LESSON ASSIGNMENT SHEET

ADA SUBCOURSE 703-3	--Nike Hercules Launching Area.
LESSON 5	--Launching Platoon Control Equipment.
CREDIT HOURS	--3.
TEXT ASSIGNMENT	--Attached memorandum.
MATERIALS REQUIRED	--None.
SUGGESTIONS	--See appendix for unfamiliar terms and abbreviations.

TRAINING OBJECTIVES

Listed below are the training objectives for this lesson. These objectives tell you what you should be able to do as a result of your studies. Therefore, you should be familiar with the objectives before you start to study.

When you have completed this lesson, you should be able to:

1. State the purpose of the LCI, SCG, and LCS and recognize the major components of each and the purpose of each major component.
2. List the functional components of the LCI, state the function of the power supplies, and recognize the functions of the LCI panel controls and indicators.
3. List the functional components of the SCI, state the function of the AF amplifier, and recognize the functions of the controls and indicators on the SCI and crew safety switch panels.
4. State the functions of the SSG and of the components of the A_G transmission system.
5. List the functional components of the launching control console and flight simulator system, state the functions of the flight simulator system components, and recognize the functions of the launching control console control and indicators.

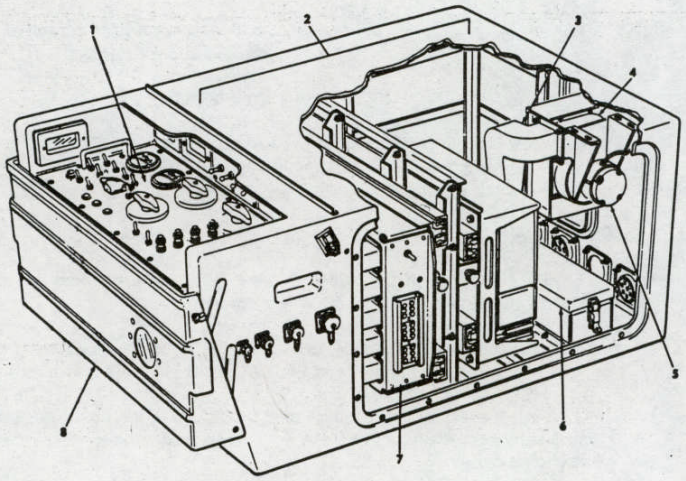
ATTACHED MEMORANDUM

(This memorandum consists of material approved for resident instruction in the US Army Air Defense School and conforms to current Department of the Army doctrine.)

1. PHYSICAL DESCRIPTION OF LAUNCHING PLATOON CONTROL EQUIPMENT

The launching platoon control equipment consists of the launching control-indicator (LCI), section control group (SCG), and launching control station (LCS).

a. Launcher control-indicator. The LCI (fig 5-1) provides control of its associated launcher and testing and monitoring facilities for as many as four missiles on the launcher and associated test stations. The LCI is housed in a skid-mounted metal cabinet. In a mobile installation, it is mounted on a dolly and emplaced to the left front of the launcher (fig 4-11). In an underground installation, three LCI's are emplaced in front of the test stations in the underground storage chamber and one is emplaced aboveground to the left front of launcher No. 4 (fig 1-4). The LCI is connected by three cables to the launcher, two cables to each test station, and two cables to the SCI. Major components of the LCI are the LCI panel, a blower system, relay panel, and two power supplies.



1 - Launcher control-indicator panel
2 - Relay compartment
3 - Blower system cooling pipe
4 - Blower system air filter cover
5 - Blower system centrifugal fan
6 - Mounting equipment storage box
7 - Relay panel
8 - Panel cover

Figure 5-1. Launcher control-indicator.

(1) The LCI panel contains the controls and indicators for operating the launcher and testing and monitoring the missiles. The relay panel contains relays associated with the controls and indicators.

(2) The blower system, which consists of a centrifugal fan, cooling pipe, and air filter cover, provides air-cooling for the electronic components.

(3) Power supplies receive 3-phase, 120-volt, 400-Hz primary power from the launcher power distribution box. The launcher, in turn, receives this

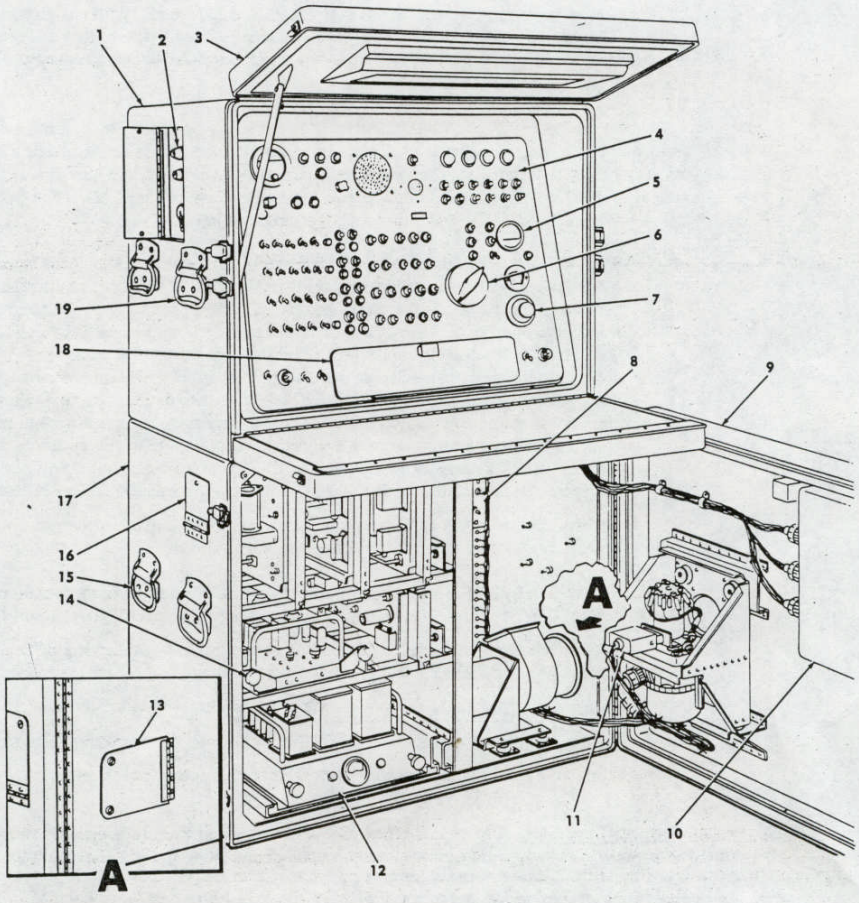
power from the section generator (mobile unit) or SSG (permanent installation). The two power supplies produce regulated -28-volt power and unregulated -28-volt power, respectively. This power is for the switches, relays, and meters in the LCI and for testing the missiles.

b. Section control group. The SCG (fig 5-2) provides operational control over, and distributes power to, the launchers in a launching section (permanent installation). In mobile installations, the SCG is housed in the section operating equipment trailer (fig 1-13). In permanent installations it is located in the section control room (fig 1-4). The SCG consists of a section control-indicator (SCI) and section simulator group (SSG).

(1) The SCI (fig 5-2) consists of the SCI panel (4), crew safety switch panel (2), and internal equipment housed in a metal cabinet. The SCI panel contains the controls and indicators for remote control of the launchers, preparation of the fire and launch order circuits, and coordination of launcher activities with the LCS. The MANUAL ORDERS door (18) provides access to the controls for conducting a firing sequence manually at the section as directed from the battery control area (BCA). Internal equipment includes an audiofrequency (AF) amplifier and intercommunication relay panel associated with the voice communications system; two relay panels and a relay rack associated with the controls and indicators on the SCI panel; and a launcher orient resolver group (mounted on the relay rack) associated with the A_G transmission system. The SCI is connected by two cables to the LCS, two cables to each LCI, and two cables to the SSG. Power for operation of the SCI is received from the SSG.

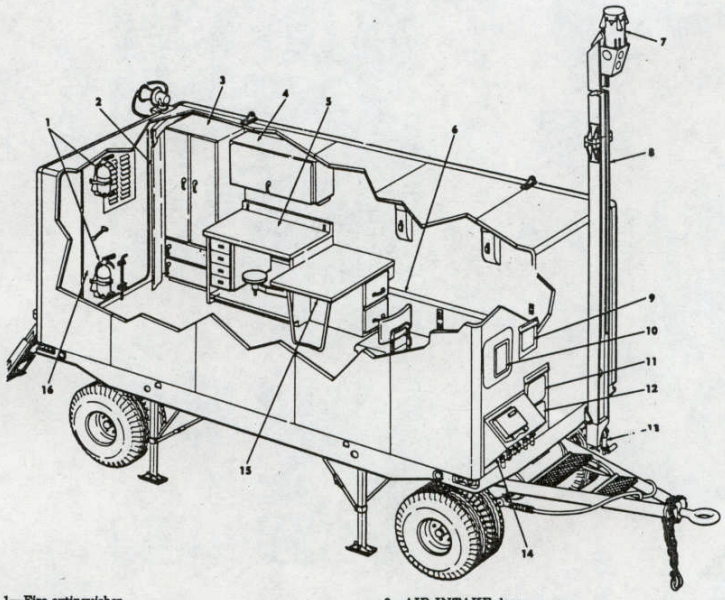
(2) The SSG (fig 5-2) distributes power to the SCI and launchers (permanent installation) and provides facilities for processing A_G data for the missiles. The SSG is housed in a metal cabinet that serves as a base for the SCI. Major components of the SSG are an electrical test panel (8), A_G data converter (11), battery charger (12), A_G power supply (14), and blower system. The SSG is connected by two cables to the SCI, one cable to the power source, and one cable to each launcher power distribution box (permanent site).

c. Launching control station. The LCS (figs 1-14 and 5-3) is the tactical control station for the LA. It coordinates activities between the BCA and LA. A missile may be fired from the LCS if the interarea cables are nonoperational. The LCS is connected by three interarea cables to the director station in the BCA, two cables to each SCI, one cable to the flight simulator group, and one cable to the power source. Major components of the LCS (fig 1-14) are the launching control console (5), intercommunication cabinet station (7), personnel heater (2), main switch box (4), and flight simulator group (3). Also, the LCS has a utility desk, launching control officer's (LCO) desk, operational display board, and utility storage cabinets.



1—Section control-indicator
2—Crew safety switch panel
3—Access door (2)
4—SCI panel
5—Slew meter
6—Launcher designator switch S44A
7—Gyro preset knob
8—Electrical test panel
9—Panel door
10—Circuit breaker panel
11—AG data converter
12—Battery charger
13—Air intake filter door
14—AG power supply
15—Handle (4)
16—Air exhaust door
17—Section simulator group
18—MANUAL ORDERS door
19—Handle (4)

Figure 5-2. Section control group.



1—Fire extinguisher
2—Blackout curtain
3—Utility storage cabinet
4—Utility storage cabinet
5—Utility desk
6—Ventilating duct
7—Flight simulator group
8—Flight simulator mast
9—AIR INTAKE door
10—EMERGENCY EXIT door
11—HEATER FUEL INTAKE door
12—REFRIGERATION EXHAUST door
13—Winch
14—Interconnecting box
15—Launching control officer's desk
16—Main entrance door

Figure 5-3. Launching control station.

(1) The launching control console (fig 1-14(5)) consists of an upper, lower, and middle section. The upper section is a storage cabinet. The middle section consists of two panels and associated equipment that contain the controls and indicators for missile and mission selection, section selection, and completion of the firing circuits from the BCA to the LA. The lower section consists of a work counter and electrical equipment associated with the flight simulator group.

(2) Intercommunications cabinet station (fig 5-4) consists of an upper compartment, lower section, and work counter. The upper compartment contains communications control equipment and storage space. The lower section consists of a fuse and control panel and telephone switchboard similar to that in the director station.

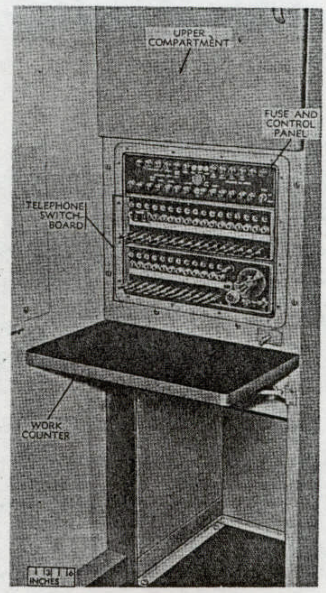


Figure 5-4. Launching control station intercommunications cabinet.

(3) The personnel heater (fig 1-14(2)) provides heat for LCS personnel. It is similar to those in the director and tracking stations.

(4) The main switch box (fig 1-14(4)) consists of a circuit braker panel, power control panel, and terminal strips. It contains the main power, console power, HEAT/VENT, and rectifier switches.

(5) Flight simulator group (fig 5-3(7)) consists of a two-section cylindrical housing that contains the flight simulator, a fan, and four antennas. The flight simulator is mounted on a 30-foot mast fastened to the front left corner of the LCS. The mast consists of three 10-foot sections.

2. FUNCTIONAL DESCRIPTION OF LCI

Functional components of the LCI (fig 5-1) consist primarily of the unregulated -28-volt power supply, regulated -28-volt power supply, controls and indicators on the LCI panel, and associated relays.

a. Power supplies. The two power supplies in the relay compartment convert 120-volt, 400-Hz input power from the section generator or SSG to -28-volt dc. The unregulated

-28-volt power supply provides power for operating the relays in the LCI and the power distribution box of the Nike Hercules launcher. The regulated -28-volt power supply provides power for the missile guidance system for test purposes and prior to launch.

b. LCI panel controls and indicators. The controls and indicators on the LCI panel (fig 5-5) are as follows:

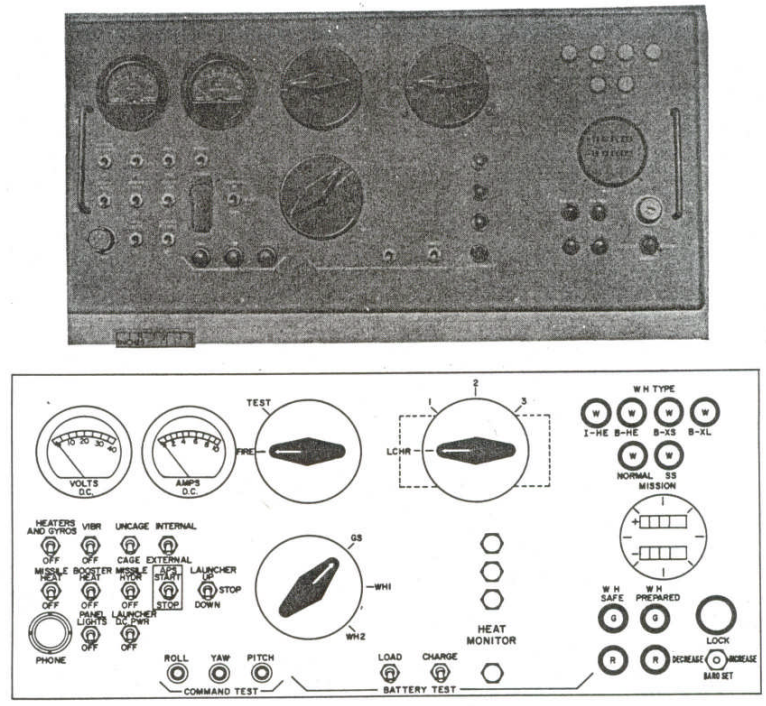


Figure 5-5. LCI panel.

(1) The voltmeter indicates the output voltage of the regulated -28-volt power supply.

(2) The ammeter indicates current to the guidance set in the missile on the launcher or at one of the test stations selected by the test station selector switch ((4) below).

(3) When turned to TEST, the TEST/FIRE rotary switch allows the LCI to exercise control over the launcher, the missile on the launcher, and the missiles at the test stations. When turned to FIRE, it allows the SCI to exercise control over the launcher and the missile on the launcher.

(4) The test station SELECTOR rotary switch selects the missile on the launcher (lchr) or at one of the test stations (1, 2, or 3) to be tested.

(5) When lit, the white WH TYPE indicator lamps indicate that the Nike Hercules missile on the launcher is prepared with an HE warhead (B-HE), small-yield nuclear warhead (B-XS), or large-yield nuclear warhead (B-XL). The I-HE indicator lamp is not used.

(6) When lit, the white MISSION indicator lamps indicate that the missile on the launcher is prepared for a surface-to-air mission (NORMAL) or a surface-to-surface mission (SS).

(7) The HEATERS AND GYROS toggle switch energizes the guidance set filament and gyro motor power supplies and a 60-second timer in the LCI.

(8) The VIBRATOR switch energizes the power supply of the missile selected by the test station selector switch. This switch is effective only if the HEATERS AND GYROS switch is on, the 60-second timer has run down, and the INTERNAL/EXTERNAL switch ((10) below) is set at EXTERNAL.

(9) The UNCAGE/CAGE toggle switch controls the caging and uncaging of the missile roll-amount gyro of the missile selected by the test station selector switch.

(10) When set at EXTERNAL, the INTERNAL/EXTERNAL toggle switch applies power from the LCI to the missile selected by the test station selector switch. The INTERNAL position is not used with missiles equipped with squib batteries.

(11) The MISSILE HEAT toggle switch energizes the missile and missile battery heater circuits.

(12) The BOOSTER HEAT toggle switch energizes the rocket-motor cluster heating blankets.

(13) The MISSILE HYDR switch is not used.

(14) The APS toggle switch is not used with missiles equipped with an HPU.

(15) The LAUNCHER switch controls the raising and lowering of the launcher erecting beam when the TEST/FIRE switch is turned to TEST.

(16) The PANEL LIGHTS toggle switch lights the panel lamps.

(17) The LAUNCHER D.C. PWR toggle switch applies -28-volt dc to the relay circuits and missile.

(18) The battery test selector rotary switch is not used with missiles equipped with squib batteries.

(19) When lit, a HEAT MONITOR indicator lamp indicates that the missile associated with the lamp has a subnormal temperature (below -5° F.), that the squib batteries in that missile are below operating temperature, or that one of the squib batteries in that missile has been prematurely activated.

(20) When lit, the WH SAFE indicator lamps indicate that the warhead of the missile selected by the test station selector switch is safe (green) or that a B-XS or B-XL warhead is not safe (red).

(21) When lit, the WH PREPARED indicator lamps indicate that the warhead of the missile selected by the test station selector switch is prepared (green) or that the B-XS or B-XL warhead is not prepared (red).

(22) The BARO SET toggle switch controls the barometric pressure setting in B-XL or B-XS warhead arming devices. The associated dial indicates the barometric pressure setting.

(23) The COMMAND TEST pushbuttons are not used with Nike Hercules missiles.

(24) The BATTERY TEST toggle switches are not used with missiles equipped with squib batteries.

3. FUNCTIONAL DESCRIPTION OF SCI

Functional components of the SCI consist primarily of an AF amplifier, associated relays of the launching section intercommunication system, and the launching section controls, indicators, and associated relays. Also, four launcher orient resolvers associated with the A_G transmission system are located in the SCI cabinet.

a. Audiofrequency amplifier. The AF amplifier provides two-way voice communication between the SCI and the launchers of the launching section. A microphone and loudspeaker are on the SCI panel, and a loudspeaker, which is also used as a microphone, is on each launcher. The AF amplifier and associated relays are mounted on two chassis in the SCI cabinet.

b. Controls and indicators. Launching section controls and indicators are on the SCI panel (fig 5-6). Associated relays are on two relay panels and a relay rack in the SCI cabinet. The controls and indicators are described below.

(1) The charging VOLTAGE meter indicates the output voltage of the battery charger in the SSG.

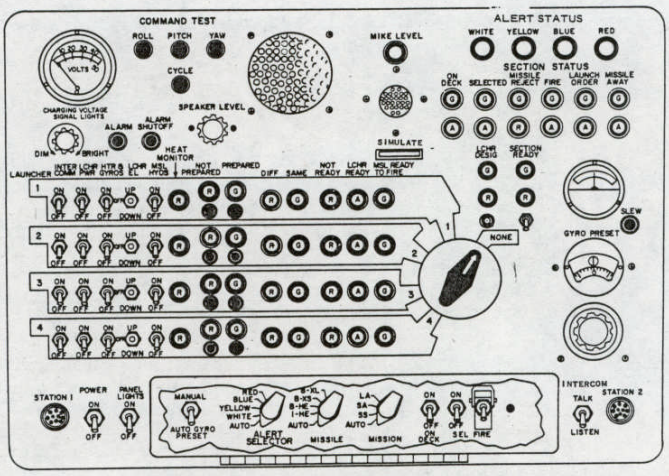


Figure 5-6. Section control-indicator panel.

(2) The COMMAND TEST pushbuttons are not used with Nike Hercules missiles.

(3) The intercommunications controls and indicators perform the following functions:

(a) The SPEAKER LEVEL knob controls the volume of the loudspeaker (adjacent to the knob).

(b) The MIKE level indicator lamp, when lit, indicates that the operator's voice is too loud or the AF amplifier (a, above) is overloaded.

(c) The INTERCOMM toggle switch at the bottom right of the SCI panel, when held at TALK (up), allows the operator to talk to all the launcher crews simultaneously. When released to LISTEN, it allows the operator to listen to the launcher crew whose INTERCOMM SWITCH ((9)(a), below) is set at ON.

(4) The ALERT STATUS indicator lamps indicate WHITE, BLUE, or RED alert status. YELLOW is not used.

(5) The SECTION STATUS indicator lamps indicate the progress of events in the launching section:

(a) ON DECK indicates that the section may be selected as next to fire (green) or will not be selected as next to fire (amber).

(b) SELECTED indicates that the section has been selected to fire (green) or has not been selected to fire (amber).

(c) MISSILE REJECT indicates that the missile has not been rejected for firing (green) or has been rejected (red). A missile reject occurs under any one of the following conditions: the MTR operator does not receive a return beacon signal from the missile at the required level and presses his MANUAL REJECT pushbutton, the missile HPU fails to reach an operating pressure of 1,600 psi within the 2-second delay between the fire command and launch order, or missile batteries fail to develop the required operating voltages during the 2-second delay between the fire command and launch order. Also, the computer transmits a reject if the missile does not reach a vertical velocity of approximately 450 knots within 5 seconds after the fire command.

(d) FIRE indicates that the fire command has been initiated (green) or has not been initiated (amber).

(e) LAUNCH ORDER indicates that the launch order has been generated at the launching control console (green) or has not been generated (amber). The launch order is received 2 seconds after the fire command. At the section, a 0.25-second delay timer provides an additional 0.25-second delay to permit the roll-amount gyro in the missile to uncage prior to lift-off.

(f) MISSILE AWAY, when lit, indicates that the missile has left the launcher or is improperly positioned on the launcher (green) or the missile is properly positioned on the launcher (amber).

(6) The SIGNAL LIGHTS knob adjusts the brightness of the indicator lamps on the SCI panel.

(7) The ALARM pushbutton, while pressed, sounds an alarm buzzer behind the SCI panel. The ALARM SHUTOFF pushbutton, when pressed, will shut off the buzzer, which sounds automatically when the equipment status is changed from WHITE to BLUE or RED.

(8) The SIMULATE indicator lamp lights when the missile firing simulator is connected to the launcher erecting beam or when the flight simulator is selected at the launching control console.

(9) The LAUNCHER panel strip (1, 2, 3, or 4) provides switches for operating the associated launcher remotely from the SCI and indicator lamps for monitoring launcher and missile operations as follows:

(a) INTERCOMM toggle switch, when set at ON, permits a launcher crewman to communicate with the SCI operator using the loudspeaker at the launcher as a microphone.

(b) LCHR PWR toggle switch, when set at ON, applies -28-volt dc to the launcher.

(c) HTR & GYROS toggle switch, when set at ON, applies power to the tube filaments in the missile guidance set, missile gyro motors, and guidance set cooling system, and starts the 60-second timer in the LCI.

(d) LCHR EL toggle switch controls the raising and lowering of the launcher.

(e) MSL HYDS toggle switch is not used with Nike Hercules missiles.

(f) A HEAT MONITOR indicator lamp, when lit, indicates that the associated missile or missile battery temperature is low, or that one of the squib batteries has been activated prematurely.

(g) NOT PREPARED indicator lamp goes out and PREPARED lamp lights when the following conditions have been met: missile umbilical cable is connected to the launching-handling rail, launching-handling rail quick-disconnect cables are connected to the launcher erecting beam, LAUNCHER POWER toggle switch ((b) above) is set at ON, WH SAFE green and WH PREPARED green lamps on the LCI are lit, PREPARED pushbutton beneath PREPARED indicator lamp has been pressed.

(h) DIFF indicator lamp goes out and SAME lamp lights when the missile and mission capability of the prepared missile on the associated launcher is the same as the missile and mission requested by the BCO.

(i) NOT READY indicator lamp goes out and LCHR READY lamp lights when the crew safety key for that launcher is inserted in its lock on the left side of the SCI cabinet and turned from SAFE to FIRE.

(j) MSL READY TO FIRE indicator lamp lights when the following conditions have been met: LCHR READY lamp is lit, launcher erecting beam is raised and locked, HTR & GYROS toggle switch has been set at ON, and the 60-second timer has run down.

(10) LAUNCHER DESIG controls are used to designate a launcher for firing as follows: The SCI operator turns LAUNCHER DESIG switch to LAUNCHER panel strip 1, 2, 3, or 4 (providing the MISSILE READY-TO-FIRE lamp on that strip is lit), and presses the pushbutton beneath LAUNCHER DESIG indicator lamps; LAUNCHER DESIG red lamp goes out and the green lamp lights.

(11) SECTION READY green lamp lights and the red lamp goes out when the following conditions have been met: LAUNCHER DESIG green lamp is lit, all crew safety keys (c below) are inserted and turned to FIRE, SECTION READY toggle switch (beneath the lamps) is set at the on (up) position.

(12) GYRO PRESET controls and indicators are used as follows: GYRO PRESET (null) meter and SLEW pushbutton for performing a gyro slew check prior to firing, GYRO PRESET dial and knob (beneath the dial) for presetting gyro azimuth into the system manually.

(13) STATION 1 and STATION 2 receptacles at the bottom left and bottom right of the SCI panel are for connecting the section chief and SCI operator telephones into the battery voice communications system.

(14) POWER toggle switch applies main power to the SCI; PANEL LIGHTS toggle switch lights the lamps in the upper panel door to provide light for the SCI panel.

(15) MANUAL ORDERS compartment provides the controls and indicators for firing a missile if data communication with the BCA is cut off:

(a) GYRO PRESET toggle switch, when set at AUTO, allows A_G data from the computer to be used for presetting the missile roll-amount gyro; when set at MANUAL allows A_G data to be set in by means of the GYRO PRESET knob on the SCI panel ((12) above) as transmitted by the computer operator.

(b) ALERT SELECTOR rotary switch, when turned to AUTO, does not affect control of equipment status from the BCA or LCS; when turned to any other position, establishes equipment status for the section and enables the switches in the MANUAL ORDERS compartment listed below.

(c) MISSILE and MISSION rotary switches, when turned to positions other than AUTO, select the type of missile and warhead, and type of mission, respectively, as directed by the BCO.

(d) ON DECK toggle switch, when set at ON, lights SECTION STATUS—ON DECK green indicator lamp on the SCI panel and extinguishes ON DECK amber lamp.

(e) SELECTED toggle switch, when set at ON, lights SECTION STATUS—SELECTED green indicator lamp on the SCI panel and extinguishes SELECTED amber lamp.

(f) FIRE toggle switch, when set at ON, lights SECTION STATUS—FIRE green indicator lamp, extinguishes FIRE amber lamp, and initiates a 2.25-second timer in the SCI. When the timer runs down, the launch order is issued automatically.

c. Crew safety switch panel controls. The crew safety switch panel (fig 5-2(2)) contains four key-operated switches: LAUNCHER 1, LAUNCHER 2, LAUNCHER 3, and LAUNCHER 4. When a switch is at SAFE, it prevents a missile from being fired from any launcher in the section. When all four keys have been inserted and turned to FIRE, a missile can be fired from one of the launchers. section simulator Gr

4. FUNCTIONAL DESCRIPTION OF SSG AND A_G TRANSMISSION SYSTEM COMPONENTS

The SSG distributes power to the launchers of a launching section (permanent installation) and contains a battery charger and components of the A_G transmission system. The battery charger (fig 5-2(12)) furnishes -28v dc power for the SCI indicators.

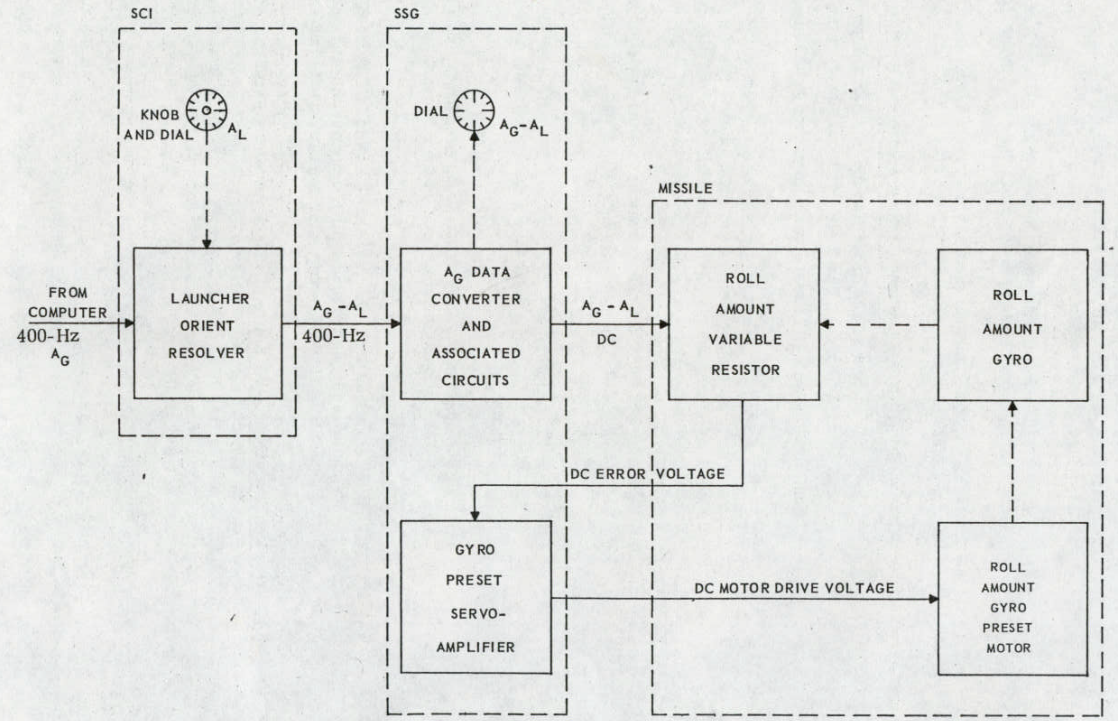


Figure 5-7. Gyro-azimuth transmission system.

a. Power distribution. In a permanent installation, the SSG receives 400-Hz power from a rotary converter or from a 400-Hz generator in the launching section. The SSG distributes this power to the SCI and launchers in the section.

b. A_G power supply. The A_G power supply (fig 5-2(14)) furnishes regulated dc voltages and unregulated ac voltages for operation of the A_G transmission system components in the launching section.

c. A_G transmission system components. The A_G transmission system presets the roll-amount gyro in the missile on the designated launcher to a known reference plane. A_G transmission system components include four launcher orient resolvers in the SCI, the A_G data converter on the door of the SSG and associated circuits mounted on three sliding panels above the A_G power supply (fig 5-2), and the roll-amount variable resistor and roll-amount gyro motor in the missile. A simplified block diagram of the A_G transmission system is shown in figure 5-7.

(1) Launcher orient resolver, associated with the designated launcher, modifies the 400-Hz A_G signal from the computer to compensate for the azimuth heading of the launcher (A_L). A_L is set into the system manually by means of a knob and dial on the launcher orient resolver. The resolver electronically subtracts A_L from A_G to determine the azimuth ($A_G - A_L$) to which the roll-amount gyro in the missile is to be preset.

(2) A_G data converter and associated circuits convert 400-Hz signals to dc signals that represent $A_G - A_L$. These dc signals are transmitted to the roll-amount variable resistor in the missile. An illuminated dial on the A_G data converter displays in mils the $A_G - A_L$ value being transmitted.

(3) Roll-amount variable resistor in the missile guidance set is physically connected to the roll-amount gyro; its setting represents the azimuth to which the gyro is preset. If the variable resistor setting is not the same as the $A_G - A_L$ value being received from the A_G data converter, the variable resistor produces a dc error voltage, which it sends back to the gyro preset servoamplifier in the SSG.

(4) Gyro preset servoamplifier produces a dc motor drive voltage proportional to the dc error voltage received from the roll-amount variable resistor. This is applied to the roll-amount gyro preset motor in the missile.

(5) Roll-amount gyro preset motor receives the dc motor drive voltage from the gyro preset servoamplifier. This causes the motor to preset the roll-amount

gyro and the roll-amount gyro variable resistor to the $A_G - A_L$ value. As the variable resistor setting approaches the $A_G - A_L$ value, it reduces the error signal output. When the variable resistor setting is the same as the $A_G - A_L$ value, the error voltage is zero and the gyro preset motor stops; however, since the A_G value received from the computer is continuously changing during an SA mission, the gyro will continue to preset until just before launch.

5. FUNCTIONAL DESCRIPTION OF LAUNCHING CONTROL CONSOLE AND FLIGHT SIMULATOR

Functional components of the launching control console are the controls and indicators on the launching control panels (fig 5-8), associated relays, and components of the flight simulator system in the lower section of the launching control console.

a. Flight simulator. Functional components of the flight simulator system are the flight simulator group (fig 5-3(7)), flight simulator control unit in the launching control console, and the RESPONDER strip on the left-hand launching control panel (fig 5-8). The flight simulator system is used to check the performance of the MTR.

(1) The flight simulator group receives time coded command signals (pulse groups) from the MTR through its two receiving antennas. If the pulse groups are properly coded, it converts them to pitch (P), yaw (Y), and burst commands and applies them to the flight simulator control unit. The flight simulator group also generates a modulator trigger pulse for each properly coded pulse group received. This pulse triggers a radar modulator in the flight simulator group, which, in turn, generates a magnetron trigger pulse and a fail-safe holdoff pulse. The magnetron trigger pulse triggers a magnetron to produce an RF response pulse. The response pulse is transmitted to the MTR through the two transmitting antennas on the flight simulator group. The fail-safe response pulse is applied to the flight simulator control unit.

(2) Flight simulator control unit displays the P and Y commands as meter indications and the burst command as a white lamp indication on the RESPONDER section of the left-hand launching control panel. The meters indicate the magnitude of the P and Y commands transmitted by the MTR. The flight simulator control unit produces a white fail-safe burst lamp indication on the RESPONDER section when it fails to receive fail-safe holdoff pulses from the flight simulator group. Therefore, when the FAIL-SAFE lamp lights, it indicates that the MTR signals are improperly coded or the MTR signals have been interrupted.

b. Launching control console left-hand panel controls and indicators. The left-hand panel contains the RESPONDER strip, four section panel strips, and a SECTION SELECTOR switch, pushbutton, and indicator lamps.

(1) RESPONDER strip controls and indicators.

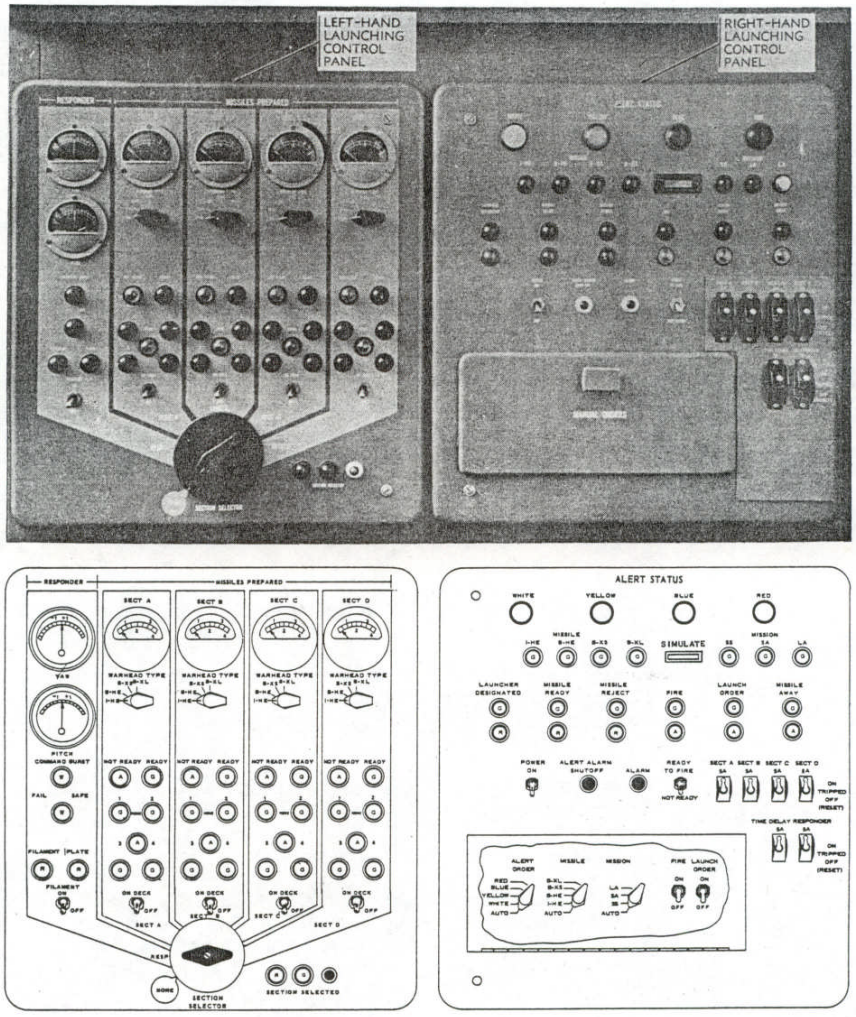


Figure 5-8. Launching control console panel.

(a) PITCH and YAW meters are calibrated from -7g to +7g to indicate the magnitude of the P and Y commands transmitted by the MTR.

(b) When lit, the COMMAND BURST indicator lamp indicates that a burst command is contained in the pulse groups being transmitted by the MTR.

(c) The FAIL-SAFE indicator lamp lights if the MTR, after having locked on the flight simulator group, slews away from the flight simulator group or transmits improperly coded messages. It thereby indicates a simulated fail-safe missile burst.

(d) When lit, the FILAMENT indicator lamp indicates filament power is being supplied to the flight simulator system.

(e) When lit, the PLATE indicator lamp indicates that plate power is being applied to the flight simulator system.

(f) When set at ON during WHITE equipment status, the FILAMENT switch applies filament power to the flight simulator system and starts a 38-second timer. When the timer runs down, plate power is applied automatically.

(2) Section panel strips (A, B, C, or D).

(a) The MISSILE PREPARED meter indicates the number of missiles prepared with the type of warhead to which the WARHEAD TYPE rotary switch is turned (B-HE, B-XS, or B-XL). Meter indications are associated with the PREPARED pushbuttons and indicator lamps on the SCI's.

(b) NOT READY/READY indicator lamps indicate that the section is not ready or ready, respectively, for firing a missile.

(c) When lit, a green launcher identification (1, 2, 3, or 4) lamp indicates that the associated launcher has been designated for firing at the SCI. When the amber NONE lamp is lit, it indicates that a launcher has not been designated.

(d) When set at the up position, the ON DECK toggle switch causes the ON DECK indicator lamp at the associated SCI to light.

(3) Section selector controls and indicators.

(a) When turned to RESP, the SECTION SELECTOR switch selects the flight simulator system for checking the MTR. When turned to A, B, C, or D, it selects the corresponding section for firing a missile.

(b) When pressed and the SECTION SELECTOR switch is turned to RESP, the SECTION SELECTED pushbutton applies plate power to the flight simulator system and lights the red PLATE indicator lamp on the RESPONDER strip. When pressed and SECTION SELECTOR switch is turned to SECT A, B, C, or D, it lights the SECTION SELECTED green indicator lamp, extinguishes the red lamp, and sends signals to the selected section.

c. Launching control console right-hand panel controls and indicators. The right-hand panel contains the equipment status lamps, MISSILE and MISSION request lamps, launching area status indicator lamps, ALERT alarm controls, circuit breakers, and MANUAL ORDERS compartment.

(1) When lit, an ALERT STATUS lamp indicates that WHITE, BLUE, or RED equipment status is in effect. YELLOW is not used.

(2) When lit a MISSILE indicator lamp indicates that a B-HE, B-XS, or B-XL missile has been requested. I-HE does not apply to Nike Hercules missiles.

(3) When lit, a MISSION lamp indicates that an SA or SS mission is to be fired. LA is not used.

(4) When lit, the SIMULATE indicator lamp indicates that the missile firing simulator or the flight simulator is being used.

(5) Launching area status indicator lamps:

(a) The LAUNCHER DESIGNATED green lamp, when lit, indicates that a launcher has been designated and a section selected for firing. The circuit that lights this lamp also causes the MISSILE DESIGNATE lamps in the director and tracking stations to light and the MTR antenna to slew to the missile on the designated launcher. The red lamp is lit when a launcher has not been designated or a section has not been selected.

(b) The MISSILE READY green indicator lamp lights and the amber lamp goes out when a launcher has been designated, a section selected, and READY TO FIRE/NOT READY toggle switch ((8) below) set at READY TO FIRE.

(c) The MISSILE REJECT lamps indicate that the missile on the designated launcher in the selected section is acceptable in the BCA (green) or that the missile has been rejected in the BCA (red).

(d) The FIRE green indicator lamp lights and the amber lamp goes out when FIRE command is received at the LA. FIRE command causes the alarm buzzer at the console to sound and starts a 2-second timer in the console.

(e) The LAUNCH ORDER green indicator lamp lights, the amber lamp goes out, and the buzzer stops sounding when the 2-second timer has run down.

The 2-second delay allows time for the squib batteries in the missile to activate, the missile HPU to develop a minimum pressure of 1,600 psi, and the roll-amount gyro to settle on the final A_G.

(6) When set at ON, the POWER toggle switch supplies power to the launching control console provided that MAIN POWER SWITCH and CONSOLE POWER SW. in the main switch box are set at ON.

(7) When pressed, the ALERT ALARM SHUTOFF pushbutton stops the siren. The siren sounds automatically when equipment status is changed from WHITE to BLUE or RED. ALARM pushbutton, while pressed, sounds the siren.

(8) The READY TO FIRE/NOT READY toggle switch, when set at READY TO FIRE, indicates that the LA is ready to fire and permits a missile to be fired from the director station or launching control console. When set at NOT READY, it indicates that the LA is not ready to fire and prevents a missile from being fired.

(9) When tripped, circuit breakers indicate an electrical overload in the associated circuit.

(10) The MANUAL ORDERS compartment contains the following switches:

(a) The ALERT ORDER rotary switch controls equipment status in the LA when turned to other than AUTO.

(b) The MISSILE rotary switch controls selection of the desired warhead when turned to other than AUTO.

(c) The MISSION rotary switch controls the selection of a mission when turned to other than AUTO.

(d) The FIRE toggle switch, when held at ON, initiates FIRE command.

(e) The LAUNCH ORDER toggle switch, when held at ON, initiates the launch order. This switch is used only when the 2-second timer is not functioning.

REQUIREMENT. Solve the following multiple-choice exercises and record your solutions on the optical scan answer form. All exercises are of equal weight (4 points). Select the one CORRECT choice. If more than one choice is correct, select the BEST one.

1. Components of the SCI include all the following items except
   a. an intercommunications relay panel.
   b. an electrical test panel.
   c. two relay panels.
   d. a launcher orient resolver group.

APPENDIX

GLOSSARY

Part I. ABBREVIATIONS

ac	alternating current
AD	air defense
ADA	air defense artillery
A_G	gyro azimuth
A_L	launcher azimuth
AF	audiofrequency
BCA	battery control area
BCO	battery control officer
B-XL	Hercules nuclear, large (warhead)
B-XS	Hercules nuclear, small (warhead)
CONUS	continental United States
dc	direct current
F	Fahrenheit
g	gravity (rate of acceleration of gravity)
HE	high explosive
HHB	headquarters and headquarters battery
hp	horsepower
HPU	hydraulic pumping unit
Hz	hertz
LA	launching area
lchr	launcher
LCI	launcher control-indicator
LCO	launching control officer
LCS	launching control station
MTR	missile tracking radar
P	pitch
psi	pounds per square inch

RF	radiofrequency
SA	surface to air
SCI	section control-indicator
SCG	section control group
SSG	section simulator group
v	volt
Y	yaw

Part II. DEFINITIONS

alternating current	An electric current that is continuously changing in magnitude and periodically reversing its direction.
caging	The act of securing a gyro to prevent movement on its gimbals (supports).
direct current	An electric current that is constant in magnitude and does not change its direction of flow.
gyro azimuth	The azimuth that orients the center of the launching area to the target position and that is continuously transmitted to the launching area by the computer until FIRE.
hertz	A unit of frequency equal to one cycle per second.
pitch	Angular displacement in the vertical plane of a missile about its center of gravity.
radiofrequency	A frequency that is useful for radio (radar) transmission.
roll	Angular displacement about the longitudinal axis of a missile.
servo	A device that electrically transmits mechanical position.
squib	A small pyrotechnic device activated by an electric current used to fire an igniter in a rocket motor or initiate activation of a storage battery.
thermal battery	A battery (primary cell) that is activated by heat and cannot be recharged.
trajectory	The curve that a missile describes in space from the time of launch to detonation.
uncaging	The act of freeing a gyro after it has begun to spin. The gyro will then maintain its relative position in space regardless of the position of the missile.
yaw	Angular displacement in the horizontal plane of a missile about its center of gravity.