DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

CH-47D (CHINOOK) FLIGHT SIMULATOR
Device 2B31A

"Approved for public release; distribution is unlimited."

HEADQUARTERS, DEPARTMENT OF THE ARMY
11 OCTOBER 1989

WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

or severe injury may result if personnel fail to observe safety precautions.

Learn the areas containing high voltage in each piece of equipment.

Under no circumstances should operation of this device be undertaken when cabinets and/or protective covers are removed or open.

WARNING

Motion system operation requires that
SEAT BELTS BE USED AT ALL TIMES.

In the cases of runaway motion, immediately activate EMERGENCY STOP switch.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

WARNING

EMERGENCY STOP

Controls are located at the instructor operator console.
Depressing this switch shuts down the entire simulator complex.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

WARNING

Sensors that detect heat, lack of airflow, and unsafe mechanical conditions are provided. UNDER NO CIRCUMSTANCES SHOULD THE SIMULATOR BE OPERATED WITH A SAFETY INTERLOCK BYPASSED.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

WARNING

FIRE

Should fire develop, activate EMERGENCY STOP and exit cockpit. DO NOT USE FIRE EXTINGUISHER IN CONFINED COCKPIT.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

WARNING

BOARDING RAMP

May fail to deploy during a power failure.
Caution should be exercised when exiting simulator.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

WARNING

Releasing trainer from freeze condition with incorrect rotor rpm may cause motion surges.

DEATH

or severe injury may result if personnel fail to observe safety precautions.

TECHNICAL MANUAL
TM 55-6930-212-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 11 October 1989

OPERATOR'S MANUAL FOR CH-47D (CHINOOK) FLIGHT SIMULATOR

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished to you.

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high-voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warnings appear in the text in this manual and are repeated here for emphasis:

WARNING

Releasing the freeze condition with incorrect rotor percentage can cause motion surges and injury to personnel. Page 8-89)

WARNING

Care must be exercised when exiting the simulator during power failure. The boarding ramp may fail to deploy. (Page 9-2)

WARNING

Before the motion system is activated, all occupants of the simulator must fasten their seat belts.

(Page 9-3)

WARNING

Do not discharge a Halon 1301 fire extinguisher in the confined area. (Page 9-4)

WARNING

Avoid prolonged exposure (5 minutes or more) to high concentrations of fire extinguishing agent and its decomposition products because of irritation to the eyes and nose. Adequate respiratory and eye relief from excessive exposure should be sought as soon as the primary fire emergency permits. Use of oxygen for personnel is recommended. (Page 9-4)

WARNING

If steam or water is observed in cockpit, activate EMERGENCY STOP switch and evacuate the cockpit immediately. (Page 9-4)

CHAPTER 1

INTRODUCTION

1-1. SCOPE.

1-2. This operator's manual contains complete operating instructions and procedures for the CH-47D (Chinook) Flight Simulator. This manual is to be used by the instructor operator to train pilots (PLT) and/or copilots (CPLT) in normal and emergency flight techniques, and tactical maneuvers of the Chinook helicopter.

1-3. GENERAL.

1-4. The simulator consists of a cockpit (trainee station), with a six-degree of-freedom motion system and a visual system that simulates the natural helicopter environment. A central computer system controls the operation of the simulator complex.

1-5. The simulator provides normal and emergency procedural mission training, navigation instrument flight operation, and day, dusk and night visual flight operations.

1-6. REPORTING OF ERRORS.

1-7. Report of errors or omissions and recommendations for improving this publication by the user are encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded directly to Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MMD, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

1-8. ABBREVIATIONS.

1-9. Standard and nonstandard abbreviations and acronyms used in this manual are contained in the Glossary.

CHAPTER 2

SIMULATOR AND SYSTEMS DESCRIPTION AND OPERATION

Section I. GENERAL

2-1. OPERATIONAL SYSTEM.

2-2. The CH-47D Flight Simulator is a fixed-base simulator for training pilots in the use of CH-47D (Chinook) helicopters. Training is conducted in the instructor/ trainee station which is equipped with visual display systems. The station is mounted on a six-degree-of-freedom hydraulic motion system and is controlled by a central computer system. The areas of the simulator complex are described further in the following paragraphs.

2-3. SIMULATOR COMPARTMENT.

2-4. The simulator compartment houses a cockpit station in the forward position and an instructor operator station (IOS) and it provides visual, motion, and sound simulation. (See figure 2-1 for the flight compartment layout.)

2-5. The trainee station is a replica of the actual aircraft cockpit. It includes facsimiles of the cockpit windows, pilot seat, main instrument and control panel, flight controls, chin window, and copilot seat. Left and right power distribution panels are actual aircraft parts.

2-6. All controls, indicators, and panels are simulated, and they are identical to those in TM 55-1520-240-10, Operator's Manual for the CH-47D Chinook Helicopter.

2-7. Three pairs of loudspeakers and one subwoofer in the simulator compartment provide realistic aural cue sounds. The sound characteristics are correct with respect to location, frequency, and loudness (within safety limits). The instructor can vary the loudness of the cue sounds.

2-8. The trainee cockpit seats can be vibrated to simulate continuous and periodic oscillations and vibrations that crew members experience during actual flight conditions and maneuvers, and also vibrations that represent progressive malfunctions. Seat vibration is isolated from the rest of the simulator compartment by means of damping elements in the seat mounting.

2-9. The ambient temperature of the simulator compartment and cockpit is controlled by adjusting the thermostat on the compartment right wall. Conditioned air is pumped through the compartment area and the helicopter cockpit heating and defrosting ducts.

2-10. Cockpit environment control system switches and controls are nonfunctional.

2-11. INSTRUCTOR OPERATOR STATION.

2-12. The instructor operator station (IOS) is in the simulator compartment, adjacent and to the rear of the cockpit. (Refer to Section II for further details.) Using the IOS, the instructor operator can control the training program and monitor and evaluate trainee performance effectively. (See figures 2-2 and 2-3 for the instructor station layout and IOS controls.)

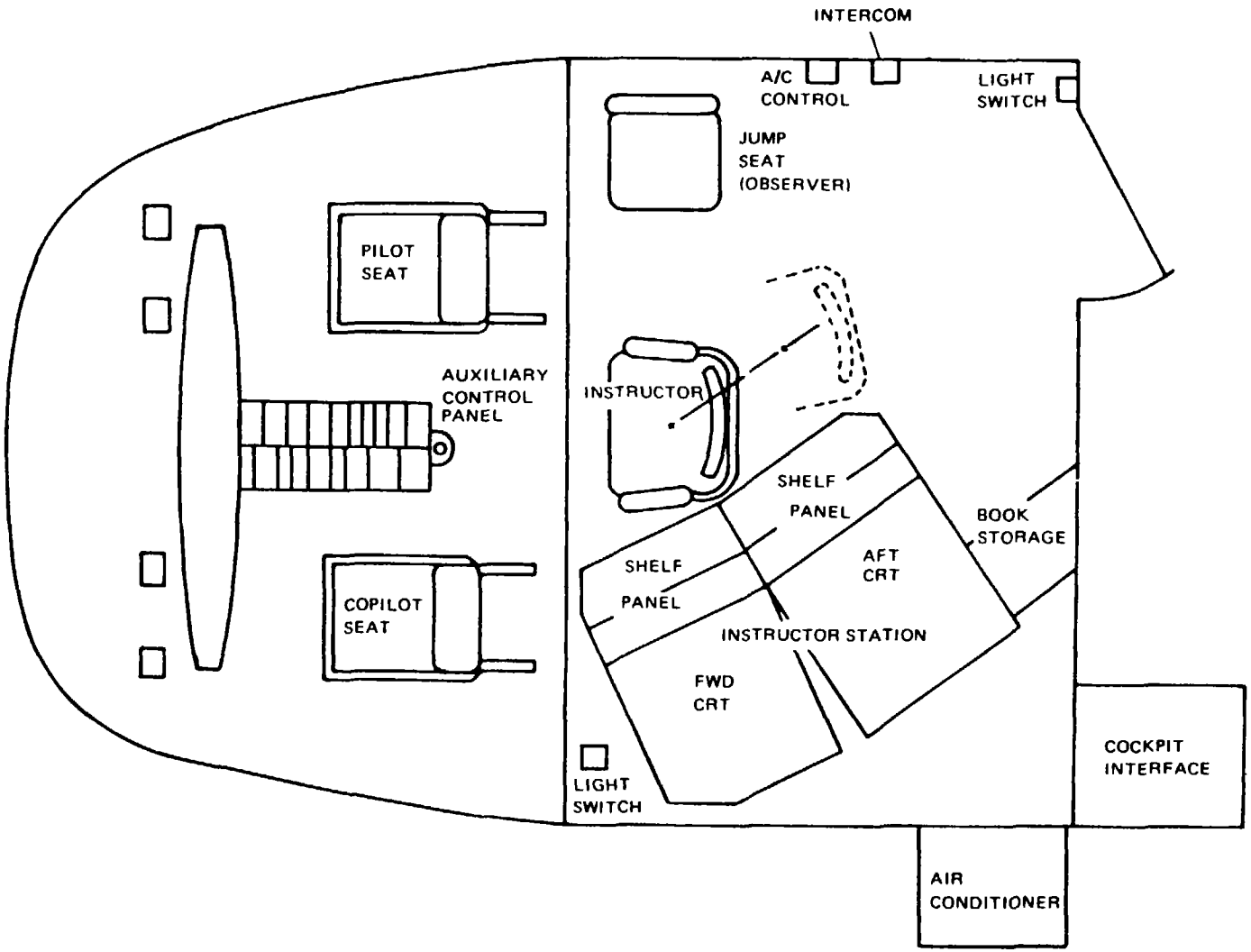


Figure 2-1. Flight Compartment Layout

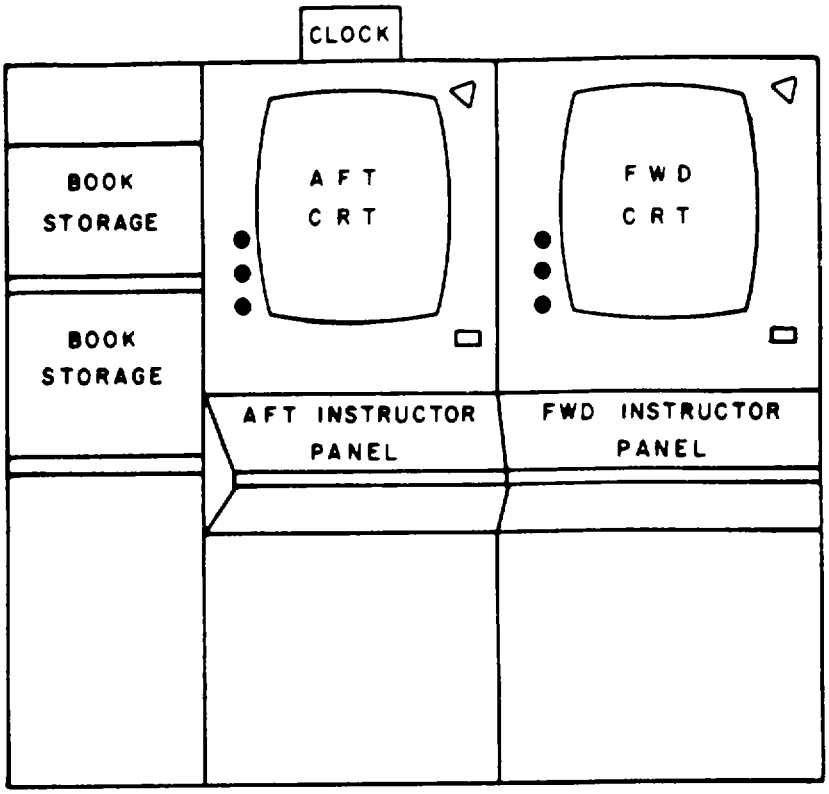


Figure 2-2. Instructor Station Layout

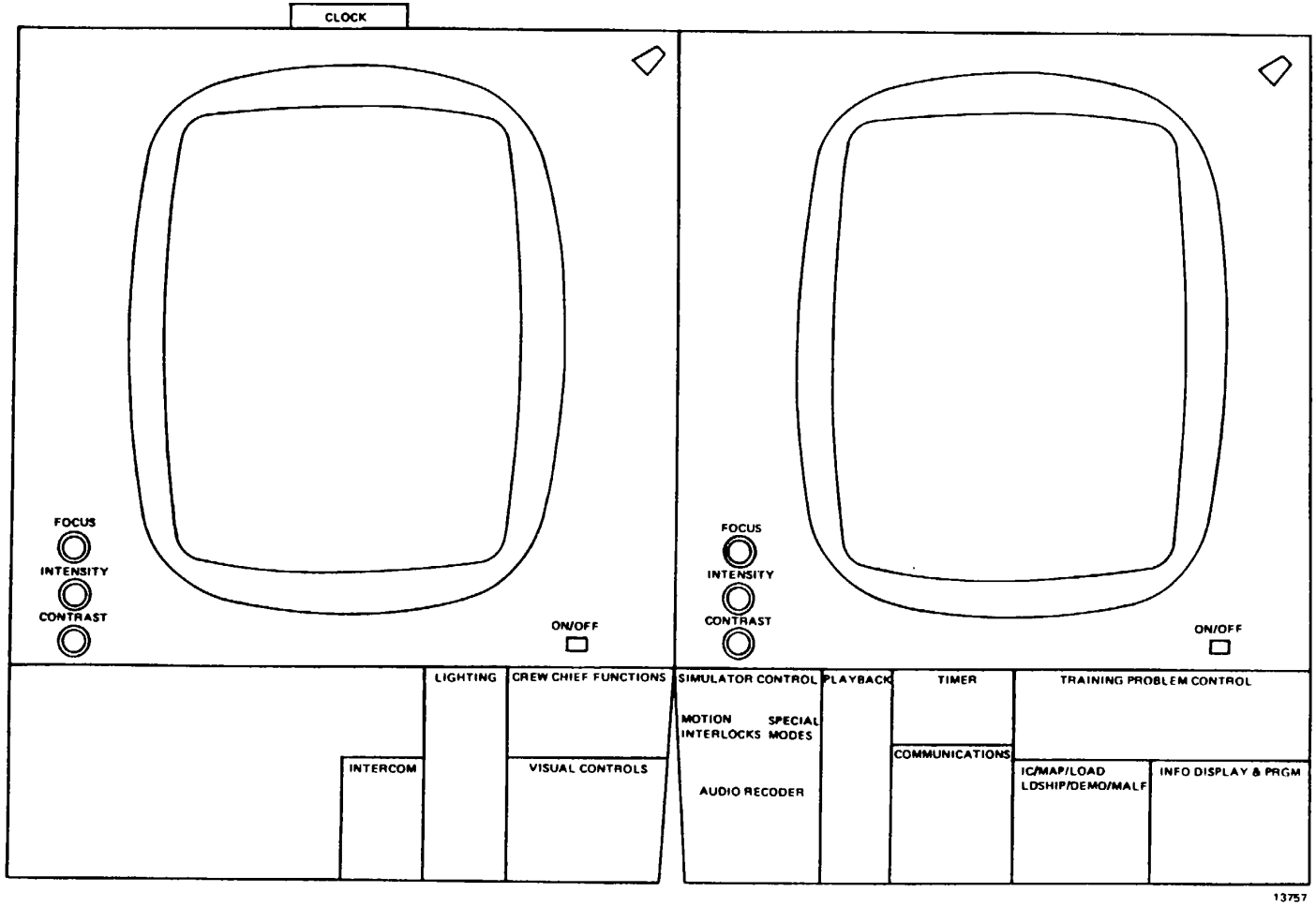


Figure 2-3. IOS Controls

2-13. MOTION SYSTEM.

2-14. The simulator compartment is mounted on a six-degree-of-freedom (6-DOF) motion system that consists of a moving platform assembly that is driven and supported from below by six hydraulic actuators. The motion system provides cues for pitch, roll, yaw, lateral, longitudinal, and vertical movements. To produce realtime dynamic motion cues, system motion can be either independent (without simultaneous motion in any other degree of freedom) or in any desired combination.

2-15. Flight simulation includes combined motion that represents changes in aircraft attitude that result directly from use of flight controls, rough air and wind, changes in aircraft weight and center of gravity that result from fuel consumption, winching operations, cargo loading, troop displacement, or weapon and ammunition depletion. Motion effects such as blade imbalance, blades out-of-track, and touchdown impact are also simulated.

2-16. Within the system mechanical limits, the simulator computer programs cause the motion system to respond realistically to aerodynamic forces and moments. After the computed accelerations have reached zero, all motions except pitch are imperceptibly washed out to neutral. Pitch attitude is maintained as necessary to simulate sustained longitudinal acceleration cues. Acceleration onset cues are scaled as large as possible for full use of the range of motion capabilities of each degree of freedom.

2-17. Depending upon which flight profile is being used, the motion system responds to computer input signals as discussed in the following paragraphs.

2-18. GROUND CONDITIONS.

2-19. The motion system simulates motion of the aircraft on the apron, taxiway, and runway. The motion is a random, low-frequency, low-amplitude, multidirectional oscillation with reasonably abrupt application. This includes irregularities of unimproved or unprepared surfaces, longitudinal effects due to abrupt brake applications, and lateral effects due to asymmetrical braking.

2-20. TAKEOFF AND LANDING.

2-21. Transition to flight is indicated by abrupt cessation of the random oscillation. The motion system provides the indications of takeoff and maintains an attitude appropriate for hover. Appropriate motion effects occur as a result of changes in simulated accelerations during transition to flight.

2-22. Similar effects are reproduced during the landing phase, causing appropriate longitudinal and vertical vibration effects to occur as in the helicopter. The motion system reproduces the landing impact according to the existing aircraft attitude and vertical and sideslip velocities. When vertical momentum is too great, landing bounce is simulated. Pitching and rolling effects of single or multi-gear contact are reproduced, and the magnitude of the bounce depends upon the current landing weight. The longitudinal effects of brake application are also simulated.

2-23. NORMAL FLIGHT.

2-24. The motion system simulates the complex and repeated cues occurring during all the maneuvers associated with airwork. Varying degrees of turbulence

introduced by the instructor produce the appropriate motion effects of yaw and roll, climb or descent, and variations in airspeed. Superimposed upon the background motion, the motion system provides characteristic periodic oscillations of the aircraft, lateral instability, and aircraft vibrations up to 5 cycles per second. In addition, continuous higher-frequency vibrations are simulated using a seat shaker in lieu of the motion system. Effects of sling load oscillations are also simulated through the motion system.

2-25. ABNORMAL FLIGHT.

2-26. The motion system reproduces the effects of rotor out-of-track and rotor out-of-balance failures. The motion simulated includes the effect of momentary incorrect control inputs. Hydraulic failure resulting in abnormal control configurations results in appropriate motion cues. High-speed characteristics and trim changes also cause appropriate effects in the motion system.

2-27. VISUAL SYSTEM.

2-28. The pilot/copilot stations have forward, left, and right side windows, and chin window visual displays. The visual generation system provides imagery to every sensor display in the simulator, including the out-the-window (OTW) scene.

2-29. DIGITAL IMAGE GENERATOR.

2-30. The digital image generator (DIG) system is a full-color visual display that provides imagery for day, dusk, and night scenes. The DIG is used for the six out the-window displays (two front, two side, and two chin window). It also provides imagery that represents night vision goggles (NVG) displays and simulates the action of a searchlight on the visual displays.

2-31. The two chin window displays are high-resolution, full-color visual displays. One display serves as the pilot's chin window, and the other serves as the copilot's chin window. Video signals are sent to each chin window display monitor from the DIG via distribution amplifiers in the visual interface cabinet.

2-32. The fields-of-view (FOV) for the windows are as follows:

Window		Pilot		Copilot
Front and side	Up	13.3 (±0.5)°	Up	13.3 (±0.5)°
	Down	22.7 (±0.5)°	Down	22.7 (±0.5)°
	Right	24 (±0.5)°	Right	24 (±0.5)°
	Left	24 (±0.5)°	Left	24 (±0.5)°
Chin	Horizontal	22 (-0.5, +3)°	Horizontal	22 (-0.5.+3)°
	Vertical	30 (-0.5, +3)°	Vertical	30 (-0.5, +3)°
	Centered	40 (±0.5)° down, 27.5 (+0.5)° left and right (both)		

2-33. COMPUTER SYSTEM.

2-34. The simulator consists of the main computational system (MCS), which is made up of central processing units (CPU's 1, 2, and 3) and their associated auxiliary processing units (APU's). Each CPU has memory that can be accessed only by it and its associated APU's.

Section II. INSTRUCTOR OPERATOR STATION DESCRIPTION

2-35. GENERAL DESCRIPTION.

2-36. The instructor operator station (IOS) accommodates one instructor and an observer. Figure 2-1 shows the arrangement of the IOS and its relationship to the trainee station. This arrangement permits close, direct contact between the instructor operator and the trainees. The locations of the forward control panel and the console control panel provide convenient control of the cockpit and direct contact with the cathode ray tube (CRT) informational displays that are required to monitor, guide, and evaluate trainee performance. Various features of the instructor areas are described in the following paragraphs.

2-37. IOS CONTROL PANELS.

2-38. The instructor station is in the cockpit behind the pilot and copilot seats. This over-the-shoulder location reduces the requirement for a remote visual repeater for the instructor. Two 19-inch displays at the instructor station and two control panels are available to the instructor. Units of the instructor station are:

Aft instructor CRT
Forward instructor CRT
Instructor left panel
Instructor right panel
Interphone control panel (in cabinet under forward CRT)
Digital clock

2-39. Flight and mission parameters are displayed on the aft CRT. The instructor can make changes to parameters during flight and can introduce malfunctions using the control panels.

2-40. IOS AREA LIGHTING.

2-41. The IOS control panel has two variable-intensity overhead lights. These lights provide ambient illumination during any phase of the training and can be detached for greater flexibility. A blue-green flip filter is provided for NVG operation.

2-42. INSTRUCTOR INTERCOMMUNICATIONS SYSTEM.

2-43. Headset cords and microphone switches for the instructor are installed in such a way that they do not interfere with training. Private communication is provided for the instructor, observers, and the computer room. A visual alert cue is provided for the instructor, and an aural alert cue is provided in the computer room.

Section III. MODES OF OPERATION

2-44. GENERAL.

2-45. The simulator can operate on-line in two categories: training and demonstration. The simulator can be used with or without the visual displays and/or motion system in operation. To set up or edit a demonstration, the simulator must be in freeze mode. Formulation of a demonstration involves recording and storing the characteristics of particular flight or mission profiles in computer memory. An accompanying audio commentary can also be recorded and synchronized to the motion. When a recorded demonstration is played back for training, the simulator flies automatically through an established mission exercise. When the simulator reflies the mission, all motion, aural sounds, instrument indications, and visual display scenes are recreated.

2-46. TRAINING.

2-47. The instructor has direct control of training. By using the IOS and tactical gaming area, the instructor can use prerecorded demonstrations, initial conditions, and preprogrammed malfunctions. Information displayed at the IOS is updated continuously during the training program to reflect current status.

Section IV. TRAINING CAPABILITIES

2-48. GENERAL.

2-49. The simulator is a fully-operational mission simulator with pilot and copilot stations that duplicate the actual helicopter cockpit configuration. The simulator simulates, in real-time, applicable normal and emergency aircraft operation with respect to both transient and steady-state flight conditions. Simulator operation involves capabilities such as engine performance, flying qualities, aircraft systems performance and operation, radio communications and navigational systems performance and operation, environmental effects, and flightpath. Simulation includes appropriate trainee and IOS instrument and aural indications, aircraft control reactions, visual cue presentations, and display traces that respond to trainee, instructor, and computer-programmed control inputs. When the visual and/or motion system is inoperative, training capabilities are limited.

2-50. TRAINING OBJECTIVES.

2-51. The simulator can be used to provide transition and continuation training proficiency flying. It can also be used to train pilots for all normal and emergency flight maneuvers, navigation, and starting, runup, and shutdown procedures. The simulator is capable of complete mission simulation and can be used to train the pilot and copilot simultaneously on the same mission. The simulator can also be used to train instructor pilots and maintenance officers.

2-52. Training can be conducted for the following basic aircraft maneuvers:

Cockpit procedures
Startup and taxiing (two- and four-wheel)
Hovering flight (including turns)
Traffic pattern
Normal takeoff from a hover
Normal takeoff from the ground
VMC approach to a hover
VMC approach to the ground
Straight-and-level flight
Level turns
Straight climbs and descents
Turning climbs and descents

2-53. ADVANCED MANEUVERS.

2-54. Training can be conducted for the following advanced maneuvers:

Maximum performance takeoff
AFCS-off flight
Running landing
Autorotation
Confined-area operations
Pinnacle operations
Sling load operations
Formation flight
NVG operations
Low-level, contour, and NOE flight
Threat detection and avoidance
Doppler navigation

2-55. EMERGENCY MANEUVERS.

2-56. Training can be conducted for the following emergency aircraft maneuvers:

Forced landings
Hydraulic malfunctions
Fuel system malfunctions
Electrical system malfunctions
AFCS malfunctions
Engine beep trim malfunctions
Engine malfunctions
Engine fire
Transmission malfunctions

2-57. INSTRUMENT MANEUVERS.

2-58. Training can be conducted for the following instrument maneuvers:

ADF and VOR orientation, interception, and tracking
Enroute navigation
Holding
ADF, GCA, VOR, and ILS approaches
Missed approaches
Two-way communication failure

2-59. SIMULATION SYSTEM CAPABILITIES.

2-60. The capabilities of various areas and systems of the simulator are:

a. Visual area navigation: A simulated area of 80 km by 100 km is provided by a computer-generated data base. This data base is divided into four equal quadrants 45 km by 55 km in area with approximately a 5-km overlap. (See figure 2-4.) This visual training map (TAC map) shows the locations of the aircraft, aircraft track, rivers, lakes, islands, plateaus, mountain ranges, 200-meter level topological contour lines, and pinnacle locations associated with the gaming areas. When the aircraft flies off the display screen, a manual map update is used to change the quadrant displayed.

NOTE

The numbered asterisks show only the initial locations of the combined visual and EW threats. Editing a threat type or location on threat array page 025 does not cause a corresponding change on the TAC map.

b. (Deleted)

c. Aircraft weight and balance: These can be selected by the instructor to provide variable loading configuration (gross weight and center of gravity). Fuel quantity can also be varied.

d. Atmospheric environment: The instructor can control the simulated environment to provide variable winds, turbulence levels (light, moderate, severe), gusts, temperature, and barometric pressure. Temperature (in degrees centigrade) and barometric pressure (in inches of mercury) are displayed at the instructor operator

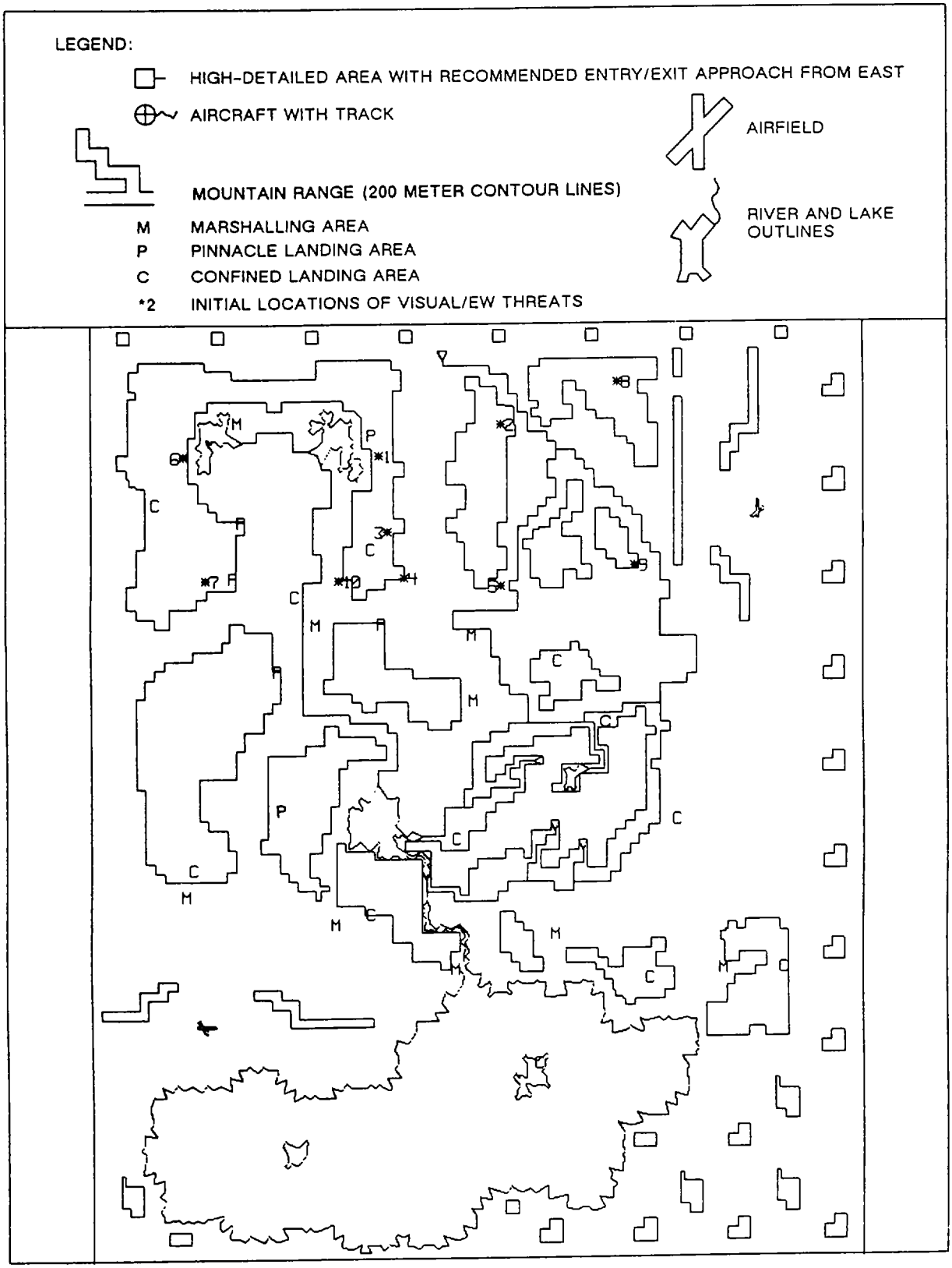


Figure 2-4. Visual Training Map (TAC Map) (Sheet 1)

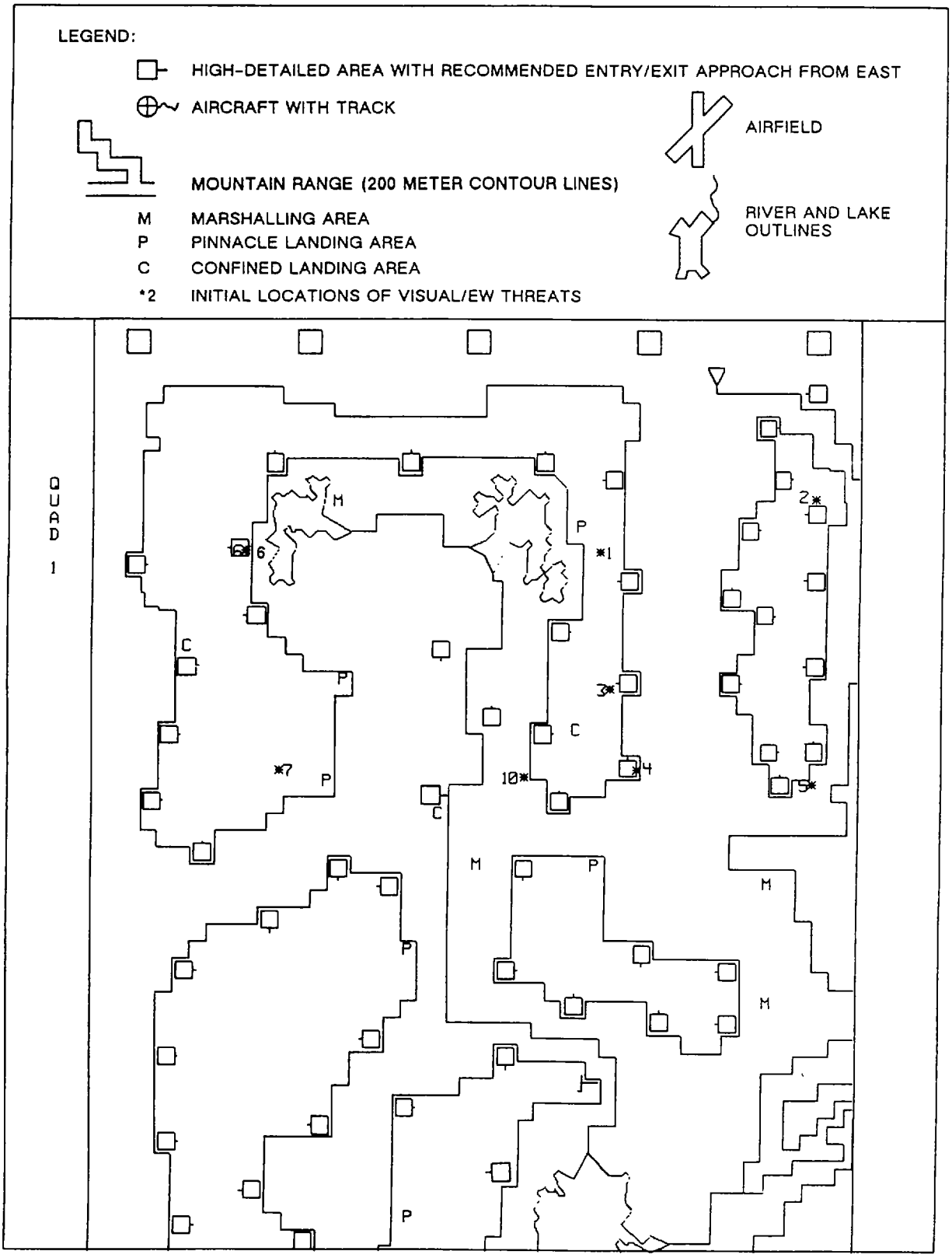


Figure 2-4. Visual Training Map (TAC Map) (Sheet 2)

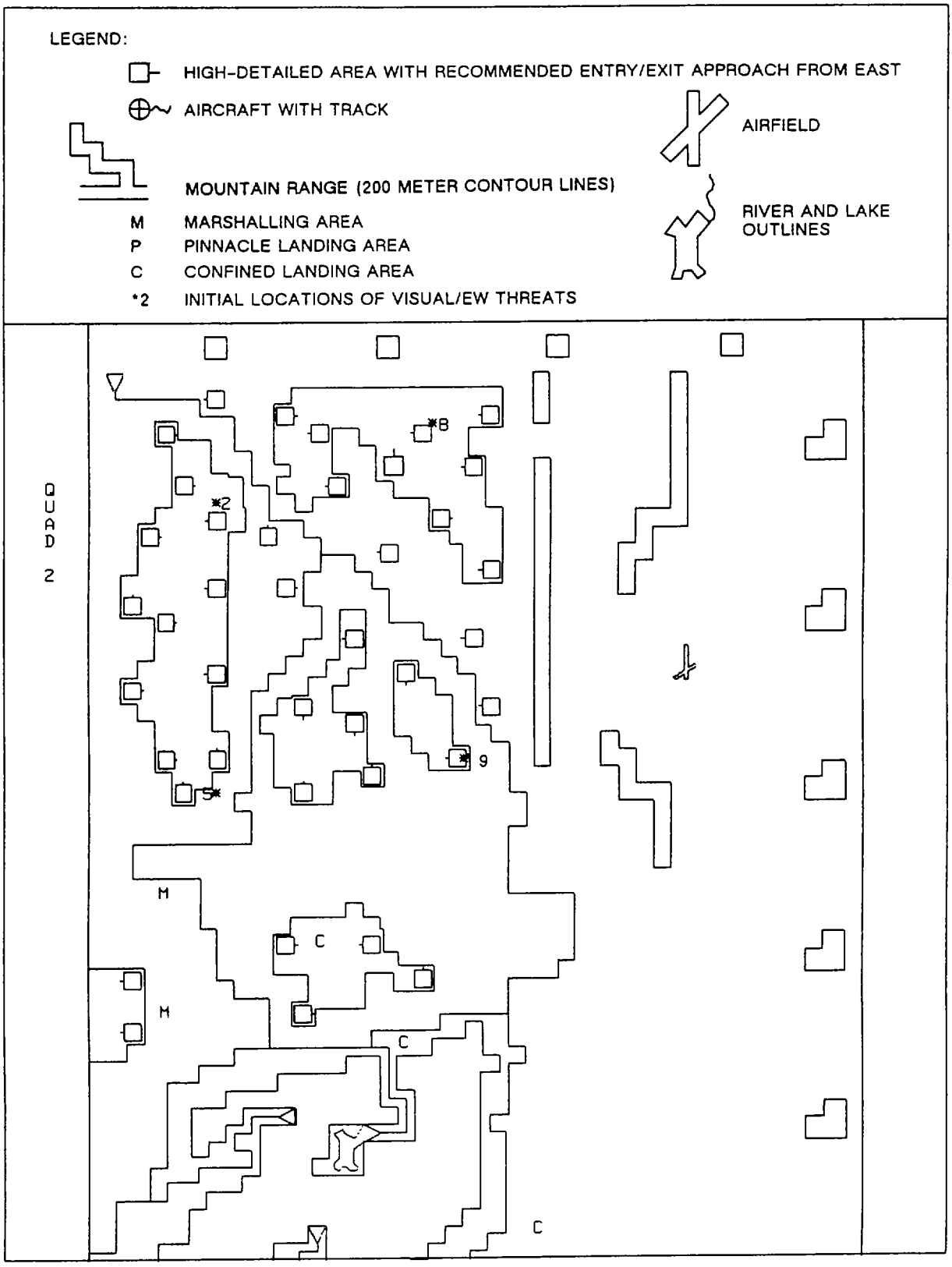


Figure 2-4. Visual Training Map (TAC Map) (Sheet 3)

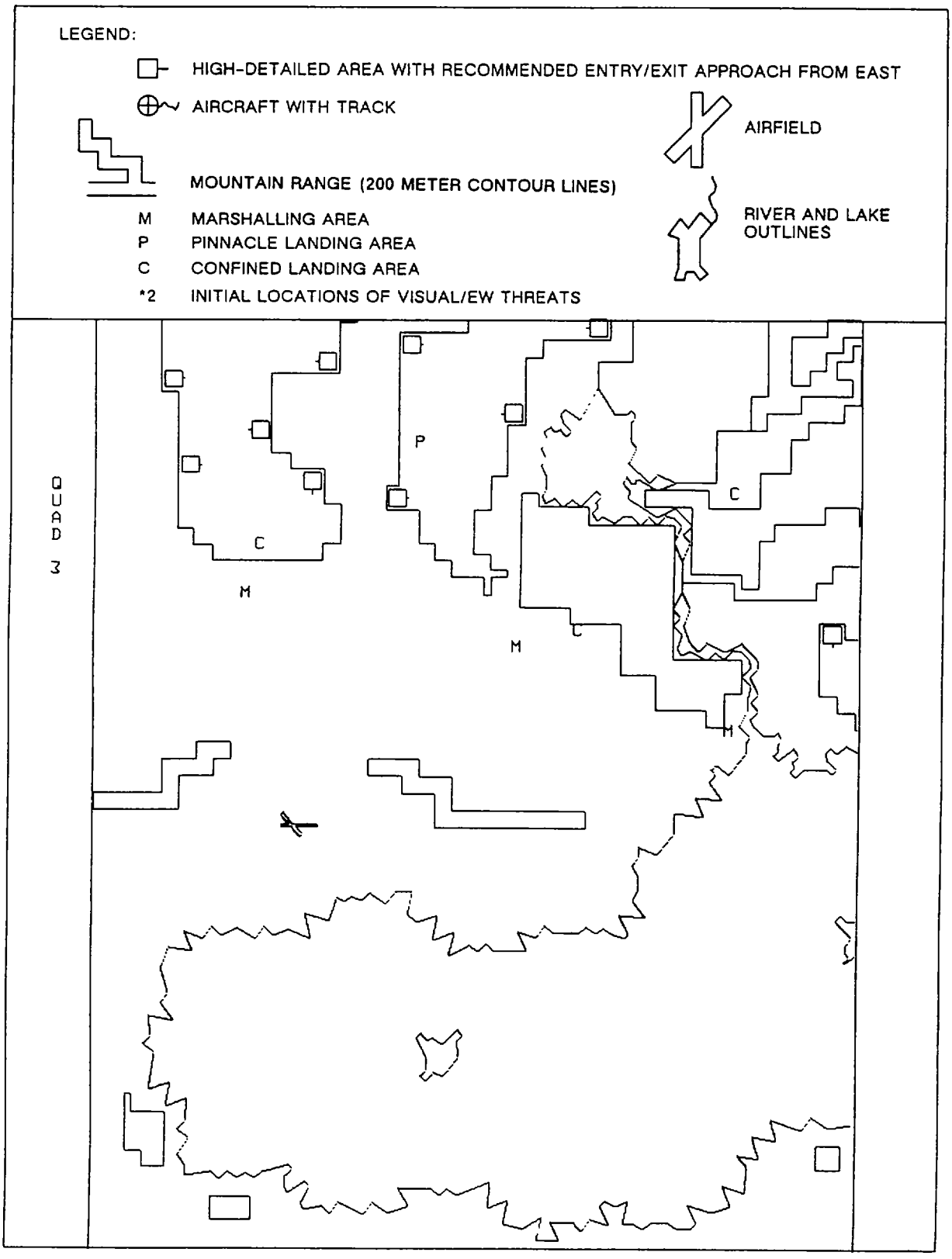


Figure 2-4. Visual Training Map (TAC Map) (Sheet 4)

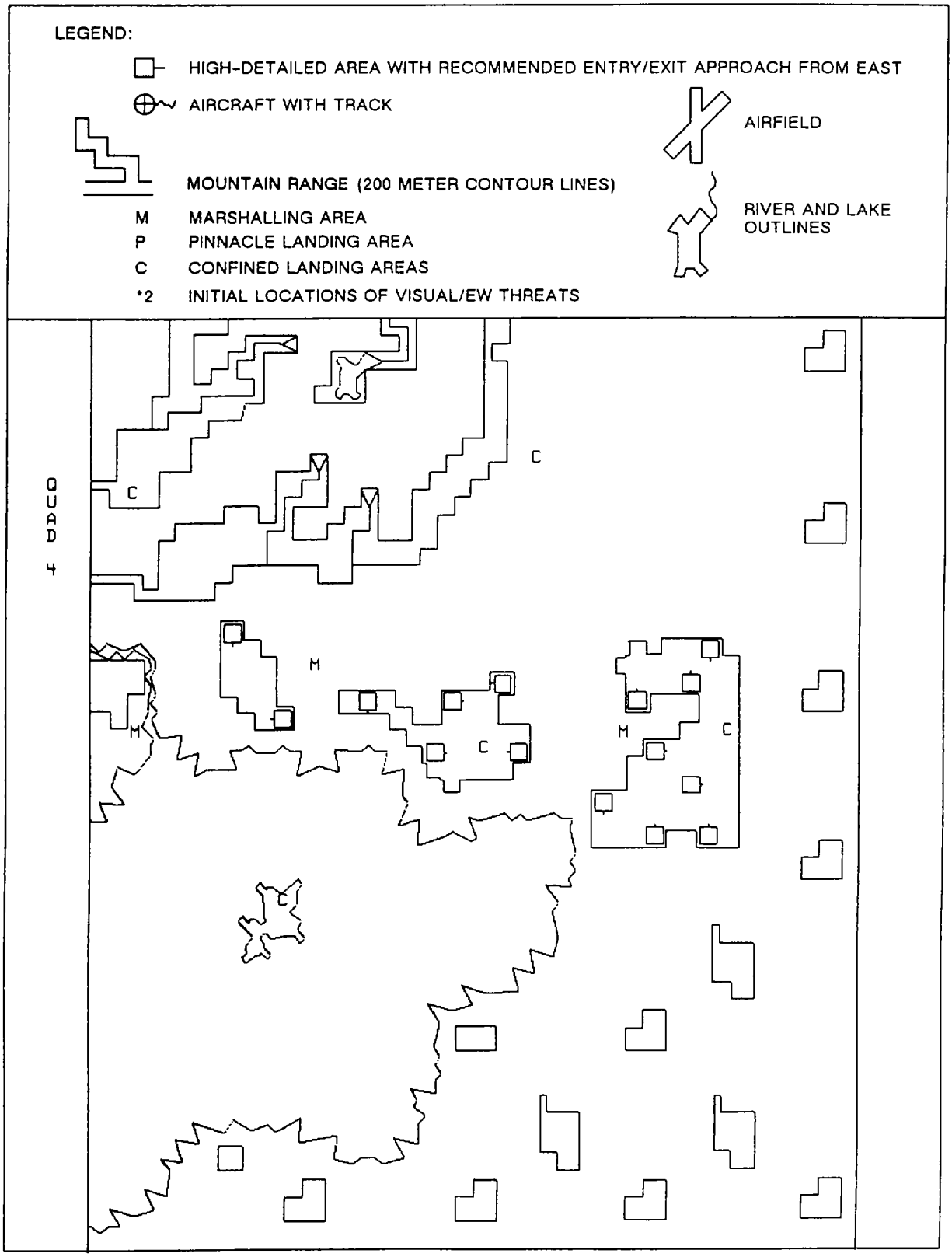


Figure 2-4. Visual Training Map (TAC Map) (Sheet 5)

station (IOS) and are referenced at mean sea level. The indications displayed on the cockpit instruments, and received by the computer, are pressure altitude, and temperature based upon the application of standard lapse (20C/1000 feet).

e. Sling loads: Six external sling loads can be selected:

(1) High-density non-aero load - 18,000 pounds, 12-foot sling (M-198).

(2) Drogued aero load - 11,015-pound disabled helicopter, 20-foot sling (AH-64).

(3) Three light loads - 2 fuel bladders (7,008 pounds per load), 14-foot sling.

(4) Tandem load - 20,000-pound military van (forward and aft hooks), 16-foot (forward), 14-foot (aft).

f. Motion cues: A six-degree-of-freedom motion base provides pitch, roll, yaw, heave, longitudinal, and lateral motion cues. Simulation is further enhanced by a seat vibration system that provides continuous and periodic oscillations and vibrations that are experienced during normal and emergency flight conditions. Motion and vibration can be both selected or deselected at the IOS console.

g. Environmental sound cues: Environmental sound cues at nine levels of loudness can be selected and varied at the IOS console.

h. Seat positions: The simulator has seat positions for a pilot and copilot in the cockpit and for an instructor and observer in the instructor area.

i. Special capabilities: The simulator has the following special capabilities:

(1) It can freeze simulator action at any instant.

(2) It can initiate a training program at any one of ten predefined locations within the gaming area (five in each of the instrument and tactical gaming areas).

(3) It can reset to an initialization point that has been modified.

NOTE

Reset is identical to initialization. They are both indicated by blinking of the FREEZE indicator.

(4) It can override an impending aircraft crash.

(5) It can record dynamically and play back up to the previous 5 minutes of a current flight.

(6) It can insert up to 10 simultaneous malfunctions.

(7) It can demonstrate prerecorded maneuvers.

(8) It can monitor program progress and trainee performance.

(9) It can freeze flight parameters selectively.

(10) It can administer audio briefings.

(11) It can stop and abort a program at any time in the event of an emergency.

(12) It can retrieve stored performance data via hardcopy printer/plotter.

(13) It provides control of the training program from the IOS, or limited control from the auxiliary control panel.

(14) It provides time history plots of airspeed, altitude, and ground track, as IOS CRT display or as hardcopy.

(15) It can alert the instructor immediately of trainee performance error.

(16) It can alter environmental conditions that act on the aircraft.

(17) It can compute and display ground-controlled approach (GCA) commands.

(18) The instructor can function as flight engineer during load maneuvers.

2-61. VISUAL SYSTEM CAPABILITIES.

2-62. The full-color visual simulation system, combined with digital image generated visual effects, provides a realistic view of ground and sky conditions.

2-63. TRAINING TASKS.

2-64. Training is carried out in operating modes of visual, motion, and cockpit simulation. The task of the trainees is to become thoroughly knowledgeable with all aspects of actual helicopter flight. The instructor's task is to maintain complete control of simulated conditions for training and to fully monitor trainee performance in all normal and emergency operational aspects of the helicopter.

2-65. SIMULATED AIRCRAFT.

2-66. The CH-47D Chinook helicopter is manufactured by Boeing-Vertol. This twin-turbine-engine, tandem-rotor, medium-lift helicopter is used to transport cargo, troops, or weapons during day, night, VFR, or IFR conditions. The helicopter can carry cargo internally and transport low-density, aerodynamic, or high-density loads suspended beneath it on slings.

2-67. DEMONSTRATION MANEUVERS.

2-68. The capability exists for 20 recorded demonstrations with synchronized audio commentary.

2-69. GROUND-CONTROLLED APPROACH.

2-70. Ground-controlled approach (GCA) instructions, based on the simulated position, are displayed on a CRT so that the instructor can read them. (See figure 2-5 for a typical lower GCA/ILS display.) By placing the GCA display at the aft CRT, the scale can be changed from 10 nautical miles (nm) to 2 nautical miles.

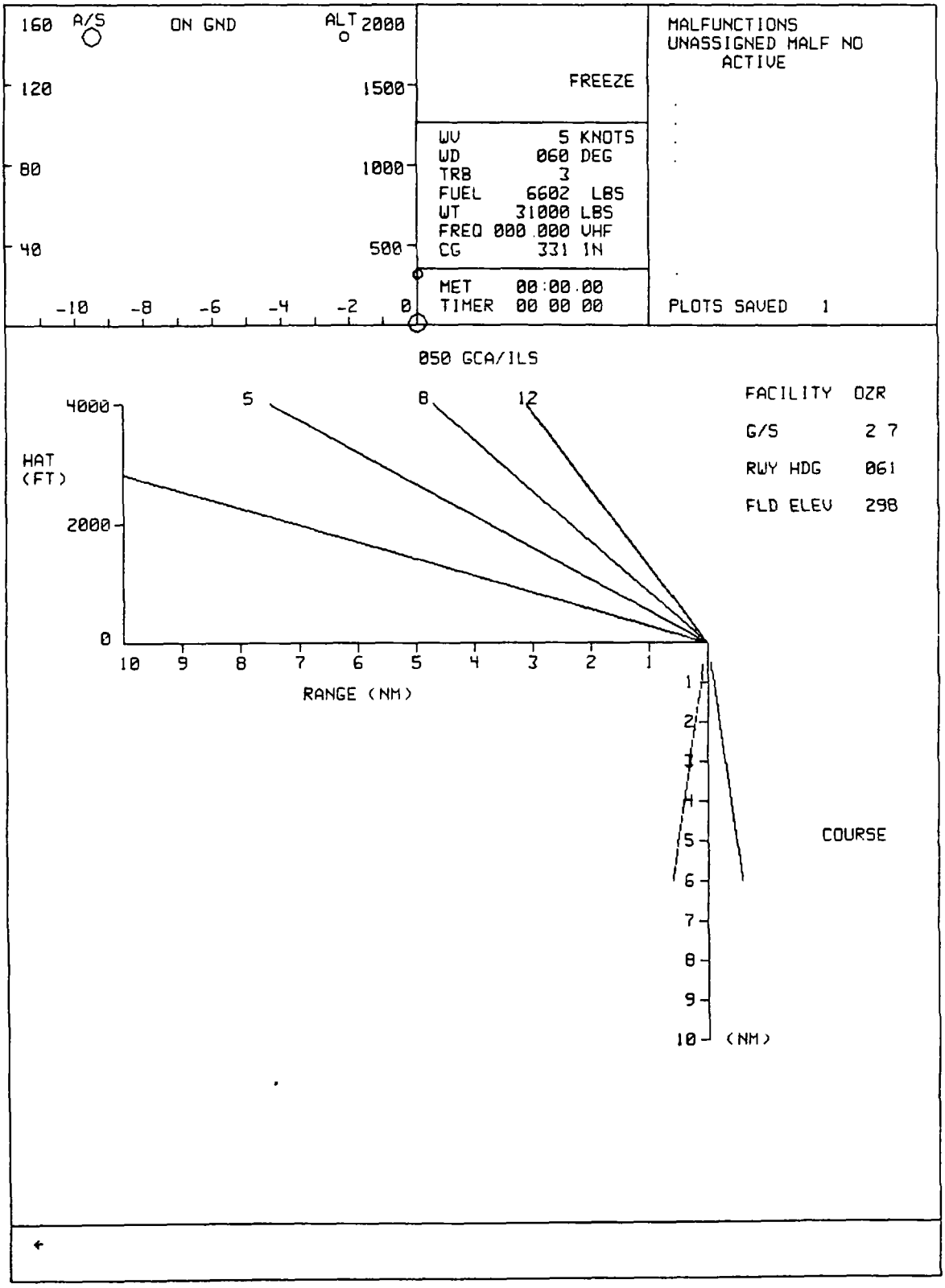


Figure 2-5. Typical Lower GCA/ILS Display

2-71. BRIEFINGS.

2-72. Briefings prior to training missions can be automated or live. Prerecorded briefings include a description of the problem to be presented and its performance criteria.

Section V. SYSTEMS SIMULATED

2-73. GENERAL.

2-74. The aircraft systems simulated are outlined in the following paragraphs.

Simulation details are not provided because each aspect of pseudo real-time simulation is implemented by unique hardware and software programs.

2-75. ACCESSORY SYSTEMS SIMULATION.

2-76. The following aircraft accessory systems provide operational status to the trainee and are simulated by software via computer control:

Auxiliary power unit (APU)
Engine - fuel
Engine - oil
Fuel supply
Transmission - oil
Rotor
Electrical power system equipment
Hydraulic system (flight and utility) Cargo hooks
AFCS
Instrument indications
Weight and balance
Navigation and communication
Flight control response
Outside environment
Day, dusk, or night conditions
Anti-ice (engine)

2-77. VISUAL SIMULATION.

2-78. The digital image generation (DIG) provides a full-color visual simulation system (day/night) which displays the following realistic ground and sky conditions:

Airfield topography
Flat, low-land topography
Hilly, mountainous terrain
Clear bright sky
Cloudy conditions
IFR conditions

2-79. SOUND SIMULATION.

2-80. Analog generation under computer control provides the following sound simulation cues:

Engine
Transmission
Rotor
APU
Hydraulic pump (No.1 power transfer unit (PTU))
Droop stop pounding
Ground start sounds
Electrical generators

2-81. MOTION SIMULATION.

2-82. An electrohydraulic-actuated, six-post, synergistic six-degree-of-freedom (6-DOF) motion system under computer control provides the following cues:

Longitudinal displacement/onset cues
Lateral displacement/onset cues
Heave displacement/onset cues
Roll attitude/onset cues
Pitch attitude/onset cues
Yaw attitude/onset cues
Turbulence effects
Rotor out-of-track/balance effects

2-83. VIBRATION SIMULATION.

2-84. An electrohydraulic seat shaker transmits vibrational effects to the trainees, but its effects are isolated from other compartment-mounted hardware and other simulator occupants.

2-85. COCKPIT INSTRUMENTATION SIMULATION .

2-86. All cockpit instruments and controls are modified actual aircraft instruments that accept outputs from dc analog circuitry under computer control and respond with the desired deflections or rotations. Three basic types of circuitry are used to drive the following classes of instruments:

Meter movement instruments
Servo instruments
Synchro instruments

2-87. RADIO COMMUNICATION AND INTERCOMMUNICATION SYSTEM SIMULATION.

2-88. An internal communication system (ICS) under computer control directs audio signals by means of C-6533/ARC control panels for:

Trainee to trainee
Trainee to IOS
IOS to trainee
Observer to IOS
IOS to observer
Trainee to observer
IOS to computer room
Computer room to IOS

NOTE

The simulator C-6533 ICS operates identically to that in the helicopter. The observer station ICS control box switches must be in the following positions for the instructor to observe communication: (1) all toggle switches down/OFF; and (2) selector switch on position 5.

The IOS C-6533 ICS control box switches must be in the following positions for total IOS communication functions: (1) toggle switches 1 through 5 up/ON; (2) AUX and NAV switches down/OFF; and (3) selector switch on position 5.

2-89. MALFUNCTION SIMULATION.

2-90. Approximately 220 malfunctions can be inserted by the instructor. Malfunctions are realistic, and they provide the pilot and copilot with meaningful training in emergency responses.

2-91. CONTROL LOADING.

2-92. The control loading system provides a realistic and responsive feel to the simulated helicopter flight controls. Electrohydraulic units, combined with a mechanical linkage system, produce initiating and reactive forces for the controls. Simulation computer feedback causes the appropriate motions of the aircraft in flight. During a demonstration playback, the cockpit flight controls are driven by the computer and appropriately positioned in response to aircraft motion.

CHAPTER 3

AVIONICS

3-1. GENERAL.

3-2. Avionics equipment is simulated under computer control, using actual aircraft panel hardware, backed up by applicable analog and digital processing and driver circuitry. Operation of most panel controls and indicators is simulated to show actual equipment functions. (Table 3-1 lists the avionics systems simulated.)

Table 3-1. Avionics Equipment Simulated

Nomenclature	Type of system
AN/APN-209	Radar Altimeter
AN/ASN-128	Doppler Navigation Set
AN/ARC-102	HF Radio Set
AN/ASN-43	Gyromagnetic Compass Set
C-6533/ARC	Interphone
AN/ARC-186(2)	VHF AM/FM Comm and Homing
AN/ARC-164	UHF Comm
AN/ARN-89	LF-ADF
AN/ARN-123	VHF NAV, ILS, and Marker Beacons
AN/APX-100	Transponder System (IFF not simulated)
AN/APR-39	Radar Warning Set
AN/ALQ-156	Missile Detector Set
M-130	Flare Dispenser

3-3. COMMUNICATIONS EQUIPMENT .

3-4. During training, the instructor can communicate with or monitor the trainees by using the appropriate IOS controls:

a. The RADIO OVERRIDE control permits communication from instructor to trainee no matter how the radio control is set.

b. The STUD MON control permits the instructor to monitor all trainee conversation no matter how the radio control is set.

c. The VHF, COMM/NAV, FM, and UHF controls permit the instructor to act as the ground communications transmitter, using the trainee receiver. Since no line-of-sight (LOS) or range limit is applied to COMM networks, the instructor must check the appropriateness of the frequency selected before transmitting.

d. The ICS control permits the instructor to communicate over the simulated aircraft ICS network when performing flight engineer functions.

e. The telephone intercom connects the IOS with the computer room and the pump room.

CHAPTER 4

DIGITAL IMAGE GENERATION SYSTEM

Section I. GENERAL DESCRIPTION

4-1. GENERAL.

4-2. The simulator uses a digital image generation (DIG) system to provide the necessary visual displays. A computer-generated data base provides tactical and instrument gaming areas of approximately 8,000 square kilometers each. The gaming area represents a generic terrain designed specifically to meet diverse training requirements related to cargo helicopter operations.

4-3. OUT-THE-WINDOW DISPLAYS.

4-4. The simulator visual system provides full visual displays in four OTW displays (two forward and two side). The display images are supplied by the DIG, which simulates day, dusk/dawn and night operations.

4-5. CHIN WINDOW DISPLAYS.

4-6. Chin windows are located on the left side of the copilot and on the right side of the pilot, both at cockpit floor level. Chin window displays are compatible with the OTW scene.

4-7. Each chin window display monitor assembly uses a self-contained color monitor and reflective optical assembly that together provide a collimated display image. The self-contained color monitor accepts the video signal from the digital image generator, processes these signals, and displays the resultant color images on the CRT. The various configurations of chin window and forward and side window displays are determined by the instructor and are shown below:

Pilot displays			Copilot displays		
Side	Chin	Front	Side	Chin	Front
ON	OFF	ON	ON	OFF	ON
ON	ON	ON	OFF	OFF	ON
OFF	OFF	ON	ON	ON	ON
OFF	ON	ON	OFF	ON	ON

4-8. NIGHT VISION GOGGLES.

4-9. The simulator is compatible with night vision devices.

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

5-1. NAVIGATION/COMMUNICATION .

5-2. The following navigation/communication functions are not simulated:

Extraneous transmissions and receiver noise
VOR voice
Masking
Voice secure capability

5-3. ENVIRONMENTAL SOUNDS.

5-4. Environmental sounds are limited to a maximum of 100 decibels.

5-5. The following sounds are not simulated:

Compressor stall
Bleed band sounds
Rain and hail
All other abnormal sounds

5-6. OVERHEAD PANEL CONTROLS.

5-7. The following overhead panel controls are not functional:

Cabinet temperature select
Cabin heat controls
Windshield wiper controls
Hoist control
Cable cutter
Emergency exit lights
Vent blower
Windshield anti-ice
Ramp isolation switch

5-8. COCKPIT CIRCUIT BREAKERS.

5-9. Table 5-1 shows which cockpit circuit breakers are not functional (NC in the class column), which are functional (F in the class column), and which are functional and poppable (FP in the class column).

Table 5-1. Functional Capabilities of Cockpit Circuit Breakers

Current	Function	Description	Class
DC	LH FUEL PUMP CONT	AUX AFT 5A	F
DC	LH FUEL PUMP CONT	MAIN AFT 5A	F
DC	LH FUEL PUMP CONT	MAIN FWD 5A	F
DC	LH FUEL PUMP CONT	AUX FWD 5A	F
DC	ENGINE NO. 1	TORQUE 5A	F
DC	ENGINE NO. 1	OIL TEMP 5A	F
DC	ENGINE NO. 1	TRIM 5A	F
DC	ENGINE NO. 1	COND CONT 5A	F
DC	ENGINE NO. 1	IGN 5A	FP
DC	ENGINE NO. 1	START & TEMP 7A	FP
DC	ENGINE NO. 1	FUEL SHUTOFF 5A	F
DC	ENGINE NO. 1	FIRE EXT 10A	F
DC		ROTOR TACH 5A	F
AC	ENGINE NO. 1	OIL PRESS 5A	F
AC	ENGINE NO. 1	TORQUE 5A	FP
AC	ENGINE NO. 1	FIRE DET 5A	F
AC	ENGINE NO. 1	TRIM & TIMER 5A	F
AC	ENGINE NO. 1	FUEL FLOW 5A	F
AC		FUEL QTY 5A	FP
AC	DC1	CROSS TIE 100A	F
AC		AC BUS TIE 70A	FP
DC	FUEL	REFUEL 7A	F
DC	FUEL	QTY 5A	FP
DC	FUEL	XFEED CONT 5A	FP
DC	UTILITY	CPLT 15A	NC
DC	UTILITY	LH FWD 15A	NC
DC	UTILITY	LH AFT 15A	NC
DC	HOIST	CONT 5A	NC
DC	HOIST	CABLE CUTTER 10A	NC
DC	ENGINE NO. 1	ANTI ICE 5A	FP
DC	CYCLIC TRIM	FWD ACTR 7A	F
DC	CYCLIC TRIM	MNL 10A	F
DC	CLTV	DRIVER ACTR 10A	F
DC	AFCS NO. 1	5A	FP
AC	AFCS NO. 1	5A	FP
AC	CLTV	DRIVER ACTR 5A	FP
AC	NAV	CPLT VGI 5A	FP
AC	NAV	CPLT HSI 5A	F
AC	NAV	CMPS 5A	F
AC	LH FUEL PUMPS	MAIN FWD 5A	PP
AC	LH FUEL PUMPS	MAIN AFT 5A	FP
AC	NO. 1	XFMR RECT 25A	FP
DC	COMM	VHF NO. 2 AM/FM 7A	F
DC	COMM	UHF AM 5A	F
DC	COMM	INTPH LH 5A	F
DC	NAV	VOR 5A	FP
DC	NAV	TURN & SLIP 5A	F
DC	NAV	CPLT HSI MODE SEL 5A	F
DC	NAV	ADF 5A	F
DC	NAV	RAD WARN 5A	F

Table 5-1. Functional Capabilities of Cockpit Circuit Breakers - Continued

Current	Function	Description	Class
DC		CHAFF 7A	F
DC	NO. 1	REV CUR CO 5A	F
DC		EXT PWR CONT 5A	F
DC	NO. 1	DC BUS CONT 5A	FP
DC	WSHLD	CPLT CONT 25A	NC
AC	WSHLD	CPLT HEAT 25A	NC
AC	NAV	CPLT HSI 5A	F
AC	NAV	DOPPLER 5A	F
AC	NAV	ADF 5A	F
AC	NAV	VOR 5A	F
AC	NAV	CMPS 5A	FP
AC	LH FUEL PUMPS	AUX FWD 5A	FP
AC	LH FUEL PUMPS	AUX AFT 5A	FP
AC	BATT	CHGR 5A	F
DC		ESS BUS FEEDER 15A	F
DC		CONT AC 5A	FP
DC	NO. 1	EMERG ENG TRIM 5A	FP
DC	CARGO HOOK	PWR 20A	F
DC	EMERG REL	CONT 5A	F
DC	THRUST BRAKE 5A	FP	
DC	CONT CENTER 5A	FP	
DC	HYDRAULICS	OIL LEVEL 5A	NC
DC	HYDRAULICS	NO. 1 BLOWER CONT 5A	NC
DC	HYDRAULICS	UTIL BLOWER 5A	NC
DC	HYDRAULICS	UTIL SYST CONT 5A	FP
DC	HYDRAULICS	BRAKE STEER 5A	FP
DC	HYDRAULICS	MAINT PNL 5A	NC
AC	XMSN	OIL TEMP 5A	FP
AC	XMSN	OIL PRESS 5A	FP
AC	LIGHTING	ILLUM SW PWR 1/2A	F
AC	LH	UTIL RCPT 15A	NC
AC	UTIL HYD	COOLING BLOWER 5A	NC
AC	NO. 1 HYD	COOLING BLOWER 5A	NC
AC	LH	CABIN AC RCPT 15A	NC
DC	APU CONT	NORM 5A	FP
DC	APU CONT	EMERG 5A	F
DC		CPLT CLOCK 5A	FP
DC		ESS BUS CONT 25A	F
DC	LIGHTING	OIL LEVEL CHECK 5A	NC
DC	LIGHTING	CABIN & RAMP 10A	NC
DC	LIGHTING	CAUTION PNL 5A	F
DC	LIGHTING	SLT CONT 5A	F
DC	LIGHTING	NVG FORM 5A	F
DC	LIGHTING	SLT FIL 25A	F
AC	LIGHTING	CPLT INST 3A	F
AC	LIGHTING	CONSOLE 3A	F
AC	LIGHTING	OVHD 3A	F
AC	LIGHTING	FORM 5A	F
AC	NO. 1	INST XMFR 5A	FP
AC	NO. 2	INST XFMR 5A	F
DC	RH FUEL PUMP CONT	AUX AFT 5A	F
DC	RH FUEL PUMP CONT	MAIN AFT 5A	F

Table 5-1. Functional Capabilities of Cockpit Circuit Breakers - Continued

Current	Function	Description	Class
DC	RH FUEL PUMP CONT	MAIN FWD 5A	F
DC	RH FUEL PUMP CONT	AUX FWD 5A	F
DC	ENGINE NO. 2	TORQUE 5A	F
DC	ENGINE NO. 2	OIL TEMP 5A	F
DC	ENGINE NO. 2	TRIM 5A	F
DC	ENGINE NO. 2	COND CONT 5A	F
DC	ENGINE NO. 2	IGN 5A	FP
DC	ENGINE NO. 2	START & TEMP 7A	FP
DC	ENGINE NO. 2	FUEL SHUTOFF 5A	F
DC	ENGINE NO. 2	FIRE EXT 10A	F
DC		ROTOR RACH 5A	F
AC	ENGINE NO. 2	TORQUE 5A	FP
AC	ENGINE NO. 2	FIRE DET 5A	F
AC	ENGINE NO. 2	TRIM & TIMER 5A	F
AC	ENGINE NO. 2	FUEL FLOW 5A	F
AC	ENGINE NO. 2	OIL PRESS 5A	F
AC	DC2	CROSS TIE 100A	F
AC		AC BUS TIE 70A	FP
DC	UTILITY RCPT	RH FWD 15A	NC
DC	UTILITY RCPT	RH AFT 15A	NC
DC	UTILITY RCPT	PILOT 15A	NC
DC	CARGO HOOK	CONT 5A	F
DC	NORM RLSE	PWR 15A	F
DC		BLADE TRACK 5A	NC
DC	CYCLIC	TRIM AFT ACTR 7A	F
DC	ENGINE NO. 2	ANTI ICE 5A	FP
DC	NO. 2	DC BUS CONT 5A	FP
DC		CRUISE GUIDE 5A	FP
DC	AFCS NO. 2	5A	FP
AC	AFCS NO. 2	5A	FP
AC		PITOT HEAT 5A	FP
AC	YAW	PORT HEAT 7A	FP
AC		HF 5A	F
AC	RH FUEL PUMPS	MAIN FWD 5A	PP
AC	RH FUEL PUMPS	MAIN AFT 5A	FP
AC	NO. 2	XFMR RECT 25A	FP
DC	COMM	KY28 5A	F
DC	COMM	HF 10A	F
DC	COMM	HF 50A	F
DC	COMM	IFF 5A	F
DC	COMM	VHF NO. 1 AM/FM 7A	F
DC	COMM	INTPH RH 5A	F
DC	NAV	TURN & SLIP 5A	F
DC	NAV	PLT HSI MODE SEL 5A	FP
DC	NAV	VHF HOM 5A	F
DC	NAV	DOPPLER 5A	F
DC	NAV	AIMS ALT 5A	F
DC	NAV	RAD ALT 5A	F
DC		MSL DET SYS 5A	F
DC	NAV	CONT VGI 5A	FP

Table 5-1. Functional Capabilities of Cockpit Circuit Breakers - Continued

Current	Function	Description	Class
AC	NAV	PILOT VGI 5A	FP
AC	VIB ABSORB	RH 7A	F
AC	VIB SBSORB	CTR 7A	F
AC	VIB ABSORB	LH 7A	F
AC	RH FUEL PUMPS	AUX FWD 5A	FP
AC	RH FUEL PUMPS	AUX AFT 5A	FP
AC	AVIONICS	COOLING 5A	NC
DC	HYDRAULICS	NO. 2 BLOWER 5A	NC
DC	HYDRAULICS	PWR XFER 5A	F
DC	HYDRAULICS	PRESS IND 5A	NC
DC	HYDRAULICS	FLUID TEMP 5A	NC
DC	HYDRAULICS	FLT CONT 5A	FP
DC	HYDRAULICS	MAINT PNL LTS 5A	NC
DC	NO. 2	REV CUR CO 5A	F
DC		AVIONICS COOLING 5A	NC
DC	VHF	ANT SEL 5A	F
DC	CABIN	HEATER CONT 7A	NC
DC		WSHLD WIPER 10A	NC
DC	WSHLD ANTI ICE	PILOT CONT 5A	NC
DC	WSHLD ANTI ICE	CTR CONT 5A	NC
AC	WSHLD ANTI ICE	PILOT HEAT 25A	NC
AC	WSHLD ANTI ICE	CTR HEAT 10A	NC
AC	NAV	PLT HSI 5A	F
AC	NAV	PLT HSI 5A	F
AC	RH	UTILITY RCPT 15A	NC
AC	NO. 2 HYD	COOLING BLOWER 5A	NC
AC	CABIN	HEATER BLOWER 15A	NC
AC	RH	CABIN AC RCPT 15A	NC
DC	TROOP ALARM	JUMP LT 5A	F
DC	TROOP ALARM	BELL 5A	F
DC		PILOT CLOCK 5A	FP
DC	NO. 2	ENERG ENG TRIM 5A	FP
DC	LIGHTING	NVG LTS 5A	FP
DC	LIGHTING	SLT FIL 25A	F
DC	LIGHTING	SLT CONT 5A	F
DC	LIGHTING	CKPT DIM CONT 5A	FP
DC	LIGHTING	COCKPIT DOME 5A	F
DC	LIGHTING	POS 5A	F
DC	LIGHTING	ANTI COL TOP 5A	F
DC	LIGHTING	ANTI COL BOT 5A	F
AC	LIGHTING	PILOT INSTR 3A	F
AC	LIGHTING	CTR INSTR 3A	F
AC	MSL DET SYS	0C 5A	F
AC	MSL DET SYS	0B 5A	F
AC	MSL DET SYS	0A 5A	F

5-10. SIMULATED ENVIRONMENT .

5-11. Limitations on environmental conditions are:

a. Wind velocity is variable from 0 to 64 knots from any direction.

b. Ground-level temperature is variable from -50 to ±50 degrees centigrade. Temperature varies with altitude in accordance with U.S. Standard Atmosphere, 1962.

5-12. SLOW-TIME PLAYBACK.

5-13. No recorded voice audio is available during slow-time playback.

5-14. OPERATING TEMPERATURE.

5-15. The simulator is designed to operate in a controlled environment. If temperature rises above 90 degrees Fahrenheit or falls below 60 degrees Fahrenheit, the simulator may be damaged.

5-16. OCCUPANCY.

5-17. During simulator operation (motion system on), only four persons (two trainees, an instructor, and an observer) are permitted in the flight compartment.

5-18. SEARCHLIGHT.

5-19. There are two searchlights on the simulator. Only one searchlight can be operated at a time. Whichever trainee turns the searchlight on first controls it.

CHAPTER 6

WEIGHT AND BALANCE

(This chapter is not used since this material does not pertain to the operation of the simulator.)

CHAPTER 7

SIMULATED MALFUNCTIONS

7-1. GENERAL DESCRIPTION.

7-2. The simulator has approximately 220 malfunctions available. The malfunctions are arranged by system on ten malfunction display pages. Ten malfunctions can be active at the same time.

7-3. MALFUNCTION INSERTION.

7-4. Malfunctions can be inserted at the IOS or at the auxiliary control panel by performing the following:

a. Use IC/MAP/LOAD/LDSHP/DEMO/MALF thumbwheel to select desired malfunction. A description of the malfunction selected appears above the active malfunction list on the status CRT display.

b. Depress INSERT switchlight below thumbwheel. The malfunction is inserted into the system, and its description appears in the active malfunction list.

7-5. MALFUNCTION DELETION.

7-6. Active malfunctions can be deleted by either of the following methods:

a. All active malfunctions can be deleted simultaneously by depressing the MASTER MALF CLEAR switchlight at the IOS control panel.

b. Active malfunctions can be deleted selectively using the ID/MAP/LOAD/ LDSHP/DEMO/MALF thumbwheel selector as follows:

(1) Set thumbwheel selector to malfunction number to be deleted. A description of the selected malfunction appears above the active malfunction list on the status CRT display.

(2) Depress DELETE switchlight. The active malfunction is deleted from the system and the active malfunction list on the status CRT display. Active malfunction descriptions below the deleted description on the status CRT are moved up on the active malfunction list.

7-7. MALFUNCTION DISABLING.

7-8. All malfunctions can be disabled by deletion, except for the ones that trip circuit breakers. Circuit breakers must be reset after malfunction deactivation. As long as a circuit breaker malfunction is active, the circuit breaker cannot be reset.

7-9. MALFUNCTION LIST.

7-10. CRT line select numbers and descriptive titles of the available malfunctions are listed in table 7-1. The malfunctions are grouped in numerical order. Malfunction details in table 7-2 include the malfunction name, method of introduction by instructor, indications and effects on related systems as presented to the instructor and trainee, and effects sensed by trainee if corrective action is not taken.

Table 7-1. Malfunction List

300 AVIONICS

301	P VGI FAIL	321	CRS/LOC INOP
302	CP VGI FAIL	322	GLDSLP IND INOP
303	P VGI ERRAT	323	P HSI PTR #1 OSC
304	CP VGI ERRAT	324	P HSI PTR #2 OSC
305	P VGI PREC	325	P HSI CRD PRECESS
306	CP VGI PREC	326	P HSI CRD ERRAT
307	HSI HDNG FRZ	327	DIR GYRO FAIL
308	SPARE	328	P HSI PTR #1 FAIL
309	SPARE	329	P HSI PTR #2 FAIL
310	UHF	330	CP HSI PTR #1 OSC
311	AV RTA	331	CP HSI PTR #2 OSC
312	FM/VHF #1	332	CP HSI CRD PRECES
313	FM/VHF #2	333	CP HSI CRD ERRAT
314	DOP NAV RTA FAIL	334	CP HSI PTR 1 FAIL
315	DOP NAV SDC FAIL	335	CP HSI PTR 2 FAIL
316	LF REC	336	FAIL RADAR ALTMTR
317	MKR BEACON	337	APR-39 ANT FAIL
318	VOR REC	338	M130 FAIL EJECT
319	ILS REC	339	ALQ-156 FAIL
320	CRS/LOC IND OVRSN		

350 APU/ELECT SYSTEM

351	APU SHUTDOWN	358	BOTH XFMR RECT
352	BAT RLY	359	BATT SYS FAIL
353	#1 GEN	360	AC BUS TIE RLY
354	#2 GEN	361	DC BUS TIE RLY
355	BOTH GENS	362	P PLT INST LT
356	#1 XFMR RECT	363	CP FLT INST LT
357	#2 XFMR RECT	364	CEN SECT INST LT

Table 7-1. Malfunction List - Continued

400 CIRCUIT BREAKERS

401	CRUISE GUIDE
402	P VGI
403	COMP
404	CP VGI
405	#1 INSTR XFMR
406	XFMR RECT #1
407	XFMR RECT #2
408	R FWD FUEL PMP
409	L FWD FUEL PMP
410	R AFT FUEL PUMP
411	L AFT FUEL PMP
412	R AFT AUX FUEL PMP
413	L AFT AUX FUEL PMP
414	R FWD AUX FUEL PMP
415	L FWD AUX FUEL PMP
416	VOR
417	AC BUS CON
418	DC BUS CONT #1
419	DC BUS CONT #2
420	BRAKE STEER
421	APU
422	AC BUS TIE #2
423	ENG TQ AC #1
424	ENG TQ AC #2
425	ENG ANTI-ICE #1
426	ENG ANTI-ICE #2
427	UTIL HYD CONT SYS
428	PITOT HEAT
429	XMSN OIL TMP IND
430	XMSN OIL PRES IND
431	#1 IGN
432	#2 IGN
433	THRST BRK
434	AFCS #1 DC
435	AFCS #1 AC
436	FUEL QTY
437	FUEL XFD
438	NVG
439	HSI MODE SEL
440	FLT CONT
441	CON CTR
442	YAW PTR HTR
443	FUEL QTY IND
444	EMER ENG #1 TRIM
445	AFCS #2 DC
446	AFCS #2 AC
447	NAV VGI CON
448	EMER ENG #2 TRIM
449	CLTV DRIVR ACTR (AC)
450	ENG #1 STRT & TMP
451	ENG #2 STRT & TMP
452	AC BUS TIE #1
453	PLT CLOCK
454	CKPT LTS DIM CONT
455	COPLT CLOCK

500 ENGINE INSTRUMENTS

501	#1 NI TACH
502	#2 NI TACH
503	SPARE
504	SPARE
505	#1 OIL PRES 0
506	#1 OIL PRES LO
507	#2 OIL PRES 0
508	#2 OIL PRES LO
509	#1 OIL TMP FRZ
510	#1 OIL TMP MIN
511	#1 OIL TMP MAX
512	#2 OIL TMP FRZ
513	#2 OIL TMP MIN
514	#2 OIL TMP MAX
515	SPARE
516	SPARE
517	PRTR TACH FLUC/FL
518	CRTR TACH FLUC/FL
519	#1 PTIT 0
520	#2 PTIT 0
521	#1 ENG TQ FLUCT
522	#2 ENG TQ FLUCT

Table 7-1. Malfunction List - Continued

550 ENGINE SYSTEMS

551	#1 STRTR VALVE FAIL	573	#1 BP TRM HI
552	#2 STRTR VALVE FAIL	574	#1 BP TRM STAT
553	#1 HOT STRT	575	#1 EMER BP TRM
554	#2 HOT STRT	576	#2 BP TRM LO
555	#1 HUNG STRT	577	#2 BP TRM HI
556	#2 HUNG STRT	578	#2 BP TRM STAT
557	#1 FIRE-STRT	579	#2 EMER BP TRM
558	#1 FIRE-FLT	580	SPARE
559	#1 FIRE-SHTDWN	581	SPARE
560	#1 FIRE LITE	582	#1 BLD BND CLOSE
561	#2 FIRE-STRT	583	#2 BLD BND OPEN
562	#2 FIRE-FLT	584	#2 BLD BND POP
563	#2 FIRE-SHTDWN	585	#1 N1 ACT
564	#2 FIRE LITE	586	#2 N1 ACT
565	#1 FLMOUT	587	#1 OIL LO
566	#2 FLMOUT	588	#2 OIL LO
567	BOTH FLMOUT	589	#1 OIL LITE
568	#1 PWR VAR	590	#2 OIL LITE
569	#2 PWR VAR	591	#1 CHIPS DETECT
570	#1 N2 OVSPD	592	#2 CHIPS DETECT
571	#2 N2 OVSPD	593	#1 SPRAG CLUTCH
572	#1 BP TRM LO	594	#2 SPRAG CLUTCH

600 FLIGHT INSTRUMENTS

601	MOIST IN STAT SYS	603	CP TRN IND
602	P TRN IND		

650 FLIGHT CONTROL/HYDRAULIC SYSTEMS

651	#1 HYD FLT CONT	665	OSC #2 AFCS YAW
652	#2 HYD FLT CONT	666	AFCS ENGAGE ERROR
653	SPARE	667	FWD LONG CYC TRM
654	DUAL HOOK FAULT	668	AFT LONG CYC TRM
655	#1 AFCS	669	BOTH LONG CYC TRM
656	#2 AFCS	670	MAN LONG CYC TRM
657	HDOVR #1 AFCS PITCH	671	THR CNT RD BRK SW
658	HDOVR #1 AFCS ROLL	672	THR CNT RD BRK FAIL
659	HDOVR #1 AFCS YAW	673	THR CCDA FAIL
660	HDOVR #2 AFCS PITCH	674	DASH LONG FAIL
661	HDOVR #2 AFCS ROLL	675	DSH STCK GRAD FRZ
662	HDOVR #2 AFCS YAW	676	LONG CCDA TRIM FL
663	OSC #2 AFCS PITCH	677	PROXIMITY SW FAIL
664	OSC #2 AFCS ROLL	678	UTL SYS FAIL APU
679	UTL HYD PUMP XMSN		

Table 7-1. Malfunction List - Continued

700 FUEL SYSTEM

701	R FWD AUX BST PMP	706	L SIDE BST PMPS
702	R AFT AUX BST PMP	707	L FUEL LEAK
703	R SIDE BST PMPS	708	R FUEL LEAK
704	L FWD AUX BST PMP	709	R MAIN OVERPRESS
705	L AFT AUX BST PMP		

800 ROTOR SYSTEM

801	BLD TRCK	803	SPARE
802	BLD BAL		

850 TRANSMISSIONS

851	MIX OIL PRES LO	859	FWD CHIPS DETECT
852	#1 OIL PRES LO	860	#1 CHIPS DETECT
853	#2 OIL PRES LO	861	#2 CHIPS DETECT
854	AFT OIL PRES LO	862	FWD TRANS VIB
855	MIX TMP HOT	863	AFT VERT SHFT PRS
856	#1 TMP HIGH	864	AUX OIL PRES LO
857	#2 TMP HIGH	865	#1 ENG XMSN HOT
858	AFT TMP HIGH	866	#2 ENG XMSN HOT

Table 7-2. Simulated Malfunction Details

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Pilot attitude indicator (VGI)	301	NO. 2 AFCS OFF caution light illuminates, OFF flag on indicator, and attitude transients.	Attitude indicator precesses at a rate of 4° per minute.
Copilot attitude indicator (VGI)	302	NO. 1 AFCS OFF caution light illuminates, OFF flag on indicator, and attitude transients. If BARO or RAD ALT is ENGAGED thrust runaway results.	Continued thrust runaway until ENGAGED function is eliminated and attitude indicator precesses 4° per minute.
Pilot vertical gyro erratic (VGI)	303	Attitude transients result.	Attitude indicator erratic.
Copilot vertical gyro erratic (VGI)	304	Attitude transients result.	Attitude indicator erratic.
Pilot vertical gyro precesses (VGI)	305	Attitude transients result (at a slower rate than 303).	Attitude indicator precesses 20 per hour.
Copilot vertical gyro precesses (VGI)	306	Attitude transients result (at a slower rate than 304).	Attitude indicator precesses 20 per hour.
HSI heading freeze	307	Pilot and copilot HSI heading freezes at last valid reading.	Pilot and copilot HSI are unreliable.
UHF transceiver	310	None	Crew transmission on the UHF is not possible. No crew sidetone.
FM/VHF No. 1	312	None	Crew transmission on the No. 1 FM/VHF is not possible. No crew sidetone.
FM/VHF No. 2	313	None	Crew transmission on the No. 2 FM/VHF is not possible. No crew sidetone.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Doppler NAV RTA (receiver transmitter antenna)	314	DOP NAV RTA appears on CRT.	1. In navigate mode, MEM light illuminates (after 8 sec). 2. In test mode. MEM light extinguishes and MAL light illuminates, MN R00000 (after 15 sec).
Doppler NAV SDC (signal data converter) power	315	DOP NAV SDC appears on CRT.	1. In navigate mode, MEM and MAL lights illuminate. 2. In test mode. NG S890000 (after 15 sec.).
LF receiver	316	LF station identification is not possible. ADF pointers remain fixed at last position prior to failure.	Crew does not receive station identification. ADF pointers remain fixed at last position prior to failure.
Marker beacon	317	Marker identification is not possible. Marker lights are inoperative. Marker lights press-to-test is inoperative.	Marker beacon system inoperative.
VOR receiver	318	If tuned to a valid VOR station: 1. Station ident is disabled. 2. VOR pointers remain fixed at 1200. 3. NAV flag appears in ID-2103. 4. Vertical needle in ID-2103 centers.	VOR navigation system inoperative.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
ILS receiver	319	If tuned to a valid ILS: 1. LOC flag appears in ID-2103. 2. Glideslope (G/S) flag appears in ID-2103. 3. Horizontal and vertical needles in ID-2103 center. 4. Station ident is disabled.	ILS navigational system inoperative.
CRS/LOC needle oversensitive	320 tuned.	If a valid course (CRS) or LOC is vertical needle in ID-2103 becomes twice as sensitive (i.e one dot true equals two dots indicated).	Vertical needle in ID-2103 becomes twice as sensitive.
CRS/LOC needle inoperative	321	Vertical needle in ID-2103 centers.	All other CRS/LOC indicators are not affected.
Glideslope needle inoperative	322	Horizontal needle in ID-2103 centers.	No valid glideslope indication.
PLT HSI No. 1 Doppler pointer oscillates	323	PLT HSI pointer No. 1 oscillates ±20°from station bearing.	Invalid Doppler station bearing.
PLT HSI No. 2 VOR/ADF pointer oscillates	324	PLT HSI pointer No. 2 oscillates ±20° from station.	Invalid VOR/ADF station bearing.
PLT HSI card excitation loss	325	PLT HSI compass card precesses at a rate of 150 per hour.	PLT HSI compass card precesses.
PLT HSI card erratic	326	PLT HSI compass card oscillates ±5° from magnetic heading.	PLT HSI compass card erratic.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Directional gyro fail	327	PLT and CPLT HSI compass cards rotate. Aircraft follows the direction of card rotation.	PLT and CPLT HSI compass cards rotate.
PLT HSI No. 1 Doppler pointer	328	PLT HSI No. 1 pointer freezes at last displayed bearing.	PLT HSI No. 1 pointer freezes at last displayed bearing.
PLT HSI No. 2 VOR/ADF pointer power fail	329	PLT HSI No. 2 pointer freezes at last displayed bearing.	PLT HSI No. 2 pointer freezes at last displayed bearing.
CPLT HSI No. 1 Doppler pointer oscillates	330	CPLT No. 1 pointer oscillates ±20° from station bearing.	Invalid Doppler station bearing.
CPLT HSI No. 2 VOR/ADF pointer oscillates	331	CPLT HSI No. 2 pointer oscillates ±20° from station bearing.	Invalid VOR/ADF station bearing.
CPLT HSI card excitation loss	332	CPLT HSI compass card precesses at a rate of 15° per hour.	CPLT HSI compass card erratic.
CPLT HSI card Erratic	333	CPLT HSI compass card oscillates ±5° from magnetic heading.	CPLT HSI compass erratic.
CPLT HSI No. 1 Doppler pointer power fail	334	CPLT HSI No. 1 pointer freezes at last displayed bearing.	CPLT HSI No. 1 pointer freezes at last displayed bearing.
CPLT HSI No. 2 VOR/ADF pointer power fail	335	CPLT HSI No. 2 pointer freezes at last displayed bearing.	CPLT HSI No. 2 pointer freezes at last displayed bearing.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Radar altimeter power fail	336	Aircraft begins to climb or descend off selected altitude if RAD ALT is ENGAGED. appears, digital display and caution lights go out, and pointer remains at last valid indication when power was lost.	If RAD ALT is ENGAGED, altitude hold function OFF flag is lost and thrust rod begins to creep.
APR-39 antenna fail	337	Instructor: CRT. Trainee: APR-39 gives wrong test indications.	APR-39 appears on AN/APR-39 gives erroneous test indications. In normal operations, no signals from left forward quadrant.
M-130 eject fail	338	M-130 fails to dispense flares on command of ALQ-156 and results in the aircraft being KILLED. M-130 does not eject flares. Flare counter does not decrement.	FLARE TEST switch on ALQ-156 does not function.
ALQ-156 fail	339	Failure of radar system to detect incoming missiles. CMINOP caution light illuminates. No dispense signal to M-130 system.	Failure of radar system to detect incoming missiles. CMINOP caution light illuminates. No dispense signal to M-130 system.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
APU automatic	351	If APU is already running, shut-down is evidenced by extinguishing of APU ON caution light and run-down sounds from aural cues. Effects on related systems are different, dependent upon opera-tion of main engines, rotor speed, and PTU operation. main engines. speed, and PTU operation.	If APU is already running, shutdown is evidenced by extinguishing of APU ON caution light and run-down sounds from aural cues. Effects on related systems are different, de-pendent upon operation of rotor
Battery relay failure	352	Only electrical bus that is energized is the HOT BATTERY. Control centering device is inoperative.	Only electrical bus that is energized is HOT BATTERY. Control center-ing device is inoperative.
Generator No. 1 failed	353	NO. 1 GEN OFF caution light illuminates.	NO. 1 GEN OFF caution light illuminates.
Generator No. 2 failed	354	NO. 2 GEN OFF caution light illuminates.	NO. 2 GEN OFF caution light illuminates.
Both generators fail	355	All associated caution lights illuminate. Only electrical power available is dc power from battery.	Abrupt helicopter atti-tude change.Control be-comes impaired.
Transformer rectifier No. 1	356	NO. 1 RECT OFF caution light illuminates.	NO. 1 RECT OFF caution light illuminates.
Transformer rectifier No. 2	357	NO. 2 RECT OFF caution light illuminates.	NO. 2 REC OFF caution light illuminates.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Both transformer rectifiers	358	All associated caution lights illuminate. Battery power is only dc power available. All dc associated equipment is inoperative.	Abrupt helicopter attitude change.Control becomes impaired.
Battery system fail	359	BATT SYS MAL caution light illuminates. No dc power is available from the battery. Battery bus may be disabled and associated equipment is inoperative.	If another electrical source is available, no effects are evident: otherwise, no dc power is available.
AC bus tie relay fail	360	If either generator is failed or turned off, disabled ac bus is not connected and all associated caution lights illuminate.	Loss of ac bus powered equipment associated with failed or turned off generator.
DC bus tie relay fail	361	If either transformer rectifier is inoperative, automatic closing of bus tie relay does not occur, disabled dc busses are not connected to operable transformer rectifier. and all associated caution lights illuminate.	All associated dc powered equipment on No. 1 or No. 2 busses is lost.
PLT FLT instrument lights	362	Pilot flight instrument lights are inoperative.	Restricted cockpit/instrument visibility.
CPLT FLT instrument lights	363	Copilot flight instrument lights are inoperative.	Restricted cockpit/instrument visibility.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Center section instrument lights	364	Center section instrument lights are inoperative.	Restricted cockpit/instrument visibility.
Circuit breaker failures	401-455	CB related system is inoperative.	CB related system is inoperative.
Gas producer (N_1) tachometer indicator	501 (No. 1 ENG) 502 (No. 2 ENG)	Gas producer indicator reads zero. No effects on other systems.	None
Engine oil pressure indicator	505 (No. 1 ENG) 507 (No. 2 ENG)	Engine oil pressure indicator slowly decreases to zero. No effects on other systems.	None
Engine oil pressure indicator Low	506 (No. 1 ENG) 508 (No. 2 ENG)	Engine oil pressure indicator reads abnormally low (30 psi). No effects on other systems.	None
Engine oil temperature indicator freezes	509 (No. 1 ENG) 512 (No. 2 ENG)	Engine oil temperature indicator does not move and does not respond to changed conditions.	None
Engine oil temperature indicator minimum	510 (No. 1 ENG) 513 (No. 2 ENG)	Engine oil temperature indicator reads -700C and does not respond to changed conditions. No effects on other systems.	None
Engine oil temperature indicator maximum	511 (No. 1 ENG) 514 (No. 2 ENG)	Engine oil temperature indicator reads ±1500C and does not respond to changed conditions. No effects on other systems.	None
Rotor tachometer fluctuates/fail	517 (Pilot) 518 (Copilot)	Small fluctuations for 5-10 seconds, then rotor tachometer indicator reads zero.	None

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Power turbine inlet temperature (PTIT) indicator	519 (No. 1 ENG) 520 (No. 2 ENG)	PTIT indicator reads zero. No other systems affected.	None
Torquemeter indicator fail	521 (No. 1 ENG) 522 (No. 2 ENG)	Torquemeter indicator needle fluctuates.	None
Engine start valve fail	551 (No. 1 ENG) 552 (No. 2 ENG)	1. Prior to start sequence, there is no response when ENG START switch is moved to MOTOR. 2. During starting sequence, but before N_1 reaches 35 percent, engine decelerates, PTIT decreases below 350°C, and aural cues and instruments reflect decreasing N_1.	None
Hot start	553 (No. 1 ENG) 554 (No. 2 ENG)	Rapid rise in PTIT to above red line value of 940°C. PTIT begins to decrease as soon as ECL is moved from flight to stop.	Rapid rise in PTIT to above red line value of 940°C.
Hung start	555 (No. 1 ENG) 556 (No. 2 ENG)	Slow N_1 acceleration with abnormal rise in PTIT. Engine overtemperature may exist.	N_1 stabilizes at 40%. Engine overtemperature may exist.
Fire-ground (non-extinguishable)	557 (No. 1 ENG) 561 (No. 2 ENG)	Fire warning lights illuminate.	None
Fire-ground (extinguishable)	558 (No. 1 ENG) 562 (No. 2 ENG)	Fire warning lights illuminate.	None

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Post shutdown fire	559 (No. 1 ENG) 563 (No. 2 ENG)	Abnormal rise in PTIT during engine coastdown with N_1 less than 35%.	Abnormal rise in PTIT during engine coastdown with N_1 less than 35%.
Detector fail (no fire)	560 (No. 1 ENG) 564 (No. 2 ENG)	Fire warning lights illuminate.	None
Flameout	565 (No. 1 ENG) 566 (No. 2 ENG)	Engine decelerates to zero. Torque on affected engine goes to zero. Good engine delivers power requirement up to topping. If demanded power exceeds topping power of good engine, rotor rpm decelerates according to load demanded.	Rotor rpm continues to decay until thrust and engine trim are adjusted on operable engine in accordance with power requirements.
Flameout both engines	567	Both engines decelerate to zero. Torque on both engines goes to zero.	Rotor rpm decays rapidly if thrust control rod is not lowered immediately.
Engine power variation	568 (No. 1 ENG) 569 (No. 2 ENG)	Fluctuation in torque, N_1,. and engine oil pressure. Normal indications on unaffected engine.	Fluctuation in torque, N_1. and engine oil pressure. Normal indications on uneffected engine.
N_2 overspeed (governor drive-shaft fail)	570 (No. 1 ENG) 571 (No. 2 ENG)	Increasing torque on affected engine, decreasing torque on unaffected engine, increase in rotor rpm, and no response of normal engine beep trim system.	Possibility exists for rotor rpm to exceed safe limits.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Low side engine beep trim	572 (No. 1 ENG) 576 (No. 2 ENG)	Decrease in torque on affected engine and increase in torque on unaffected engine, along with lack of response to normal beep trim on affected engine. Rotor rpm decreases and N1 stabilizes at or above ground idle speed (60 to 63% N_1 speed).	Rotor rpm may continue to decrease below safe operating limits, depending upon gross weight of aircraft.
High side engine beep trim	573 (No. 1 ENG) 577 (No. 2 ENG)	Increase in torque on the affected engine and a decrease in torque on unaffected engine, along with lack of response to normal engine beep trim on affected engine.	Rotor rpm may continue to increase above safe operating limits. Rotor rpm increases.
Static beep trim	574 (No. 1 ENG) 578 (No. 2 ENG)	Failure of affected engine to respond to normal beep commands or similar to a high or low side failure when thrust control is lowered or raised.	Failure of affected engine to respond to normal beep commands or similar to a high or low side failure when thrust control is lowered or raised.
Emergency beep trim	575 (No. 1 ENG) 579 (No. 2 ENG)	No rotor or N_1 rpm change when emergency beep trim is utilized.	No rotor or N1 rpm change when emergency beep trim is utilized.
Bleed band closed No. 1 ENG	582	No. 1 ENG stalls whenever N1 power demand exceeds 800 rpm per second. Rapid loss of N1 and rise in PTIT. PTIT.	No. 1 ENG stalls whenever N_1 power demand exceeds 800 rpm per second. Rapid loss of N_1 and rise in

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Bleed band open No. 2 ENG	583	Loss of power on affected engine. N_1 and PTIT increases. If engine is near topping power, affected engine indicates low torque. low torque.	Loss of power on affected engine. N_1 and PTIT increases. If engine is near topping power. affected engine indicates
Bleed band popping No. 2 ENG	584	Rapid fluctuations in N_1 and PTIT.	Rapid fluctuations in N_1 and PTIT.
Gas producer actuator or engine condition lever fail	585 (No. 1 ENG) 586 (No. 2 ENG)	Engine does not respond to any change in engine condition lever movement. Appropriate engine N1 control light on caution panel remains on when engine condition lever is in any position other than failed position. in any position other than failed position.	Engine does not respond to any change in engine condition lever movement. Appropriate engine N1 control light on caution panel remains on when engine condition lever is
Loss of engine oil	587 (No. 1 ENG) 588 (No. 2 ENG)	High engine oil temperature indication, low oil pressure indication, and bearing seizure sound 3 minutes after start of malfunction.	High engine oil temperature indication, low oil pressure indication, and bearing seizure sound 3 minutes after start of malfunction.
Engine oil low	589 (No. 1 ENG) 590 (No. 2 ENG)	NO. 1 ENG or NO. 2 ENG OIL LOW caution light illuminates.	None
Metal chips	591 (No. 1 ENG) 592 (No. 2 ENG)	NO. 1 ENG CHIP DET caution light illuminates. NO. 2 ENG CHIP DET caution light illuminates.	No. 1 engine fails after 3 minutes. None

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Moisture in static ports	601	Appropriate effects on instruments utilizing static pressure inputs. ments.	Erroneous instrument reading on affected instru-
Turn indicator	602 (PLT) 603 (CPLT)	Pilot or copilot turn indicator does not respond to turn condition.	No turn indication of failed indicator.
No. 1 hydraulic flight control system	651	NO. 1 HYD FLT CONTR and NO. 1 AFCS OFF caution lights illuminate.	NO. 1 HYD FLT CONTR and NO. 1 AFCS OFF caution lights illuminate.
No. 2 hydraulic	652	NO. 2 HYD FLT CONTR and NO. 2 AFCS OFF caution lights illuminated.	NO. 2 HYD FLT CONTR and NO. 2 AFCS OFF caution lights illuminate.
Dual hook fault	654	DUAL HOOK FAULT caution light illuminates. Loss of normal and emergency release capability for the forward and aft cargo hooks.	External load cannot be released by any means other than MANUAL release mode.
No. 1 AFCS	655	NO. 1 AFCS OFF caution light illuminates. If AFCS select switch is in BOTH or NO. 2 position, no noticeable change in stability occurs. Altitude hold function is lost.	NO. 1 AFCS OFF caution light illuminates. If AFCS select switch is in BOTH or NO. 2 position, no noticeable change in stability occurs. Altitude hold function is lost.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
No. 2 AFCS	656	NO. 2 AFCS OFF caution light illuminates. If AFCS select switch is in BOTH or NO. 1 position, no noticeable change in stability occurs. stability occurs.	NO. 2 AFCS OFF caution light illuminates. If AFCS select switch is in BOTH or NO. 1 position, no noticeable change in
Hardover in No. 1 AFCS pitch	657	Abrupt pitch attitude change.	Abrupt pitch attitude change.
Hardover in No. 1 AFCS roll and yaw	658 (Roll) 659 (Yaw)	Abrupt attitude change in appropriate axis.	Abrupt attitude change in appropriate axis.
Hardover in No. 2 AFCS pitch	660	Abrupt pitch attitude change.	Abrupt pitch attitude change.
Hardover in No. 2 AFCS roll and yaw	661 (Roll) 662 (Yaw)	Abrupt attitude change in appropriate axis.	Abrupt attitude change in appropriate axis.
Pitch oscillations in No. 2 AFCS	663	Unusual oscillations, random in occurrence, in pitch axis.	Oscillations continue causing unstable flight.
Roll oscillations in No. 2 AFCS	664	Unusual oscillations, random in occurrence, in roll axis.	Oscillations continue causing unstable flight.
Yaw oscillations in No. 2 AFCS	665	Unusual oscillations, random in occurrence, in yaw axis.	Oscillations continue causing unstable flight.
AFCS engagement error	666	Pitch pulse is realized upon engaging AFCS system from BOTH to single AFCS ON.	Momentary disturbance occurs each time AFCS is switched from one mode to another.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Longitudinal cyclic trim	667 (Forward) 668 (Aft) 669 (Both)	If CYCLIC TRIM function switch is in AUTO, pointer(s) on CYCLIC TRIM indicator(s) does not change when making a speed change.	Level fuselage attitude is not maintained as airspeed is increased or decreased.
	NOTE **Switching to the MANUAL mode for malfunctions 667, 668, and 669 enables the system to be managed in that mode with no malfunction effects.**		
Longitudinal cyclic trim manual	670	If CYCLIC TRIM function switch is in MANUAL, actuators do not respond to manual EXT or RET switch inputs.	Level fuselage attitude is not selectable by manual longitudinal cyclic trim system operation.
Thrust control rod brake switch	671	Operation of THRUST CONT BRAKE TRIGGER fails to release magnetic brake on thrust rod.	10 to 20 pounds of force are necessary to move thrust rod.
Thrust control rod brake	672	Same as 671. Corrective action attempts of pulling THRUST BRAKE circuit breaker do not affect system.	Same as 671.
Thrust cockpit control driver actuator (CCDA)	673	Loss of altitude hold, creeping thrust control rod, or rapid change in altitude or torque. altitude or torque.	Loss of altitude hold, creeping thrust control rod, or rapid change in

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
DASH fail	674	DASH actuators extend to full authority.	At airspeeds below 100 KIAS, DASH programs to full extension (helicopter pitches down). At airspeeds above 100 KIAS, DASH programs to full extension (aircraft pitches up). Airspeed hold function is lost.
DASH stick gradient freeze	675	Airspeed hold function is lost. For failed extended case, cyclic stick is displaced farther forward than normal at airspeeds below 80 knots. For failed retracted case. the effect is the same as if system were turned off. No positive stick gradient with airspeed.	If stick position is not adjusted by means of AFCS pitch trim system to alleviate unnatural stick position, sufficient stick travel for certain maneuvers may not be possible.
Longitudinal CCDA trim fail	676	Longitudinal CCDA trim motor drives to limit in same direction as trim selected (forward or aft).	Loss of pitch trim. Cyclic transients in pitch axis.
Proximity switch fail	677	At touchdown, longitudinal cyclic trim does not drive to ground (GND) position.	Longitudinal cyclic trim indicator does not drive to GND position.
UTL system fail APU	678	APU hydraulic pump does not operate.	UTL SYSTEM FAIL indicator illuminates.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
UTL hydraulic pump transmission	679	Transmission (utility hydraulic pump) does not operate.	Loss of utility hydraulics.
Auxiliary tank boost pump fail	701 (R FWD) 702 (R AFT) 704 (L FWD) 705 (L AFT)	AUX PRESS caution light illuminates and fuel in affected tanks cannot be used. Fuel quantity indication remains constant for affected tank.	AUX PRESS caution light illuminates. Fuel in affected tanks cannot be used. Fuel quantity indication remains constant for affected tank.
Main tank boost pump fail (both pumps)	703 (Right) 706 (Left)	L or R FUEL PRESS caution light illuminates. Fuel is supplied to engines from each main tank through a bypass check as long as aircraft is operated below 6,000 feet pressure altitude. Auxiliary fuel tanks continue to transfer fuel to main tanks.	If operations are being conducted above 6.000 feet pressure altitude, with crossfeed fuel valve closed, fuel starvation to affected engine results.
Uneven fuel consumption	707 (Left) 708 (Right)	Fuel quantity indicator shows uneven fuel distribution. lateral CG shift occurs. This indicates loss of fuel from affected side and not an increase in fuel consumption caused by the engine (to simulate fuel leak and/or being pumped overboard).	Fuel quantity indicator Gradual shows uneven fuel distribution. Gradual lateral CG shift occurs.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Fuel venting from right side tank vent	709	Fuel quantity indications increase in right main tank. Loss of fuel when affected tank is full through vent hole. However. if right auxiliary booster pumps are off, adverse effects are not produced, and right main tank fuel quantity begins to decrease normally.	Fuel quantity indications increase in right main tank. Loss of fuel when affected tank is full through vent hole. However, if right auxiliary booster pumps are off, adverse effects are not produced. and right main tank fuel quantity begins to decrease normally. **NOTE** **Malfunction 709 simulates simultaneous failure of the tank float valve/shutoff valve when transferring fuel from auxiliary tanks to main tank.**
Rotor blade track	801	Unacceptable one-per-revolution vibration is realized (vertical). Introduced through motion system.	Vertical vibrations persist.
Blade balance	802	Excessive one-per-revolution vibration is realized (lateral). Introduced through motion system.	Lateral vibrations persist.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
Combining XMSN oil pressure	851	Transmission oil pressure gradually decreases to below 20 psi.	XMSN oil pressure continues to decrease to 0 psi.
No. 1 ENG XMSN oil pressure	852	Transmission oil pressure gradually decreases to below 20 psi. XMSN OIL PRESS caution light illuminates as pressure drops below 20 psi.	XMSN oil pressure continues to decrease to 0 psi. After 1 minute at 0 psi. engine fails if no corrective actions are taken.
No. 2 ENG XMSN oil pressure	853	Transmission oil pressure gradually decreases to below 20 psi. XMSN OIL PRESS caution light illuminates as pressure decreases below 20 psi. is secured.	XMSN oil pressure continues to decrease to 10 psi. After 1 minute, engine oil temp slowly rises to 130°C and remains until engine
AFT XMSN OIL pressure	854	Transmission oil pressure gradually decreases to below 20 psi. XMSN OIL PRESS caution light illuminates as pressure drops below 20 psi.	XMSN oil pressure continues to decrease to 10 psi.
Combining XMSN oil temp high	855	Gradual increase in XMSN oil temperature until 140ºC is exceeded. XMSN OIL HOT caution light illuminates when temperature reaches 140ºC.	XMSN oil temperature slowly reaches 145°.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
XMSN OIL temp high	856 (No. 1 ENG) 857 (No. 2 ENG) 858 (AFT XMSN)	Gradual increase in XMSN oil temperature until temperature reaches 150ºC. XMSN OIL HOT caution light illuminates as temperature increases to 140ºC.	Gradual increase in XMSN oil temperature until temperature reaches 150°C. XMSN OIL HOT caution light illuminates as temperature increases to 140°C. **NOTE** **Instructor verifies location of metal chips.**
FWD XMSN metal chips	859	XMSN CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing.	XMSN CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing.
No. 1 ENG XMSN metal chips	860	NO. 1 ENG CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing.	NO. 1 ENG CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing.
No. 2 ENG metal chips	861	NO. 2 ENG CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing. No. 2 engine fails after 1 minute of steady illumination.	No. 2 ENG CHIP DET caution light illuminates steady after 5 seconds of intermittent flashing. No. 2 engine fails after 1 minute of steady illumination.

Table 7-2. Simulated Malfunction Details - Continued

Malfunction	Method of introduction by instructor	Indications and effects on related systems as presented to the instructor and trainee	Effects sensed by trainee if corrective action is not taken
FWD XMSN vibration	862	High-frequency vibrations are felt at directional pedals.	Vibrations persist.
AFT vertical shaft pressure	863	XMSN OIL PRESS caution light illuminates. indicate above 20 psi.	XMSN OIL PRESS caution All XMSN pressures light illuminates. All XMSN pressures indicate above 20 psi.
XMSN AUX OIL pressure low	864	XMSN AUX OIL PRESS caution light illuminates.	XMSN AUX OIL PRESS caution light illuminates.
No. 1 or No. 2 ENG XMSN HOT	865 (No. 1) 866 (No. 2)	NO. 1 or NO. 2 ENG XMSN HOT caution light illuminates.	After 2 minutes with no corrective action, af- fected engine fire warning lights illuminate.

CHAPTER 8

NORMAL OPERATING PROCEDURES

Section I. INSTRUCTOR OPERATOR STATION CONTROLS AND FUNCTIONS

8-1. GENERAL.

8-2. The IOS forward and aft control panels are shown in figures 8-1 and 8-2, respectively. Controls on these panels are described in tables 8-1 and 8-2.

8-3. The auxiliary control panel is shown in figure 8-3 and described in table 8-3. This panel is located on the aft portion of the center console. The thumbwheel selector and INSERT and DELETE switchlights have the same capabilities as the IOS forward control panel controls.

NOTE

One rule that must be followed when operating the simulator is initiate, wait, verify, proceed. This is especially true when operating keyboard and thumbwheel insert controls. The scratchpad area at the bottom of the auxiliary information display (AID) permits verification of keyboard selections before actual entry. This area also displays error messages for incorrect entry of both thumbwheel and keyboard inputs.

8-4. The controls for the digital clock at the top of the IOS are shown in figure 8-4 and described in table 8-4. These controls are accessed by lifting the access door.

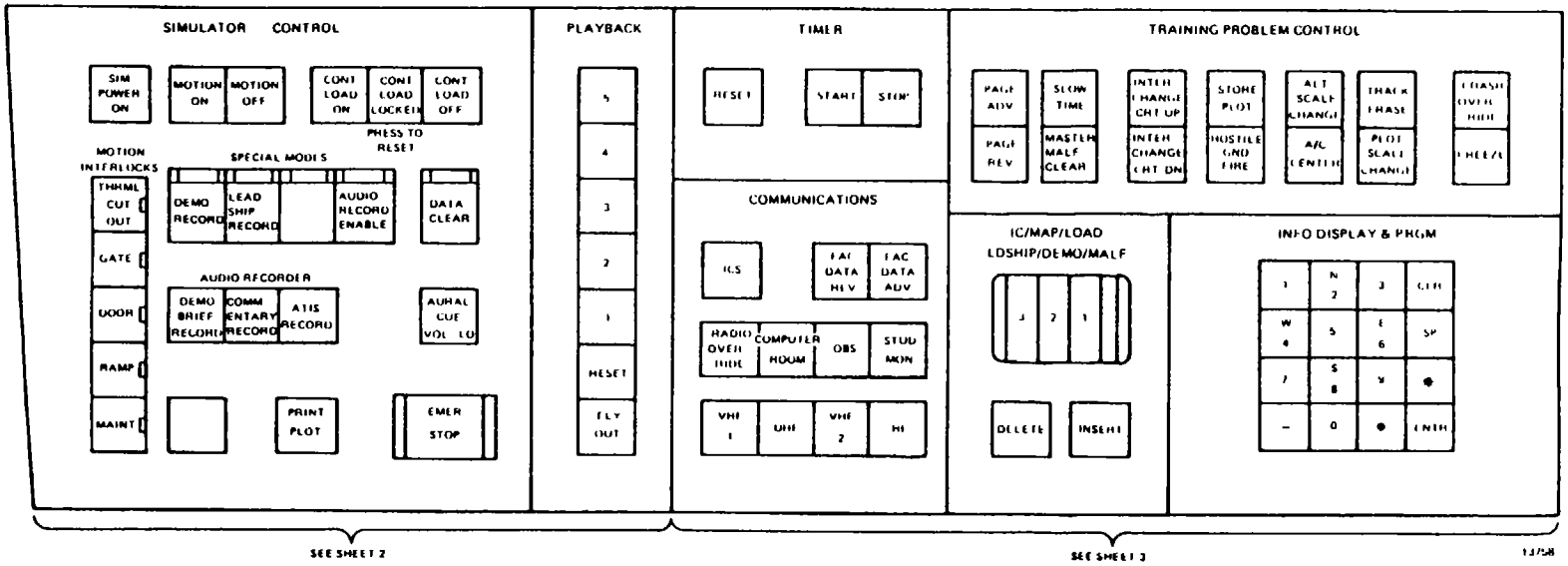


Figure 8-1. IOS Forward Control Panel (Sheet 1)

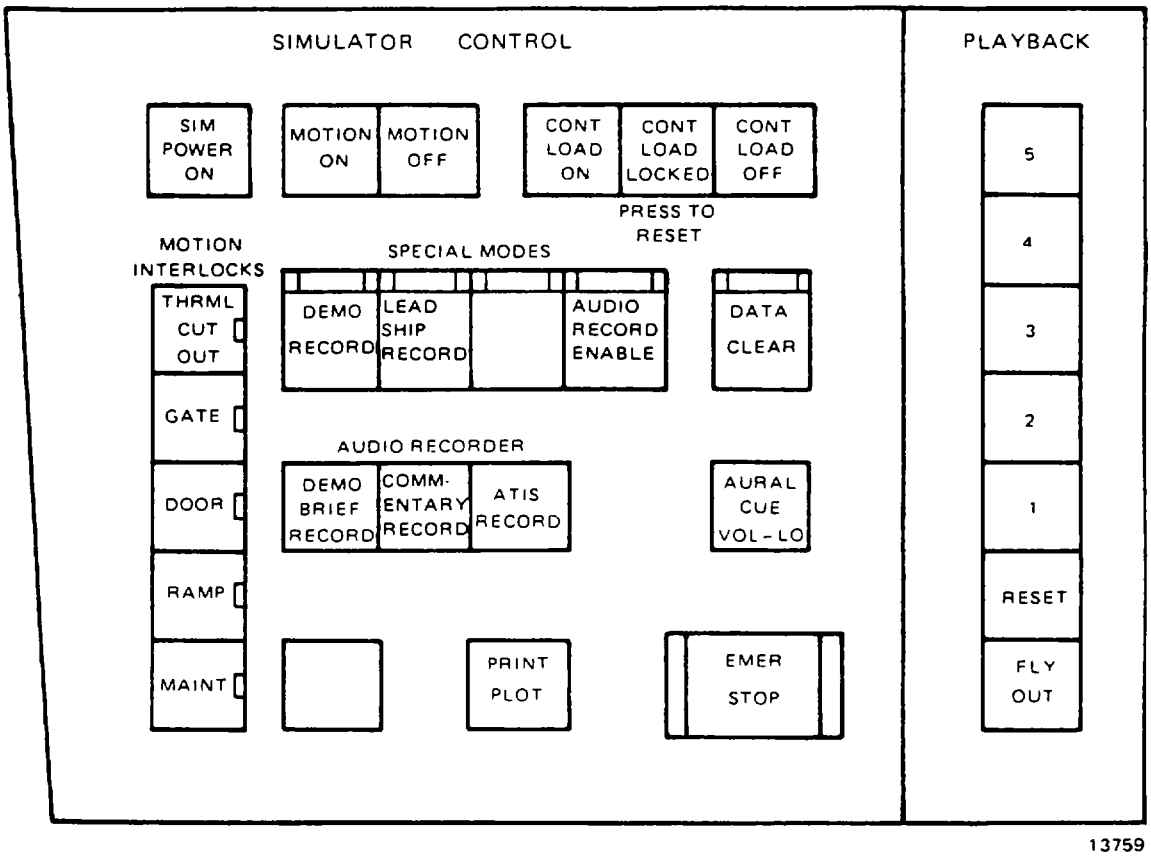


Figure 8-1. IOS Forward Control Panel (Sheet 2)

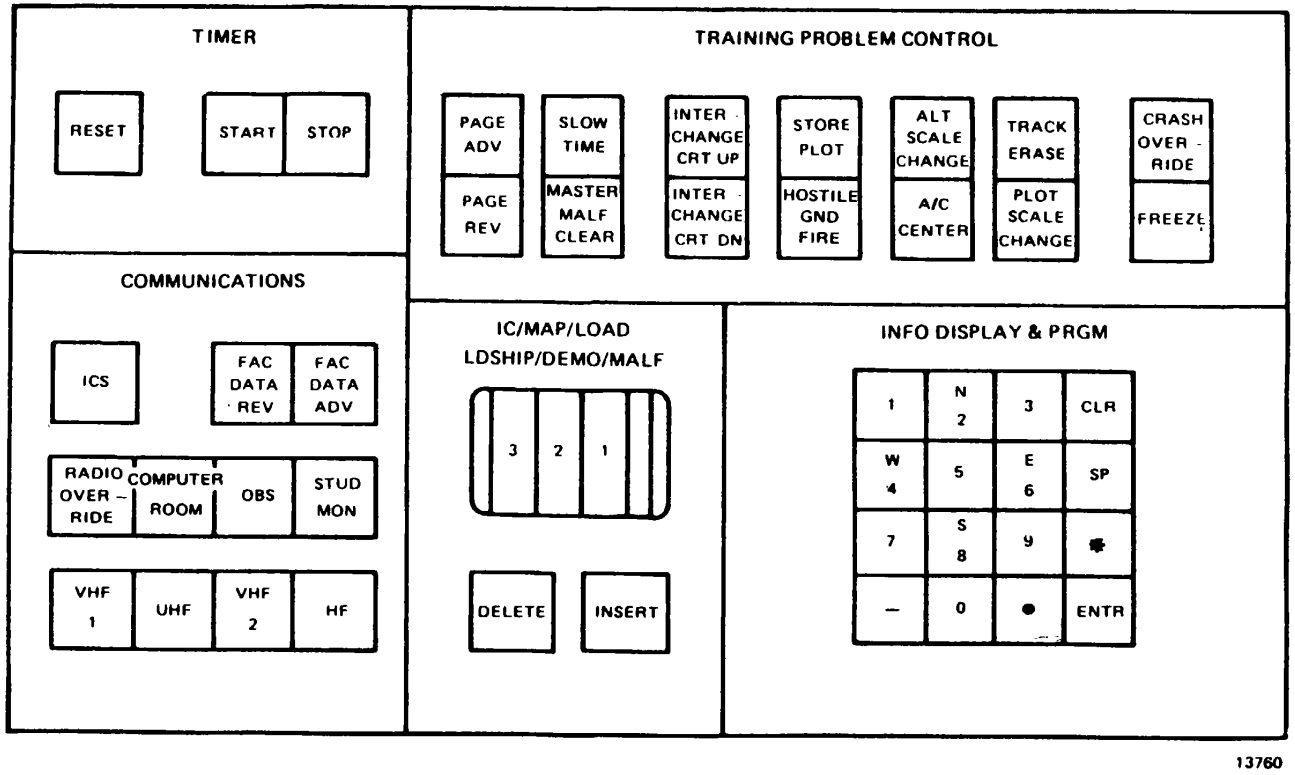


Figure 8-1. IOS Forward Control Panel (Sheet 3)

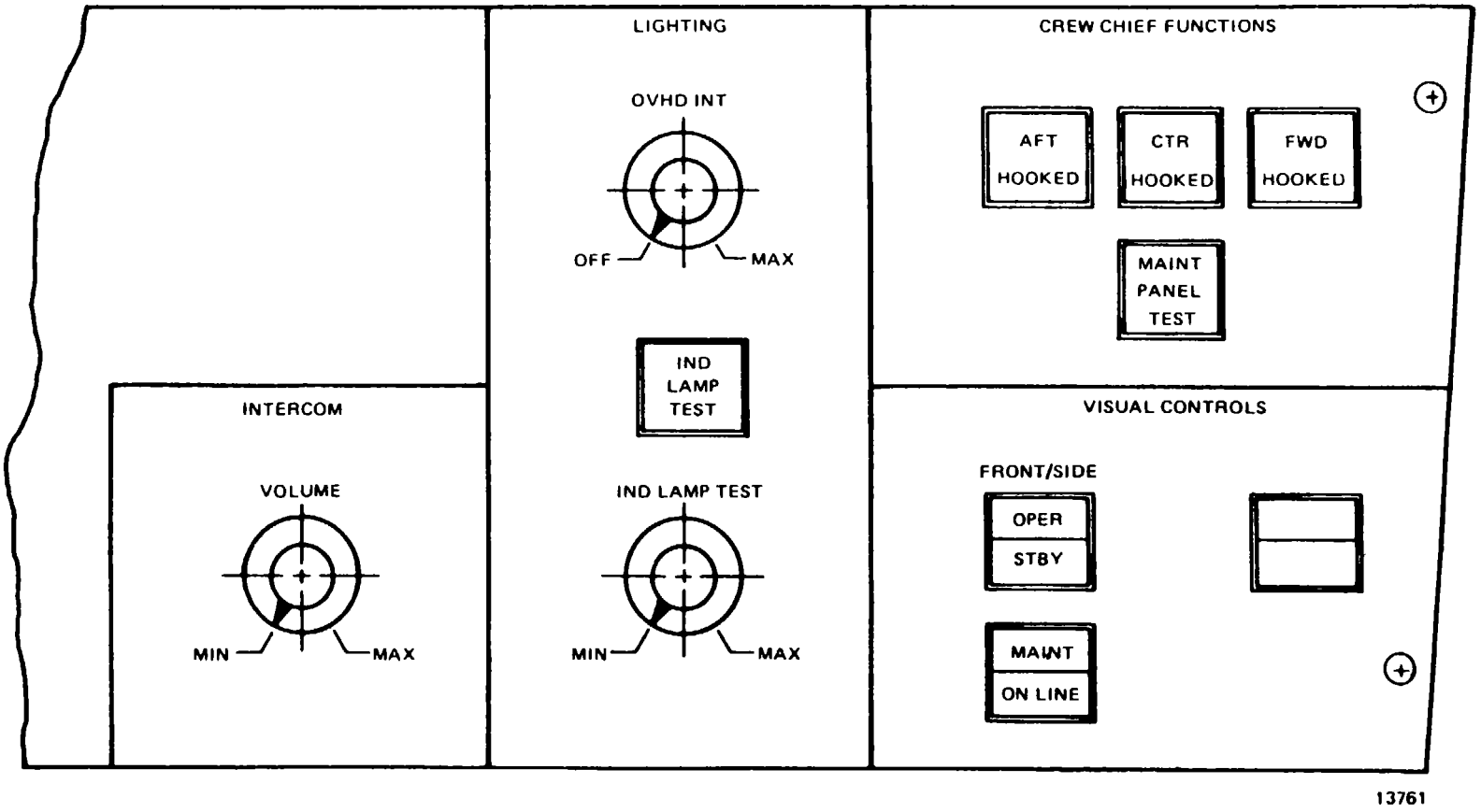


Figure 8-2. IOS Aft Control Panel

Table 8-1. IOS Forward Control Panel Controls and Indicators

Control/Indicator	Control	Function
SIMULATOR CONTROL		
SIM POWER ON indicator	Green	Indicates status of master power switch.
MOTION ON switchlight	Green	With cockpit power on, activates motion system if all interlocks are satisfied. Lamp remains illuminated so long as motion is operable.
MOTION OFF switchlight	white	Deactivates motion system. Lamp remains illuminated when motion is off.
CONT LOAD ON switchlight	Green	Activates hydraulics for control loading system. Lamp illuminates when system is on.
CONT LOAD LOCKED switchlight	Yellow	Indicates fault in loading system; press-to-reset.
CONT LOAD OFF switchlight	White	Deactivates hydraulics for control loading system. Lamp illuminates when system is on.
		NOTE **This will also not allow the motion interlock requirements to be met.**
MOTION INTERLOCKS		Motion will not operate if any motion interlock is unsatisfied.
THRML CUTOUT indicator	Yellow	Indicates thermal cutout on hydraulic pump is open.
GATE indicator	Yellow	Indicates gate to area under motion platform is open.
DOOR indicator	Yellow	Indicates cockpit door is not closed.
RAMP indicator	Yellow	Indicates ramp is not up in stowed position.
MAINT indicator	Yellow	Indicates motion system is placed in maintenance mode, or pressure gates sense weight being applied to them.
SPECIAL MODES		
DEMO RECORD switchlight	White	Allows recording of a demonstration program.
LEADSHIP RECORD switchlight	White	Allows recording ownship as leadship.

Table 8-1. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
SPECIAL MODES - continued		
AUDIO RECORD ENABLE	White	Allows AUDIO RECORDER function to be switchlight used.
DATA CLEAR switchlight	White	Clears all data previously accumulated and initiates simulator and displays to IC set 002.

Table 8-1. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
AUDIO RECORDER		Controls communications recorder (clean tape must be loaded).
DEMO BRIEF RECORD switchlight	Green	Allows instructor to record briefing.
COMMENTARY RECORD switchlight	Green	Allows instructor to record communications.
ATIS RECORD switchlight	Green	Allows instructor to record ATIS information.
AURAL CUE VOL-LO switchlight	White	Allows instructor to reduce aural cue volume to lowest level.
PRINT PLOT switchlight	White	Prints stored plots on hardcopy unit.
EMER STOP guarded switchlight	Blue/ Green	Turns off all power to entire simulator complex. Switchlight illuminates when power is on.
PLAYBACK		
1, 2, 3, 4, 5	White	Commands and indicates playback of switchlights simulator response to student performance in 1-minute increments up to 5 minutes.

NOTE

Actuating the desired playback switchlight results in a freeze condition.
FREEZE blinks until the simulator is reset for playback, then goes steady.
Audio playback status is indicated on the edit line of the CRT. When the simulator is unfrozen, playback begins at the start of the minute selected counting back minutes of recorded flight from the time playback was called for. When a playback selection is made, the light in that switch illuminates until that minute is completed, at which time the next lower number illuminates and so forth, until the simulator is at the latest recorded point. The simulator then freezes and awaits further instructions.

Table 8-1. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
PLAYBACK - continued		
RESET switchlight	White	Terminates playback and returns simulator to condition existing when playback was initiated. FREEZE must then be released for trainee to regain control.
FLY OUT switchlight	White	Terminates playback; allows simulator to be flown out of existing playback condition when FREEZE is released.
TIMER		
RESET switchlight	White	Resets digital timer on CRT time display to 00:00.
START switchlight	Green	Starts digital timer on CRT time display.
STOP switchlight	White	Stops digital timer on CRT time display.
COMMUNICATIONS		
ICS switchlight	White	Allows instructor to communicate with trainees over radio.
FAC DATA REV switchlight	White	Allows instructor to reverse facility data on CRT.
FAC DATA ADV switchlight	White	Allows instructor to advance facility data on CRT.
RADIO OVERRIDE switchlight	White	Permits instructor/trainee communication regardless of radio selection status.
COMPUTER ROOM switchlight	White	Actuation permits instructor-to-computer room communications. Lamp blinks when call is initiated by computer room. Audible tone actuates in computer room when call is initiated by instructor.
OBS switchlight	White	Actuation permits conversation between instructor and observer (three-way if computer switch is active).
STUD MON switchlight	White	Actuation permits instructor and observer to monitor all trainee communication without regard to radio control selection status.
VHF 1 switchlight	White	Permits instructor-to-student communication using VHF receiver.

Table 8-1. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
COMMUNICATIONS - continued		
UHF switchlight	White	Permits instructor-to-student communication using UHF receiver.
VHF 2 switchlight	White	Permits instructor-to-student communication using VHF 2 receiver.
HF switchlight	White	Permits instructor-to-student communication using HF receiver.
TRAINING PROBLEM CONTROL		
PAGE ADV switchlight	White	Allows instructor to advance to next page.
PAGE REV switchlight	White	Allows instructor to back up to last page.
SLOW TIME switchlight	Green	Permits performance playback of demonstrations to occur at half normal speed. (No synchronized audio is available during slow time.)
MASTER MALF CLEAR	White	Clears all active malfunctions and CRT switchlight readout of same (The circuit breakers must be manually reset.)
INTERCHANGE CRT UP switchlight	White	Interchanges CFD and TSD between fore and aft CRT.
INTERCHANGE CRT DN	White	Interchanges GPD and AID between fore and switchlight aft CRT.
STORE PLOT switchlight	White	In training mode, actuation of this switchlight stores computer memory for on-line transfer to hardcopy, an instantaneous snapshot of forward CRT.
HOSTILE GND FIRE switchlight	White	Simulates hostile ground fire.
ALT SCALE CHANGE switchlight	White	Changes alt scale 0-2000 and 0-8000 TSD altitude time history plot.
A/C CENTER switchlight .	White	Redraws GPD background and track history centered on current aircraft location (TAC map will not function.)
TRACK ERASE switchlight	White	Temporarily erases ancient track history from GPD at 1/4" per second rate (oldest to newest). Momentary depression erases out-of- tolerance alerts on ground plot display (TAC map not applicable.)

Table 8-1. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
TRAINING PROBLEM CONTROL - continued		
PLOT SCALE CHANGE switchlight	White	Each depression expands map scale by factor of 2. Approach maps change from 24 x 24, to 12 x 12, to 6 x 6, to 24 x 24 . Cross-country map changes from 96 x 96, to 48 x 48, to 24 x 24, to 96 x 96 nm. The same geographic center is retained at all scales. Changes GCA scale from 10 nm to 2 nm when display is on aft CRT
CRASH OVERRIDE switchlight	White	Overrides simulator freeze caused by crash. Lamp blinks during crash freeze.
FREEZE switchlight steady.	White	Freezes all action when lamp illuminates Indicates initialization in progress when lamp blinks.
IC/MAP/LOAD LDSHP/DEMO/MALF		
Number Select (000-999) 3-digit thumbwheel	Black/ White	Allows selection of unique numbers available for problem control. These comprise initial conditions selection, GPD background map for display, demonstration selection, malfunction selection, load page selection, and leadship.
DELETE switchlight	White	Deletes malfunction or demonstration indicated on number select thumbwheel.
INSERT switchlight	White	Inserts IC, area map, malfunction, or demonstration indicated on number select thumbwheel.
INFO DIS PLAY & PRGM		
16-button raised-finger contact keyboard includes: 1, 2-N, 3, 4-W. 5 6-E, 7, 8-S, 9, -, 0, ., CLR, SP, *, and ENTR keys	White/ Black	Used to select/edit tabular data on AID CRT. This keyboard is used to activate/ deactivate parameter freezes, radio nav transmitters, and to modify IC set 11, environmental conditions, and aircraft weight and balance.

Table 8-2. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
INTERCOM		
VOLUME variable control	Black/ White	Adjusts volume in IOS headset.
LIGHTING		
OVHD INT variable control	Black/ White	Adjusts intensity of overhead lights.
IND LAMP TEST switchlight	White	Tests all IOS indicator and auxiliary control panel lamps.
IND LAMP INT variable control	Black/ White	Adjusts intensity of IOS indicator and auxiliary control panel lamps.
CREW CHIEF FUNCTIONS		
AFT HOOKED switchlight	White	When illuminated, indicates aft load hooked; when out, indicates load released.
CTR HOOKED switchlight	White	When illuminated, indicates CTR load hooked; when out, indicates load released.
FWD HOOKED switchlight	White	When illuminated, indicates FWD load hooked; when out, indicates load released
. MAINT PANEL TEST	White .	When illuminated, indicates maintenance switchlight panel test is in progress
VISUAL CONTROLS		
OPER/STBY switchlights	White	Applies power to visual system. (Chin OPER/STBY switchlight is not operational.)
MAINT/ON LINE switchlight	White	Selects visual system on-line or in maintenance mode.

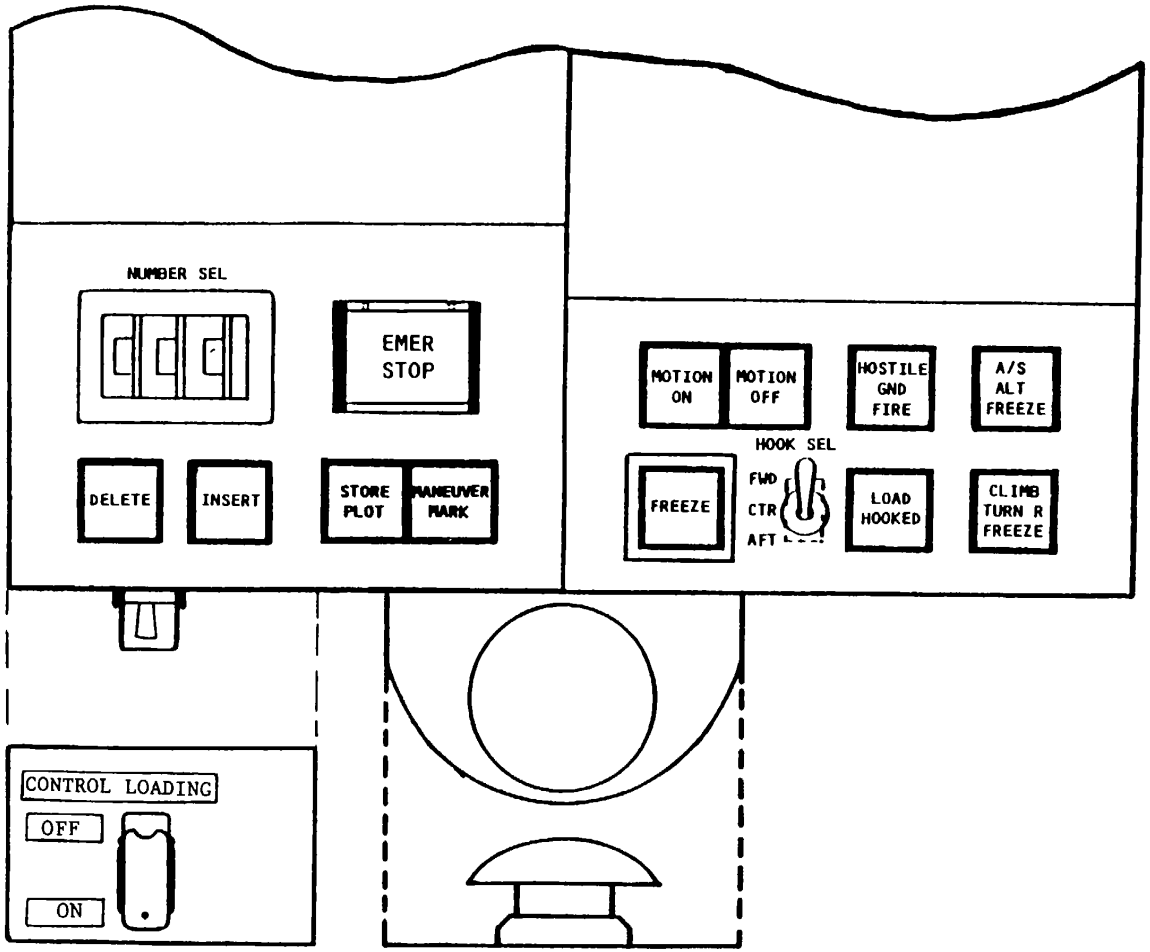


Figure 8-3. Auxiliary Control Panel

Table 8-3. IOS Forward Control Panel Controls and Indicators - Continued

Control/Indicator	Control	Function
IC/MAP/LOAD LDSHP/DEMO/MALF NUMBER SEL (000-999) 3-digit thumbwheel	Black/ White	Selects numbers for insertion/deletion of IC, map display, load page, malfunctions, leadship, or demonstrations.
EMER STOP guarded switchlight	Blue/ Green	Turns off power to entire simulator complex.
DELETE switchlight	White	Deletes malfunction or demonstration indicated by NUMBER SEL.
INSERT switchlight	White	Inserts IC, area map, malfunction, or demonstration indicated by NUMBER SEL.
STORE PLOT switchlight	White	Stores memory in training mode for transfer to hardcopy unit.
MANEWUV MARK switchlight	White	During demonstration formulation, creates and stores intermediate IC points to which the simulator can be moved.
MOTION ON switchlight	Green	With cockpit power on, activates motion system if all interlocks are satisfied. Lamp remains illuminated as long as motion is operable.
MOTION OFF switchlight	White	Deactivates motion system. Lamp remains illuminated when motion is off.
HOSTILE GND FIRE switchlight	White	Simulates hostile ground fire.
A/S ALT FREEZE switchlight	White	Freezes airspeed and altitude when activated.
FREEZE switchlight steadily.	White	Freezes all action when lamp illuminates Indicates initialization in progress when lamp blinks
HOOK SEL switch		Selects which hook (FWD, CTR, or AFT) will be used for pickup
LOAD HOOKED switchlight	White	Indicates simulated load is hooked and ready for transfer.
CLIMB TURN R FREEZE switchlight	White	When activated, freezes turn and climb rate.
Mushroom freeze switch	Yellow	Freezes all action when switch is depressed.
COPILOT CONTROL LOADING safety switch	Red/guarded cover	Deactivates motion system.

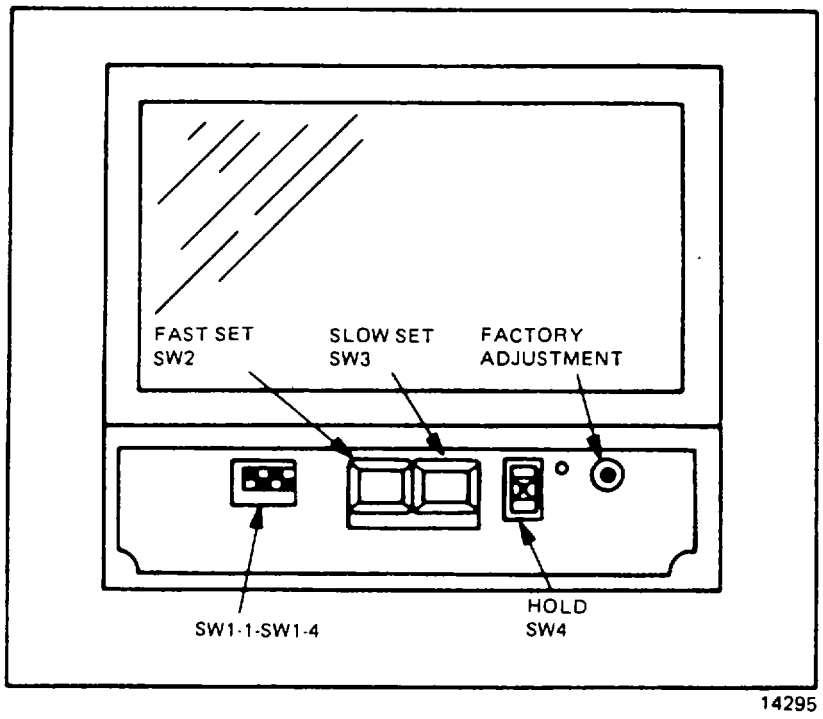


Figure 8-4. Digital Clock (Front View, Access Cover Removed)

Table 8-4. Digital Clock Controls

Control	Designation	Function
4/6-digit selector	SWi-1	Selects between 4-digit (down) and 6-digit (up) display (i.e., with or without seconds).
12/24-hour selector	SW1-2	Selects between standard 12-hour (up) format or 24-hour (military) (down) format.
Time base selector	SW1-3	Selects between 50-Hz (down) and 60-Hz (up) line frequency.
Pushbutton disable	SW1-4	Enables (up) or disables (down) time-set pushbuttons.
Fast set	SW2	Causes displayed time to advance quickly.
Slow set	SW3	Causes displayed time to advance slowly.
Hold	SW4	Freezes displayed time when up.

NOTE

A blue/green flip filter for NVG operations is also provided.

Section II. TRAINING ASSISTANCE CAPABILITIES

8-5. GENERAL DESCRIPTION.

8-6. The simulator includes two CRT displays and a hardcopy unit to aid problem control and monitoring, to provide performance history, and to allow critique and debriefing.

NOTE
If the hardcopy unit stops for any reason, the simulation computer also stops.

8-7. HARDCOPY PRINTOUT.

8-8. Any data displayed on the forward CRT can be recorded and printed as hardcopy.
Twenty recordings can be made by the instructor during a printing exercise.

8-9. GROUND PLOT DISPLAY.

8-10. Simulator progress within a simulated geographical area is plotted with respect to radio navigation facilities in either a game-centered or an aircraft-centered plot mode. One cross-country and nine approach backgrounds are available for aircraft-centered display. Five game-centered displays are available for tactical training.

8-11. During demonstration, ground plot display (GPD) map selection is automatic.

The map is displayed as it was selected, scaled, and centered during the formulation of the demonstration. The instructor can A/C CENTER and rescale the GPD display manually. (A typical GPD display is shown in figure 8-5.)

8-12. Map selection is made by the instructor during training mode operation.
Maps are selected by dialing the appropriate map number (030-045) on the 3-digit thumbwheel selector and then depressing the INSERT switchlight.

8-13. The visual system contains a total data base area of 8000 square kilometers for display in the OTW. Displays are either full-color video imagery or a scene compatible with night vision goggles (NVG). NVG images are reduced color displays.
The simulator gaming area is rectangular in shape and 80 kilometers by 100 kilometers in size. (This does not include the roll-on terrain (repetitive 5-km scene), which extends 80 NM from center of field select site.)

8-14. GCA/ILS DISPLAY.

8-15. The GCA/ILS display can be assigned to AID by selecting 050 on the thumbwheel selector, then depressing the INSERT switch. Azimuth, glidepath stylized plots are presented when altitude is less than 4000 feet AGL, range less than 10 nautical miles, and within +100 of the localizer. (A typical GCA/ILS display is shown in figure 8-6.)

8-16. The GCA/ILS display consists of two parts: the upper part, which shows aircraft vertical position and track, and the lower part, which shows aircraft horizontal position and track. The touchdown point is at the right of the display where the vertical and horizontal displays meet. The sloping lines on the vertical display show 12-degree. 8-degree, and 5-degree slopes. The lowest sloping line (unmarked) indicates the desired glideslope for the selected facility. Thus, if

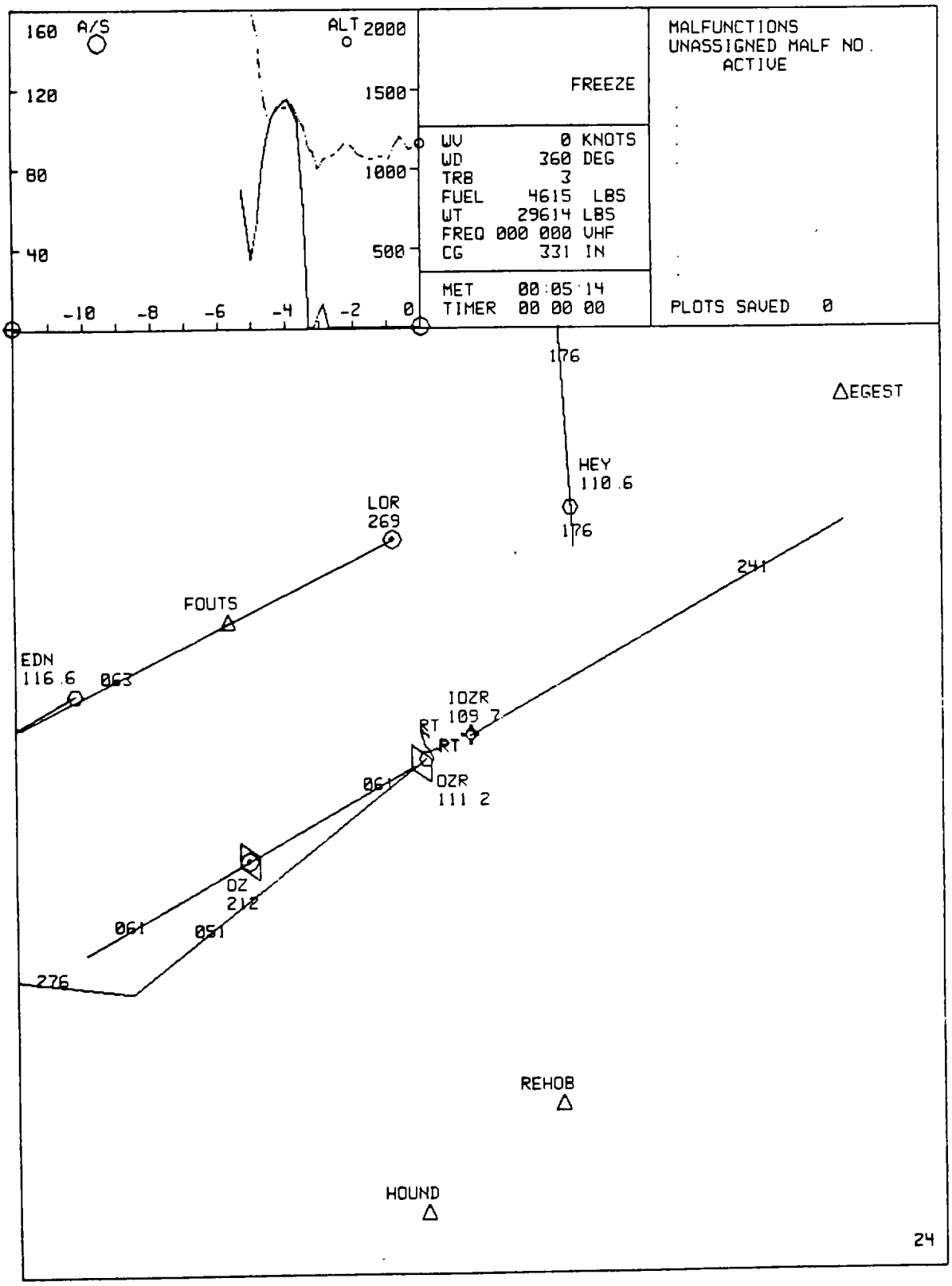


Figure 8-5. Typical GPD (Approach Map) Display

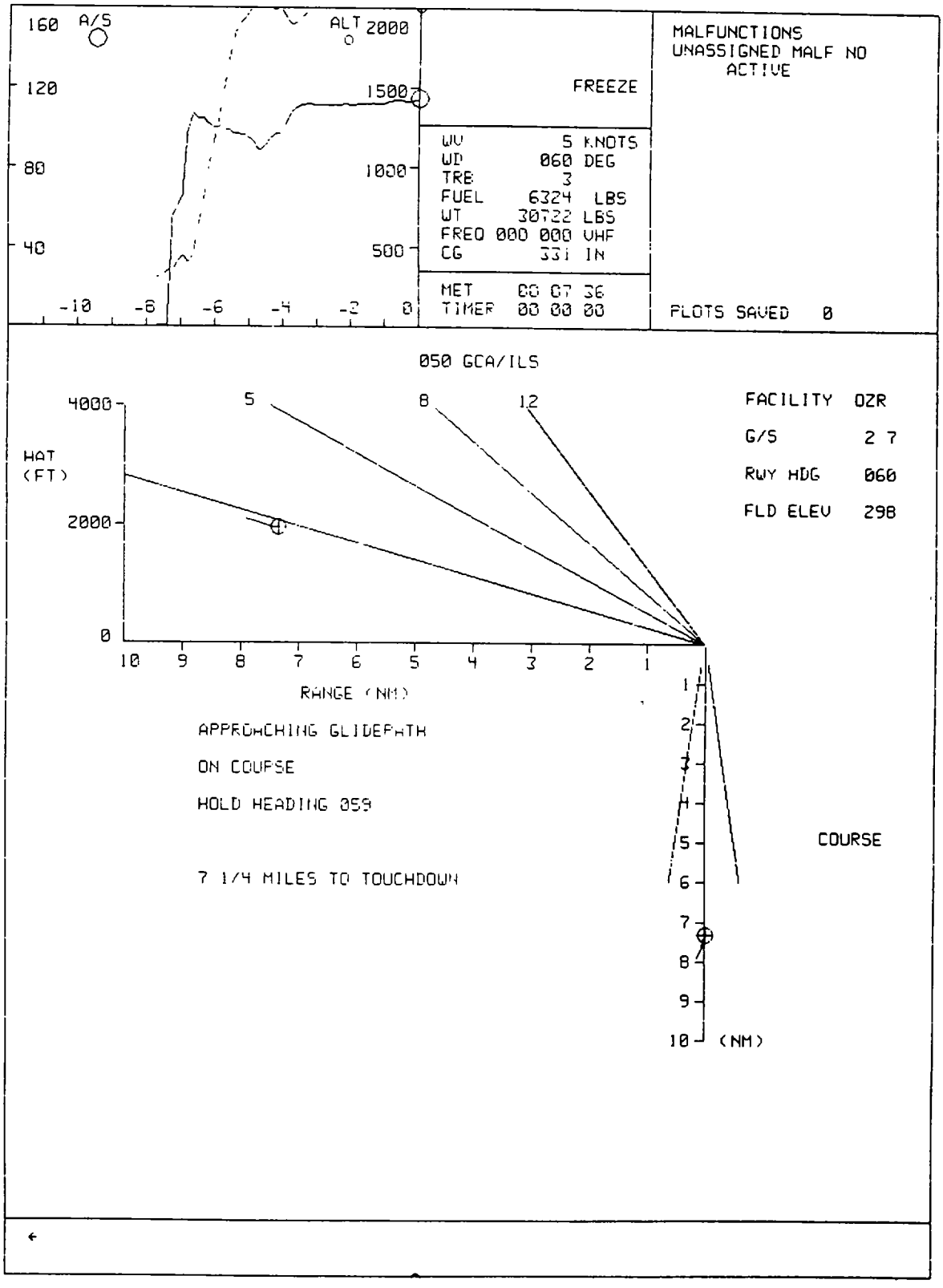


Figure 8-6. Typical GCA/ILS Display

the selected airport had a glideslope of 2.7 degrees, the flight instrument in the cockpit and the verbal guidance shown on the display would tend to guide the aircraft down a track that follows the lowest reference line. When the aircraft comes within range of the GCA/ILS display, each part of the display shows the aircraft position and track. Flight director instructions appear on the screen as appropriate. These can be read to the pilot or copilot by the instructor operator.

8-17. A maximum of five lines of precision approach radar (PAR) commands can be displayed below the glidepath plot and left of the azimuth plot. If a line contains no information useful to the problem, the line is blanked, and the lower lines are moved up. PAR commands consist of the following:

a. Line 1, a variable field, consists of short statements concerning the progress of the aircraft in the PAR mode. The message is displayed for 30 to 60 seconds, then the line is blanked. Variable field messages consist of:

Approaching glidepath
Begin descent
At decision height
Over approach lights
Over landing threshold

b. Line 2 course information messages consist of:

Well left/right of course	- within 1.5º
On course	- within .5°
Slightly left/right of course	- within 1º

c. Line 3 turn to heading information messages.

d. Line 4 glidepath information messages consist of:

Well above/below glidepath	- within 0.42º
On glidepath	- within 0.14°
Slightly above/below glidepath	- within 0.28º

e. Line 5 consists of touchdown distance information. Distance in nautical miles to touchdown is expressed in mixed numbers, with fractional readout updates in 1/4-mile increments.

8-18. Facility-centered approach plot data is provided in table 8-5. Landing area beacon data is provided in table 8-6.

8-19. EXTERNAL LOAD OPERATIONS.

8-20. Four types of external loads can be simulated: light load, high-density (HD) load, aerodynamic load, and tandem load. Six different loads are simulated.
(See table 8-7.) Information about each load is shown on one of the six load meter display pages. (see figure 8-7.) These pages show the CRT page number, load number and type, and load location (latitude/longitude). The load heading is indicated for both tandem and aero loads.

Table 8-5. Facility-Centered Approach Plots

SELECT	LOCATION	CALL	LATITUDE	LONGITUDE
		NOTE **Approach plot data is subject to change according to gaming area and training requirements.**		
031	TODENDORF	TDF	N35 50 04	W56 49 24
032	CAIRNS	OZ	N31 15 00	W85 42 00
033	DANNELLY	MGM	N32 19 30	W86 24 00
034	DOTHAN	DHN	N31 15 00	W85 25 00
035	HANCHEY	HEY	N31 21 00	W85 32 00
036	LAWSON	LS	N32 15 48	W84 55 50
037	PANAMA CITY	IPFN	N30 13 00	W85 41 00
038	PENSACOLA	PN	N30 25 30	W87 15 00
039	TALLAHASSEE	ITLH	N30 24 00	W84 21 00
040	TROY	TOI	N31 49 52	W86 06 52

Table 8-6. Landing Area Beacons

TYPE	IDENTIFICATION	FREQUENCY	ELEVATION	LATITUDE	LONGITUDE
CLA	XLW	329	512	N35 37 34	W57 00 29
PLA	XPN	374	1352	N35 42 54	W57 16 07
CLA	AVN	333	512	N35 26 12	W57 17 00
CLA	WGR	370	512	N35 44 48	W57 22 05
MA	XBZ	264	512	N35 55 08	W57 26 14
MA	XAE	388	512	N35 22 53	W56 51 46
MA	XFR	341	512	N35 42 38	W57 09 38
MA	XGY	382	512	N35 27 22	W57 30 19
CLA	XMD	352	1612	N35 28 56	W57 29 28
CLA	TBS	390	1612	N35 50 05	W57 32 16
CLA	DRG	350	512	N35 31 37	W56 55 11
MA	XDR	231	512	N35 23 05	W57 10 48
AAF	GPM	310	512	N35 20 05	W57 27 18
CLA	XBB	239	612	N35 50 38	W57 20 57
AAF	TDF	320	512	N35 50 04	W56 49 24

PLA - Pinnacle area; CLA = Confined landing area; MA = Marshalling area: AAF = Army airfield

Table 8-7. Sling Load Characteristics

Load No.	CRT page	Load Type	Item simulated	Weight (lb)	Sling (feet)	Hook preference
1	061	Light load	Two fuel bladders	7,008	14	Any
2	062	Light load	Two fuel bladders	7,008	14	Any
3	063	Light load	Two fuel bladders	7,008	14	Any
4	064	High-density load	M-198 Howitzer	18.000	12	CTR
5	065	Aerodynamic load	AH-64 Apache	11,015	20	CTR
6	066	Tandem load	Military van	20,000	16	FWD
					14	AFT

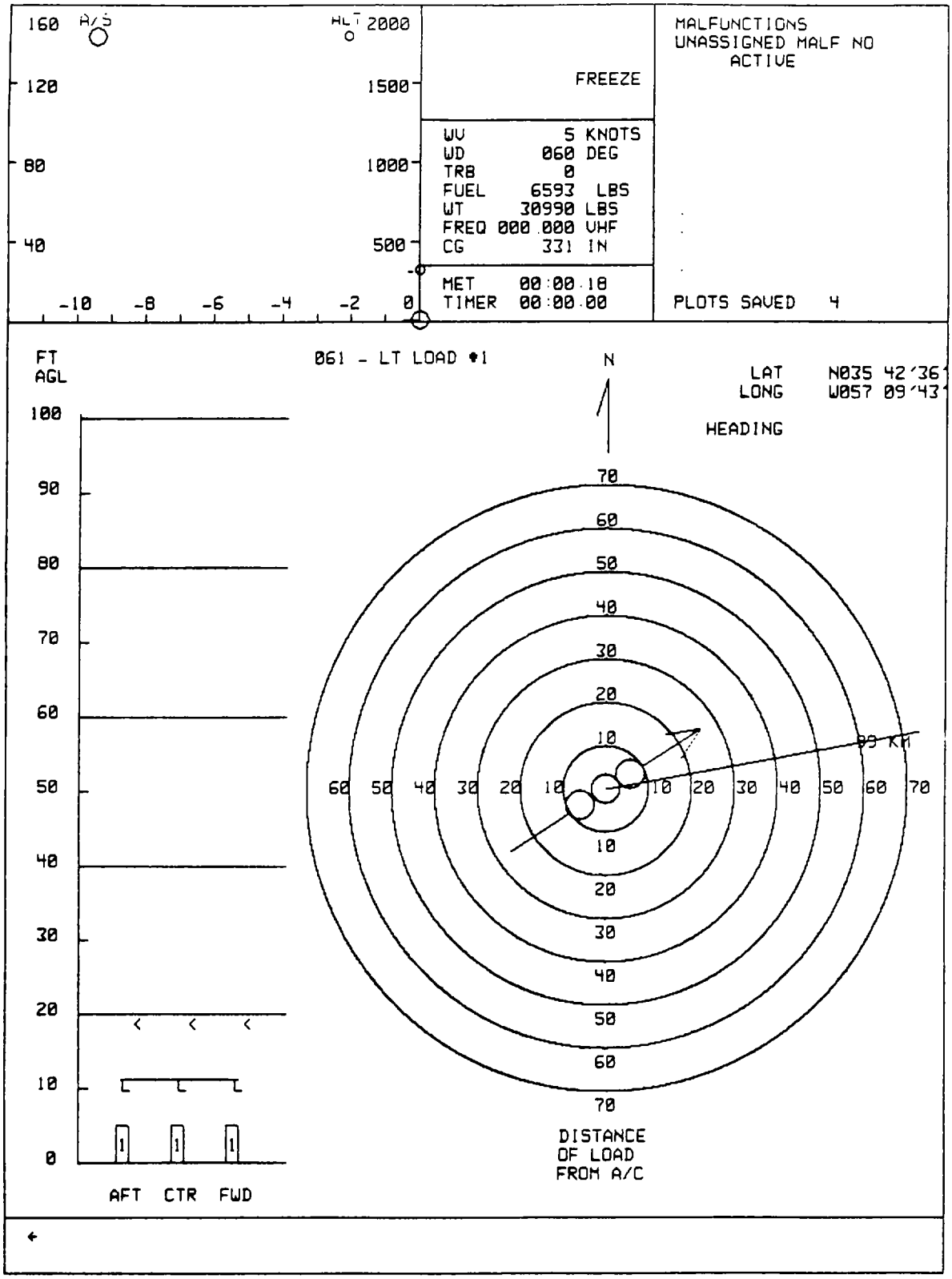


Figure 8-7. Typical Load Display (Sheet 1)

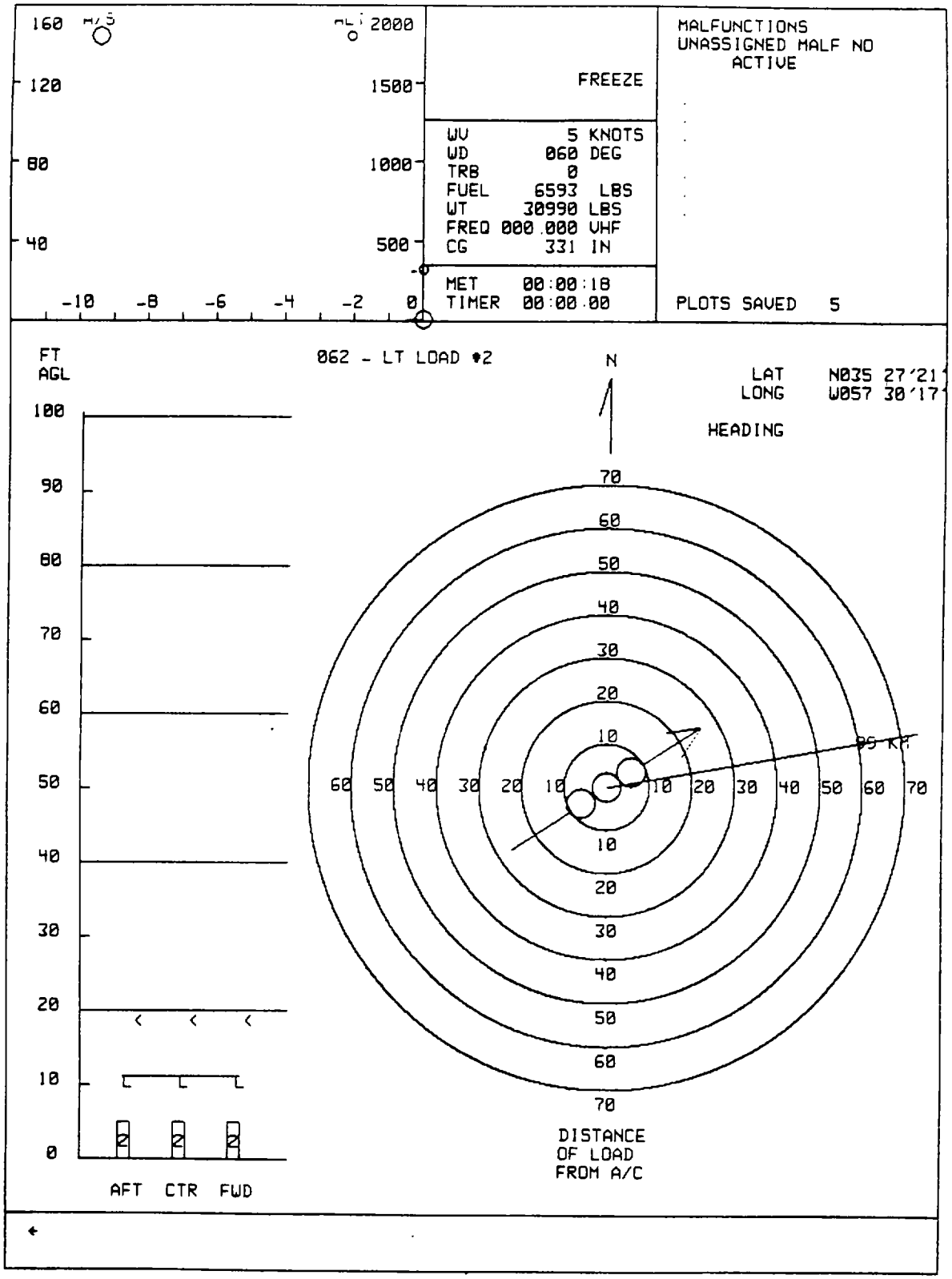


Figure 8-7. Typical Load Display (Sheet 2)

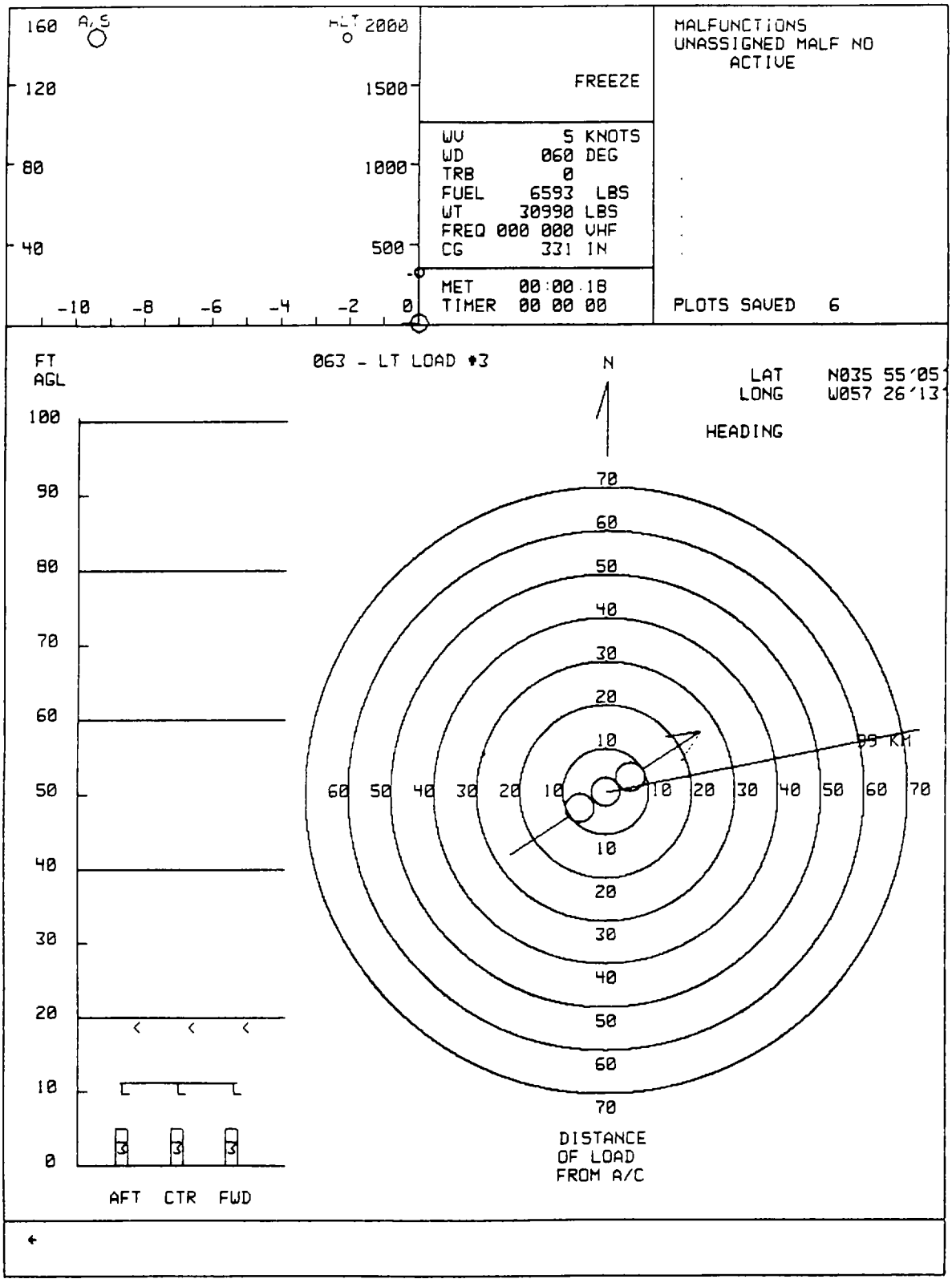


Figure 8-7. Typical Load Display (Sheet 3)

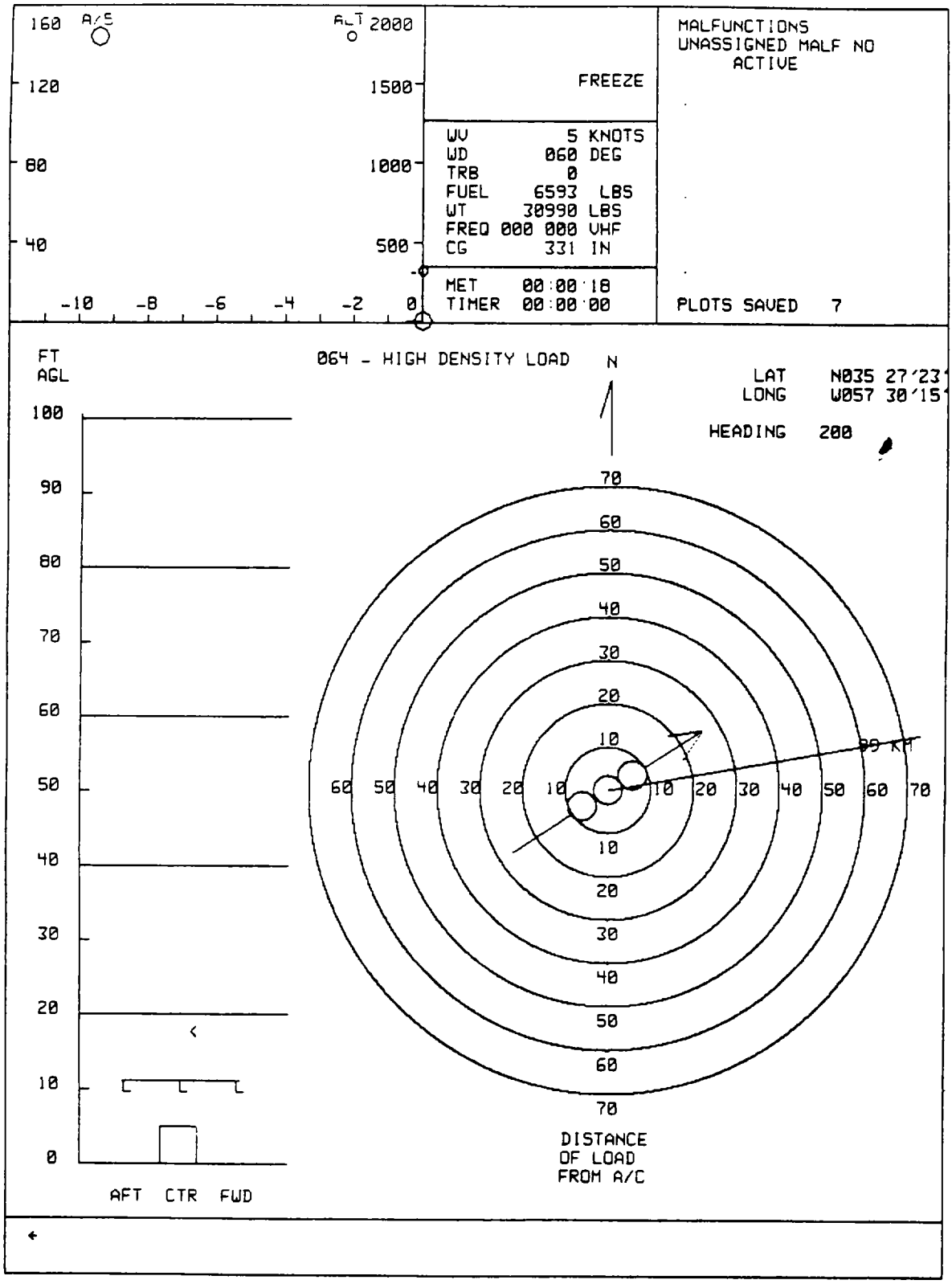


Figure 8-7. Typical Load Display (Sheet 4)

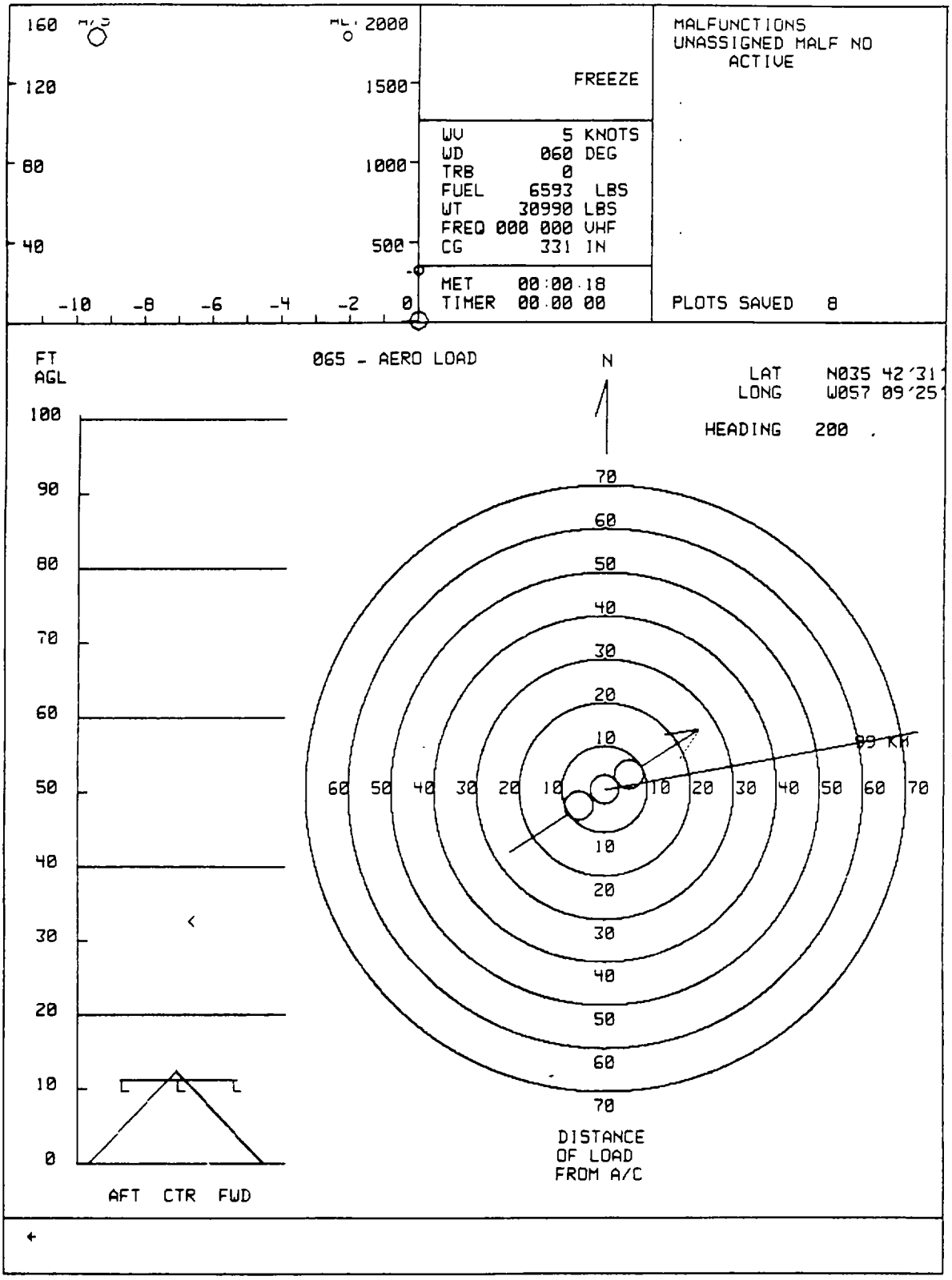


Figure 8-7. Typical Load Display (Sheet 5)

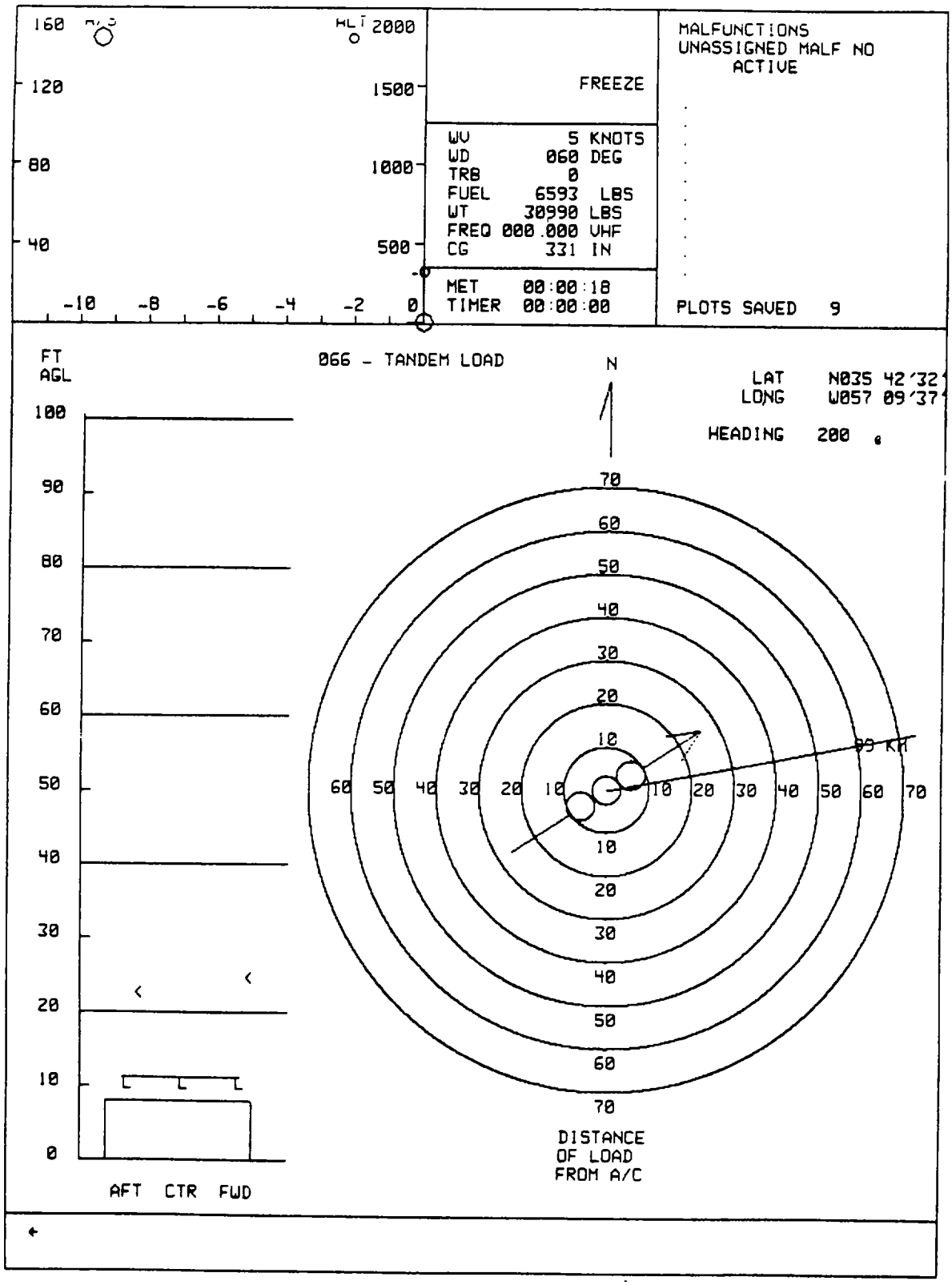


Figure 8-7. Typical Load Display (Sheet 6)

8-21. Two types of graphic representation are shown on the load meter display pages: a vertical altitude scale, and an aircraft centered, north up, horizontal scale. The altitude scale goes from 0 to 100 feet above ground level (AGL). The scale shows a representation of the load, and arrows (less than symbols) show the height where the slings become taut. A representation of the aircraft and sling hooks is also shown.

8-22. The horizontal display shows the bearing and distance to the load. The aircraft symbol, three circles and an arrow, remain centered in the display and indicates the aircraft heading. If the load is within the 70-foot radius (largest circle), then it is represented on the display. If the load is beyond the 70-foot radius, its bearing is indicated by a line coming from the aircraft, and its distance is indicated on that line in kilometers.

8-23. During load exercises, the instructor operator has the responsibility of acting as flight engineer. This involves verbally directing the pilot over the load, hooking the load, and telling the pilot to lift the load. In the simulator, hooking the load consists of pressing the appropriate button on the IOS aft control panel (AFT HOOKED, CTR HOOKED, or FWD HOOKED). On the auxiliary control panel, the toggle switch is used to select FWD, CTR, or AFT. Then the LOAD HOOKED button is pressed. Once the load is hooked and lifted, simulated flight characteristics change accordingly. Pressing the cargo hooked switches with a load attached causes the load to be released. (Required hook combinations for each load are shown in table 8-7.)

8-24. COMM/FACILITY DISPLAY.

8-25. The comm/facility display (CFD) data comprises the facility data when operating in the training mode. The first page of the selected approach map facility data is assigned to the CFD whenever a map is selected. Data consists of field elevation, departure and approach control frequencies, tower frequencies, ground control frequencies. and missed approach instructions. (See figure 8-8.)

8-26. DEMONSTRATION.

8-27. Up to 20 demonstration flights, each lasting up to 20 minutes, can be created. Each demonstration flight can be accompanied by a recorded audio briefing of up to 10 minutes and a recorded audio commentary of up to 20 minutes. A demonstration flight can be played back at either normal-speed or half-speed. Audio commentary is not included when half-speed is used.

8-28. Audio on the simulator is recorded in digital format on disk, using the digital voice system (DVS). The audio reaching the pilot or copilot headsets is recorded by the DVS when in the audio record mode and the IOS STUD MON switchlight is illuminated.

8-29. Each demonstration flight can be segmented by placing up to nine maneuver marks in it. Maneuver marks are primarily intended to allow division of a demonstration into smaller maneuvers or flight segments. Upon playback, a demonstration can be started from the beginning or from any maneuver mark point. Audio commentary is available when starting at a maneuver. Maneuver marks can also be used as starting points for rerecording a demonstration to correct errors. It is also useful to have a maneuver mark near the end of a demo to facilitate adding to the demo.

8-30. Creation of the demo flight is done in phases:

a. Record demo flight by flying the simulator.

b. Correct any errors in demo flight.

c. Record audio briefing and commentary.

NOTE

Demo dynamics must be recorded before the audio is recorded.

8-31. RECORDING THE DEMONSTRATION FLIGHT.

8-32. Before starting the recording procedure, work out a detailed scenario of the flight, including instructor actions, maneuver mark placements, and audio commentary.

NOTE

The demo playback repeats instructor station CRT display selection and interactions as well as cockpit actions. Therefore, if particular displays are desired during the demo, they must be selected during the demo recording.

8-33. Record demo flight dynamics as follows:

a. Prepare simulator for flight.

b. Place simulator in freeze mode.

c. Depress DATA CLEAR switchlight.

d. Set up cockpit to desired configuration.

e. Initialize to desired starting point by using an existing IC or an edited IC or by flying simulator to desired starting point.

f. Select desired IOS displays.

g. Select demo number to be recorded on IOS thumbwheels; i.e., 100, 110 ...290.

h. Depress DEMO RECORD switchlight.

i. Depress thumbwheel INSERT switchlight. If demo already exists, ENTRY ALREADY EXISTS message is displayed. To delete demo and allow rerecording, depress INSERT switchlight again. While demo is being deleted, WAIT message is displayed, followed by PROCEED WITH DEMO RECORD message. Clear message by depressing CLEAR key on keyboard.

j. Make a last check and prepare to fly simulator.

k. Depress FREEZE switchlight. Start flying demo. Recording process has started. Cockpit controls and instructor interactions are being recorded for future playback.

l. At planned maneuver points, depress MANEUV MARK switchlight on instructor/pilot control panel. Up to nine maneuver marks can be inserted.

m. Depress FREEZE switchlight to halt recording.

n. Depress thumbwheel DELETE switchlight. DEMO RECORD light extinguishes. Recording process is terminated. Demo just recorded has been saved on disk.

8-34. CORRECTING THE DEMONSTRATION FLIGHT.

8-35. The recorded demo can be rerecorded to correct errors or add additional material. The rerecording process can start either at the beginning of the demo or at any maneuver mark. In either case, the remainder of the demo must be rerecorded in order to retain demo continuity. If the demo is to be rerecorded from the start, follow the steps outlined in paragraph 8-33. If rerecording from a maneuver mark, proceed as follows:

a. Initialize simulator to starting maneuver mark point:

(1) Set IOS thumbwheels to maneuver number.

(2) Depress thumbwheel INSERT switchlight.

NOTE

The first two thumbwheel digits represent the demo number and the third digit the maneuver number. For example, a selection of 100 would represent start of demo, 101 first maneuver mark, and 109 ninth or last maneuver mark.

NOTE

While the simulator is initializing, the freeze lamp blinks and goes steady when initialization is complete.

(3) Depress thumbwheel DELETE switchlight.

b. Set up cockpit and IOS to desired configuration.

c. Switch record mode:

(1) Depress DEMO RECORD switchlight.

(2) Depress thumbwheel INSERT switchlight. FREEZE lamps flash while setting up for recording and then stop with PROCEED WITH DEMO RECORD message displayed. Remainder of demo from maneuver mark on has been deleted and must be rerecorded.

d. Make a last check and prepare to fly simulator.

e. Depress FREEZE switchlight. Start flying demo from maneuver mark. Refly demonstration or add to it and insert maneuver marks where planned, using MANEUV MARK switchlight as instructed in paragraph 8-33.

f. Depress FREEZE switchlight.

g. Depress thumbwheel DELETE switchlight. DEMO RECORD lamp extinguishes. Recording process is terminated. Demo just recorded replaces previously recorded demo, starting at selected maneuver point. If audio was already recorded, that must also be rerecorded, starting at selected maneuver point.

8-36. RECORDING THE AUDIO BRIEFING.

8-37. To record audio briefing, proceed as follows:

a. Select CRT page 020. Edit environmental sound to zero to reduce background noise.

b. Depress STUD MON and ICS switchlights at IOS.

c. Set volume to a comfortable level.

d. Select demo number (for which audio will be recorded) on IOS thumbwheels; i.e., 100, 110 ... 290.

e. Depress thumbwheel INSERT switchlight. Simulator initializes to start of demo. FREEZE lamp blinks and then goes steady. DEMO REPLAY ACTIVE message is displayed.

f. Depress AUDIO RECORD ENABLE switchlight.

g. Prepare to speak briefing.

h. Depress DEMO BRIEF RECORD switchlight to start recording briefing.

i. Speak briefing while keying microphone.

j. Depress DEMO BRIEF RECORD switchlight to end recording of briefing. DEMO BRIEF RECORD and AUDIO RECORD ENABLE lamps extinguish.

k. Depress thumbwheel DELETE switchlight. DEMO REPLAY ACTIVE message disappears.

NOTE
Briefings are recorded in freeze.

8-38. RECORDING THE AUDIO COMMENTARY.

8-39. To record audio commentary, proceed as follows:

a. If commentary is not recorded at the same time as briefing, repeat steps a. through d. in paragraph 8-37.

b. Depress thumbwheel INSERT switchlight. Simulator initializes to start of demo. FREEZE lamps blinks and then goes steady. DEMO REPLAY ACTIVE message is displayed. At this time, briefing message is played back. At end of briefing, simulator remains in freeze.

c. Depress AUDIO RECORD ENABLE switchlight.

d. Depress COMMENTARY RECORD switchlight.

e. Prepare to speak commentary.

f. Depress FREEZE switchlight. FREEZE lamp extinguishes. Demo begins playing back.

g. Speak commentary while keying microphone as demo proceeds according to prescribed scenario.

h. At end of demo, AUDIO RECORD ENABLE and COMMENTARY RECORD lamps extinguish.

i. Depress thumbwheel DELETE switchlight. Commentary audio has been recorded.

8-40. PLOT STORE.

8-41. During training mode, the forward CRT contents can be stored on disk for later recall or for printing as hardcopy. Twenty plot stores can be made before printing. Each plot store is called a snapshot. A snapshot is produced each time the IOS STORE PLOT switchlight is depressed.

8-42. PRINT PLOT.

8-43. After all plots are stored, a printout of the stored plots (snapshots) can be requested from the hardcopy unit. When the printout is complete, the PRINT PLOT indicator extinguishes, and a message is displayed that more plots can be stored. Average time for one snapshot is 45 seconds from storage to printing.

8-44. ADMINISTRATIVE INTERCOMMUNICATION SYSTEM.

8-45. Private communication between the IOS and the computer room or between the IOS and observer is provided via an administrative ICS network. When the COMP ROOM switchlight at the IOS is illuminated, an alerting bell rings in the computer room. (This alerting bell is reset when the call is answered in the computer room.) If the computer room initiates a call, the COMP ROOM switchlight blinks until the call is answered at the IOS. When the OBS switchlight is illuminated, private communication with the observer is possible. Simultaneous actuation of the OBS and COMP ROOM switchlights allows three-way communication over the private ICS network.

8-46. ENVIRONMENTAL/VISUAL CONDITIONS.

8-47. Environmental and visual conditions can be edited by selecting CRT page 020 or 021. Edit appropriate line by typing the line number, depressing the SPACE key, typing the value, and depressing the ENTER key.

8-48. On CRT page 020, environmental conditions (items 13 through 20) can be edited within the limits shown in table 8-8.

8-49. PARAMETER FREEZE.

8-50. Aircraft flight parameters can be frozen selectively at the IOS by editing lines 1 through 12 on current conditions page 020. Frozen parameters are flagged by an asterisk (*). To freeze a parameter, type: LINE NO., SPACE, *, ENTER. To unfreeze a parameter, type: LINE NO., SPACE, ENTER.

8-51. SOUND LEVELS.

8-52. The environmental aircraft sound level (O 9) can be changed by editing the current conditions table on the auxiliary information display (AID). To change sound level, type 20, ENTER. The appropriate line can then be edited. This process requires use of the keyboard to type: LINE NO., SPACE, 0-9, ENTER. The sound level can also be reduced to its lowest level by pressing AURAL CUE VOL-LO switchlight.

Table 8-8. Editable Environmental Conditions CRT Page 020

Line No.	Abbreviation	Description	Ranges
13	FUEL	Total fuel quantity	0 - full capacity
14	LAT	Ownship latitude	N/S deg., min., sec.
15	LONG	Ownship longitude	E/W deg., min., sec.
16	CG	Center of gravity variable 250 - 400	Depends on gross wt
17	GRWT	Gross weight	27,890 - 60.000 lb
18	BARO	Barometric pressure	27 - 31,99999 in. Hg
19	OAT	Outside air temperature	-50 - +500C
20	WV	Wind velocity	0 - 64 knots
21	WD	Wind direction	0 - 360°
22	TRB LVL	Turbulence level	0 - off, 9 - max.
23	SND LVL	Sound level	0 - off. 9 - max.
24	GRND PWR	Connected to external ground power	ON - off
25	CAIRNS WX	Selects ATIS weather message	0 - off. 1-4 message
26	SEAT SHAKER	Activates seat shaker	on - off
27	ICING ENABLE	If OAT below freezing, allows simulated ice to degrade flight performance	On - off
28	REFILL EXP	Refills expendable stores	On - off

NOTE

Expendable stores include battery charge, APU start accumulator, flares, and precharge of cargo hook.

29	CLR SAVED PLOTS	Takes saved plots back to zero	On - off
30	NVG VIS TRAINING	Prevents unexpected selection of normal scene illumination during NVG training	On - off

8-53. CRASH/FREEZE/CRASH OVERRIDE.

8-54. All simulator action can be frozen at any instant by depressing any of the three FREEZE switchlights on the IOS or auxiliary control panel. FREEZE lights stay on when freeze mode is active, indicating that the freeze condition can be removed by depressing a FREEZE switchlight.

8-55. If a crash occurs, the simulator is placed in a crash freeze mode, which is indicated by illumination of CRASH lights on the segment light panel, and by the CRASH OVERRIDE light blinking at the IOS. Depressing the FREEZE switchlight does not override the crash status. The crash can be eliminated by initializing an IC set or bypassing it, using the CRASH OVERRIDE switchlights, returning the simulator to a normal freeze status. (Table 8-9 lists crash limits.)

Table 8-9. Crash Parameters

Parameters	Crash limits
Bank angle (RL) right/left	70°
Pitch (PT) up/down	50°
Torque (TQ)	260% (dual-engine total) 150% (single-engine)
Rotor rpm (RR)	>120% maximum
Vertical speed (Vs)	5500 fpm maximum up or down in air 1000 fpm maximum touchdown (within 9 feet of terrain)

Section III. CRT DISPLAYS

8-56. GENERAL DESCRIPTION.

8-57. The CRT displays consist of forward and aft CRT's formatted as shown in figure 8-8. Data can be interchanged between displays, and any data displayed on the forward CRT can be recorded and printed on the hardcopy unit. The display system has controls for focus, intensity, and contrast for each CRT.

8-58. FORWARD CRT.

8-59. The forward CRT contains the trainer status display (TSD) in the top 4 inches of the display, the auxiliary information display (AID) in the center 10 inches of the display, and the scratchpad in the lower 2 inches of the display.

8-60. The TSD contains airspeed/altitude time history, malfunction status, trainer and environmental conditions status, time, and alerts. (See figure 8-9.) The alerts area displays any errors in key aspects of student performance, such as altitude, airspeed, and rotor speed. Items in the TRN and ENV status area, such as wind velocity (WV) and wind direction (WD), are self-explanatory. The frequency displayed shows frequency and radio set of the last transmission.

8-61. The AID displays data such as initial conditions, current conditions, malfunction lists, and navigation station facility data. During load operations or ILS/GCA operations, a stylized display can be selected for display on the AID. An index presents a listing of the data available. The index is shown automatically when the simulator is turned on. (See figure 8-10.)

8-62. AFT CRT.

8-63. The upper 4 inches of the aft CRT display contains the communications facility data (CFD). The lower 12 inches are used for the ground plot display (GPD). (Data that can be transferred into the GPD area of the CRT is discussed in Section II of this chapter.)

8-64. Displays that can be transferred onto the AID area are:

Initial conditions
Current conditions
GCA/ILS display
Load meter (sling load) display
Malfunctions
NAV facilities

8-65. The area maps are presented on the GPD. The PLOT STORE switchlight on the IOS forward control panel is used to produce a hardcopy of the displays on the forward CRT. To get hardcopy printouts of the GPD's and other items on the aft CRT, the displays must be switched, using the INTERCHANGE CRT UP and/or INTERCHANGE CRT DOWN switchlights.

8-66. A typical current conditions display is shown in figure 8-11. A typical NAV facilities group display is shown in figure 8-12. Examples of the remaining CRT displays are shown in figure 8-13.

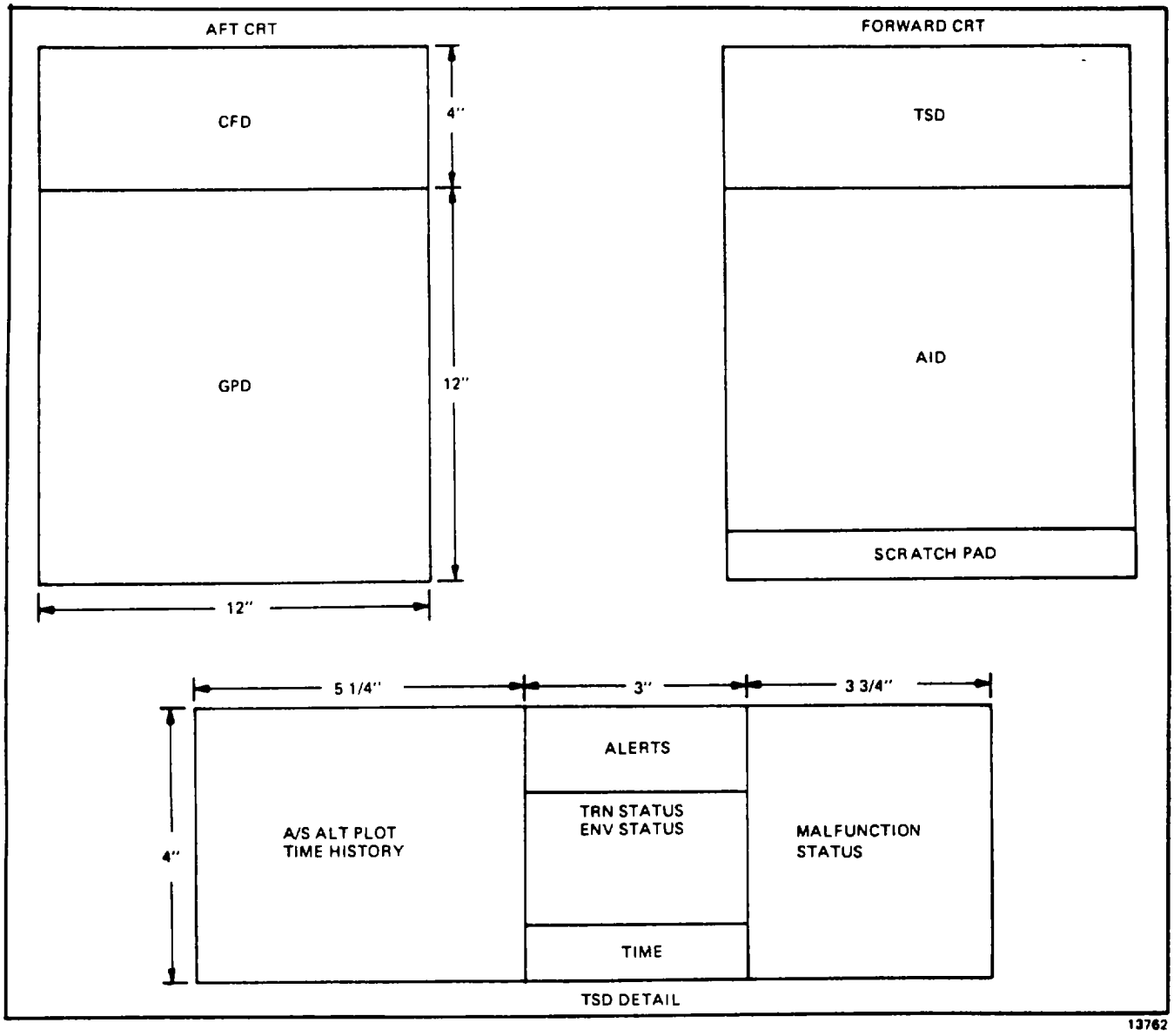


Figure 8-8. CRT Display Format

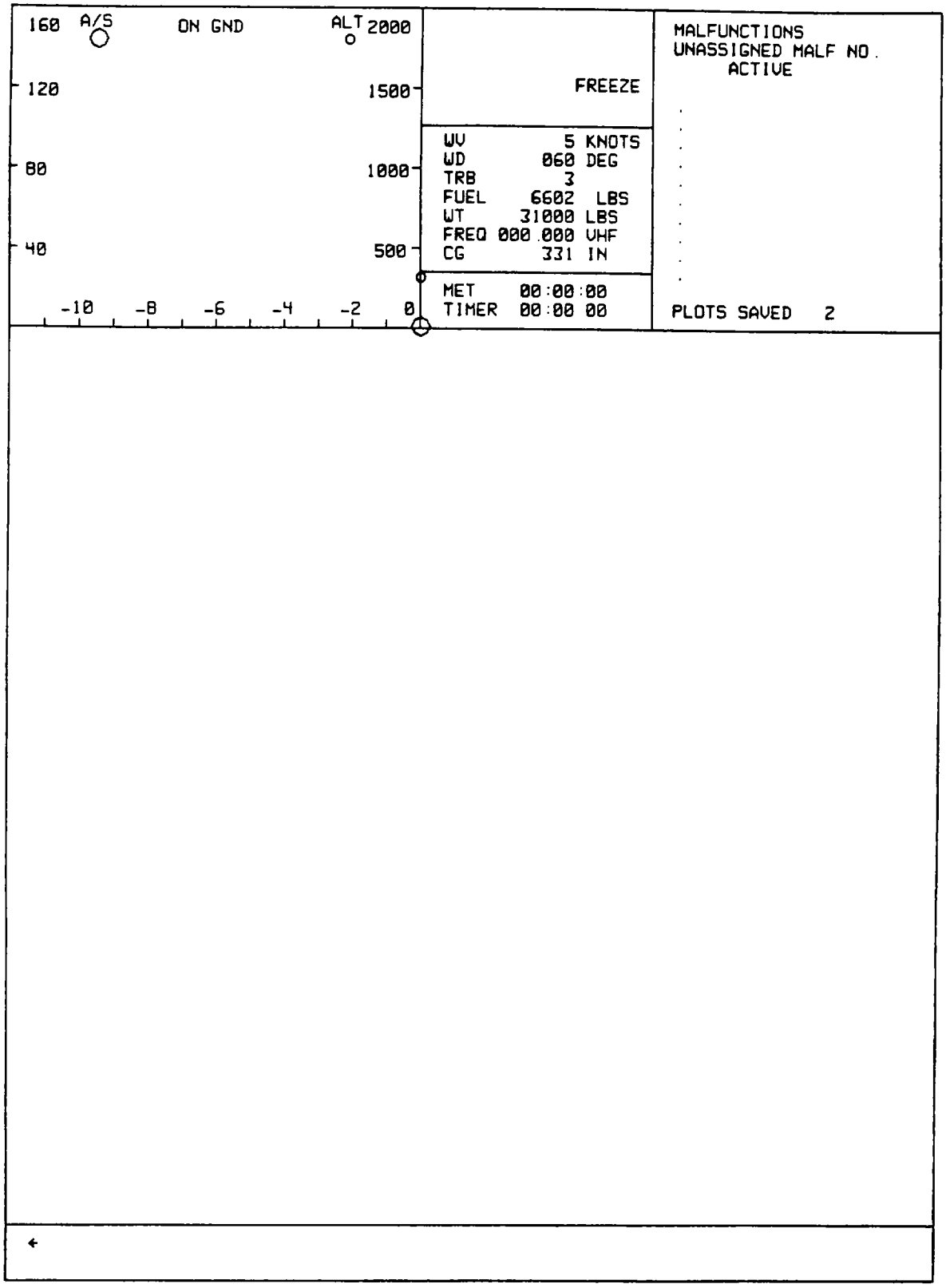


Figure 8-9. Typical TSD Display

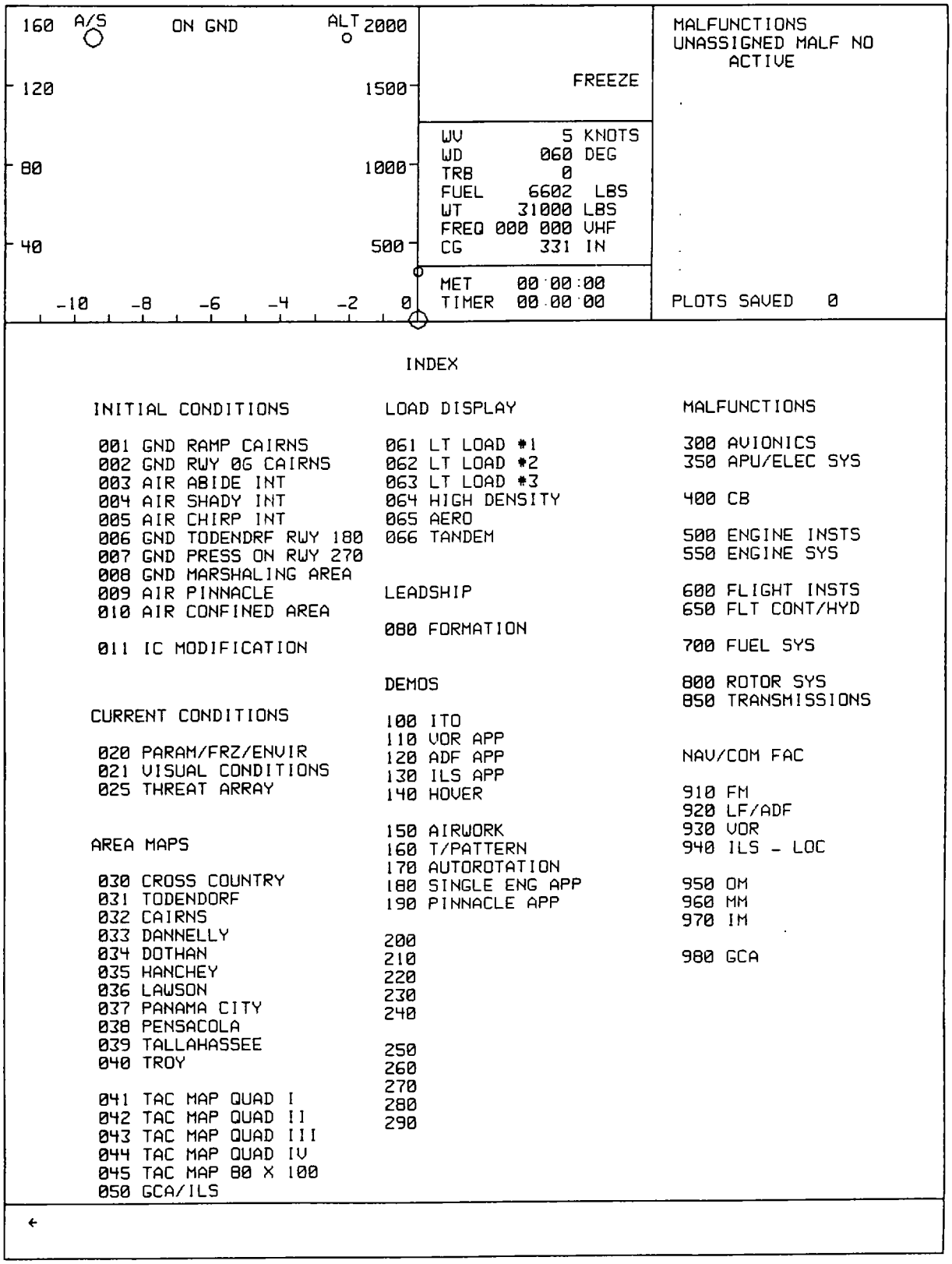


Figure 8-10. Typical Index Display

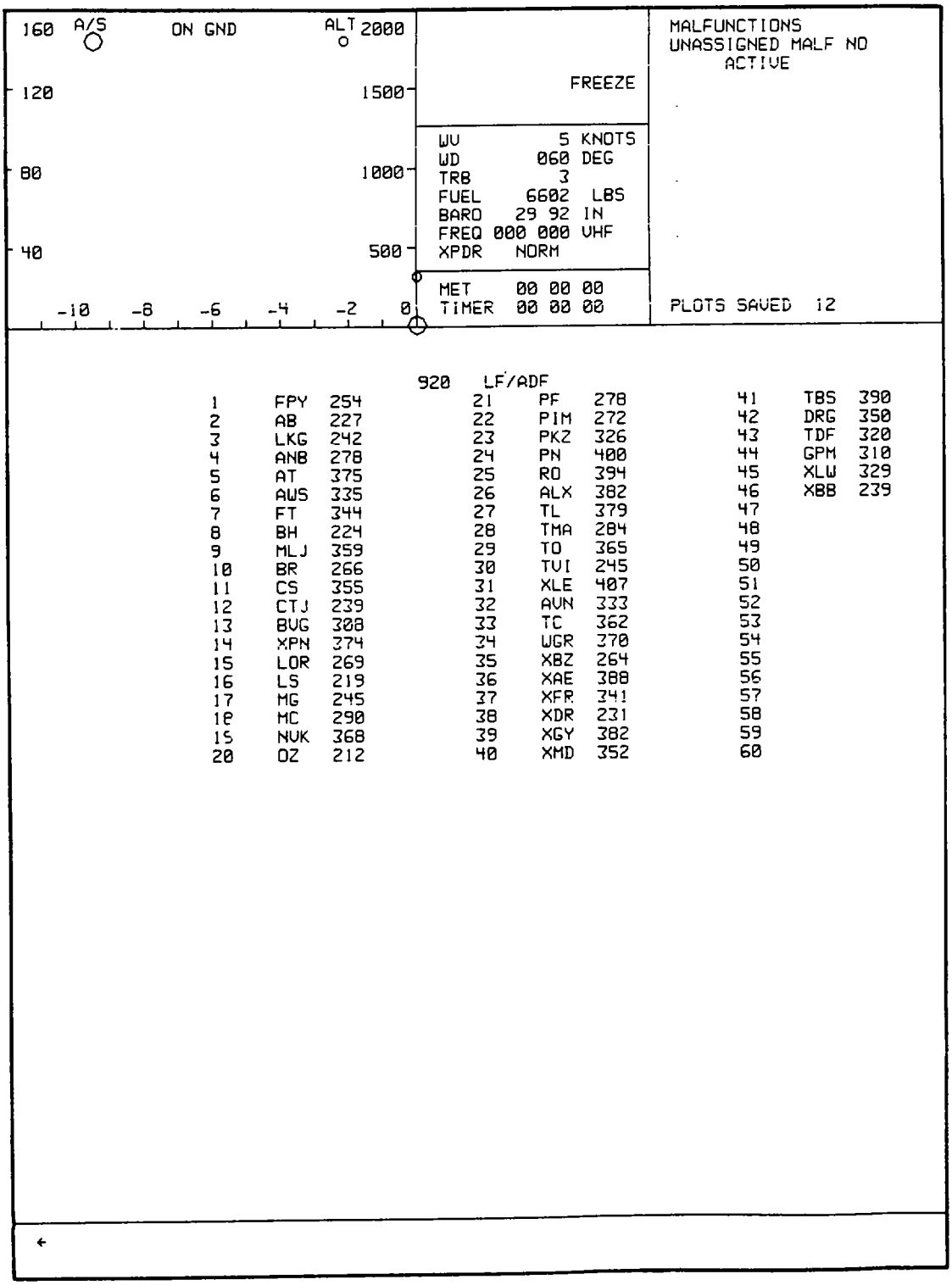


Figure 8-11. Typical Current Conditions Display

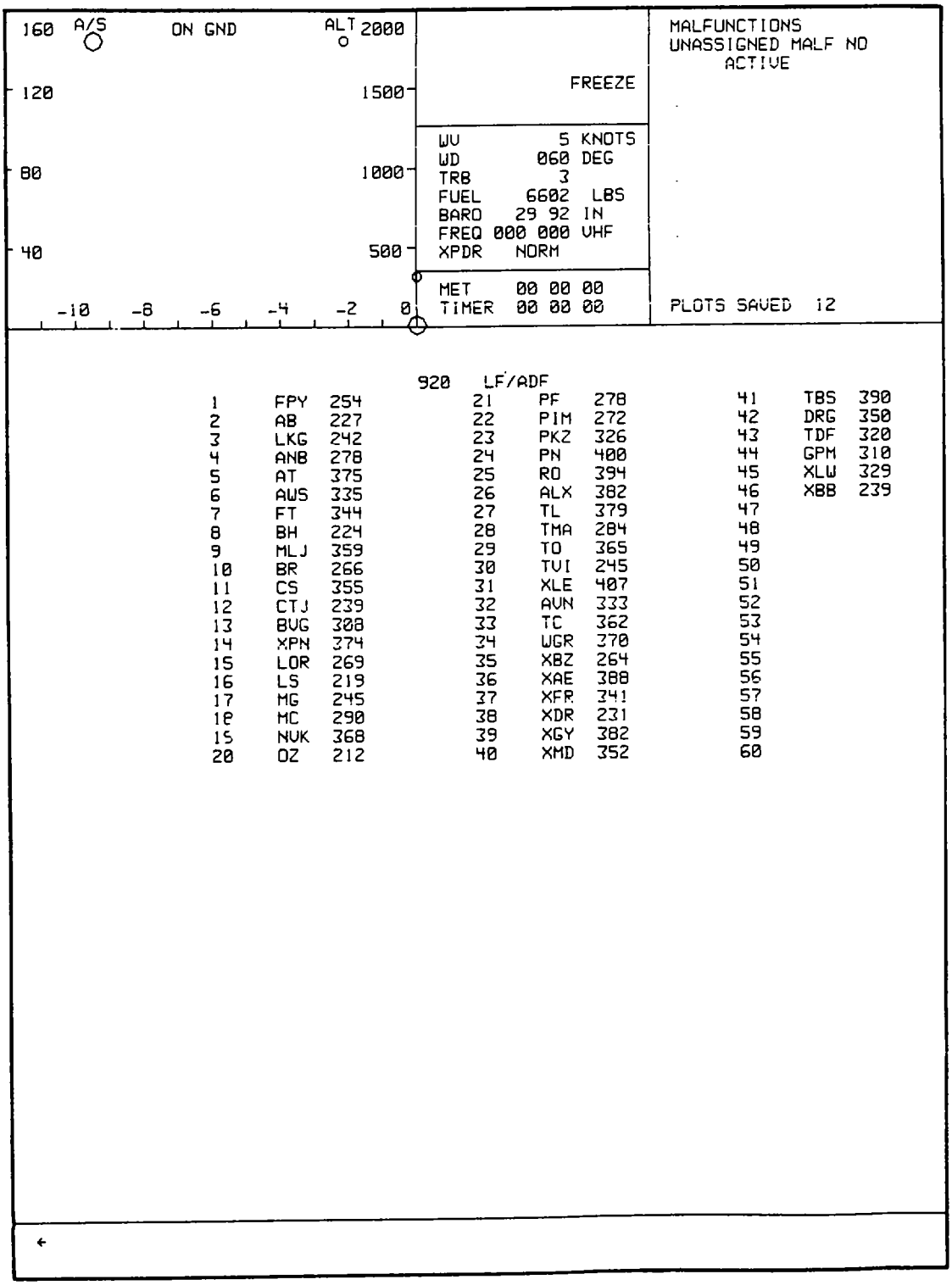
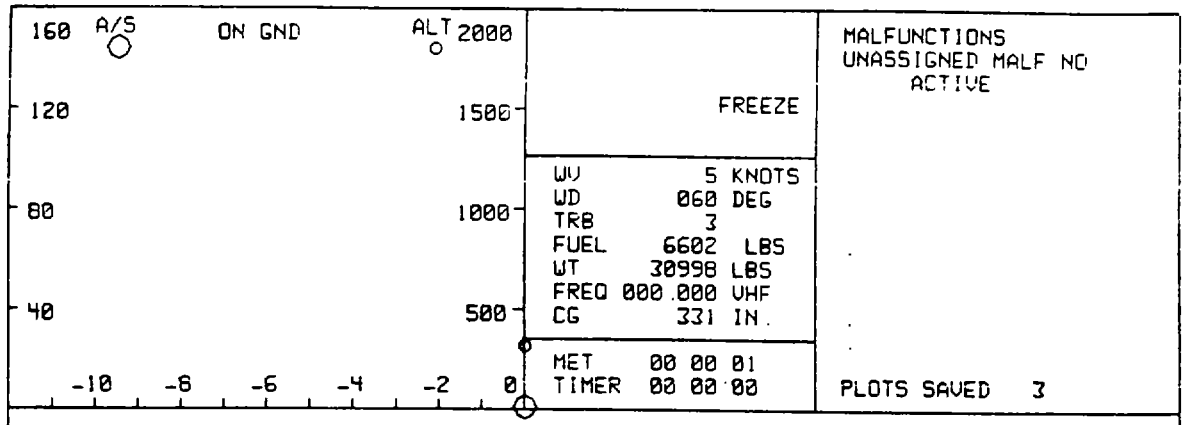


Figure 8-12. Typical NAV Facilities Group Display



INITIAL CONDITION 2 GND RWY 06 CAIRNS

01	ALT (WHL)	297 FT MSL	17	VIS	20000 FT
02	A/S	0 KNOTS	18	CEIL	2500 FT AGL
03	HDG	060 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	6602 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N031 16'14"	24	FLD SEL	CAIRNS
08	LONG	W085 43'13"			
			25	CULTURAL	5
09	CG	331 INCHES	26	RUNWAY	5
10	GRWT	31000 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29 92 INCHES	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	5 KNOTS			
14	WD	060 DEG	31	CLA LIGHTS	5
15	TRB LVL	3			
16	SND LVL	0			

SCENE ILLUM

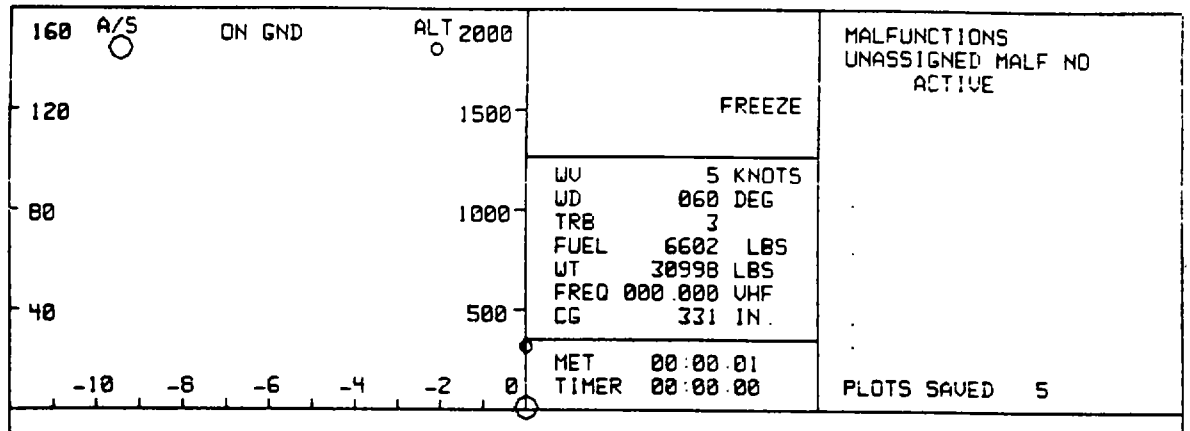
(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NIGHT-	
(11) NVG	FULL MOON	

FLD SEL

(1) CAIRNS	RWY 06
(2) DOTHAN	RWY 31
(3) LAWSON	RWY 32
(4) HANCHEY	RWY 18
(5) DANNELLY	RWY 09
(6) TODENDRF	RWY 20

KEYBOARD INPUT	RESULTING ACTION
"11" "SPACE" "ENTER"	ASSIGNMENT OF CURRENTLY DISPLAYED IC SET TO IC SET 11 AND SUBSEQUENT DISPLAY OF 11

Figure 8-13. CRT Page Display (Sheet 1)



INITIAL CONDITION 4 AIR SHADY INT

01	ALT (WHL)	4000 FT MSL	17	VIS	20000 FT
02	A/S	100 KNOTS	18	CEIL	2500 FT AGL
03	HDG	306 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	2000 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N032 02'36"	24	FLD SEL	DANNELLY
08	LONG	W086 04'40"			
			25	CULTURAL	5
09	CG	331 INCHES	26	RUNWAY	5
10	GRWT	28000 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29 92 INCHES	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	3 KNOTS			
14	WD	270 DEG	31	CLA LIGHTS	0
15	TRB LVL	3			
16	SND LVL	0			

SCENE ILLUM

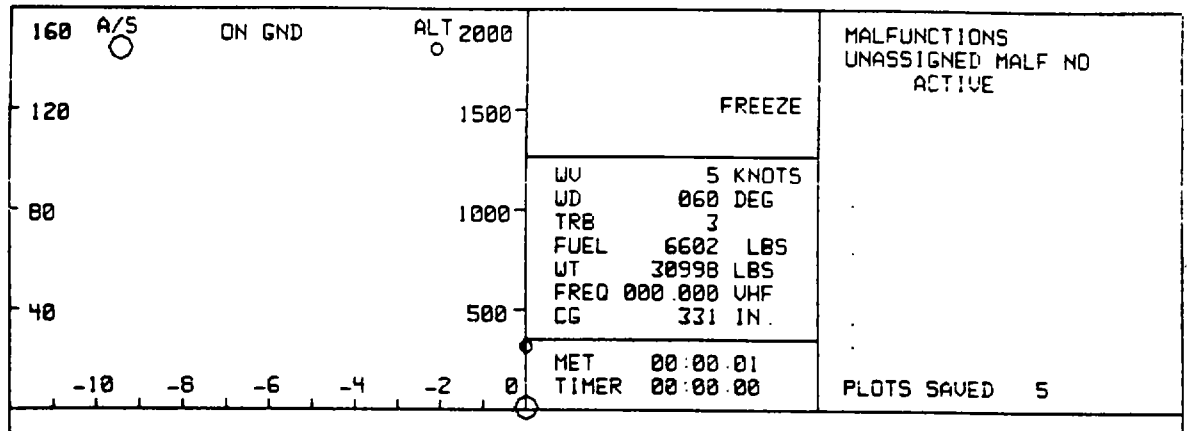
(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NIGHT-	
(11) NVG	FULL MOON	

FLD SEL

(1) CAIRNS	RWY 06
(2) DOTHAN	RWY 31
(3) LAWSON	RWY 32
(4) HANCHEY	RWY 18
(5) DANNELLY	RWY 09
(6) TODENDRF	RWY 20

KEYBOARD INPUT	RESULTING ACTION
"11" "SPACE" "ENTER"	ASSIGNMENT OF CURRENTLY DISPLAYED IC SET TO IC SET 11 AND SUBSEQUENT DISPLAY OF 11

Figure 8-13. CRT Page Display (Sheet 2)



INITIAL CONDITION 4 AIR SHADY INT

01	ALT (WHL)	4000 FT MSL	17	VIS	20000 FT
02	A/S	100 KNOTS	18	CEIL	2500 FT AGL
03	HDG	306 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	2000 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N032 02'36"	24	FLD SEL	DANNELLY
08	LONG	W086 04'40"			
			25	CULTURAL	5
09	CG	331 INCHES	26	RUNWAY	5
10	GRWT	28000 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29 92 INCHES	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	3 KNOTS			
14	WD	270 DEG	31	CLA LIGHTS	0
15	TRB LVL	3			
16	SND LVL	0			

SCENE ILLUM

(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NIGHT-	
(11) NVG	FULL MOON	

FLD SEL

(1) CAIRNS	RWY 06
(2) DOTHAN	RWY 31
(3) LAWSON	RWY 32
(4) HANCHEY	RWY 18
(5) DANNELLY	RWY 09
(6) TODENDRF	RWY 20

KEYBOARD INPUT	RESULTING ACTION
"11" "SPACE" "ENTER"	ASSIGNMENT OF CURRENTLY DISPLAYED IC SET TO IC SET 11 AND SUBSEQUENT DISPLAY OF 11

Figure 8-13. CRT Page Display (Sheet 3)

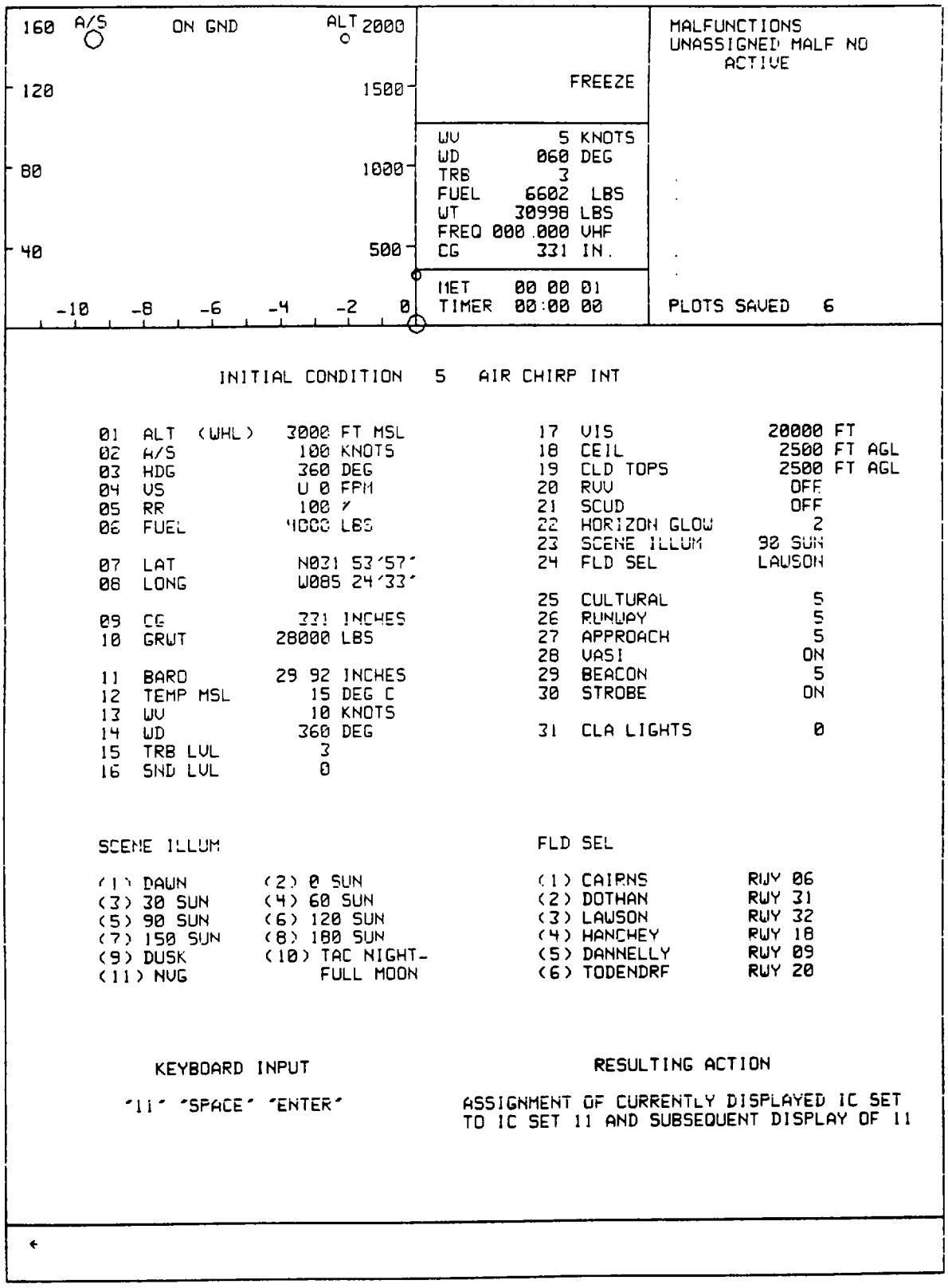


Figure 8-13. CRT Page Display (Sheet 4)

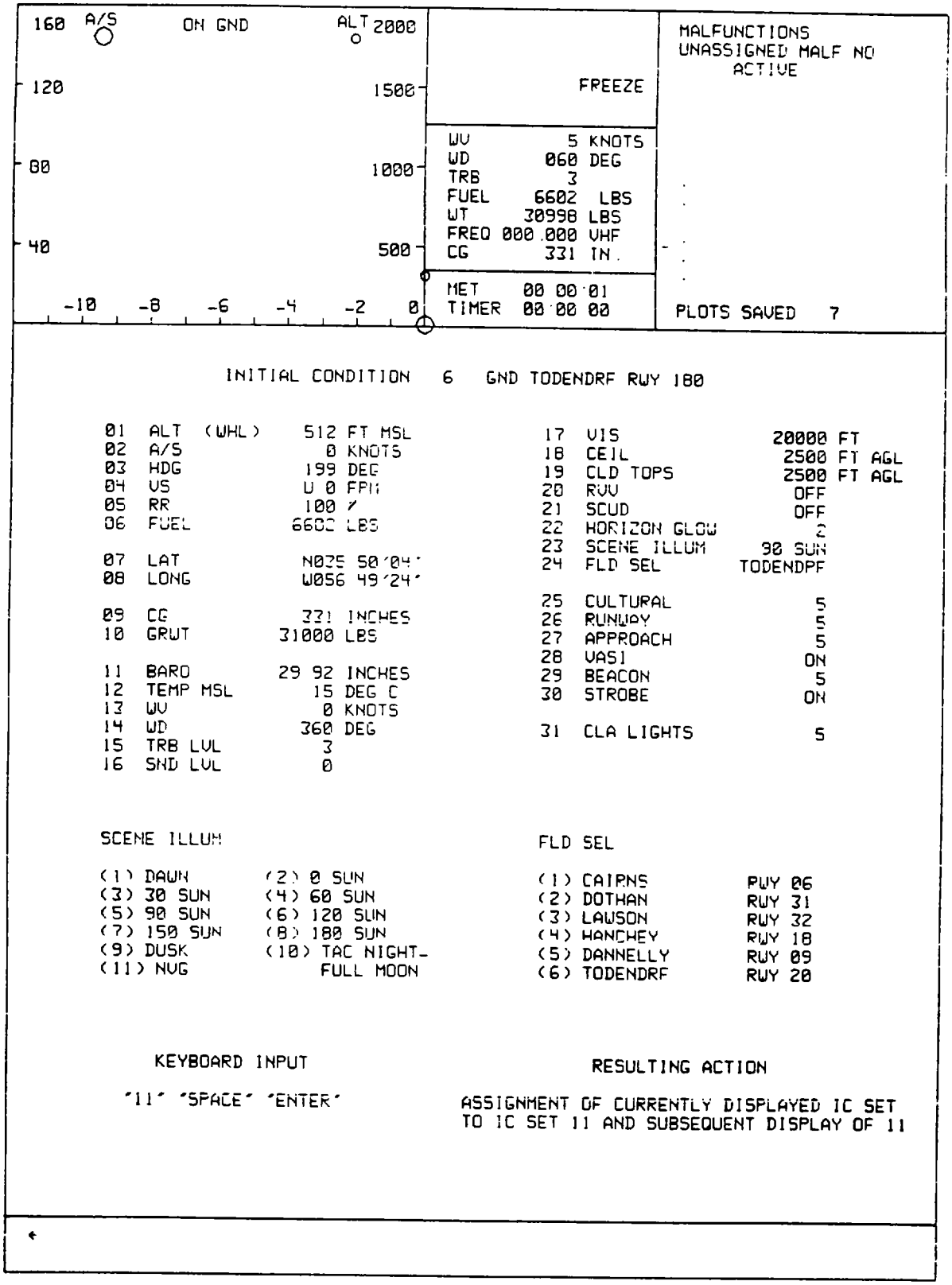
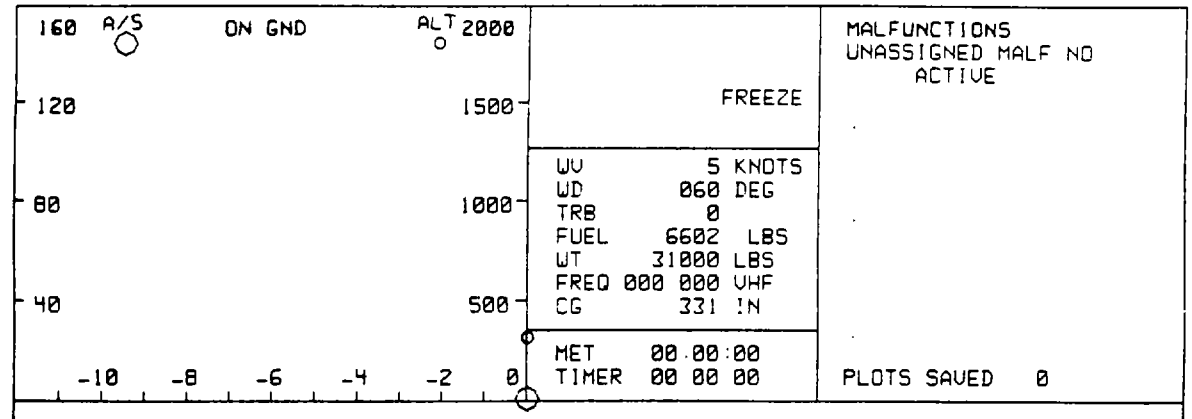


Figure 8-13. CRT Page Display (Sheet 5)



INITIAL CONDITION 7 GND PRESS ON RWY 290

01	ALT (WHL)	512 FT MSL	17	VIS	20000 FT
02	A/S	.0 KNOTS	18	CEIL	2500 FT AGL
03	HDG	289 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	6602 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N035 20'05"	24	FLD SEL	TODENDRF
08	LONG	W057 27'18"			
			25	CULTURAL	5
09	CG	331 INCHES	26	RUNWAY	5
10	GRUT	31000 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29 92 INCHES	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	0 KNOTS			
14	WD	360 DEG	31	CLA LIGHTS	5
15	TRB LVL	0			
16	SND LVL	3			

SCENE ILLUM

(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NIGHT-	
(11) NVG	FULL MOON	

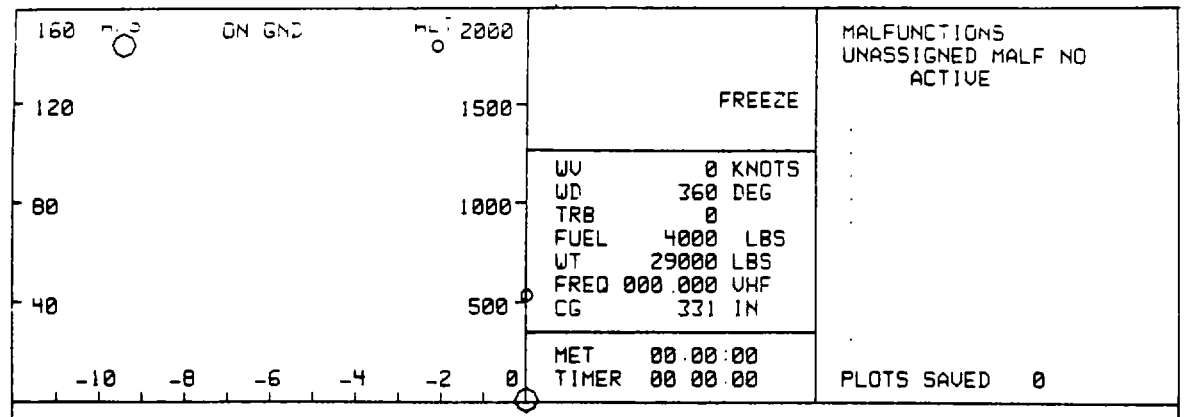
FLD SEL

(1) CAIRNS	RWY 06
(2) DOTHAN	RWY 31
(3) LAWSON	RWY 32
(4) HANCHEY	RWY 18
(5) DANNELLY	RWY 09
(6) TODENDRF	RWY 20

KEYBOARD INPUT	RESULTING ACTION
"11" "SPACE" "ENTER"	ASSIGNMENT OF CURRENTLY DISPLAYED IC SET TO IC SET 11 AND SUBSEQUENT DISPLAY OF 11

←

Figure 8-13. CRT Page Display (Sheet 6)



INITIAL CONDITION 8 GND MARSHALING AREA

01	ALT (WHL)	513 FT MSL	17	VIS	20000 FT
02	A/S	0 KNOTS	18	CEIL	2500 FT AGL
03	HDG	200 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	4000 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N035 42'38"	24	FLD SEL	TODENDRF
08	LONG	W057 09'37"			
			25	CULTURAL	5
09	CG	331 INCHES	26	RUNWAY	5
10	GRWT	29000 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29 92 INCHES	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	0 KNOTS			
14	WD	360 DEG	31	CLA LIGHTS	5
15	TRB LVL	0			
16	SND LVL	3			

SCENE ILLUM

(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NIGHT- FULL MOON	
(11) NVG		

FLD SEL

(1) CAIRNS	RWY 06
(2) DOTHAN	RWY 31
(3) LAWSON	RWY 32
(4) HANCHEY	RWY 18
(5) DANNELLY	RWY 09
(6) TODENDRF	RWY 20

KEYBOARD INPUT	RESULTING ACTION
"11" "SPACE" "ENTER"	ASSIGNMENT OF CURRENTLY DISPLAYED IC SET TO IC SET 11 AND SUBSEQUENT DISPLAY OF 11

Figure 8-13. CRT Page Display (Sheet 7)

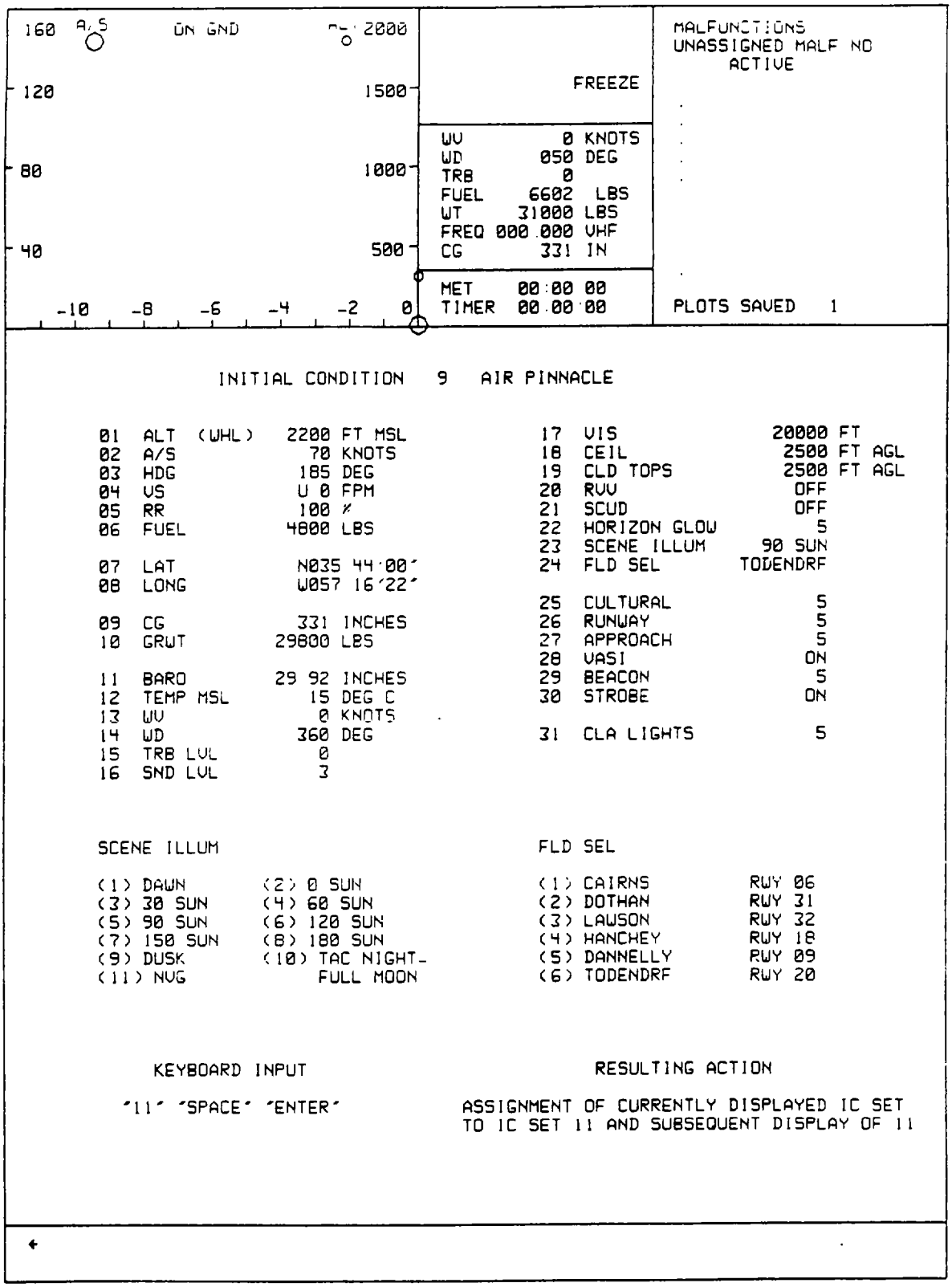


Figure 8-13. CRT Page Display (Sheet 8)

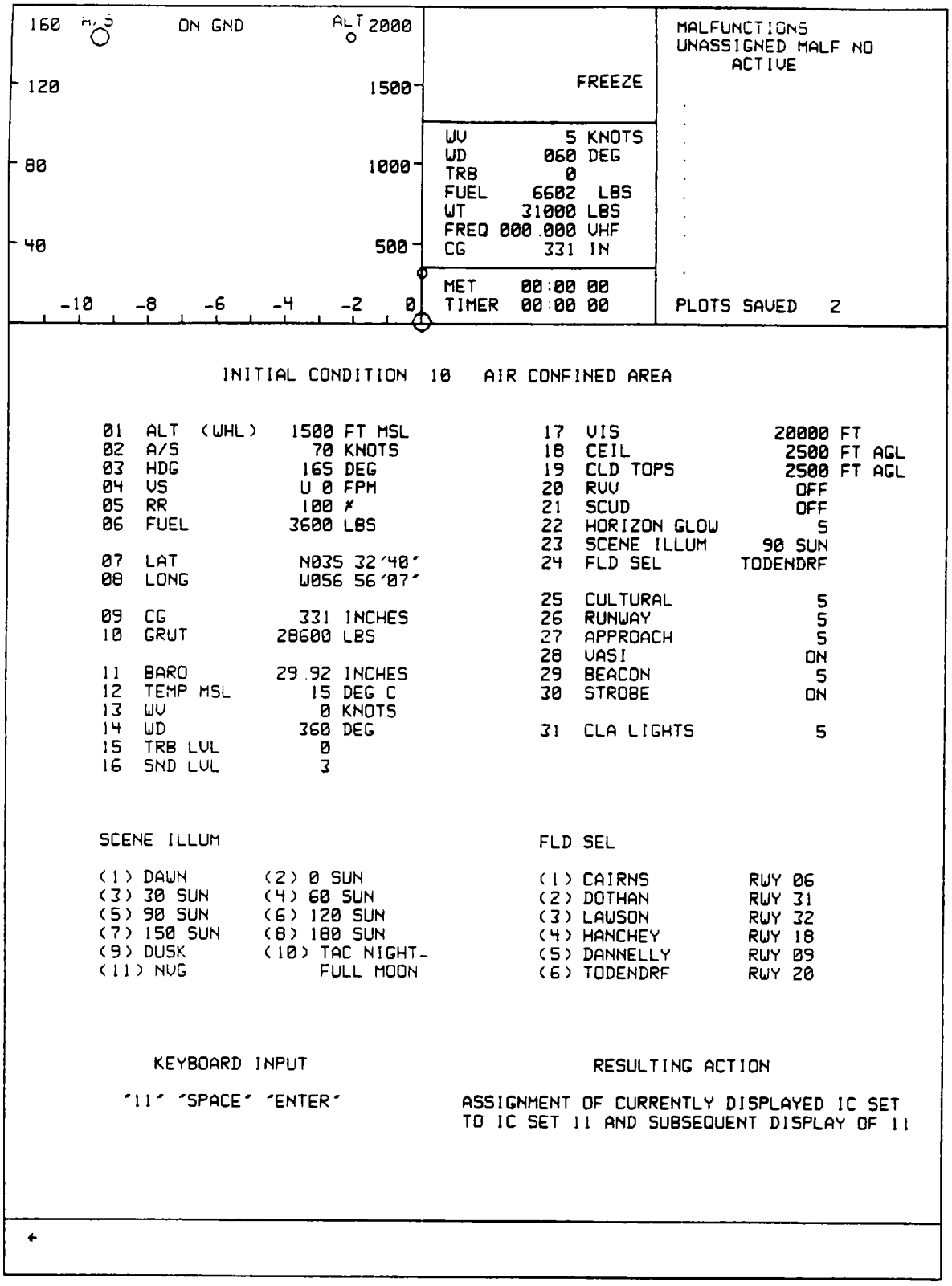
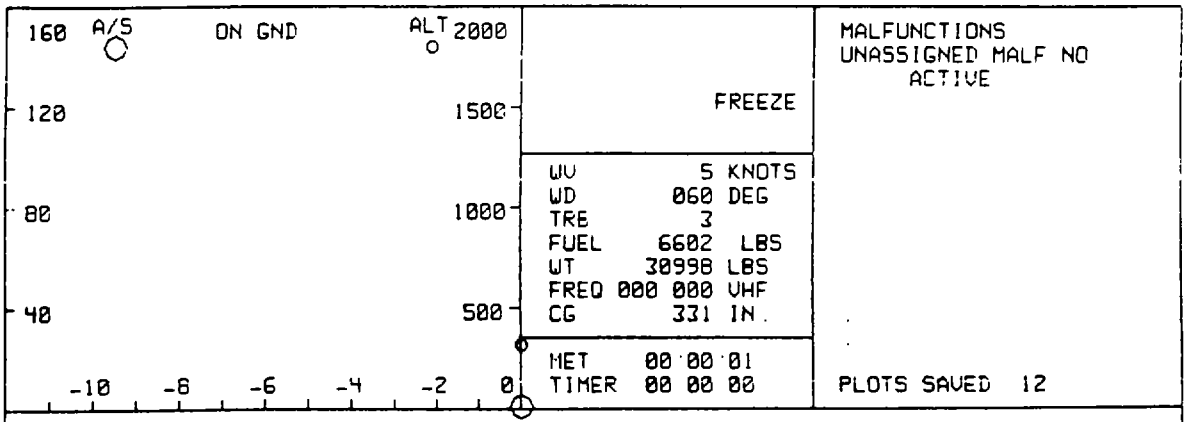


Figure 8-13. CRT Page Display (Sheet 9)



INITIAL CONDITION 11 EDITABLE

01	ALT (WHL)	1100 FT	17	VIS	20000 FT
02	A/S	70 KNOTS	18	CEIL	2500 FT AGL
03	HDG	165 DEG	19	CLD TOPS	2500 FT AGL
04	VS	U 0 FPM	20	RVV	OFF
05	RR	100 %	21	SCUD	OFF
06	FUEL	3600 LBS	22	HORIZON GLOW	5
			23	SCENE ILLUM	90 SUN
07	LAT	N035 49'05"	24	FLD SEL	TODENDRF
08	LONG	W057 23'45"			
			25	CULTURAL	5
09	CG	331 IN	26	RUNWAY	5
10	GRWT	28600 LBS	27	APPROACH	5
			28	VASI	ON
11	BARO	29.92 IN	29	BEACON	5
12	TEMP MSL	15 DEG C	30	STROBE	ON
13	WV	0 KNOTS			
14	WD	360 DEG	31	CLA LIGHTS	5
15	TRB LVL	3			
16	SND LVL	3			

SCENE ILLUM

(1) DAWN	(2) 0 SUN	
(3) 30 SUN	(4) 60 SUN	
(5) 90 SUN	(6) 120 SUN	
(7) 150 SUN	(8) 180 SUN	
(9) DUSK	(10) TAC NGT-	FULL MOON
(11) NVG		

FLD SEL

(1) CAIRNS	RWY 06	
(2) DOTHAN	RWY 31	
(3) LAWSON	RWY 32	
(4) HANCHEY	RWY 18	
(5) DANNELLY	RWY 09	
(6) TODENDRF	RWY 20	

Figure 8-13. CRT Page Display (Sheet 10)

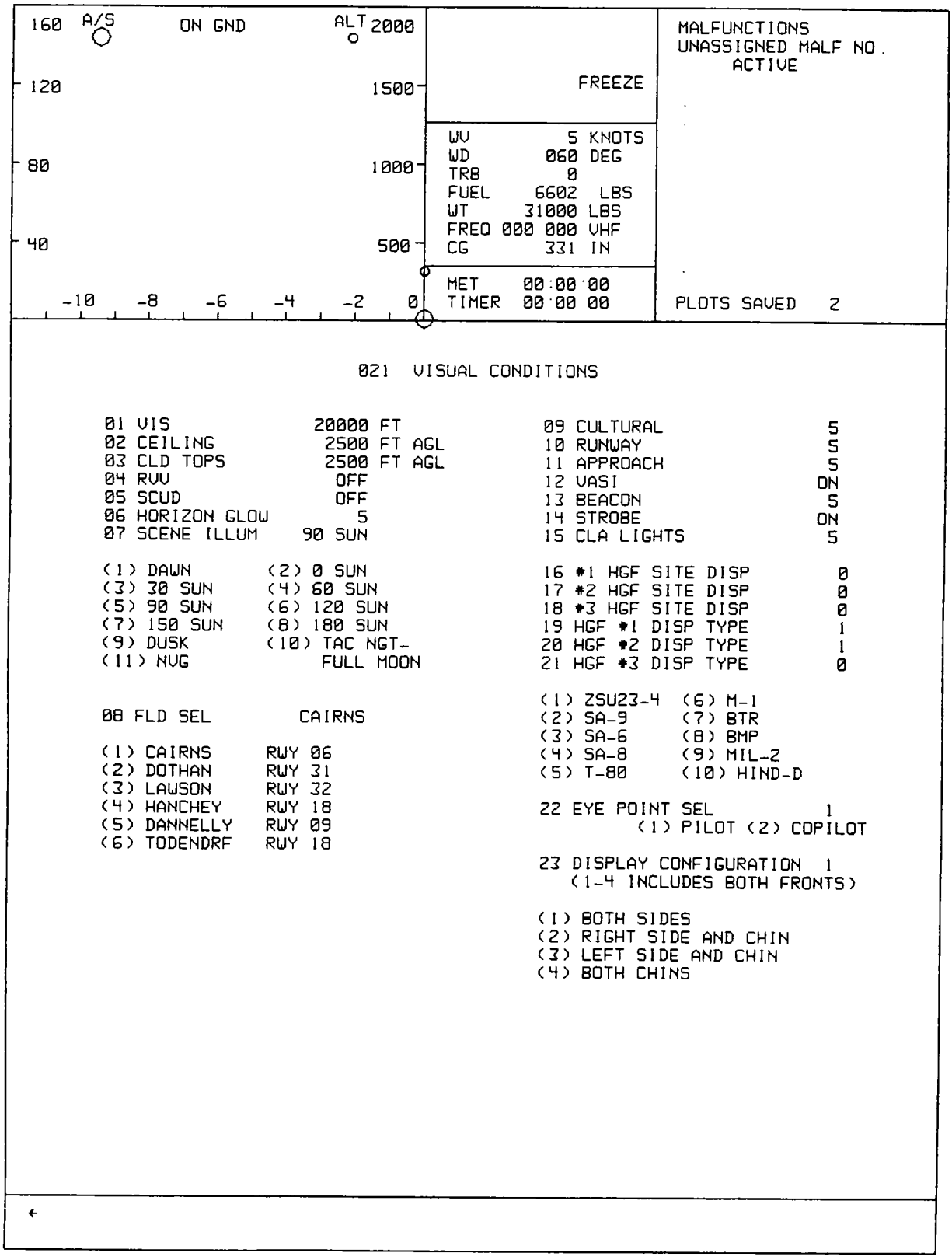


Figure 8-13. CRT Page Display (Sheet 11)

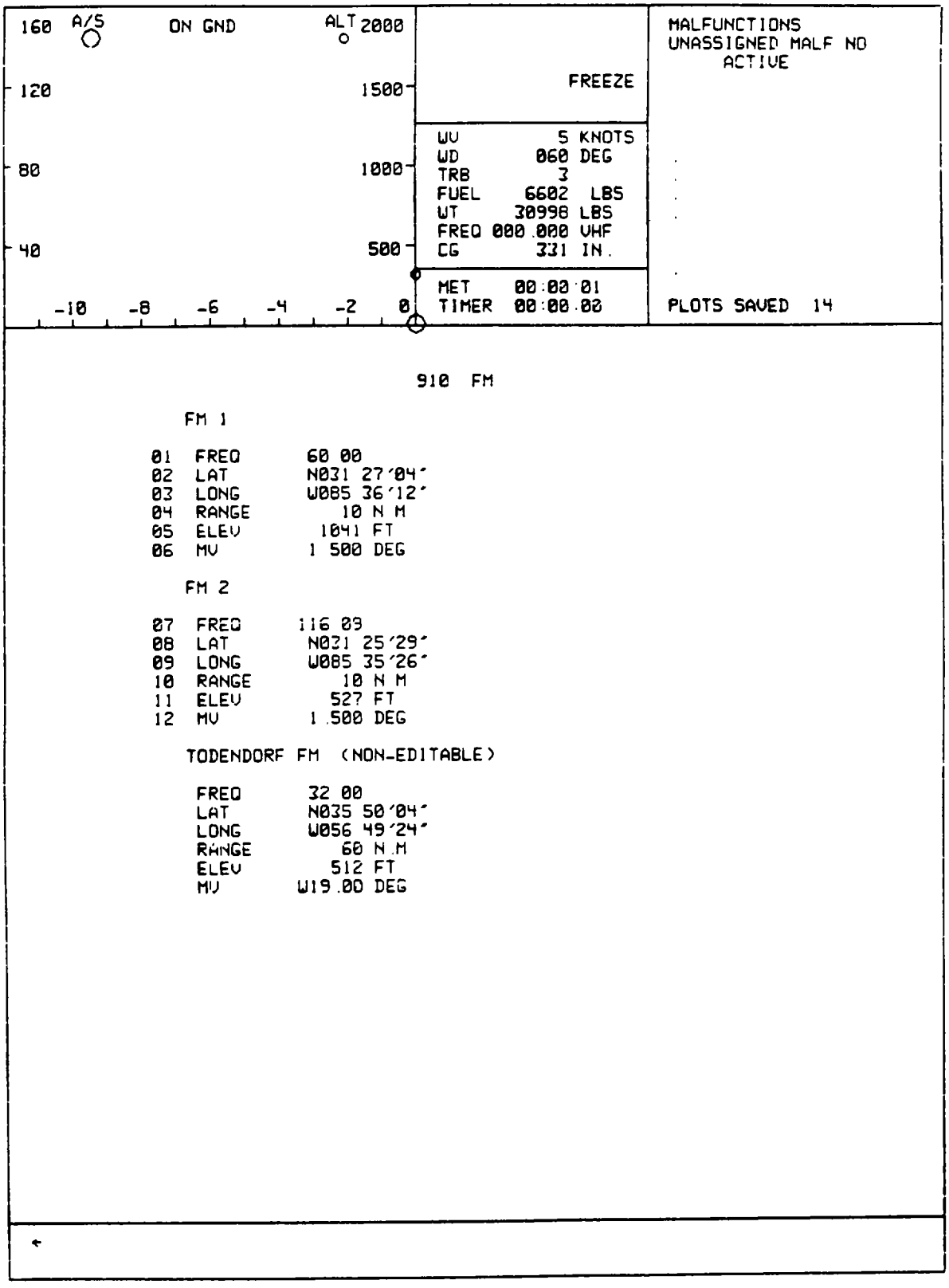


Figure 8-13. CRT Page Display (Sheet 12)

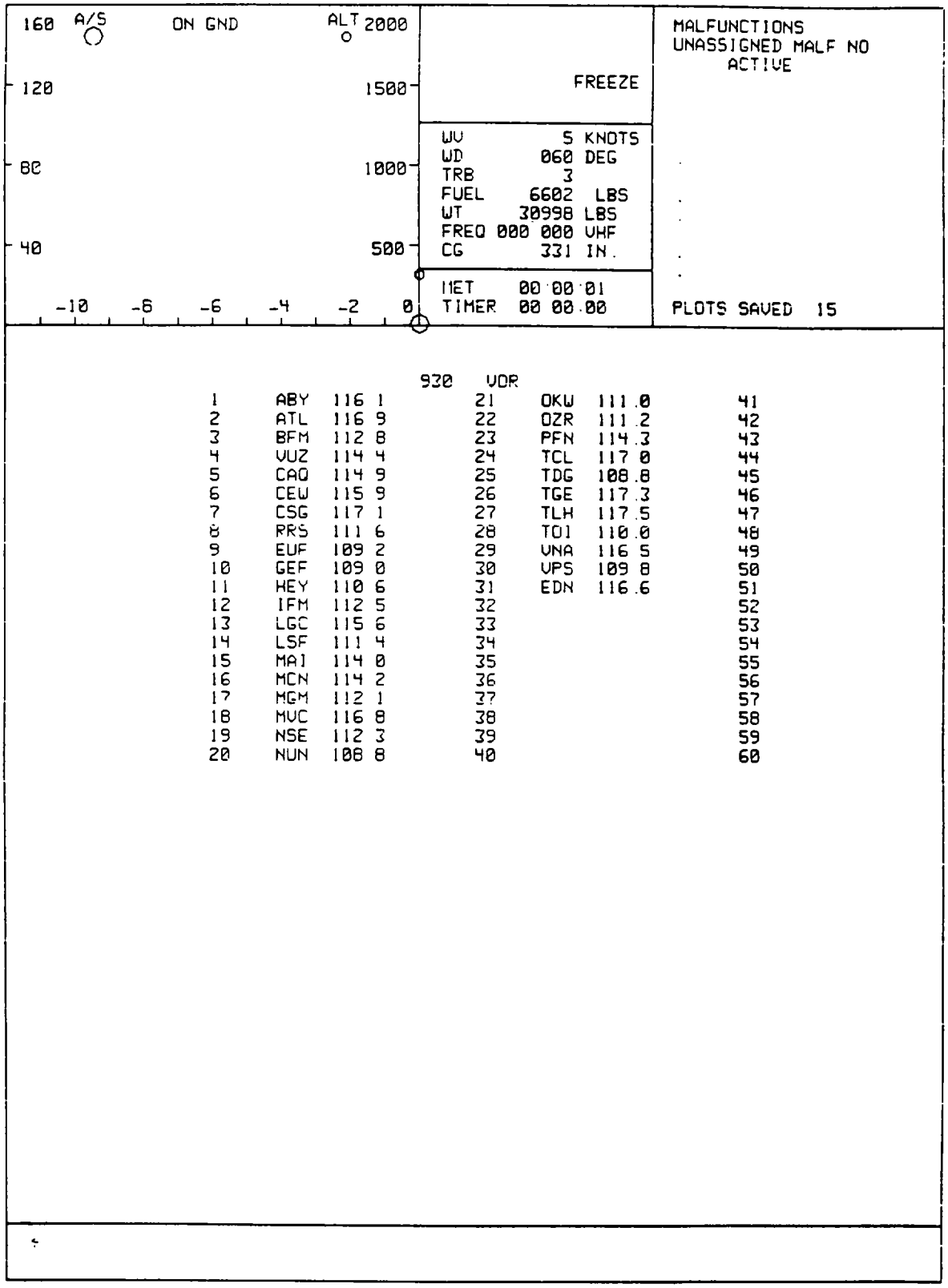


Figure 8-13. CRT Page Display (Sheet 13)

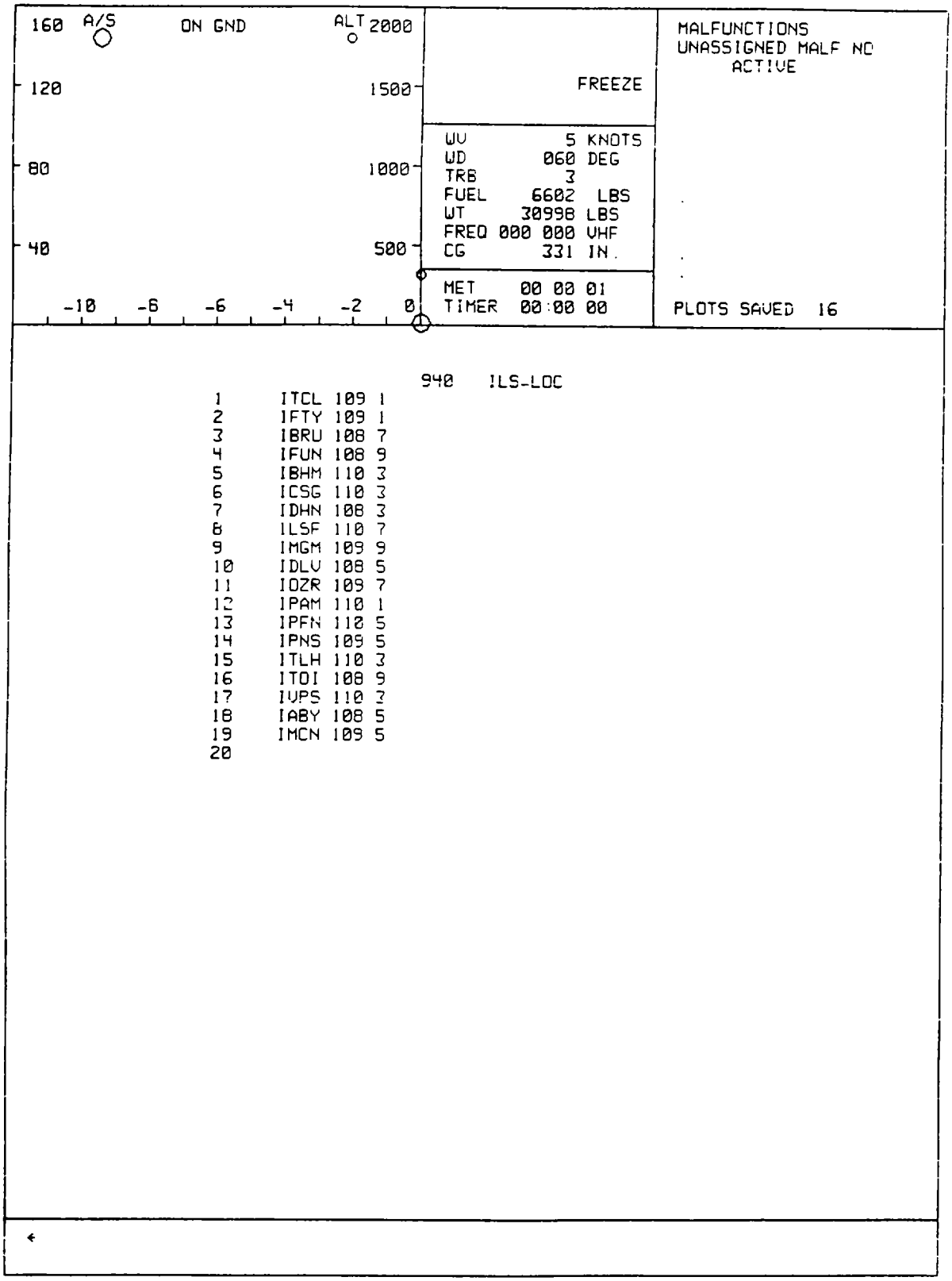


Figure 8-13. CRT Page Display (Sheet 14)

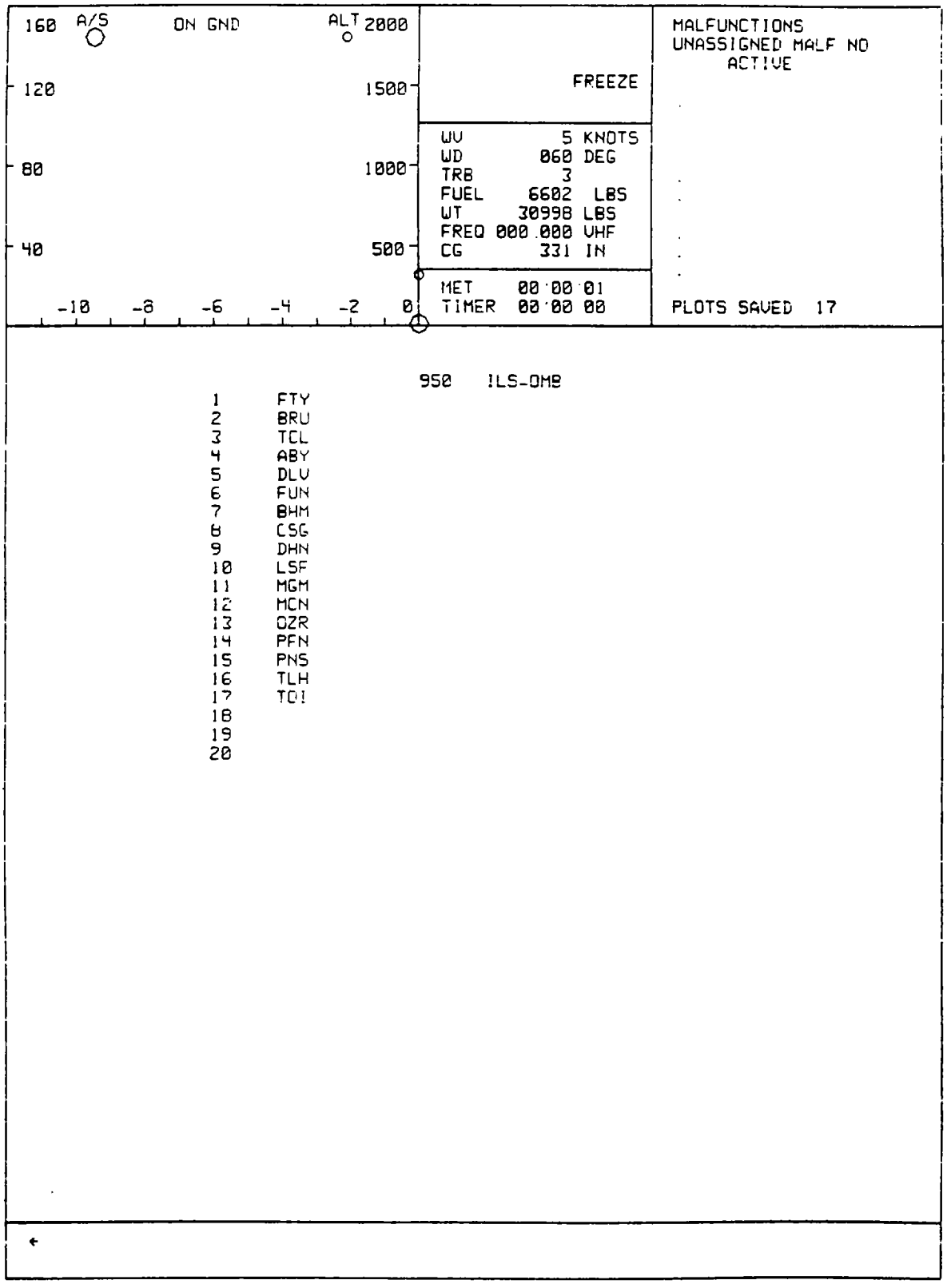


Figure 8-13. CRT Page Display (Sheet 15)

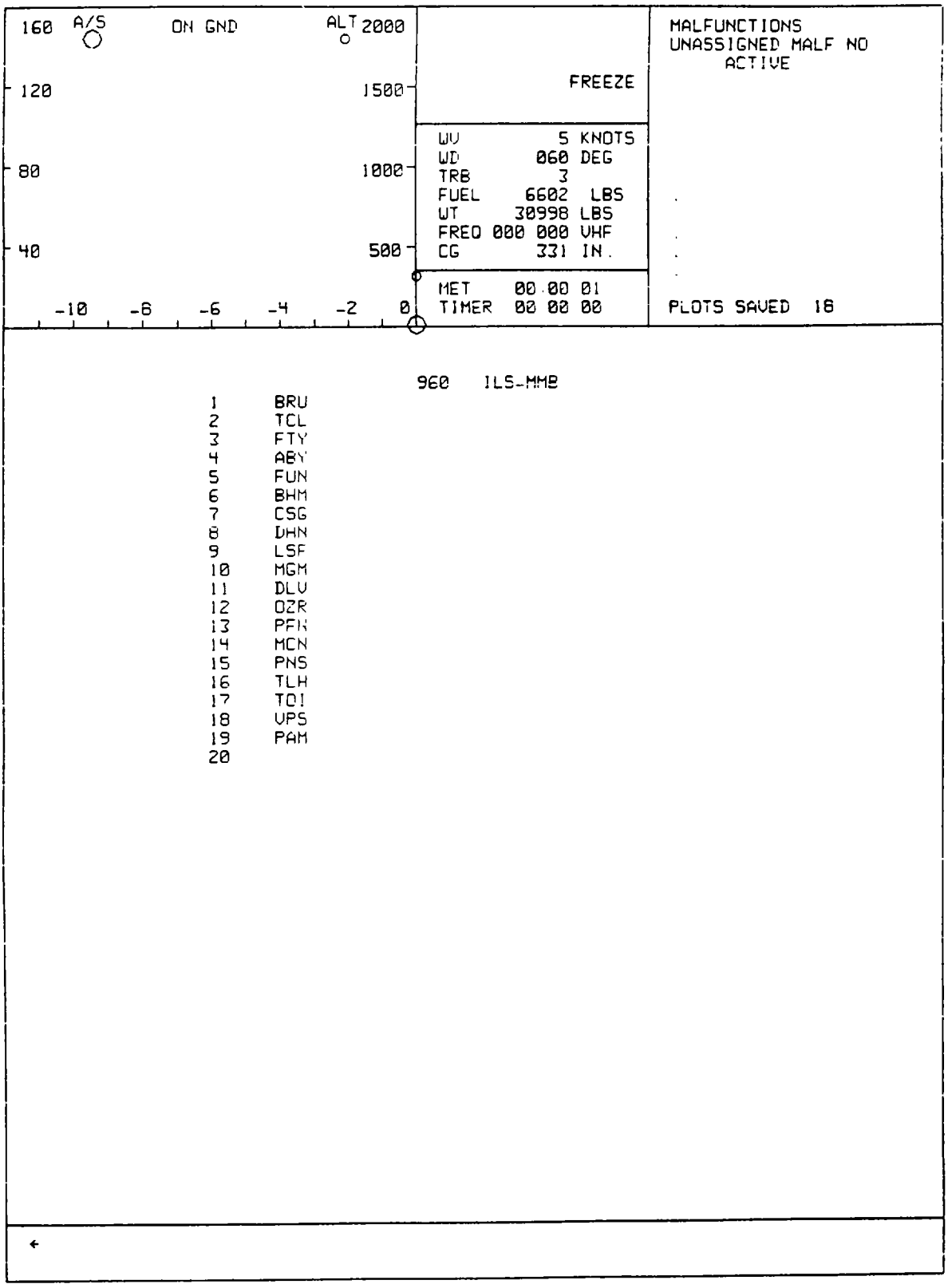


Figure 8-13. CRT Page Display (Sheet 16)

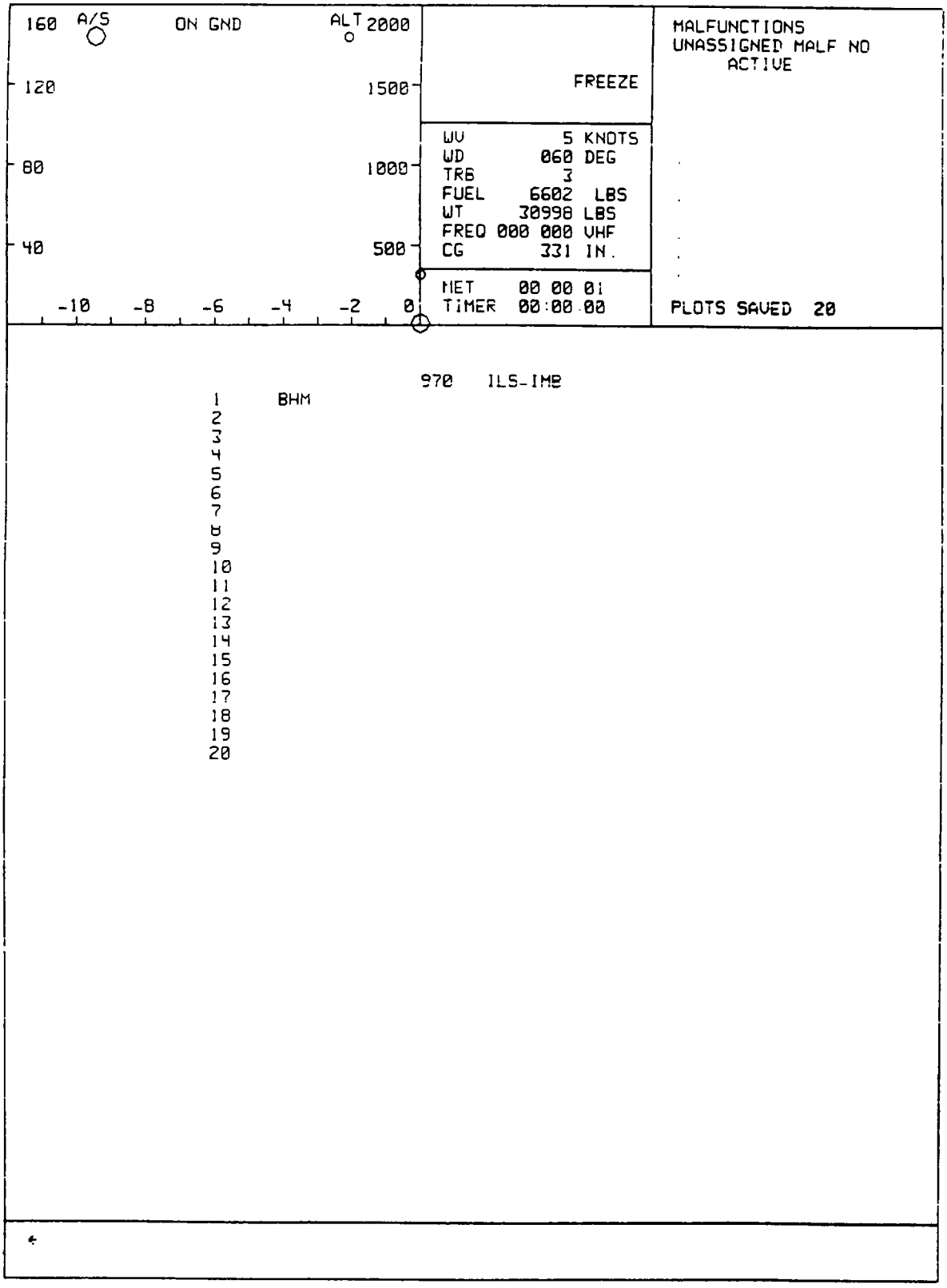


Figure 8-13. CRT Page Display (Sheet 17)

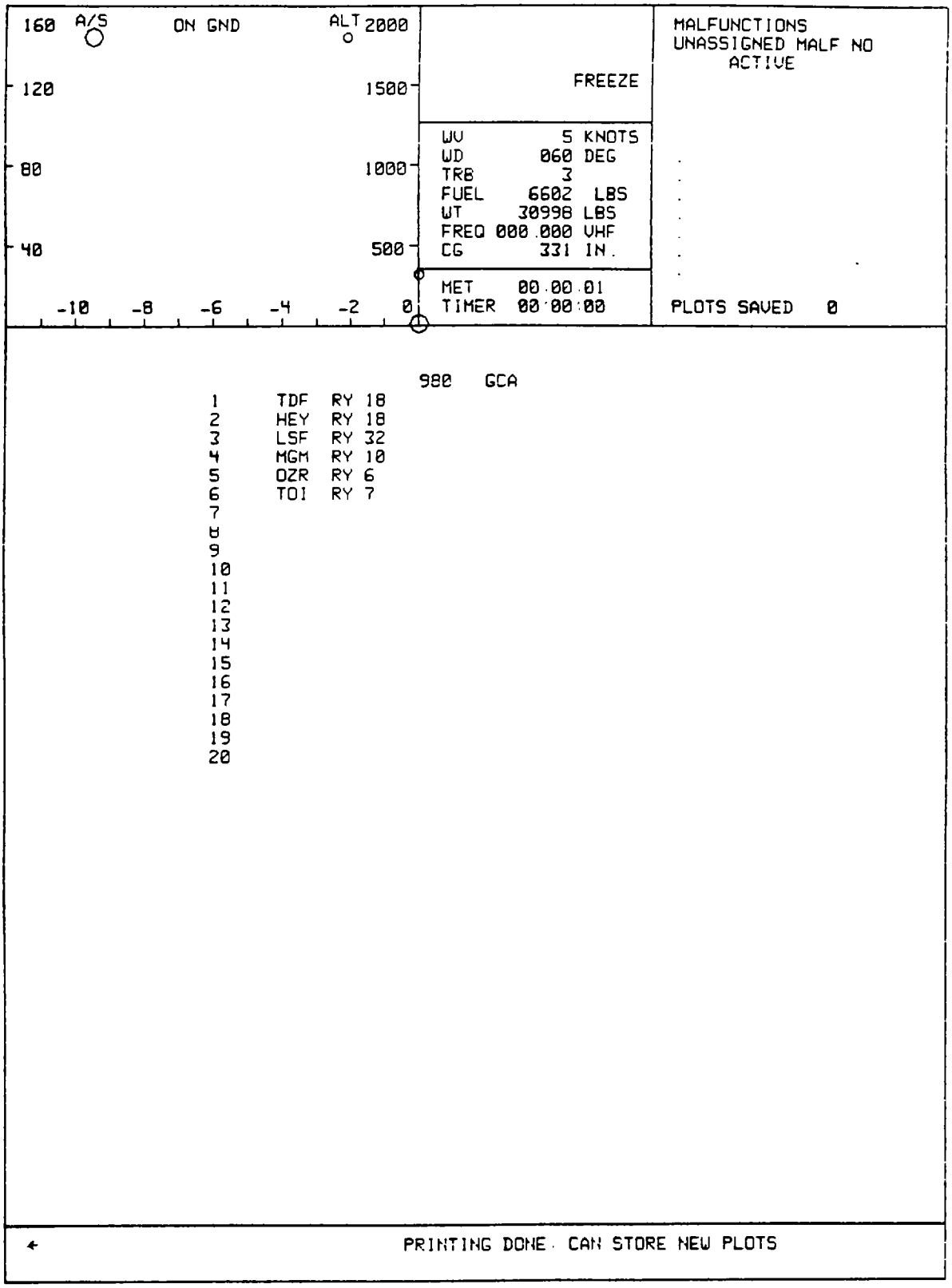


Figure 8-13. CRT Page Display (Sheet 18)

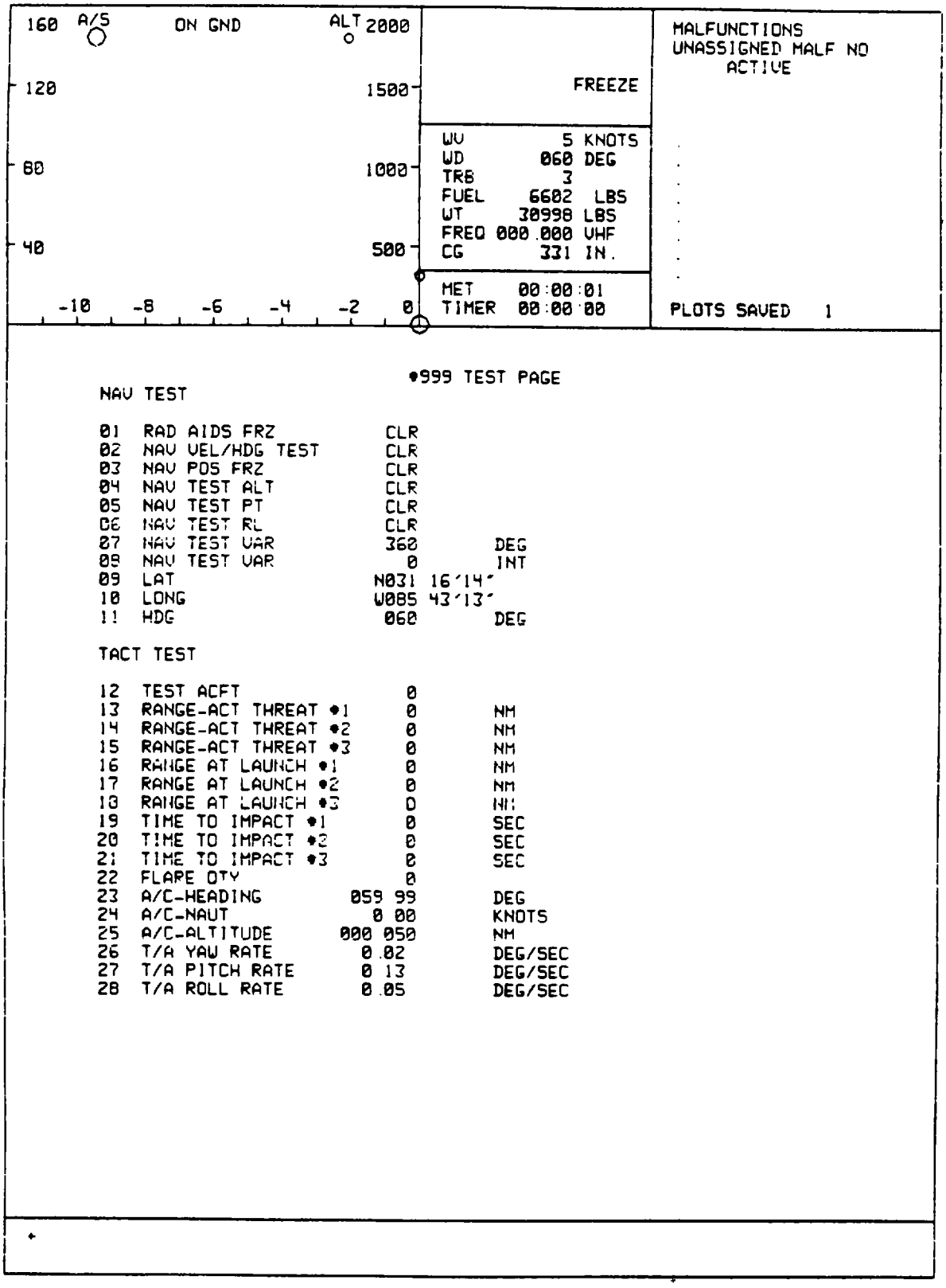


Figure 8-13. CRT Page Display (Sheet 19)

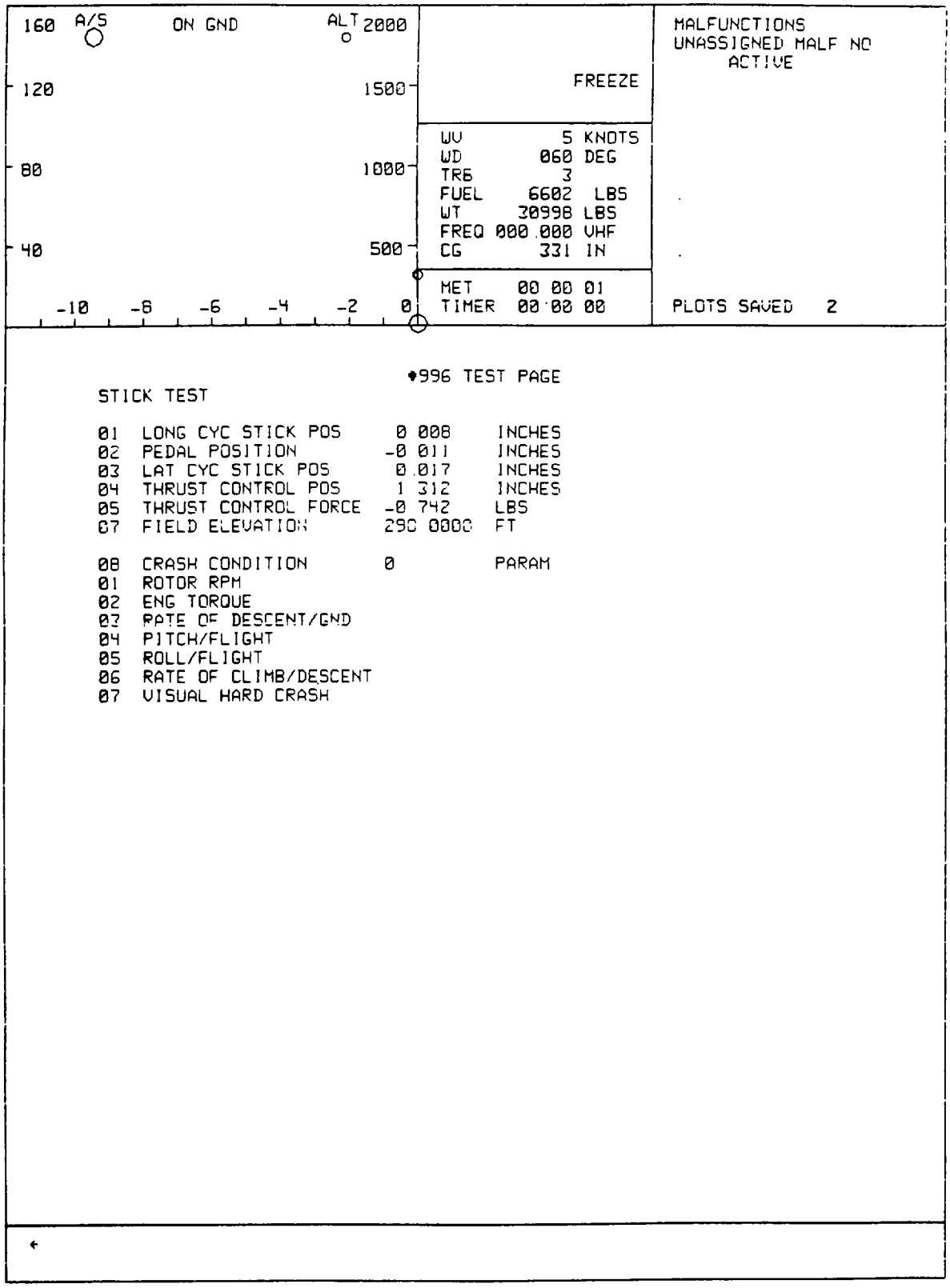
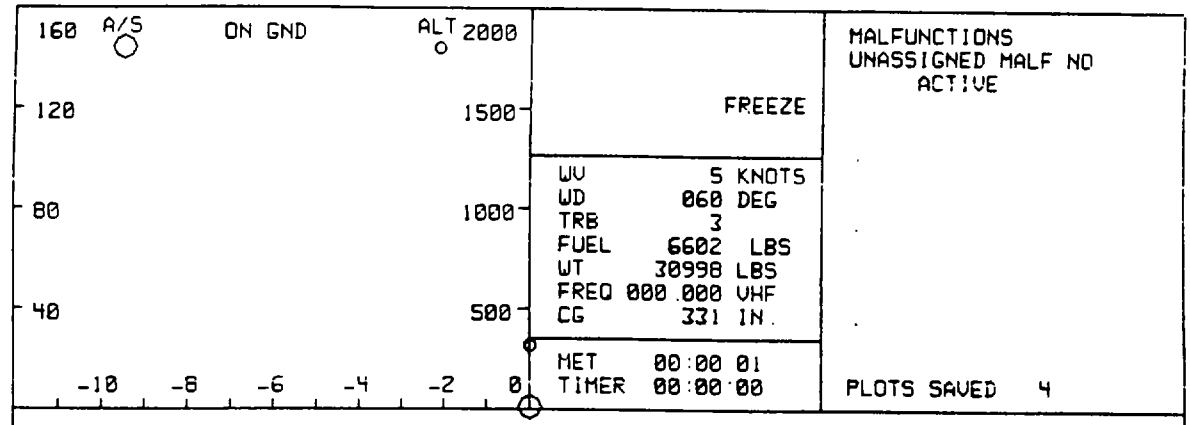


Figure 8-13. CRT Page Display (Sheet 20)



*997 TEST PAGE

ENGINE PERFORMANCE

			*1	*2	
01	GAS GEN RPM	(EGGNI)	14640	14640	RPM
02	N1 RPM %	(EINI)	78.2	78.2	%
03	N1 DOT	(EPNI)	2	2	RPM/SEC
04	PWR TURBINE	(ENII)	15135	15135	RPM
05	N2 DOT	(EPNII)	0	0	RPM/SEC
06	SHAFT HORSE POWER	(ESPH)	815 7	791 0	SHP
07	SHP STD	(ESTD)	1029 0	1029 0	SHP
08	SHAFT TORQUE	(ESQE)	18952	18376	FT-LBS
09	SHAFT TORQUE %	(EQI)	21 8	21 1	%
10	FUEL FLOW	(EFUEL)	831 9	822 7	PPH
11	PTIT	(EPTIT)	485 3	485 3	DEG C
12	NET THRUST	(EFNT)	82 7	81 0	LBS
13	BEEPER POSITION	(EFCBT)	5 7	5 7	DEG
14	N1 FUEL CONTROL	(EFANI)	100 0	100 0	DEG
15	N2 FUEL CONTROL	(EFNII)	14 6	14 6	DEG
16	EMER TRIM POSITION	(EFCAE)	0 0	0 0	DEG
17	ROTOR RPM	(ENR)	226 0	RPM	
18	ROTOR RPM%	(ENRPCT)	100 5	%	

Figure 8-13. CRT Page Display (Sheet 21)

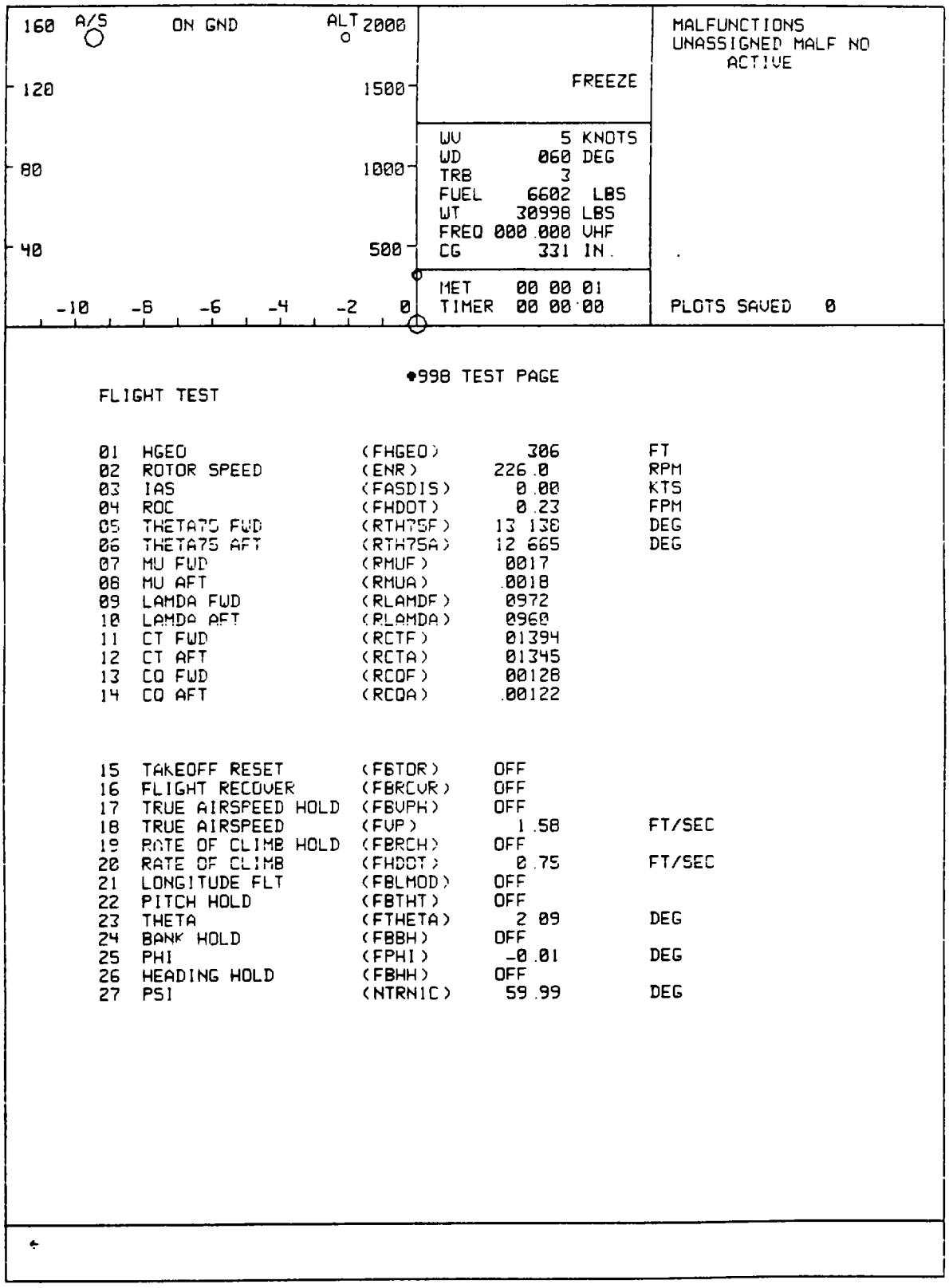
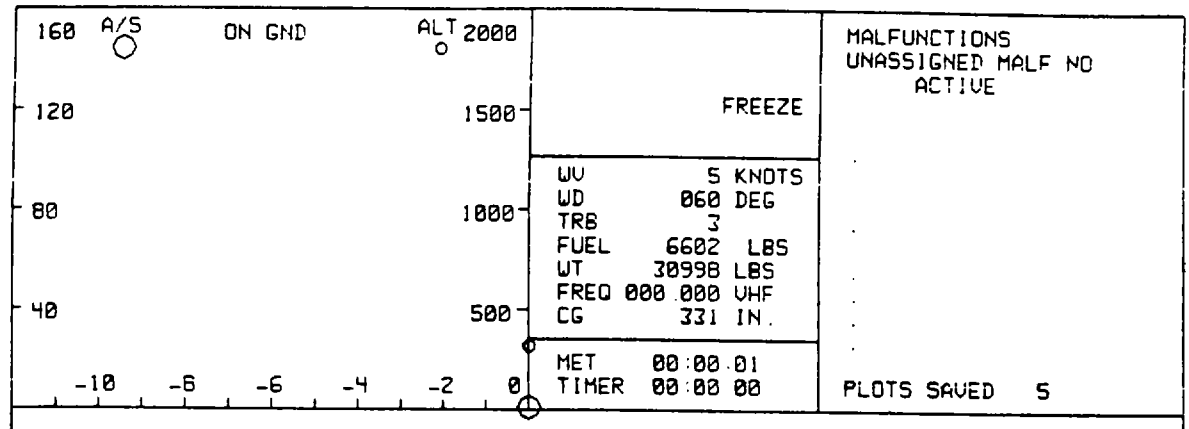


Figure 8-13. CRT Page Display (Sheet 22)



300 AVIONICS

301 P VGI FAIL
302 CP VGI FAIL

303 P VGI ERRAT
304 CP VGI ERRAT

305 P VGI PREC
306 CP VGI PREC

307 HSI HDNG FRZ

308 SPARE
309 SPARE

310 UHF
311 SPARE

312 FM/UHF #1
313 FM/UHF #2

314 DOP NAV RTA FAIL
315 DOP NAV SDC FAIL

316 LF REC
317 MKR BEACON

318 VOR REC
319 ILS REC

320 CRS/LOC IND OVRSN
321 CRS/LOC INOP

322 GLDSLP IND INOP

323 P HSI PTR #1 OSC
324 P HSI PTR #2 OSC

325 P HSI CRD PRECESS
326 P HSI CRD ERRAT

327 DIR GYRO FAIL

328 P HSI PTR #1 FAIL
329 P HSI PTR #2 FAIL

330 CP HSI PTR #1 OSC
331 CP HSI PTR #2 OSC

332 CP HSI CRD PRECES
333 CP HSI CRD ERRAT

334 CP HSI PTR 1 FAIL
335 CP HSI PTR 2 FAIL

336 FAIL RADAR ALTMTR

337 APR-39 ANT FAIL
338 M-130 FAIL EJECT
339 ALQ-156 FAIL

Figure 8-13. CRT Page Display (Sheet 23)

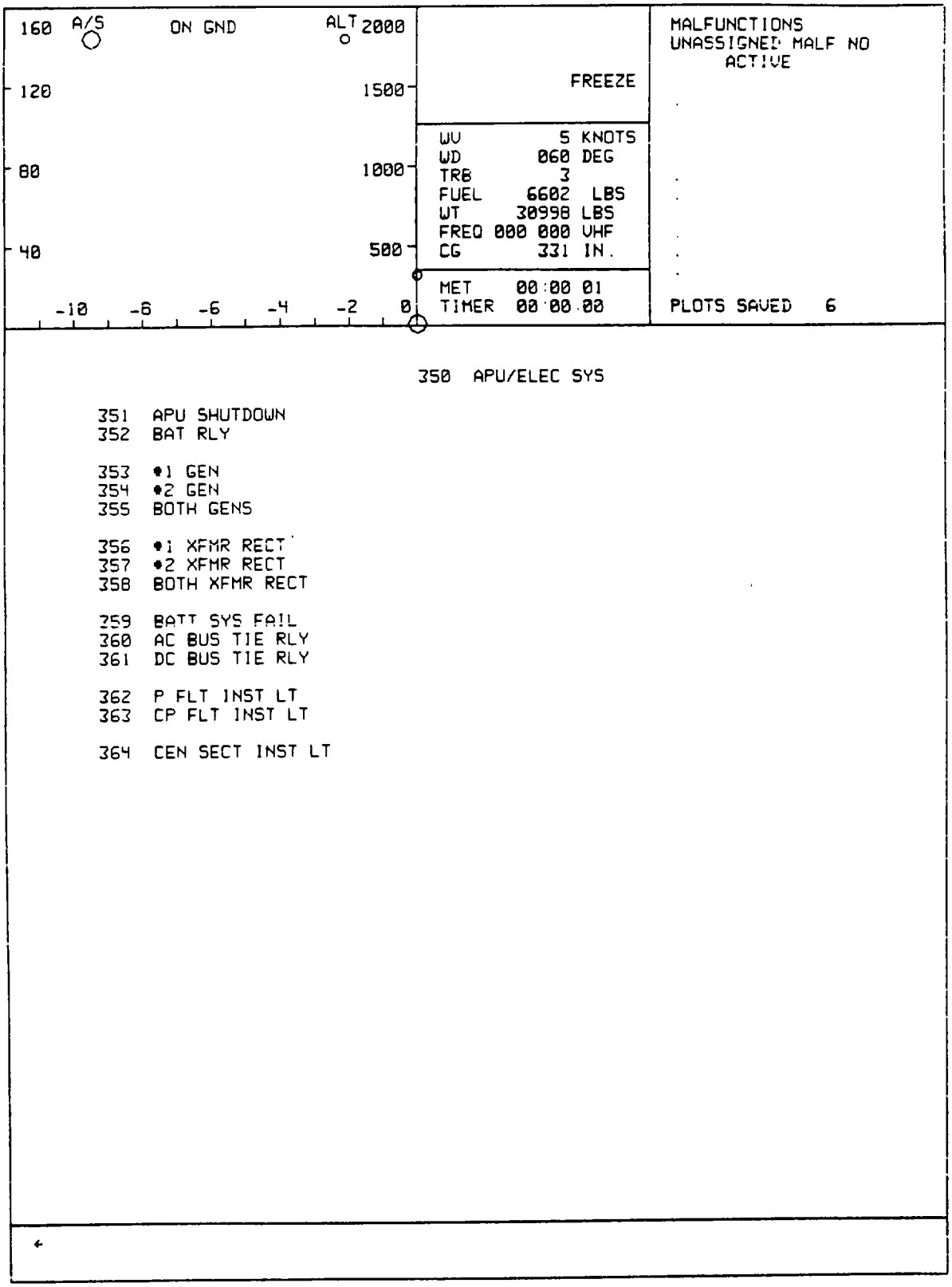


Figure 8-13. CRT Page Display (Sheet 24)

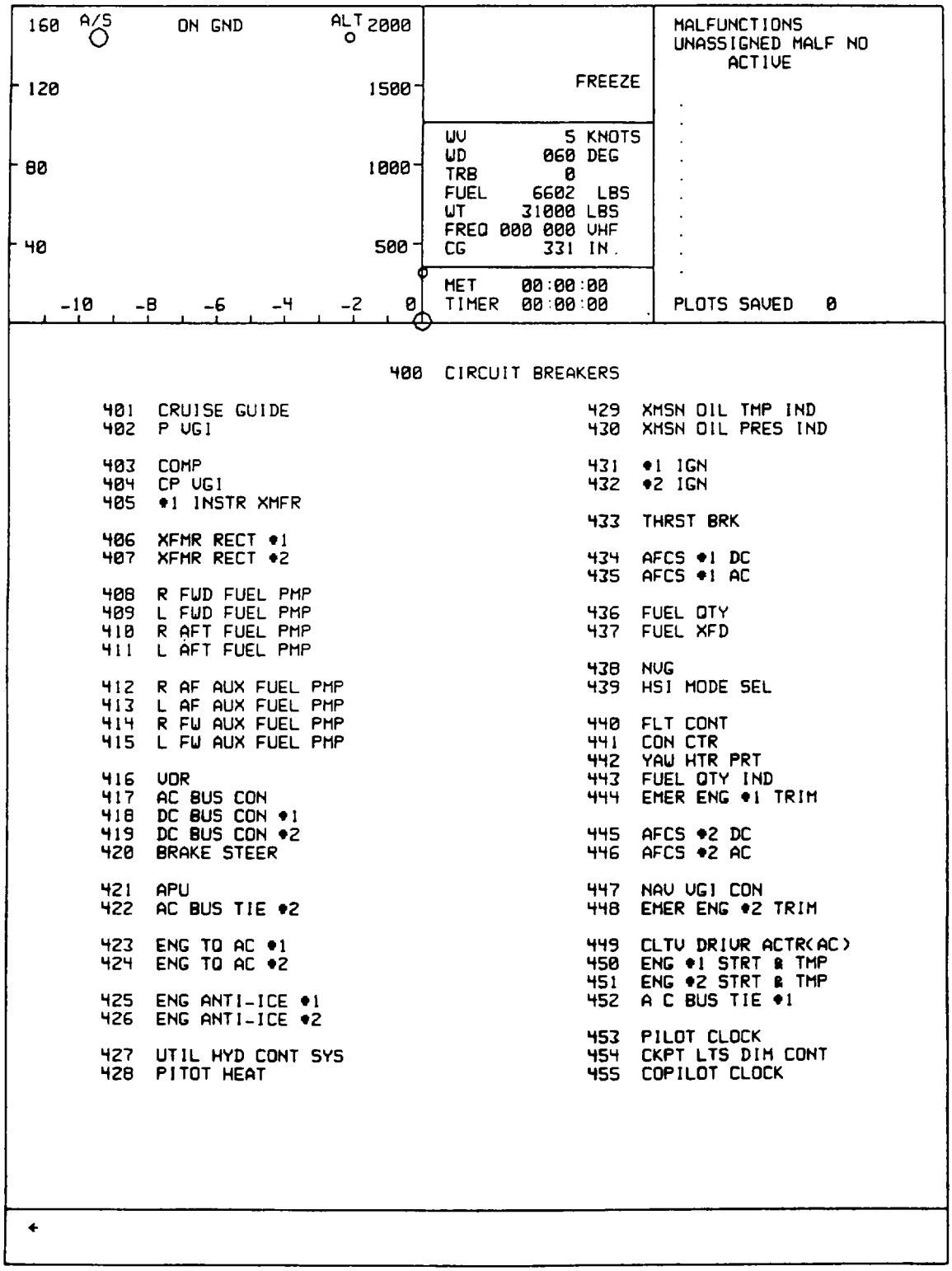
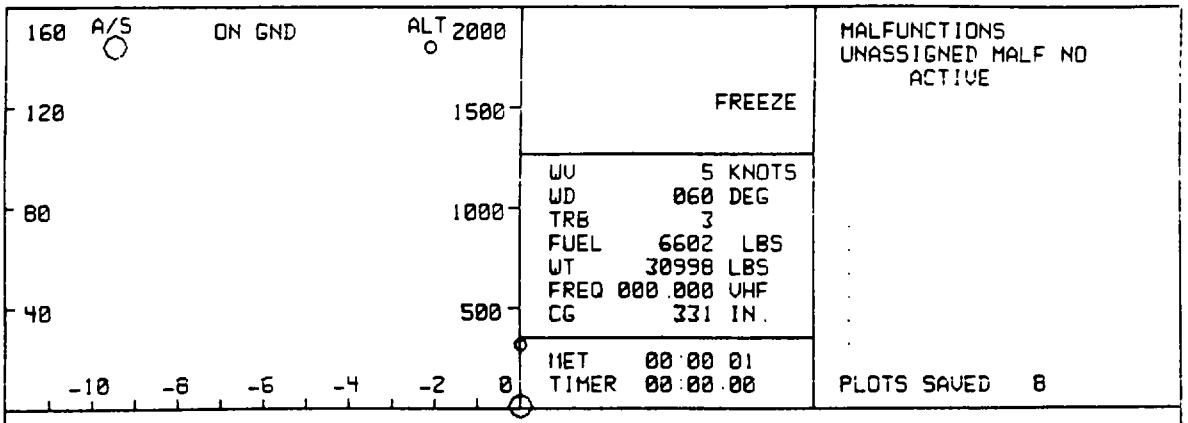


Figure 8-13. CRT Page Display (Sheet 25)



500 ENGINE INSTS

501 #1 N1 TACH
502 #2 N1 TACH

503 SPARE
504 SPARE

505 #1 OIL PRES '0'
506 #1 OIL PRES LO

507 #2 OIL PRES '0'
508 #2 OIL PRES LO

509 #1 OIL TMP FRZ
510 #1 OIL TMP MIN
511 #1 OIL TMP MAX

512 #2 OIL TMP FRZ
513 #2 OIL TMP MIN
514 #2 OIL TMP MAX

515 SPARE
516 SPARE
517 PRTR TACH FLUC/FL
518 CRTR TACH FLUC/FL

519 #1 PTIT '0'
520 #2 PTIT '0'

521 #1 ENG TQ FLUCT
522 #2 ENG TQ FLUCT

Figure 8-13. CRT Page Display (Sheet 26)

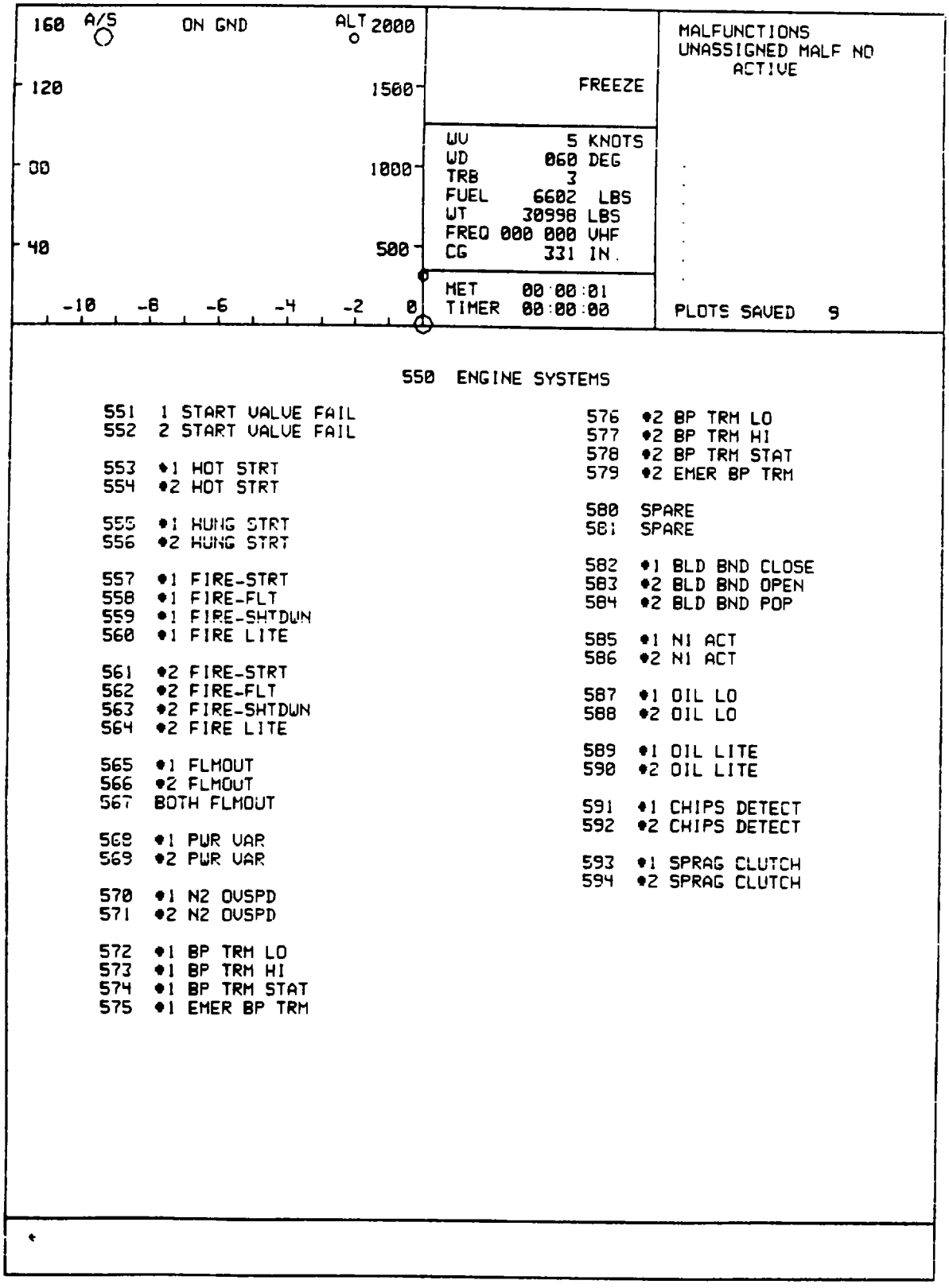


Figure 8-13. CRT Page Display (Sheet 27)

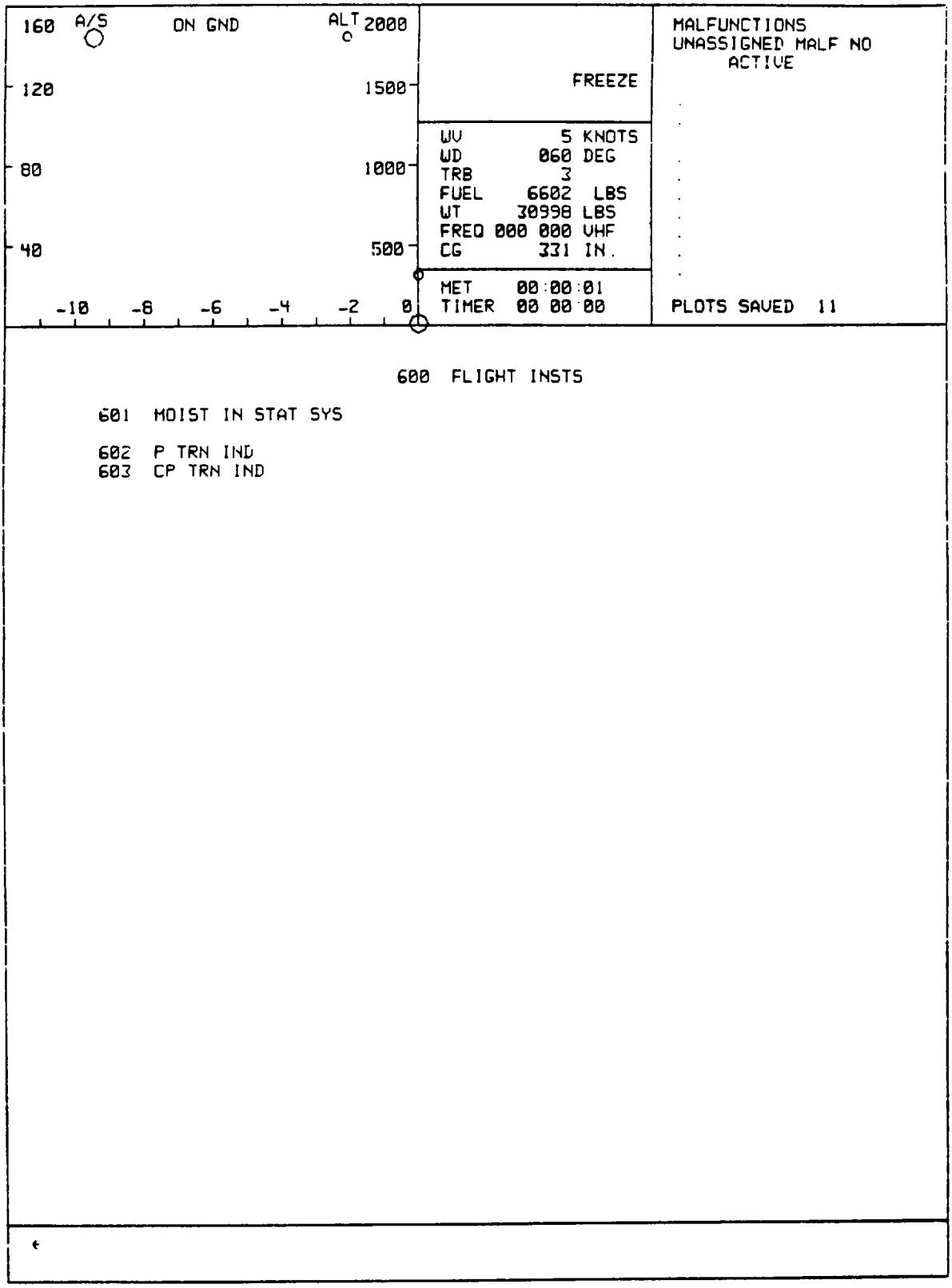
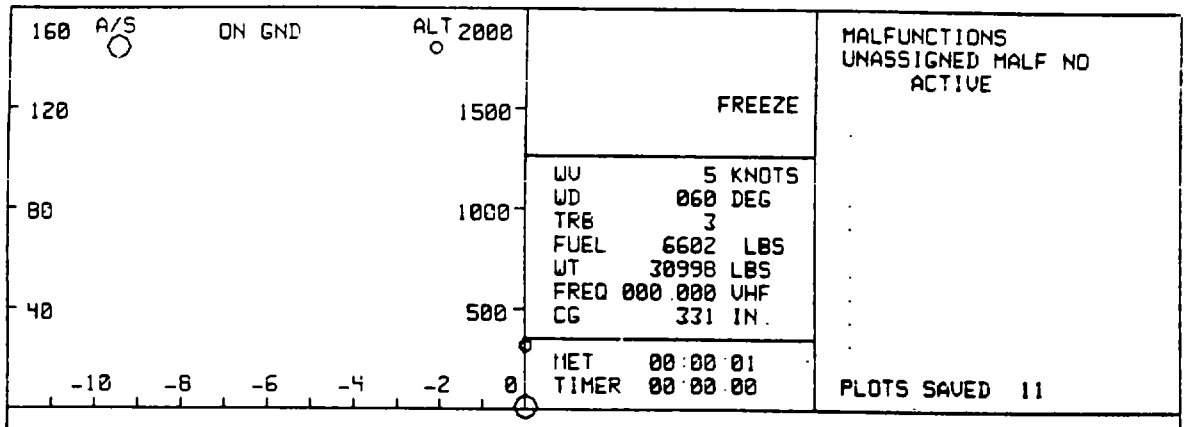


Figure 8-13. CRT Page Display (Sheet 28)



650 FLT CONT/HYD SYS

651 #1 HYD FLT CONT
652 #2 HYD FLT CONT
653 SPARE

654 DUAL HOOK FAULT

655 #1 AFCS
656 #2 AFCS

657 HDOVR 1 AFCS PTCH
658 HDOVR #1 AFCS ROL
659 HDOVR #1 AFCS YAW

660 HDOVR 2 AFCS PTCH
661 HDOVR #2 AFCS ROL
662 HDOVR #2 AFCS YAW

663 OSC #2 AFCS PITCH
664 OSC #2 AFCS ROLL
665 OSC #2 AFCS YAW

666 AFCS ENGAGE ERROR

667 FWD LONG CYC TRM
668 AFT LONG CYC TRM
669 BOTH LONG CYC TRM
670 MANL LONG CYC TRM

671 THR CNT RD BRK SW
672 THR CNT RD BRK FL

673 THR CCDA FAIL

674 DASH LONG FAIL
675 DSH STCK GRAD FRZ

676 LONG CCDA TRIM FL

677 PROXIMITY SW FAIL

678 UTL SYS FAIL APU
679 UTL HYD PUMP XMSN

Figure 8-13. CRT Page Display (Sheet 29)

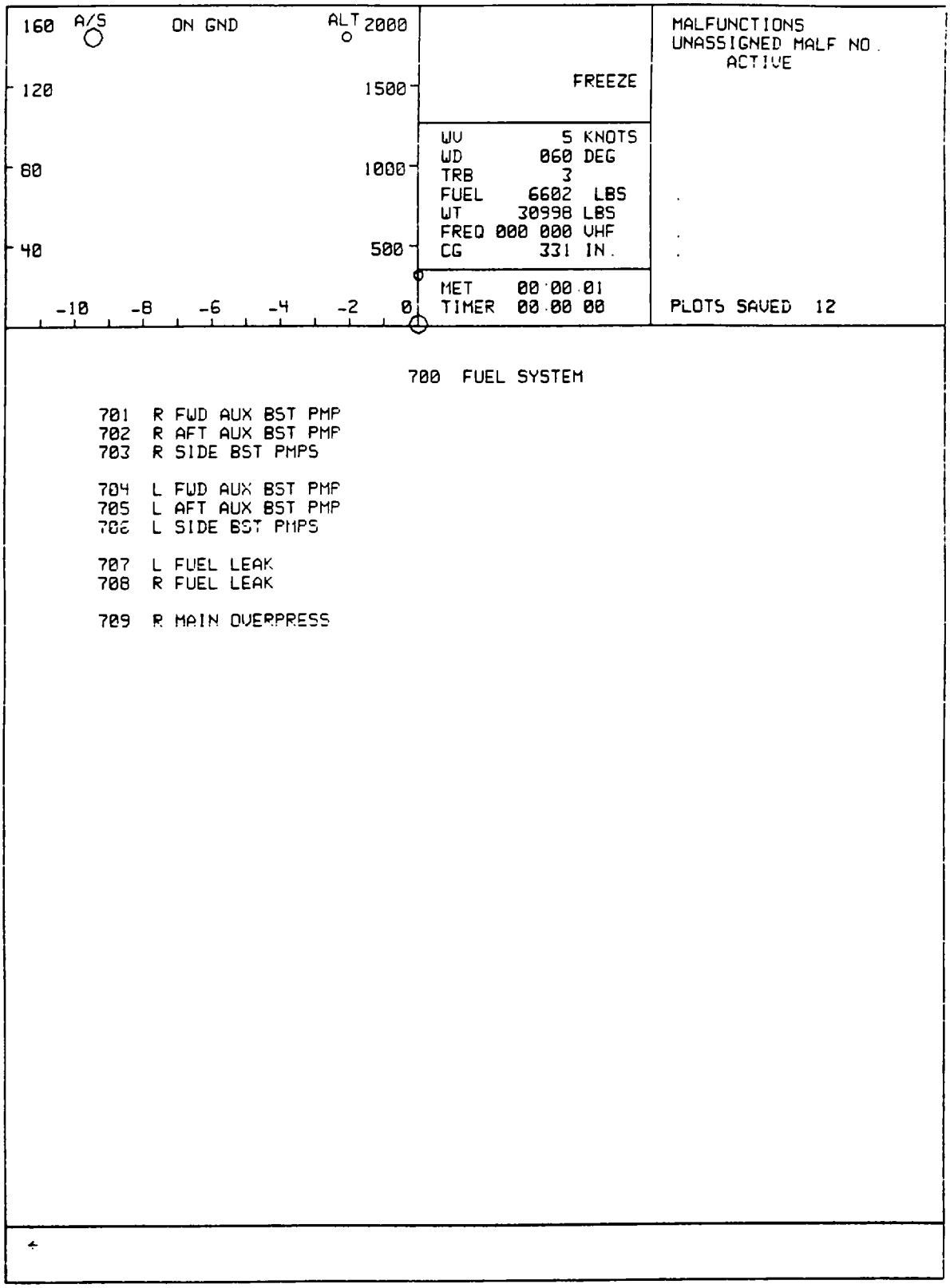


Figure 8-13. CRT Page Display (Sheet 30)

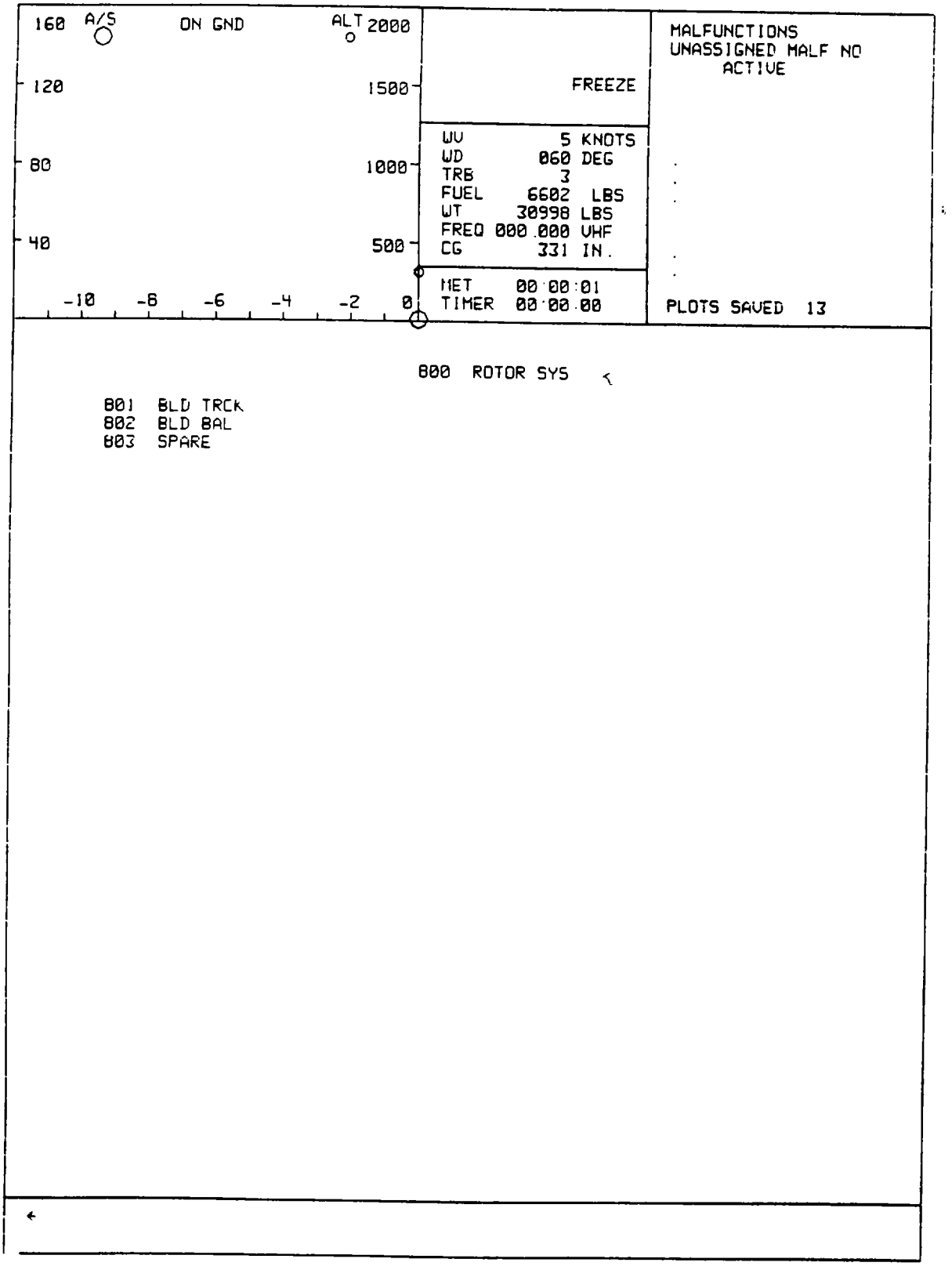


Figure 8-13. CRT Page Display (Sheet 31)

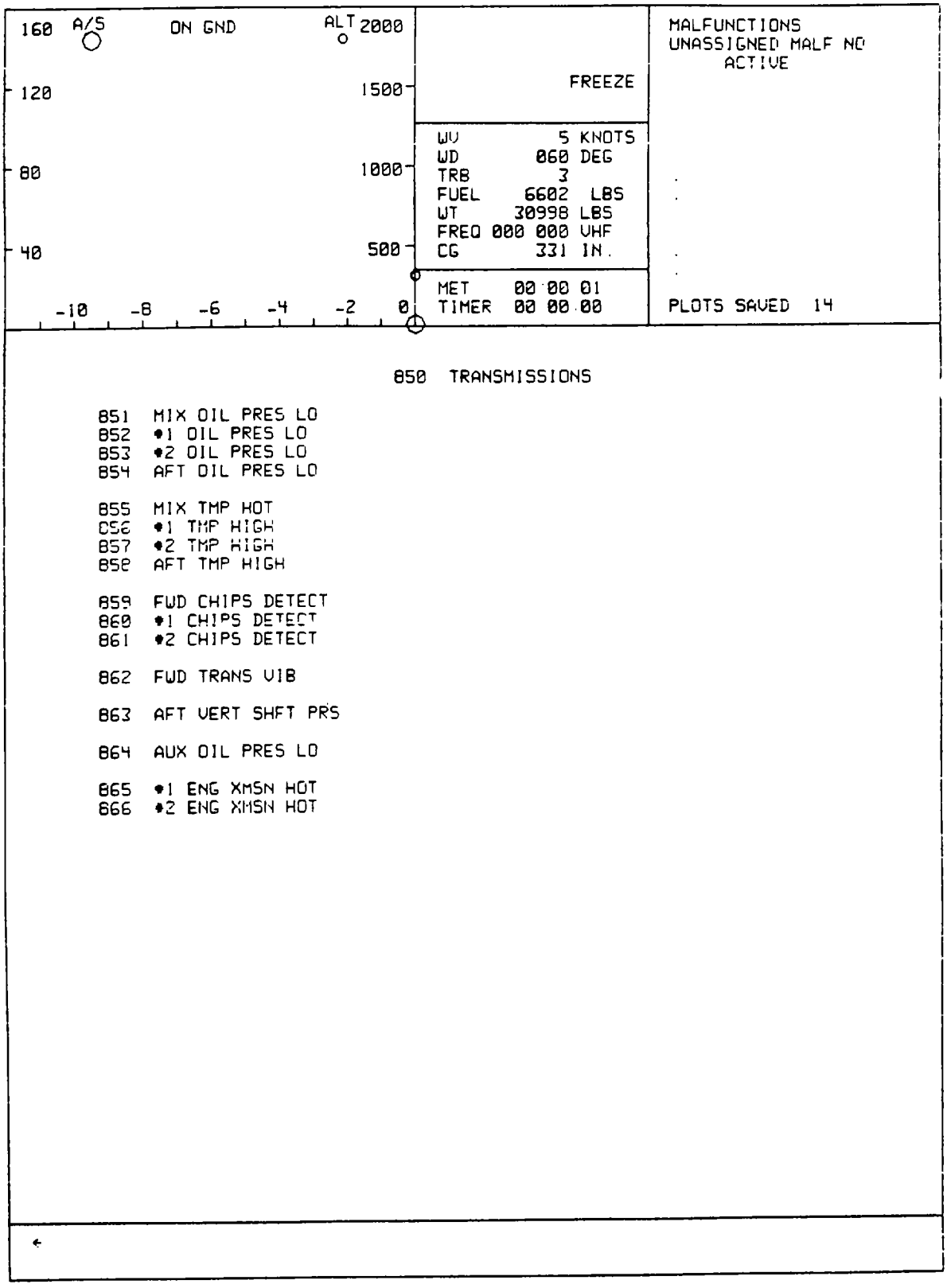


Figure 8-13. CRT Page Display (Sheet 32)

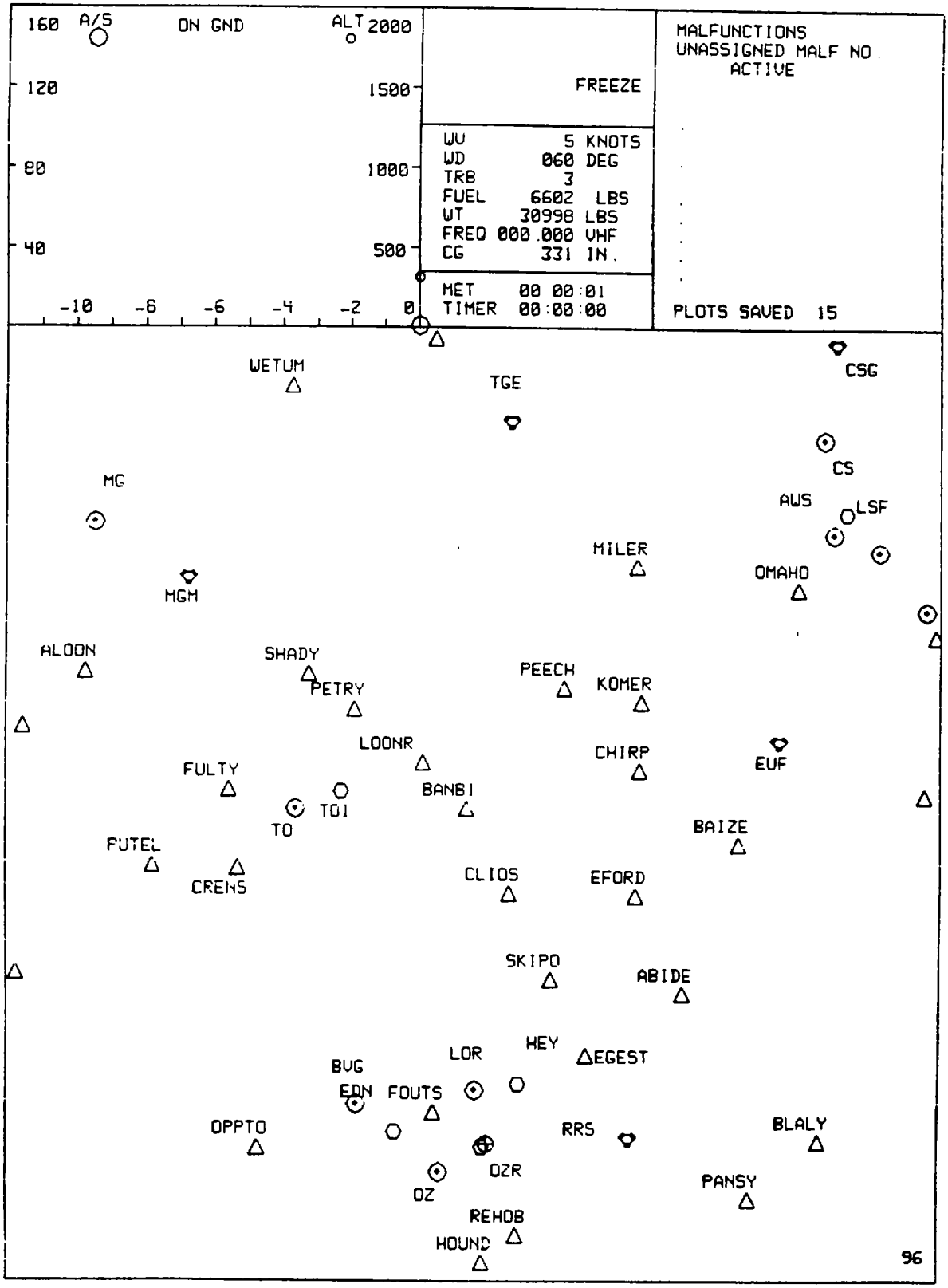


Figure 8-13. CRT Page Display (Sheet 33)

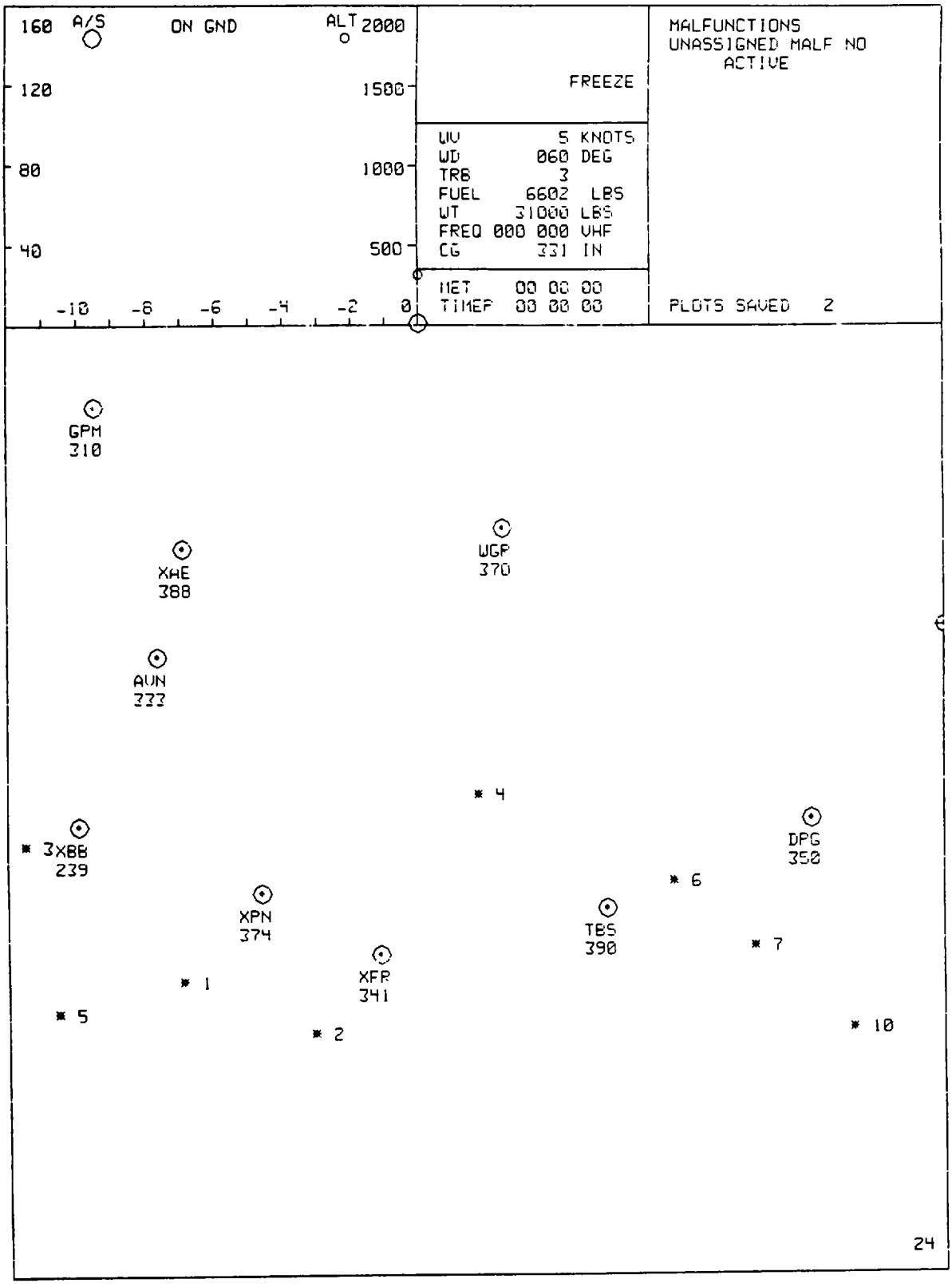


Figure 8-13. CRT Page Display (Sheet 34)

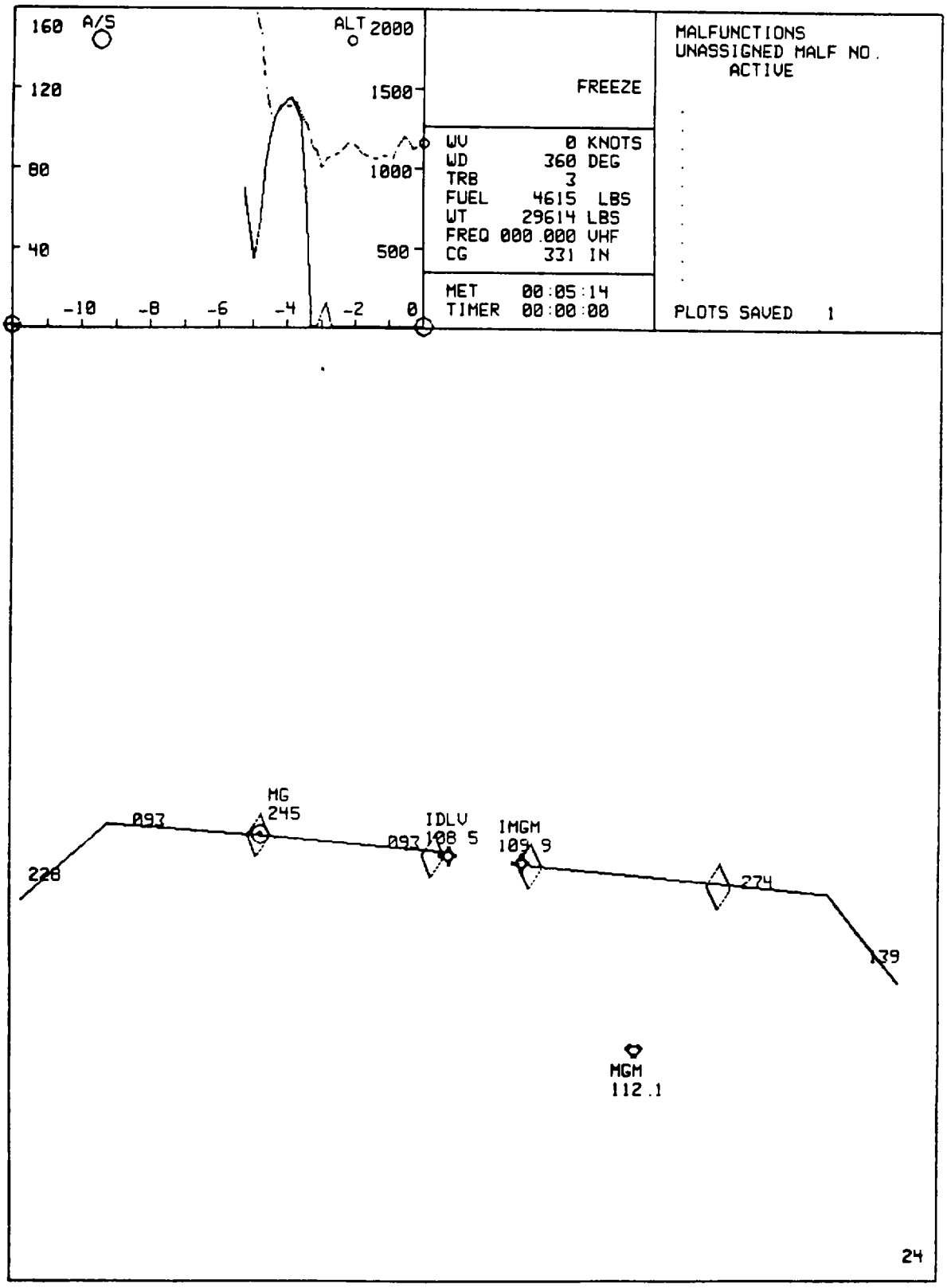


Figure 8-13. CRT Page Display (Sheet 35)

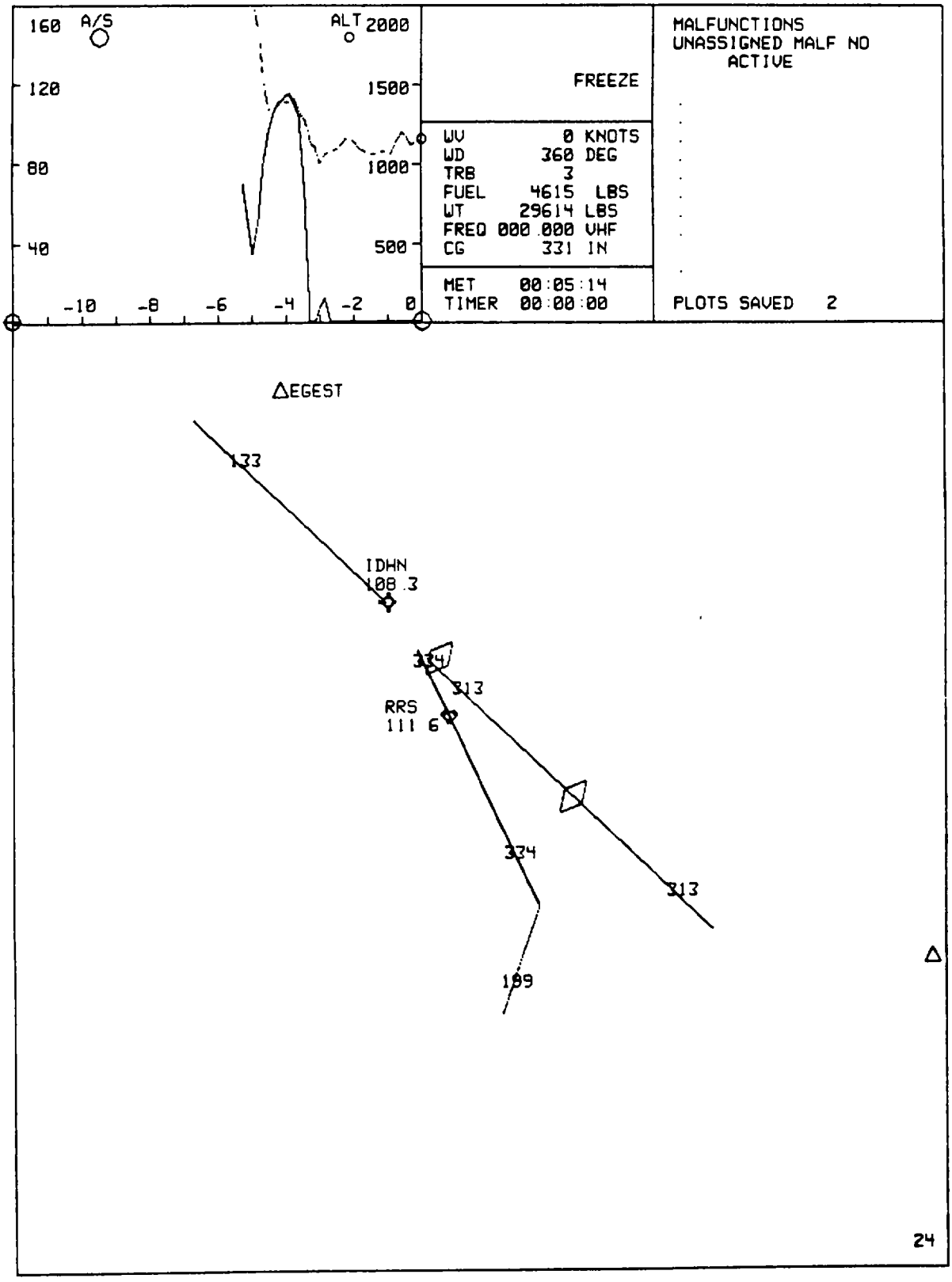


Figure 8-13. CRT Page Display (Sheet 36)

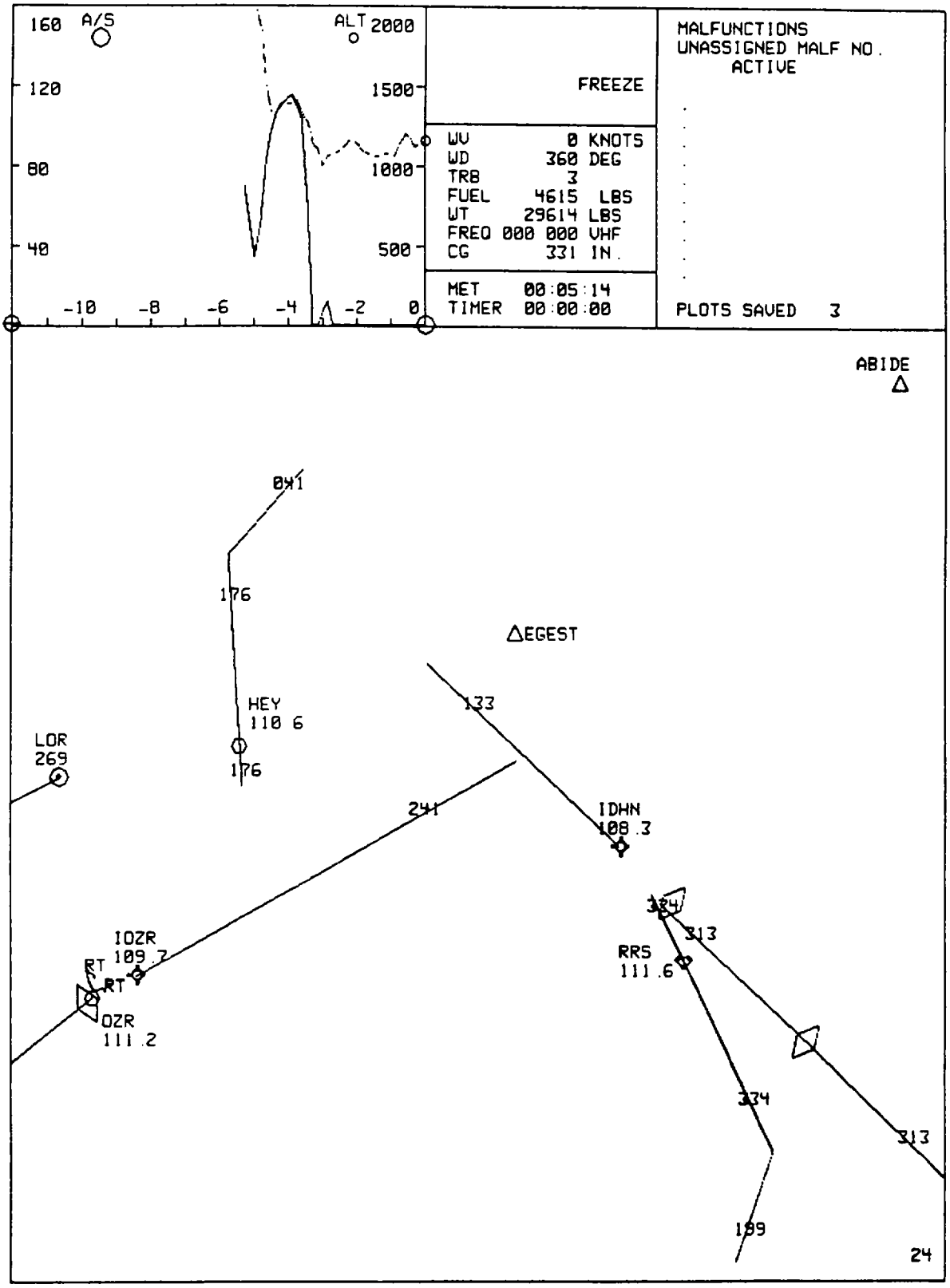


Figure 8-13. CRT Page Display (Sheet 37)

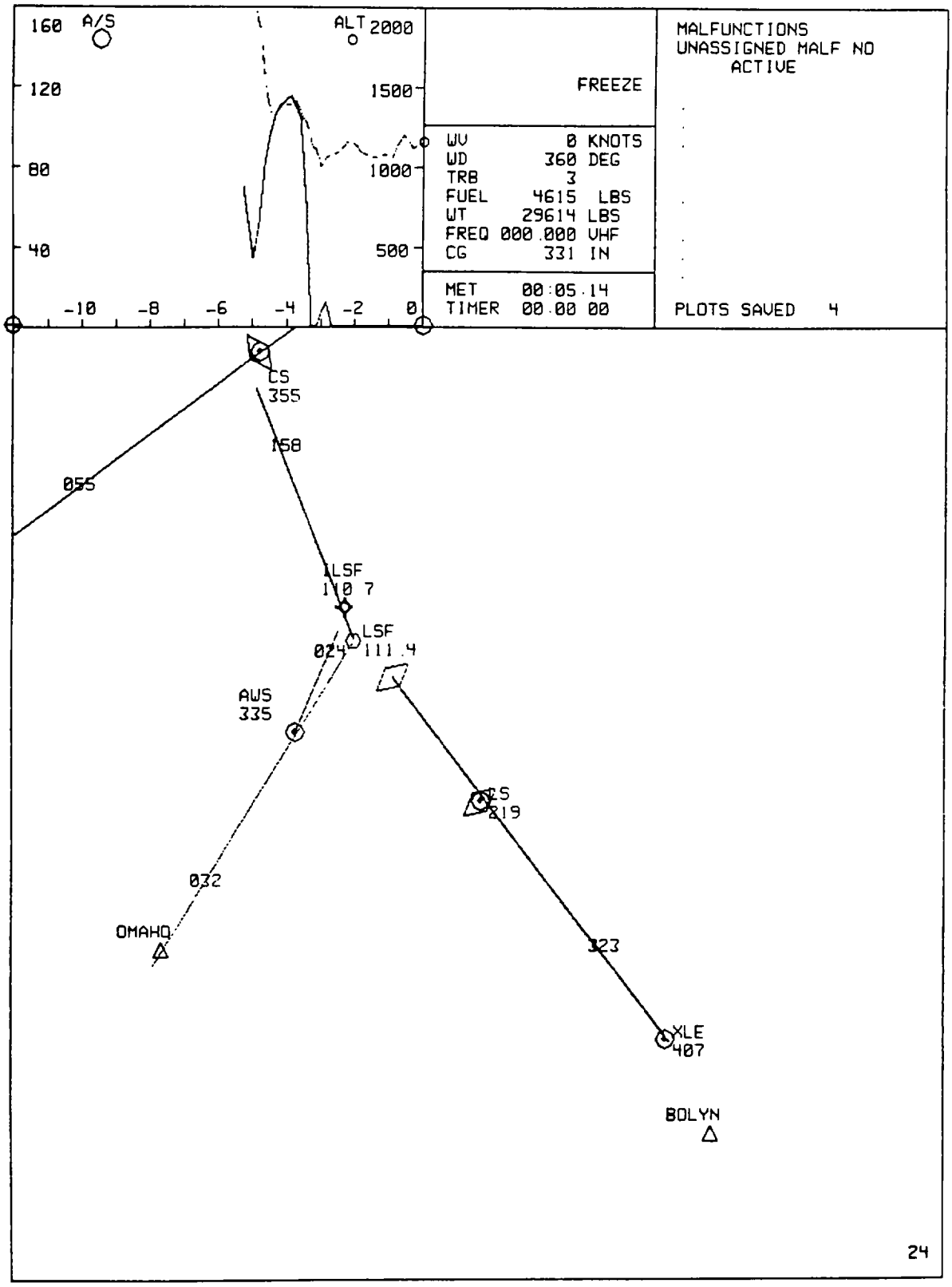


Figure 8-13. CRT Page Display (Sheet 38)

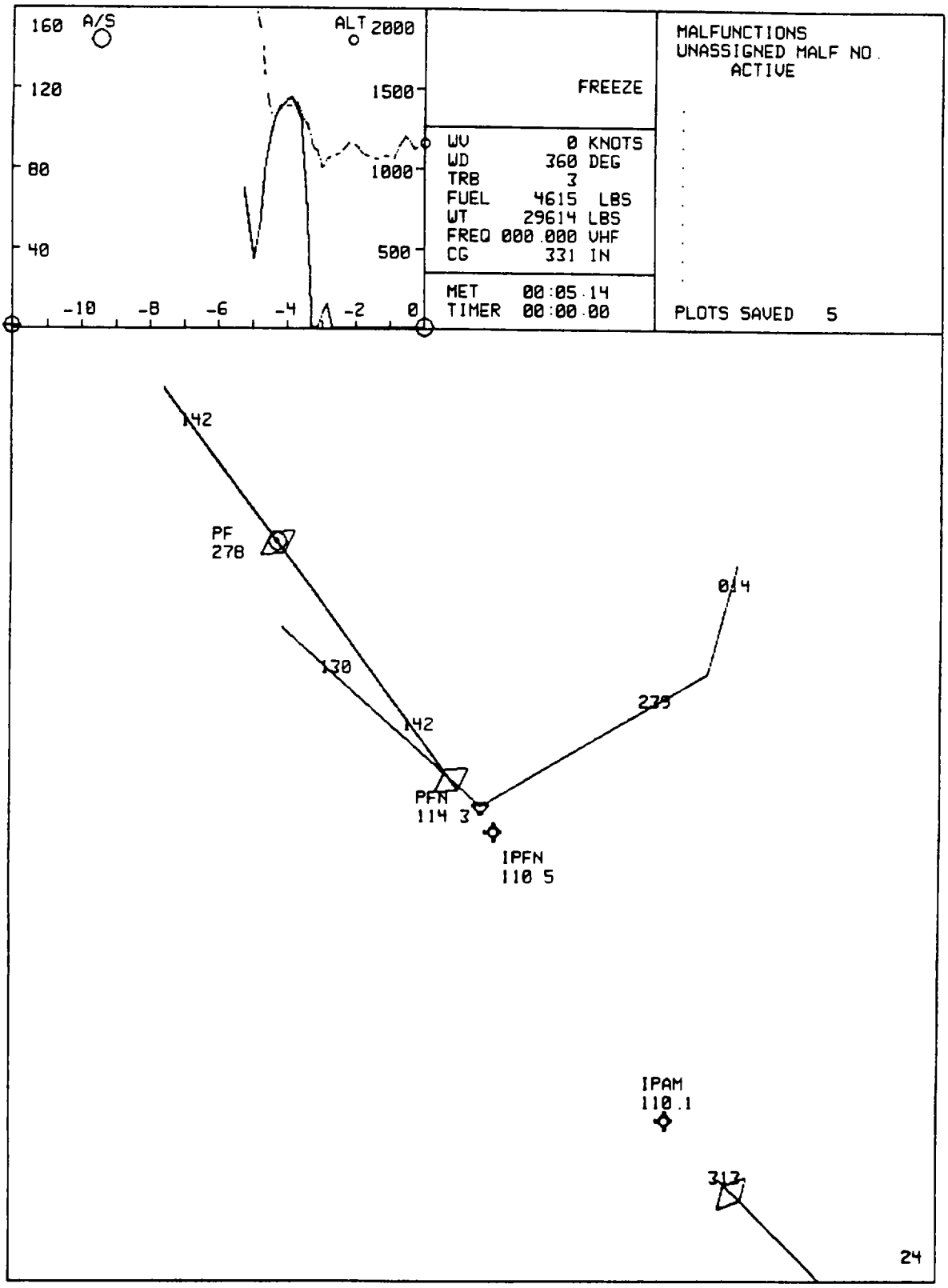


Figure 8-13. CRT Page Display (Sheet 39)

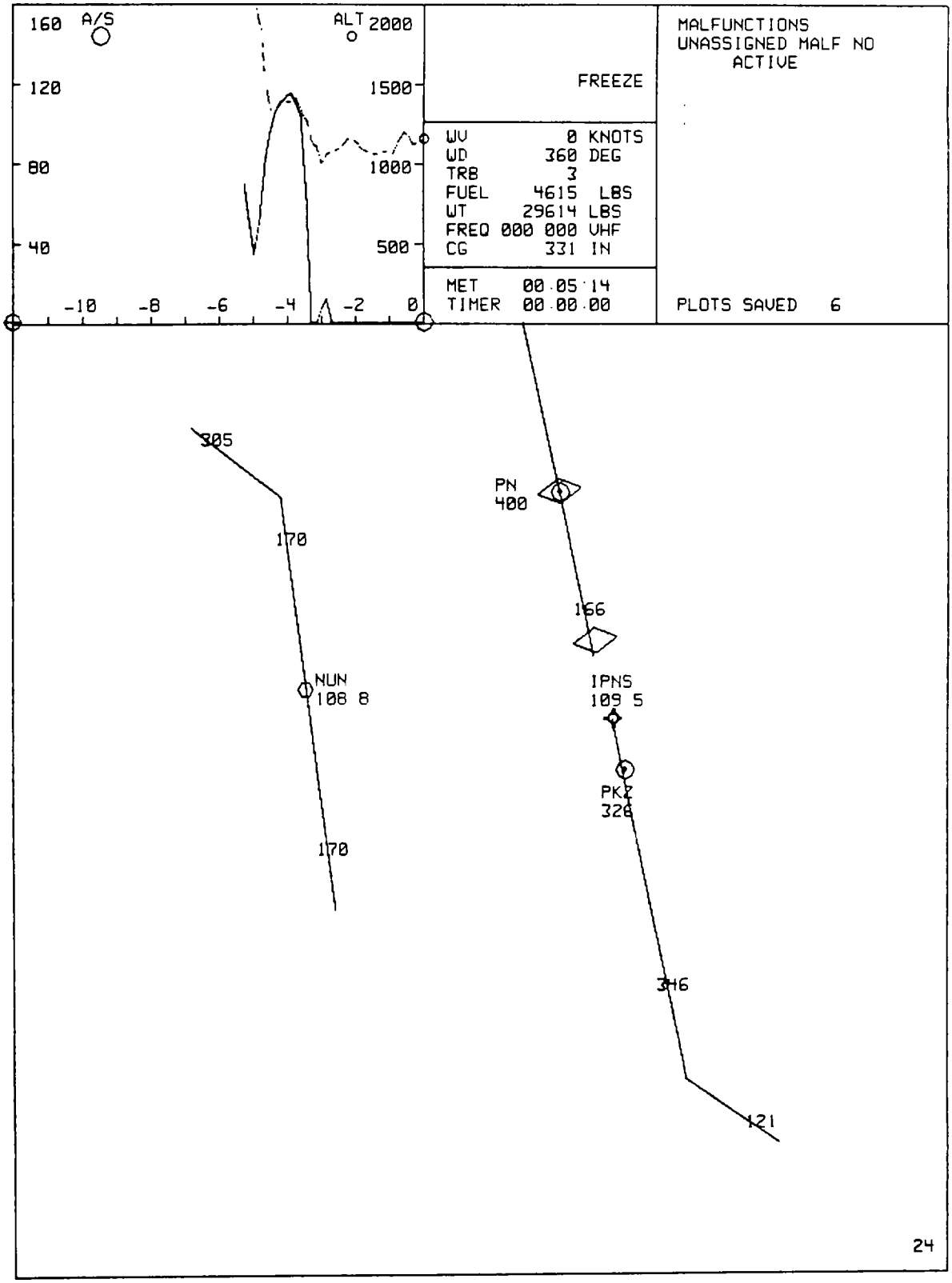


Figure 8-13. CRT Page Display (Sheet 40)

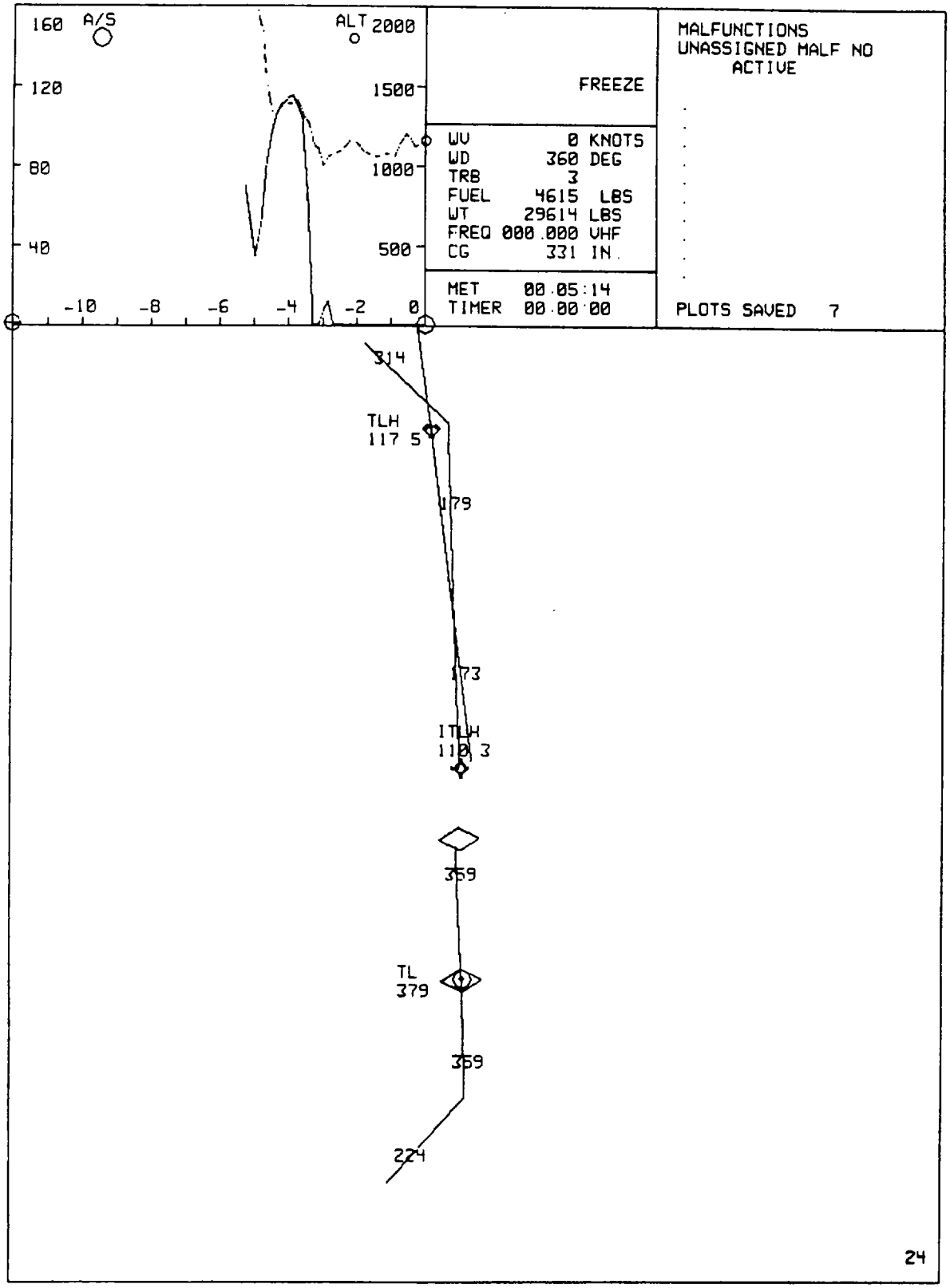


Figure 8-13. CRT Page Display (Sheet 41)

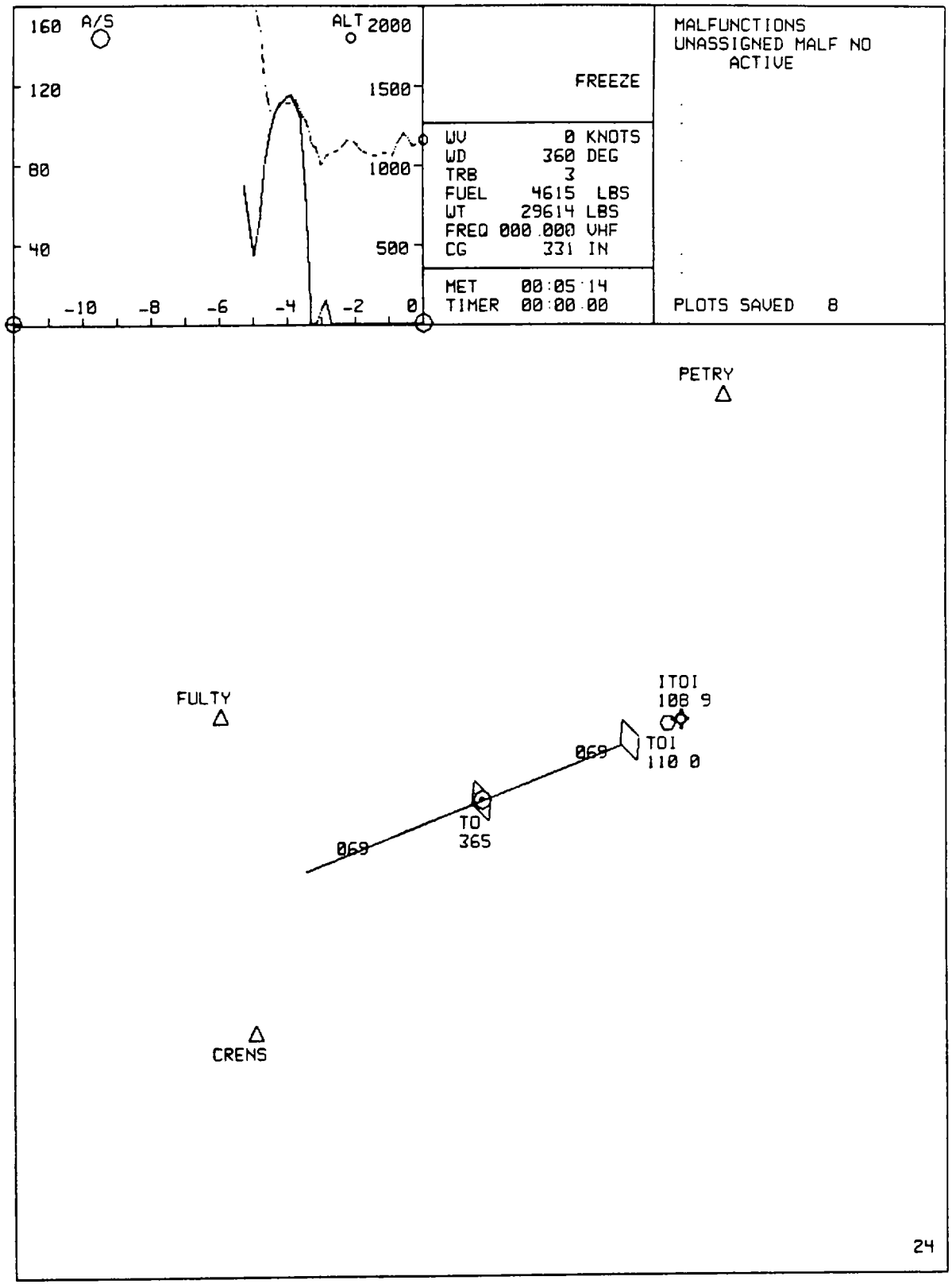


Figure 8-13. CRT Page Display (Sheet 42)

8-67. CONTROL/DISPLAY INTERRELATIONSHIPS.

8-68. The various CRT pages are called up, and information is entered, by using the thumbwheel selector and INSERT and DELETE switchlights, and by using the keyboard. Table 8-10 details, for each display page, whether the keyboard or thumbwheel switchlight is used to call up the page or enter data.

Table 8-10. IOS Control/Display Interrelationships

Display	Contents	Display callup
000 DISPLAY INDEX (AID)	Identifies (on AID) 10 IC sets, 10 approach maps, 10 demos, malfunction categories, and nav/comm radio data tables that exist in computer and indicates thumbwheel position required for selection of maps, demonstration, and IC assignment. Thumbwheel positions for selection of malfunctions reside on malfunction category pages.	On keyboard, type: 000 ENTER
001 thru 010 INITIAL CONDITIONS (AID)	Identifies (on AID) conditions that represent each of 10 preprogrammed IC sets that can be assigned for trainer initialization or reassigned to IC set 011 for modification.	On keyboard, type: 01-10 ENTER After IC set is displayed, it can be assigned to set 011 by typing 11, SPACE, ENTER.
011 RESET CONDITIONS (AID)	Identifies (on AID) conditions to which the trainer can be initialized. This page can be modified by appropriate action at the keyboard.	On keyboard, type: 11 ENTER
020 CURRENT CONDITIONS (AID)	Identifies (on AID) status of aircraft flight parameters (current value), aircraft location, aircraft weight and balance, weight of fuel, and environmental conditions. If a parameter is frozen, an asterisk appears between the line number and text. Environmental conditions, aircraft location, weight, center of gravity, and fuel values can be edited on this page.	On keyboard, type: 20 ENTER

Table 8-10. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
021 VISUAL CONDITIONS (AID)	This page contains visual system status information and control input parameters. The control parameters provided are for environmental conditions (cloud ceiling and cloud tops), time of day, lighting control, viewpoint perspective select, and visual threat location and type select.	On keyboard, type: 021 ENTER
030 thru 040 AREA MAPS (GPD)	Selected game-centered cross-country or approach maps are drawn in GPD display. The cross-country map represents a 96- by 96-mile area; the approach map represents a 24- by 24-mile area. The visual training map (TAC) map represents approximately a 50- by 60-mile area.	Select desired map on thumbwheel. Depress INSERT switchlight.
EXPAND MAP (GPD)	The map area can be expanded by a factor of 2X and 4X.	Depress PLOT SCALE CHANGE switchlight.
RECENTER MAP (GPD)	Aircraft centered plots can be selected. The center of the display is drawn at aircraft location at instant of switch depression.	Depress A/C CENTER switchlight.
041 thru 045 TAC MAPS	(Refer to paragraph 2-60 and figure 2-4. sheets 1 through 5.)	Select desired map on thumbwheel.
	NOTE **The TAC maps cannot be centered.**	
050 GCA/ILS (AID)	Assigns stylized glideslope/localizer plot display to AID display.	Select 050 on thumbwheel. Depress INSERT switchlight.
061 thru 066 LOAD DISPLAY (AID)	Assigns stylized load display for high-density or aero load pickup to AID display.	Select desired load on thumbwheel. Depress INSERT switchlight.
300 AVIONIC MALF 350 APU/ELEC SYS 400 CB POP MALF 500 ENG INST MALF 550 ENG SYS MALF 600 FLIGHT INST MALF 650 FLT CONT/HYD MALF 700 FUEL SYS MALF 800 ROTOR SYS MALF 850 XMSN MALF	Identifies (on AID) all possible malfunctions and selection numbers for a particular system that can be selected for insertion during training.	On keyboard, type: MALF PAGE NUMBER ENTER

Table 8-10. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
910 FM 920 LF/ADF 930 VOR 940 ILS-LOC 950 OM 960 MM 970 IM 980 GCA	Identifies (on AID) radio facility data that can be inspected on sub-lists for each navigation station type and edited to disable/enable radio facility. Any facility that is disabled is indicated by insertion of an asterisk between the line number and the text.	On keyboard, type: FACILITY NUMBER ENTER <u>To disable station</u> On keyboard, type: LINE NUMBER SPACE * ENTER <u>To enable station</u> On keyboard, type: LINE NUMBER SPACE ENTER
ALTITUDE AND AIRSPEED PLOT (TSD)	A 5-1/4- by 4-inch plot of altitude and airspeed performance during the preceding 12 minutes of flight. Both traces are plotted against a common elapsed-time reference along the 5-1/4-inch dimension. The 12 minutes of history accumulate from right to left. The 4-inch dimension presents 0-160 knots of airspeed or 0-2000 or 0-8000 feet of altitude. The altitude scale plot is changed by depressing ALT SCALE CHANGE switchlight.	Automatic (not freeze)
GROUND PLOT (GPD)	A ground track plot on the selected cross-country or approach map is produced as appropriate. On approach charts, the maximum length of the minimum ground track trace update represents 380 feet. On cross-country charts, the maximum length of the minimum ground track trace update represents 1/4 nmi. A maximum of 20 linear inches of trace history in either the cross-country or approach mode is plotted and retained for recall.	Automatic (not freeze)
TRACK HISTORY ERASE (GPD)	Erases ground track at a constant rate. Erasure starts at the oldest history on selected plot. This unclutters the display. Momentary depression of this switchlight erases all out-of-tolerance (OOT) data. (041-045 TAC MAP TRACK HISTORY is not applicable; refreshing map deletes previous recorded track history.)	Depress and hold TRACK ERASE switchlight.

Table 8-10. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
TRACK HISTORY ERASE (GPD) - continued	Selection of another scale or approach redraws all relevant track history.	
ALERTS (TSD)	A maximum of 20 alerts can be displayed simultaneously on the GPD. Further indications of out-of-tolerance are available continuously in the status area. An out-of-tolerance parameter links high/low intensity. During training mode, alerts are programmed for variables that exceed published limits. Limits are established for the following: IAS A/S — Yaw YW Roll RL — Pitch PT Rotor speed RR — Turn Rate RT Torque TQ (1 and 2) — Fuel Qty FUEL Altitude ALT Vertical speed at landing VS	Automatic
CURRENT CONDITIONS (AID)	A current conditions display is available for monitoring current aircraft parameters and conditions. It is used to initiate parameter freeze, change aircraft location, change aircraft weight and balance, and change environmental conditions using the IOS keyboard.	On keyboard, type: 20 ENTER
	The following parameters can be frozen and their current condition values monitored: Altitude — Torque 2 IAS — Yaw Heading — vertical speed Roll — Rotor rpm Pitch — Turn rate Torque 1 — Fuel qty	<u>To freeze parameter</u> On keyboard, type: LINE NUMBER SPACE * ENTER <u>To unfreeze parameter</u> On keyboard, type: LINE NUMBER SPACE ENTER

Section IV. AUDIO RECORD PLAYBACK/PERFORMANCE PLAYBACK

8-69. GENERAL DESCRIPTION.

8-70. Mode selection at the IOS automatically selects the appropriate record/playback unit for training mode. The system provides the 1to 5-minute audio and performance record/playback (instant replay) and audio for instructor-selected ATIS conditions, demo commentary, and communications record/playback.

8-71. INSTANT REPLAY.

8-72. Performance history is recorded automatically when the simulator is not in freeze. Audio for the performance record/playback is recorded automatically when the simulator is not in freeze and the microphone is keyed.

8-73. Playback is initiated by depressing a numbered (1 to 5 minutes) switch on the PLAYBACK panel. Both the audio and simulator flight then play back for the number of minutes selected by depressing the FREEZE switchlight on the TRAINING PROBLEM CONTROL panel. During slow-time, or during repeated playback, there is no synchronization of recorded audio with the performance playback.

8-74. Playback can be terminated at any time, and training can be continued from where the playback was initiated by depressing the RESET and then FREEZE switchlights. Playback can be terminated and the trainee allowed to take over at any point during playback by depressing the FLYOUT and then FREEZE switchlights.

8-75. ATIS.

8-76. Four different air traffic information system (ATIS) weather conditions recordings can be created. ATIS selection requires the use of the IOS keyboard. Type 20, ENTER, to display the current conditions page on the AID. Modify the appropriate line by typing LINE NO. (25), SPACE, VALUE (0-4), ENTER.

8-77. To record ATIS, proceed as follows:

a. Ensure that simulator is in FREEZE.

b. Depress STUD MON switchlight. Ensure that light is illuminated.

c. Depress AUDIO RECORD ENABLE switchlight.

d. Type 20 and depress ENTER key at keyboard.

e. Edit CAIRNS WX line 25 to 1, 2. 3, or 4 as desired.

f. Select HOT MIKE on pilot ICS box. Put on pilot headset.

g. Depress ATIS RECORD switchlight.

h. Talk into pilot headset mike for approximately 1 minute.

i. Depress ATIS RECORD switchlight. CAIRNS WX line 25 on page 20 assumes a value of 0. AUDIO RECORD ENABLE switchlight extinguishes.

j. This completes ATIS recording. Line 25 number selected (1, 2, 3, or 4) is available for use.

8-78. To check ATIS recording, proceed as follows:

a. Edit CAIRNS WX line 25 to 1, 2, 3, or 4.

b. On pilot and/or copilot ICS boxes, position AUX switch(s) to ON.

c. Depress FREEZE switchlight. Recorded ATIS message plays back over pilot and copilot headsets. Message repeats itself as long as anyone is listening.

d. Edit CAIRNS WX line 25 to 0. Line 25 assumes edited value. ATIS message ceases.

8-79. COMMUNICATIONS RECORD/PLAYBACK.

8-80. Depressing the RECORD switchlight on the SIMULATOR CONTROL panel records all instructor/trainee communications for up to 20 minutes of continuous communications. When playback is desired, depress PLAYBACK switchlight. To stop recording, depress STOP switchlight on the SIMULATOR CONTROL panel.

8-81. DEMO RECORD PLAYBACK/LEADSHIP FORMATION.

8-82. A 60-minute leadship flight can also be recreated. When played back, the leadship is correctly displayed on the ownship's visual display. A leadship flight is generated by recording a flight of the ownship while in the special leadship record mode.

8-83. LEADSHIP RECORDING.

8-84. To record a leadship flight, proceed as follows:

a. Initialize simulator to IC number that will be ownship starting point during leadship training.

(1) Select IC number on thumbwheel.

(2) Depress thumbwheel INSERT switchlight. FREEZE lamps blink while simulator is initializing and stop blinking when initialization is complete.

b. Depress FREEZE switchlight. Fly/taxi aircraft to a point in front of IC point. This is the point at which the leadship will start (appear on the visual) during normal training. This should be a point visible out the front window of the ownship when the ownship is initialized to the IC point used in a.(l) above.

c. Depress FREEZE switchlight when desired leadship starting point is achieved.

d. Select 80 on thumbwheel.

e. Depress LEADSHIP RECORD switchlight.

f. Depress thumbwheel INSERT switchlight.

g. Depress FREEZE switchlight. Fly aircraft as leadship.

h. When desired leadship flight has been completed, freeze simulator and terminate recording as follows:

(1) Depress FREEZE switchlight.

(2) Depress LEADSHIP RECORD switchlight. Leadship flight has been recorded.

8-85. LEADSHIP TRAINING.

8-86. To show the leadship in the visual scene, proceed as follows:

a. Initialize simulator to IC number used in leadship recording.

b. Select 80 on thumbwheel.

c. Depress thumbwheel INSERT switchlight.

d. Depress FREEZE switchlight. Leadship appears in visual scene at starting point and begins flying recorded flightpath. At this time, simulator is out of freeze, and student should begin flying as a following ship.

e. Depress thumbwheel DELETE switchlight to delete leadship from visual scene.

Section V. INITIAL CONDITIONS

8-87. GENERAL.

8-88. The simulator has 10 preprogrammed initial condition sets that are available for assignment as a setup or reset point. These are listed on the index display.

8-89. An existing IC set can be modified before actual initialization by using the keyboard. Type the IC page (01 through 10) to be edited, then type ENTER. The selected IC set is then displayed on the auxiliary information display (AID). Assign this set to 011 by typing 11, SPACE, ENTER. Any or all values can now be changed on a line-by-line basis using the keyboard. If a value beyond the accepted range is entered for any line, the computer refuses to accept the value, and an illegal entry message is displayed in the area below the IC set display on the scratchpad.

8-90. Initialization places the simulator within the simulated game area (e. g. , geographic position and altitude) in a steady-state flight condition from which the trainer can be flown.

WARNING

Releasing the freeze condition with incorrect rotor percentage can cause motion surges and injury to personnel.

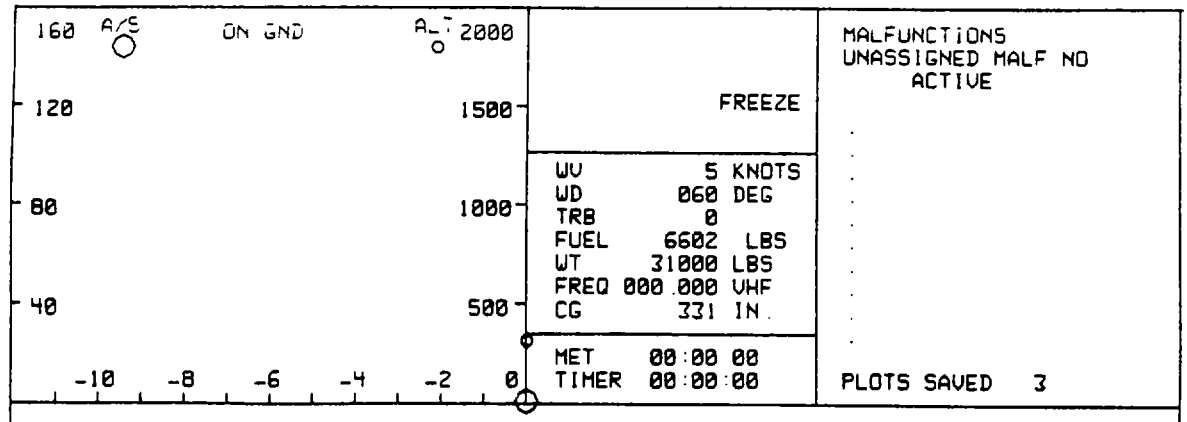
8-91. THREAT ARRAY PAGES.

8-92. Initialization of the threat environment occurs each time the simulator is loaded on-line. A specific threat condition is edited using threat array page 025. (See figure 8-14.) All threat parameters maintain initial and edited values regardless of instructor inputs to training environment controls for initial conditions; except that MODE goes to 0 (manual) and ACTIVE goes to 0 (activity levels off).

8-93. Threat array page 025 requires a line and column number for editing. There should be no space between the line and column numbers. A space should precede only the value to be entered. For example: LINE NO. , COLUMN NO. , SPACE, VALUE, ENTER. (Table 8-11 provides threat array page 025 inputs.) The absence of a specific input value is equivalent to a zero when editing page 25. When the simulator is in the automatic mode, no editing to the activity level is allowed. The three closest threats are activated automatically. No more than three threats can be automated in either the manual or auto mode.

8-94. VISUAL THREATS.

8-95. The visual threats are colocated with EW threats at the LAT/LONG shown on the threat array page 025 (figure 8-14). The LAT/LONG are representative of locations at the Todendorf gaming area only. When a different field is selected, the LAT/LONG for the EW threats must be edited by the instructor to locations in the new gaming area. When a field other than Todendorf is selected, there will not be a visual model of the threat at the new location selected by the instructor.



025 THREAT ARRAY

	TYPE 1	ACTIVE 2	LAT 3	LONG 4	ELEV (FT) 5
01	ZSU23-4	0	N035 53'10"	W057 16'13"	877
02	SA-8	0	N035 54'53"	W057 07'45"	974
03	SA-8	0	N035 48'45"	W057 15'39"	757
04	FLPWHL	0	N035 46'07"	W057 14'38"	1187
05	SA-8	0	N035 45'42"	W057 07'44"	604
06	ZSU23-4	0	N035 53'09"	W057 30'02"	1012
07	SA-6	0	N035 46'03"	W057 28'41"	966
08	SA-6	0	N035 57'23"	W056 59'25"	1064
09	FLPWHL	0	N035 46'49"	W056 58'09"	944
10	SA-4	0	N035 45'51"	W057 19'04"	590
11	MODE	0	(0-MAN,1-AUTO)		
12	SYS PWR	ON			

THREAT TYPES

(1) ZSU23-4
(2) SA-4
(3) SA-6
(4) SA-8
(5) FLPWHL

ACTIVITY LEVELS

(0) OFF
(1) SEARCH
(2) ACQUISITION
(3) TRACK
(4) MISSILE ACTIVE

Figure 8-14. Threat Array Page 025 Display

Table 8-11. Threat Array Page 025 Inputs

Column	Description	Input
1	Threat types	
	ZSU23-4	1
	SA-4	2
	SA-6	3
	SA-8	4
	Flapwheel	5
2	Threat activity level	
	Off	0
	Search	1
	Acquisition	2
	Track	3
	Missile active	4
3	Threat location (Latitude-N/S) seconds	Degrees, minutes,
4	Threat location (Longitude-E/W) seconds	Degrees, minutes
5	Threat elevation (above mean sea level-MSL)	0 to 9999 feet

NOTE

At Todendorf, the visual threat type may not coincide with the EW types on page 025 and the AN/APR-39 indicator; that is, the visual object may not look like the EW threat specified for that location.

8-96. The EW threats are activated in either a manual or automatic mode of operation. In both modes, the flight station must be integrated with the visual system. In the manual mode, the instructor edits the ACTIVE column (column 2) of the threat array page for the particular threat to be activated. Applicable activity levels are shown at the bottom of the threat array page. For the automatic mode of operation, the instructor should set line 11, column 2 to a 1. As soon as a line-of-sight (LOS) between the aircraft and threat has been established, the visual signal of the threat appears on the APR-39 indicator, and an audio tone can be heard over the pilot and copilot headsets. In the automatic mode, the threat automatically advances to the next most lethal mode as long as the LOS has not been broken. In the manual mode, threat modes are not upgraded.

8-97. The following EW threat types are also shown at the bottom of threat array page 025:

ZSU-23-4
SA-4
SA-6
SA-8
FLAPWHEEL

8-98. The APR-39 indicator displays up to three threats simultaneously. In the out-the-window visual scene, a maximum of three threats can be shown at any given time, provided that the ownship is close enough to see all three.

8-99. The relationship between visual threats (out-the-window) and the hostile ground fire switch is that when the switch is depressed, muzzle flash occurs at each of the visual threats. In practice, the distances between visual threats are such that probably only one threat muzzle flash will be seen at any given time.

8-100. KILL CONDITIONS FOR ANTI-AIRCRAFT ARTILLERY SITES.

8-101. The following are kill conditions from anti-aircraft artillery (AAA):

ZSU-23-4 - A kill from this threat occurs 4 seconds after going into track
Flapwheel - A kill occurs 10 seconds after going into track.

8-102. KILL CONDITIONS FOR SURFACE-TO-AIR MISSILES.

8-103. A kill from one of these surface-to-air missile (SAM) threats occurs as a function of that threat's range to the aircraft (at the time each threat time in track is exceeded) and that threat's average velocity. The track time for each missile is shown in table 8-12. Average velocities and an example are shown below:

Average velocities

SA-4 = Mach 1.25 = 413.75 m/sec
SA-6 = Mach 1.4 = 463.4 m/sec
SA-8 = Mach 1.0 = 331.0 m/sec

Example:

a. At a range of 10 km, the SA-4 would kill the A/C in 100000M÷413.75 m/sec = 24 seconds after the track time of 10 seconds is exceeded or 34 seconds after going into track.

b. At the same range, a kill from the SA-6 would occur in 10000M÷463.4 m/sec = 21.58 seconds after the track time is exceeded, or 28.58 seconds after going into track.

c. The SA-8, at the same range, would kill the A/C in 10000M÷331 m/sec = 30.21 seconds after track time is exceeded, or 37.21 seconds after going into track.

d. For AAA threats, a kill can be prevented by breaking the line-of-sight to the threat locations before the specified track times are exceeded.

e. For SAM threats, a kill can be prevented by breaking the line-of-sight to the threat sites any time after going into track. For the SA-8 type threat, flares have to be released.

f. Line-of-sight has to be broken for 5 seconds.

Table 8-12. AN/APR(V)l Radar Modes

Threat	Range (km)	Search (sec)	ACQ (sec)	Track (sec)	Missile activity (MA)	Comments
ZSU-23-4	>2.5	Indef				
	0.5→2.5	8	3	4		
	0 →0.5			4		
SA-4	>70	Indef				
	6→70	12	8	10	Yes	MA mode 4 sec after track
	4→			10	Yes	(design estimate)
	0→4	Indef				
SA-6	>30	Indef				
	6→30	7	7	7		
	4→6			7		
	0+4	Indef				
SA-8	>15	Indef				
	4→15	7	0	7		
	2→4			7		
	0→2	Indef				
Flapwheel	>6	Indef				
	1→6	12	8	10		
	0→1			10		

Section VI. INITIATION OF TRAINING

NOTE

A summary of basic training procedures, exclusive of training exercise requirements, is given in paragraph 2-50. This chapter defines the detailed training functions.

8-104. INITIAL PROCEDURES.

8-105. Before the first scheduled training period of the day, turn on the simulator and have maintenance personnel complete readiness checks.

8-106. Aircraft controls and switches should be checked when the cockpit is entered.

8-107. After these checks, training can proceed by securing doors, fastening seat belts, initializing motion, and unfreezing the simulator. When the simulator has been turned on (cold start) and the computer first loaded, IC set 011 contains the same initial conditions as IC set 010. This reflects a CH-47D parked on a pad, with normal training gross weight and center of gravity, engines off, APU off, fuel full, calm standard day weather, and training system in freeze condition. Depending on which initial conditions page is selected, lighting values (items 25, 26, 27, 29, and 31) are set at values ranging from 0 (off) to 5 (maximum brightness). Other values on the initial conditions pages are based on standard aeronautical terminology with self-explanatory terminology. (See figure 8-15 for a typical initial conditions display.)

8-108. If any other IC set is inserted, the engines are running and the rotor is set at 100% (provided the engine condition levers (ECL) and switches are in the proper positions).

8-109. DATA CLEAR.

8-110. Actuation of the DATA CLEAR switchlight at any time deletes all accumulated ground track and malfunctions, selects cross-country map, and initializes the simulator at IC set 002. Actuation of the MASTER MALF CLEAR switchlight deletes any existing malfunctions previously inserted, except circuit breaker malfunctions. These circuit breakers must be reset. The external loads are repositioned back to their original positions, if moved.

8-111. INITIALIZATION OF NORMAL TRAINING.

8-112. Initialization requires using IOS controls. The IC/MAP/LOAD/LDSHIP/DEMO/ MALF selector and INSERT/DELETE switchlights at the IOS and auxiliary control panels have identical capabilities. After all the occupants are seated with seat belts secured, motion can be turned on using the MOTION ON switchlight on the IOS or auxiliary control panel. The ramp then retracts and the platform rises to its erect position. The startup/shutdown checks listed in table 8-13 must be performed.

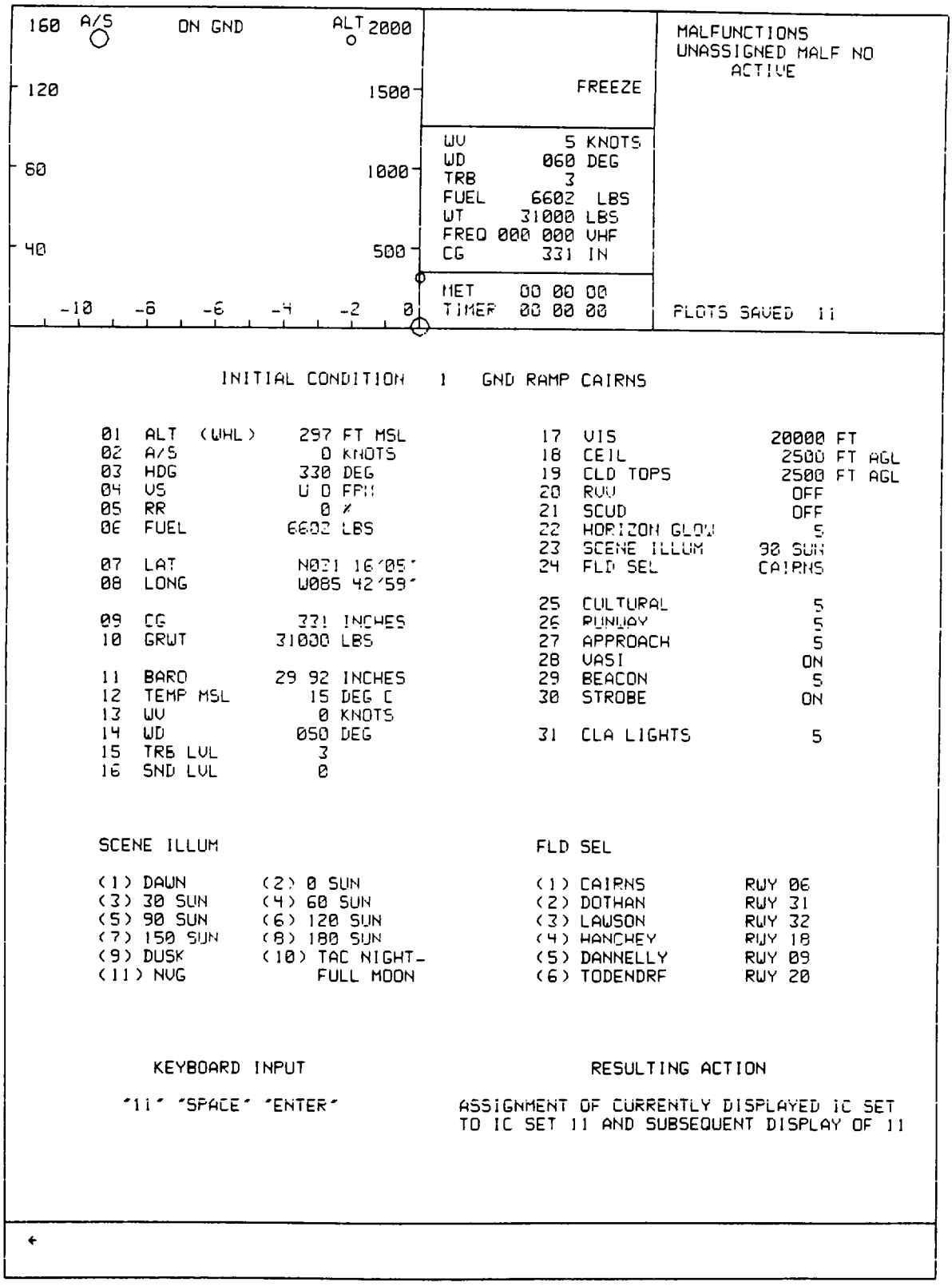


Figure 8-15. Typical Initial Conditions Display

Table 8-13. Startup/Shutdown Check Summary

Location	Check
Startup	
Cockpit maintenance area gate	Closed and latched
Simulator status forms DA 24908-12, -13, and -14	Reviewed
Exit protection bar	Pin in place
Cockpit access door	Closed and latched
IOS CRT	Intensity (INT) adjusted
IOS overhead lights	As required
Panel lights	As required
Indicator lamps	Tested
Image visibility range	As required
FWD visual display (OPER lit)	On
Simulator power (SIM PWR ON)	On
Control loading (CONT LOAD ON, CONT LOAD LOCKED extinguished)	On
Motion interlocks	All interlock requirements satisfied
Timer (start/stop)	Set as required
Crash override	As required
Thumbwheel	As required and inserted (preprogrammed or instructor-modified initial conditions, maps, etc.)
Seat belts	On and adjusted
Interphone	On and adjusted
MOTION ON	As required
Shutdown	
FREEZE (lit)	Depressed (mission complete)
MOTION OFF (lit)	MOTION ON extinguished

Table 8-13. Startup/Shutdown Check Summary - Continued

Location	Check
Shutdown - continued	
Seat belts	Off after MOTION OFF indicator lights
PRINT PLOT	Depressed as required
IOS CRT (INT)	Intensity OFF
DATA CLEAR	As required
Forms	Enter data as required

8-113. INITIALIZATION TO AN IC SET.

8-114. To initialize an IC set. dial required IC number (001 through 010) into 3-digit thumbwheel selector on CRT index display and depress INSERT switchlight. During initialization. FREEZE indicators blink until aircraft arrives at preselected steady-state condition.

8-115. During a training problem, the CRT displays current values for 12 flight parameters. These consist of altitude, airspeed, heading, roll angle, pitch angle, trim (yaw), vertical velocity, engine torque (each engine), rotor rpm. rate of turn, and fuel quantity. Any parameter can be frozen using the keyboard. (See table 8-10.)

8-116. Environmental conditions parameters (see CRT page 020. figure 8-11) also display current values that can be changed during training using the keyboard. Parameters that can be varied are fuel quantity, longitude, latitude, center of gravity, gross weight, sea-level barometric pressure, sea-level outside air temperature, wind velocity and direction, environmental sound level, turbulence level, and gaming area weather. Ground power and seat shaker can be selected or deselected.

8-117. Visual condition parameters (see CRT page 021, figure 8-13, sheet 11) also display current values and can be changed using the keyboard. The parameters that can be varied are cloud thickness, ceiling, lighting (both ground and sky), field selection, viewpoint selection, and RVR. The remaining parameters are either ON/OFF control functions or noneditable and noted as such.

8-118. INITIATION OF DEMONSTRATION.

8-119. Before initiation of a demo, ensure that engines are running and rotors are set at 100%. Edit environmental sound level to be used during demo on auxiliary information display (AID). While the simulator is in freeze, dial selected demo (100 through 199) on thumbwheel selector and depress INSERT switchlight. After initialization is complete, start demo by unfreezing simulator. When a demo ending in zero is selected in real-time, not slow-time, synchronized demo commentary is available. Demos that end in other than zero (maneuver marks) can be selected to start the demo at intermediate points. If a point is selected that does not exist, the AID displays an ENTRY DOES NOT EXIST message.

8-120. Demos are terminated automatically at their conclusion. Deselect by dialing demo on thumbwheel selector and depressing DELETE switchlight

CHAPTER 9

EMERGENCY PROCEDURES AND SAFETY

Section I. EMERGENCY PROCEDURES

NOTE
This section contains procedures to be used during an actual simulator malfunction or failure.

9-1. EMERGENCY SHUTDOWN.

9-2. EMERGENCY STOP switches are provided throughout the simulator complex for emergency shutdown of the complete simulator system. Other switches are provided to shut down the motion system only or the visual system only.

9-3. COMPLETE SIMULATOR COMPLEX.

9-4. EMERGENCY STOP switches at the following locations shut down the complete simulator complex:

Instructor operator stations
Digital linkage cabinet
Motion cabinets
Power cabinet
Motion pumps
DIG cabinets

9-5. MOTION SYSTEM.

9-6. MOTION OFF switches at the following locations shut down the motion system:

IOS simulator control panels
Auxiliary control panel (2)
Motion cabinets
Motion pump

9-7. VISUAL SYSTEM.

9-8. Switches at the following locations shut down the visual system:

IOS aft panel
Visual electronics cabinet
DIG cabinet

9-9. SYSTEM FAILURES.

9-10. If a failure is detected, use the intercom or telephone to contact the computer room and request maintenance. System failures can be caused by:

Electronic failure
Hydraulic failure
Mechanical failure
Operator-induced failure

WARNING

Care must be exercised when exiting the simulator during power failure. The boarding ramp may fail to deploy.

9-11. FACILITY POWER FAILURE.

9-12. When facility power is lost, the entire simulator complex is deactivated except for:

Emergency lighting
Ramp
Telephone intercom
Fire detection system

Section II. SAFETY

9-13. OPERATIONAL SAFETY.

9-14. The simulator is designed to operate safely during all phases of training.

WARNING

Before the motion system is activated. all occupants of the simulator must fasten their seat belts.

9-15. Each motion system uses numerous devices to ensure safe operation for personnel. These include controlled deceleration devices, cushion stops. limit-sensing, leveling, and locking devices, thermal cutout for hydraulic fluid, emergency stop switches, and red warning lights in personnel areas.

9-16. The entrance doors have safety interlocks that prevent motion activation until the door is secure. Ensure that the bar is securely closed as there is no interlock indicator on the IOS.

9-17. The motion equipment is located within a gated area with gate interlocks that prevent motion activation unless the gates are closed.

9-18. The boarding ramps are equipped with sensing switches that prevent boarding ramp motion when there is additional weight (personnel) on them. The motion system is not activated until the boarding ramp is raised completely.

9-19. Normal activation and deactivation of the motion system are accomplished at the IOS. Motion is controlled separately and is not mode-dependent.

9-19A. The copilot CONTROL LOADING safety switch is located on the left rear of the auxiliary control panel (beside the mushroom freeze switch). This red guarded switch is used to interrupt the motion interlock at the motion cabinet and to deactivate the control loading system.

9-19B. In the event that the freeze button does not halt the trainer. lift the red cover and flip the toggle switch up. The motion platform will settle and the ramp will come down. Although all flight controls will be locked, the simulator will continue to operate. Notify maintenance personnel that the problem exists and that the control loading switch is in the OFF position.

9-20. Fail-safe circuitry prevents erratic movement of the motion system during an equipment malfunction.

9-21. Temperature sensors are located in each equipment cabinet. If the temperature reaches 100"F, or if adequate airflow is not maintained, visual and aural warnings in the computer room are activated. At 110°F, the entire complex shuts down automatically.

9-22. Actuation of any EMERGENCY STOP switch results in the immediate shutdown of the entire complex, motion system, and visual system. After an EMERGENCY STOP switch has been actuated and power shuts down, the main and linkage circuit breakers must be reset manually before power can be reapplied.

9-23. In the emergency stop condition, a quick-settle control valve returns the motion platform to the settled position at the highest practicable speed. The boarding ramp lowers under power of a reserve stored-energy source. In approximately 24 to 31 seconds. depending on the position of the motion platform at the time electrical power was cut off, personnel can safely exit to the access balcony.

9-24. An emergency escape ladder is provided in case a power failure or a hydraulic failure prevents boarding ramp deployment.

WARNING

Do not discharge a Halon 1301 fire extinguisher in the confined area.

WARNING

Avoid prolonged exposure (5 minutes or more) to high concentrations of fire extinguishing agent and its decomposition products because of irritation to the eyes and nose. Adequate respiratory and eye relief from excessive exposure should be sought as soon as the primary fire emergency permits. Use of oxygen for personnel is recommended.

WARNING

If steam or water is observed in cockpit. activate EMERGENCY STOP switch and evacuate the cockpit immediately.

9-25. Four Halon fire extinguishers are located in central areas of the simulator complex: one in the computer room, two in the simulator room, and one in the pump room. Another type fire extinguisher (CF_3BR) is installed in the flight simulator compartment as part of the normal cockpit equipment.

GLOSSARY

A

AAA	Anti-aircraft artillery
AAF	Army air field
AC: A/C	Alternating current: aircraft
ACQ	Acquisition
ADF	Automatic direction finding
ADV	Advance
AE	Aerodynamic
AERO	Aerodynamic drogued (sling load operations)
AFCS	Advanced flight control system
AGL	Above ground level
AHP	Army heliport
AID	Auxiliary information display
ALT	Altitude
APU	Auxiliary power unit
A/S	Airspeed
ATC	Air traffic control
ATIS	Air traffic information system
AUTO	Automatic
AID	Auxiliary information display

B

BARO	Barometric pressure

C

C: CENT.	Centigrade
CB	Circuit breaker
CCDA	Cockpit control driver actuator
CEIL	Ceiling
CFD	Communications facility display
CG	Center of gravity
CH47FS	Army designation for simulation device
CLA	Confined landing area
CLD	Cloud
CLR	Clear
CMPTR	Computer
COMM	Communications
CONT	Control
CO2	Carbon dioxide
CPLT	Copilot
CPU	Central processing unit
CRS	Course
CRT	Cathode-ray tube (instructor visual displays)
CTR	Center

D

DB	Decibels
DC	Direct current
DCPT	Differential collective pitch
DEMO	Demonstration
DEV	Deviation
DHN	Dothan
DIG	Digital image generator
DN	Down
DOF	Degrees of freedom
DOP	Doppler
DPS	Degrees per second
DVS	Digital voice system

E

E	East
ECL	Engine condition lever
ELEC	Electrical
ELEV	Elevation
EMER	Emergency
ENG	Engine
ENTR	Enter
ENV	Environment
EW	Electronic warfare
EXP	Expenditures

F

F	Fahrenheit
FLD	Field
FLT	Flight
FM	Frequency modulated
FOV	Field of view
FPM	Feet per minute
FREQ	Frequency
FS	Flight simulator
FT	Feet
FWD	Forward

G

GCA	Ground-controlled approach
GPD	Ground plot display
GPM	Press on AAF
GRND	Ground
GRWT, GW	Gross weight
G/S	Glideslope

H

HD	High-density (sling load operations)
HDG	Heading
HEY	Hanchey AHP

H - Continued

HF	High frequency
HYD	Hydraulic
HZ	Hertz

I

IAS	Indicated airspeed
IC	Initial condition
ICS	Intercommunications system
ID	Identification
IFF	Identification friend or foe
IFR	Instrument flight regulations
ILS	Instrument landing system
INC	Instrument meteorological conditions
IND	Indicator
INFO	Information
INST	Instrument
INT	Inter; internal; intensity
INTLK	Interlock
IOS	Instructor operator station
IPFN	Panama City
ITLH	Tallahassee

K

KHZ	Kilohertz

L

LAT	Latitude
LBS	Pounds
LF	Low frequency
LH	Left-hand
LONG	Longitude
LOS	Line-of-sight
LSF/LS	Lawson AAF
LVL	Level

M

MAINT	Maintenance
MALF; MAL	Malfunction
MAX	Maximum
MEM	Memory
MET	Mission elapsed time
MGM	Dannelly
MHZ	Megahertz
MIN	Minutes; minimum

M - Continued

MISC	Miscellaneous
MOI	Method of instruction (used for communications record/playback)
MON	Monitor
MSL	Mean sea level

N

N	North
NAV	Navigation
NM; NMI	Nautical miles
NO	Number
NOE	Nap-of-earth
NVG	Night vision goggles

O

OAT	Outside air temperature
OBS	Observer
OFT	Operational flight trainer
OOT	Out-of-tolerance
OTW	Out-the-window
OVHD	Overhead
OZR/OZ	Cairns AAF

P

P, PT	Pitch
PAR	Precision approach radar
PARAM	Parameter
PN	Pensacola
POP	Poppable
PRGM, PROG	Program
PROB	Problem
PTIT	Power turbine inlet temperature
PTU	Power transfer unit
PWR	Power

Q

QTY	Quantity

R

R	Rate
REV	Reverse
RH	Right-hand
RL	Roll; bank; roll rate
RMI	Radio magnetic indicator
RPM	Revolutions per minute
RR	Rotor rpm
RT	Turn rate

R - Continued

RTA	Receiver transmitter antenna
RVR	Runway visual range
RW	Reduced visual visibility (random)

S

S	South
SAM	Surface-to-air missile
SDC	Signal data converter
SEC	Second
SEG	Segment
SEL	Selector; select
SIM	Simulator
SL	Sea level
SND	Sound level
SP	spare: space
STA	Station
STBY	Standby
STD	Standard
STUD	Student
SW	Switch
SYS	System

T

TAC	Tactical
TDF	Todendorf AAF
THRML	Thermal
TOI	Troy
TOT	Time out-of-tolerance
TQ	Torque
TR	Turn rate
TRB	Turbulence
TRN	Trainer
TSD	Trainer status display

U

UHF	Ultra high frequency
UTL	Utility

V

VASI	Visual approach slope indicator
VFR	Visual flight regulations
VHF	Very high frequency
VIS	Visual: visibility
VMC	Visual meteorlogical conditions
VNE	Values not to exceed
VOR	Very high frequency omnidirectional range
VS	Vertical speed

W

W	West
WD	Wind direction
WV	Wind velocity
WX	Weather

X

X	Times; by
XMIT	Transmit
XMSN	Transmission
XPDR	Transponder

Y

YV	Yaw; yaw rate

Z

INDEX

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

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P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3.2808.8 feet

Weights

1 *centigram = 10 milligrams = .15 grain*
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu in.
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Square measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. in.
1 sq. decimeter = 100 sq. centimeters = 15.5 inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 feet
1 sq. dekameter (are) = 100 sq. meters = 1.076.4 sq. ft.
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 hectometers = .386 sq. miles

Liquid Measure

1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons
1 liter = 10 deciliters = 33.81 fl. ounces
1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3 38 fl. ounces
1 metric ton = 10 quintals = 1.1 short tons

Approximate Conversion Factors

To change	To	Multiply by
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
sq. inches	sq. centimeters	6.451
sq. feet	sq. meters	.093
sq. yards	sq. meters	.836
sq. miles	sq. kilometers	2.590
acres	sq. hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29.573
pints	liters	.472
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound inches	newton-meters	.11296

To change	To	Multiply by
ounce inches	newton-meters	.0070062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
sq. centimeters	sq. inches	.155
sq. meters	sq. yards	10.764
sq. kilometers	sq. miles	1.196
sq. hectometers	acres	2.471
cubic meters	cubic feet	35.315
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102
pound-feet	newton-meters	1.356

Temperature (Exact)

°F Fahrenheit temperature — 5/9 (after subtracting 32) — Celsius Temperature °C

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