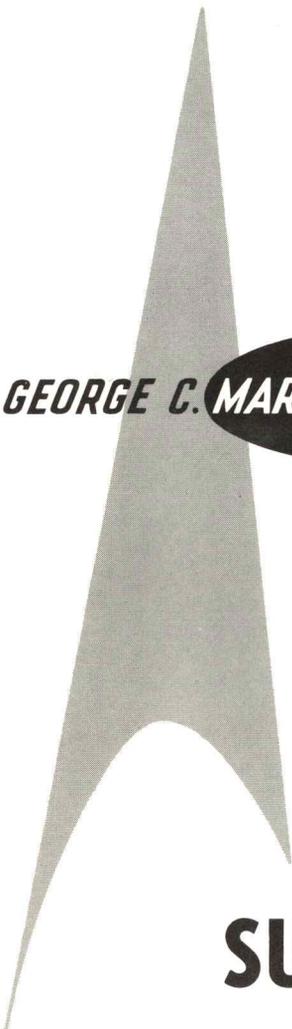


Parks



**GEORGE C. MARSHALL** **SPACE  
FLIGHT  
CENTER**  
HUNTSVILLE, ALABAMA

**ELECTRICAL  
SUPPORT EQUIPMENT  
FOR  
SATURN I PROGRAM  
BLOCK II VEHICLES**

**ASTRIONICS LABORATORY  
ELECTRICAL SYSTEMS INTEGRATION DIVISION  
SYSTEMS OPERATIONS EQUIPMENT DESIGN BRANCH**

National Aeronautics and Space Administration



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**SYSTEMS OPERATIONS EQUIPMENT DESIGN BRANCH**

**NASA**

**GEORGE C. MARSHALL SPACE FLIGHT CENTER**  
**HUNTSVILLE, ALABAMA**

# ***PURPOSE***

The purpose of this brochure is to illustrate the design configuration of the Electrical Support Equipment (ESE) used on the Saturn I Block II Program. The equipment shown herein is typical of the system hardware being used in the factory checkout, static testing, quality assurance testing, and launch of the Block II vehicles, SA-5 to SA-10 inclusive.



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# ***INTRODUCTION***

The ESE shown in this brochure was designed by the Systems Operations Equipment Design Branch of the Electrical Systems Integration Division of the Astrionics Laboratory. Fabrication was accomplished under contract with firms such as the Hayes International Corporation, SPACO, Brown Engineering Company and Chrysler Corporation Space Division, Huntsville, Alabama.

This brochure is arranged to illustrate the equipment as used in specific areas, with the serial presentation of illustrations paralleling the chronological development and use of the equipment. One exception to this area-orientation format is made in the last section of the brochure wherein a series of typical hardware is shown to illustrate the approach to standardization of design.

# **SYSTEMS DEVELOPMENT FACILITY (SDF)**

(Marshall Space Flight Center Huntsville, Alabama)

The function of the SDF is to afford development and evaluation of vehicle hardware and ESE. This facility contains electrical support equipment, operational computers, digital data acquisition equipment, and an instrument unit electrically identical to that of the flight vehicle. The stages are electrically simulated using flight type distributors, sequencers, and other electrical flight hardware. The SDF is managed by the Astrionics Laboratory.

# **SDF**

## **FIRST STAGE (S-1) ESE**

The purpose of the ESE furnished this area is to checkout all components and systems in the Saturn First Stage (S-1). All the vehicle ordnance end items are substituted for during this phase of the checkout.

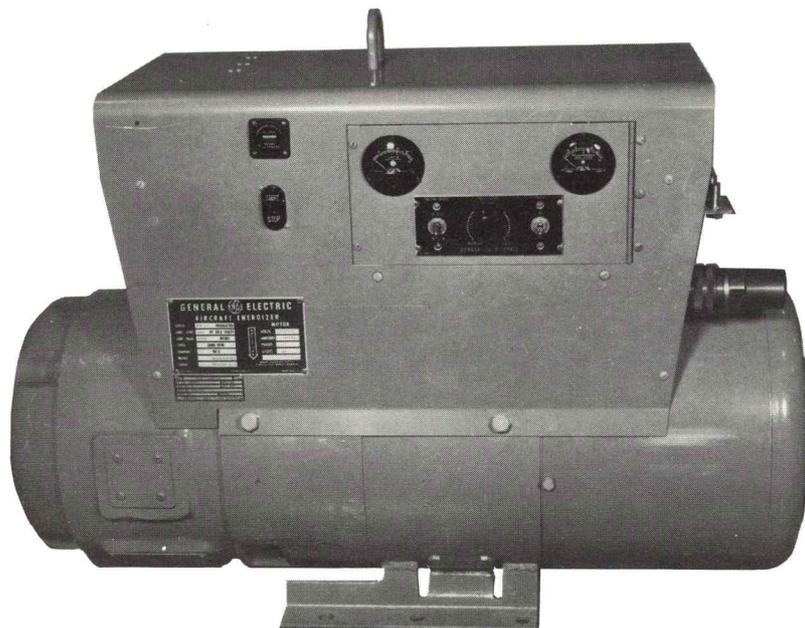
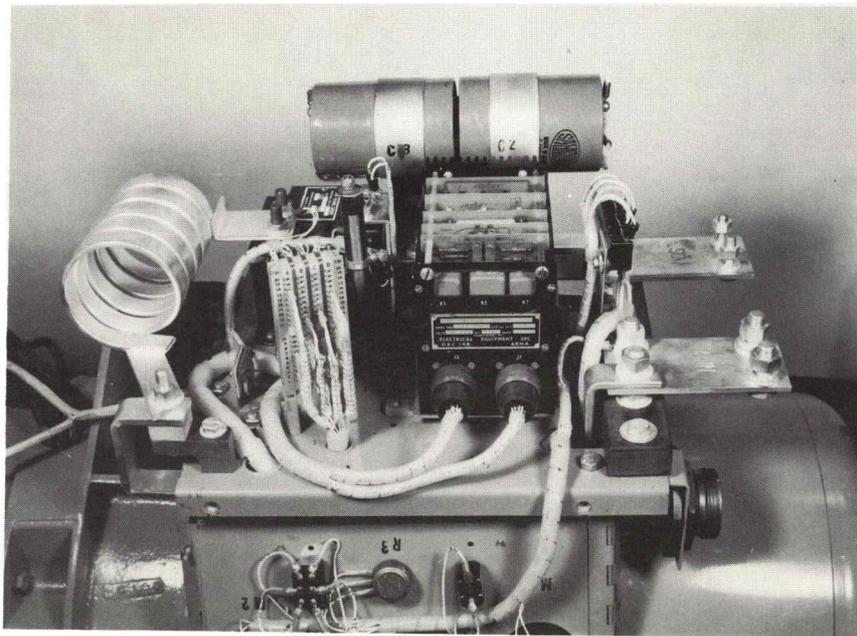
### **Description**

**Power Sources**  
**Power Distribution**  
**Propulsion System**  
**Flight Control System**  
**Ordnance System**  
**Networks Systems**  
**Measuring And Tracking Systems**  
**Systems Integration**  
**Special Test Equipment**

# **SDF**

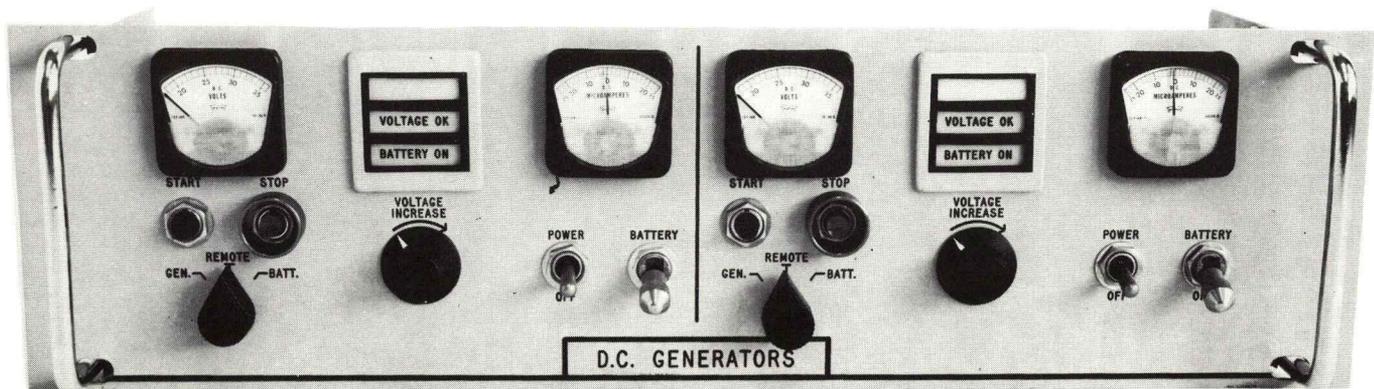
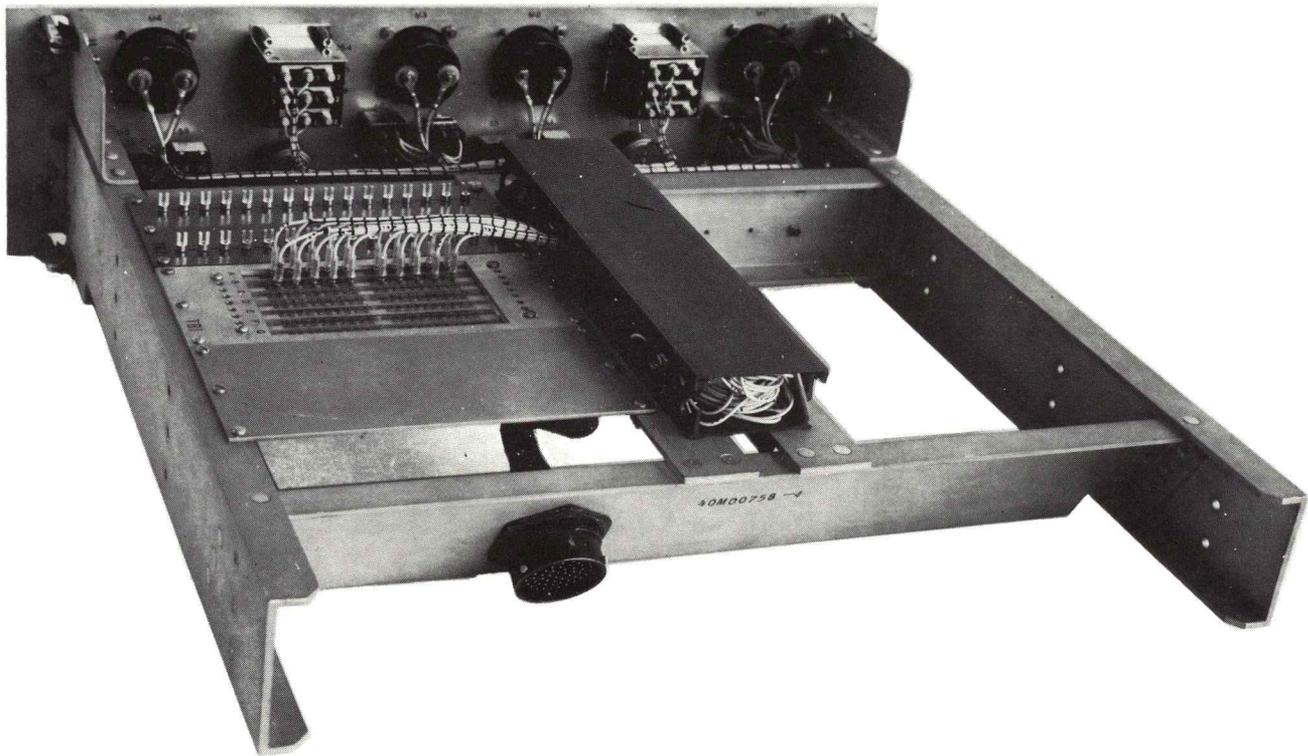
## **POWER SOURCES**

The function of these power sources is to provide 28 volts direct current (VDC), 115 volts alternating current (VAC), 208 VAC, 60 and 400 cycles per second (CPS) power to energize components in the ESE and in the vehicle. The 28 VDC generator system is made more reliable by the use of a group of 28 to 35 VDC, 160 ampere hour, nickel cadmium batteries as back-up power.



## 28VDC 500 AMP MOTOR GENERATOR SET

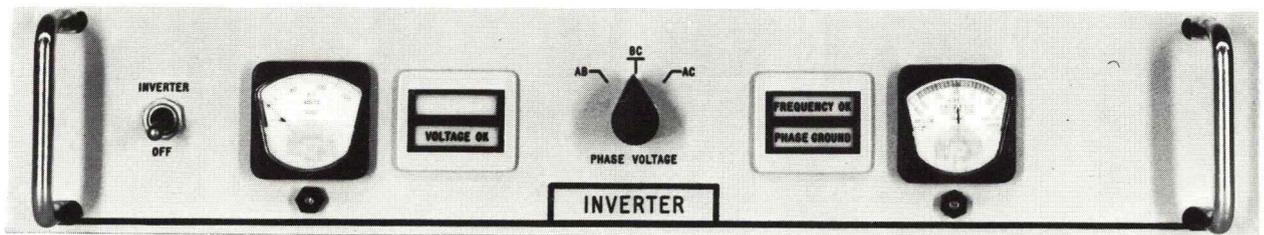
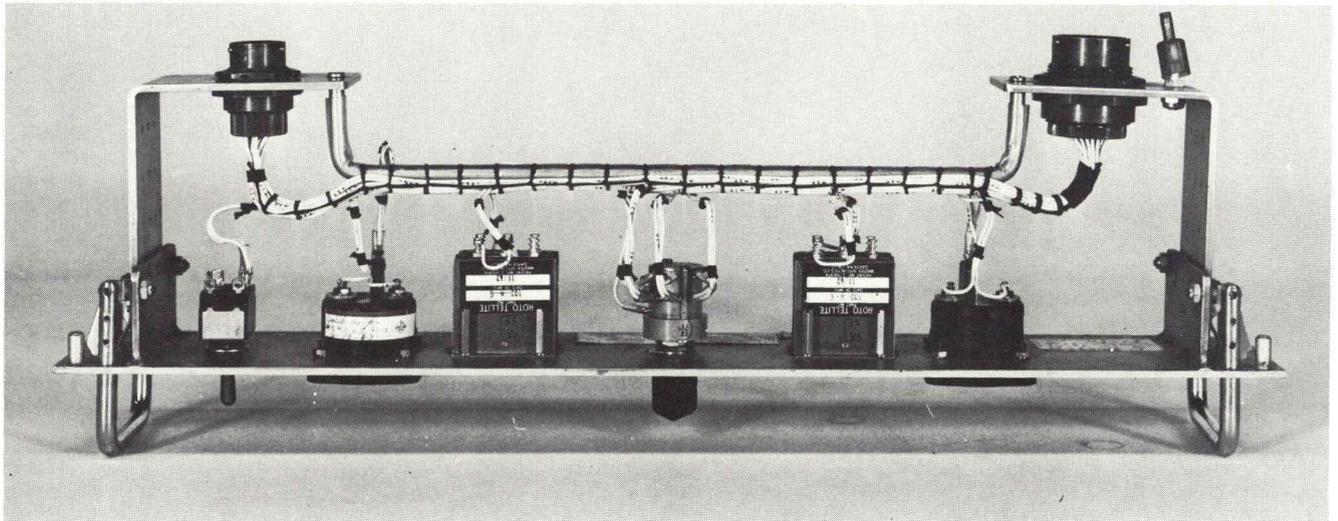
This motor generator set consists of an aircraft energizer and a regulator. The motor generator set operates on 440 volts, 3 phase, 60 cycles per second power. Each set is designed to deliver 500 amperes of direct current continuously at 28 volts. An integral part of the set is a solid state magnetic amplifier regulator. The accuracy of the regulator is 1 and 1/2 percent of the preset voltage. A sensing circuit, built into the regulator, will allow the energizer to supply the desired voltage to a remote load. Another circuit, within the regulator, emits a signal when the energizer's output voltage is within tolerance of the desired voltage (27 to 29 VDC). A third feature of the regulator is a circuit designed to remove the input power to the energizer when the output voltage rises above 38 VDC. This motor generator set is typical of those used to furnish ground power to the S-1 stage buses and associated ESE, fuel and oxidizer systems, count clock system, ground inverters, IU stage and associated ESE, S-IV stage and associated ESE, and to auxiliary equipment.



### DC GENERATORS PANEL (123A1)

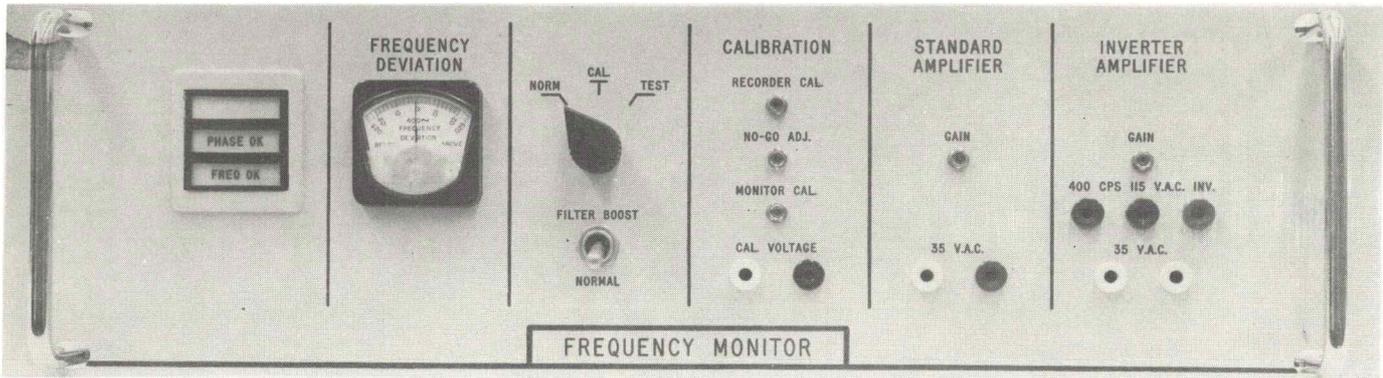
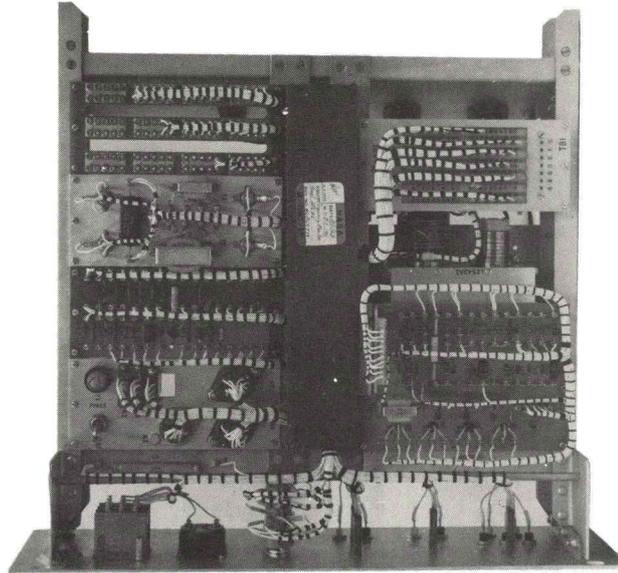
This 5-1/4 by 19-inch panel contains provisions for controlling and monitoring two DC motor generator sets. Pushbuttons are provided for starting and stopping the motor generator sets, and toggle switches are provided for connecting batteries and load.

The monitoring system consists of voltmeters and ammeters with selector switches for checking generator, battery, or remote source voltage. Voltage adjusting rheostats are provided along with indicator lights to indicate when the generator is energized, the output voltage is within acceptable limits, and the battery is supplying the load.



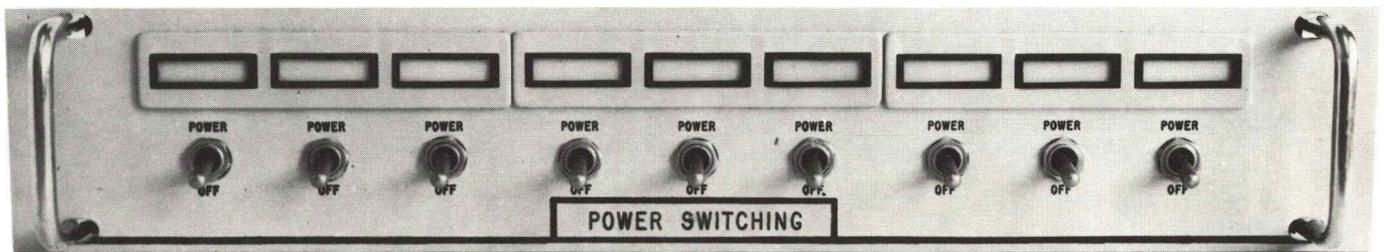
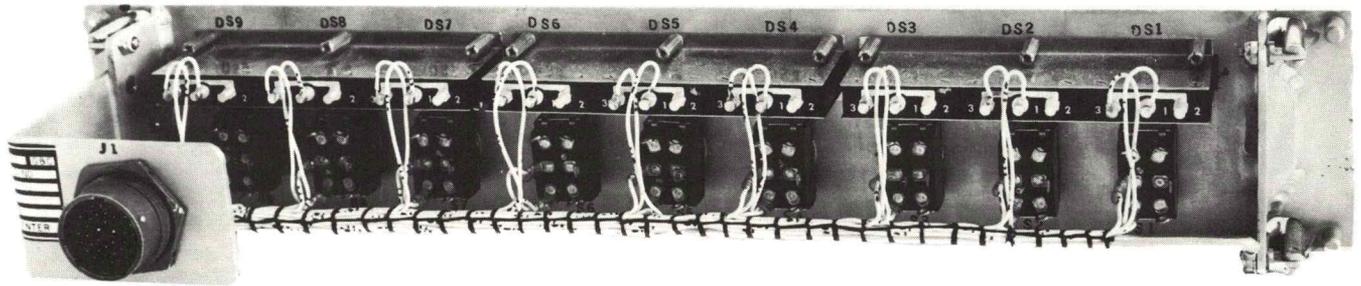
### INVERTER PANEL (125A1)

This panel controls power to the inverter. It consists of meters which indicate the output voltage and frequency from the inverter. A three position rotary switch (located in the center of the panel) makes it possible to observe the output voltage from any of the three inverter phases. There are also four lights on the panel which indicate "INVERTER ON" (blank light), "VOLTAGE OK", "FREQUENCY OK" and "PHASE GROUND".



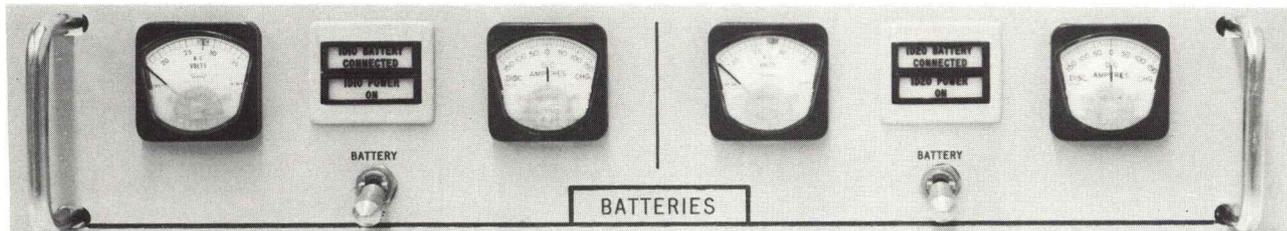
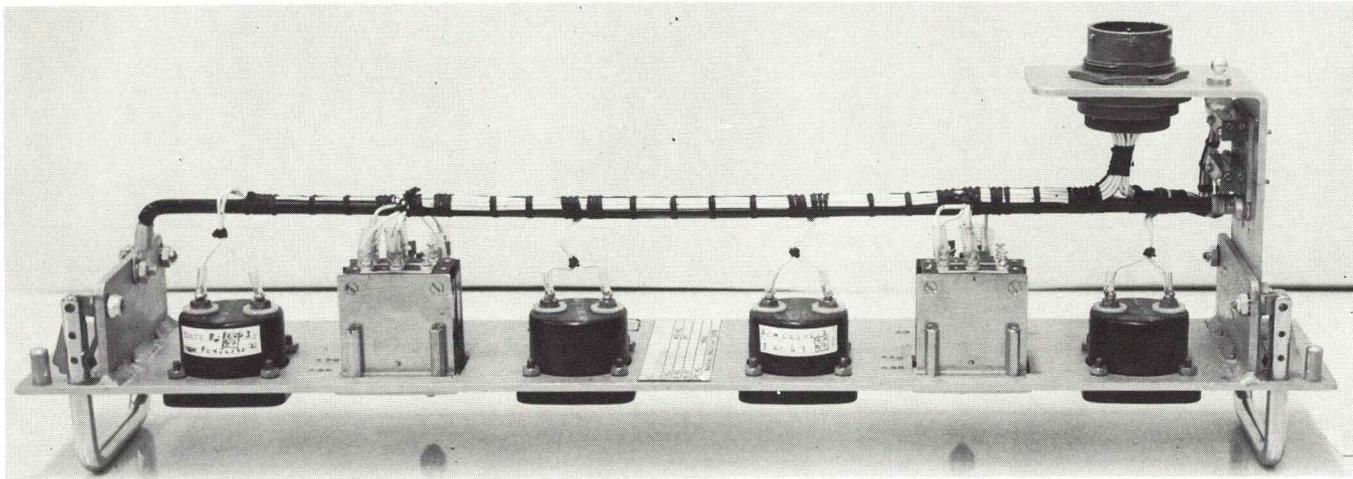
### FREQUENCY MONITOR PANEL (125A2)

This panel compares frequency of the 400 CPS AC inverters with a standard frequency generated by the standard frequency amplifier. It indicates "FREQ OK" and deviation in cycles per second which is also supplied for the inverter panel. Provisions are made on the front panel for adjusting and monitoring the inverter and frequency standard amplifier. Provisions are also made on the front panel for calibration of frequency deviation meter and frequency recorder.



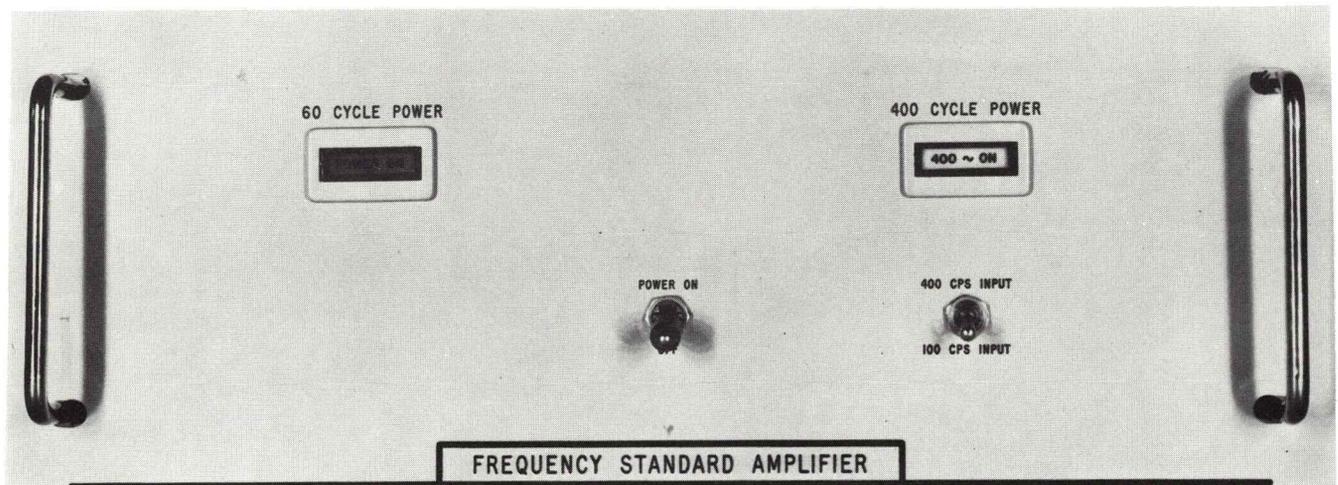
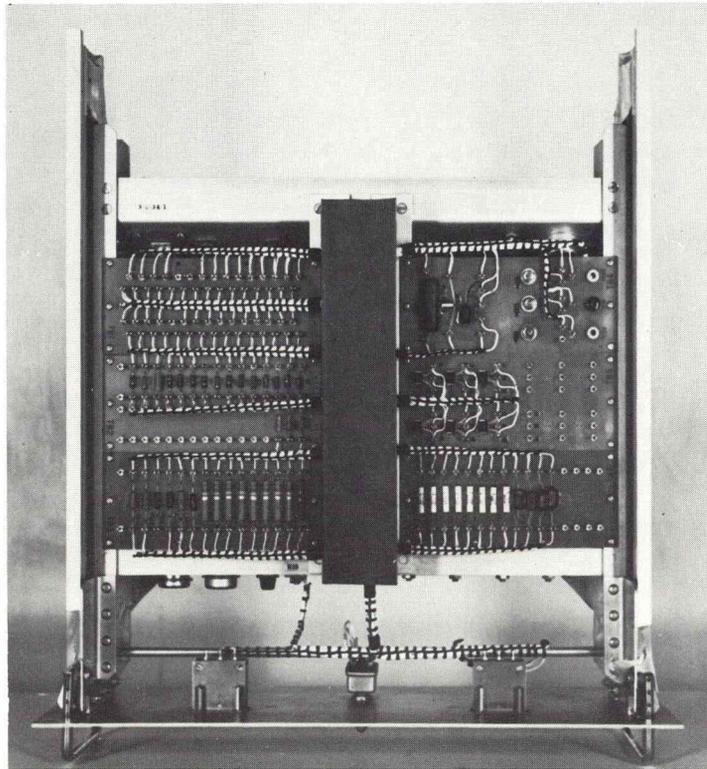
### POWER SWITCHING PANEL (146A1)

This 3-1/2 by 19-inch panel has provisions for controlling nine power sources from the rack location. Switches are provided along with indicator lights to furnish visual indication of the power source which is being used. A 39 pin connector is provided on the rear for disconnecting the panel.



### BATTERIES CONTROL PANEL (1006A1)

This panel provides voltmeters for indicating battery voltage and ammeters to indicate charge-discharge rate of the batteries. Lamps indicate whether the batteries are connected to the line. Leverlock switches are provided for connecting batteries with load.



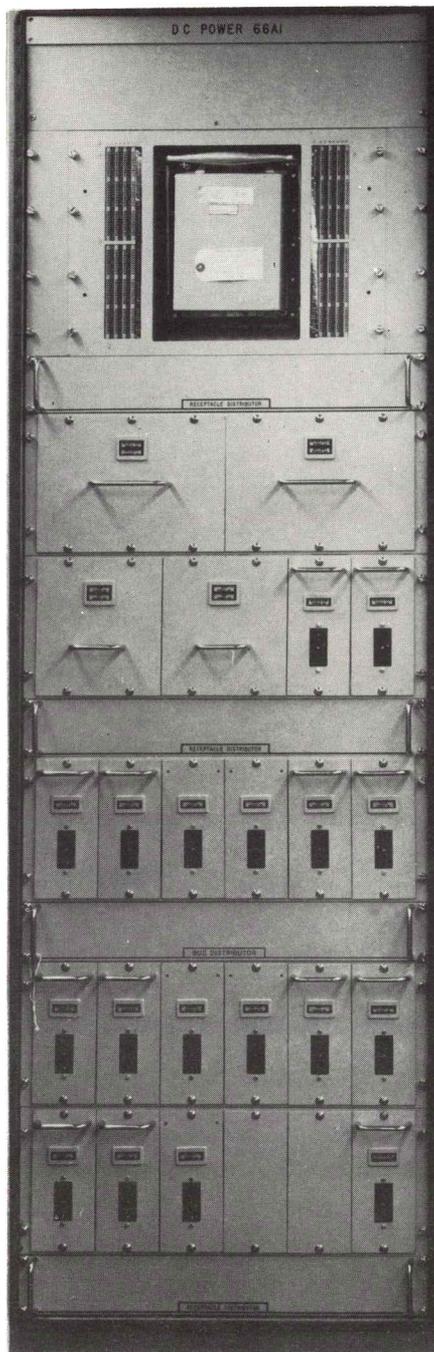
### **FREQUENCY STANDARD AMPLIFIER PANEL (125A3)**

The function of this panel is to amplify the 400 CPS reference from the frequency standard and distribute it to various panels of the ESE system. This panel also has capability of accepting a 100 CPS reference from the frequency standard, multiplying it to 400 CPS and amplifying it.

# **SDF**

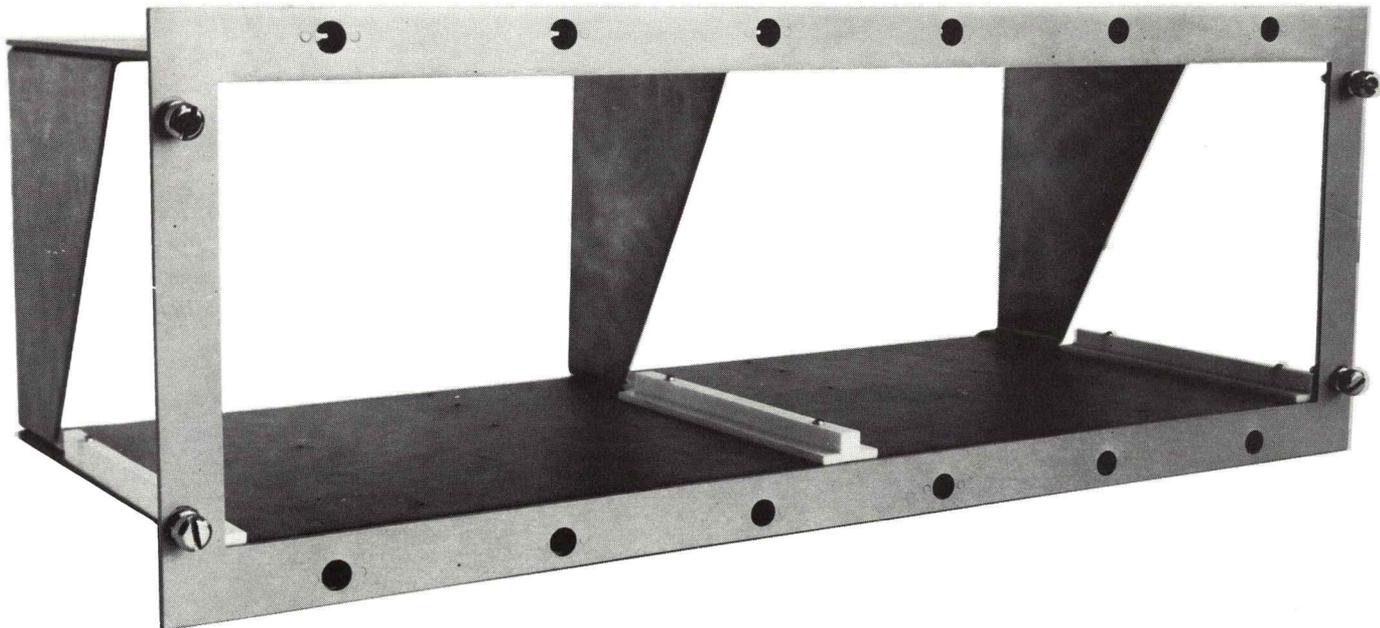
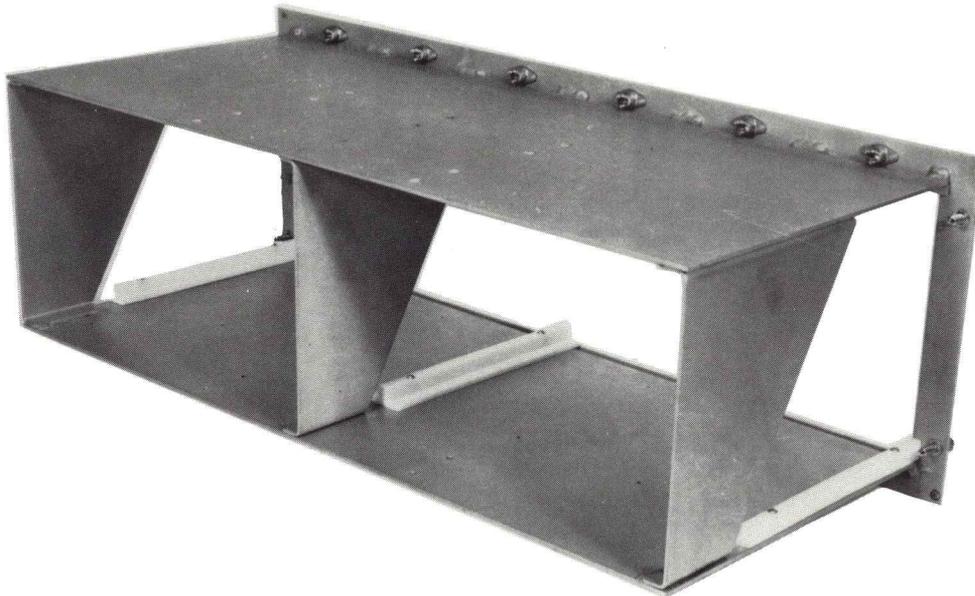
## **POWER DISTRIBUTION**

The power generated by previously described sources in the ESE is distributed by the Power Distribution System to the systems which control, monitor and relay power to the vehicle components and other complex systems during pre-launch and launch operations.



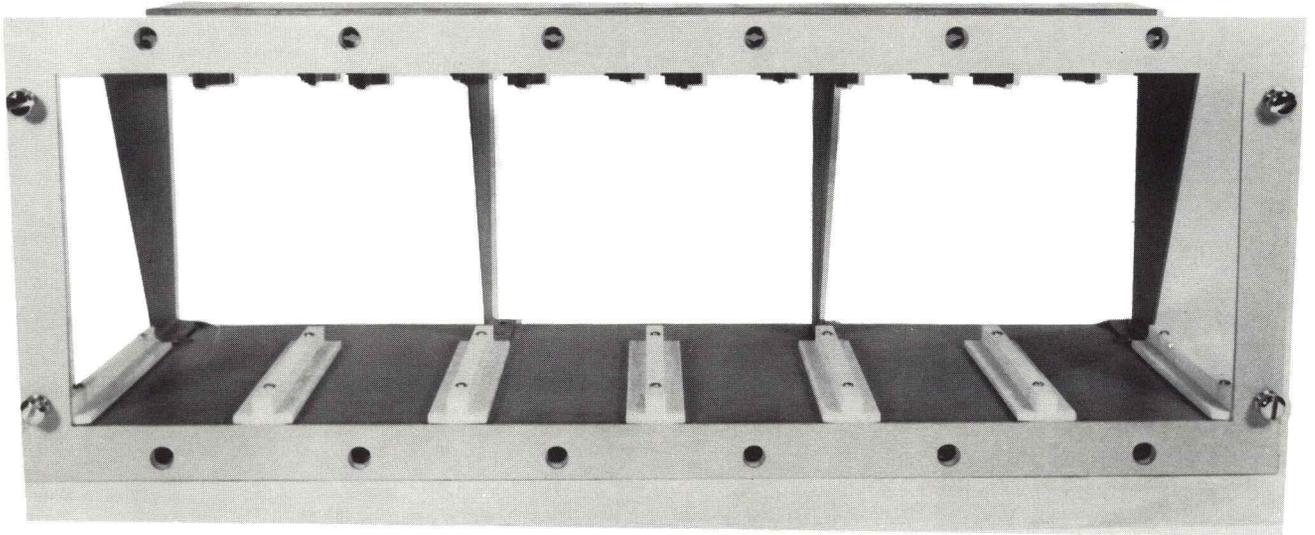
### DC POWER DISTRIBUTOR 66A1

The primary function of the 66A1 DC Power Distributor is to distribute DC power used in connection with the S-1 vehicle booster checkout and firing. The distributor is placed in a rack and is of modular construction. These modules distribute 28 VDC power to the vehicle buses and associated ESE from the S-1 generators (generators No. 1 and No. 2) and backup batteries. In addition, there is a 14 plug distributor panel which is a central point where all control and monitoring points are brought out in order that circuit changes can be made with relative ease. Also, there is a monitor panel which monitors vehicle buses, S-1 inverter, and 60KW, 400 CPS generator No. 1 voltages and commits DC generators No. 1 and No. 2 and the 60KW, 400 CPS generator.



### DC POWER FRAME TYPE 1

This frame is designed to fit in a standard 24-inch rack and has a standard 8-3/4-inch height. It is designed to hold two DC Modules, Type 1.



## DC POWER FRAME TYPE 2

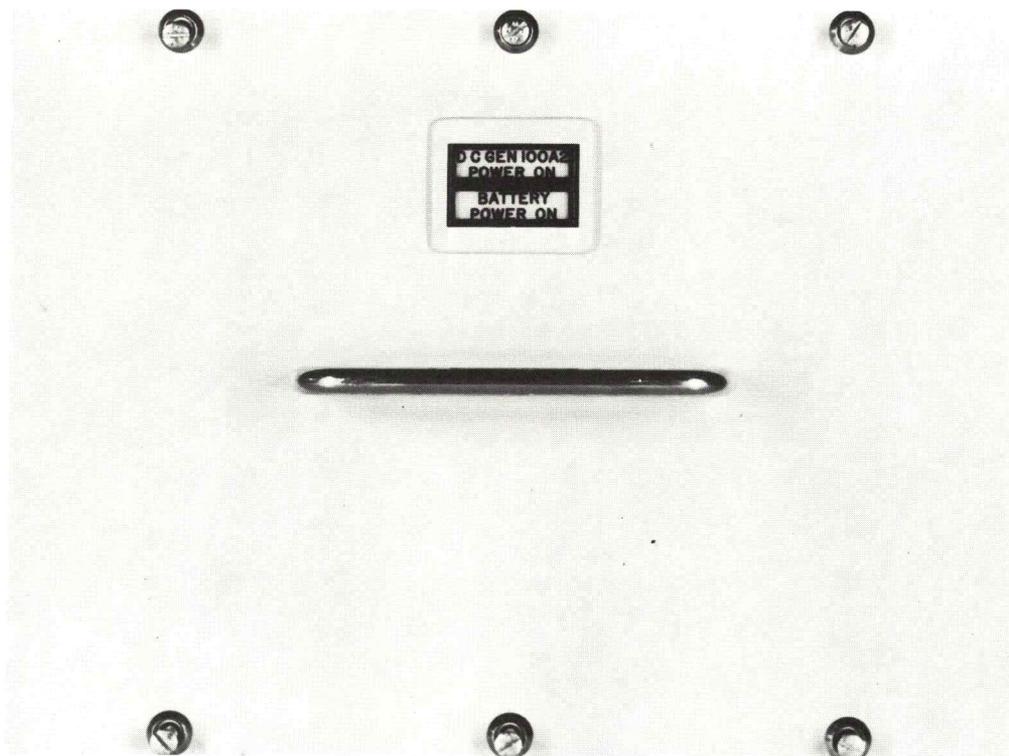
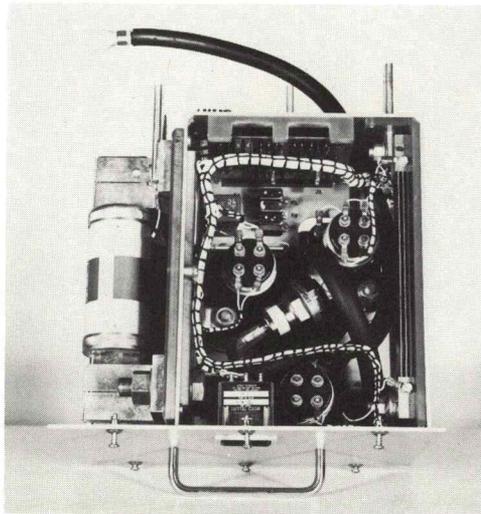
This frame is designed to fit in a standard 24-inch rack and has a standard 8-3/4-inch height. It is equipped with a positive and a negative bus with six sets of fuse clips for quick connect and disconnect of DC Power Modules Type 3.

This frame is designed to hold six DC Power Modules Type 3, but with the removal of one set of fuse clips it can be used for one Type 2 and five Type 3, DC Power Modules.



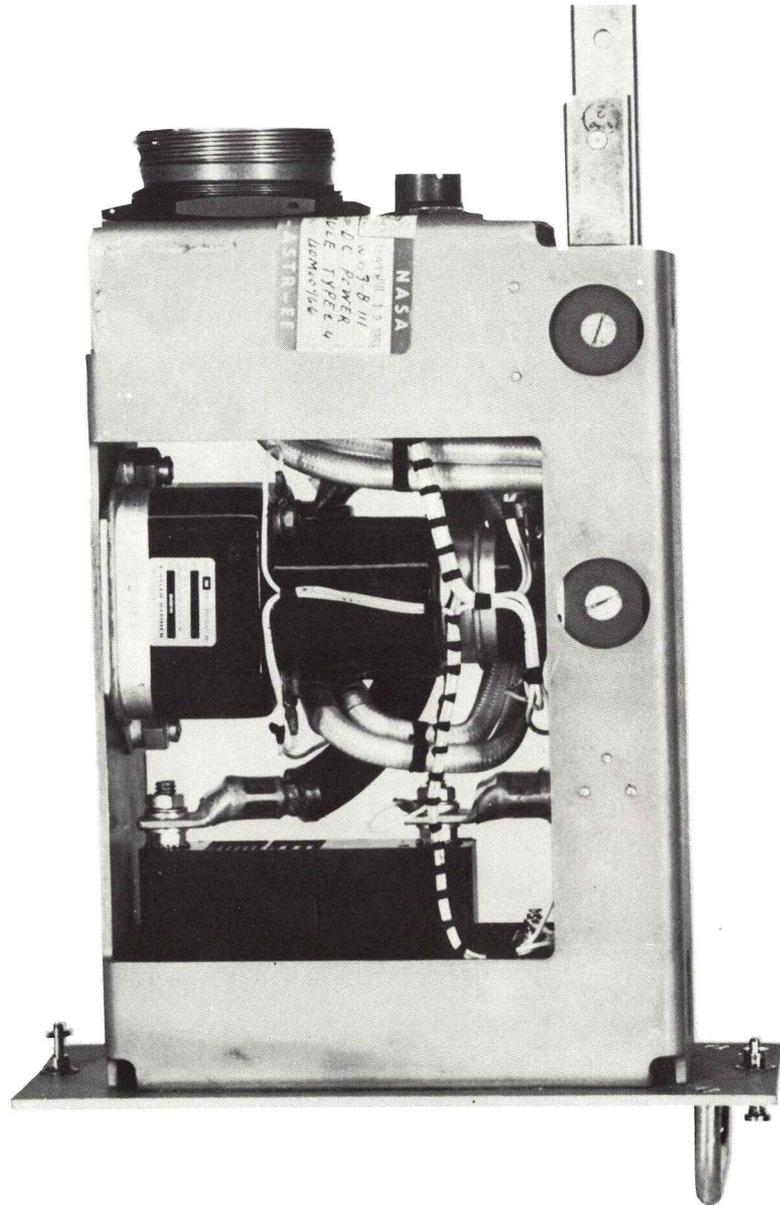
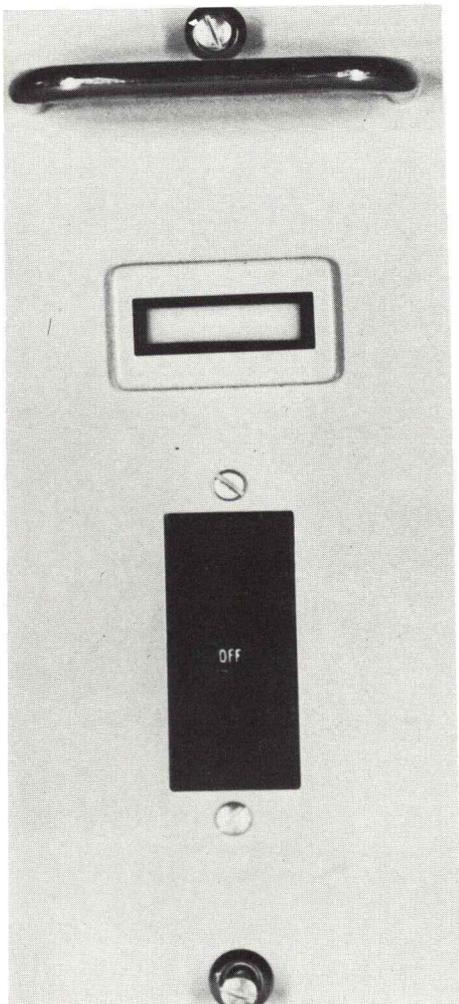
### DC POWER FRAME TYPE 3

This frame is designed to fit in a standard 24-inch rack and has a standard 8-3/4-inch height. It is designed to hold three DC Power Modules Type 4.



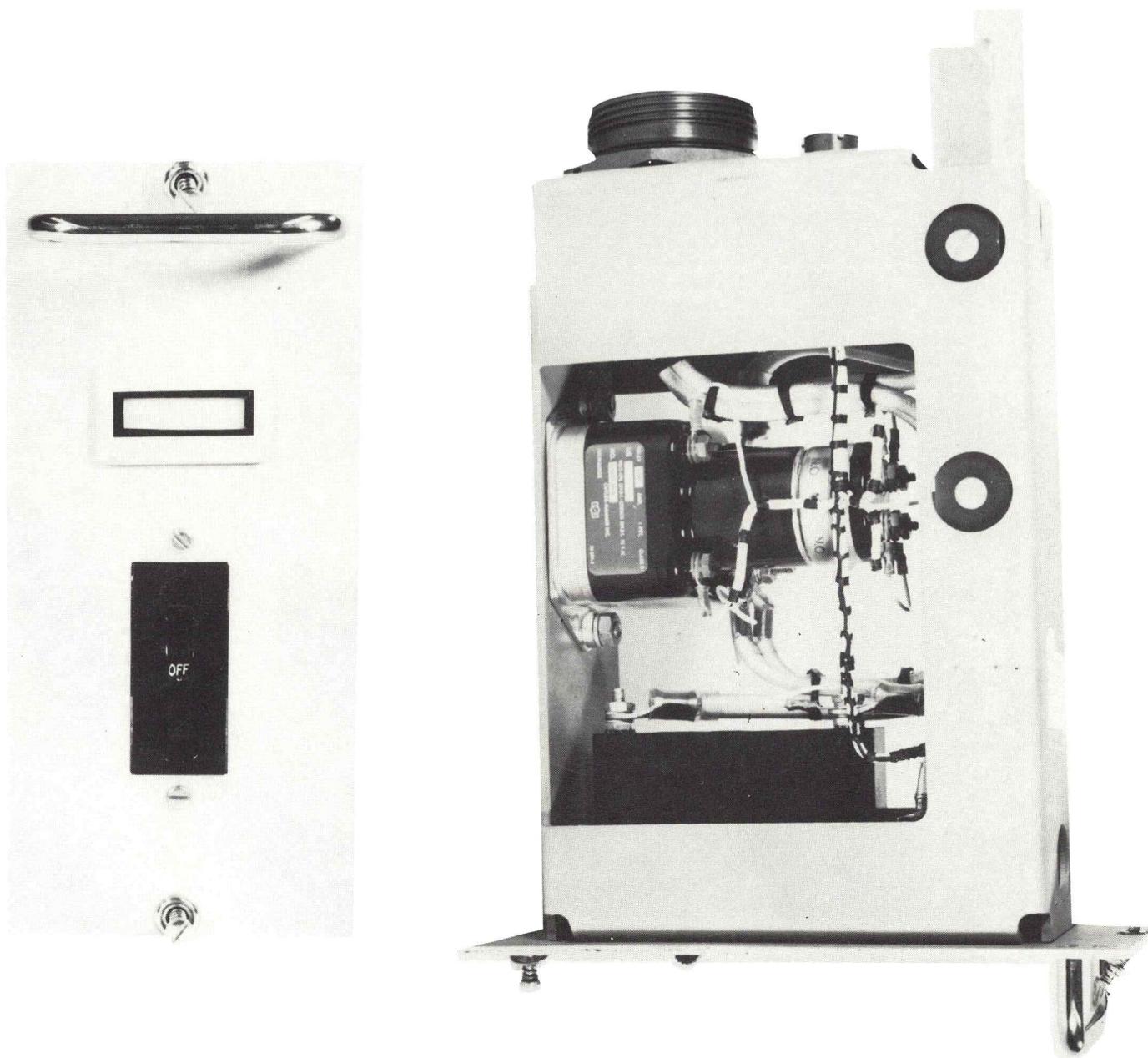
### DC POWER MODULE TYPE 1

This module is used for paralleling back-up battery power with DC generating equipment. It contains a voltage sensor which senses generator voltage and switches power output from generator to battery when generator voltage drops below a selected minimum value. In addition to the voltage sensor, power contactors are provided for power control. Both the battery and generator inputs are fused for protection and shunts are provided for monitoring output currents with recorders and for ammeters located on the DC generator control panels. Indicator lights show whether generator or battery is supplying output power. All control circuits are wired through two 10 pin miniature receptacles.



## DC POWER MODULE TYPE 2

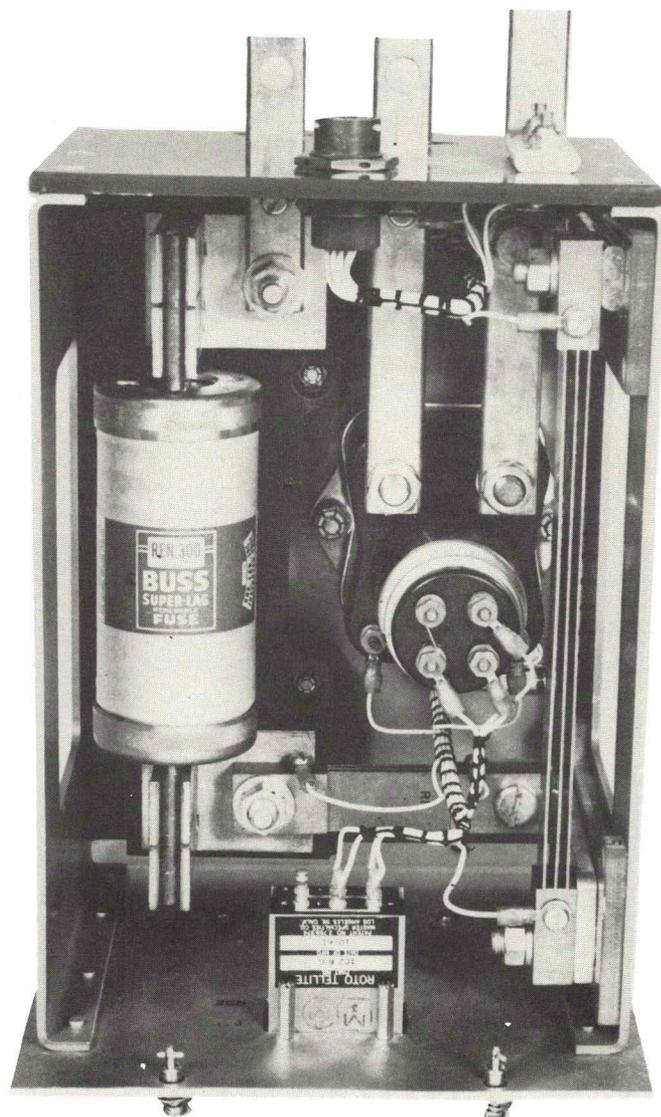
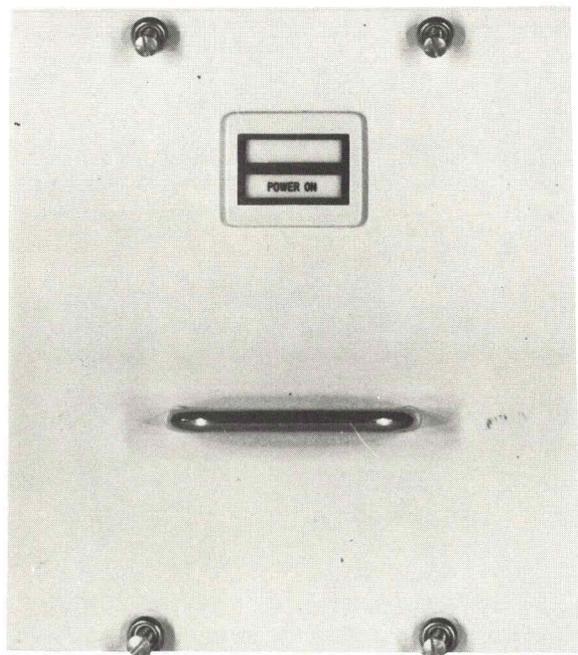
This module transmits or receives power via a four (#4) pin connector and bus bars and contains a power contactor, a circuit breaker, a power status indicating lamp, and shunt (for recorder or ammeter). The contactor, circuit breaker and shunt may be replaced by comparable components or jumpered as required to form the power circuit desired. A ten pin miniature connector is provided for control circuits.



### DC POWER MODULE TYPE 3

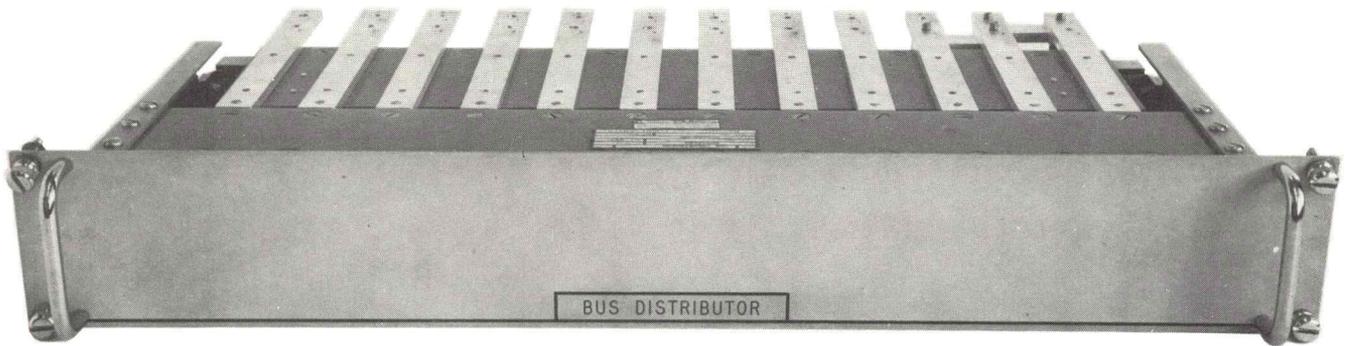
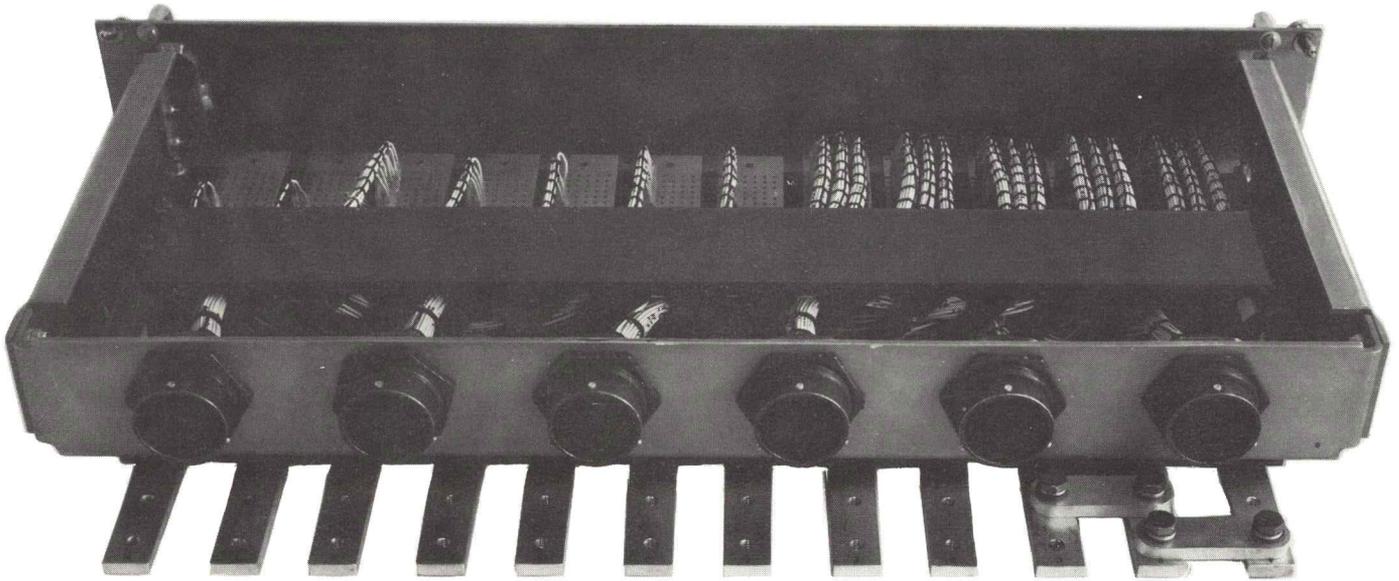
This module's input is provided through bus bars which are inserted in the fuse clips in DC power frame type 2. The power output is connected through a four pin (#4) connector and control circuits through a ten pin connector.

The module consists of a power contactor, a circuit breaker, shunt for recorder or ammeter and indicator light to indicate when the power is on. These components may be replaced by comparable items or jumpered as required to form the circuit desired.



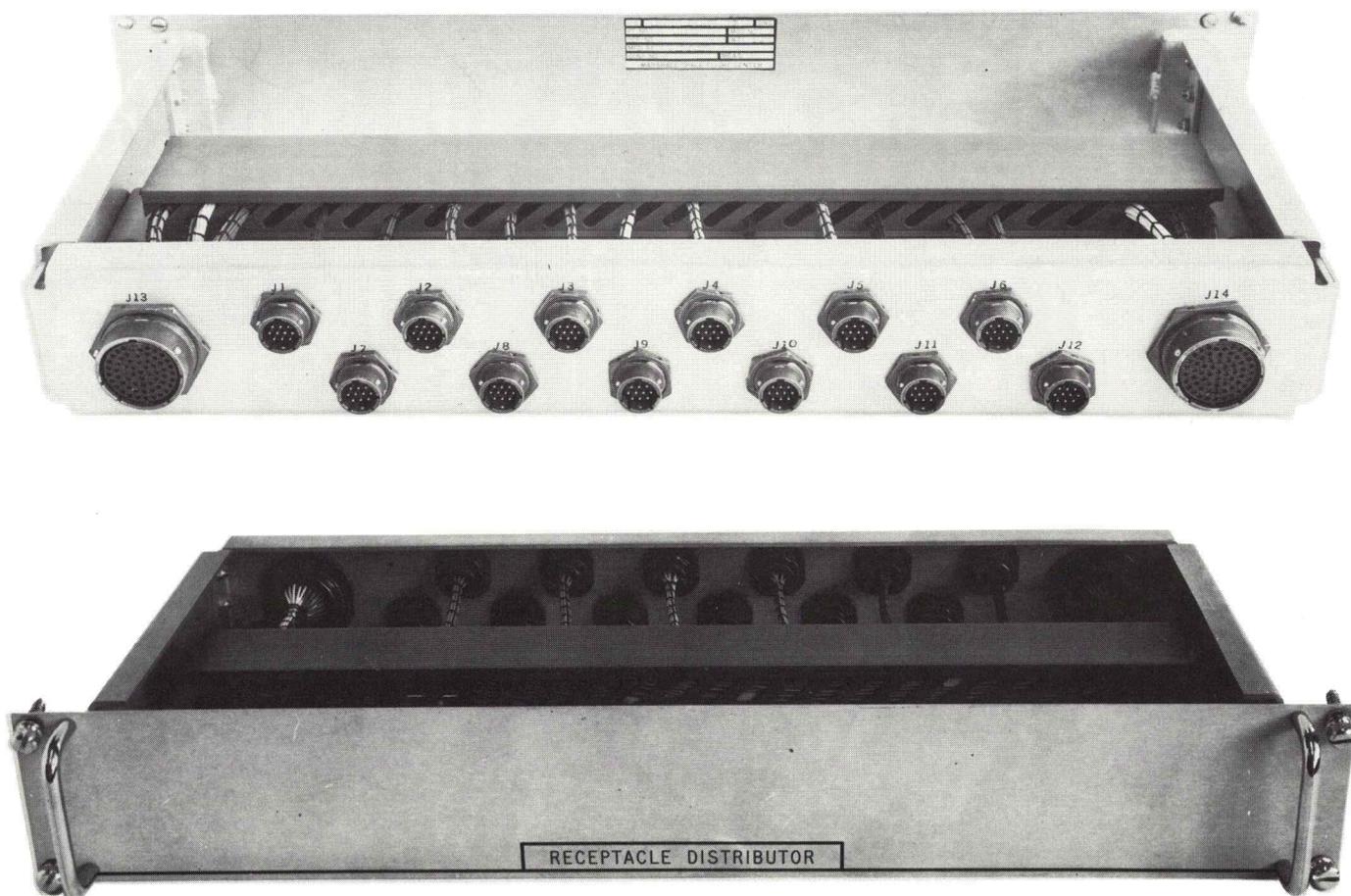
#### DC POWER MODULE TYPE 4

The power input to this module is through bolted connections on buses. The module contains a 300 amp power contactor, fuse, shunt (for recorder), ammeter and power status indicating light. The power output is also through a bolt-on bus system. Control circuits are completed through a ten pin miniature connector.



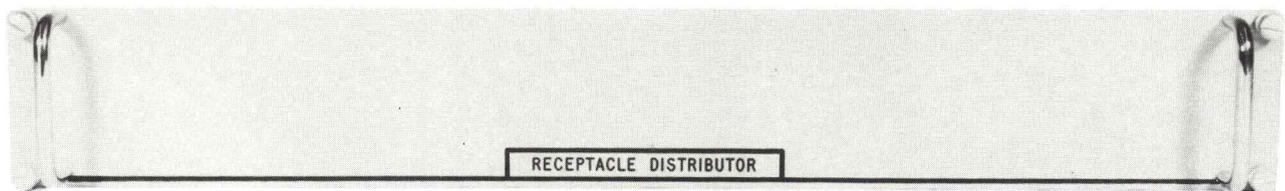
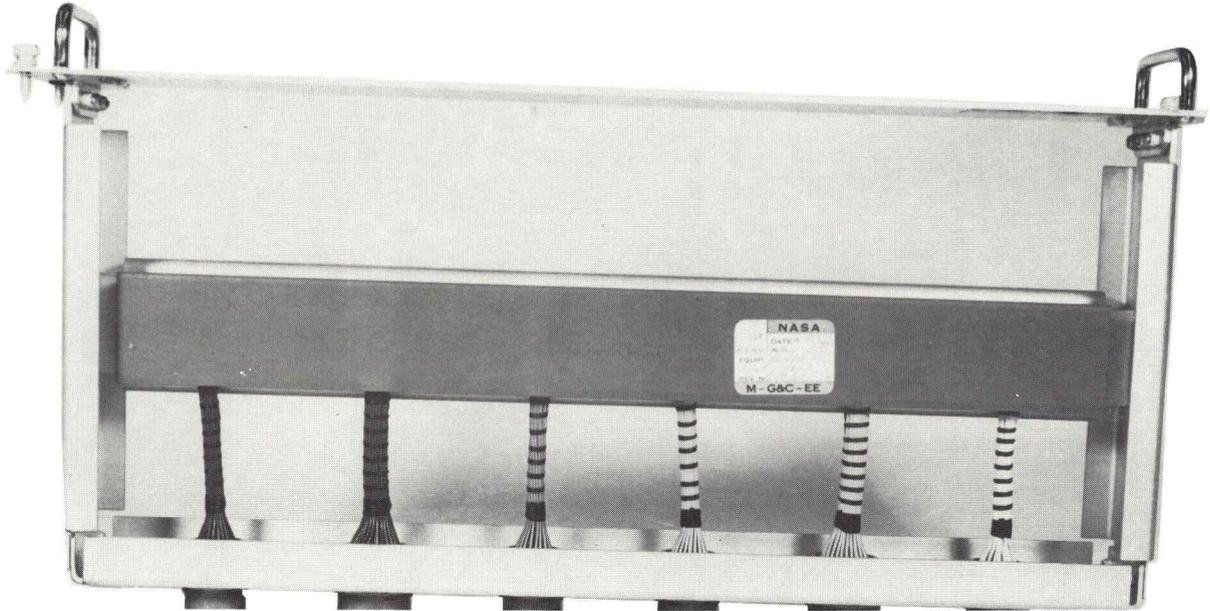
### BUS DISTRIBUTOR PANEL

This is a 24 by 3-1/2-inch panel. Input power comes in on twelve bus bars which have been drilled for 60 type 53 taper pins. These bus bars may be bused together with bus links as required. The output power is delivered through six 61 pin miniature connectors.



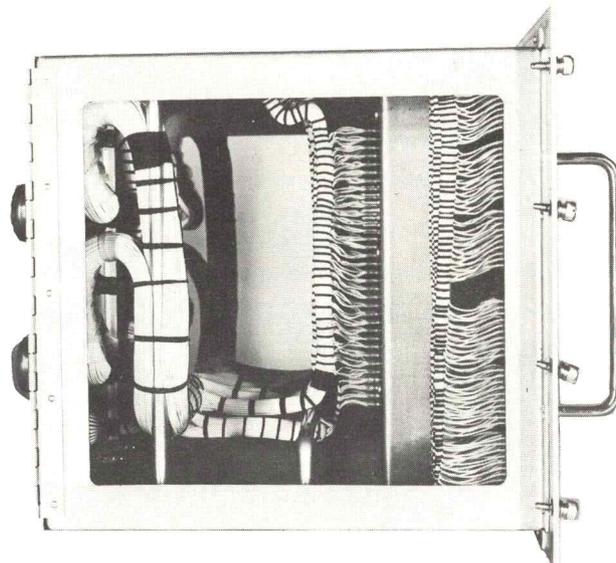
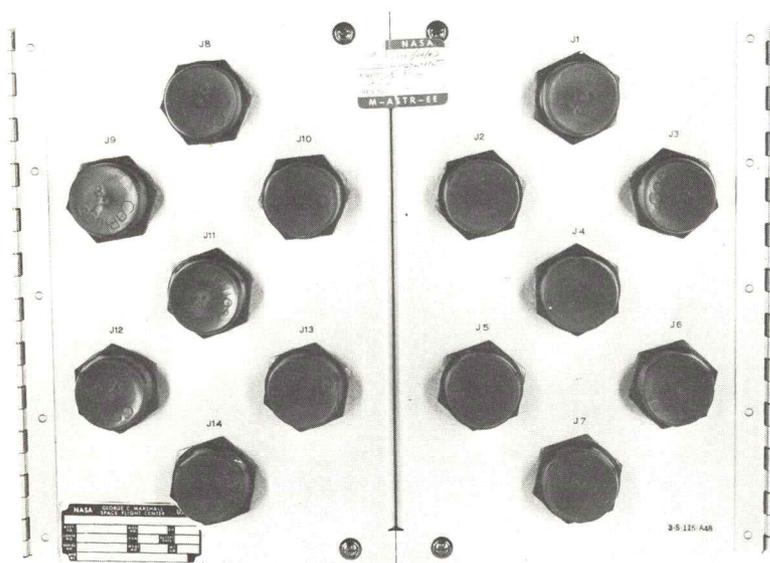
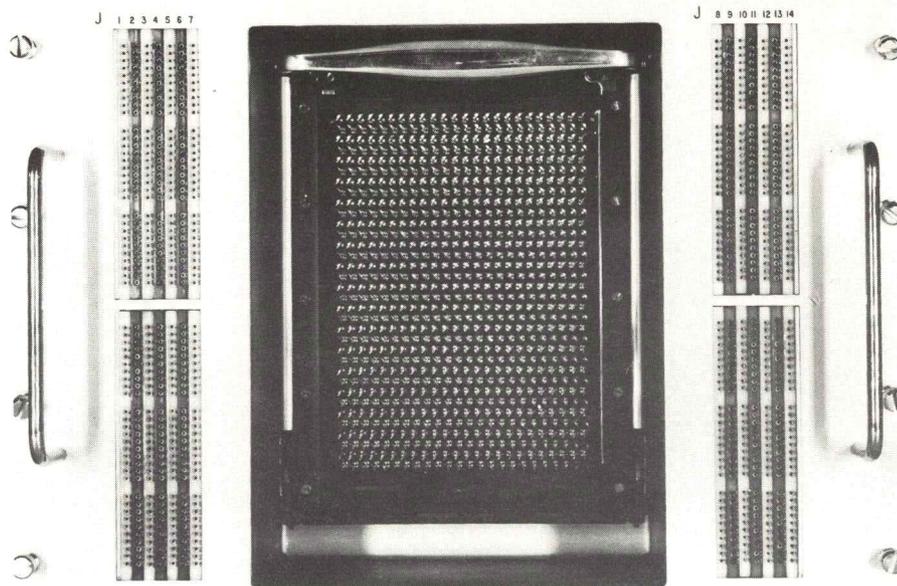
### RECEPTACLE DISTRIBUTOR PANEL TYPE 1

This panel is for a standard 24-inch rack and is 3-1/2-inches in height. The panel input consists of twelve miniature ten pin connectors, and the control leads are distributed out through two 61 pin miniature connectors.



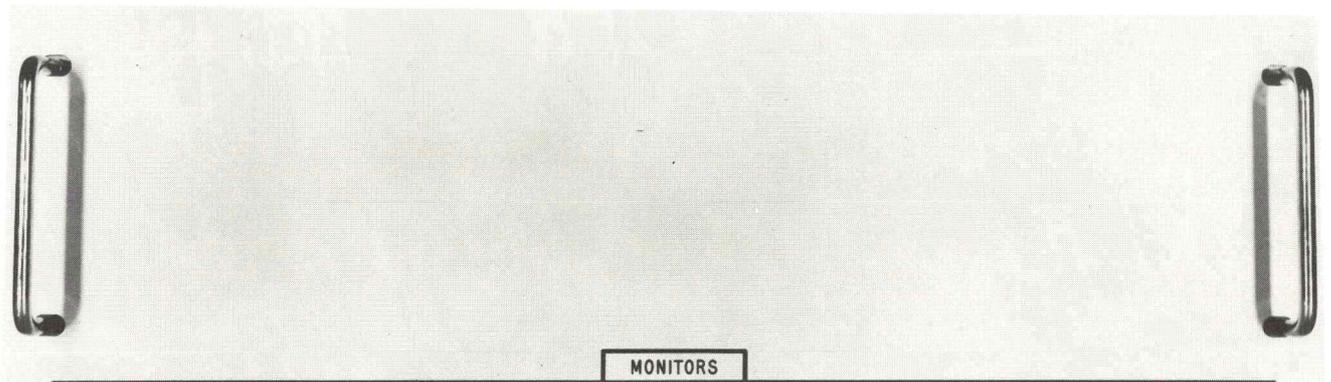
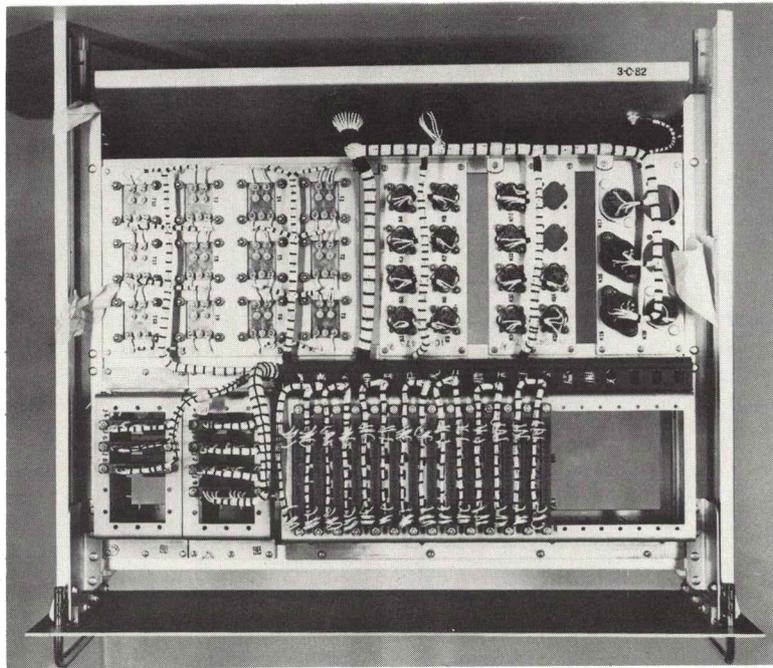
## RECEPTACLE DISTRIBUTOR PANEL TYPE 2

This panel is a standard 24-inch wide by 3-1/2 inch high panel. It consists of four 39 pin miniature connectors for inputs and two 61 pin miniature connectors for output. Generally these outputs are fed into a fourteen connector receptacle patch panel.



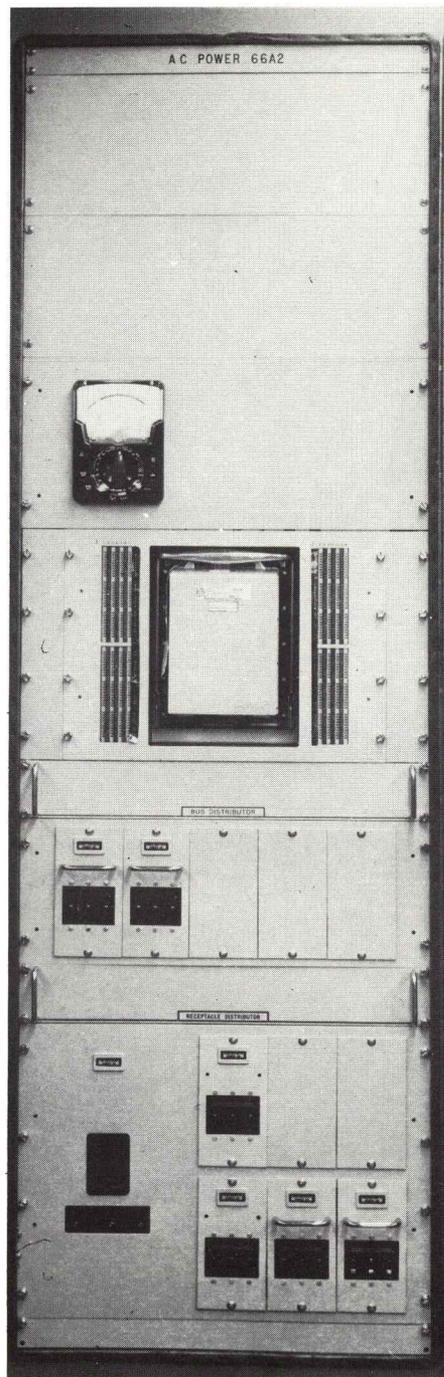
## S-1 POWER CONTROL PATCH PANEL (14 PLUG DISTRIBUTOR)

All control leads from DC generators, 60KW, AC generators, voltage monitors, inverter rack and power modules via Receptacle Distributors Type 1 and 2 are distributed to control panels and relay racks through this type patch panel. This type distributor panel is also used in other systems.



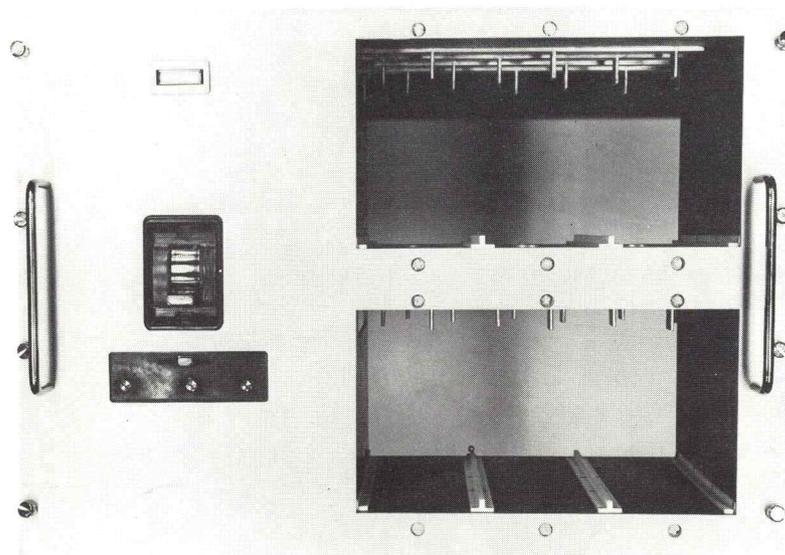
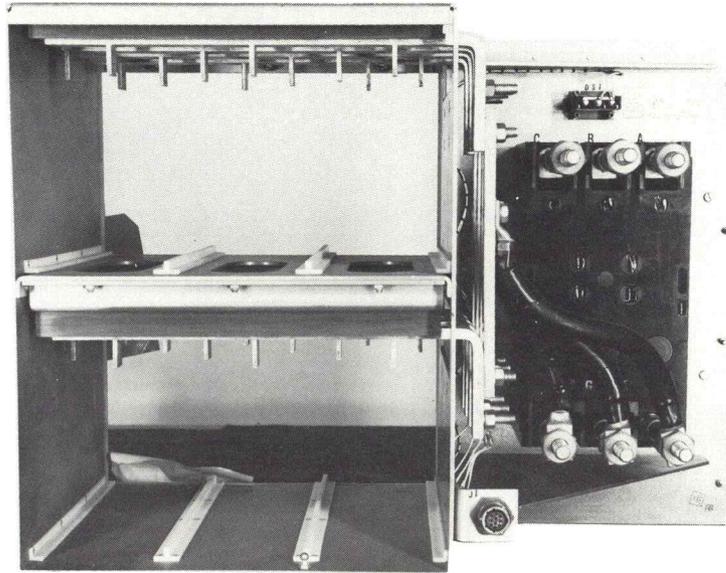
## MONITORS PANEL

This panel monitors the 60KW, 400 CPS, AC generator and vehicle inverters; provides indicator circuits for "VOLTAGE OK", and "PHASE GROUND". In addition it commits DC generators and 60KW, AC generators during the critical period of count down. Finally the panel measures vehicle bus voltages and provides circuits for indications.



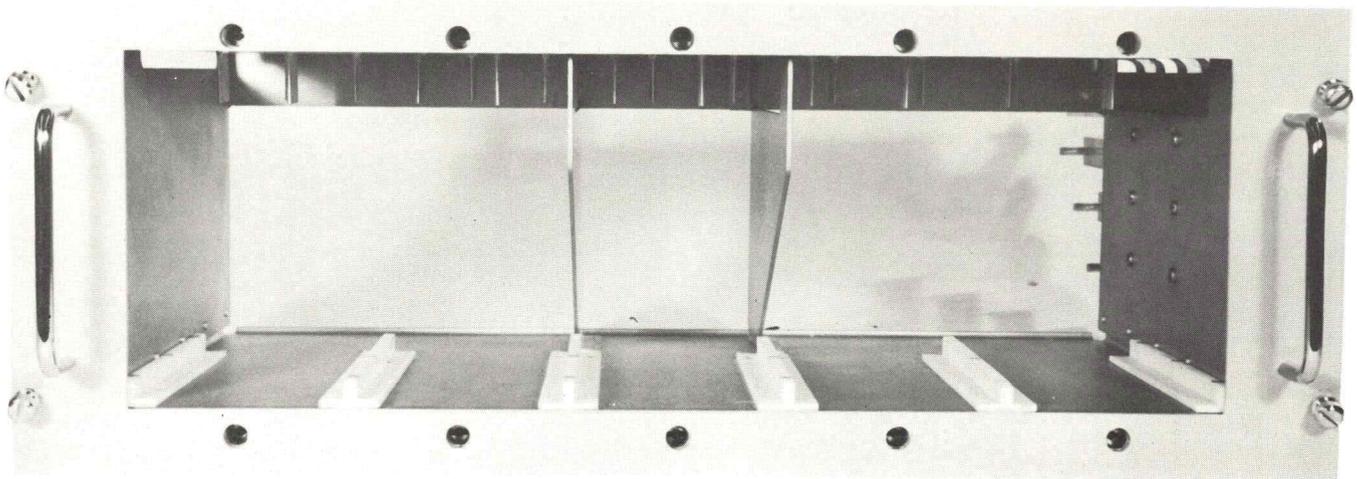
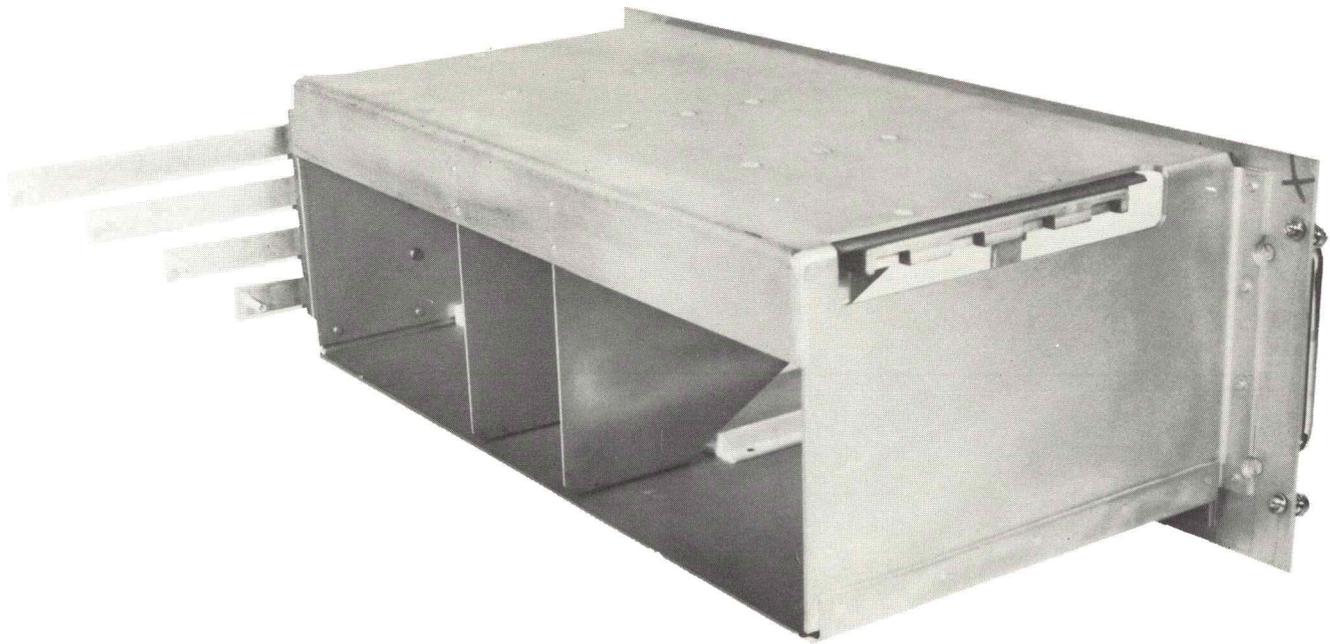
### **AC POWER DISTRIBUTOR 66A2**

The primary function of the 66A2 Power Distributor is to distribute 208V, 400 CPS, and 208V, 60 CPS power used in connection with the S-1 vehicle booster checkout and firing. The distributor is placed in a rack and is of modular construction. These modules distribute 208V, 400 CPS power to the S-1 vehicle hydraulic motors from 3Ø, 400 CPS generator No.1 and 208V, 3Ø, 60 CPS power to the heater component panel. In addition, there is a 14 connector patch panel which is a central point where all control and monitoring points are brought out to facilitate changes.



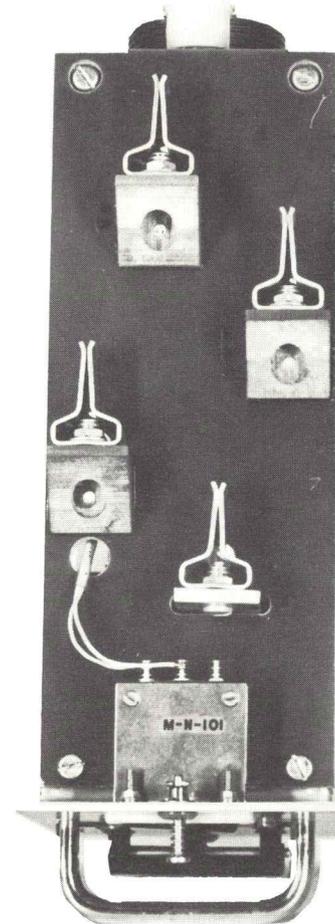
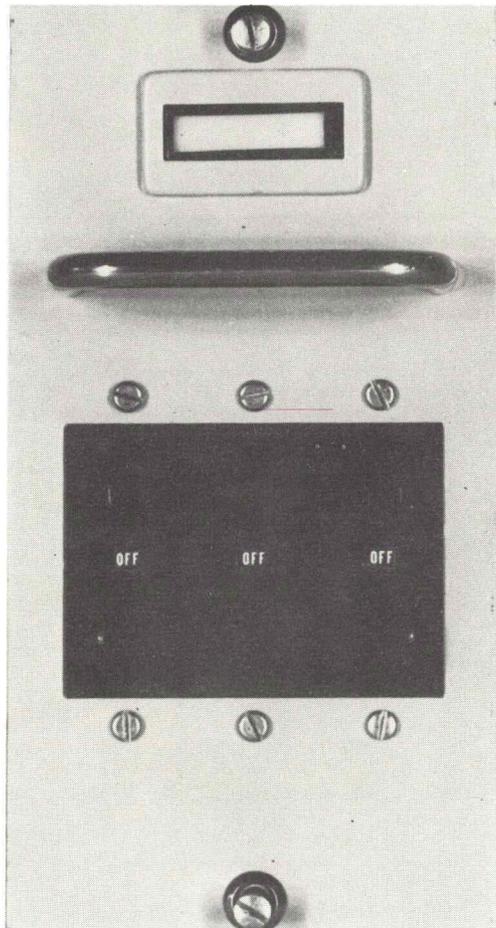
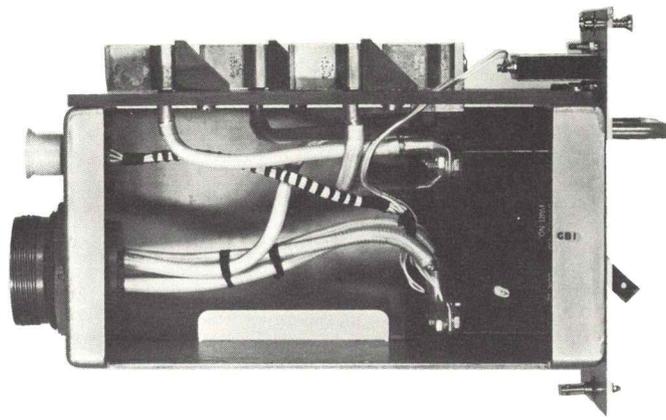
### AC POWER FRAME TYPE 1

This frame is 24 inches wide and 17-1/2 inches high and is designed to fit a standard rack. The module contains a circuit breaker and a power status indicating lamp. The design provides for six AC Power Modules Type 2. The frame provides four buses equipped with fuse clips to allow for quick connecting or disconnecting of the modules.



### AC POWER FRAME TYPE 2

This frame is designed for 24-inch standard rack and has a height of 8-3/4 inches. It is designed to hold five AC Power Modules Type 2, and is equipped with four buses with fuse clips to provide for quick connect and disconnect of the power modules.



## AC POWER MODULE TYPE 2

This module receives its input from buses in the frame through four fuse clips. The module consists of a three-phase power contactor, three-phase circuit breaker, and power status indicating light. The contactor and circuit breaker may be changed or jumpered out to meet circuit requirements. The ten pin miniature connector is provided for the controls. The power output is through a four pin (#4) connector.

No photographs available

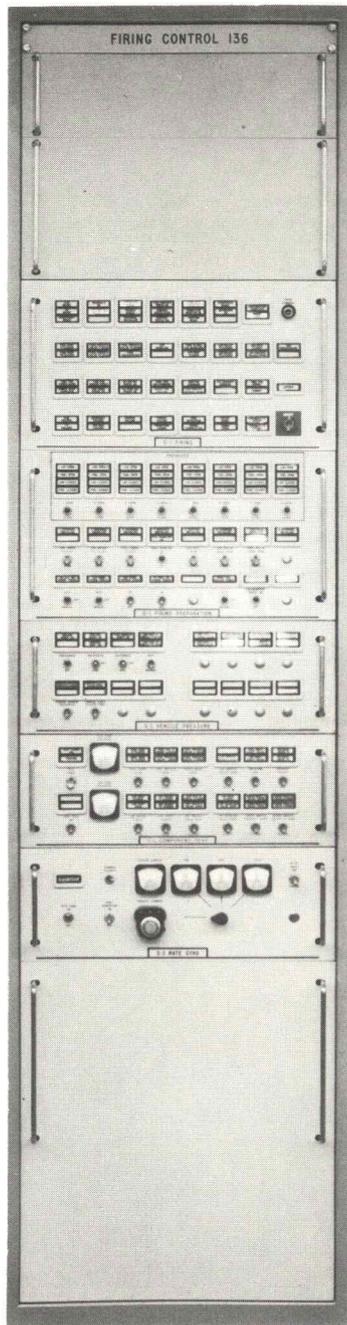
### **POWER DISTRIBUTION RACK 66SDF**

This power distribution rack is similar to the 66A1 and 66A2 power distribution racks. It provides for the distribution of auxiliary power and controls for the SDF.

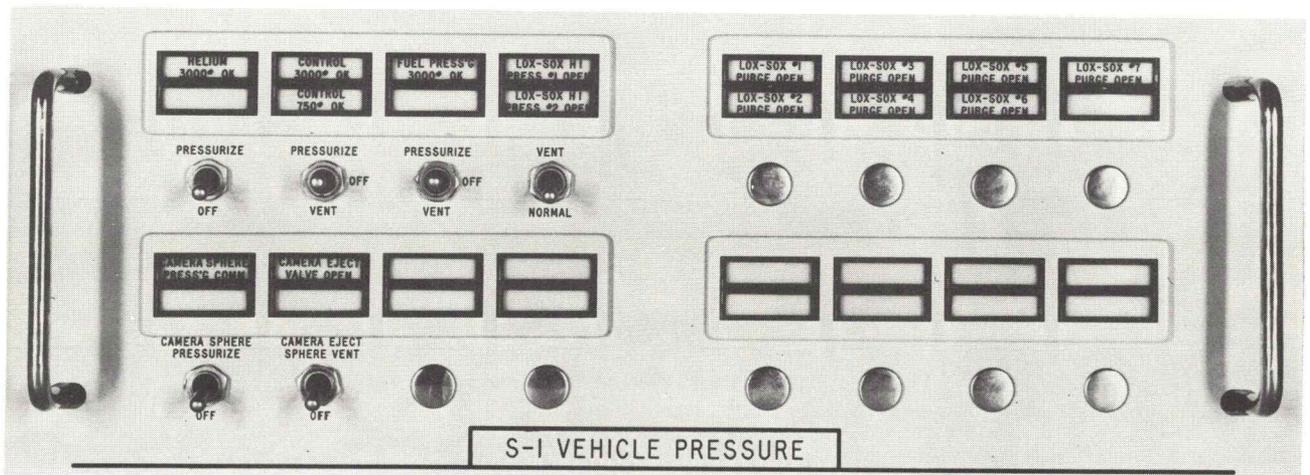
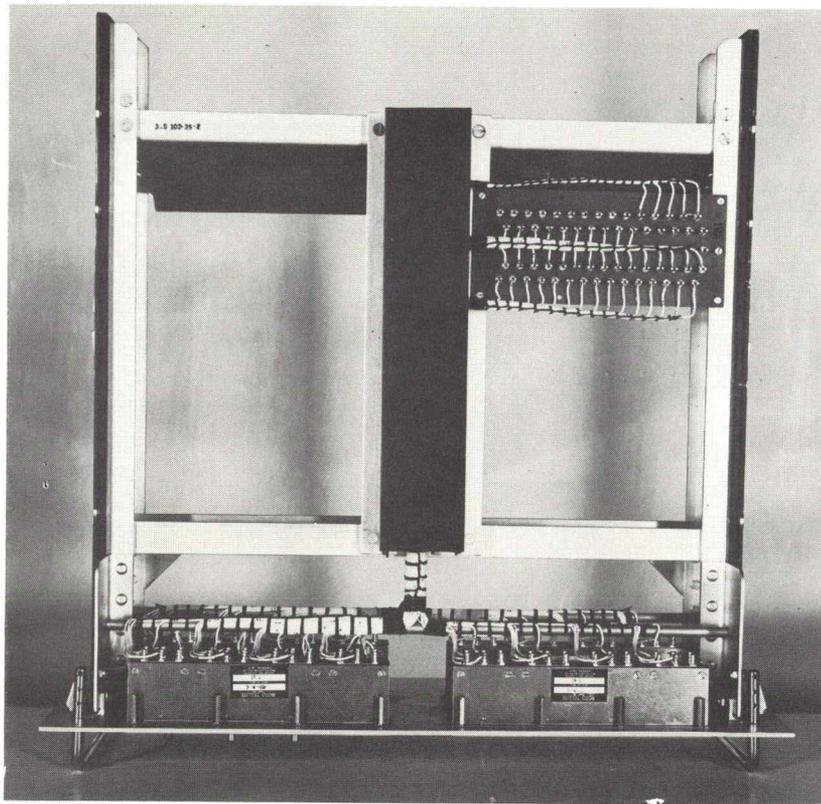
# **SDF**

## **PROPULSION SYSTEM**

The ESE associated with the vehicle Propulsion System electrically energizes, controls, monitors and tests the electrical components associated with the vehicle pneumatic systems, the vehicle pyrotechnics and electromechanical components associated with the vehicle propellant tanks and rocket engines. In addition, it sequences the systems down to the lift-off condition.



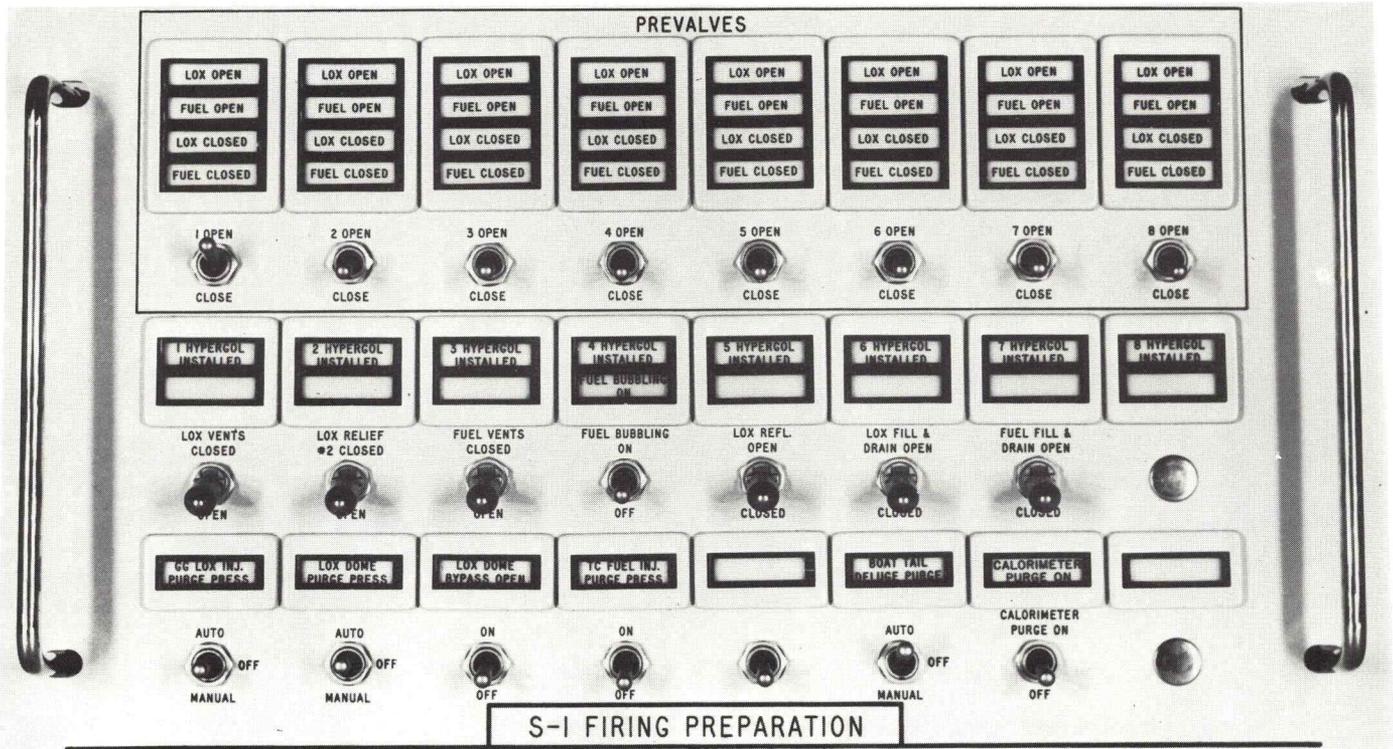
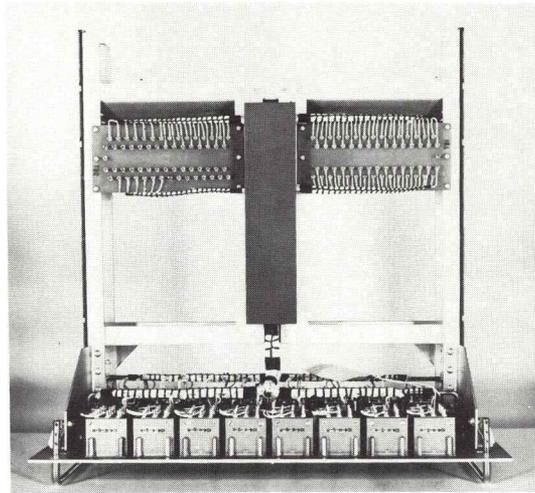
FIRING CONTROL RACK 136



### S-1 VEHICLE PRESSURE PANEL (136A1)

This panel provides supervision and control of pneumatic systems in the S-1 booster stage.

Supervision of Liquid Oxygen-Solid Oxygen (LOX-SOX) purge system is also provided. The panel is so integrated in the over-all ESE that the pressurizing must be started manually but is stopped automatically in the automatic sequencing operation.

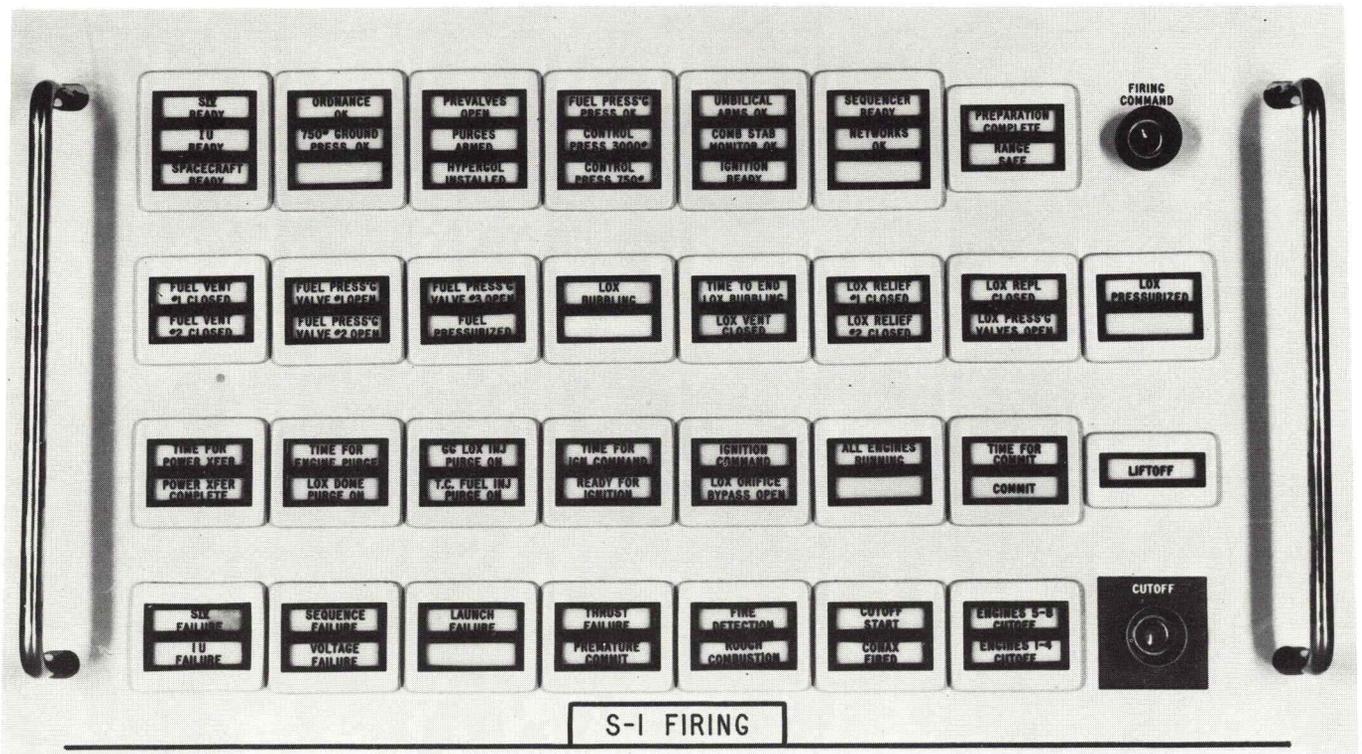
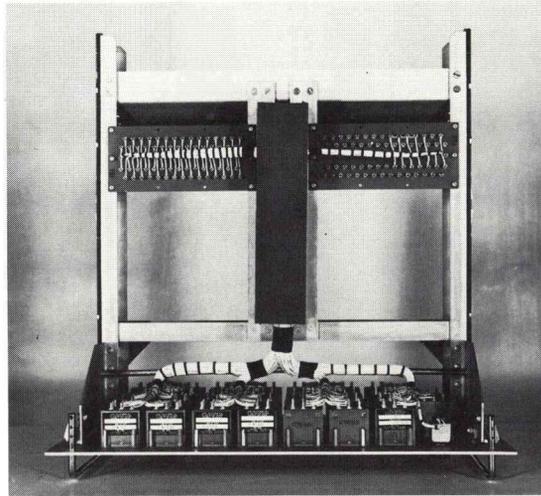


### S-1 FIRING PREPARATION PANEL (136A2)

This panel provides control and supervision of the vehicle valves and engine components connected with the propulsion system.

Separate switches and indicating lamps are provided for the pre-vent valves. The pre-vent valves must be opened by the switches, but become automatic during the automatic sequence.

Lamps and switches provide manual and automatic control, monitoring of purges and hypergolic supervision.

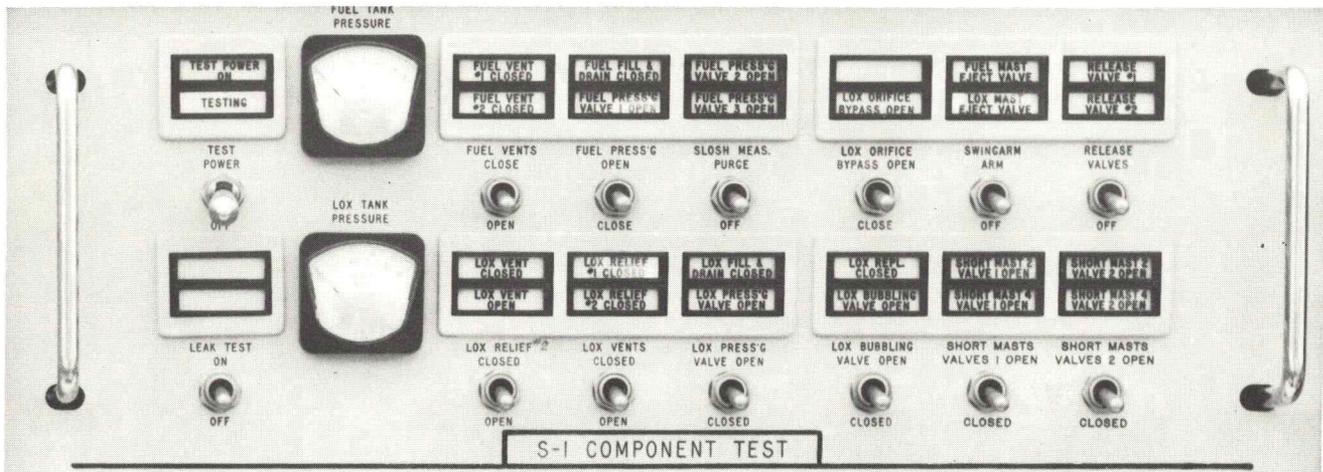
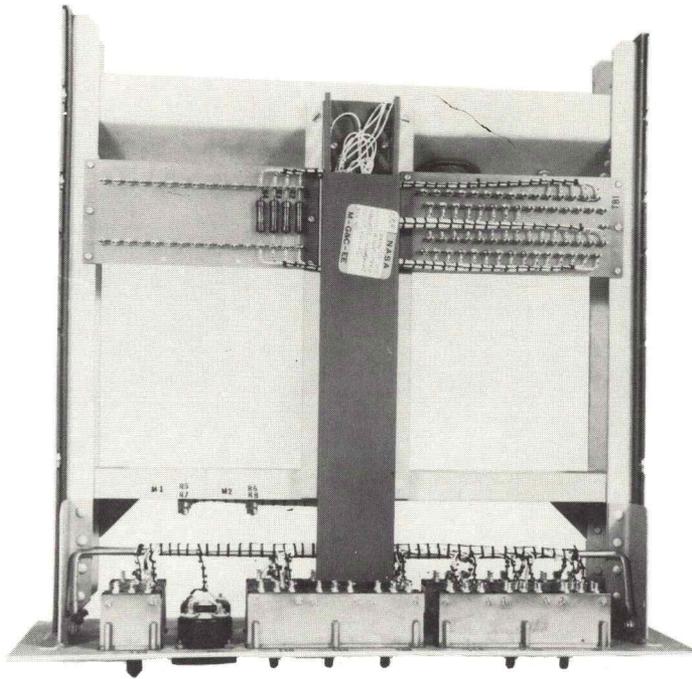


### S-I FIRING PANEL (136A3)

This panel provides indicating lamps for following the sequence through to liftoff.

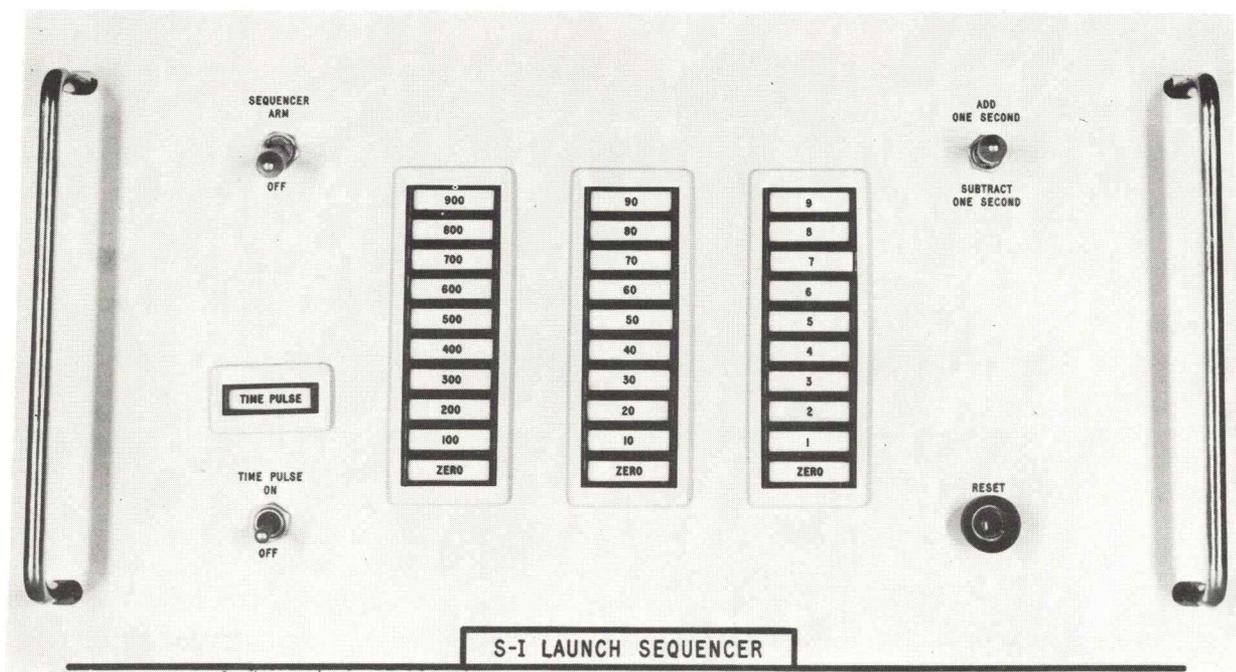
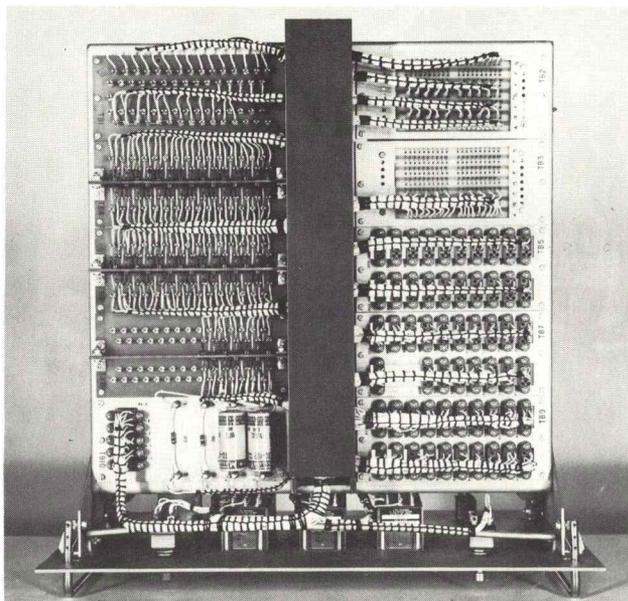
Indications such as "S-IV READY", "IU READY", "PREVALVES OPEN", "ALL ENGINES RUNNING", "IGNITION READY", "RANGE SAFE", "POWER XFER COMPLETE", "COMMIT", and "LIFTOFF" are provided to monitor the sequence status. A firing command switch is provided for starting the automatic sequence.

This panel also provides for monitoring and control of cutoff. The lamps give indications of "ENGINES 1-4 CUTOFF", "ENGINES 5-8 CUTOFF" and malfunctions causing cutoff.



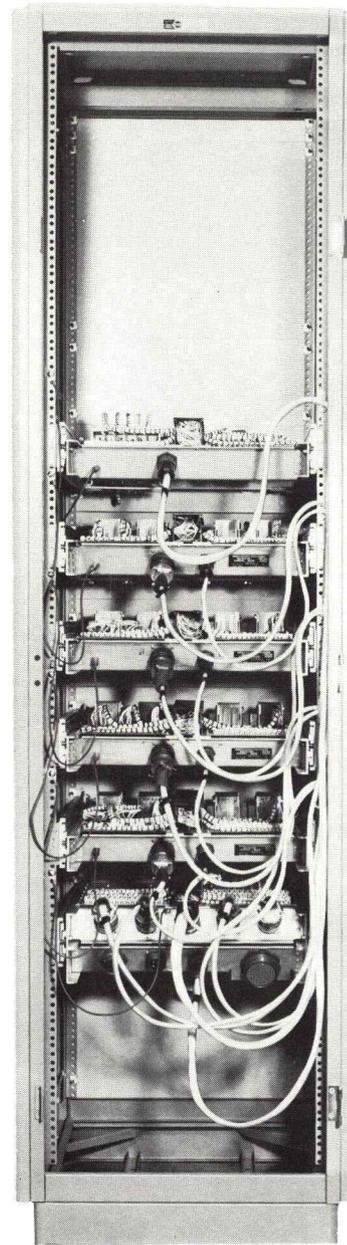
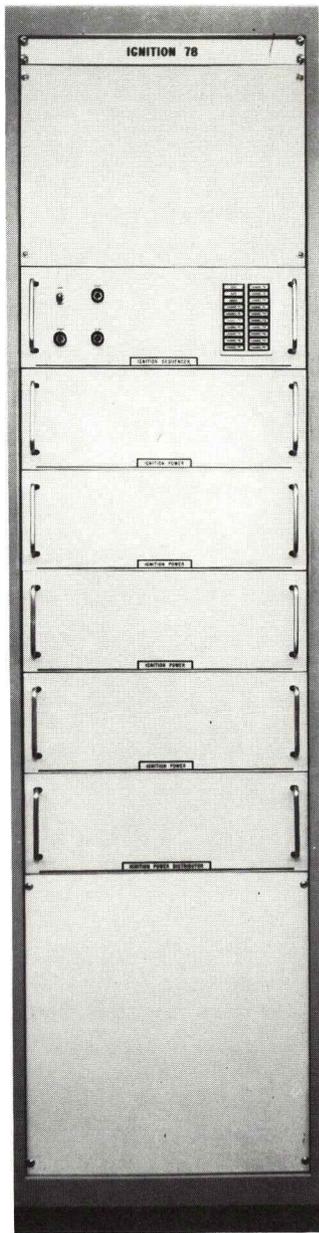
### S-1 COMPONENT TEST PANEL (136A4)

The Component Test Panel controls and monitors the operation of components such as the lox bubbling valve. These components are normally operated automatically and have no other manual control. Switches are provided for test power and component operation and lamps are provided to indicate operation of the components. The meters, located on the left side of the panel, indicate "FUEL TANK PRESSURE" and "LOX TANK PRESSURE".



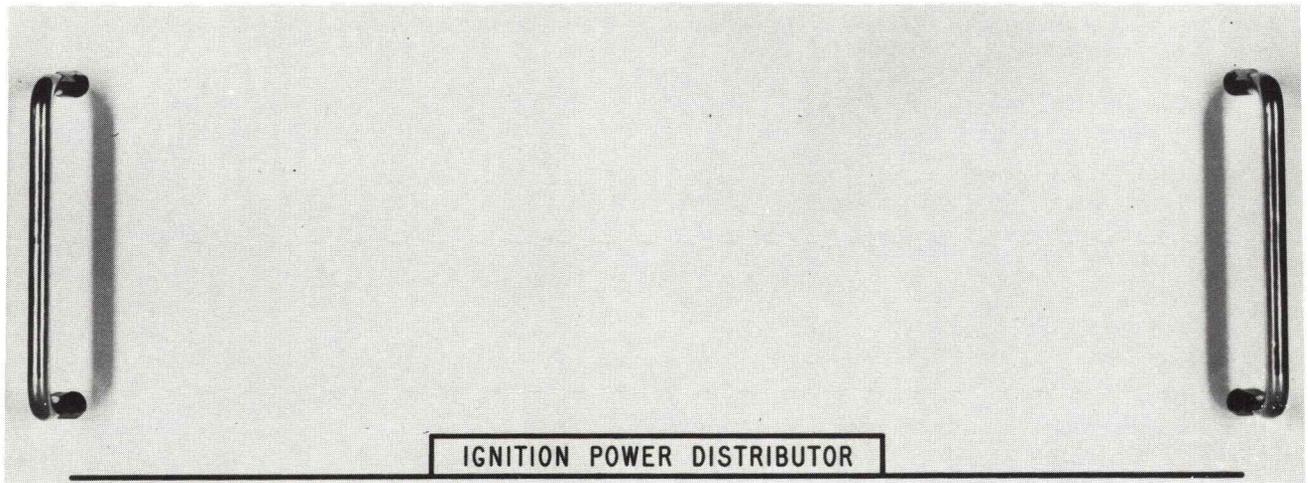
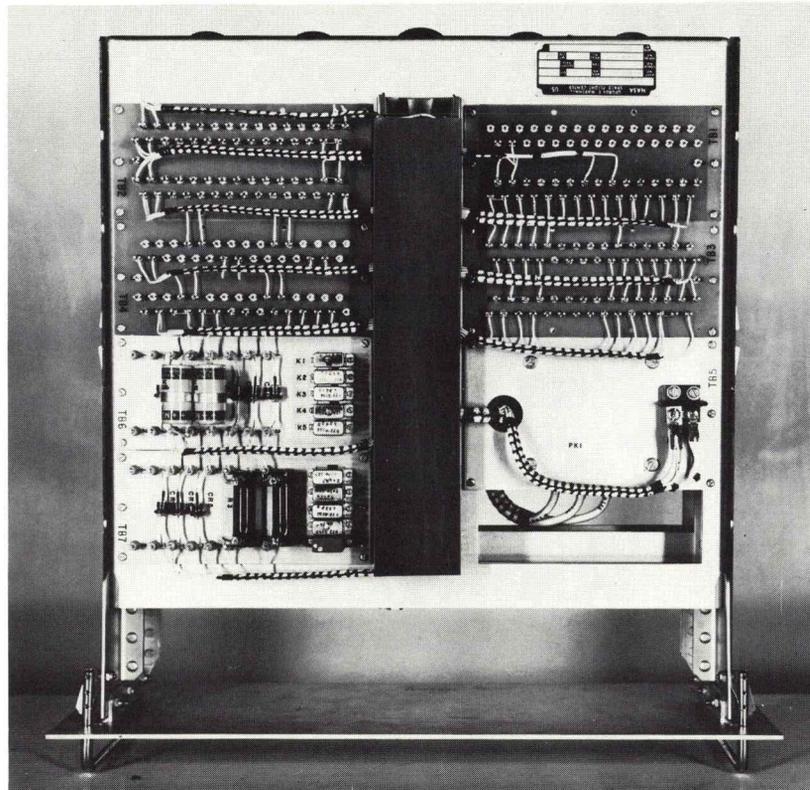
### S-I LAUNCH SEQUENCER PANEL (144A2)

This panel uses the master pulse per second (PPS) to provide sequence time for the automatic sequencing.



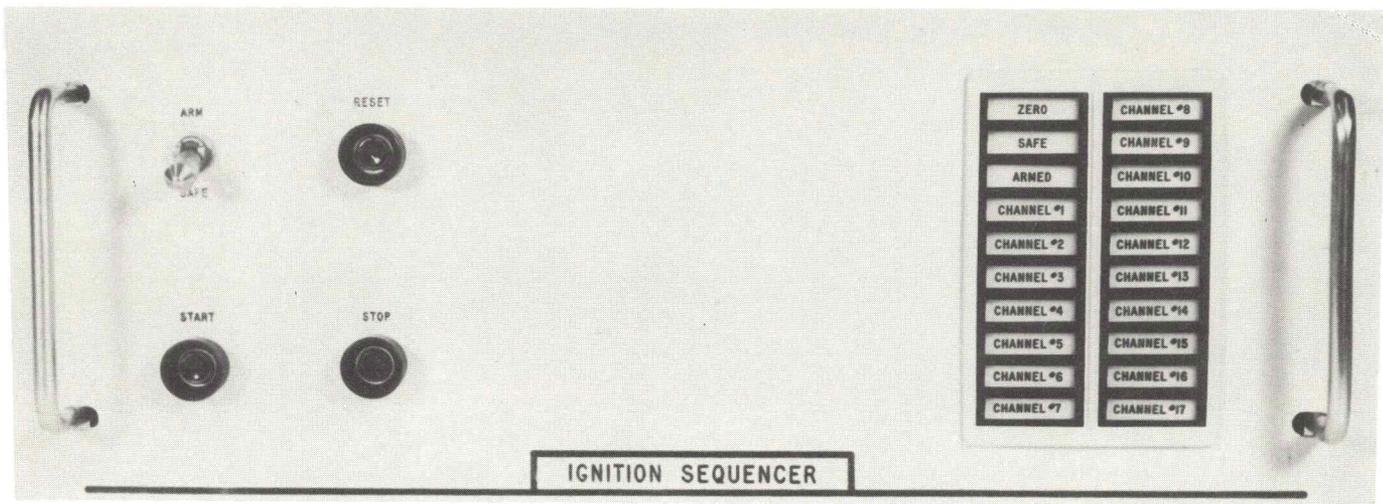
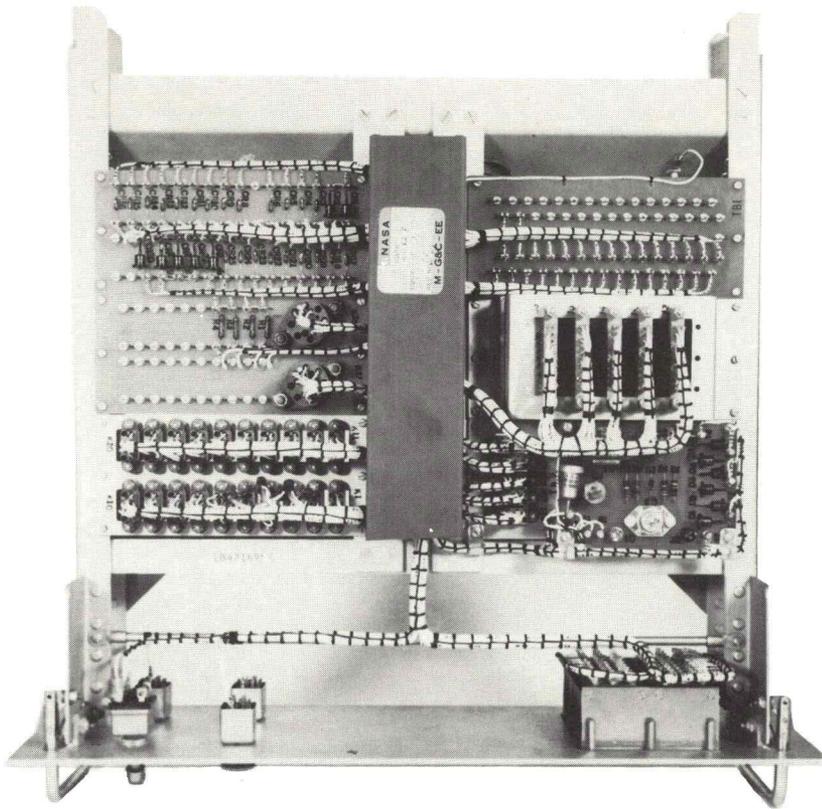
## IGNITION RACK 78

This rack provides power for and sequencing of the start-up of the turbine spinners which initiate the automatic starting of the eight engines. The timing of the sequence start-up (or cut-off) is provided by the ignition sequencer panel (see Ignition Sequencer Panel 78A2). The power for firing the 500 volt turbine spinner initiators is supplied by 115/500 volt transformers. These transformers, one for each initiator (two initiators per turbine spinner) are mounted in the ignition power panels. Firing current of one ampere is supplied to each initiator. The ignition distributor routes power, control and indication circuits to the interconnecting cables.



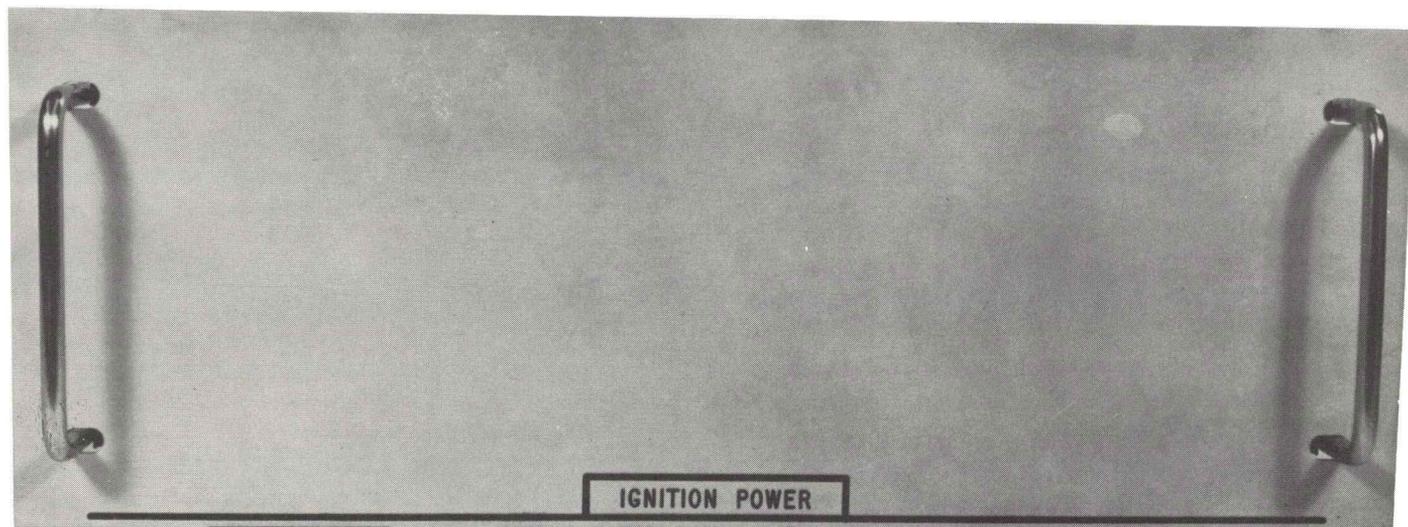
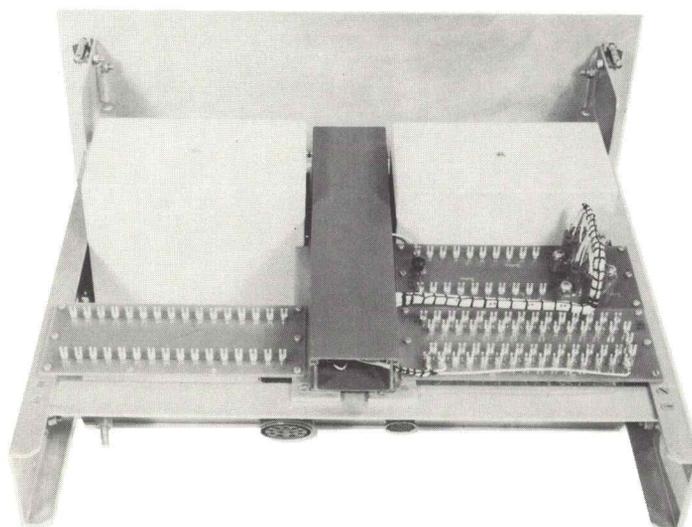
### IGNITION POWER DISTRIBUTOR PANEL (78A1)

This panel is used for distribution of power and control functions of the vehicle engine ignition system.



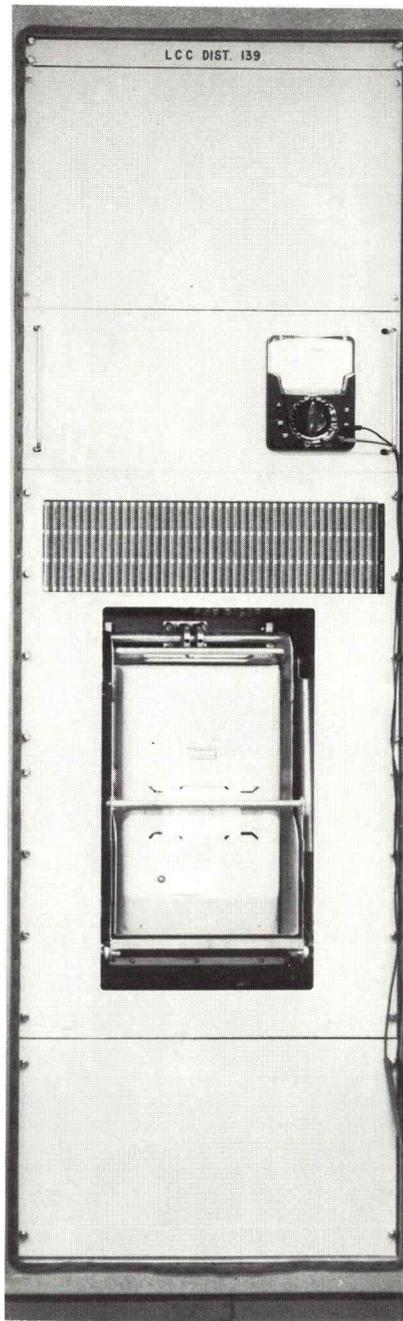
### IGNITION SEQUENCER PANEL (78A2)

This panel is a timing device for sequencing the starting or stopping of the engines by staggering the firing pulses to the turbine spinners or conax valves. Signal output and status indication and control switches are provided for testing the panel. The necessary operation controls and indications are provided on the networks panel.



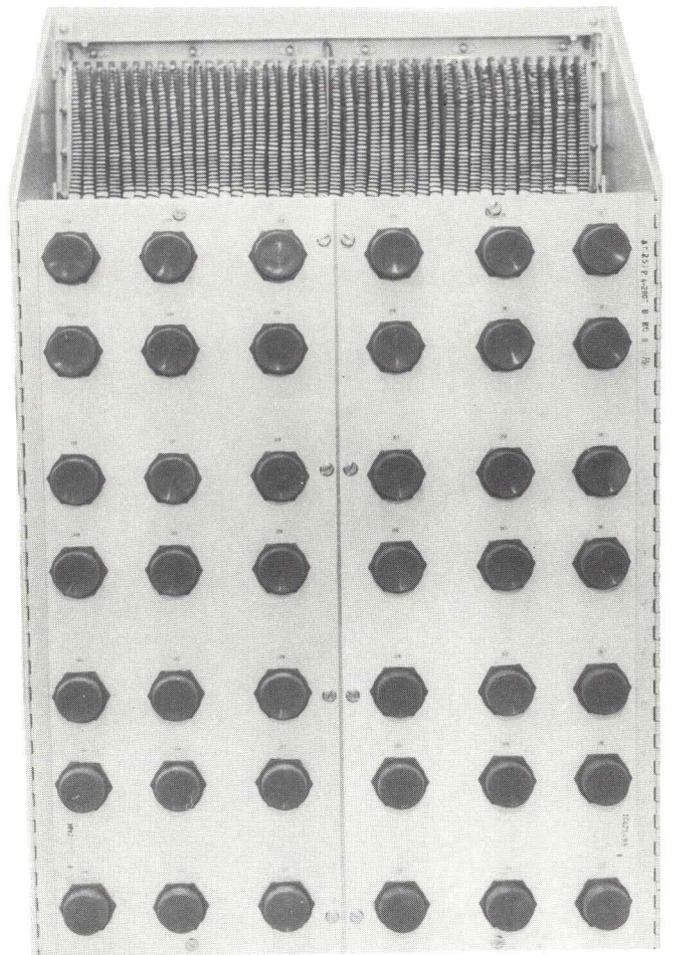
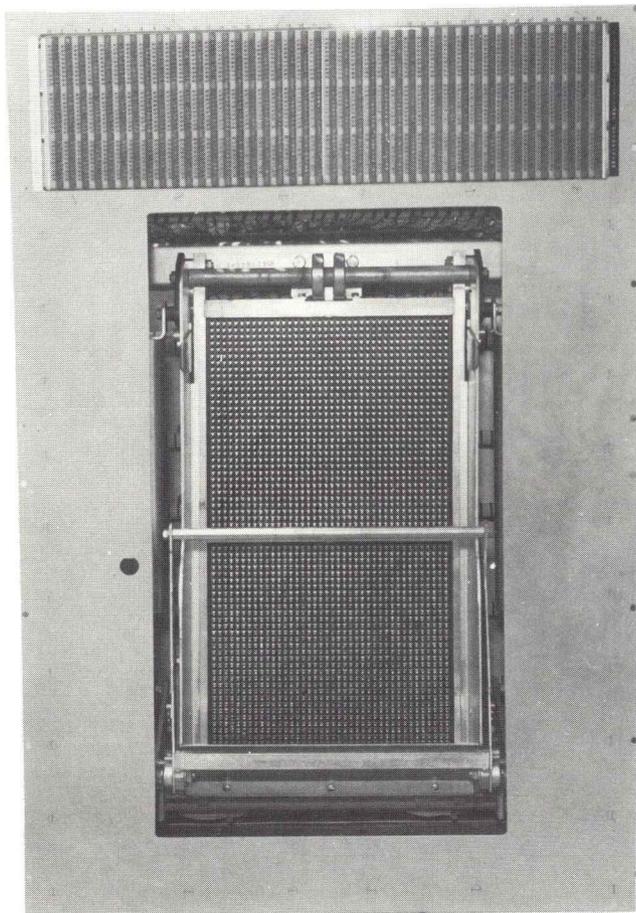
### **IGNITION POWER PANEL (78A3)**

This panel contains power supplies for firing turbine spinner initiators for two engines. Four functionally identical panels are used.



### **LCC DISTRIBUTOR RACK 139**

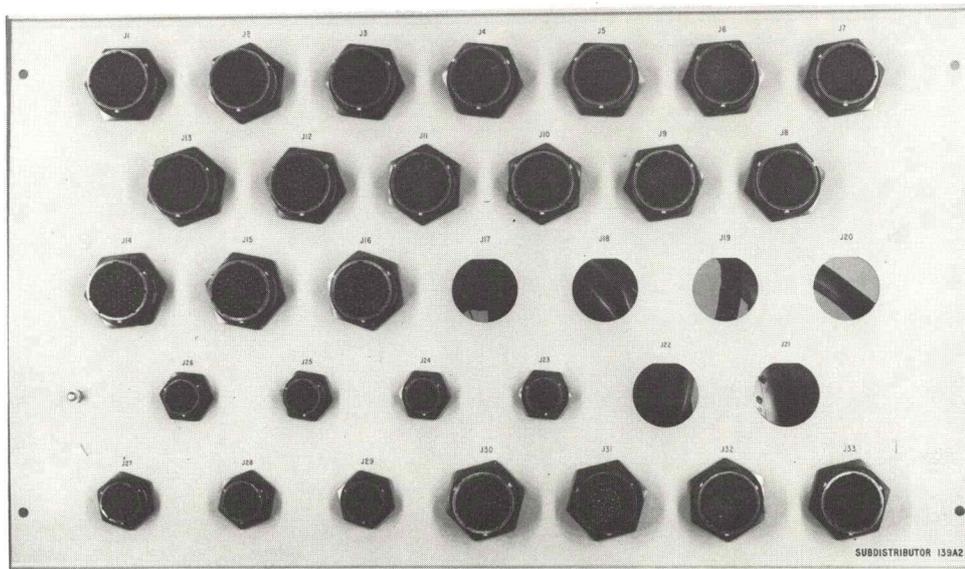
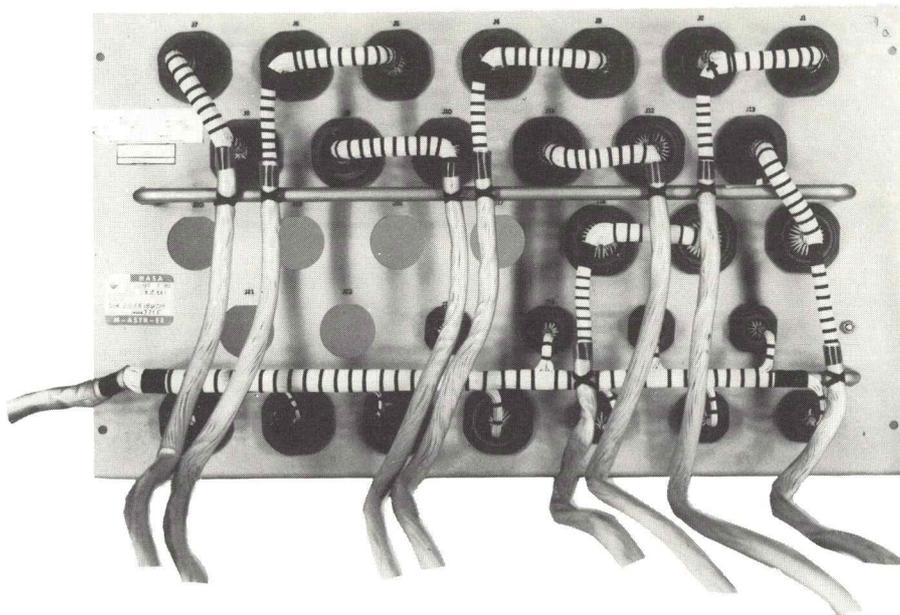
This rack serves as a distribution center for power from the utility room, indications from the vehicle, and distributes the control commands from the various panels in the Launch Control Center (LCC) to the operative components in the vehicle. The patchboard assembly affords the ultimate in flexibility in that all lines are terminated at the patchboard and any line may be patched to any other line. All lines also terminate at the test board located directly above the patchboard assembly and provides a convenient means for checking. A meter panel (VOM) is mounted nearby for this purpose.



### **42 PLUG UNSHIELDED DISTRIBUTOR PANEL (139A1)**

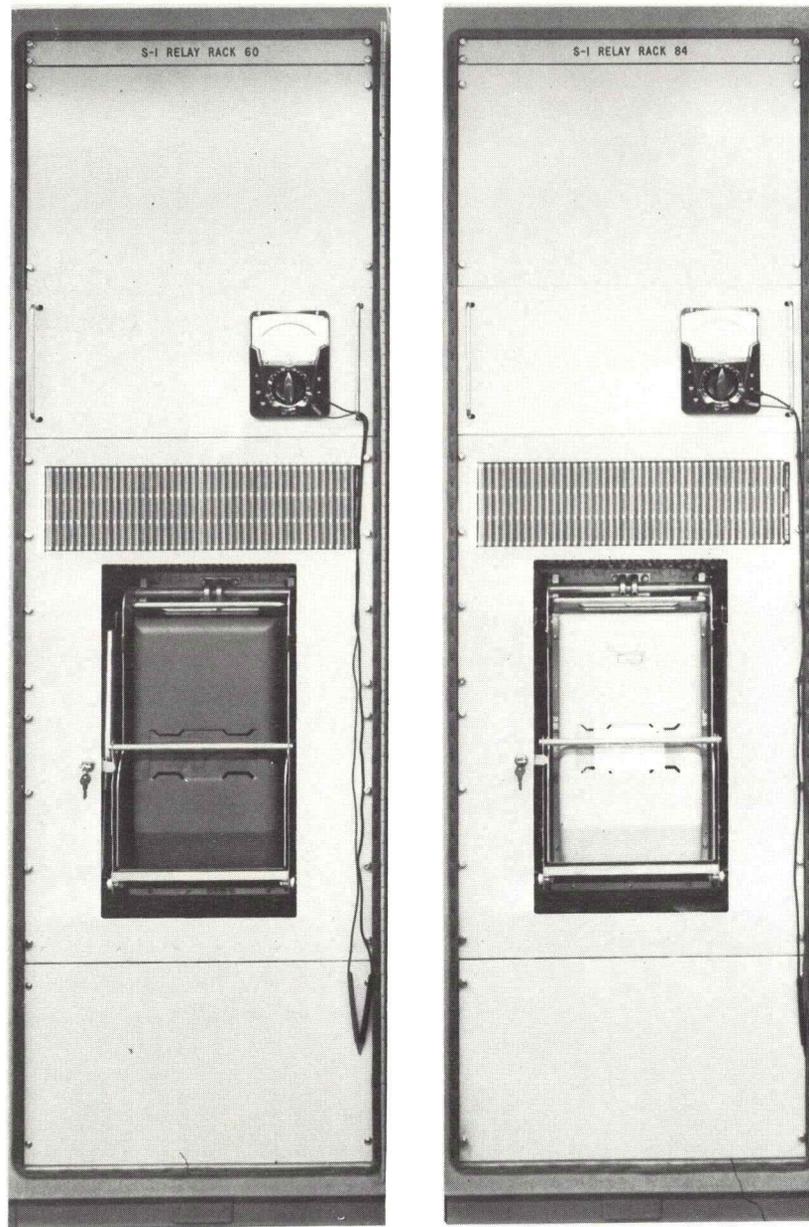
This panel consists of 42 sixty-one pin connectors, a 2,560 pin patchboard, and over 7,000 wire terminations.

Almost any circuit configuration can be created by the arrangement of jumpers on the removable program board or on the connectors cabled to the panel. The relay and diode modules which can be plugged into the connectors of the distributor panel increase its circuit versatility.



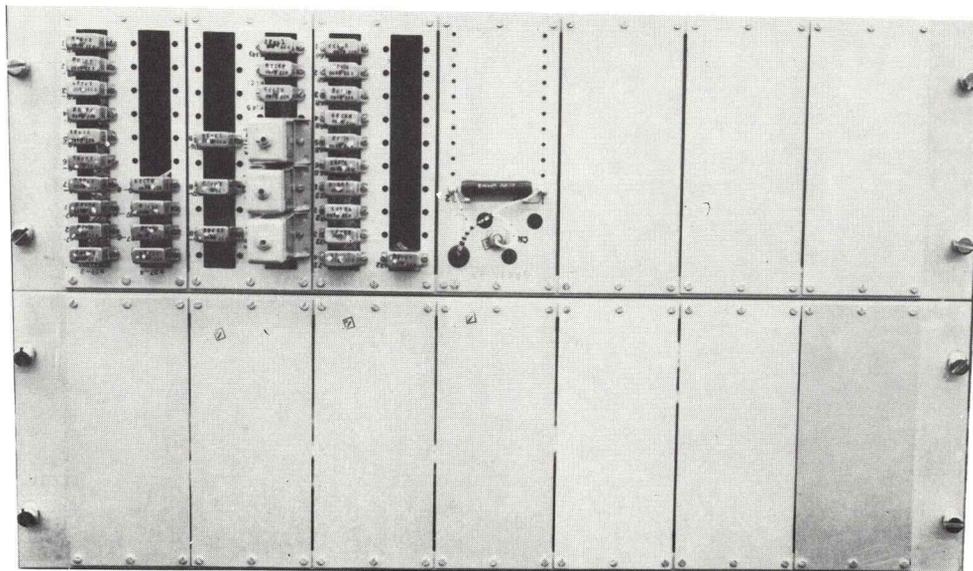
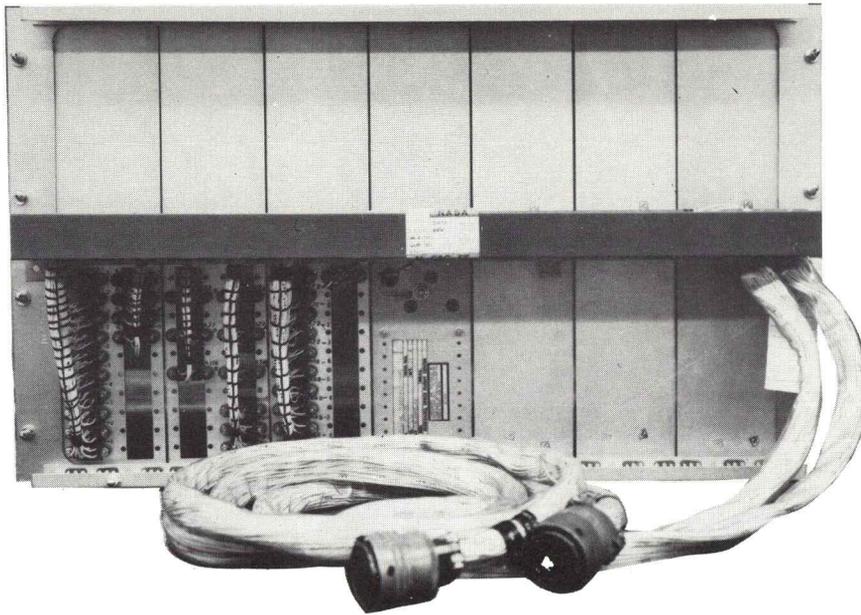
### SUB-DISTRIBUTOR PANEL (139A2)

This sub-distributor panel is used for distribution of identical signals to two or more points in lieu of split cables.



### S-1 RELAY RACKS 60 AND 84

These relay racks provide a convenient, flexible means of connecting the circuit components by using relay modules, diode modules, and special component panel all interconnected by the patch distributor. These racks are relatively close to the vehicle stage and serve as a relay station. This is necessary due to the voltage drop in the long lines from the LCC. In addition, the relay racks contain the majority of the relay and solid state logic. This logic contains all the interlock and safety circuits.



### **SPECIAL COMPONENTS PANEL (60A2)**

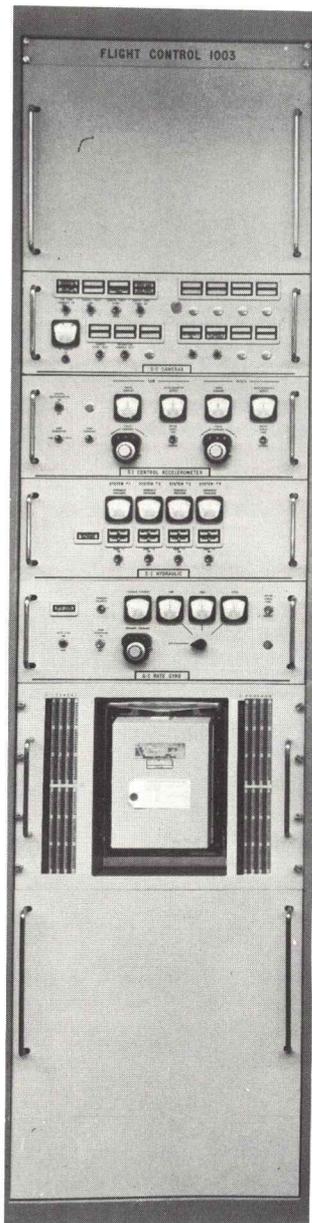
This panel contains the solid state timers, resistors, special diodes, relay circuits and all other relay rack components and circuits that can not be conveniently handled by the relay and diode modules on the patch distributor.



# **SDF**

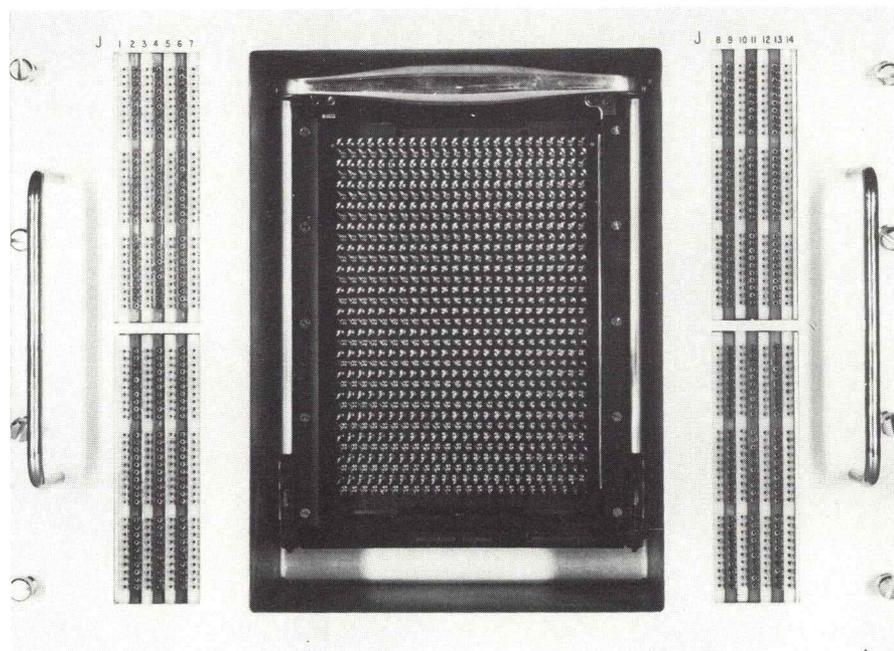
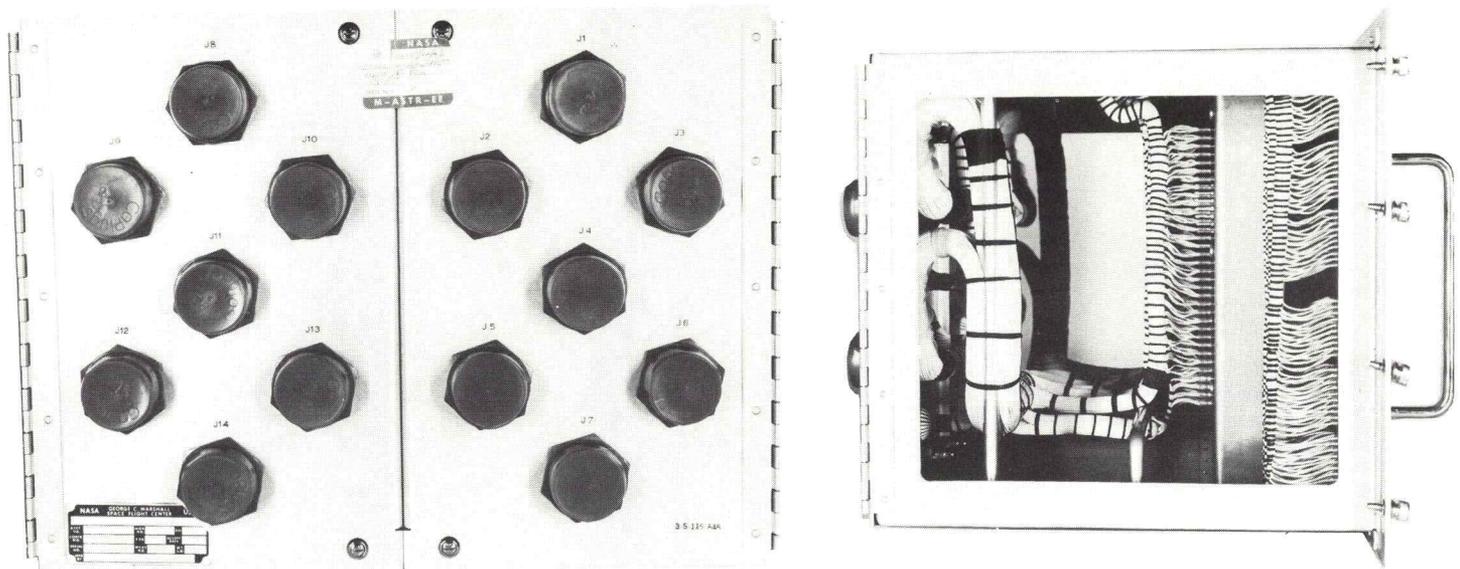
## **FLIGHT CONTROL SYSTEM**

The function of the flight control system ESE is to electrically energize, control, monitor, and test the vehicle flight control system. The operation of this system is accomplished by the assembly of several panels of interrelated or integrated functions. For example, operation of controls on one panel may cause readouts on one or more of the other panels. The equipment is used to functionally checkout and operate the vehicle flight control system at the static test areas and at the launching areas.



## FLIGHT CONTROL RACK 1003

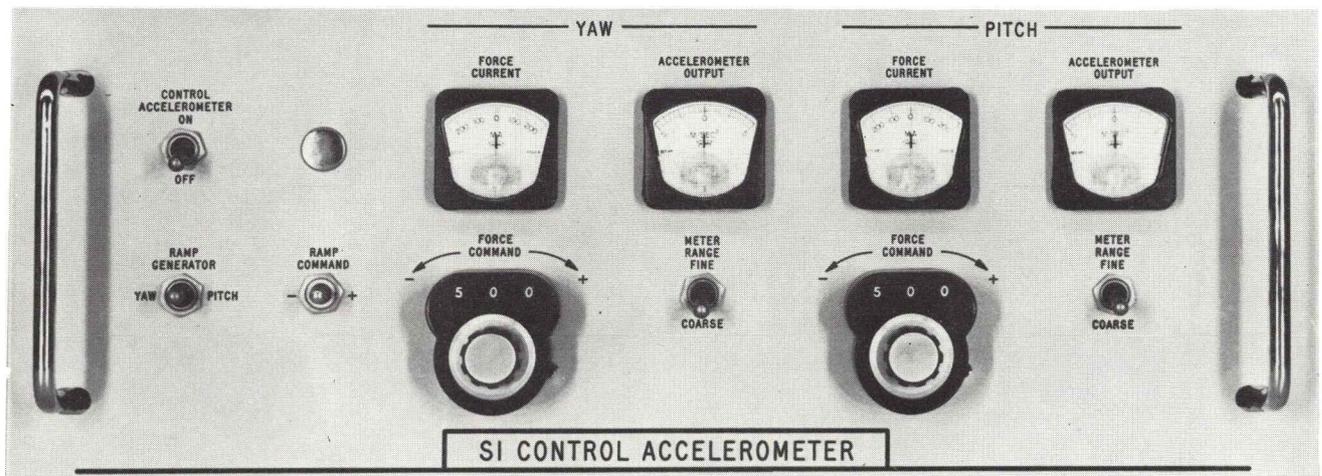
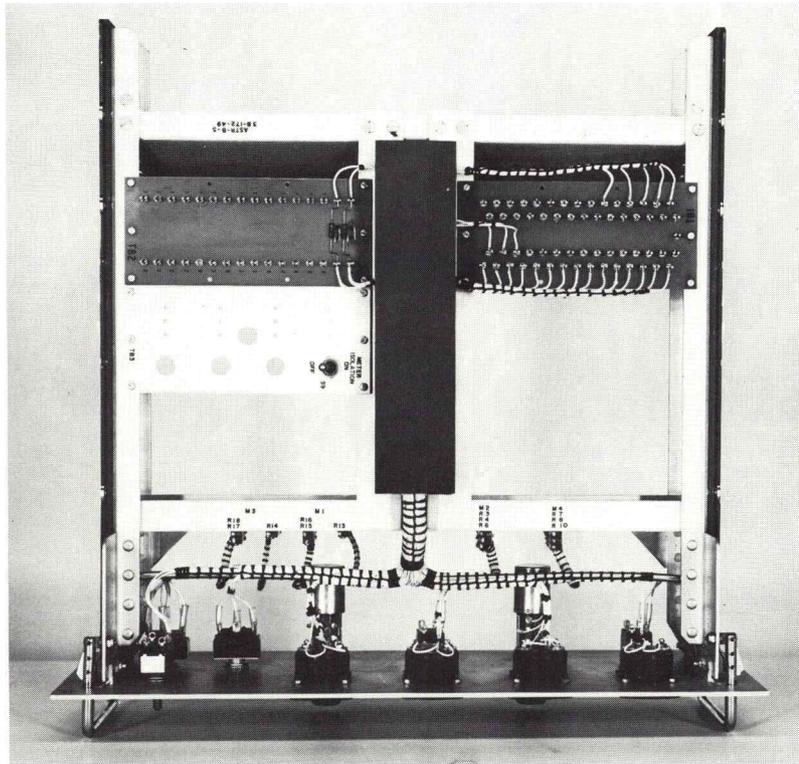
This rack distributes, controls and monitors functions in the flight control system.



### S-1 FLIGHT CONTROL DISTRIBUTOR (1003A1)

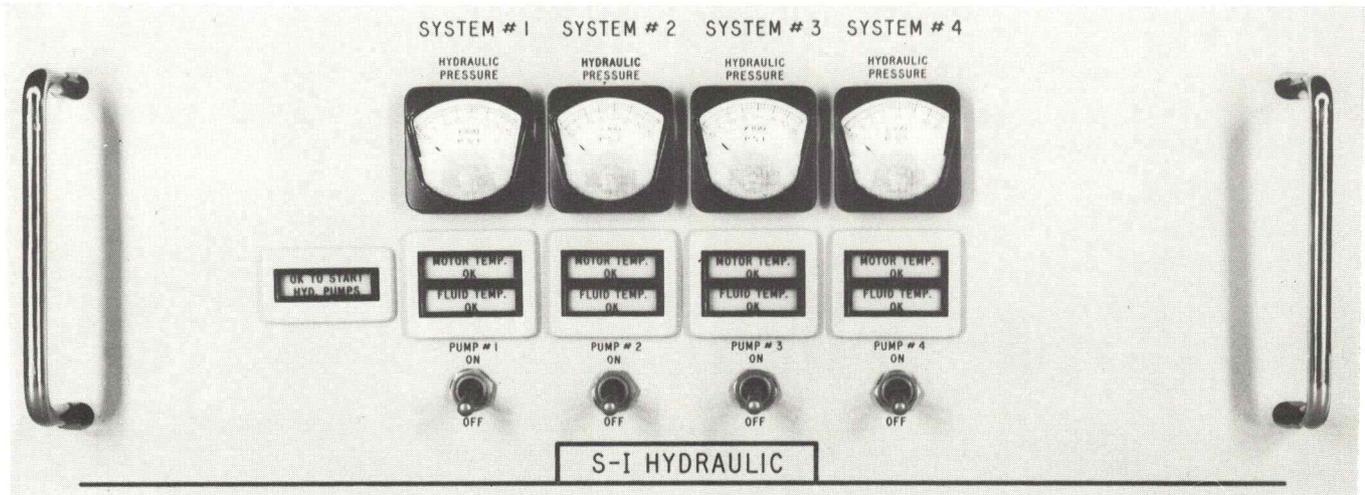
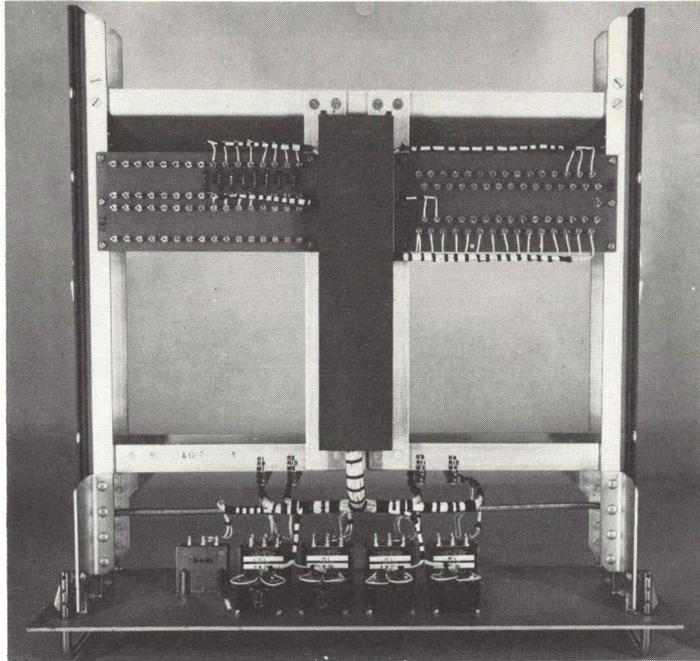
This is a 14 plug distributor used for connecting the S-1 flight control panels into the system.

In the LCC, the S-1 and IU panels will be arranged in racks in the most suitable location for ease of operation.



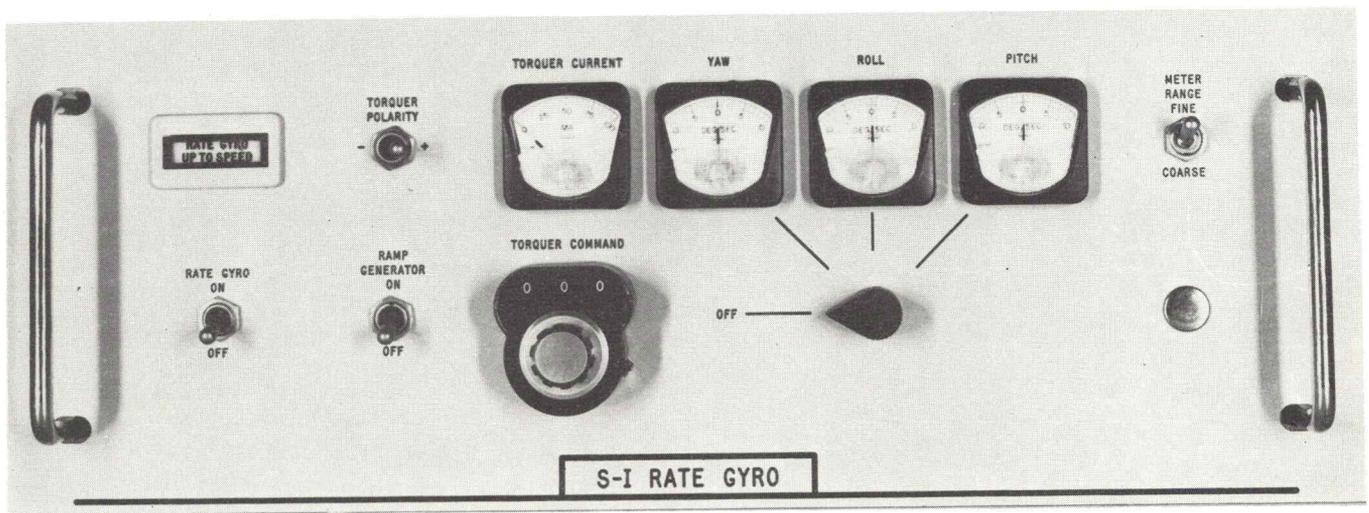
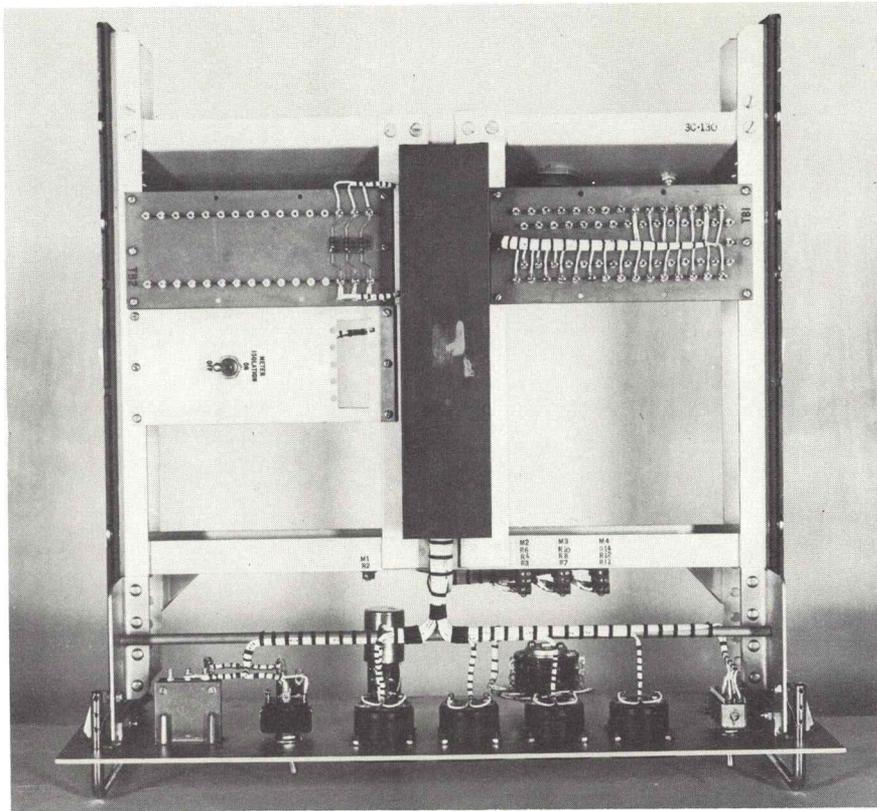
**S-1 CONTROL ACCELEROMETER PANEL (1003A2)**

The function of this panel is to provide control and monitoring capabilities for the control accelerometers. The force coils may be excited manually or automatically in order to check the servo loop and calibrate the control accelerometers.



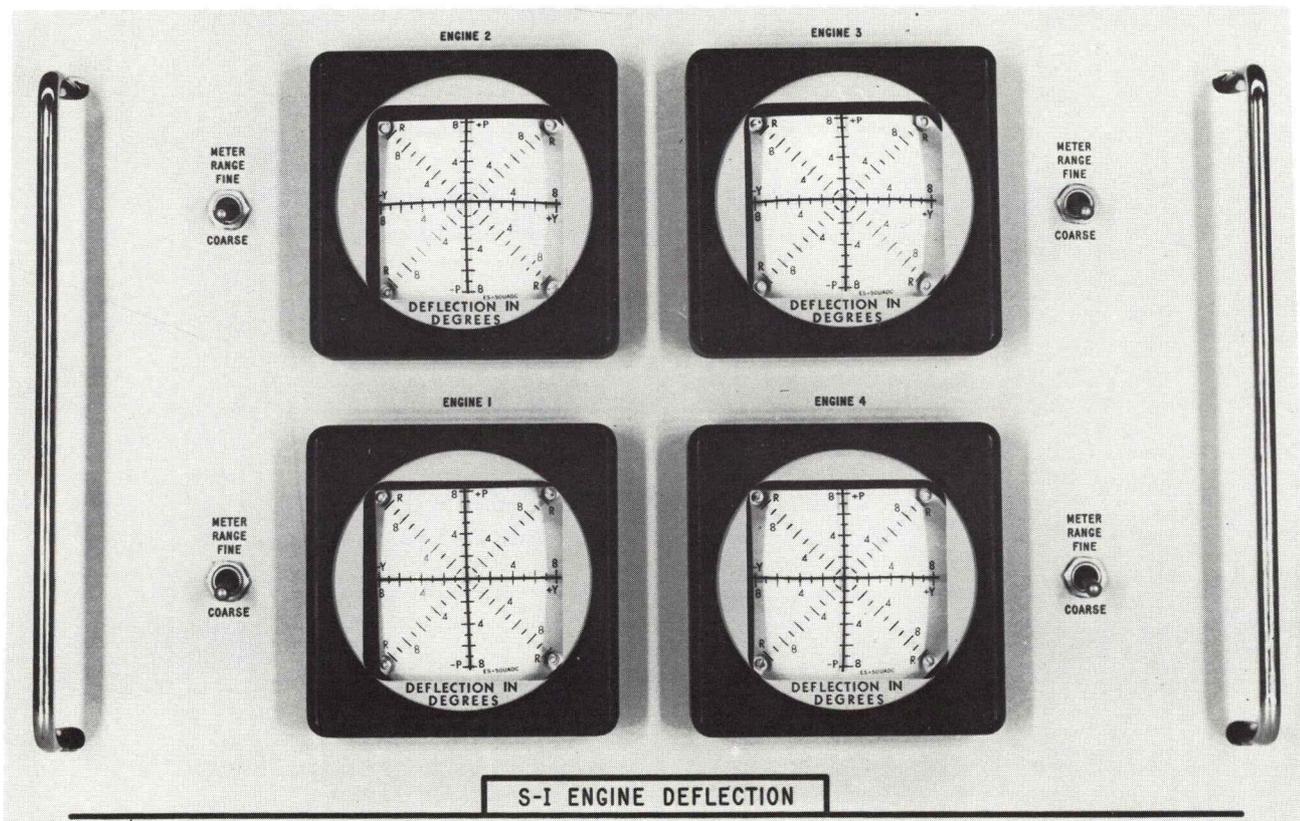
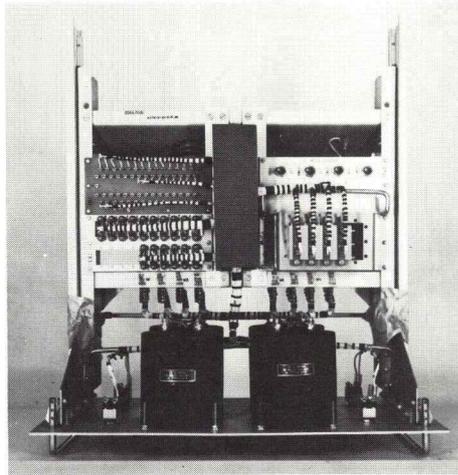
### **S-1 HYDRAULIC PANEL (1003A3)**

The function of this panel is to provide individual control and monitoring of each of the S-1 Stage Engine Hydraulic Systems.



### S-I RATE GYRO PANEL (1003A4)

This panel is used to control and monitor the S-1 rate gyro. The rate gyro is turned on by a switch located on this panel and its speed is monitored. Provisions are made for manual and automatic torquing of the gyro for calibration and control.



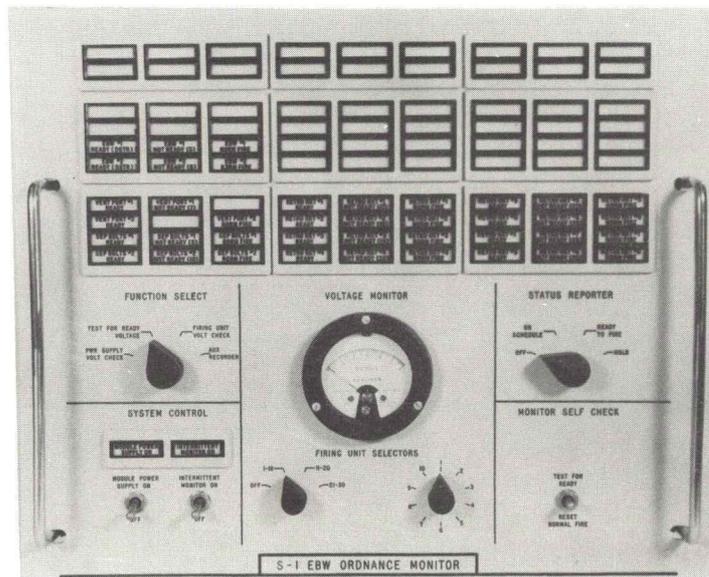
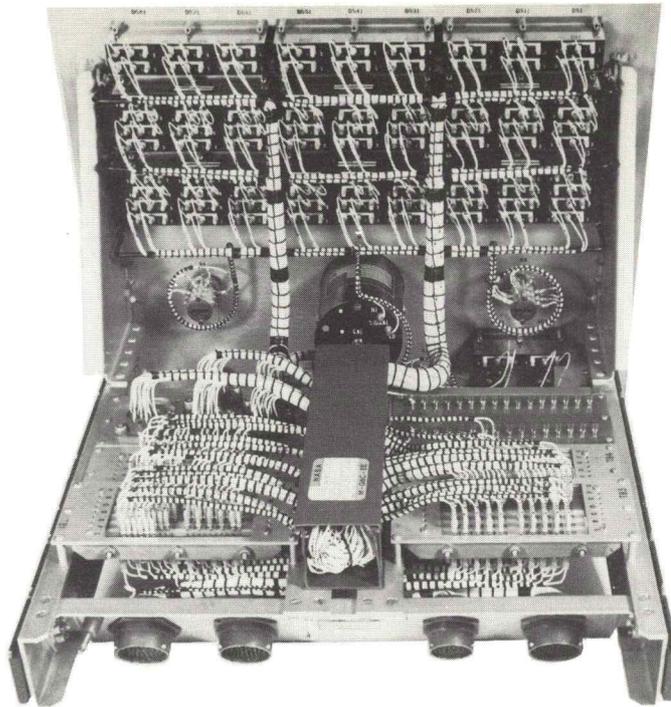
### S-1 ENGINE DEFLECTION PANEL (134A1)

This panel provides continuous monitoring of the yaw, roll and pitch positions of the four control (gimballed) engines of the S-1 Stage.

# **SDF**

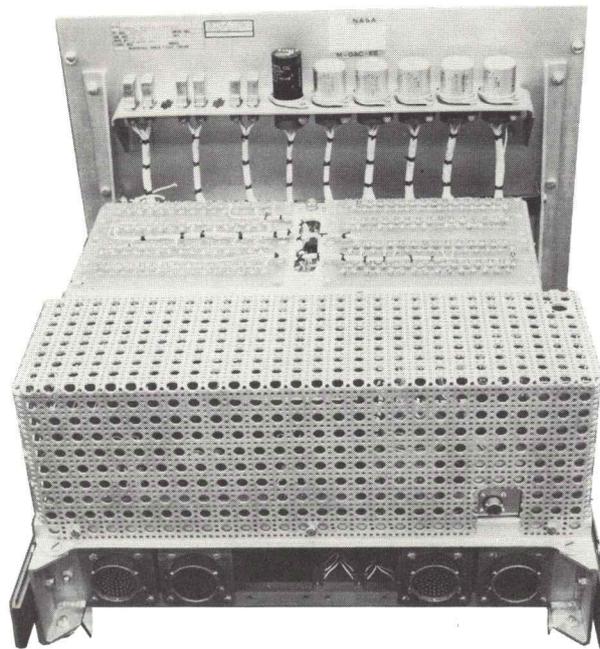
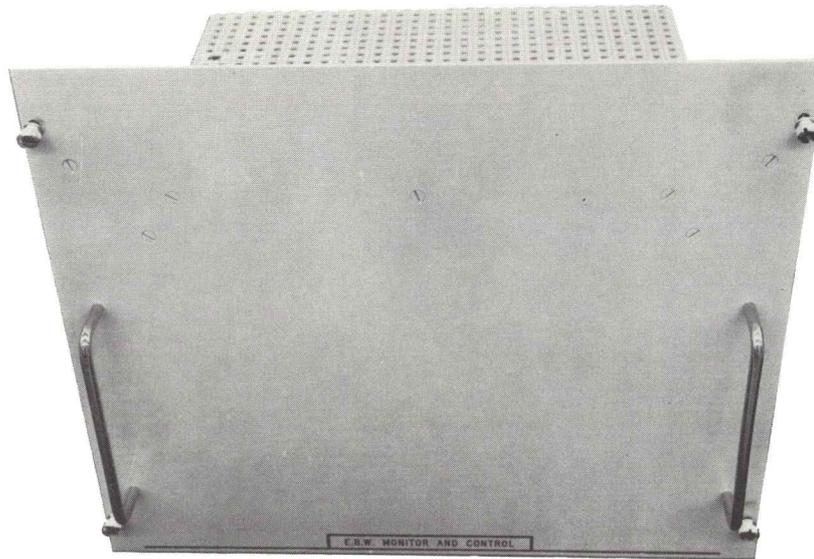
## **ORDNANCE SYSTEM**

The ESE associated with the Ordnance System is designed to test and monitor the exploding bridge wire (EBW) firing units, the safe and arm unit destruct, and the destruct system controllers. The EBW units monitored are used to fire the retro-rockets, ullage rockets, separation bolts and fuel dispersion primacord.



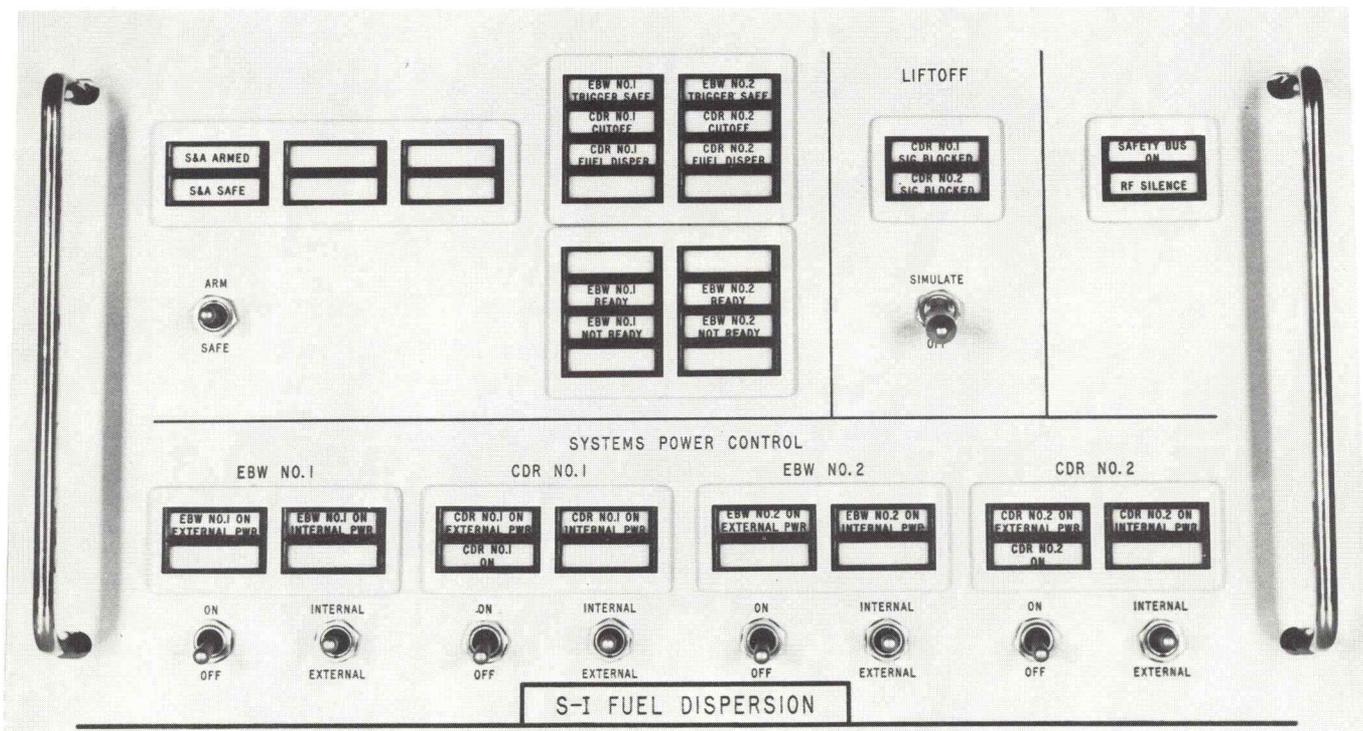
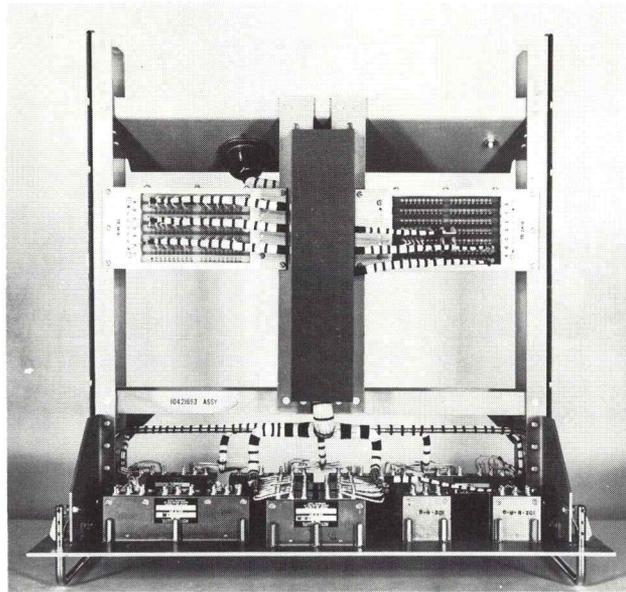
## S-1 EBW ORDNANCE MONITOR PANEL (148A3)

This panel monitors ordnance systems other than the destruct system.



### **EBW MONITOR AND CONTROL PANEL (84A4A2)**

This panel is the heart of the EBW monitoring system. It contains a regulated power supply and monitors the readiness condition of the EBW firing units.



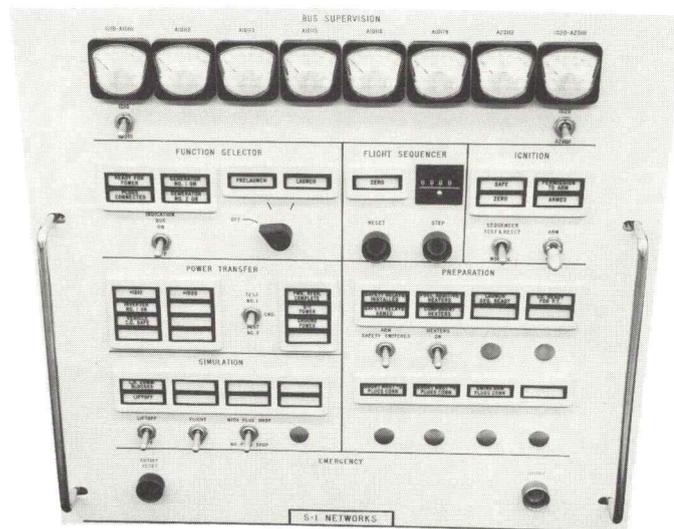
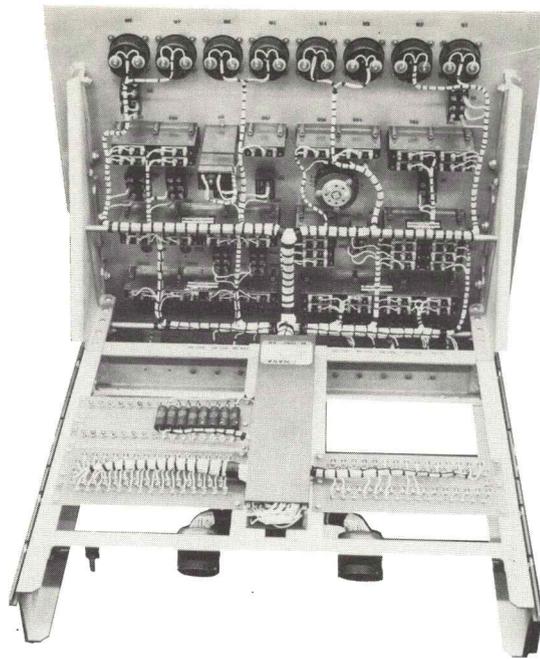
### S-1 FUEL DISPERSION PANEL (148A2)

This panel is used to monitor the status of destruct system components, and provides a status display for determining destruct capability.

# **SDF**

## **NETWORKS SYSTEM**

The ESE associated with the networks system controls and monitors the DC buses. It controls the flight sequencer, program device, and it also provides an indication of the status of power transfer.



### S-1 NETWORKS PANEL (144A1)

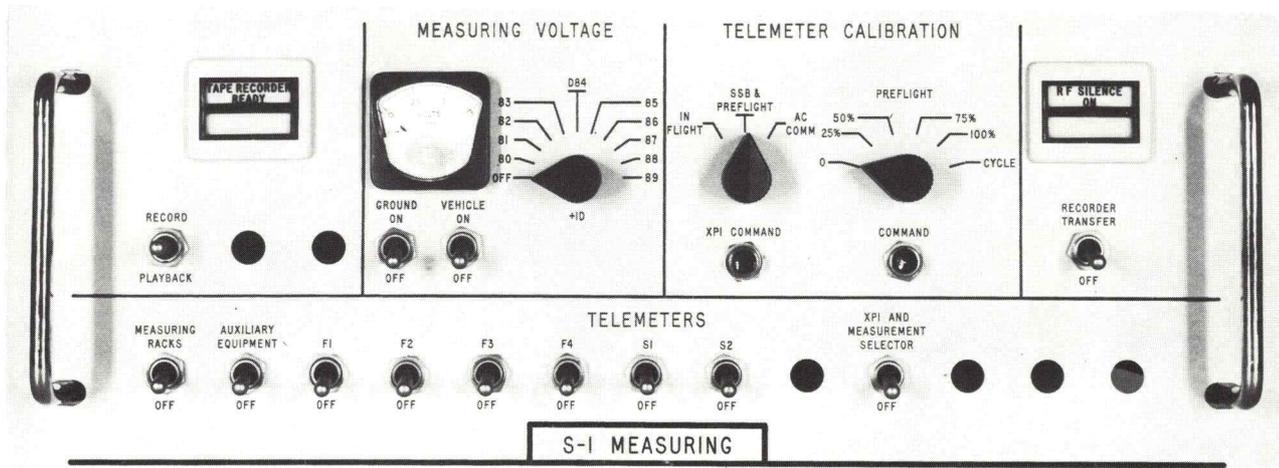
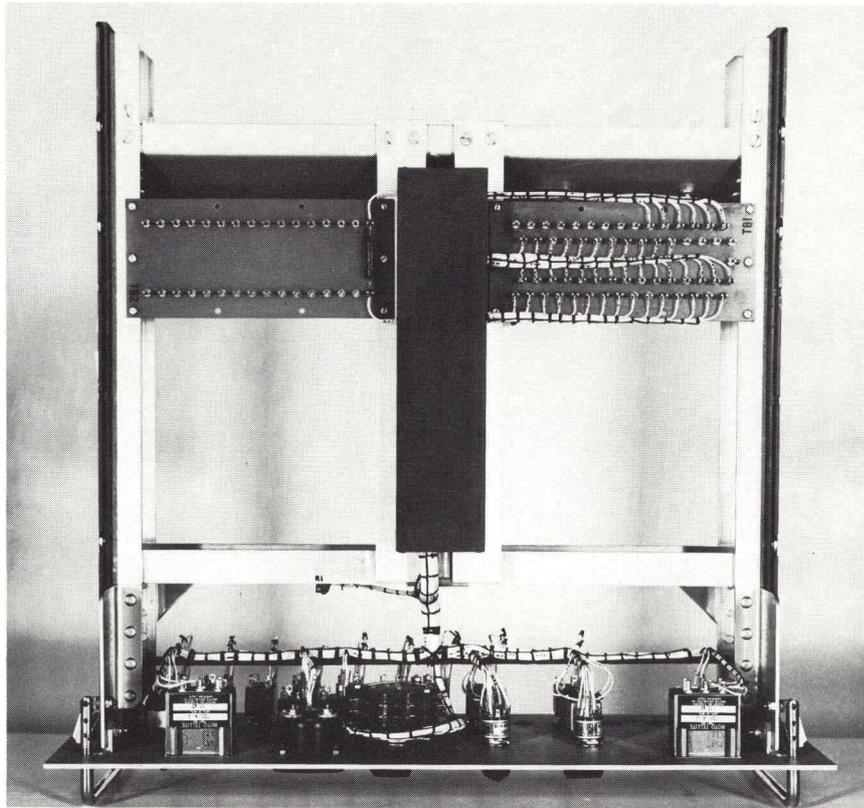
This panel provides supervision of ESE network bus voltages and vehicle battery voltages. Other launch prerequisite supervision information is provided. Test and launch buses and ground to vehicle power transfer test are controlled here.

This panel is sub-divided in sections designated simulation, network status, bus supervision, function selector, power transfer, ignition, flight sequencer, preparation and emergency.

# **SDF**

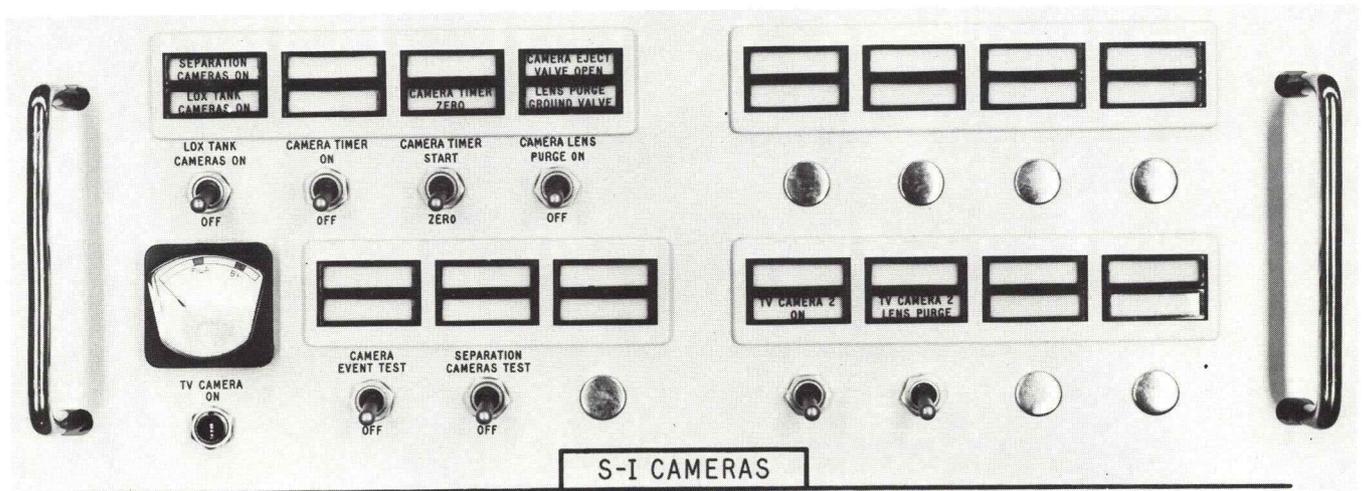
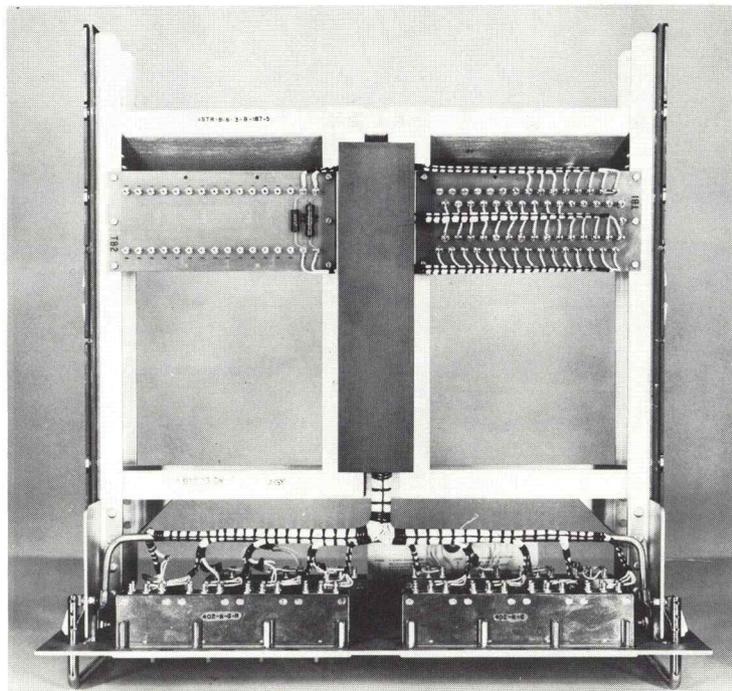
## **MEASURING AND TRACKING SYSTEMS**

The ESE associated with the measuring and tracking is used to simulate, monitor, and control the radar tracking equipment and the on-board measuring and telemetering system. This equipment is also used in connection with the calibration of telemetering equipment.



### S-1 MEASURING PANEL (129A1)

This panel provides supervision of the measuring voltages and provides for the calibration of the telemeters. The telemeters are activated from this panel and become automatic in flight. All automatic equipment associated with telemetering such as tape recorders, measuring racks and measuring selectors are controlled from this panel.



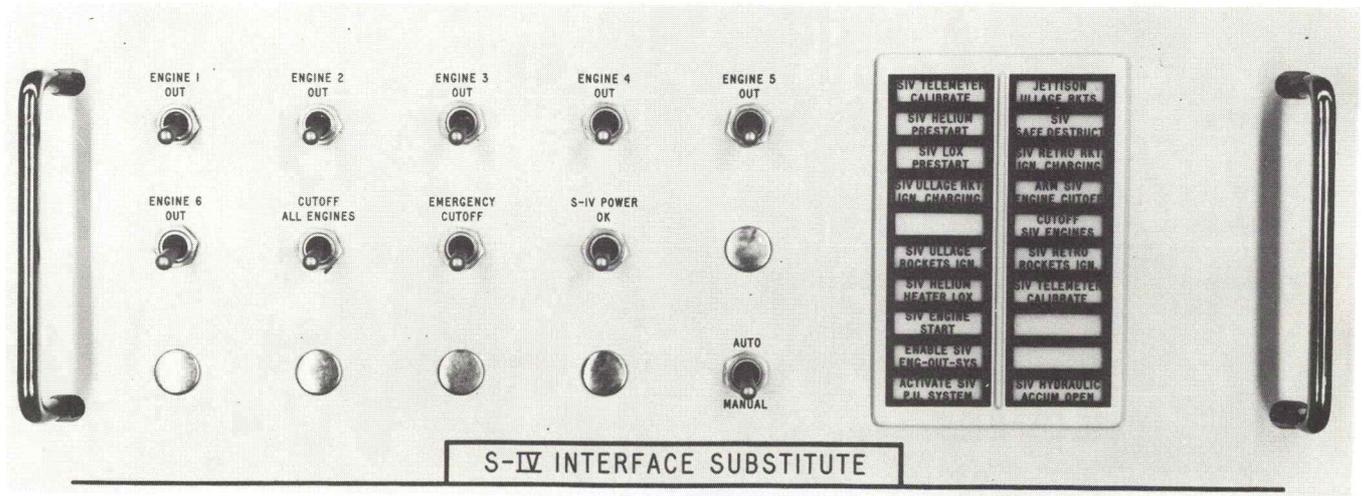
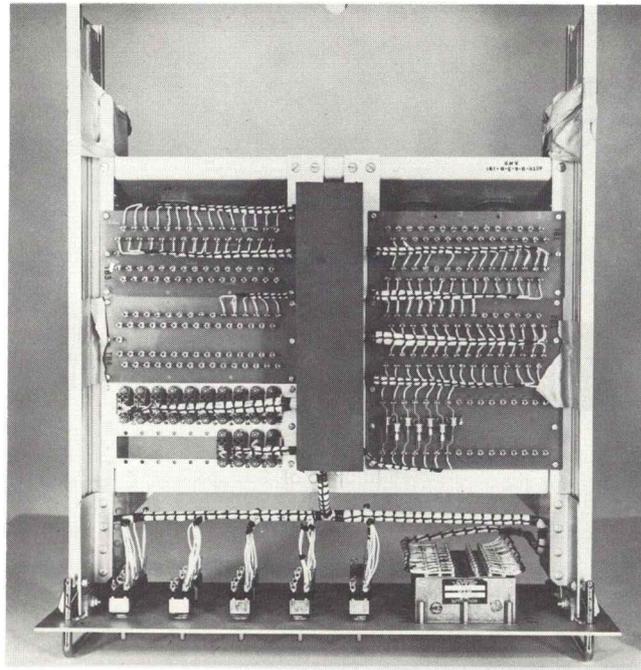
### S-I CAMERAS PANEL (129A2)

This panel provides for control and monitoring of TV and movie cameras and also for purging of camera lenses. It also provides for testing and monitoring of camera ejection system for recoverable cameras. It has spare capabilities for any related tests that may be added.

# **SDF**

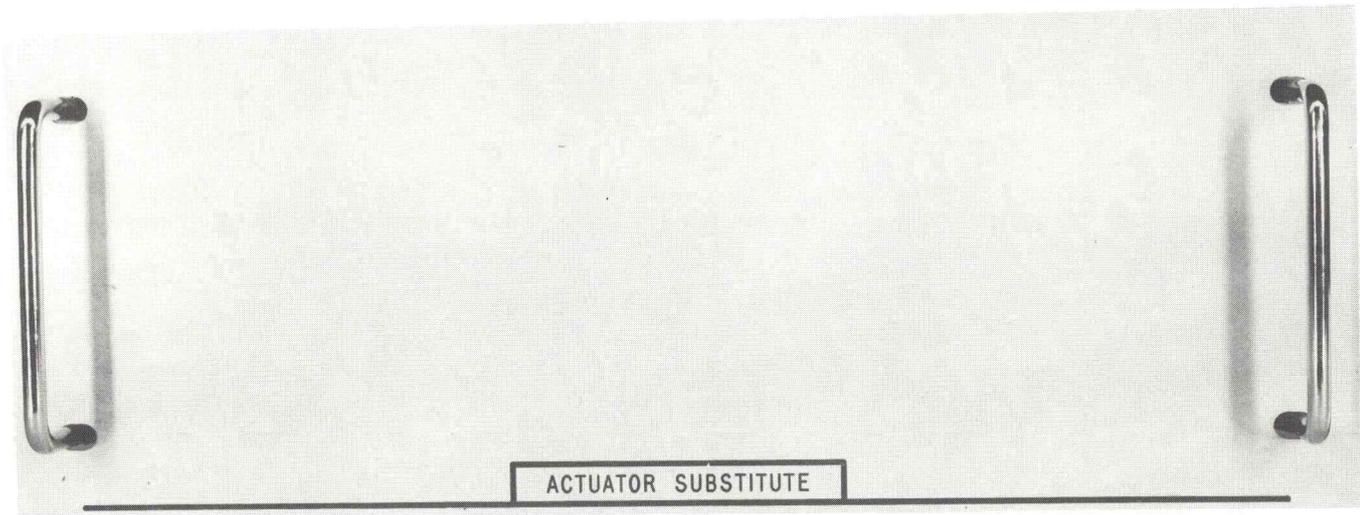
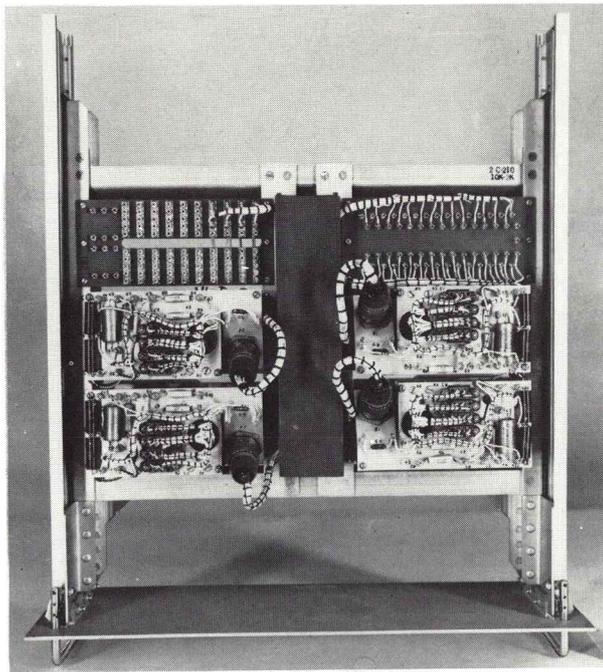
## **SYSTEMS INTEGRATION**

This equipment provides the means to interface between the S-1, S-IV and IU Stages. It also provides the means to interface between the ESE and the RCA-110A Computer. This equipment further provides means to perform functions concerned with the integrated vehicle system not performed by the individual stage ESE.



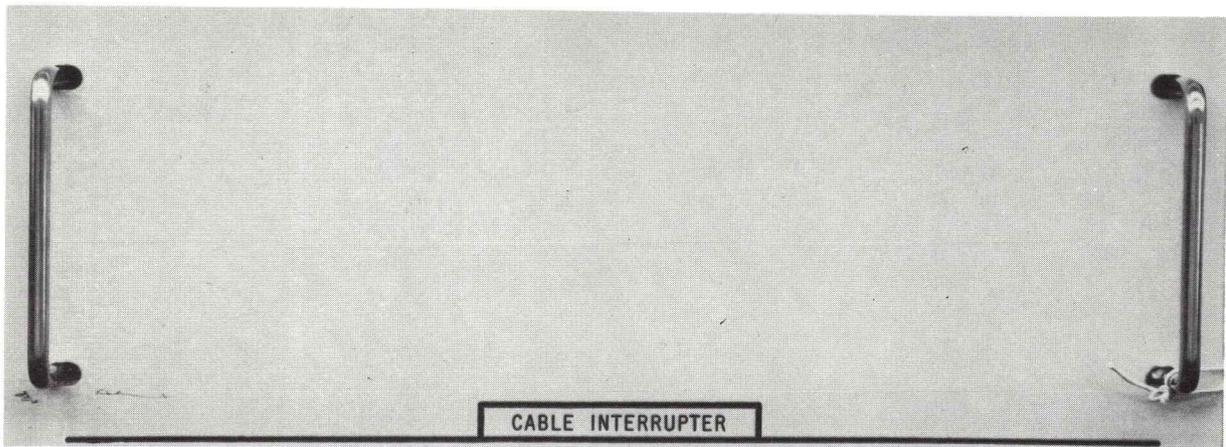
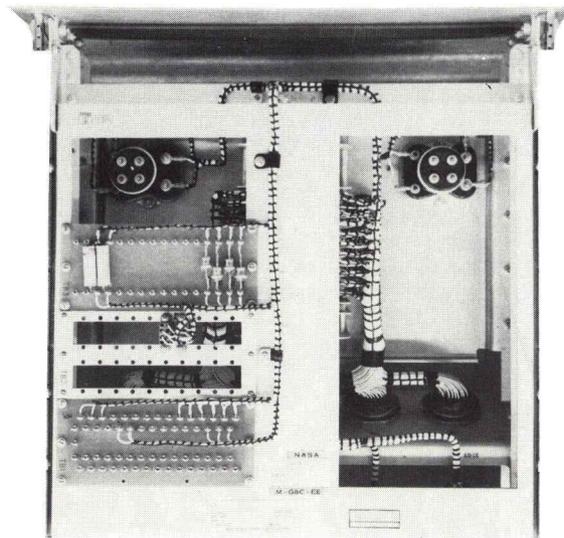
### S-IV INTERFACE SUBSTITUTE PANEL (318A1)

This panel substitutes for the S-I/S-IV interface and the IU/S-IV interface so that in the absence of the S-IV stage an integrated test of the IU and S-I may be performed.



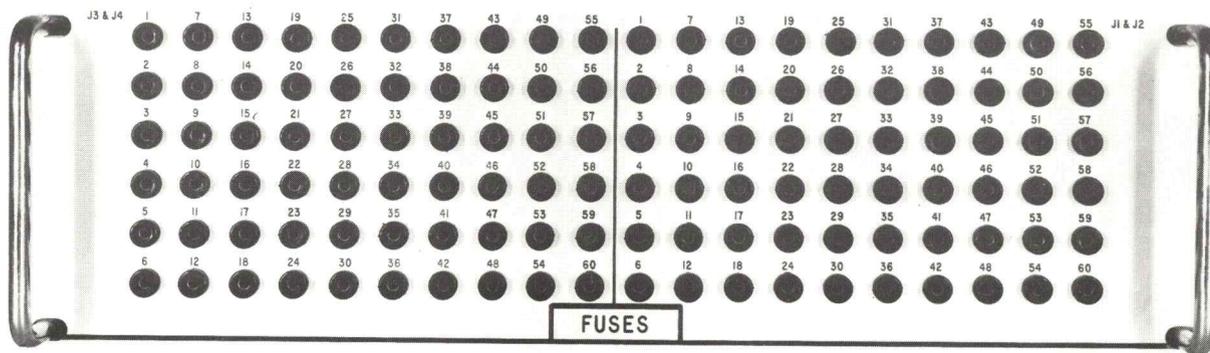
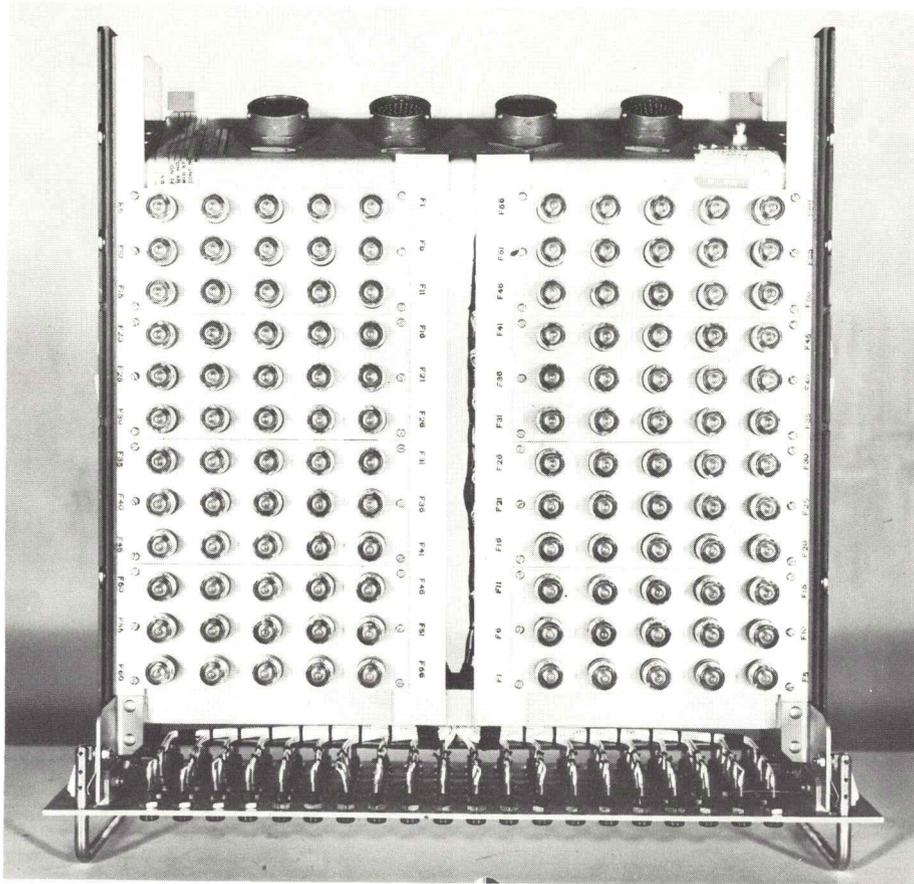
### **ACTUATOR SUBSTITUTE PANEL (318A2)**

The Actuator Substitute substitutes for the S-IV engine actuators in the flight control loop to the control computer in the IU Stage.



### CABLE INTERRUPTER PANEL

This panel has the capability of interrupting 120 circuits simultaneously for the purpose of simulating S-I and S-IV stage electrical separation.



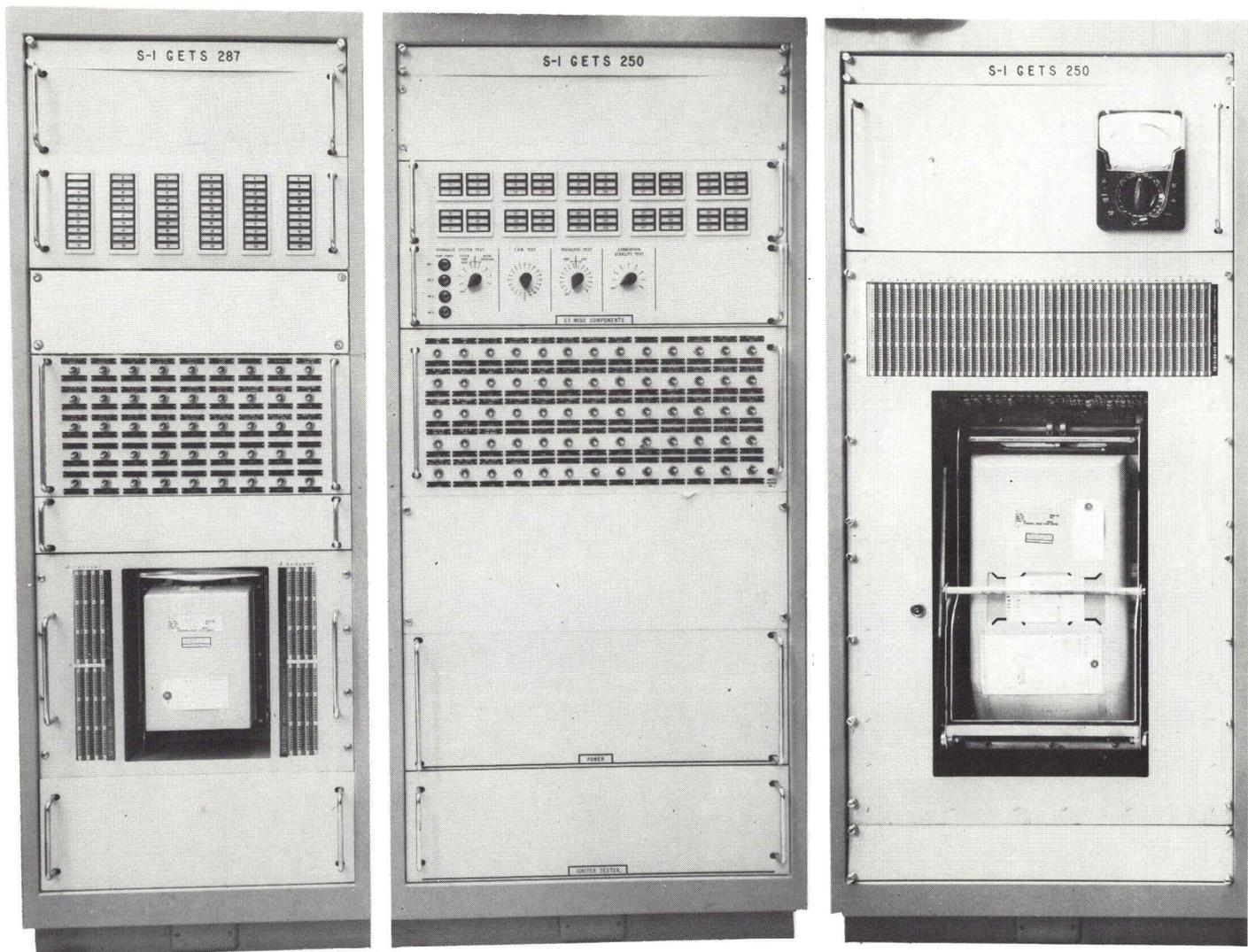
## FUSES PANEL

The function of this panel is to provide circuit protection for all lines passing through it.

# **SDF**

## **SPECIAL TEST EQUIPMENT**

There are several sets of equipment that are supplied to verify the Saturn Vehicle Electrical Systems and the ESE. These test sets are used in various areas of checkout as required and do not necessarily form a part of the equipment used to launch the vehicle.



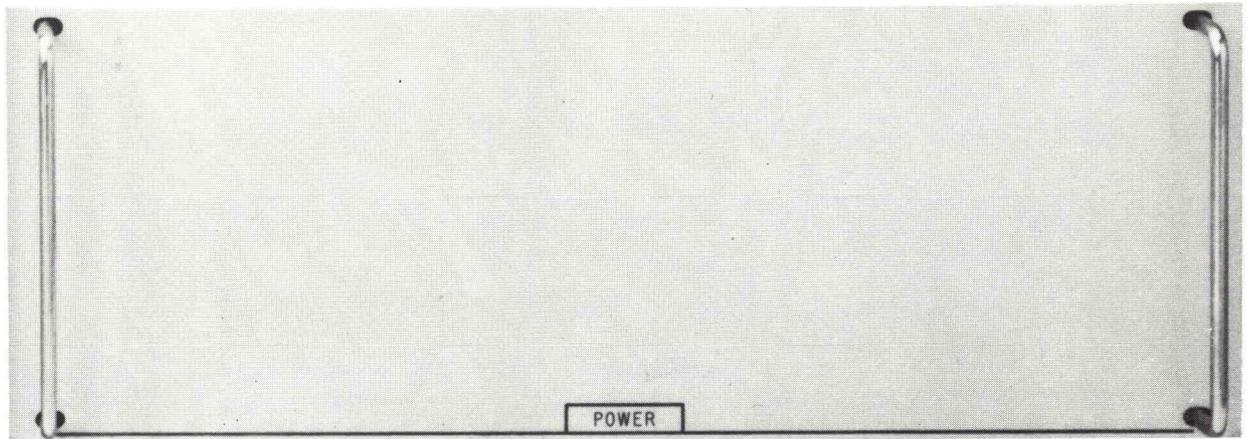
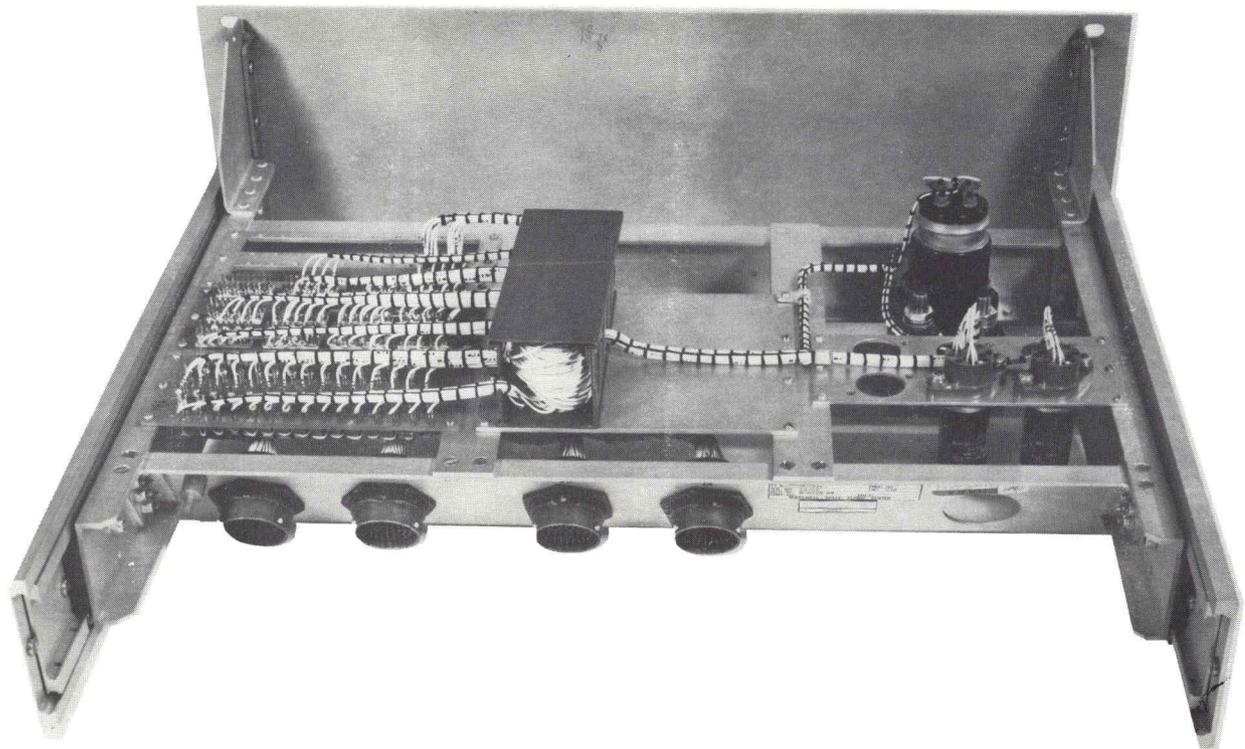
## S-1 GROUND EQUIPMENT TEST SETS (GETS) 250 AND 287

1. The purpose of the S-1 GETS is to provide a means of verifying the ESE prior to the mating of the vehicle and ESE.

2. For functional purposes the S-1 GETS break down into two physically separated, but electrically interconnected, units.

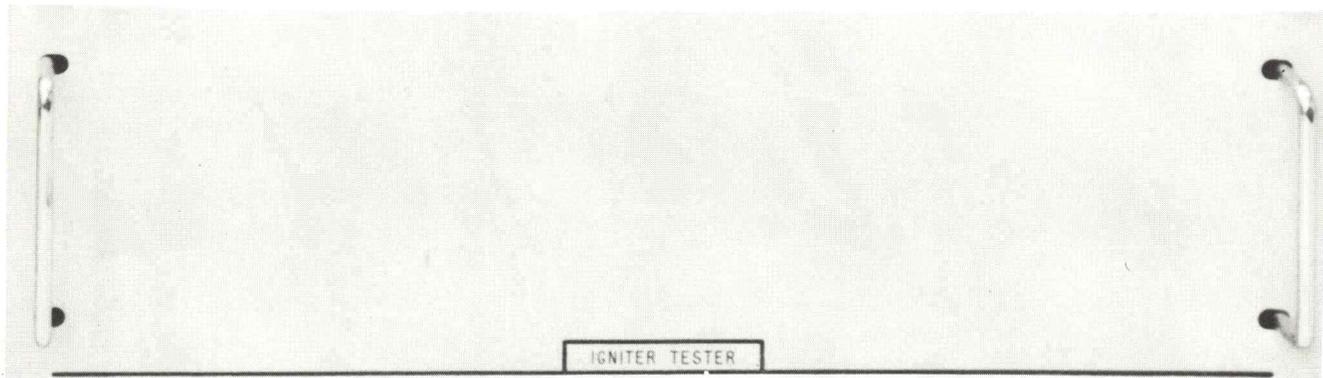
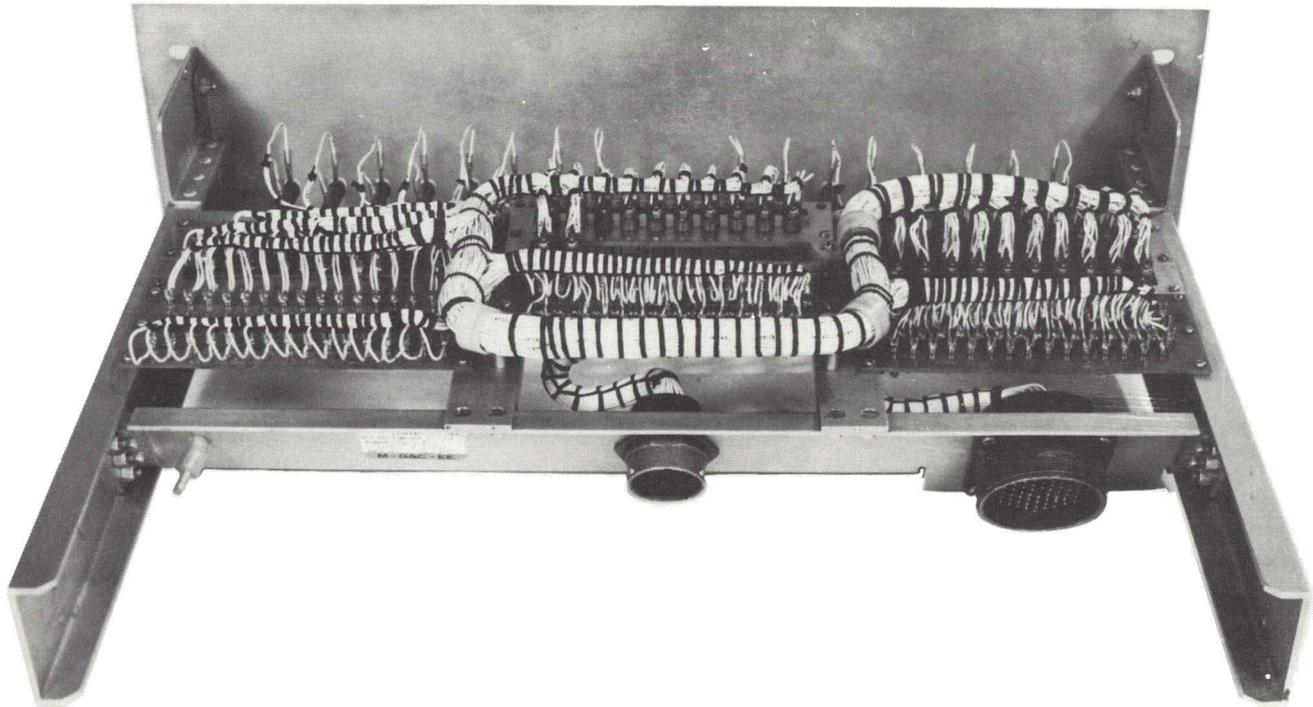
A. S-1 GETS/Vehicle (250) – This unit consists of two racks which contain a patch board assembly and various panels providing switching and monitoring necessary to substitute for or simulate all S-1 stage circuits. By this means it is possible to exercise and/or verify the S-1 ESE which will interconnect with the S-1 stage.

B. S-1 GETS/AGCS-LCC (287) – This unit consists of one rack which contains a patch board assembly and various panels providing switching and monitoring necessary to substitute for or simulate a variety of S-1 ESE ground interfaces. By this means it is possible to exercise and/or verify the S-1 ESE which will interconnect with certain portions of the GSE.



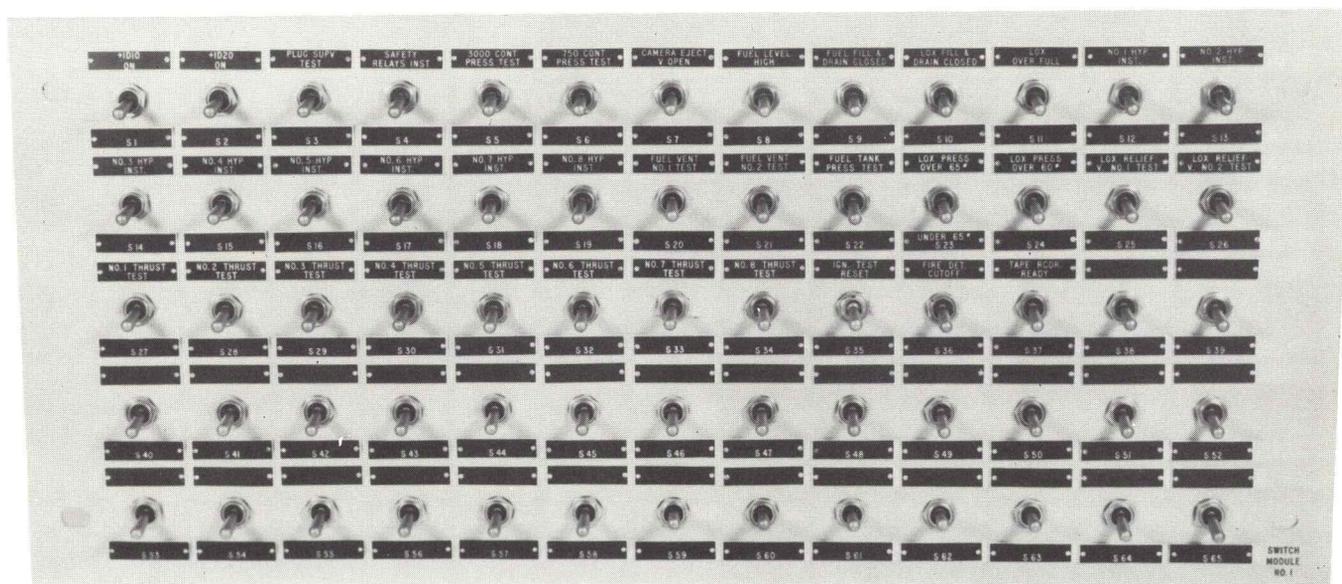
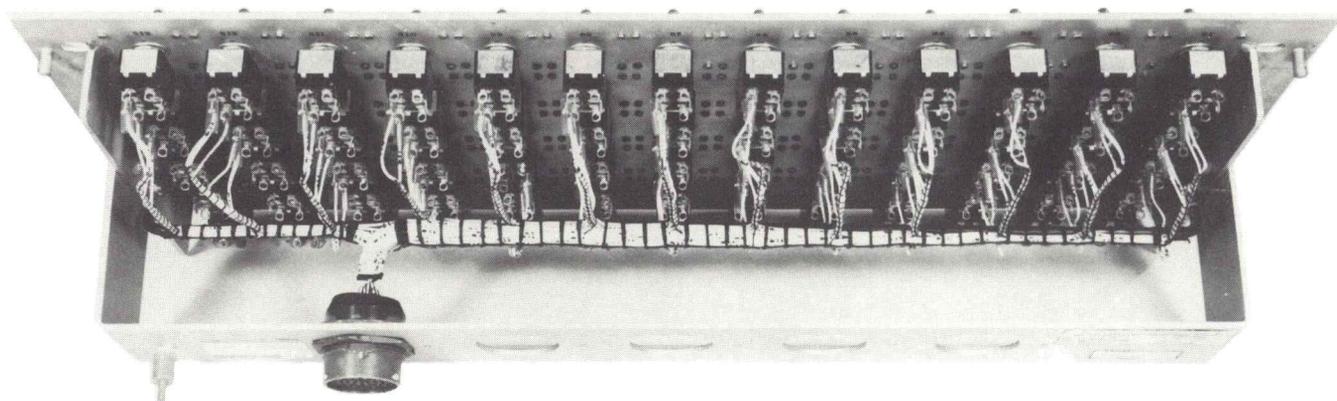
### **POWER PANEL (250A2)**

This panel contains contactors and power relays necessary for switching power circuits required in the GETS.



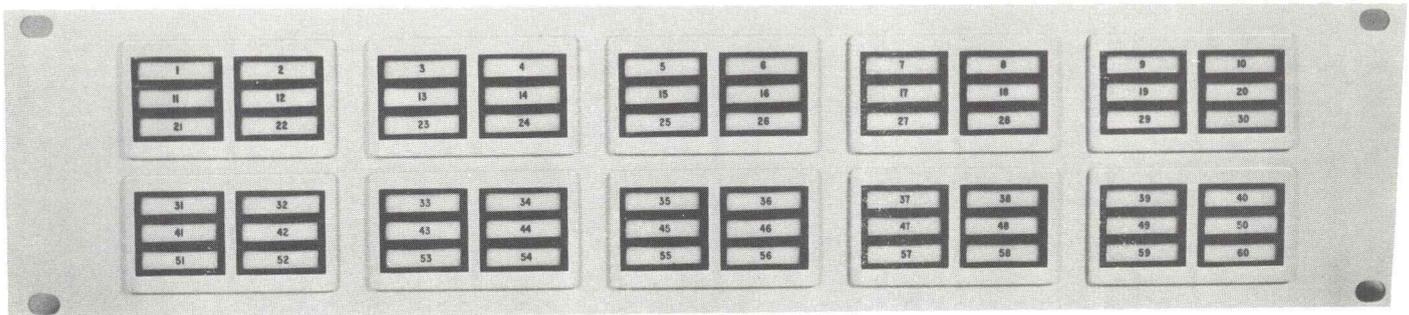
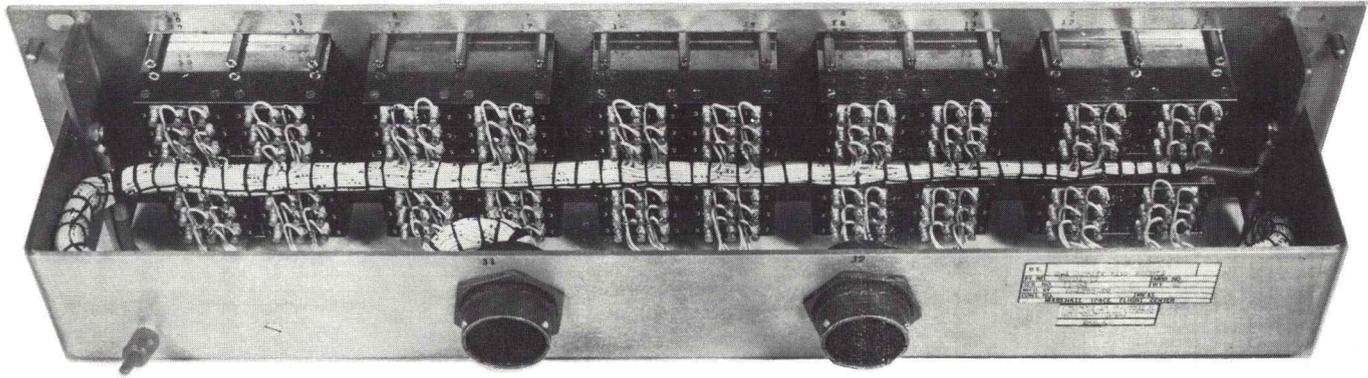
### **IGNITER TESTER PANEL (250A3)**

This tester provides substitution for the S-I Stage engine ignitors. It is used in check-out and verification of the Ignition Sequencer (78A2).



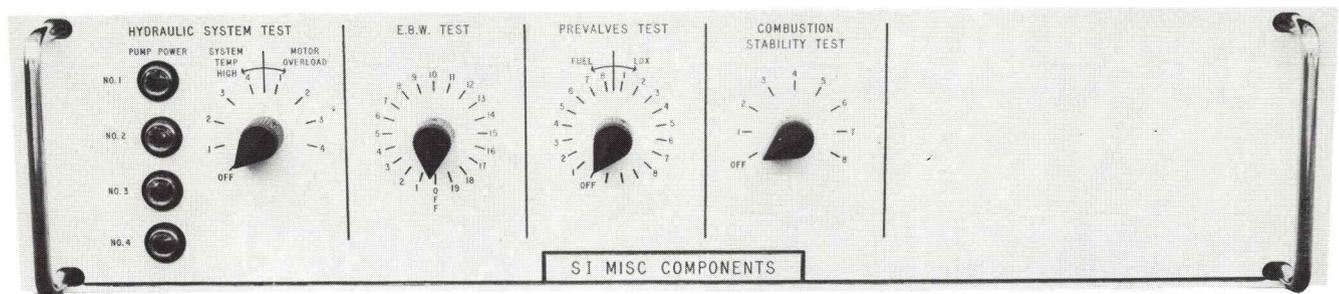
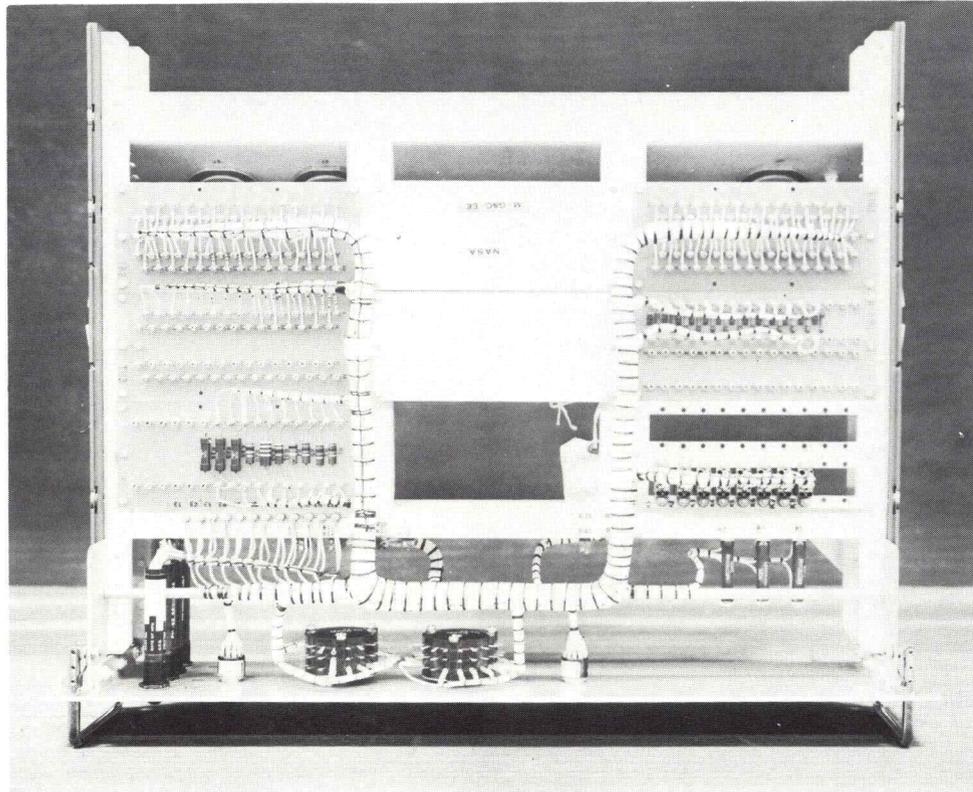
### SWITCH MODULE PANEL (250A4)

This panel contains switches wired to a connector. During the test phase, this module is patched into an associated system to give the capability of manual circuit control.



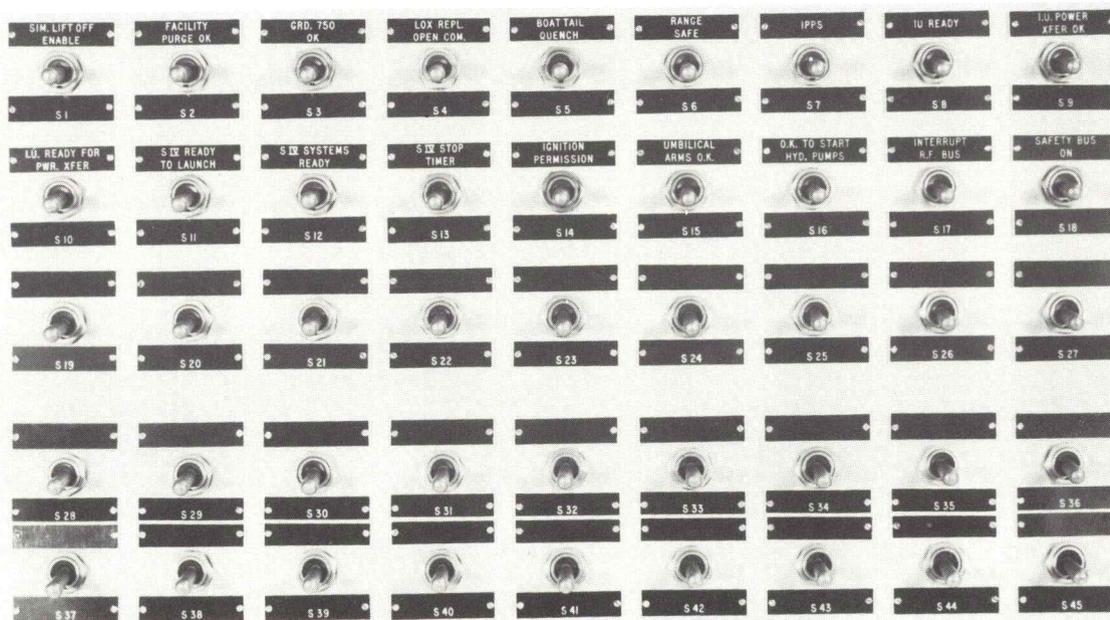
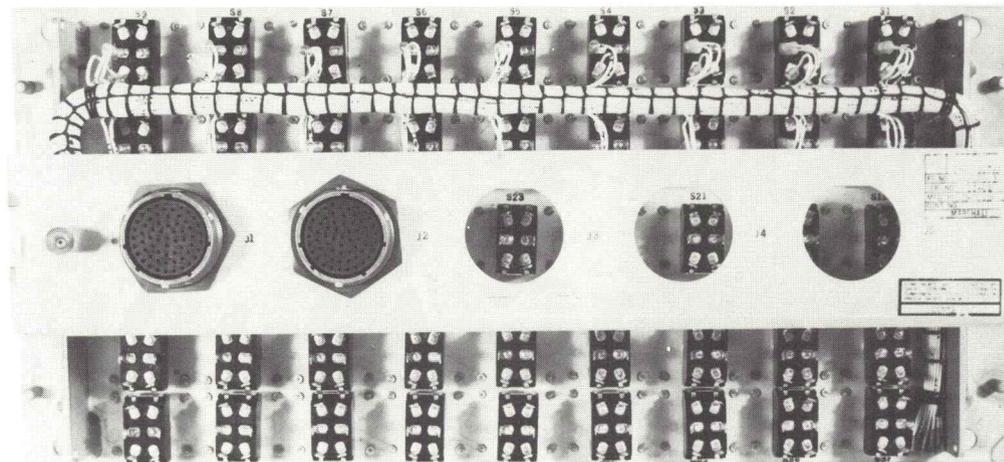
### LAMP MODULE PANEL (250A5)

This panel contains lamps wired to a connector. During the test phase, this module is patched to a system to give visual circuit status.



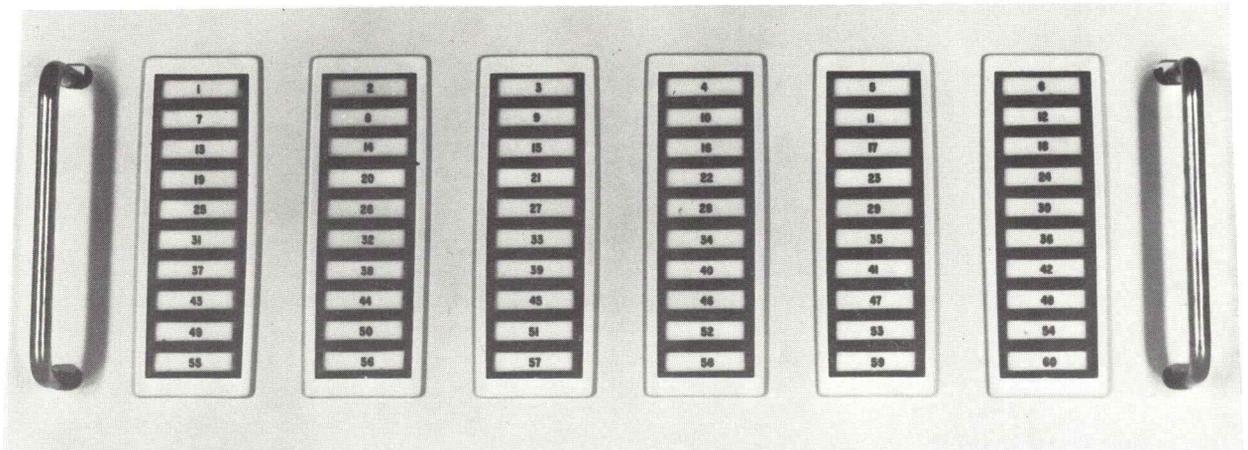
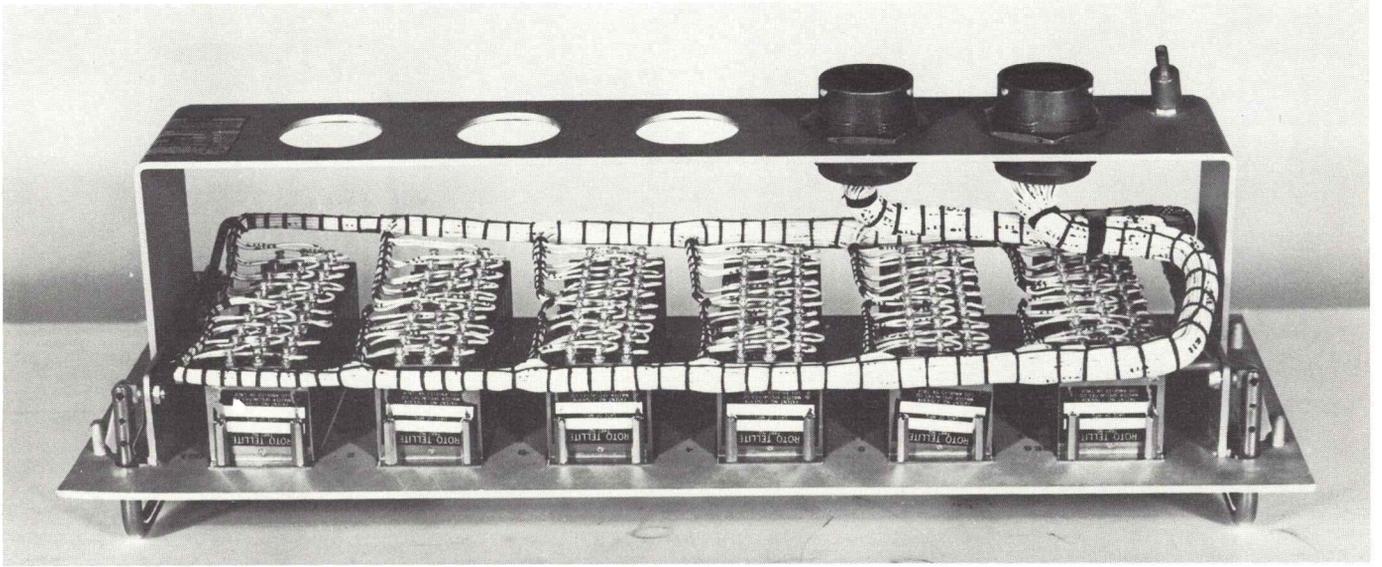
### S-1 MISC COMPONENTS PANEL (250A6)

This panel contains special components necessary for testing circuits not tested by the lamp and switch module panels.



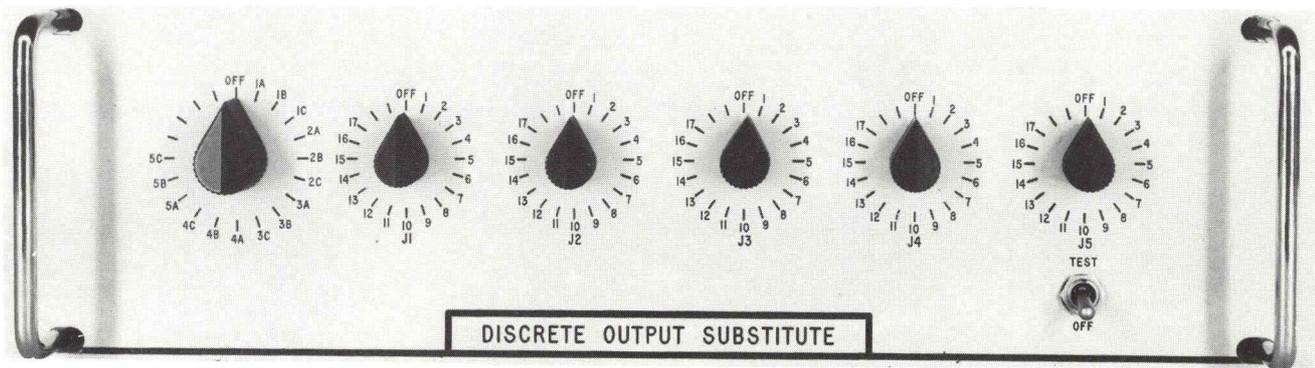
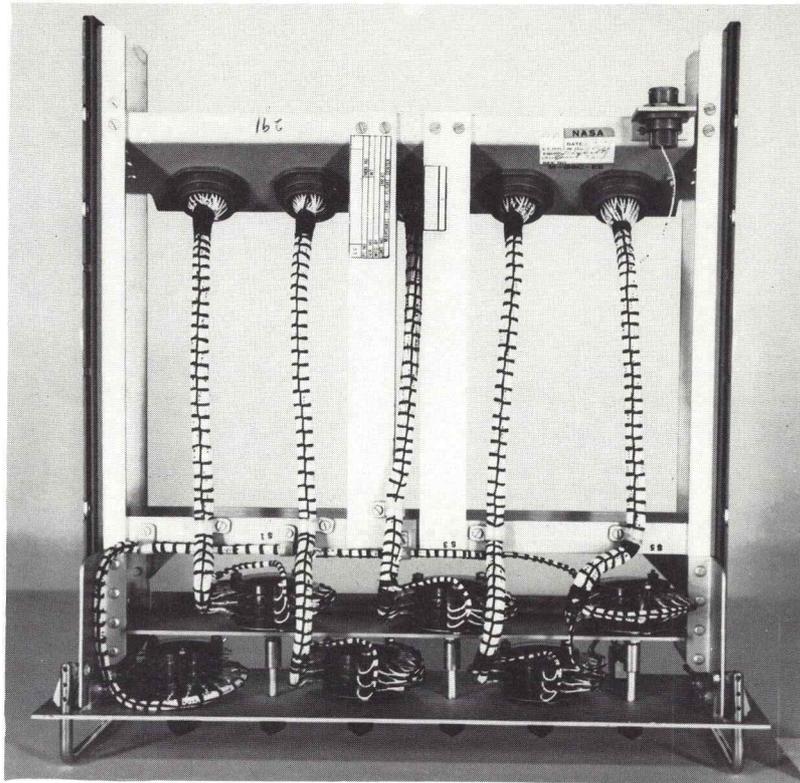
### SWITCH MODULE PANEL (287A2)

This panel contains switches wired to two connectors. During the test phase, the operation of these switches simulate or substitute the various components in the S-1 ESE.



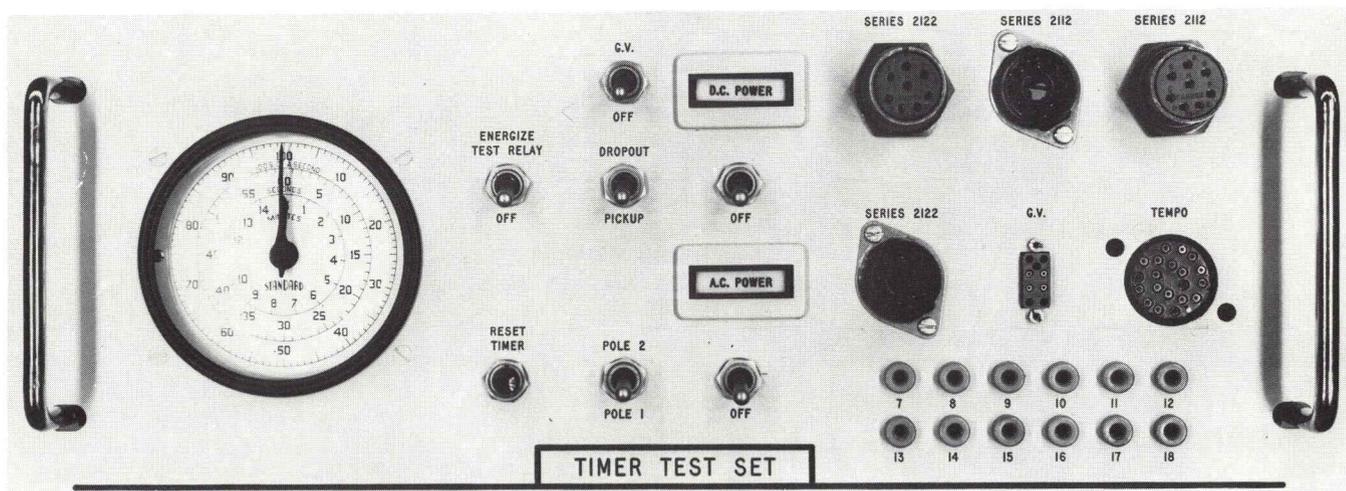
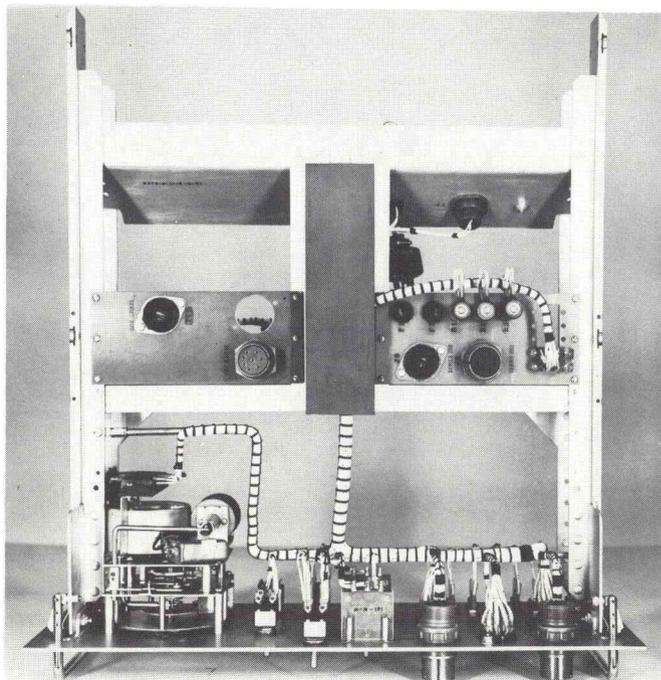
### LAMP MODULE PANEL (287A3)

This panel contains lamps wired to a connector. During the test phase, this module is patched to a system to give visual circuit status.



### DISCRETE OUTPUT SUBSTITUTE PANEL (291)

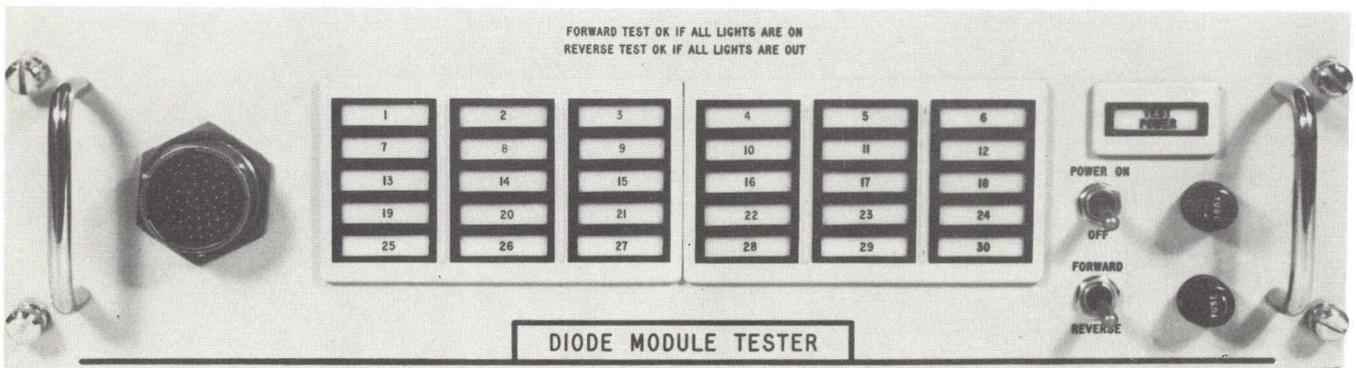
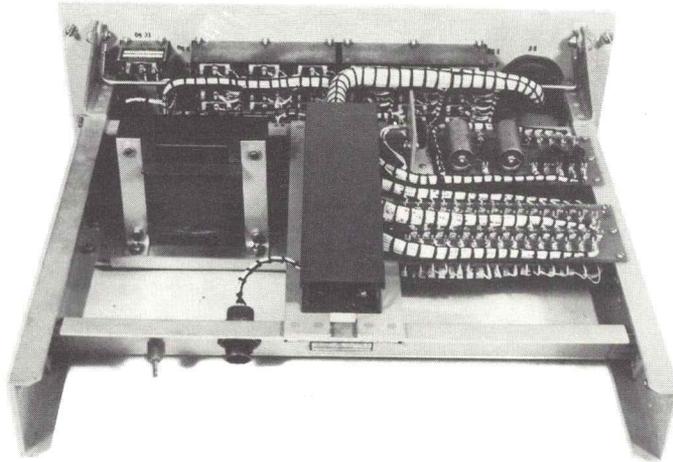
This panel provides a means of simulating Computer discrete outputs by switching a 28V signal to any one of the individual inputs on the Discrete Command Signal Conditioning Panels.



### TIMER TEST SET PANEL (259)

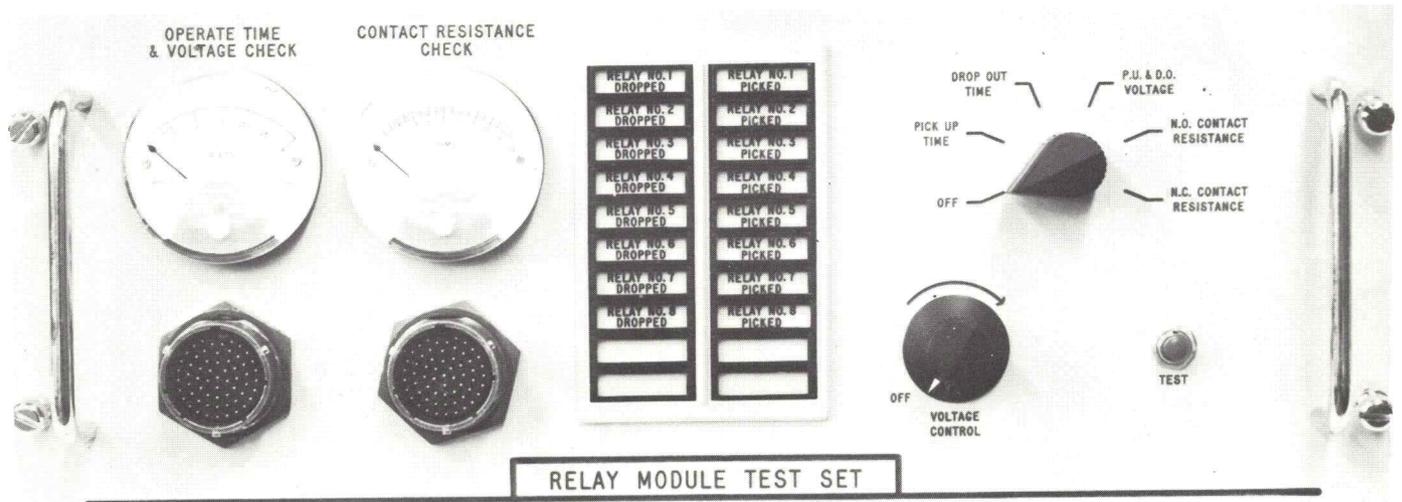
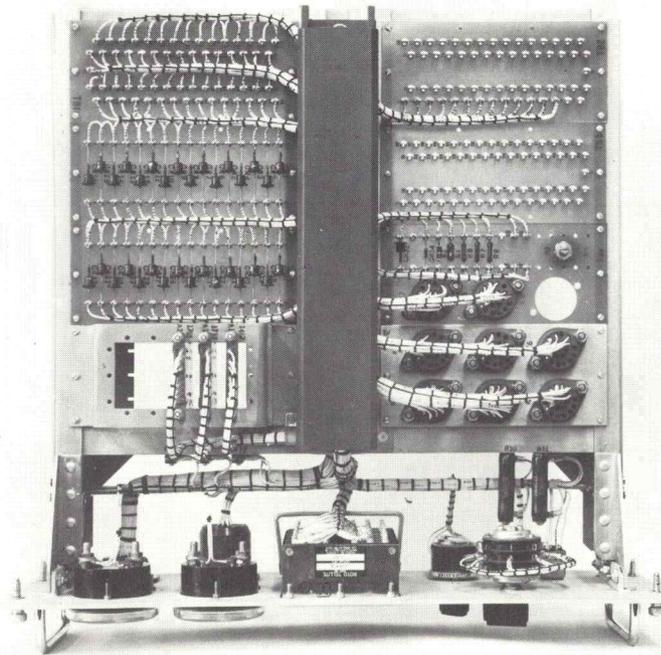
This panel provides a means to test the pick-up or drop-out time of time delay relays used throughout the system. Different types of relays are accommodated by providing mating sockets whether on the front panel or on the chassis.

Timer reads time period to nearest .01 second over a 15 minute interval.



### DIODE MODULE TESTER PANEL

This panel checks simultaneously all the diodes of a diode module for forward or reverse current, and peak inverse voltage.



### RELAY MODULE TEST SET PANEL

This panel tests the relays in the relay module. It checks the relay pull-in voltage, drop-out voltage, contact continuity and contact resistance of each relay in the module.

# **SDF**

## **INSTRUMENT UNIT (IU) STAGE ESE**

The purpose of ESE furnished this area is to checkout all of the systems in the Saturn IU Stages.

# **SDF**

## **POWER SOURCES**

See pages 4 thru 11 for ESE previously shown.

# **SDF**

## **POWER DISTRIBUTION**

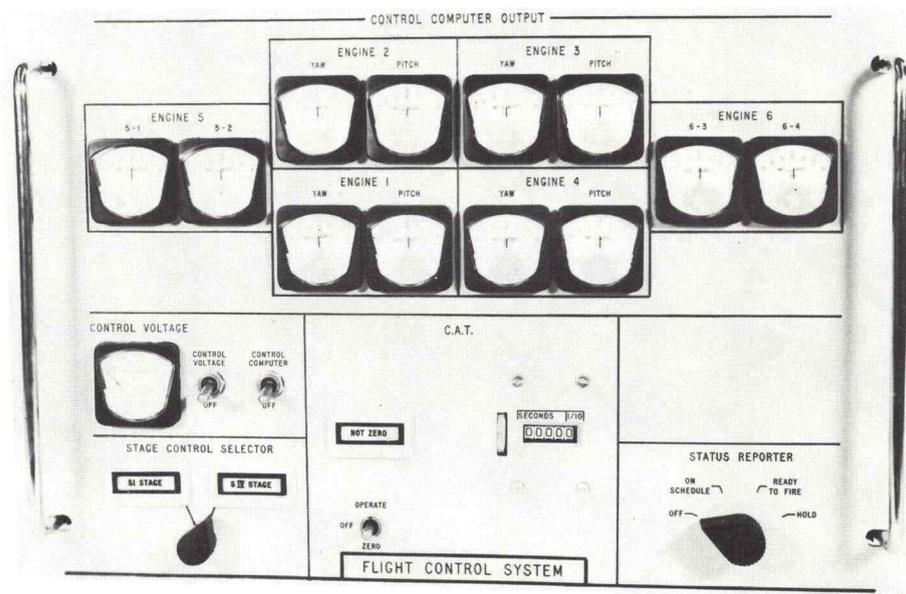
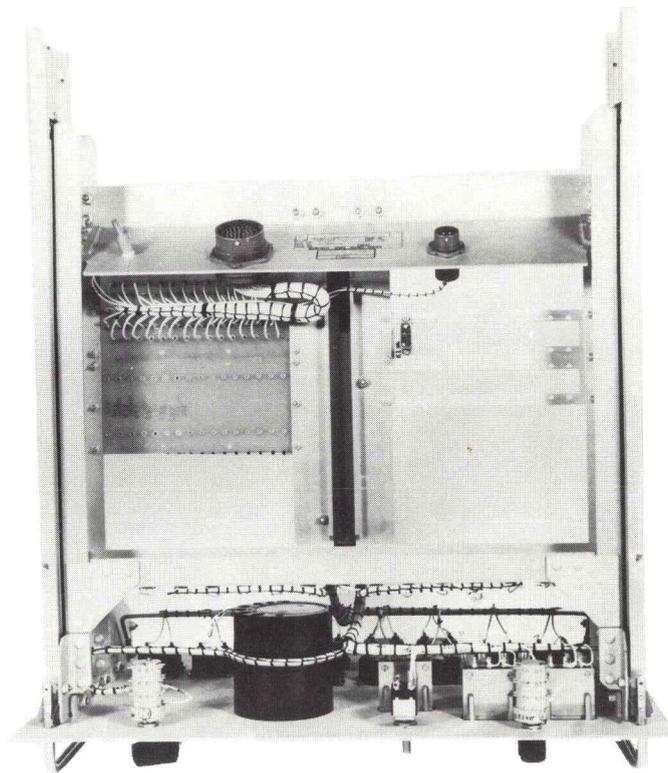
See pages 12 thru 30.

# **SDF**

## **FLIGHT CONTROL SYSTEM**

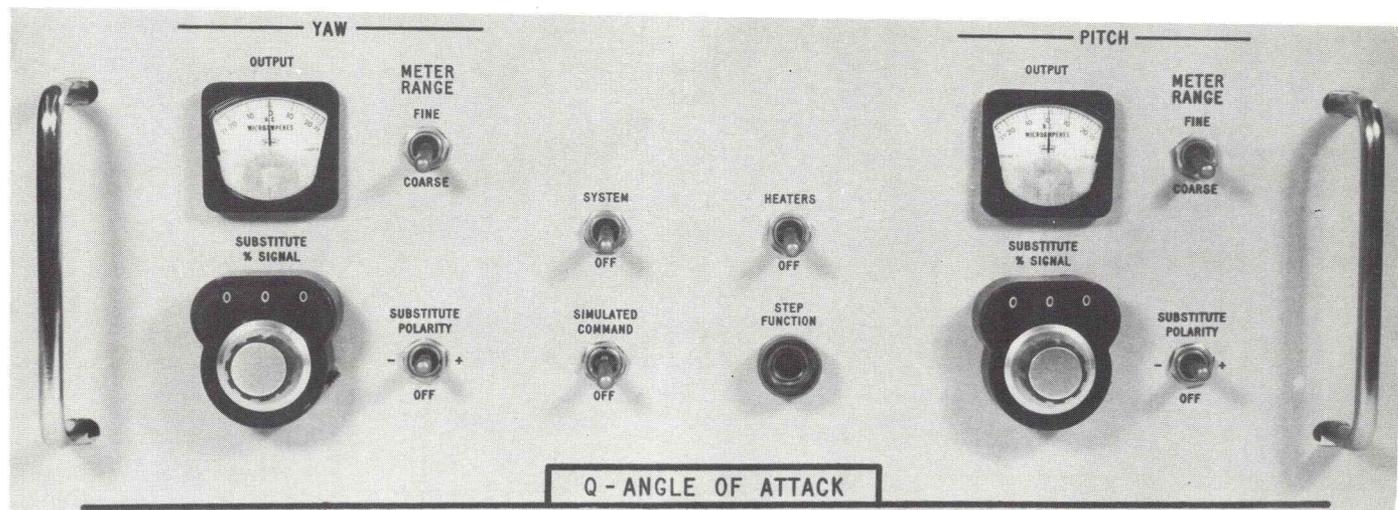
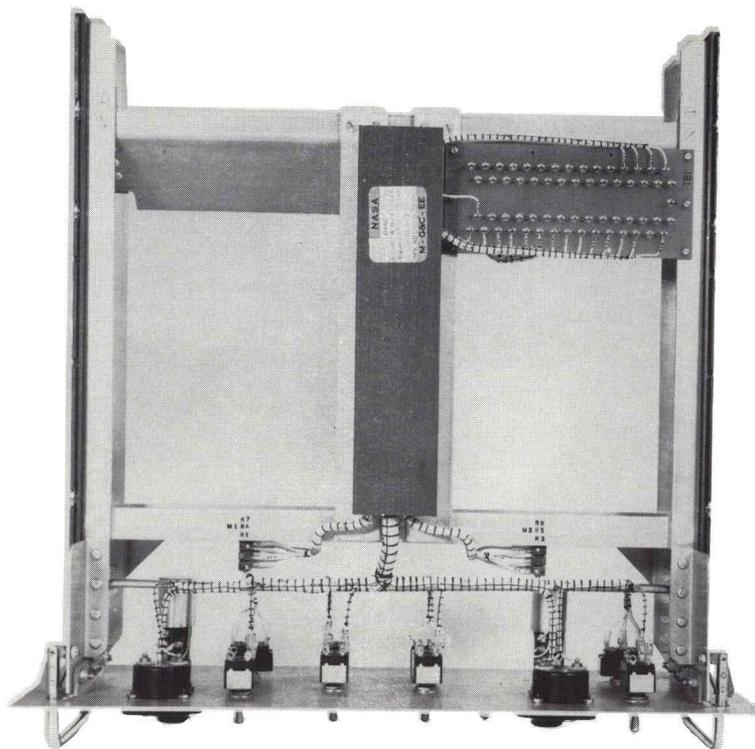
The function of the flight control system ESE is to electrically energize, control, monitor, and test the vehicle flight control system. This operation is accomplished by the assembly of several panels of interrelated or integrated functions. For example, operation of controls on one panel may cause readouts on one or more of the other panels. The equipment is used to functionally check out and operate the vehicle flight control system at the static test areas and at the launching areas.

See pages 48 thru 54.



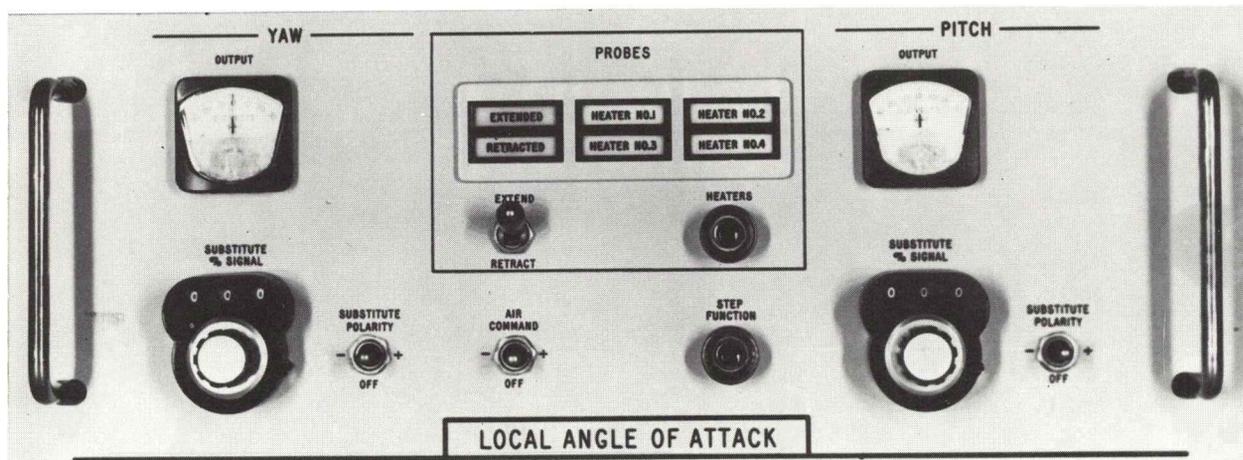
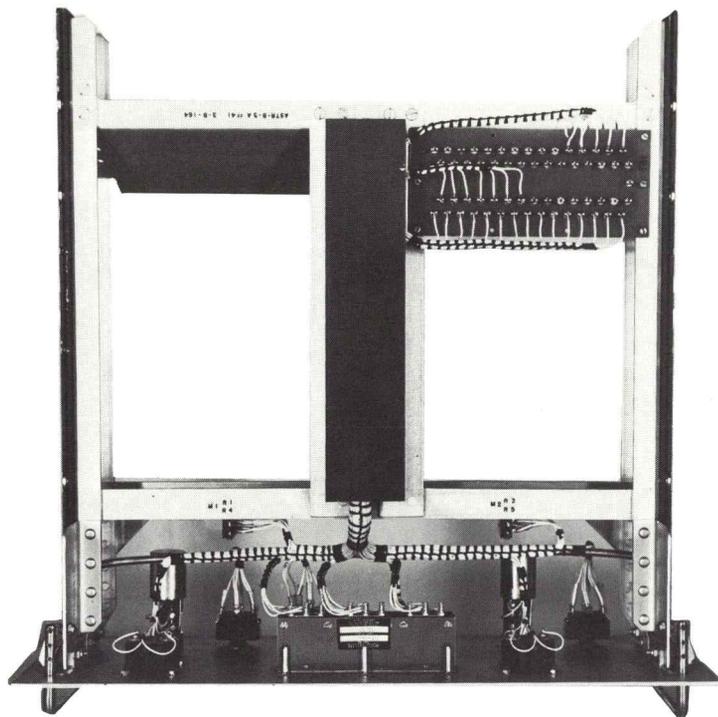
### FLIGHT CONTROL SYSTEM PANEL (134A2)

The function of this panel is to operate and monitor the Flight Control Computer and its operation with the individual stage Engine Gimbal Systems. It also reports the status of the integrated Flight Control System to the Test Conductor.



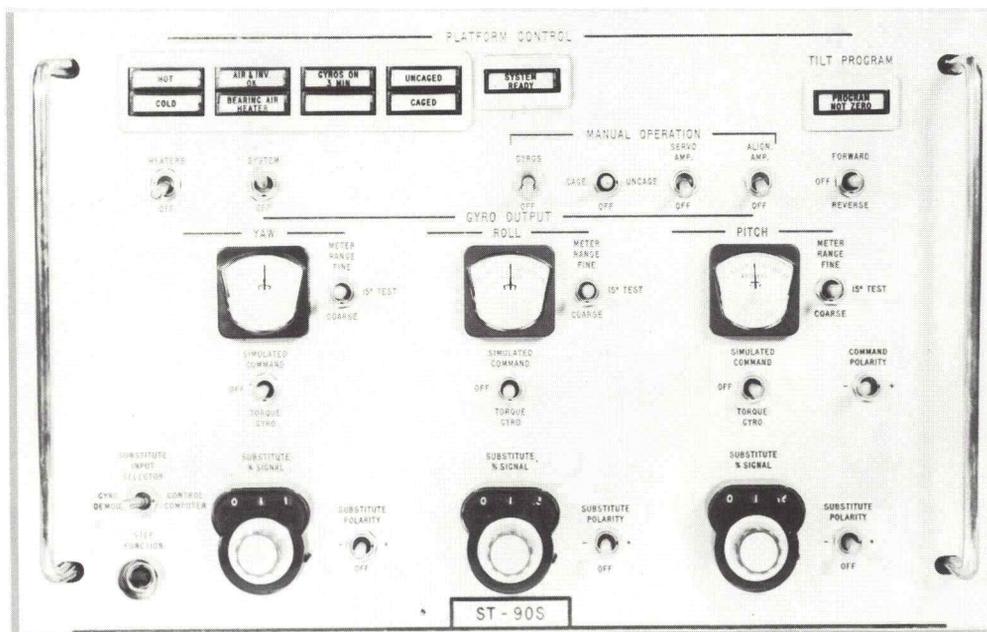
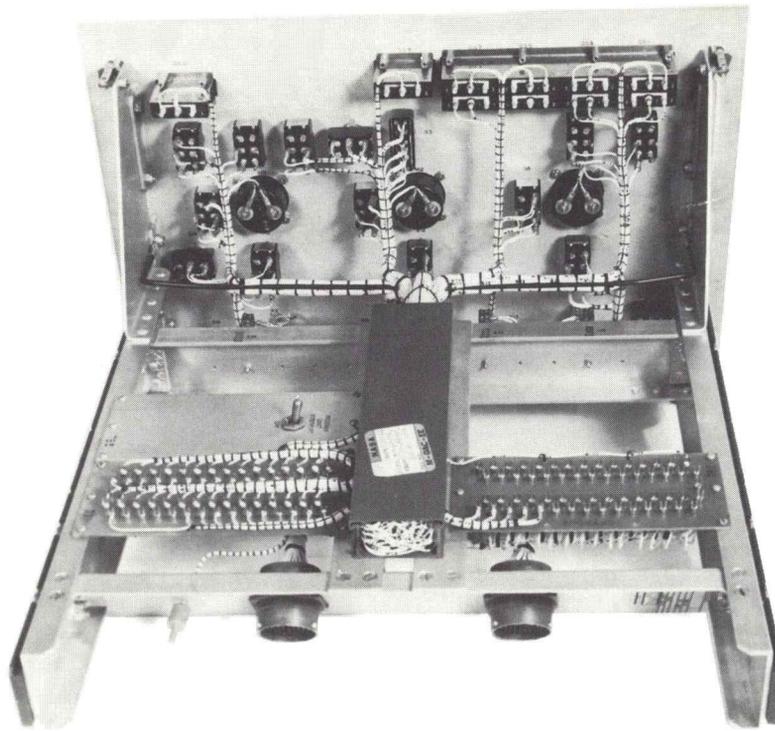
### Q - ANGLE OF ATTACK PANEL (134A5)

This panel provides capability to operate and continuously monitor, for testing and operation of the Flight Control Q-Angle of Attack System. In addition, from this panel stimulus signals may be introduced to the Flight Control Computer to provide a sub-system test of this portion of the Flight Control System Loop.



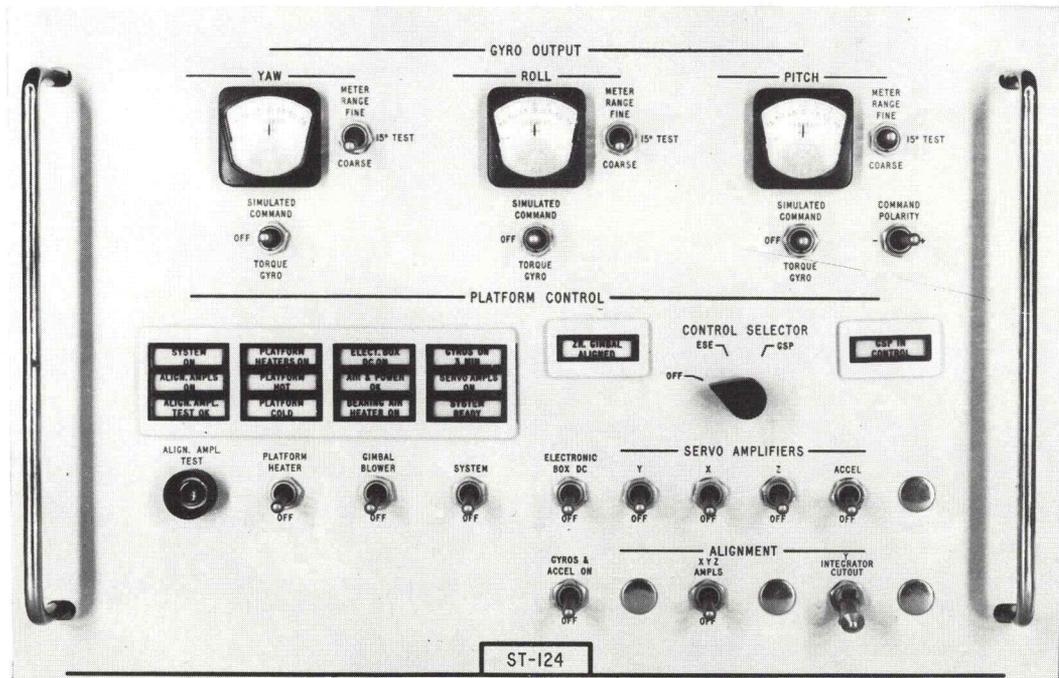
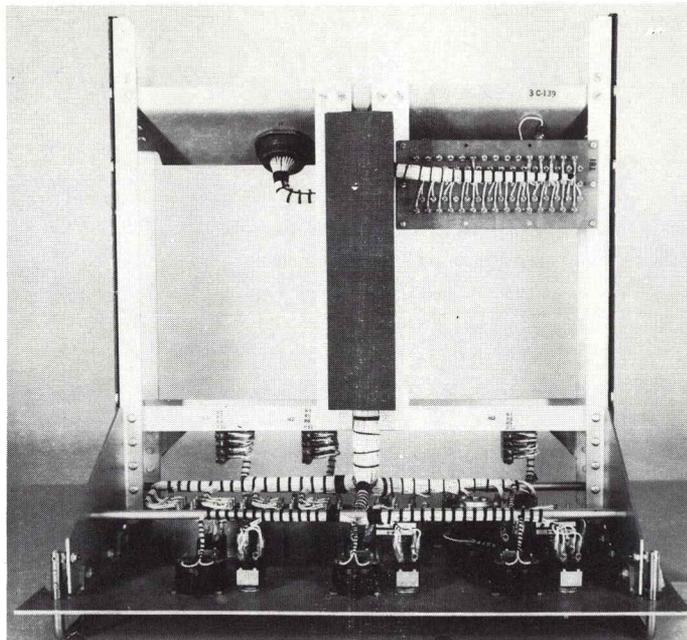
### LOCAL ANGLE OF ATTACK PANEL (134A6)

This panel provides capability to operate and continuously monitor the testing and operation of the Flight Control Local Angle of Attack System. In addition, from this panel stimulus signals may be introduced to the Flight Control Computer to provide a sub-system test of this portion of the Flight Control System Loop.



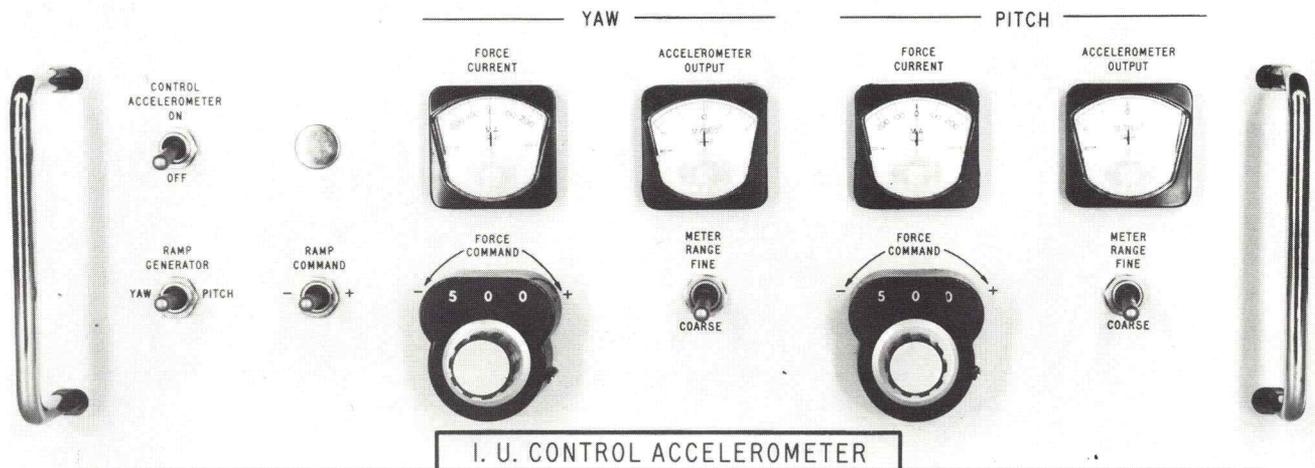
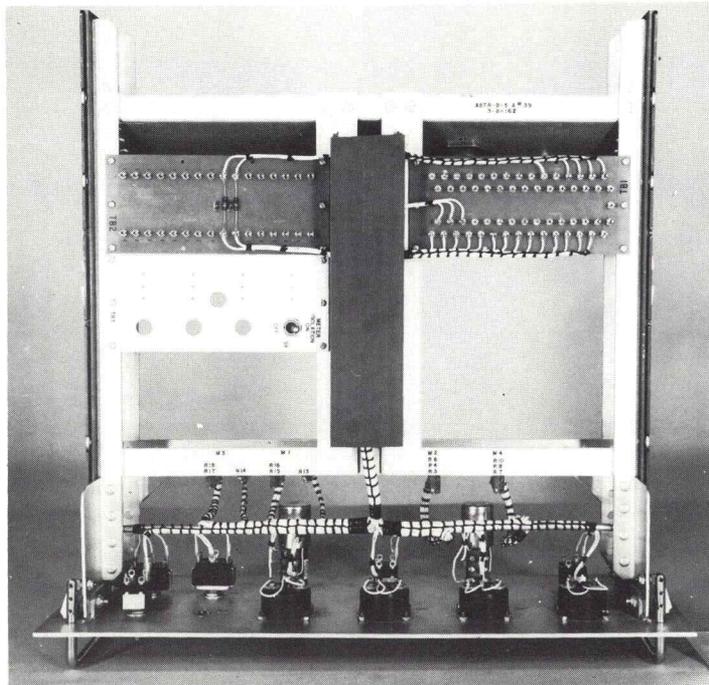
### ST-90S PANEL (134A7)

This panel provides capability to manually or automatically operate and continuously monitor for testing and launch operations of the ST-90S Stabilized Platform System. In addition, stimulus input signals may be introduced to the Flight Control Computer to provide a sub-system test of this portion of the Flight Control System Loop.



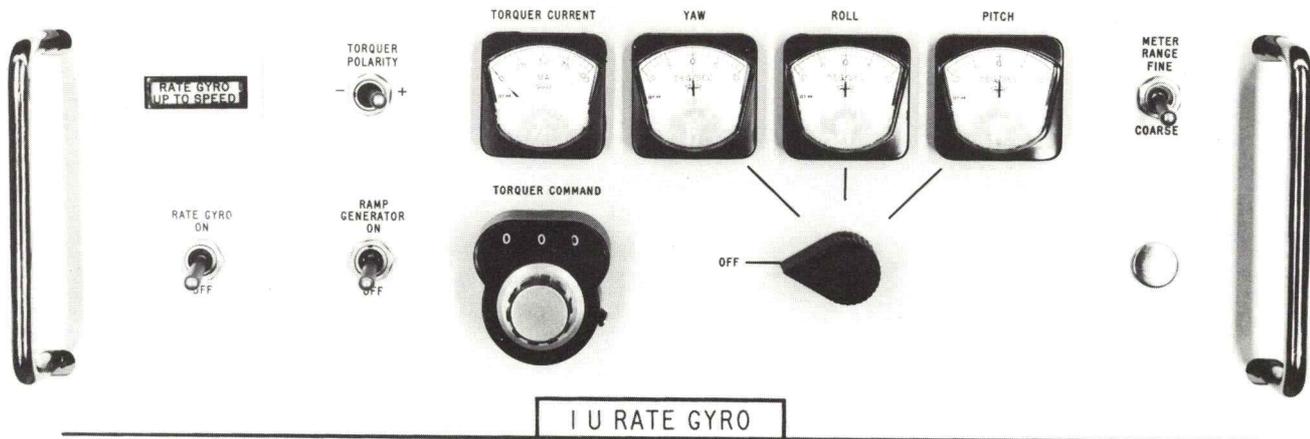
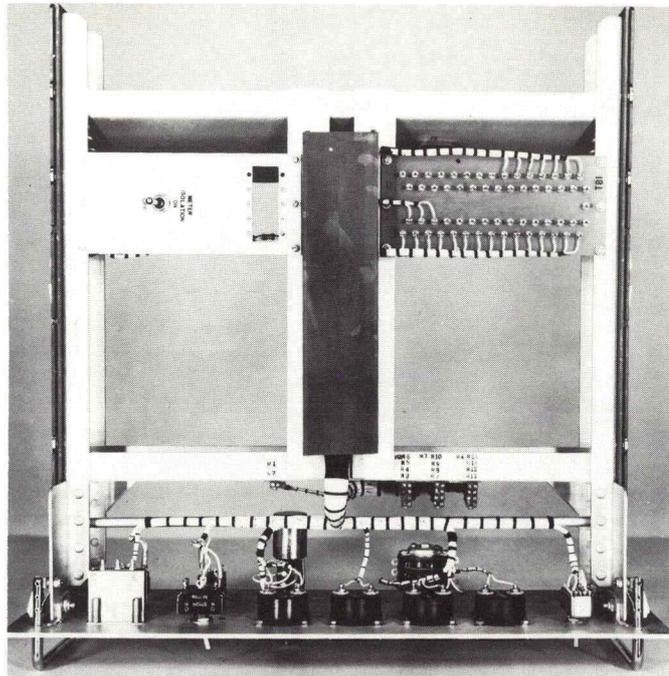
### ST-124 PANEL (134A11)

The function of this panel is to provide capability for automatic or manual operation and provide necessary continuous monitoring of the operation of the ST-124 Stabilized Platform System. In addition, this panel may command the RCA-110 Computer to introduce stimulus input signals to the IU Stage Guidance Signal Processor, and to provide a sub-system test of this portion of the Flight Control System Loop.



## IU CONTROL ACCELEROMETER PANEL (134A9)

The function of this panel is to provide capability to operate and provide continuous monitoring for testing and launch operation of the Flight Control Accelerometers System. Also from this panel stimulus signals can be introduced to the Control Accelerometers which in turn introduce an output signal to the Flight Control Computer to provide a sub-system test of this portion of the Flight Control System Loop.



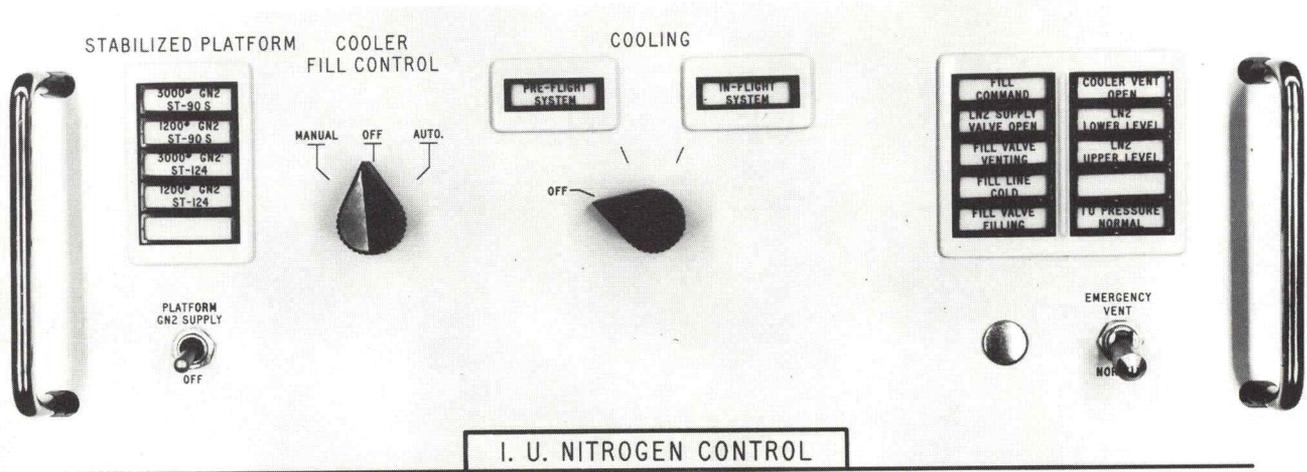
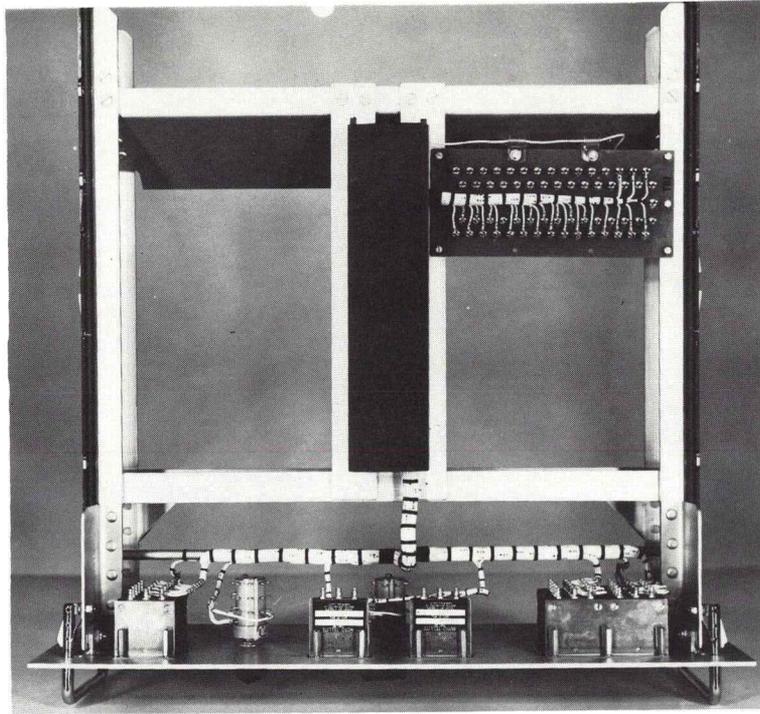
### IU RATE GYRO PANEL (134A12)

The function of this panel is to provide capability to operate and provide continuous monitoring for testing and launch operation of the Flight Control Rate Gyro System. Also stimulus signals can be introduced to the Rate Gyros which in turn introduce an output signal to the Flight Control Computer to provide a sub-system test of this portion of the Flight Control System Loop.

# **SDF**

## **ENVIRONMENTAL CONDITIONING SYSTEM**

The ESE is associated with the vehicle environmental conditioning controls, and monitors the nitrogen to the stabilized platform and the nitrogen cooling system. It also controls and monitors the engine heaters and auxiliary system heaters.

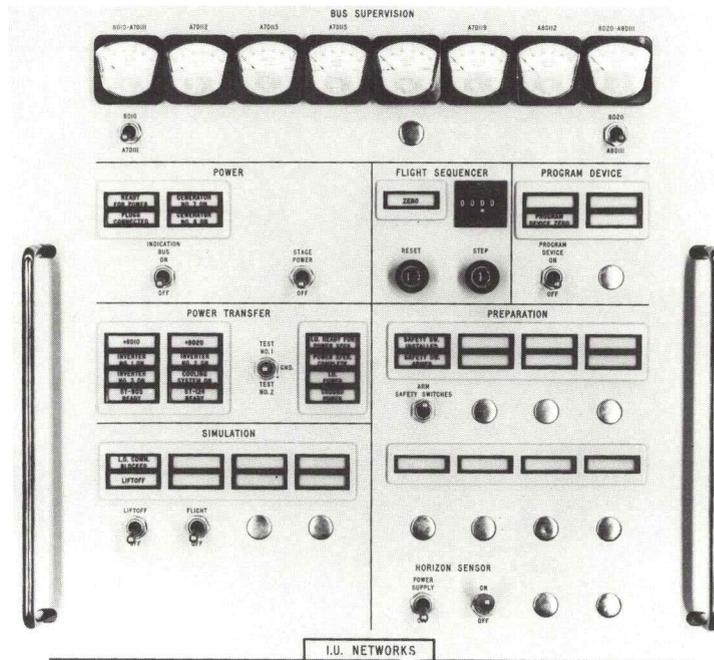
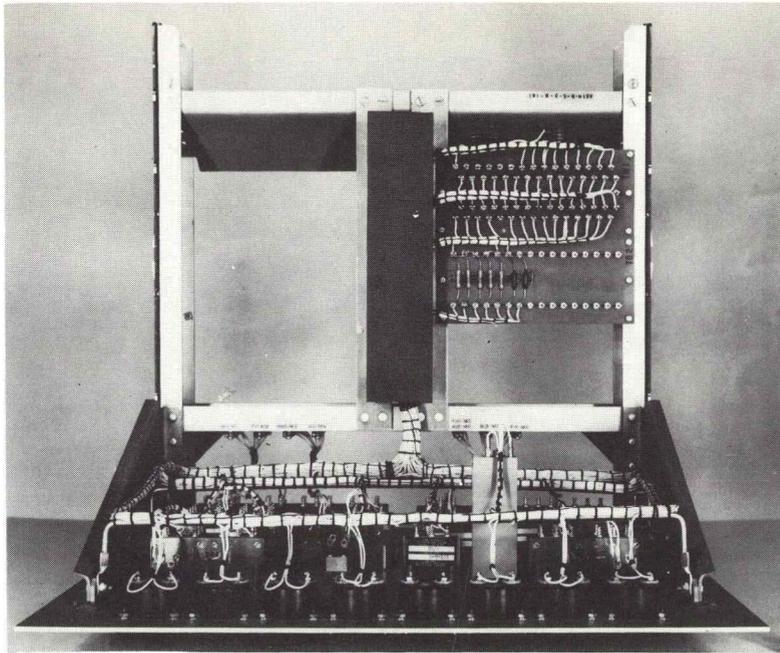


## I U NITROGEN CONTROL PANEL (162A1)

The function of this panel is to provide control and monitoring capability for the IU Stage inflight air conditioning system during pre-flight checkouts. Also, the capability exists to control and monitor the IU Stage Stabilized Platform Gaseous Nitrogen (GN<sub>2</sub>) Supply System.

**SDF**  
**IU STAGE**  
**NETWORKS SYSTEM**

The ESE associated with the networks system controls and monitors the DC buses. It controls the flight sequencer, program device, and it also provides an indication of the status of power transfer.



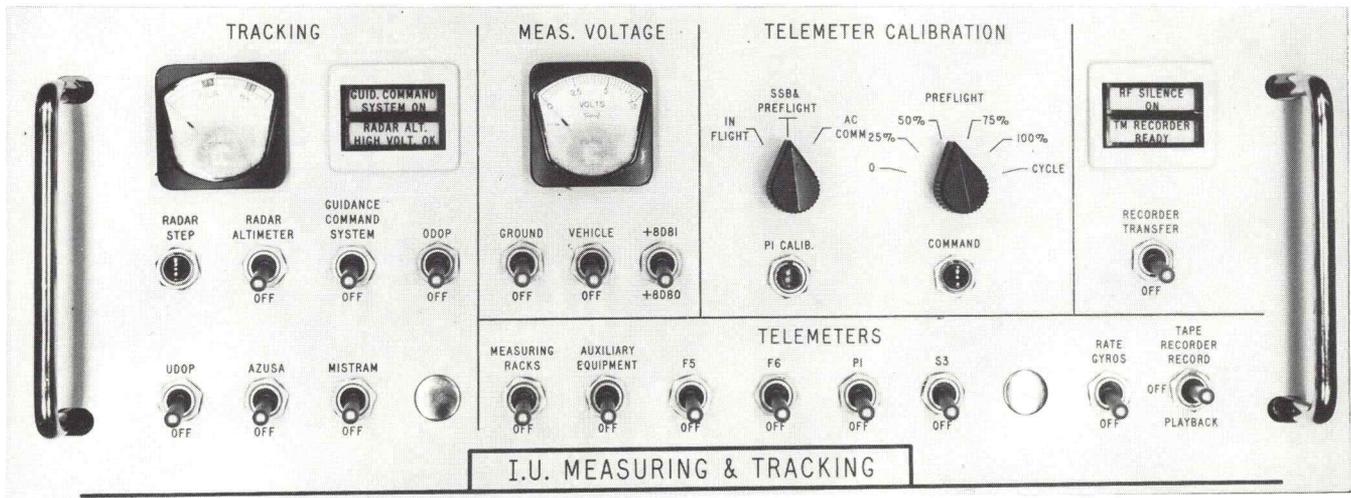
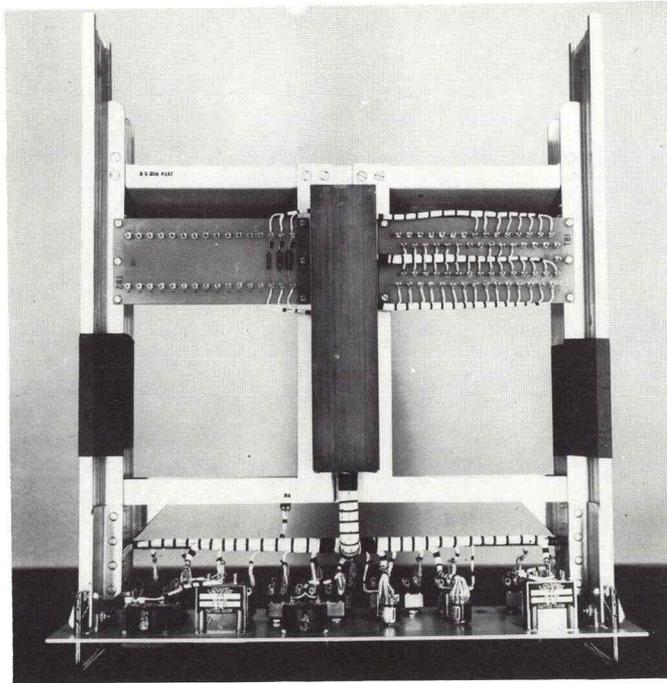
**I U NETWORKS PANEL (161A1)**

The function of this panel is to provide capability to operate and continuously monitor the various IU Stage and ground power buses; to operate, test and monitor the IU Stage Flight Sequencer, and to operate and monitor other devices and functions associated with the IU Stage network system.

# **SDF**

## **MEASURING AND TRACKING SYSTEMS**

The ESE associated with the measuring and tracking is used to simulate, monitor, and control the radar tracking equipment and the vehicle measuring and telemetering system. This equipment is also used in connection with the calibration of telemetering equipment.



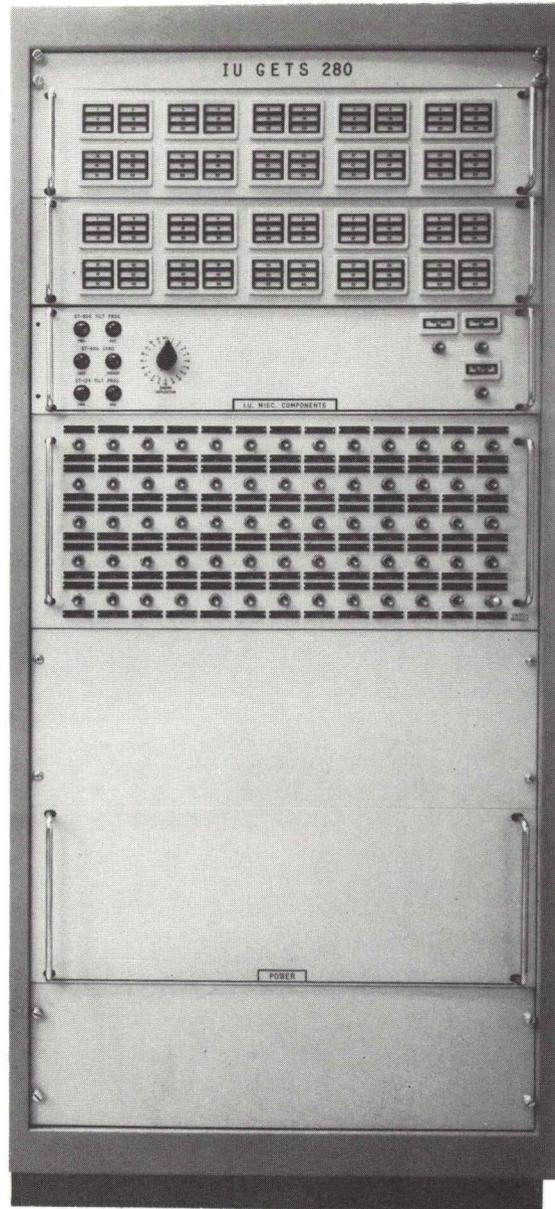
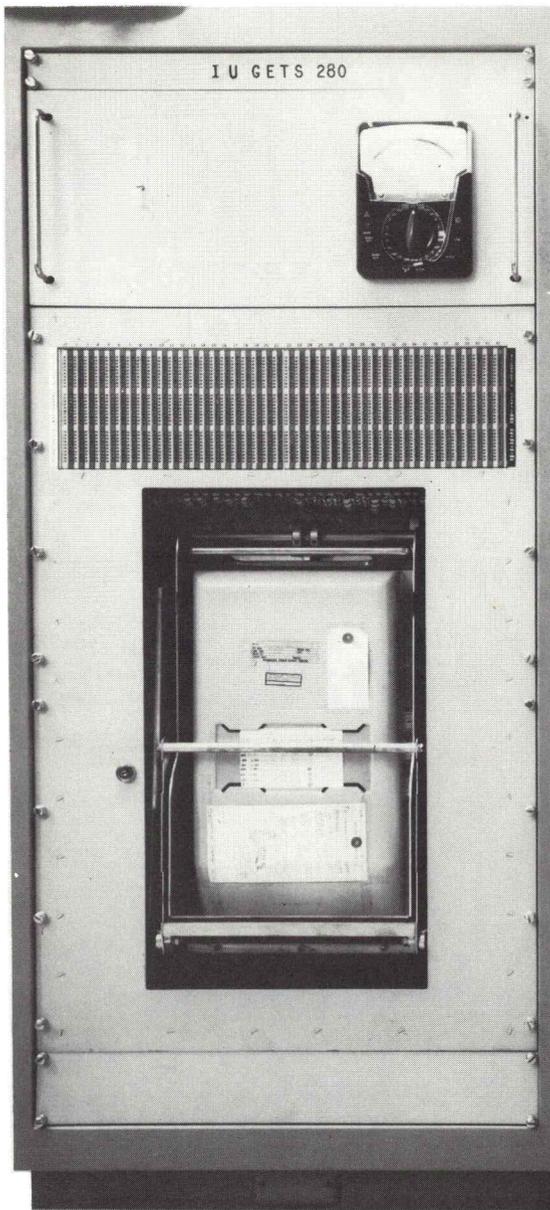
## I U MEASURING & TRACKING PANEL (163A1)

The function of this panel is to provide control and monitoring capability of the IU Stage and ground measuring power supplies, and the IU Stage tracking devices. Operation and calibration of the IU Stage telemeters are also provided.

# **SDF**

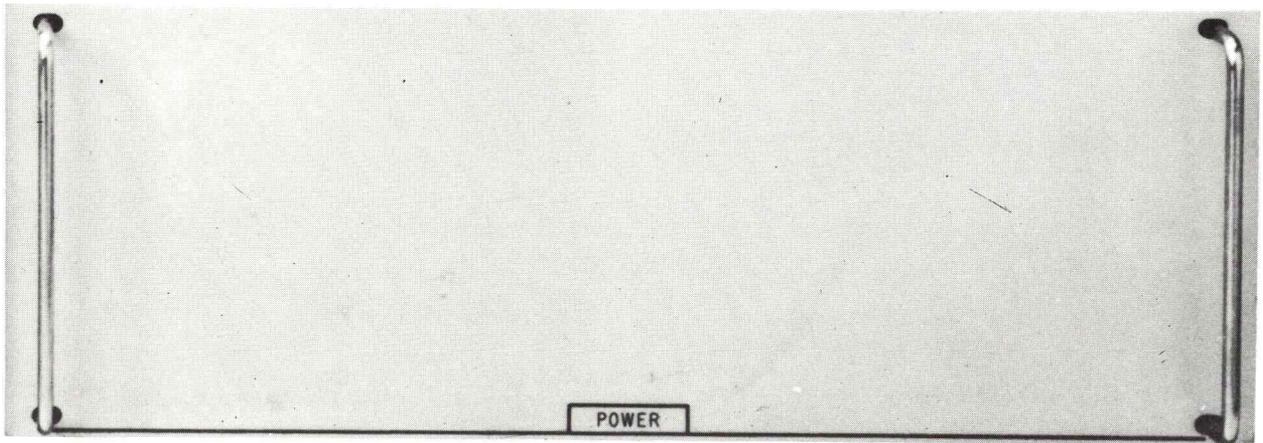
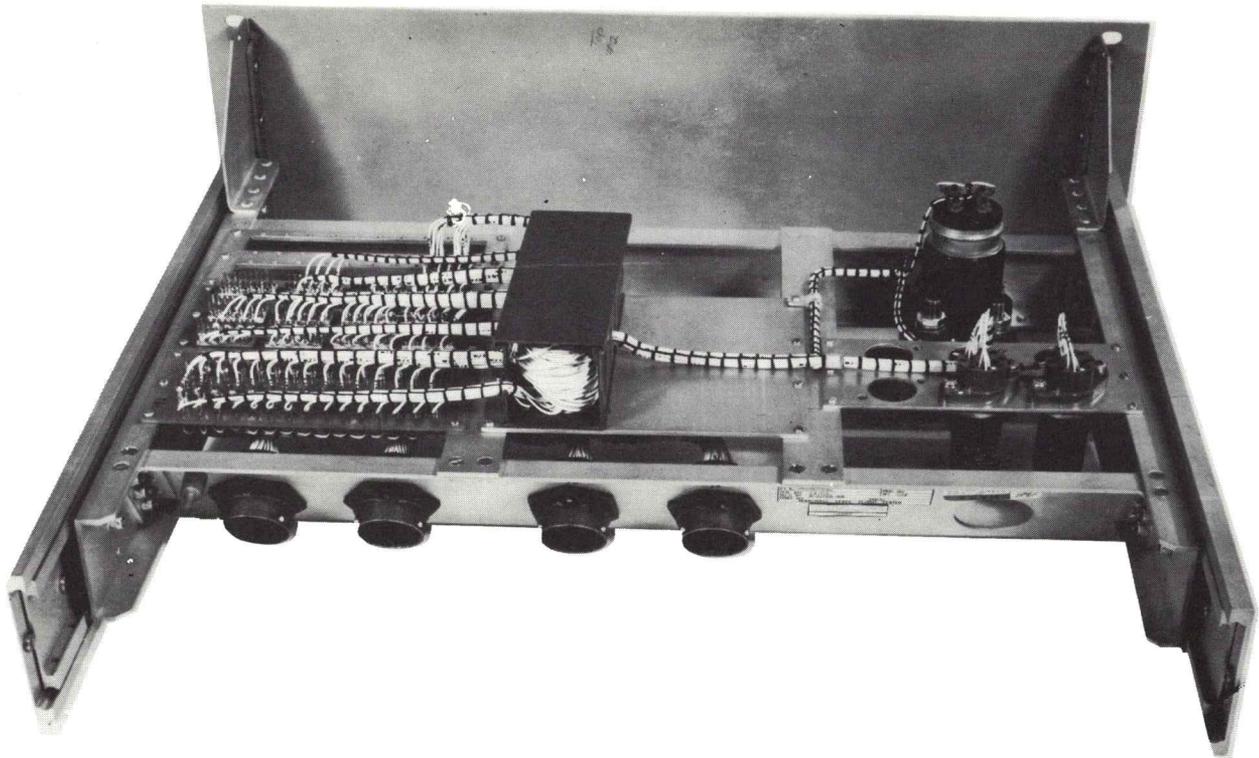
## **SPECIAL TEST EQUIPMENT**

There are several sets of equipment that are supplied to verify the Saturn Vehicle Electrical Systems and the ESE. These test sets are used in various areas of checkout as required and do not necessarily form a part of the equipment used to launch the vehicle.



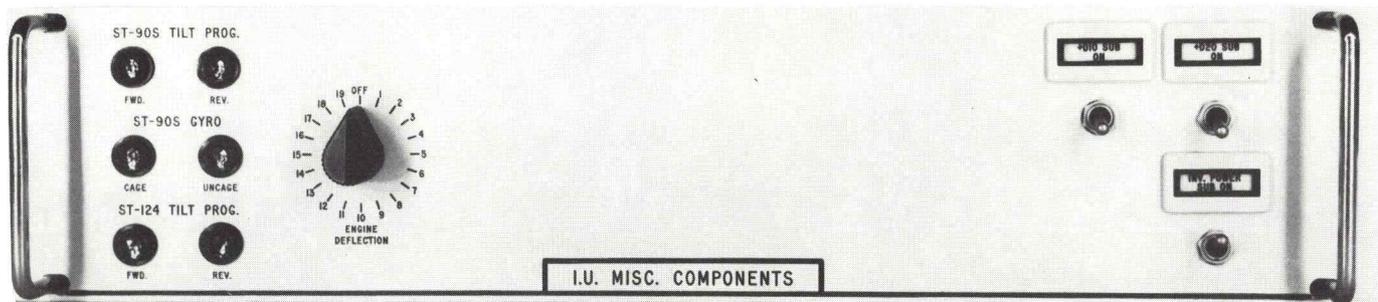
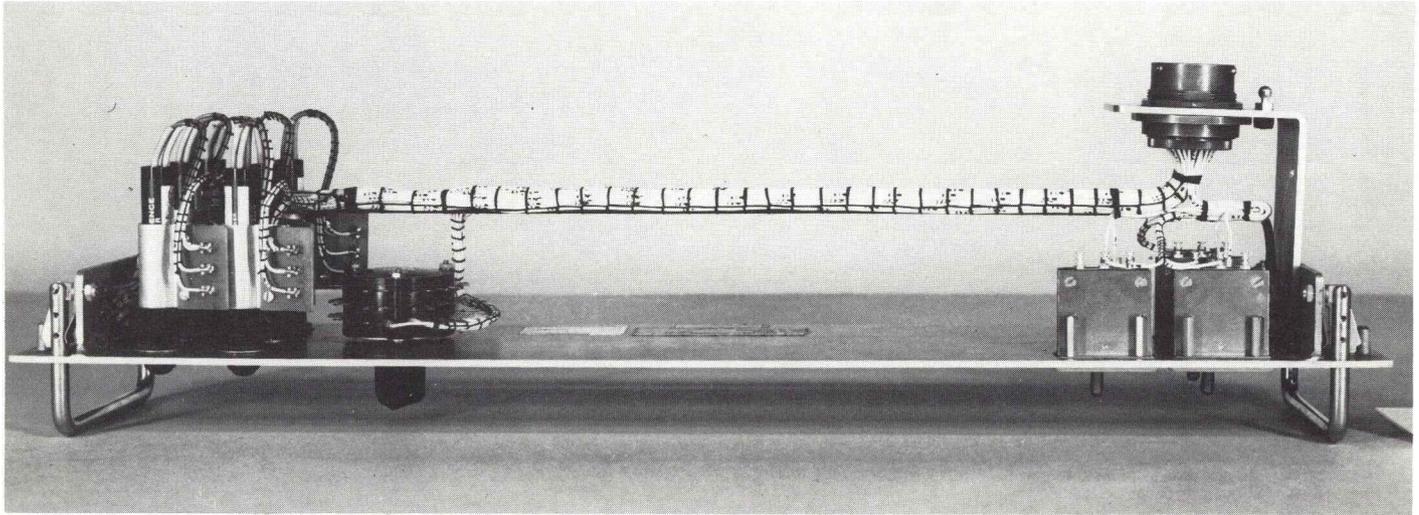
### **(IU) GROUND EQUIPMENT TEST SETS (GETS) RACKS (280)**

The purpose of the IU GETS is to provide a means of verifying the IU ESE prior to its mating with the IU Stage and system ESE. The IU GETS consist of two racks of equipment containing a patch board assembly and various panels, providing switching and monitoring necessary to substitute for or simulate all IU Stage and interfacing ESE circuits, as required to functionally check the IU ESE.



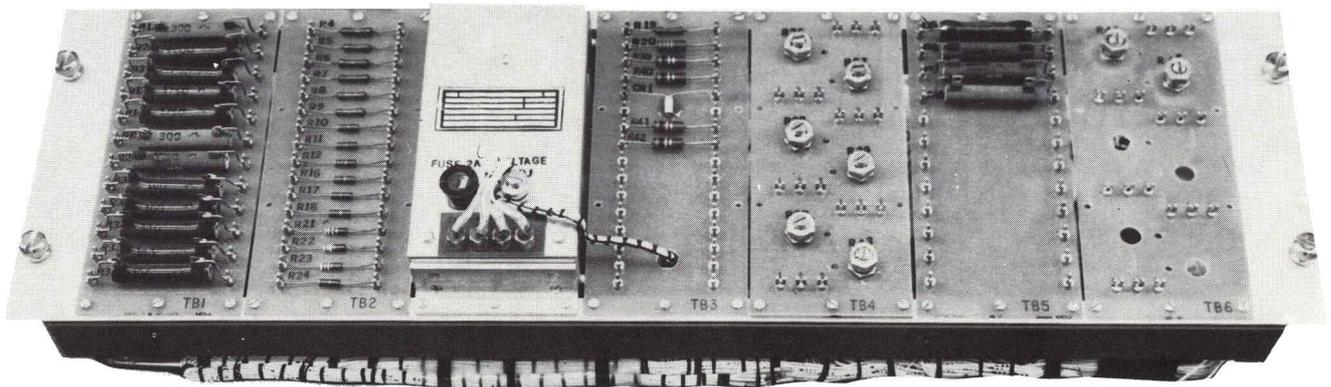
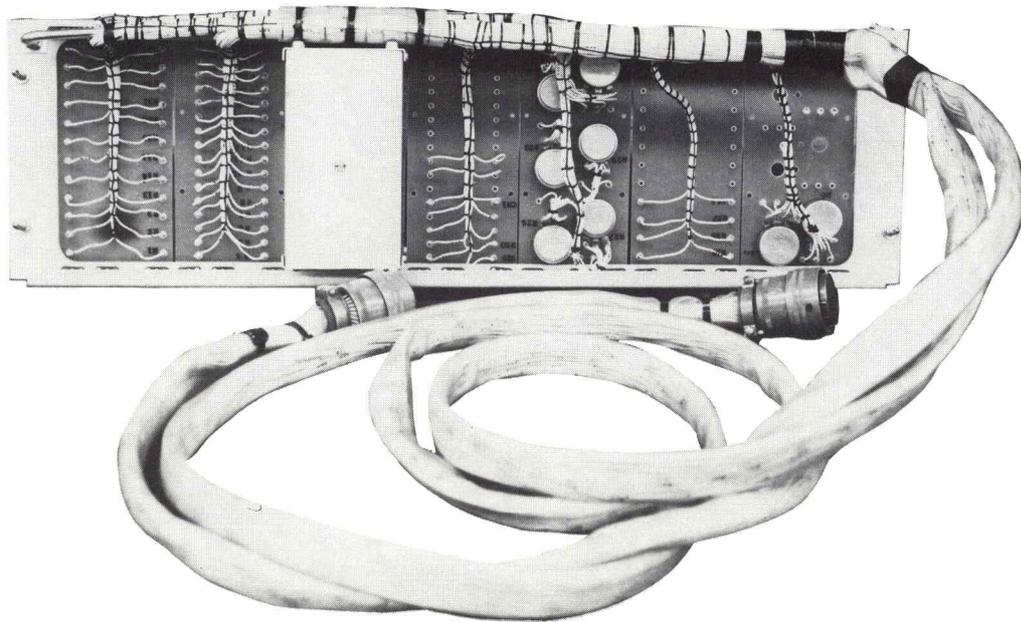
### POWER PANEL (280A2)

This panel contains contactors and power relays necessary for switching power circuits required by GETS.



## I U MISCELLANEOUS COMPONENTS PANEL (280A6)

This panel contains miscellaneous components necessary for testing circuits not tested by the lamp and switch module panels.



### MODULE ASSEMBLY PANEL (280A7)

This module is mounted in the rear of GETS Rack 280 and it facilitates the mounting of special electrical and electronic components used within this rack.

**SDF**  
**FACILITY PECULIAR EQUIPMENT**

**SDF**  
**POWER SOURCES**

See pages 4 thru 11.

# **SDF**

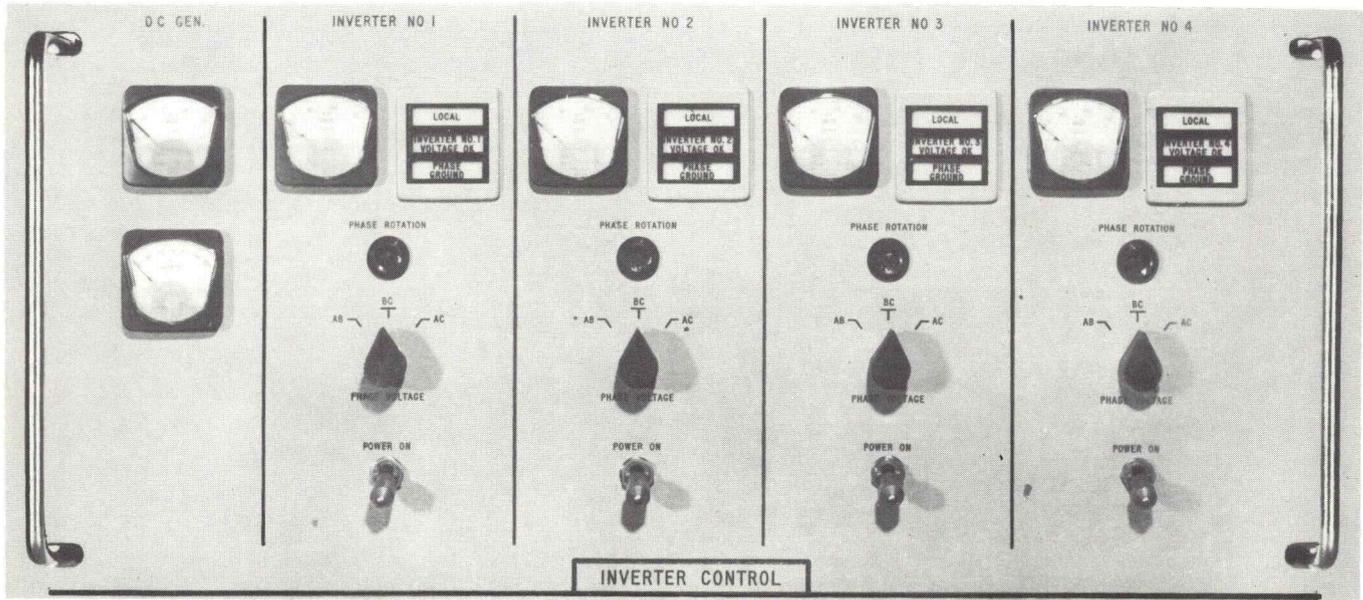
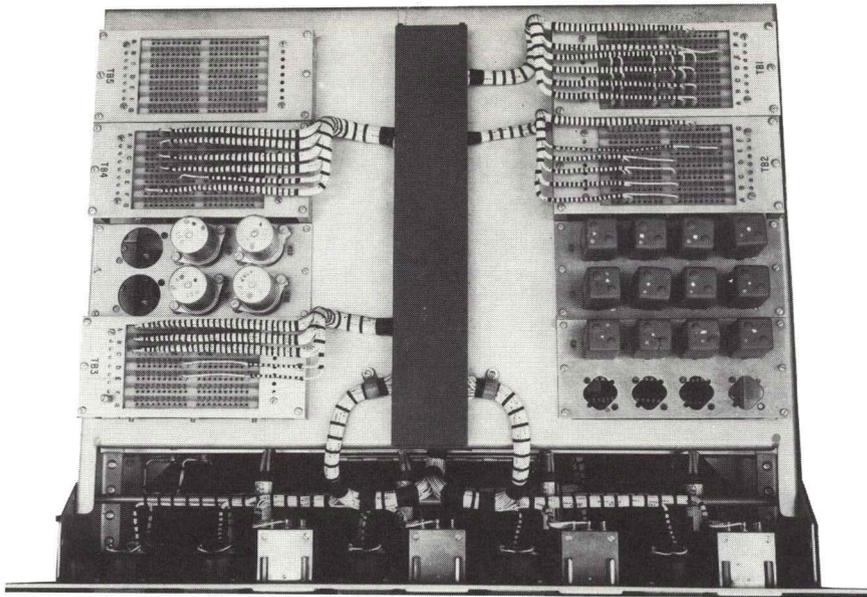
## **POWER DISTRIBUTION**

The power generated by previously described sources in the ESE is distributed by the Power Distribution System to the systems which control, monitor and relay power to the vehicle components and other complex systems during pre-launch and launch operations.

No photographs available

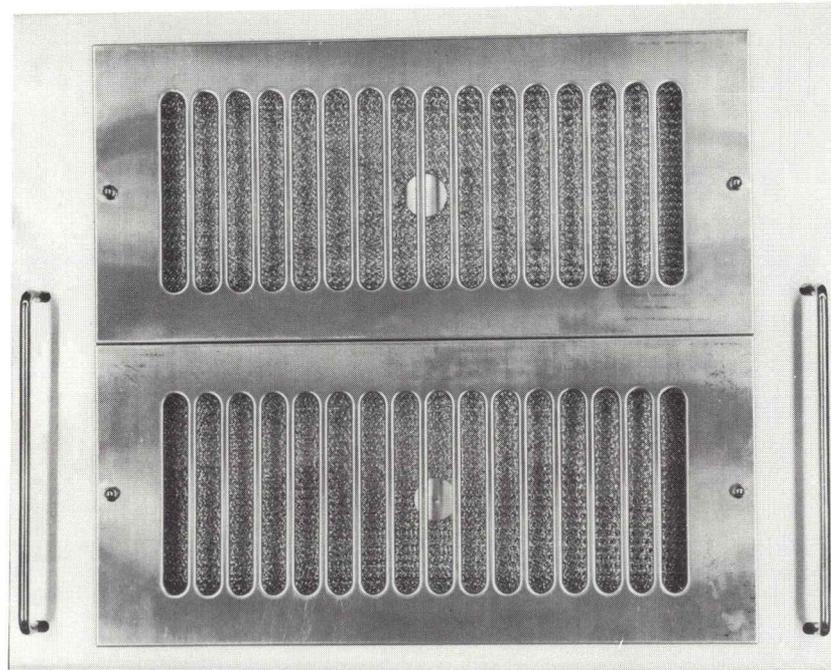
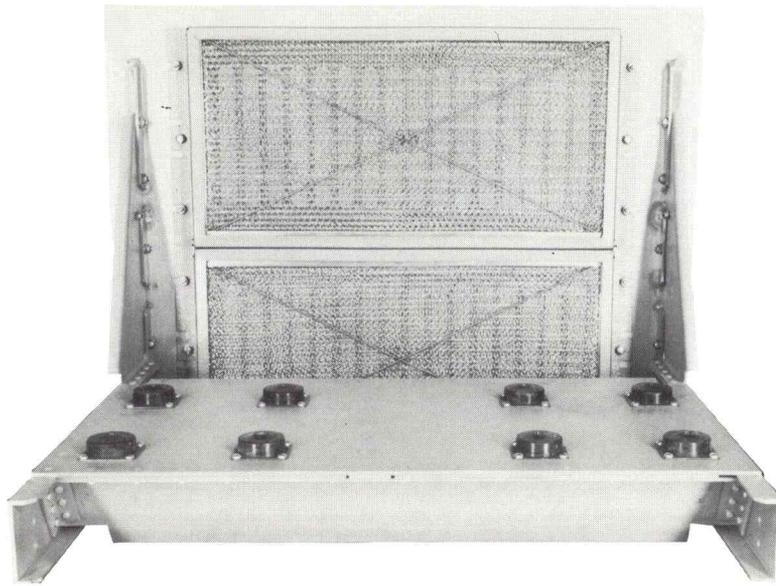
### **INVERTER RACK 90A1**

The inverter provides the power and distribution of 4 self contained ground inverters. This rack also has provisions for monitoring and controlling each inverter locally or remotely. The rack is of modular construction utilizing inverter mounting panels, DC Power Frame Type 1 and 2, AC Power Frame Type 3, DC and AC modules and an inverter control panel.



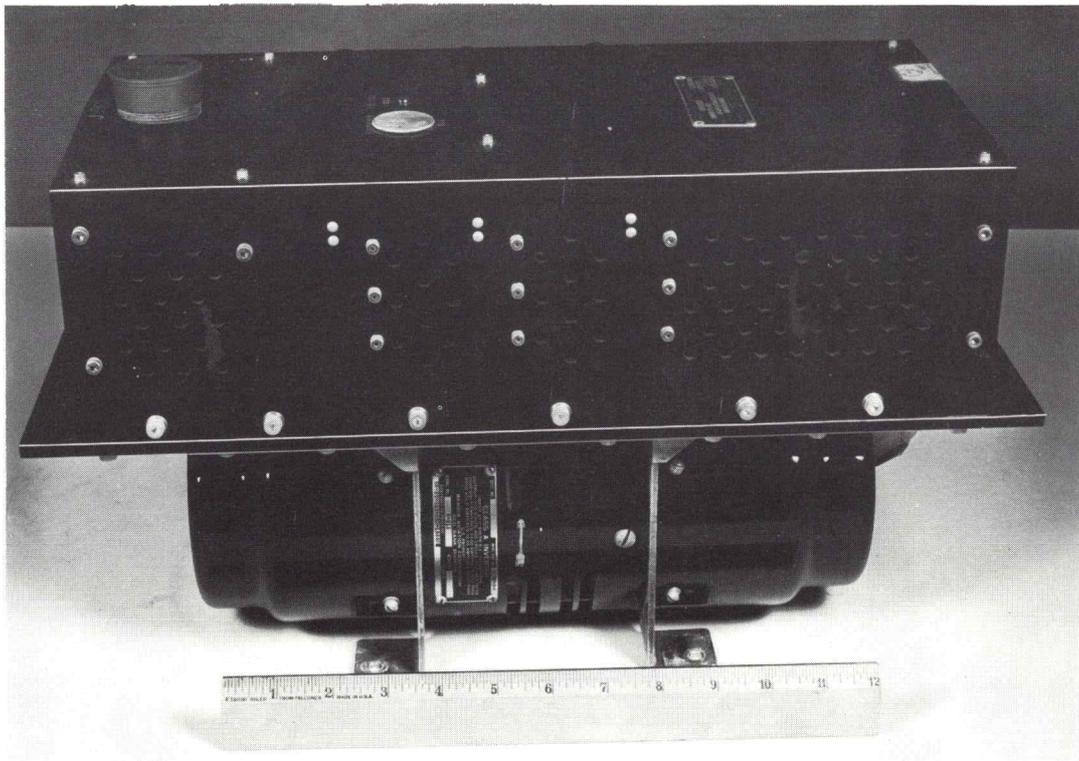
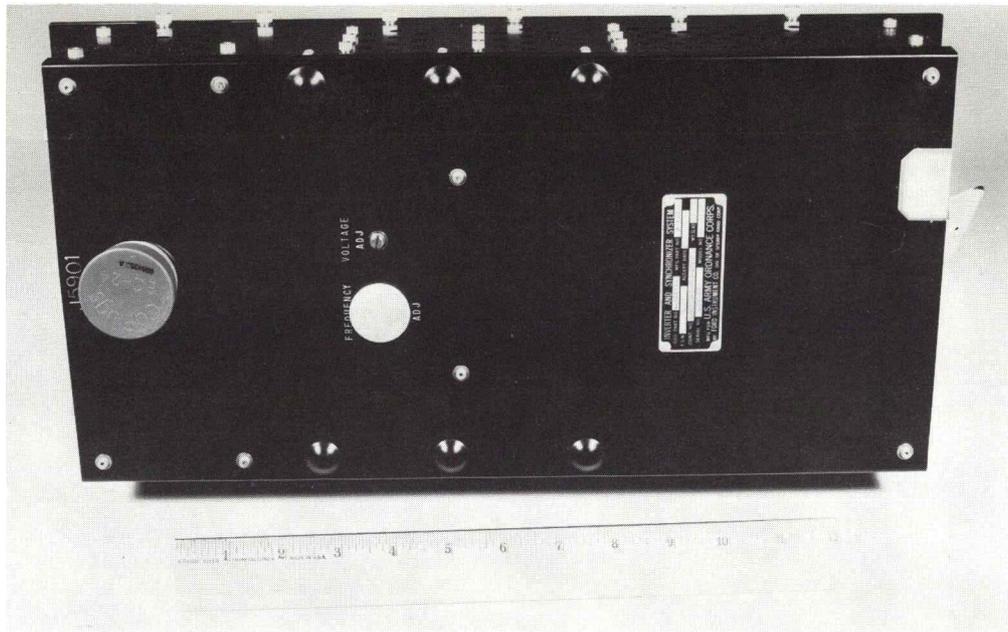
## INVERTER CONTROL PANEL

This panel provides controls for 400 CPS, AC inverters, and AC and DC power modules in the inverter rack. The panel also measures AC output voltage, provides "Voltage OK", "Phase Ground" and "Phase Rotation" lamps in addition to monitoring the DC input voltage and current to the inverters.



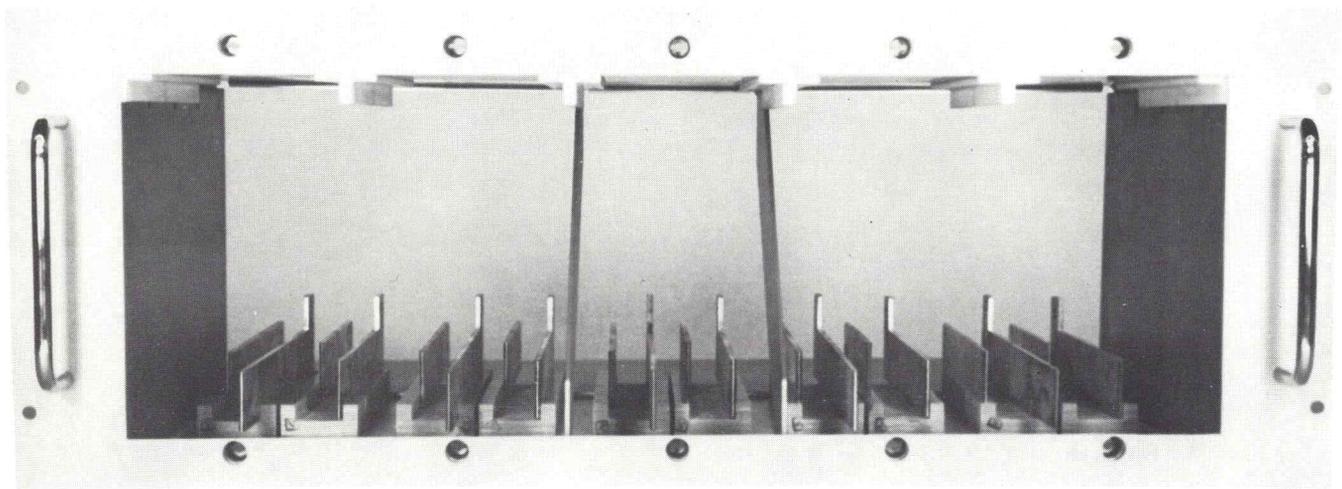
### **INVERTER MOUNTING CHASSIS**

This chassis provides mounting for two 1800 volt amperes (VA) ground inverters.



### 1800 VA INVERTER

This inverter is a motor generator set designed to generate precision 400 CPS, 115 VAC, 3 phase power. The output is rated at 1800 VA. The input is 28 VDC. The output voltage regulation is 115 VAC  $\pm$  0.5 VAC per phase. The frequency tolerance is 400 CPS  $\pm$  0.02 CPS.



### AC POWER FRAME TYPE 3

This frame is similar to AC Power Frame Type 2 except five individual sets of four buses each are provided. This frame is built to accommodate five AC Power Modules Type 2 (as is AC Power Frame Type 2).

# **SDF**

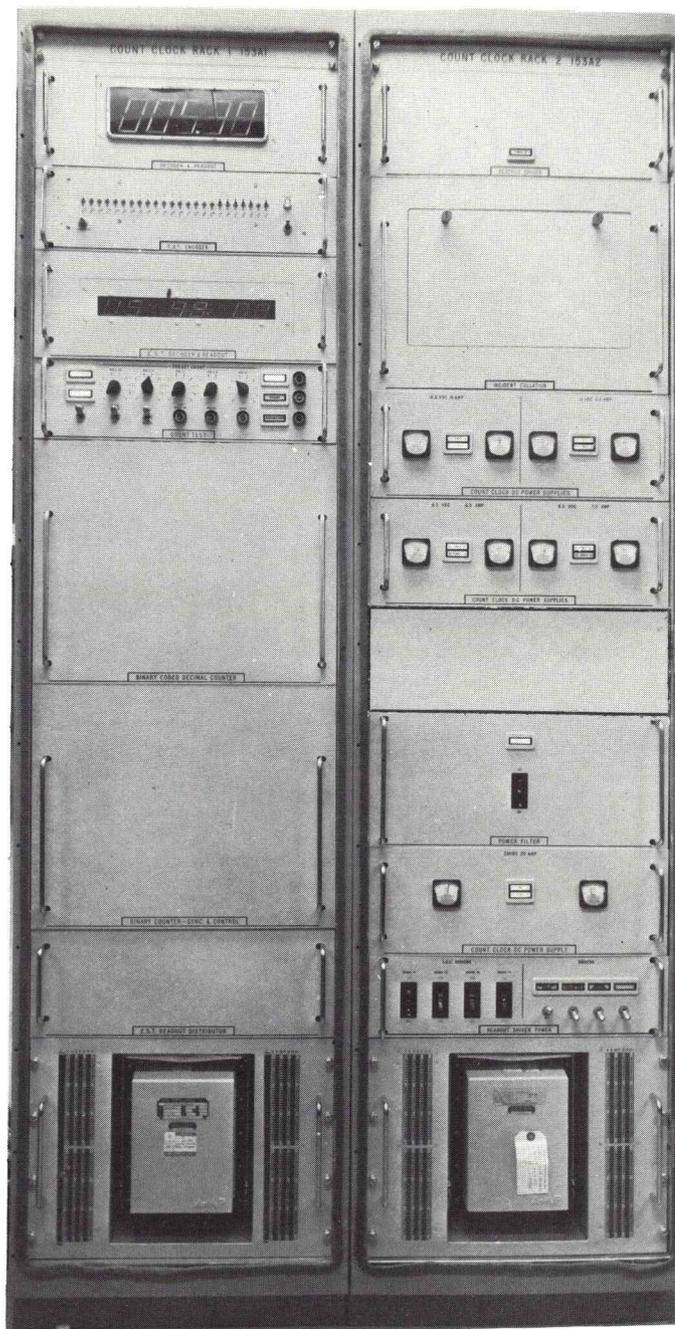
## **PROPULSION SYSTEM**

The ESE associated with the vehicle Propulsion System electrically energizes, controls, monitors and tests the electrical components associated with the vehicle pneumatic systems, the vehicle pyrotechnics and electromechanical components associated with the vehicle propellant tanks and rocket engines. In addition, it sequences the systems down to the lift-off condition.

No photographs available

### **IGNITION SIMULATOR (78A8)**

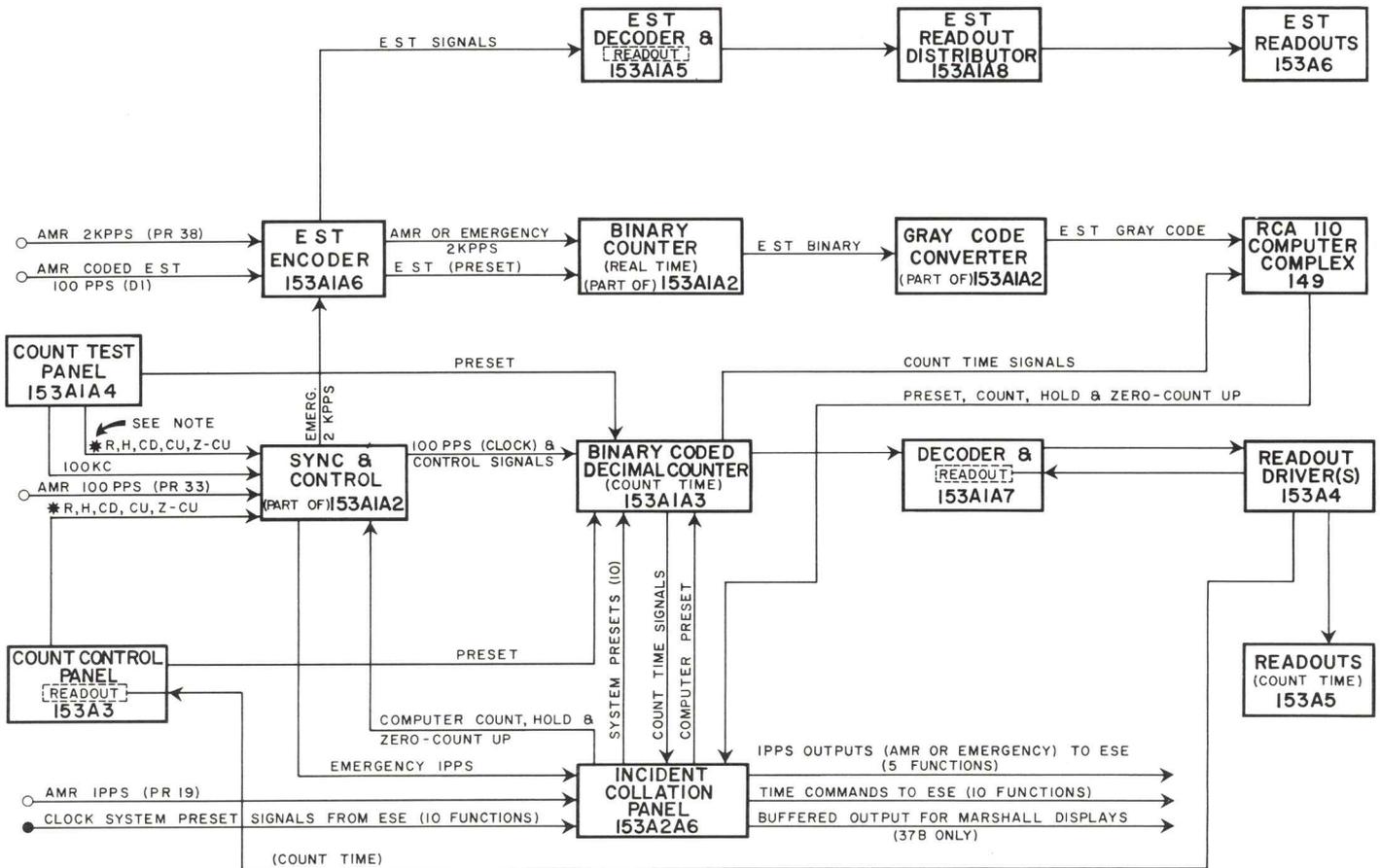
The function of this panel is to detect the normal 500 VDC turbine spinner squib firing signals from the ignition power distributor and to supply a corresponding 28 VDC signal to the S-1 Stage simulator.



## COUNT CLOCK SYSTEM

COUNT CLOCK RACK 1 153A1 AND COUNT CLOCK RACK 2 153A2

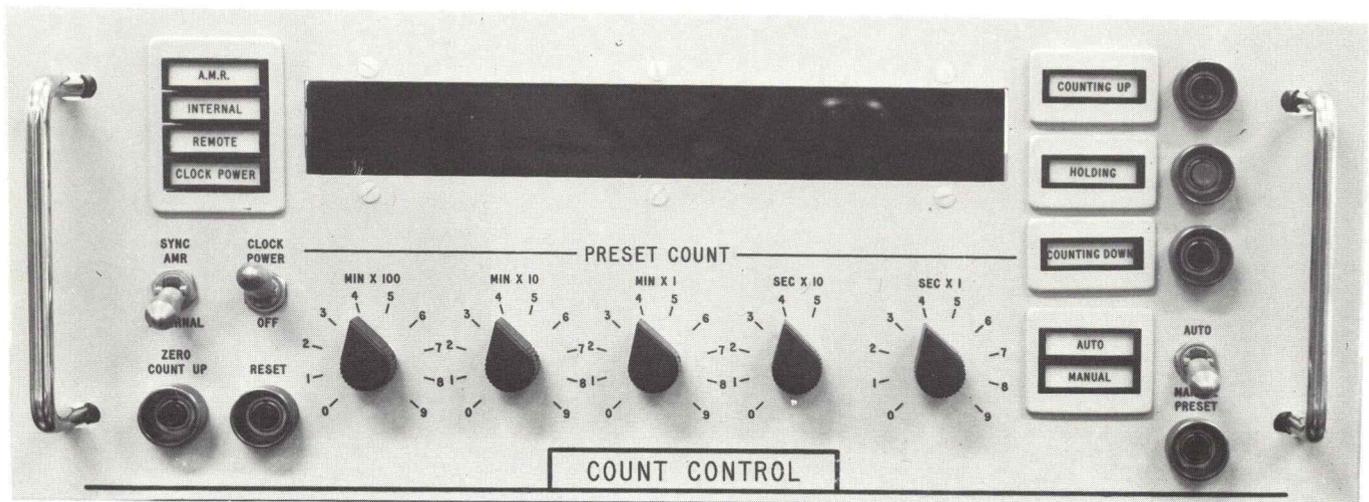
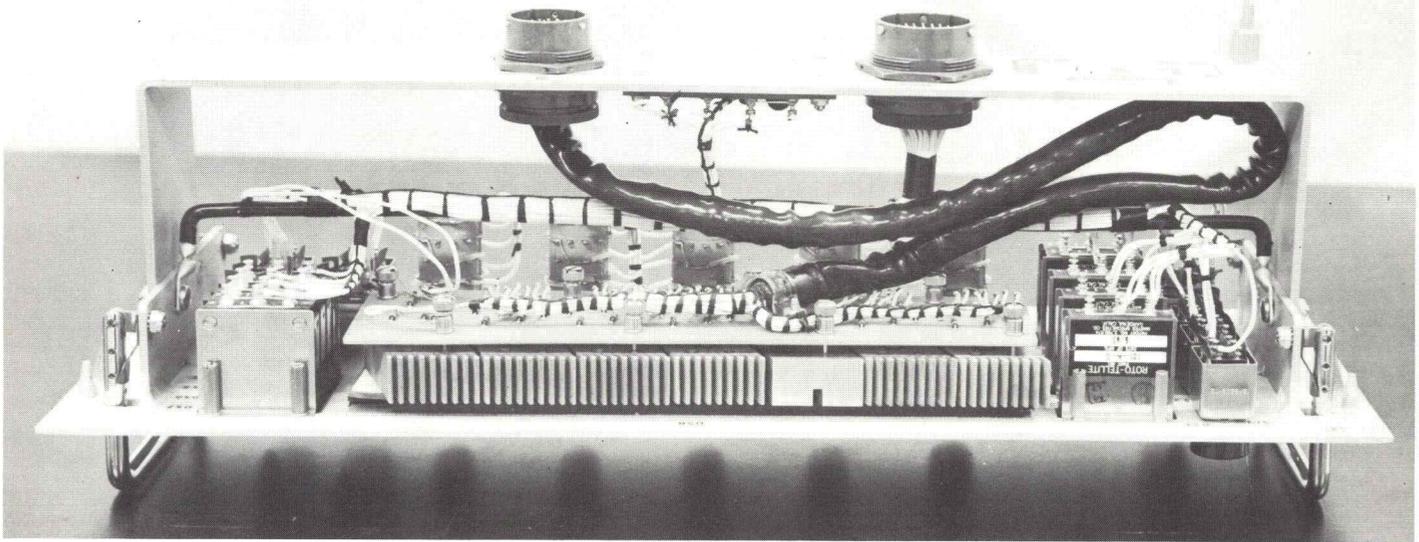
The Count Clock System is composed of the equipment necessary to give "count time" for use and display in the launch control center, launch area, the ground computer, down range timing, data display system, and timed output commands. The system also provides a real time reference to the ground computer.



**NOTE:**

- \* - RESET, HOLD, COUNT DOWN, COUNT UP & ZERO-COUNT UP

## COUNT CLOCK SYSTEM (153) FUNCTIONAL DIAGRAM



### COUNT CONTROL PANEL (153A3)

Located in the test conductors console, this panel is essentially the same as the Count Test Panel except the addition of a switch which controls Atlantic Missile Range (AMR) timing pulses and the deletion of a local-remote switch. This panel also controls the clock located in the Count Test Panel when the LOCAL-REMOTE switch on the Count Test Panel is in the REMOTE position.



### **COUNT READOUT**

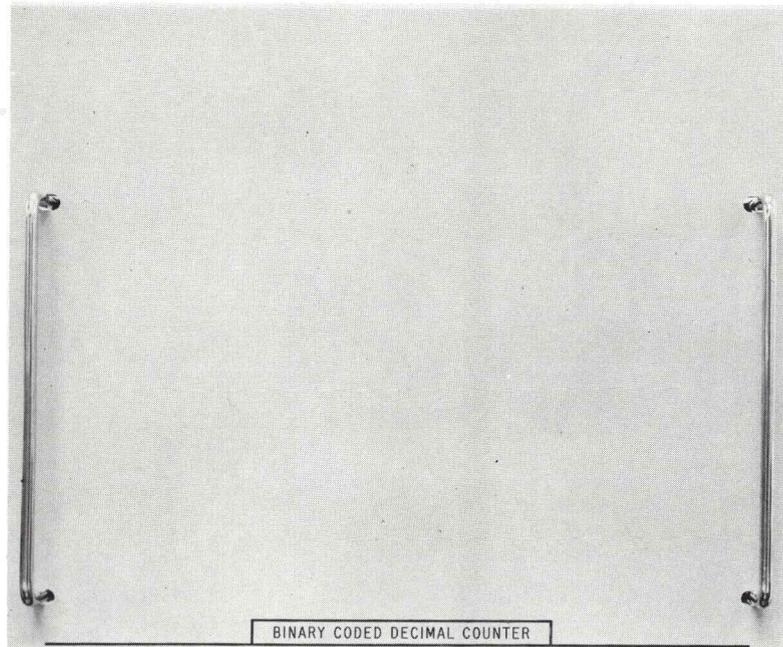
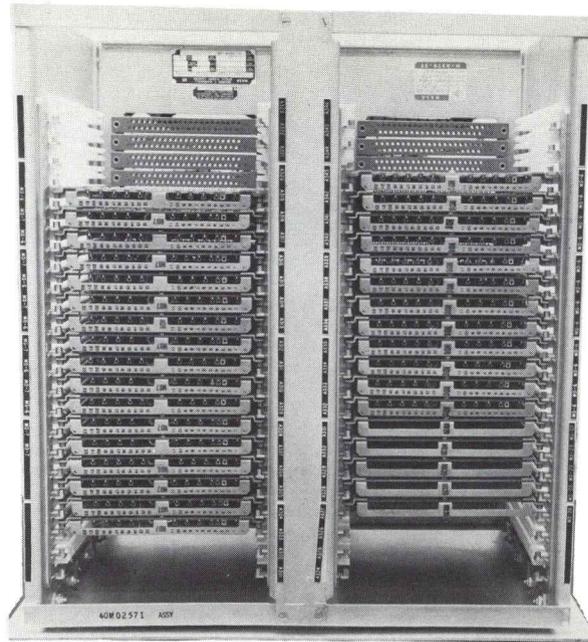
This indicator is designed to show a count readout. It is powered by the Readout Drivers.

No photographs available

### **BINARY COUNTER-SYNC AND CONTROL PANEL (153A1A2)**

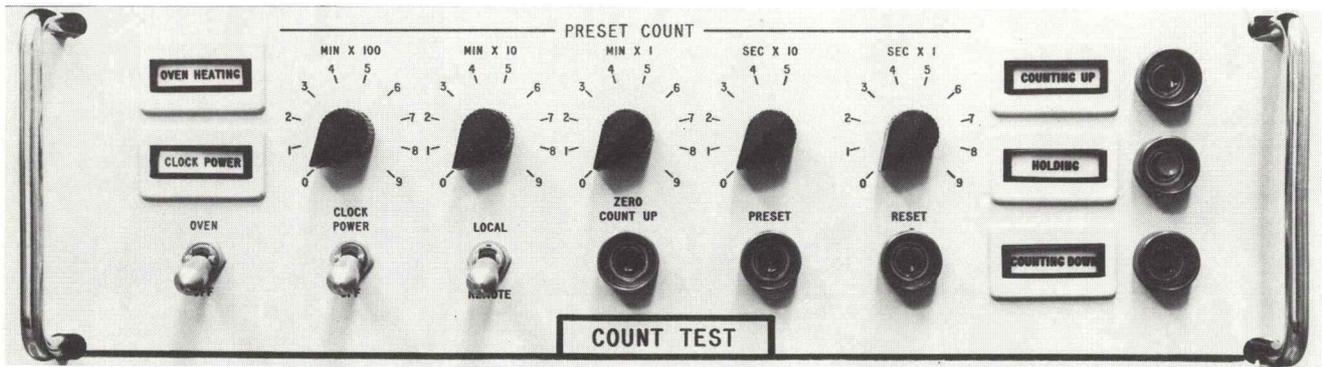
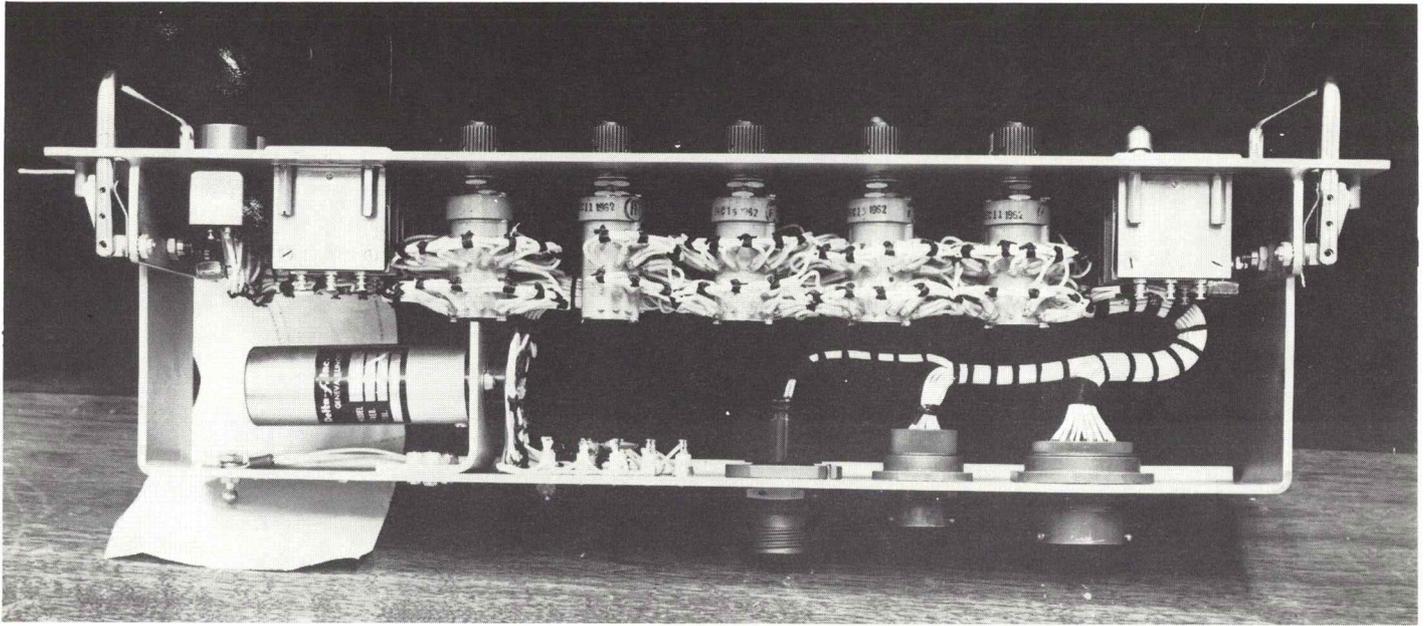
This panel functions as a 27 bit binary counter. This counter counts at 1000 counts per second, at 2400 hours it resets to zero and starts counting again. The output may be either binary or gray code. This is made possible by a self contained converter.

The circuits in this panel are controlled by the Count Test Panel. A 100KC signal, applied by the Count Test Panel is converted to 100 pulses per second which is synchronized with AMR time.



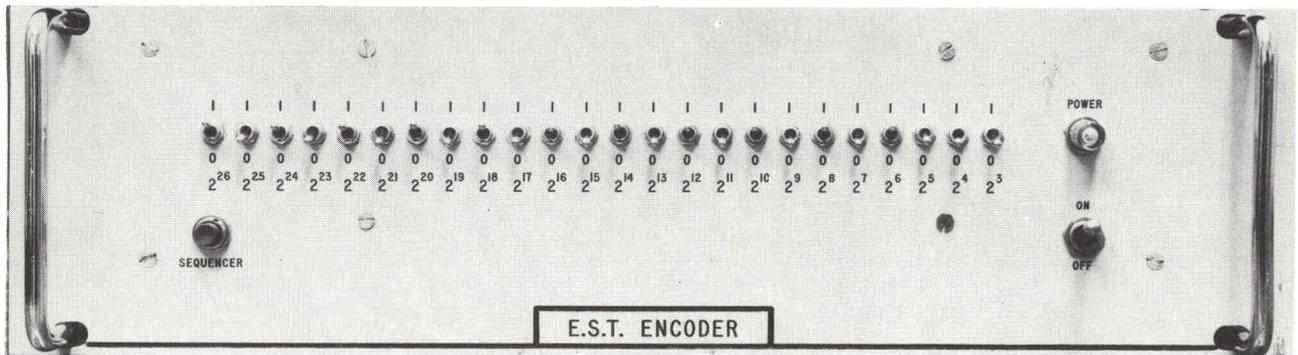
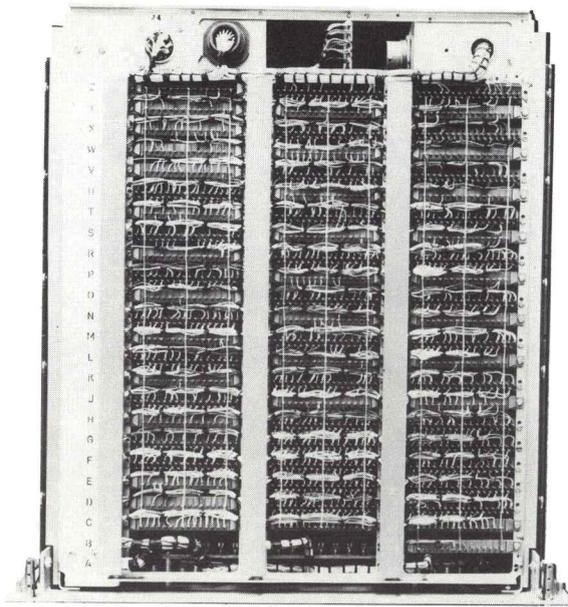
### **BINARY CODED DECIMAL COUNTER PANEL (153A1A3)**

This counter counts either up or down at one count per second. The output is a 19 bit binary coded decimal format.



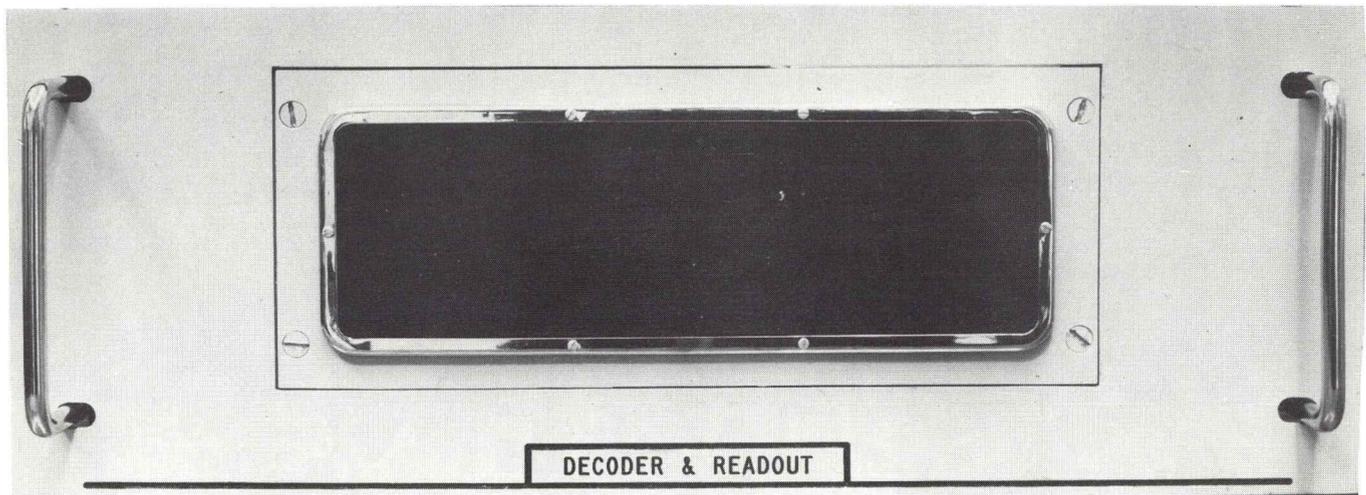
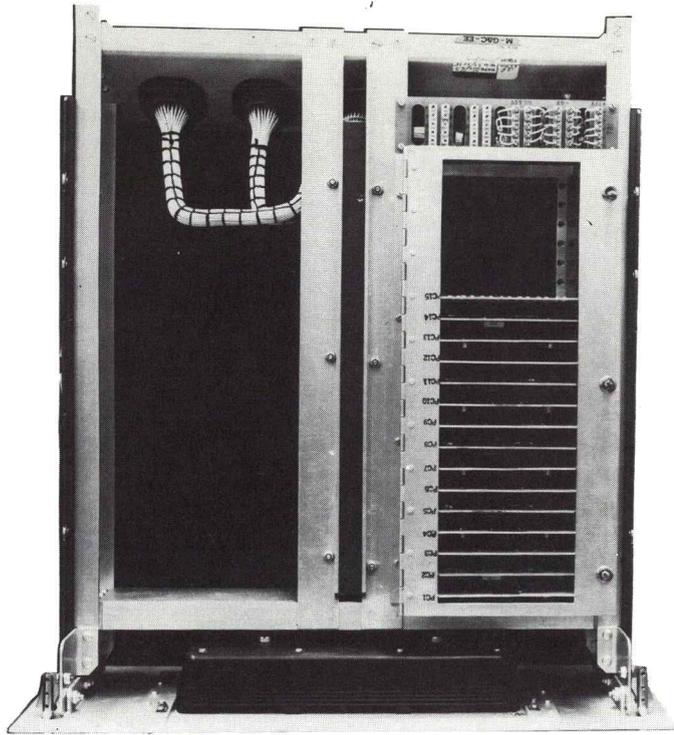
### COUNT TEST PANEL (153A1A4)

This panel consists of a 100KC temperature stabilized oscillator. The accuracy of the oscillator is stable to 5 parts in 10 million per 24 hours. It provides the controls to count up, count down, hold, preset any number from 0 to 999 minutes and 59 seconds, zero and count up, and reset. Count status lights are located on the panel. Toggle switches, located on the panel, control oven heater power, clock power, and local-remote operation.



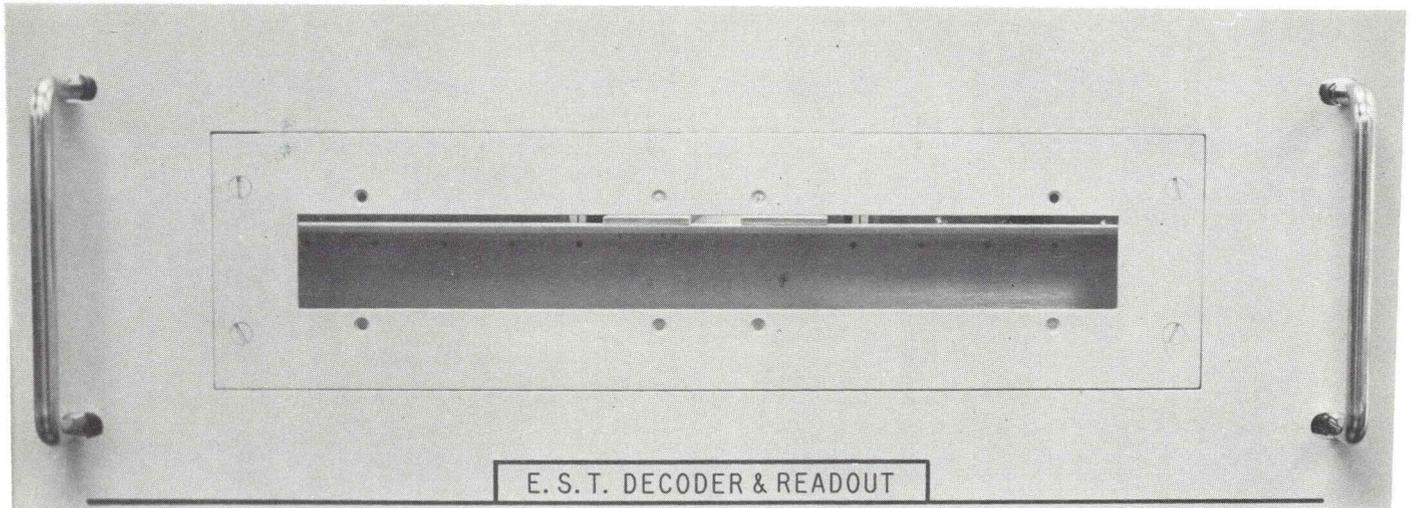
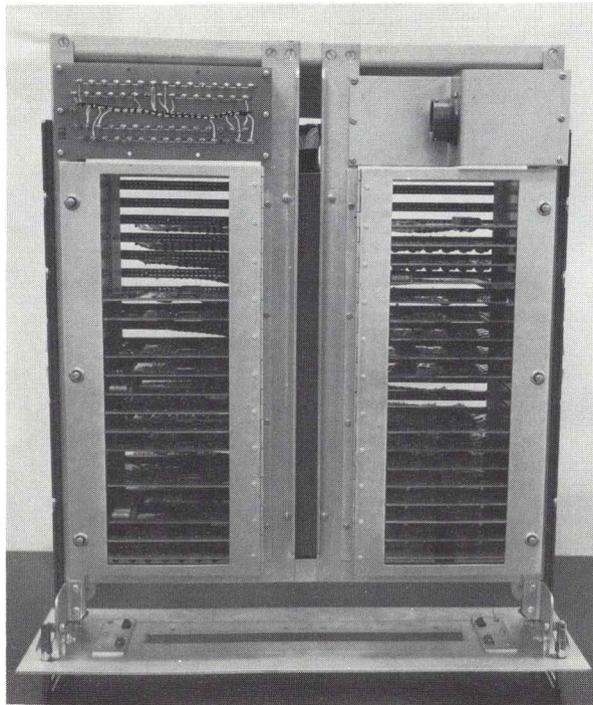
### EST ENCODER PANEL (153A1A6)

This panel receives pulse width modulated Eastern Standard Time (EST) signals and compares these with the time set in by switches located on front panel. When the times coincide, a 2KPPS signal is gated to the EST binary counter. Binary coded decimal EST signals are sent to the EST decoder.



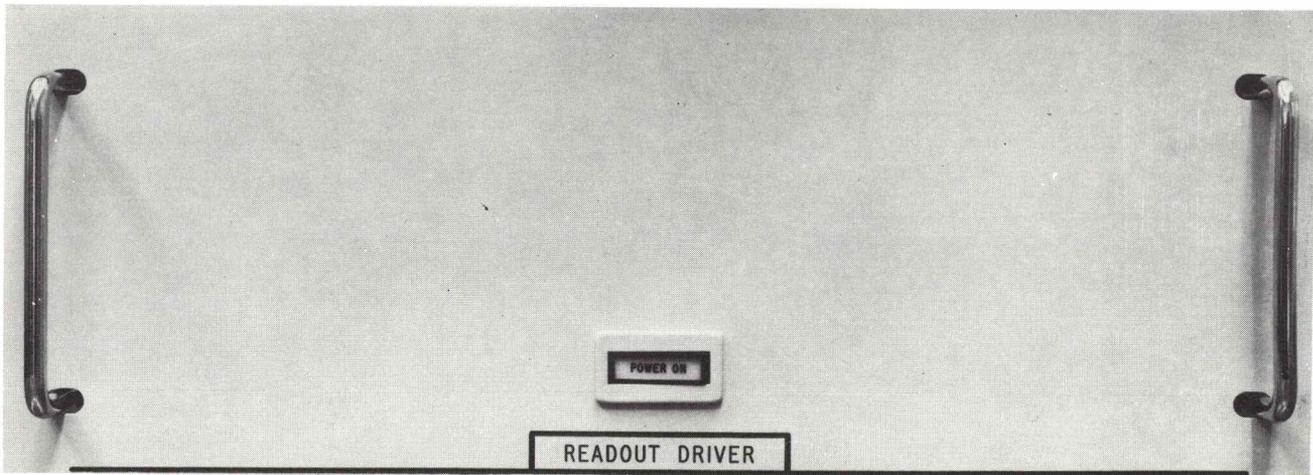
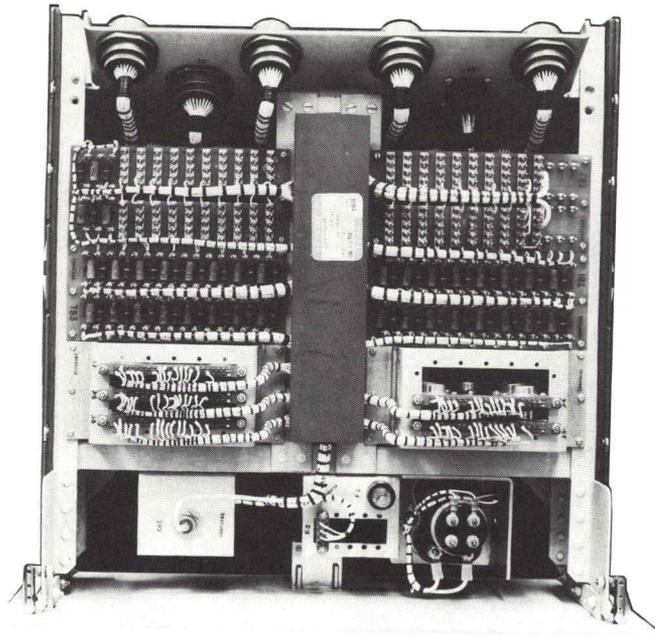
### **DECODER & READOUT PANEL (153A1A7)**

This panel provides a visual readout in seconds, tens of seconds, minutes, tens of minutes and hundreds of minutes. The input is from a binary coded decimal counter.



### **EST DECODER & READOUT PANEL (153A1A5)**

This panel provides a visual readout in seconds, minutes and hours on a 24 hour basis, i.e. 2400 is midnight from a binary coded decimal counted input signal from the EST encoder.



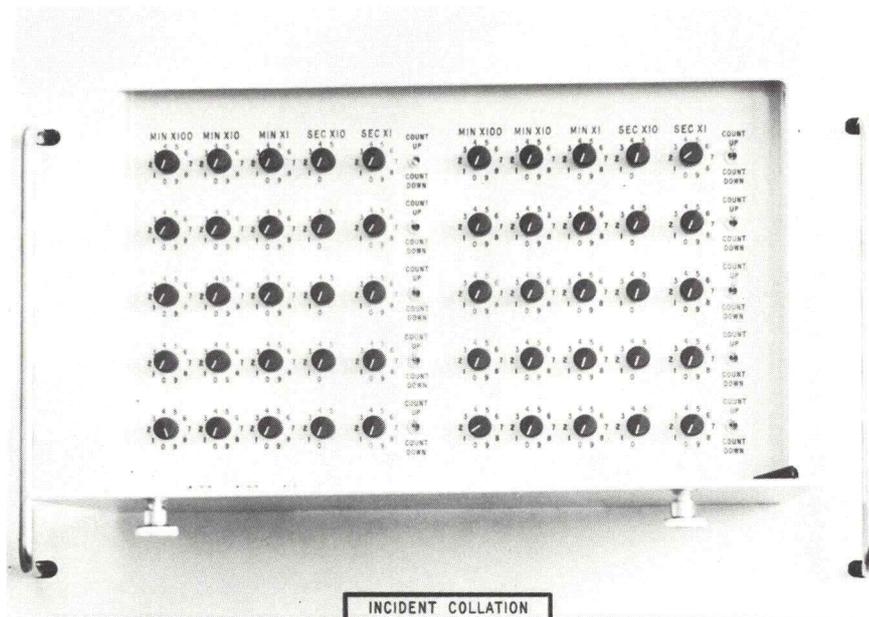
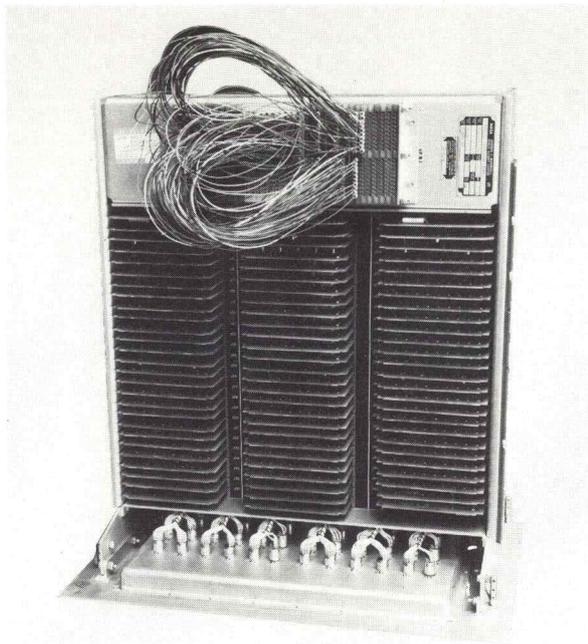
### READOUT DRIVER PANEL (153A4)

This panel is a power amplifier. The small signals from the decoder are amplified by this panel, with sufficient power to drive 10 readouts.

No photographs available

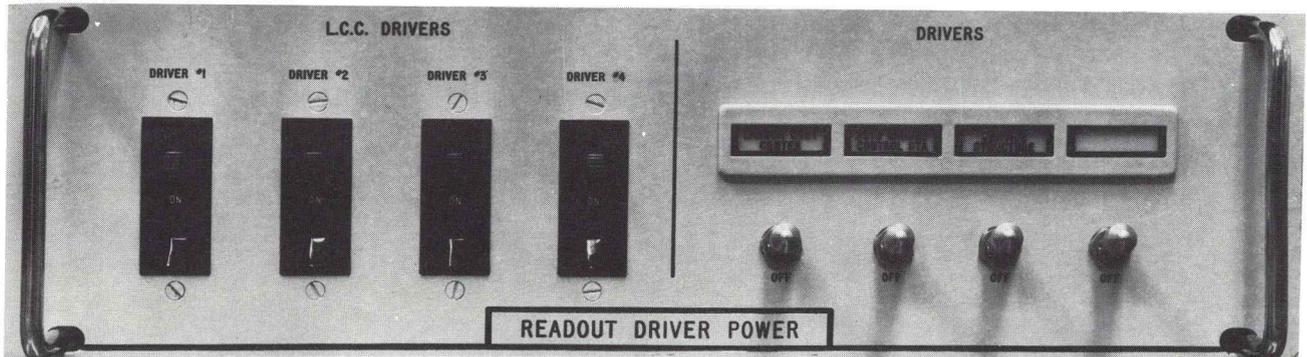
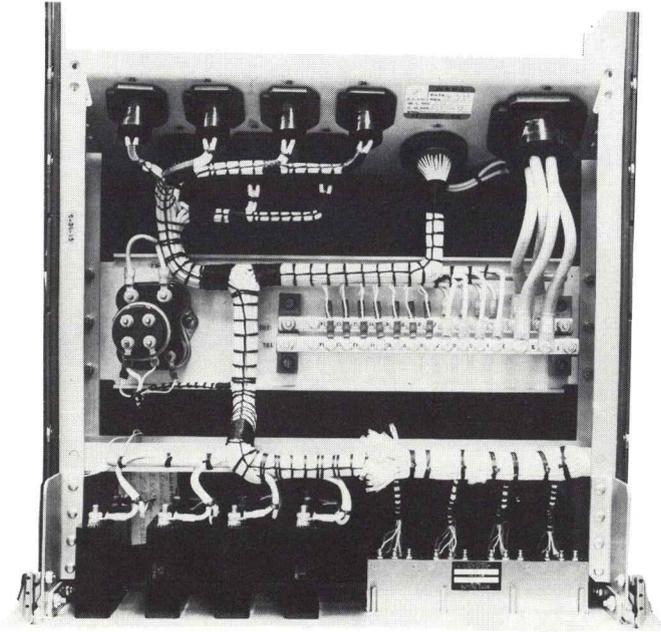
### **EST READOUT DISTRIBUTOR PANEL (153A1A8)**

The function of this panel is to distribute EST decoder signals to 9 external EST readouts.



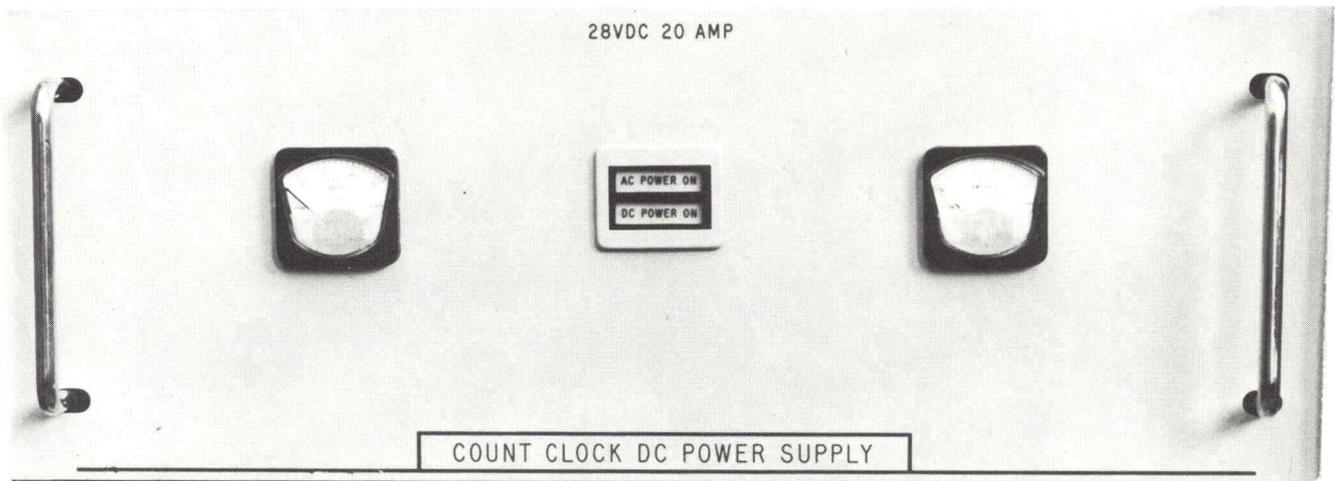
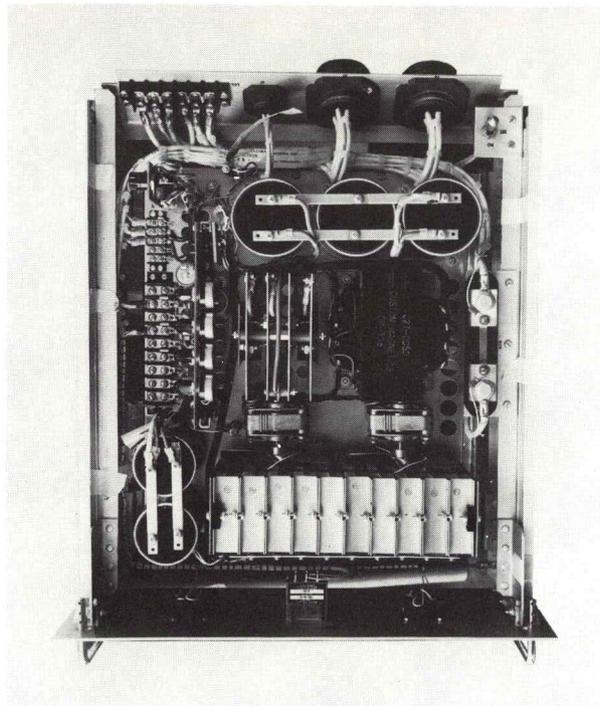
### INCIDENT COLLATION PANEL (153A2A6)

This panel has the facility of automatically presenting the count-time generator to pre-selected times upon command from the vehicle system. These preset times are determined by interconnect on taper pin blocks in the panel. The ten sets of five switches each shown on the front panel select times at which a discrete output from the panel may be obtained.



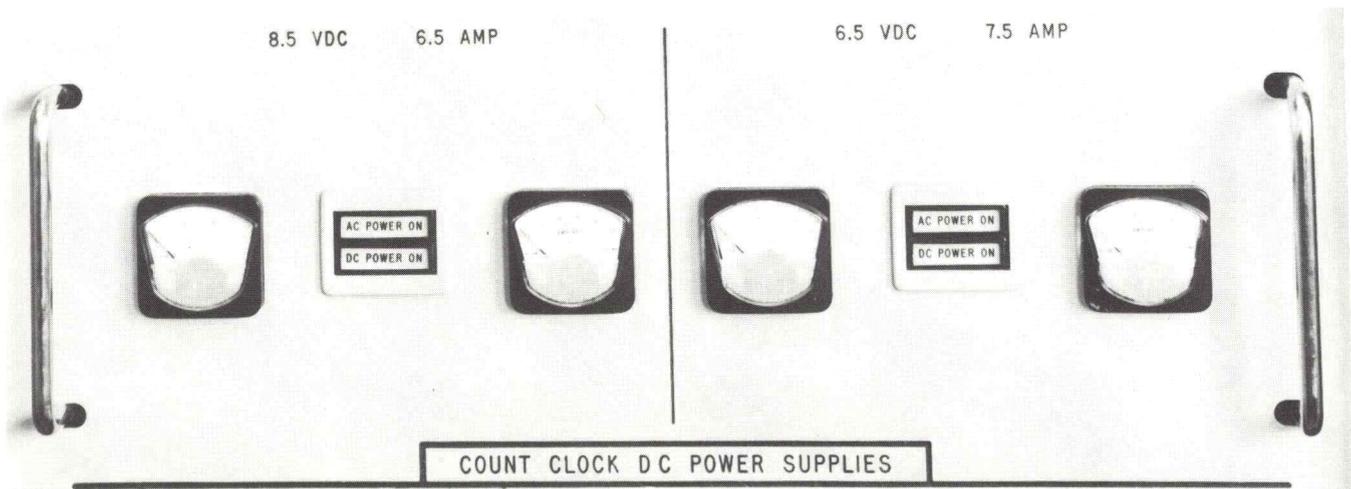
## READOUT DRIVER POWER PANEL (153A2A2)

This panel distributes power to the readout drivers.



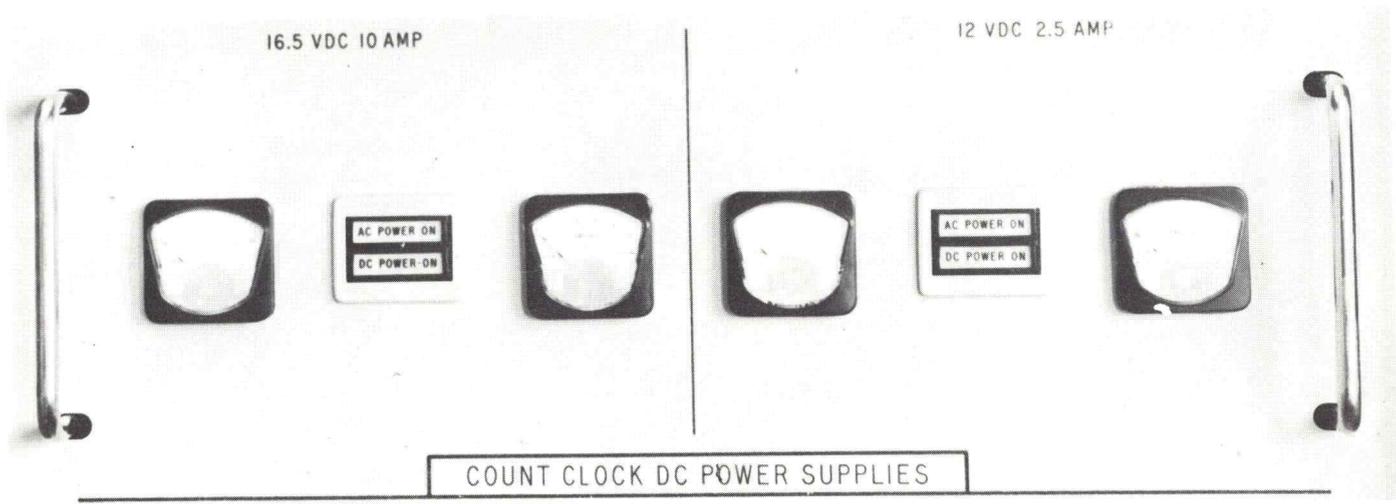
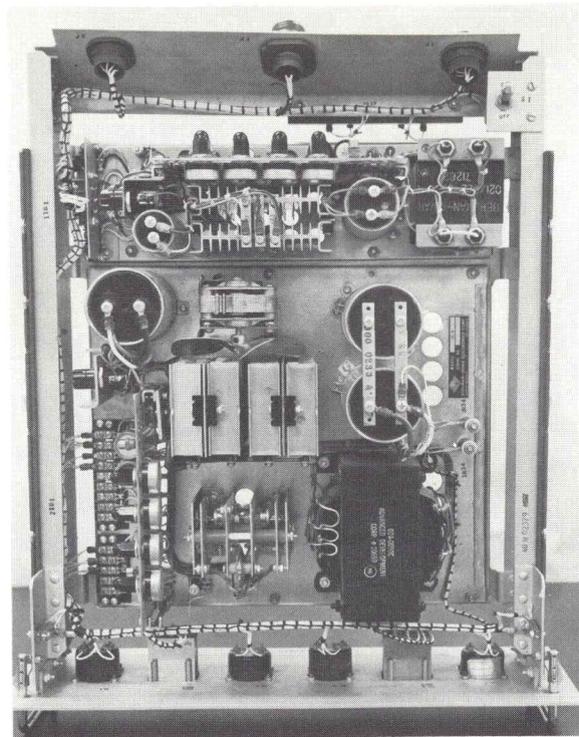
### **COUNT CLOCK DC POWER SUPPLY PANEL (153A2A9)**

This panel supplies 28VDC, 20 amperes power for the readouts and readout drivers.



**COUNT CLOCK DC POWER SUPPLIES PANEL (153A2A4)**

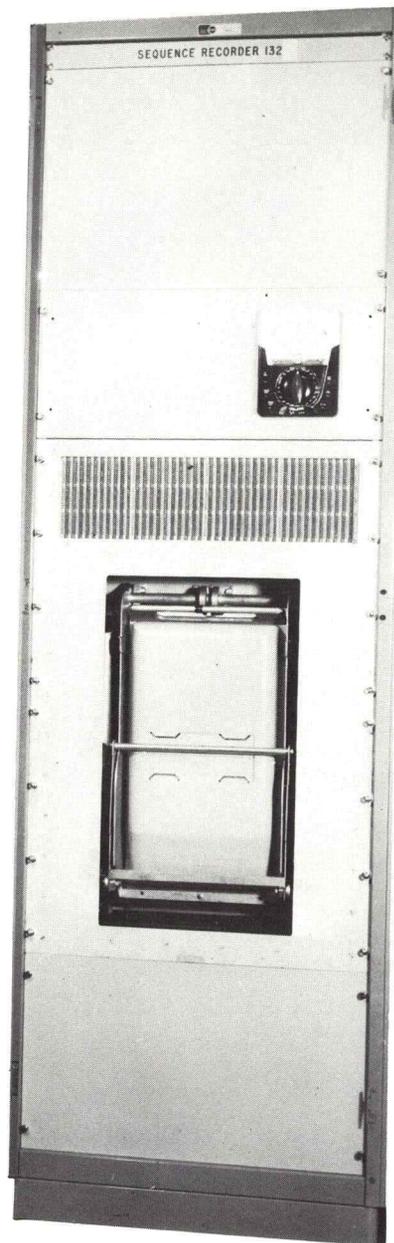
This panel supplies 8.5 VDC and 6.5 VDC bias for logic circuits.



### COUNT CLOCK DC POWER SUPPLIES PANEL (153A2A5)

This panel supplies 16.5 VDC and 12 VDC. The digital logic modules are powered by these sources.

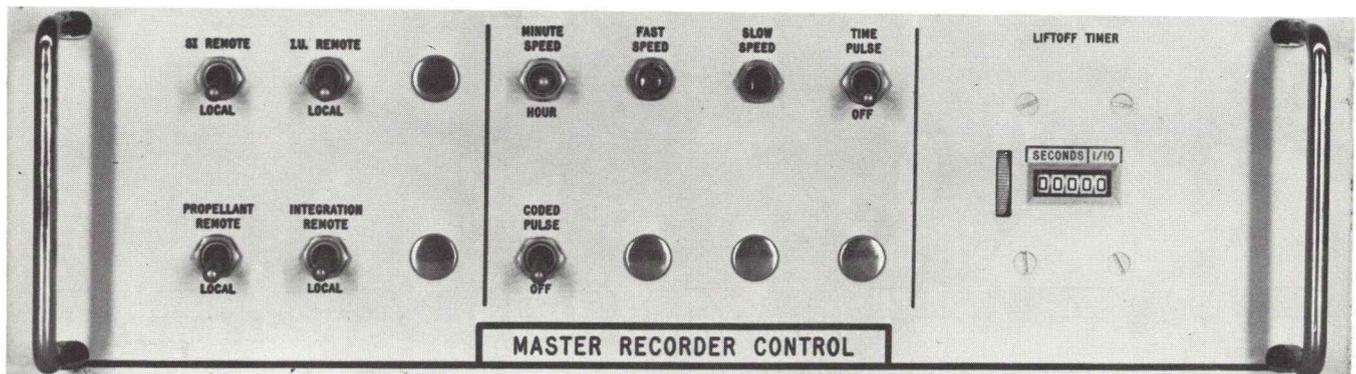
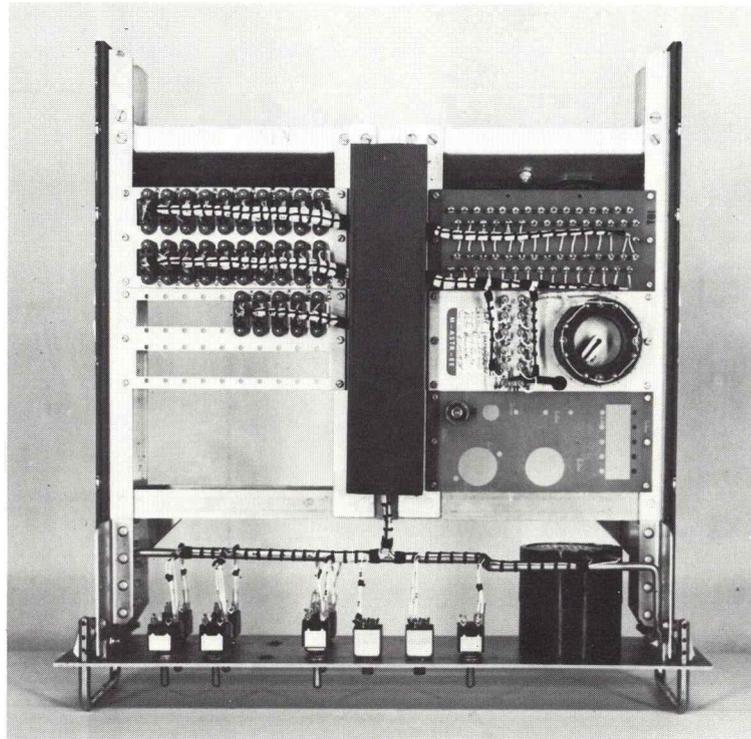
**SDF**  
**RECORDER SYSTEM**



## SEQUENCE RECORDER DISTRIBUTOR RACK 132

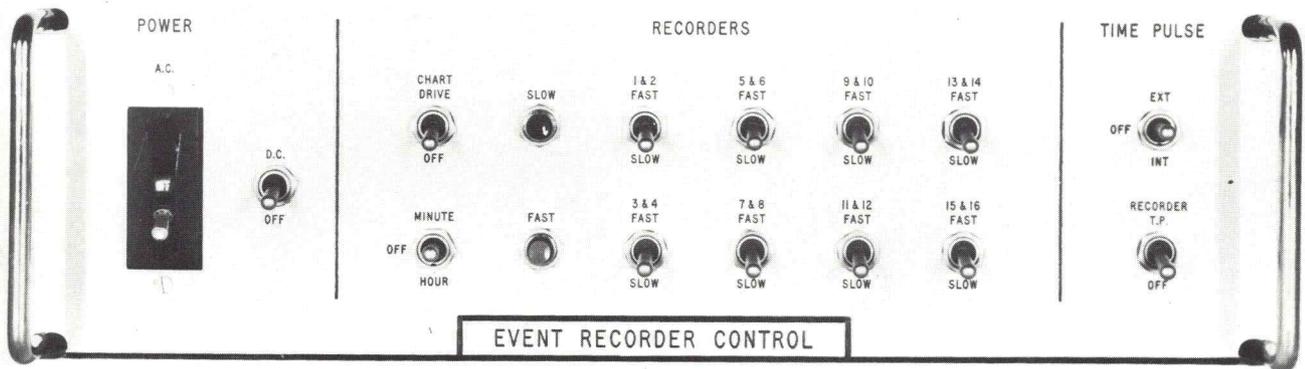
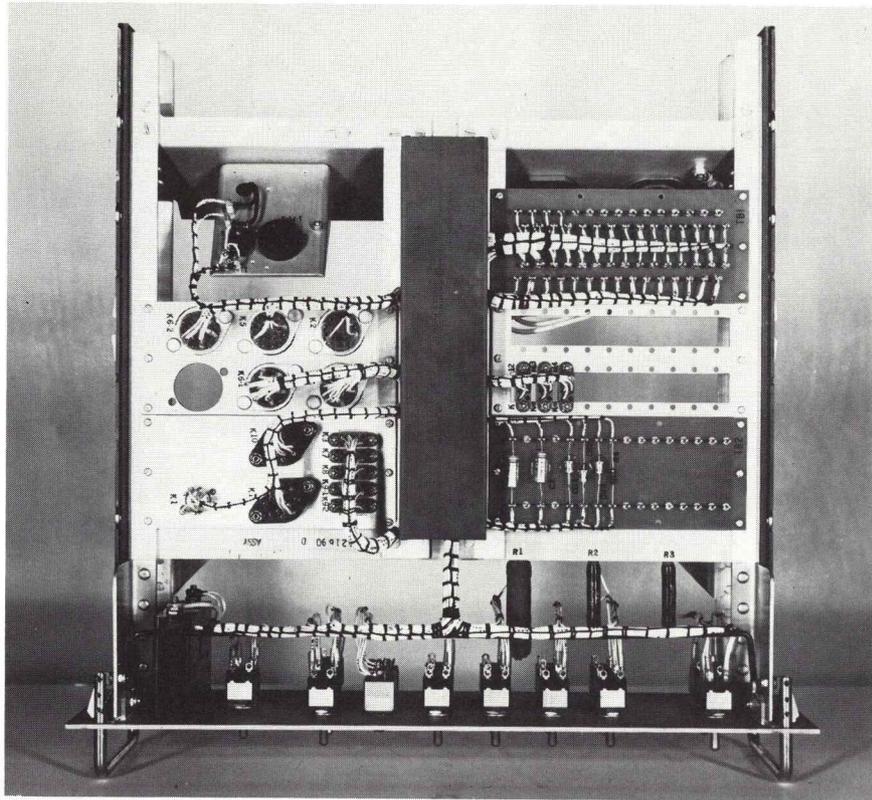
The function of this rack is to provide a distribution center to collect all of the sequence event signals to be recorded and route these signals to appropriate channels on the recorders.

This rack also distributes the recorder control signals.



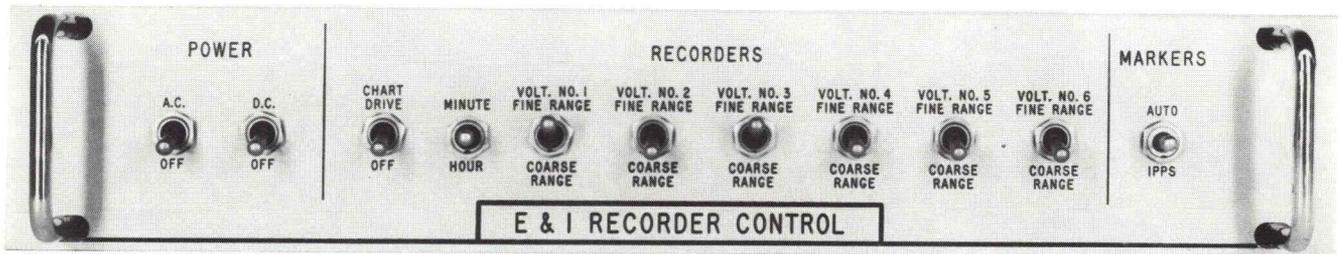
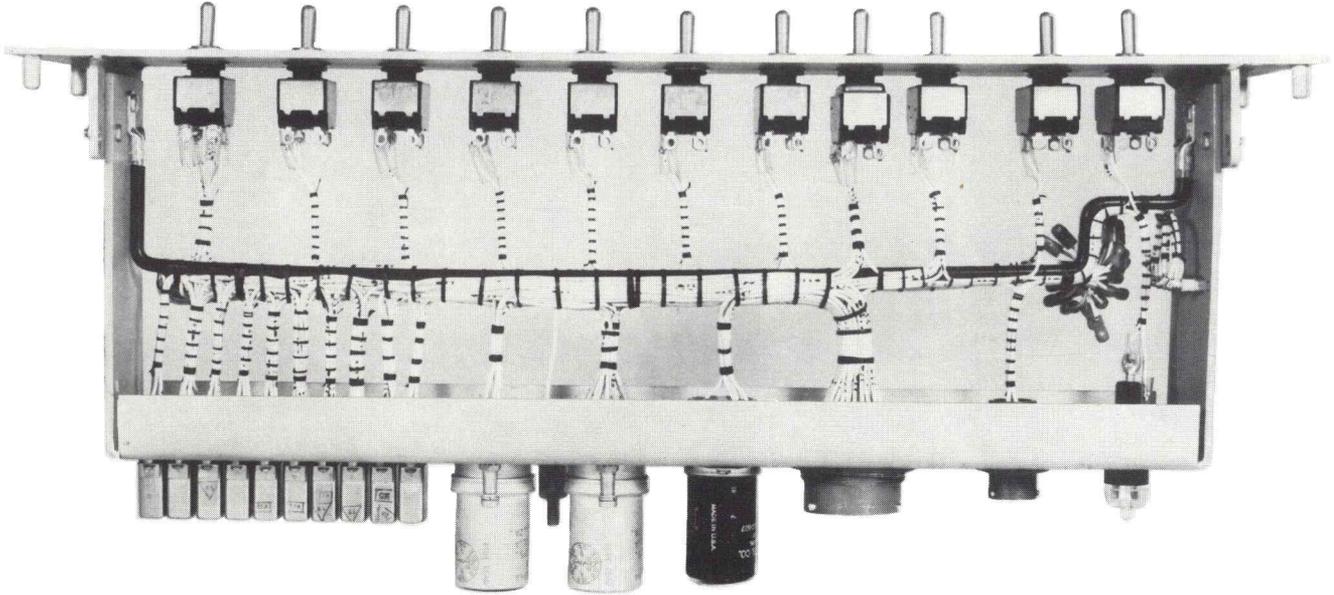
### MASTER RECORDER CONTROL PANEL (132A16)

This panel provides the capability of operating all recorders simultaneously. This eliminates the need for an operator at all four systems during the "fast speed" portion of a test.



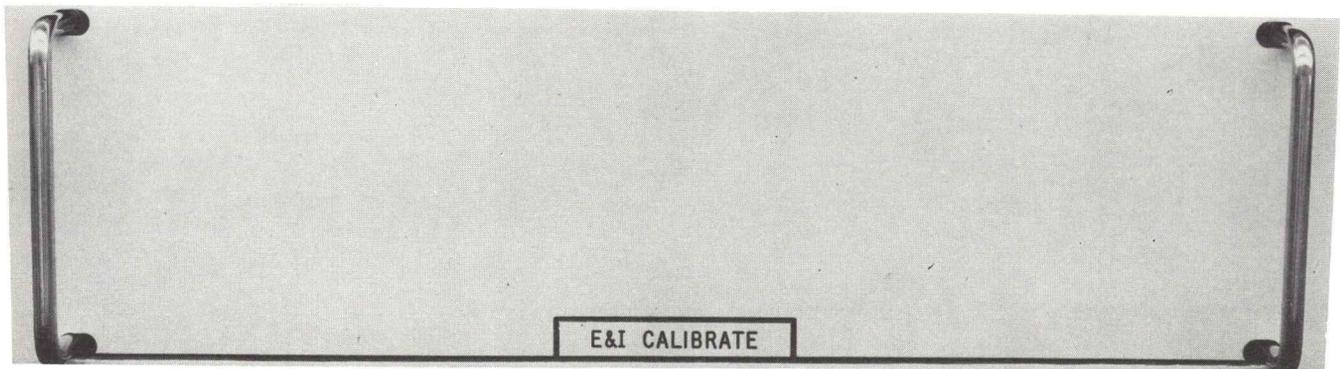
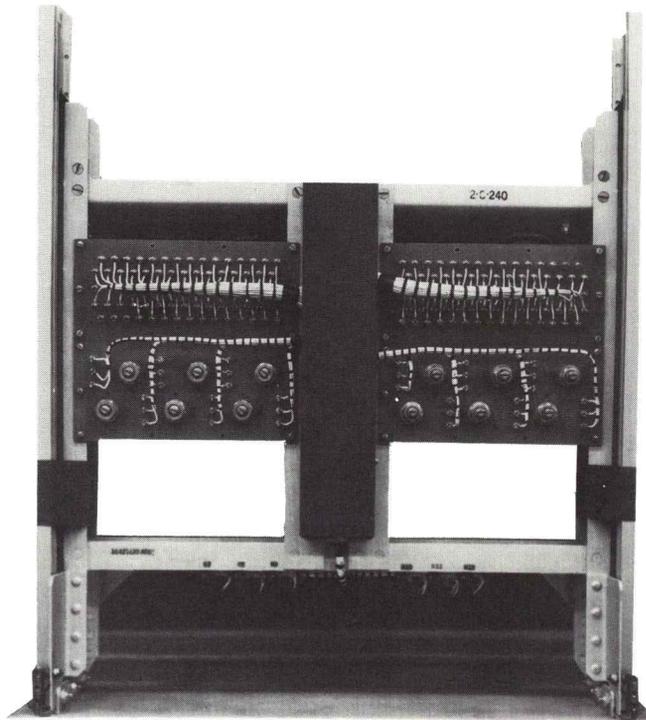
## EVENT RECORDER CONTROL PANEL

The function of this panel is to furnish power and to control the chart drive speed of 16 event recorders.



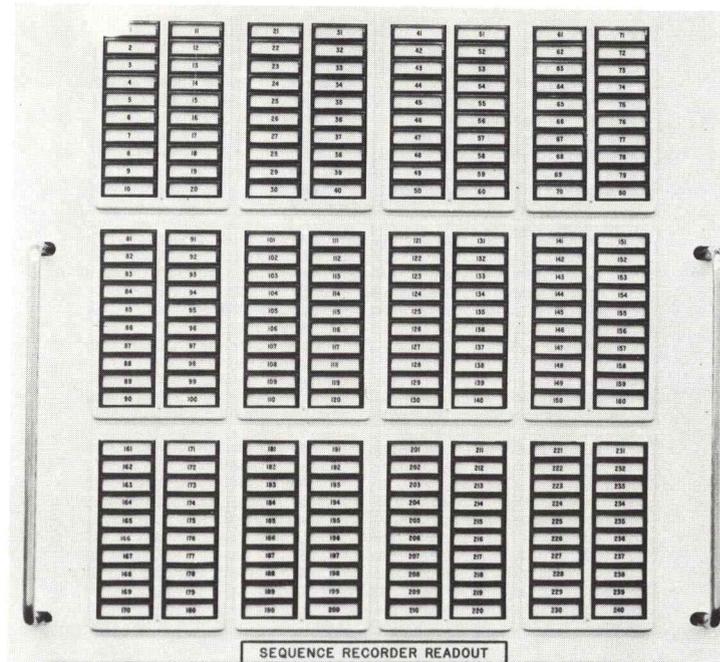
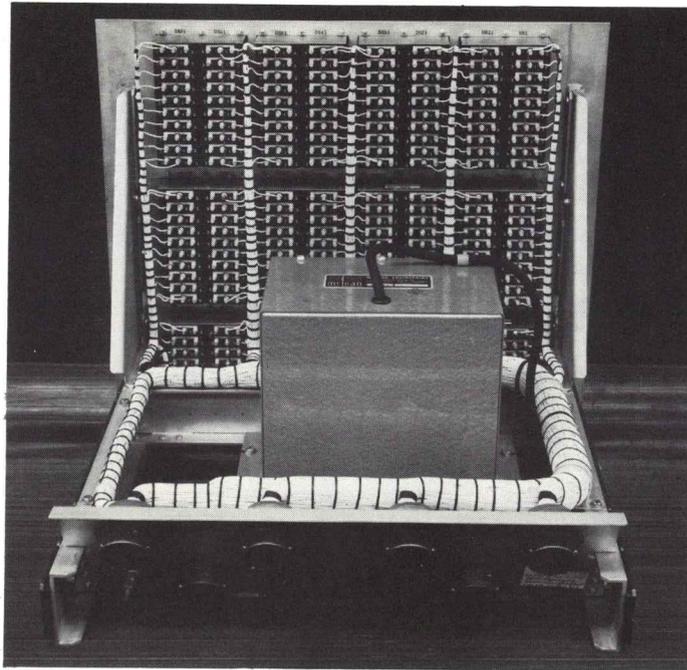
## E & I RECORDER CONTROL PANEL

This panel provides controls for the voltage and amperage recorders.



### **E & I CALIBRATE PANEL**

The function of this panel is to compensate for excessive line resistance because the voltage and current measuring recorders can not accurately record a signal when resistance of the line being recorded is beyond the recorder's calibration limits.



## SEQUENCE RECORDER READOUT PANEL

This panel provides 240 lights to indicate which channels of the event or sequence recorders are recording.

# **SDF**

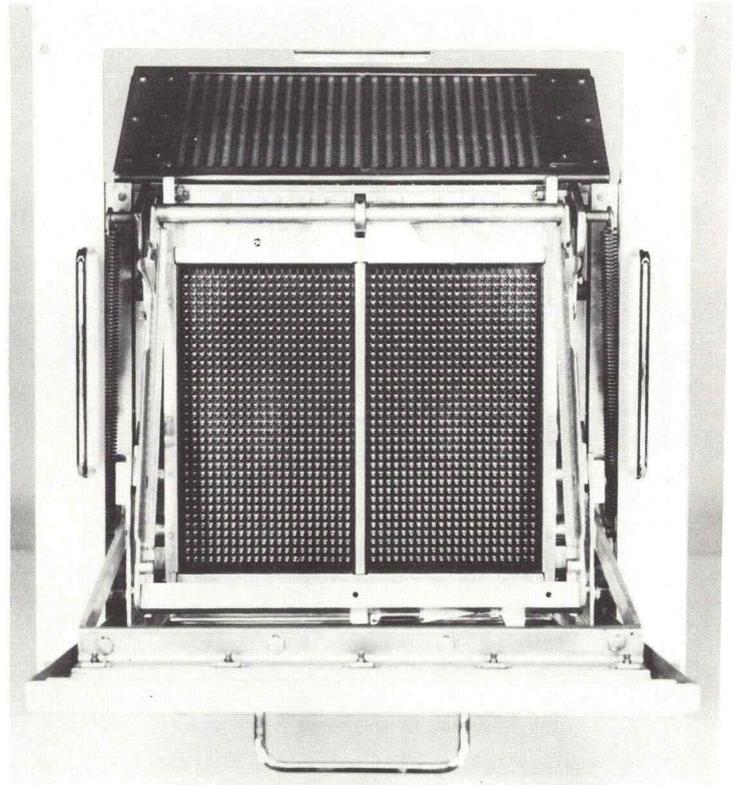
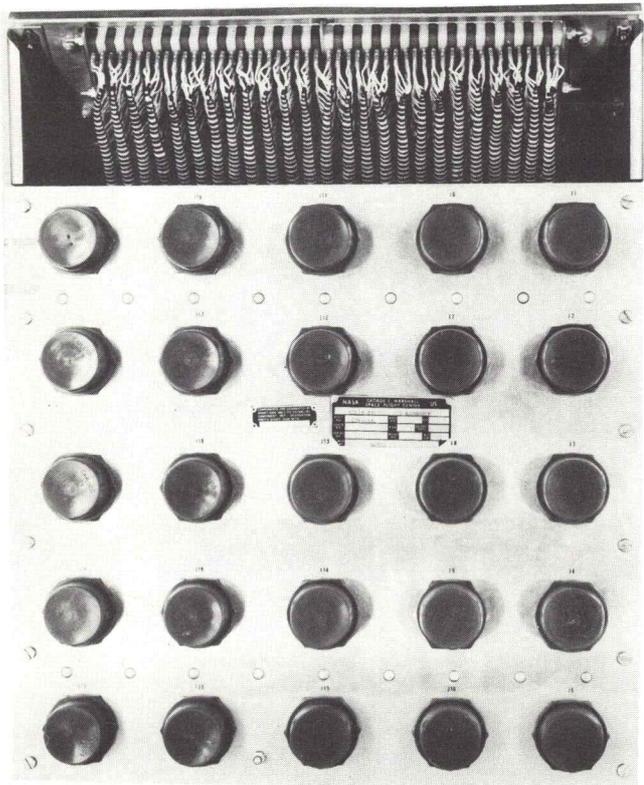
## **SYSTEMS INTEGRATION**

This equipment provides the means to interface between the S-1, S-IV and IU Stages. It also provides the means to interface between the ESE and the RCA-110A Computer. This equipment further provides means to perform functions concerned with the integrated vehicle system not performed by the individual stage ESE.

No photographs available

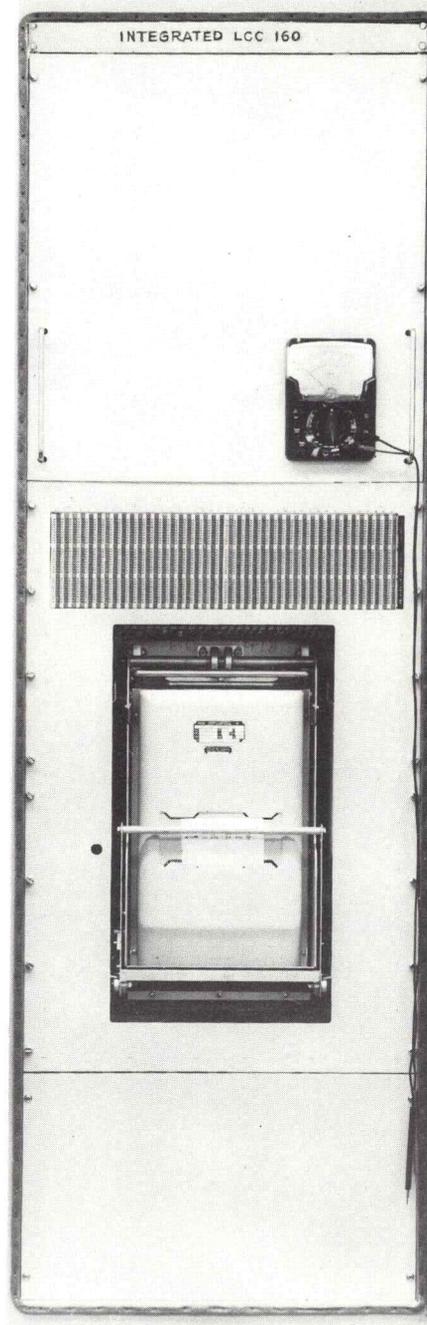
### **INTEGRATED AGCS PATCH RACK 89**

This rack consists of a 25 plug distributor and provides a means of distributing control and monitor circuits related to the Automatic Ground Control System (AGCS). A meter panel (VOM) is located in this rack for the purpose of testing these circuits.



### RELAY DISTRIBUTOR PANEL 25 PLUG (89A1)

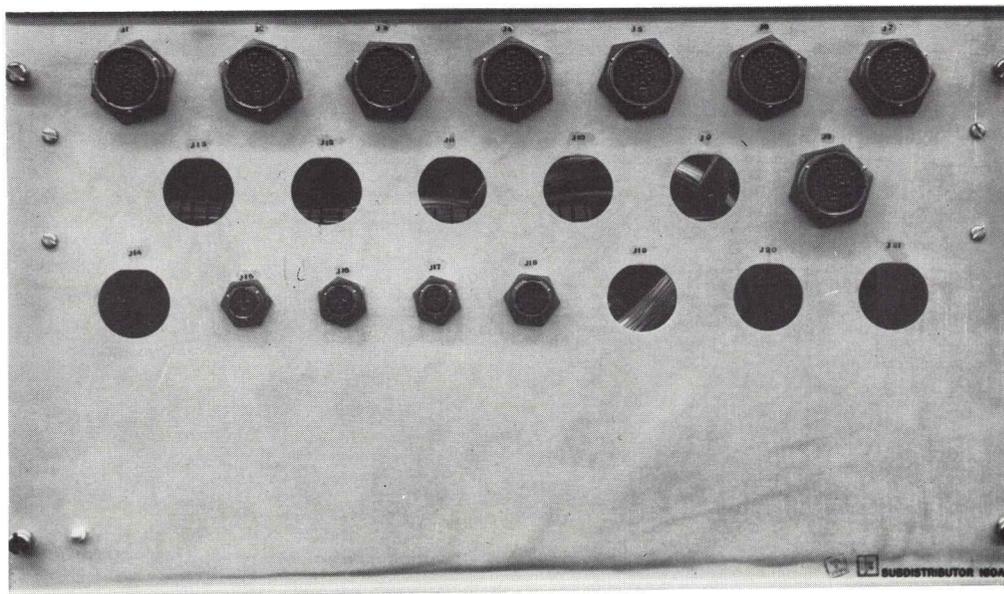
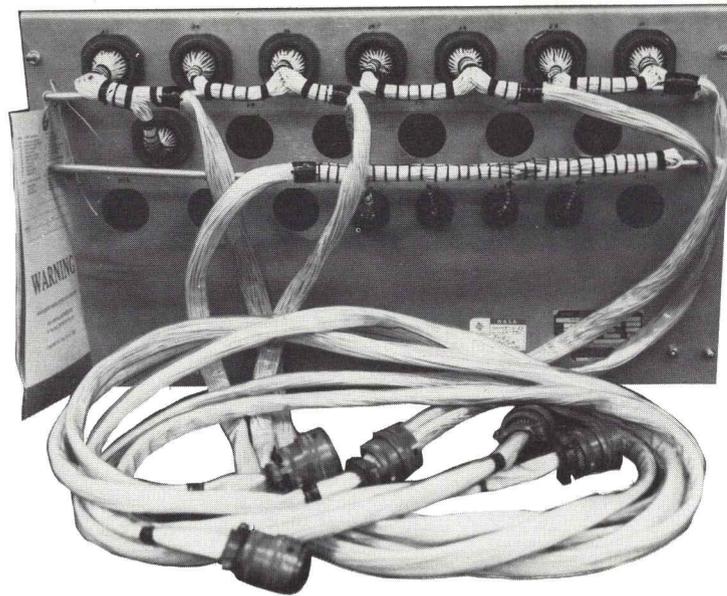
This panel is designed to be mounted into a 19-inch wide relay rack, however, by the addition of 2 standard side brackets this panel becomes compatible with the 24-inch relay rack. A 1496 pin removable patchboard serves as a quick change program board for the circuits passing through the twenty five 61 pin connectors.



### **INTEGRATED LCC PATCH RACK 160**

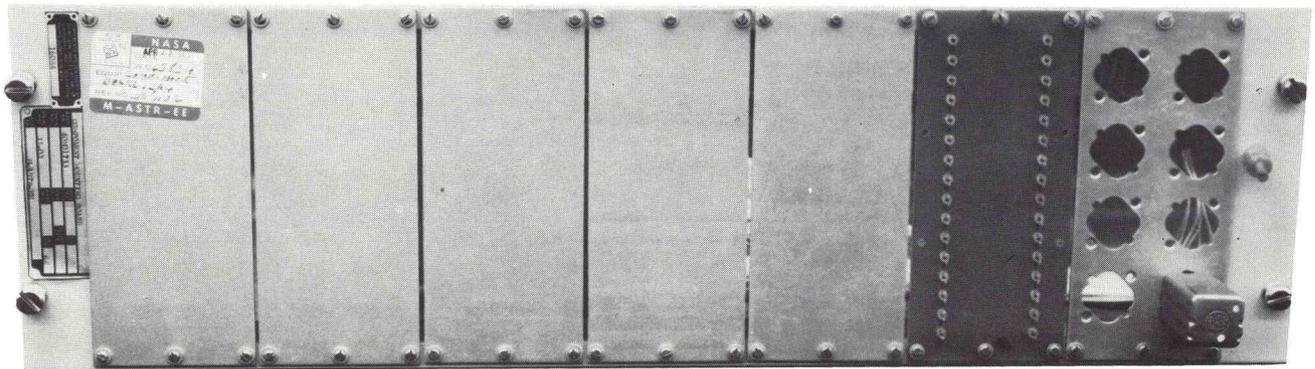
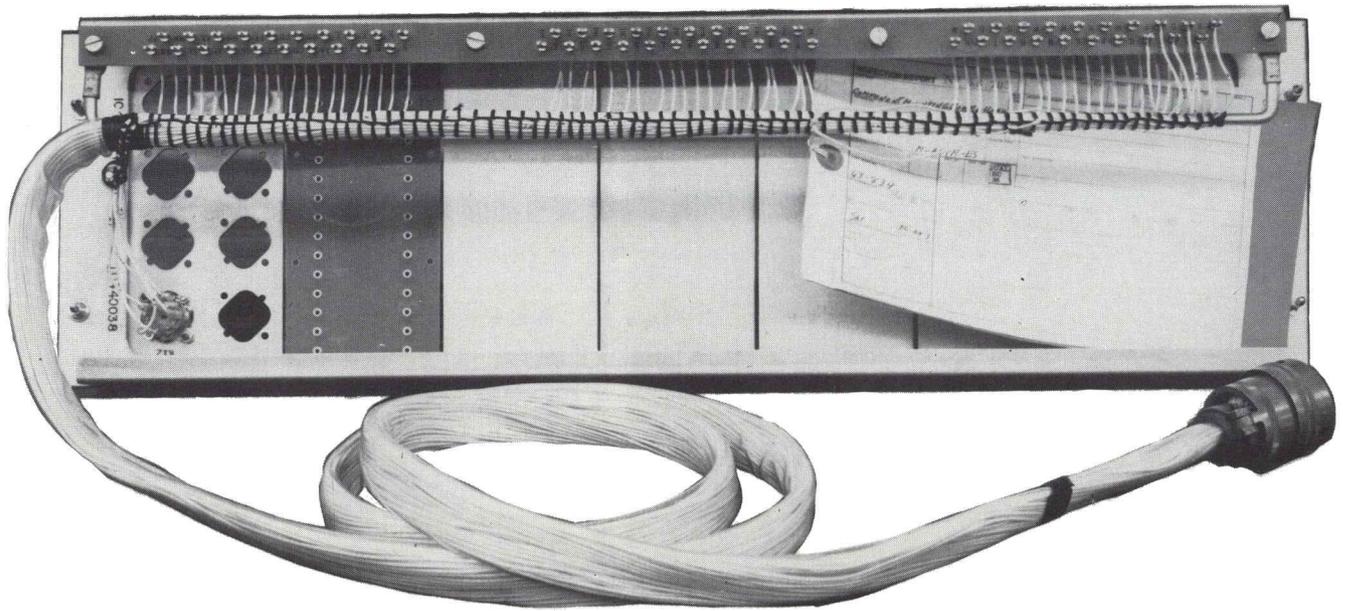
This rack consists of a 42 plug distributor and provides a means of distributing circuits related to the LCC.

A meter panel (VOM) is located in this rack for the purpose of testing these circuits.



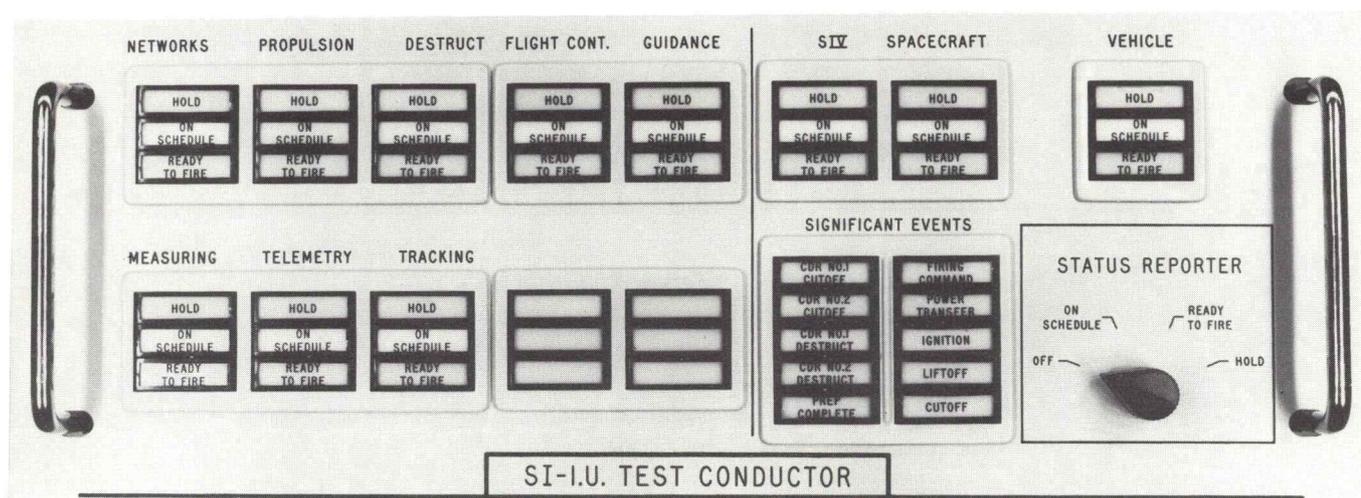
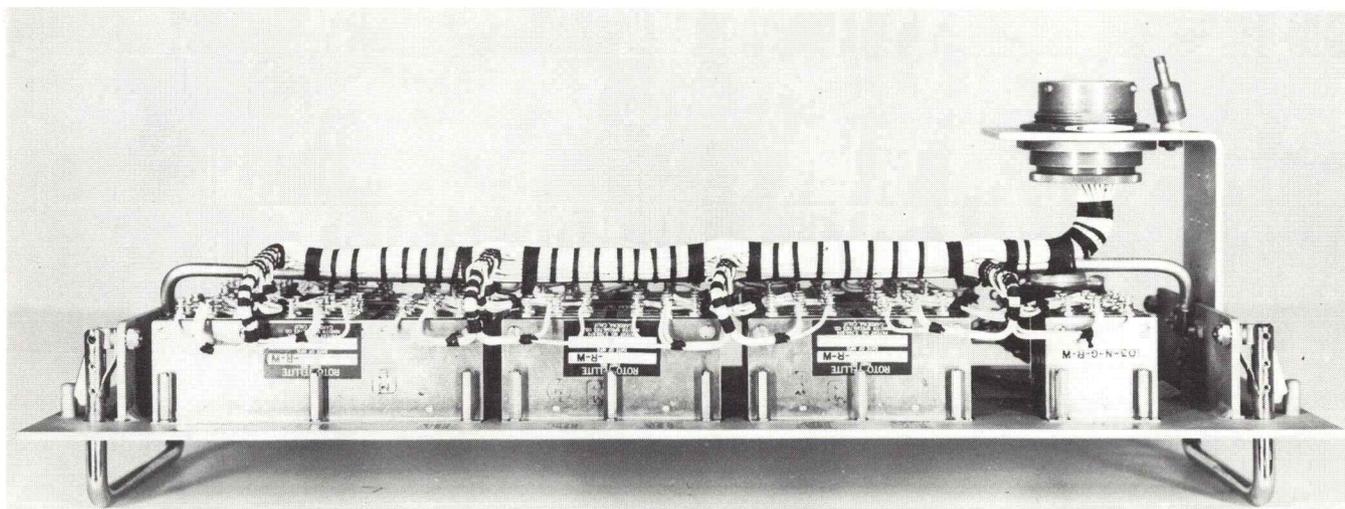
### SUB-DISTRIBUTOR PANEL (160A2)

This panel contains groups of several sizes of connectors. Each group is wired to a pigtailed 61 pin plug. This plug, when required, is patched to the Distributor Panel (160A1). The smaller connectors then match the mating connectors in the Integrated Patch Rack (LCC).



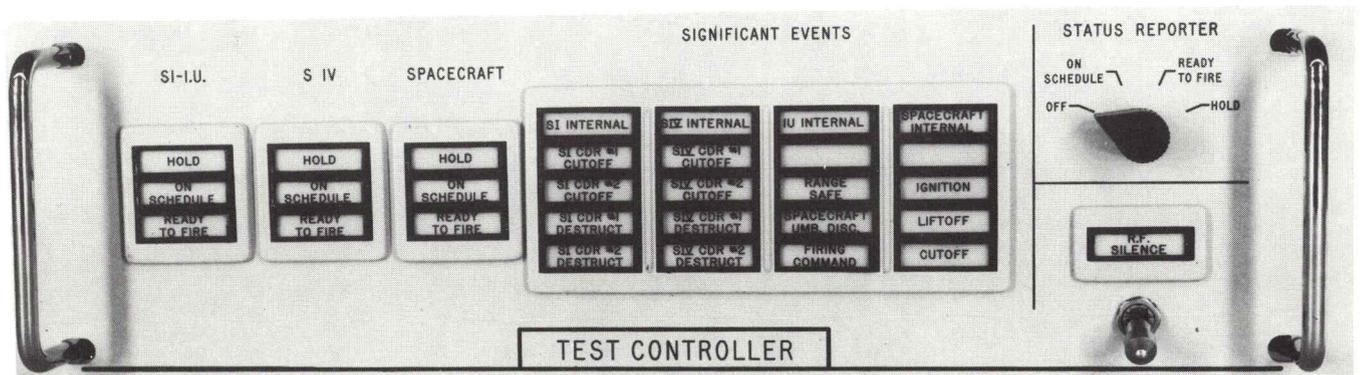
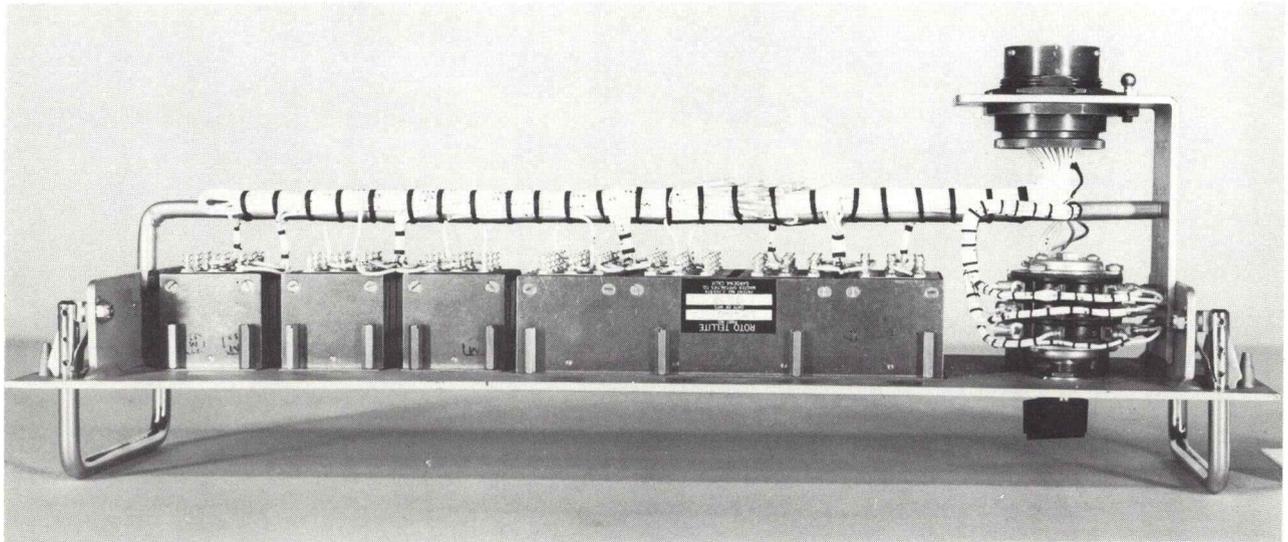
### COMPONENT MOUNTING PANEL (160A4)

This board is mounted in the rear of the Systems Integration Patch Racks 160 and it facilitates mounting of special electrical and electronic components used within this rack.



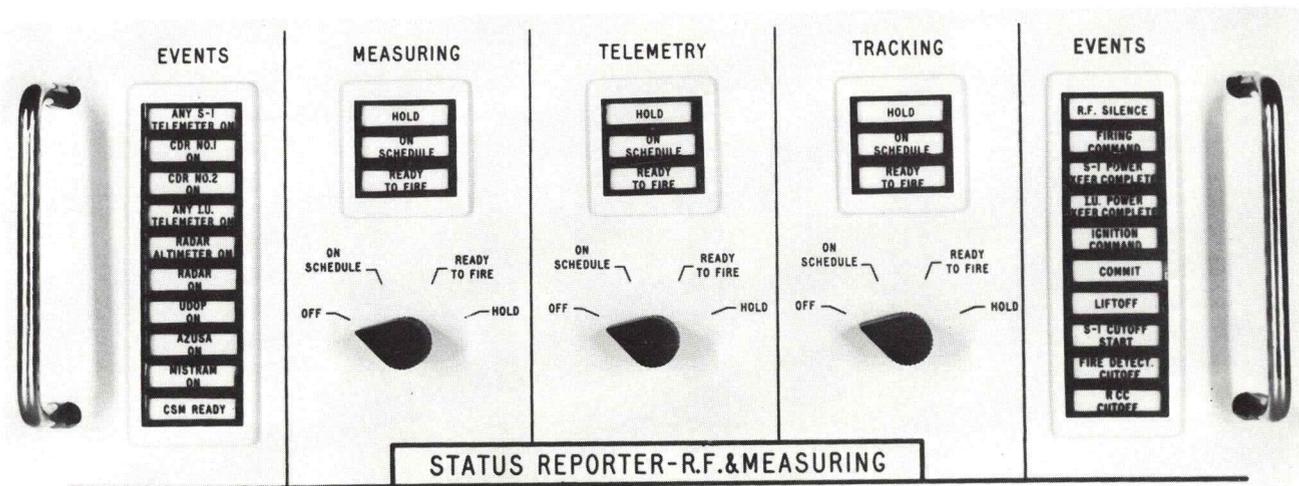
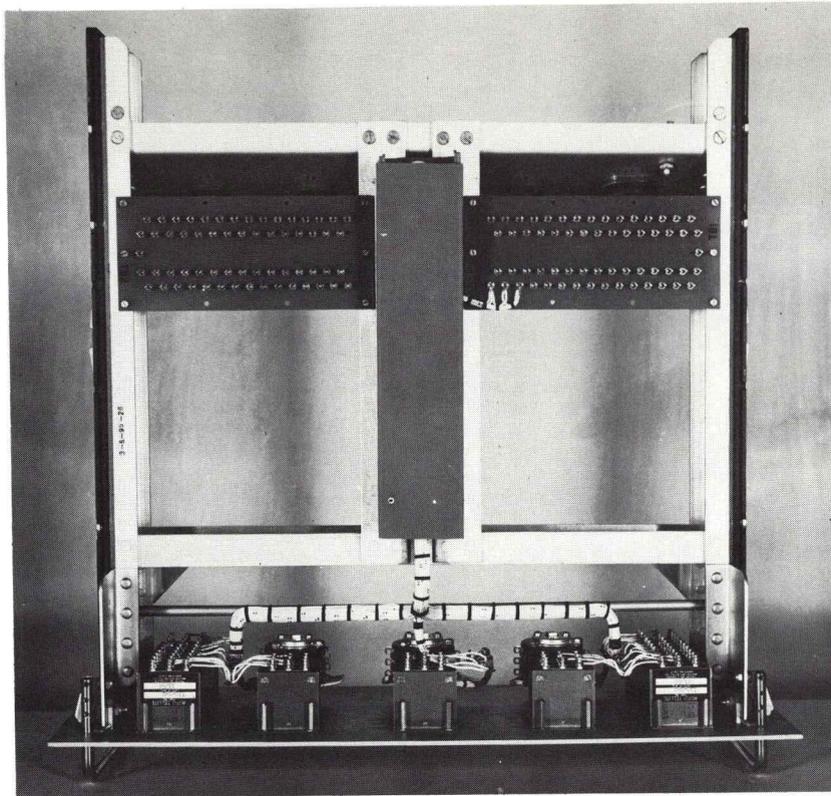
### S-1 IU TEST CONDUCTOR PANEL (137)

This panel provides the S-I/IU test conductor a centralized monitor station of various sub-systems, such as the Propulsion, Networks, Destruct, Flight Control, Guidance, Measuring, Tracking and Telemetry Areas. From these indications reporting is accomplished and reported with status selector to the Test Supervisor. Information is also displayed on lamps indicating the status of other vehicle stages and significant events in the S-1 and IU countdown.



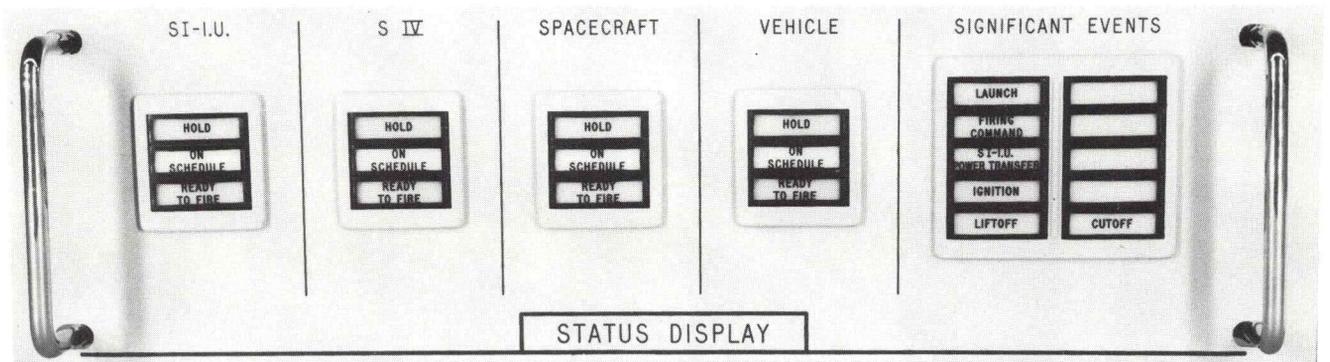
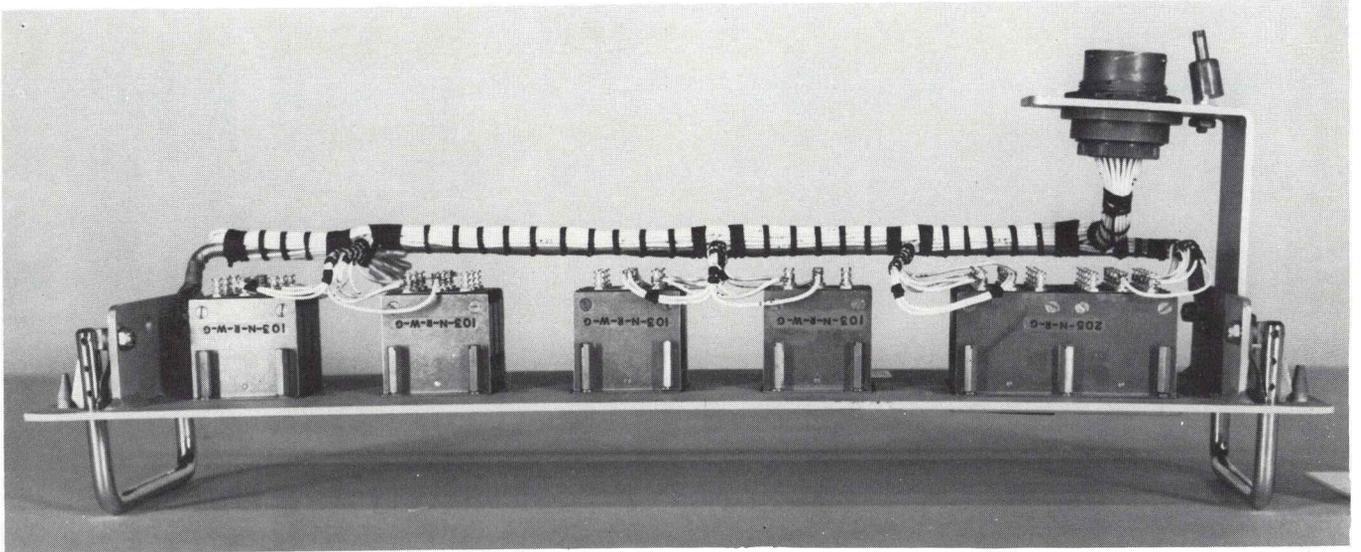
### TEST CONTROLLER PANEL (122A1)

The Test Controller is responsible for coordinating the entire vehicle countdown and launch operation. This panel provides an indication of the status of the S-I, S-IV, IU and spacecraft. From this information, vehicle status reporting is accomplished by use of the status reporter switch to the Launch Director and various Test Conductors. This panel centralizes for the Test Controller and the stage checkout status during the vehicle countdown. In addition, a switch and indicator light is provided by which RF Silence Condition at the launch complex may be established and monitored.



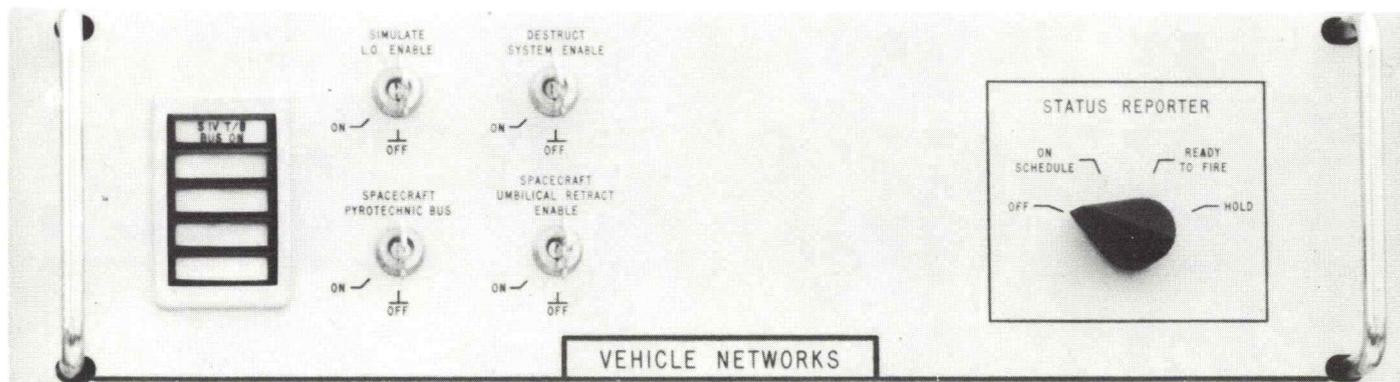
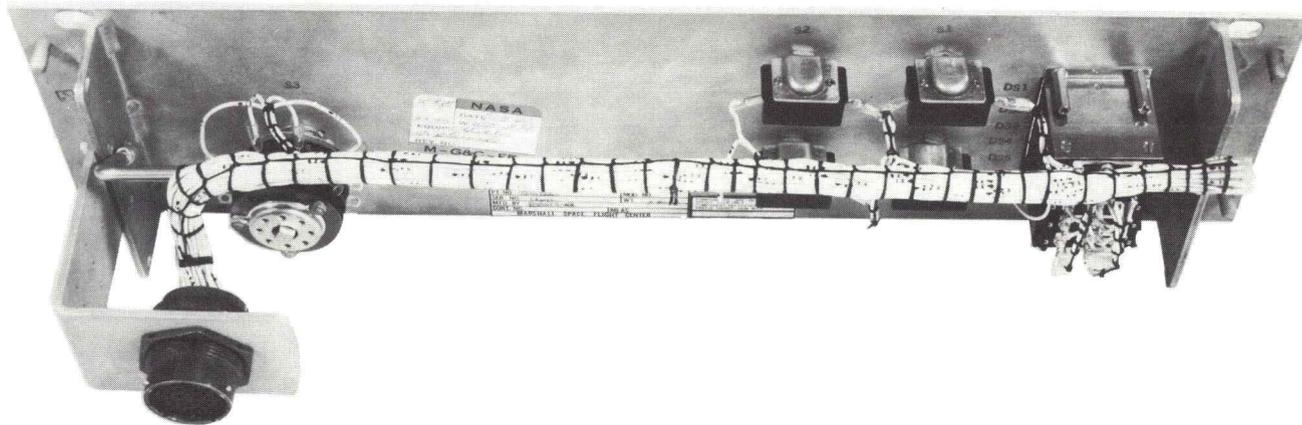
### STATUS REPORTER-RF & MEASURING PANEL (156)

This panel centralizes the RF and measuring system status of the significant events in the countdown status reporting by means of switches on the measuring, telemetry and tracking systems.



### STATUS DISPLAY PANEL (120A1 & 120A2)

This panel displays events similar to those on the Test Controller panel. One of these panels is utilized by the Launch Director, and a second one is provided in the visitors and observation room in the LCC.



### VEHICLE NETWORKS PANEL (1004)

This panel provides control of electrical network functions which are related to more than one stage of the vehicle. It contains four keyed control-switches, a status reporter switch and necessary indicator lights.

# **SDF**

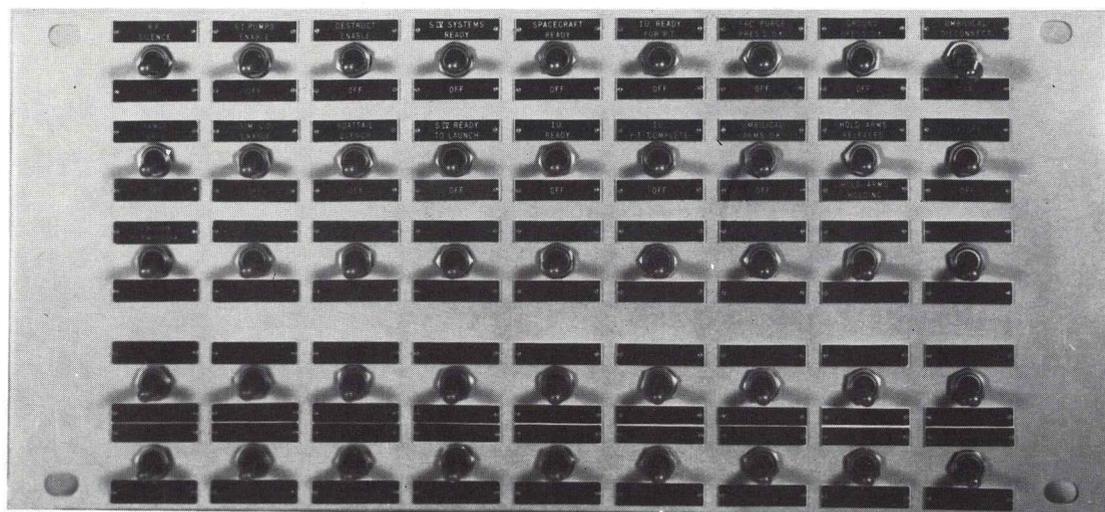
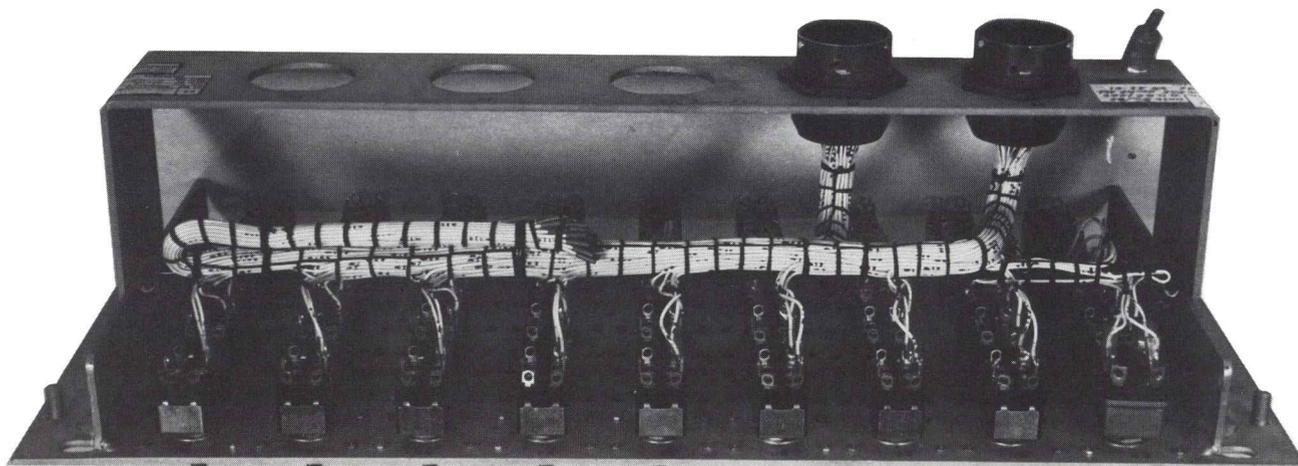
## **SPECIAL TEST EQUIPMENT**

There are several sets of equipment that are supplied to verify the Saturn Vehicle Electrical Systems and the ESE. These test sets are used in various areas of checkout as required and do not necessarily form a part of the equipment used to launch the vehicle.

No photographs available

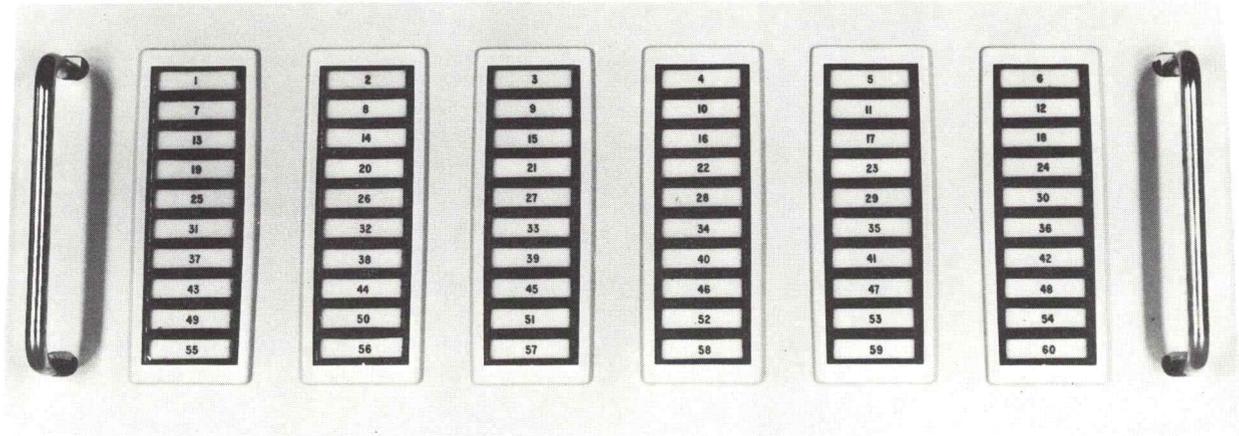
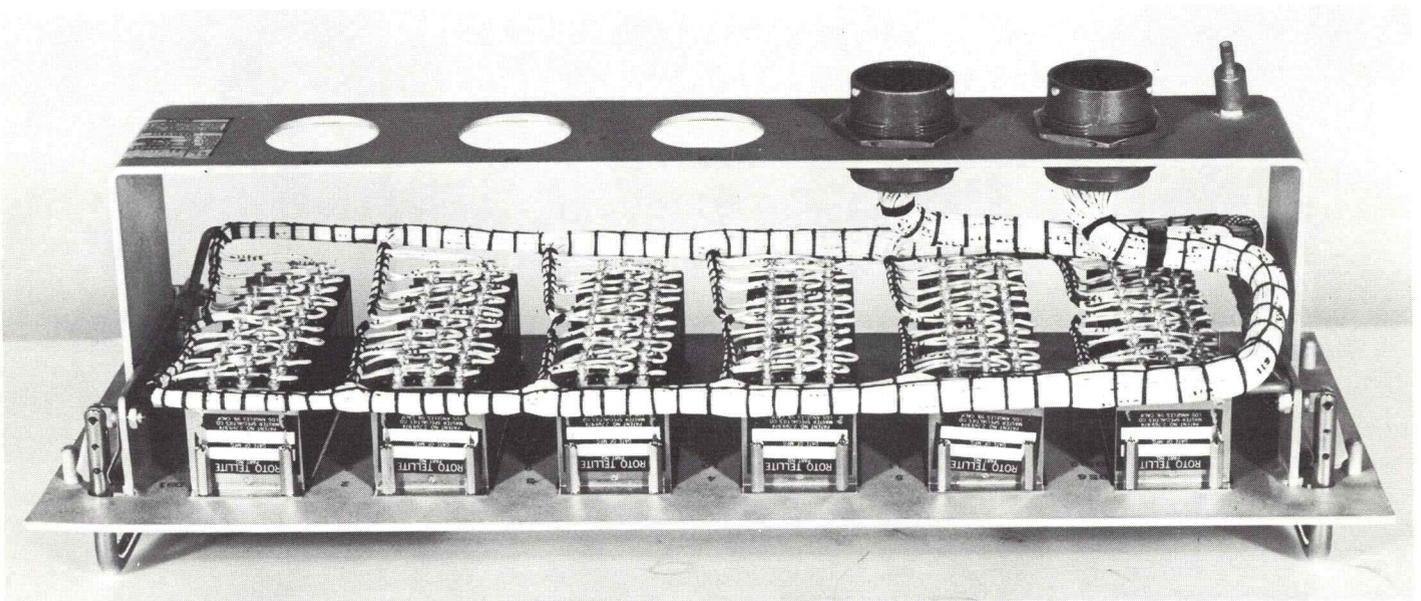
### **ESE SUBSTITUTE S-1 TEST RACK 293**

This equipment supplies signals, such as, 3000 psi pneumatic pressure, water purging, and S-IV Stage and Spacecraft ready signals not otherwise available in the system. In addition, this equipment can be used to accomplish either integrated system operation or individual stage operation to effect maximum utilization of the checkout facility. This equipment also substitutes for the AGCS Patch Distributor (89) in the SDF.



### SWITCH MODULE PANEL (293A2)

This panel contains switches wired to a connector. During the test phase, this module is patched into an associated system to give the capability of manual circuit control.



**LAMP MODULE PANEL (293A3)**

This panel contains lamps wired to a connector. During the test phase, this module is patched to a system to give visual circuit status.

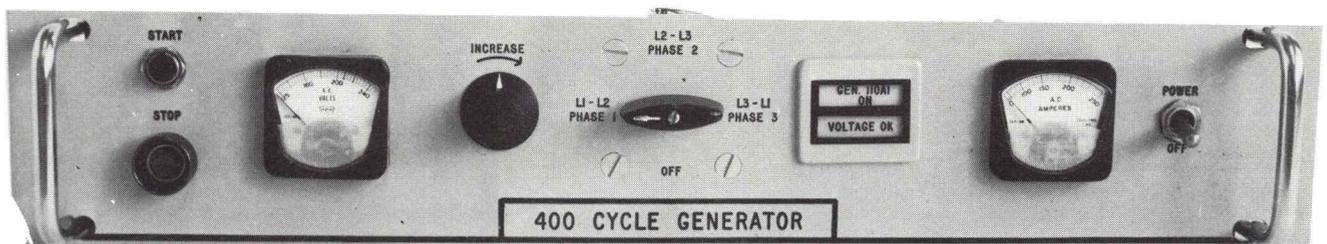
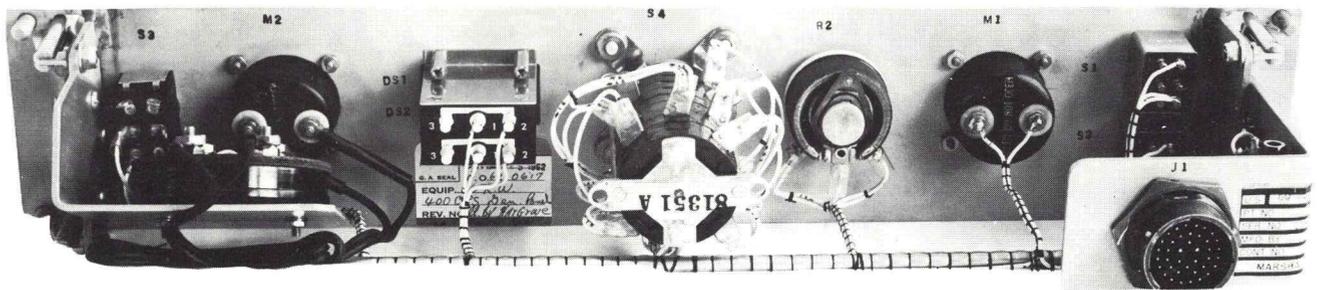
# **QUALITY LABORATORY ESE**

**STAGE 1 (S-1) CHECKOUT EQUIPMENT (2 SETS)**

# **QUALITY LABORATORY**

## **POWER SOURCES**

See pages 4 thru 11 and 155.



### 400 CPS GENERATOR PANEL (124A1)

This 3-1/2 X 19-inch panel is a standard panel used to control and monitor one 400 CPS, 3 phase generator. Push buttons for starting and stopping are provided along with an indicator light to indicate "on" condition. An ammeter and voltmeter are provided along with a selector switch for monitoring each phase. An indicator light shows when voltage is within acceptable limits. A voltage adjust rheostat is provided for remote adjustment of generator voltage.

# **QUALITY LABORATORY**

## **POWER DISTRIBUTION**

See pages 12 thru 29.

# **QUALITY LABORATORY**

## **PROPULSION SYSTEM**

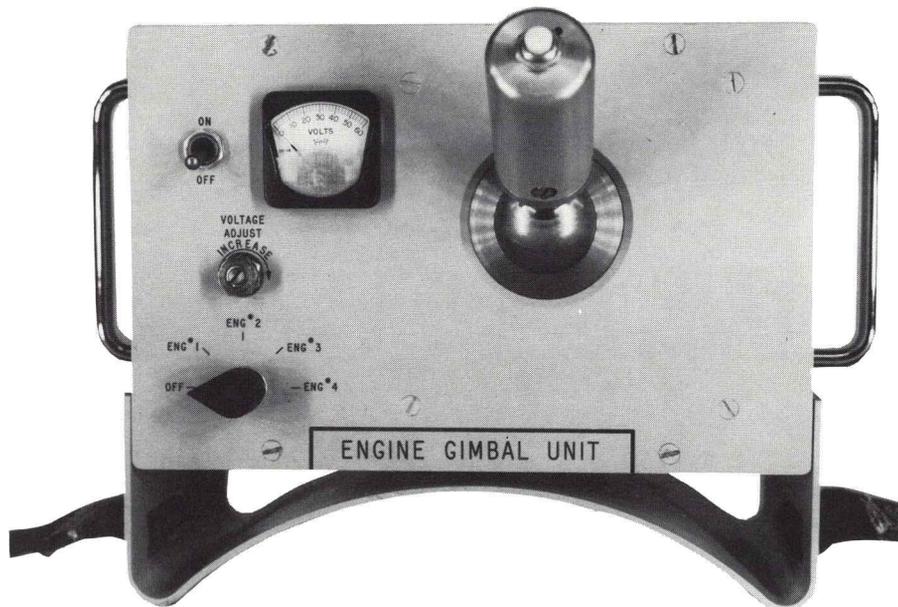
See pages 31 thru 54.

# QUALITY LABORATORY

## FLIGHT CONTROL SYSTEM

The function of the flight control system ESE is to electrically energize, control, monitor, and test the vehicle flight control system. This operation is accomplished by the assembly of several panels of interrelated or integrated functions. For example, operation of controls on one panel may cause readouts on one or more of the other panels. The equipment is used to functionally checkout and operate the vehicle flight control system at the static test areas and at the launching areas.

See pages 48 thru 54.



### ENGINE GIMBAL UNIT

This portable unit is used for S-1 Stage engine checkout. It provides local control of the H-1 type engine actuators, and can gimbal any one of the engines to any position so that mechanical clearances and engine travel can be determined on the Stage.

# **QUALITY LABORATORY**

## **ORDNANCE SYSTEM**

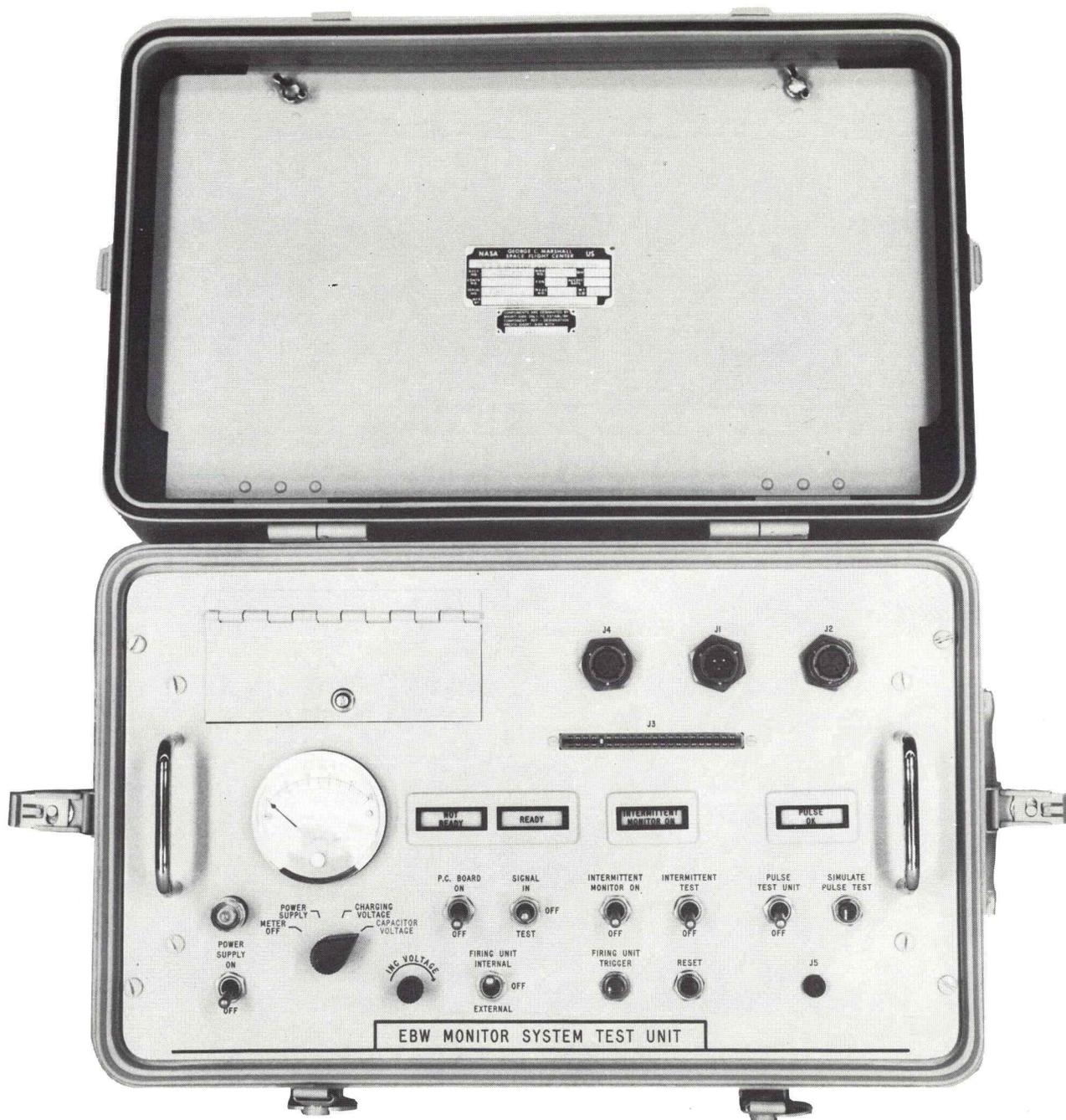
The ESE associated with the Ordnance System is designed to test and monitor the exploding bridge wire (EBW) firing units, the safe and arm unit destruct, and the destruct system controllers. The EBW units monitored are used to fire the retro-rockets, ullage rockets, separation bolts, and fuel dispersion primacord.

See Pages 55 thru 58.

No photographs available

### **EBW DESTRICT CONTROLLER TEST SET**

This panel automatically tests the Destruct Controller for wiring continuity, 100 megohm insulation breakdown, wiring shorts, component failure and the presence of the correct telemetering voltage and current.



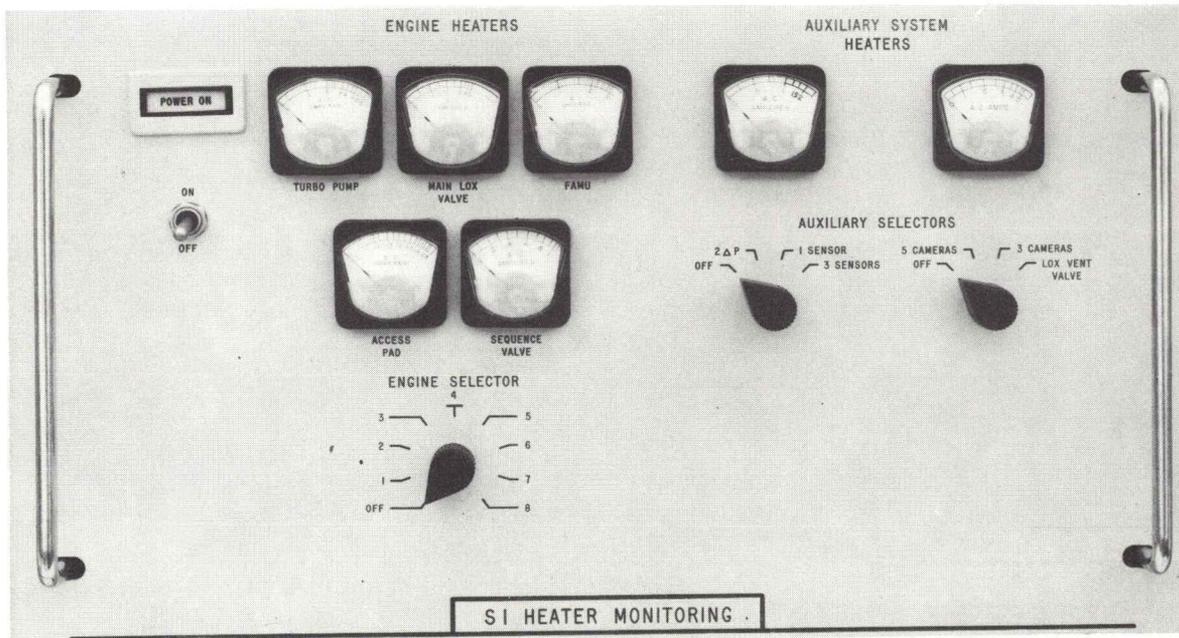
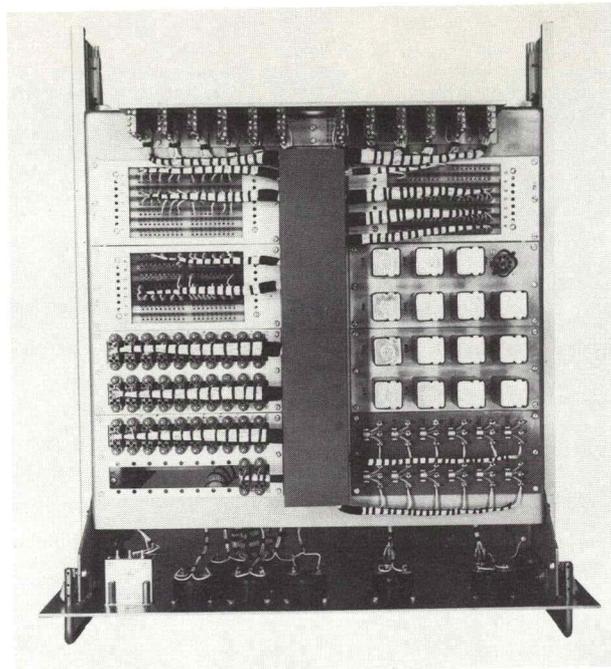
## EBW MONITOR SYSTEM TEST UNIT

This test unit is used to troubleshoot the EBW system variable voltage firing unit. It is used to vary charge for checking purposes and is designed to facilitate checkout of pulse sensors and printed circuit cards.

# **QUALITY LABORATORY**

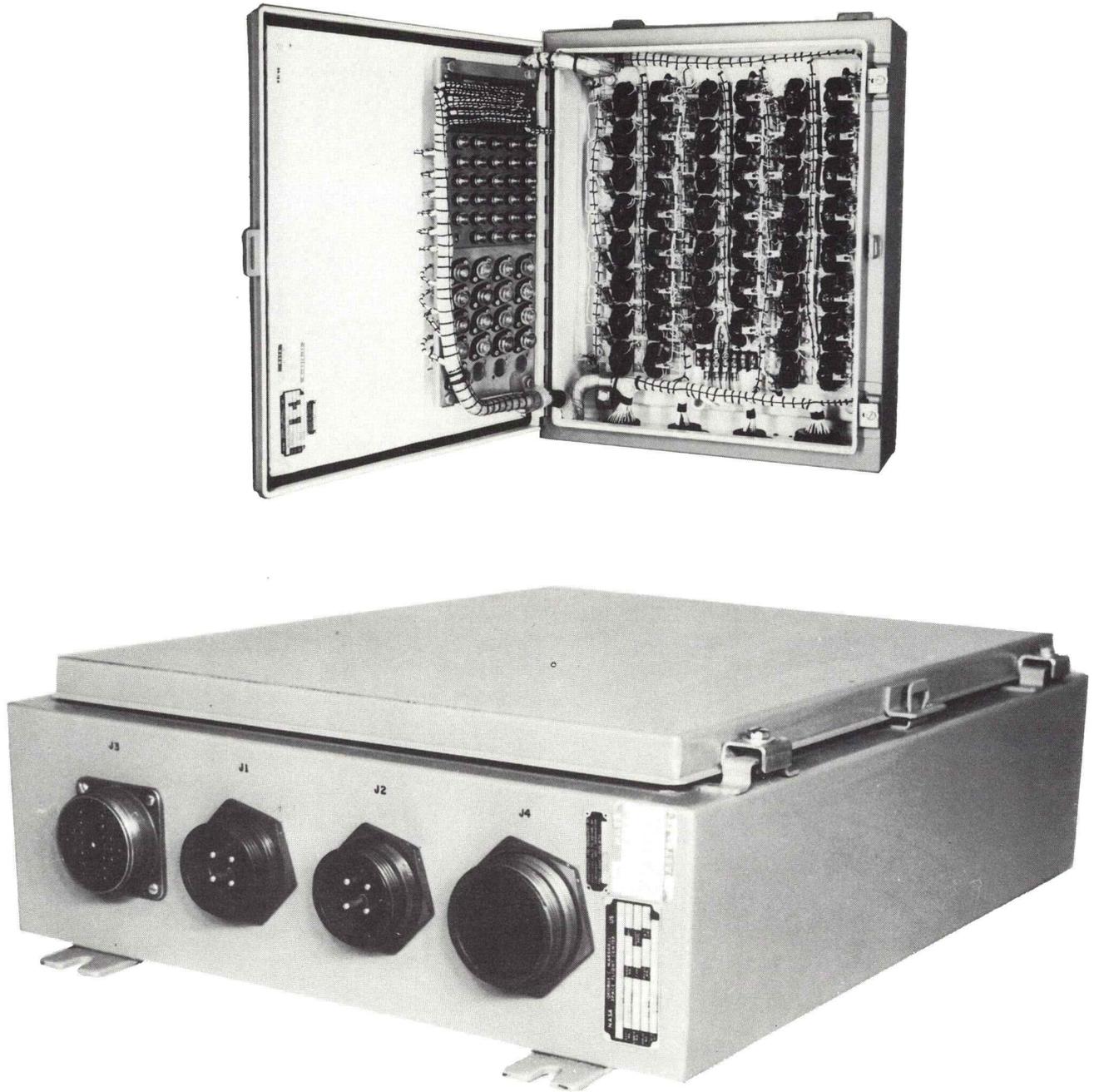
## **ENVIRONMENTAL CONDITIONING SYSTEM**

The ESE is associated with the IU Stage environmental conditioning controls, and monitors the nitrogen to the Stabilized Platform and the nitrogen cooling system. It also controls and monitors the engine heaters and auxiliary system heaters.



### S-1 HEATER MONITORING PANEL (247A1)

This panel, when used with the Heater Sensing Unit, provides a means to measure the current flow to any of the forty S-1 Stage engine heaters and some auxiliary system heaters. The panel furnishes a discrete signal to the event recorders when a heater is energized.



### HEATER SENSING UNIT (53A68)

This unit senses the current flow in the engine heaters. The current is read by the ammeters located on the Heater Monitoring Panel.

# **QUALITY LABORATORY**

## **NETWORKS SYSTEM**

See pages 59 and 60.

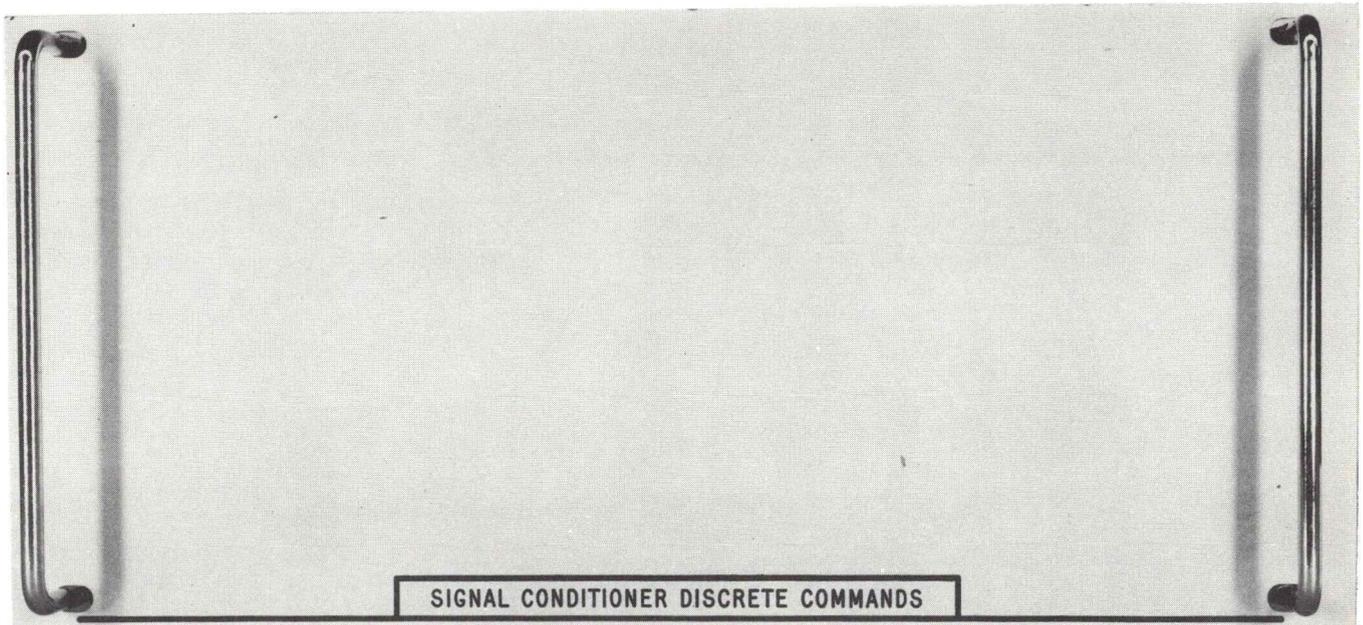
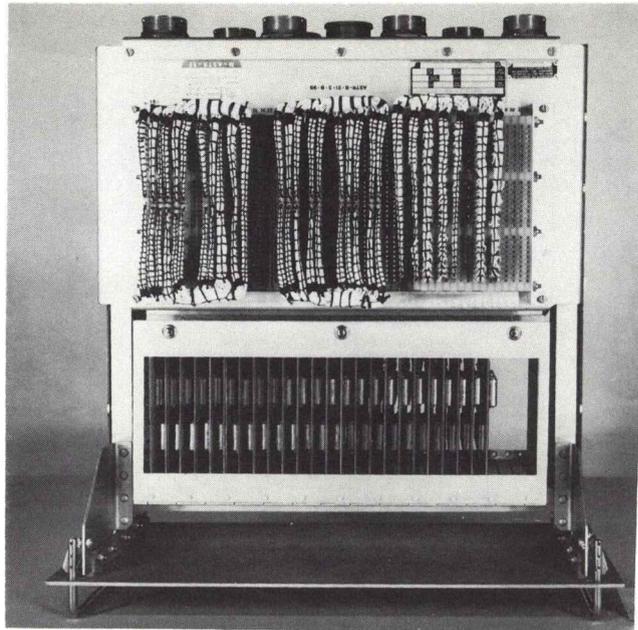
**QUALITY LABORATORY**  
**MEASURING AND TRACKING SYSTEMS**

See pages 61 thru 63.

# QUALITY LABORATORY

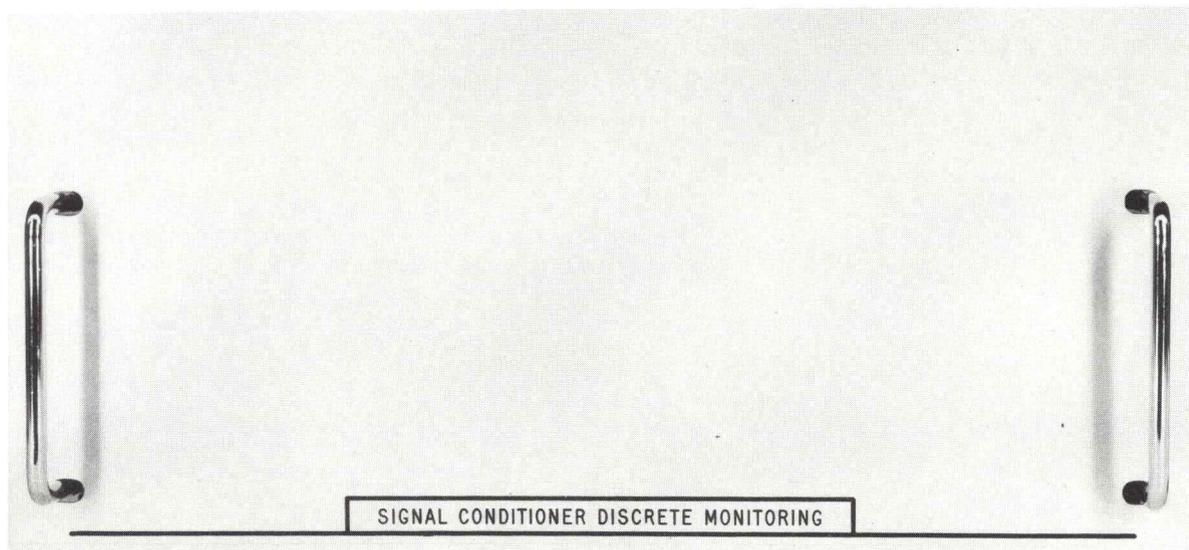
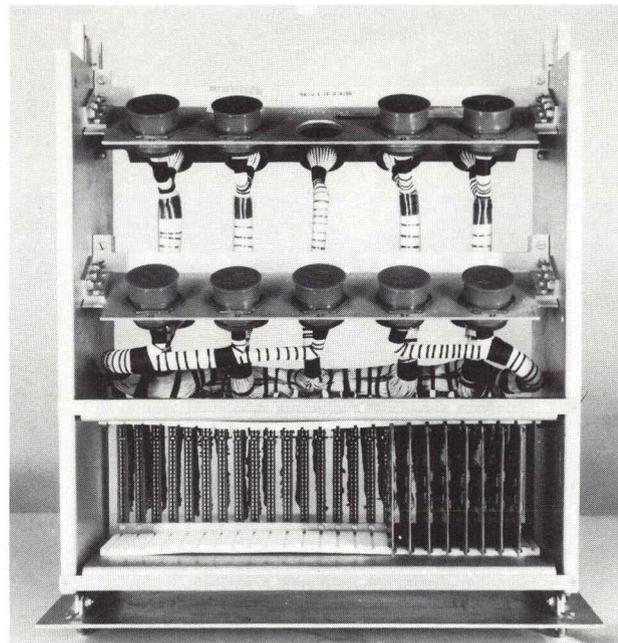
## SYSTEMS INTEGRATION

This equipment provides the means to interface between the S-1, S-IV and IU Stages. It also provides the means to interface between the ESE and the RCA-110A Computer. This equipment further provides means to perform functions concerned with the integrated vehicle system not performed by the individual ESE.



**SIGNAL CONDITIONER DISCRETE COMMANDS PANEL  
(165A2, A3, A4 AND 1008A2)**

The Signal Conditioner acts as a buffer between the ESE computer and the relays in the ESE. By using relays it allows the computer to apply the normally used ground buses to 240 lines and to switch these buses on and off with commands from the computer discrete output register.



## SIGNAL CONDITIONER DISCRETE MONITORING PANEL (165A5, 165A6 AND 1008A1)

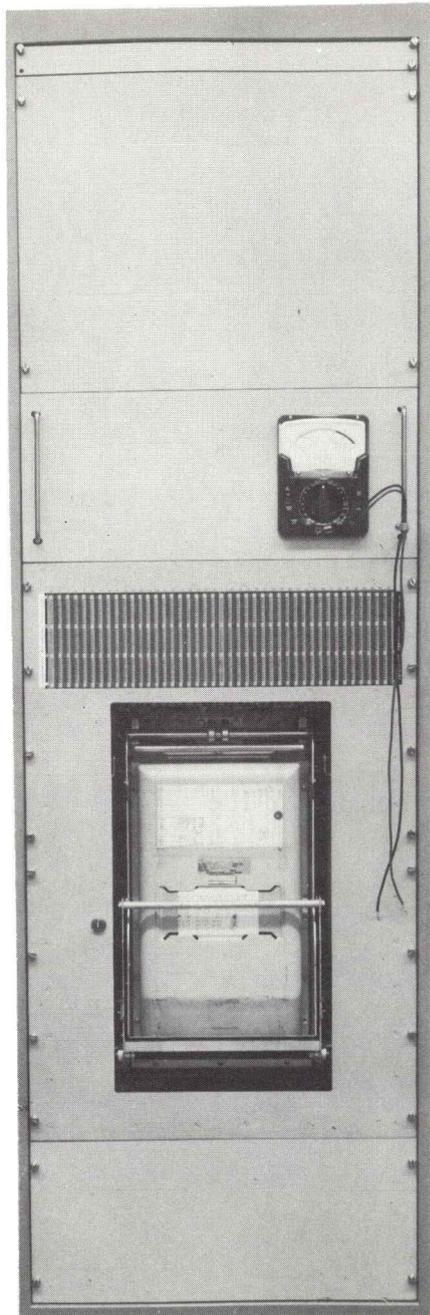
This panel provides signal conditioning for the 480 input lines into discrete input register of the computer.

The circuit used in the Signal Conditioner Discrete panels is designed to perform three primary functions:

1. To limit peak voltages applied to the discrete input register of the ESE computer to a maximum of 36 volts.
2. To prevent negative voltages from being applied to the discrete input register.
3. To conduct to ground any negative voltage spikes that may result from the inductive "kick-back" of a sequence pin or other device.

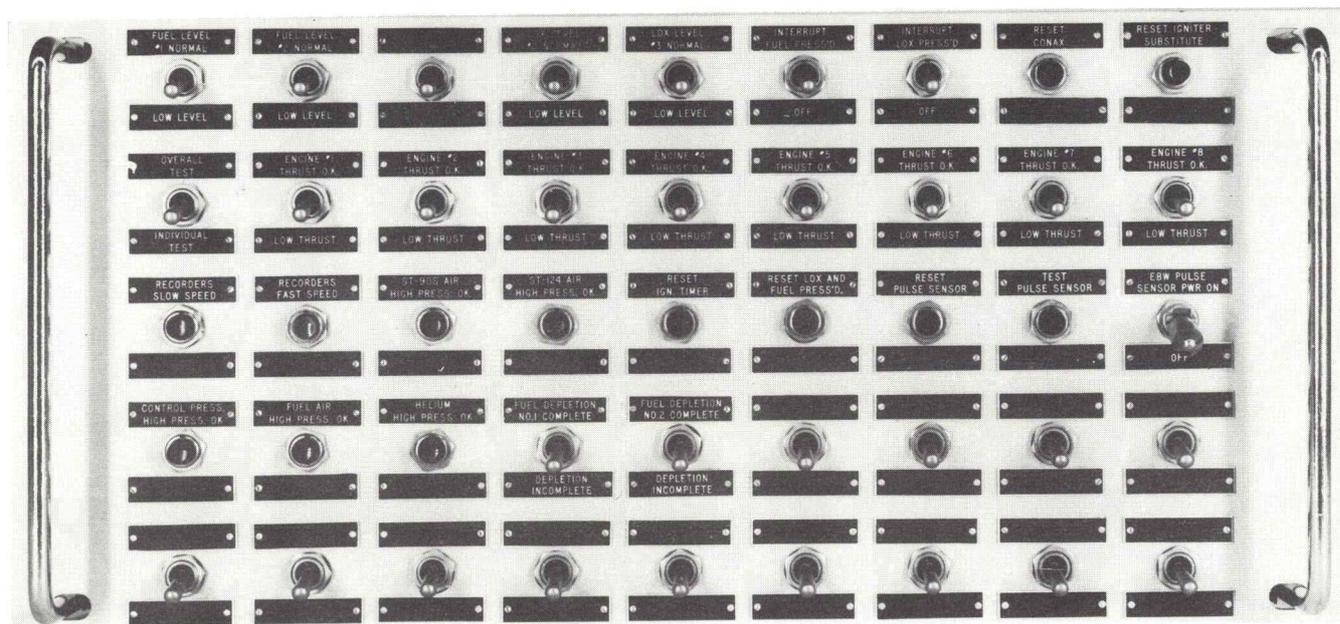
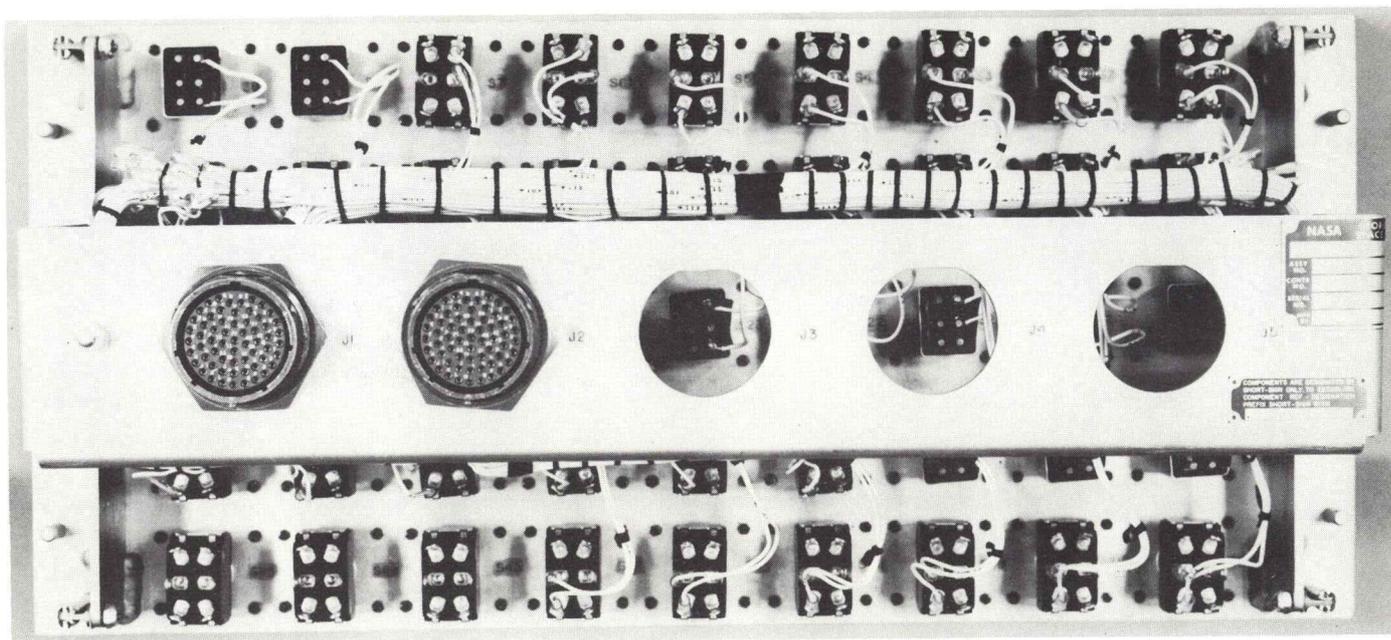
# **QUALITY LABORATORY**

## **SPECIAL TEST EQUIPMENT**



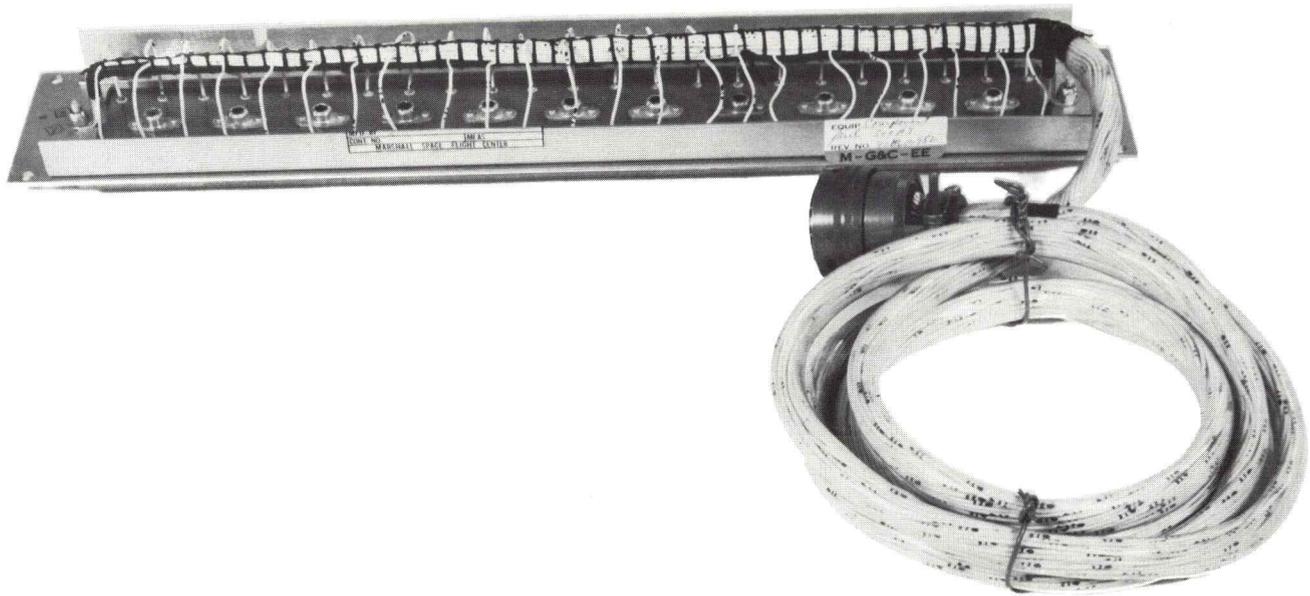
### **S-1 OVERALL TEST RACK 300**

This distribution rack is one of several racks required to make up the Overall Test System (OATS). These racks contain the panels that substitute for stage components and interfaces used during overall test.



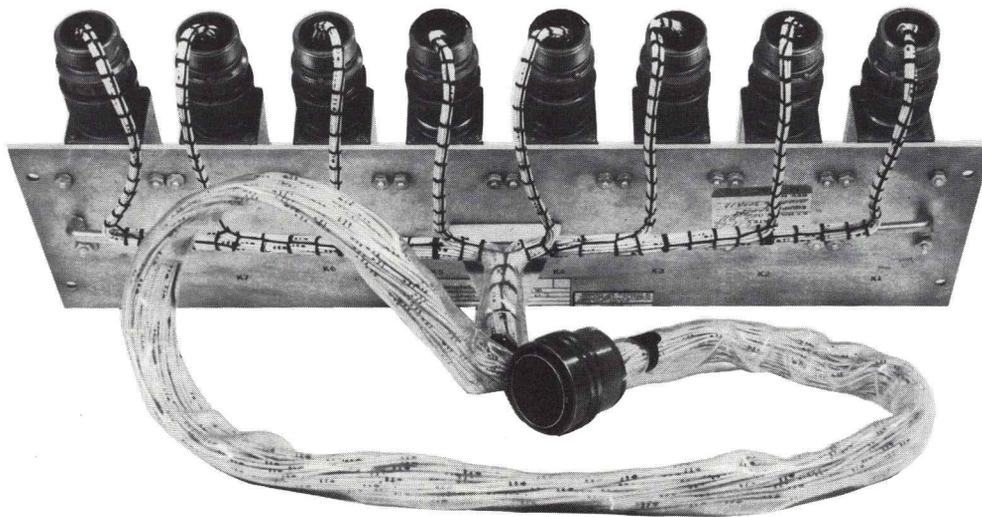
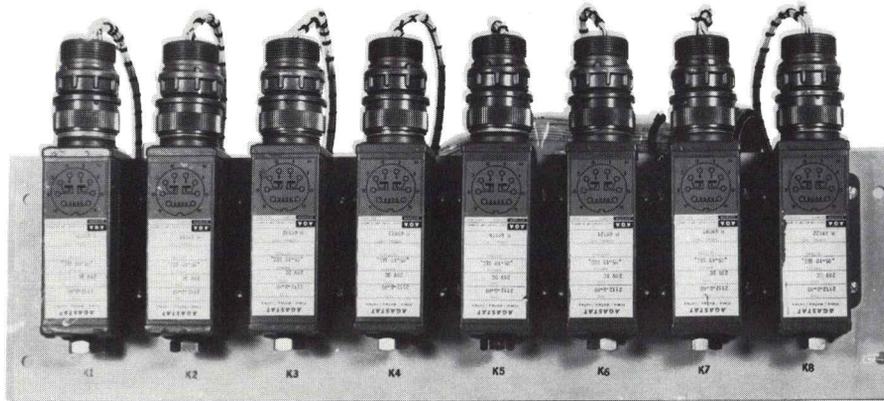
### SWITCH MODULE PANEL (300A4)

This panel consists of a number of switches wired to connectors. During overall test these switches simulate conditions that would normally be transmitted by components in the vehicle.



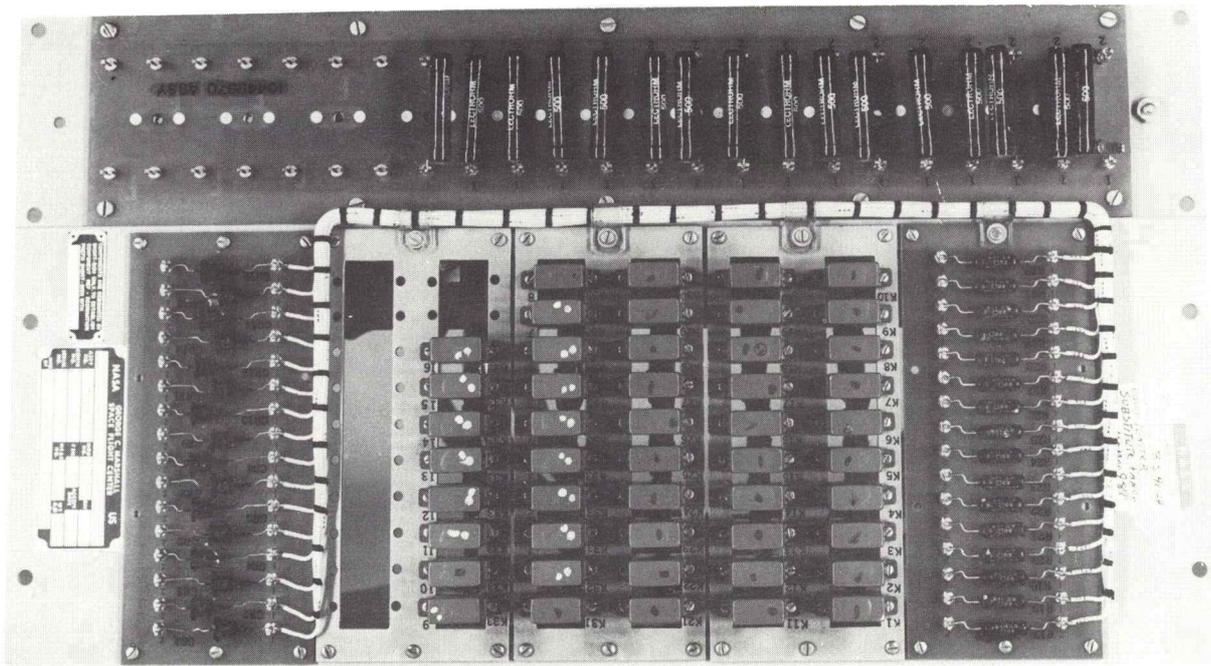
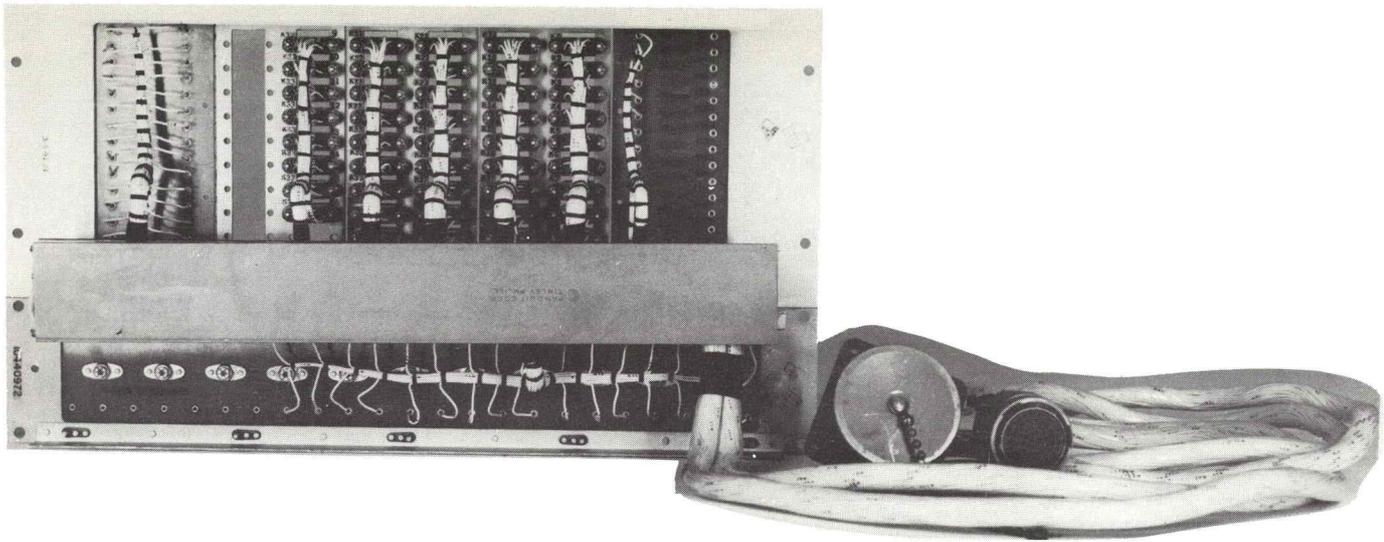
### COMPONENT PANEL (300A9)

This panel is mounted in the rear of the Overall Test Rack 300 and facilitates the mounting of special electrical and electronic components used within this rack.



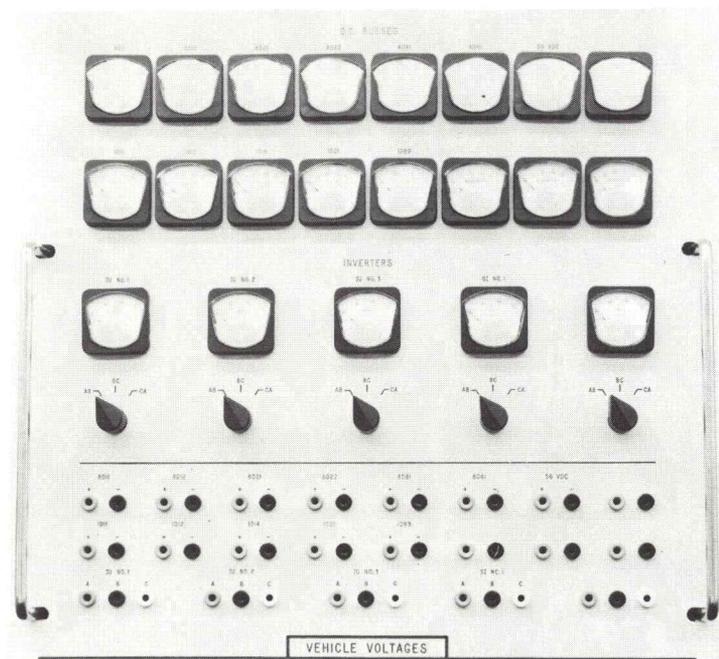
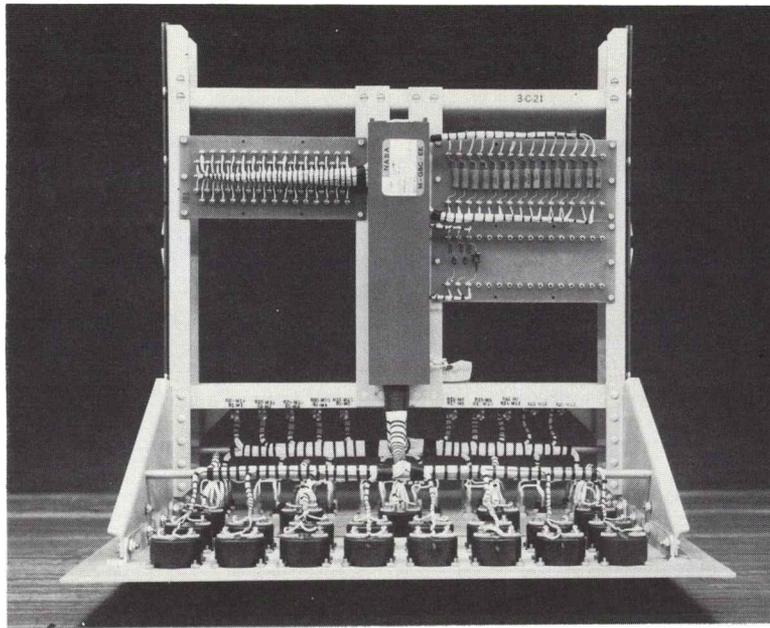
### **AGASTAT MODULE PANEL (300A10)**

This module is mounted in the rear of the Overall Test Rack 300 and it contains time delay relays which are cabled to the patch distributor.



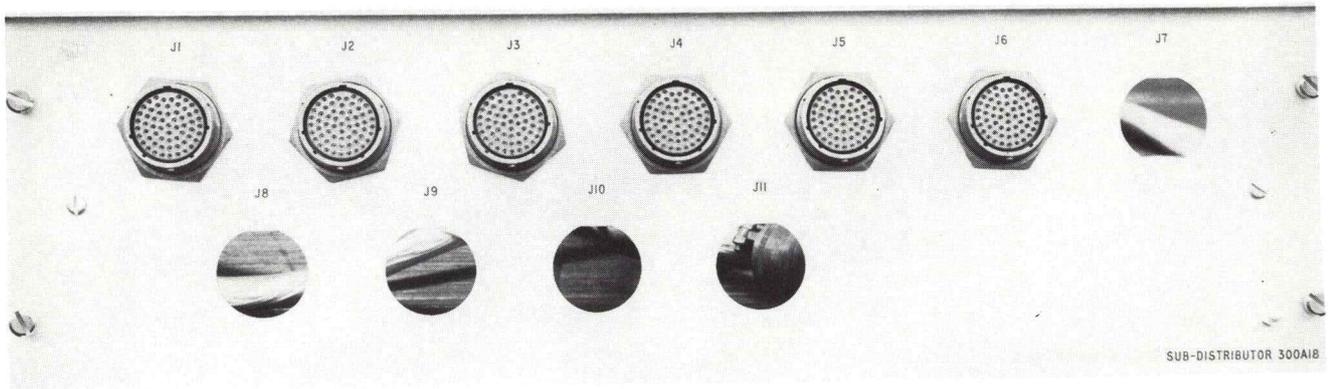
### IGNITER SUBSTITUTE PANEL (300A11)

This panel is a substitute for the S-1 engine igniters. It also has the capability of sensing the S-1 engine igniters.



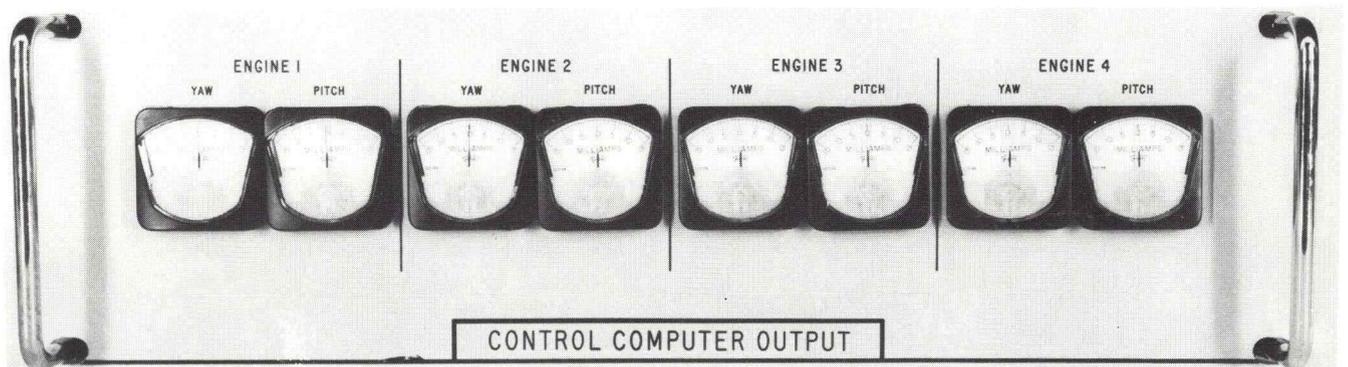
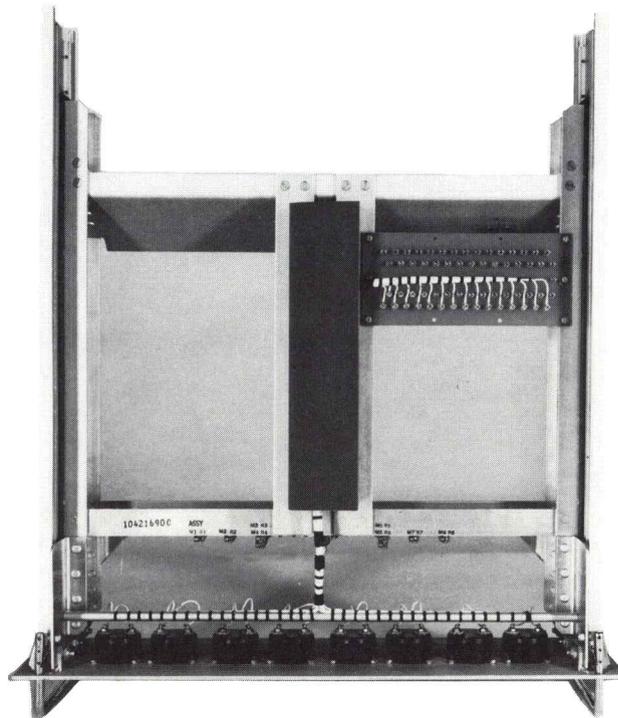
### VEHICLE VOLTAGES PANEL (300A17)

This panel contains the voltmeters required for monitoring the IU and S-1 vehicle stage DC buses and inverter voltages.



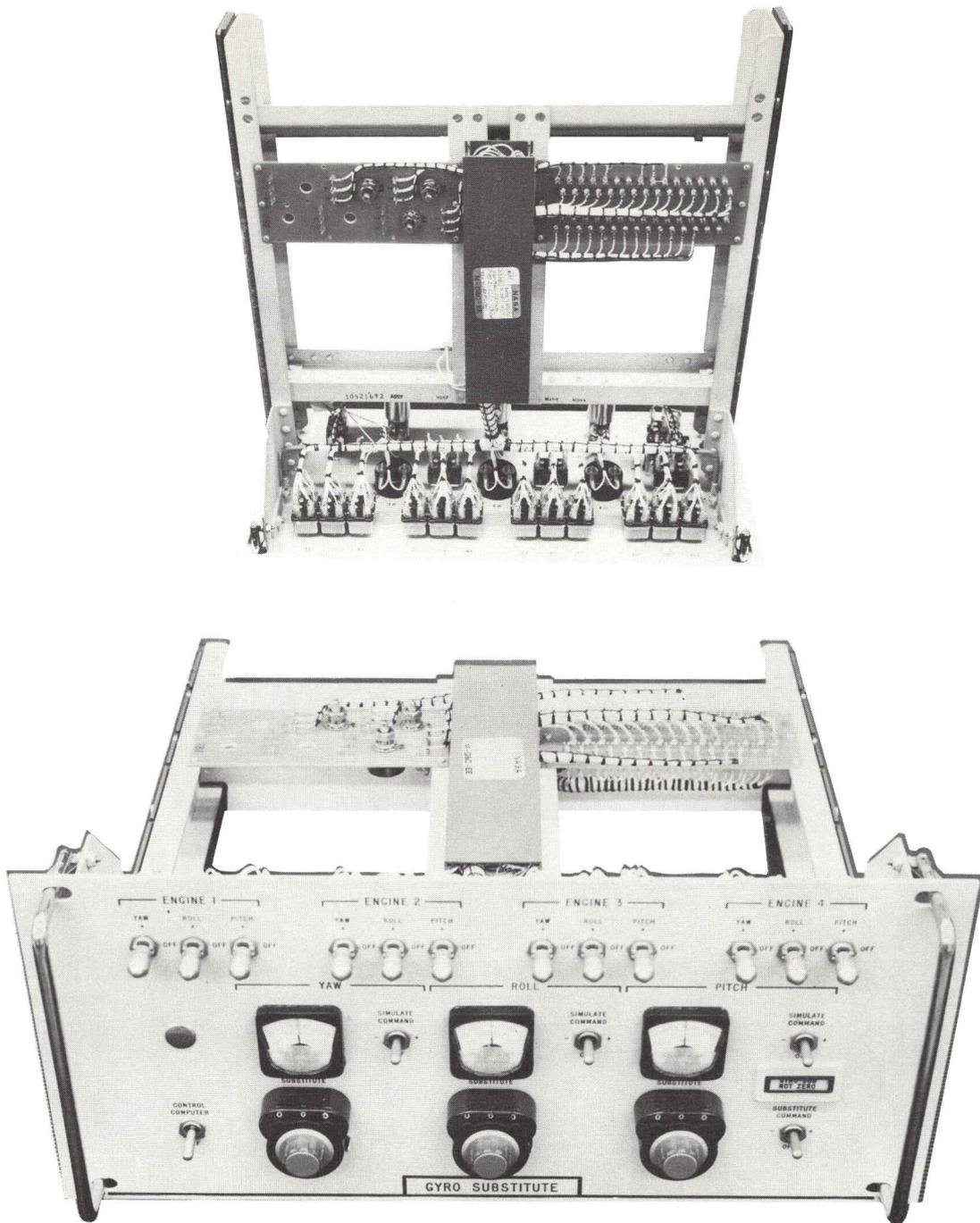
### **SUB-DISTRIBUTOR PANEL (300A18)**

This panel contains groups of 61 pin connectors. Each connector is wired to a group of smaller plugs. The 61 pin connectors, when required, are patched to the main distributor. The smaller plugs then match the mating connectors in the rack.



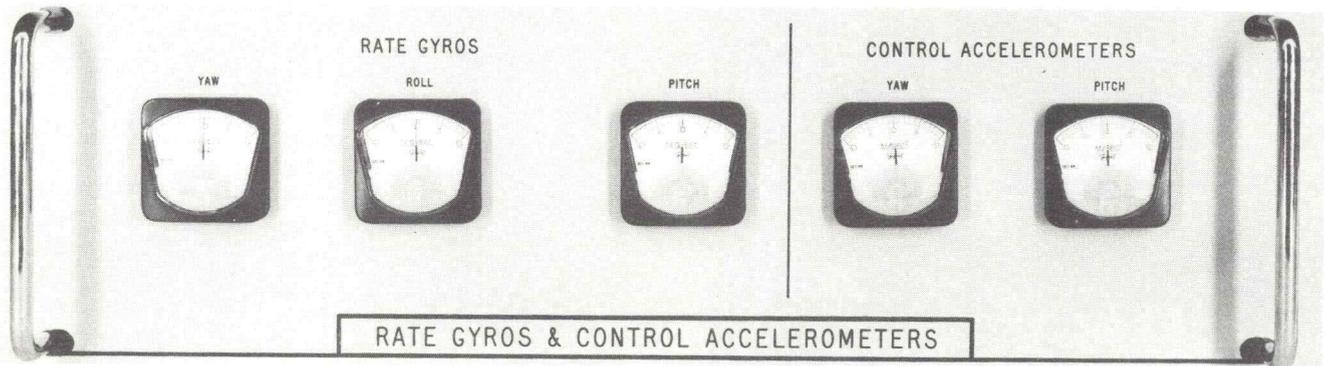
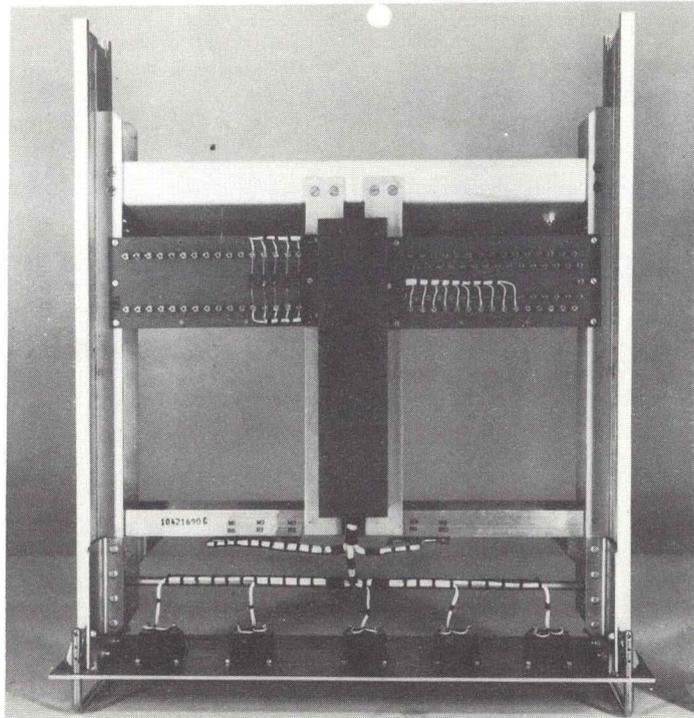
### CONTROL COMPUTER OUTPUT PANEL (311A2)

This panel monitors differential current outputs to the servo valves that control the hydraulic actuators during test.



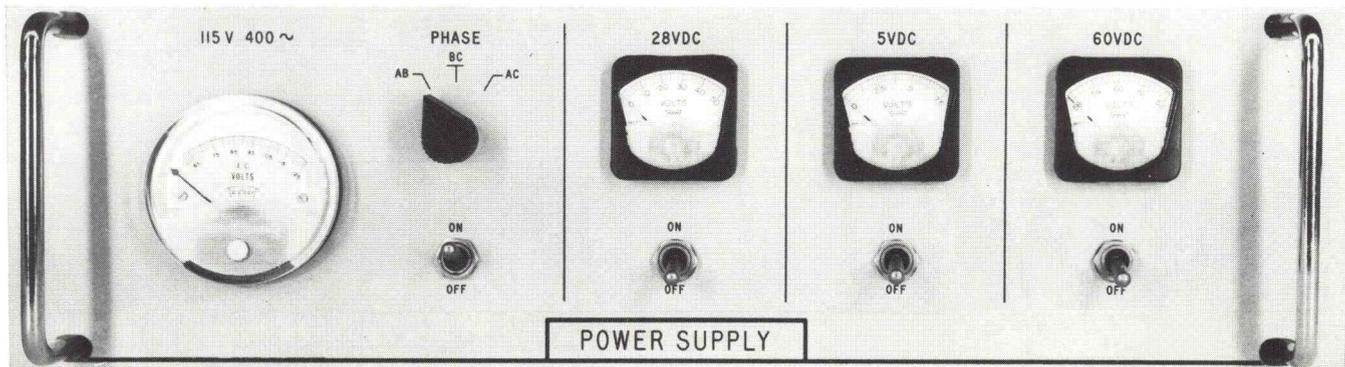
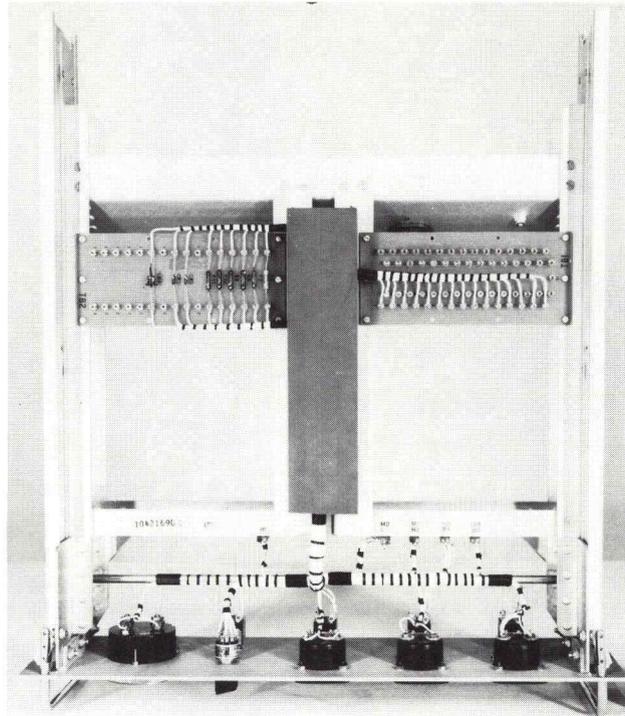
### GYRO SUBSTITUTE PANEL (311A3)

This panel controls and monitors the position of the S-1 engine gimbals when vehicle is in test stage.



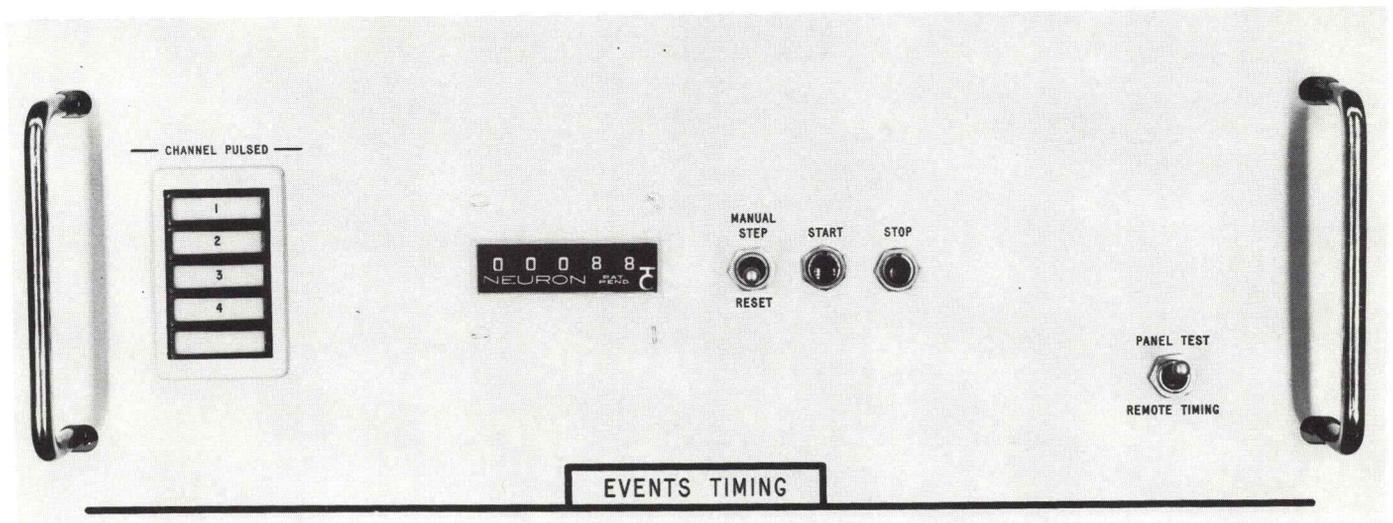
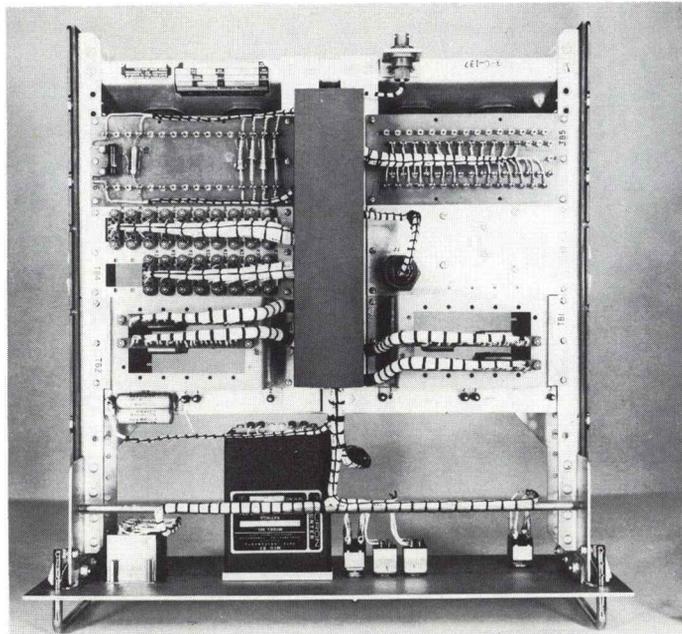
### **RATE GYROS & CONTROL ACCELEROMETERS PANEL (311A4)**

This panel monitors the yaw, roll and pitch velocity signals from the Control Signal Processor, and the pitch and yaw acceleration signals from the Control Accelerometers for the S-1 Stage Interface Test Sets (SITS).



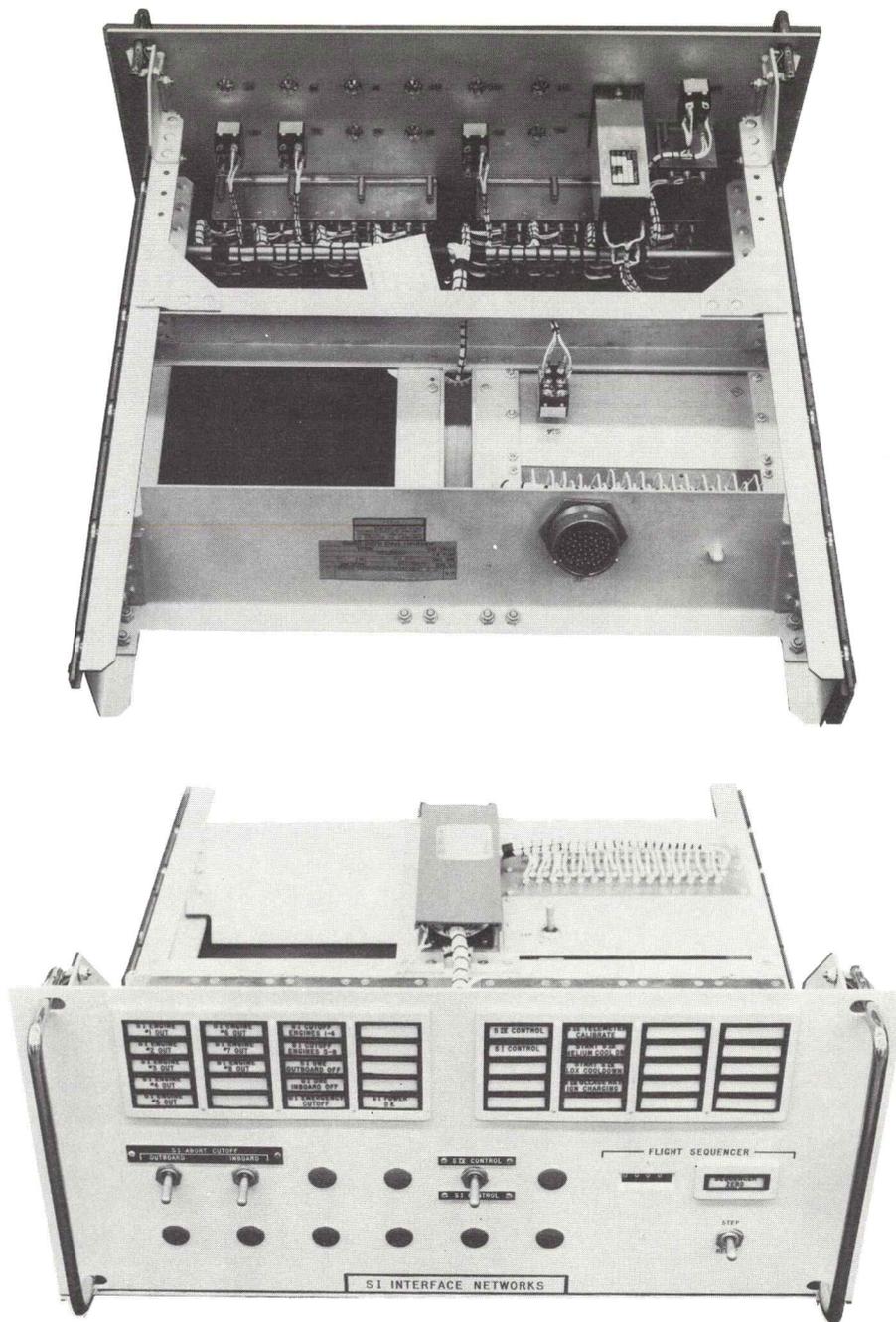
### POWER SUPPLY PANEL (311A5)

This panel supervises the 115 VAC, 400 CPS, 60 VDC, 28 VDC and 5 VDC supplied to S-1 SITS.



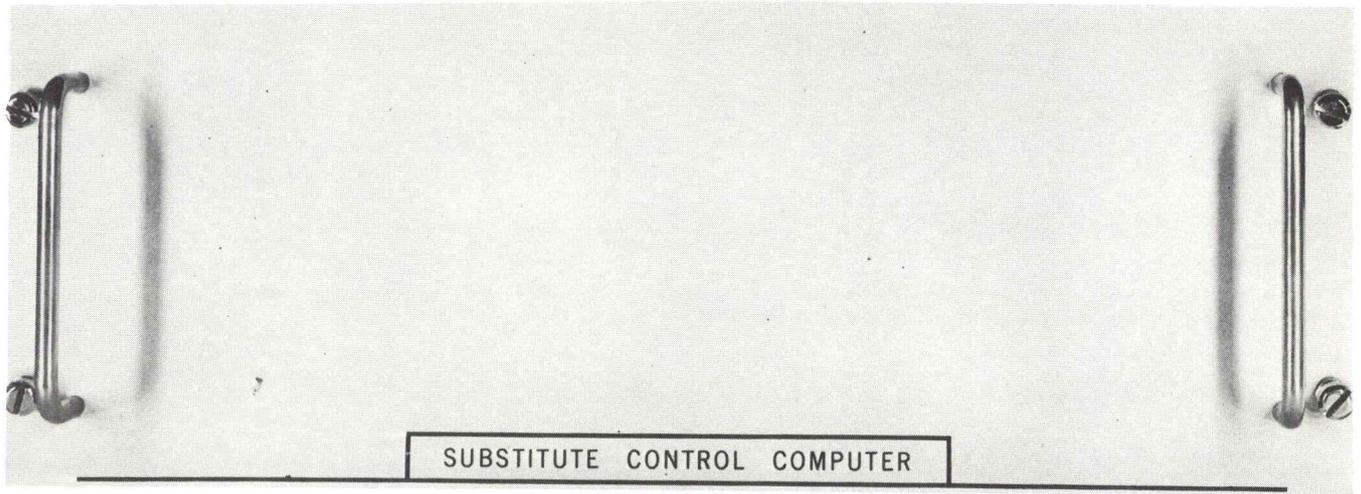
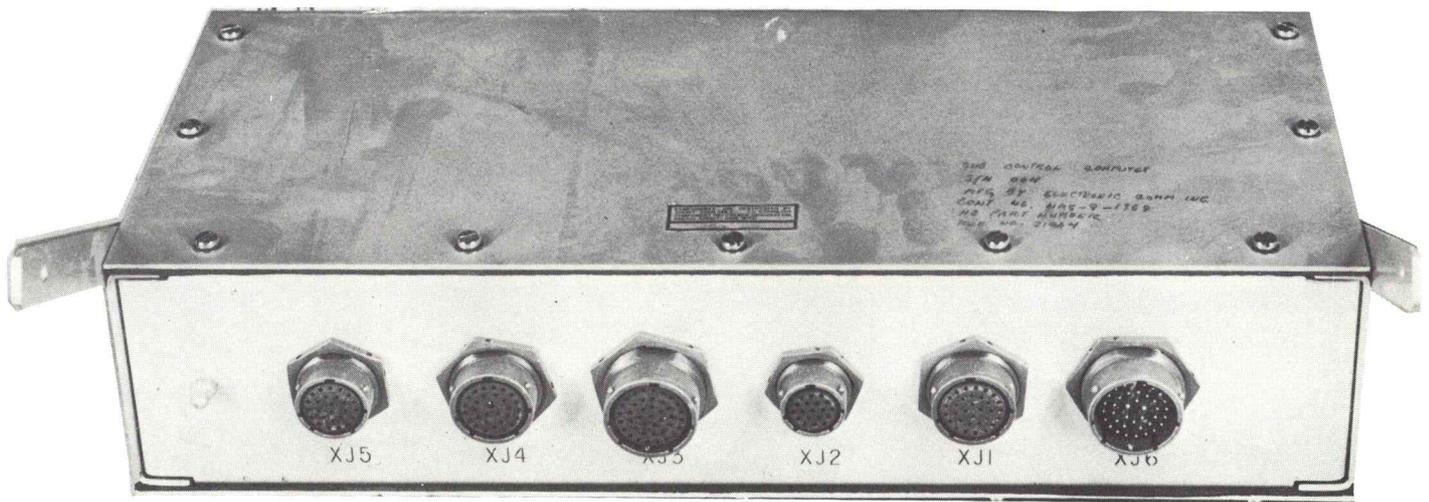
### EVENTS TIMING PANEL (311A6)

This panel is a timing device for stopping the IU Flight Sequencer and the S-1 Flight Sequencer. This panel simulates, in the S-1 SITS (311), the program device which is used in the Flight Vehicle.



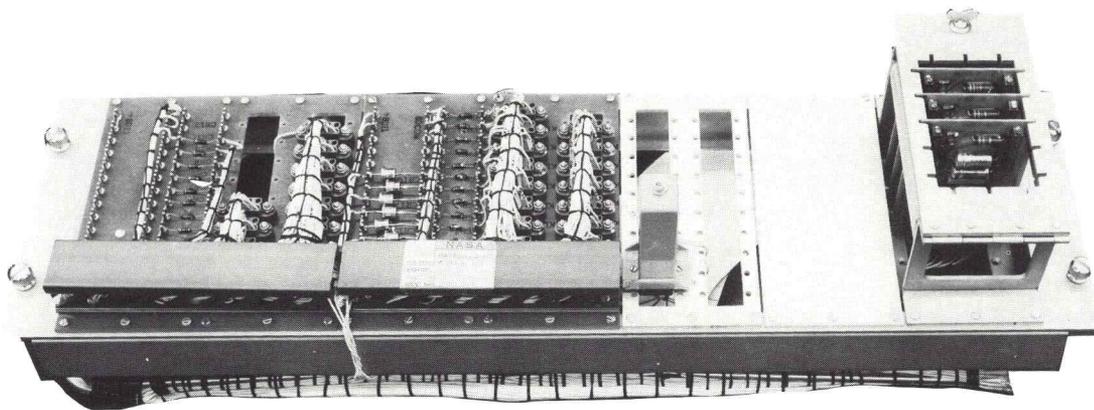
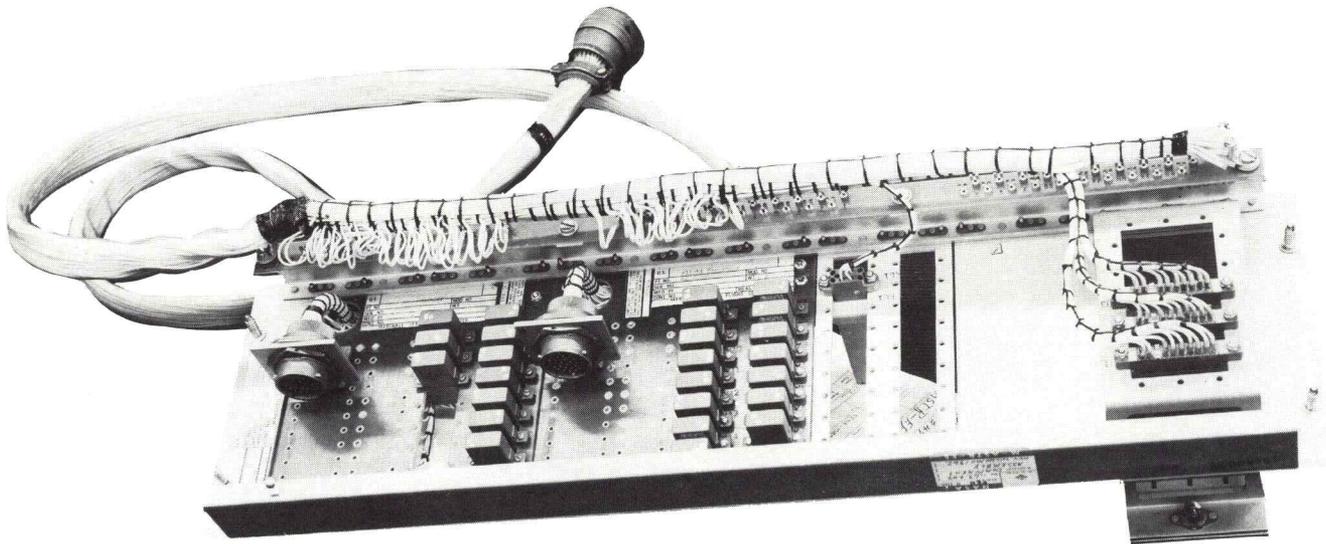
### **S-1 INTERFACE NETWORKS PANEL (311A7)**

This panel checks out the S-1 Stage electrical networks that interface with the S-IV Stage.



### **SUBSTITUTE CONTROL COMPUTER PANEL (310A4 AND 311A8)**

The function of this panel is to simulate exactly the gains, responses, etc. found in the Flight Control Computer.



## **FLIGHT SEQUENCER SUBSTITUTE PANEL (311A16)**

This panel consists of and describes the function of the following:

### **FLIGHT SEQUENCER SUBSTITUTE (311A16)**

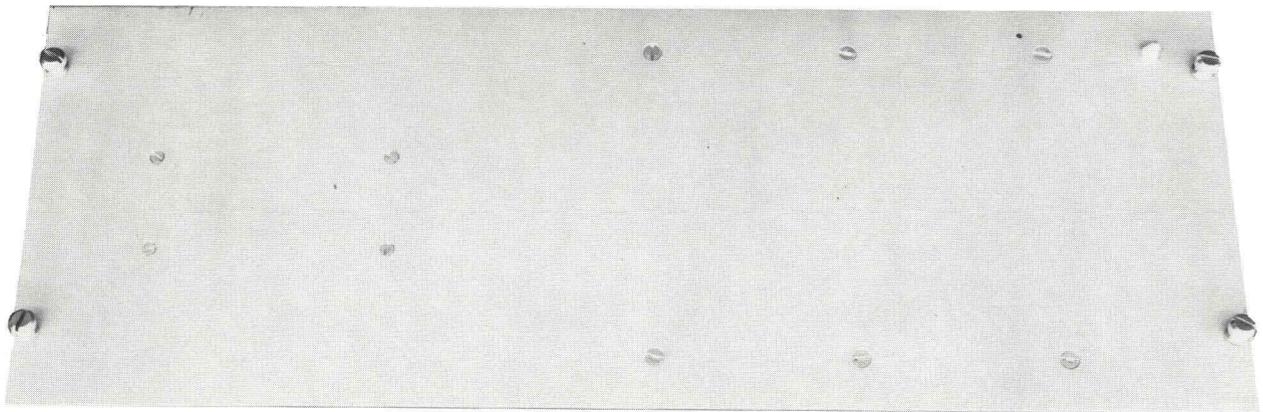
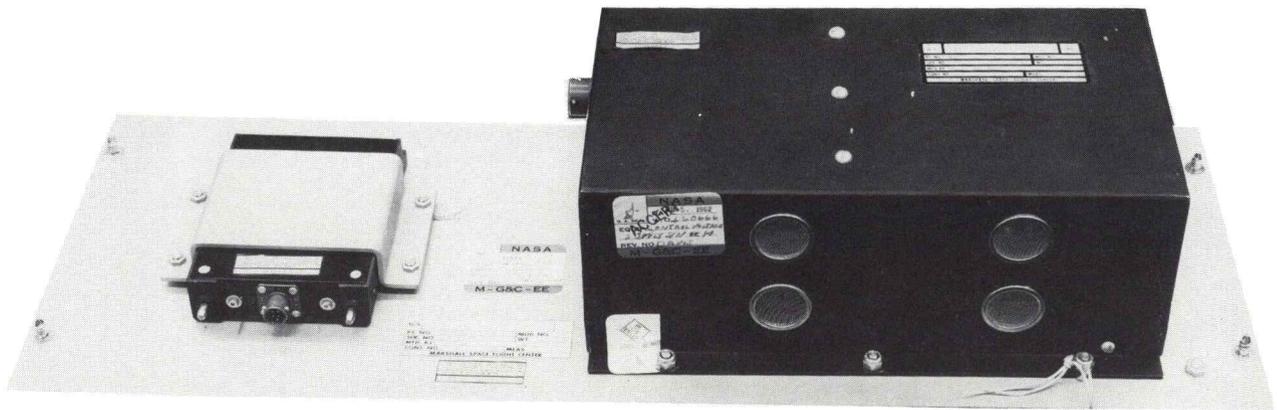
This unit substitutes for the IU Flight Sequencer. It is driven by the Program Device or by the Events Timing Panel and it sequences the operations of the SITS.

### **FLIGHT SEQUENCER SLAVE (311A26)**

This unit expands the capacity of the Flight Sequencer Substitute from 10 steps to 20 steps.

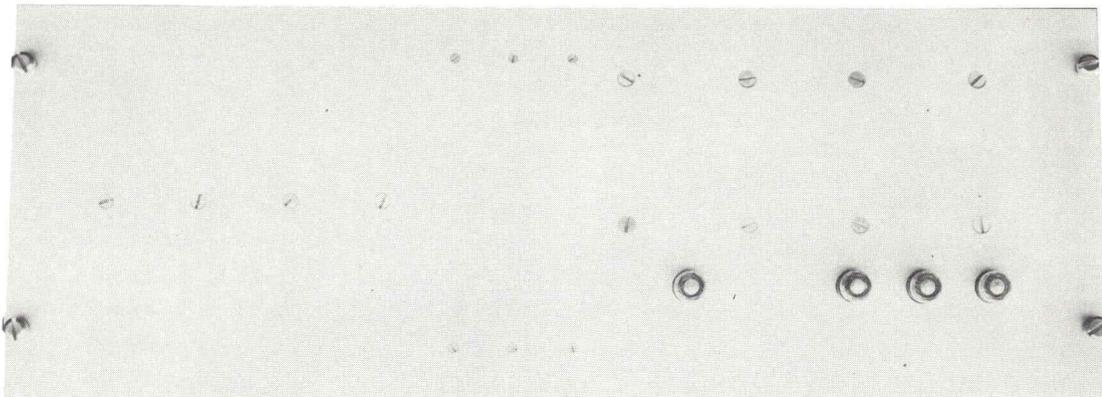
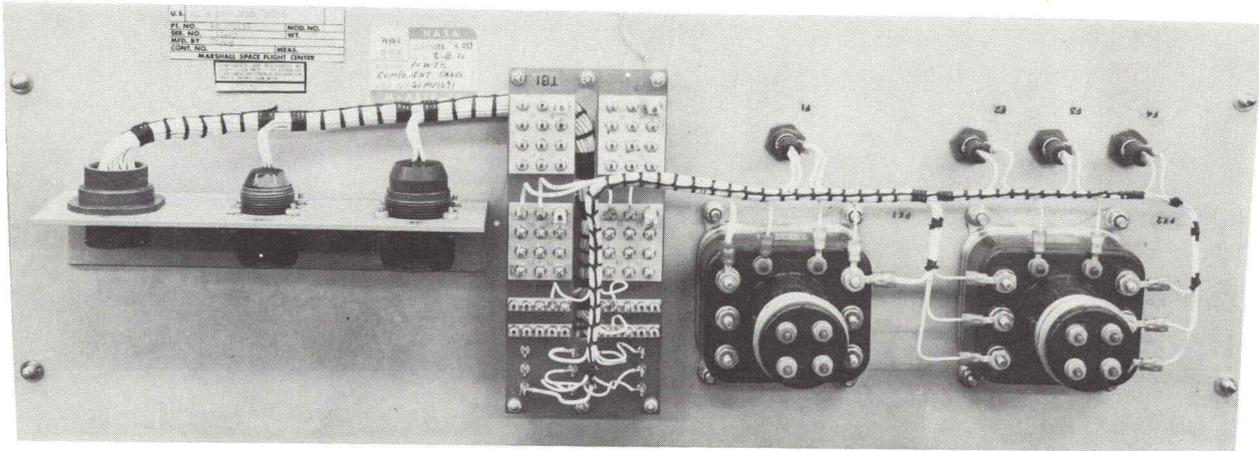
### **RAMP FUNCTION GENERATORS (311A21, 311A22 & 311A23)**

These generators introduce ramp (amplitude rate controlled) signals into the Vehicle Flight Control System for quick "confidence" checks of the various flight control loops.



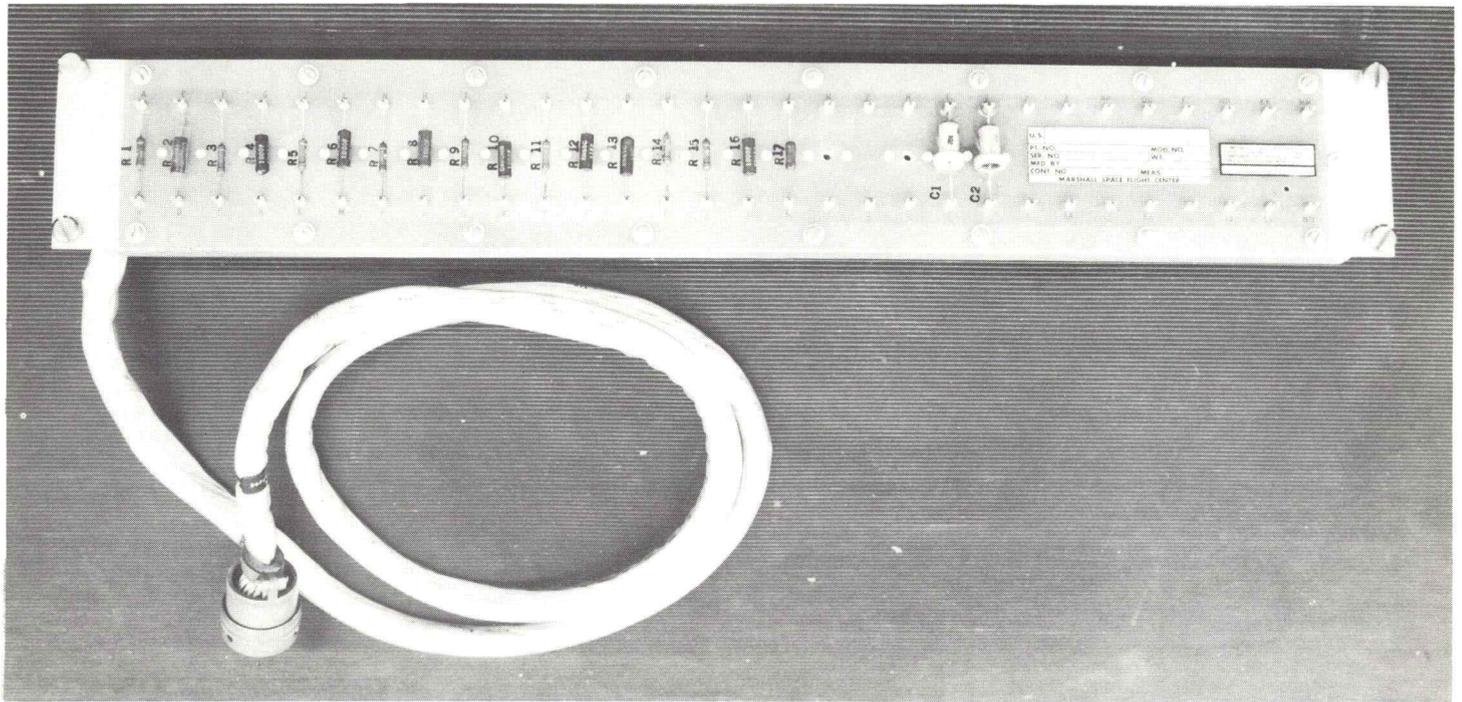
### **POWER SUPPLY PANEL (311A17 AND 311A18)**

This supply provides 60 VDC regulated and adjustable power which is used for control of the S-1 engine deflection, and 5 VDC regulated power for instrumentation of the S-1 engine deflection.



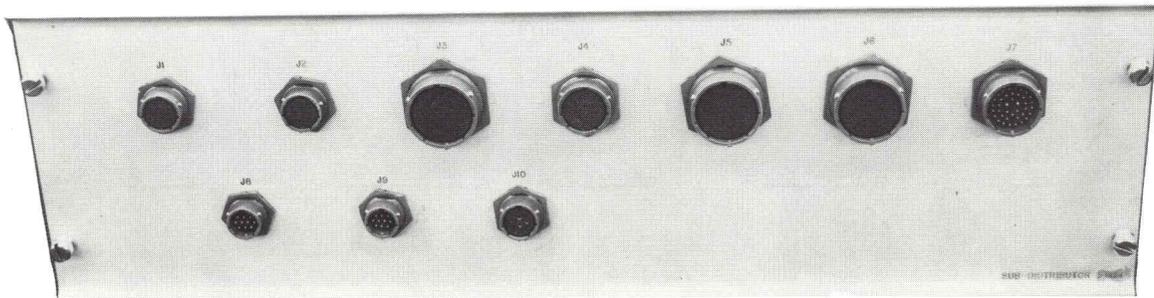
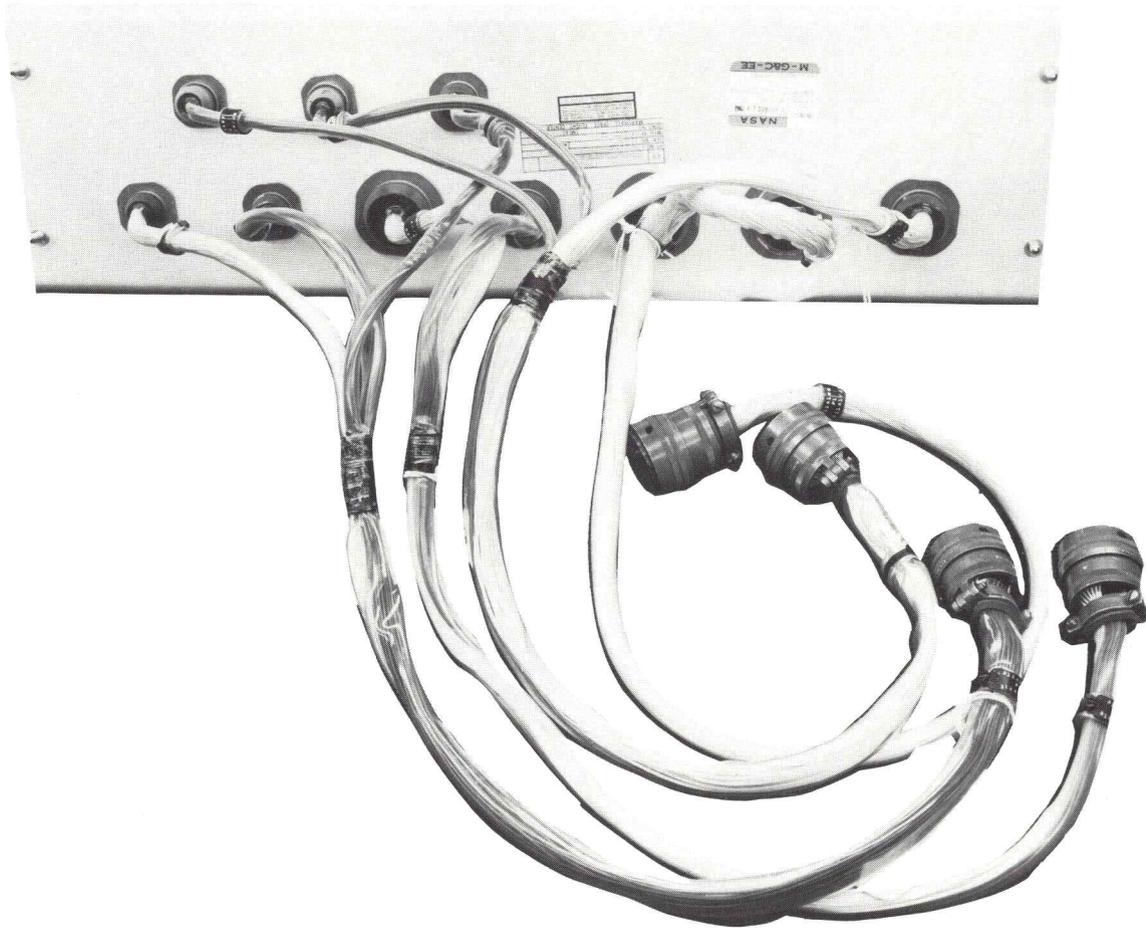
### COMPONENT BOARD PANEL (311A19)

This panel contains the contactors and fusing for controlling 28 VDC and 400 CPS, 115 VAC power inputs to S-1 SITS.



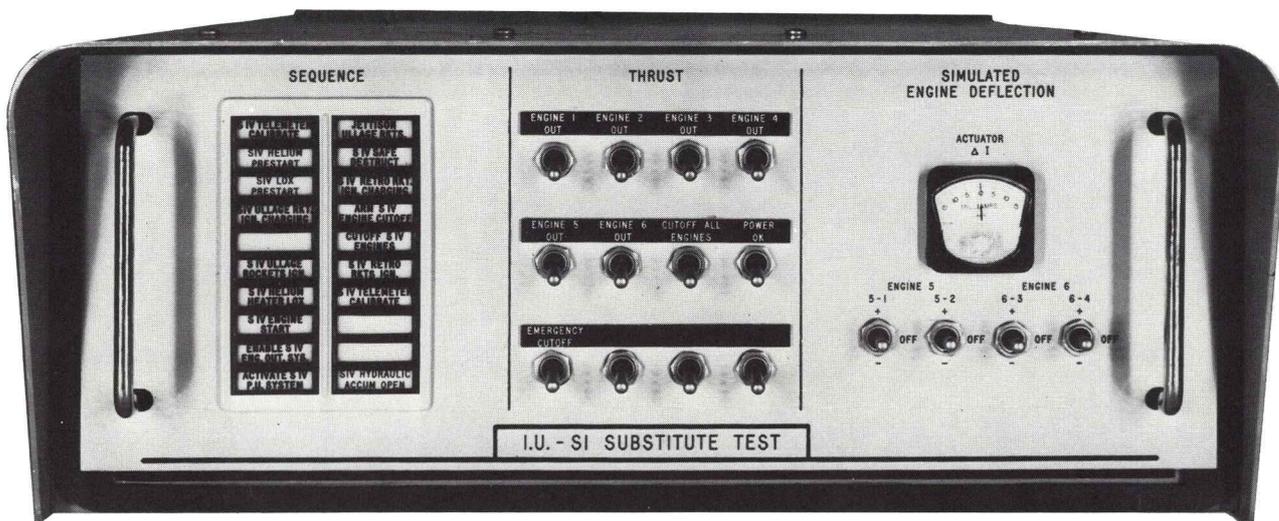
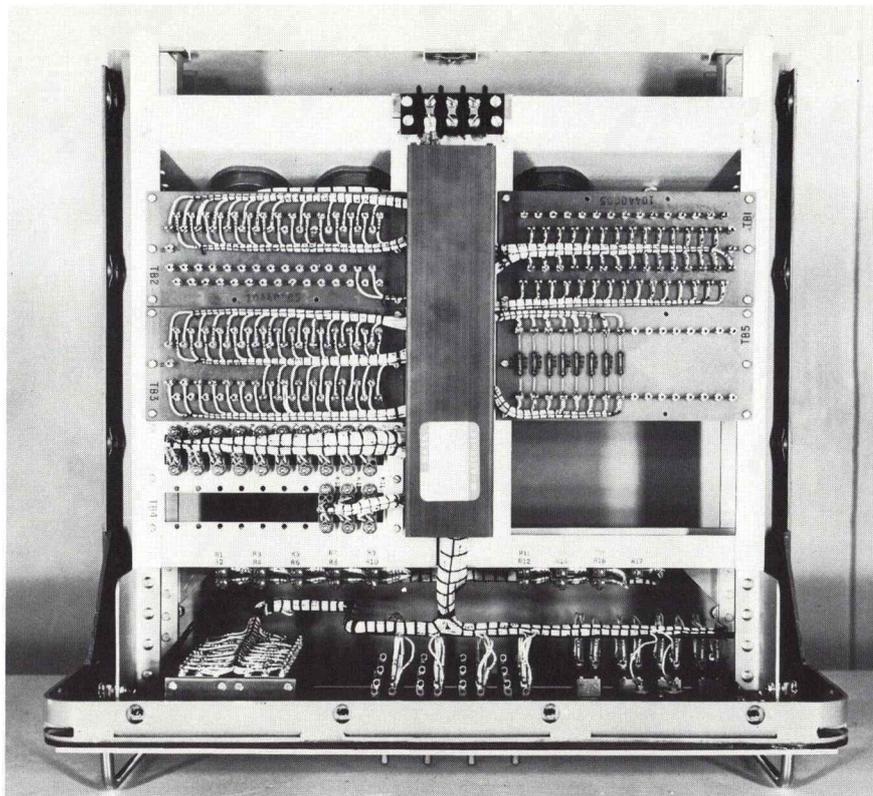
### RESISTOR/CAPACITOR BOARD PANEL (311A20)

This board is mounted in the rear of the 311 rack and it facilitates the mounting of resistors and capacitors necessary for the circuits in the S-1 SITS.



### **SUB-DISTRIBUTER PANEL (311A24)**

This panel contains groups of several sizes of connectors. Each group is wired to a pigtailed 61 pin plug. This plug, when required, is patched to the main distributor. The smaller connectors then match the mating connectors in the rack.



### IU - S-1 SUBSTITUTE TEST PANEL (258)

This panel is used to allow the IU and S-1 substitutes to be used jointly to verify each other. It provides stimulus and monitoring of those functions in the two substitutes which can not be checked with existing circuits of the opposite substitute.

# **QUALITY LABORATORY**

## **INSTRUMENT UNIT (IU) CHECKOUT**

The ESE provided for Quality Laboratories to checkout the Vehicle Instrument unit (IU) is similar to that equipment necessary to checkout the IU Stage at the SDF and the Vehicle Launch Facility (VLF 37/B) at Cape Kennedy, Florida.

See pages 24, 43, and 82 thru 103.

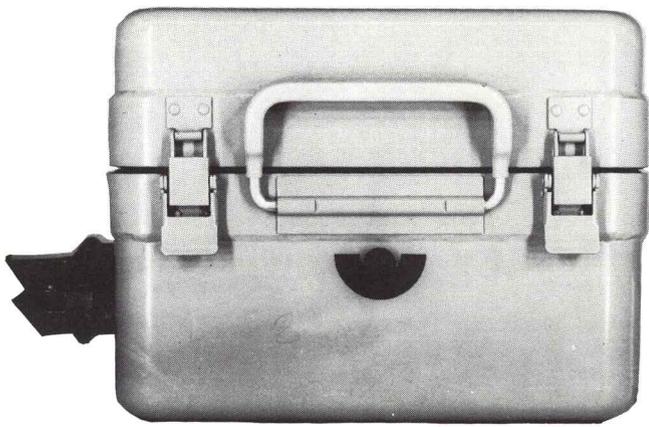
# TEST LABORATORY

## STAGE (S-1) STATIC FIRING STAND, EAST SIDE

The function of the Test Laboratory is to perform a captive test firing of S-1 Stage. Short duration and full duration static firings are performed with appropriate instrumentation to allow analysis of the performance of the Stage during these static firings.

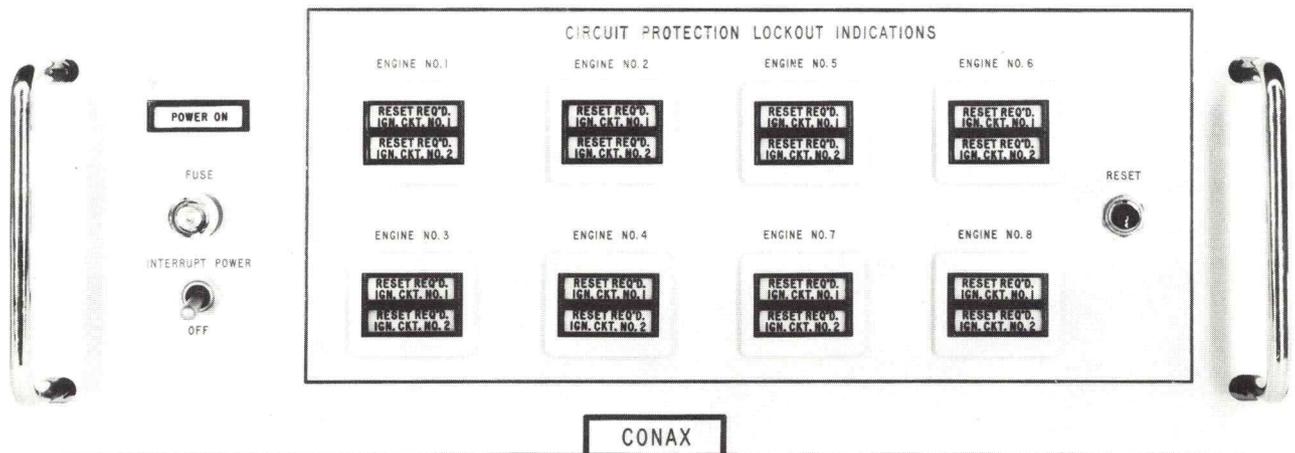
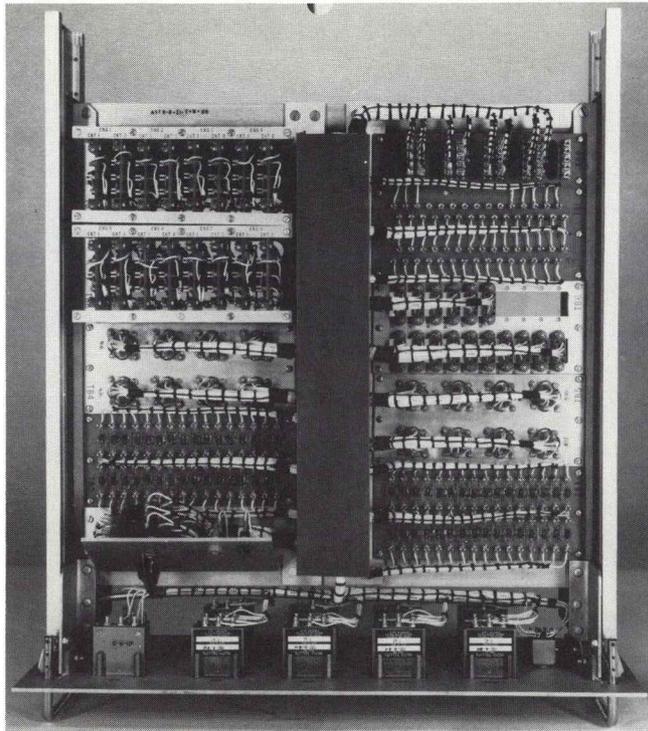
The ESE furnished this facility is generally the same as the ESE furnished the SDF and VLF 37/B. Only ESE peculiar to this facility will be shown.

POWER SOURCES.....	See pages 4 thru 11
POWER DISTRIBUTION.....	See pages 12 thru 30
PROPULSION SYSTEM.....	See pages 31 thru 54, 194 and 195
FLIGHT CONTROL SYSTEM.....	See pages 48 thru 54
COUNT CLOCK SYSTEM.....	See pages 24 and 114 thru 130
ENVIRONMENTAL CONDITIONING SYSTEM.....	See pages 163 thru 165
NETWORKS SYSTEM.....	See pages 59 and 60
SYSTEMS INTEGRATION .....	See pages 138 thru 152
SPECIAL TEST EQUIPMENT.....	See pages 24, 43, 69 thru 81 and 196



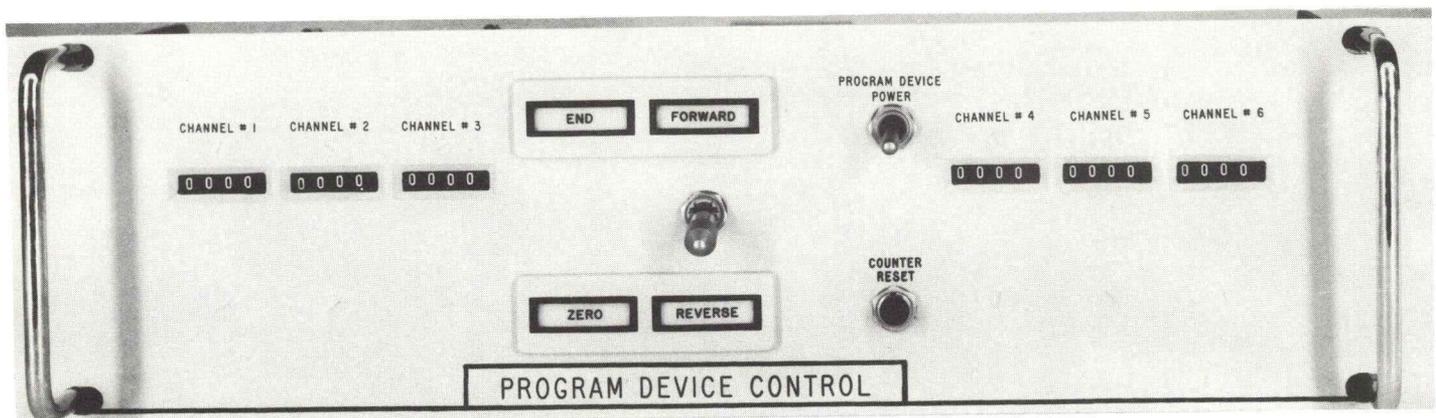
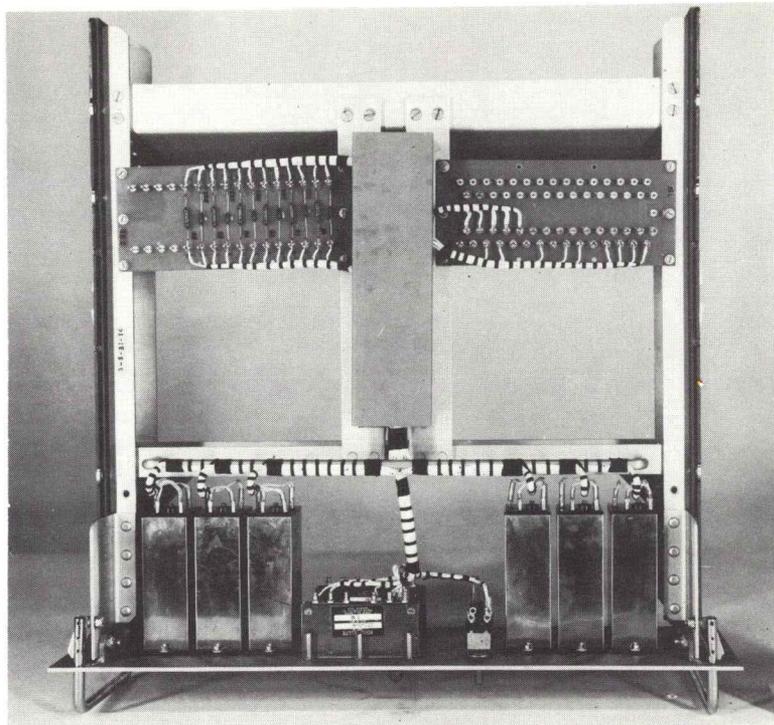
### S-1 IGNITER SAFE ARM BOX (53A69)

This box is installed as near the vehicle as possible to protect against premature ignition. Until the ignition separation is armed, the turbine spinner connectors are disconnected, shorted out and grounded.



## CONAX PANEL (300A2)

This panel contains circuits and components necessary to prove the capability of the vehicle and ground system circuitry to fire the conax valve (Engine Shutdown Valve) initiators.



### PROGRAM DEVICE CONTROL PANEL (311A15)

This panel initiates timed stepping pulses. The outputs of the IU Flight Sequencer and S-1 Flight Sequencer are monitored by this panel.

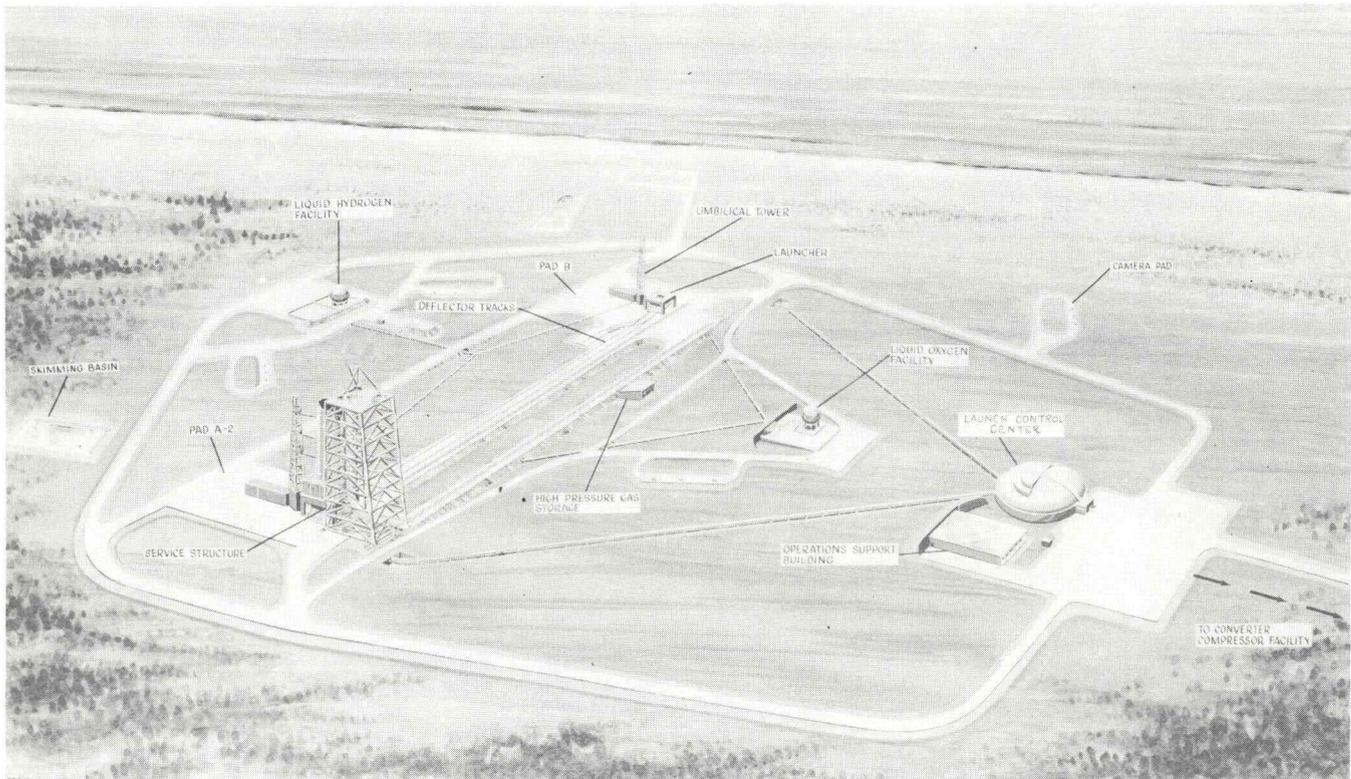
# **CHRYSLER CORP SPACE DIV (CCSD), MICHoud, LOUISIANA**

## **STAGES (S-1) CHECKOUT EQUIPMENT**

Chrysler Corporation Space Division is currently under contract to fabricate two vehicles: SA-8 and SA-10 of the Block II Program. Included in this contract is a requirement to pre-static and post-static check S-I Stages with Government furnished Ground Support Equipment.

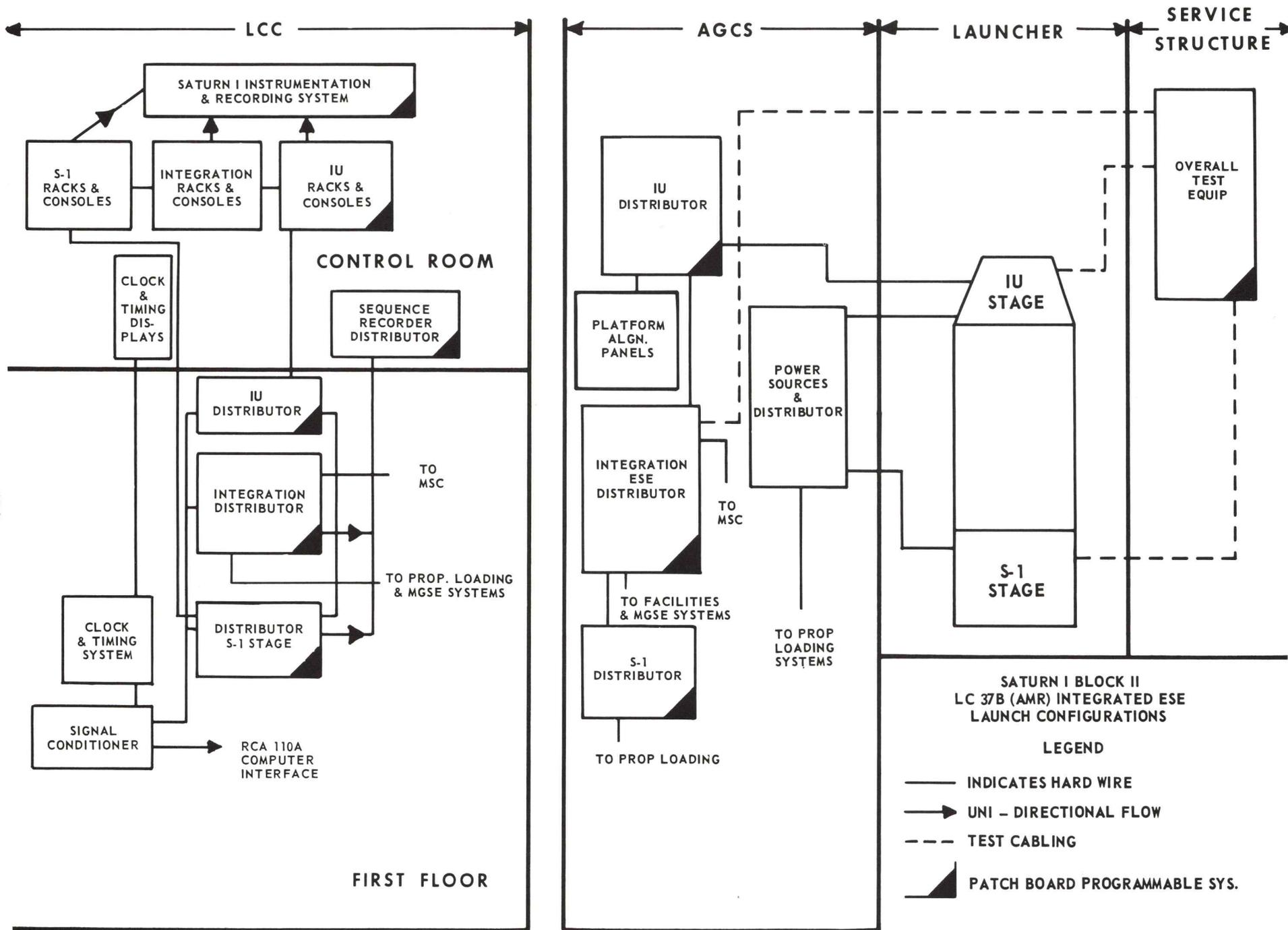
The ESE furnished CCSD Michoud is similar to that ESE used at the Quality Laboratory checkout of the S-1 Stage and its various stage sub-systems.

See pages 4 thru 81 and 153 thru 191 for similar checkout ESE.



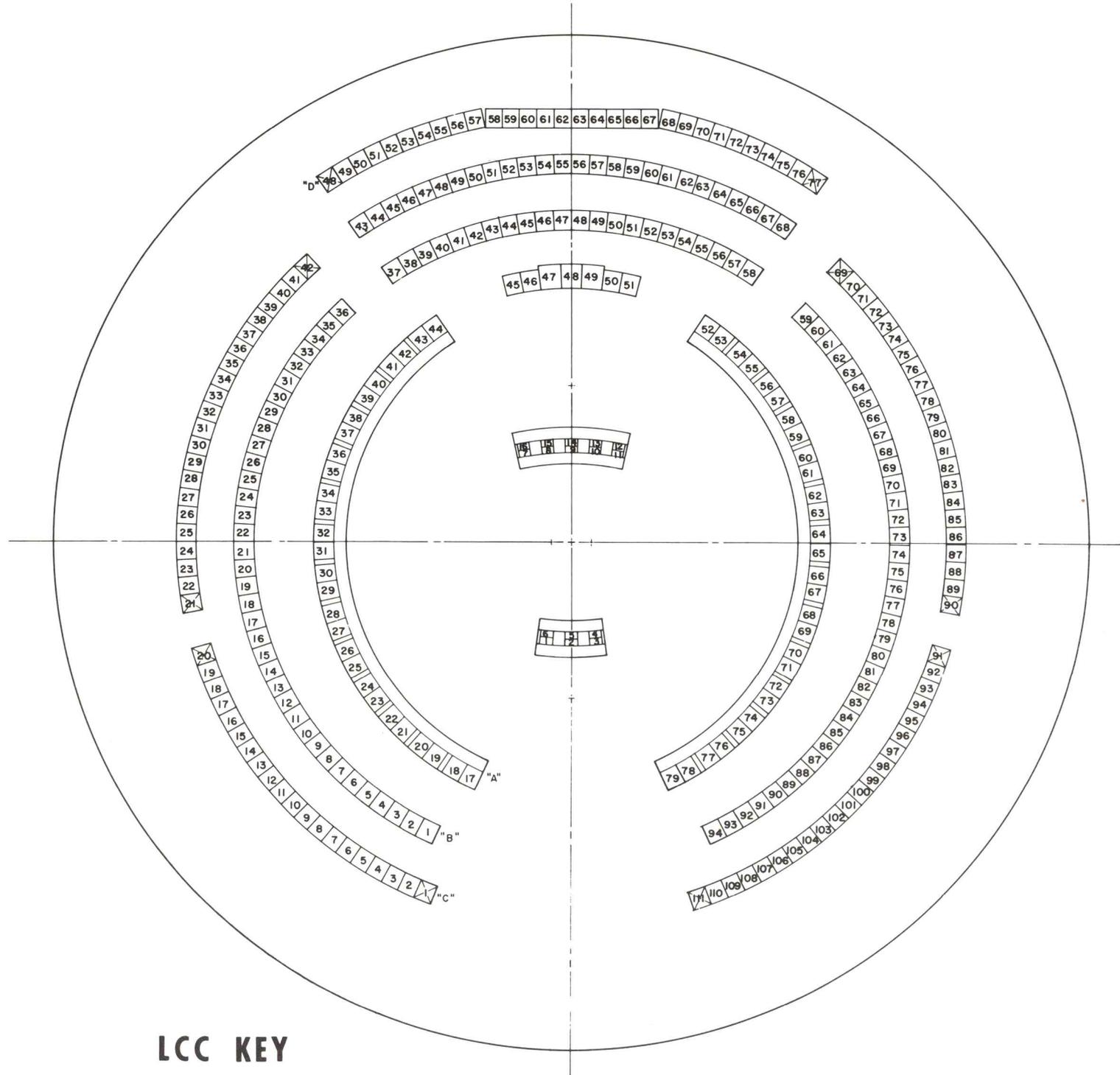
## SATURN LAUNCH FACILITY (VLF 37/B)

The Saturn I, Block II vehicles are checked out and launched from vertical launch facility 37/B. At the launch pad all stages are mated and the vehicle checkout and launch are performed. Only VLF 37/B ESE is listed herein.



LCC TO VEHICLE (FUNCTIONAL INTERCONNECT)

# LAUNCH CONTROL CENTER VLF 37/B



## LCC KEY

### AREA "A"

- 1 LAUNCH VEHICLE DIR.
- 2 TEST CONTROLLER
- 3 SPACECRAFT DIR.
- 4 VIP
- 5 LAUNCH DIR.
- 6 NASA PROJECT OFFICER
- 7 PAA PAD SAFETY
- 8 PAA PAD SAFETY
- 9 S-IV PROJECT DIR.
- 10 RF-MEAS. & TRACKING SYS. ENG.
- 11 S-I PROP. SYS ENG.
- 12 SPACECRAFT TEST CONDUCTOR
- 13 SPACECRAFT ASST. TEST COND.
- 14 S-IV TEST CONDUCTOR
- 15 S-IV ASST. TEST COND.

- 16 S-I TEST CONDUCTOR
- 17 SPACECRAFT & PAYLOAD
- 18
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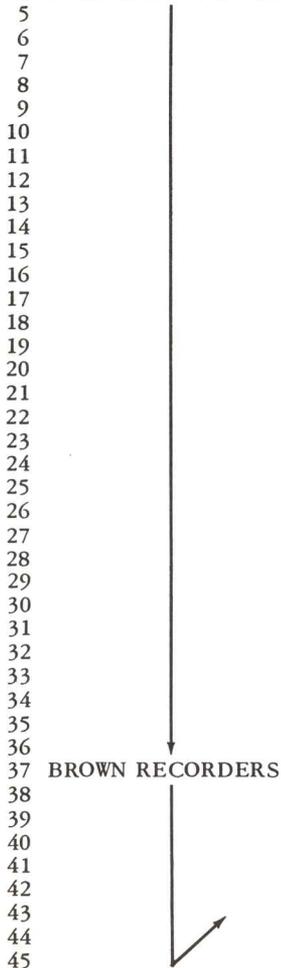
- 32
- 33
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- 39
- 40
- 41
- 42
- 43
- 44
- 45 PLOTTING BOARD AMP
- 46 PLOTTING BOARD AMP
- 47 PLOTTING BOARD NO. 1

# KEY - Continued

- 48 PLOTTING BOARD NO. 2
- 49 PLOTTING BOARD NO. 3
- 50 VDOP
- 51 INFLIGHT TELEMTRY
- 52 MEASURING SELECTOR CONTROL
- 53 I U & SI MEASURING PANEL
- 54
- 55
- 56 UMBILICAL ARMS, WATER CONT.
- 57 IU ECS COMP. TEST GROUND PRESS.
- 58 S-I PRESSURES, FIRING PREP.
- 59 S-I COMP. TEST, FIRING PANEL
- 60 S-I RECORDER READOUT
- 61 VEH. REC. READOUT I U REC. READOUT
- 62 S-I NETWORK
- 63 IU NETWORK
- 64 VEH. NETWORK LAUNCH SEQUENCER
- 65 DC POWER
- 66 DC POWER
- 67 400 POWER
- 68 400 POWER
- 69 S-I CAMERAS, GROUND CAMERAS
- 70 S-I ORDNANCE
- 71 S-I DESTRUCT
- 72 DAC DESTRUCT
- 73 DAC ORDNANCE
- 74 DAC STAGE SYS. STATUS PNL DSV4-168
- 75 DAC INST PWR CONT & MON PNL DSV4-103
- 76 DAC STAGE PWR CONT & MON PNL DSV4-102
- 77 DAC PROP SYS PREP & CONTROL DSV4-109
- 78 DAC PNEU SYS & CONTROL PNL DSV4-122
- 79 SPARE

## AREA "B"

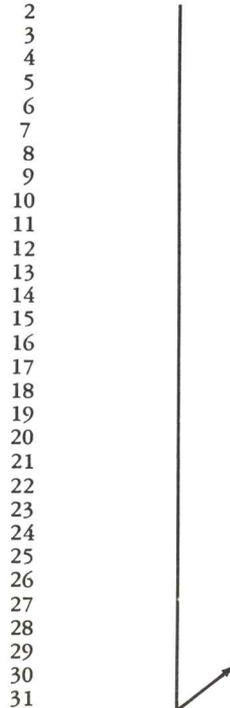
- 1 ANEMOMETER
- 2 ANEMOMETER
- 3 ANEMOMETER
- 4 SPACECRAFT & PAYLOAD



- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56
- 57 MEAS. SELECTOR DISPLAY SI NOS. 1, 2, & 3
- 58 MEAS. SELECTOR DISPLAY I U NO. 1
- 59 PROPELLANT RP-1
- 60 PROPELLANT RP-1
- 61 PROPELLANT LOX
- 62 PROPELLANT LOX
- 63 PROPELLANT LOX
- 64 PROPELLANT LH2
- 65 PROPELLANT LH2
- 66 PROPELLANT PNEUMATIC
- 67 PROPELLANT ENVIR. CONT. SYSTEM
- 68 PROPELLANT ENVIR. CONT. SYSTEM
- 69
- 70
- 71
- 72 NAVIGATION FLT CONTROL REC. NO. 1
- 73 NAVIGATION FLT CONTROL REC. NO. 2
- 74 NAVIGATION FLT CONTROL S IV ENG. POS.
- 75 RACK NO. 1
- 76 RACK NO. 2
- 77 NAVIGATION ST 90S RACK NO. 3
- 78 NAVIGATION ST 90S RACK NO. 4
- 79 NAVIGATION GUIDANCE MON RK. NO. 5
- 80 NAVIGATION GUIDANCE MON.RK. NO. 6
- 81 NAVIGATION GUIDANCE REC. RK. NO. 7
- 82 NAVIGATION ST-124 RACK NO. 8
- 83 NAVIGATION ST-124 RACK NO. 9
- 84 NAVIGATION GUIDANCE MON. RK. NO. 10
- 85 NAVIGATION GUIDANCE MON. RK. NO. 11
- 86 DAC STAGE ELECT CO RK. NO. 1 DSV 115 & 119
- 87 DAC STAGE ELECT CO RK. NO. 2 DSV 4-125-6-7
- 88 DAC PROP LOADING RK. DSV-130-131 & 227
- 89 DAC INST STRIP CHART RACK
- 90
- 91 DAC STRIP CHART
- 92
- 93
- 94

## AREA "C"

- 1 SPACECRAFT & PAYLOAD



# KEY - Continued

## AREA "D"

32	SPACECRAFT & PAYLOAD	1	83
33		2	84
34		3	85
35		4	86
36		5	87
37		6	88
38		7	89
39		8	90
40		9	91
41		10	92
42		11	93
43	CSM CUT OFF EQUIP.	12	94
44	CSM CUT OFF EQUIP.	13	95
45	CSM CEC O-GRAPH	14	96
46	CSM CEC O-GRAPH & TV MONITOR	15	97
47	ROUGH COMBUSTION CUT-OFF	16	98
48	ROUGH COMBUSTION CUT-OFF	17	99
49	CSM AMPEX TAPE RECORDER	18	100
50	CSM AMPEX ELECTRONICS	19	101
51	CSM AMPEX TAPE RECORDER	20	102
52	FIRE DETECTION	21	103
53	FIRE DETECTION	22	104
54	BROWN RECORDER & CUT-OFF EQUIP.	23	105
55	MAIN PATCH PANEL	24	106
56	MAIN PATCH PANEL	25	107
57	TEST EQUIPMENT	26	108
58		27	109
59		28	110
60		29	111
61		30	112
62		31	113
63	SANBORN TAPE RECORDER	32	114
64	SANBORN O-GRAPH	33	115
65	SPARE CEC O-GRAPH	34	116
66	AMPLIFIER	35	117
67	AMPLIFIER	36	118
68	AMPLIFIER	37	119
69	POWER	38	120
70		39	121
71	S-I RECORDER PATCH RACK	40	122
72	S-I SEQUENCE RECORDER	41	123
73	S-I SEQUENCE RECORDER	42	124
74	S-I SEQUENCE RECORDER	43	
75	S-I E & I RECORDER	44	
76	VISICORDER	45	
77	INTEGRATION PATCH RACK	46	
78	MASTER RECORDER CONTROL	47	
79	IU RECORDER PATCH RACK	48	POWER
80	IU SEQUENCE RECORDER	49	ALTERNATE LAUNCH PAD SUPPORT
81	IU SEQUENCE RECORDER	50	ALTERNATE LAUNCH PAD SUPPORT
82	IU E & I RECORDER	51	ALTERNATE LAUNCH PAD SUPPORT
83		52	ALTERNATE LAUNCH PAD SUPPORT
84	PROPELLANT REC. PATCH RACK	53	ENVIRONMENTAL FACILITY MEASURING EXPANSION
85	PROPELLANT SEQUENCE RECORDER	54	
86	PROPELLANT SEQUENCE RECORDER	55	
87	PROPELLANT SEQUENCE RECORDER	56	
88	PROPELLANT E & I RECORDER	57	
89		58	MICROSADIC SYSTEM
90	POWER	59	
91	POWER	60	
92	FREQUENCY STANDARD	61	
93	INVERTER MONITOR	62	
94	PROGRAM DEVICE	63	
95	PROGRAM DEVICE	64	
96		65	
97		66	
98		67	
99		68	VIBRATION DATA ACQUISITION SYSTEM
100		69	
101		70	
102		71	
103		72	
104		73	
105		74	LN <sub>2</sub> FACILITY PRESSURES CEC O-GRAPH
106		75	LN <sub>2</sub> FACILITY TEMPERATURES
107		76	LH <sub>2</sub> MONITORING 2 BROWN RECORDERS
108		77	POWER
109		78	
110		79	
111		80	
		81	
		82	



**GENERAL INTERIOR VIEW  
LAUNCH CONTROL CENTER  
VERTICAL LAUNCH FACILITY 37/B**

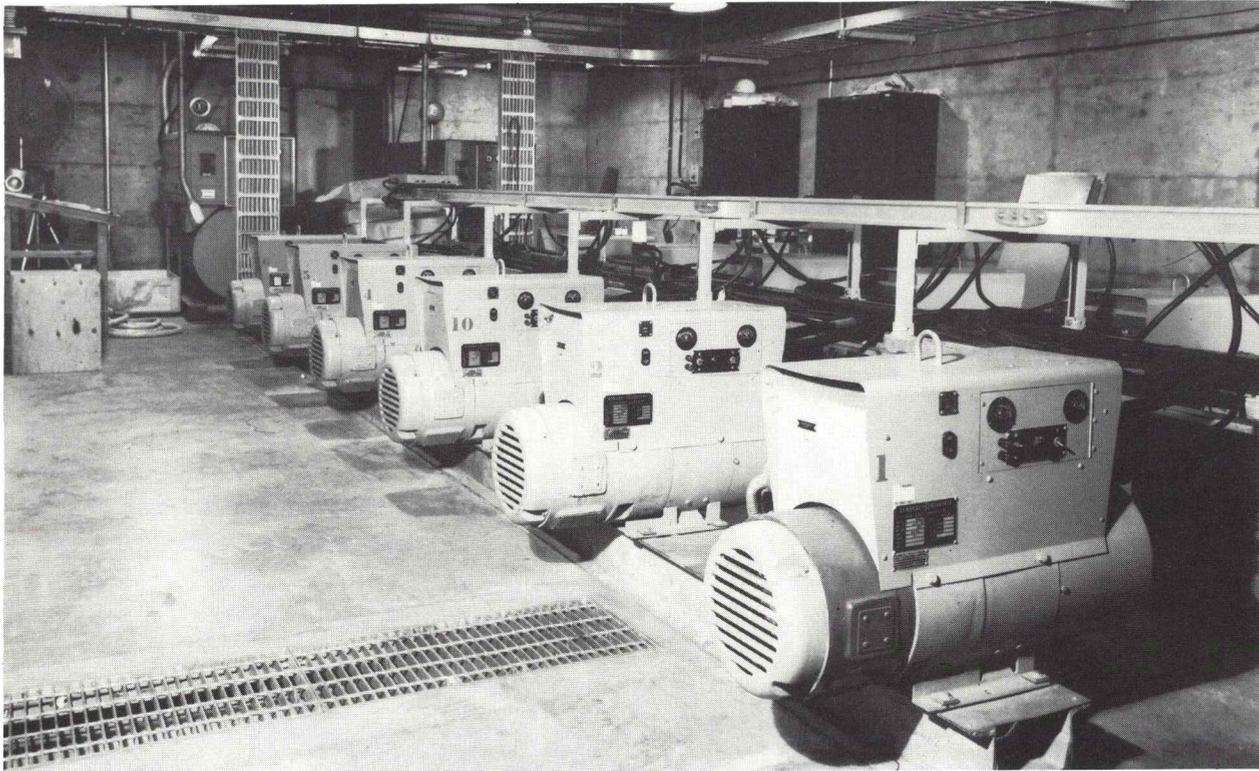
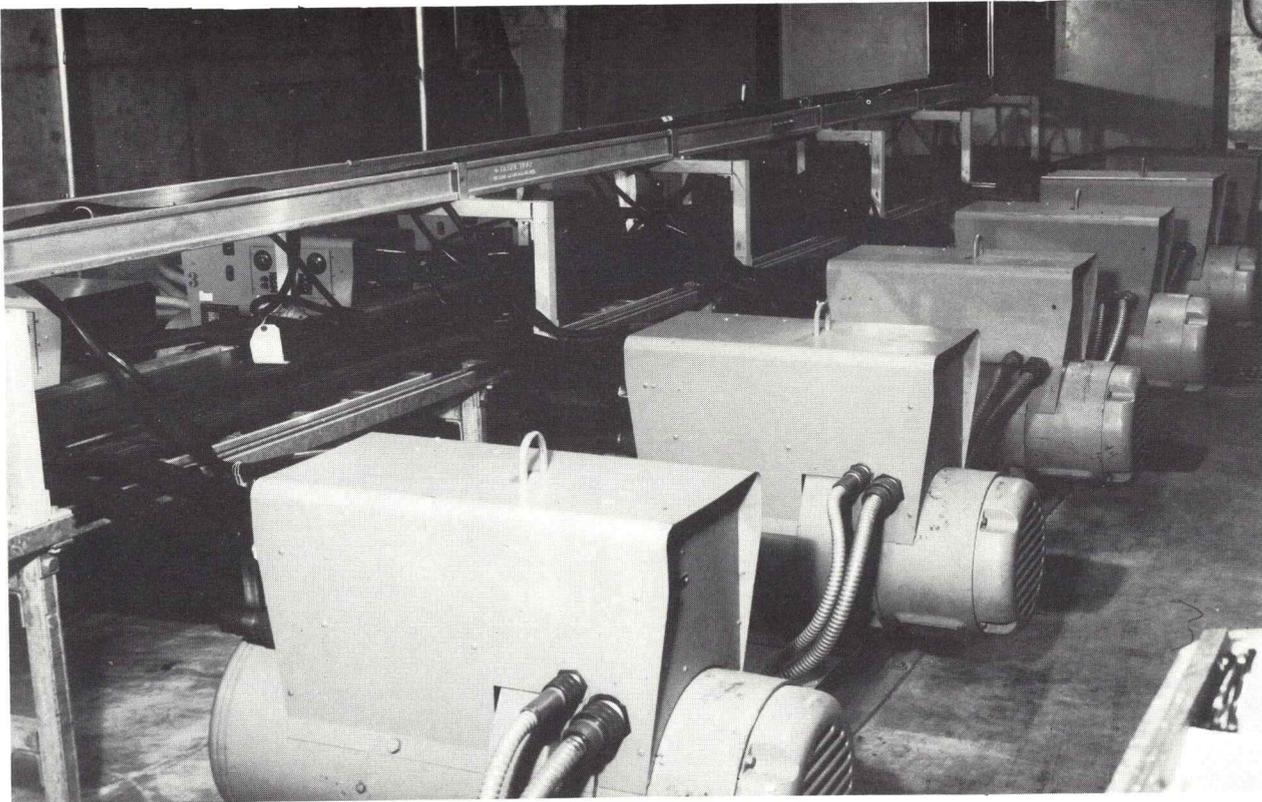
**VLf 37/B**  
**S-I STAGE CHECKOUT ESE**

# **VLf 37/B**

## **POWER SOURCES**

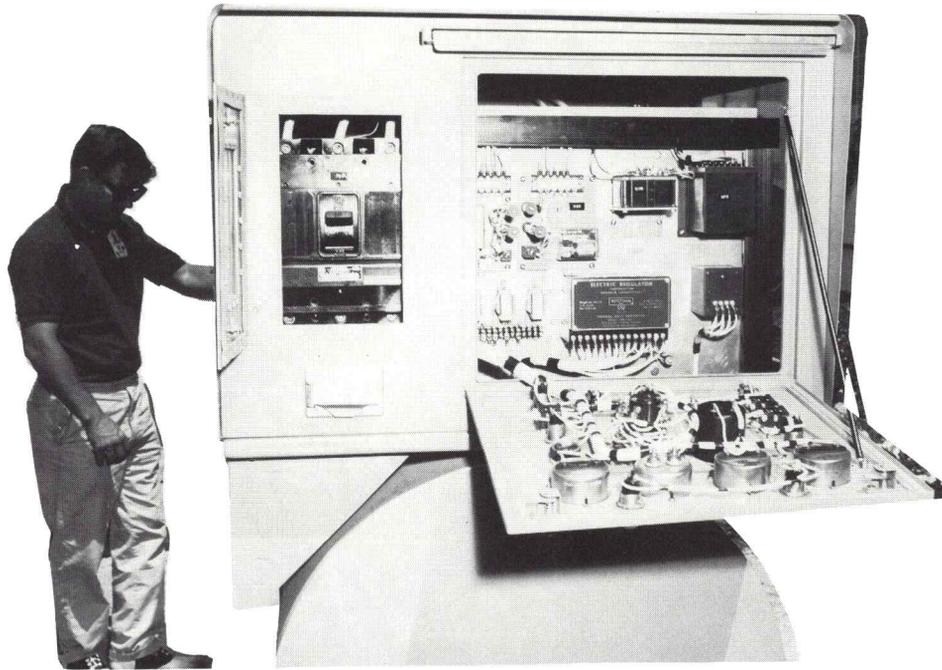
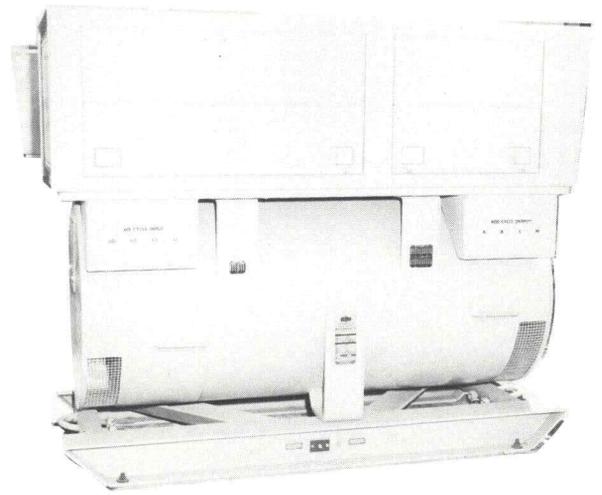
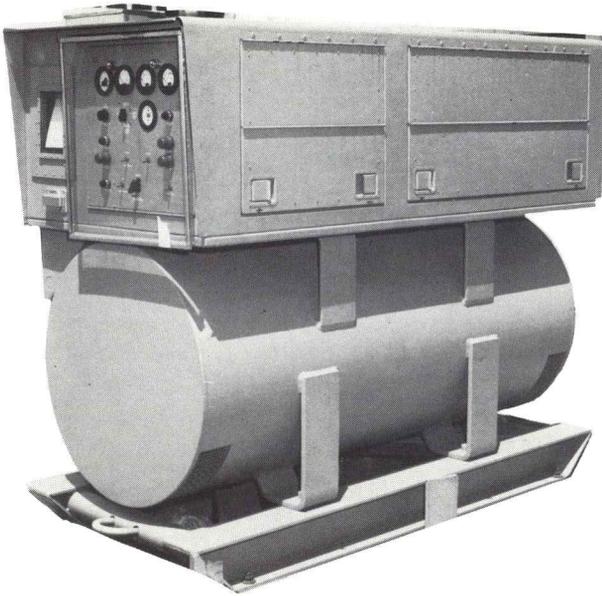
The ESE Power furnished this facility is similar to that which is furnished the SDF and the Test Laboratories at Huntsville, Alabama.

See pages 4 thru 11 and 206 thru 208.



## GENERATOR ROOM

These 28 VDC 500 ampere Motor Generator Sets located inside the AGCS at VLF 37/B supply 28 VDC to the vehicle and ESE.



### 60 KW, 208 V, 400 CPS MOTOR GENERATOR SETS

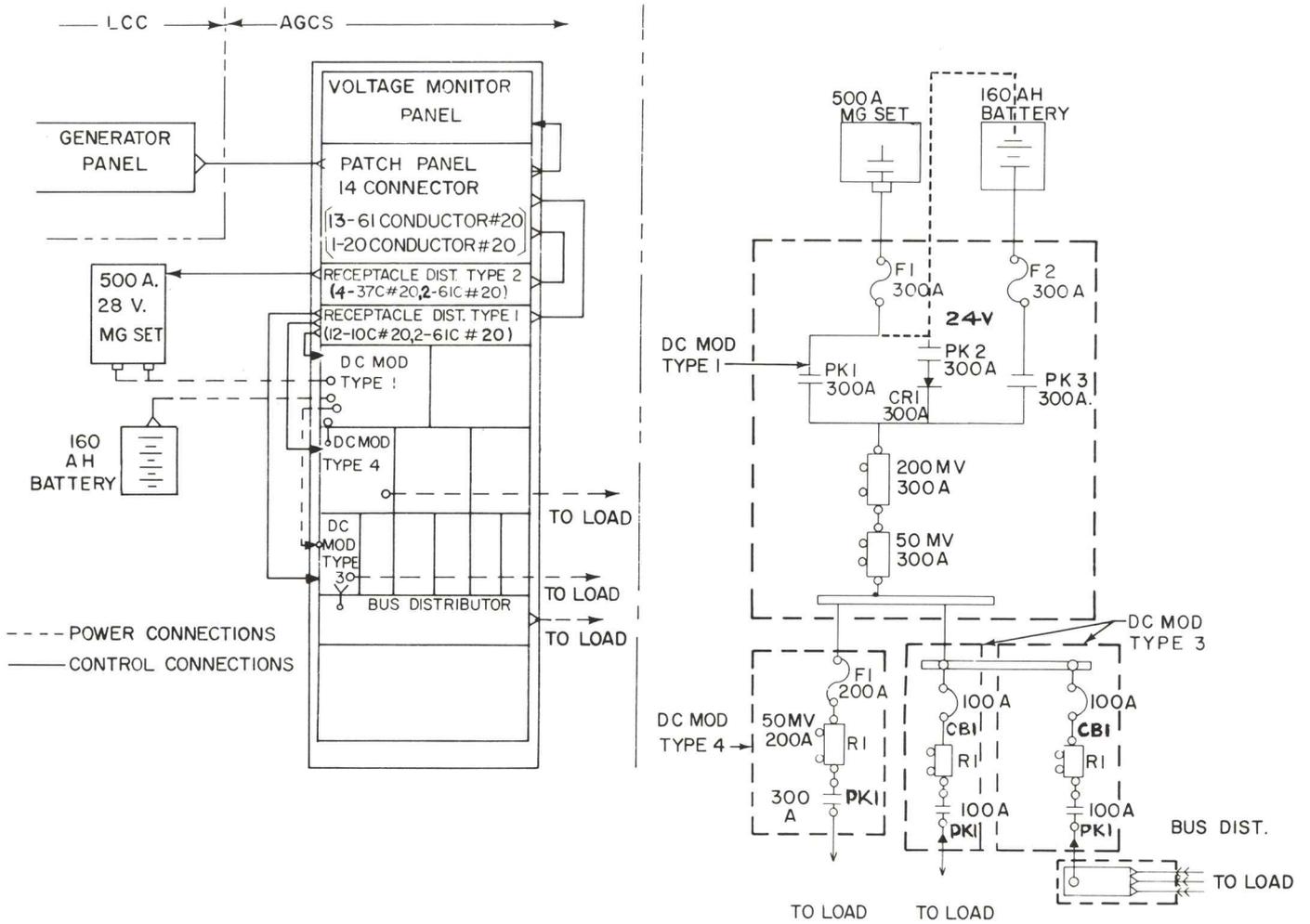
These units are motor generator sets which operate on 440 volt, 3 phase, 60 CPS power. The output of each unit is rated at 60KW, 208 volt, 3 phase, 400 CPS at 0.8 power factor. The units contain magnetic amplifier type regulators which hold the output to within  $\pm 2\%$  of the set voltage. A voltage in-tolerance circuit is built into the machines. This circuit provides a signal when the alternator voltage is within a voltage band of 203 to 213 volts.

# VLF 37/B

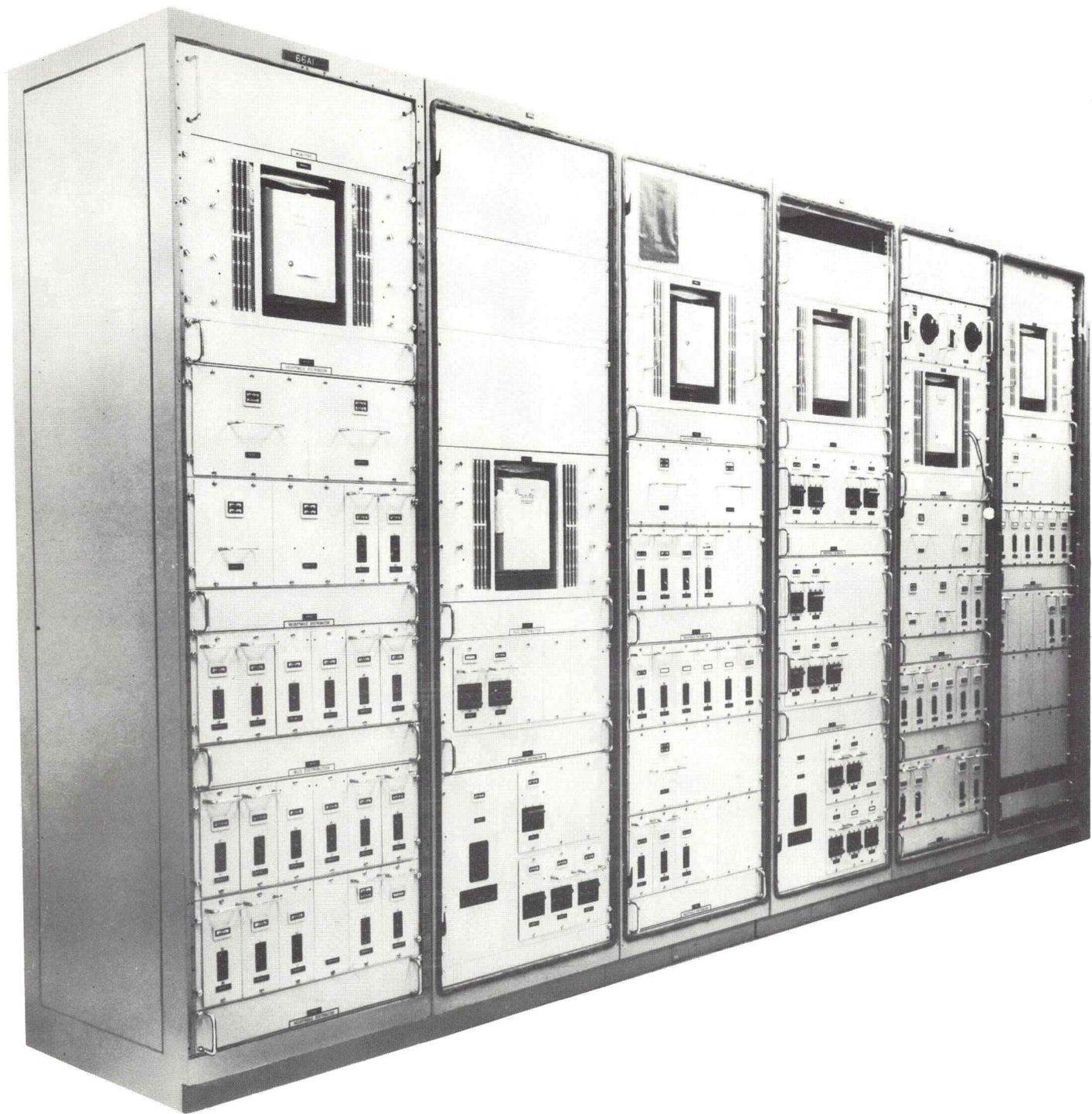
## POWER DISTRIBUTION

The power generated by previously described sources in the ESE is distributed by the Power Distribution System to the systems which control, monitor and relay power to the vehicle components and other complex systems during pre-launch and launch operations.

See pages 12 thru 29 for similar ESE.



**TYPICAL POWER CIRCUIT AND RACK INTERCONNECT**



**LCC POWER DISTRIBUTION RACKS**

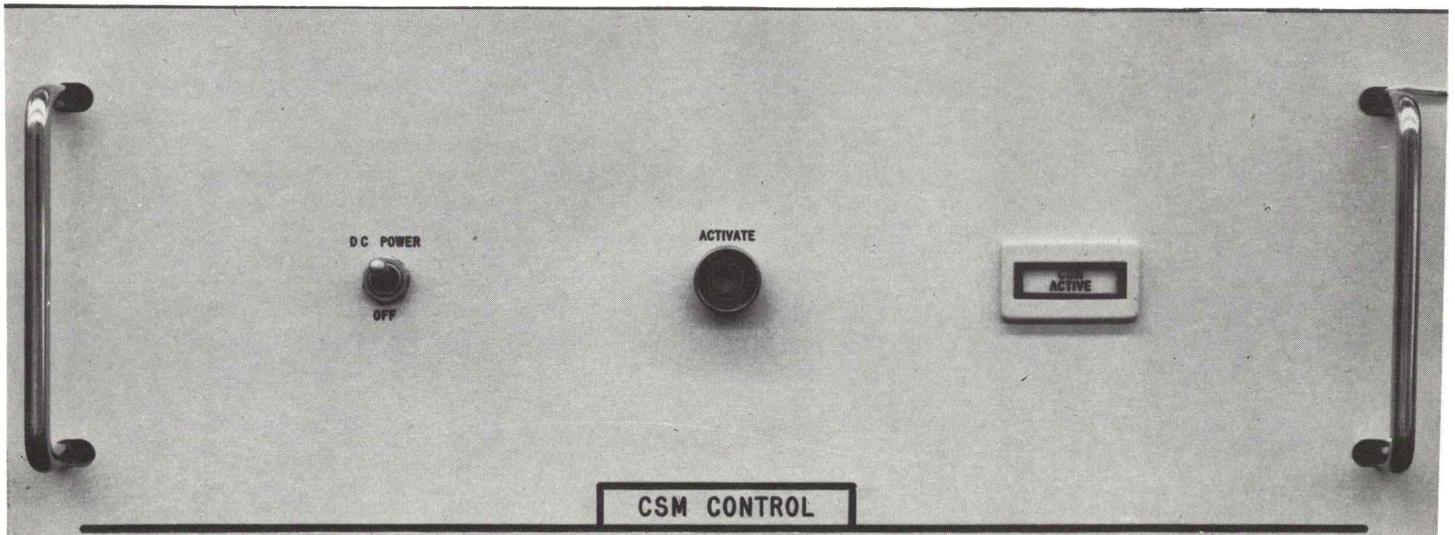
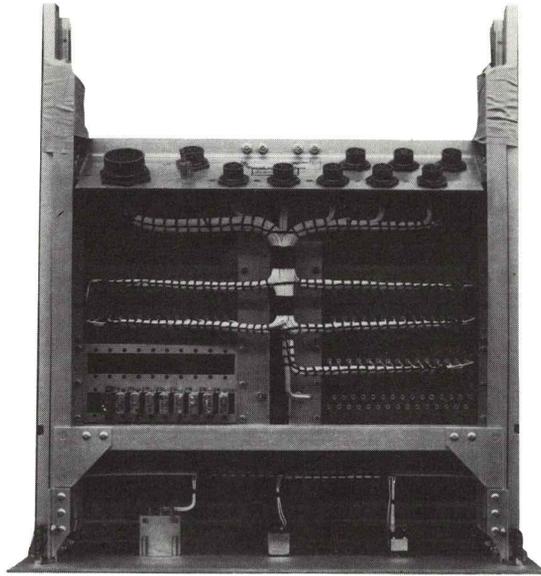
**(66A1, 66A2, 66A3, 66A4, 66A5 AND 66A6)**

# **VLf 37/B**

## **PROPULSION SYSTEM**

The ESE associated with the vehicle Propulsion System, electrically energizes, controls, monitors and tests the electrical components associated with the vehicle pneumatic systems, the vehicle pyrotechnics and electro-mechanical components associated with the vehicle propellant tanks and rocket engines. In addition, it sequences the systems down to the lift-off condition.

See pages 31 thru 47 and 212.



### **CSM CONTROL PANEL (138A9)**

This panel contains the components necessary to integrate the separate Combustion Stability Monitor (CSM) units. In addition, the ESE rough combustion cutoff circuits are distributed through this panel.

# VLF 37/B

## FLIGHT CONTROL SYSTEM

The function of the flight control system ESE is to electrically energize, control, monitor, and test the vehicle flight control system. The operation of this system is accomplished by the assembly of several panels of inter-related or integrated functions. For example, operation of controls on one panel may cause readouts on one or more of the other panels. The equipment is used to functionally check out and operate the vehicle flight control system at the static test areas and at the launching areas.

See pages 48 thru 54 for similar ESE.

# **VLF 37/B**

## **ORDNANCE SYSTEM**

The ESE associated with the Ordnance System is designed to test and monitor the exploding bridge wire (EBW) firing units, the safe and arm unit destruct, and the destruct system controllers. The EBW units monitored are used to fire the retro-rockets, ullage rockets, separation bolts and fuel dispersion primacord.

See pages 55 thru 58 and 162.

# **VLF 37/B**

## **ENVIRONMENTAL CONDITIONING SYSTEM**

The ESE is associated with the IU Stage environmental conditioning controls, and monitors the nitrogen to the stabilized platform and the nitrogen cooling system. It also controls and monitors the engine heaters and auxiliary system heaters.

See pages 163 thru 165 for similar ESE.

# **VLF 37/B**

## **NETWORKS SYSTEM**

The ESE associated with the networks system controls and monitors the DC buses. It controls the flight sequencer, program device, and also provides an indication of the status of power transfer.

See pages 59 and 60.

# VLF 37/B

## MEASURING AND TRACKING SYSTEMS

The ESE associated with the measuring and tracking is used to simulate, monitor, and control the radar tracking equipment and the on-board measuring and telemetering system. This equipment is also used in connection with the calibration of telemetering equipment.

See pages 61 thru 63.

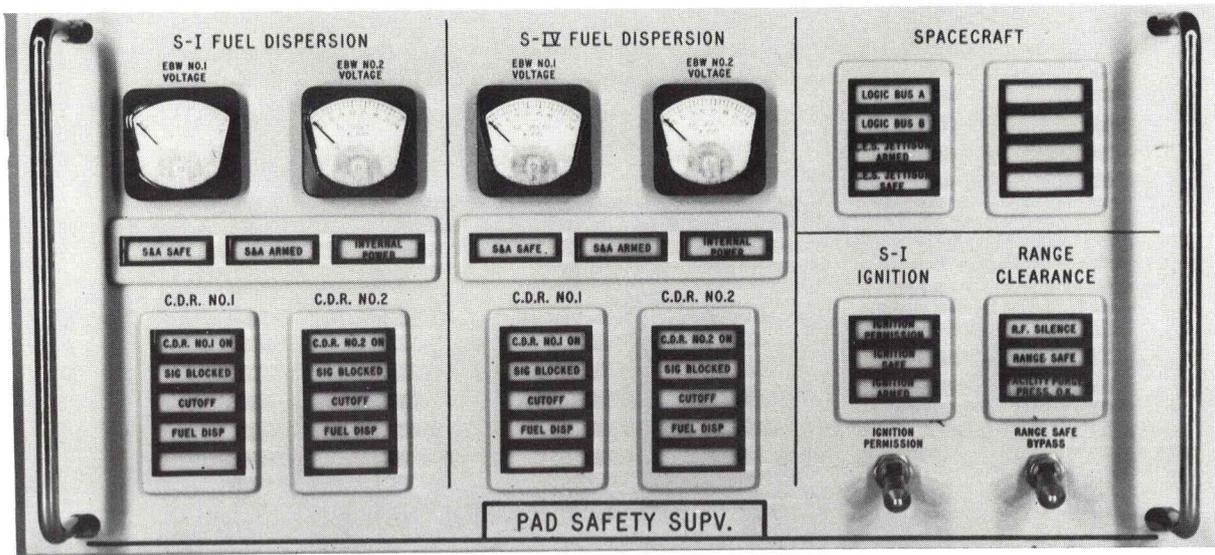
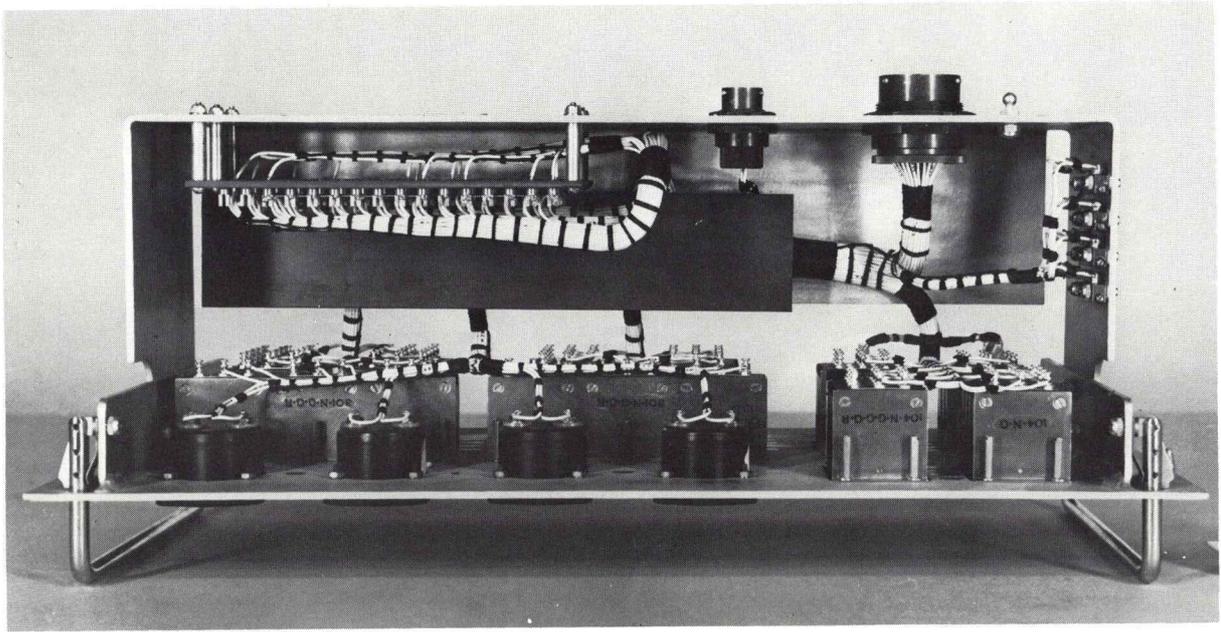
# **VLF 37/B**

## **S-I STAGE**

### **SYSTEMS INTEGRATION**

This equipment provides the means to interface between the S-1, S-IV and IU Stages. It also provides the means to interface between the ESE and the RCA-110A Computer. This equipment further provides means to perform functions concerned with the integrated vehicle system not performed by the individual stage ESE.

See pages 138 thru 148.



### PAD SAFETY SUPV. PANEL (1012)

This panel provides the Pad Safety Officer visual supervision of the S-I and S-IV Stage components capable of producing dangerous or catastrophic conditions. The panel provides monitoring of the vehicle power buses and indicates whether the vehicle components are operating on internal or external power. Supervision of the status of the vehicle Command Receivers and the Propulsion System is provided. Also, a switch is provided for use of the Pad Safety Officer which permits the vehicle to be launched.

# **VLF 37/B**

## **SPECIAL TEST EQUIPMENT**

There are several sets of equipment that are supplied to verify the Saturn Vehicle Electrical Systems and the ESE. These test sets are used in various areas of checkout as required and do not necessarily form a part of the equipment used to launch the vehicle.

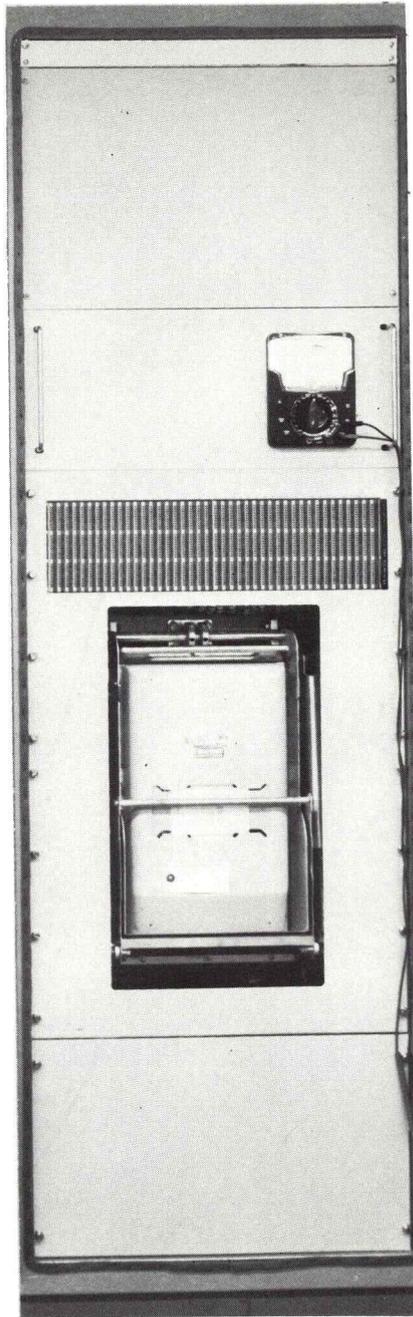
See pages 29 and 69 thru 81.

# **VLf 37/B**

## **INSTRUMENT UNIT ESE**

The ESE furnished this facility is similar to that ESE furnished the SDF for IU checkout.

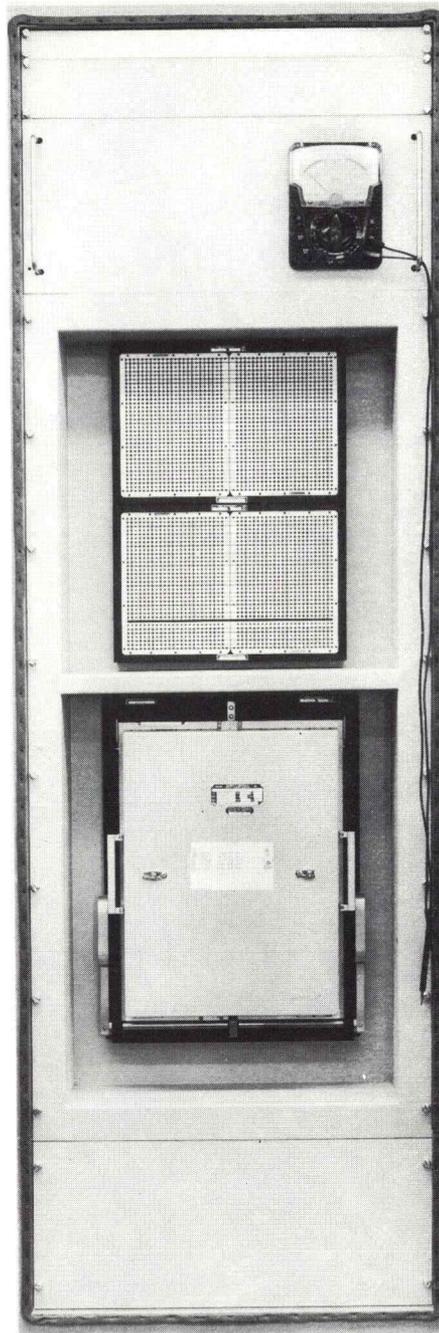
See pages 24, 43 and 82 thru 103 for similar ESE.



## IU PATCH RACK 360

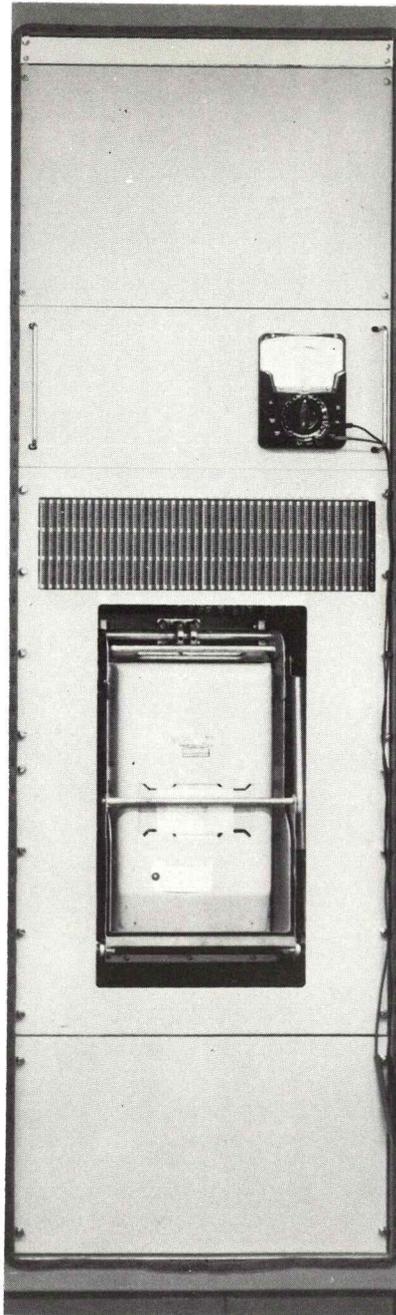
(42-61 Pin Connectors)

The function of this rack is to provide a distribution center for the unshielded ESE System control functions of the ST-90S and ST-124 Stabilized Platform Systems of the vehicle IU Stage. Relay logic necessary for the operation and checkout of these systems is located within this rack. This rack distributes functions between the vehicle IU Stage, the LCC and other patch rack systems at its location within the AGCS.



### **IU PATCH RACK 361**

The function of this rack is to provide a shielded distribution center to collect IU - ESE System shielded cables entering the AGCS from the vehicle IU Stage, and distribute control functions to the LCC and other patch racks of the IU - ESE System within the AGCS. This rack is typical of IU patch racks No. 151 and 152.



### **IU PATCH RACK 363**

(42-61 Pin Connectors)

The function of this rack is to provide a distribution center for distributing ESE System functions, other than Stabilized Platform Systems, between the vehicle IU Stage, the LCC and other patch rack systems at its location within the AGCS. Also all relay logic necessary for the operation and checkout of these functions of the IU Stage is located within this rack.

# **VLf 37/B**

## **S-IV STAGE CHECKOUT ESE**

The ESE furnished this area substitutes for the Saturn First Stage (S-1) and IU in the pre-assembly checkout of the Saturn Fourth Stage (S-IV).

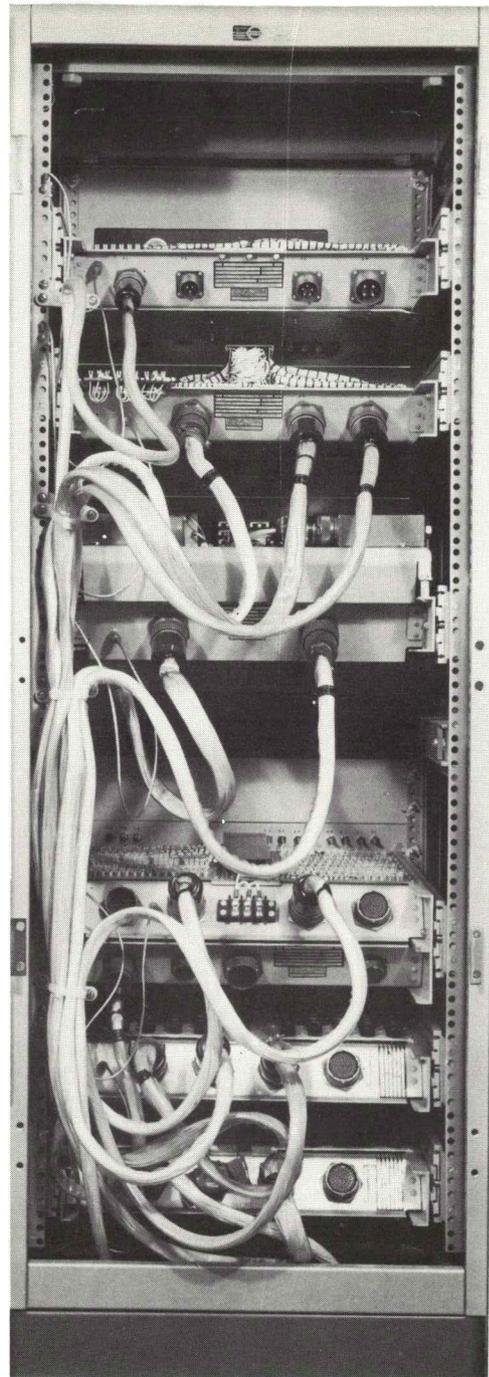
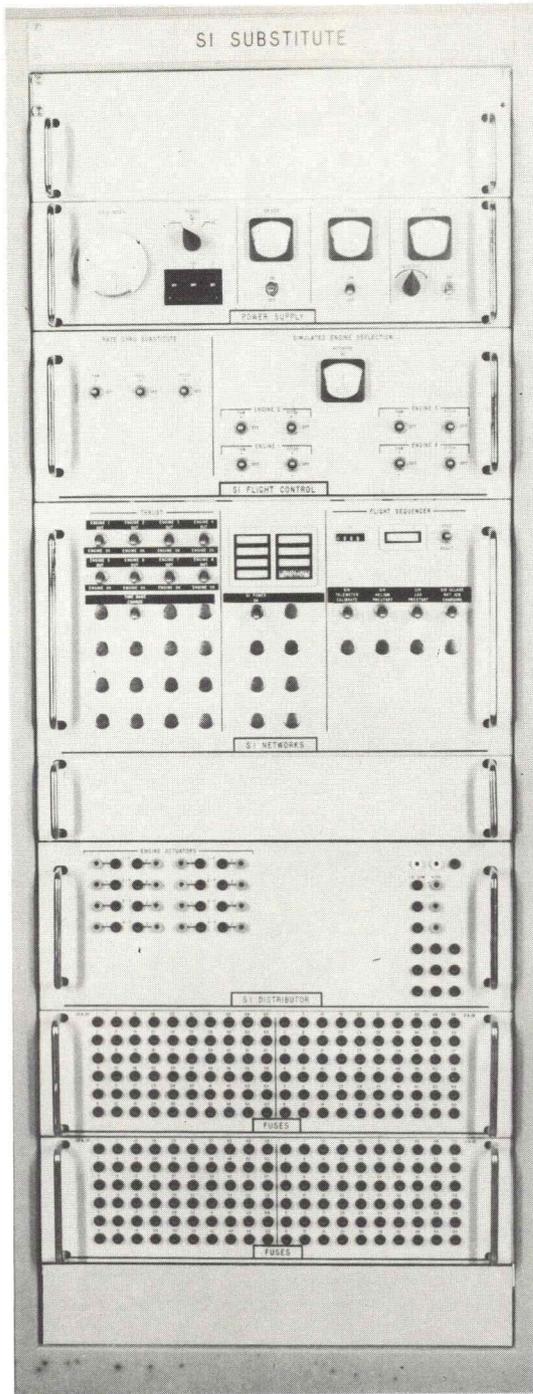
**VLF 37/B**  
**POWER SOURCES**

See pages 4 thru 11.

# **VLF 37/B**

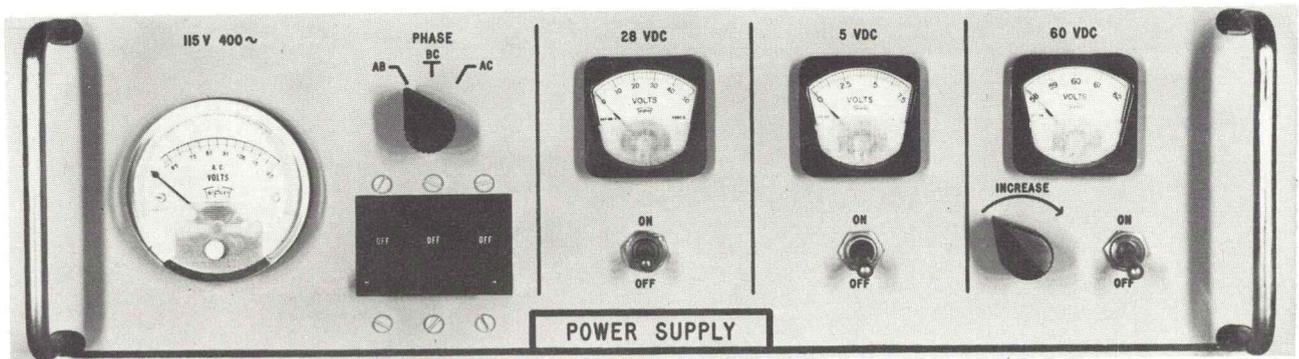
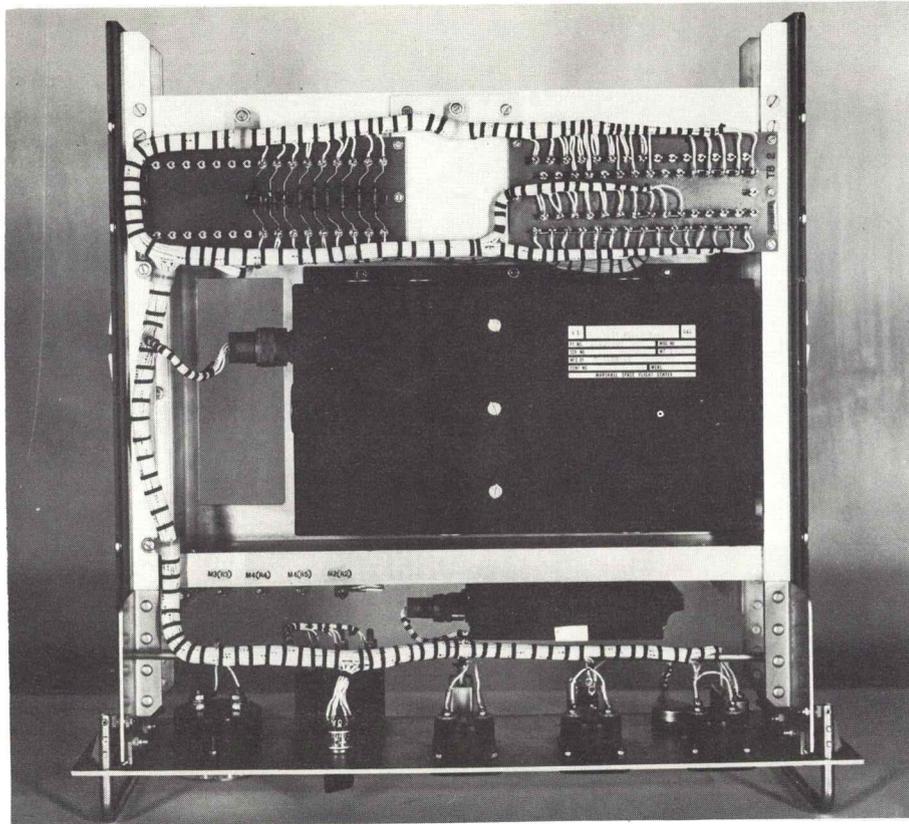
## **POWER DISTRIBUTION**

See pages 12 thru 29 for similar ESE.



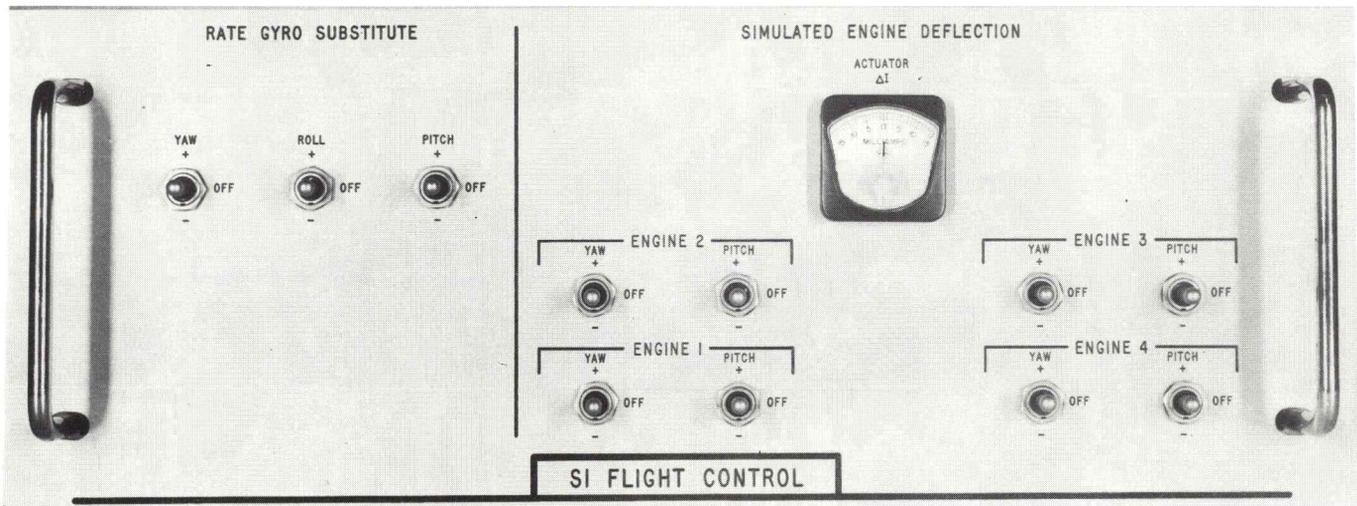
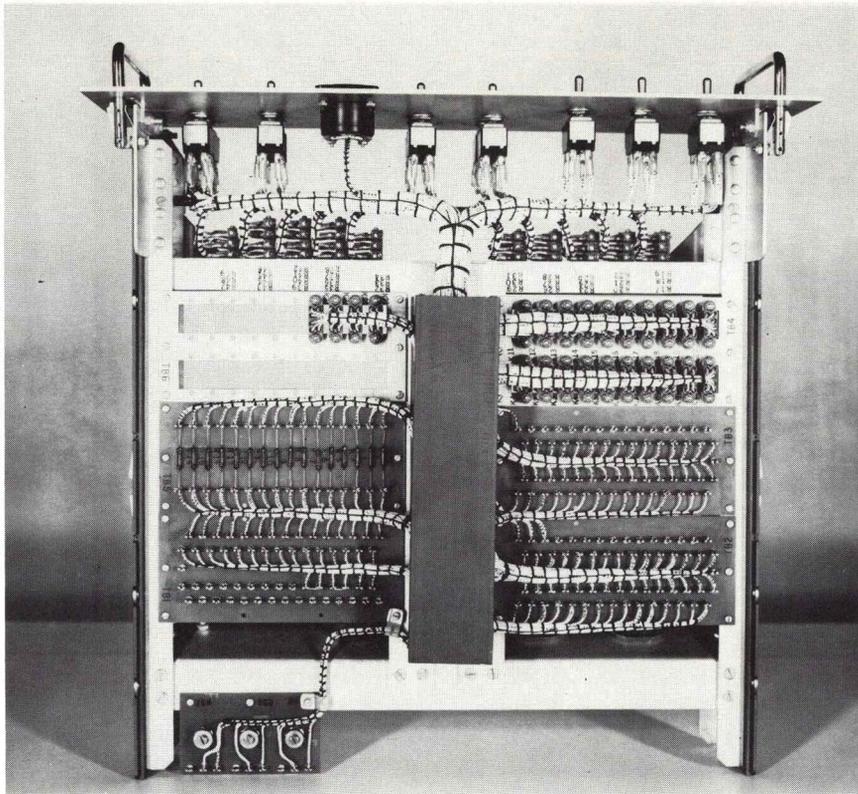
### **S-1 STAGE SUBSTITUTE RACK FOR S-IV STAGE 320**

This set of panels is designed to be used in lieu of the S-1 Stage in accomplishing checkout and verification of electrical system in S-IV Stage and IU. All significant electrical functions are simulated.



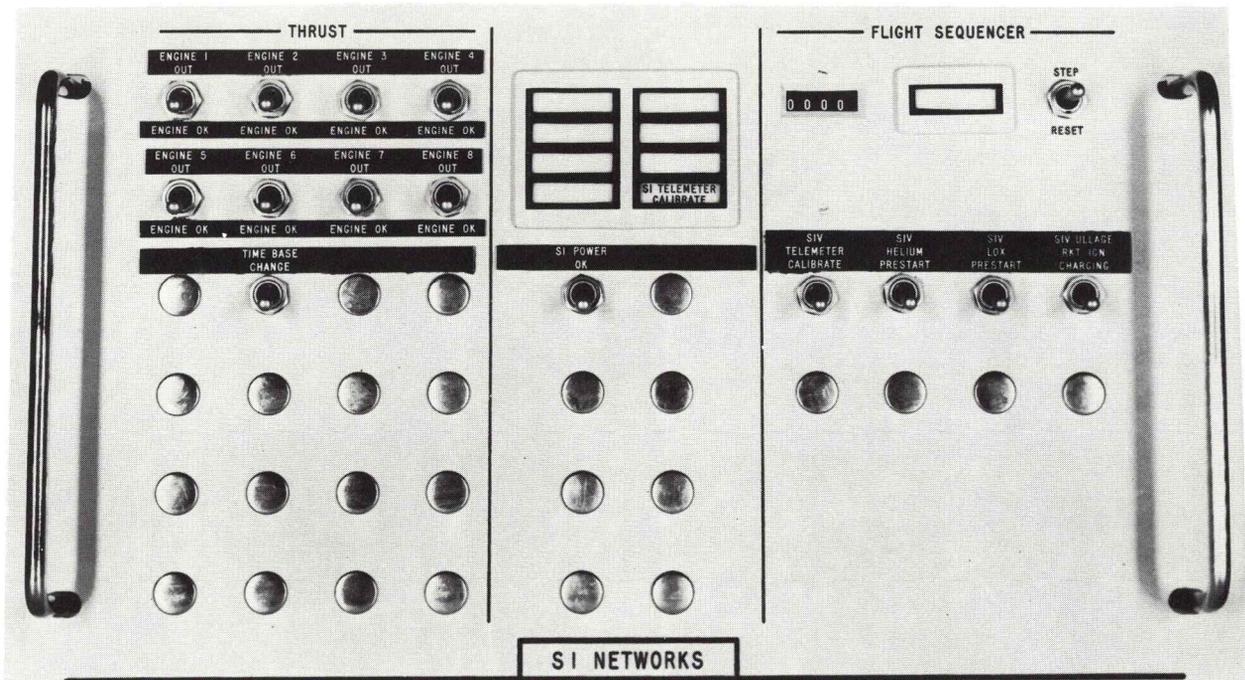
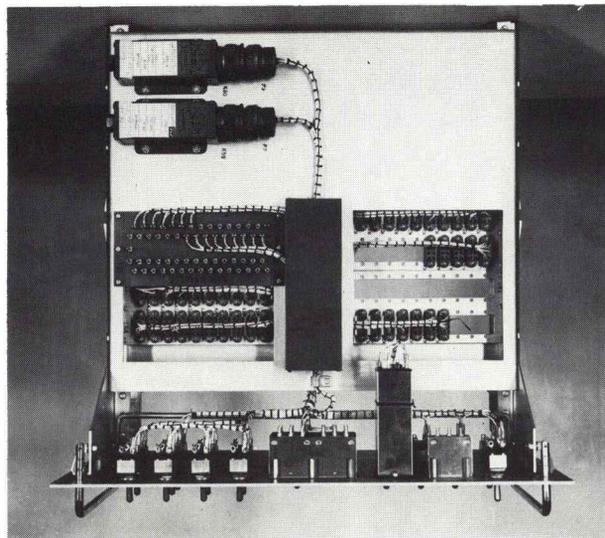
### POWER SUPPLY PANEL (320A1)

This panel supervises the 115VAC, 400CPS, 60VDC, 28VDC and 5VDC supplied to the S-1 Stage Substitute Rack 320.



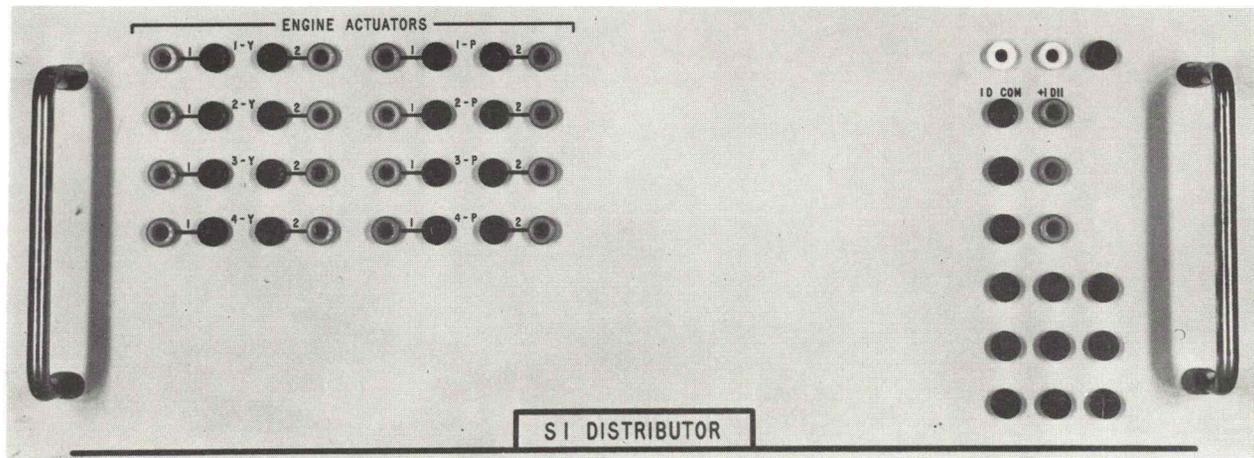
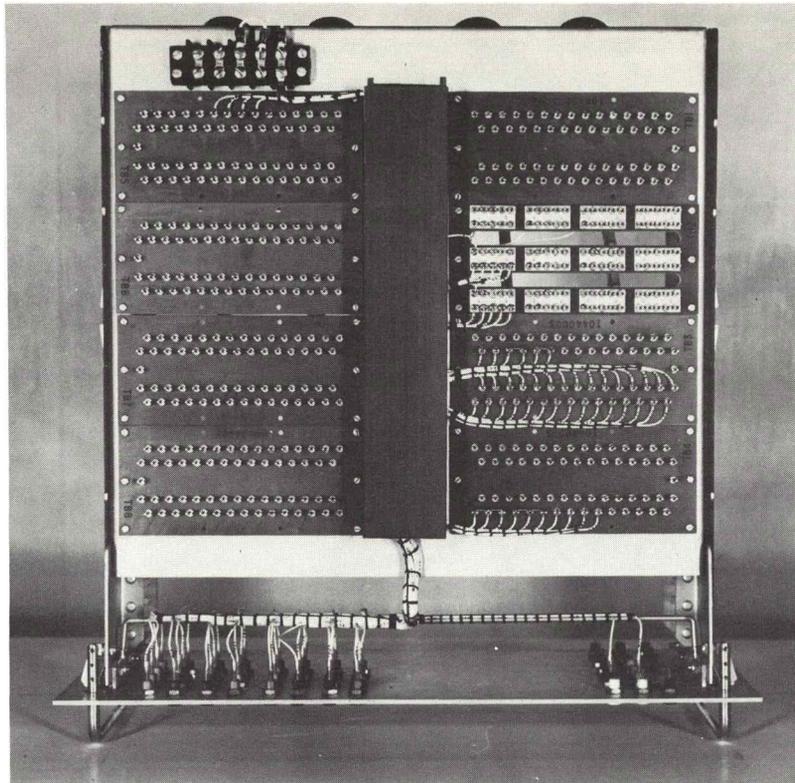
### S-1 FLIGHT CONTROL PANEL (320A2)

This panel provides simulated engine deflection signals (measuring beta) and simulated control voltage to the substitute control computer. In addition this panel provides simulated Rate Gyro Signals.



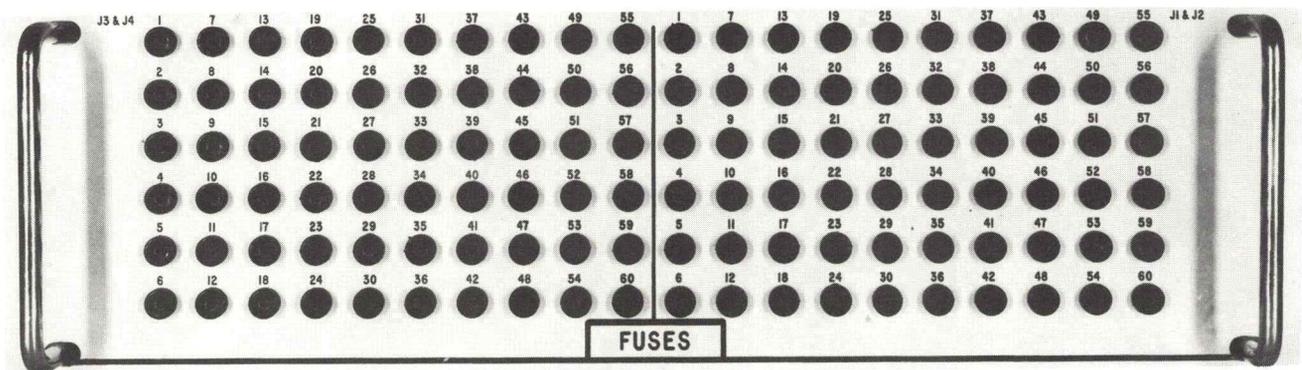
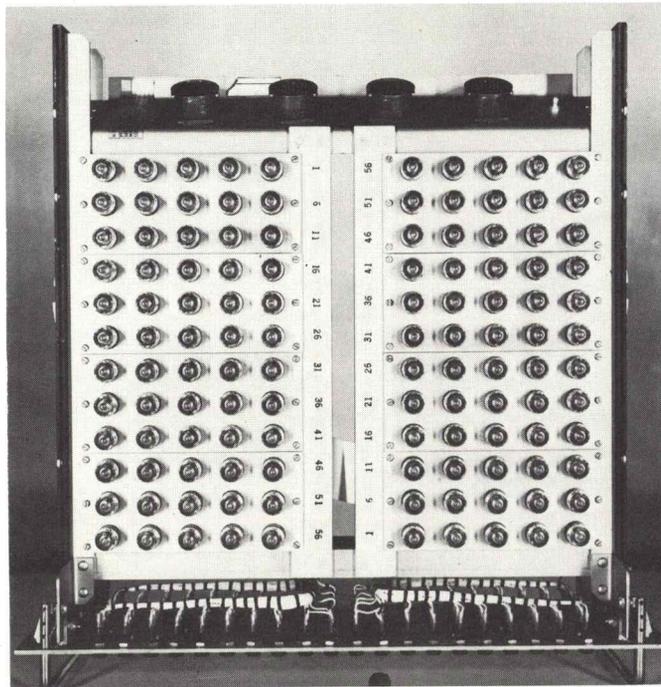
### S-1 NETWORKS PANEL (320A3)

The function of this panel is to provide all network input stimulus signals to the Saturn S-IV Stage and the IU Stage Substitute that would ordinarily be received from the S-1 Stage. This panel also provides monitoring capabilities for these signals.



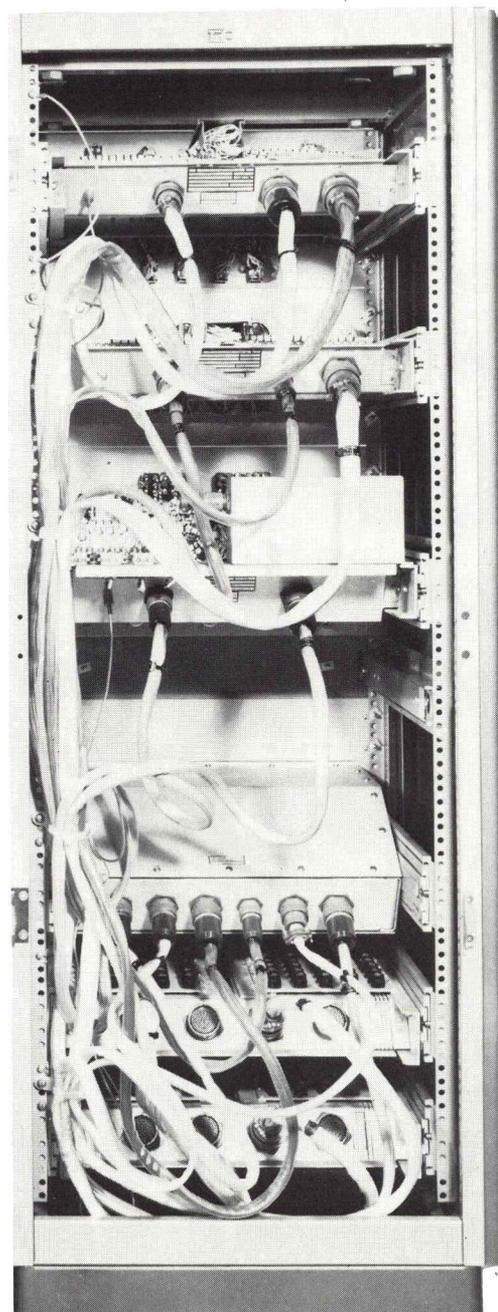
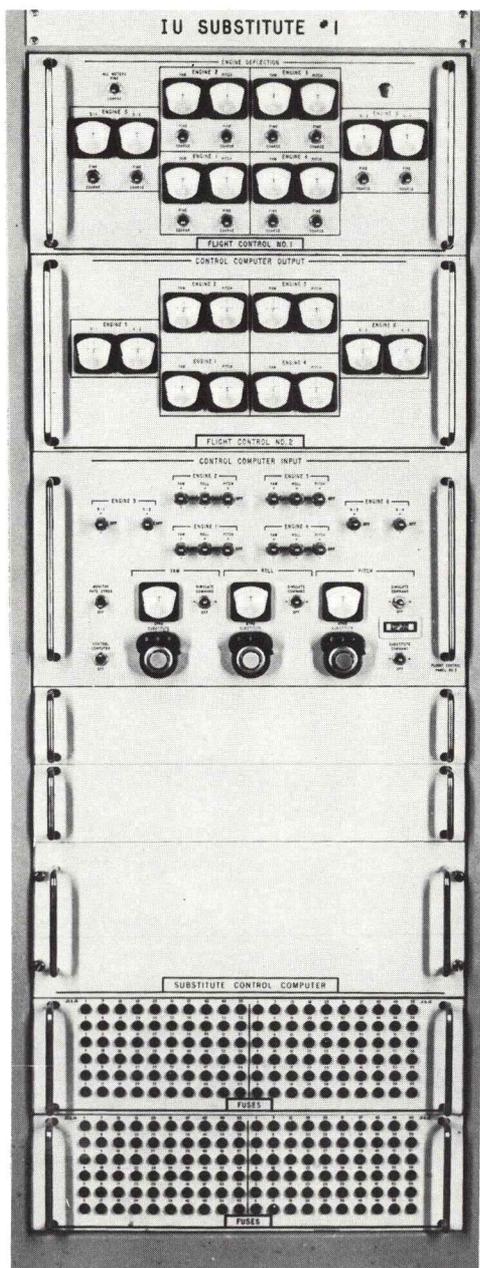
### S-1 DISTRIBUTOR PANEL (320A4)

The function of this panel is to distribute signals between the individual panels within the rack and, as required, to other items of ESE within the S-1 Stage Substitute System.



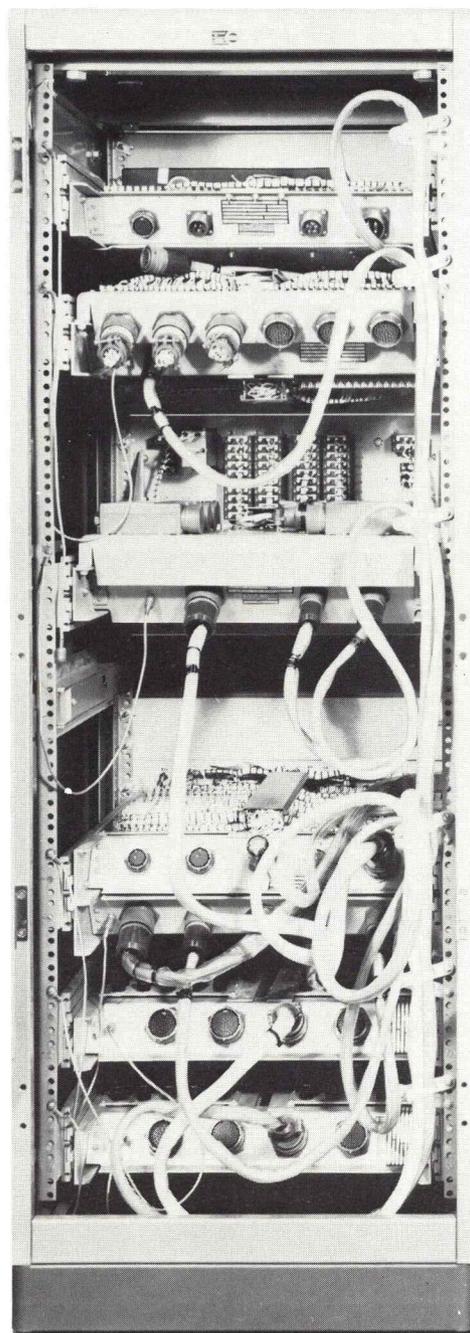
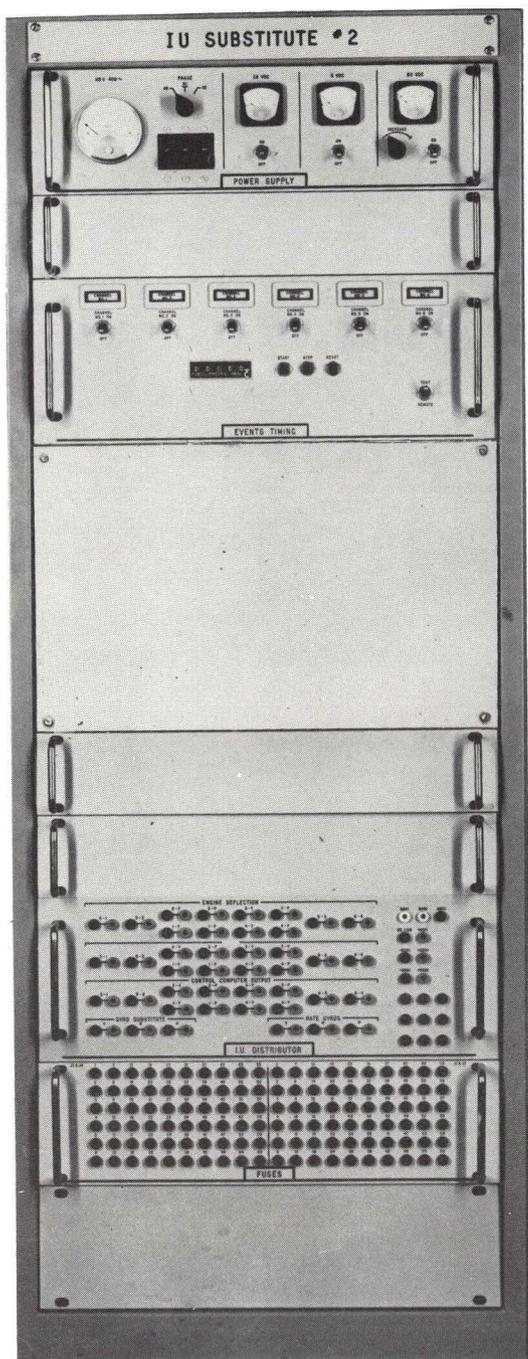
### FUSES PANEL (310A9, 310A11, 320A5, AND 320A6)

The function of this panel is to provide circuit protection for all lines passing through it.

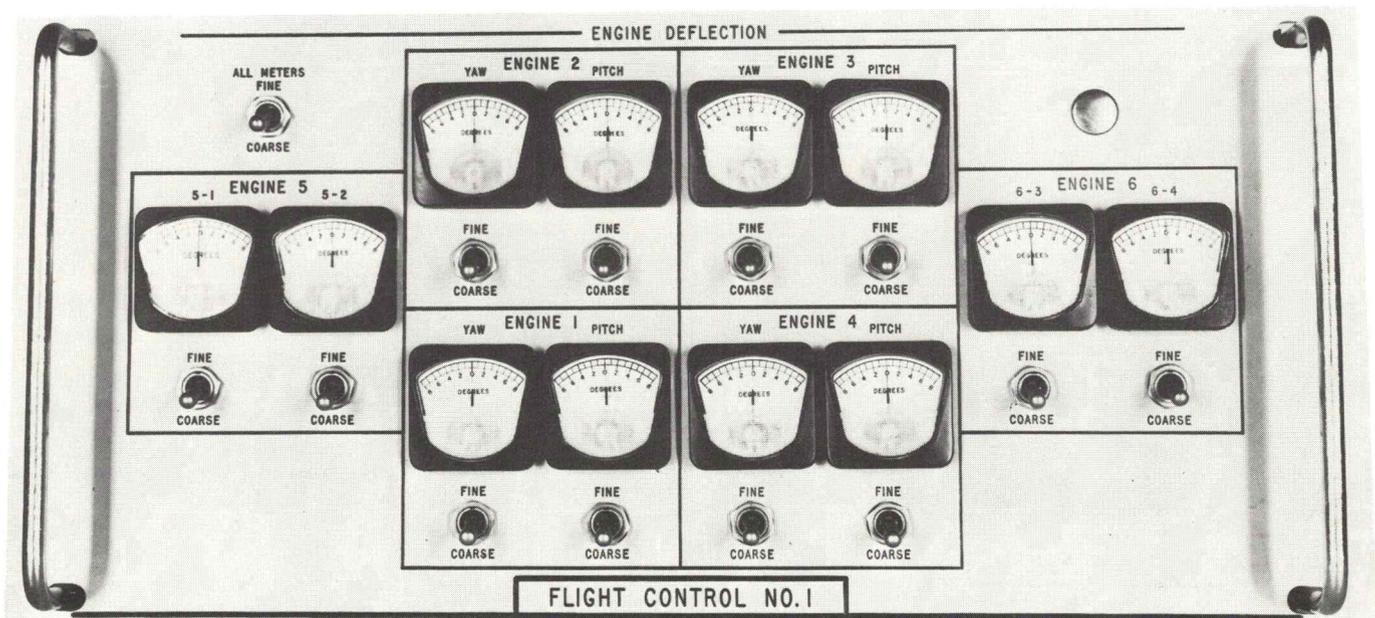
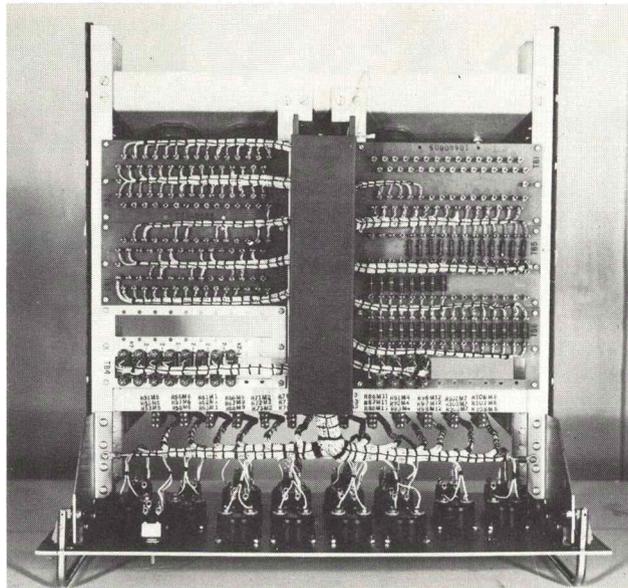


### IU SUBSTITUTE NO. 1 RACK (310)

These racks are designed to be used in lieu of the IU in accomplishing checkout and verification of the electrical system in the S-1 and S-IV Stages. All significant electrical functions are simulated.

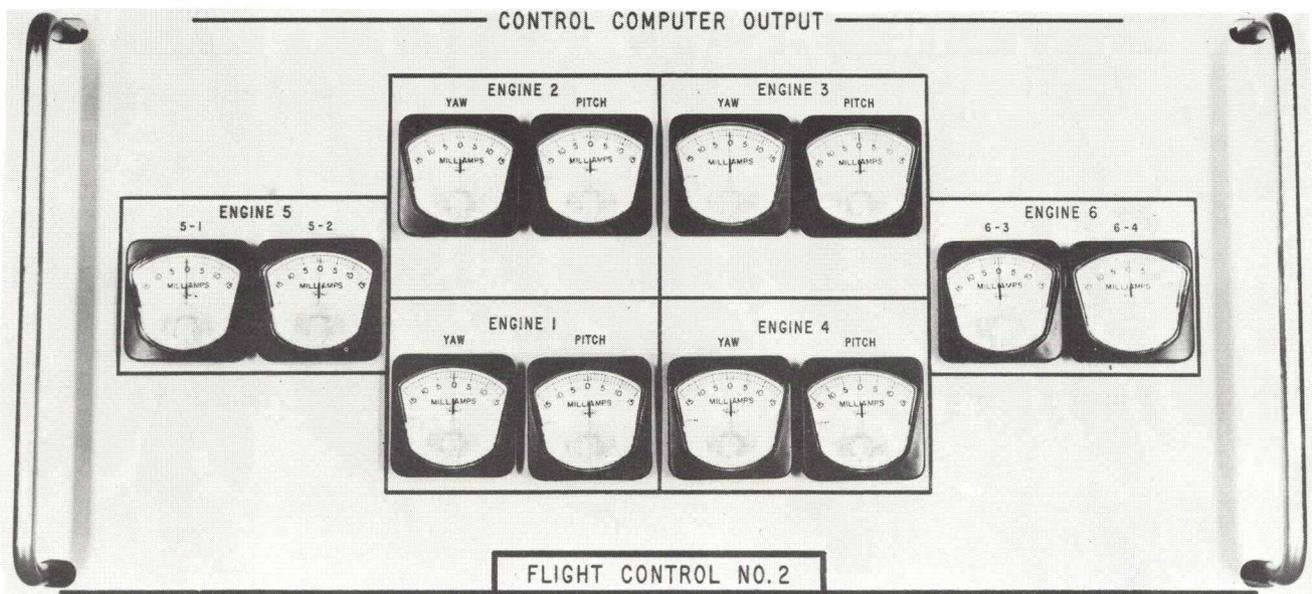
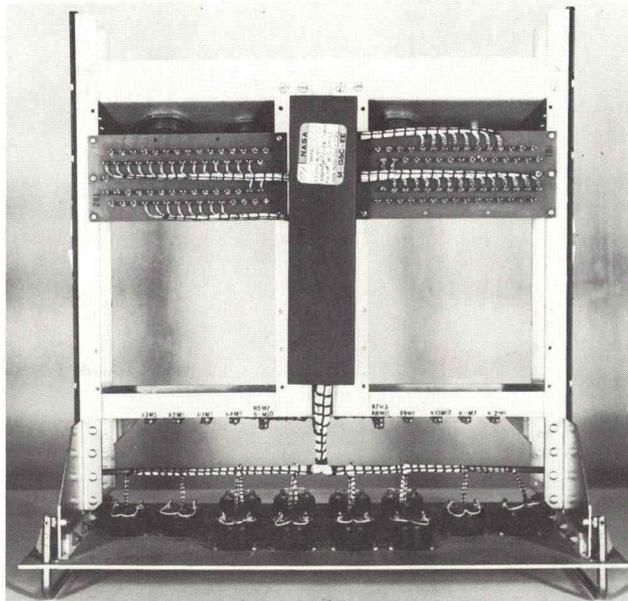


IU SUBSTITUTE NO. 2 RACK (310)



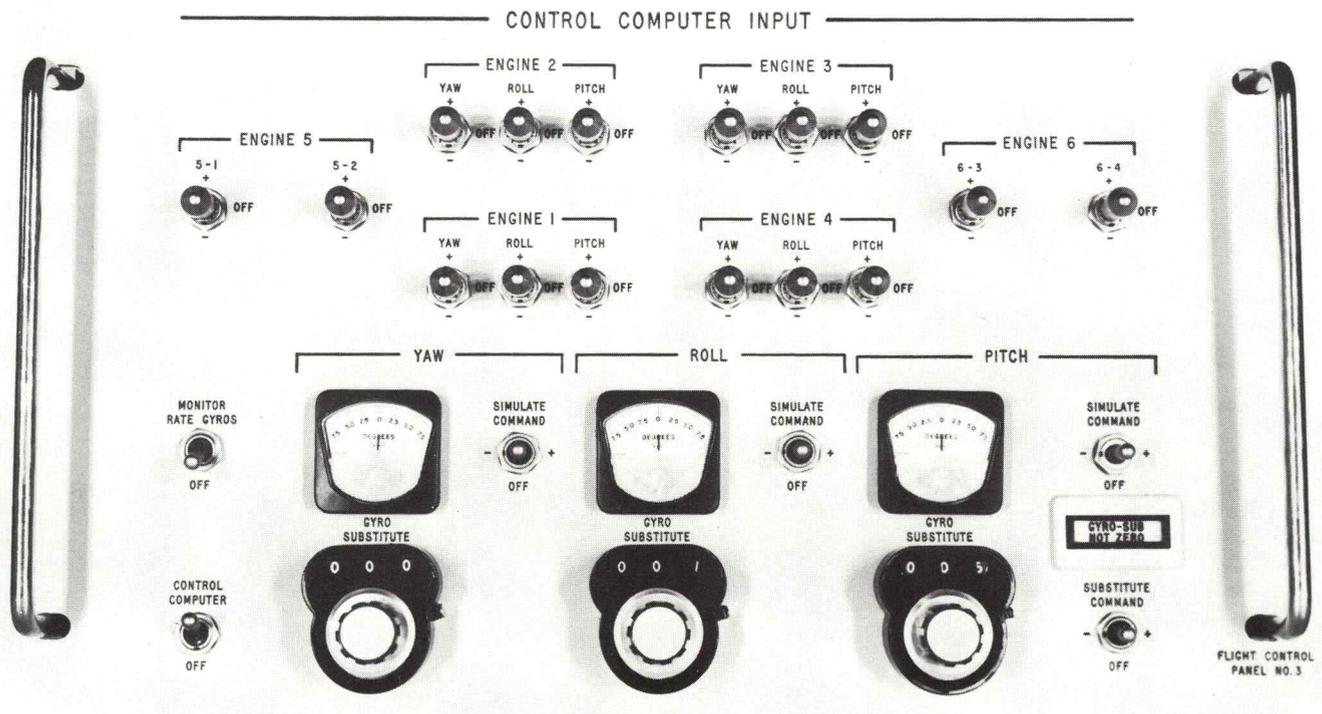
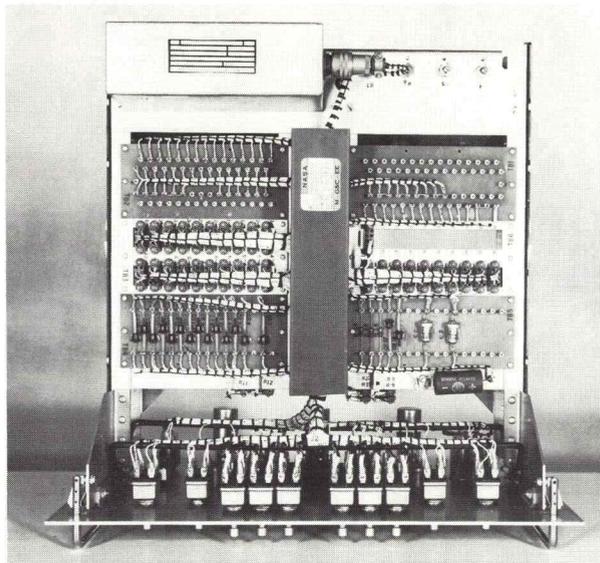
### FLIGHT CONTROL NO. 1 PANEL (310A1)

The function of this panel is to provide continuous monitoring of the Yaw, Roll, and Pitch positions of the six control engines of Saturn S-IV Stage.



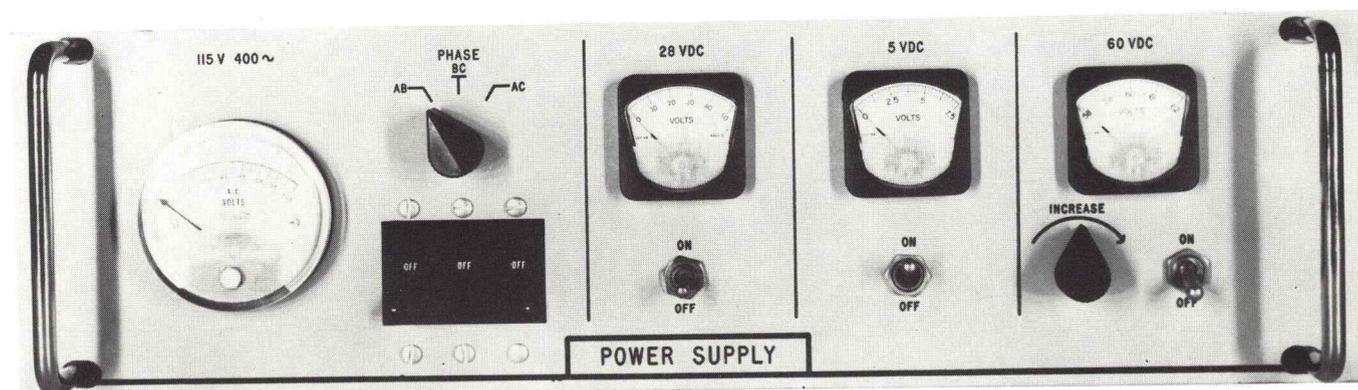
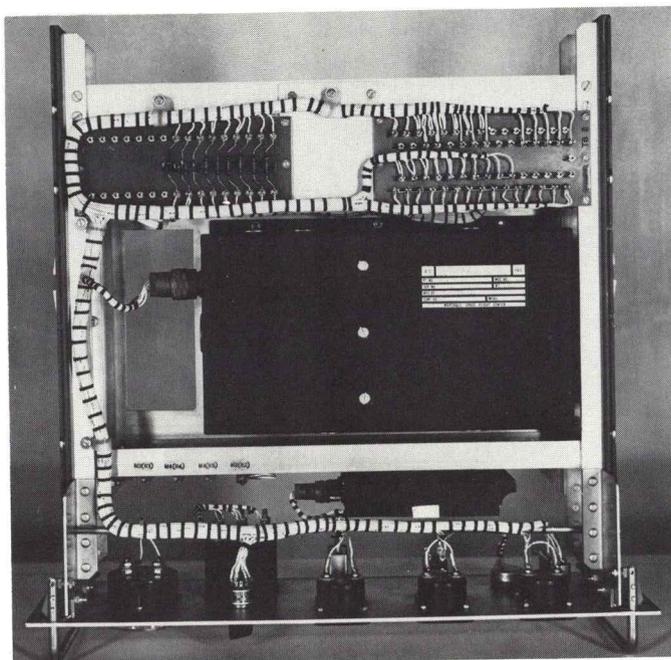
### FLIGHT CONTROL NO. 2 PANEL (310A2)

The function of this panel is to provide continuous monitoring of the output signals from the Substitute Flight Control Computer to the S-IV Stage Engine Gimbal Systems.



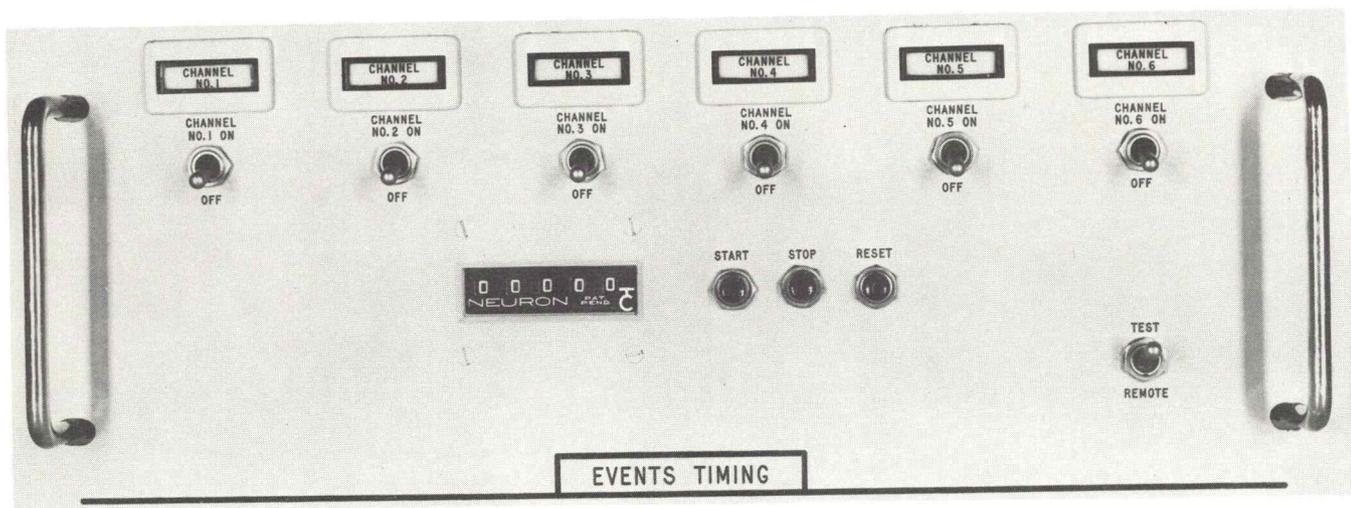
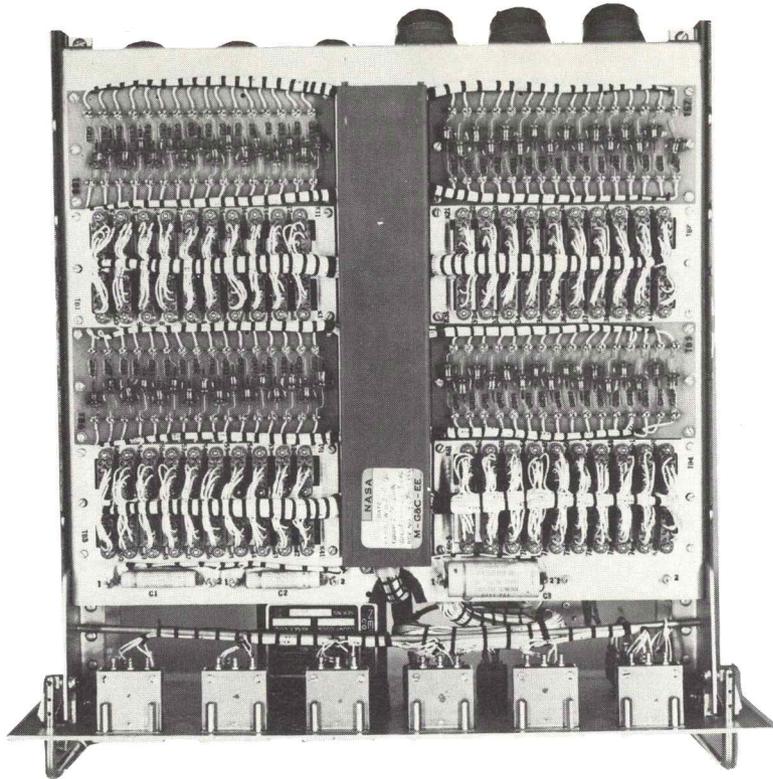
### FLIGHT CONTROL NO. 3 PANEL (310A3)

The function of this panel is to provide capability to introduce stimulus input signals to the Substitute Flight Control Computer to qualify the Engine Gimbal System during the S-IV Stage Test Program.



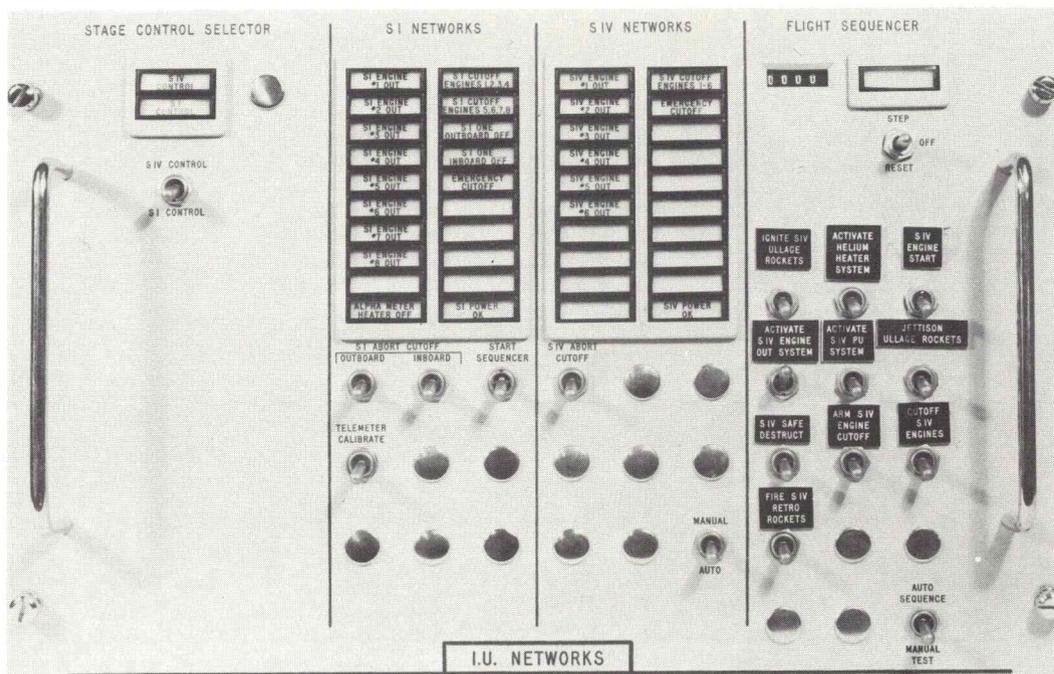
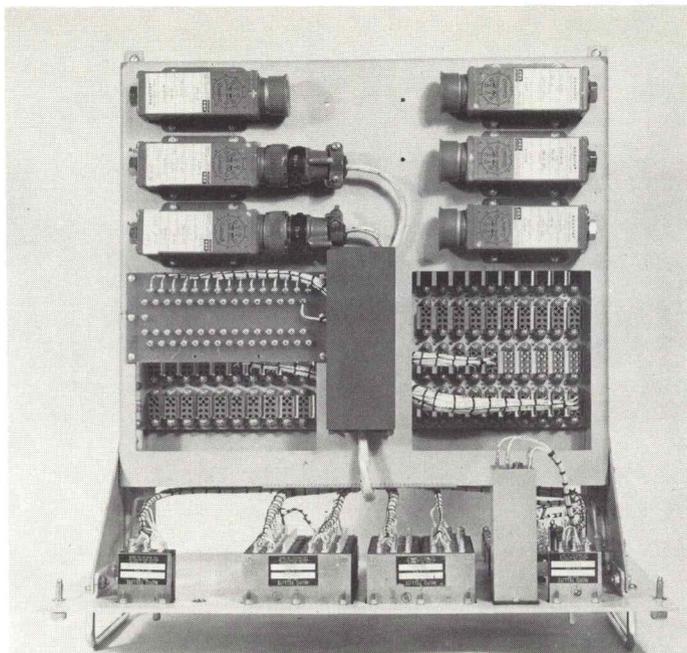
### POWER SUPPLY PANEL (310A5)

This panel supervises the 115 VAC, 400 CPS, 60 VDC, 28 VDC, and 5 VDC supplied to the IU Substitute Rack (310).



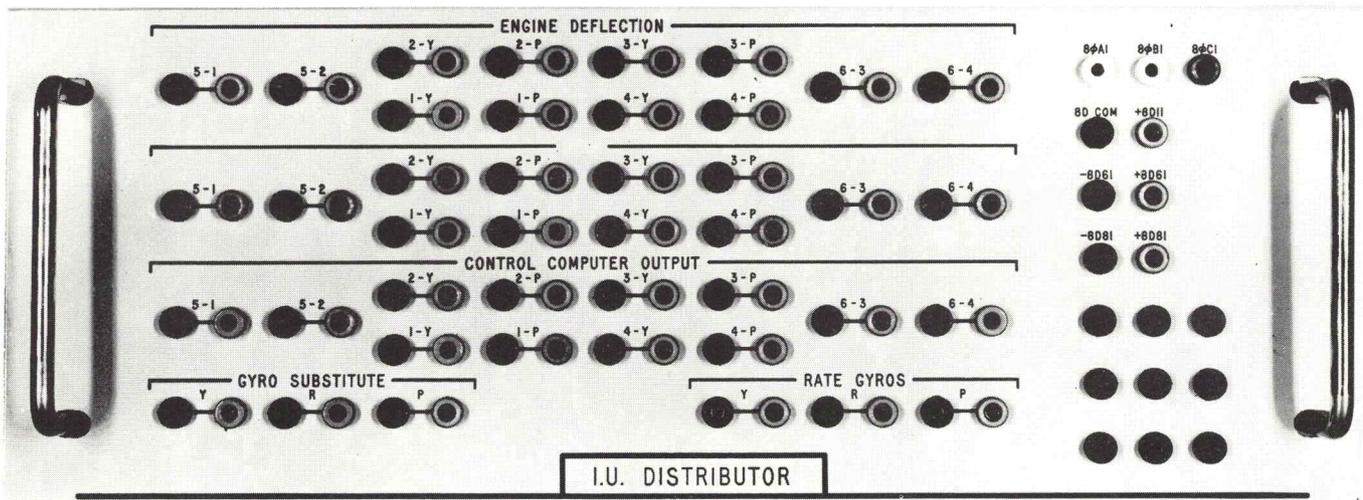
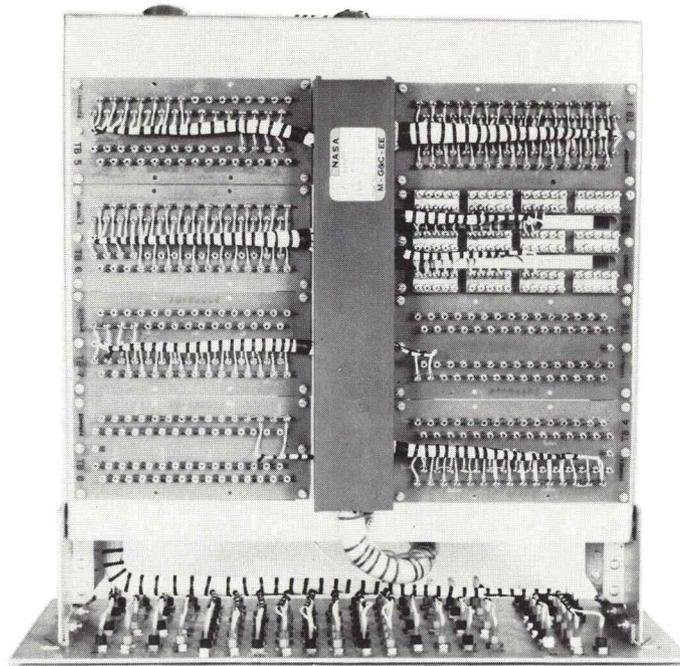
### EVENTS TIMING PANEL (310A6)

This panel is a timing device for stopping the IU Flight Sequence and the S-1 Stage Flight Sequencer. This panel simulates, in the IU Substitute 310, the program device which is used in the IU Stage.



### IU NETWORKS PANEL (310A7)

The function of this panel is to provide input stimulus for all network functions that occur in the S-IV Stage and to monitor all network functions returned to the IU Stage Substitute via the S-I or the S-IV Stage.



### IU DISTRIBUTOR PANEL (310A8)

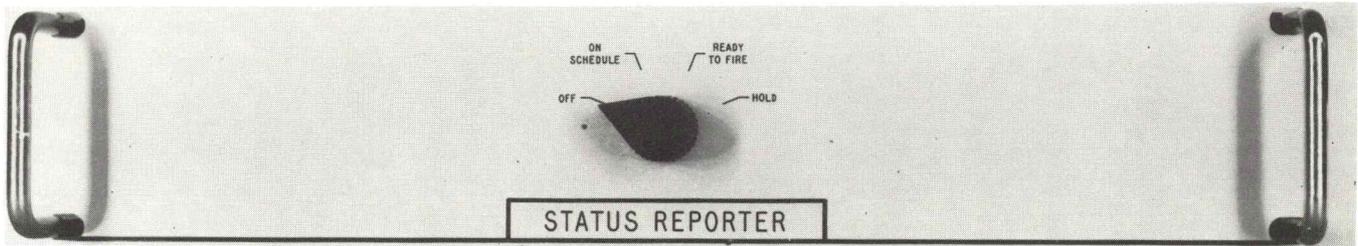
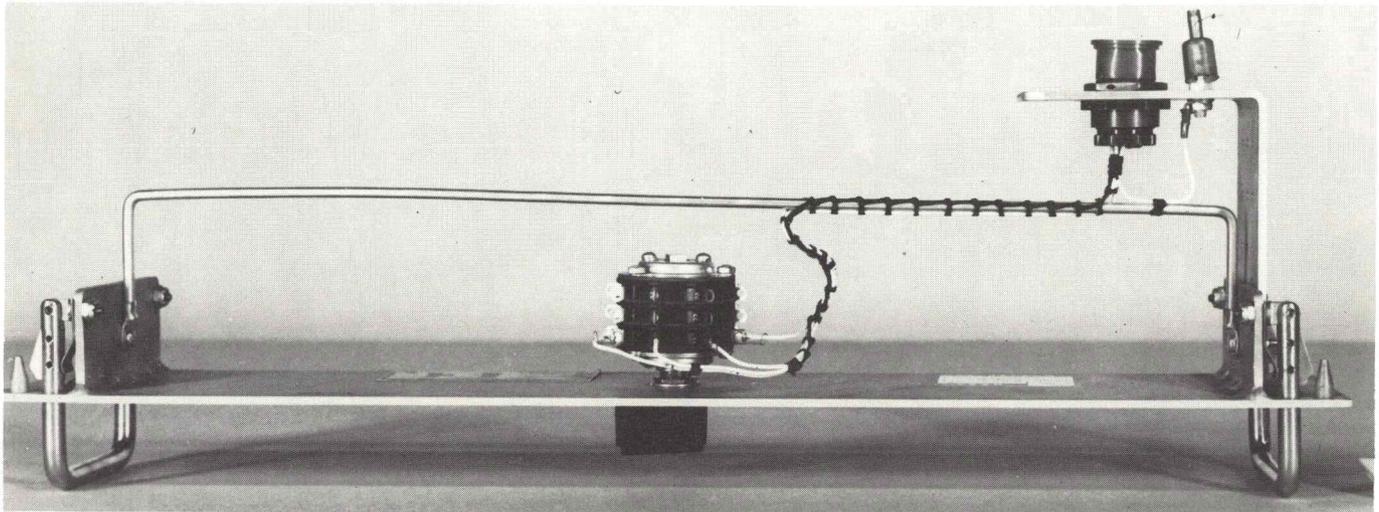
The function of this panel is to distribute signals between the individual panels within the rack and, as required, to other items of ESE within the IU Substitute system.

# VLF 37/B

## SYSTEMS INTEGRATION

This equipment provides the means to interface between the S-1, S-IV and IU Stages. It also provides the means to interface between the ESE and the RCA-110A Computer. This equipment further provides means to perform functions concerned with the integrated vehicle system not performed by the individual stage ESE.

See pages 64 thru 68, 138 thru 148 and 244.



### STATUS REPORTER PANEL

The function of this panel is to inform the Test Conductor of the status of the complete Flight Control System.

**VERTICAL LAUNCH FACILITY 37/B**  
**FACILITY PECULIAR CHECKOUT ESE**

# **VLF 37/B**

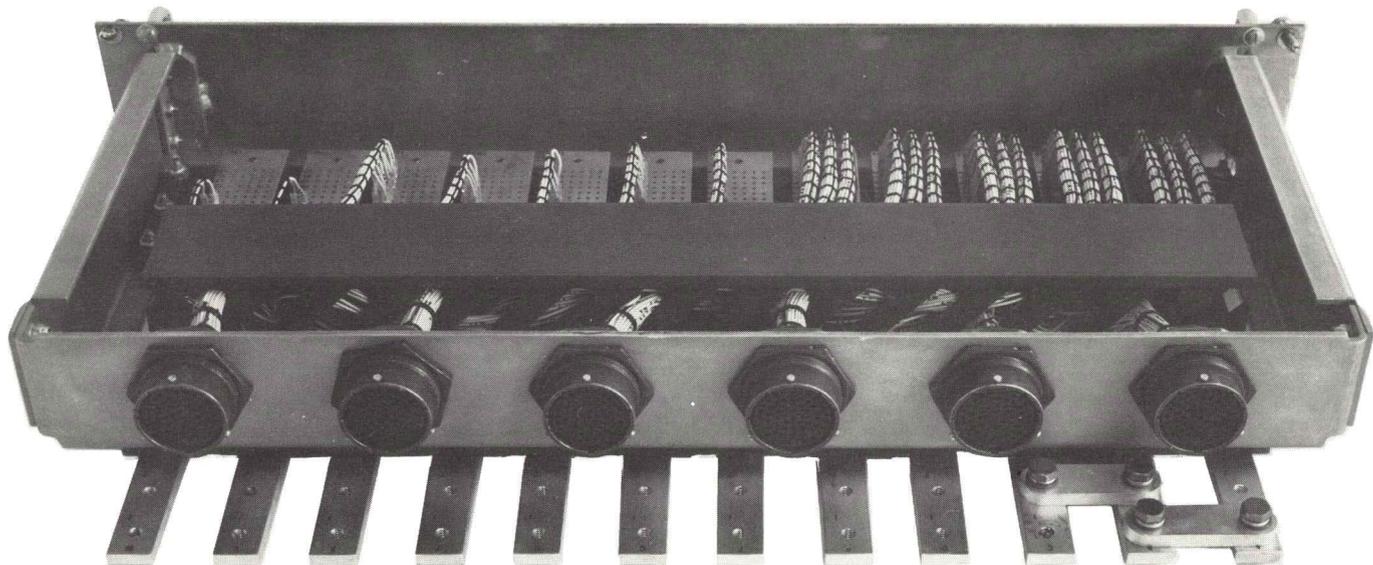
## **POWER DISTRIBUTION**

See pages 12 thru 29 and 247 thru 250.

No photographs available

### **POWER DISTRIBUTION RACK (145A1)**

The power control junction rack provides a central point in the LCC where all the controls related to the power system are collected. This includes controls for the 28 VDC 500 Amp energizers, 60KW or 45KW, 400 CPS M-G sets, inverters, power switching, and special batteries which distribute the controls from the AGCS to the appropriate control panels. The rack is composed of four 14 receptacle patch distributors (145A1A1 for S-1; 145A1A2 for auxiliary distributor; 145A1A3 for IU; 145A1A4 for upper stages) and an AC frame type II with AC modules type II for distribution of inverter #1 power in the LCC.



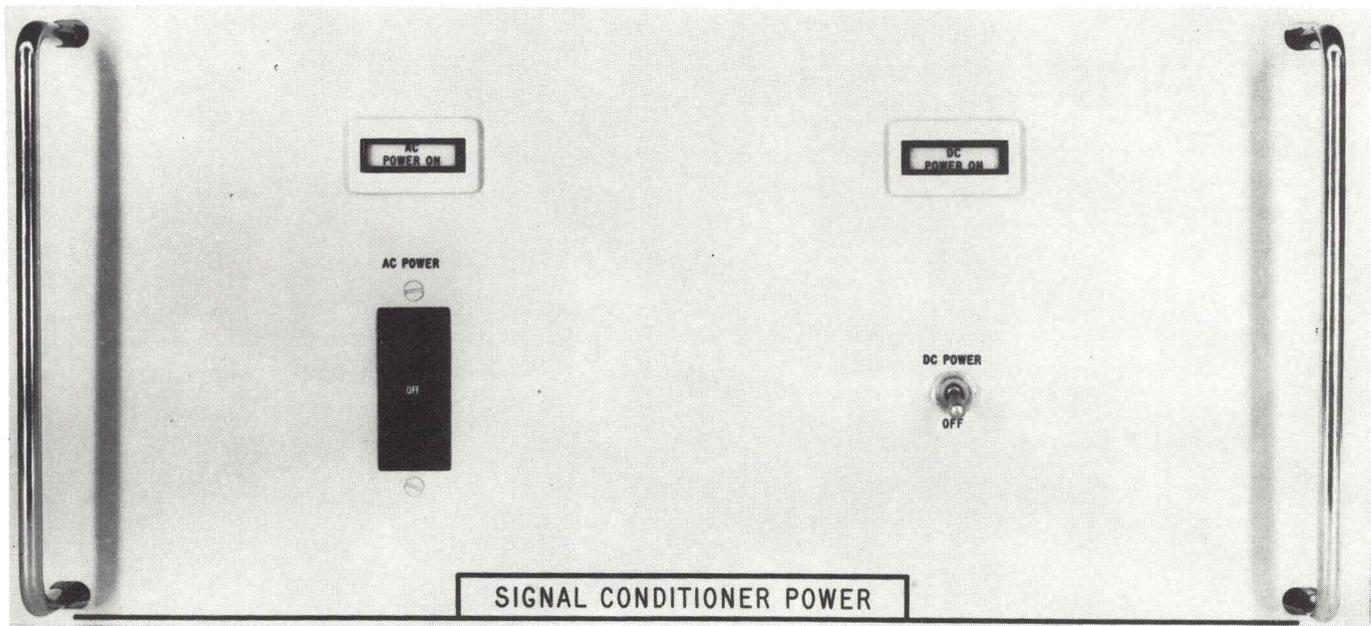
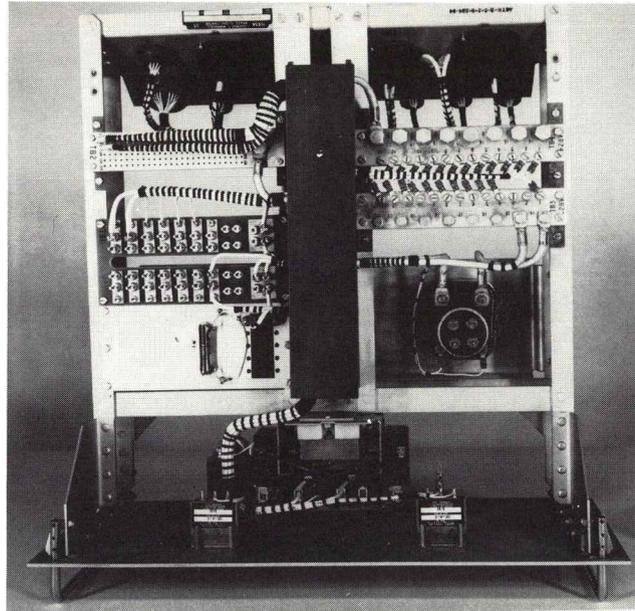
### BUS DISTRIBUTOR PANEL TYPE 3

This is a 24 by 3-1/2-inch panel. Input power enters in on twelve bus bars which have been drilled for 60 type 53 taper pins. These bus bars may be bused together with bus links as required. The output power is delivered through six 61 pin miniature connectors.

No photographs available

### **POWER DISTRIBUTION RACK (170A1)**

This power distribution rack is similar to the 66A1 and 66A2 racks (see pages 13 and 26) and it provides for distribution of power and controls to the Overall Test Sets. The rack is located in the service structure.



### **SIGNAL CONDITIONER POWER PANEL (165A7)**

This panel remotely controls the static power supply (165A10) which provides 28 VDC, 50 amps for the Signal Conditioners. This panel also has provisions for computer operation of the power supply.

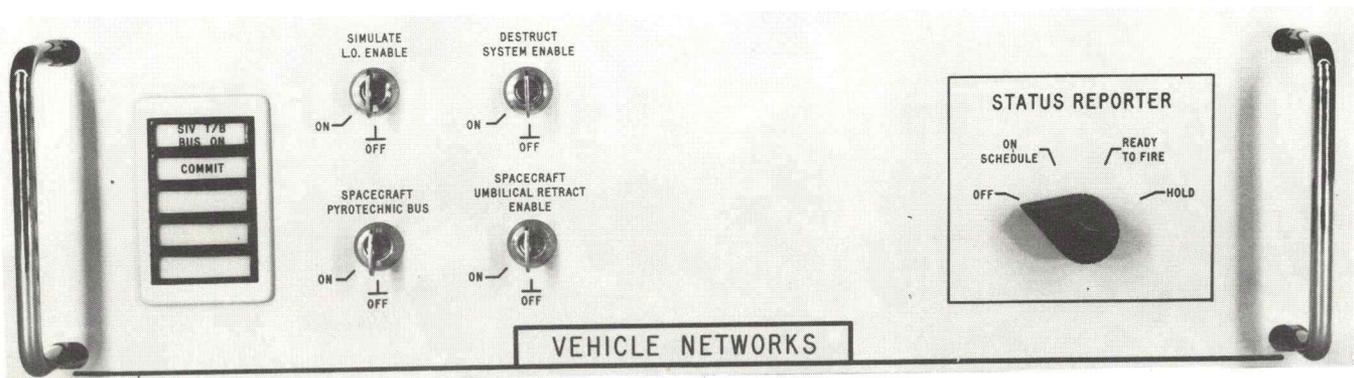
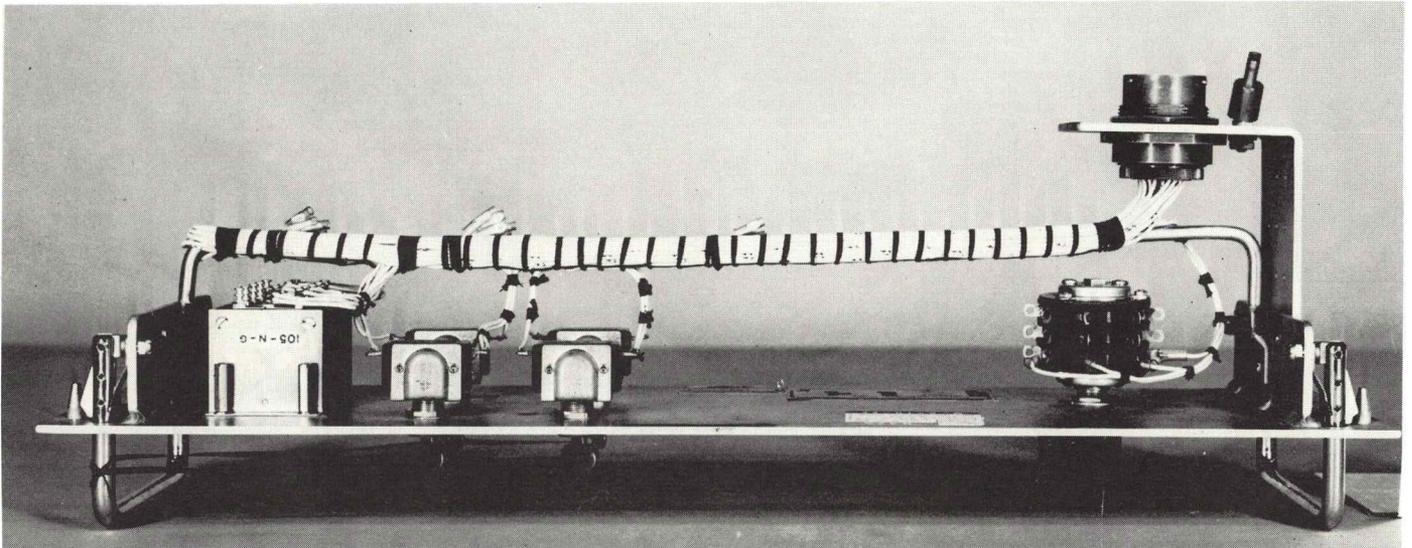
**VLF 37/B**  
**COUNT CLOCK SYSTEM**

See pages 24 and 114 thru 130.

# **VLF 37/B**

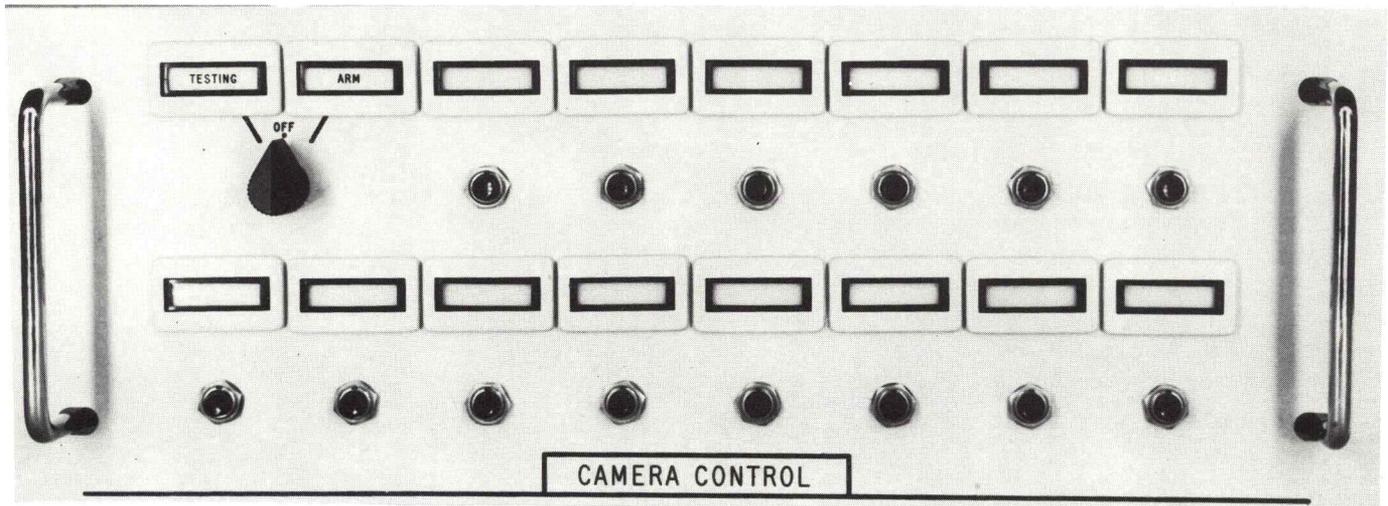
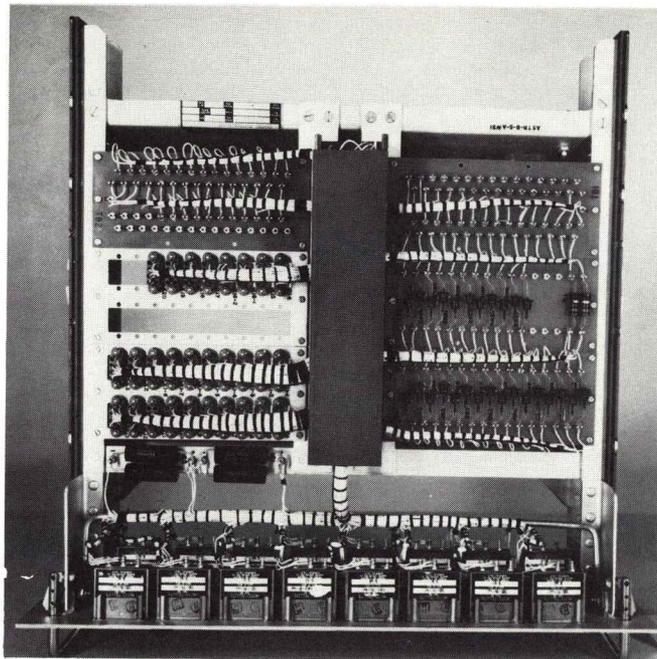
## **SYSTEMS INTEGRATION**

See pages 24, 43, 138 thru 152 and 253 thru 255.



### VEHICLE NETWORKS PANEL (1004)

This panel provides control of network functions which are related to more than one stage of the vehicle. It contains four keyed control switches, a status reporter switch and the necessary indicator lights.



### CAMERA CONTROL PANEL (157)

This panel provides countdown signals and test switches for the sequencer that starts and stops the ground cameras.

## **WATER CONTROL SYSTEM**

The water control equipment provides remote control of the VLF 37/B facility water system from the launch control center.

The system includes specifically, the control of the following water valves:

- Main water
- Fire water
- Launcher water
- Pad fogging
- Pad flushing
- Pad cooling torus ring
- Umbilical tower fogging
- Boattail quench
- Environmental control
- LH<sub>2</sub> fogging
- LOX fogging
- RP-1 fuel fogging

No Photographs Available

# VLF 37/B

## OVERALL TEST SYSTEM

The Overall Test System which consists of typical recorder hardware, distributors, control panels, test cable harness and "dummy" plug substitutes is designed to simulate the functions in the vehicle and its support mechanism which cannot feasibly be performed during a sequential test of vehicle and ESE. Propellant tanks pressurization and holddown arms release solenoids are examples of functions that are simulated. It is not the primary purpose of this equipment to verify all electrical components in the system, however, when possible, these components are simulated at the end point.

Panels and other necessary equipment in this system are mounted in a 4-Bay Console and approximately eight racks.

OAT PANELS-SATURN I - BLOCK II  
 136 FOOT LEVEL NETWORKS ROOM, COMPLEX 37  
 SERVICE STRUCTURE

PANEL NUMBER	PANEL NAME
300A1	O.A.T. DISTRIBUTOR
300A2	CONAX
300A4	SWITCH MODULE
300A10	AGASTAT MODULE
300A11	IGNITER SUBSTITUTE
300A12	FUSES
300A13	FUSES
300A14	FUSES
300A15	FUSES
300A16	METER (VOM)
300A17	VEHICLE VOLTAGES
300A18	SUB-DISTRIBUTOR
300A53	S-IV INTERFACE SUBST.
300A54	CABLE INTERRUPTER
305A1	RECORDER DISTRIBUTOR
305A2	EVENT RECORDER CONTROL
305A3	E & I CONTROL NO. 1
305A4	E & I CALIBRATE NO. 1
305A5	E & I CONTROL NO. 2
305A6	E & I CALIBRATE NO. 2
305A7	EVENT RECORDER NO. 1
305A8	EVENT RECORDER NO. 2
305A9	EVENT RECORDER NO. 3
305A10	EVENT RECORDER NO. 4
305A11	E & I RECORDER NO. 1
305A12	E & I RECORDER NO. 2
305A13	E & I RECORDER NO. 3
305A14	E & I RECORDER NO. 4
305A15	RECORDER READOUT
305A16	EVENT RECORDER NO. 5
305A17	EVENT RECORDER NO. 6
1006A1-1	BATTERIES
1006A1-2	BATTERIES

# **VLF 37/B**

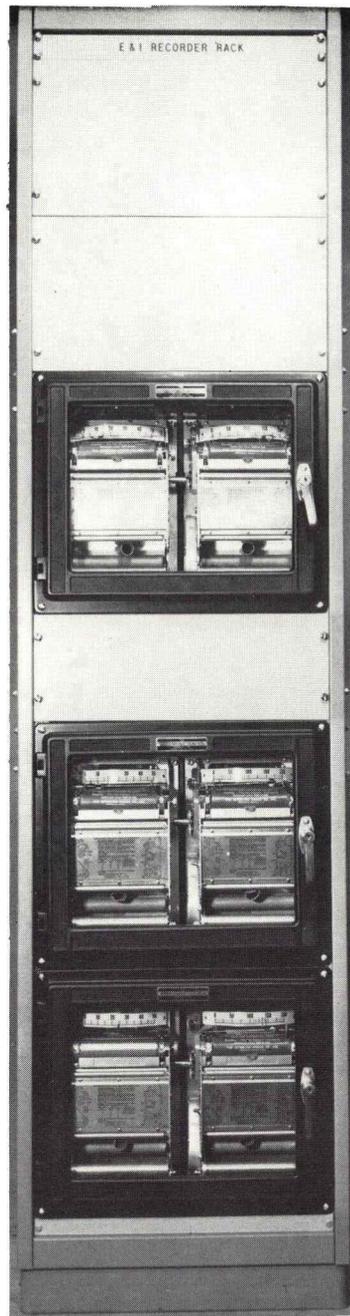
## **RECORDERS**

There are five separate recorder systems at VLF 37/B. Four of these systems are located within the LCC, namely, the First Stage (S-1), the IU, Integration and Propellant Loading. A fifth system is located on the 136 foot level of the service structure.

See pages 43, and 131 thru 137 for similar ESE.

A typical Recorder System is as follows:

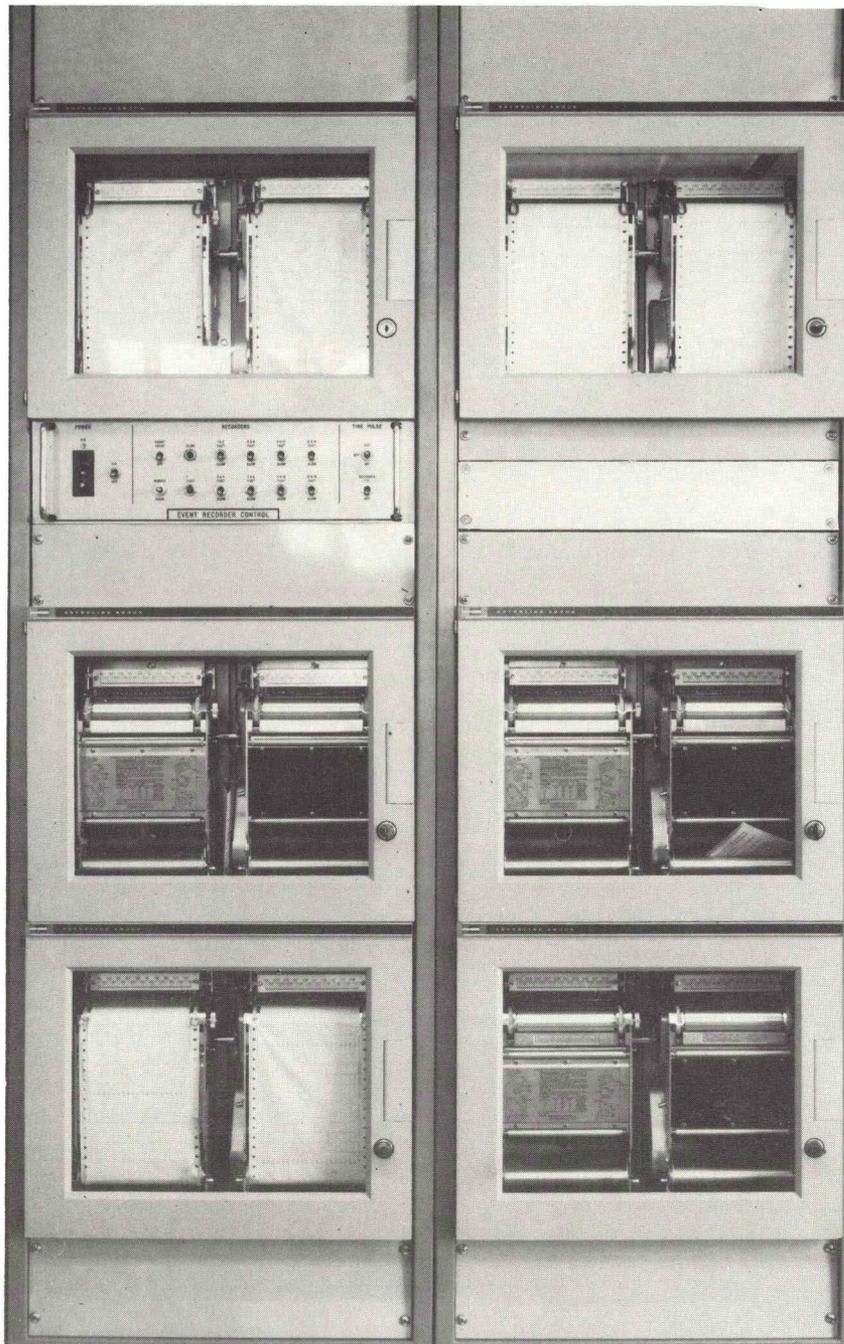
- (1) 8 dual Event Recorders – 320 pens
- (2) 3 dual E & I Recorders – 6 "E" & 6 "I"
- (3) 1 Event Recorder Control Panel
- (4) 1 E & I Recorder Control Panel
- (5) 1 E & I Calibrator Panel
- (6) 2 Recorder Readout Panels – 240 lights each
- (7) 1 Distributor



**E & I RECORDER RACK**



**RECORDERS AND BATTERY OF OAT CONSOLES**



EVENT RECORDER RACKS

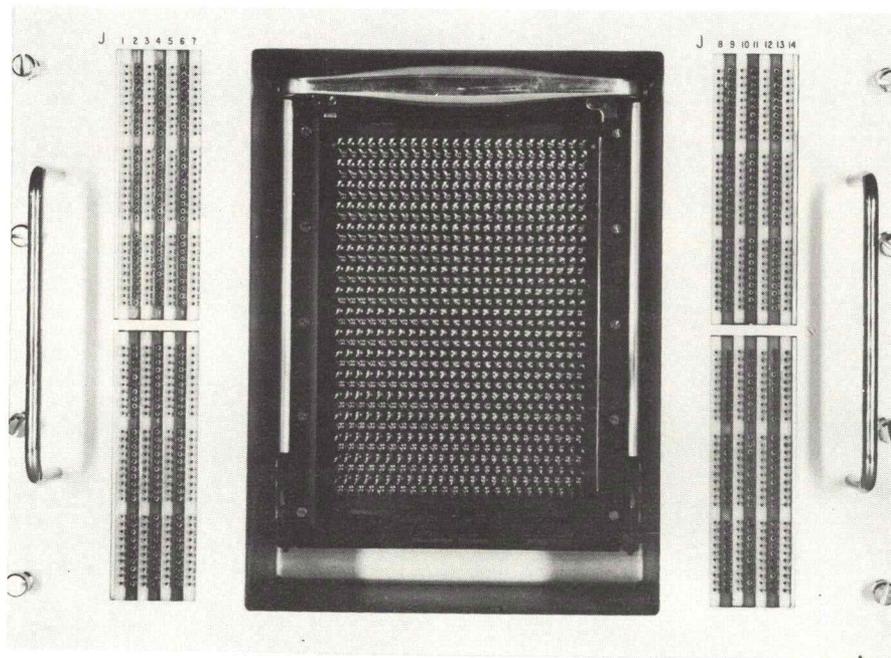
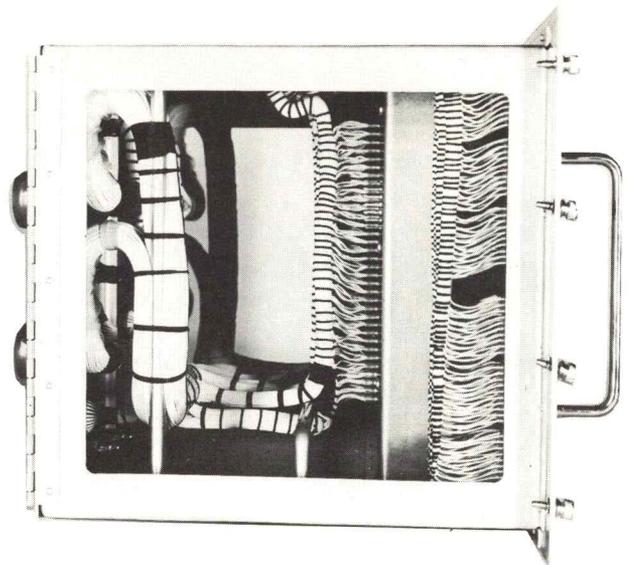
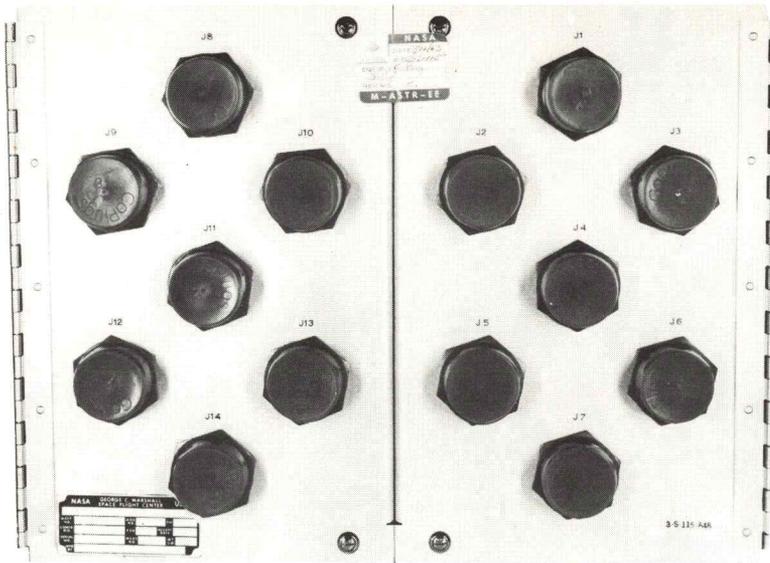
# **ATLANTIC MISSILE RANGE HANGAR "AF"**

## **FOURTH STAGE (S-IV) CHECKOUT ESE**

See pages 68, 185 and 228 thru 244.

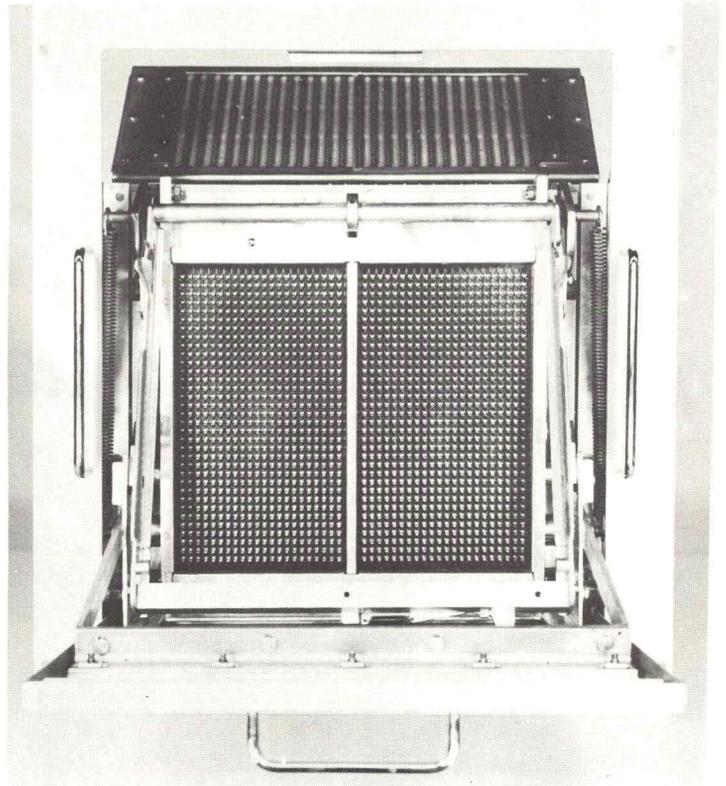
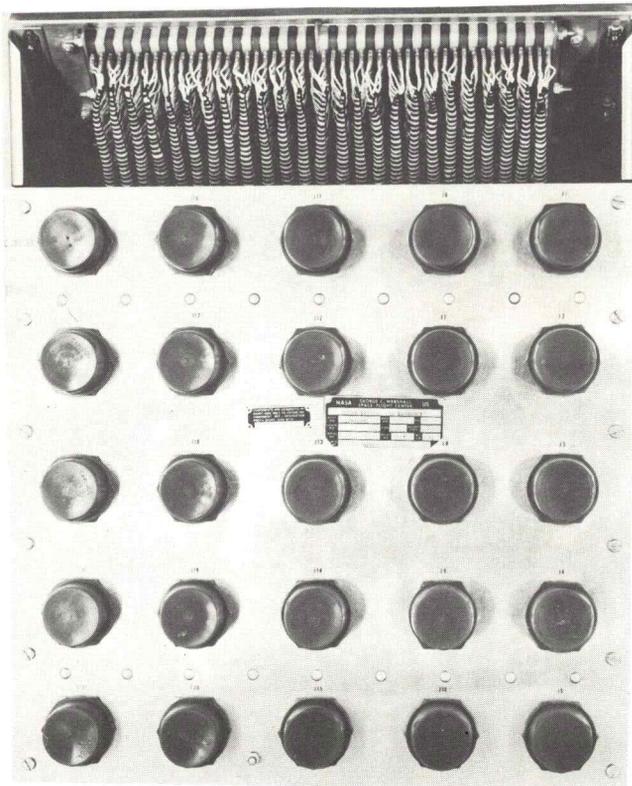
## ESE HARDWARE DESIGN STANDARDIZATION

There are approximately 230 different panels used on Saturn I, Block II, ESE. The design of these panels is kept simple, whenever it is feasible to do so. This concept is also applied to racks, distributors, modules and sub-assemblies. Several noteworthy items of equipment have been produced as a result of this concept. Areas or families of hardware which have been standardized for design versatility are terminals, connectors, panel blanks, slides, chassis, printed circuit boards, plates, relays, diodes, resistors, meters, lights, switches, etc., all of which fit the simple, uncomplicated design of the basic rack or console enclosure.



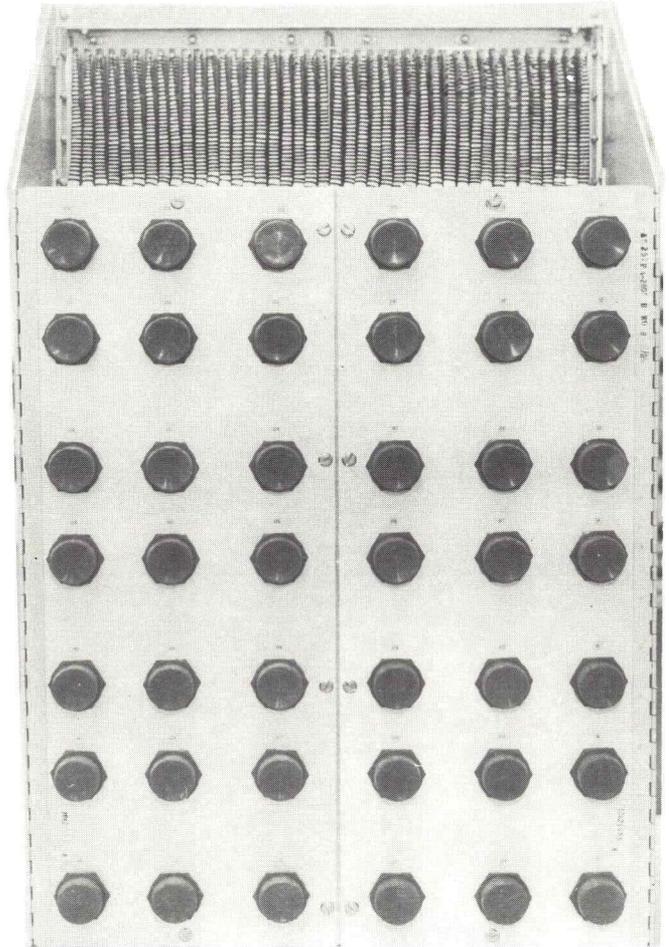
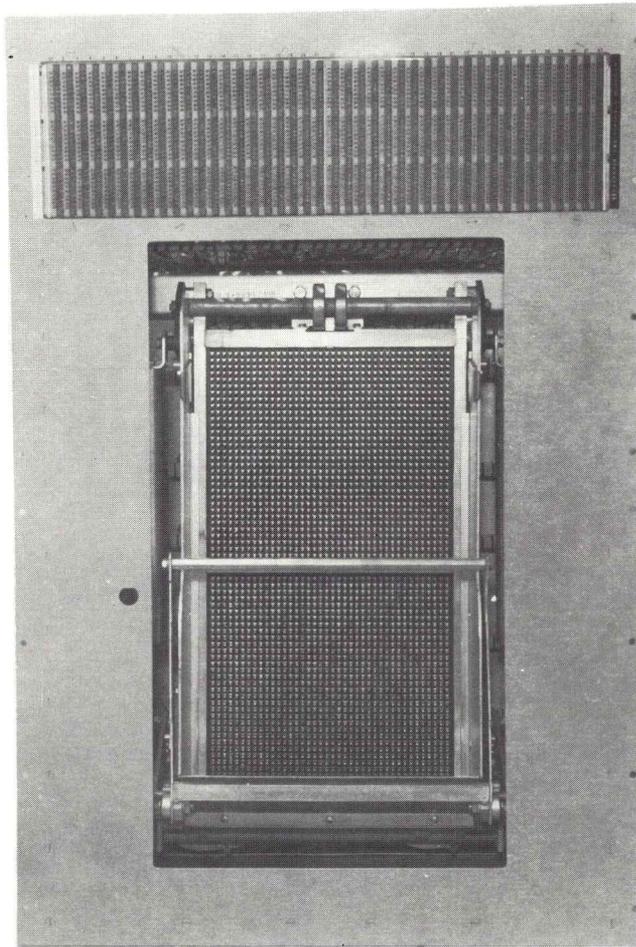
## 14 PLUG RELAY DISTRIBUTOR PANEL

This panel is designed for mounting into a standard 19-inch rack but can be mounted into a 24-inch rack by the addition of 2 adapter plates on the sides. It is equipped with a standard 816 pin removable program board.



## 25 PLUG RELAY DISTRIBUTOR PANEL

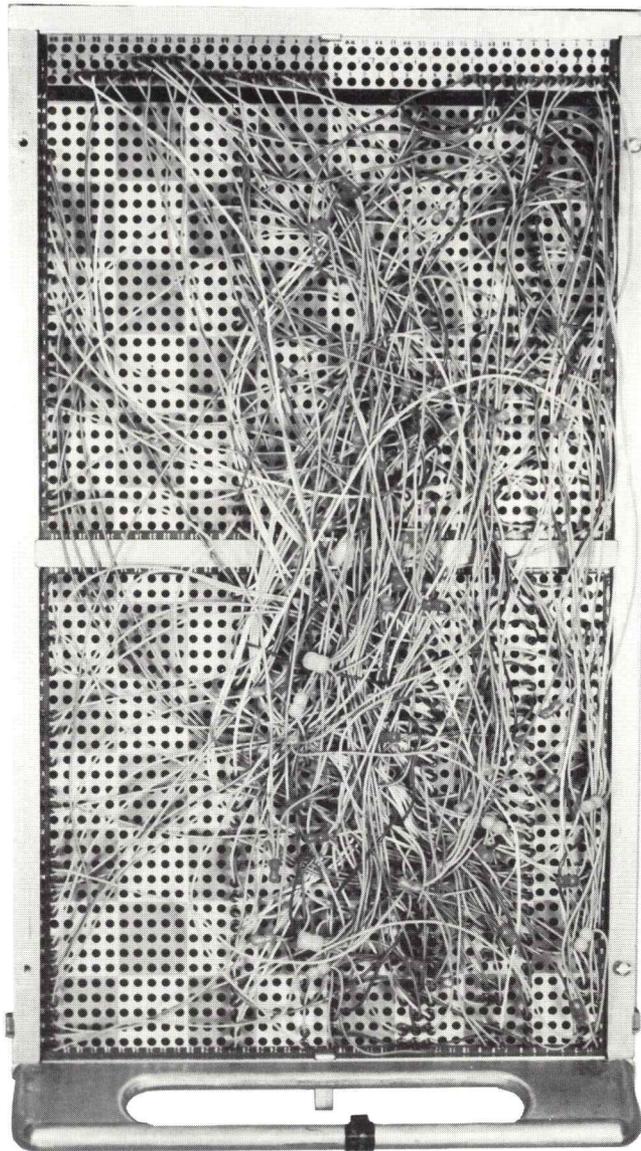
This panel is designed to be mounted into a 19-inch wide relay rack, however, by the addition of 2 standard side brackets this panel becomes compatible with the 24-inch relay rack. A 1496 pin removable patchboard serves as a quick change program board for the circuits passing through the twenty five 61 pin connectors.



## 42 PLUG UNSHIELDED DISTRIBUTOR PANEL

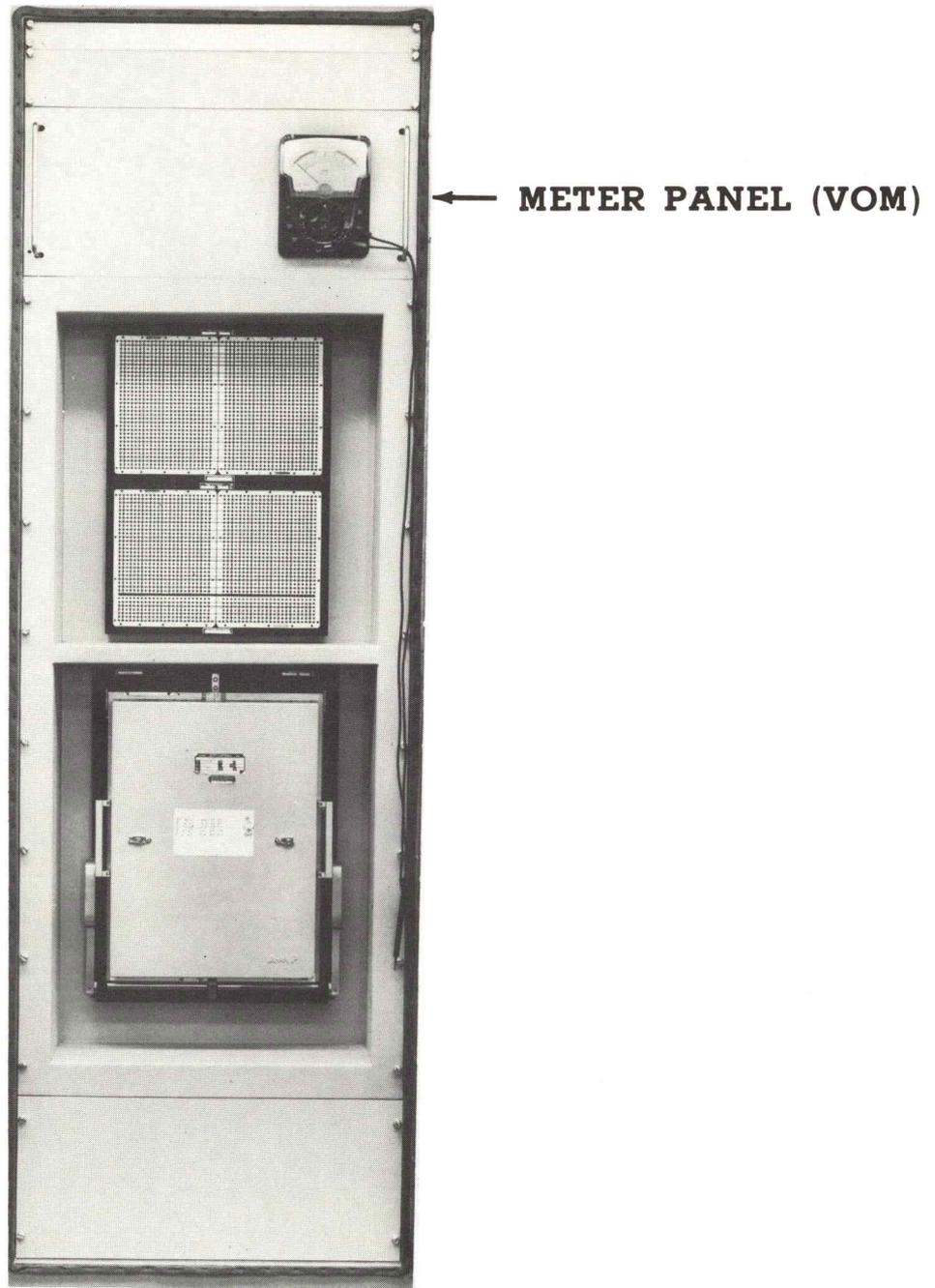
This panel consists of forty-two 61 pin connectors, a 2,560 pin patchboard and over 7,000 wire terminations.

Almost any circuit configuration can be created by the arrangement of jumpers on the removable program board or on the connectors cabled to the panel. The relay and diode modules which can be plugged into the connectors of the distributor panel increase its circuit versatility.



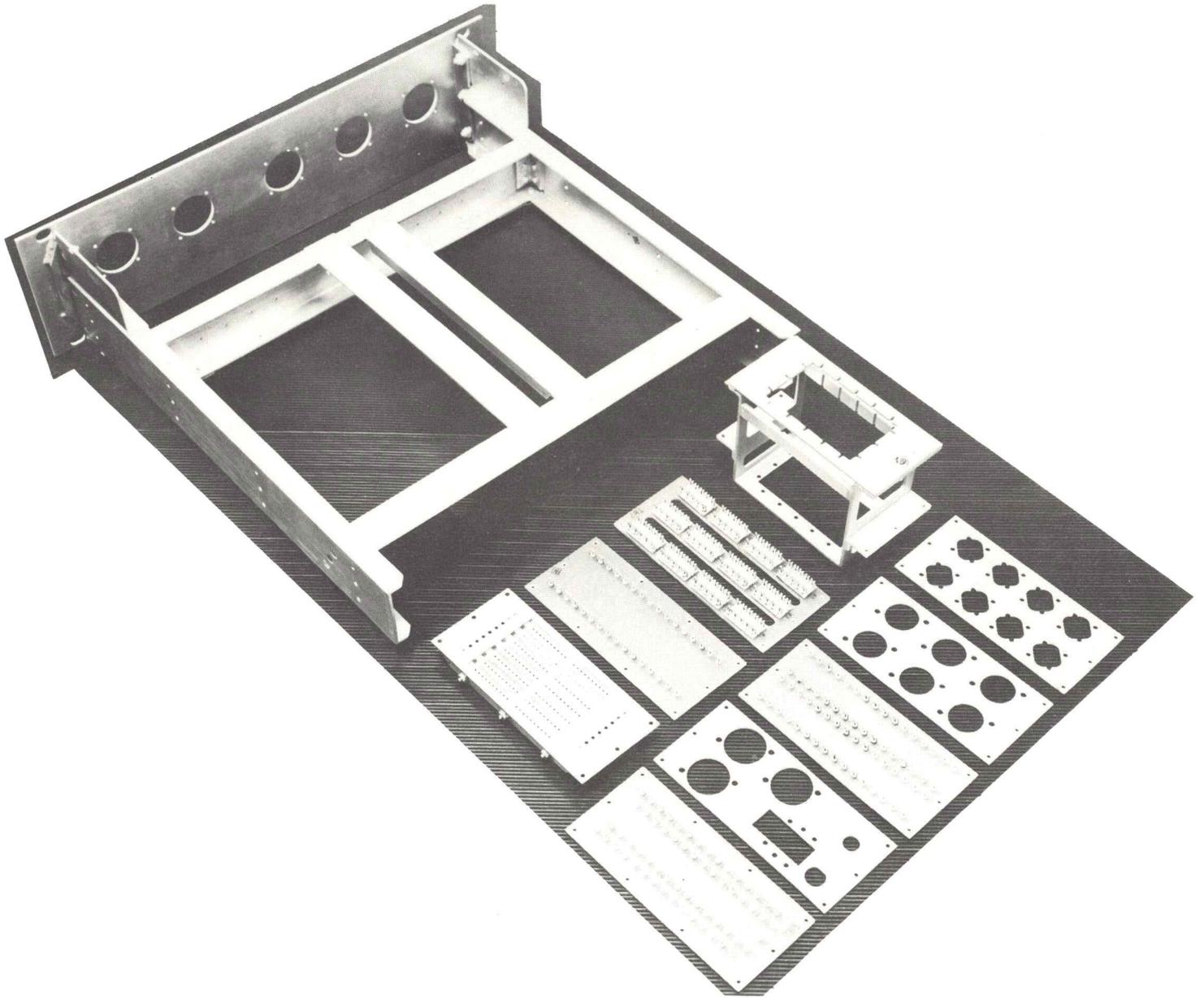
## PATCHBOARD

This patchboard is typical of many used throughout the Saturn system. It gives a high degree of circuit flexibility. The board may be prewired to replace another board as a unit to accomplish a circuit configuration change.



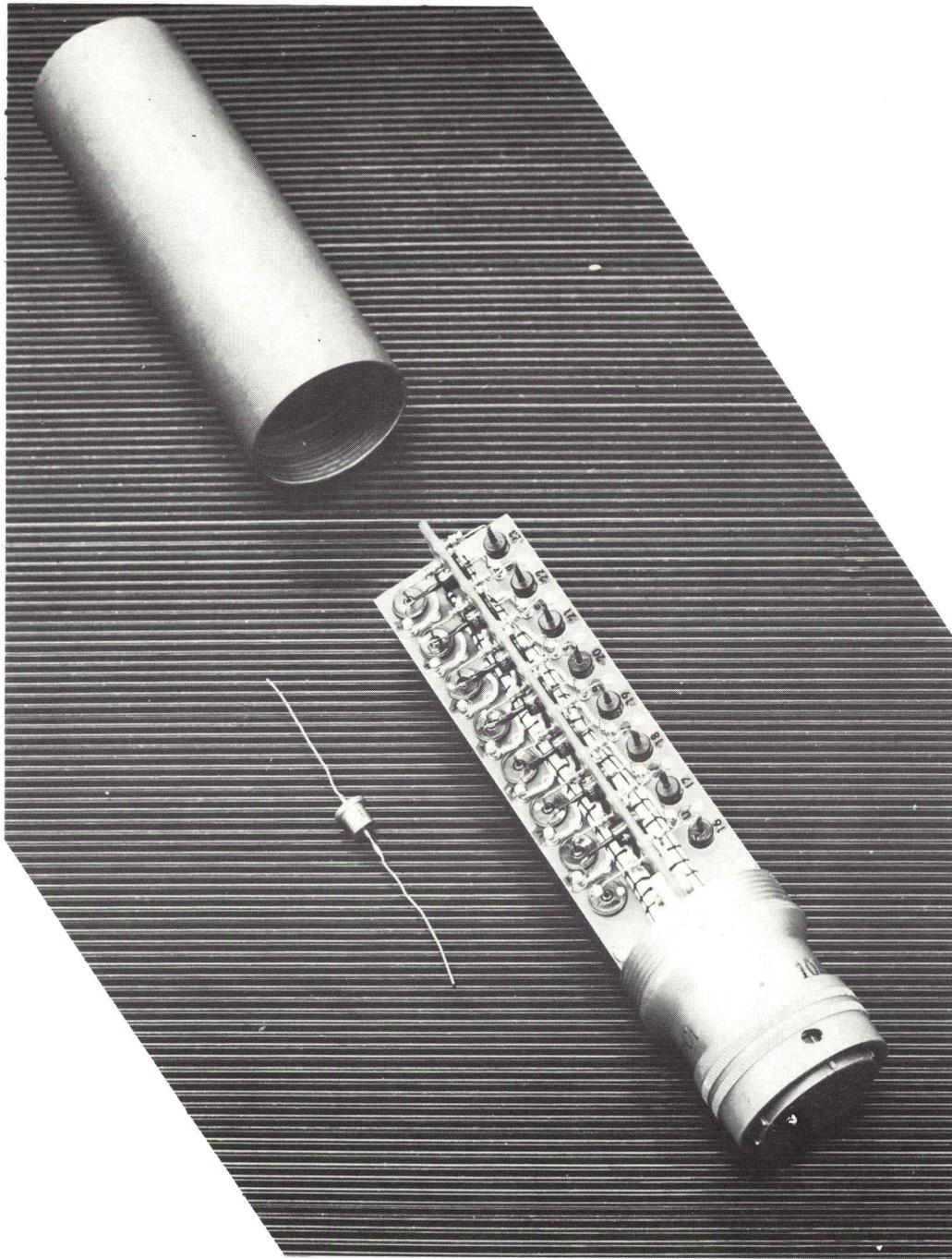
### **42 PLUG SHIELDED DISTRIBUTOR (SHOWN IN RACK)**

This distributor has the capability of providing programming for over 2500 circuits. These circuits are shielded to prevent the absorption or radiation of unwanted electrical noise. The distributor has two program boards. One board is removable for program changes. The other board allows access for circuit testing. A meter panel (VOM) located above the program board is used for this purpose.



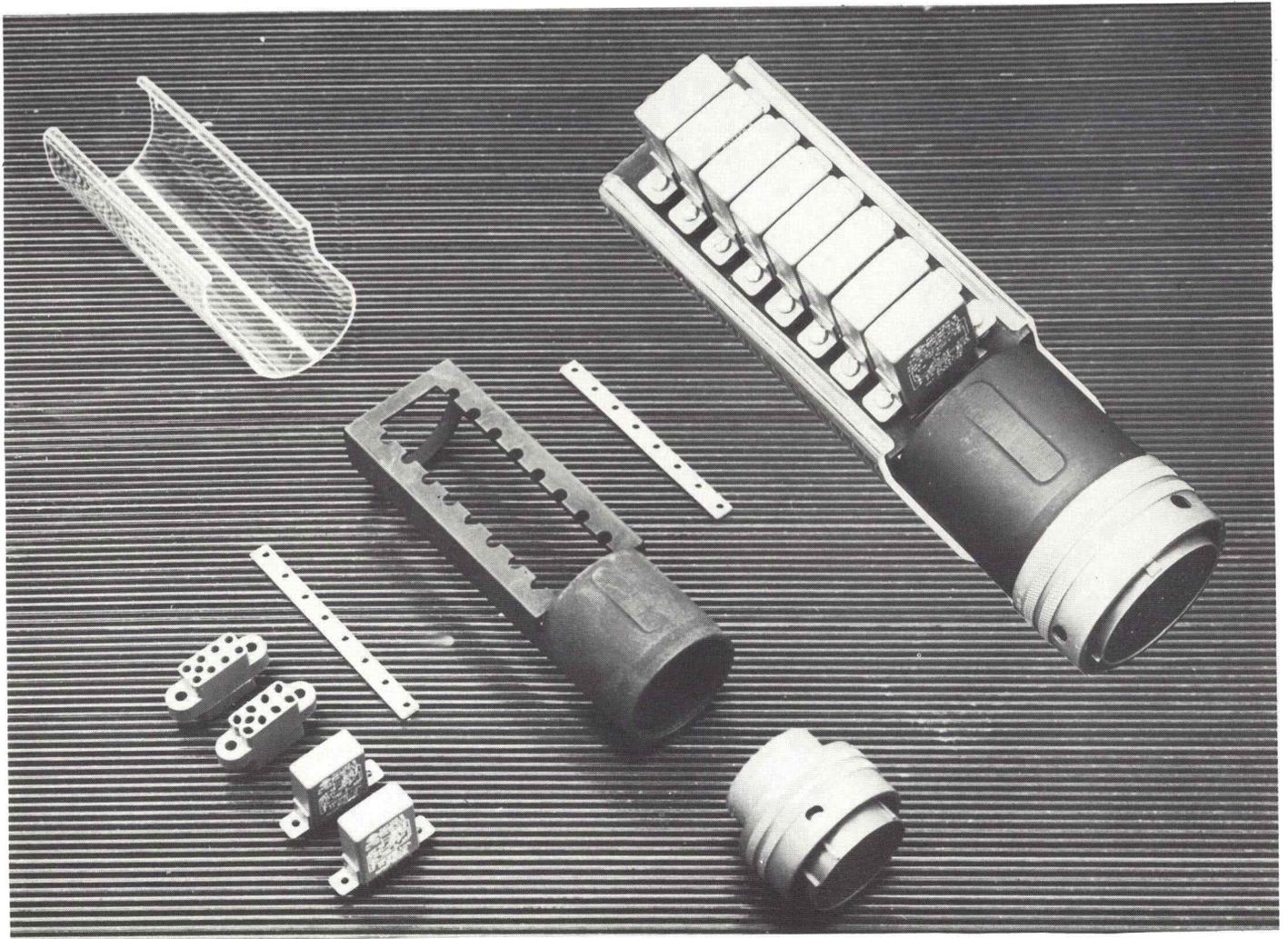
### CHASSIS (EXPLODED VIEW)

A standard chassis with a family of panels was designed to be mounted in a standard electrical equipment enclosure which is available in 19-inch and 24-inch widths. All of these assemblies employ the same basic chassis with standardized components as lamps, switches, meters, handles, fasteners and slides. In addition, a standardized centerfeed arrangement to facilitate component wiring was incorporated. Modular printed circuit board assemblies complete the requirement to keep the elements of the assembled chassis as universal as possible.



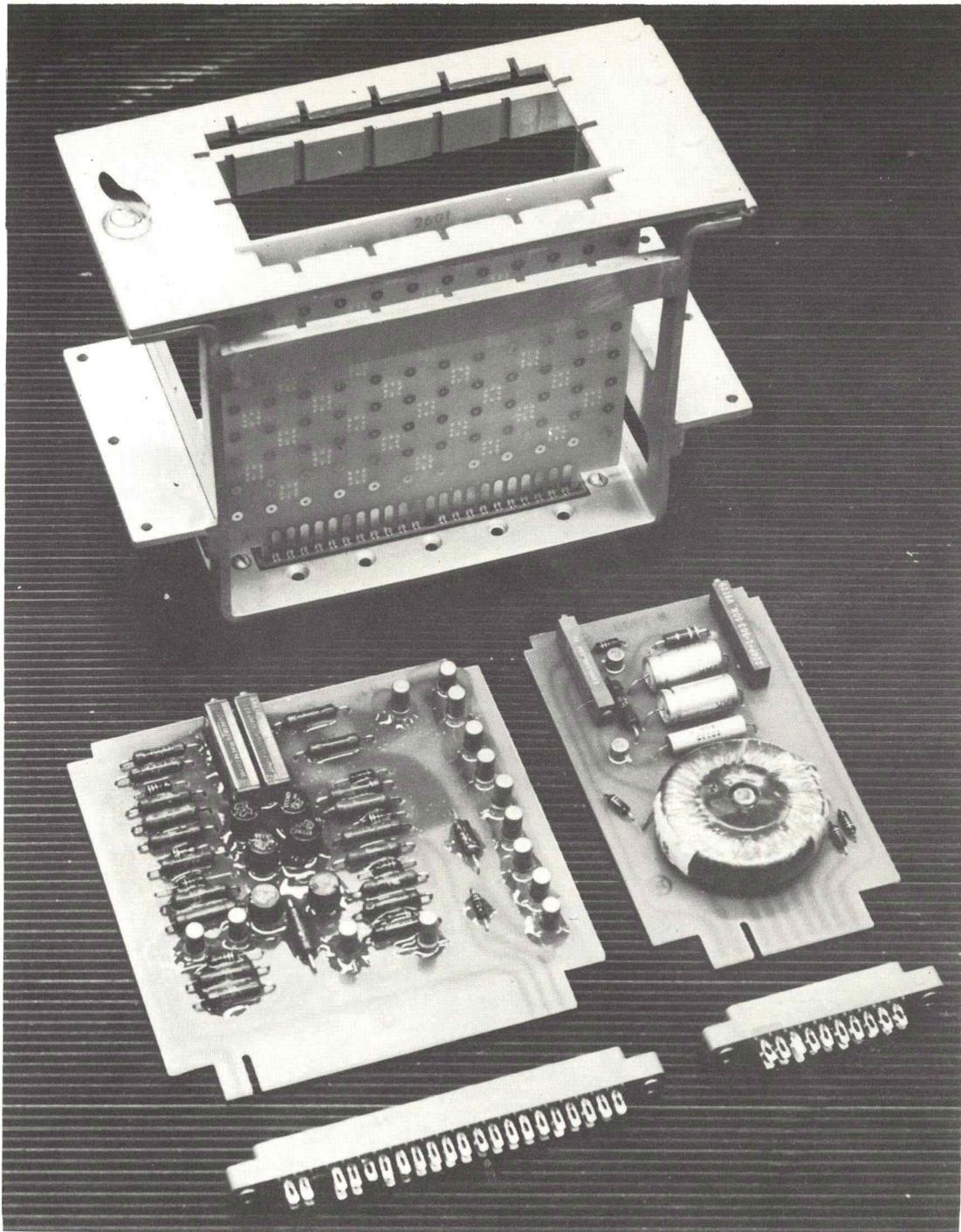
## DIODE MODULE

The diode module is used throughout the Saturn ESE. It consists of 30 diodes. Both ends of the diodes are wired to a 61 pin connector. When this module is used with a distributor it adds versatility to the circuits passing through the distributor.



## RELAY MODULE

This module consists of 8 miniature plug-in relays wired to a 61 pin connector. When implemented in the distributors it affords a versatile programmable switching circuit capability when coupled with the diode module.



## PRINTED CIRCUIT BOARD MODULE (INCLUDING THE BOARDS)

The printed circuit board module is a standardized design used throughout the Saturn Program and it provides a uniform and efficient method of packaging for printed circuit boards. It is designed for maximum reliability and ease of maintenance. The printed circuit boards also fall into this class since their mechanical size and electrical circuitry is designed around standard components.

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