PLAN OF ACTION

SATURN DEVELOPMENT FACILITY

S-II LIEF TRAINING EXERCISE

Table of Contents

1.0 PURPOSE

The purpose of the LIEF training exercise at the Saturn Development Facility (SDF) is to familiarize team members with the countdown and launch operations, develop a working knowledge of the automatic checkout programs and trouble-shooting techniques available to KSC panel operators, and to detect and analyze simulated real-time problems in a Launch Control Center environment.

2.0 OPERATIONS

2.1 GENERAL

The test will be conducted as closely to an actual countdown as possible, taking into consideration the capabilities and limitations imposed by the SDF and the time available.

Major S-II test programs will be initiated and monitored by team members on the S-II consoles and CRT displays. Problems will be injected into the countdown sequence which will result in holds, cutoff, and recycle operations. Team members will be able to utilize computer monitoring and troubleshooting techniques in the resolution of problems.

2.2 TEST SEQUENCE

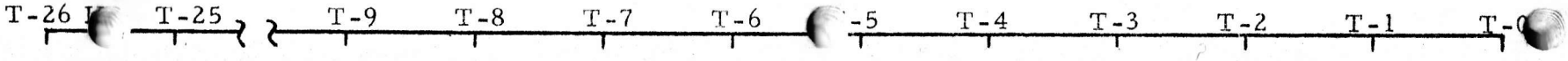
The S-II LIEF training exercise general test sequence plan is shown in Figure 1. The SDF will be configured by GE for initiation of the S-II exercise at the T-25 hour countdown time. As shown, the planned test sequence will consist of conducting the following:

a. Selected key S-II events in the T-25 to T-9 hour time period.

b. Selected key LV/S-II events in the T-9 to T-1 hour time period.

c. The complete LV sequence from T-1 hours to T-0 time period.

Further test sequence details are discussed in Paragraphs 2.3.1 and 2.3.4.



T-25 ▽ SW PWR ON

T-25 ⌐ SW Scan

T-25 ▽ Computer Supporting

T-24:45 ▽ SII Stage & ESE PWR ON

⌐ QAMS (T_o-18:30)

⌐ QAEC (T_o-17:15)

⌐ M020-19 Eng/Recirc Panel Status Cks

⌐ M020-32 C2SP/GP Panel Status Cks

⌐ VALK

▽ PM PWR ON

⌐ M020-35 PM Panel Status Cks

⌐ M020-37 Recirc Bottle Press.

⌐ M020-38 Eng He Bottle Press.

⌐ M020-88 St. Tk. Purge

⌐ M020-40 LOX Dome E6 Inj Purge

⌐ M020-30 Accum. Fill Sys. Purge

⌐ M020-41 Turbo Pump Purge

⌐ M020-39 LOX He Inj. Purge

⌐ Propellant Loading

⌐ M020-42 Thrust Ch. Jkt. Purge

⌐ M020-61 LH_2 Recirc Pump Test

⌐ DRSCR Test (VARS)

⌐ MRCV Test

⌐ S-II Special Accumulator Test

⌐ M020-34 Bottle Decay Test

▽ TM Turn ON

⌐ PWR XFR Test

⌐ VARS

⌐ VATS

▽ TCS

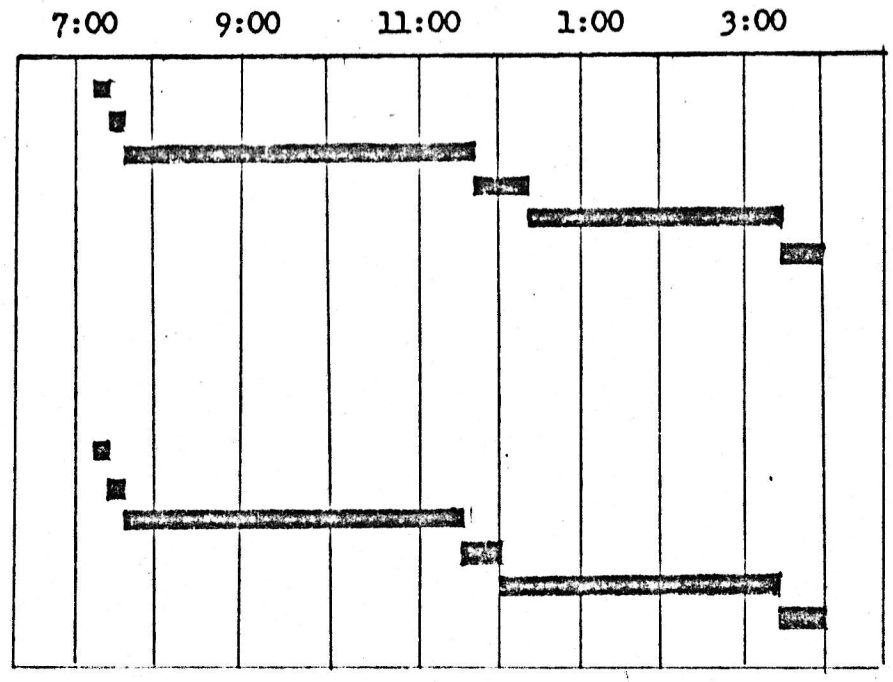
FIGURE I

SATURDAY - Oct 7

POWER UP SDF
POWER UP STAGE & ESE
T-24 HR TO T-4:30
LUNCH
T-4:30 TO TO
RECAP & DISCUSSION

SUNDAY - Oct 8

POWER UP SDF
POWER UP STAGE & ESE
T-1 HR TO T-0
LUNCH
T-1 TO T+0 SEC
RECAP & DISCUSSION



General Training Exercise Schedule

Figure 2

2.3 TRAINING OPERATION

2.3.1 Schedule - As discussed in the GE LIEF/HOSC Training Plan (Appendix A), the following schedule is planned:

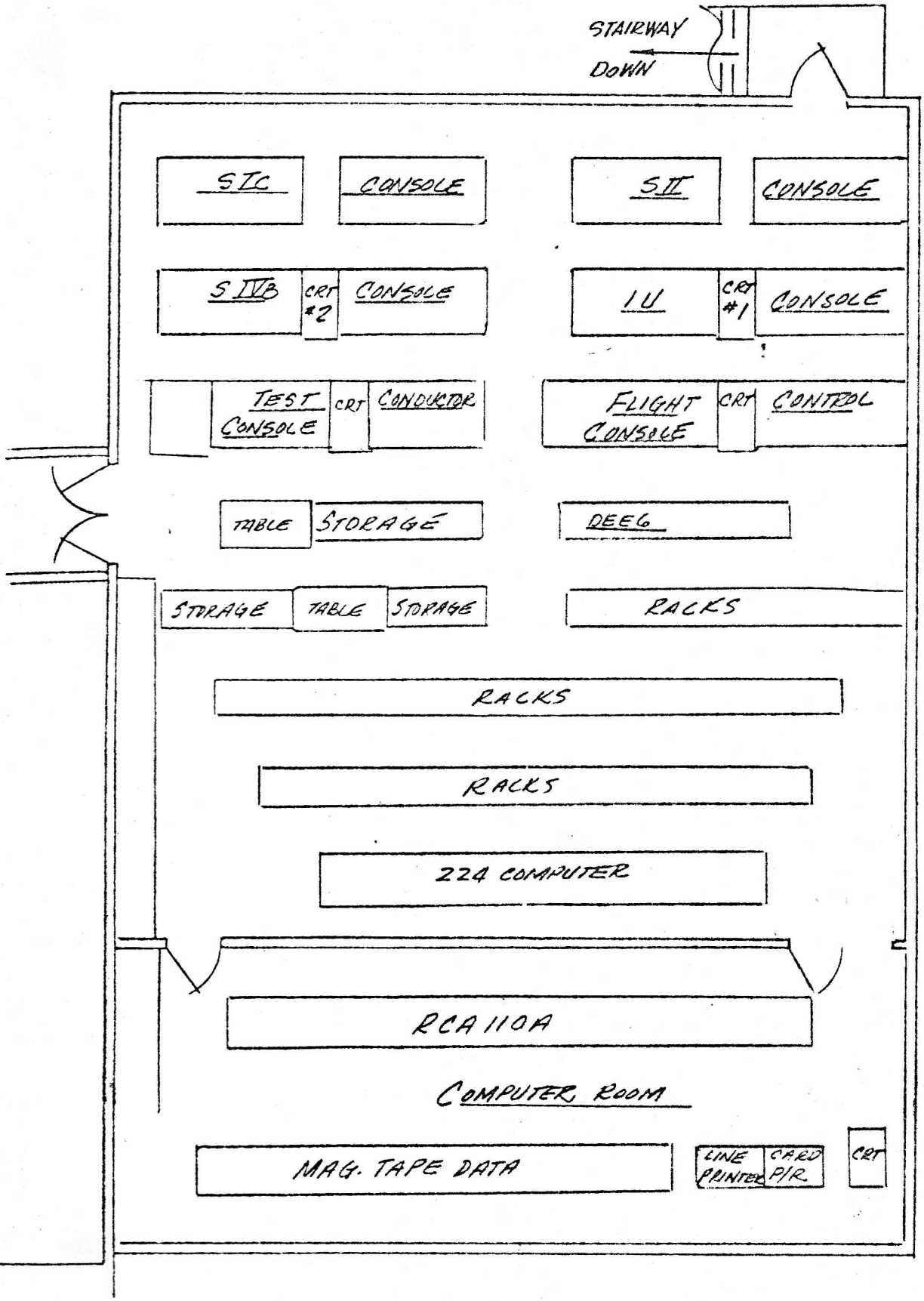
Oct 6	Indoctrination
Oct 7 & 8	SDF Countdown Training Exercise

The standard SDF operating hours are from 7:15 a.m. to 3:30 p.m. It is currently planned that the SDF power-up/power-down will be accomplished within these hours for the Oct 7 and 8 exercise. It is planned to conduct the countdown training exercise in accordance with the schedule shown in Figure 2.

2.3.2 Responsibilities - NR LIEF team members will man the S-II related panels and CRT's while GE will provide personnel for manning all other required SDF panels and equipment. LIEF members are assigned to the S-II panels as follows:

Panel/Location	Call Station	Team Member
ENGINE 1-5 COMPONENT PANELS	C2EC	J. Florey
RECIRCULATION PANEL	C2RP	J. Florey
ALL ENGINE PANEL	C2AE	J. Florey
PRESSURIZATION PANEL	C2SP	P. Ross
GROUND PNEUMATICS PANEL	C2GP	P. Ross
PROPELLANT MONITOR PANEL	C2PM	P. Ross
PROPELLANT DEPLETION PANEL	C2PU	J. Livingston
PROPELLANT UTILIZATION PANEL	C2PU	J. Livingston
NETWORKS PANEL	C2NP	J. Livingston
EBW & ORDNANCE PANEL	C2DP	F. Knowlden
PROPELLANT DISPERSION PENEL	C2DP	F. Knowlden
SII MEASURING & R.F. PANEL	C2IP	F. Knowlden
SII HYDRAULICS PANEL	C2FC	R. Hobbs
SII ENGINE DEFLECTION PANEL	C2FE	R. Hobbs
CRT #1	C2PK	D. Binns
CRT #2	C2NK	E.L.Matteson
SII TEST CONDUCTOR	C2TC	D. Lund

NOTE: MSFC PM-SAT-II personnel may also participate as Rovers.



— 2ND FLOOR —

SLF LAUNCH CONTROL CENTER

FIGURE 3

It is anticipated that the following GE personnel will be assigned as indicated below:

Function	Name
Launch Vehicle Test Conductor	Dave McCain
SIC Test Conductor	Bill Inglis
SIVB Test Conductor	Otis Green
IU Test Conductor	Tommy Tompson
SII Advisor	Bill Inglis
SDF Advisor	Don Ward

2.3.3 Panel Data - A layout showing location of the S-II SDF panels identified in the previous paragraph is shown in Figures 3 and 4. A panel stimuli/response list in accordance with the panel/member assignments is contained in Appendix B. These lists include the following type data:

Panel Photo

Panel Item Designations (Switch, Light or Meter)

Signal Transmission Mode (Hardwire, Computer, DDAS)

Signal Transmission Data (Computer Channel, DEE Channel, S-II End-Item Interface point and reference designators or measurement number)

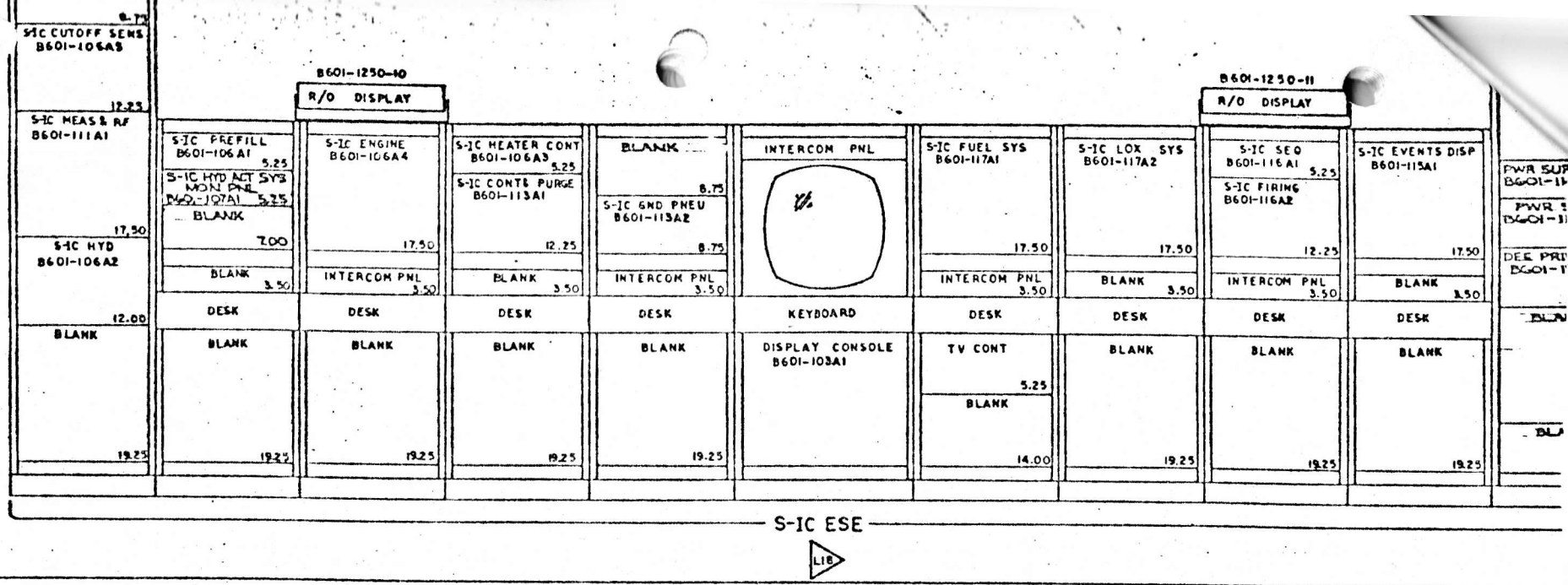
Signal Display Data (additional ESE displays for each S-II response)

One of the most useful monitoring/troubleshooting means available to the test engineer is the Display Monitor program, DMON, available on the CRT. Through this program the status of any LDI (discrete input to the LCC computer), MDI (discrete input to the mobil launcher computer), or DDAS discrete can be determined. Stage and GSE DDAS analogs can be monitored (in engineering units) and out-of-tolerance conditions detected. Pre-defined formats have been established, and by selecting the desired channel from the S-II Format Select Display index given in Appendix C, the operator can view a block of system parameters. These can be supplemented by additional measurements until both CRT pages are full.

The Command and Response stations identified in the detailed procedure will be utilized during the exercise. The command station will address the response station and identify himself similar to the following:

C2TC, C4TC this is CLTC - APPLY - - - - -

The response station will acknowledge receipt of the command.



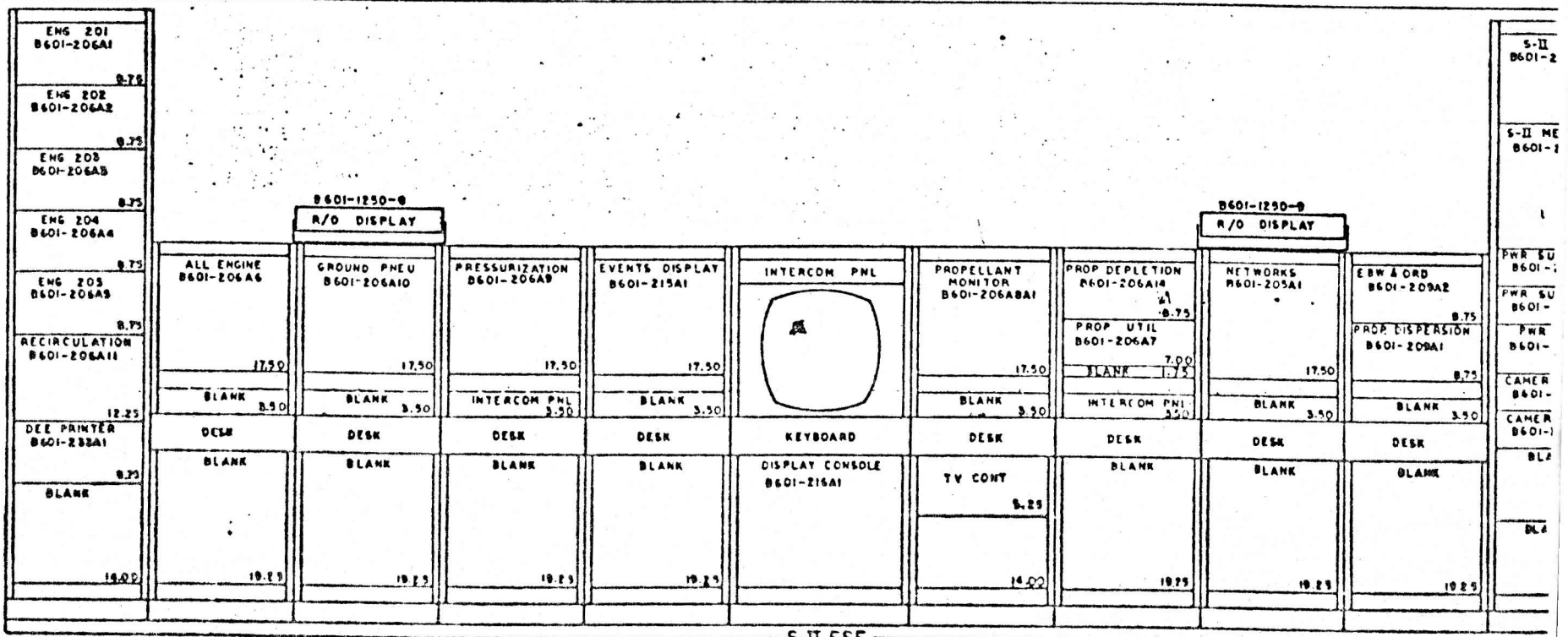
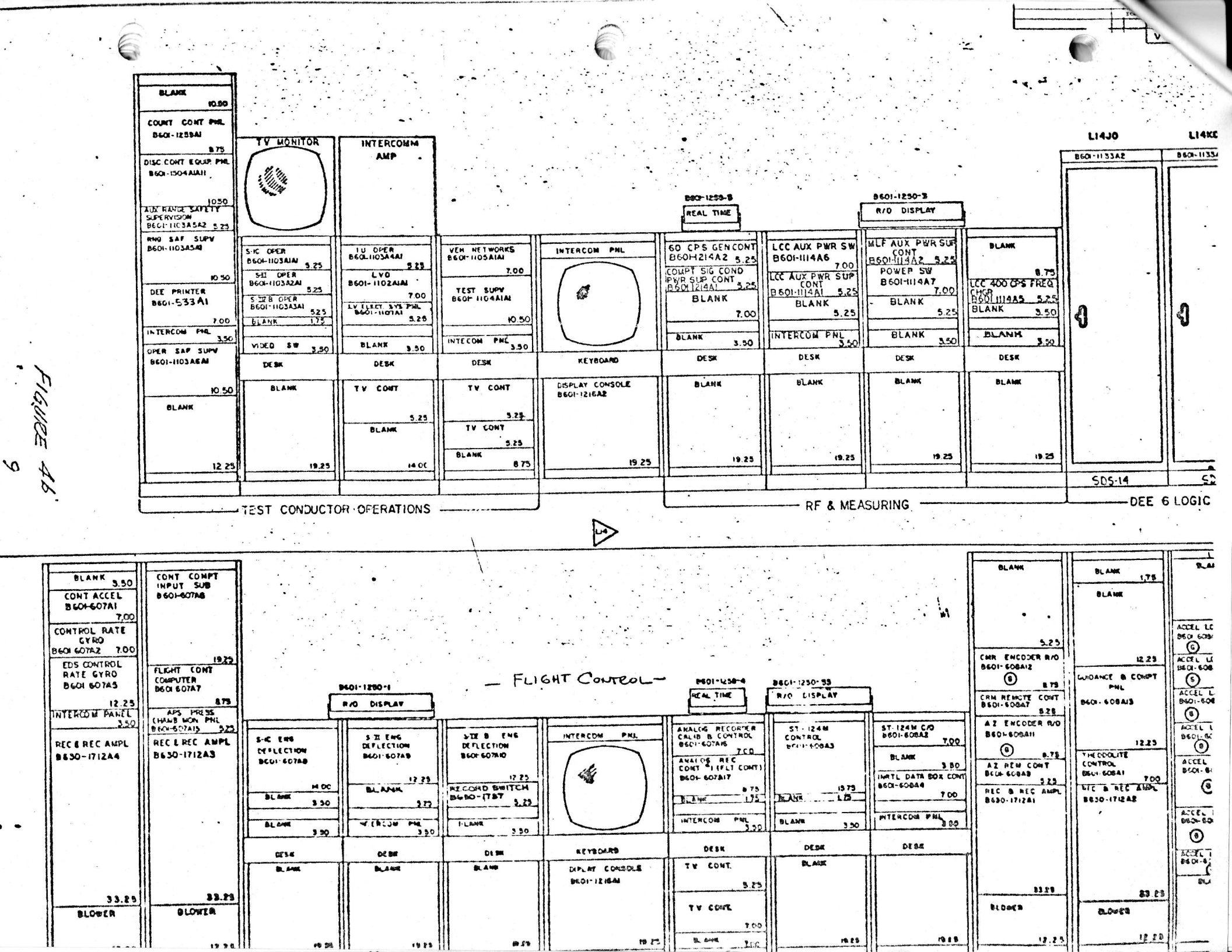


FIGURE 4a

8

DEE ENGINEERING RECORDS


BLANK 10.50
COUNT CONT PNL B601-1258A1 8.75
DISC CONT EQUIP PNL B601-1504A1A11 10.50
AUX RANGE SAFETY SUPERVISION B601-1103A5A2 5.25
RNG SAF SUPV B601-1103A5A1 10.50
DEE PRINTER B601-533A1 7.00
INTERCOM PNL 3.50
OPER SAF SUPV B601-1103A6A1 10.50
BLANK 12.25
TV MONITOR
INTERCOMM AMP
S-IC OPER B601-1103A1A1 5.25
S-II OPER B601-1103A2A1 5.25
S IVB OPER B601-1103A3A1 5.25
BLANK 1.75
VIDEO SW 3.50
DESK
BLANK 19.25
IU OPER B601-1103A4A1 5.25
LVO B601-1102A1A1 7.00
LV ELECT SYS PNL B601-1107A1 5.25
BLANK 3.50
DESK
TV CONT 5.25
BLANK 14.00
VEH NETWORKS B601-1105A1A1 7.00
TEST SUPV B601-1104A1A1 10.50
INTECOM PNL 3.50
DESK
TV CONT 5.25
TV CONT 5.25
BLANK 8.75
INTERCOM PNL
KEYBOARD
DISPLAY CONSOLE B601-1216A2 19.25
B601-1258-B
REAL TIME
60 CPS GEN CONT B60H2114A2 5.25
COMPT SIG COND PWR SUP CONT B601-2114A1 5.25
BLANK 7.00
BLANK 3.50
DESK
BLANK 19.25
LCC AUX PWR SW B601-1114A6 7.00
LCC AUX PWR SUP CONT B601-1114A1 5.25
BLANK 5.25
INTERCOM PNL 3.50
DESK
BLANK 19.25
B601-1250-3
R/O DISPLAY
MLF AUX PWR SUP CONT B601-1114A2 5.25
POWER SW B601-1114A7 7.00
BLANK 5.25
BLANK 3.50
DESK
BLANK 19.25
BLANK 8.75
LCC 400 CPS FREQ CHGR B601-1114A5 5.25
BLANK 3.50
BLANK 3.50
DESK
BLANK 19.25
L14J0
B601-1133A2
SDS-14
L14K0
TEST CONDUCTOR OPERATIONS
RF & MEASURING
DEE & LOGIC
FIGURE 46.
9
BLANK 3.50
CONT ACCEL B601-607A1 7.00
CONTROL RATE GYRO B601-607A2 7.00
EDS CONTROL RATE GYRO B601-607A5 12.25
INTERCOM PANEL 3.50
REC & REC AMPL B630-1712A4 33.25
BLOWER
CONT COMPT INPUT SUB B601-607A8 19.25
FLIGHT CONT COMPUTER B601-607A7 8.75
APS PRESS CHAMB MON PNL B601-607A13 5.25
REC & REC AMPL B630-1712A3 33.25
BLOWER
— FLIGHT CONTROL —
B601-1250-1
R/O DISPLAY
S-IC ENG DEFLECTION B601-607A8 14.00
BLANK 3.50
BLANK 3.50
DESK
BLANK
S II ENG DEFLECTION B601-607A9 12.25
BLANK 3.75
INTERCOM PNL 3.50
DESK
BLANK
S IVB ENG DEFLECTION B601-607A10 12.25
RECORD SWITCH B630-1787 5.25
BLANK 3.50
DESK
BLANK
INTERCOM PNL
KEYBOARD
DISPLAY CONSOLE B601-1216A1 19.25
B601-1258-A
REAL TIME
ANALOG RECORDER CALIB & CONTROL B601-607A16 7.00
ANALOG REC CONT & (FLT CONT) B601-607A17 8.75
BLANK 1.75
INTERCOM PNL 3.50
DESK
TV CONT 5.25
TV CONT 7.00
B601-1250-33
R/O DISPLAY
ST-124M CONTROL B601-608A3 15.75
BLANK 1.75
BLANK 3.50
DESK
BLANK
ST-124M C/O B601-608A2 7.00
BLANK 3.80
INRTL DATA BOX CONT B601-608A4 7.00
INTERCOM PNL 3.00
DESK
BLANK 5.25
CMR ENCODER R/O B601-608A12 8.75
CRM REMOTE CONT B601-608A7 8.25
AZ ENCODER R/O B601-608A11 8.75
AZ REM CONT B601-608A9 9.25
REC & REC AMPL B630-1712A1 33.25
BLOWER 12.25
BLANK 1.75
BLANK 12.25
GUIDANCE & COMPT PNL B601-608A13 12.25
THEODOLITE CONTROL B601-608A1 7.00
REC & REC AMPL B630-1712A2 33.25
BLOWER 12.25
ACCEL

Problems involving both the Stage and GSE will be injected into the simulator at various times in the countdown beginning after T-105 hrs. These problems have been developed by the G.E. test conductors at the SDF and consist of such things as erroneous discrete and analog indications. Analysis and trouble-shooting should be limited to identification of the problem, verification (by alternate measurements, etc.) and recommendation to launch, fix or scrub.

Problems detected by S-II panel operators are to be announced to the S-II test conductor over the intercom giving the reporting call station and nature of the problem.

For this test, all problems will result in a CDC hold for analysis and troubleshooting.

The countdown clock (CDC) will be under the control of the Launch Test Conductor and will be held and/or advanced at his direction. Advancing of the clock will occur at various times during the test to conserve time.

2.3.4 Procedure - The detailed procedure which will be used by the NR and GE personnel during the training exercise is contained in Appendix C. This composite procedure is comprised of the following:

a. The complete T-25 hr through plus time securing section of the "Launch Vehicle CDDT/CD-Volume II (V-20060) TCP with non-applicable (not to be performed) steps lined out,

b. the appropriate NR V-20060 support task procedures from M020 inserted in the time period,

c. the V-20060 safing Appendix,

d. the V-20060 hold option Appendix,

2.3.5 SDF Capabilities/Limitations - The SDF capabilities/limitations of major equipment categories are summarized in Figure 5. The facility is presently configured to that of AS-510. SDF electrical simulation of the S-II stage and GSE is discussed below to provide a better understanding of panel/CRT indications.

a. Hardware

1. S-II Stage Simulator

a. Electrical Control - All stage circuitry is simulated by electrical relay logic/timers per the stage electrical schematic. S-II functions for which simulator timers are used and their associated timer settings are listed in Figure 6.

b. Equipment - All stage equipment is simulated by electrical relay logic/timers except for that listed below which is installed in the simulator.

Equipment Installed In Simulator	Part No.
PCM/DDAS Assy. Model 301	50M12462-3E
AO Multiplexer Model 270	50M12461-11
BO Multiplexer Model 270	50M12461-9F
Remote Digital Sub-Multiplexer	50M12463-3
Remote Digital Sub-Multiplexer	50M12463-5
Remote Analog Sub-Multiplexer	50M12477-38
Remote Analog Sub-Multiplexer	50M12477-38
TM Calibrator Model II	50M12473-3
Switch Selector	
Range Safety Controller	
RACS Central & Remote	
Range Safety Safing Plug	

c. Measurements - Simulator measurements, channelizati and sampling rate is in accordance with the Stage IPCL, except Single Side Band capability is not provided.

Discrete measurements originate from simulator relay logic and are routed to measurement system equipment for subsequent PCM/DDAS transmission. Analog measurements originate from simulator relay logic, are routed to pre-set potentiometers and then to measurement system equipment for subsequent PCM/DDAS transmission. Thus, analog measurements will appear as a fixed value throughout the exercise unless manually varied in real time.

END ITEM CATEGORY	CAPABILITIES/LIMITATIONS	REMARKS
LCC/ML ESE	Functionally the same as KSC except no redline recorders are provided (CRT's are used instead).	See Appendix E for Major ESE interlock logic diagrams.
PROPELLANT LOADING	The SDF does not have the capability for simulating a propellant loading operation. Major loading indications are simulated for display on C2PM.	
LAUNCH SUPPORT EQUIPMENT	Forward and Aft electrical umbilicals only are provided. Retraction capability exists but will not be used during the training exercise. ECCS not simulated.	
S-II GSE S7-41 A7-71 S7-45 & S7-29	Actual console models and electrical simulation of console models exist. Elec. simulation will be utilized during the training exercise. Elec. simulation only. Not simulated.	See Paragraph 2.3.5a
S-II STAGE	Complete electrical simulation of stage.	See Paragraph 2.3.5b

Figure 5
SDF Capabilities/Limitations

Figure 6

S-II STAGE SIMULATOR TIMER DATA

S-II Stage Time Function Simulated		Time Simulation (Seconds)
Mainstage Press. Simulate		3.9
Temperature Detected		1.0
Ignition Detected	Engines	.9
Start Tank Solenoid	1 Thru 5	.5
Mainstage Control		.55
Thrust OK and Engine Cutoff		3.3
Helium Control Close		1.0
Engine 1 thru 4 Prevalves Delay		.50 ea.
Engine 5 Prevalve Delay		2.50
Engines 1 thru 5 Start Tanks Depressurizing Delay		5.0 ea.
EBW Pulse Monitor (4)		10.0
Fuel Tank 23 PSIA Delay		15.0
LOX Tank 30 PSIA Delay		15.0
Fuel Tank Depressurizing Delay		10.0
Engines 1 thru 5 He Control Tank Dump Delay		10.0 ea.
LH_2 Depletion Sensors 1 thru 5 Delay		1.5 ea.
LOX Depletion Sensors 1 thru 5 Delay		1.5 ea.

2. S-II GSE Simulator

a. Measurements - All measurements are simulated and are available to the LCC panel/CRT via ground DDAS or hardwire, as applicable.

b. Software - The software to be run during the exercise will consist of both ATOLL and machine language programs configured to the AS-512 configuration wherever possible. Exceptions to this will be where KSC has not yet updated the program (an example is VALJ) in which case the AS-511 program will be utilized.

PLAN OF ACTION

SATURN DEVELOPMENT FACILITY

S-II LIEF TRAINING EXERCISE