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DATE 11 Sept 1959

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CONVAIR DIVISION OF GENERAL DYNAMICS CORPORATION

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WS-107A-1
INSTRUMENTATION CONFIGURATION
SERIES D ARTICLE 24
SYCAMORE TEST STAND S-2
ADDENDUM TO AZB-27-008

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Instrumentation Configuration Report



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			S 1149 V, S 1252 D, S 1253 D, S 1254 D,	
			S 1255 D, U 1080 P, U 1081 P, U 1174 T,	
			U 1134 X, U 1148 X, U 1149 X, U 1150 X,	
			U 1151 X, U 1152 X, U 1153 X, U 1160 X,	
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FORWORD

This report presents tabulations of the functions to be measured via direct line instrumentation for the series "D" Captive Test Missile D-24, ~~Sycamore Test Stand 5-2~~. The tabulations are to be used by Instrumentation Design, Operations, and Data Reduction Groups to determine instrumentation, data handling, and data reduction requirements. *CR*

The measurements contained in this report comprise Convair Astronautics and Associated Contractor data requirements as evaluated on 11 September, 1959. Information contained in this report reflects current planning. Measurements have been modified, added, or deleted as dictated by current planning, philosophy and missile configuration. Measurement characteristics have been examined and readjusted where necessary, by the original requesting groups. Further measurement modification will either originate in the Test Planning Group or be submitted as a recommendation to this group. (A)

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SUMMARY

The instrumentation program is shown in three sections in this report, the first being a Master Instrumentation Log showing the latest available characteristics of individual measurements. Also included in this tabulation is an FM channelization for all those measurements to be recorded on FM as indicated in the recorder assignment presented in the second section.

The second section indicates the recorder assignment for each measurement for each test block, and lists the code of the test objectives supported by those measurements along with the priorities of the measurements in regard to the various objectives.

The third section contains a grouping of measurements by test objective. The objective header at the top of each grouping and the objective code to the right of each measurement description are utilized to identify the grouping with the test objectives. Detailed descriptions of the test objectives can be found in report AZB-27-008.

Table I summarizes the test objectives to be accomplished on the missile. Tables II and III contain a count of the direct line measurements required for evaluation of missile systems and test operation.

For ease of data reduction and clarity of communication, it has been desirable to standardize pen number assignments for the bulk of the sequence recorder measurements during "D" series captive testing. The standardized pen list is included in this report as Appendix A and measurements included in this list do not appear in the other tabulation sections.

To more explicitly define information in the tabulations, an IBM Code Key is added as Appendix B.

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TABLE I
SUMMARY OF TEST OBJECTIVES

<u>DESCRIPTION</u>	<u>CODE</u>
<u>STRUCTURE</u>	
Strain	
Demonstrate Structural Integrity of the Booster Thrust Structure	AD10
Demonstrate Tanks Structural Integrity	AD11
Demonstrate Structural Integrity of the Propellant Feed System	PD26
<u>PROPULSION</u>	
Control Pressure	
Determine Pressurization Regulators Performance Characteristics	FD38
Propellant Feed	
Determine Vernier Feed System Characteristics	PD23
Determine Hydraulic Characteristics of Vernier Start and Feed System	PD33
General Operation	
Determine Characteristics and Transients in the Start System	ZD14
Obtain Data on Booster Engine Operating Parameters	PD15
Obtain Data on Vernier Engine Operating Parameters	PD19
Demonstrate Compatibility Between Propulsion System and the Test Facility	PD28
Determine Sustainer Engine Performance Characteristics with Acoustic PU Control	PD37
Thrust	
Determine Thrust Rise Characteristics	PD39
Propellant Utilization	
Determine Capability of Acoustic PU During Closed Loop Operation	UD18
Determine Capability of Convaire PU During Closed Loop Operation	UD36

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SECTION 1-3

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TABLE I (Cont)

<u>DESCRIPTION</u>	<u>CODE</u>
<u>PROPULSION (Cont)</u>	
Propellant Utilization (Cont)	
Obtain Data Performance of Acoustica PU During Open Loop Operation	UD24
Demonstrate LO ₂ Tanking Procedures	WD01
Determine Accuracy of the Convair Propellant Loading Control System	WD02
Determine Accuracy of the Acoustica Propellant Loading System	WD05
<u>CONTROL SYSTEM</u>	
Autopilot	
Determine Booster Threshold Response	SD10
Determine Sustainer Threshold Response	SD11
Determine Booster Servo Loop Gain and Linearity	SD12
Determine Sustainer Servo Loop Gain and Linearity	SD13
Determine Booster Servo Loop Frequency Response	SD14
Determine Sustainer Servo Loop Frequency Response	SD15
<u>MISCELLANEOUS SYSTEMS</u>	
Tank Pressurization	
Demonstrate Airborne Pneumatics System Performance Adequacy	FD34
Hydraulic System	
Demonstrate Booster Performance During Peak Conditions and Staging	HD22
Demonstrate Sustainer-Vernier Performance During Peak Conditions	HD23
Demonstrate Satisfactory Hydraulic Power Switchover	HD26
Demonstrate Vernier Hydraulic Adequacy With Program Gimbaling	HD33

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TABLE I (Cont)

<u>DESCRIPTION</u>	<u>CODE</u>
<u>MISCELLANEOUS SYSTEMS (Cont)</u>	
Power Supply	
Determine Performance of the Missile Electrical System	ED15
General	
Demonstrate GSE and Operating Procedures Adequacy and Compatibility	LD11
Obtain Data to Determine Effect of Firing Environment on Load Cell Accuracy	LD13
Obtain Data for Evaluation of Take and Restraints	LD15
Establish Missile Handling, Mating and Demating Procedures	MD12
Demonstrate Flight Countdown Procedures Adequacy	MD13
Demonstrate Missile Systems and Test Facilities Compatibility	ND10
Obtain Data on Missile Systems and Associated GSE for Reliability Analysis	OD10

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TABLE I
 PROBLEM AREA DESIGNATIONS
 (Missile Systems)

<u>Missile System Instrumentation</u>		<u>Number of Measurements</u>
<u>STRUCTURE</u>	10000	
Vibration, High Frequency	13000	2
<u>PROPULSION</u>	20000	
Control Pressure	21000	4
Propellant Feed	22000	9
Propellant Flow	23000	18
General Operation	24000	22
Thrust	25000	5
Propellant Utilization	26000	<u>21</u>
	Propulsion Total	79
<u>CONTROL SYSTEM</u>	30000	
Autopilot	31000	
Control Loop	31100	17
<u>GENERAL MISSILE INSTRUMENTATION</u>	40000	
Tank Pressurization	41000	8
Hydraulic System	42000	10
Power Supply	43000	<u>5</u>
	General Total	23
<u>SEQUENCE MEASUREMENTS</u>		<u>15</u>
	GRAND TOTAL	136

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TABLE II
PROBLEM AREA DESIGNATIONS
(Test Operations)

<u>Missile System Instrumentation</u>		<u>Number of Measurements</u>
<u>PROPULSION SYSTEM</u>	70000	
Sequencing, Start	72000	4
Cutoff	73000	7
<u>CONTROL SYSTEM</u>	80000	
Test Signals	81000	1
<u>GENERAL INSTRUMENTATION</u>	90000	
General Data	95000	11
<u>SEQUENCE MEASUREMENTS</u>		<u>52</u>
	GRAND TOTAL	75

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SECTION 2-1

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DISCUSSION OF MISSILE PROBLEM AREAS

Missile D-24, the third captive test missile to be tested, will be delivered to the Sycamore Canyon Facility S-2. The captive test program for Missile D-24 will extend over a period of three months, beginning in August 1959. The purpose of these tests is to evaluate D series design changes and to provide data in support of D series flight missiles. Details of the D-24 test program are outlined in Report AZB-27-008.

The instrumentation configuration of this missile has been established as a result of a detailed analysis of missile problem areas. A general breakdown of missile systems and test operations problem areas are contained in Table II and III. In the analysis of problem areas, consideration was given to the relative status of system development, previous performance records, applicability of data which might be obtained from captive testing, instrumentation and test schedules. Details of the various problem areas and associated instrumentation are summarized in the following paragraphs.

A. Structural

Information will be gathered on the acoustical environment of the B1 Pod, in preparation for the mounting of the AIG package in this area. The unit selected for use in making this measurement is an Altec-Lansing Model 6700 Sound System.

The system is shock-mounted internally to isolate it from mechanical vibrations of up to 8G over a frequency range of 0 to 2KC. A "Free Field" calibration will be furnished by the vendor. Prior to each hot firing, a one point calibration at 140DB will be accomplished by using an input simulator which will be furnished. The information will be recorded on a wide band FM system using a 54KC oscillator deviated $\pm 40\%$. Data analysis will be accomplished by Convair (San Diego).

B. Propulsion

Propulsion system analysis can be conveniently divided into the problem areas of control pressures, propellant feed, propellant flow, thrust, and propellant utilization. Overall propulsion system performance, reliability, and compatibility with other facility and missile systems are the prime test criteria.

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1. Controls Pressure

The controls helium bottle supplies pressure directly to the booster controls manifold, the start and vernier pressurization manifold, and the sustainer gas generator reference regulator. The discharge pressure of the pneumatic regulator incorporated in each manifold is monitored as these regulators are the most sensitive and crucial elements in the system. Similarly, each reference regulator discharge pressure is measured since these regulators control the LO₂ regulators which adjust the LO₂ flow to the gas generators. The LO₂ and fuel start tank ullage pressure measurements reveal if start requirements are satisfied and repressurization of the tanks is accomplished prior to vernier engine solo operation. Finally the gas pressure in the controls helium bottle is monitored to ascertain if there is sufficient supply pressure.

All sustainer engine and gas generator control valves are hydraulically actuated by pressure derived from the sustainer hydraulic system. The hydraulic system pressure is measured as are the positions of the sustainer main LO₂ and fuel valves for performance information.

Aggregate engine operation and additional instrumentation in the propulsion system will aid in determining if the various control valves are performing properly.

2. Propellant Feed

At engine start the LO₂ and fuel start tanks supply propellants to the gas generators which produce hot gas to drive turbines geared to the LO₂ and fuel turbopumps. When the engines bootstrap the turbopumps feed propellants to the gas generators and refill the start tanks.

The hot gas pressure and temperature measurements indicate start and bootstrap operations adequacy, gas generator mixture ratio and performance levels, and failure analysis possibilities

The vernier engine propellant inlet pressures are monitored for orifice and ducting pressure drop and interface information.

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SECTION 2-3

CONVAIR | ASTRONAUTICS

The turbopump speeds are instrumented as they are the end parameters of this area and are representative of the overall feed operation.

3. Propellant Flow

During main engine operation, LO₂ and fuel from the missile tanks flow through separate turbopumps, which increase propellant pressures, to each thrust chamber.

The turbopump propellant inlet pressures and temperatures are measured to insure that engine interface requirements are satisfied and sufficient liquid pressure is available to prevent pump cavitation. In addition, the sustainer turbopump LO₂ and fuel discharge pressures measurements yield information on pump operation and efficiency and help determine general engine performance.

The sensitive and accurate turbopump speed instrumentation will respond rapidly to varying pump inlet and outlet conditions. Thus these measurements will reflect turbopump cavitation very quickly.

4. Thrust

Thrust calculations and related transient analysis will be made based on chamber pressure data and engine coefficients obtained during acceptance tests.

5. Propellant Utilization

a. Acoustica PU System

Instrumentation in the Acoustica PU Package has been planned to furnish maximum information by obtaining data on key parameters within the system.

The Acoustica sensor signals indirectly trigger multivibrators controlling a gate between an oscillator and a counter. Thus by monitoring the output of both monostable multivibrators (U1135X) information is obtained on discrete propellant levels, magnitude of propellant error signal, and the direction in which the PU valve should be moved (toward open or closed).

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The counter output is converted to an analog voltage. U1112V "Acoustica Counter Otp" thus verifies the transfer function of the error signal from digital to analog form and, when combined with U1113V "Acoustica Vlv Pos Feedback," gives the command signal to the PU valve. Logging of the fuel density bias setting will allow computation of valve position from U1113V.

b. Convair PU System

Two mercury manometers (one manometer measures differential pressure on each tank) act as variable condensers in two legs of the "Convair PU Bridge". The error signal, which is generated by the bridge, is monitored. The data thus gained furnishes information on the residual ratio of the propellants in the tanks and the value of the command signal to the sustainer main fuel valve. The PU valve position measurement also indicates if the PU system is operating properly.

c. Propellant Tanking

The Convair tanking system utilizes a discrete level sensing device for controlling the quantity of fuel placed in the missile. The quantity of LO₂ is controlled by tanking to a null on the PU bridge. Quantity of propellants tanked can be computed based on station levels converted to an equivalent mass. The tolerance in the tanking system will be obtained by comparing this data to corrected load cell data.

The Acoustica system utilizes discrete level sensor in each tank. The load cell data will also furnish information for an evaluation of this system.

C. Control Systems

1. Autopilot

Since the autopilot system has been tested extensively on previous "D" series captive missiles, only the basic input-output measurements will be taken. This instrumentation will include a measurement of the servo

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SECTION 2-5

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test signal, which is utilized in lieu of gyro outputs to gimbal the thrust chambers during captive tests, and measurements of the thrust chamber positions as indicated by the servo system feedback signals.

Although no gyro operation is planned at present, it has proved expeditious in the past to provide gyro instrumentation in preparation for special tests which may be integrated into the program. This instrumentation consists of the displacement gyro outputs.

In addition to the above instrumentation, functional tests of a qualitative nature will be performed through use of the autopilot test console.

2. Radio Guidance System

No emphasis has been placed on captive testing this system on this missile, hence, it will not be installed.

D. General Systems

1. Main Tank Pressurization

During a hot firing of a captive test article the booster tank helium supply bottles are continuously pressurized from the ground supply. The pressure measurement in the booster tank bottles will show that Phase III pressurization requirements are satisfied. Main tank ullage pressures will be monitored for system operating and failure analysis purposes.

An intensive program to test the main tank pressure regulators in a missile environment is scheduled for all D series captive articles. Inlet conditions for both regulators are established by measuring the pressure and temperature of the gas entering the LO₂ tank pressure regulator. The regulator discharge pressures are monitored to verify regulator performance.

2. Hydraulic Systems

There are two independent hydraulic systems on "D" series missiles. One system furnishes hydraulic pressure for booster engine gimbaling prior to staging. The second system furnishes hydraulic pressure for

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sustainer and vernier operation. Since the booster and the sustainer hydraulic systems will have been extensively tested on previous series missiles, instrumentation of system pressure and engine position measurements will establish the capability of these systems to perform satisfactorily.

3. Power Supply

Electrical power to the missile will be supplied from the ground during the shorter runs. For the long runs the battery-inverter combination will provide electrical power. The battery normally used on flight missiles, i.e., the manually activated primary battery, has been replaced with a remotely activated battery. Inasmuch as this will not be a change in electrical power supply operation as far as the missile is concerned, only AC frequency, Phase A voltage, and DC voltage will be instrumented in order to indicate that the missile is receiving proper electrical power.

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SECTION 2-7

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UTILIZATION OF THE FM RECORDING SYSTEM

An FM recording system will be utilized to provide an accurate high response recording medium. Manual reduction of data is being largely supplanted by automatic reduction through an electronic processing station operating from a magnetic tape recording of data.

The FM system accepts as inputs balanced and unbalanced voltages with a deviation range of less than 5 volts. These signals are used to modulate subcarrier frequencies which are then mixed together and recorded on magnetic tape. The following table indicates the subcarriers available and the data response capability.

Channel	Center Frequency CPS	Deviation % of Center Frequency	Frequency Response Flat to 2% CPS
5	1,300	± 7.5	0 - 20
6	1,700	± 7.5	0 - 25
7	2,300	± 7.5	0 - 35
8	3,000	± 7.5	0 - 45
9	3,900	± 7.5	0 - 59
10	5,400	± 7.5	0 - 81
11	7,250	± 7.5	0 - 110
12	10,500	± 7.5	0 - 160
13	14,500	± 7.5	0 - 220
A	22,000	± 15	0 - 660
C	40,000	± 15	0 - 1200
E	70,000	± 15	0 - 2100

These subcarriers are mixed six at a time and each group of six is recorded on one track of a magnetic tape. A specific grouping of six has been set up to avoid the possibility of two frequencies adding together to provide a third frequency that exists within another subcarrier band. For convenience of notation we will call the two sets of 6 subcarriers Track A and Track B. Track A contains subcarriers 5, 7, 8, 11, 12, and C; Track B contains subcarriers, 6, 9, 10, 13, A, and E. In order to avoid possible cross talk between adjacent tracks on the magnetic tape, these two track types are alternately recorded across the tape.

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The FM system has a capability of recording 11 tracks of each track type for a total of 132 measurements. There are two magnetic tape machines each containing a 14 track magnetic tape; eleven tracks of data are recorded on each tape. Track 7 is reserved for timing and speed lock. Voice is recorded on tracks 7 or 14 which are not used for data.

Specific channel assignment has been arrived at by Test Planning based on measurement frequency response requirements and playback capabilities with respect to certain groupings of measurements. High frequency flow meters and tachometer measurements are recorded directly on magnetic tape to avoid overloading to high frequency channels. This is possible since these signals are frequency modulated themselves and may be used as their own subcarriers. The magnetic tape tracks upon which these signals are recorded have no channel 5 or 6 in order to eliminate the possibility of these signals interfering with data on those channels. Hence in the FM channelization listing these signals are shown as being recorded on subcarriers 5 and 6.

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SECTION 2-9

CONVAIR ASTRONAUTICS

UTILIZATION OF THE FM RECORDING SYSTEM

An FM recording system will be utilized to provide an accurate high response recording medium. Manual reduction of data is being largely supplanted by automatic reduction through an electronic processing station operating from a magnetic tape recording of data.

The FM system accepts as inputs balanced and unbalanced voltages with a deviation range of less than 5 volts. These signals are used to modulate subcarrier frequencies which are then mixed together and recorded on magnetic tape. The following table indicates the subcarriers available and the data response capability.

Channel	Center Frequency CPS	Deviation % of Center Frequency	Frequency Response Flat to 2% CPS
5	1,300	± 7.5	0- 20
6	1,700	± 7.5	0- 25
7	2,300	± 7.5	0- 35
8	3,000	± 7.5	0- 45
9	3,900	± 7.5	0- 59
10	5,400	± 7.5	0- 81
11	7,350	± 7.5	0- 110
12	10,500	± 7.5	0- 160
13	14,500	± 7.5	0- 220
A	22,000	±15	0- 660
C	40,000	±15	0-1200
E	70,000	±15	0-2100

These subcarriers are mixed six at a time and each group of six is recorded on one track of a magnetic tape. A specific grouping of six has been set up to avoid the possibility of two frequencies adding together to provide a third frequency that exists within another subcarrier band. For convenience of notation we will call the two sets of 6 subcarriers Track A and Track B. Track A contains subcarriers 5, 7, 8, 11, 12, and C; Track B contains subcarriers, 6, 9, 10, 13, A, and E. In order to avoid possible cross talk between adjacent tracks on the magnetic tape, these two track types are alternately recorded across the tape.

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SECTION 3-1

CONVAIR  ASTRONAUTICS

MISCELLANEOUS REQUIREMENTS

1. Closed Circuit Television

Television monitoring of the D-24 Captive Article will be accomplished with the following components of the KIN TEL 1958 Industrial System:

- A. Two (2) video cameras:
Video Bandwidth -- 8 mc
Horizontal Resolution -- 600 lines
Linearity -- better than $\pm 2\%$
- B. Two (2) ARC-10A Heavy Duty Remote Control Pan and Tilt Units:
Pan Range -- $360^\circ @ 3 \text{ deg/sec}$
Tilt Range -- $\pm 45^\circ @ 3.5 \text{ deg/sec}$
- C. Two (2) ARC-4 Remote Control Turret Lens (1/2", 4", 6") with iris and focus control:
Iris Control Speed -- 5.75 deg/sec
Focus Control Speed -- 0.021 inches/sec
- D. Two (2) ACH-2 Weatherproof Housings
- E. Two (2) 17" Video Monitors
- F. Two (2) Camera Controls with 8"-TV Monitors

The arrangement of this system is covered on sketch titled "BYC-3 CLOSED CIRCUIT TELEVISION."

2. Data Processing and Handling Requirements

Data reduction and analysis will be accomplished in conjunction with Design and Development Personnel. Test results will be compiled and published in the following reports:

- A. X+3 Hour Report; Sycamore responsibility. Contains results of quick look inspection performed at the site.

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- B. **X+24 Hour Report: Sycamore & Test Evaluation responsibility.** Contains quick information on performance levels of the engines and general operation of the systems, as well as noting any malfunctions which may have occurred during the run. Preliminary test results and conclusions are listed.
- C. **X+72 Hour Report: Joint responsibility of Sycamore and Test Evaluation Group.** Contains more detailed analysis of missile performance and operation. Problems which have occurred will be investigated more closely in this report.
- D. **Monthly Report: Test Evaluation Group responsibility.** To be published each month. Summarizes the test results and test objectives accomplished during tests conducted during the previous month.
- E. **Summary Report: Test Evaluation Group responsibility.** To be published during month subsequent to the completion of the D-24 test program. Includes a detailed analysis of special investigations and missile problem areas, as well as summarizing test results.

In addition to the above tabulated report responsibilities, Test Evaluation Group will furnish STL with copies of all raw autopilot data within three days of a hot firing. Prior to seven days after a test is completed, Test Evaluation will furnish STL and Sycamore with reduced data. Design and Development Groups will be furnished with raw data and reduced data as needed.

3. Operation Visual Panel Presentations

The following tabulation of visual meters has been compiled for information purposes in order to provide a more complete picture of the important monitoring devices which will be available to test personnel in their maintenance of blockhouse test control. In order to differentiate these functions from the 1000 series direct line measurements, a 8000 series designation will apply to these visual panel presentations.

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SECTION 3-3

CONVAIR | ASTRONAUTICS

S-2 PANEL METER PRESENTATIONS

MEAS. NO.	DESCRIPTION	MEAS. RANGE	UNITS OF FUNCTION	LOCATION
E5068C	EMERGENCY GENERATOR	0-200	AMP	Facility Power Console
E5066C	MISSILE DC AMPS	0-200	AMP	Missile Power Console
E5005Q	MISSILE INT PHASE A	396-404	CPS	Missile Power Console
E5029Q	MISSILE EXT PHASE A	396-404	CPS	Missile Power Console
E5031Q	PHASE A EXT @ MSL	396-404	CPS	Missile Power Console
E5003V	MISSILE INTERNAL DC	0-40	VDC	Missile Power Console
E5006V	MISSILE INTERNAL AC	110-120	VAC	Missile Power Console
E5022V	MISSILE AC EXT @ MSL	110-120	VAC	Missile Power Console
E5023V	MISSILE EXTERNAL AC	110-120	VAC	Missile Power Console
E5030V	MISSILE DC EXT @ MSL	0-40	VDC	Missile Power Console
E5065V	MISSILE EXTERNAL DC	0-40	VDC	Missile Power Console
E5101V	GROUND DC BUS	0-30	VDC	Engine Test Panel
E5102V	MISSILE DC BUS	0-30	VDC	Engine Test Panel
F5001P	LO ₂ TANK HELIUM	0-30	PIG	Pneumatics Console
F5003P	FUEL TANK HELIUM	0-75	PIG	Pneumatics Console
F5032P	LN ₂ PRESSURE	0-400	PIG	Pneumatics Console
F5053P	NORM SUP PRESSURE	0-4000	PIG	Pneumatics Console
F5054P	EMERG SUP PRESSURE	0-4000	PIG	Pneumatics Console
F5116P	DIFFERENTIAL PRESSURE	0-5	PID	Pneumatics Console
F5246P	BSTR TANK PRESSURE	0-4000	PIG	Pneumatics Console
F5248P	SUST TANK PRESSURE	0-4000	PIG	Pneumatics Console
F5291P	SUST CONTROL PRESSURE	0-4000	PIG	Pneumatics Console
F5247T	BSTR TANK TEMPERATURE	M80-M380	DGF	Pneumatics Console
F5248T	SUST TANK TEMPERATURE	M80-M380	DGF	Pneumatics Console
F5292T	SUST CONTROL TEMPERATURE	M100-200	DGF	Pneumatics Console
L5006D	MISSILE ALIGNMENT	M50-80	MIN. OF ARC	Holddown and Release Safety Console

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S-2 PANEL METER PRESENTATIONS (Cont)

MEAS. NO.	DESCRIPTION	MEAS. RANGE	UNITS OF FUNCTION	LOCATION
P5242B	PUMP LC SPEED	0-100	PCT	LO ₂ Tanking Console
P5251D	LC THROTTLE VALVE	0-Full		LO ₂ Tanking Console
P5373P	LO ₂ STORAGE TANK	0-50	PIG	LO ₂ Tanking Console
U5091V	LO ₂ TANK LEVEL INDICATOR	80-105	PCT	LO ₂ Tanking Console
P5685M	FUEL IN MISSILE	K-100	GAL	Fuel Tanking Console
P5430P	FUEL STORAGE TANK	0-50	PIG	Fuel Tanking Console
Q5007D	THROTTLE POSITION	0-100	PCT	Flame Deflector Console
Q5008P	VERNIER DEFLECTOR	0-25	PIG	Flame Deflector Console
Q5009P	MAIN DEFLECTOR	0-300	PIG	Flame Deflector Console
Q5002R	MAIN DEFLECTOR FLOW	0-35000	GPM	Flame Deflector Console
Q5010P	FIREX PRESSURE	0-300	PIG	Firex Console
S5281C	PANEL POWER SUPPLY	0-400	MA	Autopilot Monitor Control
S5270V	FINE HEATER-PITCH	0-150	VAC	Autopilot Monitor Console
S5271V	FINE HEATER-YAW	0-150	VAC	Autopilot Monitor Console
S5272V	FINE HEATER-ROLL	0-150	VAC	Autopilot Monitor Console
S3280V	PANEL POWER SUPPLY	0-200	VDC	Autopilot Monitor Control
S5282W	DECADE EVENT TIMER	0-99999	SEC	Autopilot Monitor Console
S5176W	PROGRAM RUN TIME	0-999	SEC	Autopilot Control Console

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SECTION 3-5

CONVAIR  ASTRONAUTICS

4. Pneumatic System Validation

Validation of the tank pressure regulators follows rigorous laboratory flight certification procedures. Thus the characteristics of these regulators will already be well known and site checkout and validation will serve simply to confirm this prior knowledge.

The checkout will establish the following points:

- a. Cutoff pressures of the regulators.
- b. Regulator performance (at ambient temperatures) during simulated engine operation and
- c. Regulator response to shutdown.

Measurements required are:

P3301P GROUND LO₂ ULLAGE TANK PRESSURE
P3302P GROUND FUEL ULLAGE TANK PRESSURE

5. Load Cells

The "load cells," which consist of four strain gauge transducer outputs combined into one measurement, sense the weight of the launcher, missile, missile propellants, and any other masses supported by the launcher. On Missile D-24 a "secondary standard" for calibrating these load cells and associated read out equipment will be available. This instrumentation will aid in determining the tolerance in propellant mass when tanking to a constant level.

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CONVAIR-ASTRONAUTICS REPORT NO. AZB-77-002-24

PAGE NO. 4-1

DISCUSSION OF REASONS FOR REVISION "A" CHANGES

The following paragraphs discuss and list the changes in instrumentation for Missile 24-D that have occurred since the original publication of this report.

- I. External electrical measurements have been added since ground power will be used throughout the test. These measurements will provide the same data as those normally picked up internally at the load side of the power changeover switch, but external measurements are more convenient to make on this captive missile:

<u>MEAS. NO.</u>	<u>DESCRIPTION</u>
<u>ADD:</u>	
E1029Q	EXTERNAL AC FREQUENCY
E1065V	MISSILE EXTERNAL DC

- II. Some difficulty has been encountered with hydraulic pressure switches. The following measurements were added to furnish data in this area:

<u>ADD:</u>	
H1197X	GROUND HYD LO PRESS B
H1198X	GROUND HYD HI PRESS B
H1199X	GROUND HYD HI PRESS S&V
H1200X	GROUND HYD LO PRESS S&V

- III. The quantity of propellants placed aboard the missile is a determining factor on missile range. To aid in establishing the tolerance of the Acoustica tanking system the following measurements were added:

<u>ADD:</u>	
N1969X	AA 80% FUEL PROBE
N1970X	AA 86% FUEL PROBE
N1971X	AA 99.5% FUEL PROBE
N1972X	AA 100.2% FUEL PROBE
N1973X	AA LO ₂ RAPID SIG
N1974X	AA LO ₂ BU RAPID SIG
N1975X	AA LO ₂ FINE SIG

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<u>MEAS. NO.</u>	<u>DESCRIPTION</u>
<u>ADD:</u>	
N1976X	AA LO ₂ BU FINE SIG
N1977X	AA LO ₂ TOPG COF SIG
N1978X	AA LO ₂ EMG SIG
P1682P	PRESS DIFF ON LO ₂ TK
P1683P	PRESS DIFF FUEL TANK

- IV. High frequency oscillations, in some cases, have occurred in the propulsion system. The measurements below were added to furnish information in this area:

<u>ADD:</u>	
P14390	SUSTAINER NAA ROUGH COMBUSTION CUT-OFF ACCEL
P14520	B1 NAA ROUGH COMBUSTION CUT-OFF ACCEL
P14630	B2 NAA ROUGH COMBUSTION CUT-OFF ACCEL

- V. In some instances high frequency oscillations have been encountered in the high pressure propellant ducting. The following instrumentation will provide a means to detect and analyze these oscillations as well as yield information toward tracing past malfunctions:

<u>ADD:</u>	
P1691P	B1 LO ₂ INJ MANIFOLD
P1692P	B2 LO ₂ INJ MANIFOLD
P1693P	B1 FUEL INJ MANIFOLD
P1694P	B2 FUEL INJ MANIFOLD
P1695P	S FUEL INJ MANIFOLD

- VI. A corrosion problem had been encountered in the main engine thrust chambers when lithium chloride was used in the thrust chamber coolant tubes prior to the starting of the engines. Three insulated temperature transducers were suitably located on the skin of the purge tubes to determine whether temperatures would cause water to freeze in the tubing. The following measurements will furnish data in this area:

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<u>MEAS. NO.</u>	<u>DESCRIPTION</u>
<u>ADD:</u>	
P1764T	B1 PURGE LN NEAR BULK-HEAD
P1767T	B1 CHAMBER SKIN TEMP
P1768T	B1 PURGE LN @ ENG MAN

VII. Acoustica furnished equipment and wiring to the E-A recorders was installed in order to monitor Acoustica alternate sensor string operation. Measurements in this area include:

<u>ADD:</u>	
U1148X	LO ₂ 2 SNSRS STA 497
U1149X	LO ₂ 2 SNSRS STA 671
U1150X	LO ₂ 2 SNSRS STA 765
U1151X	LO ₂ 2 SNSRS STA 830
U1152X	LO ₂ 2 SNSRS STA 861
U1153X	LO ₂ 2 SNSRS STA 883
U1160X	FUEL 2 SNSRS STA 944
U1161X	FUEL 2 SNSRS STA 1024
U1162X	FUEL 2 SNSRS STA 1083
U1163X	FUEL 2 SNSRS STA 1126
U1164X	FUEL 2 SNSRS STA 1141
U1165X	FUEL 2 SNSRS STA 1156

VIII. The measurement below has been added so that an accurate determination may be made of the Acoustica PU sensor uncovering time by establishing the time between the sensor uncovering and the present measurement (U1135X):

<u>ADD:</u>	
U1134X	AA TIME SEARED OSC OUTPUT

IX. To further evaluate the Convair propellant tanking system the following measurements were added:

P1911X	90% FUEL LVL IND
P1907X	FUEL OVERFILL

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<u>MEAS. NO.</u>	<u>DESCRIPTION</u>
<u>ADD:</u>	
P1988X	LO ₂ 95% LVL EMER COF
P1997X	MISSILE FUELED 95%
P1998X	LO ₂ OVERFILL EMER COF
P1999X	MISSILE FUELED 100%

- X. The residual propellants and the ratio of these propellants are indicative of PU performance. The following two measurements were added to furnish information on residual propellants:

<u>ADD:</u>	
U1080P	LO ₂ TANK HEAD
U1081P	FUEL TANK HEAD

- XI. Additional data is required on gyro noise characteristics. The following instrumentation changes have been made to provide more reliable data:

<u>ADD:</u>	
S1147V	PITCH GYRO AMP OUT
S1148V	YAW GYRO AMP OUT
S1149V	ROLL GYRO AMP OUT

<u>DELETE:</u>	
S1061D	ROLL DISPL GYRO SIG
S1062D	PITCH DISPL GYRO SIG
S1063D	YAW DISPL GYRO SIG

- XII. The following measurements were added to provide information on static and coulomb friction of the engine gimbal block:

<u>ADD:</u>	
H1206P	B1 PITCH ACTR EXTEND
H1207P	B1 PITCH ACTR RETRACT
H1208P	B1 YAW ACTR EXTEND

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MEAS. NO.

DESCRIPTION

ADD:

H1209P
S1252D
S1253D
S1254D
S1255D

B1 YAW ACTR RETRACT
B1 YAW
B2 YAW
B1 PITCH
B2 PITCH

XIII. The following instrumentation was added to verify operating procedures and yield failure analysis information:

ADD:

F1994C
F1246P
F1318T

DC TO BOIL-OFF VALVE MOTOR
BOOSTER TANK HELIUM BOTTLE H1
ST PNEUMATIC REGULATOR IN

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SECTION 5

CONVAIR  ASTRONAUTICS

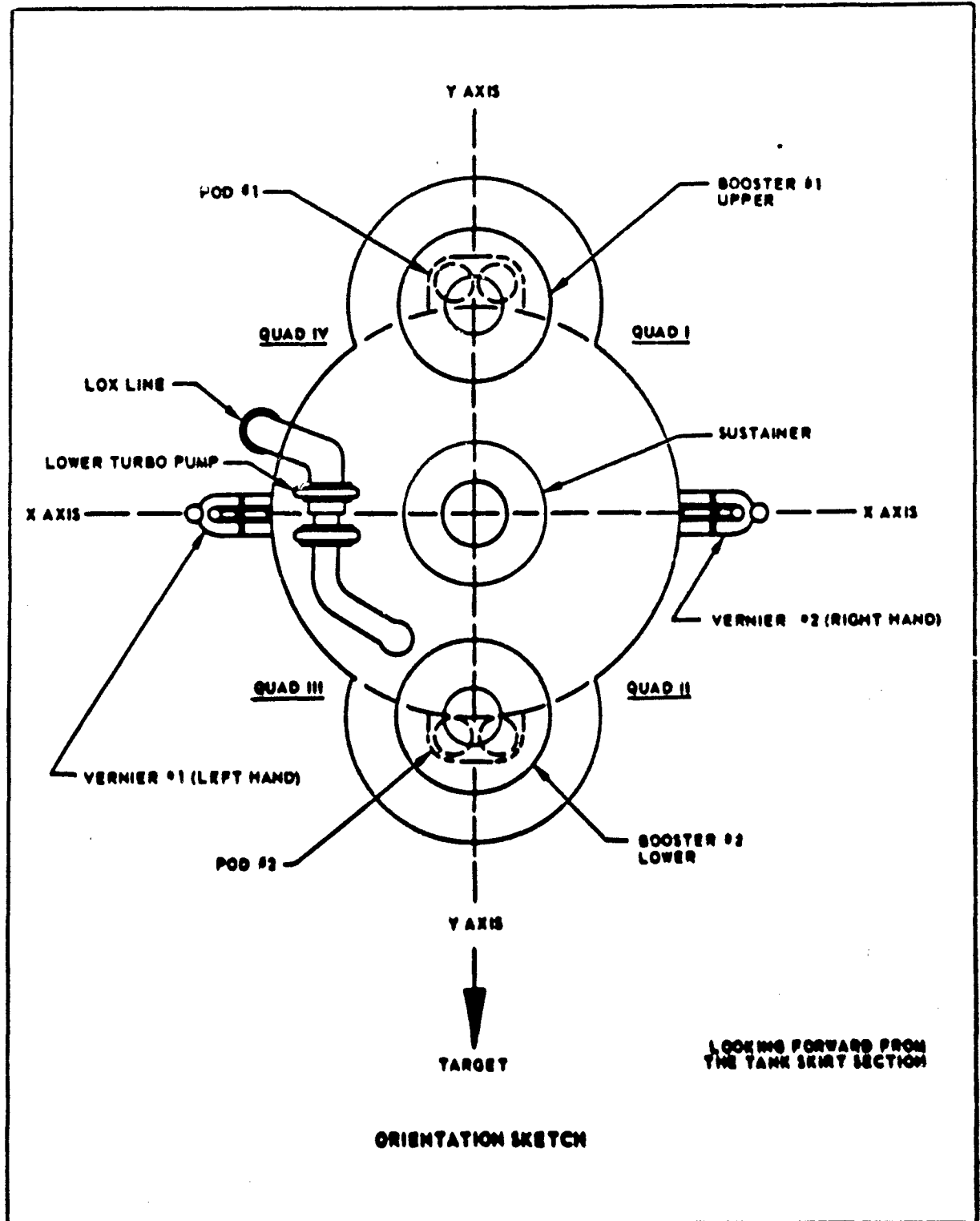
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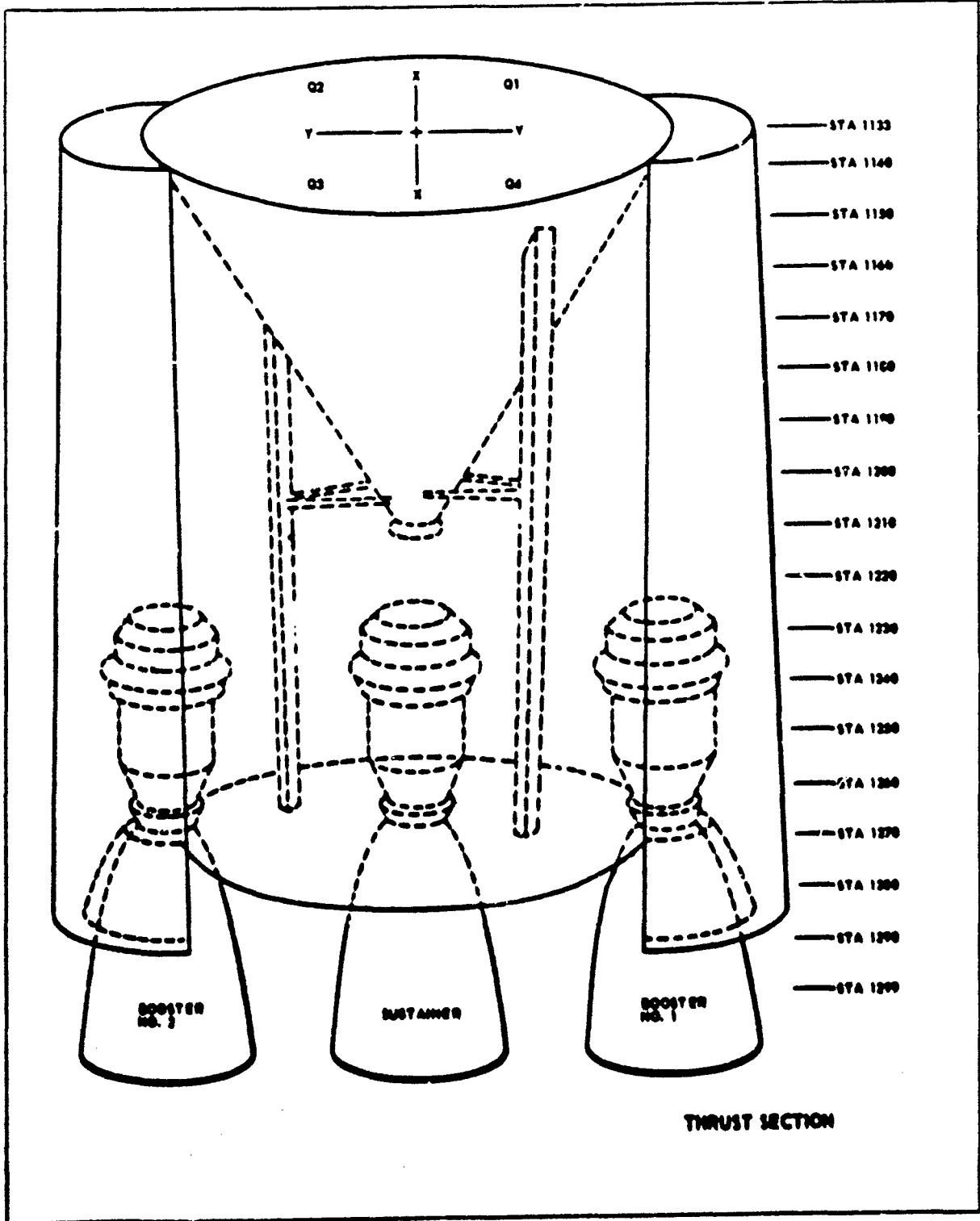
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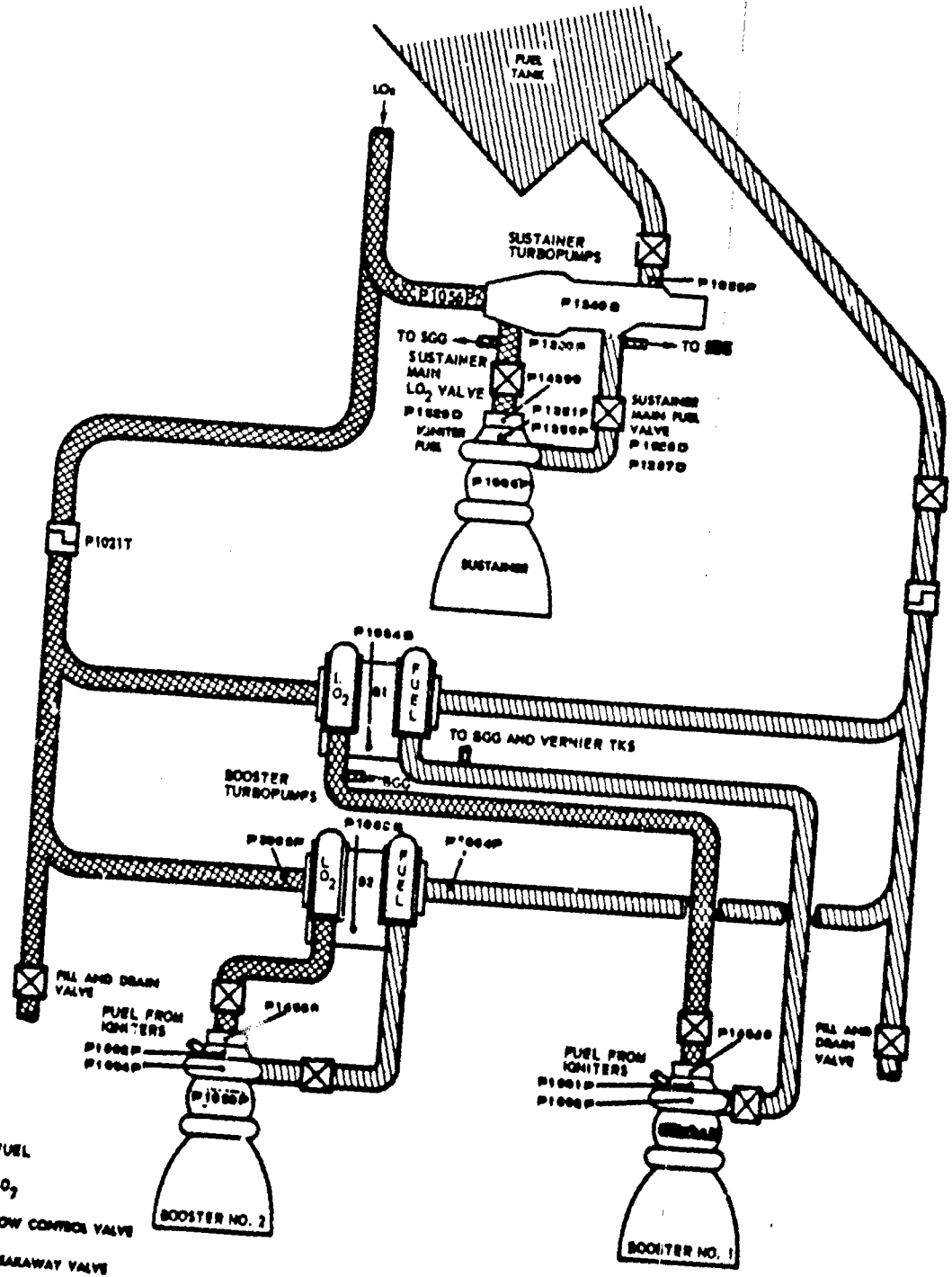
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- FUEL
- LO₂
- FLOW CONTROL VALVE
- BREAKAWAY VALVE

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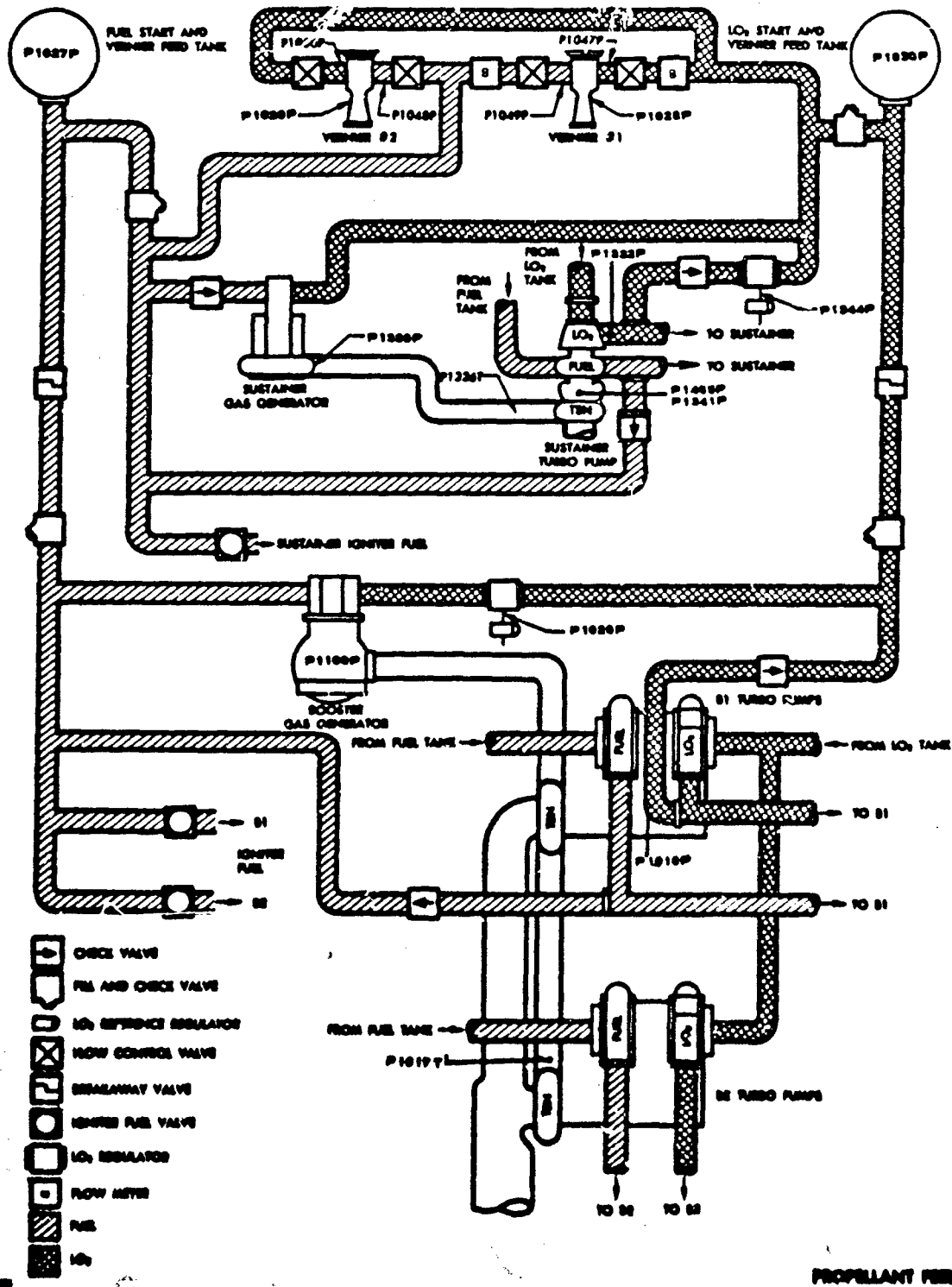
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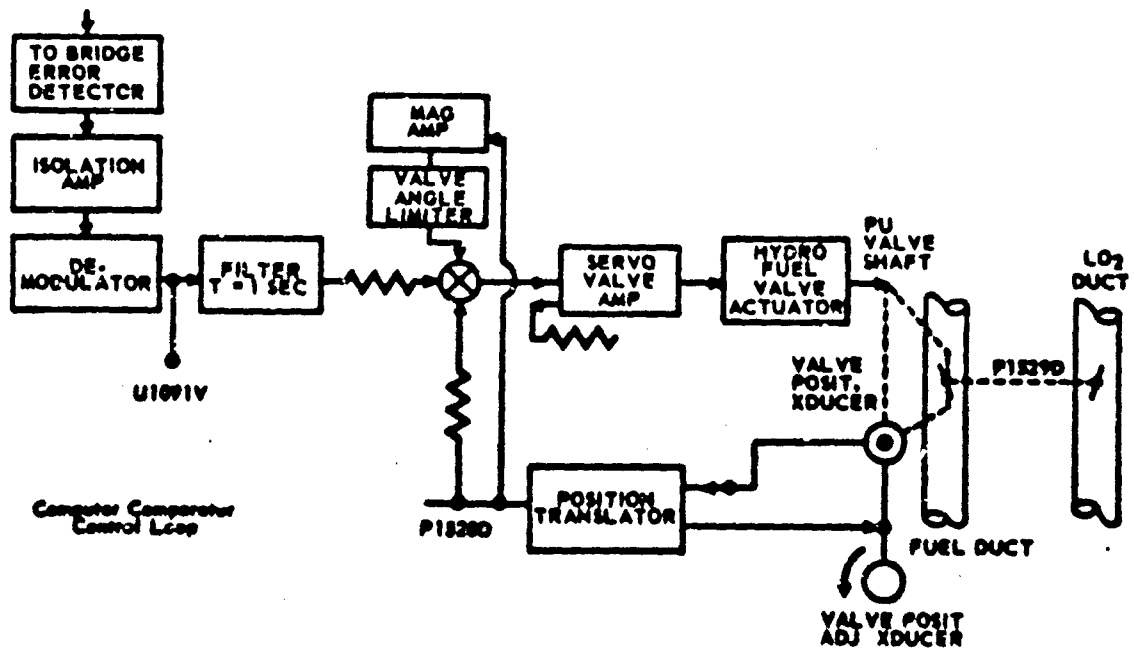
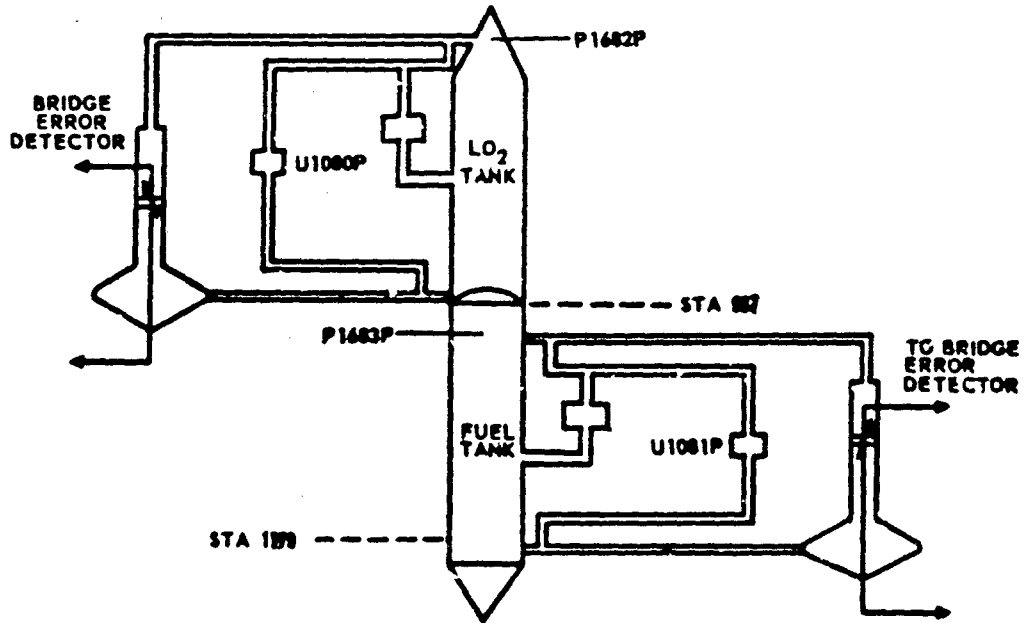
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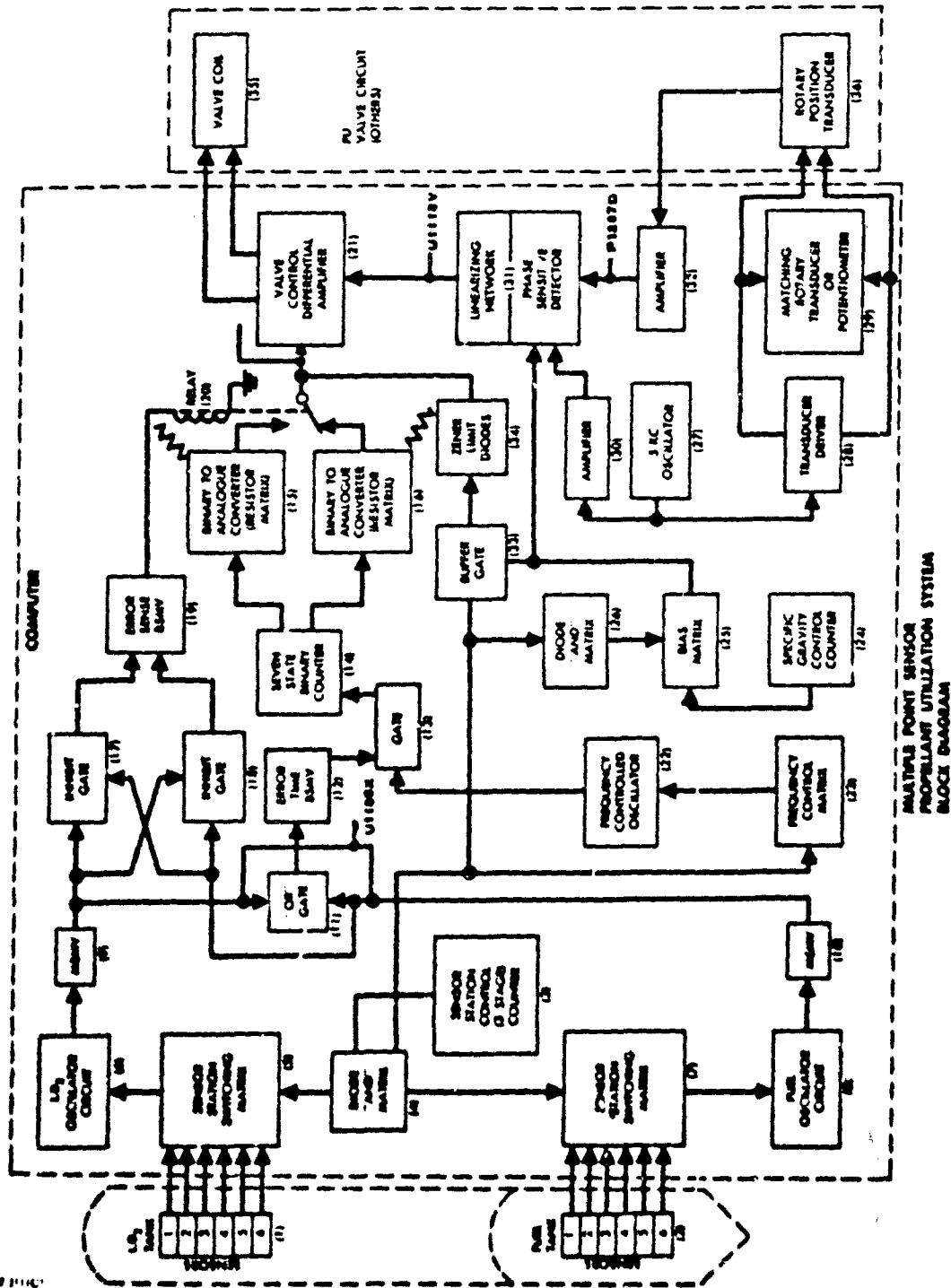
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CONVAIR PROPELLANT UTILIZATION SYSTEM

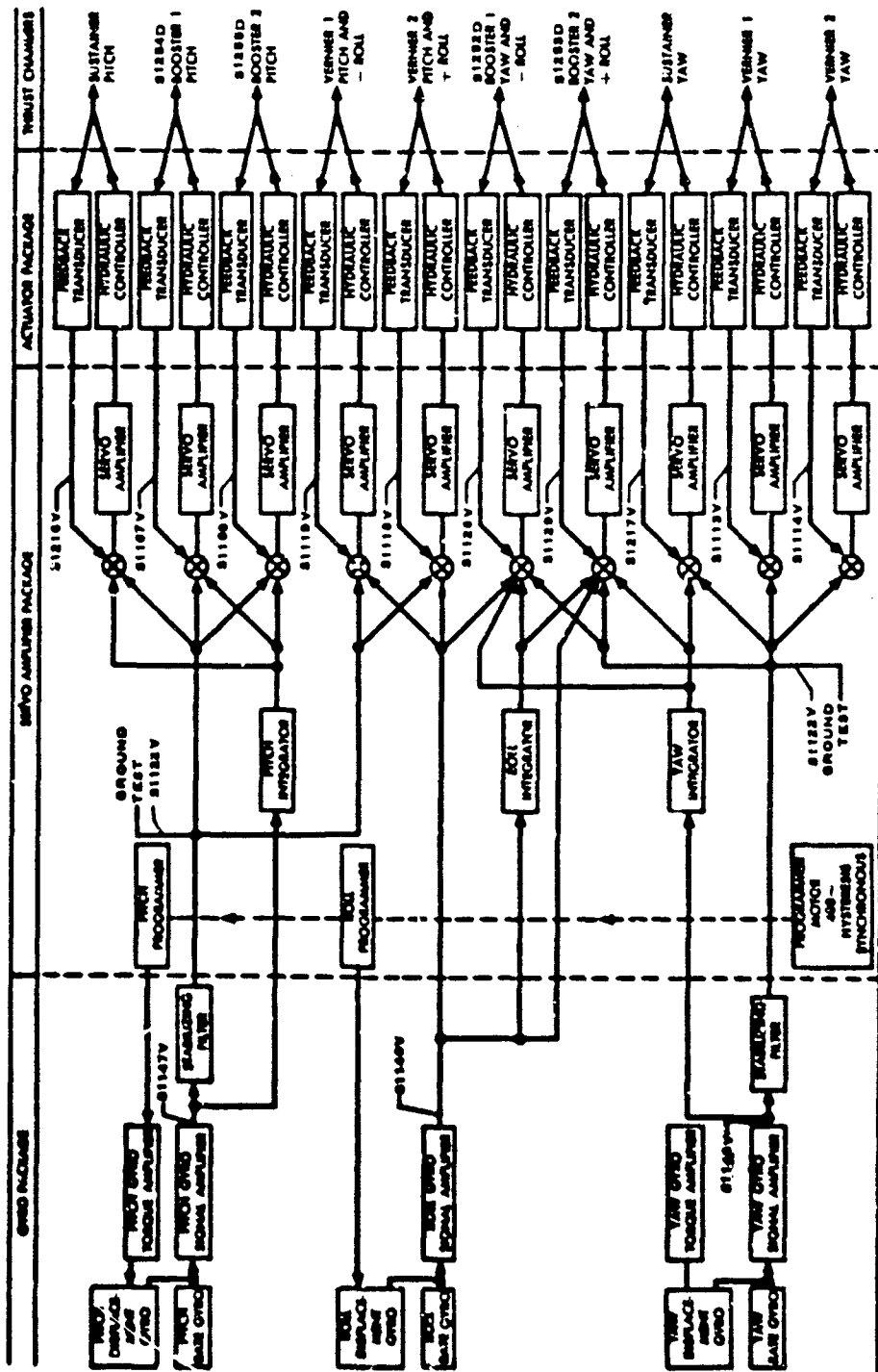
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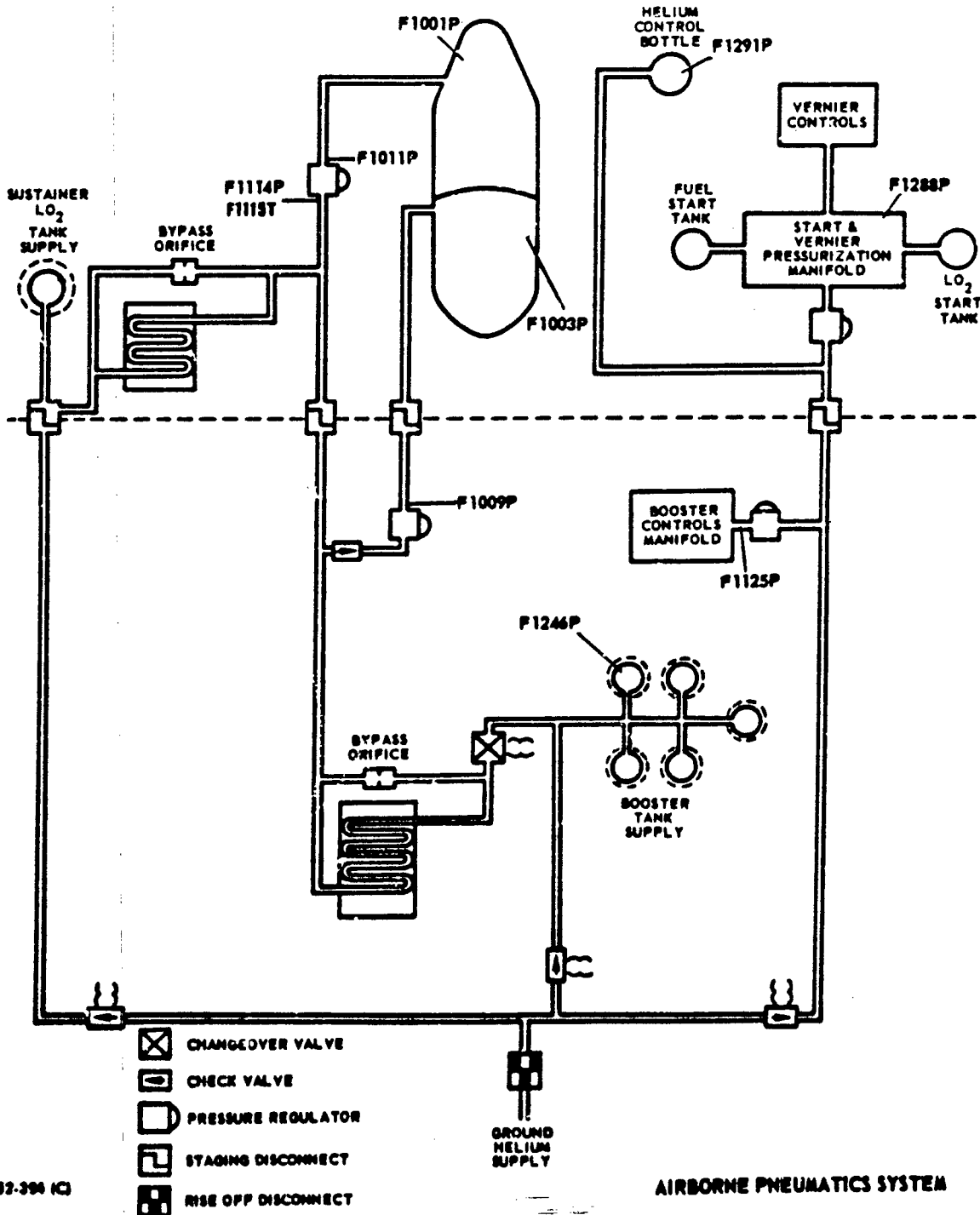
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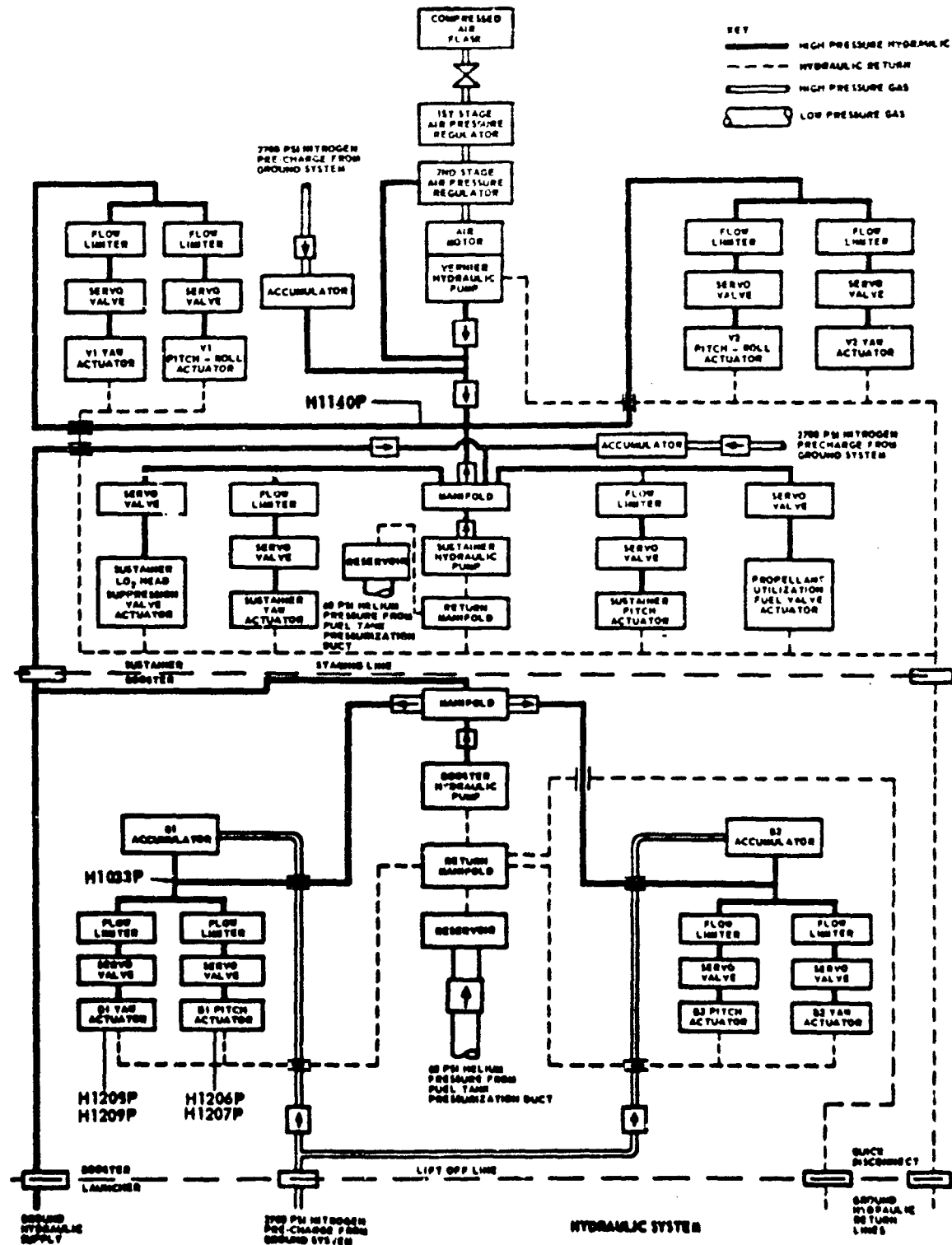
FLUSH CONTROL SYSTEM



32-394 (C)

AIRBORNE PNEUMATICS SYSTEM

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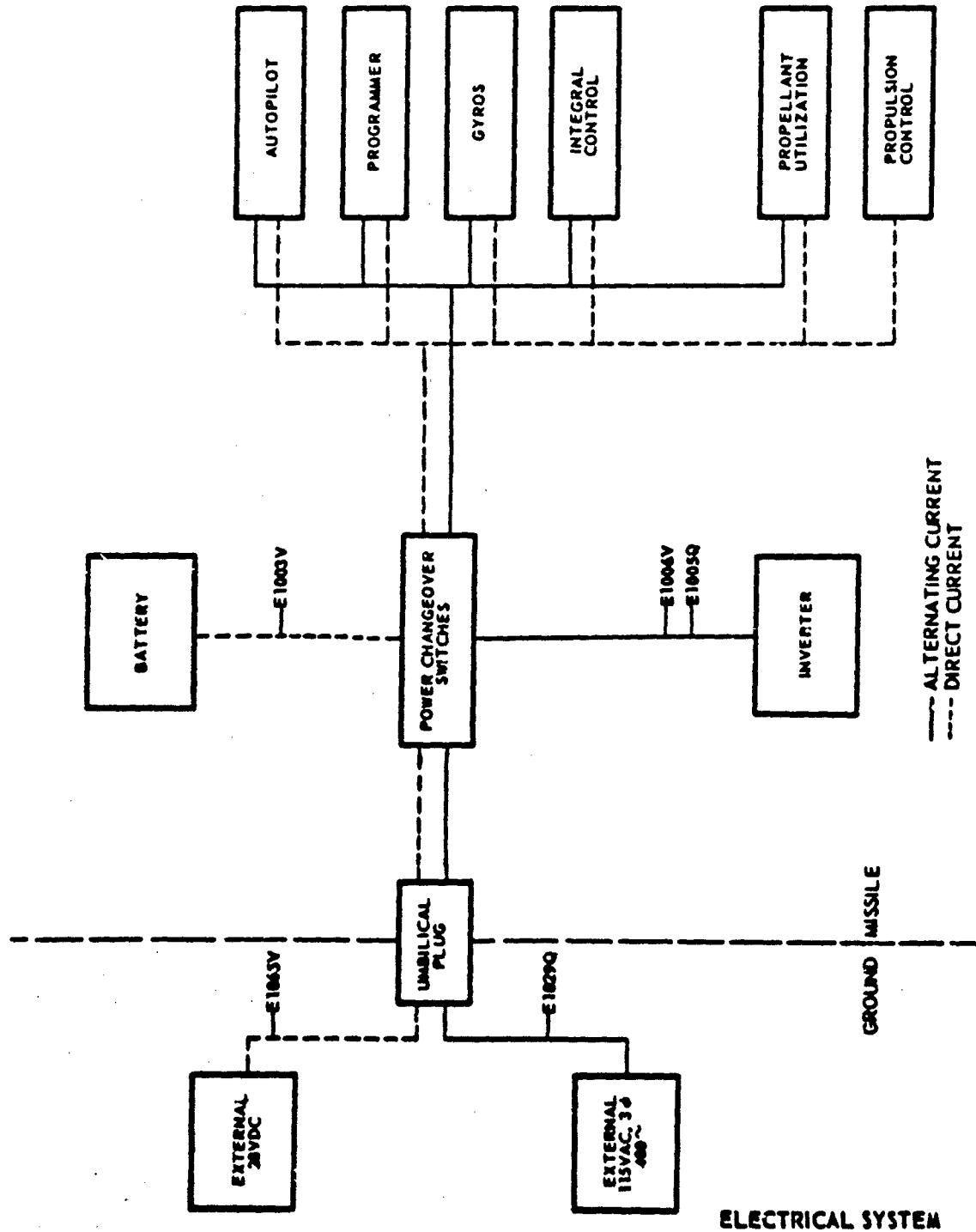
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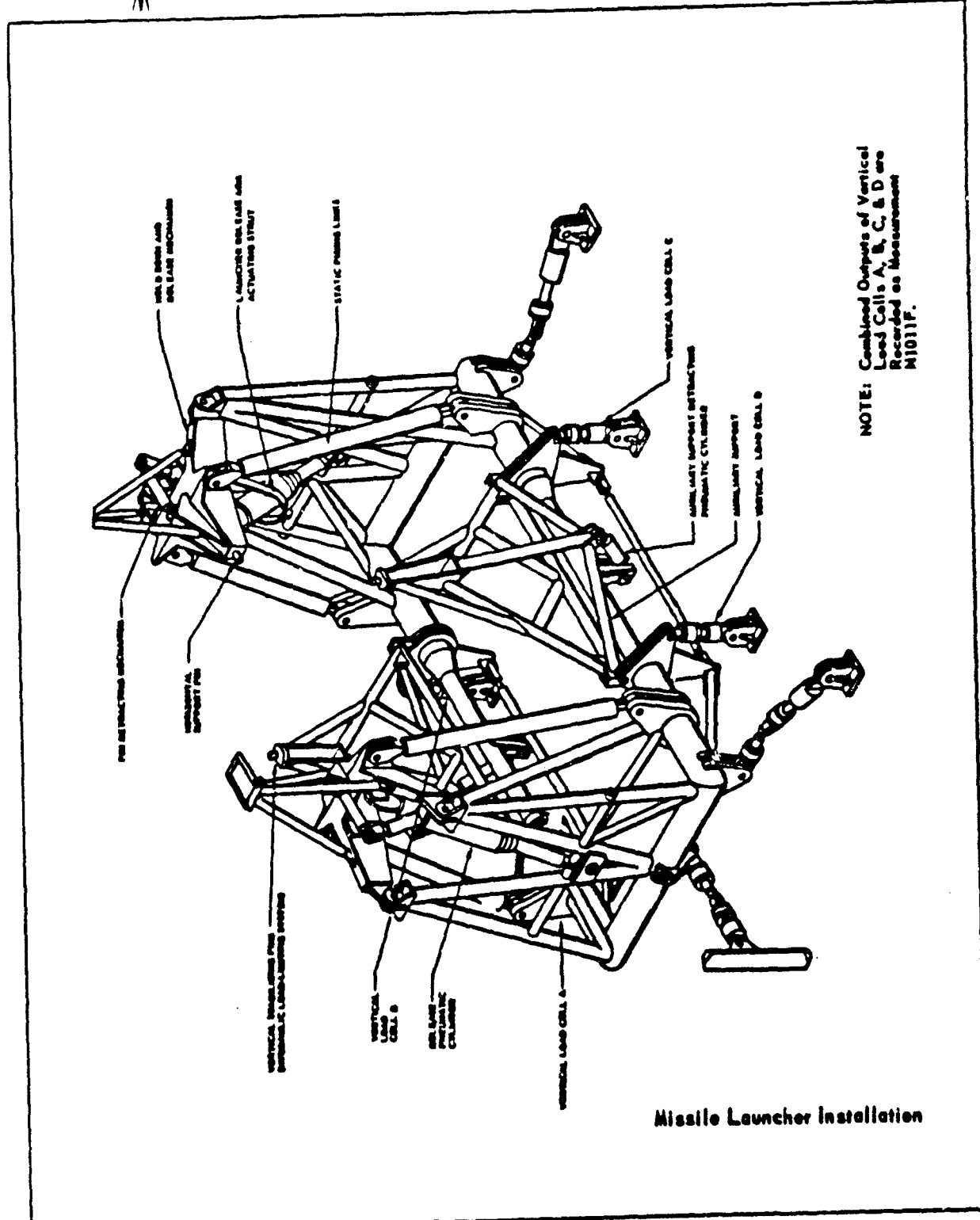
ELECTRICAL SYSTEM

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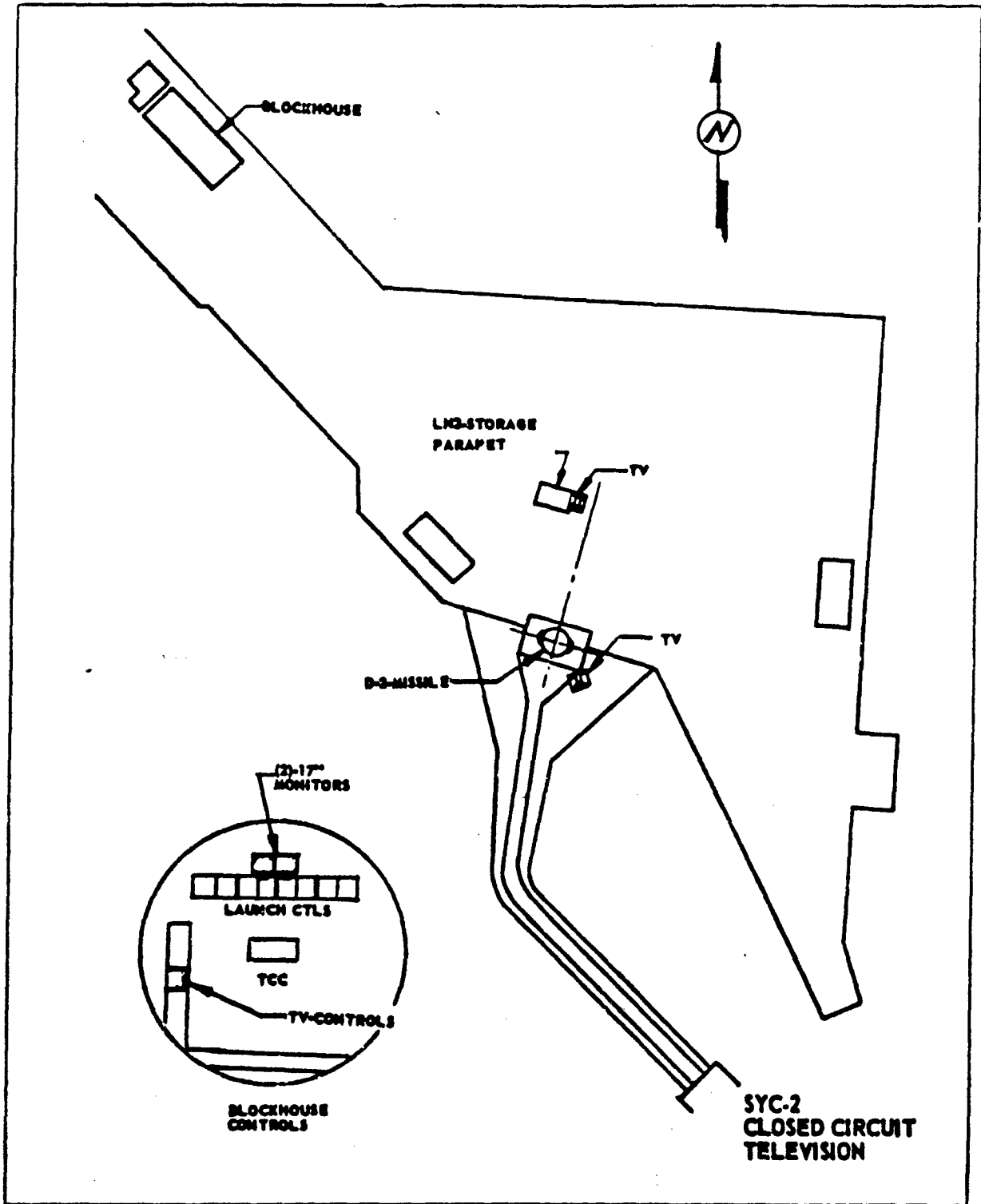
NOTE: Combined Outputs of Vertical Load Cells A, B, C, & D are Recorded as Measurement M1011P.

Missile Launcher Installation

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SECTION 6
MASTER INSTRUMENTATION LOG

The Master Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition the channel assignments for these measurements to be recorded on FM are included. The following is a brief explanation of the format of the master log.

MEASUREMENT IDENTIFICATION (SYMBOL)
Series/Station Number

MEASUREMENT DESCRIPTION
This is a brief, usually abbreviated, description of the measurement.

UNITS OF FUNCTION

TRANSDUCER IDENTIFICATION
General part number of the transducer utilized for the measurement.

TRANSDUCER LOCATION
Shell or station number and quadrant of transducer installation.

METALLIZATION DETAILS
Drawing number of transducer metallization drawing.

Transducer Serial No.

C	2	P	1027	P						0	785	P	16	SLO	89	00902	037	35	1204	2	P	
C	2	P	1027	P																		C
C	2	P	1028	P							0	345	P	4	250	7	01692	5	84	1123	3	P
C	2	P	1028	P																		C

FREQUENCY RESPONSE
Defines the frequency response requirement in cps of the instrumentation system for the measurement.

ACCURACY REQUIREMENT
Present in units of the function measured.

MEASUREMENT RANGE
Range of interest of the function being measured expressed in "units of function."

FM CHANNEL ASSIGNMENT
Indicates the recorder/tape/subcarrier assignment for a measurement when it is to be recorded on FM tape. The first two 7 for a table of recorder assignments for the various measurements.

MEASUREMENT IDENTIFICATION
Two letters are included. The first denotes the system instrumented while the latter indicates the type of measurement. Of the four numerical digits the first is used to identify the method of signal transmission from the transducer to the recorder while the remaining three provide an identification of the measurement within the system.

Note: For a more detailed explanation of this format and a key to abbreviations and symbols see Appendix B in Section 12 of this report.

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SECTION 6

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SECTION 6

MISSILE INSTRUMENTATION LOG SHEET

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WORLD NO.	INSTRUMENT NO.	TYPE	DESCRIPTION	TELETYPE NO.	SIGNALING NO.	COMMUTATOR PIN NO.	MANAGEMENT RANGE		DATE OF CHANGE OR REVISION OF FUNCTION	TYPE OF TRANSDUCER	SERIAL NO.	REASON NO.	P
							LOW	HIGH					
D 24 A			AIRFRAME										
D 24 A	1489 Y		POD 1 SOUND PRESSURE				140	170	2KC	7 01738 9	977 1	P	27 - 17557
D 24 A	1493 Y		ENG COMP SOUND PRESS				140	170	2KC	7 01738 9	1210 2	P	27 - 17556
D 24 E			ELECTRICAL										
D 24 E	1005 Q		INVERTER FREQUENCY	1	4	C	350	450		SLO			
D 24 E	1029 Q		EXTERNAL AC FREQ	2	5	C	350	450		SLO			
D 24 E	1003 V		BATTERY OUTPUT	1	4	11	15	35		SLO			
D 24 E	1004 V		INVERTER PHASE A	1	4	C	90	140		SLO			
D 24 E	1005 V		MSL EXTERNAL DC	2	5	5	0	40		SLO			
D 24 F			PNEUMATICS										
D 24 F	1994 C		DC TO BO VLV MOTOR				0	15		SLO			
D 24 F	1001 P		LO2 TANK HELIUM	1	2	8	0	45		SLO	7 01723 11 2344	480 2	P
D 24 F	1003 P		FUEL TANK HELIUM	1	2	12	0	85		SLO	7 01723 13 2758	925 Y	P
D 24 F	1009 P		FUEL PRESS REG DISCH	1	4	8	10	75		SLO	89 00502 035	32 1269 2	P
D 24 F	1011 P		LO2 PRESS REG DISCH	1	11	8	0	40		SLO	89 00502 032	1171 4	P
D 24 F	1114 P		LO2 PRESS REG INLET	1	8	13	90	3000		SLO	7 01723 803	1187 4	P
D 24 F	1125 P		B CTL PNEU REG OUT	1	2	11	200	800		SLO	7 01731 5 2630	1243 4	P

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MISSILE INSTRUMENTATION LOG SHEET
DATE 11 SEP 59

REPORT NO. 924 FH CHAIR

TIME	UNIT	STATUS	DESCRIPTION	PRESSURE		TEMPERATURE		ACCELERATION		REMARKS	TEST NUMBER	TEST POINT	TIME	STATUS	UNIT
				TYPE	VALUE	TYPE	VALUE	TYPE	VALUE						
D 24 F 1246	P	0	TE MC STL MI	SLO	7 01720 8						1230	1	P		
D 24 F 1200	P	0	ST PNEU RES OUT	SLO	7 01720 1						1903	2	P		
D 24 F 1201	P	0	S CTL ME STL	SLO	7 01720 5						2305	2	P		
D 24 F 1113	T	0	LO2 PRESS REG INLET	DGF	7 01604 3						1107	4	P		
D 24 F 1310	T	0	ST PNEU REG IN	DGF	7 01604 7						1215	2	P		
D 24 M			HYDRAULICS												
D 24 M 1033	P	0	B1 MYD ACCUMULATOR	P16							5000	1024	1	P	
D 24 M 1140	P	0	S/VDEM MYD PRESS	P16							3500	161	1	P	
D 24 M 1204	P	0	B1 PCH ACTR EXTEND	P1A							3500	3			
D 24 M 1207	P	0	B1 PCH ACTR RETRACT	P1A							3500	3			
D 24 M 1208	P	0	B1 VAN ACTR EXTEND	P1A							3500	3			
D 24 M 1209	P	0	B1 VAN ACTR RETRACT	P1A							3500	3			
D 24 M 1397	X		END MYD LO PRESS B								OFF	ON			
D 24 M 1190	X		END MYD MI PRESS B								OFF	ON			
D 24 M 1199	X		END MYD MI PRESS S6V								OFF	ON			
D 24 M 1200	X		END MYD LO PRESS S6V								OFF	ON			
D 24 M			FACILITY												
D 24 M 1011	F	0	WT & THST SYS-THRUST	1				4		11	4260	400	10		

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TIME	TIME FROM	TIME TO	FUEL	DRAIN	TEMP	PRESS	TEMPERATURE					PRESSURE					VIBRATION	ACCEL	TYPE OF MEASUREMENT	STATUS	REMARKS	CIRCUIT	SERIAL NO.													
							L	M	N	O	P	Q	R	S	T	U								V	W	X	Y	Z								
D 24 N 1969	X																																			
D 24 N 1970	X																																			
D 24 N 1971	X																																			
D 24 N 1972	X																																			
D 24 N 1973	X																																			
D 24 N 1974	X																																			
D 24 N 1975	X																																			
D 24 N 1976	X																																			
D 24 N 1977	X																																			
D 24 N 1978	X																																			
D 24 P																																				
D 24 P 1003	B		B2	PUMP	SPEED																															
D 24 P 1004	B		B1	PUMP	SPEED																															
D 24 P 1005	B		S	PUMP	SPEED																															
D 24 P 1007	D		ACOUSTIC	FUEL	VALVE	INDICATOR																														
D 24 P 1008	D		S	MAIN	FUEL	VALVE																														
D 24 P 1009	D		S	MAIN	LOZ	VALVE																														
D 24 P 1039	O		S	MAA	BCC	ACCEL																														
D 24 P 1039	O		S	MAA	BCC	ACCEL																														

27 - 17522
27 - 17522
27 - 11011

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MISSILE INSTRUMENTATION LOG SHEET

REPORT NO. B26 FM OMAH

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TIME	TEST NUMBER	TEST POINT	DESCRIPTION	TEST RESULT	TEST POINT NO.	TEST POINT NAME	OPERATIONAL STATUS		INITIALS	DATE OF CHANGE	REASON FOR CHANGE	TEST POINT NO.	TEST POINT NAME	INITIALS	DATE OF CHANGE	REASON FOR CHANGE
							ON	OFF								
D 24	P 1077	X	VERBIER CUTOFF RELAY 2	5	5	OFF	ON			STP						
D 24	P 1311	X	90% FUEL LVL IND			OFF	ON									
D 24	P 1592	X	BOOSTER EMS CUTOFF 1	4	5	OFF	ON			STP						
D 24	P 1592	X	BOOSTER EMS CUTOFF 2	8	5	OFF	ON			STP						
D 24	P 1592	X	SUSTAINER EMS CUTOFF 1	4	5	OFF	ON			STP						
D 24	P 1592	X	SUSTAINER EMS CUTOFF 2	6	5	OFF	ON			STP						
D 24	P 1622	X	S FLIGHT LOCKIN	1	4	5	OFF	ON		STP						
D 24	P 1622	X	S FLIGHT LOCKIN	2	6	5	OFF	ON		STP						
D 24	P 1626	X	PROP DEPL COF ARMING			OFF	ON			STP						
D 24	P 1629	X	PROP DEPLETION COF			OFF	ON			STP						
D 24	P 1631	X	LO2 F60 VLV AIRB OPN			OFF	ON			STP						
D 24	P 1632	X	LO2 F60 VLV AIRB CLS			OFF	ON			STP						
D 24	P 1633	X	LO2 F60 VLV 6ND OPN			OFF	ON			STP						
D 24	P 1634	X	LO2 F60 VLV 6ND CLS			OFF	ON			STP						
D 24	P 1635	X	FUL F60 VLV AIRB OPN			OFF	ON			STP						
D 24	P 1636	X	FUL F60 VLV AIRB CLS			OFF	ON			STP						
D 24	P 1637	X	FUL F60 VLV 6ND OPN			OFF	ON			STP						
D 24	P 1638	X	FUL F60 VLV 6ND CLS			OFF	ON			STP						
D 24	P 1987	X	FUEL OVERFILL PROBE			OFF	ON			STP						
D 24	P 1988	X	LO2 95% LVL EMER COF			OFF	ON			STP						
D 24	P 1997	X	MSL FUELED 95%			OFF	ON			STP						
D 24	P 1998	X	LO2 0/FILL EMER COF			OFF	ON			STP						
D 24	P 1999	X	MSL FUELED 100%			OFF	ON			STP						
P 74	C		AUTOM-FLY													

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1	2	3	4	5	6	7	8	9		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
								LOW	HIGH																	
D 24 S 1252 D		B1 YAW				2	12	7	0	20		CPS	SLO	7	01680	1										27 - 11612
D 24 S 1253 D		B2 YAW				2	12	8	0	20		CPS	SLO	7	01 68 0	1										27 - 11613
D 24 S 1254 D		B1 PITCH				2	5	8	0	20		CPS	SLO	7	01680	1										27 - 11613
D 24 S 1255 D		B2 PITCH				2	12	5	0	20		CPS	SLO	7	01680	1										
D 24 S 1107 V		B1 PCH ACTR FEEDBAK				2	2	9		M12	12	VAC														
D 24 S 1108 V		B2 PCH ACTR FEEDBAK				2	2	10		M12	12	VAC														
D 24 S 1113 V		V1 YAW ACTR FEEDBACK				2	4	9		M5	7	VAC														
D 24 S 1114 V		V2 YAW ACTR FEEDBACK				2	4	10		M5	7	VAC														
D 24 S 1118 V		V2 PCH ACTR FEEDBAK				2	4	13		M11	11	VAC														
D 24 S 1119 V		V1 PCH ACTR FEEDBAK				2	8	12		M11	11	VAC														
D 24 S 1122 V		SERVO TEST SIG				2	8	11		M11	11	VAC														
D 24 S 1128 V		B1 YAW ACTR FEEDBAK				2	2	13		M12	12	VAC														
D 24 S 1129 V		B2 YAW ACTR FEEDBAK				2	2	14		M12	12	VAC														
D 24 S 1167 V		PITCH GYRO AMP OUT				2	3	7		M10	10	VAC														
D 24 S 1168 V		YAW GYRO AMP OUT				2	3	8		M10	10	VAC														
D 24 S 1149 V		ROLL GYRO AMP OUT				2	3	11		M10	10	VAC														
D 24 S 1216 V		S PCH ACTR FEEDBACK				2	8	7		M10	10	VAC														
D 24 S 1217 V		S YAW ACTR FEEDBACK				2	8	8		M10	10	VAC														
D 24 U		PROPELLANT UTILIZ																								
D 24 U 1080 P		LO2 TANK HEAD				2	10	8	0	5	P10		SLO	7	01225	3	212					1079	1		27 - 11002	
D 24 V 1001 P		FUEL TANK HEAD				2	10	11	0	5	P10		SLO	7	01225	3						1075	1		27 - 11002	

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MISSILE INSTRUMENTATION LOG SHEET

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NO.	UNIT	SERIAL NO.	DESCRIPTION	INSTRUMENT NO.	SERVO NO.	MOUNTING		DATE OF CHANGE OF FUNCTION	TYPE OF TRANSDUCER	SERVO NO.	DATE OF CHANGE OF FUNCTION	TYPE OF TRANSDUCER	SERVO NO.	DATE OF CHANGE OF FUNCTION	TYPE OF TRANSDUCER	
						TYPE	NO.									TYPE
1	D	24 5 1061	ROLL DISPL GYRO SIG	2 3 7	M3	3	DEG	22 15								
2	D	24 5 1062	PITCH DISPL GYRO SIG	2 3 8	M3	3	DEG	27 15								
3	D	24 5 1063	YAW DISPL GYRO SIG	2 3 11	M3	3	DEG	22 15								
4	D	24 5 1107	B1 PCM ACTR FEEDBACK	2 2 9	M12	12	VAC	58 30								
5	D	24 5 1108	B2 PCM ACTR FEEDBACK	2 2 10	M12	12	VAC	57 30								
6	D	24 5 1113	V1 YAW ACTR FEEDBACK	4 9	M5	7	VAC	58 30								
7	D	24 5 1114	V2 YAW ACTR FEEDBACK	4 10	M5	7	VAC	58 30								
8	D	24 5 1118	V2 PCM ACTR FEEDBACK	4 13	M11	11	VAC	58 30								
9	D	24 5 1119	V1 PCM ACTR FEEDBACK	4 4	M11	11	VAC	58 30								
10	D	24 5 1122	SERVO TEST SIG	2 8 11	M11	12	VAC	58 30								
11	D	24 5 1128	B1 YAW ACTR FEEDBACK	2 2 13	M12	12	VAC	58 30								
12	D	24 5 1129	B2 YAW ACTR FEEDBACK	2 2 4	M12	12	VAC	58 30								
13	D	24 5 1216	S PCM ACTR FEEDBACK	2 8 7	M10	10	VAC	58 30								
14	D	24 5 1217	S YAW ACTR FEEDBACK	2 8 8	M10	10	VAC	58 30								

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SECTION 7

TEST PLAN & RECORDER ASSIGNMENTS BY SYSTEM

This section indicates the recorder assignment of each measurement for each block in which the measurement is required. In addition the code of the test objectives supported by each measurement and the measurement priority in regard to each of those objectives are listed after each measurement. The following is a brief explanation of the format used in this section.

MEASUREMENT IDENTIFICATION

Two letters are included; the first denotes the system instrumented while the latter indicates the type of measurement. The first numerical digit denotes the method of data transmission from the transmitter to the recorder; i. e., direct wire. The other three digits denote the measurement number within the system indicated by the first letter.

OBJECTIVE CODE

Test objectives supported by a measurement are indicated by listing the code of those objectives beneath the measurement. Table I may be used to correlate this code with the actual test objectives.

BLOCK I RECORDER ASSIGNMENT

This code defines the method to be utilized to record the measurement when it is required during Block I testing. The double letter here indicates that this measurement will be recorded on both a strip chart and on an FM tape.

BLOCK II RECORDER ASSIGNMENT

MEASUREMENT DESCRIPTION

C 2 H 1033 P	B1 HYD ACCUMULATOR
C 2 H 1033 P	
C 2 H 1140 P	S/VERN HYD PRESS
C 2 H 1140 P	
C 2 H 1140 P	

SK23

BF

HE50

FB22

Y

Z

Y

1

2

43010

42230

42230

MEASUREMENT IDENTIFICATION (TYPICAL)

Series/Mission Number

BLOCK I PRIORITY

This number defines the priority of this measurement during Block I testing in regard to the test objective represented by the objective code. A priority is assigned only where the objective is scheduled.

BLOCK II PRIORITY

PROBLEM AREA CODE

This code, although not utilized in this section, provides a means of grouping related measurements for instrumentation planning. (IBM coding)

Note: For a more detailed explanation of this format and a key to the abbreviations and coding see Appendix B in Section 12 of this report.

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D24 OBJ TEST PLAN

OBJ. CODE	DESCRIPTION	1	2
AD17	A 1489 Y POD 1 SOUND PRESS	F	F
	A 1489 Y	1	1
AD17	A 1493 Y ENG COMP SOUND PRESS	F	F
	A 1493 Y	1	1
ED15	E 1005 Q INVERTER FREQUENCY	F	F
	E 1005 Q		1
SD14	E 1005 Q	2	2
SD15	E 1005 Q	2	2
SD14	E 1029 Q INVERTER FREQUENCY	F	F
	E 1029 Q	2	2
	E 1029 Q	2	2
ED15	E 1003 V BATTERY OUTPUT		F
	E 1003 V		1
ED15	E 1006 V INVERTER PHASE A	F	F
	E 1006 V		1
SD14	E 1006 V	2	2
SD15	E 1006 V	2	2
	E 1065 V MSL EXTERNAL DC	F	F
FD33	F 1994 C DC TO BO VLV MOTOR	2	2
FD33	F 1001 P LO2 TANK HELIUM	SF	SF
	F 1001 P	1	1
	F 1001 P	1	1

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D24 OBJ TEST PLAN

WD02	F 1001 P	2	2
WD02	F 1001 P	2	2
WD05	F 1001 P		2
	F 1003 P FUEL TANK HELIUM	SF	SF
FD33	F 1003 P	1	1
FD37	F 1003 P	1	1
WD02	F 1003 P	2	2
01	F 1003 P	1A	1A
	F 1009 P FUEL REG DISCH	F	F
FD33	F 1009 P	2	2
FD37	F 1009 P	1	1
	F 1011 P LO2 PRESS REG DISCH	F	F
FD33	F 1011 P	2	2
FD37	F 1011 P	1	1
	F 1114 P LO2 PRESS REG INLET	F	F
FD33	F 1114 P	2	2
FD37	F 1114 P	2	2
	F 1125 P B CTL PNEU REG OUT	SF	SF
FD33	F 1125 P	2	2
01	F 1125 P	1A	1A
	F 1246 P B TANK HE BOTTLES HI	SF	SF
FD33	F 1246 P	2	2
FD37	F 1246 P	2	2
01	F 1246 P	1A	1A
	F 1288 P ST PNEU REG OUT	SF	SF
FD33	F 1288 P	2	2
01	F 1288 P	1A	1A
	F 1291 P S CTL HE BTL	FS	FS

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D24 OBJ TEST PLAN

FD33	F 1291 P		2 2
01	F 1291 P		1A 1A
	F 1115 T LO2 PRESS REG INLET		F F
FD33	F 1115 T		2 2
FD37	F 1115 T		2 2
	F 1318 T ST PNEU REG IN		S S
FD33	F 1318 T		2 2
	H 1033 P B1 HYD ACCUMULATOR		-S FS
HD22	H 1033 P		1 1
HD26	H 1033 P		1 1
SD14	H 1033 P		2 2
	H 1140 P SUS/VERN H'D PRESS		FS FS
HD23	H 1140 P		1 1
HD26	H 1140 P		1 1
HD33	H 1140 P		1 1
SD15	H 1140 P		2 2
	H 1206 P B1 PCH ACTR EXTEND		FS
SD30	H 1206 P		1
	H 1207 P B1 PCH ACTR RETRACT		FS
SD30	H 1207 P		1
	H 1208 P B1 YAW ACTR EXTEND		FS
SD30	H 1208 P		1
	H 1209 P B1 YAW ACTR RETRACT		FS
SD30	H 1209 P		1
	H 1197 X GND HYD LO PRESS		R R
HD46	H 1197 X		1 1

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	H 1198 X GND HYD HI PRESS	R	R
HD46	H 1198 X	1	1
	H 1199 X GND HYD HI PRESS S6V	R	R
HD46	H 1199 X	1	1
	H 1200 X GND HYD LO PRESS S6V	R	R
HD46	H 1200 X	1	1
	N 1011 F WT & THST SYS THRUST	SF	SF
LD19	N 1011 F	1	1
LD19	N 1011 F	2	
PD29	N 1011 F	1	1
UD20	N 1011 F	1	1
UD24	N 1011 F	2	2
WD01	N 1011 F	1	1
WD02	N 1011 F	1	1
WD05	N 1011 F		1
	N 1969 X AA 90% FUEL PROBE	R	R
	N 1970 X AA 95% FUEL PROBE	R	R
	N 1971 X AA 99.8% FUEL PROBE	R	R
UD24	N 1971 X	2	2
WD05	N 1971 X		1
	N 1972 X AA 100.2% FUEL PROBE	R	R
UD24	N 1972 X	2	2
WD05	N 1972 X		1
	N 1973 X AA LO2 RAPID SIG	R	R
	N 1974 X AA LO2 BU RAPID SIG	R	R

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	N 1975 X AA LO2 FINE SIG	R	R
UD24	N 1976 X AA LO2 BU FINE SIG	R	R
WD05	N 1976 X	2	2
	N 1976 X		1
UD24	N 1977 X AA LO2 TOPG COF SIG	R	R
WD05	N 1977 X	2	2
	N 1977 X		1
UD24	N 1978 X AA LO2 EMG SIG	R	R
WD05	N 1978 X	2	2
	N 1978 X		1
PD14	P 1083 B B2 PUMP SPEED	FS	FS
PD15	P 1083 B	1	1
PD28	P 1083 B	1	1
PD29	P 1083 B	1	1
02	P 1083 B	2	2
	P 1083 B	18	18
PD14	P 1084 B B1 PUMP SPEED	FS	FS
PD15	P 1084 B	1	1
PD28	P 1084 B	1	1
PD29	P 1084 B	1	1
02	P 1084 B	2	2
	P 1084 B	18	18
PD14	P 1349 B S PUMP SPEED	FS	FS
PD19	P 1349 B	1	1
PD23	P 1349 B	1	1
PD28	P 1349 B	1	1
PD29	P 1349 B	2	2
PD37	P 1349 B	1	1
02	P 1349 B	18	18
	P 1287 D ACOUSTIC FUL VLV XDR	SF	SF

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UD15	P 1287 D				1
UD24	P 1287 D			2	2
	P 1528 D	S MAIN FUEL VALVE		SF	SF
HD23	P 1528 D			2	2
PD28	P 1528 D			1	
PD37	P 1528 D			1	1
UD20	P 1528 D			1	1
01	P 1528 D			1A	1A
	P 1529 D	S MAIN LO2 VALVE		SF	SF
HD23	P 1529 D			2	2
PD28	P 1529 D			1	
PD37	P 1529 D			2	2
UD19	P 1529 D				2
UD20	P 1529 D			2	2
	P 1439 O	S NAA RCC ACCEL		FO	FO
PD29	P 1439 O			2	2
	P 1452 O	B1 NAA RCC ACCEL		F	F
PD29	P 1452 O			2	2
	P 1453 O	B2 NAA RCC ACCEL		F	F
PD29	P 1453 O			2	2
	P 1003 P	B2 LO2 PUMP INLET		F	F
PD18	P 1003 P			2	2
	P 1004 P	B2 FUEL PUMP INLET		F	F
PD18	P 1004 P			2	2
	P 1006 P	S THRUST CHAMBER		F	F
PD14	P 1006 P			1	1
PD28	P 1006 P			1	
PD29	P 1006 P			1	1

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PD37	P 1006 P	1 1
02	P 1006 P	18 18
01	P 1010 P B1 LUBE OIL INJ MAN	SF SF
	P 1010 P	1A 1A
PD14	P 1026 P B LO2 REG REFERENCE	SF SF
PD15	P 1026 P	2 2
PD28	P 1026 P	2 2
01	P 1026 P	1
	P 1026 P	1A 1A
PD14	P 1027 P VERNIER FUEL TANK	F F
PD19	P 1027 P	1 1
PD23	P 1027 P	1 1
PD28	P 1027 P	1 1
PD14	P 1028 P V1 THRUST CHAMBER	F F
PD19	P 1028 P	1 1
PD23	P 1028 P	1 1
PD28	P 1028 P	2 2
PD29	P 1028 P	1 1
02	P 1028 P	1 1
		18 18
PD14	P 1029 P V2 THRUST CHAMBER	F F
PD19	P 1029 P	1 1
PD23	P 1029 P	1 1
PD28	P 1029 P	2 2
PD29	P 1029 P	1 1
02	P 1029 P	1 1
		18 18
PD14	P 1030 P VERNIER LO2 TANK	F F
PD19	P 1030 P	1 1
PD23	P 1030 P	1 1
	P 1030 P	1 1

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PD28	P 1030 P	1	
PD29	P 1030 P	1	1
	P 1047 P V1 LO2 INLET	F	F
PD14	P 1047 P	2	2
PD19	P 1047 P	1	1
PD23	P 1047 P	1	1
PD28	P 1047 P	1	
	P 1048 P V2 LO2 INLET	F	F
PD14	P 1048 P	2	2
PD19	P 1048 P	1	1
PD23	P 1048 P	1	1
PD28	P 1048 P	1	
	P 1049 P V1 FUEL INLET	F	F
PD14	P 1049 P	2	2
PD19	P 1049 P	1	1
PD23	P 1049 P	1	1
PD28	P 1049 P	1	
	P 1050 P V2 FUEL INLET	F	F
PD14	P 1050 P	2	2
PD19	P 1050 P	1	1
PD23	P 1050 P	1	1
PD28	P 1050 P	1	
	P 1055 P S FUEL PUMP INLET	F	F
PD29	P 1055 P	2	2
PD37	P 1055 P	2	2
	P 1056 P S LO2 PUMP INLET	F	F
PD37	P 1056 P	2	2
02	P 1056 P	1B	1B
	P 1059 P B2 THRUST CHAMBER	F	F
PD14	P 1059 P	1	1

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PD15	P 1059 P	1 1
PD28	P 1059 P	1
PD29	P 1059 P	1 1
02	P 1059 P	1B 1B
	P 1060 P B1 THRUST CHAMBER	F F
PD14	P 1060 P	1 1
PD15	P 1060 P	1 1
PD28	P 1060 P	1
PD29	P 1060 P	1 1
02	P 1060 P	1B 1B
	P 1091 P B1 LO2 INJ MANIFOLD	O O
02	P 1091 P	1B 1B
	P 1092 P B2 LO2 INJ MANIFOLD	O O
02	P 1092 P	1B 1B
	P 1093 P B1 FUEL INJ MANIFOLD	O O
02	P 1093 P	1B 1B
	P 1094 P B2 FUEL INJ MANIFOLD	O O
02	P 1094 P	1B 1B
	P 1100 P B GG COMBUSTION CHM	F F
PD14	P 1100 P	2 2
PD15	P 1100 P	2 2
PD28	P 1100 P	1
PD29	P 1100 P	2 2
	P 1330 P S FUEL PUMP DISCH	F F
PD14	P 1330 P	1 1
PD19	P 1330 P	1 1
PD23	P 1330 P	2 2
PD28	P 1330 P	1
PD37	P 1330 P	2 2
02	P 1330 P	1B 1B

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	P 1332 P S LO2 PUMP DISCH	F F
PD14	P 1332 P	1 1
PD19	P 1332 P	1 1
PD23	P 1332 P	2 2
PD28	P 1332 P	1 1
PD37	P 1332 P	2 2

	P 1339 P S GAS GEN DISCH	F F
PD14	P 1339 P	2 2
PD28	P 1339 P	1 1
PD29	P 1339 P	2 2
PD37	P 1339 P	2 2

	P 1341 P S LUBE OIL MANIFOLD	SF SF
01	P 1341 P	1A 1A

	P 1344 P S LO2 REG REFERENCE	SF SF
PD14	P 1344 P	2 2
PD28	P 1344 P	1 1
01	P 1344 P	1A 1A

	P 1350 P S FUEL INJ MANIFOLD	O O
02	P 1350 P	1B 1B

	P 1351 P S LO2 INJ MANIFOLD	O O
PD14	P 1351 P	2 2
PD23	P 1351 P	2 2
PD37	P 1351 P	2 2
02	P 1351 P	1B 1B

	P 1465 P S LO PR LUB OIL MAN	SF SF
01	P 1465 P	1A 1A

	P 1682 P PRESS DIFF ON LO2 TK	FS FS
UD15	P 1682 P	2 2
UD24	P 1682 P	2 2
WD01	P 1682 P	1 1

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WD02	P 1682 P	1	1
WD05	P 1682 P		2
	P 1683 P PRESS DIFF ON FUL TK	FS	FS
UD15	P 1683 P		2
UD24	P 1683 P	2	2
WD01	P 1683 P	2	2
WD02	P 1683 P	1	1
WD05	P 1683 P		2
	P 1017 T B2 TURBINE INLET	SF	SF
PD14	P 1017 T	2	2
PD15	P 1017 T	2	2
PD28	P 1017 T	1	
01	P 1017 T	1A	1A
	P 1021 T LO2 AT BRKAWAY VLV	SF	SF
PD14	P 1021 T	2	2
PD29	P 1021 T	1	1
WD01	P 1021 T	2	2
	P 1326 T S TURBINE INLET	SF	SF
PD14	P 1326 T	2	2
PD28	P 1326 T	1	
01	P 1326 T	1A	1A
	P 1673 T B1 FUEL IGN VLV AMB	S	S
01	P 1673 T	1A	1A
	P 1674 T B2 FUEL IGN VLV AMB	S	S
01	P 1674 T	1A	1A
	P 1675 T ENG CTL PNEU MAN	S	S
01	P 1675 T	1A	1A
	P 1677 T FIRE DETECTOR EDISON	S	S

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01	P 1677 T	1A 1A
PD65	P 1764 T B1 PRG LN NEAR BLKHD P 1764 T	S S 1
PD15	P 1767 T B1 CHAMBER SK T P 1767 T	S S 2 2
PD65	P 1768 T B1 PURG LN @ ENG MAN P 1768 T	S S 1
	P 1311 X 90% FUEL LVL IND	R R
	P 1626 X PROP DEFL COF ARMING	R R
	P 1629 X PROP DEPLETION COF	R R
WD01	P 1631 X LO2 F&D VLV AIRB OPN P 1631 X	R R 2 2
WD01	P 1632 X LO2 F&D VLV AIRB CLS P 1632 X	R R 2 2
WD01	P 1633 X LO2 F&D VLV GND OPN P 1633 X	R R 2 2
WD01	P 1634 X LO2 F&D VLV GND CLS P 1634 X	R R 2 2
	P 1635 X FUL F&D VLV AIRB OPN	R R
	P 1636 X FUL F&D VLV AIRB CLS	R R

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	P 1637 X FUL F&D VLV GND OPN	R R
	P 1638 X FUL F&D VLV GND CLS	R R
	P 1987 X FUEL OVERFILL PROBE	R R
	P 1988 X LO2 95% LVL EMER COF	R R
	P 1997 X MSL FUELED 95%	R R
	P 1998 X LO2 O/FILL EMERG	R R
	P 1999 X MSL FUELED 100%	R R
	S 1252 D B1 YAW	F
SD30	S 1252 D	2
	S 1253 D B2 YAW	F
SD30	S 1253 D	2
	S 1254 D B1 PITCH	F
SD30	S 1254 D	2
	S 1255 D B2 PITCH	F
SD30	S 1255 D	2

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	S 1107 V B1 PCH ACTR FEEDBAK	DF DF
HD22	S 1107 V	2 2
SD14	S 1107 V	1 1
SD30	S 1107 V	2 2
SD35	S 1107 V	2 2
	S 1108 V B2 PCH ACTR FEEDBAK	DF DF
HD22	S 1108 V	2 2
SD14	S 1108 V	1 1
SD30	S 1108 V	2 2
SD35	S 1108 V	2 2
	S 1113 V V1 YAW ACTR FEEDBACK	DF DF
HD33	S 1113 V	2 2
	S 1114 V V2 YAW ACTR FEEDBACK	DF DF
HD33	S 1114 V	2 2
	S 1118 V V2 PCH ACTR FEEDBACK	DF DF
HD33	S 1118 V	2 2
	S 1119 V V1 PCH ACTR FEEDBACK	DF DF
HD33	S 1119 V	2 2
	S 1122 V SERVO TEST SIG	DF DF
HD22	S 1122 V	2 2
HD23	S 1122 V	2 2
HD33	S 1122 V	2 2
SD14	S 1122 V	1 1
SD19	S 1122 V	1 1
SD30	S 1122 V	1 1
SD35	S 1122 V	1 1
	S 1128 V B1 YAW ACTR FEEDBAK	DF DF
HD22	S 1128 V	2 2
SD14	S 1128 V	1 1
SD30	S 1128 V	2 2

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SD35	S 1128 V		2	2
	S 1129 V B2 YAW ACTR FEEDBAK	DF	DF	
HD22	S 1129 V		2	2
SD14	S 1129 V		1	1
SD30	S 1129 V			2
SD35	S 1129 V		2	2
	S 1147 V PITCH GYRO AMP OUT	F	F	
SD34	S 1147 V		1	1
	S 1148 V YAW GYRO AMP OUT	F	F	
SD34	S 1148 V		1	1
	S 1149 V ROLL GYRO AMP OUT	F	F	
SD34	S 1149 V		1	1
	S 1216 V S PCH ACTR FEEDBACK	DF	DF	
HD23	S 1216 V		2	2
SD15	S 1216 V		1	1
SD30	S 1216 V			2
SD35	S 1216 V		2	2
	S 1217 V S YAW ACTR FEEDBACK	DF	DF	
HD23	S 1217 V		2	2
SD15	S 1217 V		1	1
SD30	S 1217 V			2
SD35	S 1217 V		2	2
	U 1080 P LO2 TANK HEAD	SF	SF	
UD15	U 1080 P			1
UD20	U 1080 P		1	1
UD24	U 1080 P		1	1
	U 1081 P FUEL TANK HEAD	SF	SF	
UD15	U 1081 P			1

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UD20	U 1081 P	1	1
UD24	U 1081 P	1	1

	U 1174 T ACOUSTICA COMP TEMP	5	5
UD24	U 1174 T	2	2

	U 1091 V ERROR RATIO DEMOD OP	FS	FS
UD15	U 1091 V		2
UD20	U 1091 V	1	1
WD01	U 1091 V	1	1
WD02	U 1091 V	1	1
WD05	U 1091 V		2

	U 1113 V ACOUSTICA VLV POS FB	F	F
PF9.	U 1113 V	1	1
UD18	U 1113 V		1
UD24	U 1113 V	1	1

	U 1134 X AA TIME SHARD OSC OP	R	R
UD24	U 1134 X	2	2

	U 1139 X ACOUSTICA SNRS 816	R	R
PD37	U 1139 X		1
UD15	U 1139 X		1
UD24	U 1139 X	2	2

	U 1248 X LO2 2 SNRS STA 547		R
WD09	U 1248 X		2

	U 1249 X LO2 2 SNRS STA 646		R
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WD05	U 1149 X		2
	U 1150 X LO2 2 SNSRS STA 758		R
WD05	U 1150 X		2
	U 1151 X LO2 2 SNSRS STA 836		R
WD05	U 1151 X		2
	U 1152 X LO2 2 SNSRS STA 888		R
WD05	U 1152 X		2
	U 1153 X LO2 2 SNSRS STA 910		R
WD05	U 1153 X		2
	U 1160 X FUL 2 SNSRS STA 944		R
WD05	U 1160 X		2
	U 1161 X FUL 2 SNSRS STA 1024		R
WD05	U 1161 X		2
	U 1162 X FUL 2 SNSRS STA 1083		R
WD05	U 1162 X		2
	U 1163 X FUL 2 SNSRS STA 1126		R
WD05	U 1163 X		2
	U 1164 X FUL 2 SNSRS STA 1241		R
WD05	U 1164 X		2
	U 1165 X FUL 2 SNSRS STA 1284		R
WD05	U 1165 X		2

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D24 S 1129 V	SD14	1	1	31144
D24 S 1216 V S PCH ACTR FEEDBACK		DF	DF	
D24 S 1216 V	HD23	2	2	31176
D24 S 1216 V	SD11	1		31176
D24 S 1216 V	SD13	1		31176
D24 S 1216 V	SD15	1	1	31176
D24 S 1217 V S YAW ACTR FEEDBACK		DF	DF	
D24 S 1217 V	HD23	2	2	31181
D24 S 1217 V	SD11	1		31181
D24 S 1217 V	SD13	1		31181
D24 S 1217 V	SD15	1	1	31181

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D24	U 1091 V	ERROR RATIO DEMOD OP	SF	SF	
D24	U 1091 V		UD15	1	26190
D24	U 1091 V		UD20	1	26190
D24	U 1091 V		WD01	1	26190
D24	U 1091 V		WD02	2	26190
D24	U 1113 V	ACOUSTICA VLV POS FB	F	F	
D24	U 1113 V		PD37	1	26208
D24	U 1113 V		UD15	1	26208
D24	U 1113 V		UD24	1	26208
D24	U 1113 V		WD05	1	26208
D24	U 1135 X	ACOUSTICA SNSRS SIG	F	F	
D24	U 1135 X		PD37	1	26206
D24	U 1135 X		UD15	1	26206
D24	U 1135 X		UD24	1	26206

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D24	X	0000	X	TARE & RESTRAINTS			
D24	X	0000	X		AD10	X	X
D24	X	0000	X		AD11	X	X
D24	X	0000	X		LD11	X	X
D24	X	0000	X		LD15	X	
D24	X	0000	X		LD15		
D24	X	0000	X		MD12	X	X
D24	X	0000	X		ND10	X	X
D24	X	0000	X		OD10	X	X
D24	X	0000	X		OD10		
D24	X	0000	X		PD26	X	X
D24	X	0000	X		UD24	2	2

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FORM NO. A-788-2

SECTION 8

TEST PLAN BY OBJECTIVE

This section presents a grouping of the measurements required to support each test objective presently scheduled for this missile. In addition the priority of each measurement in regard to each test objective is defined for each test block. The following is a brief explanation of the format used in this section.

MEASUREMENT IDENTIFICATION

Two letters are included; the first denotes the system instrumented while the latter indicated the type of measurement. Of the four numerical digits the first is used to identify the method of signal transmission from the transducer to the recorder. The remaining three digits provide an identification for the measurement within the system denoted by the first letter. For example the circled measurement is P, U, system measurement number 91; a voltage measurement to be transmitted via the directline (landline) system.

BLOCK I EFFECTIVITY

An "X" in this column indicates that the objective is scheduled for Block I.

BLOCK II EFFECTIVITY

PROBLEM AREA CODE

This code, although not utilized in this section provides a means of grouping related measurements for instrumentation planning (IBM sorting).

OBJECTIVE HEADER

This header, usually abbreviated, description of the test objective.

MEASUREMENT DESCRIPTION

This is a brief, usually abbreviated, description of the measurement.

<u>OBJECTIVE HEADER</u>	<u>MEASUREMENT DESCRIPTION</u>	<u>OBJECTIVE CODE</u>	<u>BLOCK I EFFECTIVITY</u>	<u>BLOCK II EFFECTIVITY</u>	<u>PROBLEM AREA CODE</u>
<u>C 2 P 1018 T</u>	<u>OXIDIZER TOPPING</u>	PN04	X	X	2626
C 2 P 1021 T	B1 TURBINE INLET	PN04	2	2	29023
C 2 P 1021 T	LOS AT BREAKAWY VLV	PN04	1	1	23380
C 2 U 1021 P	LOS TK HD Vibrotrom	PN04	1	1	
C 2 U 1021 P	LOS TK HD VIBROTRON	PN04	1	1	28011
<u>C 2 U 1091 V</u>	<u>ERROR RATIO DEMOD OP</u>	PN04	1	1	26180

MISSILE IDENTIFICATION (TYPICAL)

Series/Missile Number

OBJECTIVE CODE

This code provides a means of grouping the measurements under the objective header (IBM sorting).

BLOCK I PRIORITY

This number defines the priority of the measurement during Block I testing in regard to the test objective it is listed under. Only those measurements required to achieve the objective are listed.

BLOCK II PRIORITY

Note: For a more detailed explanation of this format and a key to the abbreviations and coding see Appendix B in Section 12 of this report.

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OBJ. CODE	DESCRIPTION	1	2
AD10	DEMONSTRATE THE STRUCTURAL INTEGRITY OF THE BOOSTER THRUST STRUCTURE.	2	2
	X 0000 X VISUAL INSPECTION	X	X
AD11	DEMONSTRATE THE ABILITY OF THE PROPELLANT TANKS TO WITHSTAND THE VARIOUS LOADS IMPOSED DURING ENGINE STARTS, BOOSTER, AND SUSTAINER STAGE OPERATION.	2	2
	X 0000 X VISUAL INSPECTION	X	X
AD17	DETERMINE THE DB LEVELS IN THE POD & ENGINE COMPARTMENT AREAS	1	1
	A 1489 Y POD 1 SOUND PRESS	1	1
	A 1493 Y ENG COMP SOUND PRESS	1	1
ED15	DETERMINE PERFORMANCE ADEQUACY	1	

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D24 OBJ TEST PLAN

OF THE MISSILE ELECTRICAL
SYSTEM DURING LONG DURATION
RUNS, WITH REMOTELY ACTIVATED
ONE-SHOT PRIMARY BATTERY.

	E 1005 Q INVERTER FREQUENCY	1	
	E 1003 V BATTERY OUTPUT	1	
	E 1006 V INVERTER PHASE A	1	
FD33	DEMONSTRATE ADEQUACY OF THE AIRBORNE PNEUMATICS SYSTEM PERFORMANCE DURING A MULTI- STAGE CAPTIVE FIRING WITH 0 SERIES PRESSURE REGULATORS.	1	1
	F 1994 C DC TO 80 VLV MOTOR	2	2
	F 1001 P LO2 TANK HELIUM	1	1
	F 1003 P FUEL TANK HELIUM	1	1
	F 1009 P FUEL REG DISCH	2	2
	F 1011 P LO2 PRESS REG DISCH	2	2
	F 1114 P LO2 PRESS REG INLET	2	2
	F 1125 P B CTL PNEU REG OUT	2	2
	F 1246 P BOOSTER TK HE BTL HI	2	2
	F 1268 P ST PNEU REG OUT	2	2
	F 1291 P S CTL HE BTL	2	2
	F 1115 T LO2 PRESS REG INLET	2	2
	F 1318 T ST PNEU REG IN	2	2
FD37	DETERMINE PERFORMANCE CHARACT-	1	1

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D24 OBJ TEST PLAN

CHARACTERISTICS OF THE PROPELLANT
TANKS PRESSURIZATION REGULATORS.
/F&G REGULATORS/.

F 1001 P LO2 TANK HELIUM	1	1
F 1003 P FUEL TANK HELIUM	1	1
F 1009 P FUEL PRESS REG DISCH	1	1
F 1011 P LO2 PRESS REG DISCH	1	1
F 1114 P LO2 PRESS REG INLET	2	2
F 1246 P B TANK HE BOTTLES HI	2	2
F 1115 T LO2 PRESS REG INLET	2	2

HD22 DEMONSTRATE THE PERFORMANCE OF
THE BOOSTER STAGE HYDRAULIC
SYSTEM.

H 1033 P B1 HYD ACCUMULATOR	1	1
S 1107 V B1 PCH ACTR FEEDBAK	2	2
S 1108 V B2 PCH ACTR FEEDBAK	2	2
S 1122 V SERVO TEST SIG	2	2
S 1128 V B1 YAW ACTR FEEDBAK	2	2
S 1129 V B2 YAW ACTR FEEDBAK	2	2

HD23 DEMONSTRATE PERFORMANCE OF THE
SUSTAINER-VERNIER HYDRAULIC
SYSTEM DURING BOOSTER STAGE
OPERATION, STAGING, AND DURING
SUSTAINER STAGE OPERATION.

H 1140 P SUS/VERN HYD PRESS	1	1
P 1528 D S MAIN FUEL VALVE	2	2

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	P 1929 D S MAIN LO2 VALVE	2	2
	S 1122 V SERVO TEST SIG	2	2
	S 1216 V S PCH ACTR FEEDBACK	2	2
	S 1217 V S YAW ACTR FEEDBACK	2	2
ND26	DEMONSTRATE SATISFACTORY SWITCHOVER OF HYDRAULIC POWER FROM THE GROUND SUPPLY TO THE AIRBORNE SYSTEM.	1	2
	M 1033 P B1 HYD ACCUMULATOR	1	1
	M 1140 P SUB/VERN HYD PRESS	1	1
ND33	DEMONSTRATE ADEQUACY OF THE VERNIER HYDRAULIC SYSTEM DURING A RUN WITH PROGRAM GIMBALING.	1	1
	M 1140 P SUB/VERN HYD PRESS	1	1
	S 1119 V V1 YAW ACTR FEEDBACK	2	2
	S 1114 V V2 YAW ACTR FEEDBACK	2	2
	S 1118 V V2 PCH ACTR FEEDBACK	2	2
	S 1119 V V1 PCH ACTR FEEDBACK	2	2
	S 1122 V SERVO TEST SIG	2	2
ND46	OBTAIN DATA ON THE OPERATION OF PRESSURE SWITCHES 90A & 91	2	2

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D24 OBJ TEST PLAN

IN THE D SERIES GROUND HYDRAULIC SUPPLY UNIT.

	H 1197 X GND HYD LO PRESS	1	1
	H 1198 X GND HYD HI PRESS	1	1
	H 1199 X GND HYD HI PRESS S&V	1	1
	H 1200 X GND HYD LO PRESS S&V	1	1
LD11	DEMONSTRATE ADEQUACY OF COMPATIBILITY OF APPLICABLE GSE AND OPERATING PROCEDURES.	2	2
	X 0000 X NO MEASUREMENTS REQ	X	X
LD13	OBTAIN DATA TO BE USED FOR THE DETERMINATION OF THE EFFECT OF A HOT FIRING ENVIRONMENT UPON THE ACCURACY OF THE LOAD CELL SYSTEM.	1	2
	N 1011 F WT & THST SYS THRUST	1	1
	X 0000 X FIELD STD LOG	X	X
LD15	OBTAIN DATA TO ASCERTAIN TARE AND RESTRAINTS.	1	
	N 1011 F WT & THST SYS-THRUST	2	
	X 0000 X FIELD STD LOG	X	
MD10	MAINTAIN A DETAILED LOG OF MISSILE TANKING AND PRESSURIZATION CYCLES.	2	2
	X 0000 X LOG OF TANKING CYCLE	X	X

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D24 OBJ TEST PLAN

MD12	ESTABLISH MISSILE HANDLING, MATING, AND DEMATING PROCEDURES.	2	2
	X 0000 X NO MEASUREMENTS REQ	X	X
MD13	DEMONSTRATE THE ADEQUACY OF ALL PROCEDURES IN THE D SERIES FLIGHT COUNTDOWN.	1	2
	X 0000 X NO SPECIFIC MEAS REQ	X	X
MD10	DEMONSTRATE MISSILE SYSTEMS AND TEST FACILITIES COMPATIBILITY.	2	2
	X 0000 X MEAS AS REQ FOR	X	X
	X 0000 X SYSTEM CHECK OUT	X	X
	X 0000 X 6 1A & 1B MEAS	X	X
OD10	OBTAIN DATA ON THE VARIOUS MISSILE SYSTEMS AND ASSOCIATED GROUND SUPPORT EQUIPMENT FOR RELIABILITY ANALYSIS.	2	2
	X 0000 X MEAS AS REQ AS PER	X	X
	X 0000 X OTHER OBJECTIVES	X	X
PD14	DETERMINE THE OPERATIONAL CHARACTERISTICS AND THE TRAN- SIENTS IN THE ENGINE START SYSTEM DURING PROPULSION SYSTEM START AND TRANSITION TO MAINSTAGE OPERATION.	1	2
	P 1083 B 52 PUMP SPEED	1	1
	P 1084 B B1 PUMP SPEED	1	1

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D24 GBJ TEST PLAN

P 1349 B S PUMP SPEED	1	1
P 1006 P S THRUST CHAMBER	1	1
P 1026 P B LO2 REG REFERENCE	2	2
P 1027 P VERNIER FUEL TANK	1	1
P 1028 P V1 THRUST CHAMBER	1	1
P 1029 P V2 THRUST CHAMBER	1	1
P 1030 P VERNIER LO2 TANK	1	1
P 1047 P V1 LO2 INLET	2	2
P 1048 P V2 LO2 INLET	2	2
P 1049 P V1 FUEL INLET	2	2
P 1050 P V2 FUEL INLET	2	2
P 1059 P B2 THRUST CHAMBER	1	1
P 1060 P B1 THRUST CHAMBER	1	1
P 1100 P B G6 COMBUSTION CHM	2	2
P 1330 P S FUEL PUMP DISCH	1	1
P 1332 P S LO2 PUMP DISCH	1	1
P 1339 P S GAS GEN DISCH	2	2
P 1344 P S LO2 REG REFERENCE	2	2
P 1351 P S LO2 INJ MANIFOLD	2	2
P 1017 T B2 TURBINE INLET	2	2

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	P 1021 T LO2 AT BRKAWAY VLV	2	2
	P 1326 T S TURBINE INLET	3	2
	X 0000 X STANDARD SEQ MEAS	X	X
PD15	OBTAIN DATA ON OPERATING PARAMETERS THAT WILL PERMIT AN EXAMINATION OF THE BOOSTER ENGINE PERFORMANCE DURING CAPTIVE FIRINGS.	1	1
	P 1083 B B2 PUMP SPEED	1	1
	P 1084 B B1 PUMP SPEED	1	1
	P 1003 P B2 LO2 PUMP INLET	2	2
	P 1004 P B2 FUEL PUMP INLET	2	2
	P 1026 P B LO2 REG REFERENCE	2	2
	P 1059 P B2 THRUST CHAMBER	1	1
	P 1060 P B1 THRUST CHAMBER	1	1
	P 1100 P B B6 COMBUSTION CHM	2	2
	P 1017 T B2 TURBINE INLET	2	2
	P 1767 T B1 CHAMBER SK T	2	2
PD19	OBTAIN DATA ON THE OPERATING PARAMETERS THAT WILL PERMIT AN EXAMINATION OF THE PERFORMANCE OF THE VERNIER ENGINE DURING PUMP-FED AND TANK-FED	1	1

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D24 OBJ TEST PLAN

OPERATIONS.	1	1
P 1349 B S PUMP SPEED	1	1
P 1027 P VERNIER FUEL TANK	1	1
P 1028 P V1 THRUST CHAMBER	1	1
P 1029 P V2 THRUST CHAMBER	1	1
P 1030 P VERNIER LO2 TANK	1	1
P 1047 P V1 LO2 INLET	1	1
P 1048 P V2 LO2 INLET	1	1
P 1049 P V1 FUEL INLET	1	1
P 1050 P V2 FUEL INLET	1	1
P 1330 P S FUEL PUMP DISCH	1	1
P 1322 P S LO2 PUMP DISCH	1	1

D
D23 DETERMINE FLOW CHARACTERISTICS AND TRANSIENTS IN THE VERNIER FEED SYSTEM DURING THE CHANGE FROM TANK-FED TO PUMP-FED OPERATION AT PROPULSION SYSTEM START AND FROM PUMP-FED TO TANK-FED OPERATION AT SUSTAINER STAGING.

P 1349 B S PUMP SPEED	1	1
P 1027 P VERNIER FUEL TANK	1	1
P 1028 P V1 THRUST CHAMBER	2	2
P 1029 P V2 THRUST CHAMBER	2	2
P 1030 P VERNIER LO2 TANK	1	1
P 1047 P V1 LO2 INLET	1	1

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	P 1048 P V2 LO2 INLET	1	1
	P 1049 P V1 FUEL INLET	1	1
	P 1050 P V2 FUEL INLET	1	1
	P 1330 P S FUEL PUMP DISCH	2	2
	P 1332 P S LO2 PUMP DISCH	2	2
	P 1351 P S LO2 INJ MANIFOLD	2	2
PD26	DEMONSTRATE THE STRUCTURAL INTEGRITY OF THE BOOSTER, SUSTAINER, AND VERNIER PROPELLANT FEED DUCTING.	1	2
	X 0000 X VISUAL INSPECTION	X	X
PD28	DEMONSTRATE COMPATIBILITY BETWEEN THE PROPULSION SYSTEM AND TEST SUPPORT EQUIPMENT PRIOR TO MAKING LONG DURATION RUNS.	1	
	P 1083 B S2 PUMP SPEED	1	
	P 1084 B S1 PUMP SPEED	1	
	P 1349 B PUMP SPEED	1	
	P 1528 D S MAIN FUEL VALVE	1	
	P 1529 D S MAIN LO2 VALVE	1	
	P 1006 P S THRUST CHAMBER	1	
	P 1026 P S LO2 REG REFERENCE	1	

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P 1027	P VERNIER FUEL TANK	1	
P 1028	P V1 THRUST CHAMBER	1	
P 1029	P V2 THRUST CHAMBER	1	
P 1030	P VERNIER LO2 TANK	1	
P 1047	P V1 LO2 INLET	1	
P 1048	P V2 LO2 INLET	1	
P 1049	P V1 FUEL INLET	1	
P 1050	P V2 FUEL INLET	1	
P 1059	P B2 THRUST CHAMBER	1	
P 1060	P B1 THRUST CHAMBER	1	
P 1100	P S GG COMBUSTION CHAM	1	
P 1330	P S FUEL PUMP DISCH	1	
P 1332	P S LO2 PUMP DISCH	1	
P 1339	P S GAS GEN DISCH	1	
P 1344	P S LO2 REG REF	1	
P 1017	T B2 TURBINE INLET	1	
P 1326	T S TURBINE INLET	1	
PD29	OBTAIN DATA ON THE OPERATIONAL THRUST RISE CHARACTERISTICS OF THE MA-2 PROPULSION SYSTEM.	1	1
N 1011	F WT & THST SYS-THRUST	1	1

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P 1083 B B2 PUMP SPEED	2	2
P 1084 B B1 PUMP SPEED	2	2
P 1349 B S PUMP SPEED	2	2
P 1439 O S NAA RCC ACCEL	2	2
P 1452 O B1 NAA RCC ACCEL	2	2
P 1453 O B2 NAA RCC ACCEL	2	2
P 1006 P S THRUST CHAMBER	1	1
P 1028 P V1 THRUST CHAMBER	1	1
P 1029 P V2 THRUST CHAMBER	1	1
P 1030 P VERNIER LO2 TANK	1	1
P 1055 P S FUEL PUMP INLET	2	2
P 1059 P B2 THRUST CHAMBER	1	1
P 1060 P B1 THRUST CHAMBER	1	1
P 1100 P B G8 COMBUSTION CHM	2	2
P 1339 P S GAS GEN DISCH	2	2
P 1021 T LO2 AT BRKAWAY VLV	1	1
PD37 DETERMINE CAPTIVE SEA LEVEL PERFORMANCE CHARACTERISTICS OF THE SUSTAINER ENGINE WITH THE PU VALVE CONTROLLED BY THE ACOUSTICA PU SYSTEM.	1	1
P 1349 B S PUMP SPEED	1	1

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P 1528	D S MAIN FUEL VALVE	1	1
P 1529	D S MAIN LO2 VALVE	2	2
P 1006	P S THRUST CHAMBER	1	1
P 1055	P S FUEL PUMP INLET	2	2
P 1056	P S LO2 PUMP INLET	2	2
P 1330	P S FUEL PUMP DISCH	2	2
P 1332	P S LO2 PUMP DISCH	2	2
P 1339	P S GAS GEN DISCH	2	2
P 1351	P S LO2 INJ MANIFOLD	2	2
U 1113	Y ACOUSTICA VLV POS FB	1	1
U 1135	X ACOUSTICA SNRS SIG		1
PD59	DEMONSTRATE OPERATION OF 10C TYPE THRUST CHAMBER BLOW OFF COVERS.		2
	X 0000 X PHOTO COVERAGE		2
PD64	ESTABLISH POST-FIRING PURGE & FLUSH PROCEDURE FOR 10C USE.	1	2
	X 0000 X NO SPECIFIC INSTR	X	X
PD65	DETERMINE TEMPERATURE ENVIRON- MENT OF BOOSTER FUEL PURGE LINE.	1	

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D24 OBJ TEST PLAN

	P 1764 T B1 PRG LN NEAR BLKHO	1	
	P 1768 T B1 PRG LN @ ENG MAN	1	
SD14	DETERMINE THE DYNAMIC RESPONSE OF THE BOOSTER SERVO LOOP.	1	1
	E 1005 Q INVERTER OUTPUT	2	2
	E 1029 Q INVERTER FREQUENCY	2	2
	E 1006 V INVERTER PHASE A	2	2
	H 1033 P B1 HYD ACCUMULATOR	2	2
	S 1107 V B1 PCM ACTR FEEDBAK	1	1
	S 1108 V B2 PCM ACTR FEEDBAK	1	1
	S 1122 V SERVO TEST SIG	1	1
	S 1128 V B1 YAW ACTR FEEDBAK	1	1
	S 1129 V B2 YAW ACTR FEEDBAK	1	1
SD15	DETERMINE THE DYNAMIC RESPONSE OF THE SUSTAINER SERVO LOOP.	1	1
	E 1005 Q INVERTER OUTPUT	2	2
	E 1029 Q INVERTER FREQUENCY	2	2
	E 1006 V INVERTER PHASE A	2	2
	H 1140 P SUB/VERN HYD PRESS	2	2
	S 1122 V SERVO TEST SIG	1	1

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D24 OBJ TEST PLAN

	S 1216 V S PCH ACTR FEEDBACK	1 1
	S 1217 V S YAW ACTR FEEDBACK	1 1
SD30	OBTAIN DATA ON BOOSTER AND SUSTAINER GIMBAL BLOCK FRICTION DURING HOT AND COLD RUNS.	1
	H 1206 P B1 PCH ACTR EXTEND	1
	H 1207 P B1 PCH ACTR RETRACT	1
	H 1208 P B1 YAW ACTR EXTEND	1
	H 1209 P B1 YAW ACTR RETRACT	1
	S 1252 D B1 YAW	2
	S 1253 D B2 YAW	2
	S 1254 D B1 PITCH	2
	S 1255 D B2 PITCH	2
	S 1107 V B1 PCH ACTR FEEDBAK	2
	S 1108 V B2 PCH ACTR FEEDBAK	2
	S 1122 V SERVO TEST SIG	1
	S 1128 V B1 YAW ACTR FEEDBAK	2
	S 1129 V B2 YAW ACTR FEEDBAK	2
	S 1216 V S PCH ACTR FEEDBACK	2
	S 1217 V S YAW ACTR FEEDBACK	2

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SD34	OBTAIN DATA GYRO NOISE CHARACTERISTICS DURING ENGINE GIMBALING	1	1
	S 1147 V PITCH GYRO AMP OUT	1	1
	S 1148 V YAW GYRO AMP OUT	1	1
	S 1149 V ROLL GYRO AMP OUT	1	1
SD35	DETERMINE EFFECT ON THRUST CHAMBER GIMBALING RESULTING FROM INCORPORATION OF STABILIZATION FILTERS		1
	S 1107 V B1 PCH ACTR FEEDBAK	2	2
	S 1108 V B2 PCH ACTR FEEDBAK	2	2
	S 1122 V SERVO TEST SIG	1	1
	S 1128 V B1 YAW ACTR FEEDBAK	2	2
	S 1129 V B2 YAW ACTR FEEDBAK	2	2
	S 1216 V S PCH ACTR FEEDBAK	2	2
	S 1217 V S YAW ACTR FEEDBAK	2	2

UD19	DETERMINE THE CAPABILITY OF THE ACOUSTICA PU SYSTEM WHILE CONTROLLING THE MISSILE PU		1
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VALVE DURING LONG DURATION
MULTI-STAGE CAPTIVE FIRING.

	P 1287 D ACOUSTIC FUL VLV XDR	1	
	P 1529 D S MAIN LO2 VALVE	2	
	P 1682 P PRESS DIFF ON LO2 TK	2	
	P 1683 P PRESS DIFF ON FUL TK	2	
	U 1080 P LO2 TANK HEAD	1	
	U 1081 P FUEL TANK HEAD	1	
	U 1091 V ERROR RATIO DEMOD OP	2	
	U 1113 V ACOUSTICA VLV POS FB	1	
	U 1195 X ACOUSTICA SNSRS SIG	1	
UD20	DETERMINE THE CAPABILITY OF THE CONVAIR PU SYSTEM IN CON- TROLLING THE RATIO OF RESIDUAL PROPELLANTS DURING D SERIES CAPTIVE FIRINGS.	1	1
	N 1011 F WT & THST SYS-THRUST	1	1
	P 1528 D S MAIN FUEL VALVE	1	1
	P 1529 D S MAIN LO2 VALVE	2	2
	U 1080 P LO2 TANK HEAD	1	1
	U 1081 P FUEL TANK HEAD	1	1
	U 1091 V ERROR RATIO DEMOD OP	1	1
UD24	OBTAIN DATA ON THE OUTPUTS OF	1	1

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THE ACOUSTICA TANK LEVEL SENSORS AND OBTAIN COMPUTER DATA TO DETERMINE SYSTEM CAPABILITY AND FUNCTIONAL ADEQUACY DURING A LONG DURATION D SERIES CAPTIVE TEST. /OPEN LOOP CONFIGURATION/

N 1011 F WT & THST SYS-THRUST	2	2
N 1971 X AA 99.8% FUEL PROBE	2	2
N 1972 X AA 100.2% FUEL PROBE	2	2
N 1976 X AA LO2 BU FINE SIG	2	2
N 1977 X AA LO2 TOPG COF SIG	2	2
N 1978 X AA LO2 ENG SIG	2	2
P 1287 D ACOUSTC FUL VLV XDCR	2	2
P 1682 P PRESS DIFF ON LO2 TK	2	2
P 1683 P PRESS DIFF FUEL TK	2	2
U 1080 P LO2 TANK HEAD	1	1
U 1081 P FUEL TANK HEAD	1	1
U 1174 T ACOUSTICA COMP TEMP	2	2
U 1113 V ACOUSTICA V FB	1	1
U 1124 X AA TIME SHARD USC OP	2	2
U 1125 X ACOUSTICA SNSRS SIG	2	2
X 0000 X STANDARD SEQ MEAS	2	2

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D24 OBJ TEST PLAN

WD01	DEMONSTRATE THE LO2 TANKING PROCEDURE UTILIZING TANKING FACILITIES INCORPORATING SUB- COOLED LO2 TOPPING CAPABILITIES.	2	2
	N 1011 F WT & THST SYS-THRUST	1	1
	P 1682 P PRESS DIFF ON LO2 TK	1	1
	P 1683 P PRESS DIFF FUEL TK	2	2
	P 1021 T LO2 AT BRKAWAY VLV	2	2
	P 1631 X LO2 F&D VLV AIRB OPN	2	2
	P 1632 X LO2 F&D VLV AIRB CLS	2	2
	P 1633 X LO2 F&D VLV GND OPN	2	2
	P 1634 X LO2 F&D VLV GND CLS	2	2
	U 1091 V ERROR RATIO DEMOD OP	1	1
WD02	DETERMINE THE ACCURACY OF THE CONVAIR PROPELLANT LOADING CONTROL SYSTEM IN LOADING THE MISSILE TO PROPER D SERIES LEVELS.	1	1
	F 1001 P LO2 TANK HELIUM	2	2
	F 1001 P LO2 TANK HELIUM	2	2
	F 1003 P FUEL TANK HELIUM	2	2
	N 1011 F WT & THST SYS-THRUST	1	1
	P 1682 P PRESS DIFF LO2 TK	1	1
	P 1683 P PRESS DIFF FUEL TK	1	1
	U 1091 V ERROR RATIO DEMOD OP	1	1

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D24 OBJ TEST PLAN

WD05	DETERMINE THE ACCURACY OF THE ACOUSTICA PROPELLANT LOADING SYSTEM IN LOADING THE MISSILE TO PROPER D SERIES LEVELS.	1
	F 1001 P LO2 TANK HELIUM	2
	N 1011 F WT & THST SYS-THRUST	1
	N 1971 X AA 99.8% FUEL PROBE	1
	N 1972 X AA 100.2% FUEL PROBE	1
	N 1976 X AA LO2 BU FINE SIG	1
	N 1977 X AA LO2 TOPG COF SIG	1
	N 1978 X AA LO2 ENG SIG	1
	P 1682 P PRESS DIFF ON LO2 TK	2
	P 1683 P PRESS DIFF FUEL TK	2
	U 1091 V ERROR RATIO DEMOD OP	2
	U 1148 X LO2 2 SNSRS STA 547	2
	U 1149 X LO2 2 SNSRS STA 666	2
	U 1150 X LO2 2 SNSRS STA 798	2
	U 1151 X LO2 2 SNSRS STA 836	2
	U 1152 X LO2 2 SNSRS STA 888	2
	U 1153 X LO2 2 SNSRS STA 910	2
	U 1160 X FUL 2 SNSRS STA 944	2
	U 1161 X FUL 2 SNSRS STA 1024	2
	U 1162 X FUL 2 SNSRS STA 1089	2
	U 1163 X FUL 2 SNSRS STA 1126	2

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D24 OBJ TEST PLAN

U 1164 X FUL 2 SNSRS STA 1141	2
U 1165 X FUL 2 SNSRS STA 1156	2

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FIXED REQUIREMENTS

01

MONITOR

P 1003 P FUEL TANK HELIUM	1A 1A 1A
P 1125 P B CTL PNEU REG OUT	1A 1A 1A
P 1246 P B TK HE BTL HI	1A 1A 1A
P 1288 P ST PNEU REG OUT	1A 1A 1A
P 1528 D S MAIN FUEL VALVE	1A 1A 1A
P 1010 P B1 LUBE OIL INJ MAN	1A 1A 1A
P 1026 P B LO2 REG REFERENCE	1A 1A 1A
P 1291 P S CTL HE BTL	1A 1A 1A
P 1341 P S LUBE OIL MANIFOLD	1A 1A 1A
P 1344 P S LO2 REG REFERENCE	1A 1A 1A
P 1465 P S LO2 PR LUB OIL MAN	1A 1A 1A
P 1017 T B2 TURBINE INLET	1A 1A 1A
P 1526 T S TURBINE INLET	1A 1A 1A
P 1673 T B1 FUEL IGN VLV AMB	1A 1A 1A
P 1674 T B2 FUEL IGN VLV AMB	1A 1A 1A
P 1675 T ENG CTL PNEU MAN AMB	1A 1A 1A

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D24 OBJ TEST PLAN

	P 1677 T FIRE DETECTOR EDISON	1A 1A 1A
02	POST TEST INSPECTION	
	P 1083 B B2 PUMP SPEED	1B 1B 1B
	P 1084 B B1 PUMP SPEED	1B 1B 1B
	P 1349 B S PUMP SPEED	1B 1B 1B
	P 1006 P S THRUST CHAMBER	1B 1B 1B
	P 1028 P V1 THRUST CHAMBER	1B 1B 1B
	P 1029 P V2 THRUST CHAMBER	1B 1B 1B
	P 1056 P S LO2 PUMP INLET	1B 1B 1B
	P 1059 P B2 THRUST CHAMBER	1B 1B 1B
	P 1060 P B1 THRUST CHAMBER	1B 1B 1B
	P 1091 P B1 LO2 INJ MANIFOLD	1B 1B 1B
	P 1092 P B2 LO2 INJ MANIFOLD	1B 1B 1B
	P 1093 P B1 FUEL INJ MANIFOLD	1B 1B 1B
	P 1094 P B2 FUEL INJ MANIFOLD	1B 1B 1B
	P 1236 P S FUEL PUMP DISCH	1B 1B 1B
	P 1250 P S FUEL INJ MANIFOLD	1B 1B 1B
	P 1251 P S LO2 INJ MANIFOLD	1B 1B 1B

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SECTION 11

APPENDIX A

SERIES D PEN ASSIGNMENTS

For ease of data reduction and clarity of communication, it has been desirable to standardize pen number assignments to the bulk of the sequence (on-off) measurements during this series testing. This section presents these standardized measurements and their pen assignments. The measurements listed in this section are not shown elsewhere in this report.

The following is a brief explanation of the format used in this section.

Measurement Identification

Two letters are included, the first denotes the system instrumented while the later indicates the type of measurement. Of the four numerical digits the first is used to identify the method of signal transmission from the transducer to the recorder. While the remaining three provide an identification of the measurement within the system indicated by the first letter.

Pen Number

This denotes the sequence recorder pen assignment for the measurement.

P 1901 X	KIN STAGE TIMER COF	P11-B
P 1000 X	IGN FUEL V OPEN CTL	P11-B
P 1100 X	SUSTAINER REV SOL B	P11-/P/
P 1100 X	S LOR REV CLED NEW	P1-B

PEN 06	
PEN 06	
PEN 07	O
PEN 06	O

Measurement Description

This is a brief, usually abbreviated, description of the measurement.

Calligraph

An "O" in this column indicates that in addition to being recorded on a sequence recorder the measurement should be recorded on an oscillograph channel.

Plug-up Point

This indicates the electrical plug number and pin letter of the plug-up point provided in the electrical control system for this measurement. Small letters are enclosed by slashes in this section to differentiate them from large letters.

NOTE: For a more detailed explanation of this format and a key to abbreviations and coding see Appendix B in section 12 of this report.

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SERIES D PEN NUMBER 14 MAY 1959

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S	M	T		P	P	
Y	E	Y		L	E	
S	SO	E	DESCRIPTION	U	N	O
				G	N	
			TIMING PIP		PEN	1
P	1137	X	ETP PREP COMPLETE LT	P1-H	PEN	4
P	1575	X	PRE START READY	P1-J	PEN	5
P	1161	X	TCC START SWITCH	P1-K	PEN	6
P	1608	X	ENG TANKS PRES	P10-/E/	PEN	7
P	1609	X	ENG FUEL TK PRES	P11-V	PEN	8
P	1610	X	ENG LO2 TK PRES	P11-/K/	PEN	9
P	1441	X	IGNITION STAGE TIMER	P11-W	PEN	10
P	1611	X	MAIN IGNITION START	P11-/C/	PEN	11
P	1612	X	GG IGN LINK PILOT	P11-/E/	PEN	12
P	1073	X	V1 PV CLOSED MSW	P1-N	PEN	13
P	1172	X	V1 PV OPEN MSW	P1-P	PEN	14
P	1074	X	V2 PV CLOSED MSW	P1-R	PEN	15
P	1174	X	V2 PV OPEN MSW	P1-S	PEN	16
P	1613	X	V1 P CHM SWITCH ON	P11-/G/	PEN	17
P	1614	X	V2 P CHM SWITCH ON	P11-/H/	PEN	18
P	1598	X	VERNIER ENG CUTOFF	P11-/W/	PEN	19
			TIMING PIP		PEN	21
P	1621	X	IGN STAGE VLVS	P1-U	PEN	22
P	1068	X	B1 LO2 VLV CLSD MSW	P1-V	PEN	23
P	1170	X	B1 LO2 VLV OPEN MSW	P11-X	PEN	24

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P 1067 X	B2 LO2 VLV CLSD MSW	P1-W	PEN 25
P 1169 X	B2 LO2 VLV OPEN MSW	P11-Z	PEN 26
P 1616 X	B FLIGHT LOCKIN	P14-E	PEN 27
P 1617 X	MAIN STAGE LIMITER	P1-Z	PEN 28
P 1070 X	B1 FUEL VLV CLSD MSW	P1-/E/	PEN 29
P 1194 X	B1 FUEL VLV OPEN MSW	P1-/F/	PEN 30
P 1069 X	B2 FUEL VLV CLSD MSW	P1-/G/	PEN 31
P 1195 X	B2 FUEL VLV OPEN MSW	P1-/H/	PEN 32
P 1071 X	B GG VLV CLOSED MSW	P1-/A/	PEN 33
P 1147 X	B GG VLV OPEN MSW	P1-/B/	PEN 34
P 1618 X	BU FUEL MAN P SW ON	P11-T	PEN 35
P 1619 X	B2 FUEL MAN P SW ON	P11-U	PEN 36
P 1992 X	BOOSTER ENG CUTOFF	P11-/Y/	PEN 37
	TIMING PIP		PEN 41
P 1621 X	IGN STAGE VLVS	P1-U	PEN 42
P 1199 X	S LO2 HSV CLSD MSW	P1-X	PEN 43
P 1198 X	S LO2 HSV OPEN MSW	P11-/A/	PEN 44
P 1622 X	S FLIGHT LOCKIN	P10-S	PEN 45
P 1203 X	S FUEL PUV CLSD MSW	P1-/J/	PEN 46
P 1202 X	S FUEL PUV OPEN MSW	P1-/K/	PEN 47
P 1995 X	S66 VLV CLSD MSW	P1-/C/	PEN 48
P 1499 X	S66 VLV OPEN MSW	P1-/D/	PEN 49

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P 1623 X	S FUEL MAN P SW ON	P11-S	PEN 50
P 1624 X	MAIN ENGS COMPLETE	P1-/M/	PEN 51
P 1596 X	PRE-RLS COF DISARM	P11-/Z/	PEN 52
P 1593 X	SUSTAINER ENG CUTOFF	P11-/X/	PEN 54
P 1627 X	MAIN ENG TH COMPLETE	P11-/P/	PEN 56
	TIMING PIP		PEN 61
P 1072 X	BOOSTER CUTOFF RELAY	P14-P	PEN 62
P 1347 X	S CUTOFF RELAY	P14-M	PEN 63
P 1077 X	VERNIER CUTOFF RELAY	P14-A	PEN 64
P 1154 X	TCC B ENGINE COF SW	P1-/N/	PEN 65
P 1594 X	TCC SUSTAINER COF SW	P1-/P/	PEN 66
P 1164 X	TCC VERN ENG COF SW	P1-/R/	PEN 67
P 1628 X	IGN STAGE LIM COF	P11-/S/	PEN 68
P 1155 X	OBSERVER CUTOFF	P1-/S/	PEN 69
P 1566 X	DC GND PWR FAIL COF	P11-/D/	PEN 70
P 1157 X	B2 TBN OVSPEED TRIP	P11-/U/	PEN 71
P 1588 X	S TBN OVSPEED TRIP	P11-/V/	PEN 72
P 1630 X	MAIN STAGE LIM COF	P11-R	PEN 74
P 1158 X	PREP INCOMPLETE COF	P11-/B/	PEN 75
P 1192 X	B1 ROUGH COMB COF		PEN 76
P 1193 X	B2 ROUGH COMB COF		PEN 77
P 1438 X	S ROUGH COMB COF		PEN 78

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TIMING PIP		PEN	
P 1445 X	B FUEL PRE VLV OPEN	PEN	81
P 1446 X	B FUEL PRE VLV CLSD	PEN	82
P 1581 X	S FUEL PRE VLV OPEN	PEN	83
P 1580 X	S FUEL PRE VLV CLSD	PEN	84
P 1686 X	B6566 LO2 PURGE	P104-A	PEN 93
P 1687 X	B6566 FUEL PURGE	P104-P	PEN 94
P 1688 X	VERNIER ENGINE PURGE	P104-T	PEN 95
TIMING PIP			PEN 101

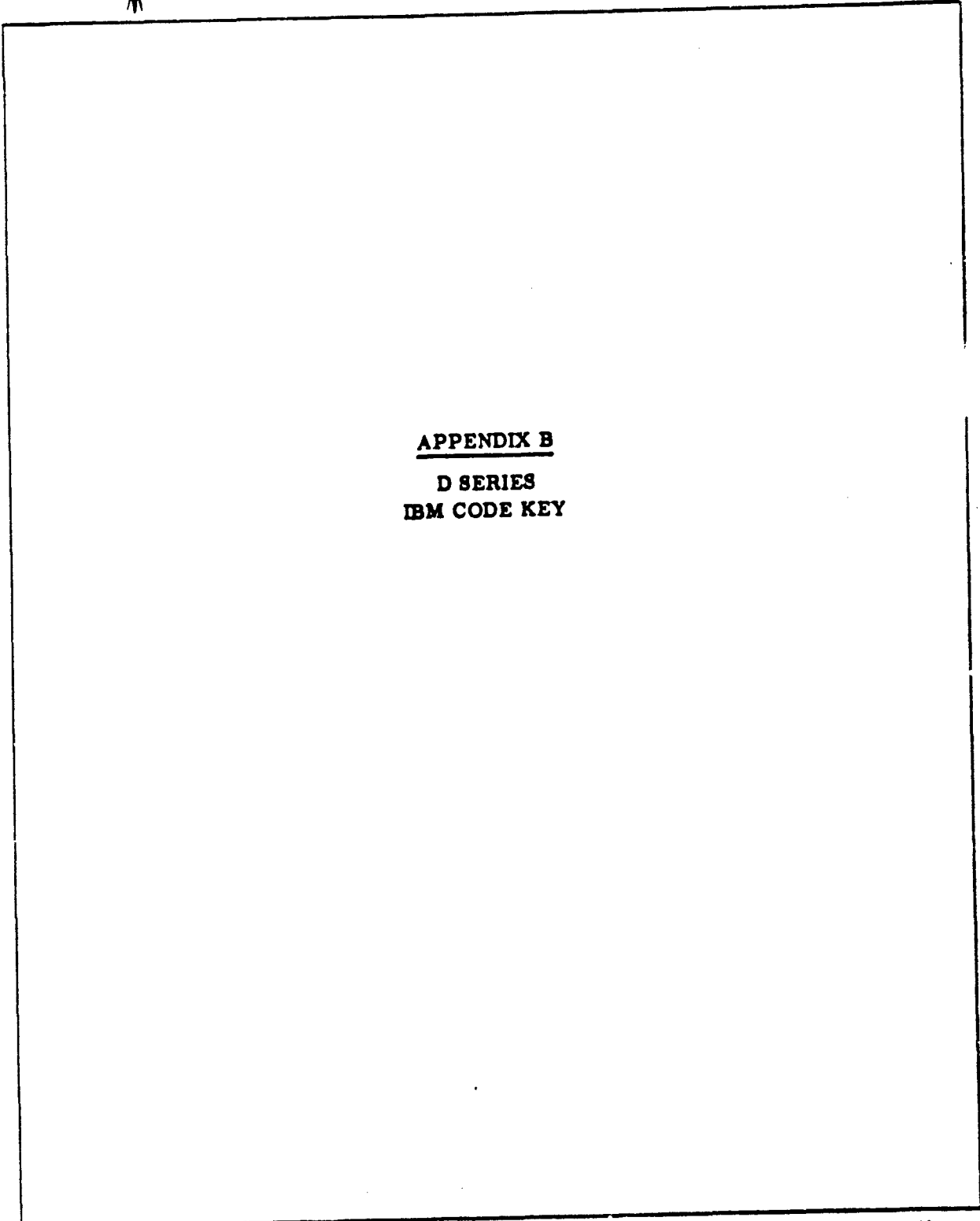
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APPENDIX B
D SERIES
IBM CODE KEY

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APPENDIX
INSTRUMENTATION CONFIGURATION
IBM CODE KEY

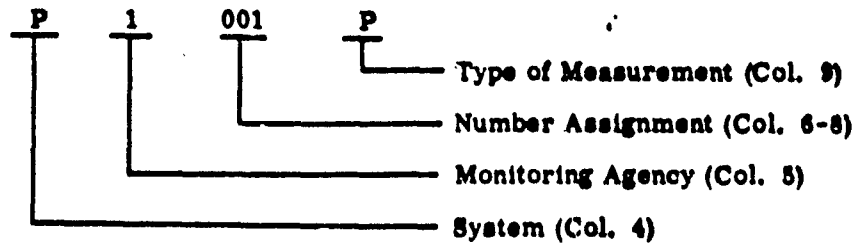
Master tabulations of all performance measurements applicable to all test articles are maintained by the Test Evaluation Group. Operational tabulations are compiled from these masters for individual missiles. All instrumentation logs are maintained on IBM punched cards. This facilitates rapid sorting, re-arrangement, and tabulation of measurements as required for program preparation and data analysis. Such storage necessitates a systematic classification of the measurements and uniformity in method used to describe the many types of measurements. To achieve this, an extensive coding of the identification, description, and measurement parameters is necessary. The following is an explanation and key for this coding. Each section may be identified in the key by the section heading or the IBM card column number.

I. MISSILE IDENTIFICATION (Col. 1-3)

This section is used to present the missile series (Col. 1) and missile number (Col. 2-3).

II. MEASUREMENT IDENTIFICATION (Col. 4-9)

A. Each measurement has a unique six-character identification. The first character defines the system within which the measurement exists. The second character defines the monitoring agency. The third, fourth, and fifth characters are number assignments which define a particular measurement within the system defined by the first character. The sixth character defines the type of measurement.



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<u>SYMBOL</u>	<u>SYSTEM (Col. 4)</u>	<u>TYPE OF MEASUREMENT (Col. 9)</u>
A	Airframe	Acceleration
B	Range Safety Beacon	Rotation Rate
C	*	Current
D	Range Safety Command	Deflection
E	Electrical	Power
F	Pressurization	Force
G	Guidance (Radio)	*
H	Hydraulic	Position
I	Guidance (Inertial)	Intensity
L	Launcher	Velocity
M	Miscellaneous	Mass
N	Facilities and Site	*
O	*	Vibration
P	Propulsion	Pressure
Q	*	Frequency
R	*	Rate
S	Flight Control System (Servo)	Strain
T	Telemetry	Temperature
U	Propellant Utilization	*
V	*	Voltage
W	*	Time
X	External	Discrete Position
Y	Nose Cone	Acoustical
Z	AZUSA Transponder	Asimuth

*Note: Unassigned

MONITORING AGENCY (Col. 5)

0 Telemetry
 1 Direct Line (Captive Test & AFMTC Landline)
 3 Checkout and Validation Instrumentation
 5 Visual Panel Presentations

III. MEASUREMENT DESCRIPTION (Col. 10-29)

Commonly used terminology is abbreviated as indicated in the List of Abbreviations at the end of this report.

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IV. MEASUREMENT RANGE (Col. 35-42)

This represents the desired capability of the measuring system. "M" preceding a number indicates minus quantity.

V. UNITS OF FUNCTION (Col. 43-45)

AMP	Amperes	LBS	Pounds
CPS	Cycles per second	MA	Milliamperes
DB	Decibels	MC	Megacycles
DBM	Decibels above 1 Milliwatts	ME	Milliwatts
DEG	Degrees Angular	MII	Microinches per inch
DGC	Degrees Centigrade	MS	Milliseconds
DGF	Degrees Fahrenheit	MV	Millivolts
DGR	Degrees Rankine	PIA	Pounds per square inch absolute
D/S	Degrees per second	PID	Pounds per square inch differential
E	Watts	PIG	Pounds per square inch gage
F/S	Feet per second	PPS	Pulses per second
FS ²	Feet per second ²	PS	Pounds per second
FTN	Foot ton	PSI	Pounds per square inch
G	Acceleration of Gravity	RPM	Revolutions per minute
GPM	Gallons per minute	RS ²	Radians per second ²
GPS	Gallons per second	SF ²	Slugs feet ²
IN	Inches	SLG	Slugs
INW	Inches of water	SPS	Samples per second
ILB	Inch pounds	UV	Microvolts
IPI	Inches per inch	UA	Microamperes
KC	Kilocycles	VAC	Volts, alternating current
KID	Thousands of pound per square in. differential	VDC	Volts, direct current
KPS	Kilo-pounds	VPK	Peak volts, AC
KPM	Thousands of RPM's	PRV	Phase reversing AC voltage

VI. FREQUENCY RESPONSE REQUIRED (Col. 49-51)

The required response of the measuring system in cycles per second unless otherwise noted or implied.

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SLO	Less than 1 cycle per second
400	400 cycles per second
1KC	1 Kilocycle (1000 cycles) per second
2MC	2 Megacycles (2,000,000 cycles) per second
STP	Step Function
UNK	Unknown

VII. TYPE OF TRANSDUCER (Col. 52-61)

*Indicates an "off the shelf" commercial transducer. This is followed by a coded identification of the vendor and the vendor model number if known.

Vendor Code

WK	Wianco Engineering Co.	BLH	Baldwin-Lima Hamilton
MASSA	Massa Laboratories, Inc.	T	Thermo Electric Co., Inc.
R-D	Rocketdyne	WAUGH	Waugh Engineering Co.

Indicates the transducer is the same one as that used for the measurement number immediately following this symbol.

VIII. TRANSDUCER SERIAL NUMBER (Col. 62-66)**IX. TRANSDUCER LOCATION (Col. 67-70)****Station Number (Col. 67-70)**

Location by station number to the nearest inch.

Quadrant Number (Col. 71)

1	Quadrant I
2	Quadrant II
3	Quadrant III
4	Quadrant IV
X	XX Axis
Y	YY Axis

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FOR LANDLINE AND CAPTIVE TEST

X. TYPE OF RECORDER (Col. 30-34)

- A AM tape
- D Sanborn type recorder
- E Eput meter, counter
- F FM tape
- G Esterline-Angus-Type-AW Graphic Recorder
- L Panel Light
- M Miscellaneous
- O Oscillograph (CEC)
- P Printer
- R EA Sequence Recorder
- S Strip chart (Brown, Speedomax)
- V Visual panel gage

FOR TELEMETERING ONLY

XI. MEASUREMENT CHANNEL ASSIGNMENTS (Col. 30-34, on TLM only)

Telemeter transmitter number (Col. 30)

Subcarrier channel numbers (Col. 31-32)

1-13, A, C, E

Pin number (Col. 33-34)

Pin number if commutated in telemeter package

Pin number 1 thru 60

TYPE OF MEASUREMENT (Col. 76, on TLM only)

- P Primary - An original measurement with one transducer, the output of which is sent to only one telemetering package.
- M Multiple - When a measurement is picked up by one transducer but sent over two or more telemetering packages the original measurement is considered primary and the repeated ones considered multiple.

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~~CONFIDENTIAL~~CONVAIR  ASTRONAUTICS**SPECIAL CODING** (Col. 76, on TLM only)

- C** Installation Drawing/Wiring Diagram
(Signal available will be shown in tabulation section 15)
(Output impedance will be shown in tabulation section 16)

XII. INSTRUMENTATION TEST PLAN**A. Measurement Functions** (Col.31-34)

Functions are assigned two or four digit codes and are classified as (1) operational requirements, (2) Post Test Failure Detection Requirements or (3) Test Objectives.

1. Operational Requirements

Operational measurements are those required on a continuing basis for checkout of the missile during the countdown and for safe operation during start, running, and shutdown of a hot firing. These measurements must be presented on a visual display, all others have no such requirement. Operational measurements are indicated by the two digit code (01).

2. Post Test Failure Detection Requirements

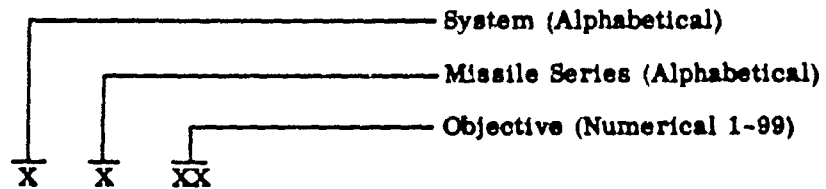
This measurement function includes those measurements which will provide "quick look" type of post test data necessary to detect a possible malfunction. Analysis of this data should indicate an unsafe firing condition. These measurements are indicated by the two digit code (02).

3. Test Objectives

- a. **Coding System:** The coding system for test objectives has been developed to provide a rapid means of identification and handling of a large number of objectives. Coded objectives are listed by system along with the instrumentation required for accomplishment.

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- b. Letters used to identify the system are identical to those used to identify the system described in Section II of the code key with the following addition:

o - overall general objectives
i.e. Reliability, Compatibility
w - propellant loading

- c. Objectives Headers

- (1) The instrumentation test plan presents a tabulation of measurements by test objectives. These test objectives have necessarily been abbreviated to fit the IBM format which limits the entire header to 20 digits.
- (2) Each objective header will contain one of the following five key terms. These terms defined below will establish a standard datum for uniform interpretation of test objectives.

DEMONSTRATE (DEM) denotes the occurrence of an action or an event during a test. The accomplishment of this type objective requires a qualitative answer. The answer will be derived through the relation of this action or event to some other known information or occurrence. This category of objective implies a minimum of airborne instrumentation, and/or that the information be obtained external to the missile.

DETERMINE (DET) denotes the measuring of performance of any unit or system. This category implies the quantitative investigation of overall operation which includes, generally, instrumentation for measuring basic inputs and outputs of the unit or system. The information obtained should indicate to what

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extent the system is operating as designed. The instrumentation should allow performance deficiencies to be isolated to either the system or to the system inputs.

EVALUATE (EVAL) denotes the measuring of over-all performance of any unit or system as well as the performance and/or interaction of its sections or subsystems that are under investigation.

The accomplishment of objectives of this type requires quantitative data on the performance of both unit or system and its sections or subsystems. Instrumentation for this category generally includes measuring basic inputs and outputs of the unit or system as well as basic inputs and outputs of its sections or subsystems. The overall performance levels of the sections or subsystems will then be analyzed for their contribution toward performance of the unit or system. This category will provide the most detailed information of any of these categories.

OBTAIN DATA (OBTN) denotes gathering engineering information which is to be measured to augment the general knowledge required in the development of the overall weapon system. This category may also be used for supplemental investigations such as environmental studies, ascertaining k factors, ground equipment studies, etc. The degree of instrumentation is not implied by this definition; individual objectives will indicate extent of instrumentation required.

ESTABLISH (ESTB) denotes gathering engineering information for the development of ground procedures and operating techniques. Objectives in this category are not necessarily dependent on analytic studies.

B. Test Block Numbers (Captive only)

Two columns of information are give under each run. These columns indicate which parameters are to be recorded on each test run. The first column gives the measurement priority. The second is used only for priority 1 measurements and gives the measurement category.

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C. Priority Symbols (Captive only)

1. These measurements are necessary to ensure safe operation or satisfactory fulfillment of the test objectives. This includes functional readiness indications, the so-called "red line" indications. The test would be authorized to either "hold" or "abort" as applicable for any one of these measurements.
2. These are measurements secondary to any particular test objective. They will contribute additional information toward fulfillment of the test objective but the test would be authorized to "hold" only if the number and nature of the incomplete instrumentation in this category appeared detrimental to accomplishment of the test objective.
3. These are measurements of general information nature. They may supplement the priority 1 and 2 measurements, or they may be of environmental nature in and around the test stand. They will be taken only when manpower and schedules permit. No hold action will be authorized for any of these measurements.

Absence of a priority entry in the first column on any run indicates that the measurement will not be made on that run.

D. Measurement Categories (Captive only)

- 1A Operations Measurements - Those functions that have to be monitored before and/or during a test. Category "A" measurements will be identified as such irrespective of whether the function has most significance before or during a test.
- 1B Post-Test Inspection Measurements - Those functions that are to be reviewed after a test to determine that systems operated properly and that the test was conducted safely.

SYSTEM EVALUATION MEASUREMENTS

A number of measurements are required for basic systems evaluation. Some of these are already included in categories 1A and 1B as defined above. The rest consist of all other priority 1 measurements.

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E. Problem Area (Col. 75-79)

This system of coding is used to group related measurements for easier analysis. Descriptive heading of this coding appear in all tabulations that are presented in this order.

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<u>A</u>			
AC	Alternating Current	BSTR	Booster
ACC	Acceleration	BTG	Beacon trigger
ACCEL	Accelerometer		Generator
ACTR	Actuator	BTL	Bottle
ACUM	Accumulator	BYP	Bypass
ACY	Accessory		
ADAPT	Adapter		<u>C</u>
AGC	Automatic Gain Control		
ALT	Alternate	C	Cycle
AMB	Ambient	CALB	Calibrate
AMP	Amplifier	CAN	Canister
ANG	Angle	CATH	Cathode
ANT	Antenna	CATHFOL	Cathode Follower
APS	Accessory Power Supply	CCT	Circuit
ASSY	Assembly	CHNL	Channel
ATT	Attitude	CHM	Chamber
AUD	Audio	CLS	Closed
AUX	Auxiliary	CLOS	Closing
AVG	Average	CLED	Closed
AX	Axis	CMPT	Composite
AZM	Azimuth	COF	Cut off
		COMB	Combustion
		COMP	Compartment
		CONV	Converter
		COR	Corner
		CP	Contractors Panel
		CTL	Control
		CTR	Center
		CYL	Cylinder
			<u>D</u>
<u>B</u>	Booster	D	Decoder
B1	Upper Booster	DBE	Doubler
B2	Lower Booster	DC	Direct Current
BAT	Battery	DCDE	Decoder
BCN	Beacon	DEFL	Deflection
BGG	Booster Gas Generator	DEFR	Deflector
BK	Break		
BLKHD	Bulkhead		
BLKHS	Blockhouse		
BLWS	Bellows		
BO	Boil Off		
BRG	Bearing		
BRKT	Bracket		
B&S	Booster & Sustainer		

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DEL	Delivery	FIN	Fine
DEM0D	Demodulator	FL	Flame
DESTR	Destructor	FLDN	Fielden
DETR	Detector	FLS	Flashing Light System
DI	Discrete Integrator	FOL	Follower
DIAM	Diametric	FR	Flow Rate
DIF	Difference	FREQ	Frequency
DIS	Discharge	FRG	Fairing
DISC	Discrete	FT	Flow Totalizer
DISCH	Discharge	FUL	Fuel
DISCON	Disconnect	FV	Fuel Valve
DISPL	Displacement	FWD	Forward
DN	Down		
DO	Drop Out		
DP	Pressure Drop		<u>G</u>
DRVE	Driver		
DSHE	Down Stream Heat Exchanger	GEN	Generator
		GFST	Ground Fuel Start Tank
DSTR	Down Stream		
DT	Temperature Drop	GFUT	Ground Fuel Ullage Tank
DY	Display		
	<u>E</u>	GG	Gas Generator
		GLUT	Ground Liquid Oxygen Ullage Tank
EMERG	Emergency	GMBAL	Gimbal
ENG	Engine	GND	Ground
ENGAGMT	Engagement	GN ₂	Gaseous Nitrogen
ETO	Ethylene Oxide	GOUT	Ground Liquid Oxygen Ullage Tank
ETP	Engine Test Panel		
EVCO	Electronic Vibration Cutoff	GOX	Gaseous Oxygen
EXT	External	GMP	Gallons Per Minute
		GRND	Ground
	<u>E</u>	GU	Ground Unit
			<u>H</u>
FAIL	Failure		
FB	Feedback	HD	Holddown
F & C	Fill & Check	HE	Helium
F & D	Fill & Drain		

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HI	High	LNG	Long
HLDR	Holder	LN ₂	Liquid Nitrogen
HORZ	Horizontal	LO	Low
HPD	Hydraulic Pump Discharge	LOKIN	Lockin
HPP	Hy Pneu Panel	LOKUP	Lockup
HSP	Helium Storage Panel	LONG	Longitudinal
HSV	Head Suppression Valve	LO ₂	Liquid Oxygen
HT	Heat	LT	Light
HTE	Heater	LUB	Lube
HYD	Hydraulic	LVL	Level
	<u>I</u>		<u>M</u>
IF	Intermediate Frequency	M	Minus
IGN	Ignitor or Ignition	MAG	Magnetron
IN	Inlet	MAN	Manifold
INFO	Information	MANR	Manometer
INJ	Injector or Injection	MC	Megacycles
INST	Instrumentation	MK	Mark
INTERR	Interrogation	MNL	Manual
INTG	Integrating	MOT	Motor
INTGD	Integrated	MPP	Missile Power Control Panel
INTL	Internal	MSG	Message
INVR	Inverter	MSL	Missile
	<u>J</u>	MSW	Microswitch
JET	Jettison	MTL	Metal
JUNCT	Junction	MULT	Multiplier
	<u>K</u>		<u>N</u>
	<u>L</u>	NAA	North American Aviation
L	Launcher	N/C	Noise cone
L/LFM	Landline FM		<u>O</u>
LIM	Limiter		
LN	Line	OP	Operational, Optical Probe, Output

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OPG	Opening	PUSV	Propellant Utilization
OPN	Open		Servo Valve
OPT	Output	PUV	Propellant Utilization
ORFC	Orifice		Valve
OSC	Oscillator	PV	Propellant Valves
OTBD	Outboard	PWR	Power
OTP	Output	PWRSUP	Power Supply
OUT	Outlet		
OVBD	Overboard		<u>Q</u>
	<u>P</u>	<u>Q</u>	Quadrant
P	Pressure		<u>R</u>
PB	Pulse Beacon	R	Rate Beacon
PB-IP	Pulse Beacon-Impact	RAD	Radial
	Predictor	RB	Rate Beacon
PCH	Pitch	RB-IP	Rate Beacon-Impact
PCP	Pressurization Control		Predictor
	Panel	RCC	Rough Combustion
PH	Phase		Cut-off
PLT	Plate	RCVB	Receiver
PMP	Pump	RD	Rocketdyne
PNEU	Pneumatic	RDY	Ready
POS	Position or Positioner	RECIRC	Recirculate
PPS	Pulses Per Second	REDNDT	Redundant
PR	Phase Reversing	RE	Reference
PREP	Preparation	REFER	Reference
PRES	Pressurizing	REG	Regulator
PRESZ	Pressurized	REGS	Regulators
PRESZ	Pressurization	REL	Relay
PREVLV	Prevails	RES	Reservoir
PRF	Pulse Repetition Rate	RET	Return
PRG	Purge	RETR	Retract
PRGR	Programmer	RF	Radio Frequency
PROP	Propellant	RG	Rate Gyro
PS	Pounds Per Second	RLF	Relief
PSUP	Power Supply	RLS	Release
PU	Propellant Utilization		

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RNG	Range	SURF	Surface
ROL	Roll	SUS	Sustainer
RSB	Range Safety Beacon	SV	Servo valve
RSC	Range Safety Command	SW	Switch
		SYS	System
			<u>T</u>
S	Sustainer		
SA	Servo Amplifier	TACH	Tachometer
SAD	Saddle	TANG	Tangential
SAT	Satisfactory	TAR	Target
SC	Subcarrier	TBN	Turbine
SDC	Secondary Distribution Center	T/C	Thermocouple
		TCC	Test Conductor's Console
SECT	Section		
SEL	Selector	TEMP	Temperature
SEP	Separation	TH	Thrust
SEQ	Sequence	THST	Thrust
SFC	Surface	TK	Tank
SFTY	Safety	TM	Telemeter
SGG	Sustainer Gas Generator	TMR	Timer
SHLD	Shield	TOT	Total
SIG	Signal	TRIG	Trigger
SNERS	Sensors	TSYS	Transfer System
SNSR	Sensor	TU	Transfer Unit
SOL	Solenoid		
ST	Static		<u>U</u>
ST	Start Tank		
STA	Station	U	Upper
STAB	Stabilizer	UMBIL	Umbilical
STGTH	Strength	UNREG	Unregulated
STP	Stop	USHE	Upstream Heat Exchanger
STR	Start		
STRT	Start		
STRUC	Structure		<u>Y</u>
SUP	Supply		
SUPP	Suppression	VDC	Volts Direct Current
SUPT	Support	V1	Left Vernier
SUR	Surface	V2	Right Vernier

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VEL	Velocity
VERN	Vernier
VERT	Vertical
VIBN	Vibration
VLV	Valve

W

WT	Weight
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X

X	Trans
XCHANGER	Exchanger
XCIT	Excitation
XDCE	Transducer
XDCRSUP	Transducer Supply
XDUCE	Transducer
XGB	Exchanger
XMTB	Transmitter
XPL	Explosive
XPNDR	Transponder
XST	Exhaust
XIAL	Crystal
XVERS	Transverse
XVTR	Transverter

Y

YEL	Yoke Roll
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Z

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