE	DEG F	207.108
T/C SURFACE TEMP -16 IN	DEG F	210.510
T/C SURFACE TEMP -13 IN	DEG F	198.614
T/C SURFACE TEMP -10 IN	DEG F	211.082
T/C SURFACE TEMP - 8 IN	DEG F	160.852
T/C SURFACE TEMP - 6 IN	DEG F	178.013
T/C SURFACE TEMP - 4 IN	DEG F	196.050
T/C SURFACE TEMP - 2 IN	DEG F	142.775
T/C SURFACE TEMP -0.3 IN	DEG F	143.519
T/C SURFACE TEMP + 3 IN	DEG F	128.309
T/C NOZZLE FLANGE TEMP	DEG F	115.301
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	672.340
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1133.894
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1168.074
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1093.564
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1006.281
NOZZLE SURFACE TEMP +28.4 IN	DEG F	835.272
NOZZLE SURFACE TEMP +40.4 IN	DEG F	671.150
NOZZLE SURFACE TEMP +57.5 IN	DEG F	540.342

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 4

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	146.980
PC, NOZZLE STAGNATION	PSIA	139.631
AXIAL THRUST, SITE	LBF	6648.095
AXIAL THRUST, VACUUM	LBF	6729.667
NOZZLE EXIT PRESSURE	PSIA	.045
FUEL DENSITY (MMH)	LB/FT3	54.759
OXIDIZER DENSITY	LB/FT3	90.411
FUEL FLOWRATE	LB/SEC	8.173
OXIDIZER FLOWRATE	LB/SEC	13.503
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.677
MIXTURE RATIO (OVERALL)	O/F	1.652
BLC FLOWRATE	LB/SEC	.612
BLC TOTAL PERCENT	%	2.824
CORE MIXTURE RATIO	O/F	1.786
FUEL INJECTOR DELTA-P	PSID	76.679
OXIDIZER INJECTOR DELTA-P	PSID	70.344
T/C COOLANT DELTA-P	PSID	13.511
T/C COOLANT DELTA-T	DEG F	140.134
THRUST CHAMBER HEAT FLUX	BTU/SEC	818.919
C-STAR, SITE	FT/SEC	5498.156
C-STAR, UMR	FT/SEC	5554.735
C-STAR EFFICIENCY	%	96.272
CF, SITE	-----	1.795
CF SITE VACUUM	-----	1.817
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	101.220
CF, VAC 72	-----	1.805
ISP, TEST	SEC	306.695
ISP, SITE VACUUM	SEC	310.458
ISP, VAC 72 PREDICTED	SEC	310.403
ISP, ODK, TEST CONDITIONS	SEC	332.994
ISP, TDK, TEST CONDITIONS	SEC	327.630
ISP EFFICIENCY	%	91.862
ENERGY RELEASE EFFICIENCY	%	96.547
C-STAR, ODE	FT/SEC	5711.043
ISP, ODE, TEST	SEC	337.961

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 5
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER.
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 140.. O/F = 1.85.

ACTUAL TEST DURATION 10.169 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	261.890
OXIDIZER TANK PRESSURE	PSIA	297.457
FUEL INTERFACE PRESSURE	PSIA	228.370
OXIDIZER INTERFACE PRESSURE	PSIA	233.348
T/C COOLANT INLET MAN. PRESSURE	PSIA	226.107
FUEL INJECTOR PRESSURE	PSIA	214.179
OXIDIZER INJECTOR PRESSURE	PSIA	223.486
CHAMBER PRESSURE NO. 1	PSIA	146.995
CHAMBER PRESSURE NO. 2	PSIA	147.707
AXIAL THRUST, SYSTEM A	LBF	6671.960
AXIAL THRUST, SYSTEM B	LBF	6681.474
Y-AXIS THRUST	LBF	4.555
Z-AXIS THRUST	LBF	27.290
AVERAGE CELL PRESSURE	PSIA	.040
CELL PRESSURE AGREEMENT	%	.176
AVERAGE FUEL FLOWRATE	GPM	62.600
FUEL FM AGREEMENT	%	.002
AVERAGE OXIDIZER FLOWRATE	GPM	69.884
OXIDIZER FM AGREEMENT	%	.250
FUEL INTERFACE TEMPERATURE	DEG F	65.199
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.868
T/C COOLANT IN TEMPERATURE	DEG F	67.099
T/C COOLANT OUT TEMPERATURE	DEG F	217.973
T/C SURFACE TEMP -16 IN	DEG F	221.180
T/C SURFACE TEMP -13 IN	DEG F	209.594
T/C SURFACE TEMP -10 IN	DEG F	221.474
T/C SURFACE TEMP - 8 IN	DEG F	168.655
T/C SURFACE TEMP - 6 IN	DEG F	186.355
T/C SURFACE TEMP - 4 IN	DEG F	204.877
T/C SURFACE TEMP - 2 IN	DEG F	149.801
T/C SURFACE TEMP -0.3 IN	DEG F	150.659
T/C SURFACE TEMP + 3 IN	DEG F	134.133
T/C NOZZLE FLANGE TEMP	DEG F	132.746
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	746.259
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1217.493
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1243.561
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1170.180
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1093.806
NOZZLE SURFACE TEMP +28.4 IN	DEG F	941.589
NOZZLE SURFACE TEMP +40.4 IN	DEG F	776.746
NOZZLE SURFACE TEMP +57.5 IN	DEG F	636.989

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 5

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	147.351
PC, NOZZLE STAGNATION	PSIA	139.984
AXIAL THRUST, SITE	LBF	6676.717
AXIAL THRUST, VACUUM	LBF	6757.791
NOZZLE EXIT PRESSURE	PSIA	.045
FUEL DENSITY (MMH)	LB/FT3	54.756
OXIDIZER DENSITY	LB/FT3	90.405
FUEL FLOWRATE	LB/SEC	7.637
OXIDIZER FLOWRATE	LB/SEC	14.076
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.713
MIXTURE RATIO (OVERALL)	O/F	1.843
BLC FLOWRATE	LB/SEC	.572
BLC TOTAL PERCENT	%	2.634
CORE MIXTURE RATIO	O/F	1.992
FUEL INJECTOR DELTA-P	PSID	66.828
OXIDIZER INJECTOR DELTA-P	PSID	76.135
T/C COOLANT DELTA-P	PSID	11.928
T/C COOLANT DELTA-T	DEG F	150.874
THRUST CHAMBER HEAT FLUX	BTU/SEC	823.850
C-STAR, SITE	FT/SEC	5502.742
C-STAR, UMR	FT/SEC	5585.269
C-STAR EFFICIENCY	%	96.574
CF, SITE	-----	1.798
CF SITE VACUUM	-----	1.820
CF, VAC 72 EXPECT	-----	1.817
CF CORRELATION	-----	100.151
CF, VAC 72	-----	1.809
ISP, TEST	SEC	307.494
ISP, SITE VACUUM	SEC	311.228
ISP, VAC 72 PREDICTED	SEC	311.247
ISP, ODK, TEST CONDITIONS	SEC	336.319
ISP, TDK, TEST CONDITIONS	SEC	330.960
ISP EFFICIENCY	%	90.879
ENERGY RELEASE EFFICIENCY	%	95.805
C-STAR, ODE	FT/SEC	5697.960
ISP, ODE, TEST	SEC	342.463

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 6
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER,
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 110., O/F = 1.45.

ACTUAL TEST DURATION 10.175 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	207.895
OXIDIZER TANK PRESSURE	PSIA	196.819
FUEL INTERFACE PRESSURE	PSIA	180.483
OXIDIZER INTERFACE PRESSURE	PSIA	151.547
T/C COOLANT INLET MAN. PRESSURE	PSIA	180.329
FUEL INJECTOR PRESSURE	PSIA	173.984
OXIDIZER INJECTOR PRESSURE	PSIA	151.458
CHAMBER PRESSURE NO. 1	PSIA	113.541
CHAMBER PRESSURE NO. 2	PSIA	115.540
AXIAL THRUST, SYSTEM A	LBF	5009.446
AXIAL THRUST, SYSTEM B	LBF	5193.172
Y-AXIS THRUST	LBF	-1.012
Z-AXIS THRUST	LBF	18.705
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	1.094
AVERAGE FUEL FLOWRATE	GPM	57.071
FUEL FM AGREEMENT	%	1.918
AVERAGE OXIDIZER FLOWRATE	GPM	50.820
OXIDIZER FM AGREEMENT	%	.114
FUEL INTERFACE TEMPERATURE	DEG F	65.284
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.614
T/C COOLANT IN TEMPERATURE	DEG F	67.349
T/C COOLANT OUT TEMPERATURE	DEG F	199.195
T/C SURFACE TEMP -16 IN	DEG F	201.951
T/C SURFACE TEMP -13 IN	DEG F	194.412
T/C SURFACE TEMP -10 IN	DEG F	208.631
T/C SURFACE TEMP - 8 IN	DEG F	158.173
T/C SURFACE TEMP - 6 IN	DEG F	175.716
T/C SURFACE TEMP - 4 IN	DEG F	193.753
T/C SURFACE TEMP - 2 IN	DEG F	140.593
T/C SURFACE TEMP -0.3 IN	DEG F	141.824
T/C SURFACE TEMP + 3 IN	DEG F	125.880
T/C NOZZLE FLANGE TEMP	DEG F	134.798
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	650.377
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1017.881
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1024.691
NOZZLE SURFACE TEMP +11.7 IN	DEG F	928.571
NOZZLE SURFACE TEMP +16.2 IN	DEG F	941.984
NOZZLE SURFACE TEMP +28.4 IN	DEG F	831.311
NOZZLE SURFACE TEMP +40.6 IN	DEG F	758.954
NOZZLE SURFACE TEMP +57.5 IN	DEG F	639.740

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RO/ICT-1 SEQUENCE 3 TEST 6

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	114.541
PC, NOZZLE STAGNATION	PSIA	108.814
AXIAL THRUST, SITE	LBF	5101.309
AXIAL THRUST, VACUUM	LBF	5177.014
NOZZLE EXIT PRESSURE	PSIA	.038
FUEL DENSITY (MMH)	LB/FT3	54.756
OXIDIZER DENSITY	LB/FT3	90.367
FUEL FLOWRATE	LB/SEC	6.962
OXIDIZER FLOWRATE	LB/SEC	10.232
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.195
MIXTURE RATIO (OVERALL)	O/F	1.470
BLC FLOWRATE	LB/SEC	.521
BLC TOTAL PERCENT	%	3.033
CORE MIXTURE RATIO	O/F	1.589
FUEL INJECTOR DELTA-P	PSID	59.444
OXIDIZER INJECTOR DELTA-P	PSID	36.918
T/C COOLANT DELTA-P	PSID	6.345
T/C COOLANT DELTA-T	DEG F	131.846
THRUST CHAMBER HEAT FLUX	BTU/SEC	656.348
C-STAR, SITE	FT/SEC	5401.575
C-STAR, UMR	FT/SEC	5439.506
C-STAR EFFICIENCY	%	95.013
CF, SITE	-----	1.767
CF SITE VACUUM	-----	1.793
CF, VAC 72 EXPECT	-----	1.774
CF CORRELATION	-----	101.105
CF, VAC 72	-----	1.781
ISP, TEST	SEC	296.682
ISP, SITE VACUUM	SEC	301.085
ISP, VAC 72 PREDICTED	SEC	300.896
ISP, ODK, TEST CONDITIONS	SEC	327.023
ISP, TDK, TEST CONDITIONS	SEC	321.642
ISP EFFICIENCY	%	90.659
ENERGY RELEASE EFFICIENCY	%	95.905
C-STAR, ODE	FT/SEC	5685.098
ISP, ODE, TEST	SEC	332.106

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3

SERIES RD/ICT-1 SEQUENCE 3 TEST 7

TEST DESCRIPTION

PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAMMBER, LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 110., O/F = 1.65.

ACTUAL TEST DURATION 10.203 SEC

DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	196.455
OXIDIZER TANK PRESSURE	PSIA	204.414
FUEL INTERFACE PRESSURE	PSIA	172.855
OXIDIZER INTERFACE PRESSURE	PSIA	166.381
T/C COOLANT INLET MAN. PRESSURE	PSIA	171.555
FUEL INJECTOR PRESSURE	PSIA	163.367
OXIDIZER INJECTOR PRESSURE	PSIA	161.088
CHAMBER PRESSURE NO. 1	PSIA	115.949
CHAMBER PRESSURE NO. 2	PSIA	116.294
AXIAL THRUST, SYSTEM A	LBF	5222.484
AXIAL THRUST, SYSTEM B	LBF	5231.330
Y-AXIS THRUST	LBF	-2.025
Z-AXIS THRUST	LBF	20.975
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.084
AVERAGE FUEL FLOWRATE	GPM	52.664
FUEL FM AGREEMENT	%	.026
AVERAGE OXIDIZER FLOWRATE	GPM	53.668
OXIDIZER FM AGREEMENT	%	.052
FUEL INTERFACE TEMPERATURE	DEG F	65.284
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.784
T/C COOLANT IN TEMPERATURE	DEG F	67.266
T/C COOLANT OUT TEMPERATURE	DEG F	213.612
T/C SURFACE TEMP -16 IN	DEG F	217.129
T/C SURFACE TEMP -13 IN	DEG F	206.908
T/C SURFACE TEMP -10 IN	DEG F	221.243
T/C SURFACE TEMP - 8 IN	DEG F	167.374
T/C SURFACE TEMP - 6 IN	DEG F	185.750
T/C SURFACE TEMP - 4 IN	DEG F	204.756
T/C SURFACE TEMP - 2 IN	DEG F	148.589
T/C SURFACE TEMP -0.3 IN	DEG F	149.933
T/C SURFACE TEMP + 3 IN	DEG F	132.678
T/C NOZZLE FLANGE TEMP	DEG F	152.246
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	707.967
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1120.208
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1142.070
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1063.518
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1026.692
NOZZLE SURFACE TEMP +28.6 IN	DEG F	922.548
NOZZLE SURFACE TEMP +40.4 IN	DEG F	821.858
NOZZLE SURFACE TEMP +57.5 IN	DEG F	704.250

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 7

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	116.122
PC, NOZZLE STAGNATION	PSIA	110.316
AXIAL THRUST, SITE	LBF	5226.907
AXIAL THRUST, VACUUM	LBF	5303.538
NOZZLE EXIT PRESSURE	PSIA	.042
FUEL DENSITY (MMH)	LB/FT3	54.759
OXIDIZER DENSITY	LB/FT3	90.359
FUEL FLOWRATE	LB/SEC	6.425
OXIDIZER FLOWRATE	LB/SEC	10.804
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.230
MIXTURE RATIO (OVERALL)	O/F	1.682
BLC FLOWRATE	LB/SEC	.481
BLC TOTAL PERCENT	%	2.793
CORE MIXTURE RATIO	O/F	1.818
FUEL INJECTOR DELTA-P	PSID	47.245
OXIDIZER INJECTOR DELTA-P	PSID	44.966
T/C COOLANT DELTA-P	PSID	8.188
T/C COOLANT DELTA-T	DEG F	146.347
THRUST CHAMBER HEAT FLUX	BTU/SEC	672.323
C-STAR, SITE	FT/SEC	5464.952
C-STAR, UMR	FT/SEC	5525.991
C-STAR EFFICIENCY	%	95.681
CF, SITE	-----	1.786
CF SITE VACUUM	-----	1.812
CF, VAC 72 EXPECT	-----	1.798
CF CORRELATION	-----	100.776
CF, VAC 72	-----	1.801
ISP, TEST	SEC	303.366
ISP, SITE VACUUM	SEC	307.813
ISP, VAC 72 PREDICTED	SEC	307.816
ISP, ODK, TEST CONDITIONS	SEC	332.802
ISP, TDK, TEST CONDITIONS	SEC	327.391
ISP EFFICIENCY	%	90.858
ENERGY RELEASE EFFICIENCY	%	96.271
C-STAR, ODE	FT/SEC	5711.631
ISP, ODE, TEST	SEC	338.784

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 8
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER, LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 110., O/F = 1.85.

ACTUAL TEST DURATION 10.203 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	185.931
OXIDIZER TANK PRESSURE	PSIA	210.585
FUEL INTERFACE PRESSURE	PSIA	165.227
OXIDIZER INTERFACE PRESSURE	PSIA	169.348
T/C COOLANT INLET MAN. PRESSURE	PSIA	163.926
FUEL INJECTOR PRESSURE	PSIA	157.300
OXIDIZER INJECTOR PRESSURE	PSIA	164.169
CHAMBER PRESSURE NO. 1	PSIA	115.227
CHAMBER PRESSURE NO. 2	PSIA	115.792
AXIAL THRUST, SYSTEM A	LBF	5212.941
AXIAL THRUST, SYSTEM B	LBF	5215.425
Y-AXIS THRUST	LBF	-1.772
Z-AXIS THRUST	LBF	20.219
AVERAGE CELL PRESSURE	PSIA	.039
CELL PRESSURE AGREEMENT	%	.082
AVERAGE FUEL FLOWRATE	GPM	49.206
FUEL FM AGREEMENT	%	.030
AVERAGE OXIDIZER FLOWRATE	GPM	55.586
OXIDIZER FM AGREEMENT	%	.093
FUEL INTERFACE TEMPERATURE	DEG F	65.199
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.784
T/C COOLANT IN TEMPERATURE	DEG F	67.223
T/C COOLANT OUT TEMPERATURE	DEG F	225.198
T/C SURFACE TEMP -16 IN	DEG F	228.589
T/C SURFACE TEMP -13 IN	DEG F	216.611
T/C SURFACE TEMP -10 IN	DEG F	230.118
T/C SURFACE TEMP - 8 IN	DEG F	174.245
T/C SURFACE TEMP - 6 IN	DEG F	193.128
T/C SURFACE TEMP - 4 IN	DEG F	212.378
T/C SURFACE TEMP - 2 IN	DEG F	154.884
T/C SURFACE TEMP -0.3 IN	DEG F	155.617
T/C SURFACE TEMP + 3 IN	DEG F	138.013
T/C NOZZLE FLANGE TEMP	DEG F	168.668
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	758.553
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1191.389
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1213.324
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1142.780
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1088.504
NOZZLE SURFACE TEMP +28.4 IN	DEG F	987.908
NOZZLE SURFACE TEMP +40.4 IN	DEG F	871.009
NOZZLE SURFACE TEMP +57.5 IN	DEG F	756.246

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 8

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	115.509
PC, NOZZLE STAGNATION	PSIA	109.734
AXIAL THRUST, SITE	LBF	5214.183
AXIAL THRUST, VACUUM	LBF	5291.801
NOZZLE EXIT PRESSURE	PSIA	.042
FUEL DENSITY (MMH)	LB/FT3	54.759
OXIDIZER DENSITY	LB/FT3	90.356
FUEL FLOWRATE	LB/SEC	6.003
OXIDIZER FLOWRATE	LB/SEC	11.190
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.193
MIXTURE RATIO (OVERALL)	O/F	1.864
BLC FLOWRATE	LB/SEC	.450
BLC TOTAL PERCENT	%	2.615
CORE MIXTURE RATIO	O/F	2.015
FUEL INJECTOR DELTA-P	PSID	41.791
OXIDIZER INJECTOR DELTA-P	PSID	48.660
T/C COOLANT DELTA-P	PSID	6.626
T/C COOLANT DELTA-T	DEG F	157.975
THRUST CHAMBER HEAT FLUX	BTU/SEC	678.085
C-STAR, SITE	FT/SEC	5447.588
C-STAR, UMR	FT/SEC	5531.567
C-STAR EFFICIENCY	%	95.669
CF, SITE	-----	1.791
CF SITE VACUUM	-----	1.818
CF, VAC 72 EXPECT	-----	1.819
CF CORRELATION	-----	99.911
CF, VAC 72	-----	1.807
ISP, TEST	SEC	303.265
ISP, SITE VACUUM	SEC	307.780
ISP, VAC 72 PREDICTED	SEC	307.694
ISP, ODK, TEST CONDITIONS	SEC	335.479
ISP, TDK, TEST CONDITIONS	SEC	329.645
ISP EFFICIENCY	%	89.770
ENERGY RELEASE EFFICIENCY	%	95.608
C-STAR, ODE	FT/SEC	5694.199
ISP, ODE, TEST	SEC	342.852

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 9
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER, LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 125., O/F = 1.45.

ACTUAL TEST DURATION 10.202 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	254.569
OXIDIZER TANK PRESSURE	PSIA	233.846
FUEL INTERFACE PRESSURE	PSIA	219.047
OXIDIZER INTERFACE PRESSURE	PSIA	189.268
T/C COOLANT INLET MAN. PRESSURE	PSIA	214.663
FUEL INJECTOR PRESSURE	PSIA	202.424
OXIDIZER INJECTOR PRESSURE	PSIA	183.428
CHAMBER PRESSURE NO. 1	PSIA	131.113
CHAMBER PRESSURE NO. 2	PSIA	132.126
AXIAL THRUST, SYSTEM A	LBF	5921.771
AXIAL THRUST, SYSTEM B	LBF	5927.777
Y-AXIS THRUST	LBF	3.037
Z-AXIS THRUST	LBF	25.645
AVERAGE CELL PRESSURE	PSIA	.036
CELL PRESSURE AGREEMENT	%	.091
AVERAGE FUEL FLOWRATE	GPM	65.126
FUEL FM AGREEMENT	%	.079
AVERAGE OXIDIZER FLOWRATE	GPM	57.612
OXIDIZER FM AGREEMENT	%	.021
FUEL INTERFACE TEMPERATURE	DEG F	65.284
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.784
T/C COOLANT IN TEMPERATURE	DEG F	67.182
T/C COOLANT OUT TEMPERATURE	DEG F	199.102
T/C SURFACE TEMP -16 IN	DEG F	202.419
T/C SURFACE TEMP -13 IN	DEG F	191.961
T/C SURFACE TEMP -10 IN	DEG F	205.481
T/C SURFACE TEMP - 8 IN	DEG F	155.960
T/C SURFACE TEMP - 6 IN	DEG F	173.419
T/C SURFACE TEMP - 4 IN	DEG F	190.852
T/C SURFACE TEMP - 2 IN	DEG F	138.047
T/C SURFACE TEMP -0.3 IN	DEG F	139.886
T/C SURFACE TEMP + 3 IN	DEG F	124.301
T/C NOZZLE FLANGE TEMP	DEG F	170.721
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	712.073
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1107.917
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1117.468
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1033.500
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1021.239
NOZZLE SURFACE TEMP +28.4 IN	DEG F	932.090
NOZZLE SURFACE TEMP +40.4 IN	DEG F	854.631

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 9

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	131.620
PC, NOZZLE STAGNATION	PSIA	125.039
AXIAL THRUST, SITE	LBF	5924.774
AXIAL THRUST, VACUUM	LBF	5997.461
NOZZLE EXIT PRESSURE	PSIA	.040
FUEL DENSITY (MMH)	LB/FT3	54.759
OXIDIZER DENSITY	LB/FT3	90.375
FUEL FLOWRATE	LB/SEC	7.946
OXIDIZER FLOWRATE	LB/SEC	11.601
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.546
MIXTURE RATIO (OVERALL)	O/F	1.460
BLC FLOWRATE	LB/SEC	.595
BLC TOTAL PERCENT	%	3.045
CORE MIXTURE RATIO	O/F	1.578
FUEL INJECTOR DELTA-P	PSID	70.804
OXIDIZER INJECTOR DELTA-P	PSID	51.808
T/C COOLANT DELTA-P	PSID	12.239
T/C COOLANT DELTA-T	DEG F	131.920
THRUST CHAMBER HEAT FLUX	BTU/SEC	749.452
C-STAR, SITE	FT/SEC	5460.182
C-STAR, UMR	FT/SEC	5497.009
C-STAR EFFICIENCY	%	96.086
CF, SITE	-----	1.786
CF SITE VACUUM	-----	1.808
CF, VAC 72 EXPECT	-----	1.773
CF CORRELATION	-----	101.993
CF, VAC 72	-----	1.795
ISP, TEST	SEC	303.115
ISP, SITE VACUUM	SEC	306.834
ISP, VAC 72 PREDICTED	SEC	306.603
ISP, ODK, TEST CONDITIONS	SEC	327.031
ISP, TDK, TEST CONDITIONS	SEC	321.696
ISP EFFICIENCY	%	92.487
ENERGY RELEASE EFFICIENCY	%	97.400
C-STAR, ODE	FT/SEC	5682.603
ISP, ODE, TEST	SEC	331.760

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 10
TEST DESCRIPTION
PERFORMANCE EVALUATION OF RD INTEGRATED REGEN CAHMBER.
LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE, MMH/NTO
HELIUM-SATURATED AT 225 PSIA. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.201 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	241.299
OXIDIZER TANK PRESSURE	PSIA	247.613
FUEL INTERFACE PRESSURE	PSIA	209.724
OXIDIZER INTERFACE PRESSURE	PSIA	197.745
T/C COOLANT INLET MAN. PRESSURE	PSIA	206.270
FUEL INJECTOR PRESSURE	PSIA	195.219
OXIDIZER INJECTOR PRESSURE	PSIA	191.132
CHAMBER PRESSURE NO. 1	PSIA	132.556
CHAMBER PRESSURE NO. 2	PSIA	133.383
AXIAL THRUST, SYSTEM A	LBF	6013.950
AXIAL THRUST, SYSTEM B	LBF	6023.180
Y-AXIS THRUST	LBF	3.543
Z-AXIS THRUST	LBF	23.879
AVERAGE CELL PRESSURE	PSIA	.040
CELL PRESSURE AGREEMENT	%	.177
AVERAGE FUEL FLOWRATE	GPM	60.899
FUEL FM AGREEMENT	%	.059
AVERAGE OXIDIZER FLOWRATE	GPM	61.009
OXIDIZER FM AGREEMENT	%	.085
FUEL INTERFACE TEMPERATURE	DEG F	65.284
OXIDIZER INTERFACE TEMPERATURE	DEG F	69.699
T/C COOLANT IN TEMPERATURE	DEG F	67.182
T/C COOLANT OUT TEMPERATURE	DEG F	209.991
T/C SURFACE TEMP -16 IN	DEG F	214.247
T/C SURFACE TEMP -13 IN	DEG F	202.001
T/C SURFACE TEMP -10 IN	DEG F	215.168
T/C SURFACE TEMP - 8 IN	DEG F	163.182
T/C SURFACE TEMP - 6 IN	DEG F	181.398
T/C SURFACE TEMP - 4 IN	DEG F	199.314
T/C SURFACE TEMP - 2 IN	DEG F	144.956
T/C SURFACE TEMP -0.3 IN	DEG F	146.182
T/C SURFACE TEMP + 3 IN	DEG F	130.251
T/C NOZZLE FLANGE TEMP	DEG F	188.170
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	762.650
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1192.763
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1216.070
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1149.628
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1097.404
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1011.066
NOZZLE SURFACE TEMP +60.6 IN	DEG F	910.573
NOZZLE SURFACE TEMP +57.5 IN	DEG F	802.671

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 15 NOV 3
SERIES RD/ICT-1 SEQUENCE 3 TEST 10

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	132.970
PC, NOZZLE STAGNATION	PSIA	126.321
AXIAL THRUST, SITE	LBF	6018.565
AXIAL THRUST, VACUUM	LBF	6098.650
NOZZLE EXIT PRESSURE	PSIA	.043
FUEL DENSITY (MMH)	LB/FT3	54.759
OXIDIZER DENSITY	LB/FT3	90.390
FUEL FLOWRATE	LB/SEC	7.430
OXIDIZER FLOWRATE	LB/SEC	12.287
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.716
MIXTURE RATIO (OVERALL)	O/F	1.654
BLC FLOWRATE	LB/SEC	.556
BLC TOTAL PERCENT	%	2.823
CORE MIXTURE RATIO	O/F	1.788
FUEL INJECTOR DELTA-P	PSID	62.250
OXIDIZER INJECTOR DELTA-P	PSID	58.162
T/C COOLANT DELTA-P	PSID	11.051
T/C COOLANT DELTA-T	DEG F	142.809
THRUST CHAMBER HEAT FLUX	BTU/SEC	758.656
C-STAR, SITE	FT/SEC	5468.583
C-STAR, UMR	FT/SEC	5525.392
C-STAR EFFICIENCY	%	95.754
CF, SITE	-----	1.796
CF SITE VACUUM	-----	1.820
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	101.383
CF, VAC 72	-----	1.808
ISP, TEST	SEC	305.256
ISP, SITE VACUUM	SEC	309.318
ISP, VAC 72 PREDICTED	SEC	309.278
ISP, ODK, TEST CONDITIONS	SEC	332.705
ISP, TDK, TEST CONDITIONS	SEC	327.387
ISP EFFICIENCY	%	91.513
ENERGY RELEASE EFFICIENCY	%	96.448
C-STAR, ODE	FT/SEC	5711.073
ISP, ODE, TEST	SEC	338.003

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 1
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 30.203 SEC
DATA SLICE TIME 29.000 SEC TO 30.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	236.723
OXIDIZER TANK PRESSURE	PSIA	243.340
FUEL INTERFACE PRESSURE	PSIA	207.015
OXIDIZER INTERFACE PRESSURE	PSIA	195.202
T/C COOLANT INLET MAN. PRESSURE	PSIA	205.126
FUEL INJECTOR PRESSURE	PSIA	189.911
OXIDIZER INJECTOR PRESSURE	PSIA	188.820
CHAMBER PRESSURE NO. 1	PSIA	128.225
CHAMBER PRESSURE NO. 2	PSIA	128.608
AXIAL THRUST, SYSTEM A	LBF	5915.423
AXIAL THRUST, SYSTEM B	LBF	5915.906
Y-AXIS THRUST	LBF	-10.129
Z-AXIS THRUST	LBF	31.442
AVERAGE CELL PRESSURE	PSIA	.025
CELL PRESSURE AGREEMENT	%	.127
AVERAGE FUEL FLOWRATE	GPM	60.733
FUEL FM AGREEMENT	%	.055
AVERAGE OXIDIZER FLOWRATE	GPM	61.557
OXIDIZER FM AGREEMENT	%	.095
FUEL INTERFACE TEMPERATURE	DEG F	101.566
OXIDIZER INTERFACE TEMPERATURE	DEG F	102.598
T/C COOLANT IN TEMPERATURE	DEG F	103.521
T/C COOLANT OUT TEMPERATURE	DEG F	242.574
T/C SURFACE TEMP -16 IN	DEG F	245.272
T/C SURFACE TEMP -13 IN	DEG F	239.205
T/C SURFACE TEMP -10 IN	DEG F	245.330
T/C SURFACE TEMP - 8 IN	DEG F	194.393
T/C SURFACE TEMP - 6 IN	DEG F	210.981
T/C SURFACE TEMP - 4 IN	DEG F	229.588
T/C SURFACE TEMP - 2 IN	DEG F	177.339
T/C SURFACE TEMP -0.3 IN	DEG F	174.398
T/C SURFACE TEMP + 3 IN	DEG F	159.401
T/C NOZZLE FLANGE TEMP	DEG F	52.738
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	603.598
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1135.283
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1218.808
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1201.844
NOZZLE SURFACE TEMP +16.2 IN	DEG F	972.173
NOZZLE SURFACE TEMP +28.4 IN	DEG F	658.602
NOZZLE SURFACE TEMP +40.4 IN	DEG F	545.140
NOZZLE SURFACE TEMP +57.5 IN	DEG F	439.814

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	128.417
PC, NOZZLE STAGNATION	PSIA	121.996
AXIAL THRUST, SITE	LBF	5915.664
AXIAL THRUST, VACUUM	LBF	5965.369
NOZZLE EXIT PRESSURE	PSIA	.031
FUEL DENSITY (MMH)	LB/FT3	53.561
OXIDIZER DENSITY	LB/FT3	87.542
FUEL FLOWRATE	LB/SEC	7.248
OXIDIZER FLOWRATE	LB/SEC	12.006
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.254
MIXTURE RATIO (OVERALL)	O/F	1.657
BLC FLOWRATE	LB/SEC	.543
BLC TOTAL PERCENT	%	2.819
CORE MIXTURE RATIO	O/F	1.791
FUEL INJECTOR DELTA-P	PSID	61.494
OXIDIZER INJECTOR DELTA-P	PSID	60.404
T/C COOLANT DELTA-P	PSID	15.215
T/C COOLANT DELTA-T	DEG F	139.053
THRUST CHAMBER HEAT FLUX	BTU/SEC	720.576
C-STAR, SITE	FT/SEC	5408.210
C-STAR, UMR	FT/SEC	5465.466
C-STAR EFFICIENCY	%	94.696
CF, SITE	-----	1.828
CF SITE VACUUM	-----	1.843
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	102.664
CF, VAC 72	-----	1.831
ISP, TEST	SEC	307.245
ISP, SITE VACUUM	SEC	309.827
ISP, VAC 72 PREDICTED	SEC	309.830
ISP, ODK, TEST CONDITIONS	SEC	332.647
ISP, TDK, TEST CONDITIONS	SEC	327.324
ISP EFFICIENCY	%	91.642
ENERGY RELEASE EFFICIENCY	%	96.670
C-STAR, ODE	FT/SEC	5711.132
ISP, ODE, TEST	SEC	338.085

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 2
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 140., O/F = 1.45.

ACTUAL TEST DURATION 10.206 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	303.531
OXIDIZER TANK PRESSURE	PSIA	274.196
FUEL INTERFACE PRESSURE	PSIA	258.357
OXIDIZER INTERFACE PRESSURE	PSIA	219.785
T/C COOLANT INLET MAN. PRESSURE	PSIA	255.862
FUEL INJECTOR PRESSURE	PSIA	241.860
OXIDIZER INJECTOR PRESSURE	PSIA	214.242
CHAMBER PRESSURE NO. 1	PSIA	145.070
CHAMBER PRESSURE NO. 2	PSIA	145.697
AXIAL THRUST, SYSTEM A	LBF	6579.787
AXIAL THRUST, SYSTEM B	LBF	6589.828
Y-AXIS THRUST	LBF	3.545
Z-AXIS THRUST	LBF	30.790
AVERAGE CELL PRESSURE	PSIA	.039
CELL PRESSURE AGREEMENT	%	.018
AVERAGE FUEL FLOWRATE	GPM	73.908
FUEL FM AGREEMENT	%	.090
AVERAGE OXIDIZER FLOWRATE	GPM	65.446
OXIDIZER FM AGREEMENT	%	.058
FUEL INTERFACE TEMPERATURE	DEG F	102.256
OXIDIZER INTERFACE TEMPERATURE	DEG F	102.943
T/C COOLANT IN TEMPERATURE	DEG F	104.466
T/C COOLANT OUT TEMPERATURE	DEG F	228.545
T/C SURFACE TEMP -16 IN	DEG F	229.721
T/C SURFACE TEMP -13 IN	DEG F	220.581
T/C SURFACE TEMP -10 IN	DEG F	230.907
T/C SURFACE TEMP - 8 IN	DEG F	183.211
T/C SURFACE TEMP - 6 IN	DEG F	197.671
T/C SURFACE TEMP - 4 IN	DEG F	215.287
T/C SURFACE TEMP - 2 IN	DEG F	167.665
T/C SURFACE TEMP -0.3 IN	DEG F	165.090
T/C SURFACE TEMP + 3 IN	DEG F	150.934
T/C NOZZLE FLANGE TEMP	DEG F	77.345
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	633.885
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1071.063
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1094.247
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1013.052
NOZZLE SURFACE TEMP +16.2 IN	DEG F	963.152
NOZZLE SURFACE TEMP +28.4 IN	DEG F	787.153
NOZZLE SURFACE TEMP +40.4 IN	DEG F	652.888
NOZZLE SURFACE TEMP +57.5 IN	DEG F	522.014

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	145.383
PC, NOZZLE STAGNATION	PSIA	138.114
AXIAL THRUST, SITE	LBF	6584.807
AXIAL THRUST, VACUUM	LBF	6663.911
NOZZLE EXIT PRESSURE	PSIA	.045
FUEL DENSITY (MMH)	LB/FT3	53.547
OXIDIZER DENSITY	LB/FT3	87.523
FUEL FLOWRATE	LB/SEC	8.818
OXIDIZER FLOWRATE	LB/SEC	12.762
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.580
MIXTURE RATIO (OVERALL)	O/F	1.447
BLC FLOWRATE	LB/SEC	.660
BLC TOTAL PERCENT	%	3.060
CORE MIXTURE RATIO	O/F	1.565
FUEL INJECTOR DELTA-P	PSID	96.477
OXIDIZER INJECTOR DELTA-P	PSID	68.859
T/C COOLANT DELTA-P	PSID	14.003
T/C COOLANT DELTA-T	DEG F	124.080
THRUST CHAMBER HEAT FLUX	BTU/SEC	782.265
C-STAR, SITE	FT/SEC	5462.880
C-STAR, UMR	FT/SEC	5498.237
C-STAR EFFICIENCY	%	96.194
CF, SITE	-----	1.797
CF SITE VACUUM	-----	1.819
CF, VAC 72 EXPECT	-----	1.771
CF CORRELATION	-----	102.682
CF, VAC 72	-----	1.806
ISP, TEST	SEC	305.140
ISP, SITE VACUUM	SEC	308.806
ISP, VAC 72 PREDICTED	SEC	308.549
ISP, ODK, TEST CONDITIONS	SEC	326.803
ISP, TDK, TEST CONDITIONS	SEC	321.516
ISP EFFICIENCY	%	93.212
ENERGY RELEASE EFFICIENCY	%	97.877
C-STAR, ODE	FT/SEC	5678.995
ISP, ODE, TEST	SEC	331.294

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 3
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 140., O/F = 1.65.

ACTUAL TEST DURATION 10.168 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	279.736
OXIDIZER TANK PRESSURE	PSIA	285.589
FUEL INTERFACE PRESSURE	PSIA	241.809
OXIDIZER INTERFACE PRESSURE	PSIA	226.142
T/C COOLANT INLET MAN. PRESSURE	PSIA	239.840
FUEL INJECTOR PRESSURE	PSIA	228.588
OXIDIZER INJECTOR PRESSURE	PSIA	219.249
CHAMBER PRESSURE NO. 1	PSIA	145.551
CHAMBER PRESSURE NO. 2	PSIA	145.194
AXIAL THRUST, SYSTEM A	LBF	6586.153
AXIAL THRUST, SYSTEM B	LBF	6593.007
Y-AXIS THRUST	LBF	3.545
Z-AXIS THRUST	LBF	29.412
AVERAGE CELL PRESSURE	PSIA	.045
CELL PRESSURE AGREEMENT	%	.128
AVERAGE FUEL FLOWRATE	GPM	68.144
FUEL FM AGREEMENT	%	.157
AVERAGE OXIDIZER FLOWRATE	GPM	68.404
OXIDIZER FM AGREEMENT	%	.113
FUEL INTERFACE TEMPERATURE	DEG F	102.687
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.460
T/C COOLANT IN TEMPERATURE	DEG F	104.917
T/C COOLANT OUT TEMPERATURE	DEG F	241.284
T/C SURFACE TEMP -16 IN	DEG F	242.923
T/C SURFACE TEMP -13 IN	DEG F	234.163
T/C SURFACE TEMP -10 IN	DEG F	242.520
T/C SURFACE TEMP - 8 IN	DEG F	191.481
T/C SURFACE TEMP - 6 IN	DEG F	207.108
T/C SURFACE TEMP - 4 IN	DEG F	225.344
T/C SURFACE TEMP - 2 IN	DEG F	175.041
T/C SURFACE TEMP -0.3 IN	DEG F	171.739
T/C SURFACE TEMP + 3 IN	DEG F	157.828
T/C NOZZLE FLANGE TEMP	DEG F	107.092
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	735.326
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1190.064
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1229.815
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1163.338
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1086.264
NOZZLE SURFACE TEMP +28.4 IN	DEG F	932.915
NOZZLE SURFACE TEMP +40.4 IN	DEG F	770.829
NOZZLE SURFACE TEMP +57.5 IN	DEG F	629.751

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 3

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	145.373
PC, NOZZLE STAGNATION	PSIA	138.104
AXIAL THRUST, SITE	LBF	6589.580
AXIAL THRUST, VACUUM	LBF	6679.081
NOZZLE EXIT PRESSURE	PSIA	.049
FUEL DENSITY (MMH)	LB/FT3	53.536
OXIDIZER DENSITY	LB/FT3	87.504
FUEL FLOWRATE	LB/SEC	8.128
OXIDIZER FLOWRATE	LB/SEC	13.336
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.464
MIXTURE RATIO (OVERALL)	O/F	1.641
BLC FLOWRATE	LB/SEC	.609
BLC TOTAL PERCENT	%	2.836
CORE MIXTURE RATIO	O/F	1.774
FUEL INJECTOR DELTA-P	PSID	83.215
OXIDIZER INJECTOR DELTA-P	PSID	73.877
T/C COOLANT DELTA-P	PSID	11.252
T/C COOLANT DELTA-T	DEG F	136.367
THRUST CHAMBER HEAT FLUX	BTU/SEC	792.510
C-STAR, SITE	FT/SEC	5491.839
C-STAR, UMR	FT/SEC	5547.256
C-STAR EFFICIENCY	%	96.175
CF, SITE	-----	1.799
CF SITE VACUUM	-----	1.823
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	101.644
CF, VAC 72	-----	1.811
ISP, TEST	SEC	307.002
ISP, SITE VACUUM	SEC	311.172
ISP, VAC 72 PREDICTED	SEC	311.115
ISP, ODK, TEST CONDITIONS	SEC	332.669
ISP, TDK, TEST CONDITIONS	SEC	327.287
ISP EFFICIENCY	%	92.166
ENERGY RELEASE EFFICIENCY	%	96.884
C-STAR, ODE	FT/SEC	5710.260
ISP, ODE, TEST	SEC	337.622

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 4
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 140., O/F = 1.85.

ACTUAL TEST DURATION 10.202 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	261.433
OXIDIZER TANK PRESSURE	PSIA	297.457
FUEL INTERFACE PRESSURE	PSIA	229.928
OXIDIZER INTERFACE PRESSURE	PSIA	232.924
T/C COOLANT INLET MAN. PRESSURE	PSIA	228.777
FUEL INJECTOR PRESSURE	PSIA	219.108
OXIDIZER INJECTOR PRESSURE	PSIA	225.027
CHAMBER PRESSURE NO. 1	PSIA	144.588
CHAMBER PRESSURE NO. 2	PSIA	144.440
AXIAL THRUST, SYSTEM A	LBF	6567.170
AXIAL THRUST, SYSTEM B	LBF	6573.928
Y-AXIS THRUST	LBF	14.941
Z-AXIS THRUST	LBF	26.760
AVERAGE CELL PRESSURE	PSIA	.044
CELL PRESSURE AGREEMENT	%	.028
AVERAGE FUEL FLOWRATE	GPM	62.491
FUEL FM AGREEMENT	%	.001
AVERAGE OXIDIZER FLOWRATE	GPM	71.582
OXIDIZER FM AGREEMENT	%	.172
FUEL INTERFACE TEMPERATURE	DEG F	103.032
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.805
T/C COOLANT IN TEMPERATURE	DEG F	105.409
T/C COOLANT OUT TEMPERATURE	DEG F	252.792
T/C SURFACE TEMP -16 IN	DEG F	253.880
T/C SURFACE TEMP -13 IN	DEG F	244.954
T/C SURFACE TEMP -10 IN	DEG F	252.154
T/C SURFACE TEMP - 8 IN	DEG F	199.520
T/C SURFACE TEMP - 6 IN	DEG F	216.552
T/C SURFACE TEMP - 4 IN	DEG F	238.456
T/C SURFACE TEMP - 2 IN	DEG F	182.416
T/C SURFACE TEMP -0.3 IN	DEG F	178.024
T/C SURFACE TEMP + 3 IN	DEG F	163.511
T/C NOZZLE FLANGE TEMP	DEG F	131.720
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	800.853
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1273.927
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1302.843
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1237.475
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1159.016
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1025.516
NOZZLE SURFACE TEMP +40.4 IN	DEG F	862.321
NOZZLE SURFACE TEMP +57.5 IN	DEG F	723.009

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 4

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	144.514
PC, NOZZLE STAGNATION	PSIA	137.289
AXIAL THRUST, SITE	LBF	6570.549
AXIAL THRUST, VACUUM	LBF	6658.561
NOZZLE EXIT PRESSURE	PSIA	.049
FUEL DENSITY (MMH)	LB/FT3	53.525
OXIDIZER DENSITY	LB/FT3	87.479
FUEL FLOWRATE	LB/SEC	7.452
OXIDIZER FLOWRATE	LB/SEC	13.952
TOTAL PROPELLANT FLOWRATE	LB/SEC	21.404
MIXTURE RATIO (OVERALL)	O/F	1.872
BLC FLOWRATE	LB/SEC	.558
BLC TOTAL PERCENT	%	2.608
CORE MIXTURE RATIO	O/F	2.024
FUEL INJECTOR DELTA-P	PSID	74.594
OXIDIZER INJECTOR DELTA-P	PSID	80.513
T/C COOLANT DELTA-P	PSID	9.669
T/C COOLANT DELTA-T	DEG F	147.382
THRUST CHAMBER HEAT FLUX	BTU/SEC	785.307
C-STAR, SITE	FT/SEC	5474.831
C-STAR, UMR	FT/SEC	5559.171
C-STAR EFFICIENCY	%	96.175
CF, SITE	-----	1.804
CF SITE VACUUM	-----	1.828
CF, VAC 72 EXPECT	-----	1.820
CF CORRELATION	-----	100.431
CF, VAC 72	-----	1.817
ISP, TEST	SEC	306.980
ISP, SITE VACUUM	SEC	311.092
ISP, VAC 72 PREDICTED	SEC	310.955
ISP, ODK, TEST CONDITIONS	SEC	336.510
ISP, TDK, TEST CONDITIONS	SEC	330.594
ISP EFFICIENCY	%	90.698
ENERGY RELEASE EFFICIENCY	%	95.896
C-STAR, ODE	FT/SEC	5692.576
ISP, ODE, TEST	SEC	342.998

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3

SERIES RD/ICT-1 SEQUENCE 4 TEST 5

TEST DESCRIPTION

HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 110., O/F = 1.45.

ACTUAL TEST DURATION 10.154 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	213.844
OXIDIZER TANK PRESSURE	PSIA	193.970
FUEL INTERFACE PRESSURE	PSIA	185.800
OXIDIZER INTERFACE PRESSURE	PSIA	160.447
T/C COOLANT INLET MAN. PRESSURE	PSIA	184.144
FUEL INJECTOR PRESSURE	PSIA	177.776
OXIDIZER INJECTOR PRESSURE	PSIA	157.236
CHAMBER PRESSURE NO. 1	PSIA	115.708
CHAMBER PRESSURE NO. 2	PSIA	114.786
AXIAL THRUST, SYSTEM A	LBF	5161.911
AXIAL THRUST, SYSTEM B	LBF	5168.878
Y-AXIS THRUST	LBF	-18.739
Z-AXIS THRUST	LBF	27.159
AVERAGE CELL PRESSURE	PSIA	.036
CELL PRESSURE AGREEMENT	%	.105
AVERAGE FUEL FLOWRATE	GPM	58.758
FUEL FM AGREEMENT	%	.104
AVERAGE OXIDIZER FLOWRATE	GPM	51.641
OXIDIZER FM AGREEMENT	%	.020
FUEL INTERFACE TEMPERATURE	DEG F	102.946
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.374
T/C COOLANT IN TEMPERATURE	DEG F	105.696
T/C COOLANT OUT TEMPERATURE	DEG F	234.551
T/C SURFACE TEMP -16 IN	DEG F	236.280
T/C SURFACE TEMP -13 IN	DEG F	227.839
T/C SURFACE TEMP -10 IN	DEG F	237.347
T/C SURFACE TEMP - 8 IN	DEG F	188.452
T/C SURFACE TEMP - 6 IN	DEG F	203.961
T/C SURFACE TEMP - 4 IN	DEG F	221.585
T/C SURFACE TEMP - 2 IN	DEG F	172.260
T/C SURFACE TEMP -0.3 IN	DEG F	170.288
T/C SURFACE TEMP + 3 IN	DEG F	156.015
T/C NOZZLE FLANGE TEMP	DEG F	136.851
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	675.082
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1015.174
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1042.414
NOZZLE SURFACE TEMP +11.7 IN	DEG F	947.643
NOZZLE SURFACE TEMP +16.2 IN	DEG F	961.542
NOZZLE SURFACE TEMP +28.4 IN	DEG F	862.159
NOZZLE SURFACE TEMP +40.4 IN	DEG F	804.997
NOZZLE SURFACE TEMP +57.5 IN	DEG F	697.005

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 5

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	115.247
PC, NOZZLE STAGNATION	PSIA	109.485
AXIAL THRUST, SITE	LBF	5165.394
AXIAL THRUST, VACUUM	LBF	5238.092
NOZZLE EXIT PRESSURE	PSIA	.041
FUEL DENSITY (MMH)	LB/FT3	53.528
OXIDIZER DENSITY	LB/FT3	87.494
FUEL FLOWRATE	LB/SEC	7.008
OXIDIZER FLOWRATE	LB/SEC	10.067
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.074
MIXTURE RATIO (OVERALL)	O/F	1.437
BLC FLOWRATE	LB/SEC	.525
BLC TOTAL PERCENT	%	3.074
CORE MIXTURE RATIO	O/F	1.553
FUEL INJECTOR DELTA-P	PSID	62.529
OXIDIZER INJECTOR DELTA-P	PSID	41.989
T/C COOLANT DELTA-P	PSID	6.368
T/C COOLANT DELTA-T	DEG F	128.855
THRUST CHAMBER HEAT FLUX	BTU/SEC	645.616
C-STAR, SITE	FT/SEC	5473.145
C-STAR, UMR	FT/SEC	5507.235
C-STAR EFFICIENCY	%	96.445
CF, SITE	-----	1.778
CF SITE VACUUM	-----	1.803
CF, VAC 72 EXPECT	-----	1.770
CF CORRELATION	-----	101.888
CF, VAC 72	-----	1.791
ISP, TEST	SEC	302.523
ISP, SITE VACUUM	SEC	306.781
ISP, VAC 72 PREDICTED	SEC	306.501
ISP, ODK, TEST CONDITIONS	SEC	325.844
ISP, TDK, TEST CONDITIONS	SEC	320.628
ISP EFFICIENCY	%	92.721
ENERGY RELEASE EFFICIENCY	%	98.001
C-STAR, ODE	FT/SEC	5674.895
ISP, ODE, TEST	SEC	330.863

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 6
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/O S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 110., O/F = 1.65.

ACTUAL TEST DURATION 10.198 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	201.947
OXIDIZER TANK PRESSURE	PSIA	200.616
FUEL INTERFACE PRESSURE	PSIA	177.314
OXIDIZER INTERFACE PRESSURE	PSIA	163.838
T/C COOLANT INLET MAN. PRESSURE	PSIA	175.752
FUEL INJECTOR PRESSURE	PSIA	168.676
OXIDIZER INJECTOR PRESSURE	PSIA	160.317
CHAMBER PRESSURE NO. 1	PSIA	115.468
CHAMBER PRESSURE NO. 2	PSIA	115.792
AXIAL THRUST, SYSTEM A	LBF	5165.253
AXIAL THRUST, SYSTEM B	LBF	5172.048
Y-AXIS THRUST	LBF	-6.584
Z-AXIS THRUST	LBF	22.597
AVERAGE CELL PRESSURE	PSIA	.040
CELL PRESSURE AGREEMENT	%	.119
AVERAGE FUEL FLOWRATE	GPM	55.080
FUEL FM AGREEMENT	%	.100
AVERAGE OXIDIZER FLOWRATE	GPM	53.723
OXIDIZER FM AGREEMENT	%	.059
FUEL INTERFACE TEMPERATURE	DEG F	102.774
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.632
T/C COOLANT IN TEMPERATURE	DEG F	105.244
T/C COOLANT OUT TEMPERATURE	DEG F	243.772
T/C SURFACE TEMP -16 IN	DEG F	246.287
T/C SURFACE TEMP -13 IN	DEG F	238.150
T/C SURFACE TEMP -10 IN	DEG F	247.563
T/C SURFACE TEMP - 8 IN	DEG F	194.742
T/C SURFACE TEMP - 6 IN	DEG F	211.102
T/C SURFACE TEMP - 4 IN	DEG F	231.162
T/C SURFACE TEMP - 2 IN	DEG F	177.701
T/C SURFACE TEMP -0.3 IN	DEG F	175.486
T/C SURFACE TEMP + 3 IN	DEG F	160.488
T/C NOZZLE FLANGE TEMP	DEG F	159.431
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	728.490
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1082.058
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1146.179
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1071.711
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1037.019
NOZZLE SURFACE TEMP +28.4 IN	DEG F	945.166
NOZZLE SURFACE TEMP +40.4 IN	DEG F	854.136
NOZZLE SURFACE TEMP +57.5 IN	DEG F	748.985

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 6

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	115.630
PC, NOZZLE STAGNATION	PSIA	109.848
AXIAL THRUST, SITE	LBF	5168.651
AXIAL THRUST, VACUUM	LBF	5249.240
NOZZLE EXIT PRESSURE	PSIA	.045
FUEL DENSITY (MMH)	LB/FT3	53.536
OXIDIZER DENSITY	LB/FT3	87.466
FUEL FLOWRATE	LB/SEC	6.570
OXIDIZER FLOWRATE	LB/SEC	10.469
TOTAL PROPELLANT FLOWRATE	LB/SEC	17.039
MIXTURE RATIO (OVERALL)	O/F	1.594
BLC FLOWRATE	LB/SEC	.492
BLC TOTAL PERCENT	%	2.888
CORE MIXTURE RATIO	O/F	1.723
FUEL INJECTOR DELTA-P	PSID	53.046
OXIDIZER INJECTOR DELTA-P	PSID	44.688
T/C COOLANT DELTA-P	PSID	7.076
T/C COOLANT DELTA-T	DEG F	138.528
THRUST CHAMBER HEAT FLUX	BTU/SEC	650.737
C-STAR, SITE	FT/SEC	5502.620
C-STAR, UMR	FT/SEC	5553.663
C-STAR EFFICIENCY	%	96.432
CF, SITE	-----	1.774
CF SITE VACUUM	-----	1.801
CF, VAC 72 EXPECT	-----	1.788
CF CORRELATION	-----	100.739
CF, VAC 72	-----	1.789
ISP, TEST	SEC	303.338
ISP, SITE VACUUM	SEC	308.067
ISP, VAC 72 PREDICTED	SEC	307.970
ISP, ODK, TEST CONDITIONS	SEC	330.776
ISP, TDK, TEST CONDITIONS	SEC	325.244
ISP EFFICIENCY	%	91.634
ENERGY RELEASE EFFICIENCY	%	97.011
C-STAR, ODE	FT/SEC	5706.222
ISP, ODE, TEST	SEC	336.193

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 7
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 110., O/F = 1.85.

ACTUAL TEST DURATION 10.196 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	185.931
OXIDIZER TANK PRESSURE	PSIA	209.161
FUEL INTERFACE PRESSURE	PSIA	165.858
OXIDIZER INTERFACE PRESSURE	PSIA	168.500
T/C COOLANT INLET MAN. PRESSURE	PSIA	165.070
FUEL INJECTOR PRESSURE	PSIA	159.196
OXIDIZER INJECTOR PRESSURE	PSIA	164.169
CHAMBER PRESSURE NO. 1	PSIA	114.986
CHAMBER PRESSURE NO. 2	PSIA	115.289
AXIAL THRUST, SYSTEM A	LBF	5158.887
AXIAL THRUST, SYSTEM B	LBF	5162.512
Y-AXIS THRUST	LBF	-3.039
Z-AXIS THRUST	LBF	21.585
AVERAGE CELL PRESSURE	PSIA	.041
CELL PRESSURE AGREEMENT	%	.022
AVERAGE FUEL FLOWRATE	GPM	49.865
FUEL FM AGREEMENT	%	.050
AVERAGE OXIDIZER FLOWRATE	GPM	56.572
OXIDIZER FM AGREEMENT	%	.112
FUEL INTERFACE TEMPERATURE	DEG F	102.946
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.718
T/C COOLANT IN TEMPERATURE	DEG F	105.367
T/C COOLANT OUT TEMPERATURE	DEG F	258.398
T/C SURFACE TEMP -16 IN	DEG F	260.699
T/C SURFACE TEMP -13 IN	DEG F	254.944
T/C SURFACE TEMP -10 IN	DEG F	260.732
T/C SURFACE TEMP - 8 IN	DEG F	204.883
T/C SURFACE TEMP - 6 IN	DEG F	222.975
T/C SURFACE TEMP - 4 IN	DEG F	243.185
T/C SURFACE TEMP - 2 IN	DEG F	186.649
T/C SURFACE TEMP -0.3 IN	DEG F	182.980
T/C SURFACE TEMP + 3 IN	DEG F	167.621
T/C NOZZLE FLANGE TEMP	DEG F	175.853
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	776.301
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1195.527
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1222.941
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1155.106
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1098.772
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1009.140
NOZZLE SURFACE TEMP +40.4 IN	DEG F	899.139
NOZZLE SURFACE TEMP +57.5 IN	DEG F	794.031

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 7

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	115.137
PC, NOZZLE STAGNATION	PSIA	109.381
AXIAL THRUST, SITE	LBF	5160.699
AXIAL THRUST, VACUUM	LBF	5242.769
NOZZLE EXIT PRESSURE	PSIA	.045
FUEL DENSITY (MMH)	LB/FT3	53.533
OXIDIZER DENSITY	LB/FT3	87.469
FUEL FLOWRATE	LB/SEC	5.948
OXIDIZER FLOWRATE	LB/SEC	11.025
TOTAL PROPELLANT FLOWRATE	LB/SEC	16.972
MIXTURE RATIO (OVERALL)	O/F	1.854
BLC FLOWRATE	LB/SEC	.445
BLC TOTAL PERCENT	%	2.625
CORE MIXTURE RATIO	O/F	2.004
FUEL INJECTOR DELTA-P	PSID	44.059
OXIDIZER INJECTOR DELTA-P	PSID	49.032
T/C COOLANT DELTA-P	PSID	5.874
T/C COOLANT DELTA-T	DEG F	153.031
THRUST CHAMBER HEAT FLUX	BTU/SEC	650.761
C-STAR, SITE	FT/SEC	5500.790
C-STAR, UMR	FT/SEC	5584.309
C-STAR EFFICIENCY	%	96.568
CF, SITE	-----	1.778
CF SITE VACUUM	-----	1.807
CF, VAC 72 EXPECT	-----	1.818
CF CORRELATION	-----	99.370
CF, VAC 72	-----	1.796
ISP, TEST	SEC	304.064
ISP, SITE VACUUM	SEC	308.900
ISP, VAC 72 PREDICTED	SEC	308.853
ISP, ODK, TEST CONDITIONS	SEC	335.399
ISP, TDK, TEST CONDITIONS	SEC	329.930
ISP EFFICIENCY	%	90.146
ENERGY RELEASE EFFICIENCY	%	95.894
C-STAR, ODE	FT/SEC	5696.262
ISP, ODE, TEST	SEC	342.666

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 8
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 125., O/F = 1.45.

ACTUAL TEST DURATION 10.196 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	254.569
OXIDIZER TANK PRESSURE	PSIA	233.371
FUEL INTERFACE PRESSURE	PSIA	218.896
OXIDIZER INTERFACE PRESSURE	PSIA	189.692
T/C COOLANT INLET MAN. PRESSURE	PSIA	215.807
FUEL INJECTOR PRESSURE	PSIA	205.078
OXIDIZER INJECTOR PRESSURE	PSIA	184.584
CHAMBER PRESSURE NO. 1	PSIA	131.113
CHAMBER PRESSURE NO. 2	PSIA	131.121
AXIAL THRUST, SYSTEM A	LBF	5867.704
AXIAL THRUST, SYSTEM B	LBF	5874.582
Y-AXIS THRUST	LBF	-6.584
Z-AXIS THRUST	LBF	28.655
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.113
AVERAGE FUEL FLOWRATE	GPM	65.893
FUEL FM AGREEMENT	%	.117
AVERAGE OXIDIZER FLOWRATE	GPM	58.708
OXIDIZER FM AGREEMENT	%	.042
FUEL INTERFACE TEMPERATURE	DEG F	103.205
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.632
T/C COOLANT IN TEMPERATURE	DEG F	105.655
T/C COOLANT OUT TEMPERATURE	DEG F	234.458
T/C SURFACE TEMP -16 IN	DEG F	236.983
T/C SURFACE TEMP -13 IN	DEG F	225.263
T/C SURFACE TEMP -10 IN	DEG F	235.477
T/C SURFACE TEMP - 8 IN	DEG F	186.239
T/C SURFACE TEMP - 6 IN	DEG F	201.904
T/C SURFACE TEMP - 4 IN	DEG F	219.405
T/C SURFACE TEMP - 2 IN	DEG F	170.567
T/C SURFACE TEMP -0.3 IN	DEG F	168.354
T/C SURFACE TEMP + 3 IN	DEG F	154.563
T/C NOZZLE FLANGE TEMP	DEG F	174.827
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	713.441
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	946.981
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1105.177
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1021.230
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1016.073
NOZZLE SURFACE TEMP +28.4 IN	DEG F	931.560
NOZZLE SURFACE TEMP +40.4 IN	DEG F	865.049
NOZZLE SURFACE TEMP +57.5 IN	DEG F	768.106

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 8

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.117
PC, NOZZLE STAGNATION	PSIA	124.561
AXIAL THRUST, SITE	LBF	5871.143
AXIAL THRUST, VACUUM	LBF	5947.783
NOZZLE EXIT PRESSURE	PSIA	.042
FUEL DENSITY (MMH)	LB/FT3	53.525
OXIDIZER DENSITY	LB/FT3	87.478
FUEL FLOWRATE	LB/SEC	7.858
OXIDIZER FLOWRATE	LB/SEC	11.442
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.300
MIXTURE RATIO (OVERALL)	O/F	1.456
BLC FLOWRATE	LB/SEC	.589
BLC TOTAL PERCENT	%	3.050
CORE MIXTURE RATIO	O/F	1.574
FUEL INJECTOR DELTA-P	PSID	73.961
OXIDIZER INJECTOR DELTA-P	PSID	53.467
T/C COOLANT DELTA-P	PSID	10.729
T/C COOLANT DELTA-T	DEG F	128.803
THRUST CHAMBER HEAT FLUX	BTU/SEC	723.684
C-STAR, SITE	FT/SEC	5508.643
C-STAR, UMR	FT/SEC	5545.020
C-STAR EFFICIENCY	%	96.956
CF, SITE	-----	1.777
CF SITE VACUUM	-----	1.800
CF, VAC 72 EXPECT	-----	1.772
CF CORRELATION	-----	101.561
CF, VAC 72	-----	1.787
ISP, TEST	SEC	304.199
ISP, SITE VACUUM	SEC	308.170
ISP, VAC 72 PREDICTED	SEC	307.913
ISP, ODK, TEST CONDITIONS	SEC	326.893
ISP, TDK, TEST CONDITIONS	SEC	321.572
ISP EFFICIENCY	%	92.928
ENERGY RELEASE EFFICIENCY	%	97.879
C-STAR, ODE	FT/SEC	5681.592
ISP, ODE, TEST	SEC	331.620

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 9
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 125., O/F = 1.85.

ACTUAL TEST DURATION 10.170 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	223.911
OXIDIZER TANK PRESSURE	PSIA	253.309
FUEL INTERFACE PRESSURE	PSIA	197.256
OXIDIZER INTERFACE PRESSURE	PSIA	201.136
T/C COOLANT INLET MAN. PRESSURE	PSIA	195.207
FUEL INJECTOR PRESSURE	PSIA	187.256
OXIDIZER INJECTOR PRESSURE	PSIA	194.598
CHAMBER PRESSURE NO. 1	PSIA	129.909
CHAMBER PRESSURE NO. 2	PSIA	130.619
AXIAL THRUST, SYSTEM A	LBF	5905.862
AXIAL THRUST, SYSTEM B	LBF	5912.730
Y-AXIS THRUST	LBF	-3.039
Z-AXIS THRUST	LBF	23.483
AVERAGE CELL PRESSURE	PSIA	.044
CELL PRESSURE AGREEMENT	%	.127
AVERAGE FUEL FLOWRATE	GPM	56.892
FUEL FM AGREEMENT	%	.046
AVERAGE OXIDIZER FLOWRATE	GPM	64.187
OXIDIZER FM AGREEMENT	%	.144
FUEL INTERFACE TEMPERATURE	DEG F	103.291
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.805
T/C COOLANT IN TEMPERATURE	DEG F	105.573
T/C COOLANT OUT TEMPERATURE	DEG F	256.285
T/C SURFACE TEMP -16 IN	DEG F	258.582
T/C SURFACE TEMP -13 IN	DEG F	250.828
T/C SURFACE TEMP -10 IN	DEG F	257.095
T/C SURFACE TEMP - 8 IN	DEG F	202.201
T/C SURFACE TEMP - 6 IN	DEG F	220.430
T/C SURFACE TEMP - 4 IN	DEG F	243.441
T/C SURFACE TEMP - 2 IN	DEG F	184.472
T/C SURFACE TEMP -0.3 IN	DEG F	180.321
T/C SURFACE TEMP + 3 IN	DEG F	165.687
T/C NOZZLE FLANGE TEMP	DEG F	195.355
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	776.301
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1180.550
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1231.192
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1164.698
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1107.836
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1024.118
NOZZLE SURFACE TEMP +40.6 IN	DEG F	919.585
NOZZLE SURFACE TEMP +57.5 IN	DEG F	826.744

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 9

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	130.264
PC, NOZZLE STAGNATION	PSIA	123.751
AXIAL THRUST, SITE	LBF	5909.296
AXIAL THRUST, VACUUM	LBF	5996.813
NOZZLE EXIT PRESSURE	PSIA	.047
FUEL DENSITY (MMH)	LB/FT3	53.525
OXIDIZER DENSITY	LB/FT3	87.470
FUEL FLOWRATE	LB/SEC	6.785
OXIDIZER FLOWRATE	LB/SEC	12.509
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.294
MIXTURE RATIO (OVERALL)	O/F	1.844
BLC FLOWRATE	LB/SEC	.508
BLC TOTAL PERCENT	%	2.634
CORE MIXTURE RATIO	O/F	1.993
FUEL INJECTOR DELTA-P	PSID	56.992
OXIDIZER INJECTOR DELTA-P	PSID	64.334
T/C COOLANT DELTA-P	PSID	7.951
T/C COOLANT DELTA-T	DEG F	150.712
THRUST CHAMBER HEAT FLUX	BTU/SEC	731.101
C-STAR, SITE	FT/SEC	5474.752
C-STAR, UMR	FT/SEC	5557.350
C-STAR EFFICIENCY	%	96.084
CF, SITE	-----	1.800
CF SITE VACUUM	-----	1.827
CF, VAC 72 EXPECT	-----	1.817
CF CORRELATION	-----	100.527
CF, VAC 72	-----	1.816
ISP, TEST	SEC	306.284
ISP, SITE VACUUM	SEC	310.820
ISP, VAC 72 PREDICTED	SEC	310.858
ISP, ODK, TEST CONDITIONS	SEC	335.863
ISP, TDK, TEST CONDITIONS	SEC	330.452
ISP EFFICIENCY	%	90.757
ENERGY RELEASE EFFICIENCY	%	96.051
C-STAR, ODE	FT/SEC	5697.877
ISP, ODE, TEST	SEC	342.475

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 10
TEST DESCRIPTION
HOT-PROPELLANT PERFORMANCE AND POST-FIRE THERMAL EVALUATION OF ROCKETDYNE INTEGRATED ENGINE, INJECTOR L/D S/N1, 75 TO 1 NOZZLE, UNSAT MMH/NTO AT 103 DEG F. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.196 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	241.299
OXIDIZER TANK PRESSURE	PSIA	247.613
FUEL INTERFACE PRESSURE	PSIA	209.986
OXIDIZER INTERFACE PRESSURE	PSIA	198.593
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.033
FUEL INJECTOR PRESSURE	PSIA	197.874
OXIDIZER INJECTOR PRESSURE	PSIA	192.672
CHAMBER PRESSURE NO. 1	PSIA	131.835
CHAMBER PRESSURE NO. 2	PSIA	132.629
AXIAL THRUST, SYSTEM A	LBF	5956.739
AXIAL THRUST, SYSTEM B	LBF	5963.590
Y-AXIS THRUST	LBF	-4.052
Z-AXIS THRUST	LBF	25.624
AVERAGE CELL PRESSURE	PSIA	.043
CELL PRESSURE AGREEMENT	%	.125
AVERAGE FUEL FLOWRATE	GPM	61.722
FUEL FM AGREEMENT	%	.025
AVERAGE OXIDIZER FLOWRATE	GPM	62.214
OXIDIZER FM AGREEMENT	%	.107
FUEL INTERFACE TEMPERATURE	DEG F	103.464
OXIDIZER INTERFACE TEMPERATURE	DEG F	103.891
T/C COOLANT IN TEMPERATURE	DEG F	105.696
T/C COOLANT OUT TEMPERATURE	DEG F	246.167
T/C SURFACE TEMP -16 IN	DEG F	249.104
T/C SURFACE TEMP -13 IN	DEG F	240.377
T/C SURFACE TEMP -10 IN	DEG F	246.277
T/C SURFACE TEMP - 8 IN	DEG F	194.509
T/C SURFACE TEMP - 6 IN	DEG F	211.586
T/C SURFACE TEMP - 4 IN	DEG F	230.679
T/C SURFACE TEMP - 2 IN	DEG F	177.821
T/C SURFACE TEMP -0.3 IN	DEG F	174.398
T/C SURFACE TEMP + 3 IN	DEG F	160.609
T/C NOZZLE FLANGE TEMP	DEG F	212.802
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	825.388
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1141.188
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1276.625
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1218.221
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1155.089
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1074.550
NOZZLE SURFACE TEMP +40.4 IN	DEG F	960.476
NOZZLE SURFACE TEMP +57.5 IN	DEG F	898.890

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 16 NOV 3
SERIES RD/ICT-1 SEQUENCE 4 TEST 10

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	132.232
PC, NOZZLE STAGNATION	PSIA	125.620
AXIAL THRUST, SITE	LBF	5960.164
AXIAL THRUST, VACUUM	LBF	6045.700
NOZZLE EXIT PRESSURE	PSIA	.046
FUEL DENSITY (MMH)	LB/FT3	53.522
OXIDIZER DENSITY	LB/FT3	87.460
FUEL FLOWRATE	LB/SEC	7.360
OXIDIZER FLOWRATE	LB/SEC	12.123
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.483
MIXTURE RATIO (OVERALL)	O/F	1.647
BLC FLOWRATE	LB/SEC	.551
BLC TOTAL PERCENT	%	2.829
CORE MIXTURE RATIO	O/F	1.780
FUEL INJECTOR DELTA-P	PSID	65.642
OXIDIZER INJECTOR DELTA-P	PSID	60.440
T/C COOLANT DELTA-P	PSID	9.159
T/C COOLANT DELTA-T	DEG F	140.472
THRUST CHAMBER HEAT FLUX	BTU/SEC	739.240
C-STAR, SITE	FT/SEC	5503.269
C-STAR, UMR	FT/SEC	5559.259
C-STAR EFFICIENCY	%	96.366
CF, SITE	-----	1.788
CF SITE VACUUM	-----	1.814
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	101.107
CF, VAC 72	-----	1.802
ISP, TEST	SEC	305.909
ISP, SITE VACUUM	SEC	310.299
ISP, VAC 72 PREDICTED	SEC	310.235
ISP, ODK, TEST CONDITIONS	SEC	332.540
ISP, TDK, TEST CONDITIONS	SEC	327.228
ISP EFFICIENCY	%	91.855
ENERGY RELEASE EFFICIENCY	%	96.819
C-STAR, ODE	FT/SEC	5710.771
ISP, ODE, TEST	SEC	337.814

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125.. O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 7.000 SEC TO 8.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.926
OXIDIZER TANK PRESSURE	PSIA	246.188
FUEL INTERFACE PRESSURE	PSIA	209.561
OXIDIZER INTERFACE PRESSURE	PSIA	197.745
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.796
FUEL INJECTOR PRESSURE	PSIA	192.186
OXIDIZER INJECTOR PRESSURE	PSIA	191.132
CHAMBER PRESSURE NO. 1	PSIA	133.278
CHAMBER PRESSURE NO. 2	PSIA	132.880
AXIAL THRUST, SYSTEM A	LBF	6000.013
AXIAL THRUST, SYSTEM B	LBF	6004.917
Y-AXIS THRUST	LBF	-0.506
Z-AXIS THRUST	LBF	30.811
AVERAGE CELL PRESSURE	PSIA	.038
CELL PRESSURE AGREEMENT	%	.113
AVERAGE FUEL FLOWRATE	GPM	60.681
FUEL FM AGREEMENT	%	.070
AVERAGE OXIDIZER FLOWRATE	GPM	60.561
OXIDIZER FM AGREEMENT	%	.076
FUEL INTERFACE TEMPERATURE	DEG F	56.579
OXIDIZER INTERFACE TEMPERATURE	DEG F	61.127
T/C COOLANT IN TEMPERATURE	DEG F	58.030
T/C COOLANT OUT TEMPERATURE	DEG F	186.904
T/C SURFACE TEMP -16 IN	DEG F	181.174
T/C SURFACE TEMP -13 IN	DEG F	186.945
T/C SURFACE TEMP -10 IN	DEG F	204.290
T/C SURFACE TEMP - 8 IN	DEG F	154.560
T/C SURFACE TEMP - 6 IN	DEG F	170.474
T/C SURFACE TEMP - 4 IN	DEG F	190.658
T/C SURFACE TEMP - 2 IN	DEG F	136.042
T/C SURFACE TEMP -0.3 IN	DEG F	141.498
T/C SURFACE TEMP + 3 IN	DEG F	119.697
T/C NOZZLE FLANGE TEMP	DEG F	46.569
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	156.421
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	484.454
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	463.828
NOZZLE SURFACE TEMP +11.7 IN	DEG F	430.441
NOZZLE SURFACE TEMP +16.2 IN	DEG F	311.231
NOZZLE SURFACE TEMP +28.4 IN	DEG F	202.749
NOZZLE SURFACE TEMP +40.4 IN	DEG F	177.096
NOZZLE SURFACE TEMP +57.5 IN	DEG F	138.895

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	133.079
PC, NOZZLE STAGNATION	PSIA	126.425
AXIAL THRUST, SITE	LBF	6002.465
AXIAL THRUST, VACUUM	LBF	6079.105
NOZZLE EXIT PRESSURE	PSIA	.044
FUEL DENSITY (MMH)	LB/FT3	54.999
OXIDIZER DENSITY	LB/FT3	91.000
FUEL FLOWRATE	LB/SEC	7.436
OXIDIZER FLOWRATE	LB/SEC	12.279
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.714
MIXTURE RATIO (OVERALL)	O/F	1.651
BLC FLOWRATE	LB/SEC	.557
BLC TOTAL PERCENT	%	2.825
CORE MIXTURE RATIO	O/F	1.785
FUEL INJECTOR DELTA-P	PSID	59.106
OXIDIZER INJECTOR DELTA-P	PSID	58.052
T/C COOLANT DELTA-P	PSID	15.610
T/C COOLANT DELTA-T	DEG F	128.874
THRUST CHAMBER HEAT FLUX	BTU/SEC	685.158
C-STAR, SITE	FT/SEC	5473.664
C-STAR, UMR	FT/SEC	5530.115
C-STAR EFFICIENCY	%	95.844
CF, SITE	-----	1.790
CF SITE VACUUM	-----	1.813
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	100.990
CF, VAC 72	-----	1.801
ISP, TEST	SEC	304.471
ISP, SITE VACUUM	SEC	308.359
ISP, VAC 72 PREDICTED	SEC	308.308
ISP, ODK, TEST CONDITIONS	SEC	332.661
ISP, TDK, TEST CONDITIONS	SEC	327.350
ISP EFFICIENCY	%	91.247
ENERGY RELEASE EFFICIENCY	%	96.166
C-STAR, ODE	FT/SEC	5711.027
ISP, ODE, TEST	SEC	337.937

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	240.841
OXIDIZER TANK PRESSURE	PSIA	246.188
FUEL INTERFACE PRESSURE	PSIA	210.410
OXIDIZER INTERFACE PRESSURE	PSIA	198.169
T/C COOLANT INLET MAN. PRESSURE	PSIA	208.559
FUEL INJECTOR PRESSURE	PSIA	192.944
OXIDIZER INJECTOR PRESSURE	PSIA	191.132
CHAMBER PRESSURE NO. 1	PSIA	132.556
CHAMBER PRESSURE NO. 2	PSIA	132.629
AXIAL THRUST, SYSTEM A	LBF	6009.557
AXIAL THRUST, SYSTEM B	LBF	6017.632
Y-AXIS THRUST	LBF	-2.278
Z-AXIS THRUST	LBF	31.443
AVERAGE CELL PRESSURE	PSIA	.035
CELL PRESSURE AGREEMENT	%	.099
AVERAGE FUEL FLOWRATE	GPM	60.901
FUEL FM AGREEMENT	%	.076
AVERAGE OXIDIZER FLOWRATE	GPM	60.561
OXIDIZER FM AGREEMENT	%	.076
FUEL INTERFACE TEMPERATURE	DEG F	57.428
OXIDIZER INTERFACE TEMPERATURE	DEG F	62.230
T/C COOLANT IN TEMPERATURE	DEG F	58.914
T/C COOLANT OUT TEMPERATURE	DEG F	190.829
T/C SURFACE TEMP -16 IN	DEG F	187.766
T/C SURFACE TEMP -13 IN	DEG F	189.279
T/C SURFACE TEMP -10 IN	DEG F	206.044
T/C SURFACE TEMP - 8 IN	DEG F	159.726
T/C SURFACE TEMP - 6 IN	DEG F	173.013
T/C SURFACE TEMP - 4 IN	DEG F	192.230
T/C SURFACE TEMP - 2 IN	DEG F	137.497
T/C SURFACE TEMP -0.3 IN	DEG F	141.983
T/C SURFACE TEMP + 3 IN	DEG F	122.126
T/C NOZZLE FLANGE TEMP	DEG F	46.569
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	208.517
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	573.207
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	569.414
NOZZLE SURFACE TEMP +11.7 IN	DEG F	529.473
NOZZLE SURFACE TEMP +16.2 IN	DEG F	385.871
NOZZLE SURFACE TEMP +28.4 IN	DEG F	250.193
NOZZLE SURFACE TEMP +40.4 IN	DEG F	214.739
NOZZLE SURFACE TEMP +57.5 IN	DEG F	167.948

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	132.593
PC, NOZZLE STAGNATION	PSIA	125.963
AXIAL THRUST, SITE	LBF	6013.595
AXIAL THRUST, VACUUM	LBF	6083.340
NOZZLE EXIT PRESSURE	PSIA	.040
FUEL DENSITY (MMH)	LB/FT3	54.985
OXIDIZER DENSITY	LB/FT3	90.914
FUEL FLOWRATE	LB/SEC	7.461
OXIDIZER FLOWRATE	LB/SEC	12.267
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.728
MIXTURE RATIO (OVERALL)	O/F	1.644
BLC FLOWRATE	LB/SEC	.559
BLC TOTAL PERCENT	%	2.833
CORE MIXTURE RATIO	O/F	1.777
FUEL INJECTOR DELTA-P	PSID	60.351
OXIDIZER INJECTOR DELTA-P	PSID	58.539
T/C COOLANT DELTA-P	PSID	15.615
T/C COOLANT DELTA-T	DEG F	131.915
THRUST CHAMBER HEAT FLUX	BTU/SEC	703.691
C-STAR, SITE	FT/SEC	5449.926
C-STAR, UMR	FT/SEC	5505.655
C-STAR EFFICIENCY	%	95.436
CF, SITE	-----	1.800
CF SITE VACUUM	-----	1.820
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	101.478
CF, VAC 72	-----	1.809
ISP, TEST	SEC	304.827
ISP, SITE VACUUM	SEC	308.363
ISP, VAC 72 PREDICTED	SEC	308.321
ISP, ODK, TEST CONDITIONS	SEC	332.473
ISP, TDK, TEST CONDITIONS	SEC	327.149
ISP EFFICIENCY	%	91.305
ENERGY RELEASE EFFICIENCY	%	96.225
C-STAR, ODE	FT/SEC	5710.538
ISP, ODE, TEST	SEC	337.727

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 14.000 SEC TO 15.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.926
OXIDIZER TANK PRESSURE	PSIA	248.087
FUEL INTERFACE PRESSURE	PSIA	209.561
OXIDIZER INTERFACE PRESSURE	PSIA	199.017
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.796
FUEL INJECTOR PRESSURE	PSIA	192.565
OXIDIZER INJECTOR PRESSURE	PSIA	192.287
CHAMBER PRESSURE NO. 1	PSIA	131.835
CHAMBER PRESSURE NO. 2	PSIA	132.126
AXIAL THRUST, SYSTEM A	LBF	6035.000
AXIAL THRUST, SYSTEM B	LBF	6043.063
Y-AXIS THRUST	LBF	-2.531
Z-AXIS THRUST	LBF	32.075
AVERAGE CELL PRESSURE	PSIA	.029
CELL PRESSURE AGREEMENT	%	.067
AVERAGE FUEL FLOWRATE	GPM	60.461
FUEL FM AGREEMENT	%	.064
AVERAGE OXIDIZER FLOWRATE	GPM	61.001
OXIDIZER FM AGREEMENT	%	.085
FUEL INTERFACE TEMPERATURE	DEG F	57.513
OXIDIZER INTERFACE TEMPERATURE	DEG F	63.502
T/C COOLANT IN TEMPERATURE	DEG F	59.082
T/C COOLANT OUT TEMPERATURE	DEG F	196.333
T/C SURFACE TEMP -16 IN	DEG F	196.867
T/C SURFACE TEMP -13 IN	DEG F	193.247
T/C SURFACE TEMP -10 IN	DEG F	209.433
T/C SURFACE TEMP - 8 IN	DEG F	158.057
T/C SURFACE TEMP - 6 IN	DEG F	176.155
T/C SURFACE TEMP - 4 IN	DEG F	194.890
T/C SURFACE TEMP - 2 IN	DEG F	139.193
T/C SURFACE TEMP -0.3 IN	DEG F	143.436
T/C SURFACE TEMP + 3 IN	DEG F	124.796
T/C NOZZLE FLANGE TEMP	DEG F	46.569
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	321.483
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	762.601
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	793.118
NOZZLE SURFACE TEMP +11.7 IN	DEG F	752.523
NOZZLE SURFACE TEMP +16.2 IN	DEG F	560.142
NOZZLE SURFACE TEMP +28.4 IN	DEG F	399.041
NOZZLE SURFACE TEMP +40.4 IN	DEG F	307.965
NOZZLE SURFACE TEMP +57.5 IN	DEG F	240.028

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.980
PC, NOZZLE STAGNATION	PSIA	125.381
AXIAL THRUST, SITE	LBF	6039.032
AXIAL THRUST, VACUUM	LBF	6097.990
NOZZLE EXIT PRESSURE	PSIA	.035
FUEL DENSITY (MMH)	LB/FT3	54.993
OXIDIZER DENSITY	LB/FT3	90.868
FUEL FLOWRATE	LB/SEC	7.408
OXIDIZER FLOWRATE	LB/SEC	12.350
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.758
MIXTURE RATIO (OVERALL)	O/F	1.667
BLC FLOWRATE	LB/SEC	.555
BLC TOTAL PERCENT	%	2.808
CORE MIXTURE RATIO	O/F	1.802
FUEL INJECTOR DELTA-P	PSID	60.584
OXIDIZER INJECTOR DELTA-P	PSID	60.307
T/C COOLANT DELTA-P	PSID	15.231
T/C COOLANT DELTA-T	DEG F	137.251
THRUST CHAMBER HEAT FLUX	BTU/SEC	726.981
C-STAR, SITE	FT/SEC	5416.516
C-STAR, UMR	FT/SEC	5475.370
C-STAR EFFICIENCY	%	94.838
CF, SITE	-----	1.816
CF SITE VACUUM	-----	1.833
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	102.044
CF, VAC 72	-----	1.821
ISP, TEST	SEC	305.651
ISP, SITE VACUUM	SEC	308.635
ISP, VAC 72 PREDICTED	SEC	308.647
ISP, ODK, TEST CONDITIONS	SEC	332.951
ISP, TDK, TEST CONDITIONS	SEC	327.590
ISP EFFICIENCY	%	91.210
ENERGY RELEASE EFFICIENCY	%	96.176
C-STAR, ODE	FT/SEC	5711.342
ISP, ODE, TEST	SEC	338.379

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 19.000 SEC TO 20.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.926
OXIDIZER TANK PRESSURE	PSIA	247.138
FUEL INTERFACE PRESSURE	PSIA	209.561
OXIDIZER INTERFACE PRESSURE	PSIA	198.593
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.796
FUEL INJECTOR PRESSURE	PSIA	192.565
OXIDIZER INJECTOR PRESSURE	PSIA	191.902
CHAMBER PRESSURE NO. 1	PSIA	131.353
CHAMBER PRESSURE NO. 2	PSIA	131.624
AXIAL THRUST, SYSTEM A	LBF	6028.647
AXIAL THRUST, SYSTEM B	LBF	6043.063
Y-AXIS THRUST	LBF	-3.037
Z-AXIS THRUST	LBF	30.812
AVERAGE CELL PRESSURE	PSIA	.026
CELL PRESSURE AGREEMENT	%	.045
AVERAGE FUEL FLOWRATE	GPM	60.681
FUEL FM AGREEMENT	%	.070
AVERAGE OXIDIZER FLOWRATE	GPM	60.835
OXIDIZER FM AGREEMENT	%	.028
FUEL INTERFACE TEMPERATURE	DEG F	60.569
OXIDIZER INTERFACE TEMPERATURE	DEG F	63.417
T/C COOLANT IN TEMPERATURE	DEG F	62.193
T/C COOLANT OUT TEMPERATURE	DEG F	200.248
T/C SURFACE TEMP -16 IN	DEG F	200.310
T/C SURFACE TEMP -13 IN	DEG F	196.047
T/C SURFACE TEMP -10 IN	DEG F	210.141
T/C SURFACE TEMP - 8 IN	DEG F	159.688
T/C SURFACE TEMP - 6 IN	DEG F	177.847
T/C SURFACE TEMP - 4 IN	DEG F	196.946
T/C SURFACE TEMP - 2 IN	DEG F	141.252
T/C SURFACE TEMP -0.3 IN	DEG F	145.010
T/C SURFACE TEMP + 3 IN	DEG F	126.616
T/C NOZZLE FLANGE TEMP	DEG F	46.569
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	416.000
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	922.031
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	971.574
NOZZLE SURFACE TEMP +11.7 IN	DEG F	935.380
NOZZLE SURFACE TEMP +16.2 IN	DEG F	714.430
NOZZLE SURFACE TEMP +28.4 IN	DEG F	552.088
NOZZLE SURFACE TEMP +40.4 IN	DEG F	390.189
NOZZLE SURFACE TEMP +57.5 IN	DEG F	308.531

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.489
PC, NOZZLE STAGNATION	PSIA	124.914
AXIAL THRUST, SITE	LBF	6035.855
AXIAL THRUST, VACUUM	LBF	6088.957
NOZZLE EXIT PRESSURE	PSIA	.033
FUEL DENSITY (MMH)	LB/FT3	54.854
OXIDIZER DENSITY	LB/FT3	90.874
FUEL FLOWRATE	LB/SEC	7.416
OXIDIZER FLOWRATE	LB/SEC	12.317
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.733
MIXTURE RATIO (OVERALL)	O/F	1.661
BLC FLOWRATE	LB/SEC	.555
BLC TOTAL PERCENT	%	2.815
CORE MIXTURE RATIO	O/F	1.795
FUEL INJECTOR DELTA-P	PSID	61.076
OXIDIZER INJECTOR DELTA-P	PSID	60.413
T/C COOLANT DELTA-P	PSID	15.231
T/C COOLANT DELTA-T	DEG F	138.055
THRUST CHAMBER HEAT FLUX	BTU/SEC	732.043
C-STAR, SITE	FT/SEC	5403.014
C-STAR, UMR	FT/SEC	5460.922
C-STAR EFFICIENCY	%	94.604
CF, SITE	-----	1.821
CF SITE VACUUM	-----	1.837
CF, VAC 72 EXPECT	-----	1.796
CF CORRELATION	-----	102.315
CF, VAC 72	-----	1.826
ISP, TEST	SEC	305.869
ISP, SITE VACUUM	SEC	308.560
ISP, VAC 72 PREDICTED	SEC	308.569
ISP, ODK, TEST CONDITIONS	SEC	332.815
ISP, TDK, TEST CONDITIONS	SEC	327.477
ISP EFFICIENCY	%	91.235
ENERGY RELEASE EFFICIENCY	%	96.189
C-STAR, ODE	FT/SEC	5711.217
ISP, ODE, TEST	SEC	338.204

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 24.000 SEC TO 26.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	240.384
OXIDIZER TANK PRESSURE	PSIA	246.188
FUEL INTERFACE PRESSURE	PSIA	209.986
OXIDIZER INTERFACE PRESSURE	PSIA	197.745
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.796
FUEL INJECTOR PRESSURE	PSIA	192.565
OXIDIZER INJECTOR PRESSURE	PSIA	190.746
CHAMBER PRESSURE NO. 1	PSIA	130.872
CHAMBER PRESSURE NO. 2	PSIA	131.121
AXIAL THRUST, SYSTEM A	LBF	6022.293
AXIAL THRUST, SYSTEM B	LBF	6030.347
Y-AXIS THRUST	LBF	-3.543
Z-AXIS THRUST	LBF	30.939
AVERAGE CELL PRESSURE	PSIA	.025
CELL PRESSURE AGREEMENT	%	.127
AVERAGE FUEL FLOWRATE	GPM	60.901
FUEL FM AGREEMENT	%	.076
AVERAGE OXIDIZER FLOWRATE	GPM	60.726
OXIDIZER FM AGREEMENT	%	.030
FUEL INTERFACE TEMPERATURE	DEG F	62.607
OXIDIZER INTERFACE TEMPERATURE	DEG F	65.963
T/C COOLANT IN TEMPERATURE	DEG F	64.376
T/C COOLANT OUT TEMPERATURE	DEG F	204.157
T/C SURFACE TEMP -16 IN	DEG F	204.046
T/C SURFACE TEMP -13 IN	DEG F	198.265
T/C SURFACE TEMP -10 IN	DEG F	213.876
T/C SURFACE TEMP - 8 IN	DEG F	161.668
T/C SURFACE TEMP - 6 IN	DEG F	180.022
T/C SURFACE TEMP - 4 IN	DEG F	198.397
T/C SURFACE TEMP - 2 IN	DEG F	143.069
T/C SURFACE TEMP -0.3 IN	DEG F	146.342
T/C SURFACE TEMP + 3 IN	DEG F	128.919
T/C NOZZLE FLANGE TEMP	DEG F	47.593
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	515.078
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	943.814
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1117.455
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1090.896
NOZZLE SURFACE TEMP +16.2 IN	DEG F	859.422
NOZZLE SURFACE TEMP +28.4 IN	DEG F	678.735
NOZZLE SURFACE TEMP +40.4 IN	DEG F	475.820
NOZZLE SURFACE TEMP +57.5 IN	DEG F	379.237

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	130.997
PC, NOZZLE STAGNATION	PSIA	124.447
AXIAL THRUST, SITE	LBF	6026.320
AXIAL THRUST, VACUUM	LBF	6076.025
NOZZLE EXIT PRESSURE	PSIA	.031
FUEL DENSITY (MMH)	LB/FT3	54.813
OXIDIZER DENSITY	LB/FT3	90.634
FUEL FLOWRATE	LB/SEC	7.437
OXIDIZER FLOWRATE	LB/SEC	12.263
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.700
MIXTURE RATIO (OVERALL)	O/F	1.649
BLC FLOWRATE	LB/SEC	.557
BLC TOTAL PERCENT	%	2.828
CORE MIXTURE RATIO	O/F	1.782
FUEL INJECTOR DELTA-P	PSID	61.568
OXIDIZER INJECTOR DELTA-P	PSID	59.750
T/C COOLANT DELTA-P	PSID	15.231
T/C COOLANT DELTA-T	DEG F	139.780
THRUST CHAMBER HEAT FLUX	BTU/SEC	743.323
C-STAR, SITE	FT/SEC	5391.939
C-STAR, UMR	FT/SEC	5448.074
C-STAR EFFICIENCY	%	94.415
CF, SITE	-----	1.825
CF SITE VACUUM	-----	1.840
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	102.561
CF, VAC 72	-----	1.828
ISP, TEST	SEC	305.905
ISP, SITE VACUUM	SEC	308.428
ISP, VAC 72 PREDICTED	SEC	308.423
ISP, ODK, TEST CONDITIONS	SEC	332.552
ISP, TDK, TEST CONDITIONS	SEC	327.248
ISP EFFICIENCY	%	91.288
ENERGY RELEASE EFFICIENCY	%	96.219
C-STAR, ODE	FT/SEC	5710.900
ISP, ODE, TEST	SEC	337.862

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 30.000 SEC TO 32.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.926
OXIDIZER TANK PRESSURE	PSIA	248.087
FUEL INTERFACE PRESSURE	PSIA	209.561
OXIDIZER INTERFACE PRESSURE	PSIA	199.017
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.414
FUEL INJECTOR PRESSURE	PSIA	192.186
OXIDIZER INJECTOR PRESSURE	PSIA	191.902
CHAMBER PRESSURE NO. 1	PSIA	131.113
CHAMBER PRESSURE NO. 2	PSIA	131.373
AXIAL THRUST, SYSTEM A	LBF	6041.390
AXIAL THRUST, SYSTEM B	LBF	6049.419
Y-AXIS THRUST	LBF	-5.568
Z-AXIS THRUST	LBF	31.950
AVERAGE CELL PRESSURE	PSIA	.023
CELL PRESSURE AGREEMENT	%	.113
AVERAGE FUEL FLOWRATE	GPM	60.571
FUEL FM AGREEMENT	%	.067
AVERAGE OXIDIZER FLOWRATE	GPM	61.165
OXIDIZER FM AGREEMENT	%	.022
FUEL INTERFACE TEMPERATURE	DEG F	63.457
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.745
T/C COOLANT IN TEMPERATURE	DEG F	65.299
T/C COOLANT OUT TEMPERATURE	DEG F	207.133
T/C SURFACE TEMP -16 IN	DEG F	207.490
T/C SURFACE TEMP -13 IN	DEG F	200.717
T/C SURFACE TEMP -10 IN	DEG F	216.097
T/C SURFACE TEMP - 8 IN	DEG F	163.415
T/C SURFACE TEMP - 6 IN	DEG F	182.077
T/C SURFACE TEMP - 4 IN	DEG F	200.574
T/C SURFACE TEMP - 2 IN	DEG F	145.127
T/C SURFACE TEMP -0.3 IN	DEG F	147.915
T/C SURFACE TEMP + 3 IN	DEG F	130.616
T/C NOZZLE FLANGE TEMP	DEG F	48.617
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	620.127
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1047.621
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1235.304
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1219.717
NOZZLE SURFACE TEMP +16.2 IN	DEG F	995.719
NOZZLE SURFACE TEMP +28.4 IN	DEG F	675.072
NOZZLE SURFACE TEMP +40.4 IN	DEG F	563.485
NOZZLE SURFACE TEMP +57.5 IN	DEG F	450.748

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.243
PC, NOZZLE STAGNATION	PSIA	124.680
AXIAL THRUST, SITE	LBF	6045.405
AXIAL THRUST, VACUUM	LBF	6092.195
NOZZLE EXIT PRESSURE	PSIA	.029
FUEL DENSITY (MMH)	LB/FT3	54.792
OXIDIZER DENSITY	LB/FT3	90.521
FUEL FLOWRATE	LB/SEC	7.394
OXIDIZER FLOWRATE	LB/SEC	12.336
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.730
MIXTURE RATIO (OVERALL)	O/F	1.668
BLC FLOWRATE	LB/SEC	.554
BLC TOTAL PERCENT	%	2.807
CORE MIXTURE RATIO	O/F	1.803
FUEL INJECTOR DELTA-P	PSID	60.943
OXIDIZER INJECTOR DELTA-P	PSID	60.659
T/C COOLANT DELTA-P	PSID	15.229
T/C COOLANT DELTA-T	DEG F	141.833
THRUST CHAMBER HEAT FLUX	BTU/SEC	749.863
C-STAR, SITE	FT/SEC	5393.825
C-STAR, UMR	FT/SEC	5452.860
C-STAR EFFICIENCY	%	94.440
CF, SITE	-----	1.828
CF SITE VACUUM	-----	1.842
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	102.512
CF, VAC 72	-----	1.830
ISP, TEST	SEC	306.405
ISP, SITE VACUUM	SEC	308.777
ISP, VAC 72 PREDICTED	SEC	308.805
ISP, ODK, TEST CONDITIONS	SEC	332.957
ISP, TDK, TEST CONDITIONS	SEC	327.593
ISP EFFICIENCY	%	91.243
ENERGY RELEASE EFFICIENCY	%	96.221
C-STAR, ODE	FT/SEC	5711.366
ISP, ODE, TEST	SEC	338.412

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 1
TEST DESCRIPTION
50-SECOND PERFORMANCE SURVEY AND 30-MIN. POST-FIRE THERMAL EVALUATION OF RD INTEGRATED ENGINE. NORMAL SHUTDOWN AT 1500 DEG F REDLINE NOZZLE TEMP. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 44.224 SEC
DATA SLICE TIME 36.000 SEC TO 38.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	239.926
OXIDIZER TANK PRESSURE	PSIA	246.663
FUEL INTERFACE PRESSURE	PSIA	209.137
OXIDIZER INTERFACE PRESSURE	PSIA	198.169
T/C COOLANT INLET MAN. PRESSURE	PSIA	207.414
FUEL INJECTOR PRESSURE	PSIA	192.186
OXIDIZER INJECTOR PRESSURE	PSIA	191.132
CHAMBER PRESSURE NO. 1	PSIA	130.872
CHAMBER PRESSURE NO. 2	PSIA	131.121
AXIAL THRUST, SYSTEM A	LBF	6028.672
AXIAL THRUST, SYSTEM B	LBF	6036.704
Y-AXIS THRUST	LBF	-6.327
Z-AXIS THRUST	LBF	32.202
AVERAGE CELL PRESSURE	PSIA	.023
CELL PRESSURE AGREEMENT	%	.009
AVERAGE FUEL FLOWRATE	GPM	60.681
FUEL FM AGREEMENT	%	.070
AVERAGE OXIDIZER FLOWRATE	GPM	60.945
OXIDIZER FM AGREEMENT	%	.026
FUEL INTERFACE TEMPERATURE	DEG F	63.966
OXIDIZER INTERFACE TEMPERATURE	DEG F	68.764
T/C COOLANT IN TEMPERATURE	DEG F	65.928
T/C COOLANT OUT TEMPERATURE	DEG F	208.432
T/C SURFACE TEMP -16 IN	DEG F	208.600
T/C SURFACE TEMP -13 IN	DEG F	201.183
T/C SURFACE TEMP -10 IN	DEG F	215.745
T/C SURFACE TEMP - 8 IN	DEG F	163.299
T/C SURFACE TEMP - 6 IN	DEG F	182.560
T/C SURFACE TEMP - 4 IN	DEG F	200.453
T/C SURFACE TEMP - 2 IN	DEG F	145.127
T/C SURFACE TEMP -0.3 IN	DEG F	147.915
T/C SURFACE TEMP + 3 IN	DEG F	131.101
T/C NOZZLE FLANGE TEMP	DEG F	49.640
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	705.228
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1158.321
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1320.824
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1316.305
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1105.755
NOZZLE SURFACE TEMP +28.4 IN	DEG F	768.105
NOZZLE SURFACE TEMP +40.4 IN	DEG F	646.378
NOZZLE SURFACE TEMP +57.5 IN	DEG F	523.105

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RO/ICT-1 SEQUENCE 5 TEST 1

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	130.997
PC, NOZZLE STAGNATION	PSIA	124.447
AXIAL THRUST, SITE	LBF	6032.688
AXIAL THRUST, VACUUM	LBF	6078.011
NOZZLE EXIT PRESSURE	PSIA	.029
FUEL DENSITY (MMH)	LB/FT3	54.778
OXIDIZER DENSITY	LB/FT3	90.453
FUEL FLOWRATE	LB/SEC	7.406
OXIDIZER FLOWRATE	LB/SEC	12.282
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.688
MIXTURE RATIO (OVERALL)	O/F	1.658
BLC FLOWRATE	LB/SEC	.555
BLC TOTAL PERCENT	%	2.817
CORE MIXTURE RATIO	O/F	1.793
FUEL INJECTOR DELTA-P	PSID	61.189
OXIDIZER INJECTOR DELTA-P	PSID	60.135
T/C COOLANT DELTA-P	PSID	15.229
T/C COOLANT DELTA-T	DEG F	142.504
THRUST CHAMBER HEAT FLUX	BTU/SEC	754.587
C-STAR, SITE	FT/SEC	5395.183
C-STAR, UMR	FT/SEC	5452.724
C-STAR EFFICIENCY	%	94.467
CF, SITE	-----	1.827
CF SITE VACUUM	-----	1.841
CF, VAC 72 EXPECT	-----	1.796
CF CORRELATION	-----	102.531
CF, VAC 72	-----	1.829
ISP, TEST	SEC	306.412
ISP, SITE VACUUM	SEC	308.714
ISP, VAC 72 PREDICTED	SEC	308.724
ISP, ODK, TEST CONDITIONS	SEC	332.753
ISP, TDK, TEST CONDITIONS	SEC	327.424
ISP EFFICIENCY	%	91.299
ENERGY RELEASE EFFICIENCY	%	96.256
C-STAR, ODE	FT/SEC	5711.169
ISP, ODE, TEST	SEC	338.137

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2
TEST DESCRIPTION
HIGH-PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE.
TARGET PCNS = 152., O/F = 1.65. SHUTDOWN DUE TO
1500 DEG F NOZZLE TEMP.

ACTUAL TEST DURATION 33.290 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	314.513
OXIDIZER TANK PRESSURE	PSIA	321.667
FUEL INTERFACE PRESSURE	PSIA	269.813
OXIDIZER INTERFACE PRESSURE	PSIA	253.268
T/C COOLANT INLET MAN. PRESSURE	PSIA	260.440
FUEL INJECTOR PRESSURE	PSIA	250.581
OXIDIZER INJECTOR PRESSURE	PSIA	243.516
CHAMBER PRESSURE NO. 1	PSIA	158.793
CHAMBER PRESSURE NO. 2	PSIA	159.267
AXIAL THRUST, SYSTEM A	LBF	7218.470
AXIAL THRUST, SYSTEM B	LBF	7228.788
Y-AXIS THRUST	LBF	-2.784
Z-AXIS THRUST	LBF	34.465
AVERAGE CELL PRESSURE	PSIA	.036
CELL PRESSURE AGREEMENT	%	.105
AVERAGE FUEL FLOWRATE	GPM	72.758
FUEL FM AGREEMENT	%	.039
AVERAGE OXIDIZER FLOWRATE	GPM	72.359
OXIDIZER FM AGREEMENT	%	.186
FUEL INTERFACE TEMPERATURE	DEG F	61.928
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.236
T/C COOLANT IN TEMPERATURE	DEG F	66.134
T/C COOLANT OUT TEMPERATURE	DEG F	198.664
T/C SURFACE TEMP -16 IN	DEG F	198.150
T/C SURFACE TEMP -13 IN	DEG F	192.662
T/C SURFACE TEMP -10 IN	DEG F	206.515
T/C SURFACE TEMP - 8 IN	DEG F	158.057
T/C SURFACE TEMP - 6 IN	DEG F	175.914
T/C SURFACE TEMP - 4 IN	DEG F	192.955
T/C SURFACE TEMP - 2 IN	DEG F	140.404
T/C SURFACE TEMP -0.3 IN	DEG F	142.224
T/C SURFACE TEMP + 3 IN	DEG F	127.341
T/C NOZZLE FLANGE TEMP	DEG F	74.214
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	321.483
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1880.602
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	712.476
NOZZLE SURFACE TEMP +11.7 IN	DEG F	668.929
NOZZLE SURFACE TEMP +16.2 IN	DEG F	513.454
NOZZLE SURFACE TEMP +28.4 IN	DEG F	366.762
NOZZLE SURFACE TEMP +40.4 IN	DEG F	329.311
NOZZLE SURFACE TEMP +57.5 IN	DEG F	271.503

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	159.030
PC, NOZZLE STAGNATION	PSIA	151.079
AXIAL THRUST, SITE	LBF	7223.629
AXIAL THRUST, VACUUM	LBF	7296.326
NOZZLE EXIT PRESSURE	PSIA	.040
FUEL DENSITY (MMH)	LB/FT3	54.868
OXIDIZER DENSITY	LB/FT3	90.635
FUEL FLOWRATE	LB/SEC	8.894
OXIDIZER FLOWRATE	LB/SEC	14.612
TOTAL PROPELLANT FLOWRATE	LB/SEC	23.506
MIXTURE RATIO (OVERALL)	O/F	1.643
BLC FLOWRATE	LB/SEC	.666
BLC TOTAL PERCENT	%	2.834
CORE MIXTURE RATIO	O/F	1.776
FUEL INJECTOR DELTA-P	PSID	91.551
OXIDIZER INJECTOR DELTA-P	PSID	84.485
T/C COOLANT DELTA-P	PSID	9.859
T/C COOLANT DELTA-T	DEG F	132.530
THRUST CHAMBER HEAT FLUX	BTU/SEC	842.821
C-STAR, SITE	FT/SEC	5485.907
C-STAR, UMR	FT/SEC	5541.511
C-STAR EFFICIENCY	%	96.068
CF, SITE	------	1.802
CF SITE VACUUM	------	1.820
CF, VAC 72 EXPECT	------	1.794
CF CORRELATION	------	101.488
CF, VAC 72	------	1.809
ISP, TEST	SEC	307.307
ISP, SITE VACUUM	SEC	310.400
ISP, VAC 72 PREDICTED	SEC	310.344
ISP, ODK, TEST CONDITIONS	SEC	333.032
ISP, TDK, TEST CONDITIONS	SEC	327.606
ISP EFFICIENCY	%	91.920
ENERGY RELEASE EFFICIENCY	%	96.397
C-STAR, ODE	FT/SEC	5710.426
ISP, ODE, TEST	SEC	337.685

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2
TEST DESCRIPTION
HIGH-PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE.
TARGET PCNS = 152., O/F = 1.65. SHUTDOWN DUE TO
1500 DEG F NOZZLE TEMP.

ACTUAL TEST DURATION 33.290 SEC
DATA SLICE TIME 14.000 SEC TO 15.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	314.513
OXIDIZER TANK PRESSURE	PSIA	321.667
FUEL INTERFACE PRESSURE	PSIA	270.237
OXIDIZER INTERFACE PRESSURE	PSIA	253.692
T/C COOLANT INLET MAN. PRESSURE	PSIA	262.729
FUEL INJECTOR PRESSURE	PSIA	249.823
OXIDIZER INJECTOR PRESSURE	PSIA	243.516
CHAMBER PRESSURE NO. 1	PSIA	157.589
CHAMBER PRESSURE NO. 2	PSIA	158.262
AXIAL THRUST, SYSTEM A	LBF	7231.181
AXIAL THRUST, SYSTEM B	LBF	7244.683
Y-AXIS THRUST	LBF	-6.327
Z-AXIS THRUST	LBF	33.454
AVERAGE CELL PRESSURE	PSIA	.031
CELL PRESSURE AGREEMENT	%	.077
AVERAGE FUEL FLOWRATE	GPM	72.813
FUEL FM AGREEMENT	%	.072
AVERAGE OXIDIZER FLOWRATE	GPM	72.414
OXIDIZER FM AGREEMENT	%	.077
FUEL INTERFACE TEMPERATURE	DEG F	61.673
OXIDIZER INTERFACE TEMPERATURE	DEG F	67.661
T/C COOLANT IN TEMPERATURE	DEG F	65.213
T/C COOLANT OUT TEMPERATURE	DEG F	199.596
T/C SURFACE TEMP -16 IN	DEG F	200.602
T/C SURFACE TEMP -13 IN	DEG F	192.311
T/C SURFACE TEMP -10 IN	DEG F	205.820
T/C SURFACE TEMP - 8 IN	DEG F	157.241
T/C SURFACE TEMP - 6 IN	DEG F	175.430
T/C SURFACE TEMP - 4 IN	DEG F	192.351
T/C SURFACE TEMP - 2 IN	DEG F	139.193
T/C SURFACE TEMP -0.3 IN	DEG F	141.134
T/C SURFACE TEMP + 3 IN	DEG F	126.008
T/C NOZZLE FLANGE TEMP	DEG F	74.214
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	430.019
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1986.840
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	936.181
NOZZLE SURFACE TEMP +11.7 IN	DEG F	893.132
NOZZLE SURFACE TEMP +16.2 IN	DEG F	692.781
NOZZLE SURFACE TEMP +28.4 IN	DEG F	550.897
NOZZLE SURFACE TEMP +40.4 IN	DEG F	423.976
NOZZLE SURFACE TEMP +57.5 IN	DEG F	345.377

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	157.926
PC, NOZZLE STAGNATION	PSIA	150.029
AXIAL THRUST, SITE	LBF	7237.932
AXIAL THRUST, VACUUM	LBF	7299.826
NOZZLE EXIT PRESSURE	PSIA	.035
FUEL DENSITY (MMH)	LB/FT3	54.832
OXIDIZER DENSITY	LB/FT3	90.642
FUEL FLOWRATE	LB/SEC	8.895
OXIDIZER FLOWRATE	LB/SEC	14.624
TOTAL PROPELLANT FLOWRATE	LB/SEC	23.519
MIXTURE RATIO (OVERALL)	O/F	1.644
BLC FLOWRATE	LB/SEC	.666
BLC TOTAL PERCENT	%	2.833
CORE MIXTURE RATIO	O/F	1.777
FUEL INJECTOR DELTA-P	PSID	91.897
OXIDIZER INJECTOR DELTA-P	PSID	85.590
T/C COOLANT DELTA-P	PSID	12.906
T/C COOLANT DELTA-T	DEG F	134.383
THRUST CHAMBER HEAT FLUX	BTU/SEC	854.707
C-STAR, SITE	FT/SEC	5444.750
C-STAR, UMR	FT/SEC	5500.459
C-STAR EFFICIENCY	%	95.346
CF, SITE	-----	1.819
CF SITE VACUUM	-----	1.834
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	102.239
CF, VAC 72	-----	1.822
ISP, TEST	SEC	307.743
ISP, SITE VACUUM	SEC	310.375
ISP, VAC 72 PREDICTED	SEC	310.344
ISP, ODK, TEST CONDITIONS	SEC	333.039
ISP, TDK, TEST CONDITIONS	SEC	327.620
ISP EFFICIENCY	%	91.903
ENERGY RELEASE EFFICIENCY	%	96.384
C-STAR, ODE	FT/SEC	5710.519
ISP, ODE, TEST	SEC	337.720

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2
TEST DESCRIPTION
HIGH-PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE.
TARGET PCNS = 152., O/F = 1.65. SHUTDOWN DUE TO
1500 DEG F NOZZLE TEMP.

ACTUAL TEST DURATION 33.290 SEC
DATA SLICE TIME 19.000 SEC TO 20.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	314.055
OXIDIZER TANK PRESSURE	PSIA	322.617
FUEL INTERFACE PRESSURE	PSIA	269.813
OXIDIZER INTERFACE PRESSURE	PSIA	254.116
T/C COOLANT INLET MAN. PRESSURE	PSIA	263.492
FUEL INJECTOR PRESSURE	PSIA	248.685
OXIDIZER INJECTOR PRESSURE	PSIA	243.901
CHAMBER PRESSURE NO. 1	PSIA	157.348
CHAMBER PRESSURE NO. 2	PSIA	157.760
AXIAL THRUST, SYSTEM A	LBF	7247.088
AXIAL THRUST, SYSTEM B	LBF	7260.577
Y-AXIS THRUST	LBF	-6.327
Z-AXIS THRUST	LBF	33.455
AVERAGE CELL PRESSURE	PSIA	.028
CELL PRESSURE AGREEMENT	%	.060
AVERAGE FUEL FLOWRATE	GPM	72.758
FUEL FM AGREEMENT	%	.039
AVERAGE OXIDIZER FLOWRATE	GPM	72.633
OXIDIZER FM AGREEMENT	%	.081
FUEL INTERFACE TEMPERATURE	DEG F	64.306
OXIDIZER INTERFACE TEMPERATURE	DEG F	68.085
T/C COOLANT IN TEMPERATURE	DEG F	67.436
T/C COOLANT OUT TEMPERATURE	DEG F	203.785
T/C SURFACE TEMP -16 IN	DEG F	204.104
T/C SURFACE TEMP -13 IN	DEG F	195.578
T/C SURFACE TEMP -10 IN	DEG F	208.741
T/C SURFACE TEMP - 8 IN	DEG F	159.455
T/C SURFACE TEMP - 6 IN	DEG F	177.605
T/C SURFACE TEMP - 4 IN	DEG F	194.890
T/C SURFACE TEMP - 2 IN	DEG F	141.737
T/C SURFACE TEMP -0.3 IN	DEG F	143.315
T/C SURFACE TEMP + 3 IN	DEG F	127.343
T/C NOZZLE FLANGE TEMP	DEG F	74.214
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	537.271
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1145.488
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1106.524
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1070.384
NOZZLE SURFACE TEMP +16.2 IN	DEG F	852.533
NOZZLE SURFACE TEMP +28.4 IN	DEG F	689.846
NOZZLE SURFACE TEMP +40.4 IN	DEG F	513.478
NOZZLE SURFACE TEMP +57.5 IN	DEG F	417.169

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	157.554
PC, NOZZLE STAGNATION	PSIA	149.676
AXIAL THRUST, SITE	LBF	7253.833
AXIAL THRUST, VACUUM	LBF	7310.836
NOZZLE EXIT PRESSURE	PSIA	.032
FUEL DENSITY (MMH)	LB/FT3	54.773
OXIDIZER DENSITY	LB/FT3	90.549
FUEL FLOWRATE	LB/SEC	8.879
OXIDIZER FLOWRATE	LB/SEC	14.653
TOTAL PROPELLANT FLOWRATE	LB/SEC	23.532
MIXTURE RATIO (OVERALL)	O/F	1.650
BLC FLOWRATE	LB/SEC	.665
BLC TOTAL PERCENT	%	2.826
CORE MIXTURE RATIO	O/F	1.784
FUEL INJECTOR DELTA-P	PSID	91.131
OXIDIZER INJECTOR DELTA-P	PSID	86.347
T/C COOLANT DELTA-P	PSID	14.807
T/C COOLANT DELTA-T	DEG F	136.350
THRUST CHAMBER HEAT FLUX	BTU/SEC	865.605
C-STAR, SITE	FT/SEC	5428.989
C-STAR, UMR	FT/SEC	5485.289
C-STAR EFFICIENCY	%	95.062
CF, SITE	-----	1.827
CF SITE VACUUM	-----	1.841
CF, VAC 72 EXPECT	-----	1.795
CF CORRELATION	-----	102.593
CF, VAC 72	-----	1.829
ISP, TEST	SEC	308.252
ISP, SITE VACUUM	SEC	310.675
ISP, VAC 72 PREDICTED	SEC	310.658
ISP, ODK, TEST CONDITIONS	SEC	333.199
ISP, TDK, TEST CONDITIONS	SEC	327.800
ISP EFFICIENCY	%	91.940
ENERGY RELEASE EFFICIENCY	%	96.422
C-STAR, ODE	FT/SEC	5711.007
ISP, ODE, TEST	SEC	337.910

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2
TEST DESCRIPTION
HIGH-PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE.
TARGET PCNS = 152., O/F = 1.65. SHUTDOWN DUE TO
1500 DEG F NOZZLE TEMP.

ACTUAL TEST DURATION 33.290 SEC
DATA SLICE TIME 30.000 SEC TO 32.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	314.970
OXIDIZER TANK PRESSURE	PSIA	322.617
FUEL INTERFACE PRESSURE	PSIA	269.813
OXIDIZER INTERFACE PRESSURE	PSIA	254.116
T/C COOLANT INLET MAN. PRESSURE	PSIA	265.399
FUEL INJECTOR PRESSURE	PSIA	247.169
OXIDIZER INJECTOR PRESSURE	PSIA	243.516
CHAMBER PRESSURE NO. 1	PSIA	157.107
CHAMBER PRESSURE NO. 2	PSIA	157.508
AXIAL THRUST, SYSTEM A	LBF	7250.293
AXIAL THRUST, SYSTEM B	LBF	7260.576
Y-AXIS THRUST	LBF	-8.098
Z-AXIS THRUST	LBF	34.213
AVERAGE CELL PRESSURE	PSIA	.025
CELL PRESSURE AGREEMENT	%	.132
AVERAGE FUEL FLOWRATE	GPM	72.867
FUEL FM AGREEMENT	%	.036
AVERAGE OXIDIZER FLOWRATE	GPM	72.743
OXIDIZER FM AGREEMENT	%	.084
FUEL INTERFACE TEMPERATURE	DEG F	65.411
OXIDIZER INTERFACE TEMPERATURE	DEG F	70.803
T/C COOLANT IN TEMPERATURE	DEG F	68.065
T/C COOLANT OUT TEMPERATURE	DEG F	205.738
T/C SURFACE TEMP -16 IN	DEG F	206.264
T/C SURFACE TEMP -13 IN	DEG F	196.862
T/C SURFACE TEMP -10 IN	DEG F	210.491
T/C SURFACE TEMP - 8 IN	DEG F	160.503
T/C SURFACE TEMP - 6 IN	DEG F	178.935
T/C SURFACE TEMP - 4 IN	DEG F	195.857
T/C SURFACE TEMP - 2 IN	DEG F	142.463
T/C SURFACE TEMP -0.3 IN	DEG F	143.557
T/C SURFACE TEMP + 3 IN	DEG F	128.313
T/C NOZZLE FLANGE TEMP	DEG F	75.238
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	754.457
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1093.294
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1345.754
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1332.883
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1125.819
NOZZLE SURFACE TEMP +28.4 IN	DEG F	813.121
NOZZLE SURFACE TEMP +40.4 IN	DEG F	698.635
NOZZLE SURFACE TEMP +57.5 IN	DEG F	625.177

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 2

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	157.308
PC, NOZZLE STAGNATION	PSIA	149.442
AXIAL THRUST, SITE	LBF	7255.434
AXIAL THRUST, VACUUM	LBF	7306.112
NOZZLE EXIT PRESSURE	PSIA	.029
FUEL DENSITY (MMH)	LB/FT3	54.743
OXIDIZER DENSITY	LB/FT3	90.381
FUEL FLOWRATE	LB/SEC	8.887
OXIDIZER FLOWRATE	LB/SEC	14.648
TOTAL PROPELLANT FLOWRATE	LB/SEC	23.536
MIXTURE RATIO (OVERALL)	O/F	1.648
BLC FLOWRATE	LB/SEC	.666
BLC TOTAL PERCENT	%	2.828
CORE MIXTURE RATIO	O/F	1.782
FUEL INJECTOR DELTA-P	PSID	89.861
OXIDIZER INJECTOR DELTA-P	PSID	86.208
T/C COOLANT DELTA-P	PSID	18.231
T/C COOLANT DELTA-T	DEG F	137.673
THRUST CHAMBER HEAT FLUX	BTU/SEC	874.842
C-STAR, SITE	FT/SEC	5419.711
C-STAR, UMR	FT/SEC	5475.797
C-STAR EFFICIENCY	%	94.902
CF, SITE	-----	1.830
CF SITE VACUUM	-----	1.843
CF, VAC 72 EXPECT	-----	1.794
CF CORRELATION	-----	102.701
CF, VAC 72	-----	1.831
ISP, TEST	SEC	308.275
ISP, SITE VACUUM	SEC	310.428
ISP, VAC 72 PREDICTED	SEC	310.414
ISP, ODK, TEST CONDITIONS	SEC	333.138
ISP, TDK, TEST CONDITIONS	SEC	327.735
ISP EFFICIENCY	%	91.885
ENERGY RELEASE EFFICIENCY	%	96.366
C-STAR, ODE	FT/SEC	5710.855
ISP, ODE, TEST	SEC	337.846

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 3A
TEST DESCRIPTION
LOW-PRESSURE PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE. AUTOMATIC LOW-FLOW SHUTDOWN ON FIRST ATTEMPT AT PCNS = 98., O/F = 1.65. INCREASED TANK PRESSURES 10 PSI AND RECYCLED.

ACTUAL TEST DURATION 40.196 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	177.237
OXIDIZER TANK PRESSURE	PSIA	181.628
FUEL INTERFACE PRESSURE	PSIA	156.947
OXIDIZER INTERFACE PRESSURE	PSIA	149.428
T/C COOLANT INLET MAN. PRESSURE	PSIA	152.863
FUEL INJECTOR PRESSURE	PSIA	147.441
OXIDIZER INJECTOR PRESSURE	PSIA	145.681
CHAMBER PRESSURE NO. 1	PSIA	107.518
CHAMBER PRESSURE NO. 2	PSIA	106.996
AXIAL THRUST, SYSTEM A	LBF	4822.907
AXIAL THRUST, SYSTEM B	LBF	4831.908
Y-AXIS THRUST	LBF	-8.604
Z-AXIS THRUST	LBF	22.221
AVERAGE CELL PRESSURE	PSIA	.033
CELL PRESSURE AGREEMENT	%	.008
AVERAGE FUEL FLOWRATE	GPM	49.208
FUEL FM AGREEMENT	%	.085
AVERAGE OXIDIZER FLOWRATE	GPM	49.586
OXIDIZER FM AGREEMENT	%	.128
FUEL INTERFACE TEMPERATURE	DEG F	65.411
OXIDIZER INTERFACE TEMPERATURE	DEG F	70.548
T/C COOLANT IN TEMPERATURE	DEG F	68.482
T/C COOLANT OUT TEMPERATURE	DEG F	211.406
T/C SURFACE TEMP -16 IN	DEG F	209.882
T/C SURFACE TEMP -13 IN	DEG F	206.793
T/C SURFACE TEMP -10 IN	DEG F	223.925
T/C SURFACE TEMP - 8 IN	DEG F	169.703
T/C SURFACE TEMP - 6 IN	DEG F	188.120
T/C SURFACE TEMP - 4 IN	DEG F	207.592
T/C SURFACE TEMP - 2 IN	DEG F	150.815
T/C SURFACE TEMP -0.3 IN	DEG F	154.328
T/C SURFACE TEMP + 3 IN	DEG F	134.978
T/C NOZZLE FLANGE TEMP	DEG F	88.555
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	467.756
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	771.982
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	820.349
NOZZLE SURFACE TEMP +11.7 IN	DEG F	721.088
NOZZLE SURFACE TEMP +16.2 IN	DEG F	744.770
NOZZLE SURFACE TEMP +28.0 IN	DEG F	668.217
NOZZLE SURFACE TEMP +40.4 IN	DEG F	620.103
NOZZLE SURFACE TEMP +57.5 IN	DEG F	525.881

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 3A

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	107.257
PC, NOZZLE STAGNATION	PSIA	101.894
AXIAL THRUST, SITE	LBF	4827.408
AXIAL THRUST, VACUUM	LBF	4893.708
NOZZLE EXIT PRESSURE	PSIA	.036
FUEL DENSITY (MMH)	LB/FT3	54.743
OXIDIZER DENSITY	LB/FT3	90.315
FUEL FLOWRATE	LB/SEC	6.002
OXIDIZER FLOWRATE	LB/SEC	9.978
TOTAL PROPELLANT FLOWRATE	LB/SEC	15.980
MIXTURE RATIO (OVERALL)	O/F	1.663
BLC FLOWRATE	LB/SEC	.450
BLC TOTAL PERCENT	%	2.813
CORE MIXTURE RATIO	O/F	1.797
FUEL INJECTOR DELTA-P	PSID	40.184
OXIDIZER INJECTOR DELTA-P	PSID	38.424
T/C COOLANT DELTA-P	PSID	5.422
T/C COOLANT DELTA-T	DEG F	142.924
THRUST CHAMBER HEAT FLUX	BTU/SEC	613.316
C-STAR, SITE	FT/SEC	5442.646
C-STAR, UMR	FT/SEC	5500.806
C-STAR EFFICIENCY	%	95.297
CF, SITE	-----	1.786
CF SITE VACUUM	-----	1.810
CF, VAC 72 EXPECT	-----	1.796
CF CORRELATION	-----	100.798
CF, VAC 72	-----	1.799
ISP, TEST	SEC	302.098
ISP, SITE VACUUM	SEC	306.247
ISP, VAC 72 PREDICTED	SEC	306.225
ISP, ODK, TEST CONDITIONS	SEC	332.192
ISP, TDK, TEST CONDITIONS	SEC	326.848
ISP EFFICIENCY	%	90.538
ENERGY RELEASE EFFICIENCY	%	96.129
C-STAR, ODE	FT/SEC	5711.250
ISP, ODE, TEST	SEC	338.250

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 3A
TEST DESCRIPTION
LOW-PRESSURE PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE. AUTOMATIC LOW-FLOW SHUTDOWN ON FIRST ATTEMPT AT PCNS = 98., O/F = 1.65. INCREASED TANK PRESSURES 10 PSI AND RECYCLED.

ACTUAL TEST DURATION 40.196 SEC
DATA SLICE TIME 30.000 SEC TO 32.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	175.407
OXIDIZER TANK PRESSURE	PSIA	179.729
FUEL INTERFACE PRESSURE	PSIA	155.250
OXIDIZER INTERFACE PRESSURE	PSIA	147.732
T/C COOLANT INLET MAN. PRESSURE	PSIA	153.626
FUEL INJECTOR PRESSURE	PSIA	144.787
OXIDIZER INJECTOR PRESSURE	PSIA	144.140
CHAMBER PRESSURE NO. 1	PSIA	105.107
CHAMBER PRESSURE NO. 2	PSIA	105.237
AXIAL THRUST, SYSTEM A	LBF	4806.984
AXIAL THRUST, SYSTEM B	LBF	4819.194
Y-AXIS THRUST	LBF	-9.111
Z-AXIS THRUST	LBF	21.968
AVERAGE CELL PRESSURE	PSIA	.022
CELL PRESSURE AGREEMENT	%	.001
AVERAGE FUEL FLOWRATE	GPM	48.714
FUEL FM AGREEMENT	%	.182
AVERAGE OXIDIZER FLOWRATE	GPM	49.257
OXIDIZER FM AGREEMENT	%	.134
FUEL INTERFACE TEMPERATURE	DEG F	65.665
OXIDIZER INTERFACE TEMPERATURE	DEG F	71.058
T/C COOLANT IN TEMPERATURE	DEG F	67.897
T/C COOLANT OUT TEMPERATURE	DEG F	217.898
T/C SURFACE TEMP -16 IN	DEG F	218.649
T/C SURFACE TEMP -13 IN	DEG F	210.297
T/C SURFACE TEMP -10 IN	DEG F	226.154
T/C SURFACE TEMP - 8 IN	DEG F	170.985
T/C SURFACE TEMP - 6 IN	DEG F	190.900
T/C SURFACE TEMP - 4 IN	DEG F	209.771
T/C SURFACE TEMP - 2 IN	DEG F	151.783
T/C SURFACE TEMP -0.3 IN	DEG F	154.449
T/C SURFACE TEMP + 3 IN	DEG F	136.310
T/C NOZZLE FLANGE TEMP	DEG F	89.579
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	736.693
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1066.792
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1257.352
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1221.073
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1098.906
NOZZLE SURFACE TEMP +28.4 IN	DEG F	987.389
NOZZLE SURFACE TEMP +40.4 IN	DEG F	831.419
NOZZLE SURFACE TEMP +57.5 IN	DEG F	707.558

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 3A

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	105.172
PC, NOZZLE STAGNATION	PSIA	99.913
AXIAL THRUST, SITE	LBF	4813.089
AXIAL THRUST, VACUUM	LBF	4856.473
NOZZLE EXIT PRESSURE	PSIA	.025
FUEL DENSITY (MMH)	LB/FT3	54.740
OXIDIZER DENSITY	LB/FT3	90.267
FUEL FLOWRATE	LB/SEC	5.941
OXIDIZER FLOWRATE	LB/SEC	9.906
TOTAL PROPELLANT FLOWRATE	LB/SEC	15.848
MIXTURE RATIO (OVERALL)	O/F	1.667
BLC FLOWRATE	LB/SEC	.445
BLC TOTAL PERCENT	%	2.808
CORE MIXTURE RATIO	O/F	1.802
FUEL INJECTOR DELTA-P	PSID	39.615
OXIDIZER INJECTOR DELTA-P	PSID	38.968
T/C COOLANT DELTA-P	PSID	8.839
T/C COOLANT DELTA-T	DEG F	150.001
THRUST CHAMBER HEAT FLUX	BTU/SEC	637.200
C-STAR, SITE	FT/SEC	5381.334
C-STAR, UMR	FT/SEC	5440.233
C-STAR EFFICIENCY	%	94.222
CF, SITE	-----	1.816
CF SITE VACUUM	-----	1.832
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	101.982
CF, VAC 72	-----	1.820
ISP, TEST	SEC	303.712
ISP, SITE VACUUM	SEC	306.450
ISP, VAC 72 PREDICTED	SEC	306.474
ISP, ODK, TEST CONDITIONS	SEC	332.228
ISP, TDK, TEST CONDITIONS	SEC	326.867
ISP EFFICIENCY	%	90.562
ENERGY RELEASE EFFICIENCY	%	96.205
C-STAR, ODE	FT/SEC	5711.348
ISP, ODE, TEST	SEC	338.387

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 3A
TEST DESCRIPTION
LOW-PRESSURE PERFORMANCE EVALUATION OF ROCKETDYNE INTEGRATED ENGINE. AUTOMATIC LOW-FLOW SHUTDOWN ON FIRST ATTEMPT AT PCNS = 98., O/F = 1.65. INCREASED TANK PRESSURES 10 PSI AND RECYCLED.

ACTUAL TEST DURATION 40.196 SEC
DATA SLICE TIME 38.000 SEC TO 40.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	174.491
OXIDIZER TANK PRESSURE	PSIA	179.254
FUEL INTERFACE PRESSURE	PSIA	154.826
OXIDIZER INTERFACE PRESSURE	PSIA	147.308
T/C COOLANT INLET MAN. PRESSURE	PSIA	153.626
FUEL INJECTOR PRESSURE	PSIA	144.028
OXIDIZER INJECTOR PRESSURE	PSIA	143.370
CHAMBER PRESSURE NO. 1	PSIA	104.625
CHAMBER PRESSURE NO. 2	PSIA	104.734
AXIAL THRUST, SYSTEM A	LBF	4794.259
AXIAL THRUST, SYSTEM B	LBF	4803.299
Y-AXIS THRUST	LBF	-9.617
Z-AXIS THRUST	LBF	21.969
AVERAGE CELL PRESSURE	PSIA	.021
CELL PRESSURE AGREEMENT	%	.011
AVERAGE FUEL FLOWRATE	GPM	48.604
FUEL FM AGREEMENT	%	.179
AVERAGE OXIDIZER FLOWRATE	GPM	49.147
OXIDIZER FM AGREEMENT	%	.136
FUEL INTERFACE TEMPERATURE	DEG F	65.835
OXIDIZER INTERFACE TEMPERATURE	DEG F	71.398
T/C COOLANT IN TEMPERATURE	DEG F	67.856
T/C COOLANT OUT TEMPERATURE	DEG F	218.917
T/C SURFACE TEMP -16 IN	DEG F	220.111
T/C SURFACE TEMP -13 IN	DEG F	210.765
T/C SURFACE TEMP -10 IN	DEG F	226.623
T/C SURFACE TEMP - 8 IN	DEG F	171.217
T/C SURFACE TEMP - 6 IN	DEG F	191.384
T/C SURFACE TEMP - 4 IN	DEG F	209.892
T/C SURFACE TEMP - 2 IN	DEG F	151.904
T/C SURFACE TEMP -0.3 IN	DEG F	154.811
T/C SURFACE TEMP + 3 IN	DEG F	136.552
T/C NOZZLE FLANGE TEMP	DEG F	90.604
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	803.581
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	1148.857
NOZZLE SURFACE TEMP + 9.9 IN	DEG F	1336.078
NOZZLE SURFACE TEMP +11.7 IN	DEG F	1317.664
NOZZLE SURFACE TEMP +16.2 IN	DEG F	1183.572
NOZZLE SURFACE TEMP +28.4 IN	DEG F	1015.944
NOZZLE SURFACE TEMP +40.4 IN	DEG F	898.296
NOZZLE SURFACE TEMP +57.5 IN	DEG F	815.346

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RO/ICT-1 SEQUENCE 5 TEST 3A

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
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PC, INJECTOR END	PSIA	104.600
PC, NOZZLE STAGNATION	PSIA	99.446
AXIAL THRUST, SITE	LBF	4798.779
AXIAL THRUST, VACUUM	LBF	4840.228
NOZZLE EXIT PRESSURE	PSIA	.024
FUEL DENSITY (MMH)	LB/FT3	54.734
OXIDIZER DENSITY	LB/FT3	90.246
FUEL FLOWRATE	LB/SEC	5.927
OXIDIZER FLOWRATE	LB/SEC	9.882
TOTAL PROPELLANT FLOWRATE	LB/SEC	15.809
MIXTURE RATIO (OVERALL)	O/F	1.667
BLC FLOWRATE	LB/SEC	.444
BLC TOTAL PERCENT	%	2.808
CORE MIXTURE RATIO	O/F	1.802
FUEL INJECTOR DELTA-P	PSID	39.369
OXIDIZER INJECTOR DELTA-P	PSID	39.690
T/C COOLANT DELTA-P	PSID	9.597
T/C COOLANT DELTA-T	DEG F	151.061
THRUST CHAMBER HEAT FLUX	BTU/SEC	640.196
C-STAR, SITE	FT/SEC	5369.124
C-STAR, UNR	FT/SEC	5427.999
C-STAR EFFICIENCY	%	96.008
CF, SITE	-----	1.819
CF SITE VACUUM	-----	1.835
CF, VAC 72 EXPECT	-----	1.797
CF CORRELATION	-----	102.120
CF, VAC 72	-----	1.823
ISP, TEST	SEC	304.543
ISP, SITE VACUUM	SEC	306.165
ISP, VAC 72 PREDICTED	SEC	306.195
ISP, ODK, TEST CONDITIONS	SEC	322.211
ISP, TDK, TEST CONDITIONS	SEC	326.821
ISP EFFICIENCY	%	94.479
ENERGY RELEASE EFFICIENCY	%	96.120
C-STAR, ODE	FT/SEC	5711.944
ISP, ODE, TEST	SEC	339.302

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 4

TEST DESCRIPTION
FINAL FIRING OF ROCKETDYNE INTEGRATED REGEN CHAMBER ENGINE
USING LIKE DOUBLET INJECTOR S/N1, 75 TO 1 NOZZLE,
UNSATURATED MMH/NTO. TARGET PCNS = 125., O/F = 1.65.

ACTUAL TEST DURATION 10.174 SEC
DATA SLICE TIME 9.000 SEC TO 10.000 SEC

PARAMETER	UNITS	AVG. MEASURED VALUE
FUEL TANK PRESSURE	PSIA	237.439
OXIDIZER TANK PRESSURE	PSIA	245.239
FUEL INTERFACE PRESSURE	PSIA	207.415
OXIDIZER INTERFACE PRESSURE	PSIA	196.474
T/C COOLANT INLET MAN. PRESSURE	PSIA	201.311
FUEL INJECTOR PRESSURE	PSIA	194.401
OXIDIZER INJECTOR PRESSURE	PSIA	190.361
CHAMBER PRESSURE NO. 1	PSIA	132.079
CHAMBER PRESSURE NO. 2	PSIA	131.875
AXIAL THRUST, SYSTEM A	LBF	5965.011
AXIAL THRUST, SYSTEM B	LBF	5976.307
Y-AXIS THRUST	LBF	-4.049
Z-AXIS THRUST	LBF	27.529
AVERAGE CELL PRESSURE	PSIA	.036
CELL PRESSURE AGREEMENT	%	.009
AVERAGE FUEL FLOWRATE	GPM	60.186
FUEL FM AGREEMENT	%	.166
AVERAGE OXIDIZER FLOWRATE	GPM	60.724
OXIDIZER FM AGREEMENT	%	.030
FUEL INTERFACE TEMPERATURE	DEG F	65.920
OXIDIZER INTERFACE TEMPERATURE	DEG F	71.390
T/C COOLANT IN TEMPERATURE	DEG F	69.557
T/C COOLANT OUT TEMPERATURE	DEG F	211.494
T/C SURFACE TEMP -14 IN	DEG F	212.182
T/C SURFACE TEMP -12 IN	DEG F	203.436
T/C SURFACE TEMP -10 IN	DEG F	217.209
T/C SURFACE TEMP - 8 IN	DEG F	145.081
T/C SURFACE TEMP - 6 IN	DEG F	183.859
T/C SURFACE TEMP - 4 IN	DEG F	203.926
T/C SURFACE TEMP - 2 IN	DEG F	107.449
T/C SURFACE TEMP -0.3 IN	DEG F	140.973
T/C SURFACE TEMP + 3 IN	DEG F	132.490
T/C NOZZLE FLANGE TEMP	DEG F	102.079
NOZZLE SURFACE TEMP + 7.2 IN	DEG F	539.172
NOZZLE SURFACE TEMP + 7.8 IN	DEG F	824.593
NOZZLE SURFACE TEMP + 9.8 IN	DEG F	932.973
NOZZLE SURFACE TEMP +11.7 IN	DEG F	863.156
NOZZLE SURFACE TEMP +16.8 IN	DEG F	848.008
NOZZLE SURFACE TEMP +23.4 IN	DEG F	774.934
NOZZLE SURFACE TEMP +40.4 IN	DEG F	731.557
NOZZLE SURFACE TEMP +57.0 IN	DEG F	666.510

6K OMS ENGINE TECHNOLOGY
SUPPORT PROGRAM - TASK XII
ROCKETDYNE INTEGRATED CHAMBER

DATE 21 NOV 3
SERIES RD/ICT-1 SEQUENCE 5 TEST 4

PERFORMANCE DATA

PARAMETER	UNITS	CALCULATED VALUE
PC, INJECTOR END	PSIA	131.675
PC, NOZZLE STAGNATION	PSIA	125.376
AXIAL THRUST, SITE	LBF	5970.659
AXIAL THRUST, VACUUM	LBF	6043.843
NOZZLE EXIT PRESSURE	PSIA	.039
FUEL DENSITY (MMH)	LB/FT3	54.734
OXIDIZER DENSITY	LB/FT3	90.274
FUEL FLOWRATE	LB/SEC	7.340
OXIDIZER FLOWRATE	LB/SEC	12.214
TOTAL PROPELLANT FLOWRATE	LB/SEC	19.554
MIXTURE RATIO (OVERALL)	O/F	1.664
BLC FLOWRATE	LB/SEC	.590
BLC TOTAL PERCENT	%	2.811
CORE MIXTURE RATIO	O/F	1.799
FUEL INJECTOR DELTA-P	PSID	62.486
OXIDIZER INJECTOR DELTA-P	PSID	58.386
T/C COOLANT DELTA-P	PSID	6.850
T/C COOLANT DELTA-T	DEG F	142.839
THRUST CHAMBER HEAT FLUX	BTU/SEC	749.614
C-STAR, SITE	FT/SEC	5472.797
C-STAR, UMR	FT/SEC	5531.197
C-STAR EFFICIENCY	%	95.824
CF, SITE	-----	1.795
CF SITE VACUUM	-----	1.817
CF, VAC 72 EXPECT	-----	1.796
CF CORRELATION	-----	101.161
CF, VAC 72	-----	1.805
ISP, TEST	SEC	305.343
ISP, SITE VACUUM	SEC	309.086
ISP, VAC 72 PREDICTED	SEC	309.060
ISP, ODK, TEST CONDITIONS	SEC	332.891
ISP, TDK, TEST CONDITIONS	SEC	327.540
ISP EFFICIENCY	%	91.306
ENERGY RELEASE EFFICIENCY	%	96.349
C-STAR, ODE	FT/SEC	5711.282
ISP, ODE, TEST	SEC	338.295