
Technical Manual

OPERATOR'S MANUAL

FOR

AH-1 Q-to-S (COBRA) FLIGHT WEAPONS SIMULATOR

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HEADQUARTERS, DEPARTMENT OF THE ARMY

7 APRIL 1987

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 each student station control panel and at each 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 FLIGHT SIMULATOR BE OPERATED WITH A SAFETY WARNING DEVICE 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.

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 229 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
a - b.....	0	7-1 - 7-2.1.....	1		
A - B.....	1	7-2.2 Blank.....	1		
Record of Changes.....	1	7-3.....	1		
Blank.....	0	7-4 - 7-15.....	0		
i - iv.....	1	7-16 - 7-18.2.....	1		
V.....	0	7-19.....	1		
vi.....	1	7-20 - 7-21.....	0		
vii - ix.....	0	7-22.....	1		
x Blank.....	0	7-23 - 7-28.....	0		
1-1.....	0	7-29.....	1		
1-2 Blank.....	0	7-30 - 7-57.....	0		
2-1 - 2-3.....	0	7-58.....	1		
2-4 - 2-4.1.....	1	7-59 - 7-105.....	0		
2-4.2 Blank.....	1	7-106.....	1		
2-5.....	0	7-107.....	0		
2-6 - 2-8.....	1	7-108.....	1		
2-9 - 2-10.....	0	7-109 - 7-111.....	0		
2-11 - 2-12.....	1	7-112 Blank.....	0		
2-13 - 2-21.....	0	8-1 - 8-25.....	0		
2-22.....	1	8-26 Blank.....	0		
3-1 - 3-3.....	0	9-1 - 9-4.....	0		
3-4 Blank.....	0	Glossary 1-			
4-1.....	1	Glossary 5.....	0		
4-2 Blank.....	0	Glossary 6.....	1		
5-1 - 5-3.....	0	Glossary 7.....	0		
5-4 - 5-5.....	1	Glossary 8 Blank.....	0		
5-6 Blank.....	0	Index 1.....	1		
6-1.....	1	Index 2.....	0		
6-2.....	0	Index 3.....	1		
6-3 - 6-4.....	1	Index 4.....	0		
6-5.....	1	Index 5.....	1		
6-6 Blank.....	0	Index 6 -			
		Index 8.....	1		

*Zero in this column indicates an original page.

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HEADQUARTERS
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WASHINGTON, D.C., 31 August 1989

OPERATOR'S MANUAL
FOR
AH-1 Q-to-S (COBRA) FLIGHT WEAPONS SIMULATOR

TM 55-6930-210-10, 7 April 1987, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
A and B	A and B
i through vi	i through vi
2-3 and 2-4	2-3 and 2-4
---	2-4.1/2-4.2
2-5 through 2-8	2-5 through 2-8
2-11 and 2-12	2-11 and 2-12
2-21 and 2-22	2-21 and 2-22
4-1/4-2	4-1/4-2
5-3 and 5-4	5-3 and 5-4
5-5/5-6	5-5/5-6
6-1 through 6-4	6-1 through 6-4
6-5/6-6	6-5/6-6
7-1 and 7-2	7-1 and 7-2
---	7-2.1/7-2.2
7-3 and 7-4	7-3 and 7-4
7-15 through 7-18	7-15 through 7-18
---	7-18.1 and 7-18.2
7-19 through 7-22	7-19 through 7-22
7-29 and 7-30	7-29 and 7-30
7-57 and 7-58	7-57 and 7-58
7-105 through 7-108	7-105 through 7-108
Glossary 5 and Glossary 6	Glossary 5 and Glossary 6
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TABLE OF CONTENTS

NOTE

An alphabetical index is located at the back of this manual.
The introduction (Chapter 1) explains the material covered in each section.

Section/Para		Page
	SAFETY SUMMARY	viii
CHAPTER 1.	INTRODUCTION	1-1
	1-1. SCOPE	1-1
	1-2. GENERAL	1-1
	1-2.a. Simulation	1-1
	1-2.b. Configuration	1-1
	1-3. REPORTING OF ERRORS	1-1
	1-4. ABBREVIATIONS	1-1
CHAPTER 2.	SYSTEM DESCRIPTION AND OPERATION	2-1
Section I.	GENERAL	2-1
	2-1. OPERATIONAL SYSTEM	2-1
	2-2. SIMULATOR COMPARTMENTS	2-1
	2-3. INSTRUCTOR/OPERATOR STATIONS	2-3
	2-4. MOTION SYSTEM	2-3
	2-5. VISUAL SYSTEM	2-4
	2-5.1 TELESCOPIC SIGHT UNIT	2-4
	2-6. COMPUTER SYSTEM	2-4.1
Section II.	INSTRUCTOR/OPERATOR STATION DESCRIPTION	2-5
	2-7. GENERAL DESCRIPTION	2-5
	2-8. IOS CONTROL PANELS	2-5
	2-9. PILOT/GUNNER CONTROL PANELS	2-5
	2-10. INSTRUCTOR SEATS	2-5
	2-11. OBSERVER SEATS	2-5
	2-12. IOS AREA LIGHTING	2-5
	2-13. INSTRUCTOR INTERCOMMUNICATIONS SYSTEM	2-9
	2-14. WORK SURFACE	2-9
	2-15. TIME REFERENCES	2-9
Section III.	MODES OF OPERATION	2-10
	2-16. GENERAL	2-10
	2-17. TRAINING	2-10
	2-17.a. Independent Training	2-10
	2-17.b. Integrated Training	2-10
	2-18. CHECKRIDE	2-12
	2-19. DEMONSTRATION	2-12
	2-19.1 TSU MODES	2-12
Section IV.	TRAINING CAPABILITIES	2-13
	2-20. GENERAL	2-13
	2-21. TRAINING OBJECTIVES	2-13
	2-21.a. Basic Maneuvers	2-13

Section/Para		Page
2-21.b.	Advanced Maneuvers	2-13
2-21.c.	Emergency Maneuvers	2-14
2-21.d.	Nap--of-the-Earth Maneuvers	2-14
2-21.e.	Gunnery Maneuvers	2-14
2-22.	SIMULATION SYSTEM CAPABILITIES	2-15
2-22.a.	Visual Area Navigation	2-15
2-22.b.	Nav/Comm Radio	2-15
2-22.c.	Tactical Environment	2-15
2-22.d.	Atmospheric Environment	2-15
2-22.e.	Motion Cues	2-15
2-22.f.	Environmental Sound Cues	2-15
2-22.g.	Seat Positions	2-15
2-22.h.	Special Capabilities	2-15
2-23.	VISUAL SYSTEM CAPABILITIES	2-16
2-24.	TRAINING TASKS	2-17
2-24.a.	Simulated Aircraft	2-17
2-24.b.	Flight Control	2-17
2-24.c.	Pilot/Gunner Tasks	2-17
2-24.d.	Instructor/Operator Tasks	2-18
2-24.e.	Automation of Instructional Function	2-18
2-24.f.	Briefing	2-19
2-24.g.	Critique	2-19
2-24.h.	Cueing	2-19
2-24.i.	Feedback	2-20
Section V.	SYSTEMS SIMULATED	2-21
2-25.	GENERAL	2-21
2-26.	ACCESSORY SYSTEMS	2-21
2-27.	SOUND SIMULATION	2-21
2-27.a.	Aircraft Sounds	2-21
2-27.b.	Weapon Sounds	2-21
2-28.	MOTION SIMULATION	2-21
2-29.	VIBRATION SIMULATION	2-22
2-30.	COCKPIT INSTRUMENTATION SIMULATION	2-22
2-31.	RADIO COMMUNICATION AND INTERCOMMUNICATION SYSTEM SIMULATION	2-22
2-32.	MALFUNCTION SIMULATION	2-22
2-33.	CONTROL LOADING	2-22
2-34.	ARMAMENT SYSTEMS	2-22
CHAPTER 3.	AVIONICS	3-1
3-1.	GENERAL	3-1
3-2.	COMMUNICATIONS EQUIPMENT	3-1
3-3.	NAVIGATION EQUIPMENT	3-2
3-4.	RADAR AND TRANSPONDER EQUIPMENT	3-3
CHAPTER 4.	TACTICS	4-1
4-1.	GENERAL	4-1
4-2.	VISUAL SIMULATION	4-1
4-3.	TRAINING	4-1
4-4.	EVALUATION	4-1

Section/Para		Page
CHAPTER 5.	OPERATING LIMITS AND RESTRICTIONS	5-1
5-1.	GENERAL	5-1
5-2.	AVIONICS	5-1
5-3.	TEMPERATURE AND HUMIDITY	5-1
5-4.	OCCUPANCY	5-1
5-5.	MOTION SYSTEM	5-2
5-6.	VISUAL SYSTEM	5-2
5-7.	AUDIO SYSTEM	5-2
5-8.	IOS CRT CONTROLLABLE PARAMETERS	5-2
5-8.a.	Environmental Conditions	5-2
5-8.b.	Freezable Flight Conditions	5-3
5-8.c.	Editable Flight Conditions	5-3
5-8.d.	Miscellaneous Conditions	5-3
5-8.e.	Malfunctions	5-3
5-9.	COCKPIT CIRCUIT BREAKERS	5-3
5-10.	ARMAMENT SYSTEM	5-4
5-11.	TELESCOPIC SIGHT UNIT TARGETS	5-4
5-12.	INDEPENDENT MODE	5-4
5-13.	INTEGRATED MODE	5-5
CHAPTER 6.	VISUAL SYSTEM	6-1
6-1.	GENERAL DESCRIPTION	6-1
6-1.a.	Integrated Mode	6-1
6-1.b.	Independent Mode	6-1
6-2.	CAMERA MODEL SYSTEM	6-1
6-3.	MODEL BOARD	6-1
6-4.	CULTURAL LIGHTING	6-3
6-4.a.	Runway Acquisition Lighting	6-3
6-4.b.	Confined Area Lighting	6-3
6-5.	FIELD-OF-VIEW (FOV)	6-3
6-5.a.	Through-the-Window Displays	6-3
6-5.b.	Telescopic Sight Unit	6-4
6-6.	WEAPONS EFFECTS	6-4
6-7.	VISUAL SYSTEM CAPABILITIES	6-4
6-7.a.	Lighting	6-4
6-7.b.	Field-of-View	6-4
6-7.c.	Landing Areas	6-4
6-7.d.	Special Effects	6-4
6-7.e.	Weapons Effects	6-5
6-7.f.	Altitude Representation	6-5
6-7.g.	Focus	6-5
6-7.h.	Ambient Light Effect	6-5
6-7.i.	Probe Protection	6-5
6-7.j.	Visual Transition	6-5
6-7.k.	Night Vision Goggles	6-5

Section/Para		Page
CHAPTER 7.	NORMAL OPERATING PROCEDURES	7-1
Section I.	INITIATION OF TRAINING	7-1
	7-1. INITIAL PROCEDURES	7-1
	7-2. ZEROING (DATA CLEAR)	7-1
	7-3. INITIALIZATION OF NORMAL TRAINING	7-9
	7-3.a. Initialize to a Preprogrammed IC Set	7-9
	7-3.b. Initialize to an IC Set Not Preprogrammed	7-9
	7-3.c. Initialize to a Preprogrammed Checkride IC Set	7-9
	7-3.d. Weapon Loading	7-9
	7-3.e. Helmet Sight Subsystem Calibration	7-15
	7-3.f. Target Selection	7-17
	7-3.g. Visual Selection	7-17
	7-3.h. Training Control and Monitor	7-18.1
	7-4. INITIALIZATION OF CHECKRIDE	7-20
	7-5. TERMINATION OF CHECKRIDE	7-21
	7-6. INITIALIZATION OF DEMONSTRATION	7-21
	7-7. TERMINATION OF DEMONSTRATION	7-21
Section II.	INITIAL CONDITIONS	7-22
	7-8. GENERAL	7-22
Section III.	INSTRUCTOR STATION CONTROLS AND FUNCTIONS	7-23
	7-9. GENERAL	7-23
Section IV.	FWS TRAINING CAPABILITIES	7-50
	7-10. GENERAL	7-50
	7-11. PLOT STORE	7-50
	7-12. PRINT PLOT	7-50
	7-13. CRT MAP DISPLAY	7-51
	7-14. GROUND-CONTROLLED APPROACH DISPLAY	7-51
	7-15. RADAR EMITTER THREATS AND WEAPON CONTROL	7-55
	7-16. COMMUNICATIONS FACILITY DATA	7-59
	7-17. NAVIGATION FACILITY DATA	7-61
	7-18. DEMONSTRATION	7-61
	7-19. PERFORMANCE MONITORED TOLERANCES	7-64
	7-20. AUTOMATED CHECKRIDE	7-64
	7-21. CHECKRIDE DISPLAY	7-66
	7-22. PILOT/GUNNER PERFORMANCE ERROR PRINT SYSTEM	7-66
	7-23. INTERCOMMUNICATION SYSTEM	7-66
	7-24. ENVIRONMENTAL CONDITIONS	7-69
	7-25. PARAMETER FREEZE	7-69
	7-26. SOUND LEVELS	7-69
	7-27. FREEZE/CRASH OVERRIDE	7-69
Section V.	SIMULATED MALFUNCTIONS	7-70
	7-28. GENERAL	7-70
	7-29. MALFUNCTION INSERTION	7-70
	7-30. MALFUNCTION DELETION	7-70
	7-31. CLEARING MALFUNCTIONS	7-71
	7-32. MALFUNCTION LIST	7-71
	7-33. ICING MALFUNCTIONS	7-71

Section/Para		Page
Section VI.	CRT DISPLAYS	7-103
	7-34. GENERAL	7-103
	7-35. DISPLAY FORMATS	7-103
	7-36. CONTROL/DISPLAY INTERRELATIONSHIPS	7-105
Section VII.	AUDIO RECORD/PLAYBACK AND PERFORMANCE RECORD/PLAYBACK	7-111
	7-37. GENERAL	7-111
	7-38. DYNAMIC RECORD/PLAYBACK	7-111
	7-39. DEMONSTRATION PLAYBACK	7-111
	7-40. CHECKRIDE BRIEFING PLAYBACK	7-111
CHAPTER 8.	OFF-LINE MODIFICATIONS OF FLIGHT SIMULATOR PROGRAMS	8-1
Section I.	CHECKRIDE EDIT AND FORMULATION	8-1
	8-1. GENERAL DESCRIPTION	8-1
	8-2. PFOS SYSTEM DESCRIPTION	8-1
	8-2.a. Inputs	8-1
	8-2.b. Processing	8-1
	8-2.c. Outputs	8-1
	8-3. OPERATIONAL ENTRY AND CONTROL	8-4
	8-3.a. To Formulate an Entire Checkride	8-4
	8-3.b. To Revise an Existing Checkride	8-6
	8-3.c. Data Format	8-9
	8-3.d. Monitoring Elapsed Time Between Segments (LTM)	8-12
	8-3.e. Monitoring Event Time (TIM)	8-12
	8-3.f. Time as an End Condition	8-12
	8-3.g. Checkride Data Deck Restrictions	8-13
	8-3.h. Error Notification	8-14
Section II.	DEMONSTRATION EDIT AND FORMULATION	8-15
	8-4. GENERAL	8-15
	8-5. DEMONSTRATION DESCRIPTION	8-15
	8-6. OPERATIONAL CONSIDERATIONS	8-15
	8-7. SPECIAL CONSIDERATIONS	8-18
	8-8. DEMONSTRATION FORMULATION PROCEDURE	8-18
	8-9. FORMULATION REVIEW/PLAYBACK	8-20
	8-10. AUDIO EDITING	8-21
	8-11. DEMONSTRATION PLAYBACK CHECK	8-24
CHAPTER 9.	EMERGENCY PROCEDURES AND SAFETY	9-1
Section I.	EMERGENCY PROCEDURES	9-1
	9-1. EMERGENCY SHUTDOWN	9-1
	9-1.a. Complete Simulator Complex	9-1
	9-1.b. Motion System Only	9-1
	9-1.c. Complex Excluding Visual	9-1
	9-2. SYSTEM FAILURES	9-1
	9-3. FACILITY POWER FAILURE	9-2
Section II.	SAFETY	9-3
	9-4. OPERATIONAL SAFETY	9-3
	GLOSSARY	Glossary 1
	INDEX	Index 1

LIST OF ILLUSTRATIONS

Figure	Title	Page
2-1	Typical Simulator and Computer Rooms of Q-to-S System Complex	2-2
2-2	Pilot Flight Weapons Simulator Compartment	2-6
2-3	Gunner Flight Weapons Simulator Compartment	2-7
2-4	Instructor/Operator Station General Layout	2-8
6-1	Visual Room Layout	6-2
7-1	Initial Conditions	7-2
7-2	Index Page	7-3
7-3	IC Listing Page	7-4
7-4	Basic Instruction Page 1	7-5
7-5	Basic Instruction Page 2	7-6
7-6	Basic Instruction Page 3	7-7
7-7	Basic Instruction Page 4	7-8
7-8	VFR Checkride Program Page 070	7-10
7-9	IFR Checkride Program Page 080	7-11
7-10	Tactical Weapons Checkride Program Page 090	7-12
7-11	Tactical Instrument Checkride Program Page 100	7-13
7-12	Weapons Configuration Page 060	7-14
7-13	Performance Page 061	7-16
7-13.1	Target Engagement Points Page 023	7-18
7-14	Visual Conditions Page 021	7-18.2
7-15	Parameter/Freeze/Environment Page 020	7-19
7-16	Panel Lights and Intercom Panels	7-24
7-17	Simulator Control Panel	7-25
7-18	IOS Visual System Panel	7-29
7-19	Demonstration Control and Performance Playback Panel	7-32
7-20	Communications Panel	7-37
7-21	Dome Lights and Emergency Stop Control and Switches	7-40
7-22	Problem Control, Timer, and IC/MAP/MALF/DEMO/CHKRD Panel	7-42
7-23	CRT Display Control Panel	7-45
7-24	Pilot/Gunner Control Panel	7-48
7-25	Cross-Country Map Page 030	7-52
7-26	Cairns Approach Map Page 032	7-53
7-27	Ground-Controlled Approach Page 045	7-54
7-28	Threat Array Page 025	7-56
7-29	Threat Window Array Page 026	7-57
7-30	Tactical Map Page 050	7-58
7-31	Student History Page 062	7-60
7-32	Typical Navigation Facility Page	7-62
7-33	Typical Navigation Facility Subpage	7-63
7-34	Typical Checkride CRT Display	7-67
7-35	Typical Error Printout Summary Page	7-68
7-36	CRT Display Format	7-104
8-1	Checkride PFOS Functional Block Diagram	8-2
8-2	Typical Checkride Data Input Keypunch Form	8-3
8-3	Possible Checkride Plan (Rough)	8-5
8-4	VFR Checkride Job Deck	8-7
8-5	Weapons Checkride Job Deck	8-7
8-6	Typical Printed Page of a Checkride	8-8

LIST OF TABLES

Number	Title	Page
2-1	Integrated/Independent Operation Features	2-11
3-1	Avionics Systems	3-1
6-1	Cultural Lighting	6-3
7-1	Values Not To Exceed	7-65
7-2	Malfunction List	7-72
7-3	Simulated Malfunction Details	7-77
7-4	IOS Control/Display Interrelationships	7-105
8-1	Permissible Special Action Cues Syntax	8-10
8-2	Allowable Aircraft Parameters	8-11

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 and cautions appear in the text of this manual, and are repeated here for emphasis:

WARNING

Alert student pilot and student gunner to remain clear from all flight controls prior to initialization. Abrupt movement of the controls when positioned by the computer may cause personal injury. (Page 7-9)
(Page 7-34)
(Page 7-44)

WARNING

Below 20 knots, airspeed cyclic feedback forces become uncontrollable. (Page 7-93)

WARNING

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

WARNING

Prior to the activation of motion, all occupants of the simulated cockpit and IOS (limited to three persons per flight compartment) are required to fasten seat belts. (Page 9-3)

WARNING

Do not discharge a CO2 fire extinguisher in the confined cockpit. (Page 9-4)

CAUTION

To avoid any possibility of visual system damage, notify visual personnel prior to initiating an off-line status. (Page 7-28)

CAUTION

Avoid prolonged engagement (in excess of 3 to 5 seconds duration) of HOSTILE GROUND FIRE switchlight to avert system damage. (Page 7-30)

CHAPTER 1

INTRODUCTION

1-1. SCOPE. This operator's manual contains complete operating instructions and procedures for the flight weapons simulator (FWS) system for the AH-1 Q-to-S modernized Cobra helicopter. This manual is primarily for use by an instructor/operator for the training of student pilots and/or gunners in the techniques involved for all normal and emergency flight, tactical maneuvers, and weapons delivery of the helicopter.

1-2. GENERAL. The AH-1 Q-to-S FWS consists of two operational flight simulator compartments (pilot and gunner), each having a six-degree-of-freedom motion system. Each cockpit is equipped with a visual system that simulates natural helicopter environment surroundings. A central computer system controls the operation of the simulator complex. The hardware and software that comprise this complex were designed and built by the Link Flight Simulation Division of the Singer Company, Binghamton, New York.

a. Simulation. The FWS provides normal and emergency procedural flight training and weapons delivery. Additional capabilities include navigation instrument flight operation, day, dusk, and night visual flight operations, and ordnance delivery systems of the attack helicopter.

b. Configuration. The airframe of the helicopter, Army Number 78-23099, equipped with a turbine engine, serves as a basis for simulation and configuration.

1-3. REPORTING OF ERRORS. 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 direct to: Commander, U.S. Army Aviation Systems Command, ATTN: AMSAV-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

1-4. ABBREVIATIONS. Nonstandard abbreviations used in this manual are contained in the Glossary.

CHAPTER 2

SYSTEM DESCRIPTION AND OPERATION

Section I. GENERAL

2-1. OPERATIONAL SYSTEM. The AH-1 Q-to-S FWS is a fixed-base simulation system designed for training in the use of AH-1S modernized Cobra helicopters. Figure 2-1 shows the recommended general arrangement of a portion of the system complex within the Government-built facility. The simulator room where training is conducted consists of two instructor/crew stations equipped with visual display systems. Each station is mounted on a six-degree-of-freedom hydraulic motion system and controlled by a central computer system. The basic areas of the simulator complex are further described in the following paragraphs.

2-2. SIMULATOR COMPARTMENTS. The simulator room contains separate flight weapons simulator compartments for individual training of pilot and gunner. Each simulator compartment houses a cockpit station and an instructor/operator station (IOS). The cockpit stations are located in the forward portion of their respective flight compartments. Each flight simulator compartment includes visual, motion, and sound simulation. The pilot and gunner can train either in independent modes of operation with separate and unique flight conditions, or in an integrated mode with common training conditions.

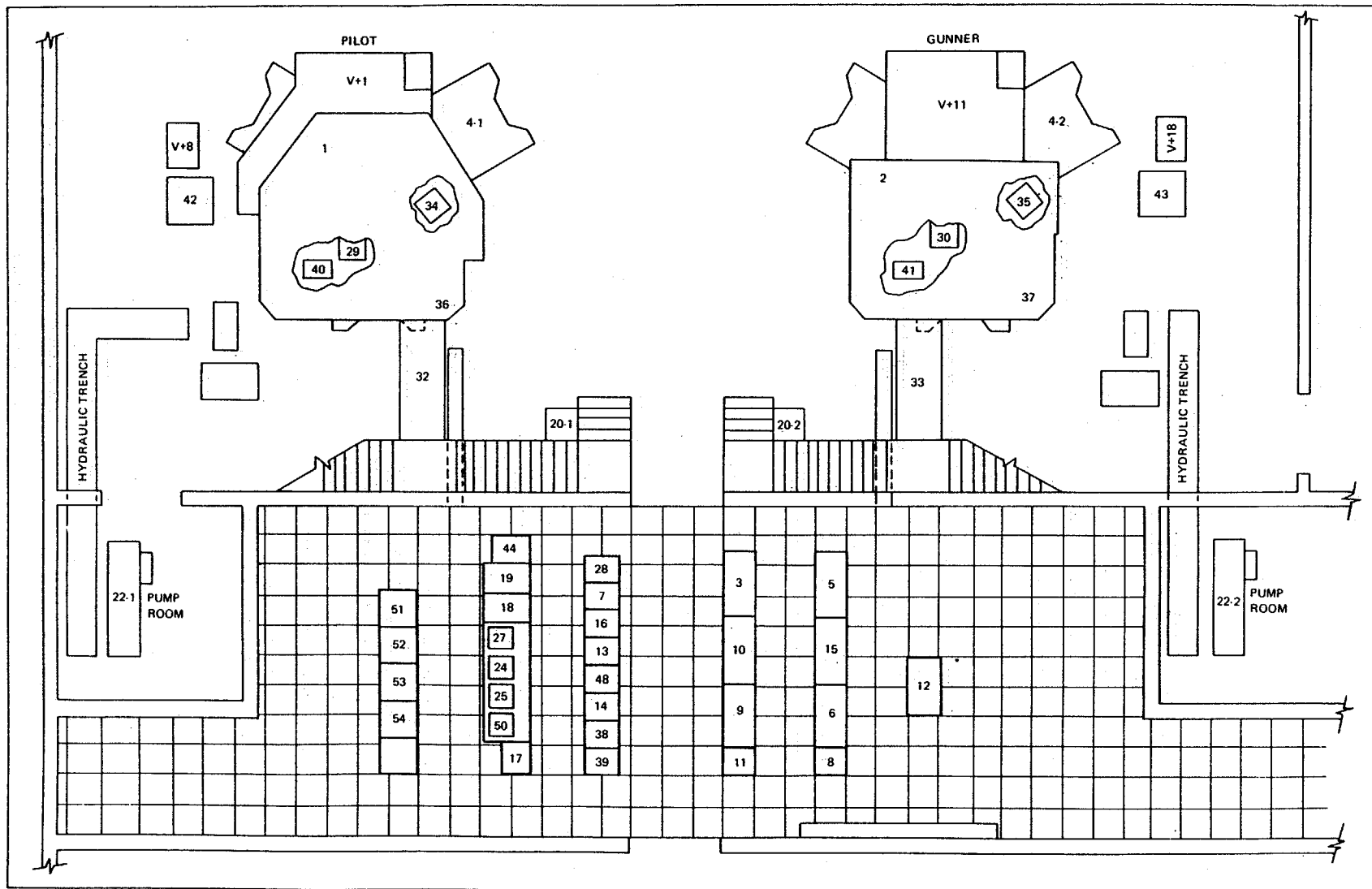
a. The pilot station is a replica of the aircraft pilot position and includes facsimiles of the cockpit window arrangements. The pilot seat, main instrument and control panel, flight controls, helmet sight subsystem, head-up display, and left and right equipment consoles are actual aircraft type parts.

b. The gunner station is a replica of the aircraft gunner position. Actual aircraft cockpit equipment includes the main instrument and control panel, left and right equipment consoles, flight controls, seat, helmet sight subsystem (HSS), and telescopic sight unit (TSU).

c. All controls, indicators, and panels operate in a simulated condition and are identical in appearance as those in TM-55-6930-236-10, Operator's Manual for AH-1S Modernized Cobra Helicopter.

d. Four pairs of loudspeakers in each simulator compartment provide realistic aural cue sounds with characteristics correct in respect to location, frequency, and loudness (within limits of safety). Aural cue sounds can be varied in loudness by the instructor/operator.

e. The cockpit seats can be vibrated to simulate the continuous and periodic oscillations and vibrations experienced by the crew during flight conditions and maneuvers. Vibrations representing progressive malfunctions are also simulated. Seat vibration is isolated from the remainder of the simulator station by means of damping elements in the seat mounting construction.



11463

Figure 2-1. Typical Simulator and Computer Rooms of Q-to-S System Complex

f. The ambient temperature of the flight simulator compartment and the cockpit is controlled by adjusting the thermostat located on the back wall of the compartment. Conditioned air is ducted through the compartment area and the normal helicopter cockpit heating and defrosting ducts. The cockpit environment control system switches and controls are nonfunctional.

g. The low level step lighting for the IOS is provided for safety and is a function of simulator power. The step lights are controlled by a wall switch at the right compartment door.

2-3. INSTRUCTOR/OPERATOR STATIONS. The IOSs are located adjacent and to the rear of the cockpit in each simulator compartment. (Refer to Section II for further details.) The IOS allows instructors to control the training program and effectively monitor and evaluate pilot/gunner performance. During training, the pilot and gunner IOS function in either independent or integrated modes of operation, with the pilot IOS having overriding control in the integrated mode.

2-4. MOTION SYSTEM. Each simulator compartment is mounted on a six-degree-of-freedom motion system consisting of a moving platform assembly driven and supported from below by six identical hydraulic actuators. The motion system is capable of providing cues for pitch, roll, yaw, lateral, longitudinal, and vertical movements. System motion can be either independent (without simultaneous motion in any other degree of freedom) or in any combination desired to produce real-time dynamic motion cues.

a. Flight simulation includes combined motion representing changes in aircraft attitude as a direct result of flight control inputs, rough air and wind, changes in aircraft weight and center of gravity resulting from fuel consumption or weapon and ammunition depletion. Also, motion effects such as blade stall, blade imbalance, damping failure, blades out-of-track, and touchdown impact can be produced.

b. The computer-controlled simulation program causes the motion system to respond realistically to aerodynamic forces and moments within the mechanical limits of the system. All motions except pitch are imperceptibly washed out to the neutral position after the computed accelerations have reached zero. Pitch attitude is maintained as necessary to simulate sustained longitudinal acceleration cues. Acceleration onset cues are scaled as large as possible to fully utilize the range of motion capabilities of each degree-of-freedom.

c. Depending on the particular flight program, the motion system responds to computer input signals as noted in the following examples:

(1) Ground conditions. The motion system provides the vibrational indications appropriate to motion of the aircraft during startup. The system produces a random, low-frequency, low-amplitude, multidirectional oscillation with reasonably abrupt application. The computer simulation program varies the amplitude of oscillation to reproduce the irregularities of less than ideal flight takeoff conditions.

(2) Takeoff and landing. The motion system provides simulated realistic effects for all forms of takeoff, flight, and landing conditions.

(a) During engine runup and initial hover for takeoff, the ground performance of the motion system is as described in paragraph (1) above. The motion system maintains an attitude appropriate for hover and provides the correct indications of takeoff. Appropriate motion effects occur as a result of changes in acceleration and lift during transition to forward flight.

(b) Similar effects are reproduced during the landing phase. The motion system causes appropriate longitudinal, vertical, and low-frequency vibration effects to occur as in the helicopter. The motion system correctly reproduces the landing impact according to the existing aircraft attitude and vertical and side-slip velocities. When the vertical momentum is greater than the absorption capabilities of the landing skids, landing bounce is simulated.

(3) Normal flight. The motion system correctly simulates the complex and repeated cues occurring during maneuvers associated with normal flight conditions. The random introduction of varying degrees of turbulence produces the appropriate motion effects of small variations in yaw and roll, climb or descent, and airspeed. Superimposed upon the flight maneuver motions is the background motion. The motion system provides characteristic periodic oscillations of the aircraft, lateral instability, and aircraft vibrations up to a maximum of 5 cycles per second. Continuous higher frequency vibrations are simulated using the seat shaker in lieu of the motion system.

(4) Abnormal flight. The motion system correctly reproduces the effects of rotor out-of-track failures. The seat shaker provides cues for rotor out-of-balance conditions. The motion simulated includes the effect of momentary incorrect control inputs as well as conditions appropriate to malfunctions. An aircraft hydraulic system failure resulting in abnormal directional control of the aircraft is provided by appropriate motion cues. High airspeed characteristics and trim change effects are also produced by the motion system.

2-5. VISUAL SYSTEM. The student pilot station is provided with forward and left side window visual displays. The student gunner station is equipped with a forward window display only. (Refer to Chapter 6 for visual systems details.)

2-5.1 TELESCOPIC SIGHT UNIT. The student gunner station is equipped with a telescopic sight unit (TSU). The optics in the TSU tube are directed toward a CRT located in front of the cockpit. The video image for the CRT is developed by the computer reconstructed images from scene photographs (CRISP) system. Three types of image are provided: a realistic, high-detail, visible spectrum scene; a realistic forward-looking infrared (FLIR) scene; and a simplified symbolic scene. The high-detail scene is commonly referred to as the CRISP scene; therefore, the three scenes are referred to as CRISP, FLIR, and symbolic.

a. The CRISP scene is based on actual photographs of the model board that have been digitized and stored in the CRISP system on a laser disk storage device. This process allows a high-detail, full-color video image to be displayed in the TSU. Because of limited computer memory and processing capabilities, only specific areas of the model board have been photographed and digitized for the CRISP. These areas are referred to as target engagement points (TEP's).

b. The boundaries of a TEP can be visualized as a 50-foot vertical cylinder with a 5-meter radius, the center of which is located at particular coordinates on the model board. Selecting a TEP on CRT page 20 activates the CRISP mode. If CRISP mode is selected and the simulated aircraft position is within the boundaries of the TEP, the TSU displays a CRISP image. If the same conditions are met and the FLIR is turned on, the TSU displays a FLIR image. If the simulated aircraft position is outside the boundaries of the TEP or the CRISP mode is deselected (a TEP selection of 0), the TSU displays a simplified symbolic imagery.

c. TEP's are set up with 84-degree fields of view. The aircraft is able to change heading and altitude allowing the student pilot and gunner to find and track moving targets in the TSU.

d. When CRISP mode is selected, a mask feature can be selected on CRT page 21. If the aircraft is in a TEP, the mask simulates a wall that is 20 meters in front of the aircraft and 5 meters below the TEP center. Students can practice attacking from behind this wall.

e. The CRISP and FLIR scenes show realistic moving targets based on photographs of models. The instructor/operator selects CRISP mode, a TEP, and a target of interest (TOI) that can be seen from that TEP. The instructor/operator then selects one of two predetermined target paths and target velocity and initiates target motion.

f. A smoke screen feature can be selected on CRT page 61. This simulates the release of 15 smoke cannisters by the current target of interest. This feature is not available for targets 19 and 20, both of which are HIND's.

g. The symbolic scene shows simplified representations of the targets, horizon, and flat terrain. If the simulated aircraft position drifts outside the limits of the TEP, the CRISP image automatically switches to symbolic image. Continuity between the CRISP target position and the symbolic target position is maintained even when the TOI is moving. If the CRISP mode is deselected, the instructor/operator selects a heading for the moving target rather than a pathway.

h. IOS repeater monitors allow the instructor/operators to see the same image that is displayed in the TSU. (See figure 2-4.)

2-6. COMPUTER SYSTEM. The computer system consists of five Digital Equipment Corporation PDP-11/55 computer systems with associated memory and peripheral units. The operational software consists of an executive program and real-time simulation programs. The real-time programs, in conjunction with the appropriate hardware, provide simulation of flight performance, engine and related systems, aircraft accessory systems, radio communication and navigation equipment, atmospheric conditions, flight control systems, and malfunctions.

Section II. INSTRUCTOR/OPERATOR STATION DESCRIPTION

2-7. GENERAL DESCRIPTION. Each IOS accommodates one instructor and an observer. Figures 2-2 and 2-3 indicate the arrangement of the instructor/operator stations and their relationship with the cockpit stations. The IOS are designed to permit close, direct contact between instructors and crew. The location of the left and right IOS consoles provides convenient control of or both cockpits, and direct contact with the CRT displays of information required to monitor, guide, and evaluate pilot/gunner performance. A brief description of the various features of the instructor/operator areas is described in the following paragraphs.

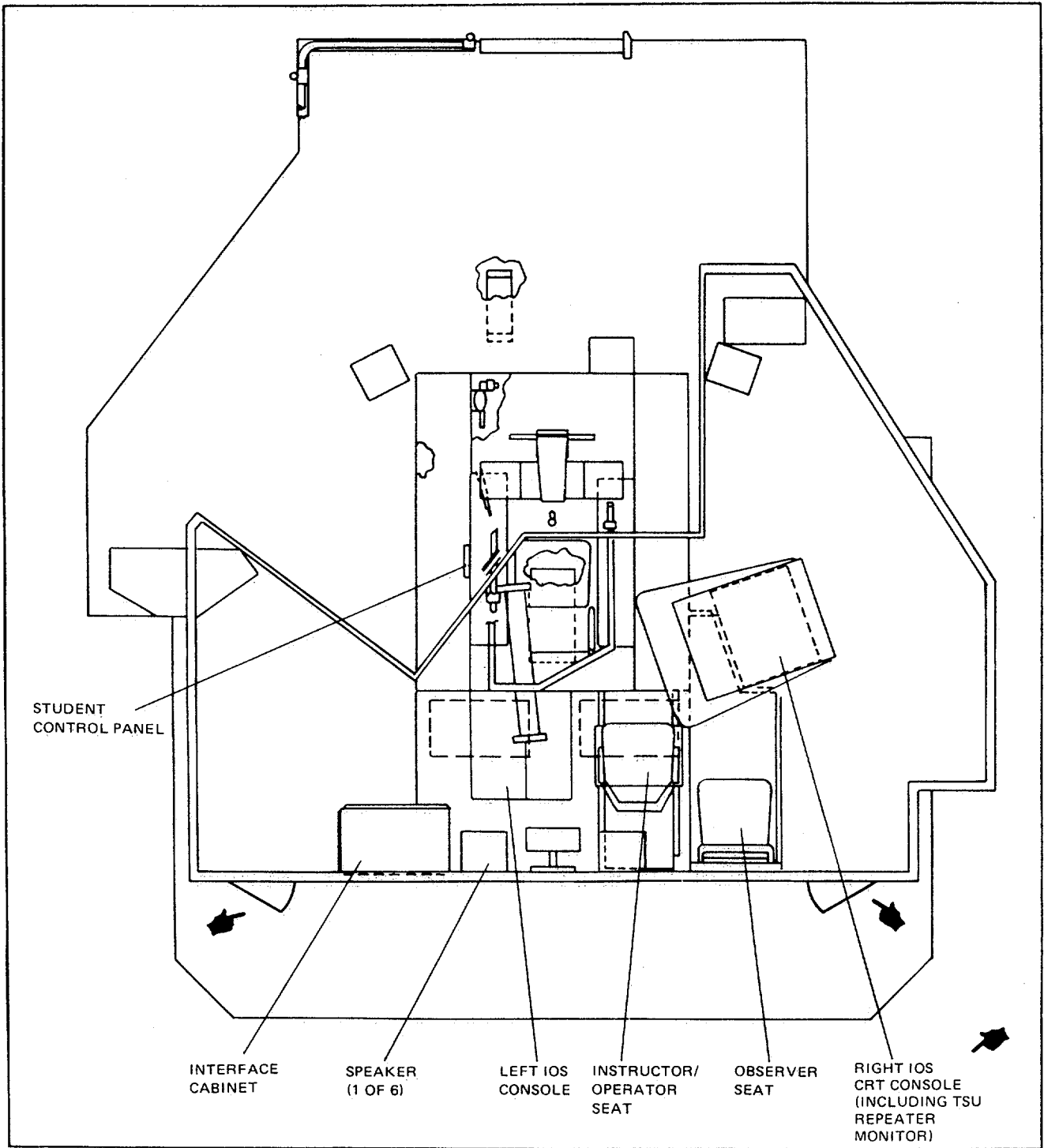
2-8. IOS CONTROL PANELS. Figure 2-4 shows the general layout of the pilot FWS flight compartment and also the left and right IOS console control panels. The layout of the gunner FWS flight compartment is nearly the same except for the cockpit and a few IOS controls. Panel layout is such that maximum efficiency and ease of controlling any training situation is ensured. A single CRT is provided with a 2-page memory so that the instructor can switch between two pages relevant to a particular training situation. The CRT console can be rotated and locked to three positions to provide optimum viewing angles for the instructor. Ongoing problem controls and displays are, in general, assigned to one page of display memory, while basic simulator controls are relegated to the other page. Related CRT display controls are located on the raised panel to the right of the CRT. Problem flight characteristics and problem controls are located to the left of the CRT. Simulator setup and communications controls are located on the left IOS console. Only minor differences exist in the control labeling and functions between the pilot and gunner instructor panels.

2-9. PILOT/GUNNER CONTROL PANELS. The student pilot control panel is located along the outer edge of the left side canopy rail. (See figure 2-2.) The student gunner control panel is located along the outer edge of the right side canopy rail. (See figure 2-3.)

2-10. INSTRUCTOR SEATS. The instructor/operator seat is mounted on a track to allow forward or rearward adjustment for optimum positioning. The seat also has a 360-degree swivel capability as well as up and down adjustment to enable the instructor to adjust for optimum CRT and/or cockpit station instruments viewing angle. Positive locks in the track, swivel, and height systems prevent the seat from moving in response to motions of the flight weapons simulator compartment. The normal position of the seat places the instructor's eye level slightly above and to the right of the pilot/gunner eye level in order to permit easier surveillance of the cockpit instrument and control panels. The seat back incline angle and the armrests are also adjustable.

2-11. OBSERVER SEATS. A fold-down observer seat, equipped with an abdominal seat belt, is located on the back wall of the simulator compartment. It is permanently mounted and nonadjustable, but positioned to facilitate overall viewing of instructor/pilot or gunner performance. An intercommunication system (ICS) panel, consisting of a headset jack, volume control, and a cord of sufficient length so as to be noninterfering, provides observer communication with the instructor/operator.

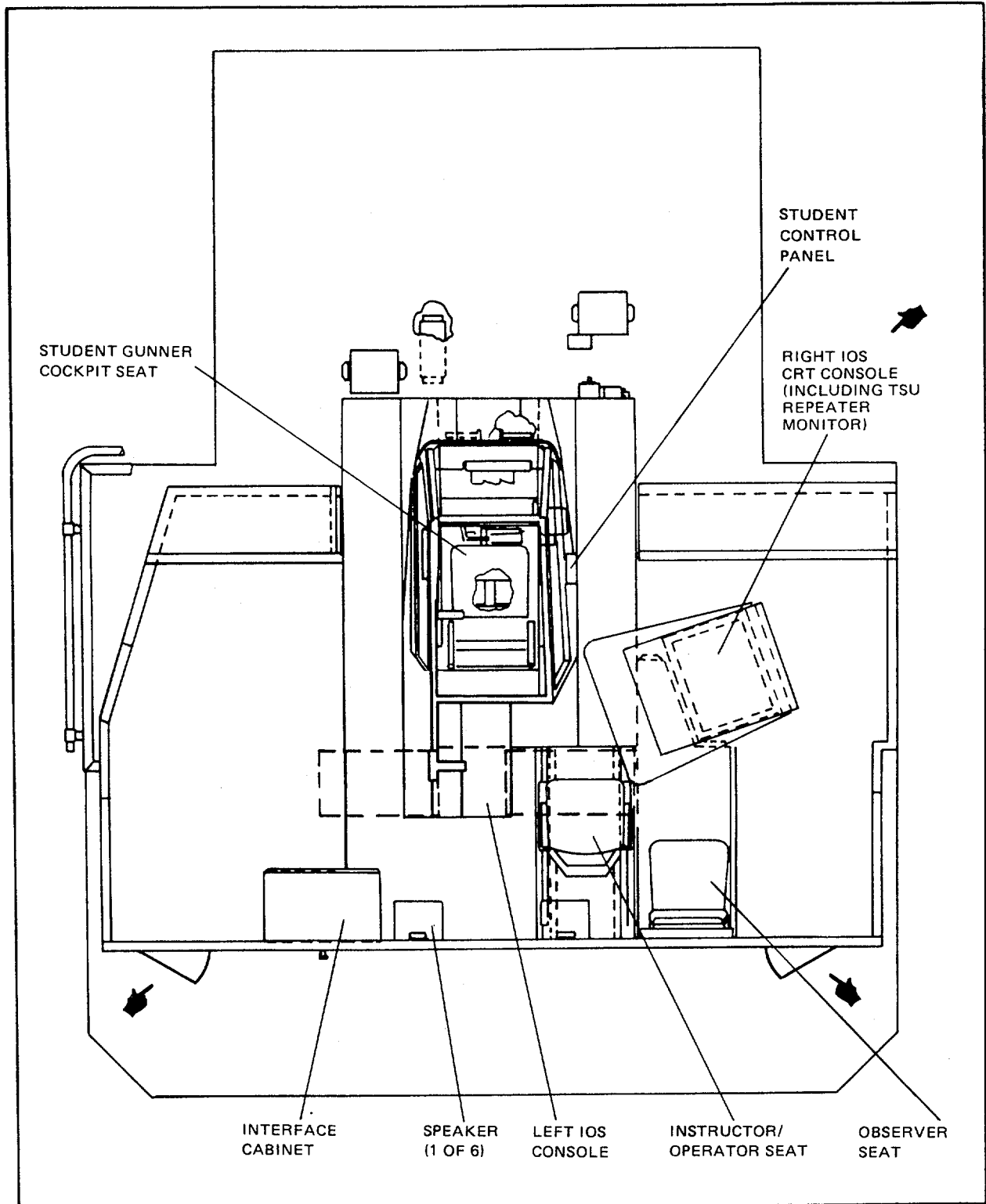
2-12. IOS AREA LIGHTING. The left IOS console is provided with a variable low-intensity recessed panel light to provide ambient illumination during any phase of the training. Many of the left and right IOS control panel switches are back-lighted to facilitate identification.



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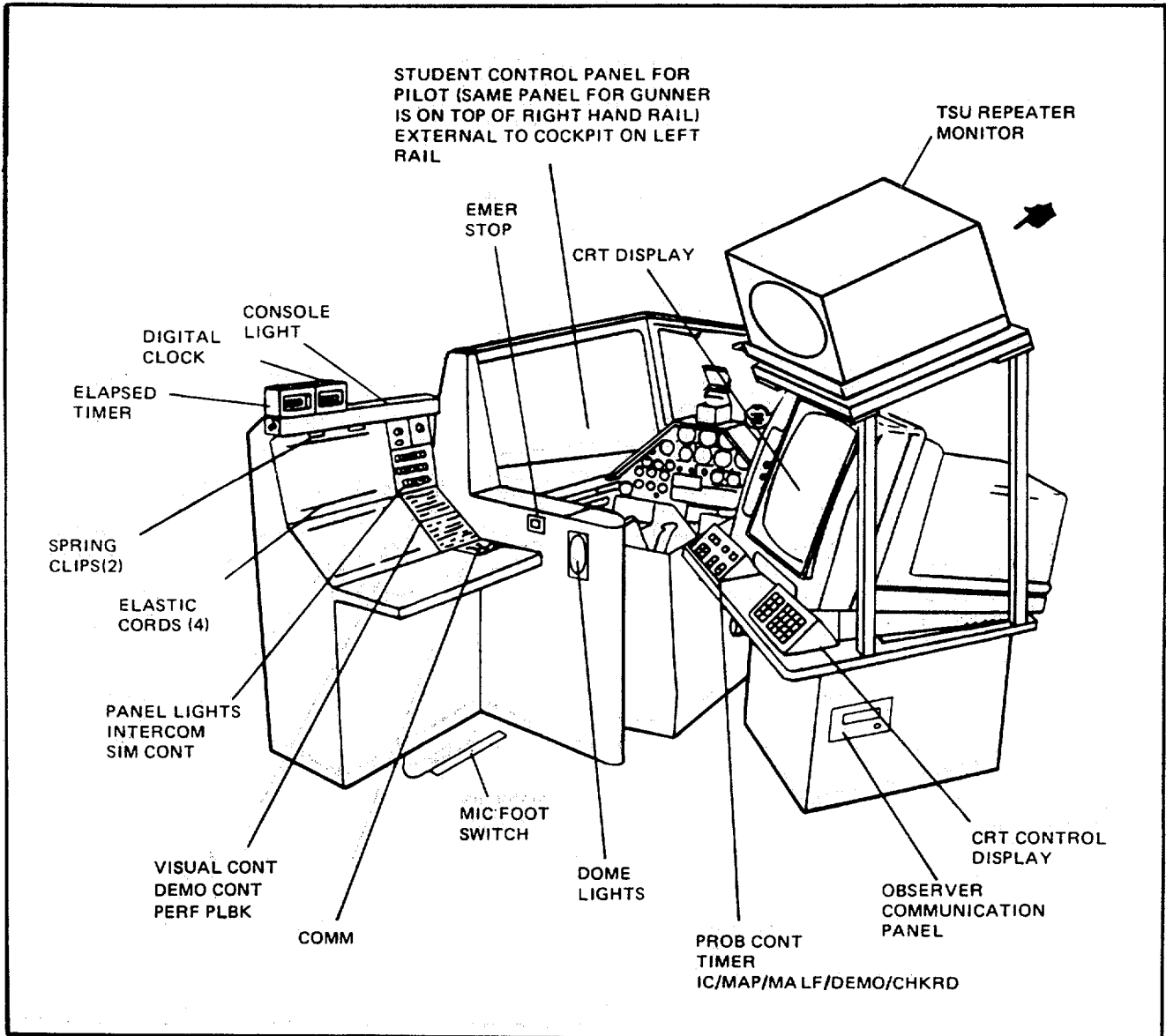
Figure 2-2. Pilot Flight Weapons Simulator Compartment

Change 1 2-6



15281

Figure 2-3. Gunner Flight Weapons Simulator Compartment



15285

Figure 2-4. Instructor/Operator Station General Layout

2-13. INSTRUCTOR INTERCOMMUNICATIONS SYSTEM. Headset cords and microphone foot-switches for each instructor are installed to permit minimum interference with the training function. Communication on a private basis is provided for instructors, observers, and the computer room. A visual warning cue is provided for the instructors, and an aural warning cue is provided in the computer room.

2-14. WORK SURFACE. The left IOS console has a large illuminated area provided for placement of maps, procedures, etc., which can be affixed beneath the elastic cords. Just below, a 10-inch-deep writing/working surface is provided.

2-15. TIME REFERENCES. A digital readout time-of-day clock is located on top of the left IOS console. An adjacent second digital readout clock with front panel controls provides elapsed time measurements.

Section III. MODES OF OPERATION

2-16. GENERAL. The FWS can operate on-line in three categories: training, checkride, and demonstration. The FWS is used in the training and checkride categories with the visual displays and motion system in operation. With two separate visual systems, both cockpits can have their own dedicated forward visual display, or the pilot cockpit can have both forward and left side visual whenever the gunner cockpit is either not using through-the-window visual or is using the same forward visual as the pilot. The pilot or gunner cockpit can either be operated independently or both can be operated as on a single integrated mission as crewmembers of the same aircraft. Training cannot be conducted when the FWS is operating to set up or edit a demonstration. Formulation of a demonstration involves recording and storing in the computer memory the characteristics of particular flight or mission profiles. An accompanying audio commentary can also be recorded and synchronized to the motion. During playback of a recorded demonstration for training, the FWS flies itself through an established mission exercise in a hands-off-the-controls condition. As the simulator reflies the mission, all motion, aural sounds, instrument indications, and visual display scenes are recreated. This can show the pilot and/or gunner standard or particular maneuvers or special flight problems. (Further information on the AH-1 Q-to-S demonstration category is given in Chapter 8 of this manual.) The system features available to each cockpit for the modes of both independent and integrated operation are outlined in table 2-1.

2-17. TRAINING. The administration of training to individuals occupying the pilot or gunner cockpits is under the positive control of the instructor/operator. For either integrated or independent modes, the instructor/operator can employ integrated or pilot independent checkrides with automatic performance recording, prerecorded demonstrations, initial conditions, preprogrammed malfunctions, or other aids through the use of controls and CRT displays provided at the IOS. Information displayed at the IOS is updated continuously during the training program to reflect current status.

a. Independent Training. In the independent mode, each instructor/operator is free to control any of the manual features of the simulator. This includes inserting own cockpit malfunctions, changing initial conditions, weapon loading configurations, and selecting nav/comm equipment and facilities. In addition, a training session can be frozen, and from 1- to 5-minute dynamic playback of the current transpired flight conditions is available for review. Nav/comm facilities cannot be failed by the gunner instructor.

b. Integrated Training. In the integrated mode, the administration of training to the crew in both cockpits is under the positive control of the pilot instructor. The pilot instructor controls the manual features of the simulator. This includes inserting malfunctions, changing initial conditions, selecting nav/comm equipment and facilities, and all aspects of training. The gunner instructor generally acts as an observer and has use of only the emergency controls, hardcopy requests, timer, and CRT display select (without editing capability). All aspects of training in the integrated mode can be accomplished without a gunner instructor present.

Table 2-1. Integrated/Independent Operation Features

Integrated		Pilot independent		Gunner independent	
a.	Recording or editing a demonstration.	a.	N/A	a.	N/A
b.	Demonstration playback - preprogrammed audio, slow-time, and pause. System will not respond to student control inputs. respond to student control inputs.	b.	Automated flight with preprogrammed audio, slow-time, and pause. System will not	b.	Automated flight with preprogrammed audio, slow-
NOTE					
If both pilot and gunner select the same demo, the first cockpit selecting the demo receives audio, audio is not available to the other cockpit while in use by the first.					
c.	Checkride exercise - with audio briefing and performance monitoring of exercise.	c.	Checkride exercise - with audio briefing and performance monitoring exercise.	c.	N/A
d.	Dynamic recording/performance playback - with audio (no audio in slow-time).	d.	Dynamic recording/performance playback - with audio (no audio in slow-time). slow-time).	d.	Dynamic recording/performance playback - with audio (no audio in
e.	Program variation and controls - Malfunctions Initial conditions Zeroing Environmental conditions Nav fail Parameter freeze Problem freeze Refuel/arm Threats Hardcopy Timer Display select (No edit)	e.	All comm fail facilities and threats. PILOT IOS ONLY BOTH IOS GUNNER IOS	e.	All except nav/
f.	CRISP fixed or fly mode f.	f.	N/A	f.	CRISP fixed mode only.

2-18. CHECKRIDE. In the checkride category, automatic performance recording and error scoring programs are employed under software program control. Preprogrammed aircraft flight conditions of visual, instrument, tactical visual, and tactical instrument checkride exercises are administered to the crew. The pilot instructor/operator can select either of the checkrides. Any of several subexercises within each checkride can be selected during independent or integrated operation. The checkrides are not available separately to the gunner instructor. However, the gunner instructor could be in the simulator to observe techniques and procedures during the integrated checkride. Once initiated, a checkride program continues in segments until the checkride is completed or until a situation develops from which the pilot/gunner cannot continue the checkride (e.g., the simulator crashes or is way off course). During the checkride, the instructor is able only to select and view different pages, maps, etc., and is not able to edit anything. The instructor can, however, advance segments, inhibit malfunctions during exercises, or terminate the checkride at any time. Provisions are made to allow for resumption of the checkride following a manual interruption by the instructor without repeating the entire flight. Characteristics and performance information displayed at the instructor station is updated continuously during the checkride to reflect the status of the checkride and of the simulated aircraft. Error print summary and snapshot plots of pilot/gunner checkride performance are available from the hard-copy printer/plotter. When training or checkride activities are not in progress and maintenance requirements permit, the computer complex can be used for the development or modification of automated demonstrations and checkride programs. (Refer to Chapter 8 of this manual.)

2-19. DEMONSTRATION. For demonstration playback, the instructor/operator can select any of up to 20 recorded demonstrations. Each demonstration can be further subdivided with up to nine separate maneuvers. These individual maneuvers can be selectively accessed, or they can be rearranged to formulate one mission for playback. Synchronized audio accompanying the demonstration is not available to the pilot or gunner compartment if the other instructor has already chosen the same demonstration with audio. The instructor can delete a demonstration at any point. The maximum length of audio capabilities for a demonstration is 30 minutes. Refer to Chapter 8, Section II for demonstration edit and formulation.

2-19.1 TSU MODES. The TSU has two basic modes of operation: CRISP mode and non-CRISP mode. CRISP mode is entered when a TEP is selected at the IOS. If a zero is entered for the TEP selection, the TSU is in non-CRISP mode. When CRISP mode is selected, the TSU displays a realistic CRISP or FLIR scene if the simulated aircraft position is within the boundaries of the selected TEP. If non-CRISP mode is selected or the simulated aircraft position is outside the TEP boundaries, the TSU displays a simplified symbolic image. Within the CRISP mode there are two additional modes: fixed mode and fly mode. Fly mode can be selected only when the FWS is operating in integrated mode. In the fly mode, the student pilot is responsible for maintaining the simulated aircraft position within the boundaries of the TEP. In fixed mode, if the aircraft flies within 50 meters of the TEP coordinates, the horizontal position is automatically updated to, and held at, the TEP coordinates. Fixed mode is used primarily with gunner independent mode. It relieves the student gunner of the task of maintaining the horizontal position.

Section IV. TRAINING CAPABILITIES

2-20. GENERAL. The AH-1 Q-to-S FWS is a fully operational flight weapons simulator with separate student pilot and gunner simulator compartments. Each has its own six-degree-of-freedom motion system, visual system, and instructor station. Each cockpit station duplicates its portion of the actual helicopter cockpit configuration. The FWS simulates, in real-time, applicable normal and emergency aircraft operation with respect to both transient and steady-state flight conditions. Operation of the simulator involves such capabilities as engine performance, flying qualities, weapons systems performance and operation, aircraft systems performance and operation, radio communications and navigation systems performance and operation, environmental effects, nap-of-the-earth operation, and flightpath. Simulation is reflected by appropriate pilot/gunner and instructor station instrument and aural indications, aircraft control reactions, visual cue presentations, and display traces responding to pilot/gunner, instructor, and computer-programmed controller inputs. Use of the FWS when the visual and/or motion system is inoperative severely limits training capabilities.

2-21. TRAINING OBJECTIVES. The FWS can be used to provide transition training and proficiency flying and weapons delivery practice. The simulator can be used to train aviators to perform all normal and emergency flight maneuvers, weapons delivery operations, nap-of-the-earth (NOE) flight and navigation, and starting, runup, and shutdown procedures. It is capable of full mission simulation, and it can be used for training of both the pilot and gunner simultaneously on the same mission or independently on different missions. This is accomplished in either integrated or independent operating modes of visual, motion, and cockpit simulation available to both pilot and gunner in any situation. The FWS can also be used for the training of instructor pilots.

a. Basic Maneuvers. Training for the following basic aircraft maneuvers can be conducted:

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

b. Advanced Maneuvers. Training for the following advanced aircraft maneuvers can be conducted:

- Maximum performance takeoff
- Steep approach
- Basic autorotation (power recovery and termination with power)
- SCAS-OFF (stability and control augmentation system) flight
- Running landings

- High-speed flight
- High-speed dive (normal)
- High-speed dive (steep)
- Running takeoff
- Night operations

c. Emergency Maneuvers. Training for the following emergency aircraft maneuvers can be conducted:

- Forced landings (normal and high-speed)
- Autorotative glides and turns
- Decelerations
- Simulated tail rotor control failure
- Simulated hydraulic failure
- Transient torque control
- Pitch cone coupling failure
- Emergency procedures (including emergency shutdown procedures)
- Autorotations with turns (power recovery, termination with power, touchdown)
- Hovering autorotation
- Basic autorotations (power recovery, termination with power, touchdown)
- Low-level, flat glide autorotation
- Low-level, high-speed autorotation (with power recovery, termination with power, touchdown)

d. Nap-of-the-Earth Maneuvers. Training for the following low-level nap-of-the-earth (NOE) aircraft maneuvers can be conducted:

- Low-level navigation techniques
- Hovering in and out of ground effect
- NOE takeoff
- NOE flight
- NOE approach
- NOE downwind takeoff
- NOE downwind flight
- NOE downwind approach
- NOE navigation
- NOE radio procedure
- NOE quick stop
- Masking and unmasking techniques
- Scan and detection techniques

e. Gunnery Maneuvers. Training for the following tactical gunnery maneuvers can be conducted:

- Weapons cockpit procedures
- Combat sight setting
- Diving fire
- Running fire
- Diving to running fire
- Low-level/NOE firing (combat sight setting)
- Low-level/NOE firing

2-22. SIMULATION SYSTEM CAPABILITIES. Capabilities of the various areas and systems of the FWS are outlined below.

a. Visual Area Navigation. A simulated area of terrain 256 by 256 nautical miles contains 126 navigation aids (radio stations). The actual terrain represented by the model board is 10.5 by 3.9 nautical miles.

b. Nav/Comm Radio. Navigation and communication radio capabilities are provided in Chapter 3.

c. Tactical Environment. Any of ten different weapon loading configurations listed on CRT page 060 are available for firing at three targets, one of which may be moving, selected from the targets available. Gun tracer trajectories, folded-fin aerial rocket (FFAR) and tube-launched, optically tracked, wire command link (TOW) missile flightpaths, weapon burnout, and ground impact are displayed.

d. Atmospheric Environment. The simulated environment can be controlled by the instructor to provide variable winds, turbulence levels (light, moderate, severe), temperature, and barometric pressure. Temperature in degrees centigrade and barometric pressure in inches of mercury are displayed on the instructor/operator station (IOS) and are referenced at mean sea level. The indications presented on the cockpit instruments, and as seen by the computer, are pressure altitude and temperature based upon application of standard lapse (2C/1000 feet).

e. Motion Cues. A six-degree-of-freedom motion base provides motion cues of pitch, roll, yaw, heave, longitudinal and lateral. The simulation is further enhanced by a seat vibration system for both the pilot and gunner seats. The seat vibration system can provide continuous and periodic oscillations and vibrations experienced during normal and emergency flight conditions, including progressive malfunctions. Both motion and vibration can be selected or deselected at the 108 console CRT.

f. Environmental Sound Cues. Environmental sound cues are available at nine levels of loudness and can be selected or varied at the IOS console CRT.

g. Seat Positions. Each flight simulator compartment provides seat positions for one student, an instructor/operator, and an observer.

h. Special Capabilities. The FWS has some limitations that preclude its utilization for training in certain maneuvers. The most serious limitation is in the area of visual field-of-view required for contact flight. Aircraft airspeed for low-level and nap-of-the-earth flights should be limited to a maximum of 90 knots in order to remain within safe operating limits for low-level flight probe protection. Above 90 knots, the performance of the dynamic software protection is marginal. Invalid crashes may occur, or an impending crash may not be detected. On the other hand, the FWS provides the following unique capabilities that the operational aircraft cannot provide:

- (1) Freeze simulator action at any instant.

- (2) Initiate a training program at any one of 10 predefined locations within the game environment from which the flight can proceed.
- (3) Reset the training program to an initialization point that has been modified.

NOTE

Reset is identical to initialization, indicated by freeze indicator blinking.

- (4) Override an impending aircraft crash.
- (5) Dynamically record and play back up to previous 5 minutes of a current flight.
- (6) Insert up to 5 of 207 malfunctions simultaneously.
- (7) Demonstrate prerecorded maneuvers automatically.
- (8) Administer VFR, IFR tactical weapons and tactical instrument checkrides.
- (9) Monitor program progress and pilot/gunner performance.
- (10) Freeze flight parameters selectively.
- (11) Administer audio briefings automatically.
- (12) Stop and abort a program at any time in event of emergency.
- (13) Retrieve stored performance data via hardcopy printer/plotter.
- (14) Fully control training program from IOS, or limited control from pilot/gunner cockpit station.
- (15) View on IOS CRT and/or obtain hardcopy time history plots of airspeed, altitude, and ground track.
- (16) Immediately alert instructor/operator of pilot/gunner performance error.
- (17) Alter environmental conditions that act on the aircraft.
- (18) Compute and display ground-controlled approach (GCA) commands.
- (19) Train gunner in absolute safety.
- (20) Train pilot and gunner both independently and/or simultaneously.

2-23. VISUAL SYSTEM CAPABILITIES. The full-color visual simulation system, combined with computer-generated visual effects, provides a realistic view of ground and sky conditions to the pilot and gunner. (Additional information on the visual system and its capabilities is contained in Chapter 6.)

2-24. TRAINING TASKS. Training of pilot and gunner is carried out in either integrated or independent operating modes of visual, motion, and cockpit simulation. The task of the students is to become thoroughly knowledgeable with all aspects of the pilot and gunner positions of the helicopter. The instructor task is to maintain complete control of simulated conditions for training and to fully monitor crew performance in all normal and emergency operational aspects of the helicopter.

a. Simulated Aircraft. The AH-1S modernized Cobra, manufactured by Bell Helicopter Company, is a single-turbine-engine, single-rotor, high-performance attack helicopter with a two-man crew seated in tandem, the gunner in front of the pilot. The primary mission of this aircraft is that of an armed tactical aircraft with capabilities including weapons delivery, low-altitude high-speed flight, nap-of-the-earth flight, search and target acquisition, reconnaissance, multiple weapons fire support, and troop aircraft support.

b. Flight Control. The simulated flight can be controlled by the following:

(1) By the pilot in the integrated mode with the gunner acting as gunner only, unless gunner control is selected by the pilot instructor.

(2) By both pilot and gunner in the independent mode, each flying completely separate and independent aircraft.

(3) By the instructor via prerecorded demonstrations in either integrated or independent modes.

c. Pilot/Gunner Tasks. The task of a pilot/gunner in the FWS is to learn, practice, and verify the skills and knowledges associated with the pilot and gunner positions on the actual helicopter. The FWS provides transition training, proficiency flying, weapons delivery practice, and the training of instructor pilots.

(1) Pilot independent mode. The following tasks can be conducted in this mode:

- Pilot transitional training
- Pilot gunnery training
- Instrument procedures
- Engine control
- Navigation/communication problems
- Nap-of-the-earth flight
- Emergency procedures

(2) Gunner independent mode. The following tasks can be conducted in this mode:

- Gunner transitional training
- Gunner aircraft control
- Gunner engine control
- Gunner training (with manual or automatic aircraft control)
- Special emergency procedures

(3) Integrated mode. The following tasks can be conducted in this mode:

- Pilot/gunner transitional training
- Pilot/gunner gunnery training
- Crew coordination in normal flight, emergency conditions, instrument conditions, and weapons delivery
- Aircraft and engine control
- Navigation/communication problems
- Nap-of-the-earth navigation, crew coordination, and gunnery techniques

d. Instructor/Operator Tasks. The task of the instructor/operator is to facilitate and verify learning by the student crew. Instructional and operational functions include:

- (1) Selection of mission or lesson plan.
- (2) Preflight briefing of students.
- (3) Demonstration of proper techniques and procedures.
- (4) Observation, monitoring, and critique of student performance.
- (5) Evaluation of individual or crew training needs.
- (6) Identification of areas that need coaching or more special practice.
- (7) Scheduled structuring of subsequent practice.
- (8) Preproblem setup of helicopter configuration and position.
- (9) Setup and modification of environmental conditions.
- (10) Random insertion and removal of simulated malfunctions.
- (11) Hardcopy recording of important aspects of student performance.
- (12) Monitoring and controlling operational status of simulator.
- (13) Serving as an air traffic controller when appropriate.

e. Automation of Instructional Functions. Many facets of the functions noted above have been automated, thus unburdening the instructor/operator. An additional value of this automation is the standardization it provides. Among the more important features of the FWS in terms of automating instructor function are the following:

(1) Demonstration maneuvers. Prerecorded demonstrations of maneuvers are available to the instructor as training aids to be used to demonstrate certain maneuvers to the pilot and/or gunner. Autoflight tapes are available to the pilot or gunner instructors in the independent modes to provide the pilot and gunner with tactical flight for gunnery training and problem solving.

(2) Automated standard checkrides. With checkride exercises, the instructor does not have to set or modify initial conditions (aircraft and environment), insert malfunctions, or select scoring and error measurement requirements. These are all accomplished automatically. Separate checkrides are provided for visual and instrument flight, tactical visual, and tactical instrument flight.

(3) Ground-controlled approach (GCA). Proper GCA instructions based on the simulated position are displayed on the IOS CRT page 045. This enables the instructor/operator to simply read them, rather than having to interpret graphic displays.

(4) Automatic briefings. These prerecorded briefings include a description of each checkride and its performance criteria.

(5) Scoring and evaluation. During the checkride exercise, a record is made of the errors during each segment of the checkride. Parameters such as the frequency of deviation of the simulated helicopter systems from predetermined standards and the cumulative time out of specified tolerances are recorded automatically and output in hardcopy form. Other evaluation data is available to the instructor/operator from CRT displays and from direct observation of the crew and their instruments and indicators.

f. Briefing. Briefings prior to training missions can be either prerecorded audio or live. Prerecorded briefings include a description of the checkride problem content to be presented and performance criteria. Such automated briefings can provide the following advantages over live briefings:

(1) They relieve the instructor of one of the less challenging aspects of his job, while ensuring that needed content is presented.

(2) They provide standardization, both in form and content of the briefing. This standardization enhances the subsequent evaluation of trainee performance, making the task presented to different individuals truly identical.

(3) They allow the crew to obtain a repeat of part or all of the briefing without being inhibited by the possibility of wasting instructor time.

g. Critique. While critique of crew performance after a training exercise is not automated, it can be based on a comprehensive and standardized set of criteria. Errors made during each segment of the checkride are presented as a frequency of deviation from predetermined standards. Such critiquing is aided by the available hardcopy records of student performance. Such pictures are often worth the proverbial thousand words of instructor comment. A learning feature that can be most useful in critiquing is the 1- to 5-minute dynamic playback of student performance. This can be accomplished either in real-time or in slow-time. Another function is the hardcopy plot of graphic displays available at instructor discretion.

h. Cueing. Cueing is sometimes defined as the provision of stimuli, usually of a secondary or faint nature, that guides the crew to the correct response. Such cueing, sometimes called prompting, is of considerable value in programmed instruction. Application of prompts or cues are gradually withdrawn or faded as learning progresses. Cueing has a somewhat different meaning in the context of the FWS. Cues for action are the stimuli normally present in helicopter flight such as:

instrument and indicator readings, positions of cockpits controls, aspects of the out-the-window visual scene, cockpit motion and vibration, feel of the controls, and sounds associated with helicopter operations. These cues are simulated with a high degree of realism.

i. Feedback. Feedback to the student concerning the adequacy of the performance is provided in two ways: from the pattern of cues resulting from control reactions in the course of operation of the simulated helicopter, and from the measures of performance that can be made available after a training exercise. Feedback during the exercise is provided by the cueing methods as described above. Feedback after the exercise is provided by the scoring and evaluation hardcopy records.

Section V. SYSTEMS SIMULATED

2-25. GENERAL. The aircraft systems simulated by the FWS are outlined in the following paragraphs. Since each aspect of pseudo real-time simulation employs unique hardware and computer software programs to implement them, simulation details are not provided.

2-26. ACCESSORY SYSTEMS. The following accessory systems to the aircraft that provide operational status to the crew are simulated by software via computer control:

Auxiliary power unit (APU)	Instrument indications
Engine-fuel	Weight and balance
Engine-oil	Navigation and communication
Fuel supply	Armament
Transmission oil	Flight controls
Power train	Outside environment
Rotor	Day, dusk, or night conditions
Electrical power system	Stability and control augmentation (SCAS)
Hydraulic system	

2-27. SOUND SIMULATION. Analog generation under computer control provides the following sound simulation cues:

a. Aircraft Sounds. The following aircraft sounds are simulated:

Engine
Compressor stall
APU
Ground reflected and crash
Main rotor
Touchdown skid
Transmission and gear train
Hydraulics

b. Weapon Sounds. The following weapon sounds are simulated:

FFAR
TOW missile
Universal turret 20-mm and 30-mm automatic gun

2-28. MOTION SIMULATION. An electrohydraulic-actuated 6-post synergistic six-degree-of-freedom 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

2-29. VIBRATION SIMULATION. An electrohydraulic seat shaker is used to transmit vibrational effects to the students while isolating the effects from other compartment mounted hardware and occupants.

2-30. COCKPIT INSTRUMENTATION SIMULATION. All cockpit instruments and controls simulated are actual modified aircraft instruments. Blue-green lighting compatible with the night vision goggles is provided by floodlights and utility lights. Compatible postlights provide supplemental instrument lighting. The instruments 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

2-31. RADIO COMMUNICATION AND INTERCOMMUNICATION SYSTEM SIMULATION. The radio communications, guidance, and ICS systems simulated are listed and described in Chapter 3.

2-32. MALFUNCTION SIMULATION. 207 malfunctions (listed in Chapter 7, table 7-2) are available for selection and insertion into the simulator.

2-33. CONTROL LOADING. The control loading system provides a realistic and responsive feeling to the simulated helicopter flight controls. Electrohydraulic units combined with a mechanical linkage system produce control initiating and reactive forces. Feedback from the simulation computer results in appropriate motions of the aircraft in flight. During a demonstration playback or a dynamic performance playback, the cockpit flight controls are driven by the computer and appropriately positioned in response to the motion of the aircraft.

2-34. ARMAMENT SYSTEMS. Simulation for the following armament systems is provided:

- Helmet sight subsystem
- Head-up display
- TOW missile
- Universal turret 20-mm and 30-mm automatic gun
- FFAR 19-tube rocket launcher
- FFAR 7-tube rocket launcher

CHAPTER 3

AVIONICS

3-1. GENERAL. Simulation for all onboard avionics equipment utilizes actual aircraft panel hardware backed up by applicable analog and digital processing and driver circuitry all under computer control. Operation of nearly all panel controls and indicators is simulated to depict actual equipment functions. Table 3-1 lists the avionics systems that are simulated in the FWS.

Table 3-1. Avionics Systems

Class	Nomenclature	Name
Communications	C-6533/ARC	Communications Control Set
	AN/ARC-114A	VHF/FM Radio Set
	AN/ARC-115	VHF/AM Radio Set
	AN/ARC-164	UHF Radio Set
Navigation	AN/ARN-89B	Auto Direction Finder Receiver Set
	AN/ARN-123V	VOR/LOC/GS/MB Receiver Set
	AN/ASN-43	Gyromagnetic Compass Set
	ID-2103A	Horizontal Situation Indicator
	ID-2104A	Attitude Direction Indicator
	ID-205A	Radio Magnetic Compass Indicator
	AN/ASN-128	Doppler Navigation Set
Radar and Transponder	AN/APR-39	Radar Signal Detector Set
	AN/APX-100	IFF Transponder Set
	APN-209	Radar Altimeter

3-2. COMMUNICATIONS EQUIPMENT. Simulated radio communications are such that the two-way communication primarily takes place between the crew and the instructor(s). At the same time, electronics interfacing with the computer, which defines and controls some of the variables, allows for complete system flexibility. System power controls and indications, aircraft flight parameters, and simulated equipment failure commands are brought into the computer for processing. From this, the necessary commands are then generated for the avionics and system related equipments. The following communications equipment is simulated:

a. C-6533/ARC communications control panels, in both the pilot and gunner instrument panels, integrate control of the aircraft communications equipment. Selection switches and volume adjustment provide for pilot/gunner intercommunication and simulated radio receiving and transmission. Both IOS consoles have modified communications control panels that are functionally similar to the student panels but provide additional capabilities. Additional panels are located in the facility computer room and at each observer station.

b. AN/ARC-114A VHF/FM radio set provides a two-way communications channel between the student gunner and the instructor/operator. This channel is used for communications on all frequencies of the radio set. The unit also has FM homing capabilities and is used in conjunction with the attitude direction indicator (ADI) and the horizontal situation indicator (HSI) cockpit navigation instruments.

c. TSEC/KY-28 voice security equipment panel, near the middle of the pilot right console, is normally used in conjunction with the AN/ARC-114A to provide secure two-way communication. Although this panel is present, it is nonfunctional.

d. AN/ARC-115 VHF/AM radio set provides a two-way communications channel between the pilot and the instructor/operator. This channel is used for communications on all frequencies of the unit.

e. AN/ARC-164 UHF radio set normally provides two-way communications between the pilot and ground-based equipment. Located in the pilot right console, a communications channel is established between the pilot and the instructor.

3-3. NAVIGATION EQUIPMENT. Navigation systems and equipment provide location and course related information to the pilot and gunner via radio receiving links and instrument panel indications. Simulated navigation equipment is as follows:

a. AN/ARN-89B auto direction finder (ADF) receiver set develops navigational course information from ground-based transmitter sources. This receiver is partially simulated in the FWS and is used in conjunction with the radio magnetic indicator (RMI) and the HSI cockpit instruments, giving aircraft bearing and course information. Indications are based on the station that the receiver is tuned to. An audio tone is produced which varies in loudness depending upon the simulated directional positioning of the aircraft.

NOTE

There is no correlation between the simulated navigation facilities of the real-world environment and the terrain model of the visual system.

b. AN/ARC-123 VOR/LOC/GS/MB receiver set (VHF omni-range/localizer/glide-slope/marker beacon) enables the pilot to determine present position and direction to a given point, and maintain course on a predetermined flightpath related to a ground-based transmitter. Simulation includes computer-generated signals that provide the appropriate position and direction indications on the HSI and ADI cockpit instruments. An audio tone depicting flightpath is also received from the simulated ground-based transmitter.

c. AN/ASN-43 gyromagnetic compass system provides the pilot and gunner accurate reference indications of the magnetic heading of the helicopter. Functional control of this system is through the C6347 compass controller panel located in the pilot right console. Directional information is supplied to the HSI and RMI cockpit instruments. System simulation involves the computer and interface circuitry to drive the cockpit instruments providing the directional information based on the simulated positioning of the aircraft.

d. ID-2103A HSI, ID-2104A ADI, and ID-2105A RMI are pilot or gunner cockpit instruments that provide visual indications of appropriate location, attitude, and course information as determined by the avionics equipment. These instruments are driven directly by the computer via appropriate interface circuitry. In addition, a standby compass in the gunner cockpit, indicating the simulated aircraft magnetic heading, is also driven by the computer and interface circuits.

e. AN/ASN-128 Doppler navigation set is a self-contained navigation system that operates in conjunction with the aircraft heading and vertical reference systems. Simulated velocity, position, and heading information is presented on the ASN-128 display panel. This is generated by the computer after determining the mode of operation and the related system parameters that are affected by the current conditions of the FWS.

3-4. RADAR AND TRANSPONDER EQUIPMENT. The following equipment is limited in simulation to provide status indications to either the pilot or instructor/operator:

a. AN/APR-39 radar signal detector set provides a visual and audio indication to warn the pilot of a potential threat to the aircraft. The control panel, in the pilot right console, is toward the rear. A choice of five different radar threats can be selected by the instructor/operator, and up to three simultaneous warning threats can be displayed on the cockpit instruments.

b. Identification friend or foe (IFF) transponder set enables the helicopter to identify itself automatically when properly challenged by an external radar system. The control panel is in the pilot right console. Simulation is limited to the status reporting of panel switch positions on the IOS console CRT display.

c. APN-209 radar altimeter is a terrain-tracking and altitude-sensing system. An altitude indication is provided to the student and also displayed on the IOS CRT display in a scrolling graph form.

CHAPTER 4

TACTICS

4-1. GENERAL. The FWS, having full mission tactical weapons capabilities, enables the student pilot and/or gunner to practice and improve proficiency in missions involving missile and rocket delivery and gunnery exercises. The following armament systems and components are simulated and interfaced with the computer via signal conditioning equipment:

- M97 universal turret 20-mm and 30-mm gun
- M65 TOW missile
- M200 19-tube FFAR rocket launcher
- M158 7-tube FFAR rocket launcher
- M136 HSS TSU
- M76 head-up display (HUD)
- M138 rocket management subsystem
- M22 fire control computer laser range finder
- AN/AAS-32 airborne laser tracker
- AN/ALQ-144 infrared jammer pilot armament control panel

4-2. VISUAL SIMULATION. The simulated environment consists of through-the-window displays for the pilot and gunner with the tactical target in the visual scene. Scorable targets of opportunity are provided in the visual scene at selected locations in the form of military vehicles or missile launching sites. The display also portrays such weapon effects as gun tracer trajectories, FFAR and TOW missile flightpaths, weapon burnout, or ground impact. The TSU images (CRISP, FLIR, and symbolic) also show weapons effects such as tracers, missiles, and impact. The TSU scene always includes a computer-generated image of the sighting reticle with READY, ATTACK, and GUN flags and laser range finder readouts. The CRISP and FLIR scenes correlate with the through-the-window scenes, the symbolic scene does not.

4-3. TRAINING. To initiate a problem, the instructor/operator enters CRISP mode by selecting a TEP. The instructor/operator then selects a TOI and fixed or fly mode. The instructor/operator may set the simulated aircraft position or direct the students to fly to the TEP location. The student gunner can operate the TSU and/or FLIR controls to locate and fire at a target. The instructor/operator selects one of two pre-defined target paths for the TOI and a target velocity, and then initiates target motion. In non-CRISP mode, the instructor/operator selects a target heading instead of a target path. Weapon loading is then carried out by the instructor/operator by means of IOS console CRT/keyboard action. Ten different weapon loading configurations are available. The current status of remaining armament at each aircraft weapon station can be presented on the CRT and is based on the initial conditions of the weapon loading configuration and weapons previously fired.

4-4. EVALUATION. The instructor is provided with weapon scoring data on a CRT page. The displayed data provides the number of rounds fired, number of hits, an accumulative center-of-mass displayed as distance over or short, left or right, and burst duration where applicable. The aural cue system provides for simulation of normal and abnormal sounds that make up the cockpit acoustic environment. Weapon sounds include: FFAR, TOW missile, and universal turret 20-mm and 30-mm gun.

CHAPTER 5

OPERATING LIMITS AND RESTRICTIONS

5-1. GENERAL. The flight weapons simulator was designed to have a high degree of similarity to the actual helicopter. Since the purpose of the FWS is for pilot transition and gunnery training, certain operations and functions of the aircraft are only partially simulated or not at all. Those operations and functions that follow were determined to have very low or no applicability for the enhancement of pilot and gunner training and proficiency. General items include the following:

- Transparent canopy plexiglass is not present.
- Canopy removal arm/fire mechanisms are installed but nonfunctional.
- Pilot lighting control panel is functional but limited.
- Rain removal/heat switch is installed but nonfunctional.
- Secondary torque meter and clock cockpit instruments are omitted.

5-2. AVIONICS. Communications equipment provides for instructor and crew communications but not actual signal reception or transmission. Discrete frequency radio communications channels are not available. (Additional limitations that exist with the avionics equipment are described in Chapter 3.)

5-3. TEMPERATURE AND HUMIDITY. The simulator compartments and motion systems are required to operate in a comfort-controlled environment at a temperature of 75 (± 10)°F (22 (± 6)°C) at a 50 (± 5)% relative humidity. The computer complex is required to operate in a controlled environment of 70 (± 5)°F (21 (± 3)°C) at a 50 (± 5)% relative humidity. The visual area is required to operate within a temperature range of 72 (± 7)°F (22 (± 4)°C) at a 50 (± 5)% relative humidity.

a. In the course of operation, variations in room temperature must not result in the development of relative humidity above 70% or below 30% at any temperature within the range from 50°F (10°C) to 100°F (38°C). Temperature sensors in the equipment cabinets are capable of sensing two overheat temperatures. At 100°F (38°C), they illuminate a light on the failure indications panel indicating that a particular cabinet location is in an overheat condition. In addition, an aural warning is activated. If the overheating condition is not corrected, the entire simulator complex is automatically shut down when the temperature exceeds 110°F (44°C).

b. The internal temperature of the pilot and gunner FWS compartments is controlled by separate, dedicated air conditioners ducted at supplementary outlets within the compartment and the normal cockpit heating and defrosting ducts. Separate thermostat controls are provided on the inside rear wall of each compartment. The cockpit air temperature controls, although present, are nonfunctional.

5-4. OCCUPANCY. During simulated maneuvers, safety reasons require that occupancy of each flight compartment is limited to three persons: the pilot or gunner, an instructor/operator, and an observer.

5-5. MOTION SYSTEM. For multiaxis motion, the maximum platform excursion values are given below with respect to a forward reference point. These are measured with respect to an origin established when the motion platform is considered to be at a neutral position; that is, with the hydraulic cylinder legs at midposition:

Vertical:	32 inches up, 23 inches down
Lateral:	+42 inches
Longitudinal:	±48 inches
Pitch:	24° down, 260 up
Roll:	+22°
Yaw:	+29°

5-6. VISUAL SYSTEM. The camera model system generated field-of-view is 48 degrees horizontally and 36 degrees vertically as seen on the cockpit display. Visual flight simulation takes place on a terrain model representing a rectangular geographical area of 10.5 by 3.9 nautical miles scaled at 1:1000. The entire model board terrain surface can be illuminated to provide day, dusk, or night conditions. When first turned on or when going from night to day conditions, a wait of up to 20 minutes may be required before the visual scene is available at full brightness. The visual system represented altitude of 2000 feet is limited by the 2-foot travel limit of the gantry. For simulation training purposes, the ambient light level of the cockpit must be adjusted and set at 1FR nighttime levels.

5-7. AUDIO SYSTEM. No briefings are conducted after a checkride exercise is initiated. Once programmed, accompanying audio cannot be turned off while a demonstration continues. Audio is not available during slow-time playback. All aural cues are limited in loudness to within established safe levels of hearing. Sounds associated with rain and hail are not provided.

5-8. IOS CRT CONTROLLABLE PARAMETERS. The CRT display pages provide instructor/operator control for aircraft environment, flight, and miscellaneous related parameters. Selectable values for edit are limited within the range normally found in a realistic world or within the limitations of the actual helicopter.

NOTE

To ensure reliable and valid playback of dynamic performance recordings or demonstrations in integrated or independent training modes, a limited number of edits to the IOS CRT page parameters are allowed while in a freeze condition. This is due to the amount of buffer memory space allocated for storage of edited parameters. Once the limitation is reached, which is indicated by a message on the CRT, the simulator must be taken out of the freeze condition for a short period of time before more edits can take place.

a. Environmental Conditions. Selections of environmental conditions are limited as follows:

Barometric Pressure	- 27 to 32 inches Hg
Outside Air Temperature	- 50°C to +50°C
	- 58°F to +122°F
Wind Velocity	- 0 to 50 knots
Wind Direction	- 001 to 360 degrees
Horizontal Wind Gust	- 0 to 30 knots

Visibility	- 0 to 60,000 feet
Ceiling	- 0 to 1,850 feet
Cloud Thickness	- 0 to 1,000 feet
Turbulence Level	- 0 to 9 (state levels)
Day/Dusk/Night	- 0/1/2 (selection)

b. Freezable Flight Conditions. During a training exercise, the following aircraft flight conditions are a direct result of the student flight inputs and are freezable only; these conditions are editable during setup of initial conditions:

Altitude	0 - 20,000 feet
Airspeed	0 - 190 knots
Heading	001 to 360 degrees
Vertical Speed	-6000 to +6000 feet per minute
RPM	0 to 105%

NOTE

Conditions of roll, pitch, yaw, torque pressure, and rate-of-turn are all interdependent flight parameters that assume in-turn conditions under software control and are neither editable nor freezable.

c. Editable Flight Conditions. Aircraft flight condition editable parameters are:

Fuel Loading	1743 pounds maximum
Latitude	N 090°00'00"
	S 089°00'00"
Longitude	E 180°00'00"
	W180°00'00"

d. Miscellaneous Conditions. Parameter limits for related conditions are:

Sound Level	0 - 9 (state levels)
Seat Shaker	on/off
Runway Edge Lights	on/off
Runway Pinnacle	on/off
Confined Area Lights	on/off
Airfield Approach Lights	on/off
Airfield Strobe	on/off
Hostile Ground Fire Select	1 - 10
Field Select	1 - 6
Weapon Configuration	0 - 10
Auxiliary Power Unit (APU)	on/off

e. Malfunctions. In either an integrated or independent training mode, insertion or deletion of malfunctions is not allowed while in a freeze condition.

5-9. COCKPIT CIRCUIT BREAKERS. Circuit breakers listed below are functional but not poppable:

AC Circuit Breaker Panel:
REF XMFR

DC Circuit Breaker Panel:
FUEL/OIL VALVE
POS LTS
ANTI COLL LT

5-10. ARMAMENT SYSTEM. Armament simulation is implemented so that the instructor must inform the pilot/gunner which weapon load configuration is in effect and that cockpit actions and indications must be compatible. The following conditions and limits exist:

- a. The trajectory and impact point display cues are representative only for a maximum aircraft to target-of-interest range of 6000 meters.
- b. For the occurrence of simultaneous firing of the FFAR rocket and the 20-mm turret gun, the TSU supports the turret gun fire. Rocket fire is then slightly degraded.

5-11. TELESCOPIC SIGHT UNIT. The TSU has the following limitations:

- a. The TSU displays realistic CRISP or FLIR scenes only when CRISP mode is selected and the simulated aircraft position is within the boundaries of the selected TEP. Otherwise, a symbolic scene is displayed in the TSU.
- b. When a symbolic scene is being displayed, a maximum of three targets can be displayed.
- c. Only one target can be selected as the TOI, and only the TOI can be a moving target.
- d. When CRISP mode is selected, target movement is limited to one of two predetermined target paths.
- e. When CRISP mode is deselected, the movement of a symbolic target involves horizontal movement in a straight line along a selected heading. The target does not follow changes in terrain elevation that may be present at the corresponding location on the model board.
- f. Targets that appear in the through-the-window scene do not move. A spot of light is introduced into the camera-model board image, however, which shows the location of a moving target.
- g. The simulated FOV for the FLIR narrow FOV image is slightly larger than the FOV in the actual aircraft. The difference should not be noticeable to the user.
- h. CRISP is only available from airfield 2.
- i. Once a TEP is selected, only TOI's existing for that TEP can be engaged. (See figure 7-13.1.)
- j. Visibility effects such as fog should be set up before the training session begins.

5-12. INDEPENDENT MODE. This mode is limited as follows:

- a. Demonstrations cannot be dynamically recorded.

b. Only one visual system is available to the pilot if the gunner is using visual. However, selection of front and side visual by the pilot instructor removes visual from the gunner. As a result, no visual is available to the gunner if the pilot is using both front and side visual.

c. No demonstration audio is available if the other cockpit is already using the same demonstration with audio.

d. Instructors cannot initiate malfunctions affecting the other cockpit.

e. The pilot cannot use a moving target.

f. The pilot instructor is required to provide TOW ATTACK SEQ and TOW FIRE inputs to the pilot.

g. The gunner instructor is required to provide MASTER ARM and PILOT HSS inputs to the gunner.

h. No checkrides or exercises are available to the gunner cockpit.

i. The gunner has no radio communications other than ICS to instructor.

j. The gunner cannot affect electronic warfare threat environment.

k. The gunner instructor/operator cannot fail navigation radio facilities.

l. CRISP fly mode cannot be selected. Fixed mode is automatically selected.

m. The TEP can be selected only from the gunner station IOS.

5-13. INTEGRATED MODE. This mode is limited as follows:

a. The TEP can be selected only from the pilot station IOS.

b. The gunner visual is the same as the pilot front visual.

c. The gunner instructor/operator has no IOS control or editing functions. However, selection of CRT page displays without edit, and motion off, emergency stop, freeze, timer reset, and hardcopy request are available to the gunner instructor/operator.

NOTE

The gunner can unfreeze the simulator only when the pilot IOS-GUNNER CONT switch-light is selected (illuminated).

CHAPTER 6

VISUAL SYSTEM

6-1. **GENERAL DESCRIPTION.** A full-color camera model system (CMS) image generator visual simulation system is provided with the flight weapon simulator. The CMS visual system greatly enhances training capability by presenting to the student a realistic view of an environmental scene that responds to the simulated operation of the helicopter. There are two separate CMS systems supplied for the flight weapons simulator complex. They can operate either independently or in common, depending upon the selected system mode of operation.

a. **Integrated Mode.** In the integrated mode, the visual scene is presented to the pilot with a forward window and a side window display, when selected. Each display provides the appropriate view from the pilot seat. The gunner is provided with a single forward display identical to the pilot forward display. In addition, the gunner is provided with a TSU that displays realistic CRISP or FLIR scenes, or a simplified symbolic image. The realistic scenes correspond to the image in the out-the-window display.

b. **Independent Mode.** In the independent mode, both front and side displays are available to the pilot, provided the gunner instructor does not have visual selected. When gunner visual is selected, the pilot has visual available in the forward display only. If the pilot instructor has selected FRONT AND SIDE, then visual is not available to the gunner.

6-2. **CAMERA MODEL SYSTEM (Figure 6-1).** The CMS consists of two light-bank illuminated model boards, each viewed by a television camera and an optical probe system mounted on a gantry transport. Servo-mechanisms on the gantry provide three-dimensional movement and positioning of the camera and probe in accordance with the position and altitude of the simulated aircraft. The video signal is used as an input to the main video processor where the special effects, including visibility and horizon, are inserted. The signal levels are then properly scaled to drive the displays in the cockpit. Day, dusk, and night conditions are simulated by the illumination levels of the light banks.

6-3. **MODEL BOARD.** The two CMS's contain identical 24-foot by 64-foot vertically-mounted, three-dimensional terrain model boards. Model board scene extenders (mirrors) are used to increase the view available in the cockpit even when close to the edge of the model. Sufficient points of visual reference on the models provide navigation cues consistent with the field-of-view provided. Model features include provisions for nap-of-the-earth (NOE) flight and a typical staging field. Targets are provided visually in the form of military vehicles, buildings, etc., and weapon range targets.

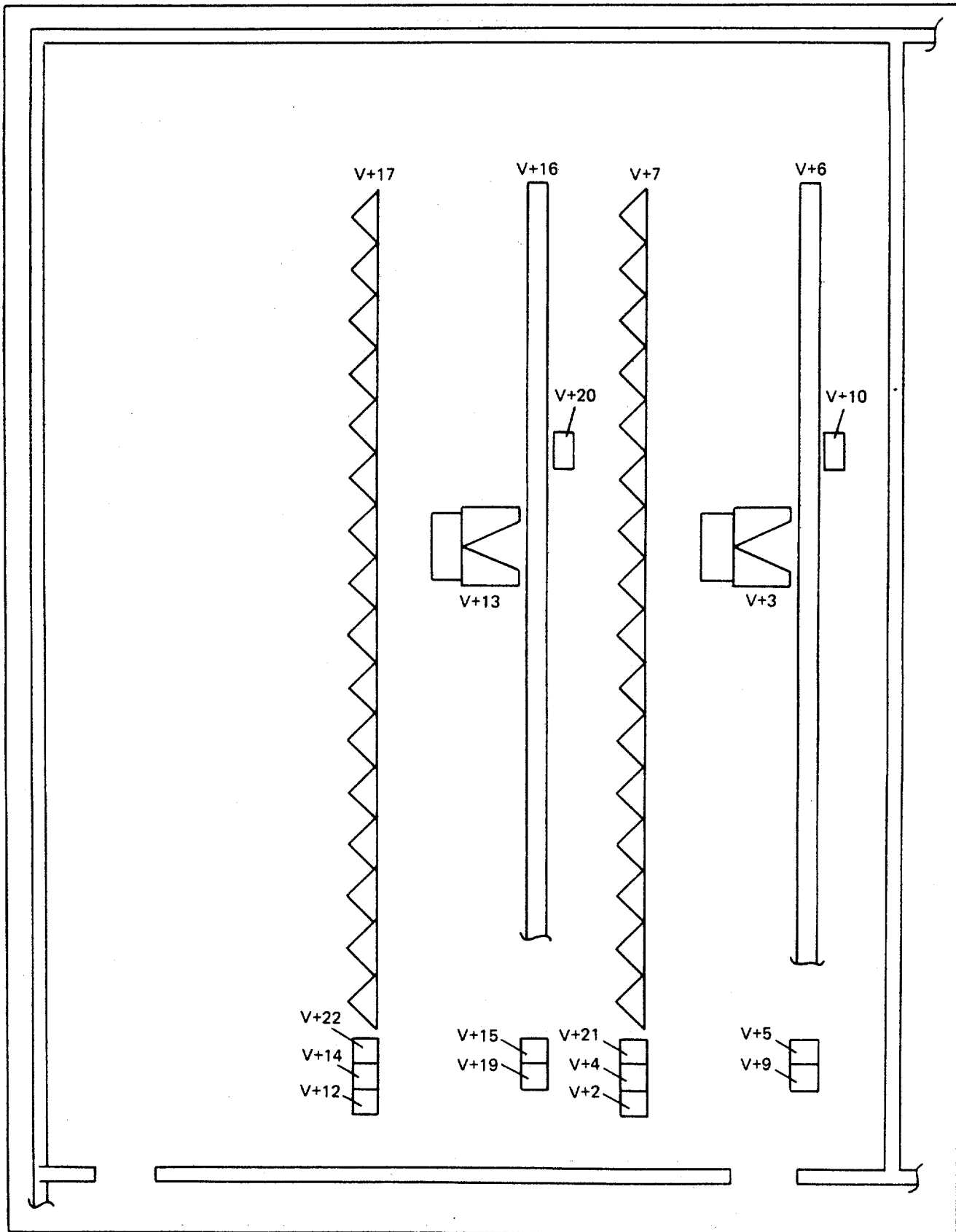


Figure 6-1. Visual Room Layout

11464

6-4. CULTURAL LIGHTING. The cultural lighting provided is listed in table 6-1. Under instructor/operator control, each of the five on/off control groups can be independently selected to be on or off as desired to enhance the training exercise.

a. Runway Acquisition Lighting. Approach and/or edge lighting is provided to simulate fields that have approach lighting in the real world. The runway edge lighting is selected for long-range approaches to the runway to aid in visually finding the runway. This feature is not intended to represent real-world approach lighting, and, in some cases, the correlation between model board features and the electronically generated lights will not be exact.

b. Confined Area Lighting. Beacons are located at each confined landing area (CLA) and the pinnacle (except CLA #7) to aid in acquisition of the area. These beacons can be turned on and off using IOS CRT page 21. In addition to the beacons, an electronically generated spot is provided at a preselected CLA to aid in acquiring the area at long range. The electronic spot replaces the beacon beyond ranges where the beacon can be easily seen depending on altitude, the rain, and mission conditions, but normally one nautical mile slant range. The correlation between the electronic spot and the model features/beacon will not be exact.

Table 6-1. Cultural Lighting

On/off control groups	Description	Color	Number of groups
1	Runway Edge	White	1
1	Taxi	White	1
2	Inverted Y	White	1
2	Pinnacle	White	1
3	Confined Landing Areas	White	1
4	Approach No. 1	White	1
4	Approach No. 2	White	1
4	Approach No. 3	White	1
4	Approach No. 4	White	1
5	Strobe	White	1

6-5. FIELD-OF-VIEW (FOV). The visual images generated by the CMS are displayed to the pilot forward and side window displays and the gunner forward window display. The TSU image (CRISP, FLIR, or symbolic) is viewed through the mechanically fabricated TSU optics.

a. Through-the-Window Displays. The window visual displays are collimated; i.e., viewed at infinity. The total FOV visible by movement of the student's head is approximately 48 degrees horizontal and 36 degrees vertical for each display, with a 5.5-degree gap between the pilot forward and side window displays. All video system controls are preset, and the colors of the scene have been especially

modeled to provide maximum contrast and enhance the training environment. The instructor/operator, therefore, has no requirement to adjust or control the color signal presented in the cockpit.

b. Telescopic Sight Unit. In the TSU, the CRISP and symbolic scenes have an apparent FOV consisting of a 36-degree circular image (in other words, when looking in the TSU, the student gunner's eye travels 36 degrees to scan the full image from side to side). The actual FOV (the angle of the scene image when viewed through the cockpit window) is 28 degrees in low magnification and 4.6 degrees in high magnification. For the TSU FLIR scene, a rectangular image is presented. The actual FOV in FLIR narrow FOV is 1.89 degrees by 2.52 degrees. The actual FOV in FLIR wide FOV is 4.52 degrees by 6.03 degrees.

6-6. WEAPONS EFFECTS. Weapons effects are generated by the weapon effects generator (WEG) to provide the students with a visual scene that includes target signatures. The cockpit window displays portray such weapon effects as gun tracer trajectories, FFAR and TOW missile flightpaths, and weapon burnout or ground impact. The TSU imagery presents similar effects for the student gunner, which are generated by the CRISP system. These include weapons impact effects, tracers, and missile launch effects (whiteout in CRISP night scene and FLIR scene). The weapons effects in each of the three types of TSU scenes (CRISP, FLIR, or symbolic) are represented in different ways.

6-7. VISUAL SYSTEM CAPABILITIES. The following is a summary of the capabilities of the CMS system:

a. Lighting. The light bank provides either day, dusk, or night conditions of the visual scene.

b. Field-of-View. Each cockpit visual display provides an FOV of 48 degrees horizontal and 36 degrees vertical, centered on the horizon with the proper perspective for the student.

c. Landing Areas. The model board provides landing areas as defined on CRT pages 030 through 040.

d. Special Effects. The visual effects generator produces signals that, when displayed, create the impressions of clouds, fog, blue sky, and above-cloud simulation, and transition between them. An artificial horizon circuit provides for a smooth transition from model board terrain video to a cloud haze band and then to blue sky above clouds. The visual effects of ceiling, overcast, and visibility ranging can be selected at the IOS console. This allows transition between IFR and VFR.

e. Weapons Effects. The WEG provides pilot/gunner with visual projectile and target signatures.

f. Altitude Representation. The eyepoint altitude simulated by the visual system is continuously tracked from 6.25 to 2000 feet above the runway level, which corresponds in scale to the limit of the Z-carriage excursion. No visual model board terrain is presented above altitudes of 2000 feet; the visual scene changes to flight through clouds and then flight above clouds at higher altitude.

g. Focus. Optical probe focus is dynamically controlled by the software to maintain optimum focus at all altitudes. Under instructor control, the automatic tilt and focus controls can be disabled to provide a special focus condition optimized for NOE flight or confined landing area operation.

h. Ambient Light Effect. The daylight ambient light level of the cockpit is less than that encountered during normal daytime VFR flight. It is therefore necessary to keep IOS control panel and FWS compartment overhead lighting set at IFR nighttime levels.

i. Probe Protection. A probe-height sensor system is provided to protect the probe from contacting the model board. If such contact should occur, which is highly unlikely, optical misalignment and possibly costly damage could occur.

j. Visual Transition. When the simulated aircraft leaves the model board perimeter areas, no visual terrain reference exists, and simulated flight through clouds occurs.

k. Night Vision Goggles. The simulator cockpit has been modified for use with the AN/AVS-6 aviators night vision imagery system (ANVIS), and AN/PVS-5 night vision goggles (NVG) so that the instruments and controls are visible when the pilot/copilot wears NVG or ANVIS. Blue-green lighting compatible with the night vision goggles is provided by floodlights and utility lights. Compatible postlights provide supplemental instrument lighting.

CHAPTER 7

NORMAL OPERATING PROCEDURES

Section I. INITIATION OF TRAINING

7-1. INITIAL PROCEDURES. A training program can take various paths, depending upon the level of crew expertise, or the need to present a broadly defined or a speciality program of instruction. Certain minimum procedural steps usually take place for initiating training:

a. System turnon and readiness checks are performed by maintenance personnel following the procedure given in Chapter 2, Section I, of TD-55-6930-210-23-1. These are completed prior to the first scheduled training period of the day.

b. Prior to entering cockpit, the crew should ensure all safety/gate interlocks are established to enable operation of motion system.

c. For all training, these procedures apply to both instructor/operators in the independent mode and to the pilot-instructor/operator in the integrated mode. The cockpits are initially in the independent mode at the completion of turnon and readiness checks. If it is desired to operate in the integrated mode, it must be selected while both cockpits are in freeze.

d. Training can now proceed by securing doors, fastening all seat belts, initiating motion, and unfreezing the simulator. When the system has been turned on (cold start) and the computer first loaded, the FWS is initialized at IC set 002 (CRT page 02) and is in a freeze condition. (See figure 7-1, sheet 1, for a description of the initial conditions (IC) values on CRT page 02.) For alternate IC choices, the system INDEX page can be accessed by simply depressing the ENTER keyswitch on the IOS CRT console. However, at times, due to display memory assignment locations, it may also be necessary to depress the INTERCHANGE DISPL keyswitch to view the INDEX. Once displayed, the instructor/operator can obtain additional information, parameter selections, and simplified programming instructions by depressing the DISPL ADV or the DISPL REV switchlights. These sequentially step through the index related CRT pages (shown in figures 7-2 through 7-7). Other preprogrammed IC sets can be called up or a complete IC set can be initiated and modified by the instructor/operator on CRT page 11. (See figure 7-1, sheet 2.) Preprogrammed checkrides or demonstrations can be called up as part of the training program. Weapon loading configuration, target selection, and visual scene effects can be initiated or modified as desired. Information on the use and setup of these conditions is provided further in this chapter.

7-2. ZEROING (DATA CLEAR). Actuating DATA CLEAR at any time deletes all accumulated ground track and previously entered malfunctions, clears the out-of-tolerance error table, unfreezes all parameters, and resets the mission elapsed time (MET) indication on the CRT. The MASTER MALF CLR/INH deletes any existing malfunctions previously inserted.

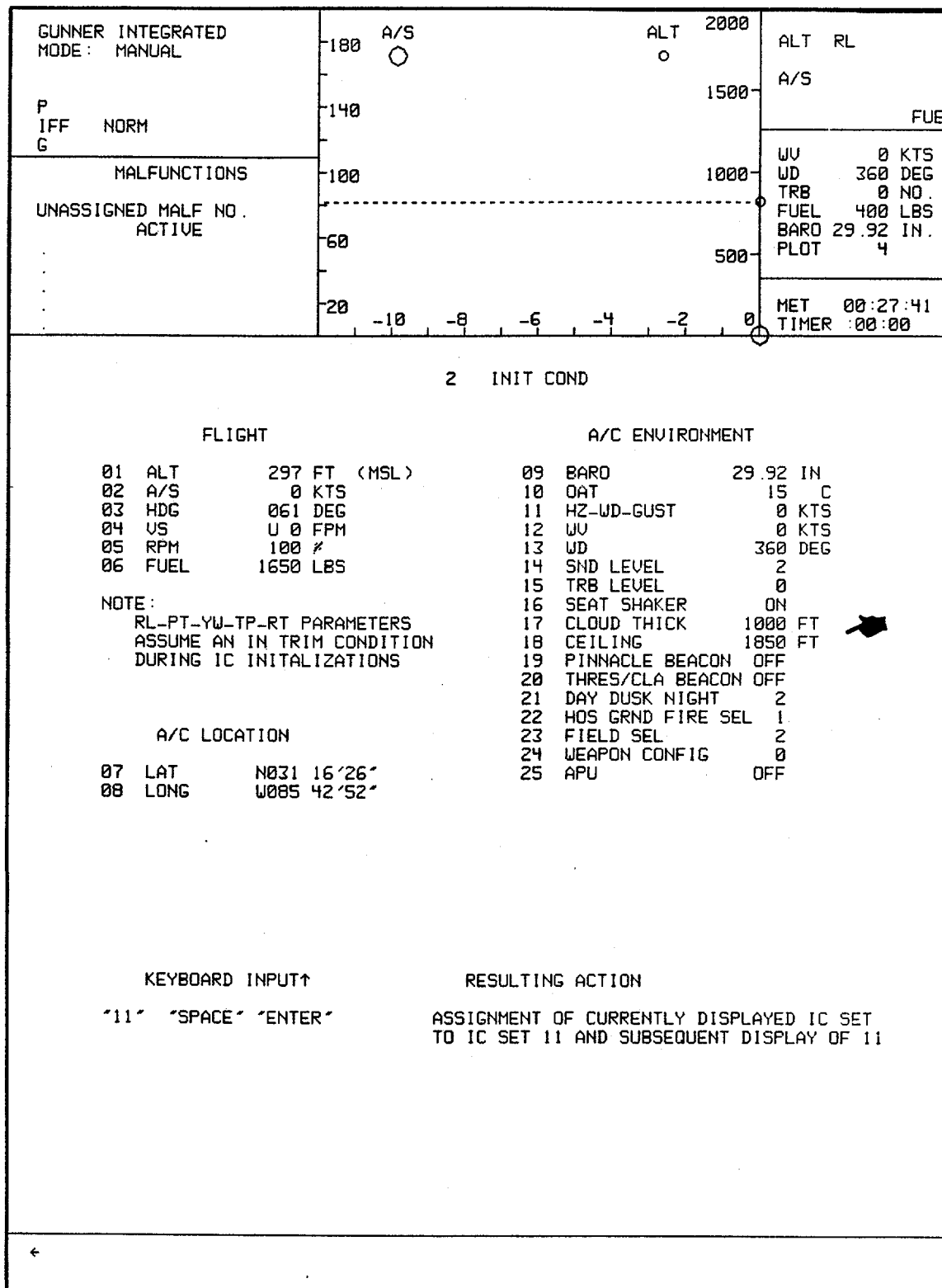


Figure 7-1. Initial Conditions (Sheet 1)

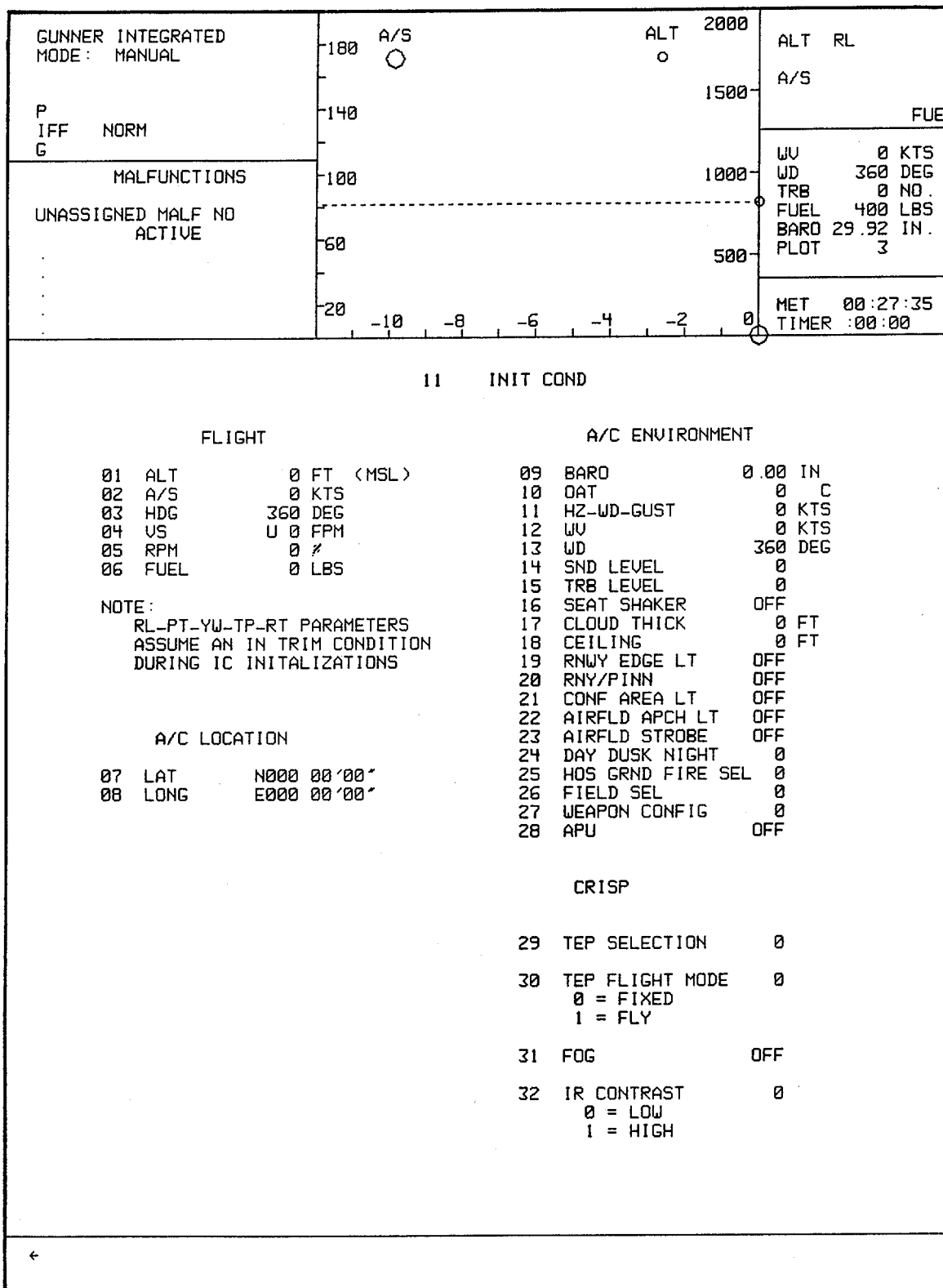
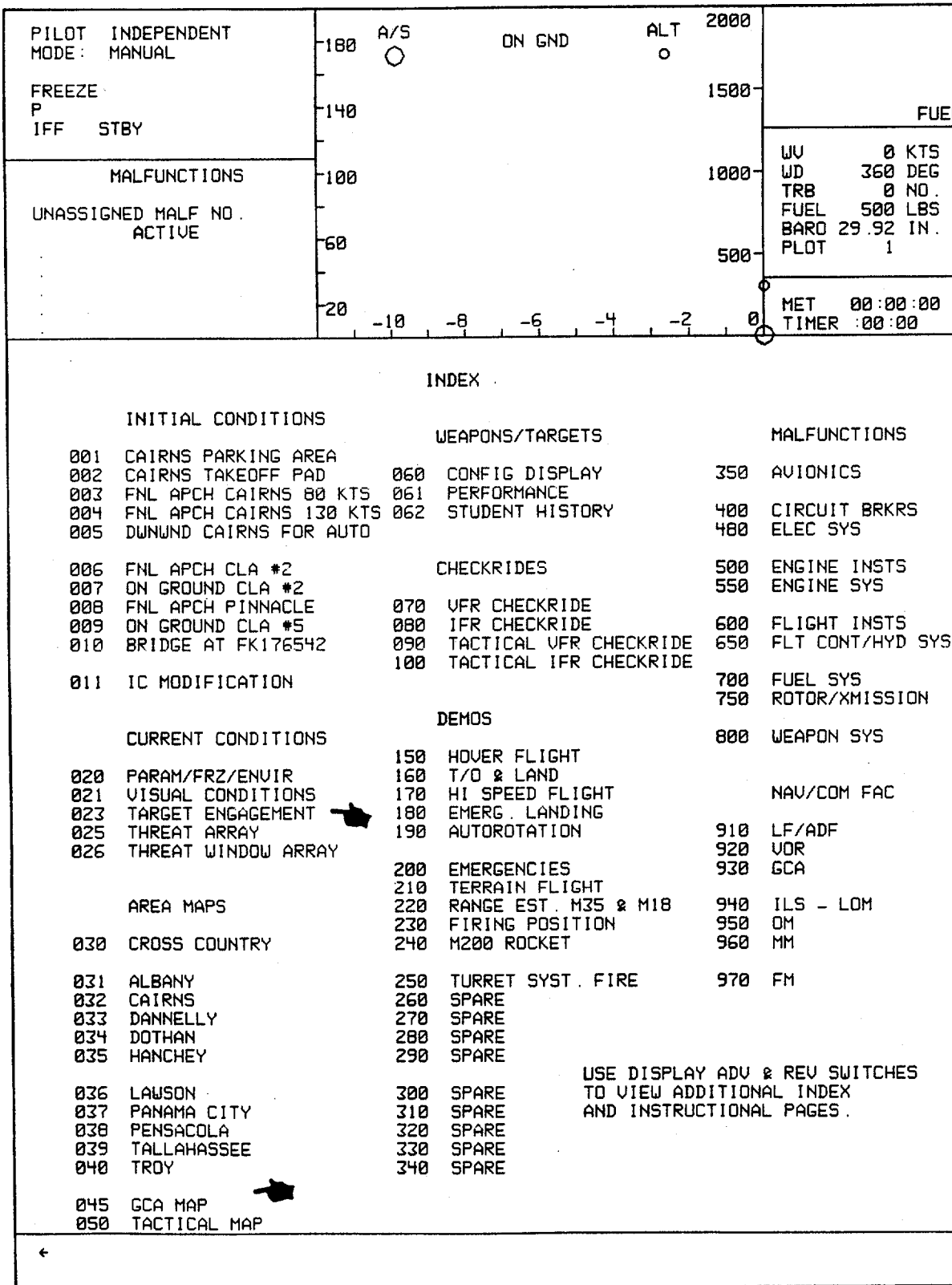


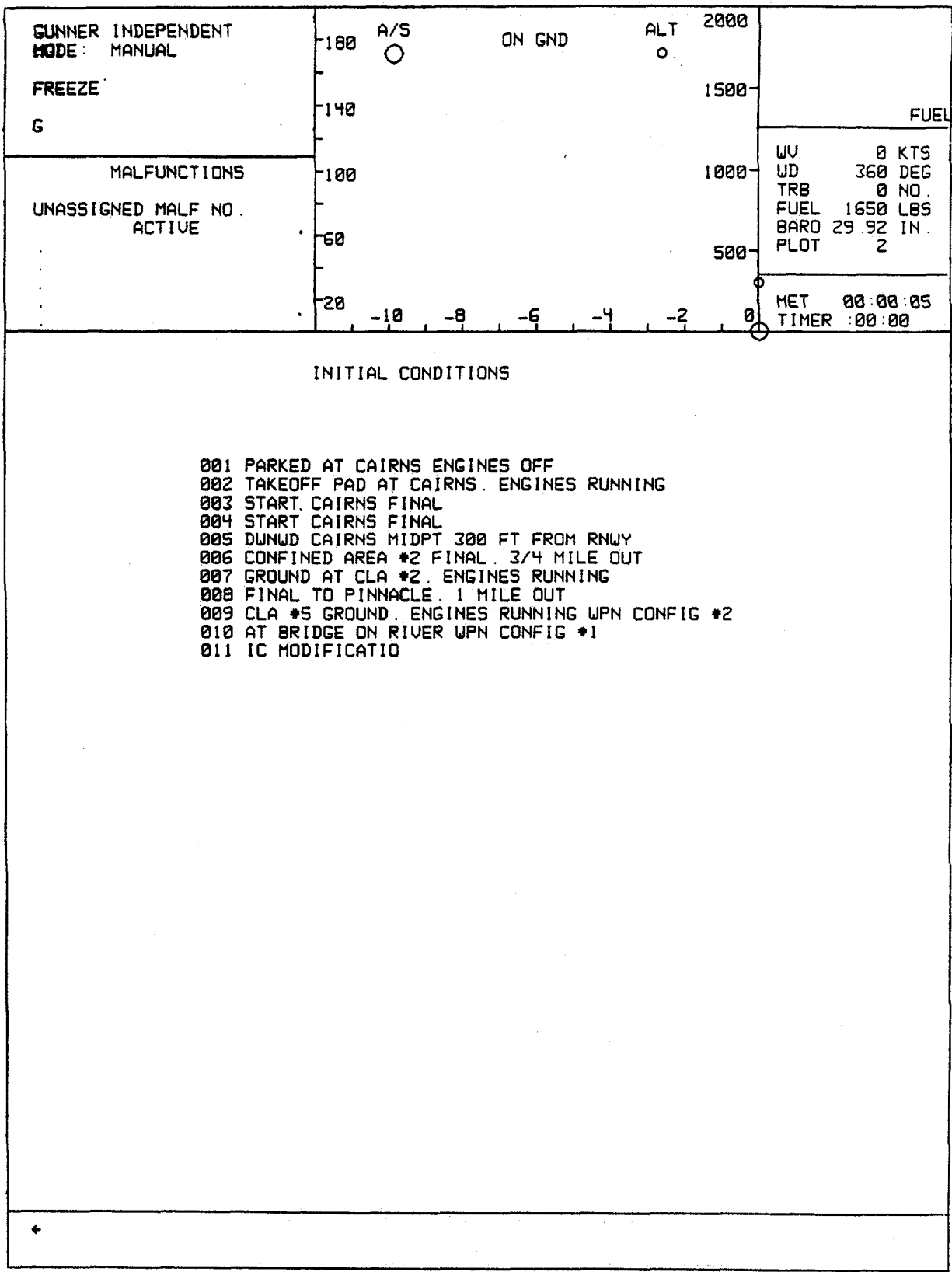
Figure 7-1. Initial Conditions (Sheet 2)

Change 1 7-2.1/(7-2.2 blank)



10659

Figure 7-2. Index Page



10660

Figure 7-3. IC Listing Page

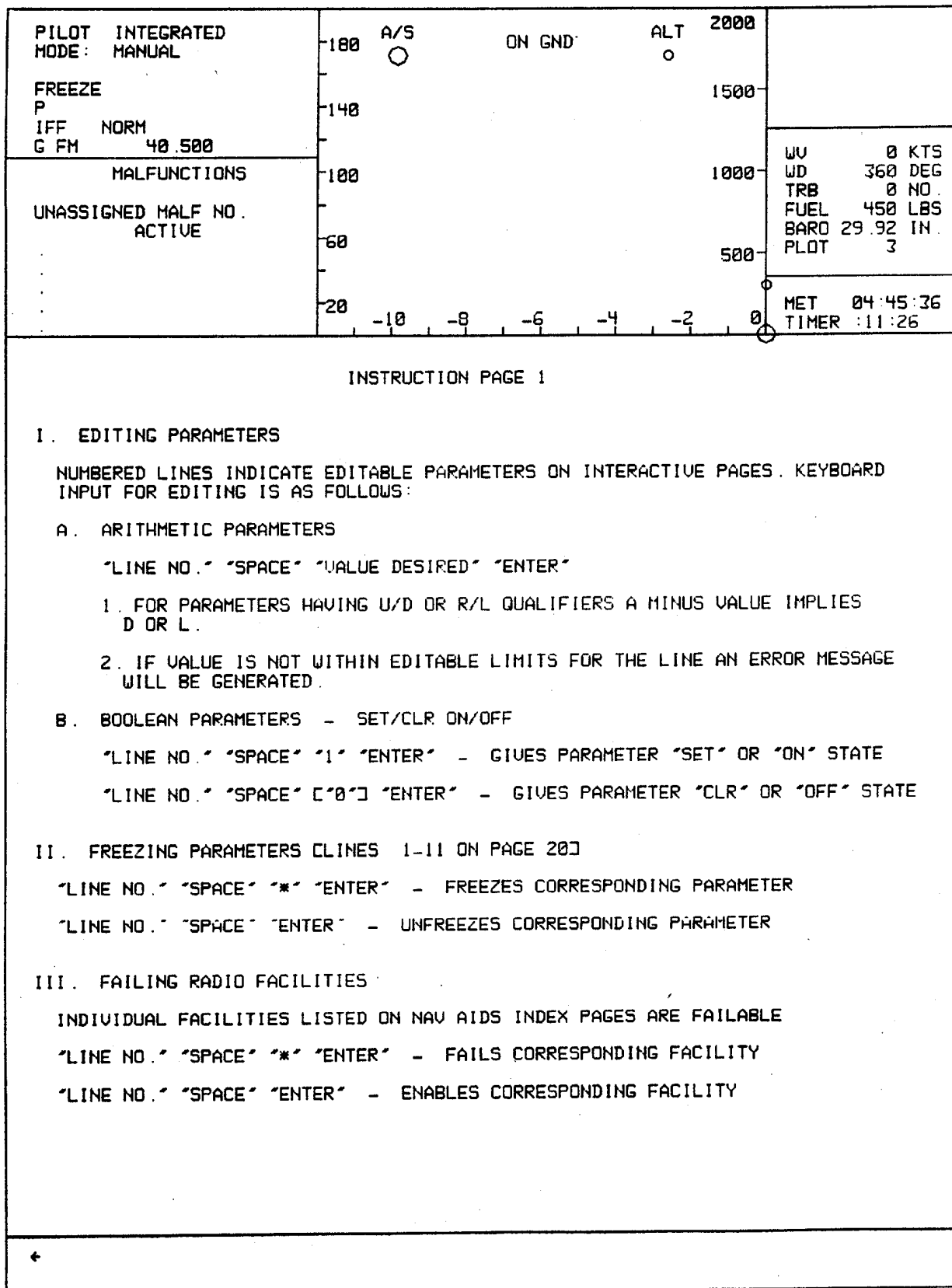
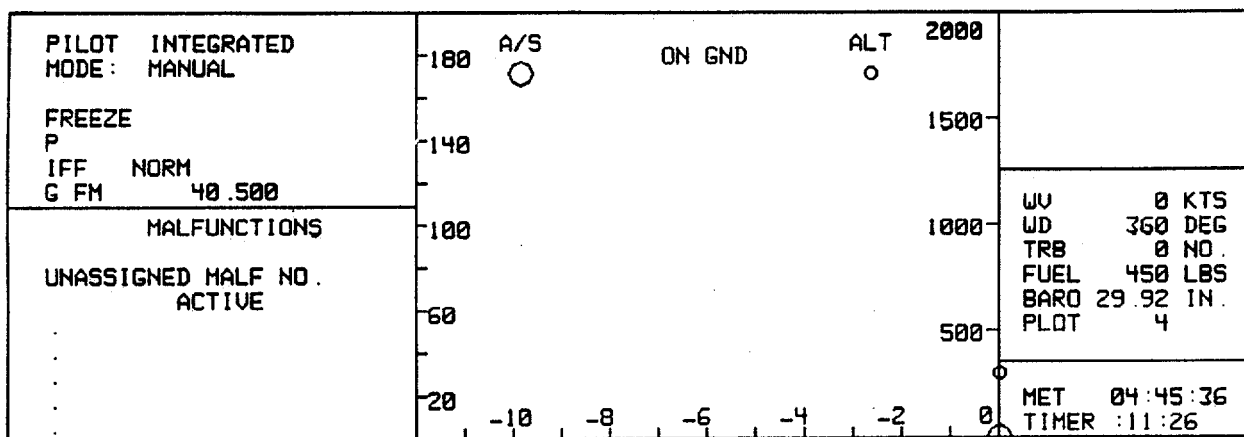


Figure 7-4. Basic Instruction Page 1



INSTRUCTION PAGE 2

IV. INITIAL CONDITIONS

1. TRAINER MUST BE IN FREEZE BEFORE AN IC SET CAN BE INSERTED.
2. IC SETS ARE INSERTED BY DIALING THE SET NUMBER (1-11) ON THE THUMBWHEEL AND PUSHING THE INSERT SWITCH.
3. ONLY IC SET 11 IS EDITABLE. VALUES OF ANOTHER DISPLAYED IC SET MAY BE TRANSFERRED TO SET 11 FOR EDITING (SEE INSTRUCTIONS ON IC PAGES). IC SET 11 WILL RETAIN ITS EDITED VALUES FOR THE DURATION OF THE DAY OR UNTIL NEW VALUES ARE ENTERED BY THE INSTRUCTOR.
4. ADDITIONAL IC SETS BEYOND SET 11 ARE REACHED VIA THE DISPLAY ADVANCE AND REVERSE SWITCHES. TO INSERT ONE OF THESE SETS IT MUST FIRST BE TRANSFERRED TO SET 11. SET 11 CAN THEN BE INSERTED VIA THE THUMBWHEEL.

U. OFFLINE MODE

1. BOTH COCKPITS MUST BE IN FREEZE TO GO OFFLINE. IF THEY ARE NOT THE OFFLINE SWITCHES ARE BLINKED.
2. ONCE IN FREEZE TRAINER MAY BE PUT IN OFFLINE MODE FROM EITHER COCKPIT VIA OFFLINE SWITCH.
3. OFFLINE MODE IS NOT REQUIRED TO PROCESS HARDCOPYS. ALL HARDCOPY PROCESSING IS CURRENTLY DONE ONLINE. THE OFFLINE MODE IS PROVIDED FOR FUTURE USE.
4. OFFLINE MODE CAN BE DELETED BY THE COCKPIT THAT REQUESTED IT. VIA THE OFFLINE SWITCH.

VI. INTEGRATED MODE

1. BOTH COCKPITS MUST BE IN FREEZE BEFORE ENTERING OR LEAVING INTEGRATED MODE. IF NOT IN FREEZE INTEGRATED MODE SWITCH IS BLINKED.
2. ONCE IN FREEZE THE PILOT COCKPIT CAN TAKE TRAINER IN OR OUT OF INTEGRATED MODE VIA INTEGRATED MODE SWITCH.

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Figure 7-5. Basic Instruction Page 2

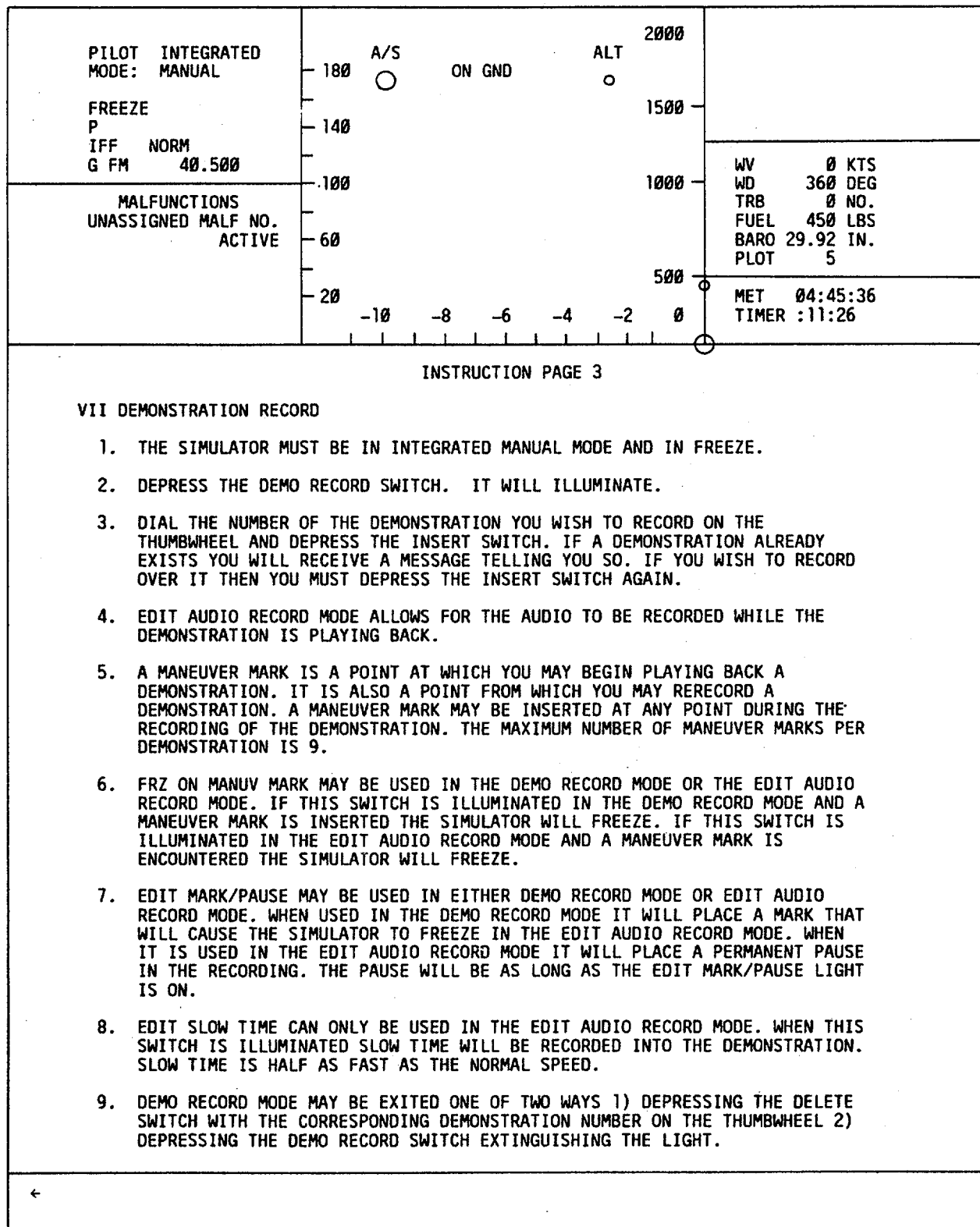
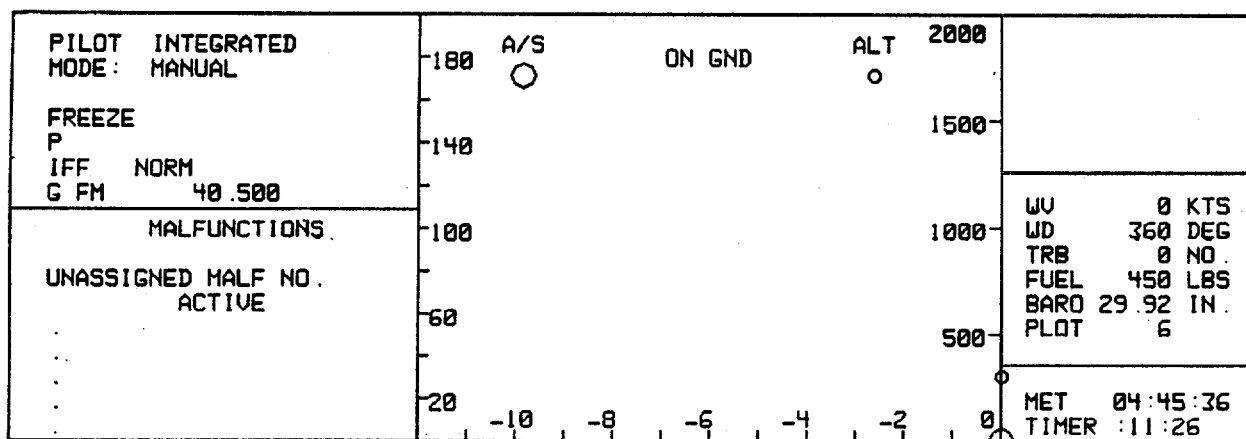


Figure 7-6. Basic Instruction Page 3



INSTRUCTION PAGE 4

VIII DEMONSTRATION PLAYBACK

1. THE SIMULATOR MUST BE IN MANUAL MODE AND IN FREEZE. IT MAY BE IN INDEPENDENT OR INTEGRATED MODE.
2. DIAL THE NUMBER OF THE DEMONSTRATION OF INTEREST ON THE THUMBWHEEL. DEPRESS THE INSERT SWITCH.
3. WHEN THE FREEZE LIGHT STOPS BLINKING DEPRESS IT AND THE DEMONSTRATION WILL BEGIN.
4. A DEMONSTRATION MAY BE STARTED FROM A MANEUVER MARK. ADD THE MANEUVER MARK OF INTEREST (1-9) TO THE DEMONSTRATION NUMBER. THE REST OF THE PROCEDURE IS THE SAME AS A DEMONSTRATION PLAYBACK.

IX CHECKRIDE/EXERCISE MODE

1. THE SIMULATOR MUST BE IN MANUAL MODE AND IN FREEZE.
2. A CHECKRIDE OR EXERCISE MAY BE SELECTED ONLY BY THE PILOT COCKPIT IN EITHER THE INDEPENDENT OR INTEGRATED MODE.
3. DIAL THE CHECKRIDE NUMBER OF INTEREST ON THE THUMBWHEEL. DEPRESS THE INSERT SWITCH. WHEN THE FREEZE LIGHT STOPS BLINKING DEPRESS IT.
4. THE INSTRUCTOR IS ONLY ALLOWED TO LOOK AT PAGES AND MAPS.
5. AN EXERCISE IS A SUBSET OF A CHECKRIDE. TO SELECT AN EXERCISE ADD THE EXERCISE NUMBER (1-9) OF INTEREST TO THE CHECKRIDE NUMBER. THEN DIAL THIS NUMBER ON THE THUMBWHEEL AND DEPRESS INSERT. THE REST OF THE PROCEDURE IS THE SAME AS CHECKRIDE.

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Figure 7-7. Basic Instruction Page 4

7-3. **INITIALIZATION OF NORMAL TRAINING.** Initialization requires use of and is performed at the IOS consoles. The student control panel switches are in parallel with the IOS controls and are available for a problem or emergency use. The FREEZE, EMER STOP, and MOTION ON, MOTION OFF switchlights at the IOS and pilot/ gunner control panels have identical capabilities. (Functions of these controls are discussed in Section III of this chapter.)

WARNING

Alert student pilot and student gunner to remain clear from all flight controls prior to initialization. Abrupt movement of the controls when positioned by the computer may cause personal injury.

a. Initialize to a Preprogrammed IC Set. The desired IC number (01 through 10) should be dialed into the three-digit thumbwheel selector and the INSERT switchlight depressed. During initialization, the FREEZE indicators blink until the FWS arrives at the preselected steady-state conditions, at which time all flight controls are correctly positioned by the computer. When initialization is complete, the FREEZE indicator reverts to steady ON. The FWS is now ready for training mode operation. Before continuing, the operator may want to select an appropriate CRT display page for problem monitoring.

b. Initialize to an IC Set Not Preprogrammed. An existing IC is assigned to IC set 11 and then edited. This operation is performed at the CRT console keyboard. First, type the desired IC page 01 through 10, which is to be edited, then type ENTER. The selected IC set appears on the CRT display. Assign this set to set 11 by typing 11, space, ENTER. Now any or all values of the displayed set can be changed on a line-by-line basis by using the keyboard. When a value outside the limits of the accepted range is entered for any line, the computer refuses to accept the value upon entry, and an error message is displayed in the 1-inch scratchpad display area below the IC set display. Once editing is complete, the modified IC set can be initialized by dialing 011 on the 3-digit thumbwheel and depressing the insert switchlight.

c. Initialize to a Preprogrammed Checkride IC Set. Training can be initialized from a group of four IC sets preprogrammed for checkrides (70, 80, 90 and 100). As shown in the CRT display pages (figures 7-8 through 7-11), these four major checkride programs can be subdivided into checkride exercises. The exercises within a program can be individually selected or arranged in any order to form a program.

d. Weapon Loading. Ten different weapon configurations are available on CRT page 60. (See figure 7-12.) This display is presented on the CRT by typing 60, ENTER on the CRT console keyboard. Determine and select the appropriate weapon configuration number, which is then loaded onboard the aircraft using either of the following procedures:

(1) Call up current conditions parameter/freeze/environment set page 20 by typing 20, ENTER on the CRT. Type line 25, space, configuration number previously derived from page 60 (1 through 10), ENTER on keyboard.

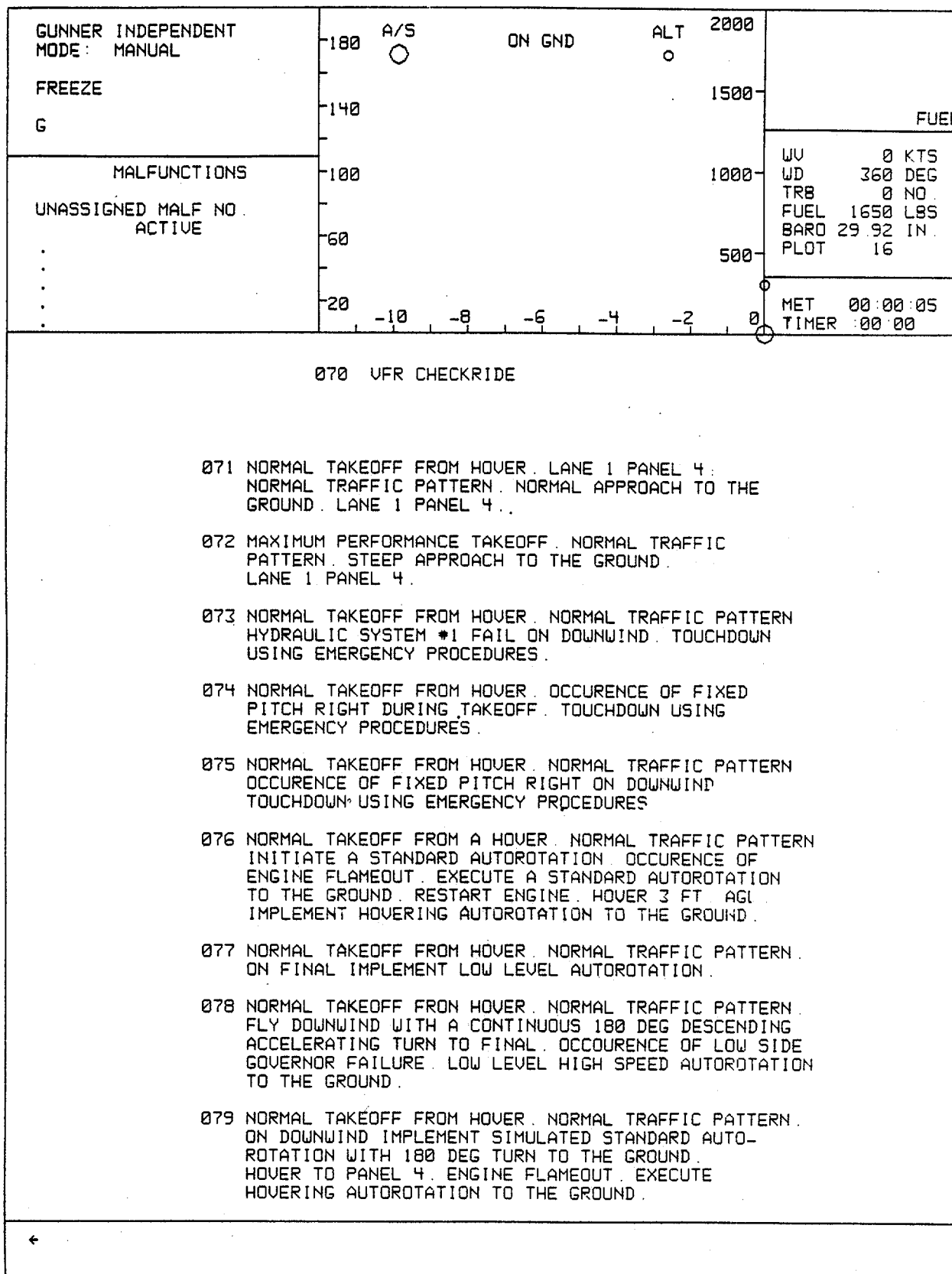
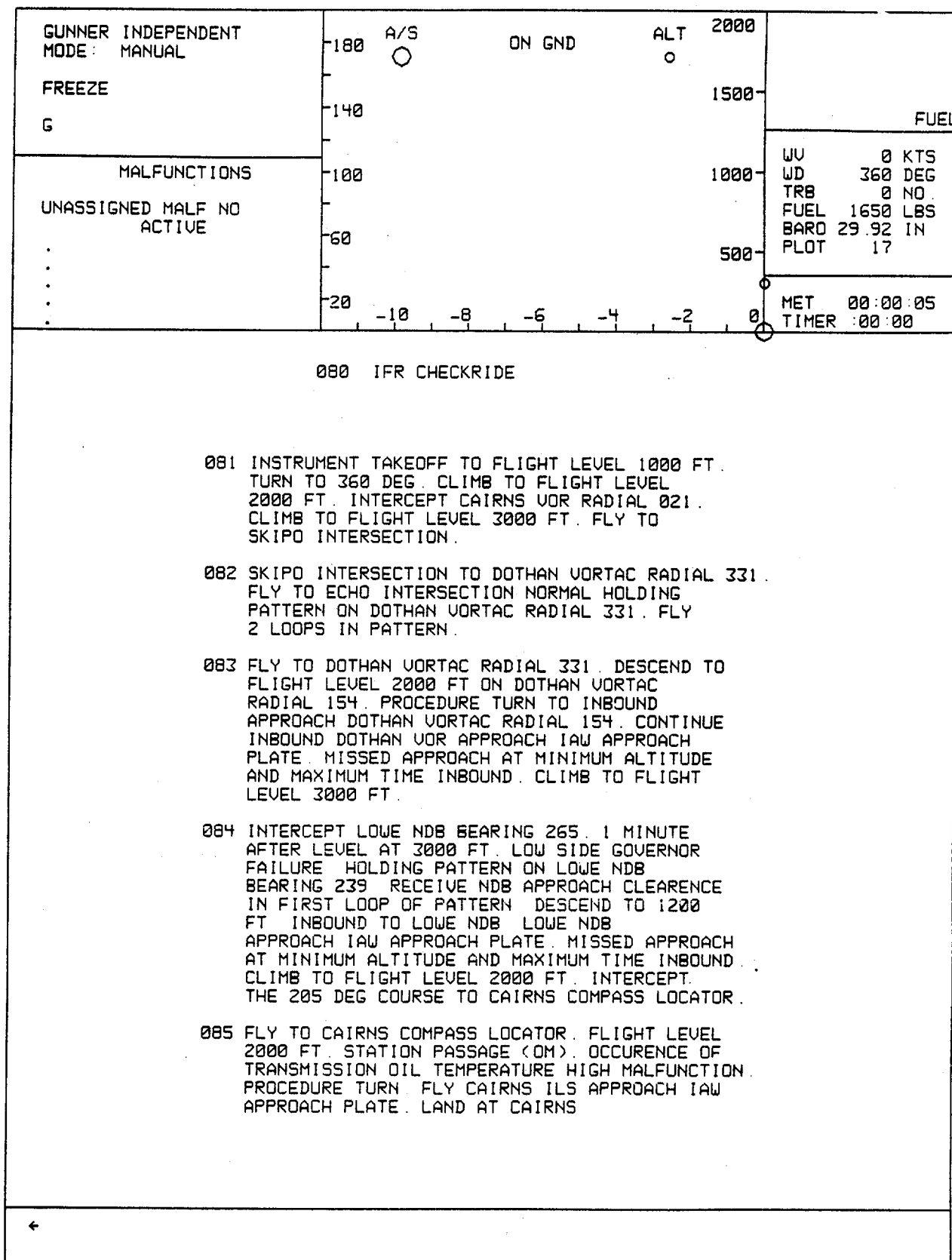


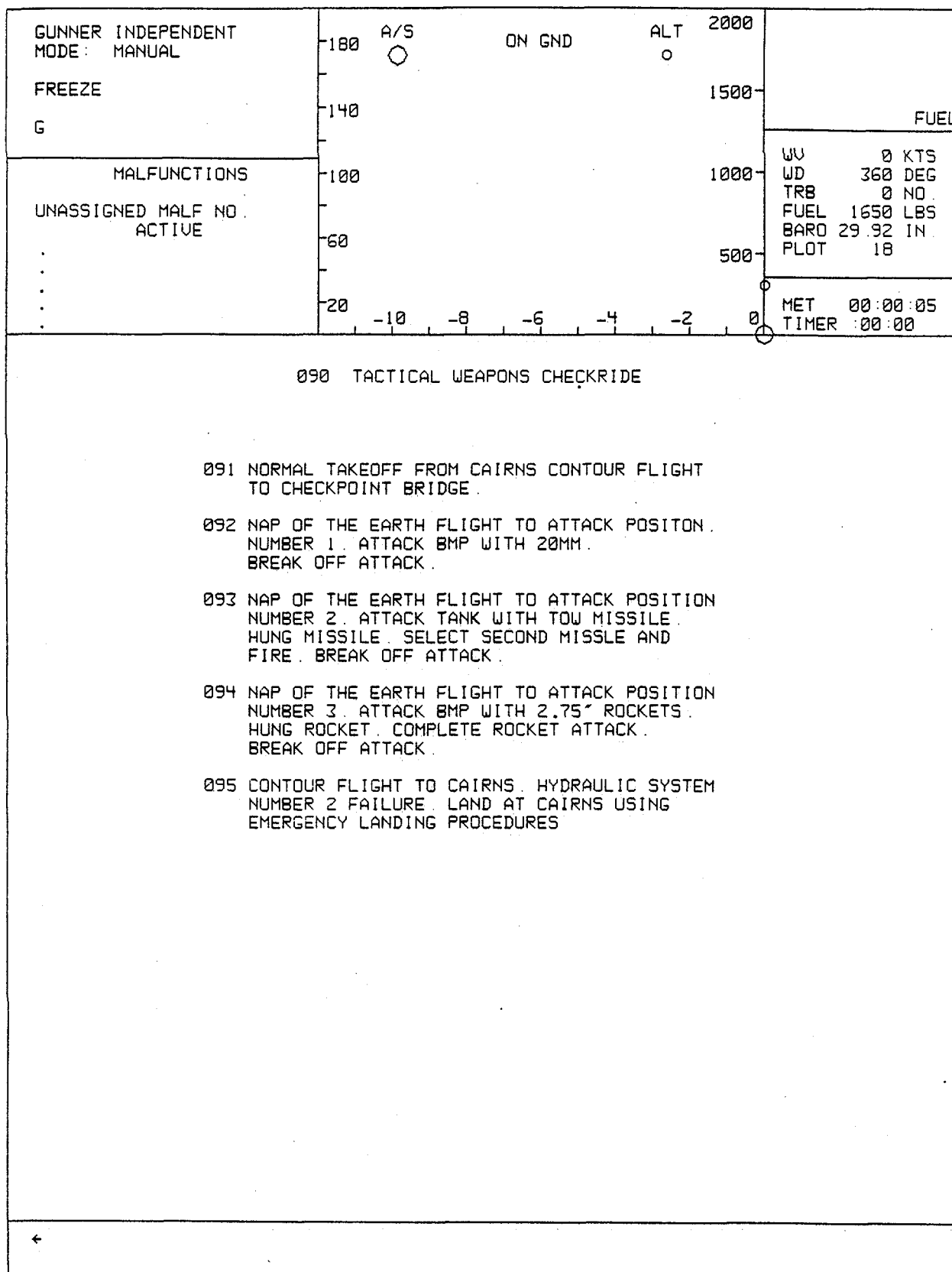
Figure 7-8. VFR Checkride Program Page 070

10665



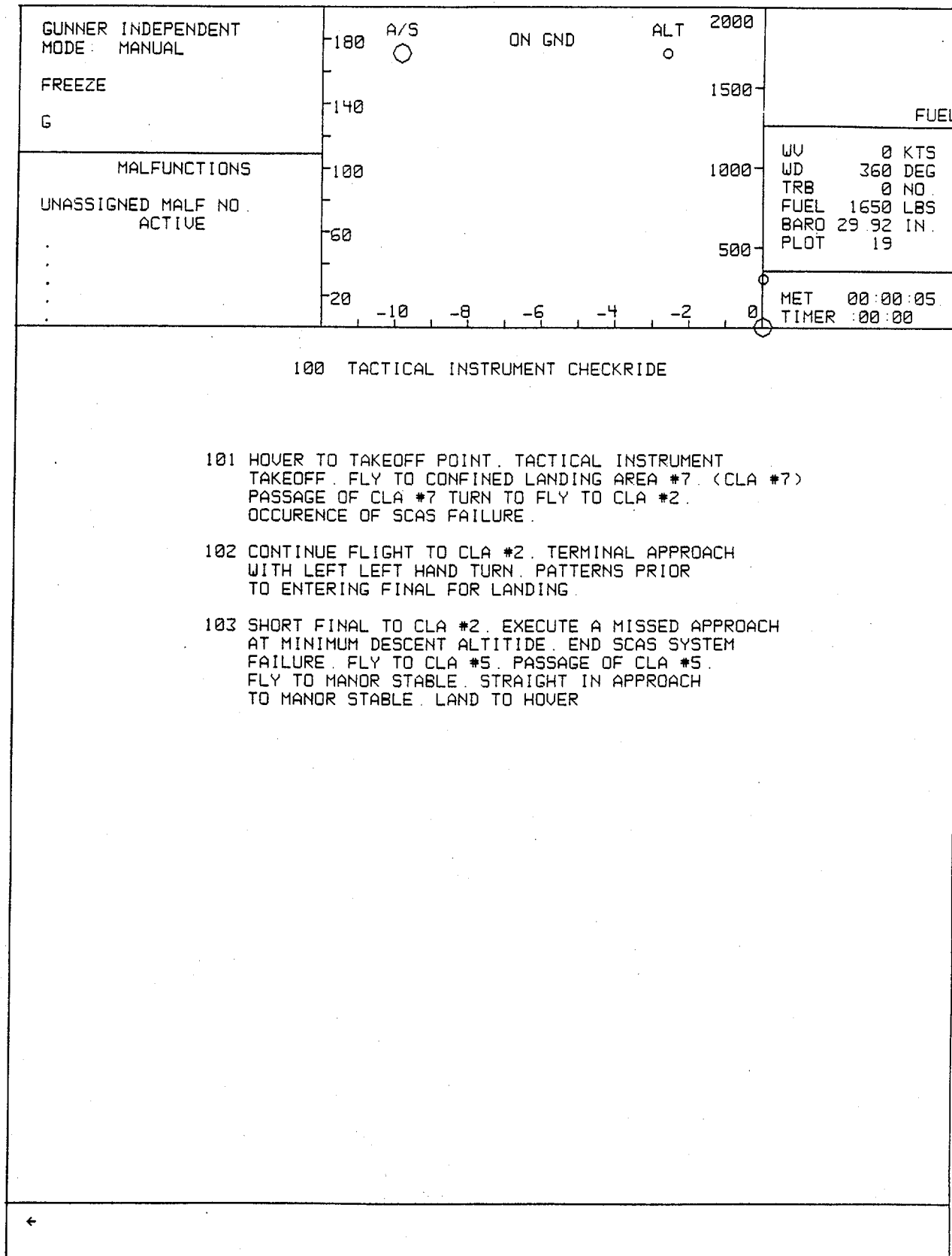
10666

Figure 7-9. IFR Checkride Program Page 080



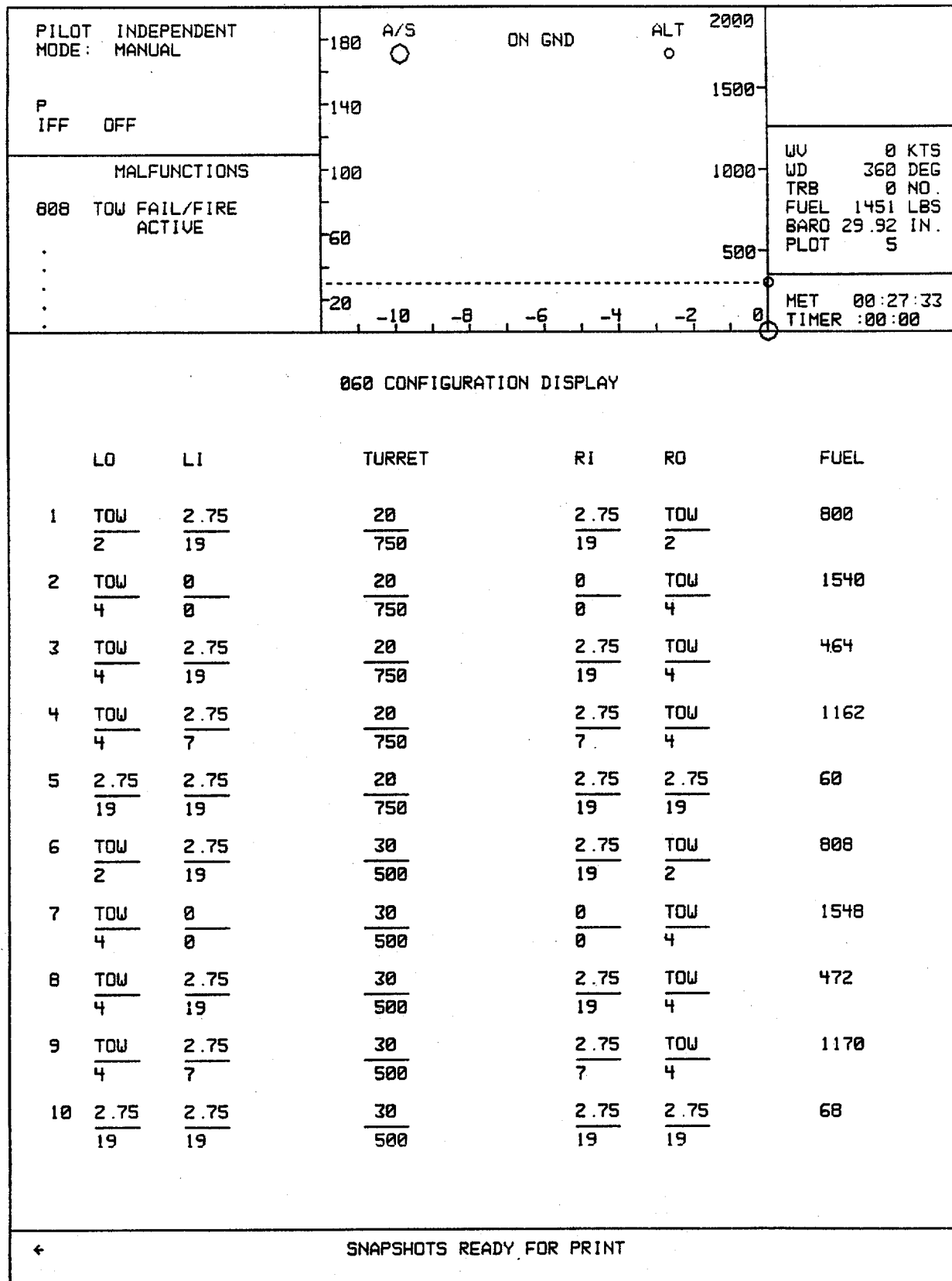
10667

Figure 7-10. Tactical Weapons Checkride Program Page 090



10668

Figure 7-11. Tactical Instrument Checkride Program Page100



10669

Figure 7-12. Weapons Configuration Page 060

(2) Call up performance display page 61. (See figure 7-13.) Type line number 7, space, configuration number derived from page 60 (1 through 10), ENTER.

e. Helmet Sight Subsystem Calibration. Two slightly different calibration procedures are utilized, depending upon the operating mode. Perform the appropriate procedure as required:

(1) Integrated mode. Calibration to each individual student helmet must be performed. For the integrated mode, perform the following steps:

NOTE

Helmets must be calibrated by both the pilot and gunner to have a completely aligned system.

(a) Initialize IC set 02 and release freeze.

(b) On page 061 of IOS CRT display, edit: line 2 (MOVING TGT) to 0 and line 10 (AIM POINT) to OFF.

(c) On page 20 of the IOS CRT display, set line 24 on. This puts a dot in the center of the visual display for each cockpit.

(d) The student pilot first centers the HSS reticle over the alignment dot and depresses the ACTION switch on the cyclic stick.

(e) The student gunner centers the HSS reticle over the alignment dot and depresses the ACTION switch on the cyclic stick.

(f) The alignment dot turns off for both the pilot and the gunner, completing the alignment for the integrated mode.

(g) If the alignment dot fails to turn off, the calibration procedure was not accurately performed. Should this occur, repeat the above steps.

(2) Independent mode. Calibration to each individual student helmet must be performed. For the independent mode, perform the following steps:

NOTE

This is the final calibration for either the pilot or student gunner in the independent mode only.

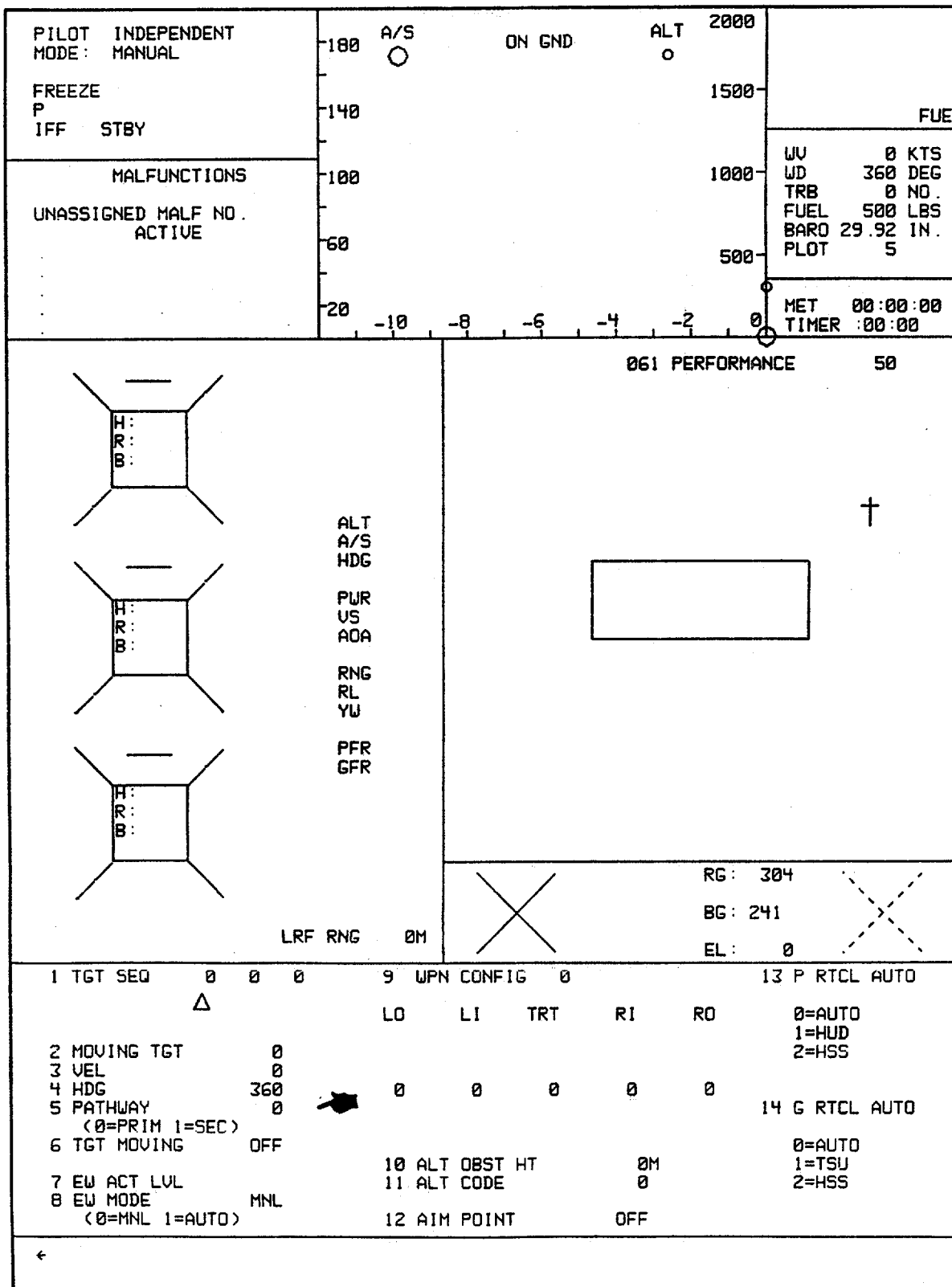
(a) Lift and repeat step (a) from above.

(b) Lift and insert step (b) from above.

(c) On page 20 of the IOS CRT display, set line 24 on. This puts a dot in the center of the visual display.

(d) Center the HSS reticle over the alignment dot and depress the ACTION switch on the cyclic stick.

(e) The alignment dot turns off, completing the alignment.



10670

Figure 7-13. Performance Page 061

(f) If the alignment dot fails to turn off, the calibration procedure was not accurately performed. Should this occur, repeat the above steps.

f. Target Selection. The instructor can call up the tactical map display for determining the selected target sequence, hostile ground fire, or electronic warfare area targets by typing page number 50, ENTER on the keyboard. With respect to the model board, the tactical map display shows the location of 26 targets available to be scored upon (represented by non-bold and non-circled numbers) and the available TEP's and their fields of view (represented as right angles). The number by the TEP indicates the TEP number, and its position by the angle or line indicates (roughly) the TEP field of view. CRT page 23 lists the TEP's, their latitudes, longitudes, and altitudes, and the targets that can be seen from each. (See figure 7-13.1.) The airfield is indicated by the small rectangle. The location of the helicopter is indicated by the cross within the circle, and the helicopter flightpath is shown by a dotted line as the simulated mission progresses. (See figure 7-30 for an example of CRT page 50.)

(1) Up to three targets in sequence can be entered by typing line 1, space, X_1 , space, X_2 , space, X_3 , ENTER, where X is the selected target number in the category of 1 through 26. Any combination of numbers is allowed. The TARGET ADV switchlight provides sequential selection of the target of interest. Once scoring information is present, the target sequence on CRT page 61 must be advanced to select the first in sequence before three new targets can be entered.

NOTE

FWS must be out of freeze to activate target advance.

(2) A moving target can be selected and edited on CRT page 50 or 61. Edit the appropriate line number for moving target. Edit the appropriate line number for velocity (up to 50 knots). If a TEP is selected (CRISP mode, CRT page 20), select a pathway (primary or secondary, CRT page 50 or 61, line 5). If the TEP selection is 0 (non-CRISP mode), edit the appropriate line number for heading (1 - 360 degrees). Activate target movement by editing line 3 on CRT page 50 or 61. Activation of the target advance switchlight will automatically reset the moving target to its point of origin.

NOTE

Moving target selected must match target of interest in target sequencing line.

(3) On page 61, a target aimpoint or video dot can be selected by typing line 10, space, 1, ENTER.

g. Visual Selection. The pilot instructor can select forward visual, or forward and side visual for the pilot. The gunner instructor can select forward visual by actuating the desired switchlight on the VISUAL CONTROL panel. In the integrated mode, the gunner views the same scene as the pilots forward visual. In the independent mode, the forward visual is not available to the gunner if the pilot is using side visual.

(1) Day, dusk, or night and conditional lighting is controlled by editing the appropriate line on the visual conditions CRT page 21. (See figure 7-14.) When

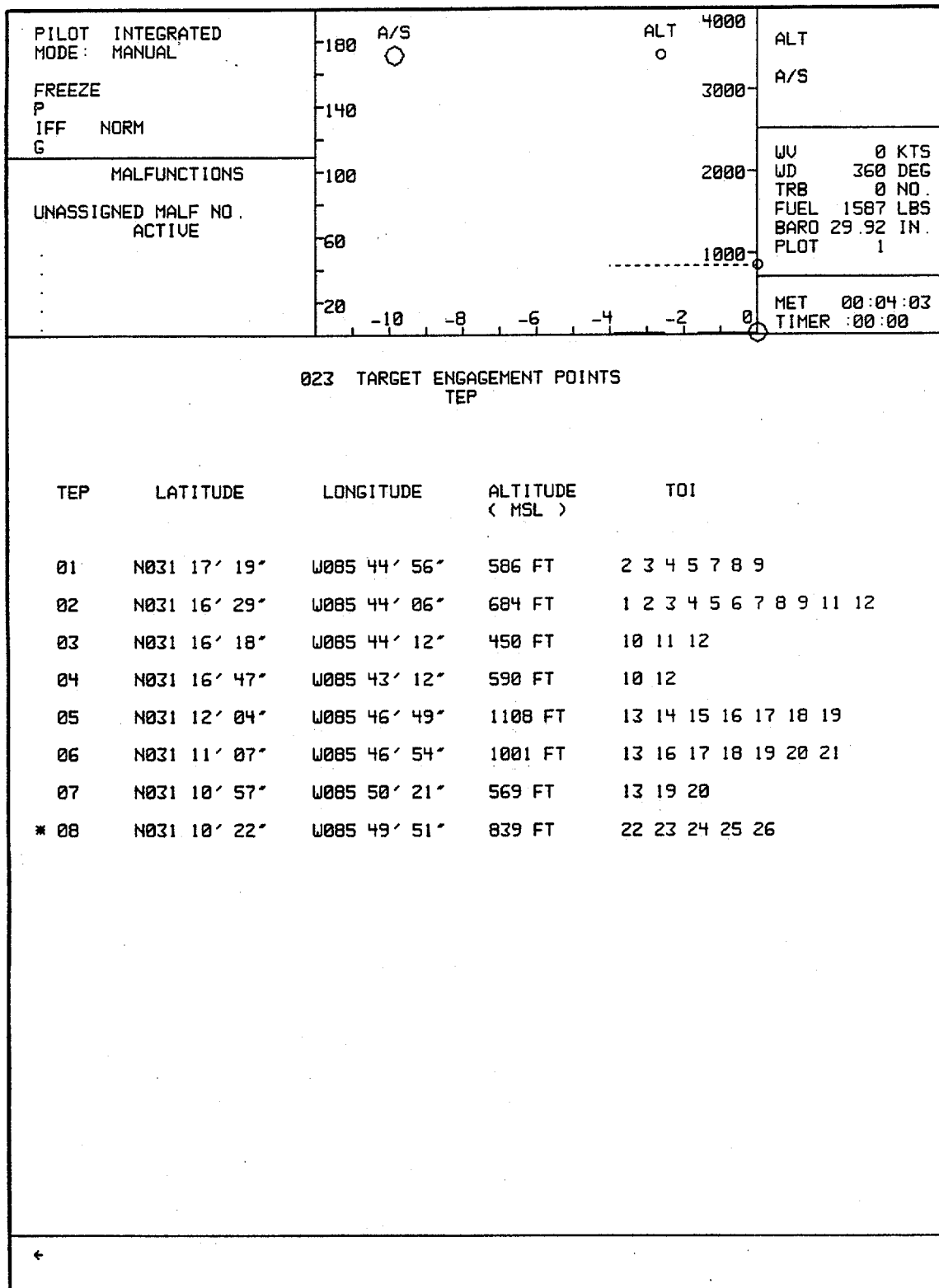


Figure 7-13.1 Target Engagement Points Page 023

going from night or dusk to day lighting, a waiting period of approximately 20 minutes is necessary with the camera model visual system.

(2) The VISIBILITY RANGE potentiometer on the IOS visual system panel can be changed at any time, with the approximate visibility range in feet indicated on CRT page 21.

h. Training Control and Monitor. Current flight conditions and environmental values can be continuously monitored on CRT page 20 as they pertain to the training exercise. (See figure 7-15.)

PILOT INTEGRATED MODE: MANUAL FREEZE P IFF NORM G MALFUNCTIONS UNASSIGNED MALF NO. ACTIVE	180 A/S ○ 140 100 60 20 -10 -8 -6 -4 -2 0	ALT 4000 ○ 3000 2000 1000 ○ MET 00:04:03 TIMER :00:00																																										
021 VISUAL CONDITIONS <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;"></td> <td style="width: 30%; text-align: center;">VISIBILITY</td> <td style="width: 30%; text-align: center;">60000 FT.</td> </tr> <tr> <td>1</td> <td>CLOUD THICKNESS 1000 FT.</td> <td>(NOT EDITABLE)</td> </tr> <tr> <td>2</td> <td>CEILING 1850 FT.</td> <td></td> </tr> <tr> <td>3</td> <td>PINNACLE BEACON OFF</td> <td>HARDWARE CONF.</td> </tr> <tr> <td>4</td> <td>THRES/CLA BEACON OFF</td> <td>IG*1 1 IG*2 2</td> </tr> <tr> <td>5</td> <td>DAY(1) DUSK(2) NIGHT(3)</td> <td>1 = FRONT 2 = SIDE 3 = INVALID 4 = UNAVAILABLE</td> </tr> <tr> <td>6</td> <td>HOSTILE GROUND FIRE SELECTION (1-10)</td> <td></td> </tr> <tr> <td>7</td> <td>FIELD SELECTION 2</td> <td>ASSIGNMENT</td> </tr> <tr> <td></td> <td>1 = GOLDBERG RWY 36 2 = CAIRNS RWY 06 3 = DOTHAN RWY 31 4 = LAWSON RWY 32 5 = HANCHEY RWY 15 6 = DANNELLY RWY 09</td> <td>PILOT FRONT = 1 PILOT SIDE = 2 GUNNER = 0</td> </tr> <tr> <td></td> <td>CRISP</td> <td>0 = OFF 1 = IG*1 2 = IG*2</td> </tr> <tr> <td>8</td> <td>FOG OFF</td> <td>TIME UNTILL FULL LAMP BANK INTENSITY</td> </tr> <tr> <td>9</td> <td>IR CONTRAST 0 0 = LOW 1 = HIGH</td> <td>0 MIN</td> </tr> <tr> <td>10</td> <td>MASK OFF</td> <td></td> </tr> <tr> <td>11</td> <td>FLIR COOLDOWN OVR OFF</td> <td></td> </tr> </table>				VISIBILITY	60000 FT.	1	CLOUD THICKNESS 1000 FT.	(NOT EDITABLE)	2	CEILING 1850 FT.		3	PINNACLE BEACON OFF	HARDWARE CONF.	4	THRES/CLA BEACON OFF	IG*1 1 IG*2 2	5	DAY(1) DUSK(2) NIGHT(3)	1 = FRONT 2 = SIDE 3 = INVALID 4 = UNAVAILABLE	6	HOSTILE GROUND FIRE SELECTION (1-10)		7	FIELD SELECTION 2	ASSIGNMENT		1 = GOLDBERG RWY 36 2 = CAIRNS RWY 06 3 = DOTHAN RWY 31 4 = LAWSON RWY 32 5 = HANCHEY RWY 15 6 = DANNELLY RWY 09	PILOT FRONT = 1 PILOT SIDE = 2 GUNNER = 0		CRISP	0 = OFF 1 = IG*1 2 = IG*2	8	FOG OFF	TIME UNTILL FULL LAMP BANK INTENSITY	9	IR CONTRAST 0 0 = LOW 1 = HIGH	0 MIN	10	MASK OFF		11	FLIR COOLDOWN OVR OFF	
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4	THRES/CLA BEACON OFF	IG*1 1 IG*2 2																																										
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10	MASK OFF																																											
11	FLIR COOLDOWN OVR OFF																																											

Figure 7-14. Visual Conditions Page 021

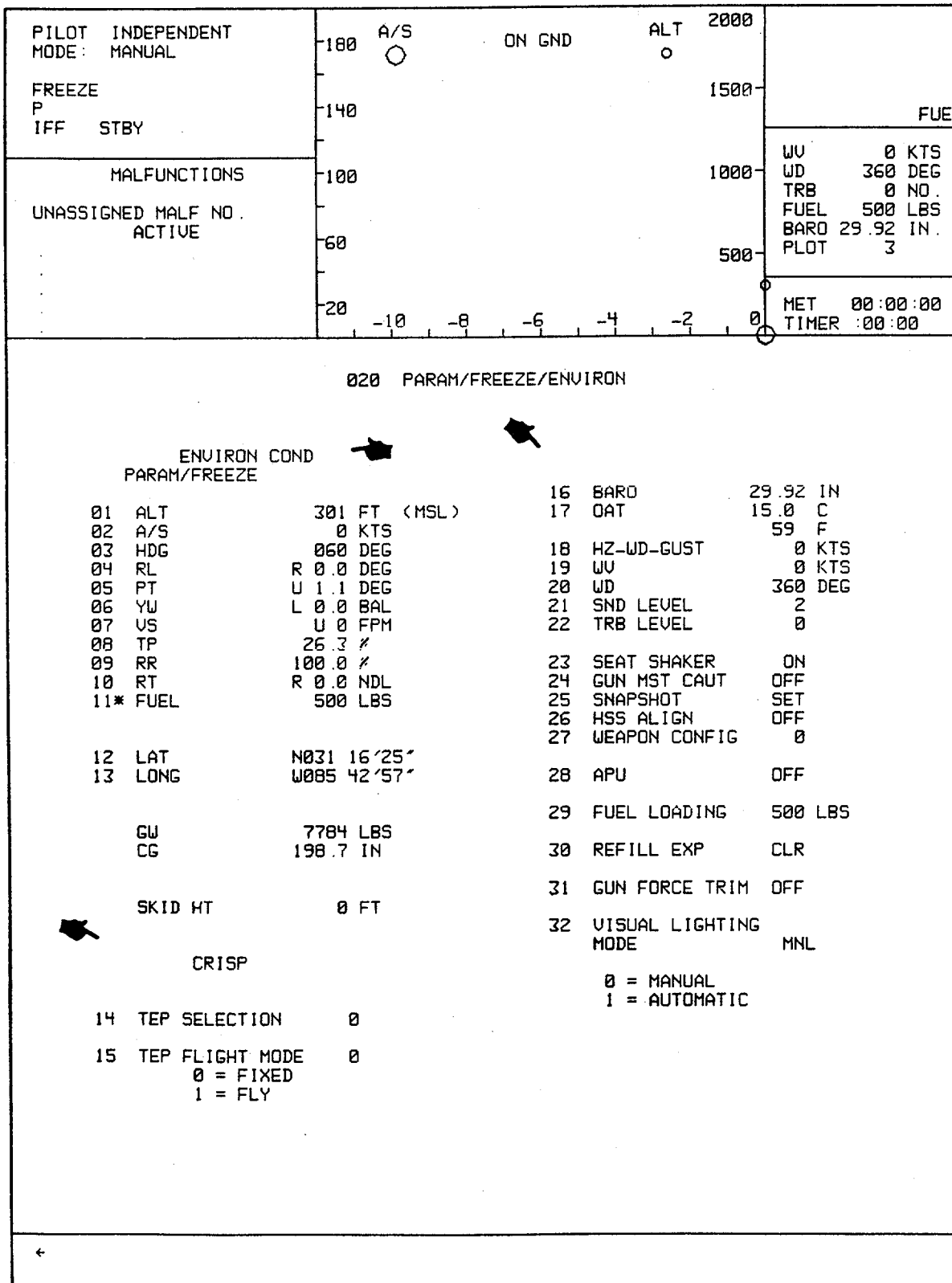


Figure 7-15. Parameter/Freeze/Environment Page 020

(1) During the course of a training exercise, current values are displayed for 11 flight parameters. These consist of altitude, airspeed, heading, roll angle, pitch angle, trim (yaw), vertical speed, torque pressure, rotor rpm percentage, rate-of-turn, and fuel quantity. Any one or more of these parameters, except torque pressure, can be frozen or released by keyboard entry.

(2) To freeze a parameter on lines 1 through 11 on CRT page 20, at the keyboard type the line number, space, * (asterisk character), ENTER. The asterisk symbol appears on the display adjacent to the line number indicating that the parameter has been frozen. To unfreeze or release the parameter, type the line number, space, ENTER.

(3) Current values are also displayed for environmental conditions. These line items, numbers 14 through 20 (figure 7-15), can be changed during the exercise by use of the CRT keyboard. Parameters that can be varied are: barometric pressure, outside air temperature, horizontal wind gust, wind velocity, wind direction, environmental sound level, and turbulence level. On CRT page 21, the visibility range, ceiling, cloud thickness, and day, dusk, or night condition are some of the other parameters that can be edited.

(4) To alter an environmental condition, enter via the keyboard the line number, space, desired value, ENTER. Set/clear and on/off conditions are edited using a numerical input of 1 for set or on, or a numerical input of 0 for off or clear.

NOTE

Visibility range on CRT Page 21 is edited by adjusting visibility range potentiometer.

7-4. INITIALIZATION OF CHECKRIDE. There are four major categories of checkrides. Within each category, a checkride exercise can be selected. (See checkride CRT pages, figures 7-8 through 7-11.)

- 070 VFR Checkride
- 080 IFR Checkride
- 090 Tactical Weapons Checkride
- 100 Tactical Instrument Checkride

NOTE

Checkrides are not available to the gunner cockpit in the independent mode.

a. Should initialization be desired to a checkride, set appropriate category number on the thumbwheel (70, 80, 90 or 100) and depress INSERT. The FWS initializes automatically to the start of the selected checkride. When initial procedures and checks are completed by the crew, unfreeze the FWS to start the checkride. An automatic audio briefing describing the checkrides is provided when a checkride ending in zero is selected.

b. Checkrides that end in other than zero (exercises) can be selected individually. No audio briefings are provided with exercises. Up to nine exercises can be programmed in a checkride. Should a point be selected that does not exist, a message at the bottom of the CRT indicates ENTRY DOES NOT EXIST.

7-5. TERMINATION OF CHECKRIDE. The checkride will either terminate automatically upon its conclusion, or manually if the instructor deletes the checkride.

7-6. INITIALIZATION OF DEMONSTRATION. Prior to initiation of a demonstration, ensure that engine is running at operating rpm percentage. The environmental, visibility range, and sound level to be used during demonstration should be edited on CRT pages 20 and 21. Then, while the simulator is frozen, dial the selected demonstration number from the CRT INDEX page on the thumbwheel selector and depress INSERT. When initialization is complete, unfreeze to start the demonstration. Synchronized demonstration audio commentary is available when a demonstration is selected. Should a point be selected that does not exist, a message at the bottom of the CRT indicates ENTRY DOES NOT EXIST.

7-7. TERMINATION OF DEMONSTRATION. Demonstrations terminate automatically at conclusion. They can be manually interrupted and terminated by dialing demonstration number on the thumbwheel selector and depressing DELETE switchlight.

Section II. INITIAL CONDITIONS

7-8. GENERAL. The FWS has 10 preprogrammed initial condition (IC) sets available for assignment as a setup or reset point for training exercises. A selected IC set can be modified by transposition to IC set 011, edited as desired, and inserted via the three-digit thumbwheel as IC set 011. (Refer to paragraph 7-3.(b).)

a. During initialization, the computer establishes the FWS at the geographic location of the latitude and longitude of the selected IC set. Simultaneously, conditions of appropriate flight control positioning, flight parameters, and environment will be achieved. The 10 preprogrammed IC sets are listed on CRT display pages shown in figures 7-2 and 7-3. A typical IC set page is shown in figure 7-1.

b. During the initialization process, the computer drives controls as required to achieve the demanded steady-state airspeed, altitude, and heading before leaving the freeze condition from which the pilot/gunner can proceed.

NOTE

During editing, IC flight parameters cannot be set to exact values and are subject to software control modification within the allowable tolerances given below. The flight parameters not listed on the IC pages, such as roll, pitch, yaw, torque, and rate-of-turn, assume whatever values are necessary to trim the aircraft to the conditions specified by the inserted IC.

Altitude	±10 feet
Airspeed	± 2 knots
Heading	± 2 degrees
Vertical speed	± 100 feet per minute
RPM	± 2%
Fuel	± 10 pounds

c. If a TEP is selected and IC page 11 is inserted, the simulated aircraft position is initiated at the coordinates and altitude listed for the selected TEP on CRT page 23. Other items that are initialized when a TEP is selected are heading, airspeed (set to 0), and vertical speed (set to 0). The flight controls are set trimmed to a stable hover condition.

Section III. INSTRUCTOR STATION CONTROLS AND FUNCTIONS

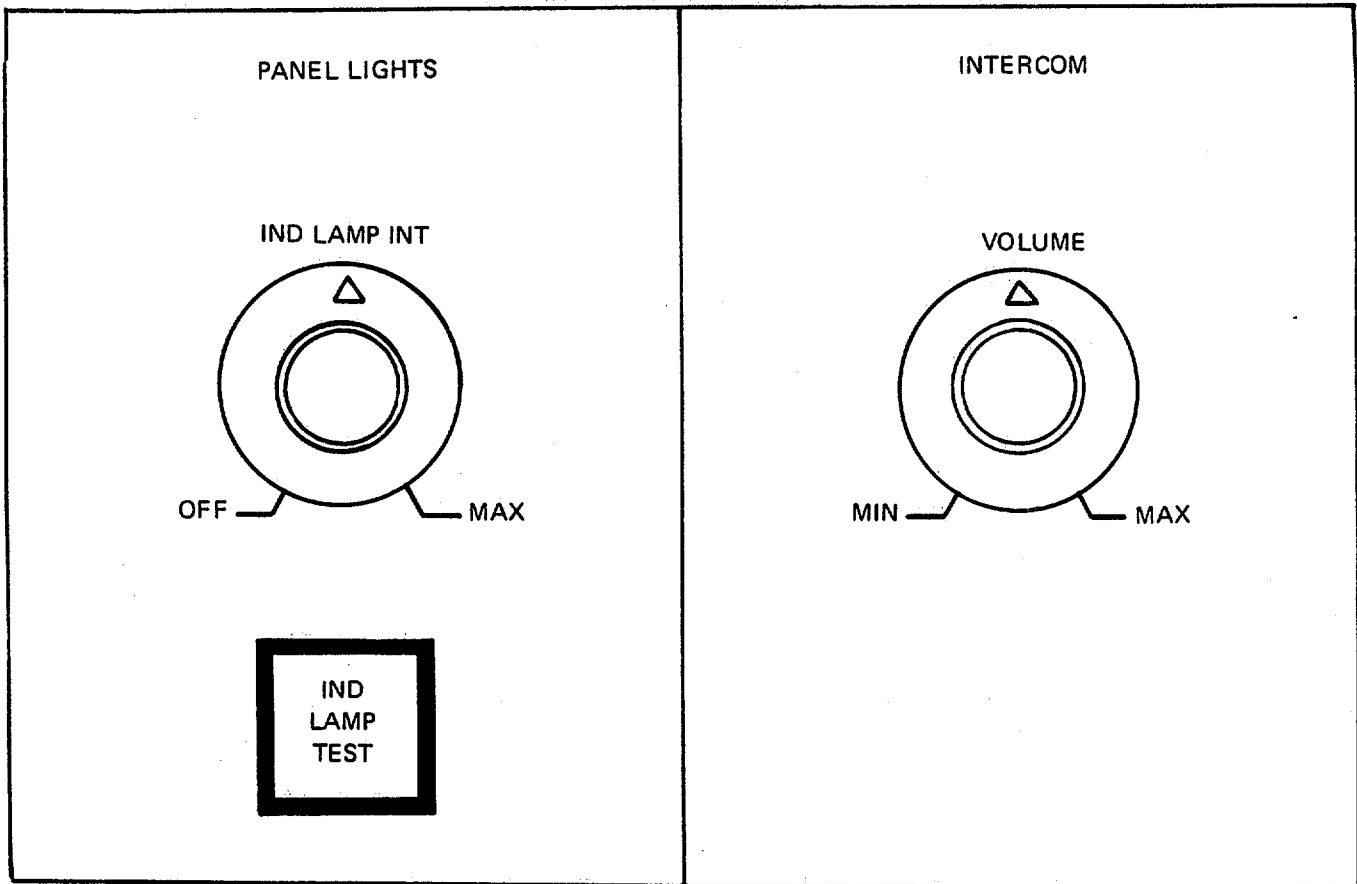
7-9. GENERAL. Figures 2-2 through 2-4 show the locations of the student and instructor/operator station (IOS) control panels. Locations of controls on the IOS control panels are shown in figures 7-16 through 7-23. Figure 7-24 shows the layout of controls on the student control panels. Controls on the student control panels are electrically connected in parallel, having the same capabilities as the controls at the IOS.

a. The figures and accompanying text that follow list each control, its location and type, and the function of each switch. This information should be utilized by the instructor/operator to become initially familiar with the control panels. It can then be used as a reference until full familiarity is achieved. Further information is provided in paragraph 7-36 regarding the thumbwheel and keyboard utilization.

b. One rule that must be followed when operating the FWS is to initiate the command, wait for it to be executed, verify that the function or parameter has changed to the new and correct value, and then proceed to the next step. This is especially true when operating the CRT keyboard, thumbwheel number select, and insert switchlights. The scratchpad area at the bottom of the CRT display allows verification of keyboard inputs prior to their actual entry. This area also displays error messages for incorrectly executed entries of either thumbwheel or keyboard inputs.

c. The IOS console indicators and switchlights have been color coded, and are based on the following:

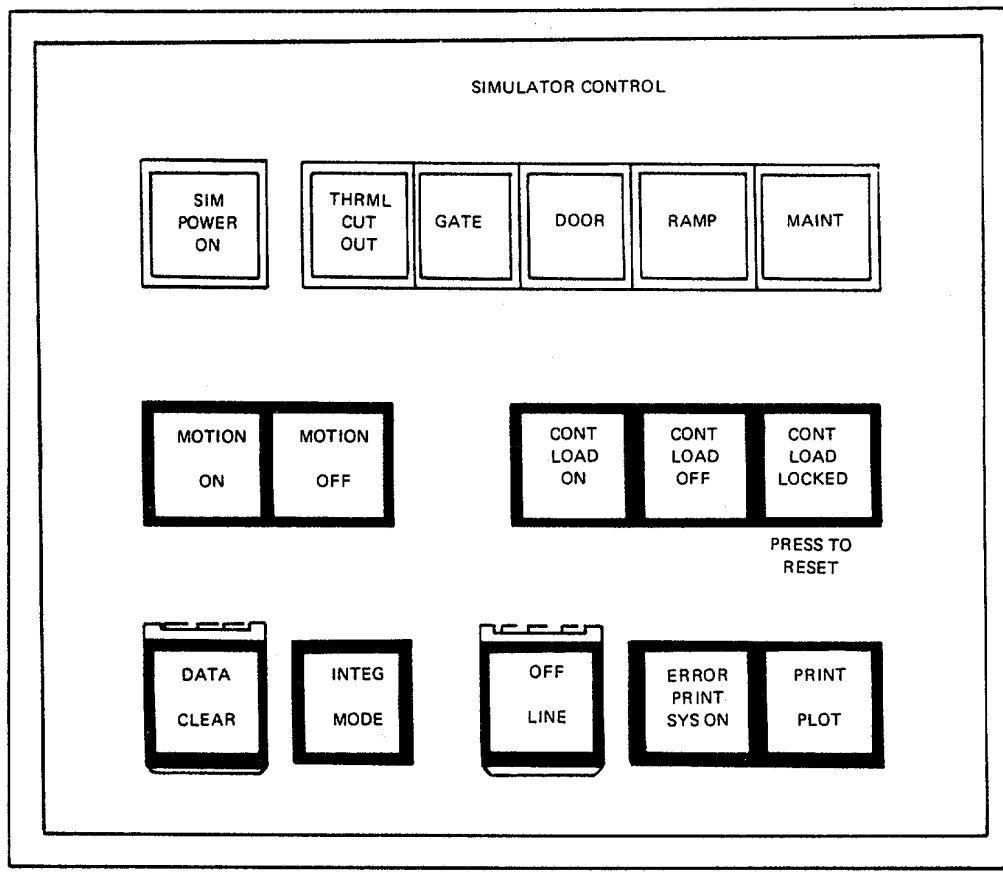
- (1) Green illuminated nomenclature represents an active system, i.e., MOTION ON, CONTROL LOADING ON, etc.
- (2) Red illuminated background denotes an emergency control, i.e., EMERGENCY STOP.
- (3) Yellow illuminated nomenclature represents an FWS alert, i.e., failure of motion interlocks to be satisfied.
- (4) White illuminated nomenclature represents status indications, positions or conditions of FWS control such as: PROBLEM FREEZE, RESET, VHF NAV COMM, etc.



05607

Nomenclature	Function
IND LAMP INT control (single-turn potentiometer)	Permits instructor to vary intensity of indicator lights and switchlights on IOS control panels and student control panels. This control is operable at both stations in either independent or integrated mode.
IND LAMP TEST switchlight	When depressed and held for test, illuminates all indicator lamps on IOS control panels and student control panels to verify bulb operation. This control is operable at both stations in either independent or integrated mode.
VOLUME control (single-turn potentiometer)	Permits instructor to vary sound level to headset. This control is operable at both stations in either independent or integrated mode.

Figure 7-16. Panel Lights and Intercom Panels



Nomenclature	Function
SIM POWER ON indicator	Indicates status of FWS system master power switch. Power is turned on at main power cabinet in computer room. When power is turned on, both simulators have power and capability for motion.
Motion interlocks (group of 5 indicators)	Indicate status of interlocks. Motion platform cannot operate when any interlock is open. Each motion interlock system is independent, whether in integrated or independent mode.
THRML CUT OUT	Indicates that thermal cutout interlock on hydraulic pumping unit is open. Respective motion system will be deactivated.
GATE	Indicates that gate from computer floor to floor underneath motion platform is open. Both motion systems will be deactivated.
DOOR	Indicates that cockpit door is not locked. Respective motion system will be deactivated.

Figure 7-17. Simulator Control Panel (Sheet 1)

Nomenclature	Function
Motion interlocks - continued	
RAMP	Indicates that boarding ramp is not up in stowed position. Respective motion system will not operate.
MAINT	Indicates that motion system has been placed in a maintenance mode by operation of the SYSTEM CONTROL keyswitch at the motion system cabinet. In this mode, motion system is controlled only from motion system cabinet. Refer to TD 55-6930-213-23-5 for additional information.
MOTION ON switchlight	Activates motion system, provided that interlocks are satisfied. This switchlight blinks during motion system transition to neutral. When motion system attains neutral switchlight reverts to steady on. On IOS console, SIM POWER ON must be on for this switchlight to operate. Interlock function includes access ramp. After switch actuation, boarding ramp rises and clears motion platform before motion becomes operational. Prior to responding to mission flight control inputs, motion platform erects to neutral position. Neutral position is a point at which the hydraulic cylinder legs are extended approximately halfway. Operation of this switchlight is not mode-dependent.
MOTION OFF switchlight	Deactivates motion platform. Motion platform returns at controlled rate to neutral position prior to reaching settled position. This switchlight is lit when motion is off. Upon settling of motion system, boarding ramp is lowered and aligns with motion platform. Operation of this switchlight is not mode-dependent.
CONT LOAD ON switchlight	Activates valve that directs hydraulic pressure to control loading system. Switchlight is lit when control loading is on. Operation of this switchlight is not mode-dependent.

Figure 7-17. Simulator Control Panel (Sheet 2)

Nomenclature	Function
CONT LOAD OFF switchlight	Activation closes valve through which hydraulic pressure is supplied to control loading system. This switchlight is illuminated when control loading is off. Operation of this switchlight is not mode- dependent.
CONT LOAD LOCKED switchlight	Illuminates to indicate an abnormal operating condition or fault in control loading system. Cockpit flight controls lock up, preventing any further movement. Once fault is cleared, activation of switchlight extinguishes light and resets system. Operation of this switchlight is not mode-dependent.
DATA CLEAR switchlight	Clears all data accumulated during previous training session. Initializes trainer to clean conditions. Activation of this switchlight clears track history, clears out-of-tolerance table, removes all active malfunctions, clears MET CRT indication, restores all frozen parameters to unfrozen condition, and initializes all displays. In integrated mode, this switchlight at gunner instructor station functions only as indicator light.
INTEG MODE switchlight	Activation by pilot instructor/operator allows an integrated mission to be flown. Deactivation returns both cockpits to independent operation.

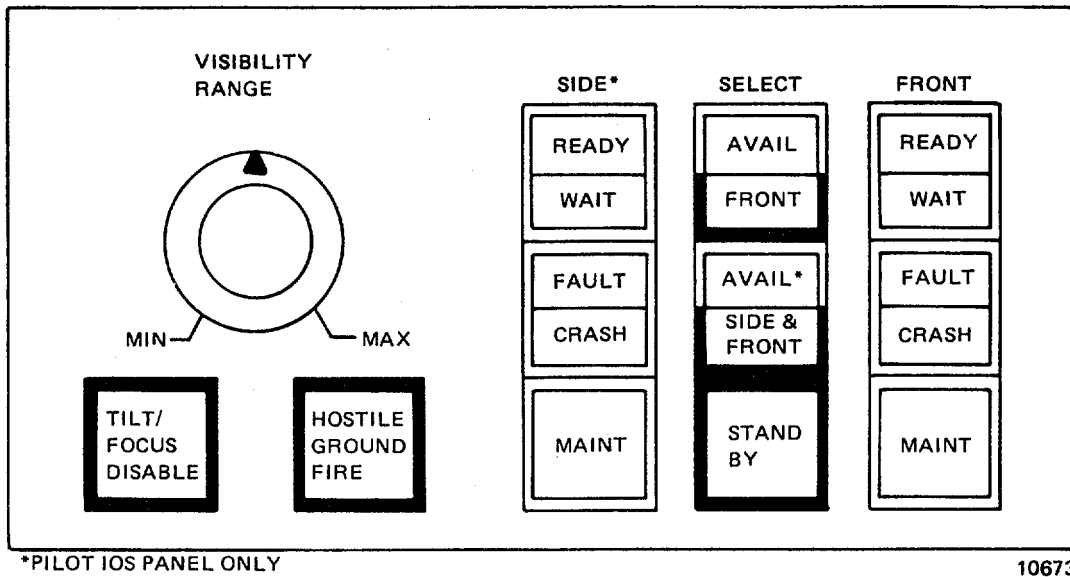
NOTE

Selection of this mode should first be coordinated with maintenance personnel using communications system. The changeover can cause a delay of approximately 20 minutes. This mode can be entered only when both cockpits are in manual mode freeze condition. If gunner cockpit is not frozen, gunner and pilot instructor INTEG MODE indicator lights blink. Both indicators illuminate steadily during integrated mode operation.

Figure 7-17. Simulator Control Panel (Sheet 3)

Nomenclature	Function
OFF LINE switchlight	<p>Enables instructor to use computer in off-line mode for printing out stored plots for both cockpits in an uninterrupted manner. However, it is not necessary to switch off-line to obtain hardcopy data. Formulation of demonstrations is also done off-line. Activation of this switchlight a second time returns FWS to on-line freeze mode and extinguishes light.</p> <p style="text-align: center;"><u>CAUTION</u></p> <p>To avoid any possibility of visual system damage, notify visual personnel prior to initiating an off-line status.</p> <p style="text-align: center;"><u>NOTE</u></p> <p>For independent mode, both cockpits must be in freeze to go off-line. If both cockpits are not in freeze condition, activation of either OFF LINE switchlight only causes FREEZE switchlight to blink at the other IOS console. When both are in freeze condition, system can be put in off-line mode from either cockpit via OFF-LINE switchlight. Once in off-line, either cockpit can request off-line processing. The system can be taken out of off-line mode at any time by depressing OFF LINE switchlight and holding down until light goes out.</p>
ERROR PRINT SYS ON switchlight	<p>When simulator is on-line, activation results in student performance deviations in excess of aircraft not-to-exceed values (VNE) to be printed out as they occur. During an exercise, this switchlight also controls printing of checkride exercise parameters. During checkride, both VNE and checkride parameters are printed automatically. In integrated mode, this switchlight at gunner instructor station functions only as an indicator light.</p>
PRINT PLOT switchlight	<p>In off-line or on-line modes, permits either instructor to print out stored snapshots (up to a combined maximum of 20).</p>

Figure 7-17. Simulator Control Panel (Sheet 4)



Nomenclature	Function
VISIBILITY RANGE control (single-turn potentiometer)	Permits instructor to vary visibility of through-the-window visual scene from unlimited (maximum) to full haze (minimum). Also effects CRISP scene in TSU. (Does not affect FLIR or symbolic scenes.)
TILT/FOCUS DISABLE switchlight	Illuminates when turned on, disabling Scheimpflug focus correction (tilt) of probe. This provides an alternate focus curve for low-level, close-to-vertical objects focusing. This is not an optimum focus correction for general flying and it is up to instructor/operator to determine when this feature should be used. Instructor selection of this focus mode at low altitude levels can cause a noticeable out-of-focus condition during the 2- to 3-second transition period. Selection at higher altitude will result in a less noticeable out-of-focus condition during the transition period.

Figure 7-18. IOS Visual System Panel (Sheet 1)

Nomenclature

Function

CAUTION

Avoid prolonged engagement (in excess of 3 to 5 seconds duration) of HOSTILE GROUND FIRE switchlight to avert system damage.

HOSTILE GROUND FIRE
momentary-action switchlight

When depressed and held, enables hostile ground fire from a preselected site on model board that must be in view on visual scene. When activated, results in flashing red spot in the general area of weapon site. Due to positioning accuracy, the spot may appear to move with respect to model features.

SIDE READY/WAIT (pilot IOS only),
FRONT READY/WAIT
lens indicator

Allows instructor to determine when visual system is in a usable mode (READY) or is in a mode which will require a period of time before a visual scene is presented (WAIT). WAIT indicator illuminates when a visual reset is in progress or any gantry axis is beyond model board boundaries.

SIDE FAULT/CRASH (pilot IOS only),
FAULT/CRASH
split-lens indicator

Provides two modes of status FRONT notification. When illuminated steadily, reset is possible from IOS by returning system to operate mode. When flashing, reset is not possible, and visual personnel must be notified of a problem. FAULT indicates when any visual system fault has occurred, placing system in standby. CRASH indicates that visual system detected crash. Visual maintenance personnel should be notified at the time this occurs and for repeating fault/crash indications (steady illumination). Resetting without notifying visual personnel may destroy data, making it difficult or impossible to find the problem cause at a later time. A visual system fault or crash will cause a simulator freeze.

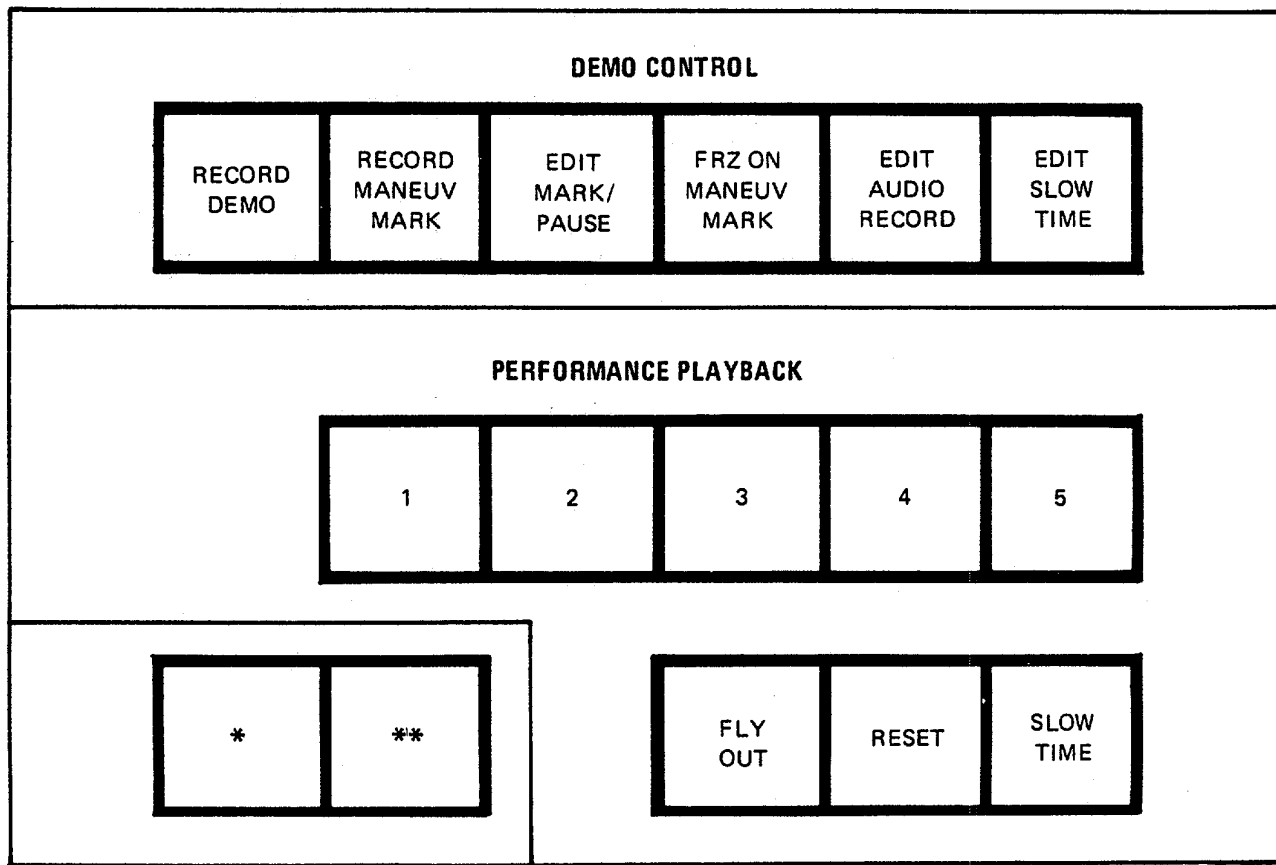
SIDE MAINT (pilot IOS only),
FRONT MAINT
status indicator

Denotes that visual system is in a pure maintenance mode and is not available to cockpit. Flashing indicates that visual system is on-line with computer, visual system test box is ON, and visual is not available for training.

Figure 7-18. IOS Visual System Panel (Sheet 2)

Nomenclature	Function
SELECT AVAIL/FRONT switchlight/indicator	When AVAIL portion illuminates, it indicates that front window visual is available. By depressing switch so that lower half (FRONT) illuminates, setup for front window becomes dedicated to that student station in independent mode. In integrated mode, the same visual scene is assigned to both pilot and gunner front window.
SELECT AVAIL/ SIDE & FRONT (pilot IOS only) switchlight/indicator	When AVAIL portion is illuminated, it indicates that both front and side window are available for use. Depressing switch so lower half illuminates assigns both visual systems to pilots cockpit for both a front and side window display. In independent mode, this results in no visual system being available to gunner. In integrated mode, gunner has the same forward visual available as the pilot.
STAND BY switchlight	When depressed so that it illuminates, whichever visual system assigned to pilot cockpit is placed in an off-line mode with display blanked. In independent mode, visual system assigned to pilot station remains until released by use of AVAIL/FRONT or AVAIL/SIDE & FRONT switches. (Gunner station cannot select.) In integrated mode, STANDBY function places both pilot and gunner visual system in an off-line mode.

Figure 7-18. IOS Visual System Panel (Sheet 3)



10674

PILOT INSTRUCTOR
 * TOW ATTACK SEQ
 ** TOW FIRE

GUNNER INSTRUCTOR
 * PILOT HSS INPUT
 ** MASTER ARM

Nomenclature

Function

RECORD DEMO alternate-action light

Allows instructor to generate a switch-demonstration program assigned to demonstration number inserted in thumbwheel. FREEZE switchlight blinks until FWS is ready and then goes steady. Unfreezing starts demonstration recording of simulator performance as flown. Old demonstration is erased as new recording is made.

Demonstrations can be prepared only in integrated mode. Gunner and pilot instructor controls operate in parallel. Once recorded, demonstrations can be given in either integrated or independent mode. See Chapter 8, Section II for demonstration edit and formulation.

Figure 7-19. Demonstration Control and Performance Playback Panel (Sheet 1)

Nomenclature	Function
RECORD MANEUV MARK momentary-action switchlight	Permits instructor/operator to prepare a demonstration in segments to facilitate editing of demonstration. When creating demonstration, activation of this switchlight stores flight parameters for subsequent reset. RECORD MANEUV MARK is operational only in RECORD DEMO mode. Maneuver marks appear on ground track.
EDIT MARK/PAUSE dual-function momentary-action switchlight/	When depressed during recording of demonstration, maneuver being recorded is indexed. During audio editing only, FWS enters freeze condition upon reaching these indexed points. When lit during audio editing of demonstration, prerecorded maneuver stops, but audio recorder continues to operate in record mode at normal speed. This permits interruption of demonstration playback without interruption of recording of an audio accompaniment. Once pauses and audio commentary are edited into demonstration, they remain there as a permanent part of that demonstration.
FRZ ON MANEUV MARK alternate- tion switchlight	Causes FWS to freeze whenever a maneuver mark is encountered. In RECORD DEMO mode, whenever RECORD MANEUV MARK is activated, simulator freezes. In EDIT AUDIO RECORD mode, whenever a previously recorded maneuver mark is encountered, simulator freezes.
EDIT AUDIO RECORD alternate- tion switchlight	Permits instructor/operator to edit or add new audio to demonstration number inserted via thumbwheel. Old audio is erased as new audio is recorded.
EDIT SLOW TIME alternate-action switchlight	Used in EDIT AUDIO RECORD mode to insert slow-time into demonstration. Audio tape recorder continues to operate at its normal speed, thus permitting instructor to add commentary during slow-time. A second depression of this switch terminates slow-time. Once slow-time and audio commentary are edited into demonstration, they remain there as a permanent part of that demonstration.

Figure 7-19. Demonstration Control and Performance Playback Panel (Sheet 2)

Nomenclature

Function

WARNING

Alert student pilot and student gunner to remain clear from all flight controls prior to initialization. Abrupt movement of the controls when positioned by the computer may cause personal injury.

1,2,3,4,5, (PERFORMANCE PLAYBACK) switchlights

This set of switchlights commands and indicates playback of current FWS response to student performance in 1-minute increments up to 5 minutes prior in time. Depressing desired performance playback switchlight number causes FREEZE switchlight to blink until simulator is reset for playback. FREEZE then goes steady. Audio playback status is indicated on edit line of CRT. By unfreezing simulator, playback begins at start of minute(s) selected - counting back minutes of recorded flight from the time playback was called for. When playback selection is made, the light in that number switch illuminates until that minute is completed, at which time next lower number illuminates and so forth until simulator is at the latest recorded point. Simulator then freezes and awaits further instructions. In integrated mode, this switchlight at gunner IOS functions only as an indicator light.

FLY OUT switchlight

Activation terminates 1- to 5-minute current playback and permits student to fly simulator from the point where playback just ended. In integrated mode, this switchlight at gunner IOS functions only as an indicator light.

RESET momentary-action switchlight

When depressed at any time during the current 1- to 5-minute performance playback, returns simulator to exactly where it was when playback was initiated. Activating during performance playback terminates playback, and returns simulator to where it was when playback was initiated, during which time FREEZE switchlight flashes. When

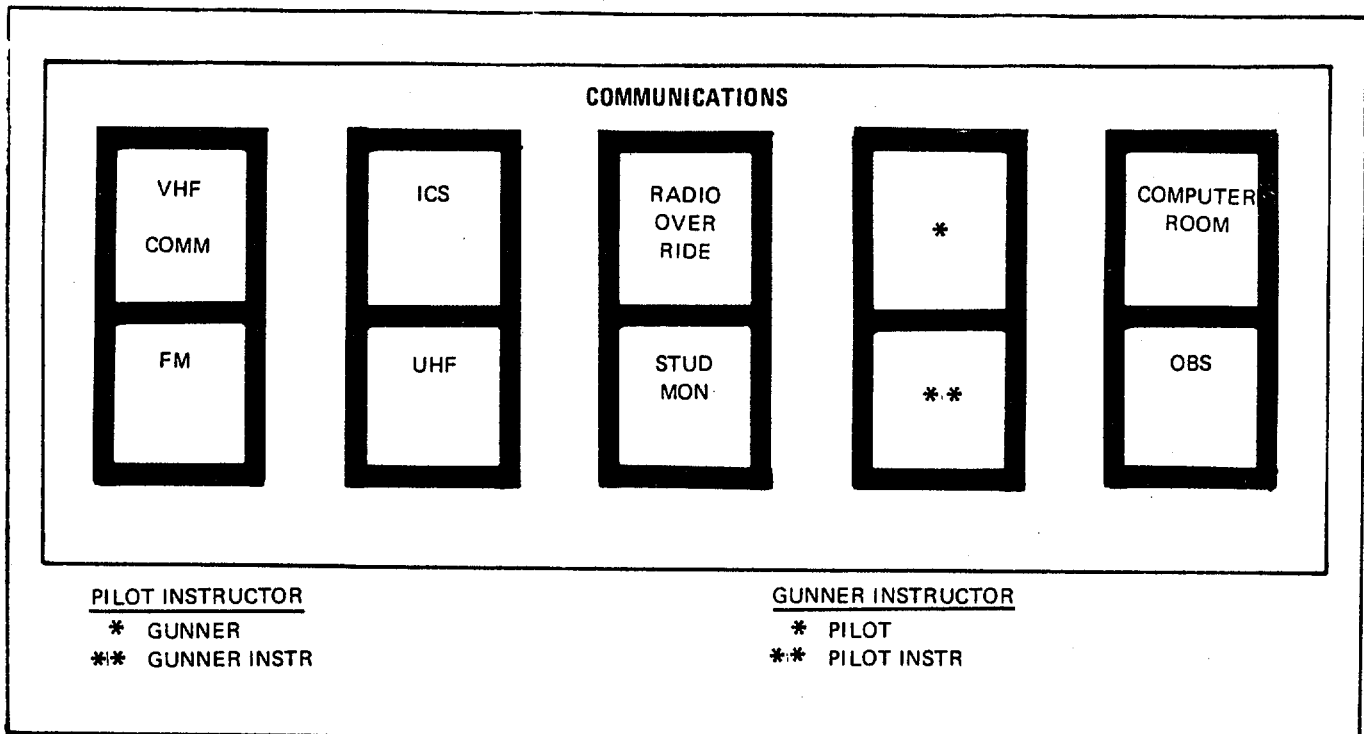
Figure 7-19. Demonstration Control and Performance Playback Panel (Sheet 3)

Nomenclature	Function
RESET momentary-action switchlight continued	returned to point of initiation, FREEZE switchlight illuminates steadily. The FWS is then ready to continue where it left off by pressing FREEZE. In integrated mode, this switchlight at gunner IOS functions only as an indicator light.
SLOW TIME momentary-action switchlight	When depressed during performance playback, causes FWS to operate at one-half normal speed. Second depression causes the FWS to return to normal speed operation. There is no audio during slow-time. In integrated mode, this switchlight at gunner IOS functions only as an indicator light.
TOW ATTACK SEQ (pilot IOS only) momentary-action switchlight	Used in independent mode to permit pilot instructor to make an input to pilot that would normally be received from gunner. Depressing TOW ATTACK SEQ shows a presentation on HUD of a TOW missile selected for launch as if gunner had performed the operation.
TOW FIRE (pilot IOS only) momentary-action switchlight	Used in independent mode to permit pilot instructor to make an input to pilot that would normally be received from gunner. Depressing TOW FIRE fires a TOW missile (assuming launch conditions have been met) and shows a post-launch presentation on HUD. Maneuver limits are the actual system limits until missile impact or wire cut, whichever occurs first.
PILOT HSS INPUT (gunner IOS only) momentary-action switchlight	Used in independent mode to permit gunner instructor to make an input to gunner that would normally be received from pilot. Activation of this switch causes simulated pilot HSS line-of-sight, which is directed at a selected target-of-interest, to automatically redirect turret and/or TSU to the same target-of-interest, following activation of the PHS ACQ switch.

Figure 7-19. Demonstration Control and Performance Playback Panel (Sheet 4)

Nomenclature	Function
MASTER ARM (gunner IOS only) momentary-action switchlight	Used in independent mode to permit gunner instructor to make an input to gunner that would normally be received from pilot. This switch has the same effect as pilot master arm switch. This is a 3-state presentation: OFF simulates master arm switch in off position, flashing simulates master arm switch in STBY position, ON simulates master arm switch in ARM position. Transition is from OFF to STBY, then to ARM and OFF with successive activations by instructor/ operator.
NOTE	
Initiation of any mode change or selecting AUTO FLIGHT automatically sets this switch to OFF.	

Figure 7-19. Demonstration Control and Performance Playback Panel (Sheet 5)



10675

Nomenclature	Function
VHF COMM switchlight	Permits instructor to communicate with crew over VHF/AM radio set, using XMIT on headset cord switch.
ICS (intercommunication system) switchlight	Permits initiating instructor to switchlight communicate with crew over simulated aircraft ICS network, using ICS on headset cord switch.
RADIO OVERRIDE switchlight	Permits instructor to talk to crew without regard to radio control settings. In integrated mode, RADIO OVERRIDE switchlight at gunner IOS station functions only as an indicator light. Use either XMIT or ICS on headset cord switch. This function is one-way communication from instructor to crew and cannot be used simultaneously with ICS switchlight. If both switchlights are selected, only IC operates.

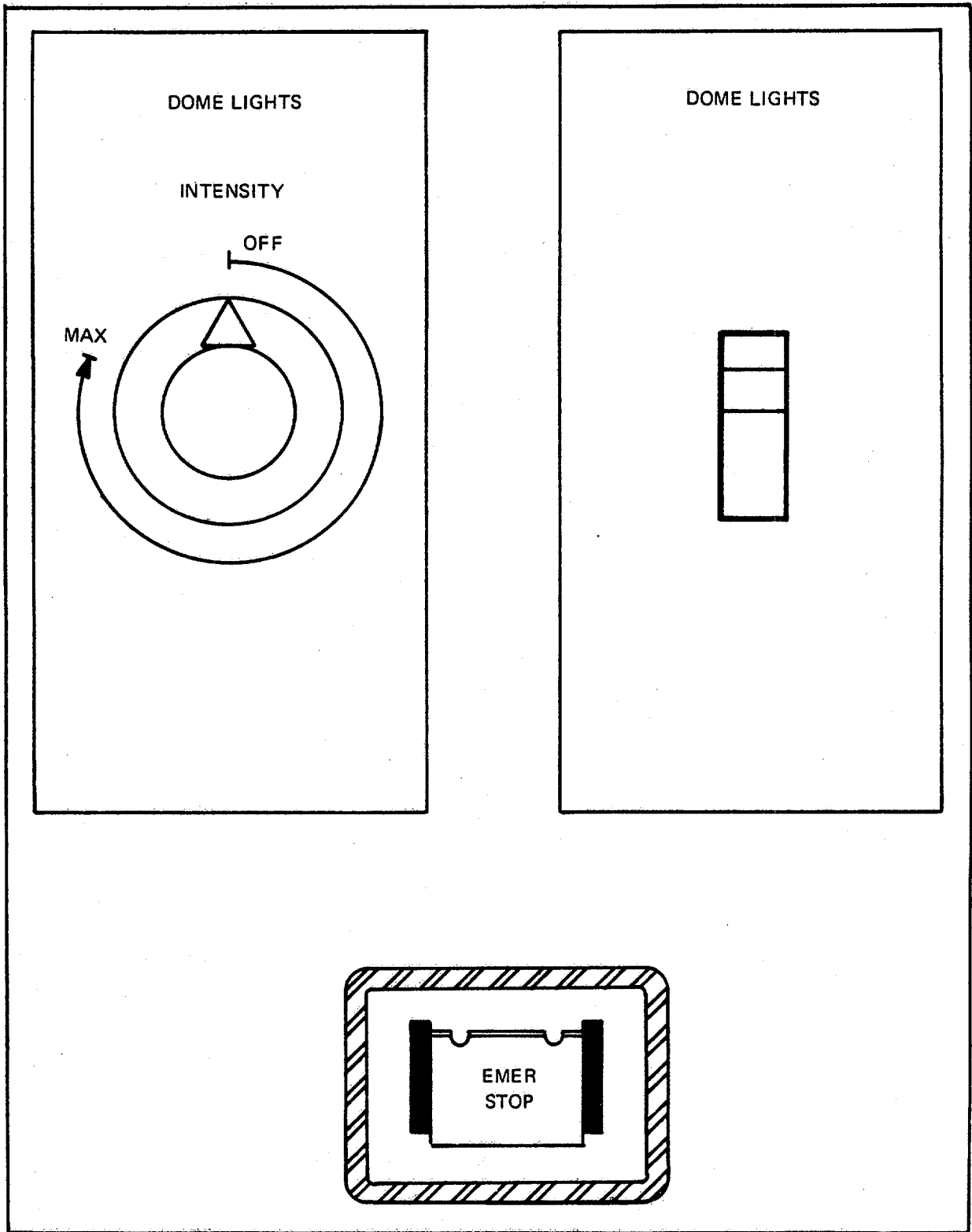
Figure 7-20. Communications Panel (Sheet 1)

Nomenclature	Function
GUNNER (pilot IOS only) switchlight	Permits pilot instructor to override aircraft ICS system to talk to gunner in independent mode, using either XMIT or ICS onheadset cord switch. When GUNNER and ICS switchlights are both selected, only ICS operates.
NOTE	
This function is necessary for pilot instructor to coordinate switching from independent to integrated mode.	
PILOT (gunner IOS only) switchlight	Permits gunner instructor to override aircraft ICS system to talk to pilot in independent mode, using either XMIT or ICS on headset cord switch. When PILOT and ICS switchlights are both selected, only ICS operates.
COMPUTER ROOM switchlight	Permits instructor to talk with computer room personnel. When instructor initiates a call to or receives a call from the computer room, this switchlight blinks until call is answered, at which time light goes on steadily. When instructor initiates a call, an alerting bell rings in computer room.
FM switchlight	Permits instructor to communicate to student over VHF/FM radio set, using XMIT on headset cord switch.
UHF switchlight	Permits instructor to communicate to student over UHF radio set receiver, using XMIT on headset cord switch.
STUD MON switchlight	Permits instructor and observer to monitor all student communications without regard to other student and instructor communication control settings.
GUNNER INSTR (pilot IOS only) switchlight	Permits pilot instructor to communicate with gunner instructor, using ICS on headset cord switch. When pilot instructor initiates or receives a call, this switchlight blinks until call is answered. Switchlight then goes on steadily. COMPUTER ROOM switchlight is disabled if this function is already in use.

Figure 7-20. Communications Panel (Sheet 2)

Nomenclature	Function
PILOT INSTR (gunner IOS only) switchlight	Permits gunner instructor to communicate with pilot instructor using ICS on headset cord switch. When gunner instructor initiates or receives a call, this switchlight blinks until call is answered. Switchlight then goes on steadily. COMPUTER ROOM switchlight is disabled if this function is already in use.
	OBS (observer) switchlight Permits instructor and observer to talk with each other privately. Instructor uses ICS on headset cord switch. Observer has hot microphone operation. Observer can monitor what instructor hears by selecting receiver switch 4 on observer ICS unit. When actuated in conjunction with COMPUTER ROOM switchlight, enables three-way conversation between computer room, instructor, and observer.

Figure 7-20. Communications Panel (Sheet 3)

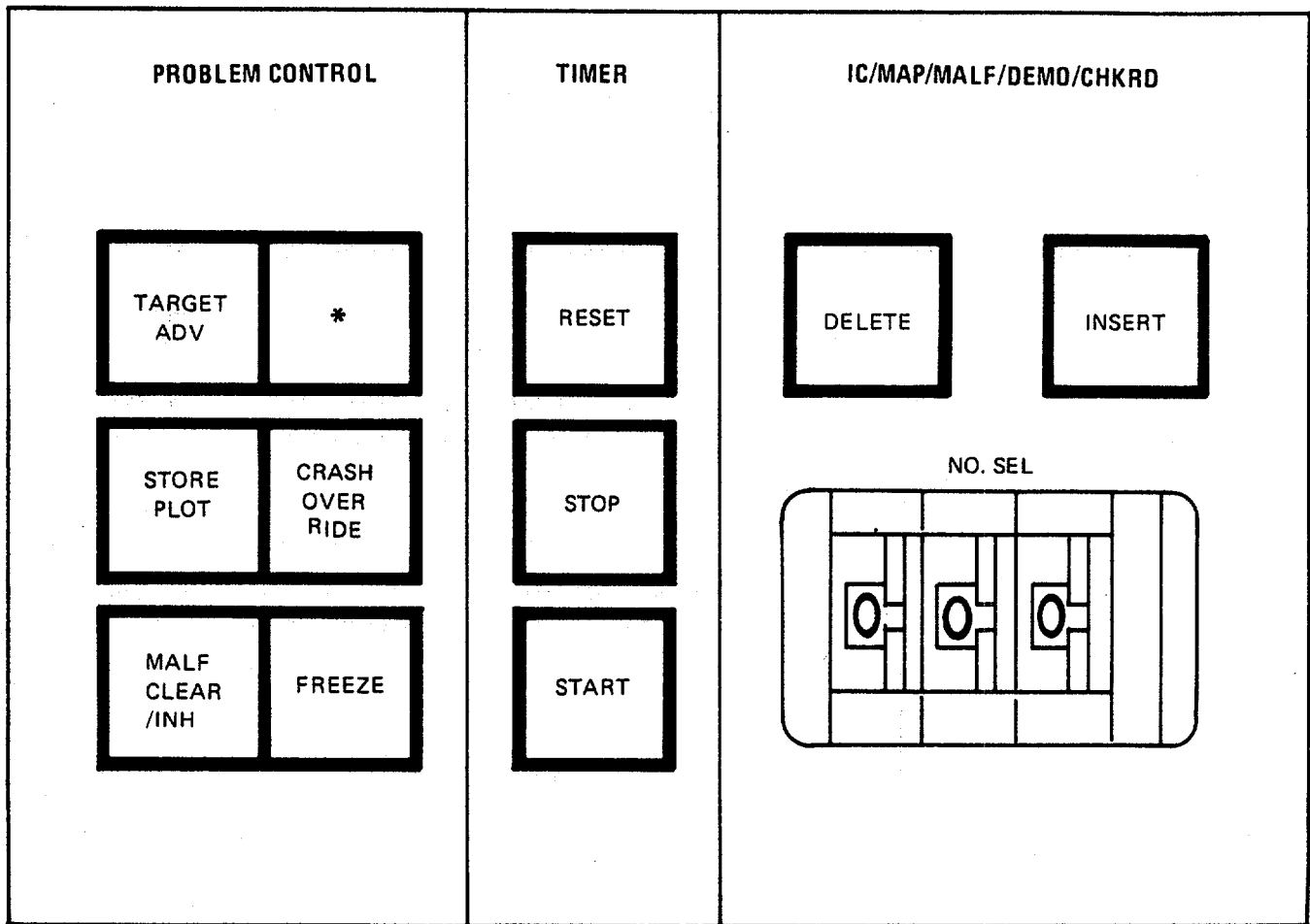


05611

Figure 7-21. Dome Lights and Emergency Stop Control and Switches (Sheet 1)

Nomenclature	Function
INTENSITY DOME LIGHTS (OFF-MAX) single-turn dimmer control	Provides variable intensity control of over head fluorescent lighting.
DOME LIGHTS (on/off) wall lightswitch	Permits on/off control of overhead fluorescent lighting. Located adjacent to compartment entrance door and overrides setting of variable INTENSITY DOME LIGHTS control.
EMER STOP switchlight	When depressed, turns off all power to FWS. This switchlight is guarded with black barriers and a spring-loaded clear cover to prevent inadvertent actuation. The switch- light is illuminated when power is ON. All EMER STOP controls throughout simulator complex are functional at all times (lit red) regardless of simulator mode.
FOOT LIGHTS (on/off) wall lightswitch	Permits on/off control of low-intensity foot lights. Located adjacent to compartment entrance door.

Figure 7-21. Dome Lights and Emergency Stop Controls and Switches (Sheet 2)



10676

PILOT INSTRUCTOR

* GUNNER CONT

GUNNER INSTRUCTOR

* AUTO FLIGHT

Nomenclature	Function
TARGET ADV switchlight	Directs computer to use next target selected as a basis for weapon scoring. Target advance cannot be accomplished with FWS in freeze.
GUNNER CONT	When operating in integrated mode, (pilot IOS-only) switchlight permits transfer of flight control to gunner station. Remains lit while in this mode. Does not function in independent mode.
AUTO FLIGHT	Permits gunner instructor to use pilot (gunner IOS only) switchlight portion of a demonstration for gunner training. Pilot portion of demonstration flies gunner cockpit while gunner trains in specific tasks.

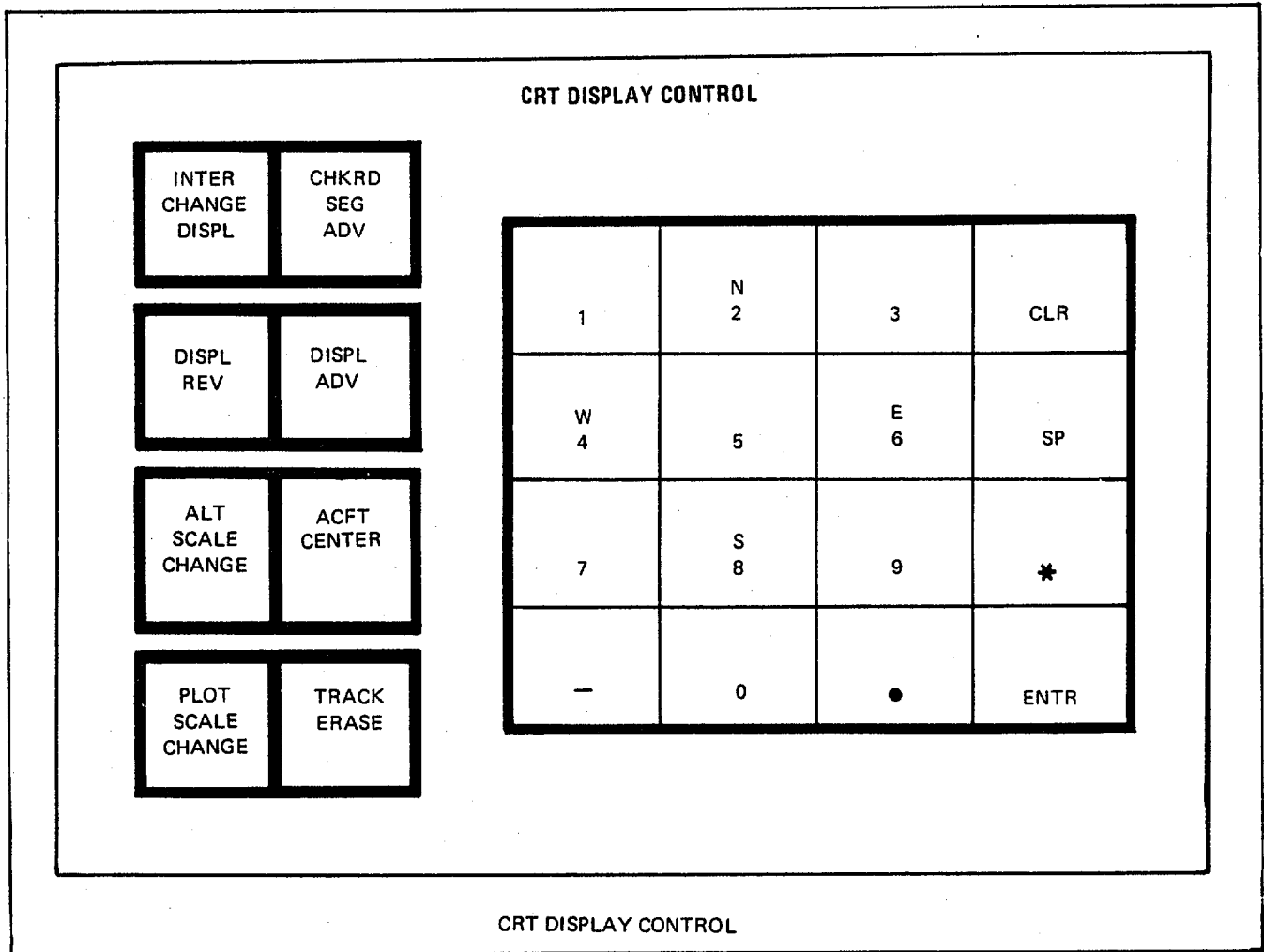
Figure 7-22. Problem Control, Timer, and IC/MAP/MALF/DEMO/CHKRD Panel (Sheet 1)

Nomenclature	Function
STORE PLOT switchlight	When activated, stores in computer an instantaneous snapshot of current CRT display for future transfer to hardcopy. Active from either cockpit in any mode. Up to 20 snapshots can be stored before hardcopy printout needs to be made.
CRASH OVERRIDE switchlight	When activated, bypasses crash equations so that simulator will not enter a CRASH FREEZE. Second depression allows impending crashes to place the FWS in a freeze condition each time they occur. Switchlight blinks when crash occurs. In integrated mode, CRASH OVERRIDE switchlight at gunner IOS functions only as an indicator light.
MALF CLEAR/INH switchlight	Clears all active malfunctions from simulator. If malfunction number is currently selected on thumbwheel, that malfunction continues to be displayed above space allotted to active malfunctions on CRT. In integrated mode, MASTER MALF CLR/INH switchlight at gunner IOS functions only as an indicator light. During checkride exercise, activation of this switchlight inhibits all pre-programmed malfunctions until switchlight is again depressed. Upper area of CRT where active malfunctions are displayed is then cleared. Not functional in checkride mode.
FREEZE switchlight	When activated, freezes FWS during a problem to allow briefings, explanations, or instructions. Second depression releases freeze and starts FWS where it was before freeze. In integrated mode, FREEZE switch can be activated at either pilot or gunner IOS. If FREEZE is initiated by either gunner instructor/operator or student, for whatever reason, only the pilot instructor/ operator or student can release freeze. If GUNNER CONT switchlight is selected (illuminated) on pilot IOS, and FREEZE is initiated by gunner, anyone in either pilot or gunner compartments can release freeze.

Figure 7-22. Problem Control, Timer, and IC/MAP/MALF/DEMO/CHKRD Panel (Sheet 2)

Nomenclature	Function
RESET switchlight	Resets digital timer indication to 00:00 in upper right corner area on CRT display.
STOP switchlight	Stops digital timer count indication on CRT display.
START switchlight	Resumes or starts digital timer indication on CRT display.
NOTE	
These three switchlights above have no control over digital time-of-day clock or elapsed timer mounted on top of left IOS console.	
DELETE switchlight	Any malfunction, checkride, or demonstration currently selected on thumbwheel is deleted when this switchlight is depressed. In integrated mode, DELETE switchlight at gunner IOS is not operational.
WARNING	
Alert student pilot and student gunner to remain clear from all flight controls prior to initialization. Abrupt movement of the controls when positioned by the computer may cause personal injury.	
INSERT switchlight	Inserts checkride, initial condition, area map, malfunction, or demonstration, depending on number selected on thumbwheel. In integrated mode, INSERT switchlight at gunner IOS inserts only CRT display page selections.
NO. SEL (000-999) 3-digit thumbwheel	Selects one of 1,000 unique numbers 3-available for insertion or deletion of initial conditions, map displays, malfunctions, demonstrations, or checkrides. When a malfunction number is selected, that malfunction is displayed in upper area of CRT directly above space allocated to active malfunctions. In integrated mode, this thumbwheel at gunner IOS can only be used to select CRT display pages. No inputs to training program can be initiated by gunner instructor/operator.

Figure 7-22. Problem Control, Timer, and IC/MAP/MALF/DEMO/CHKRD Panel (Sheet 3)



05616

Nomenclature

Function

INTER CHANGE DISPL switchlight

Permits instructor to readily switch between two selected CRT pages. Two pages selected must be from different groups. One group can consist of cross-country and approach maps while the other group can consist of data pages, GCA, or weapon scoring displays. This switchlight uses the most recent selection in each group. In checkride mode, two CRT displays are programmed to appear as appropriate. One display is always the leg display. Second display can be map, weapon scoring, or GCA display. Instructor can override automatic graphic display by selecting specific graphic display.

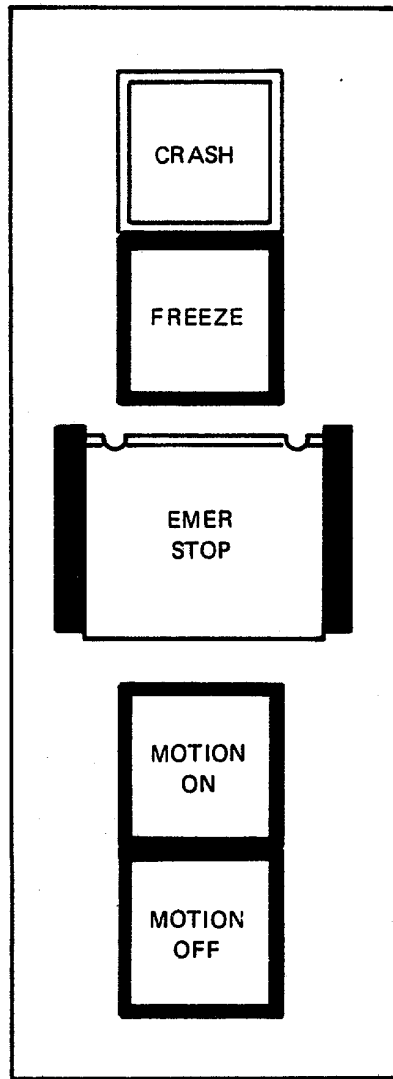
Figure 7-23. CRT Display Control Panel (Sheet 1)

Nomenclature	Function
CHKRD SEG ADV switchlight	Advances CRT leg display and criteria for computer performance evaluation to next checkride segment regardless of trainer status or student performance. In integrated mode, CHKRD SEG ADV switchlight at gunner IOS functions only as an indicator light.
DISPL REV switchlight	Permits instructor to easily step backwards through multiple page CRT displays such as malfunctions or nav/comm facilities. Communication scenario and clearance-in-effect portion of a particular checkride leg display may require more than one page.
DISPL ADV switchlight	Permits instructor to easily step forward through multiple page CRT displays such as malfunctions or nav/comm facilities. Communication scenario and clearance-in-effect portion of a particular checkride leg display may require more than one page.
ALT SCALE CHANGE switchlight	Alternately changes altitude scale on CRT display from 0 to 2,000 feet to 0 to 4,000 feet and back. When scale change is initiated, any existing flight track on plot changes to represent the same track at new scale.
ACFT CENTER switchlight	Redraws area maps and track history centered around current aircraft position. When cross-country map, or approach map is being displayed, depressing this momentary switchlight causes displayed map area to be shifted and centered around current aircraft position.
PLOT SCALE CHANGE switchlight	Changes scale of area map and GCA displays and scale of aircraft/target situation on CRT page 61 (figure 7-13). Approach maps change between 32 x 32, 16 x 16, and 8 x 8 nautical mile scales. Cross-country maps change between 128 x 128, 64 x 64, and 32 x 32 nautical mile scales. GCA alternates between 10 and 2.5 nautical mile scales. The same geographic center is retained at all scales. For the aircraft/target situation, the gunnery field-of-view scale can be

Figure 7-23. CRT Display Control Panel (Sheet 2)

Nomenclature	Function
PLOT SCALE CHANGE switchlight continued	switched between 50, 100, 200, or 400 milliradians. A decrease in scale factor increases the represented target size on CRT page only.
TRACK ERASE switchlight	Temporarily erases (at 1/4 inch/second) aircraft track history, from oldest to newest on CRT ground track plot. When altitude scale is changed or map is recalled, entire track reappears unless data clear has been depressed.
Alphanumeric keyboard	These 16 keyswitches are used in selection of tabular displays on CRT and in modifying of parameter values on CRT pages. Keys labeled N, E, S, and W permit instructor to designate North or South for latitude and East or West for longitude. The dash or minus symbol is used to input a negative value or decrement when changing CRT pages. The period specifies incremental data and the asterisk is used to select options. In integrated mode, keyboard at gunner instructor station is not operational. Can select any CRT page but cannot edit.

Figure 7-23. CRT Display Control Panel (Sheet 3)



05614

Nomenclature	Function
CRASH indicator	When flashing, indicates to pilot/gunner that FWS has crashed, and/or is in crash override mode.
FREEZE switchlight	When depressed, freezes the FWS during a problem. Second depression releases freeze and starts the FWS at the same point where it was when FREEZE was initiated. If gunner initiates freeze, only pilot instructor/ operator or pilot can release the freeze. However, if GUNNER CONT switchlight is selected on pilot IOS and FREEZE is initiated by gunner, then anyone in either pilot or gunner compartments can release freeze.

Figure 7-24. Pilot/Gunner Control Panel (Sheet 1)

Nomenclature	Function
EMER STOP switchlight	When depressed, turns off all power to FWS. This switchlight is guarded with black barriers and a spring-loaded clear cover to prevent inadvertent actuation. Switchlight is illuminated when power is ON. All EMER STOP controls throughout simulator complex are functional at all times (lit red) regardless of simulator mode.
MOTION ON switchlight	Activates motion system, provided that interlocks are satisfied. This switchlight is lit while motion is on. On IOS console, SIM POWER ON must be on for this switchlight to operate. Interlock function includes access ramp. After switch activation, boarding ramp rises and clears motion platform before motion becomes operational. Prior to responding to mission flight control inputs, motion platform erects to neutral position. Neutral position is a point at which hydraulic cylinder legs are extended approximately halfway. Operation of this switchlight is not mode-dependent.
MOTION OFF switchlight	Deactivates motion platform. Motion platform returns at a controlled rate to neutral position prior to reaching settled position. This switchlight is lit when motion is off. Upon settling of motion system, boarding ramp is lowered and aligns with motion platform. Operation of this switchlight is not mode-dependent.

Figure 7-24. Pilot/Gunner Control Panel (Sheet 2)

Section IV. FWS TRAINING CAPABILITIES

7-10. GENERAL. The fight weapons simulator (FWS) includes supporting hardware and software to enhance user understanding of the training concept, aid problem control and monitoring, and provide a history for critique and evaluation of pilot/gunner performance. This hardware consists of a right IOS console CRT display, available disk memory storage of current training conditions and parameters, and a Versatec printer/plotter hardcopy output device. The temporary loss due to equipment malfunction of any part of this supporting hardware does not prevent training capability but does degrade the FWS operating efficiency to some extent.

7-11. PLOT STORE. During training modes, the displayed CRT contents can be stored (referred to as a snapshot) on disk for later recall or hardcopy print on the Versatec printer.

a. A total of 20 such snapshots from either or both cockpits can be made before a print plot is requested. A snapshot is recorded whenever the IOS console STORE PLOT switchlight is depressed. The current number of snapshots is displayed on the CRT.

b. During a checkride, segment data automatically initiates plot store at various points in the checkride. In addition, the instructor can initiate plot store at any time.

c. Snapshots can be cleared by printing them or by editing PARAM/FREEZE/ ENVIRON CRT page 20, line 23. (See figure 7-15.)

7-12. PRINT PLOT. Either during or at the conclusion of the training exercise, a printout of the stored snapshots can be requested from the printer by depressing PRINT PLOT switchlight.

a. This can be initiated with the FWS either on-line or off-line. If hardcopy prints are needed immediately without interruption, then it may be desirable to switch the FWS off-line for dedicated printout time. During on-line operations when computer background time becomes available, the snapshots in memory are converted and begin to print out automatically. No loss of data occurs if the printout process is interrupted when computer time is required for running the training exercise (foreground time). When background time again becomes available, the printout resumes. If defects show up in the completed hardcopy printout, the snapshots can be printed over again since the data remains held in memory as long as no additional STORE PLOTS have been initiated. When a printout is completed, memory storage of snapshots is erased when the next STORE PLOT command is initiated.

b. Either instructor/operator can initiate a PRINT PLOT command regardless of the operating mode. It should be noted that when PRINT PLOT is initiated, no additional snapshots can be taken until the printout is done. However, if it becomes necessary to obtain a particular snapshot, then depressing the PRINT PLOT button again (to a non-illuminated state) halts the printing and a snapshot can then be taken. The plots printed out and the one currently interrupted is not erased from memory if additional STORE PLOTS are initiated. They are added on, providing the total number stored does not exceed 20.

7-13. CRT MAP DISPLAY. Progress of the FWS within the simulated geographical areas is plotted relative to radio navigation facilities in either a game-centered or aircraft-centered plot mode. One cross-country and ten approach backgrounds are available for map-centered displays. These area maps are referenced on the INDEX page as CRT pages 30 through 40. (Figures 7-25 and 7-26 are typical cross-country and approach maps.)

a. During a demonstration or a checkride, map selection is automatic; i.e., called up by the computer based on data stored in memory. During a demonstration, the map is displayed as it was selected, scaled, and centered during the formulation of the demonstration. Similarly, during a checkride, the cross-country or approach is displayed for the appropriate map center. The instructor/operator also has the option to depress ACFT CENTER and rescale the map display manually.

b. During training mode operation, map selection is left to the discretion of the instructor/operator. Maps are selected by dialing the appropriate map number from 030 to 040 on the three-digit thumbwheel selector and then depressing the INSERT switchlight or by typing the appropriate number on the keyboard and then typing ENTER.

c. The cross-country plot is scaled 128 by 128 nautical miles with 2 and 4-power expansion capabilities. Approach plots are scaled 32 by 32 nm with 2 and 4-power expansion capabilities. Elapsed time history marks are automatically inserted along the ground track once each 5 minutes. Out-of-tolerance alerts are drawn adjacent to the track as required. The instructor/operator can temporarily erase previous history to unclutter the CRT.

7-14. GROUND-CONTROLLED APPROACH DISPLAY. The CRT display of the GCA map is shown in figure 7-27.

a. The GCA display can be called up by either selecting 045 on the thumbwheel selector and then depressing the INSERT switchlight or typing 45, ENTER on the keyboard. Azimuth and glidepath-stylized plots are presented when altitude is less than 4500 feet above ground level, the range less than 10 nautical miles, and within a given number of degrees of the approach course. (See Paragraph 7-14c below.)

b. A maximum of five text lines of precision approach radar (PAR) commands can be displayed in the area below the glidepath plot and left of the azimuth plot. If any line contains no information that is useful to the current program, the line is blanked and the lower lines move up. PAR commands consist of the following:

(1) Line 1, variable message, consists of short statements concerning the progress of the aircraft in the PAR mode. The message is displayed for 30 to 60 seconds; then line 1 is blank. Variable messages may consist of:

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

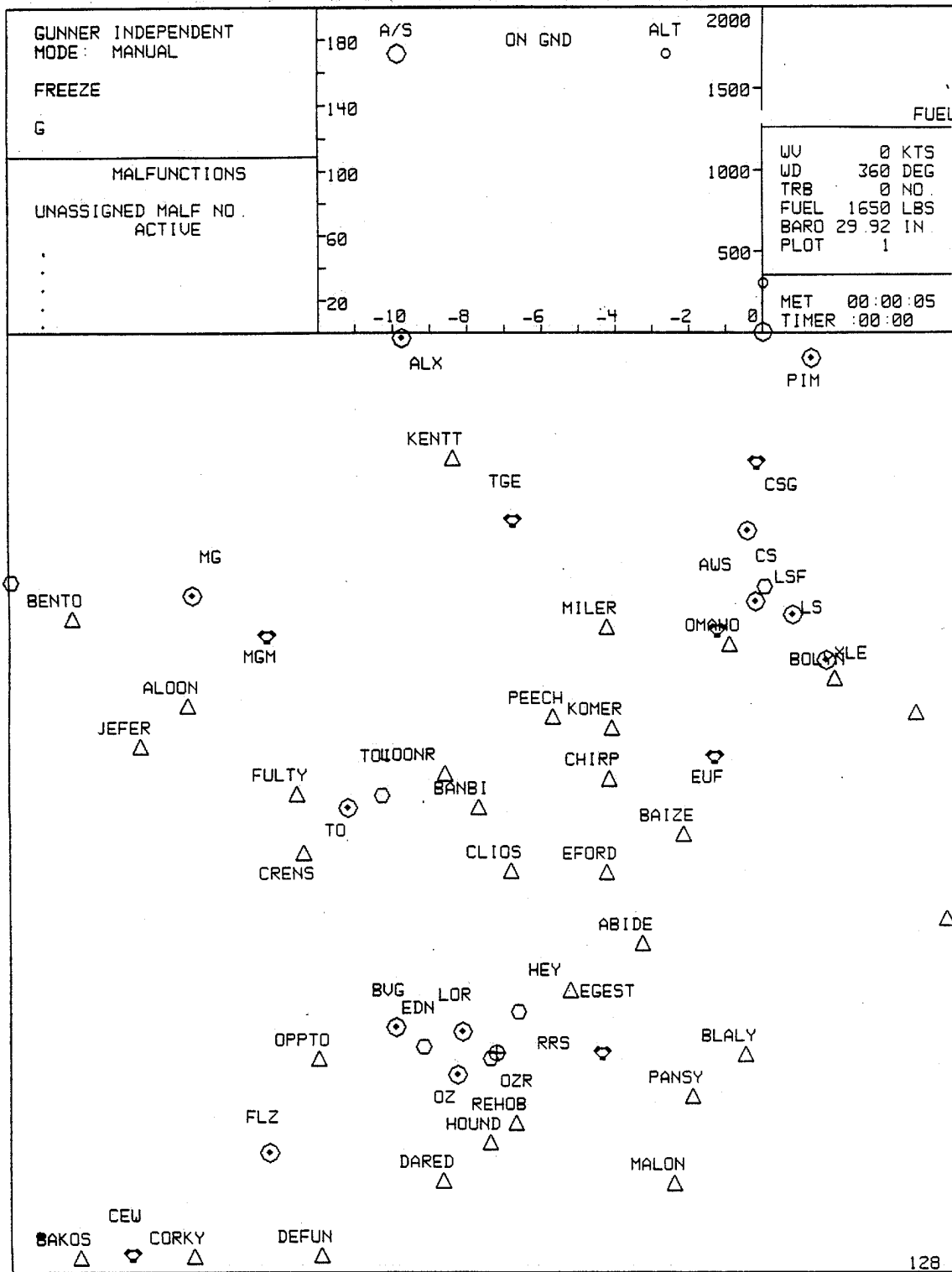


Figure 7-25. Cross-Country Map Page 030

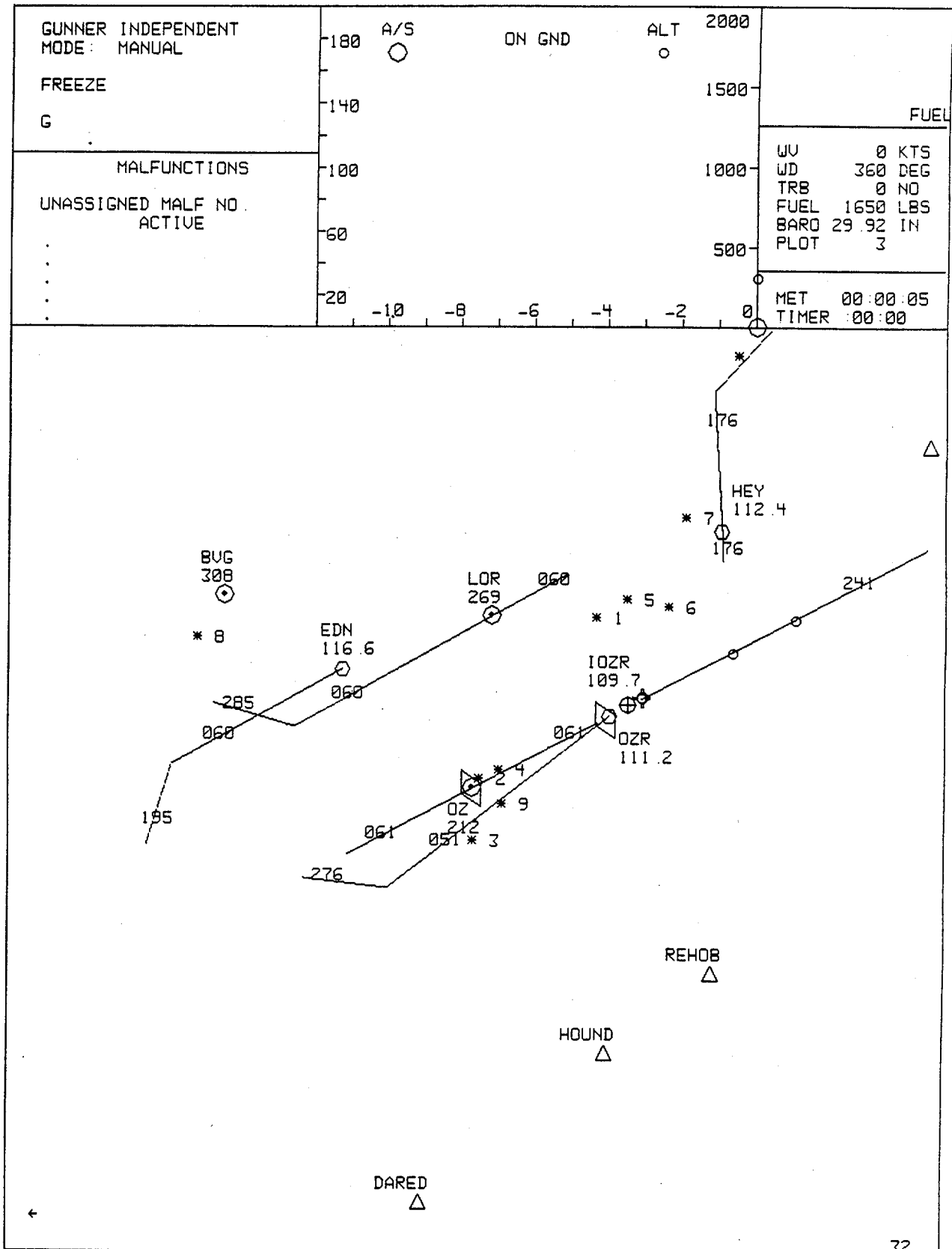
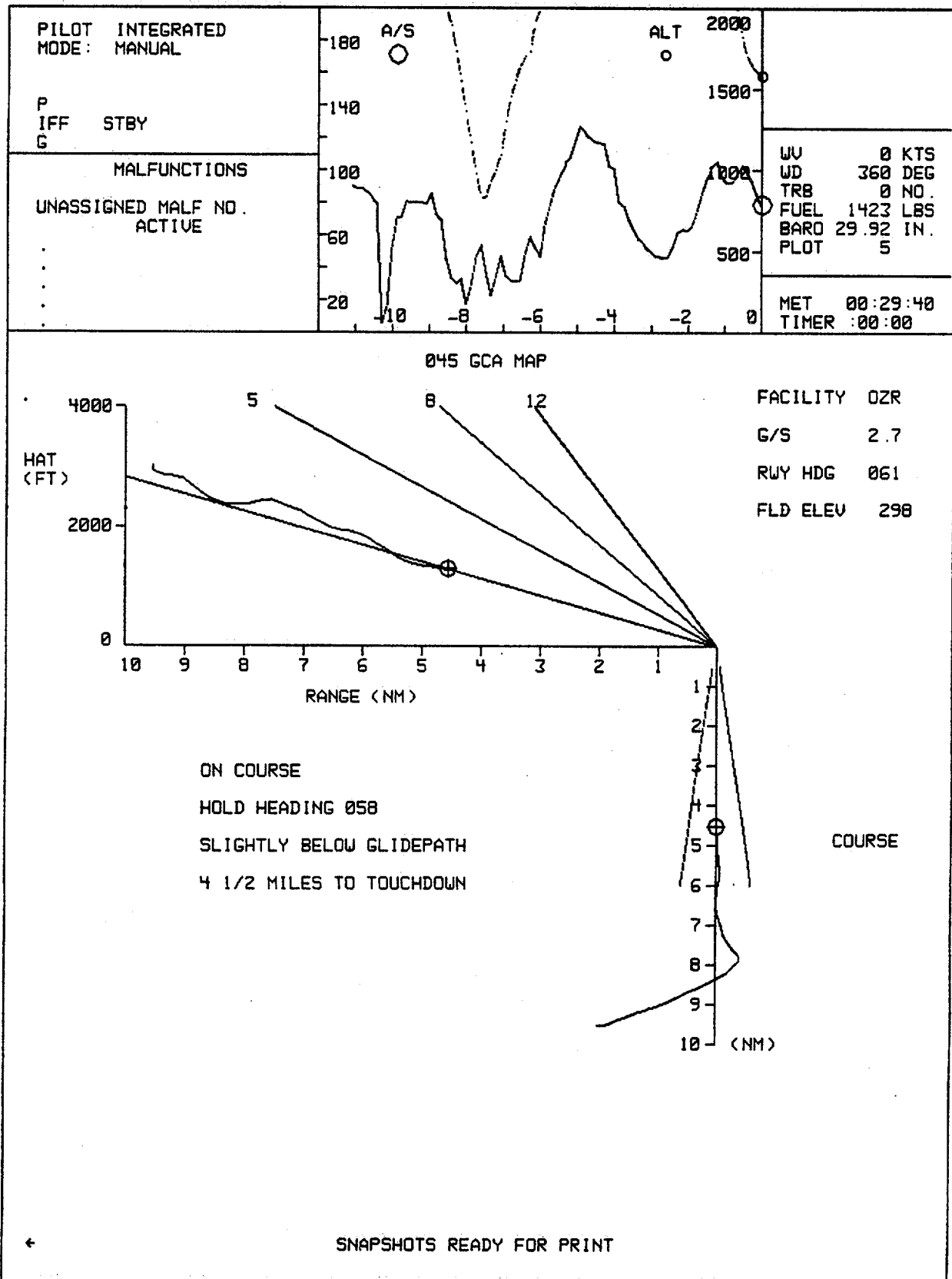


Figure 7-26. Cairns Approach Map Page 032



10879

Figure 7-27. Ground-Controlled Approach Page 045

- (2) Line 2, course information message, may consist of:

On course error less than 0.50 Slightly left/right of course error less than 1.50 Well left/right of course error greater than 1.50

- (3) Line 3, glidepath information message, may consist of:

On glidepath error less than 0.280 Slightly above/below glidepath error less than 0.420 Well above/below glidepath error greater than 0.420

- (4) Line 4, touchdown distance information message, indicates distance in nautical miles to touchdown. The number is expressed as a mixed number with a fractional readout update in 1/4-mile increments.
- (5) Line 5, turn to heading information message, consists of steering commands that vector the aircraft either on course during surveillance mode or steering commands to stay on course during the PAR mode.

c. Switching to GCA display 045 too early during approach on pattern vectoring may cause misorientation to airfield other than destination selected. It is recommended that aircraft symbol be vectored to within 10 NM of desired destination airfield, within 10 degrees of final approach course centerline and aircraft heading within 15 degrees of final approach course heading before switching to GCA page 045.

7-15. RADAR EMITTER THREATS AND WEAPON CONTROL. The instructor/operator has available editable CRT pages to effect hostile target selection, radar emitter threats to the aircraft, and assignment of the weapon loading configuration.

a. Threat array CRT page 025 (figure 7-28) and threat window array page 026 (figure 7-29) provide the instructor/operator with 10 different ground radar emitter threats to the aircraft. These CRT pages describe the type, activity level, location, and the directional scanning area for each emitter site. The degree of activity can be edited for either manual or automatic mode and applies to the three closest sites relative to the position of the aircraft. Line 11 on CRT page 025 is not editable and serves only as information as to the mode of operation. Manual or auto mode is selectable on CRT page 050, line 08 or on CRT page 61, line 6. For the automatic mode, when radar emitter contact with the aircraft is made, the degree of activity advances automatically and, after certain time delays, shoots down the helicopter unless evasive maneuvers are performed by the student. Manual mode allows the instructor/operator full control for advancing or delaying the degree of activity. The system power status line item on page 025 indicates the status of the APR-39 radar signal detector set. The APR-39, when turned on, provides a visual and audible warning to the student pilot that an emitter threat has made contact with the aircraft.

b. Three of the ten radar emitters are collocated with scorable targets (see figure 7-30) and are visually represented on the model board. Two other targets are collocated with figure representations on the model board, but are not scorable. That is, they can be fired upon but the scoring will be against one of the other selected targets elsewhere, and the student performance will be judged grossly in error. The remaining five radar emitters are scattered off the model

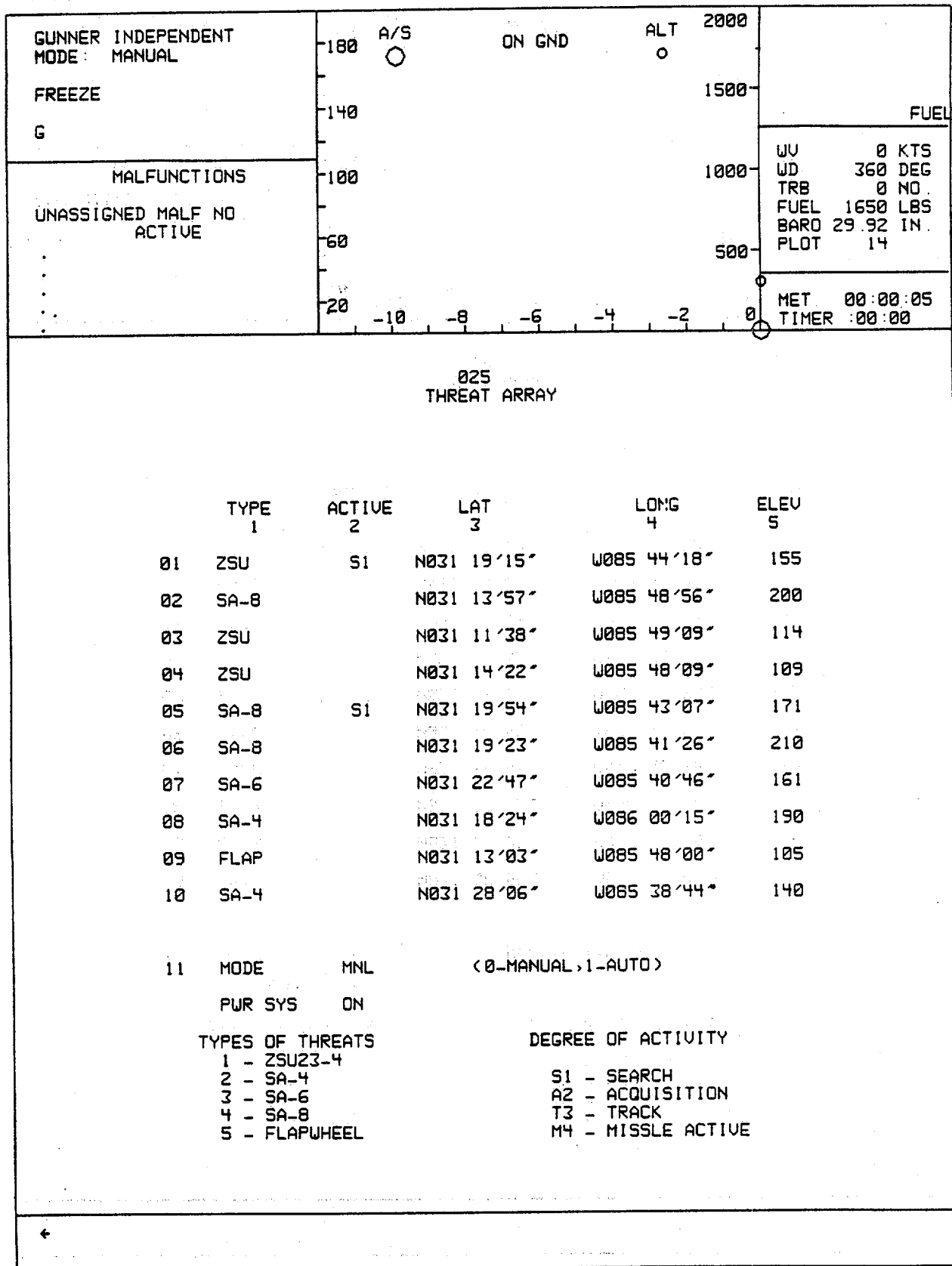
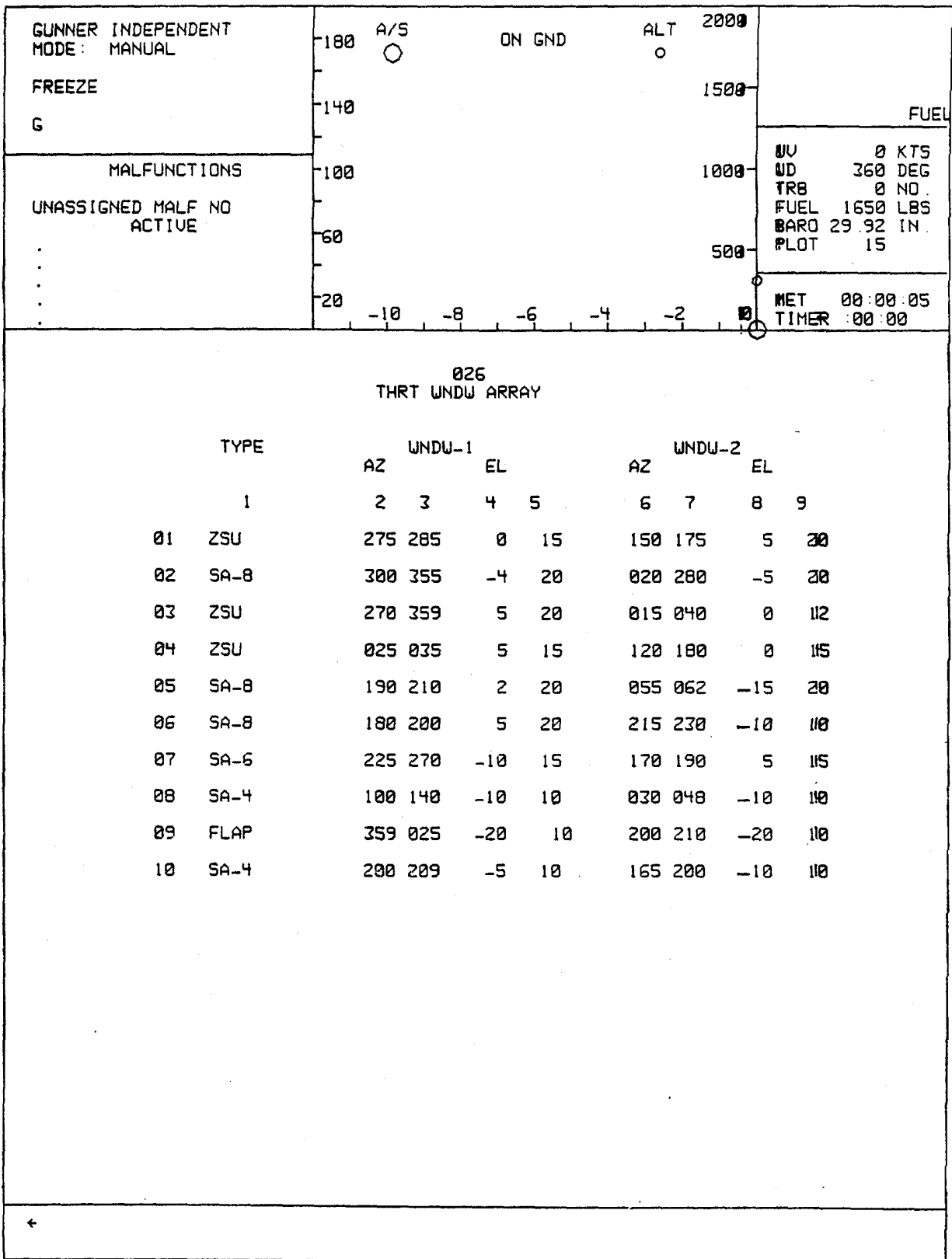


Figure 7-28. Threat Array Page 025



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Figure 7-29. Threat Window Array Page 026

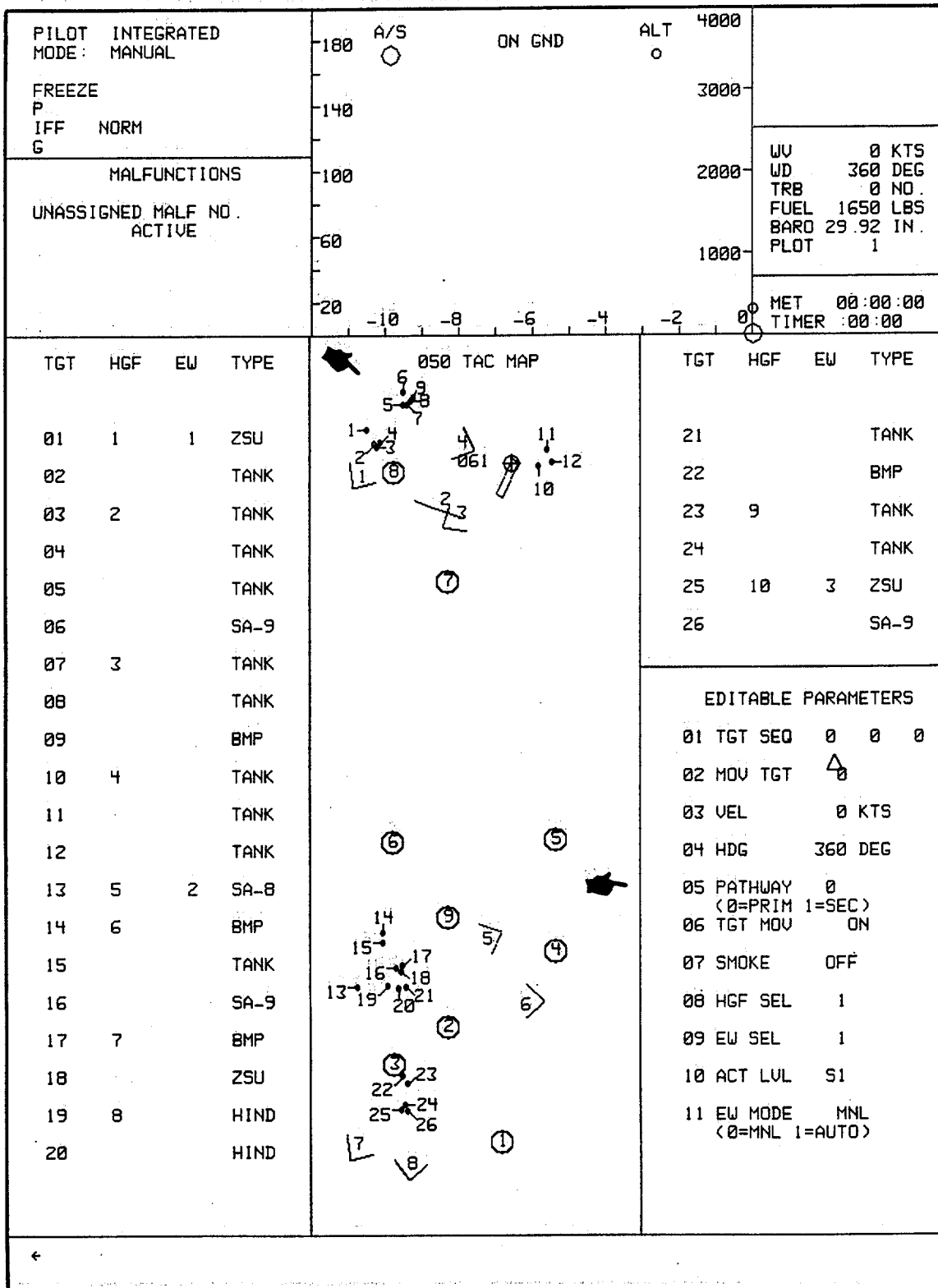


Figure 7-30. Tactical Map Page 050

board but within the boundaries of the instrument gaming area. The threat emitter defined parameters on CRT pages 025 and 026 are editable. However, editing can result in confusion for both the instructor/operator and the student, since the latitude, longitude, elevation, and window parameters must be directly related to and correspond with the actual terrain of the model board. This also applies to the emitter window parameters. Ideally, when it is desired to set up new threat array location(s), editing can be performed at the CRT, and when all new parameters are realistic and compatible, a software change can be made off-line. Editing on CRT page 025 and 026 is accomplished by entering line and column numbers, space, new parameter, enter. For example: To change EW threat 01 activity level to acquisition, do: 1, 2, space, 2, enter, on alpha-numeric keyboard.

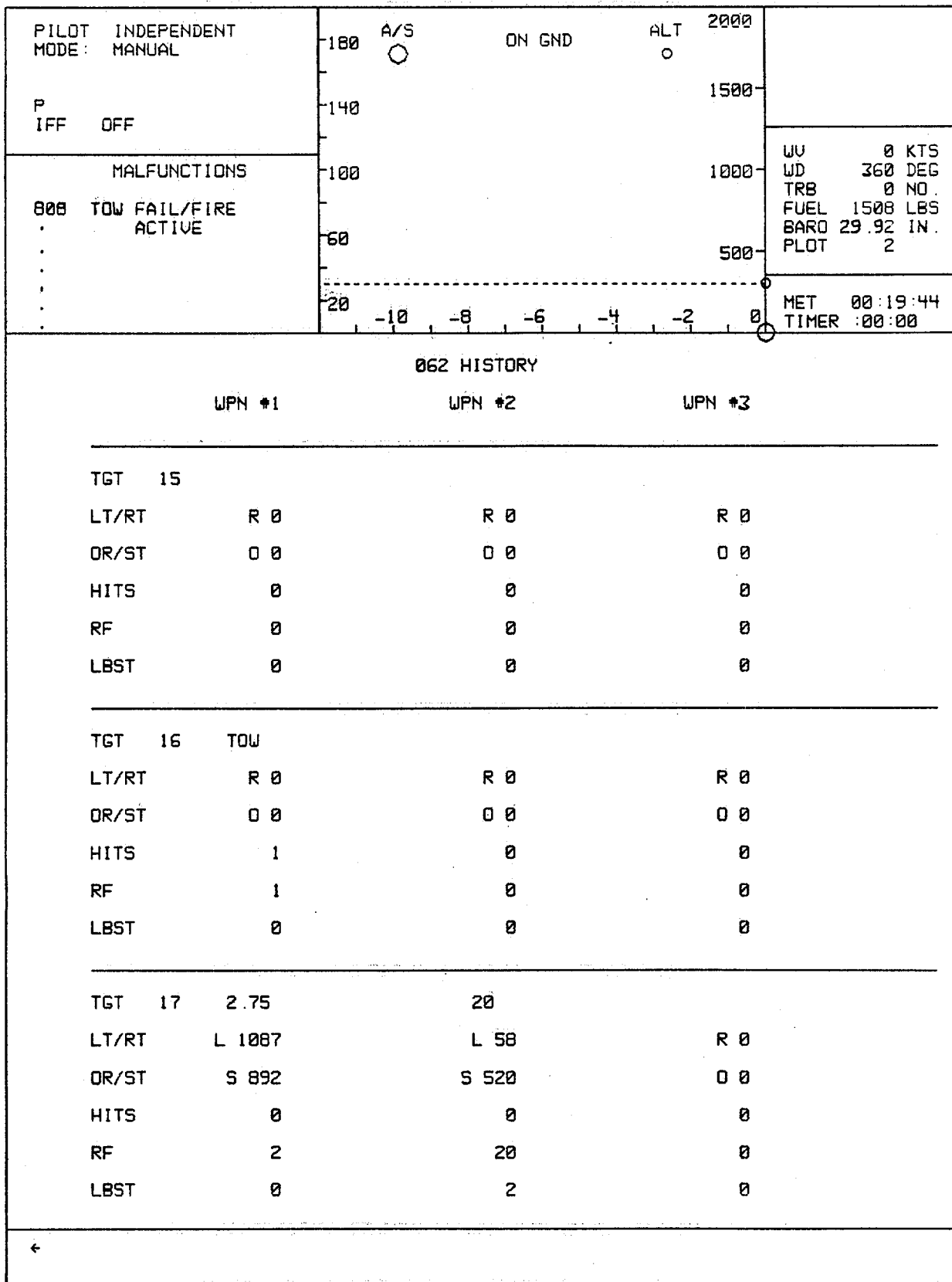
c. Ground targets are provided in the visual scene in the form of military vehicles, buildings, etc., and weapon targets. Up to three targets in sequence can be selected by the instructor, with one as a moving target to be displayed on the TSU. For scoring purposes, the selected target on the TSU is always considered broadside and perpendicular to the line-of-sight of the aircraft. Tracers impacting or overlaying the target are scored as a hit. Tracers not overlaying or impacting the target are scored as a miss. The scorable target of interest is selected by activation of the target advance switchlight. This action causes the target designator symbol (A) to advance to the next available target in the sequencing line (see figure 7-13 and figure 7-30). This can be accomplished on CRT page 050 or CRT page 061. Three scoring bugs (one for each weapon system) are depicted on CRT page 061. When threat is advanced, scaling information is transposed to Student History page 062.

d. Weapon loading is selected by the instructor/operator on the configuration display CRT page 060 (figure 7-12). Ten different weapon loading configurations are available. The current status of the weapons mission control and remaining armament at each aircraft weapon station is presented on the performance display CRT page 061 (figure 7-13). At the lower central portion of the CRT page is a listing of the selected weapons configuration including the number of rounds remaining. Also included at the bottom of the page are several editable lines for target sequence, weapon configuration, and laser parameter selection.

7-16. COMMUNICATIONS FACILITY DATA. Communications facility data is displayed whenever a map is selected for one of the approach plots.

a. Approach map facility data consists of field elevation, departure and approach control frequencies, tower frequencies, and ground control frequencies. All communications facility data is shown on the appropriate map displays.

b. When operating in checkride, the CRT displays the instructor-provided communications scenario for each checkride segment or leg. The DISPL ADV switchlight allows the instructor/operator to inspect upcoming scenarios, and the DISPL REV switchlight allows the instructor to inspect past scenario pages on a page-by-page basis each time the appropriate switchlight is depressed. When a checkride segment advance occurs, the appropriate page for that segment is automatically displayed. All communications scenario messages are shown with appropriate checkride parameter information on the CRT page display.



10683

Figure 7-31. Student History Page 062

7-17. NAVIGATION FACILITY DATA. Seven groups of navigation facilities are available, one group of which is not specified (FM). The groups and the related CRT display page numbers are as follows:

(910)	LF/ADF
(920)	VOR
(930)	GCA
(940)	ILS-LOC
(950)	ILS-OMB
(960)	ILS-MMB
(970)	FM

a. The facility groups above are identified on their respective CRT pages. A typical page is shown in figure 7-32. From any facility group page other than 970 (FM), subpages are accessed on the CRT by typing in the line number and depressing ENTER. A typical subpage, shown in figure 7-33, provides specific information for the navigation facility selected. Other subpages within the group may be accessed by depressing the DISPL ADV or DISPL REV switches as desired. To leave the navigation facility subpage to access other CRT pages, first depress ENTER to access the INDEX and then select the desired page.

b. FM facilities are defined on CRT page 970. When called, the first two facilities contain no defined data allowing two FM stations to be located anywhere in the game environment. The third facility is defined and not editable. This station provides homing to the stagefield. No subpages exist for these facilities.

7-18. DEMONSTRATION. The simulator has the ability to demonstrate maneuvers and techniques using prerecorded exercises of actual flight maneuvers. This is resident on disk memory along with accompanying audio commentary recorded on cassette magnetic tape. In the independent mode, audio is not available to one cockpit if the other cockpit is already using the same demonstration.

a. The instructor/operator cannot edit the CRT pages. IOS switches applicable to motion, visual, communications, and CRT selection remain operational. During the demonstration playback mode of operation, the FWS is under computer control. The commentary remains synchronized (i.e., pauses, when the demonstration is frozen). There are up to nine maneuver marks per demonstration; these are intermediate points from which a demonstration or portion thereof can be initiated. If demonstration audio is not available, a message on the bottom of the IOS CRT alerts the instructor/operator. If a demonstration is requested for an intermediate point, accompanying audio will not be available.

b. When a demonstration is selected, the CRT displays the appropriate page(s) that were programmed during the recording.

c. In independent mode, actuation of the AUTO FLIGHT switchlight at the gunner IOS CRT console, before selection of a demonstration or maneuver, allows the pilot portion of the demonstration to control and fly the gunner cockpit while the gunner trains in his specific tasks.

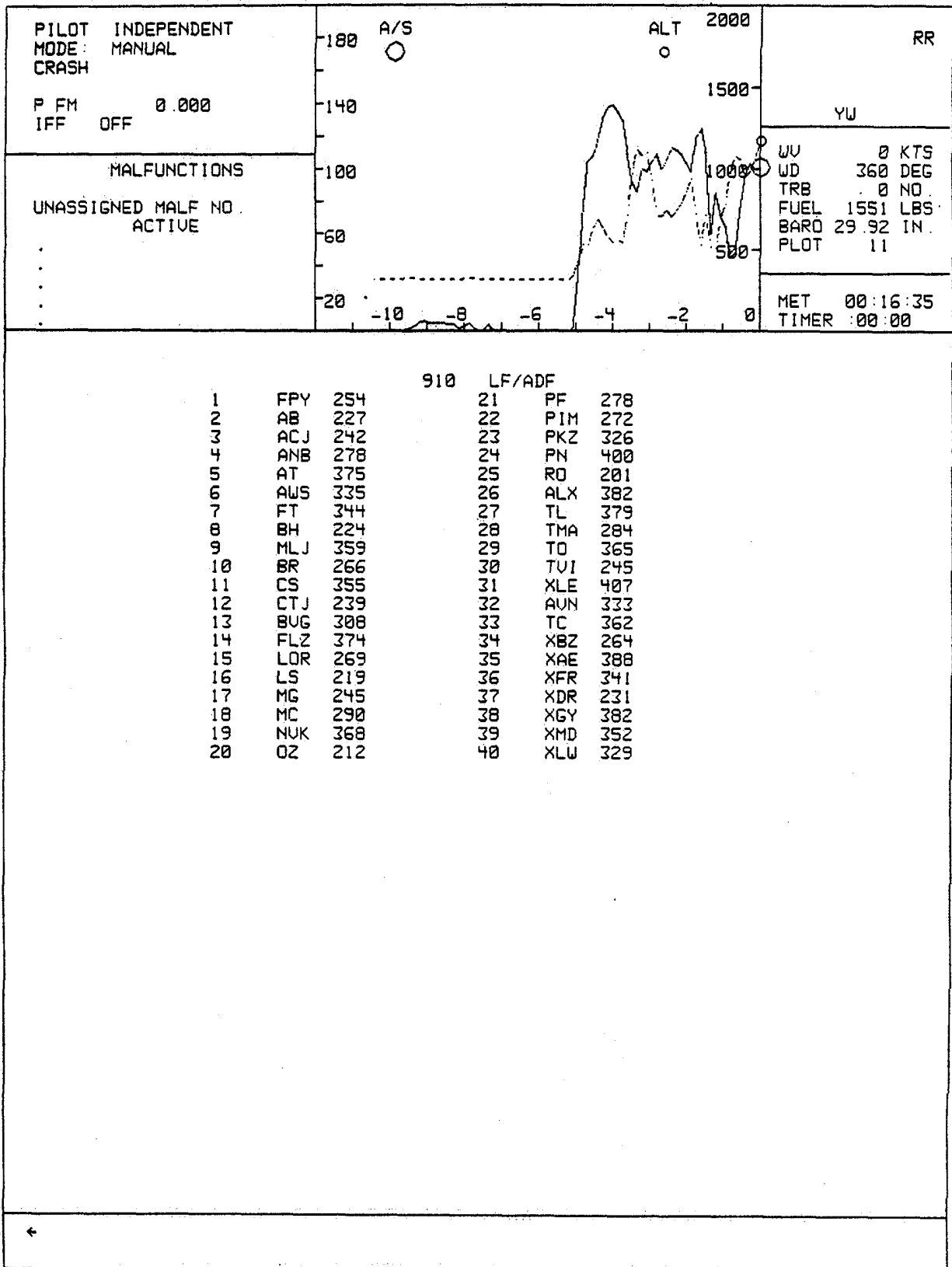


Figure 7-32. Typical Navigation Facility Page

PILOT INTEGRATED MODE: MANUAL	180 A/S ON GND ALT 2000 ○	1500	
P FM 30.000 IFF NORM G	140		
MALFUNCTIONS	100	1000	WIND 0 KTS WD 360 DEG TRB 0 NO. FUEL 1543 LBS BARO 29.92 IN. PLOT 2
UNASSIGNED MALF NO. ACTIVE	60	500	
.	20	0	MET 00:16:13 TIMER 00:00
ADF STATION DATA			
GA ALB-DO NDB4 ABY			
STATION	2		
CALL	AB		
LAT	N031 27'22"		
LONG	W084 16'35"		
TDZ ELEV	196		
MAG VAR	-0.20		
FREQUENCY	227.0		
RANGE	532		
PRINT DONE . CAN REPRINT OR STORE/PLOT			

11292

Figure 7-33. Typical Navigation Facility Subpage

7-19. PERFORMANCE MONITORED TOLERANCES. Monitored tolerances of a student's performance during a checkride are specified for each segment at the time of formulation. The checkride monitor display indicates both desired value and tolerance applied for each segment. Training tolerances are based on values not to exceed (VNE) and are shown in table 7-1. These tolerances may be changed by rewrite of the software program. The VNE monitor is operable in either training or checkride modes. The VNE automatically triggers alert messages that are displayed on the CRT.

7-20. AUTOMATED CHECKRIDE. Tactical checkrides, a visual flight rules (VFR) checkride, and an instrument flight rules (IFR) checkride are available to the pilot in the independent mode or to both the pilot and gunner in the integrated mode. During a checkride, the Instructor/operator can perform no editing functions that can vary the difficulty or alter the exercise. The Instructor/operator is required to perform certain duties that cannot be performed by the computer. These duties are primarily associated with providing air traffic controller (ATC) communications or necessary crew communications. The Instructor can also override and advance schedule segments at any time, regardless of trainer status or trainee performance, by depressing CHKRD SEG ADV switchlight or inhibit malfunctions during exercises by actuating the MASTER MALF CLR/INH switchlight.

a. An automated checkride consists of a series of predetermined maneuvers with associated parameters entered in memory against which a set of predetermined performance standards are specified. Each checkride is segmented into exercises. The Instructor can select the whole checkride or any of the exercises. The pilot/gunner flies the FWS and is evaluated by the computer program to the degree, frequency, and duration of deviation from predefined performance tolerances. When an exercise is selected, automatic monitoring is limited to the parameters defined for the selected exercise. The program prints out error data regarding pilot/gunner performance of each segment during the checkride. The Instructor can use the printout for evaluation and critique of the pilot/gunner performance. Hardcopy printout consists of errors detected for each checkride segment along with the MET at the end of the segment monitored. In addition, snapshots (stored plots) of the CRT can be printed out by the Versatec printer that show ground track, air-speed, altitude plots, plus status and time.

b. During a checkride, the segment or leg display is presented automatically. The display contains the communications scenario of ATC messages and briefs, the segment description, performance monitoring data for the leg, and information on the next leg. The segment description contains the numerical designation of the leg and a brief description of the maneuver performed during the leg. The right column of the display is reserved for pertinent remarks and when necessary an expanded description of the leg. Related map, weapon scoring, or GCA displays are preprogrammed as appropriate. This graphic display is available to the Instructor/operator by actuation of the INTERCHANGE DISPL switchlight. After a second actuation of this switchlight, the display returns to the leg display. At any time, the Instructor/operator can override the automatic advance of the segment display by selecting a specific numerical designation during the checkride. The Instructor can step forward or backward through the checkride segments by depressing the DISPL ADV or DISPL REV switchlights.

Table 7-1. Values Not To Exceed

Parameter	VNE low limit	VNE high limit	Crash trigger
Roll	60° left	60° right	Exceeds limits of 250 left or right when skid height is less than 10 ft in altitude
Pitch	2 ball widths left	2 ball widths right	Exceeds limits of 600 nose up or 800 nose down for normal in-flight conditions; exceeds 130 nose up or 250 nose down when skid height is less than 10 ft in altitude
Yaw	2 ball widths left	2 ball widths right	N/A
Yaw Rate	- 80°/sec	+80°/sec	Turn rate exceeds 1000/sec when skid height is less than 10 ft in altitude
Altitude	N/A	14000 feet	N/A
Airspeed	-30 knots	+170 knots	Exceeds limits of -35 knots or 40 knots lateral left or right when skid height is less than 10 ft in altitude; exceeds 200 knots for normal in-flight conditions
Vertical Velocity	- 2000 ft/min	+2000 ft/min	Landing descent of more than -600 ft/min at skid touchdown
Rotor Torque	0%	100%	Exceeds limit of 120%
Rotor RPM (emergency)	91%	105%	Rotor rpm limits of greater than 109% or less than 53% under normal flight conditions
Rotor RPM (automatic)	97%	101%	
Fuel	160 lb.	1750 lb.	N/A
G Load	N/A	N/A	Greater than 3.5 at pull out of dive condition

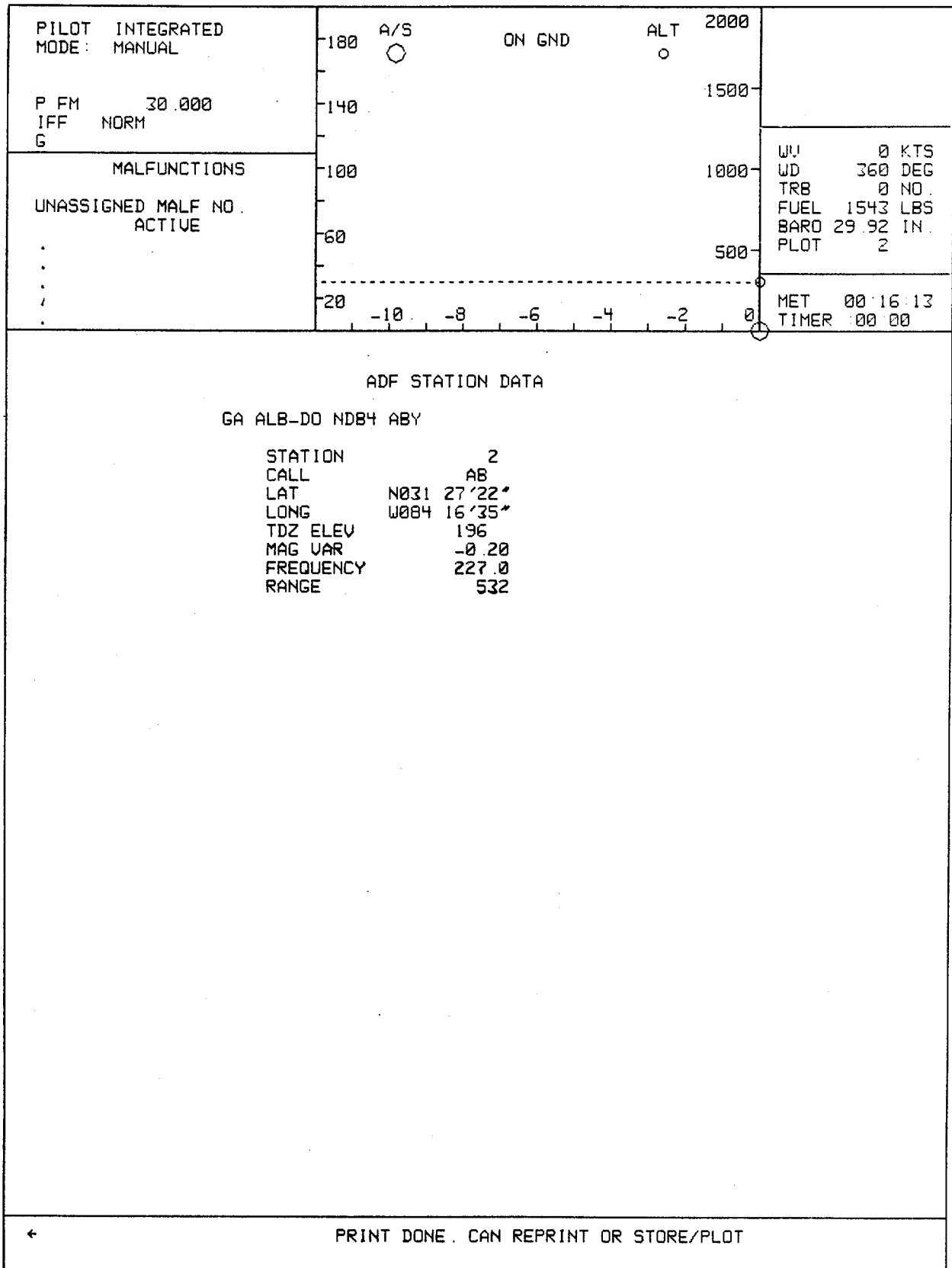
7-21. CHECKRIDE DISPLAY. During a checkride, the CRT display automatically presents and updates checkride maneuver requirements and pilot/gunner performance for each segment. In addition, the CRT presents information, as typically shown in figure 7-34, on accumulation of error for the monitored segment as follows:

- a. Lines 1 through 6, when all applicable, display maneuver number, maneuver description, segment end conditions, and parameter values and tolerances that the monitor program checks.
- b. Line 7 displays MET.
- c. Lines 8 and 9 consist of header titles describing monitored parameters formatted:

PARAM ID	CURRENT VALUE	CURRENT DEV	MAX OOT VALUE	FREQ OOT	TOTAL TOT
-------------	------------------	----------------	------------------	-------------	--------------

7-22. PILOT/GUNNER PERFORMANCE ERROR PRINT SYSTEM. Pilot/gunner performance errors are printed on the Versatec printer in the computer room whenever the ERROR PRINT SYS ON switchlight at the left IOS console is illuminated, printer is turned on, and chemicals and paper loaded. Pilot information is printed to the left and gunner information to the right in independent mode. Both are printed to the left in integrated mode. Figure 7-35 is representative of a typical error printout summary page. During a checkride, the checkride monitor data is printed at segment end. During training or checkride operations, the system prints a log of gross pilot error (VNE) and the time of occurrence. The printout also indicates when any VNE returns to within the normal envelope of allowed limits.

7-23. INTERCOMMUNICATION SYSTEM. Private communications between Instructors, computer room, and observer is provided via an intercommunication system (ICS) network.



11292

Figure 7-34. Typical Checkride CRT Display.

00:07:23	IFR	046		A/S			
00:07:37	IFR	046		A/S		TR	
00:07:56	IFR	046				TR	
00:08:15	IFR	050					
053	DESCENT	ROT	720PS	IAS 100+-10K		CONTINUE DESCENT	
				ALT > 1900'		START INBOUND TURN	
				ROD 500+-100FPM			
MET	00:09:10	MANUAL ADVANCE					
PARM	CURRENT	CURRENT	MAX OOT	FREQ	TOTAL		
ID	VALUE	DEVIATION	VALUE	OOT	TOT		
IAS	95:37						
ALT	1875.0	25.0	1870.0	1	3		
ROD	450.5						
057	LEVEL TURN	HDG	249+-1DEG	IAS 100+-10K		CONTINUE TURN	
				ALT > 1600		START NDB APPROACH	
				ROT 3+-1DPS		START DESCENT TO 160	
MET	00:11:05	MANUAL ADVANCE					
PARM	CURRENT	CURRENT	MAX OOT	FREQ	TOTAL		
ID	VALUE	DEVIATION	VALUE	OOT	TOT		
IAS	95.02						
ALT	1650.0						
ROT	4.06	0.06	4.06	1	5		
00:15:19	IFR	062		PT			
00:20:01	IFR	067					
069	LEVEL FLIGHT	AOB 10DEC		IAS 100+-10K		START APPROACH. TURN	
	ALL	TIME 3SEC		ALT 2000+-100'		OUTBOUND FROM CAIRNS	
						OUTER COMPASS LOCATOR	
MET	00:21:32	MANUAL ADVANCE					

05629

Figure 7-35. Typical Error Printout Summary Page

7-24 ENVIRONMENTAL CONDITIONS. During a normal training mode of operation (not checkride or demo), outside air temperature (OAT), barometric pressure, wind, day/ dusk or night visual condition, turbulence level, visibility range, ceiling, and cloud thickness can be changed by editing the current conditions pages 020 or 021 on the CRT. Using the keyboard, the appropriate line is edited by typing line number, space, new value, and then ENTER. Parameters such as lighting, seat shaker, and APU are controlled by inputting numerical values of 1 for ON and 0 for OFF.

7-25. PARAMETER FREEZE. Aircraft flight parameters can be selectively frozen at the IOS by editing lines 1 and 3 through 11 on the current conditions CRT page 020. Frozen parameters are flagged by an asterisk symbol (*). To freeze a parameter, use keyboard to type line number, space, * (asterisk symbol), ENTER. To unfreeze a parameter, use keyboard to type line number, space, ENTER.

7-26. SOUND LEVELS. The environmental aircraft sound level, edited using number 0 through 9, can be changed by editing the current conditions CRT page 020. This requires using the keyboard to input line number, space, (0-9), ENTER.

7-27. FREEZE/CRASH OVERRIDE. The Instructor/operators and crew have the capability to place the simulator in a freeze condition if a problem arises or to allow time for explanation or instruction. A CRASH OVERRIDE switchlight, available only to the Instructor/operator, bypasses computer command so that the simulator does not enter a crash freeze condition if Student performance exceeds established limits. Motion cueing is not available in crash override.

a. All action of the FWS can be frozen at any instant by depressing the FREEZE switchlight at either the IOS or pilot/gunner control panels. The FREEZE switchlight illuminates steady when the freeze mode is active. The freeze condition can be removed by redepressing the FREEZE switchlight.

b. Unusual conditions of attitude, rotor rpm, airspeed, vertical speed, torque, or combinations of the preceding can trigger a simulator crash. If a crash occurs, the simulator is placed in a crash freeze mode indicated by blinking of CRASH switchlights at the pilot/gunner control panels and the CRASH OVERRIDE switchlight blinking at the IOS. The FREEZE switchlight illuminates steady. Depression of the FREEZE switchlight does not override the crash status. The crash can be eliminated by initialization of an IC set or bypassed by use of the CRASH OVERRIDE switchlight. Depression of the CRASH OVERRIDE switchlight reverts the simulator to a normal freeze status. If the CRASH OVERRIDE switchlight is selected (illuminated steady) during a training exercise and the pilot/gunner triggers a simulator crash, the only indication is a blinking CRASH message in the upper left cockpit status area of the CRT display. The Instructor/operator can then manually freeze the FWS if desired.

c. If a visual probe crash/fault occurs, the visual system goes into RETRACT mode that inhibits further mechanical movement of the system and presents an in-clouds scene to the FWS. (Refer to PROBE FAULT/CRASH reset switchlight functions in Section III of this chapter for details.) Should a visual probe crash/fault occur, the simulator will automatically enter a freeze condition.

Section V. SIMULATED MALFUNCTIONS

7-28. GENERAL. There are 207 simulated malfunctions available for the FWS systematically arranged on 11 CRT pages. These pages are used to reference the malfunction for selection and possible insertion into the training exercise. Any of the 11 CRT pages can be displayed by typing the appropriate page number, ENTER at the IOS keyboard.

a. In the independent mode, neither Instructor can insert or delete malfunctions that affect the other cockpit. In the integrated mode, the pilot Instructor controls the malfunction for both cockpits and the gunner Instructor has no malfunction editing control. In either mode, insertion or deletion of malfunctions while in a freeze condition is not allowed.

b. Malfunctions as presented on the CRT pages that are associated with the pilot only are preceded by the letter P. Those applicable to the gunner only are indicated by the letter G. Malfunctions with no annotation are applicable to both.

c. A total of five malfunctions can be active simultaneously for each cockpit in the independent mode. In the integrated mode, five active malfunctions shared by both cockpits can be active simultaneously. When five are currently active and another malfunction is inserted, the oldest malfunction is automatically deleted and replaced by the new entry.

7-29. MALFUNCTION INSERTION. During checkrides, the selected preprogrammed malfunctions are automatically displayed when active. In the training mode, malfunctions can be inserted at the IOS control panel.

a. The thumbwheel is used to insert the applicable line number for the desired malfunction. A descriptive title of the malfunction and its number appear above and to the left in the malfunctions status area of the CRT display.

b. Depressing the INSERT switchlight above the thumbwheel inserts the malfunction into the system, and the description of the malfunction inserted appears in the malfunctions status area.

7-30. MALFUNCTION DELETION. Active malfunctions can be deleted at any time, except during freeze or when operating in the checkride mode, by either of the two following methods:

a. All active malfunctions can be deleted simultaneously by depression of the MALF/CLR/INH switchlight at the IOS control panel.

b. Selective deletion of active malfunctions can be made using thumbwheel selector as follows:

(1) The thumbwheel selector is set to the applicable line number for the malfunction to be deleted. A descriptive title of the selected malfunctions and their associated numbers appear above and to the left in the malfunction status of the CRT display.

(2) Depressing the DELETE switchlight deletes the active malfunction from the system and from the malfunctions status area of the CRT display. Active malfunction descriptions that are listed below the deleted description in the status area are moved up on the active malfunction list.

7-31. CLEARING MALFUNCTIONS. All malfunctions can be cleared by deletion except the ones that trip circuit breakers (CB). Circuit breakers must be manually reset after the malfunction has been deleted. When a CB malfunction is active, the circuit breaker cannot be manually reset. Actuation of the MALF/CLR/INH switchlight at the IOS control panel during an exercise clears all preprogrammed malfunctions until the switchlight is depressed again.

7-32. MALFUNCTION LIST. Table 7-2 lists the CRT line select number and descriptive title of the available malfunctions. Primarily, malfunctions are grouped by system in numerical order and shown as they are displayed on the CRT. The malfunction details in table 7-3 include the method of introduction, indications and effects on related systems, effects sensed by Student; prior to corrective action, and any corrective action that is required.

NOTE

Malfunction numbers 601, 603, and 763 are incorporated under malfunction number 572, and occur simultaneously. Independent selection of these malfunctions will have no effect on instrument indications on flight characteristics.

Malfunctions number 803 through 806 are not available. Independent selection of these malfunctions will have no effect on weapon system.

7-33. ICING MALFUNCTIONS. Icing malfunctions will occur or take effect in different ways:

- a. Instructor/operator selects the appropriate icing malfunction number and depresses INSERT.
- b. Instructor/operator reduces visibility (using VSBY range control) and monitors VSBY on CRT page 21 to an altitude of less than 2600 feet as trainer is flown into an icing condition.
- c. Instructor/operator edits free air temperature on CRT page 20 to less than 4.40C and/or trainer is flown to an altitude whereby the standard lapse rate reduces indicated temperature to less than 4.40C.
- d. The following are chronological steps and resultants of icing conditions:
 - (1) After 2 minutes, pitot/static stoppage occurs with airspeed decreasing at a rate of 1 Km/second (unless pitot heat is applied).
 - (2) After 4 minutes, additional power requirements are necessary to maintain altitude.
 - (3) After 6 minutes, rotor out-of-balance condition occurs as icing is asymmetrically shed from blades.
- e. Deletion of icing malfunction is accomplished as follows:
 - (1) Select DELETE; observe reverse chronological sequence of onset.

(2) When free air temperature is edited (page 20) to be greater than 4.4C, observe reverse chronological sequence of onset.

(3) When standard lapse rate increases temperature to a condition greater than 4.4C, observe reverse chronological sequence of onset.

Table 7-2. Malfunction List

350 Avionics Systems

351	P AI	362	P AN/APX100 KIT
352	G AI	363	P AN/APX100 ANT
		364	P AN/APX100 ALT
353	GYRO COMP INOP	365	P ADI GS INOP
354	COMP SLV INOP		
		366	P ADI FLIGHT DIR
355	P UHF XCVR		
356	G VHF/FM XCVR	367	P CRS OVERSEN
357	P VHF/AM XCVR	368	P HSI GS INOP
		369	P HSI NAV
358	P LF-ADF	370	P HSI RNG DISPLAY
359	P VOR/ILS/MB	371	P HSI BRG PTR #1
		372	P HSI BRG PTR #2
360	G DPLR RTA	373	P HSI HDG PRECE
361	G DPLR SDC		

400 Circuit Breakers

AC/ARM Panel

401	ADF RCVR-AC	414	TMS PWR-AC
402	ATTD IND PLT-AC	415	TURRET PWR-AC
403	GYRO CMPS-AC	416	HSS PWR-AC
404	RADIO BLWR-AC	417	LRP PWR-DC
405	SEL PWR-AC	418	TMS BLWR-DC
		419	TURRET DRIVE-DC
406	PWR FACTOR CORR-AC	420	TURRET GUN-DC
407	REF XFMR-AC	421	TURRET STOW-DC
408	28 VAC XFMR-AC	422	ALT PWR-AC
		423	ALT PWR-DC
409	ENG VIB METER-AC	424	HUD PWR-DC
		425	HUD BLWR-AC
410	SCAS PWR-AC		
411	ADS PWR-DC		
412	ADS ANTI ICE-AC		
413	FUEL QTY-AC		

Table 7-2. Malfunction List - Continued

400 Circuit Breakers - continued

DC Panel

426	G ATTD IND-DC	454	IGN SOL-DC
427	FM XCVR-DC	455	GOV CNTR-DC
428	VOICE SCTY-DC	456	IDLE STOP SOL-DC
429	UHF XCVR-DC	457	ENG DEICE-DC
430	ADF RCVR-DC	458	FIRE DETR-DC
431	VOR ILS-DC	459	TEMP IND ENG XMN-DC
432	VOR ILS-AC	460	TGT IND-DC
433	ICS PLT-DC	461	GAS PROD-DC
434	ICS GNR-DC	462	DUAL TACH-DC
435	IFF XPDR-DC	463	ECS CONTR-DC
436	DPLR NAV-DC		
437	UHF XCVR-DC	464	EMER HYD PMP-DC
438	RADAR ALTM-DC	465	HYD CONTR-DC
439	GEN FIELD-DC	466	SCAS PWR-DC
440	GEN BUS RESET-DC	467	FORCE TRIM-DC
441	DC VM-DC	468	TURN/SLIP IND-DC
442	P HTR-DC	469	ALTM-DC
443	SRCH LT CONTR-DC	470	RPM WARN-DC
444	ANTI COLL LT-DC	471	TRQ IND-DC
445	POS LT-DC	472	FUEL/OIL VALVE-DC
446	TRU-AC	473	FUEL BOOST FWD-DC
447	INV-DC	474	FUEL BOOST AFT-DC
448	SRCH LT PWR-DC		
449	CAUT LT-DC	475	IR JAM CONTR-DC
450	P INST LT-DC	476	IR JAM PWR-DC
451	G INST LT-DC	477	RADAR WARN-
452	CKPT LT-DC		
453	START RLY-DC		

480 Electrical System

481	P CMPLT ELEC FAIL
482	P DC GEN
483	FAULTY RELAY
484	P A/C INVERTER
485	P ALTERNATOR FAIL
486	P INSTR LIGHTS
487	G INSTR LIGHTS
488	P TRU FAI

Table 7-2. Malfunction List - Continued

500 Engine Instruments

501 P N1 TACH
 502 G N1 TACH
 503 ROTOR TACH
 504 N2 TACH

 505 P TRQMTR
 506 G TRQMTR

 507 P ENG OIL PRESS LOW
 508 P ENG OIL PRESS IND
 509 P ENG OIL TEMP IND

 510 P TURBINE GAS TEM

550 Engine Systems

551 P HOT START	562 OIL BYPASS
552 P HUNG START	563 SPARE
553 FLAMEOUT	564 BLD BAND STUCK OPEN
554 COMPR STALL	565 BLD BAND STUCK CLSD
555 FUEL CTL RPM GAIN	566 GOV SW HIGH SIDE
556 FUEL CTL RPM LOSS	567 GOV SW LOW SIDE
557 ENG OIL LOSS	568 ENG FIRE
558 ENG STARTER	569 P FIRE LIGHT
559 P INL GD VANE OPEN	570 ENG CHIPS
560 P INL GD VANE CLSE	571 ENG CHIPS LIGHT
561 ENG FUEL PMP	572 ICE

600 Flight Instruments

601 SPARE
 602 P TRN NDL

 603 SPARE

Table 7-2. Malfunction List - Continued650 Flight Control Hydraulic System

651 #1 HYD SYS
 652 #2 HYD SYS
 653 BOTH HYD SYS

654 P HDOVR SCAS-PITCH
 655 P HDOVR SCAS-ROLL
 656 P HDOVR SCAS-YAW

657 P MOTOR SCAS-PITCH
 658 P MOTOR SCAS-ROLL
 659 P MOTOR SCAS-YAW

660 P TOTAL SCA

700 Fuel System

701 P FUEL QTY IND ZERO
 702 P FUEL QTY IND STCK

703 P FWD BST PMP
 704 P AFT BST PMP

705 P CNTMTD FUEL FLTR

706 FUEL LOW LIGHT

707 P FUEL OVRCONSMP

750 Rotor/Transmission

751	MN RTR TRCK	759	XMN OIL BYPASS
752	MN RTR BAL	760	SHORT SHAFT
753	TL RTR HI FRQ VIBR	761	90 DEG GR BOX LOSS
754	LOSS OF TL RTR	762	TL RTR THRUST LOSS
755	TL RTR FIXED PITCH	763	SPARE
756	P XMN OIL-PRES HIGH	764	XMN CHIPS MALF
757	P XMN OIL-TMP HIGH		
758	XMN OIL PRES LOSS		
765	XMN CHIPS LIG		

Table 7-2. Malfunction List - Continued

800 Weapons Systems

801	20 MN FAIL/FIRE	818	ALT FAIL
802	20 MN RUNAWAY		
		819	LRF FAIL
803	7.62 FAIL/FIRE(LT)		
804	7.62 FAIL/FIRE(RT)	820	RMS FAIL
805	7.62 RUNAWAY(LT)		
806	7.62 RUNAWAY(RT)	821	LASER FAIL
807	JAMMED GUN TURRET	822	P AN/APR39 IND
808	TOW FAIL/FIRE	823	PARTIAL HUD FAIL
809	TOW HANG FIRE		
		824	G TOW BIT-MCA FAIL
810	2.75 FAIL/FIRE(LO)	825	G TOW BIT-EPS FAIL
811	2.75 FAIL/FIRE(LI)	826	G TOW BIT-SCA FAIL
812	2.75 FAIL/FIRE(RI)	827	G TOW BIT-TSU FAIL
813	2.75 FAIL/FIRE (RO)		
814	2.75 HANG FIRE(LT)	828	P HSS BIT FAIL
815	2.75 HANG FIRE(RT)	829	G HSS BIT FAIL
816	FCC FAIL	830	P HSS RETICLE FAIL
		831	G HSS RETICLE FAIL
817	HUD FAIL	832	HSS BIT-EIA FAI

Table 7-3. Simulated Malfunction Details

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>350 AVIONICS SYSTEMS MALFUNCTIONS</u>					
P AI	#351	Pilot attitude indicator frozen at last position.	N/A	Check CB in.	<u>Instructor</u> : P AI appears on CRT. <u>Student</u> :: Attitude indications remain unchanged or will be erroneous as aircraft move in pitch and roll.
G AI	#352	Gunner attitude indicator frozen at last position.	N/A	Check CB in.	<u>Instructor</u> : G AI appears on CRT. <u>Student</u> :: Attitude indications remain unchanged or will be erroneous as aircraft moves in pitch and roll.
GYRO COMP INOP	#353	Pilot gyrosyn compass frozen at last heading.	N/A	Check CB in.	<u>Instructor</u> : GYRO CMP INOP appears on CRT. <u>Student</u> :: Heading card does not move with changes in aircraft heading.
COMP SLV INOP	#354	Gunner RMI frozen at last heading.	N/A	Check CB in.	<u>Instructor</u> : COMP SLV INOP appears on CRT. <u>Student</u> :: Heading card does not move with changes in aircraft heading.
P UHPF XCVR	#355	No UHF signal reception	N/A or transmit.	Check CB in.	<u>Instructor</u> : P UHF XCVR appears on CRT. <u>Student</u> :: Transceiver not operative.
G VHF/FM	#356	No VHF/FM signal reception or transmit.	N/A	Check CB in.	<u>Instructor</u> : GVHF/FM CVRXCVR appears on CRT. <u>Student</u> :: Transceiver not operative

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>350 AVIONICS SYSTEMS MALFUNCTIONS - continued</u>					
P VHF/AM XCVR	#357	No VHF/AM signal reception or transmit.	N/A	Check CB in.	<u>Instructor</u> : P VHF/AM XCVR appears on CRT. <u>Student</u> :: Transceiver not operative.
P LF-ADF	#358	No identification or bearing information.	N/A	Check CB in.	<u>Instructor</u> : P LF-ADF appears on CRT. <u>Student</u> :: No reception.
P VOR/ILS/MB	#359	No glideslope, bearing, or localizer information.	N/A	Check CB in.	<u>Instructor</u> : P VOR/ILS/MB appears on CRT. <u>Student</u> :: No reception.
G DPLR RTA	#360	Doppler navigation set alphanumeric display indicator error. MAL panel light illuminates.	MEM panel light illuminates. TEST MODE SET for manual navigation of aircraft is presented.	Check CB .Initiate TEST MODE on the Doppler nav panel.	<u>Instructor</u> : G DPLR RTA appears on CRT. Switch off <u>Student</u> :: Erroneous velocity, position and steering infor-
S DPLR SDC	#361	Doppler navigation set alphanumeric display indicator error. MAL panel light illuminates.	MEM panel light illuminates. TEST MODE SET for manual navigation of aircraft. mation is presented.	Check CB .Initiate test mode on the Doppler nav panel. <u>Student</u> ::	<u>Instructor</u> : G DPLR RTA appears on CRT. Switch off Erroneous velocity,
P AN/APX 100 KIT	#362	NO-GO and KIT indicators illuminate while MODE 4 switch is set to TEST. Transponder not able to identify aircraft due to external computer malfunction.	N/A	None	<u>Instructor</u> :P AN/APX 100 KIT appears on CRT. <u>Student</u> :: Transponder panel status indicator shows fault.
P AN/APX 100 ANT	#363	NO-GO and ANT indicators illuminate when any mode switch is set to test. Transponder not able to identify aircraft due to problem with antenna.	N/A	None	<u>Instructor</u> : P AN/APX 100 ANT appears on CRT. <u>Student</u> :: Transponder panel status indicator shows fault.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
350 AVIONICS SYSTEMS MALFUNCTIONS - continued					
P AN/APX 100 ALT	#364	NO-GO and ALT indicators illuminate indicating failure is due to attitude digitizer. status indicator shows fault.	N/A	None	<u>Instructor</u> : P AN/APX 100 ALT appears on CRT. <u>Student</u> :: Transponder panel
P ADI GS INOP	#365	On attitude direction indicator instrument, slope indicator remains centered and GS (glide slope) flag reflect	N/A	None	<u>Instructor</u> : P ADI GS INOP appears on CRT. <u>Student</u> :: ADI does not
P ADI FLIGHT DIR	#366	On attitude direction indicator instrument, horizontal steering bar remains centered but FD (flight director) flag is out of view.	N/A	None	aircraft slope movements. <u>Instructor</u> : P ADI FLIGHT DIR appears on CRT. <u>Student</u> :: ADI horizontal steering bar does not reflect aircraft movements.
P CRS OVERSEN#367		Horizontal situation indicator course deviation bar sensitivity is increased by a factor of four. Similarly, attitude direction indicator horizontal steering bar is oversensitive by a factor of four.	N/A	None	<u>Instructor</u> : P CRS OVERSEN appears on CRT. <u>Student</u> :: HSI and ADI indications are difficult to center with aircraft under control.
P HSI GS INOP	#368	On horizontal situation indicator, glide slope deviation pointer remains centered and GS flag comes into view.	N/A	None	<u>Instructor</u> :P HSI GS appears on CRT. <u>Student</u> :: HSI glide slope pointer does not reflect
P HSI NAV	#369	aircraft movements. On horizontal situation indicator course deviation bar remains centered but NAV (navigation) warning flag is out of view	N/A	None	<u>Instructor</u> : P HSI NAV appears on CRT. <u>Student</u> : Course deviation bar does not reflect aircraft movements.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> (s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
350 AVIONICS SYSTEMS MALFUNCTIONS - continued					
P HSI RNG DISPLAY	#370	On horizontal situation indicator, RANGE indication does not function.	N/A	None	<u>Instructor</u> : P HSI RNG DISPLAY appears on the CRT. <u>Student</u> : RANGE indication does not change in response to aircraft movement.
P HSI BRG PTR #1	#371	On horizontal situation indicator, bearing pointer number 1 gives erroneous indication of selected ground station location. number 1 indication.	N/A	At HSI control panel select BRG PTR 2, if available.	<u>Instructor</u> : P HSI BRG PTR#91 appears on the CRT. <u>Student</u> : Not able to select and rely on bearing pointer
P HSI BRG PTR #2	#372	On horizontal situation indicator, bearing pointer number 2 gives erroneous indication of selected ground station location. number 2 indication.	N/A	At HSI control panel select BRG PTR 1, if available.	<u>Instructor</u> : P HSI BRG PTR 92 appears on the CRT. <u>Student</u> : Not able to select and rely on bearing pointer
P HSI HDG	#373	On horizontal situation indicator, heading pointer processes (gyrates) at approximately 10' per minute. No other effects are noted.	None	None	<u>Instructor</u> : PHSIHDG PRECE appears on the CRT. <u>Student</u> : HSI course pointer does not have a steady indication.
400 CBS AC/ARM and DC PANELS MALFUNCTIONS					
Selected individual popping circuit breakers. All are AC or DC push-pull, non-toggle type.	#401 through 477	Any number of CB's indicated on CRT page 400 can be popped under instructor control. The indications are the physically popped breaker, and simulation of interrupted electrical power to the associated equipment. All correct power-off characteristics are exhibited.	Popped CB(s) and power-off characteristics for the associated equipment.	Attempt to reset CB, which may, or may not, be resettable depending <u>Instructor</u> discretion.	<u>Instructor</u> : Applicable title of the popped CB appears on upon the CRT. <u>Student</u> : Popped breaker and associated power-off characteristics for the associated equipment.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
480 ELECTRICAL SYSTEMS MALFUNCTIONS					
P CMPLT ELEC FAIL	#481	All electrical components including lights and instruments cease to function.	All electrical systems are inoperative.	Land as soon as possible. Check position of ELEC PWR EMERG OFF switch on gunner MISCELLANEOUS control panel.	<u>Instructor</u> : CMPLT ELEC FAIL appears on CRT. <u>Student</u> ::All instruments, lights, and other electrically driven components cease to function.
P DC GEN	#482	DC GEN caution lights illuminate. Other indications depend on operating mode and crew station control switching. The 3 distribution busses (ESS, NONESS, ARMAMENT) can be powered from the transformer/rectifier unit (TRU) bus which is powered by the alternator. of powering ESS bus are the battery or externally from the ground power unit.	DC GEN caution lights in both cockpits illuminate. No equipment will lack power if the alternator is available to power the TRU. If the alternator is unavailable, the essential bus and ac bus can be powered by the battery, and all nonessential bus loads will be available. Additional sources voltage, ammeter reads 0.	Check the GEN switch on pilot PWR panel is on CRT. not off. Switch down to reset and then turn back on. Check GEN BUS RESET and GEN FIELD CB's. restored, switch the GEN SW to off and the GEN FIELD CB to open. Voltmeter reads battery	<u>Instructor</u> : P DC GEN appears <u>Student</u> :: DC GEN caution lights illuminate in both cockpits. If not
FAULTY RELAY #483		ALTER and RECT caution lights illuminated intermittently. With alternator selected, ac source relay intermittently cycles ac loads to and from the inverter and alternator.(When relay is de-energized, ac source is the inverter and ALTER and RECT lights illuminate; when relay is energized, ALT and RECT lights extinguish indicating the alternator is the source.)	ALTER and RECT caution lights illuminate intermittently. Total effect is dependent on operating mode and cockpit switching.	Assure that a dc source input to the inverter is selected as a backup as soon as possible when the alternator is switched out by the faulty relay.	<u>Instructor</u> : Malfunction title appears on CRT. <u>Student</u> :: ALTER and RECT caution lights illuminate intermittently.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
480 ELECTRICAL SYSTEMS MALFUNCTIONS - continued					
P A/C INVERTER	#484	If the alternator is off, all ac power will be lost regardless of dc generator, external power, and battery status. Equipment loss (with associated power-off indications; e.g., SCAS NO-GO lights) will be the following: TRU FUEL QTY ENG VIB MTR SCAS PWR ATTD IND PLT REF XXFMR 28 VAC XFHR GYRO CMPS RADIO BLWR TURRET PWR HSS PWR SECU PWR TMS PWR ADS ANTI ICE ALT POWER HUD BLWR PWR FACTOR CORR ADF RCVR VOR/ILS	Loss of ac powered equipment if the alternator is off.	Check INV CB. If in, select alternator if available.	<u>Instructor</u> : Malfunction title appears on CRT. <u>Student</u> : Loss of ac operated equipment if alternator is not available; otherwise no impact, except that no backup source of ac power is available.
ALTERNATOR FAIL	#485	ALTER and RECT caution lights illuminate, indicating that the alternator is not supplying power. Power to all busses is still available if the dc generator is operating and the inverter is operating (depending on operating mode and crew station switching).If the dc generator is not available, the essential bus can be by the battery.	ALTER and RECT caution lights illuminate. Other effects depend on operating mode and crew station control switching, and could range from loss of all electrically operated equipment, to loss of none.	ALTN switch to OFF, then RESET, then turn back ON.	<u>Instructor</u> : Malfunction title appears on CRT. <u>Student</u> :. ALTEIR and RECT caution lights illuminate. If the alternator is selected as the sole source of electrical power, all electrically operated equipment will fail until an alternate source (dc generator, battery, external power) is selected. powered

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
480 ELECTRICAL SYSTEMS MALFUNCTIONS - continued					
P INSTR LIGHTS	#486	Pilots instrument panel illumination is interrupted.	Loss of illumination of all instrument panel lights.	Check all pilot INST LTS CB.	<u>Instructor</u> : PLT PNL LTS appears on CRT. <u>Student</u> : Loss of all instrument panel illumination.
G INSTR LIGHTS	#487	Gunners instrument panel illumination is interrupted.	Loss of illumination of all instrument panel lights.	Check all gunners INST LTS CB.	<u>Instructor</u> : GNR PNL LTS appears on CRT. <u>Student</u> : Loss of all instrument panel illumination.
TRU FAI	#488	The RECT caution lights illuminate and dc busses can not receive power from the alternator.	RECT caution light illuminates and dc power is lost if dc generator is off and battery or ext power is not available. DC power can be selected from an alternate source by proper cockpit switching.	Check TRU circuit breaker. Select dc generator if available and not previously selected.	<u>Instructor</u> : Malfunction title appears on CRT. <u>Student</u> : RECT caution lights on. Other indications dependent on cockpit switching, range from loss of all dc power to loss on no dc power.
500 ENGINE INSTRUMENT MALFUNCTIONS					
P N1 TACH G N1 TACH	#501 #502	Failure of mechanical linkage between engine and instrument system operation.	Gas generator tachometer returns to zero.	Check indications that engine is still operating No effect on gas temperature indicators, engine sound). stays at zero in engine-start.	<u>Instructor</u> :N1 TACH appears on CRT. (N2, torque and exhaust <u>Student</u> : :Gas generator tachometer needle goes to zero, or
ROTOR TACH	#503	Failure of mechanical linkage between rotor and instrument system operation. temperature indicators, engine sound).	Rotor tachometer returns to zero. No effect on activates.	Check indications that engine is still operating RPM warning system torque and exhaust gas	<u>Instructor</u> : ROTOR TACH appears on CRT. (N1 engine tachometer, <u>Student</u> :: Rotor tachometer needle goes to zero.
N2 TACH	#504	Failure of mechanical linkage between engine and instrument .No effect on system operation.	Rotor tachometer returns to zero. RPM warning system activates.	Check indications that engine is still operating (N1 rotor tachometer torque and turbine gas temperature indicators, engine sound).	<u>Instructor</u> :N2 TACH in appears on CRT. U <u>Student</u> :: Engine tachometer needle goes to zero.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>500 ENGINE INSTRUMENT MALFUNCTIONS - continued</u>					
P TRQMTR G TRQMTR	#505 #506	Torquemeter returns to zero. No effect on aircraft or systems operation.	Torquemeter goes to zero psi.	Check TRQ IND CB. Check indications that engine power is available. If in integrated mode, check with gunner.	<u>Instructor</u> : Words TRQMTR appears on CRT. <u>Student</u> : Torquemeter indication goes to zero.
P ENG OIL PRESS LOW	#507	Due to bad pressure transducer, instrument reading decreases to 70 PSI during normal engine operation. No effect on aircraft or systems operation.	Engine oil pressure indicator will not rise above 70 PSI. Land as soon as possible.	Check ENGINE OIL PRESS light not illuminated. Check other engine indications.	<u>Instructor</u> :ENG OIL PRESS IND appears on CRT. <u>Student</u> :Engine oil pressure indicator decreases to zero.
P ENG OIL	#508	Instrument reading decreases to zero.No other effect on aircraft or system operation.	Engine oil pressure indicator goes to zero.	Check ENGINE OIL PRESS light not illuminated. Check ENG/XMSN TEMP IND CB. Check other engine indications.	<u>Instructor</u> : ENG OIL PRESS IND appears on CRT. <u>Student</u> : Engine oil pressure indicator decreases to zero.
P ENG OIL TEMP IND	#509	Engine oil temperature indication high. No effect on aircraft or system operation.	Oil temperature indicator goes from present reading to 1200C at a rate of 150C/30 second.	Ensure ENG OIL BYP switch is OFF. Accomplish normal landing at nearest safe landing area.	<u>Instructor</u> : ENG OIL PRESS IND appears on CRT. <u>Student</u> : Engine oil temperature indicator increases to 1200C at a rate of 150C/30 seconds.
P TURBINE GAS TEM	#510	Instrument reading decreases to zero. No other effect on aircraft or system operations.	Engine TGT indicator goes to zero.	Check TGT IND CB. Check all other engine parameters for normal response.	<u>Instructor</u> :TGT IND appears on CRT. <u>Student</u> : TGT instrument decreases to zero and does not respond to any change in engine control and/or electrical interruption. (CB cycling.)

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
550 ENGINE SYSTEMS MALFUNCTIONS					
FLAMEOUT	#553	Flameout indications are: Sudden reduction of engine noise. A sudden drop in engine rpm, gas producer rpm, rotor rpm, oil pressure, and torque meter indications. A left yaw resulting from the reduction in engine torque. Total lack of engine response to throttle movements. Gradual decrease in TGT, engine oil temperature and transmission oil pressure.	Flameout indications are: Sudden reduction of engine noise. A sudden drop in engine rpm, gas producer rpm, rotor rpm, oil pressure, and torque meter indications. A left yaw resulting from the reduction in engine torque. Total lack of engine response to throttle movements. Gradual decrease in TGT, engine oil temperature, transmission oil temperature, and transmission oil pressure.	Enter autorotation. If altitude permits, attempt air start.	<u>Instructor</u> : FLAMEOUT appears on CRT. <u>Student</u> :: Engine shutdown indications and left yaw resulting from loss of torque.
P HOT START	#551	Normal gas producer speed for start is evident, but TGT exceeds starting temperature limit.	TGT rises beyond normal safe operating range.	Abort start as follows: Close throttle. Fuel switch - OFF. Starter - Continue to energize until TGT decreases. Complete engine shutdown.	<u>Instructor</u> :HOT START appears on CRT. <u>Student</u> :: TGT exceeds starting temperature limit.
P HUNG START	#552	Gas producer rpm fails to accelerate beyond 20%.	Gas producer rpm maintains a value of approximately 20% while TGT is within the normal operating range.	Close throttle. Shut off fuel. Motor engine to clear fuel vapor.	<u>Instructor</u> : HUNG START appears on CRT. <u>Student</u> :: Gas producer rpm fails to exceed 20%.No engine runup indications.
COMPR STALL	#554	Fluctuation in gas producer rpm occurs accompanied by a fast TGT rise. Engine rpm remains normal. Increase in engine noise is evident.	TGT increases beyond normal operating limits.Engine noise continues to increase.	Reduce power. Rain removal/ECU-switch - OFF. If stall progresses, enter autorotation.	<u>Instructor</u> : COMPR STALL appears on CRT. <u>Student</u> :: Gas producer indications fluctuate; TGT rises rapidly above safe operating limit and popping noise heard from engine compartment."

NOTE

This condition occurs during high power settings.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>550 ENGINE SYSTEMS MALFUNCTIONS - continued</u>					
FUEL CTL RPM GAIN	#555	Engine rpm exceeds maximum governing rpm (1021).	Engine rpm exceeds maximum indicator reading .HIGH RPM light illuminates if 1031 is exceeded.	Increase collective to load rotor and sustain engine/ rotor rpm below red line. Reduce throttle until normal operating rpm is obtained. Retard throttle to IDLE, and place governor switch in emergency position. Advance throttle slowly until operating rpm is obtained, and control engine rpm manually by coordinating throttle and collective.	<u>Instructor</u> : FUEL CTL RPM GAIN appears on CRT. <u>Student</u> :: Engine rpm indications increase to maximum exceeding safe limits.
FUEL CTL RPM LOSS	<u>Instructor</u> #556	Engine rpm indicates below minimum governing rpm (91%).	Engine rpm remains below minimum governing rpm. LOW RPN warning light illuminates .Audible warning is heard in pilot and gunner headsets.	Enter autorotation and select forced landing area. Check gas producer to ensure engine has not failed Retard throttle to engine IDLE, and place governor switch in the emergency position. Advance throttle slowly until operating rpm is obtained, and control engine rpm manually by coordinating throttle and collective.	<u>Instructor</u> : FUEL CTL RPM LOSS appears on CRT. <u>Student</u> : Engine rpm remains below 91% until corrective action occurs, at which time normal operation ensues. Audio warning may be disabled with RPM WARNING switch to OFF.
ENG OIL LOSS	#557	Engine oil pressure indication decreases at a rate of 10 psi/minute. ENG OIL PRESS caution light illuminates if pressure drops below 27 psi. ENG OIL BYPASS caution light illuminates, and oil temperature indicator rises abnormally high.	Engine oil pressure indicator decreases at 10 psi/min. ENG OIL PRESS caution light illuminates if pressure drops below 27 psi.	Land at nearest safe area.	<u>Instructor</u> : ENG OIL PRESS LOSS appears on CRT. <u>Student</u> : Engine oil pressure indicator decreases at a rate of 10 psi/minute. ENG OIL PRESS and ENG OIL BYPASS caution lights are on if pressure is below 27 psi. High oil temperature.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>550 ENGINE SYSTEMS MALFUNCTIONS - continued</u>					
ENG STARTER	#558	Defective starter relay results in no engine start rpm response to actuation of starter switch.	No indication or sound of engine start up.	Check ignition keyswitch. Check START RLY CB. battery.	<u>Instructor</u> : ENG STARTER Check appears on CRT. <u>Student</u> :: No audible or visible indications of normal start procedure.
P INL GD VANE OPEN	#559	A lag in N1 occurs when advancing throttle from low to high power settings.	No apparent indication unless power is increased. A noticeable lag in N1 is experienced with low power setting (N1 83%).	Avoid rapid power changes. Land as soon as possible at an area that will permit a run-on landing.	<u>Instructor</u> : INL GD VANE OPEN appears on CRT. <u>Student</u> :: A noticeable lag in N1 indication occurs when power is increased.
EP INL GD VANE CLSD	#560	An instantaneous rise in TGT may occur.	If a collective application is made that would normally result in more than 44% torque, N2 (engine and rotor) deteriorates while N1 and TGT increase.	Adjust collective pitch as required to maintain N2 RPM. Jettison wing stores as applicable. Land as soon as practicable at an area that will permit a run-on landing.	<u>Instructor</u> : INL GD VANE CLSD appears on CRT. <u>Student</u> :: TGT indication shows instantaneous rapid increase and continues to increase beyond safe operating limits.
NG FUEL PMP	#561	One element of dual element pump fails. ENG FUEL PUMP caution light illuminates.	MASTER CAUTION light illuminates. ENG FUEL PUMP caution light area illuminates.	Land as soon as possible at nearest safe landing	<u>Instructor</u> : ENG FUEL PMP appears on CRT. <u>Student</u> :: ENG FUEL PUMP caution light illuminates.
ENG OIL BYPASS	#562	Engine oil is bypassing oil cooler. ENG OIL BYPASS caution light illuminates. Engine oil temperature rises. MASTER CAUTION light on.	ENG OIL BYPASS caution light is on. Engine oil temp indicator rises to 1200C at a rate of approximately 20°/sec.	Set ENG OIL BYP switch to off. Oil temperature should decrease.	<u>Instructor</u> : OIL BYPASS appears on CRT. 13 <u>Student</u> :: ENG OIL BYPASS caution light illuminates. Engine oil temp indicator rises to 1200C at a rate of approximately 20°/sec.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>550 ENGINE SYSTEMS MALFUNCTIONS - continued</u> °					
ENG INL OBST	#563	Engine icing is suspected, a loss of power and a rise in TGT.	Loss of engine power and TGT continues to rise. when de-icing is introduced, power is restored to normal in approximately 2 minutes. A rise in TGT occurs when ENG DEICE is used.	Establish IAS at 100 knots or less. Turn on engine DEICE switch.	<u>Instructor</u> : ENG INL OBST appears on CRT. <u>Student</u> : A rise in TGT and loss of power occur.
BLD BAND STUCK OPEN	#564	When gas generator speed is above 85%, engine indicates lower than normal torque, and N1 and TGT increase .All engine parameters will be normal if main gas generator is reduced below 85%.	When gas generator speed is above 85%, the engine indicates lower than normal torque, and N1 and TGT increase. For engine operation below 80% N1, no abnormal effects are realized.	Reduce power to keep TGT within limits.	<u>Instructor</u> : BLD BAND STUCK OPEN appears on CRT. <u>Student</u> :. Lower than normal higher than normal N1 and TGT for power setting.
BLD BAND STUCK CLSD	#565	When gas generator speed is below 78%, engine indicates a loss in N1.An attempt to accelerate the engine rapidly results in stall characteristics. All engine parameters will be normal if main gas generator is 78% when malfunction is inserted.	When the gas generator speed is below 78%, engine indicates a loss in N1.Any attempts to accelerate engine rapidly results in stall characteristics. parameters will be normal if N1 is above 78% when malfunction is inserted. when engine is stalled, there is a further loss in N1, and an increase in TGT.	Avoid sudden power changes. If sudden power change causes stall, put throttle in flight idle and collective to flat pitch. Stall will then subside and engine All engine can be operated with slow power changes.	<u>Instructor</u> : BLD BAND STUCK CLSD appears on CRT. <u>Student</u> :. Engine operates normally with slow power changes. If engine is normally stalled, gas producer indications fluctuate and TGT rises rapidly above safe operating limit.
GOV SW HIGH SIDE	#566	Engine rpm requested prior to failure is adjustable downward, but not upward.	Engine RPM continues to indicate the value prior to failure if rpm increase is attempted. Any decrease will not be adjustable upward	During engine run-up, shut engine down.	<u>Instructor</u> : GOV SW HIGH SIDE appears on CRT. <u>Student</u> :. No greater engine rpm than at time of failure .can be selected with RPM INC/DEC switch

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>550 ENGINE SYSTEMS MALFUNCTIONS - continued</u>					
GOV SW LOW SIDE	#567	Engine rpm requested prior to failure is adjustable upward, but not downward.	Engine RPM continues to indicate the value prior to failure if an rpm decrease is selected Any attempt to decrease rpm is not possible with GOV INC/DEC switch.	Manage engine by alternate means.	<u>Instructor</u> : GOV SW LOW SIDE appears on CRT. <u>Student</u> :: No response to DEC position of GOV INC/DEC switch.
ENG FIRE	#568	FIRE light illuminates, accompanied by excessive TGT for the state of engine operation (start of normal inflight operation).	Fire light is on and TGT is excessive. TGT decreases	If on ground: a. Close throttle b. Fuel switch off c. Motor engine until d. Complete engine shut-down If in flight: a. Land (power off or on depending on circumstances) b. Throttle, fuel, and battery off c. Clear helicopter	<u>Instructor</u> : ENG FIRE appears on CRT. <u>Student</u> :: Abnormally high TGT accompanied by FIRE light.
P FIRE LIGHT	#569	FIRE light illuminates, and there are no accompanying signs that a fire exists. Normal TGT, engine operation, electrical, etc. No other systems are affected.	Fire light ON.	If on ground: a. Close throttle b. Fuel switch off c. Motor engine until TGT decreases d. Complete engine shut-down If in flight: a. Land (power off or on depending on circumstances) b. Throttle, fuel, and battery off	<u>Instructor</u> : P FIRE LIGHT appears on CRT. <u>Student</u> :: Fire light illuminates.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
550 ENGINE SYSTEMS MALFUNCTIONS - continued					
ENG CHIPS	#570	ENG CHIP and CHIP DETECTION lights illuminate on pilot and gunner caution panel, accompanied by erratic engine operation and excessive oil temperature. Three minutes after initial indication, the engine fails.	ENG CHIP and CHIP DETECTOR lights illuminate, engine rpm, TGT, and torque oscillate erratically, high oil temperature and subsequent engine failure with associated systems.	Land as soon as possible.	<u>Instructor</u> : ENGINE CHIPS appears on CRT. <u>Student</u> : ENG CHIP and CHIP DETECTOR lights illuminate, engine rpm, TGT, and torque oscillate erratically, high oil temperature and subsequent engine failure with associated systems.
ENG CHIPS LIGHT	#571	Shorted engine chip detector causes ENG CHIP light to illuminate on pilot caution panel, and CHIP DETECTOR light on gunner caution panel to illuminate.No effect on aircraft or system operation.	Pilots ENG CHIP light and gunners CHIP DETECTOR light illuminate.	Land as soon as possible.	<u>Instructor</u> : ENG CHIPS LIGHT appears on CRT. <u>Student</u> : ENG CHIP light illuminates at pilot caution panel, CHIP DETECTOR light also illuminates at gunner caution panel.
ICE	#572	Icing is evidenced by a rise in TGT if outside temperature is below 4.40C.The malfunction input enables icing, if engine de-ice circuit is deenergized. NOTE Vehicle icing occurs automatically (not as a function of instructor input) when the outside temperature reaches below - 0°C and the turbulence level exceeds 6.When this occurs, vehicle drag increases and increased vehicle weight due to ice accumulation requires slightly higher than normal power application.	Above normal TGT. Reduced performance	Turn-on engine DEICE switch. CRT.	<u>Instructor</u> :ICE appears on CRT. <u>Student</u> : Higher than normal TGT.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>550 ENGINE SYSTEMS MALFUNCTIONS - continued</u>					
ICE - continued	#572	NOTE Pitot static icing is incorporated per discussion in Flight Instruments Section (separate malfunction).			
<u>600 FLIGHT INSTRUMENTS MALFUNCTIONS</u>					
SPARE	#601				
P TRN NDEL	#602	Turn needle inoperative and returns to zero.	Absence of turn needle deflection with changes in heading.	Check TURN & SLIP IND CB. on CRT.	<u>Instructor</u> : TRN ND appears <u>Student</u> :: No deflection of turn needle with change in heading.
SPARE	#603				
II HYD SYS	#651	#1 HYD PRESS caution light on. MASTER CAUTION light on. Yaw SCAS actuator centers and locks. pedals are stiff but movable (loss of tail rotor boost).	Difficult to make directional changes using pedals. Directional Check EMER HYD PUMP CB in. directional pedals.	Ensure emergency hydraulic switch off for both pilot and gunner to prevent depletion of accumulator. Hydraulic control CB in. light on. SCAS - Disengage YAW channel. MASTER ARM switch to off. Land at nearest available safe landing area. Emergency hydraulic switch to on at final approach.	<u>Instructor</u> : II HYD SYS appears on CRT. <u>Student</u> !1 HYD PRESS caution light on. MASTER CAUTION Difficult to move

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>650 FLIGHT CONTROL/HYDRAULIC SYSTEM MALFUNCTIONS</u>					
#1 HYD SYS - continued	#651			NOTE Due to a possible failure of the operating system caused by fluid seepage into the inoperative system, a running landing is recommended with touchdown speed of 50 knots, terrain permitting.	
#2 HYD SYS	#652	#2 HYD PRESS caution light on. MASTER CAUTION light on.	Increase in difficulty to control pitch and roll due to loss of pitch/roll SCAS.	Ensure emergency hydraulic switch off for both pilot and gunner to prevent depletion of the accumulator. Hydraulic control CB in. Check EMER HYD PUMP CB in. SCAS - disengage pitch and roll channels. MASTER ARM switch to off. Land as soon as practicable. Land at nearest available safe landing area. Emergency collective hydraulic switch on (final approach). NOTE Due to a possible failure of the operating system caused by fluid seepage into the inoperative system, a running landing is recommended with touchdown speed of 50 knots, terrain permitting.	<u>Instructor</u> :#2 HYD SYS appears on CRT. <u>Student</u> ::#2 HYD PRESS caution light on. MASTER CAUTION light on. Increased difficulty in control of pitch and roll.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>650 FLIGHT CONTROL/HYDRAULIC SYSTEM MALFUNCTIONS - continued</u>					
BOTH HYD SYS 1653		Indications: #1 HYD PRESS and 12 HYD PRESS caution lights on. light on.	All cyclic and pedal movements difficult. MASTER CAUTION Collective will not move.	<p>Ensure emergency hydraulic switch off for both pilot and gunner to prevent depletion of the accumulator.</p> <p style="text-align: center;">NOTE</p> <p>If necessary to turn emergency collective hydraulic switch on to maintain a flying aircraft, turn it on and leave it on. If not, wait until final approach. Hydraulic circuit breaker on.</p> <p>Check EMER HYD PUMP CB in.</p> <p>SCAS - disengage all channels.</p> <p>Maintain speed where control forces are manageable.</p> <p>Land at nearest available safe landing area.</p> <p style="text-align: center;"><u>WARNING</u></p> <p>Below 20 knots, air-speed cyclic feedback forces become uncontrollable.</p> <p style="text-align: center;">NOTE</p> <p>Execute running landing with speed of 50 knots, terrain permitting.</p>	<p><u>Instructor</u>: BOTH HYD SYS appears on CRT.</p> <p><u>Student</u>:: #1 HYD PRESS and #2 HYD PRESS caution lights on. MASTER CAUTION light on. Difficult to change direction, pitch and roll.</p>

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>650 FLIGHT CONTROL/HYDRAULIC SYSTEM MALFUNCTIONS - continued</u>					
P HDOVR	1654	Nose-down moment induced in aircraft due to SCAS actuator full extension.	<u>Student</u> : experiences nose-down indications and motion cues.	Disengage entire SCAS system. Reengage unaffected channels. Retrim cyclic stick).	<u>Instructor</u> : HDOVR SCAS - PITCH appears on CRT. <u>Student</u> : Experiences initial nose-down pitching. Increased difficulty to control pitch due to loss of SCAS operation.
P HDOVR	#655	Roll right moment induced in aircraft due to SCAS actuator full extension.	<u>Student</u> : experiences roll right indications and moment cues.	Disengage entire SCAS system. Reengage unaffected channels. Retrim roll control (lateral cyclic stick).	<u>Instructor</u> : HDOVR SCAS - ROLL appears on CRT. <u>Student</u> : Experiences initial right rolling. Increased difficulty to control roll due to loss of SCAS operation.
P HDOVR SCAS	1656	Left yawing moment induced in aircraft due to SCAS actuator full extension.	Trainee experiences left yawing indications and motion cues.	Disengage entire SCAS system. Reengage unaffected channels. Retrim yaw control (pedals).	<u>Instructor</u> : HDOVR SCAS-YAW appears on CRT. <u>Student</u> : Experiences cockpit yaw left and increased difficulty to control yaw due to loss of SCAS operation.
P MOTOR SCAS-PITCH	1657	Oscillation in pitch axis due to SCAS actuator oscillations.	Continued oscillations in pitch axis if SCAS is not disengaged.	Disengage SCAS pitch channel.	<u>Instructor</u> : MOTOR SCAS-DITCH appears on CRT. <u>Student</u> : Experiences cockpit oscillation in pitch axis.
P MOTOR SCAS-ROLL	1658	Oscillation in roll axis due to SCAS actuator oscillations.	Continued oscillations in roll axis if SCAS if not disengaged.	Disengage SCAS roll channel. appears on CRT.	<u>Instructor</u> : MOTOR SCAS-ROLL <u>Student</u> : Experiences cockpit oscillations in roll axis.
P MOTOR SCAS-YAW	1659	Oscillation in yaw axis due to SCAS actuator oscillations.	Continued oscillations in yaw axis if SCAS is not disengaged.	Disengage SCAS yaw channel. appears on CRT.	<u>Instructor</u> : MOTOR SCAS-YAW <u>Student</u> : Experiences cockpit oscillation in yaw axis.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>650 FLIGHT CONTROL/HYDRAULIC SYSTEM MALFUNCTIONS - continued</u>					
P TOTAL SCAS	1660	All SCAS inputs to control systems are removed.	Continued difficulty in maintaining trimmed and stable attitude.	Turn SCAS master POWER switch off.	<u>Instructor</u> : TOTAL SCAS appears on CRT. <u>Student</u> :. Experiences sudden increase in difficulty to maintain stable attitude due to loss of SCAS operation.
<u>700 FUEL SYSTEM MALFUNCTIONS</u>					
P FUEL QTY IND ZERO	#701	Instrument reading decreases to zero. on system operation.	Fuel pressure indication No other effect	Check fuel quantity with PRESS-TO-TEST switch. Check A/C FUEL QTY CB.	<u>Instructor</u> : FUEL QTY IND ZERO appears on CRT. <u>Student</u> :. Fuel pressure indicator goes to zero.
P FUEL QTY IND STCK	#702	Instrument fails in last position and is inoperative. No other effect on system operation.	Fuel quantity indicator remains fixed and does not vary with fuel usage.	Check fuel quantity with PRESS-TO-TEST switch. Check A/F FUEL QTY CB.	<u>Instructor</u> : FUEL QTY IND STCK appears on CRT. <u>Student</u> :. Fuel quantity indicator remains fixed in last position and does not vary with diminishing fuel.
P FWD BST PMP	#703	FWD FUEL BOOST caution light on. Fuel pressure may decrease. light on.	FWD FUEL BOOST caution light on. Fuel pressure indication MASTER CAUTION MASTER CAUTION light on.	Pull to open FWD FUEL BOOST CB. If above 6000 feet, may drop to a lower value. Avoid nose-down attitude of greater than 150 if less than 320 lbs of fuel remain.	<u>Instructor</u> : FWD BST PMP appears on CRT. descend to below 6000 feet. <u>Student</u> :. FWD FUEL BOOST caution light on. Fuel pressure may decrease. MASTER CAUTION light on.
P AFT BST PMP	#704	AFT FUEL BOOST caution light on. MASTER CAUTION light on.	AFT FUEL BOOST caution light on.	Pull to open AFT FUEL BOOST CB. If above 6000 feet, descend to below 6000 feet.	<u>Instructor</u> : AFT BST PMP appears on CRT. I <u>Student</u> :. AFT FUEL BOOST caution light on. MASTER CAUTION light on. o

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>700 FUEL SYSTEM MALFUNCTIONS - continued</u>					
P CNTMTD FUEL FLTR	#705	FUEL FILTER caution light comes on. Fuel bypass valve opens to allow fuel to bypass clogged filter.	FUEL FILTER caution light comes on. MASTER CAUTION light on.	Land at nearest available safe landing area.	<u>Instructor</u> : CNTMTD FUEL FLTR appears on CRT. <u>Student</u> : FUEL FILTER caution light comes on. MASTER CAUTION light on.
<u>750 ROTOR/TRANSMISSION MALFUNCTIONS</u>					
FUEL LOW LIGHT	J706	Short in low-level circuit causes FUEL LOW caution light to illuminate. MASTER CAUTION light also illuminates. effects on system.	Caution lights remain illuminated. indicator provides valid fuel indication. No other	Land as soon as possible. Fuel quantity	<u>Instructor</u> : FUEL LOW LIGHT appears on CRT. <u>Student</u> : FUEL LOW caution light illuminates.
P FUEL OVRCONSMP	9707	Fuel consumption rate is 1000 lbs/hour regardless of power requirements.	Rapid decrease shown on quantity indicator.	Land prior to illumination of the FUEL LOW caution light.	<u>Instructor</u> : FUEL OVRCONSMP appears on CRT. <u>Student</u> : Excessive fuel consumption rate is noted.
MN RTR TRCK	9751	Vertical vibrations.	Vertical vibrations.	Land as soon as possible.	<u>Instructor</u> : MN RTR TRCK appears on CRT. <u>Student</u> : Experiences cockpit vertical vibration in seat.
MN RTR BAL	1752	Lateral and rolling vibrations.	Lateral and rolling vibrations.	Land as soon as possible. appears on CRT.	<u>Instructor</u> : MN RTR BAL appears on CRT. <u>Student</u> : Experiences cockpit lateral and rolling vibration in seat.
TL RTR HI FRQ VIBR	#753	High-frequency vibrations at tail section.	High-frequency pedal flutter.	Land as soon as possible.	<u>Instructor</u> : TL RTR HI FRO VIBR appears on CRT. <u>Student</u> : Experiences vibrations in seat.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>750 ROTOR/TRANSMISSION MALFUNCTIONS - continued</u>					
LOSS OF RL RTR	#754	Nose-down moments induced in aircraft. gravity shift occurs. of all tail rotor control.	<u>Student</u> : experiences pitch Center of Loss cues.	Perform autorotational down, yaw right, and roll left indication and motion	<u>Instructor</u> : LOSS OF TL RTR landing. appears on CRT. <u>Student</u> :. Experiences cockpit pitch down, yaw right, and roll left. Pedal movement has no effect on flight.
TL RTR PITCH FIXED PITCH	1755	Loss of tail rotor pitch control.	When power and/or trim is changed, aircraft yaws. Student experiences loss of directional control, and pedals are frozen.	Control helicopter by means of cyclic throttle and collective.	<u>Instructor</u> : TL RTR FIXED appears on CRT. <u>Student</u> :. Experiences loss of directional control.
P XMN-OIL PRES HIGH	1756	Instrument pressure indication increases abnormally high. No other effect on system.	Transmission oil pressure indicator increases to 1000 psi.	Land as soon as possible.	<u>Instructor</u> : XMSN OIL-PRES HIGH appears on CRT. <u>Student</u> :. Transmission oil pressure indicator decreases to zero at a rate of approximately 10 psi/minute.
P XMN OIL-TMP HIGH	1757	Open circuit in thermo-sense bulb causes instrument to indicate high temperature. No other effect on system.	Transmission oil temperature indicator increases to 120°C at a rate of 300C/second. (Normal temperature is approximately 780C.)	Land as soon as possible. appears on CRT.	<u>Instructor</u> : XMN OIL-TMP HIGH <u>Student</u> :. Transmission oil temperature indicator increases to 120°C at a rate of 30°C/second.
XMN OIL PRES LOSS	9758	Transmission oil pressure drops to 0 psi. Indicator reads zero, and TRANS OIL PRESS caution light is on when pressure is less than approximately 30 psi. Oil circulation stops.	Transmission oil pressure indicator reads zero, and TRANS OIL PRESS caution light is on. MASTER CAUTION light on. High transmission temperature indication and associated caution lights are on.	Land immediately. power throughout approach and landing.	Maintain <u>Instructor</u> : XMN OIL LOSS appears on CRT. H3 <u>Student</u> :. Transmission oil pressure indicator reads zero. XMSN OIL PRESS caution light illuminates.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>750 ROTOR/TRANSMISSION MALFUNCTIONS - continued</u>					
XMN OIL BYPASS	#759	TRANS OIL BYPASS caution light on. Transmission oil is bypassing oil cooler. Transmission oil temperature rises. MASTER CAUTION light on.	TRANS OIL BYPASS light on. MASTER CAUTION light on. Transmission oil temperature indicator increases to 120°C at a rate of approximately 20°C/second.	Land immediately. Maintain power throughout approach and landing.	<u>Instructor</u> : XMN OIL BYPASS caution light illuminates. Transmission oil temperature indicator increases to 120°C at a rate of approximately 20°C/second.
SHORT SHAFT	#760	Shaft between engine and transmission has sheared. Engine rpm abruptly increases. Rotor rpm decreases.	Loss of power to main and tail rotor. Low rpm audible warning. RPM warning light on.	Close throttle immediately. Follow procedures for autorotation landing. abruptly increases.	<u>Instructor</u> : SHORT SHAFT appears on CRT. <u>Student</u> :: Effects of loss of engine power. Engine rpm Rotor rpm decreases.
90 DEG GR BOX LOSS	#761	Loss of tail rotor.	When power is changed and/or trim is changed, aircraft yaws. Student experiences loss of directional control, and pedals are frozen.	Control helicopter by means of cyclic throttle, and collective.	<u>Instructor</u> : 90 DEC GR BOX LOSS appears on CRT. <u>Student</u> :: Experiences loss of directional control.
TL RTR THRUST LOSS	1762	Break in drive system results in nose right (left sideslip) and roll left, with no response to pedal inputs.	Nose right, left roll cues (motion, visual, instruments). No response to pedal inputs.	Perform autorotational landing.	<u>Instructor</u> : TL RTR THRUST LOSS appears on CRT. <u>Student</u> :: Experiences nose right, left roll cues (motion, visual instruments) and no response to pedal inputs.
SPARE	#763				
XMN CHIPS	#764	TRANS CHIP and CHIP DETECTOR lights illuminate, accompanied by increase in transmission noise, rise in transmission oil temperature, and illumination of TRANS OIL HOT lights.	TRANS CHIP and CHIP DETECTOR lights illuminate. Transmission noise increases, transmission oil temperature increases above normal, and the TRANS OIL HOT light illuminate.	Land as soon as possible.	<u>Instructor</u> : XMN CHIPS MALF appears on CRT. <u>Student</u> :: TRANS CHIP, CHIP DETECTOR, TRANS OIL HOT lights all illuminate. Increase in transmission sound and increase in transmission oil temperature indication.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor</u> /operator and <u>Student</u> :
<u>750 ROTOR/TRANSMISSION MALFUNCTIONS - continued</u>					
XMN CHIPS LIG	#765	A short in detector output causes TRANS CHIP light on pilot caution panel and the CHIP DETECTOR light on gunner caution panel to illuminate. No other effects on systems operation.	TRANS CHIP and CHIP DETECTOR caution lights on.	Land as soon as possible.	<u>Instructor</u> : XMN CHIPS LIG appears on CRT. <u>Student</u> :: TRANS CHIP and CHIP DETECTOR caution lights illuminate at caution panels.
<u>800 WEAPONS SYSTEMS MALFUNCTIONS</u>					
20 MN FAIL/FIRE	1801	None	20mm fails to fire.	Use different weapon.	<u>Instructor</u> : 20MM FAIL/FIRE appears on CRT. <u>Student</u> :: 20 mm fails to fire.
20MM RUNAWAY	\$802	None	20mm continues to fire after trigger release.	Remove arm or appropriate circuit breaker(s).	<u>Instructor</u> : 20MM RUNAWAY appears on IOS. <u>Student</u> :: Weapon continues to fire.
7.62 FAIL/FIRE (LT) 7.62 FAIL/FIRE (RT)	\$803 (LT) \$804 (RT)	None	Affected 7.62mm wing pod fails to fire.	Use remaining weapons.	<u>Instructor</u> : 7.62 FAIL/FIRE (LT) or (RT) appears on CRT. <u>Student</u> :: 7.62mm fails to fire.
7.62 RUNAWAY (LT) 7.62 RUNAWAY (RT)	#805 (LT) \$806 (RT)	None	Affected 7.62mm wing pod continues firing after release of FIRE switch.	Remove arm or appropriate circuit breaker(s).	<u>Instructor</u> : 7.62 RUNAWAY (LT) or (RT) appears on CRT. <u>Student</u> :: Weapon continues to fire.
JAMMED GUN	\$807	None	Turret weapon fails to fire.	Use another weapon.	<u>Instructor</u> : JAMMED GUN TURRET appears on CRT. <u>Student</u> :: Turret jammed.
TOW FAIL/FIRE	#808	None	TOW missile fails to fire.	Use different weapons or select next missile.	<u>Instructor</u> : TOW FAIL/FIRE appears on CRT. <u>Student</u> :: TOW misfire.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor/operator</u> and <u>Student</u> :
<u>800 WEAPONS SYSTEMS MALFUNCTIONS</u>					
TOW HANG FIRE	1809	None	Next TOW fired burns in in tube causing yaw moment.	Gain control of helicopter. Perform hang fire procedure.	<u>Instructor</u> : TOW HANG FIRE appears on CRT. <u>Student</u> :. Tow hang fire.
2.75 FAIL/FIRE (LO)	1810	None	Rockets from affected station fail to fire.	Use other stations to perform mission. Maintain control of asymmetrically loaded helicopter.	<u>Instructor</u> : 2.75 FAIL/FIRE (LO, LI, RI, or RO) appears on CRT. <u>Student</u> :. Bit of RMS shows failed SU at affected station.
2.75 FAIL/FIRE (LI)	#811				
2.75 FAIL/FIRE (RI)	#812				
2.75 FAIL/FIRE (RO)	#813				
2.75 HANG FIRE (LT)	0814	None	Next rocket fired from appropriate side burns in tube causing yaw moment to helicopter.	Gain control of helicopter. Remove fire signals.	<u>Instructor</u> : 2.75 HANG FIRE (LT or RT) appears on CRT. <u>Student</u> :. Rocket hangs in tube.
2.75 HANG FIRE (RT)	1815				
FCC FAIL	0816	HUD shows raw laser range.	Total loss of FCC aiming corrections and ballistic calculations. FCC INOP on caution panel.	Estimate required aiming corrections.	<u>Instructor</u> : FCC FAIL appears on CRT. <u>Student</u> :. Loss of FCC. <u>Instructor</u> : HUD FAIL appears on CRT.
HUD FAIL	0817	Pilot must estimate aim angle.	Total loss of HUD image.	None.	<u>Student</u> :. Loss of HUD. <u>Instructor</u> : HUD FAIL appears on CRT.
ALT FAIL	1818	None	None	Find target manually.	<u>Student</u> :. ALT fails test mode. <u>Instructor</u> : ALT FAIL appears on CRT.
LRF FAIL	0819	LRF fails to provide range to target.	Loss of LRF data in TSU.	Manually estimate range.	<u>Student</u> :. Loss of LRF. <u>Instructor</u> : LRF FAIL appears on CRT.
RMS FAIL	0820	None	Rockets fire in mode single quantity, all regardless of panel selection. Bit run, center digit blanked ICDU Fail.	Remove fire signal and/or power. Change firing modes if to use single, all.	<u>Student</u> :. Loss of LRF. <u>Instructor</u> : RMS FAIL appears on CRT. <u>Student</u> :. Performing BIT on RMS shows failed ICDU.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by student(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor/operator</u> and <u>Student</u> :
<u>800 WEAPONS SYSTEMS MALFUNCTIONS - continued</u>					
LASER FAIL	{821	Laser is inoperative. Laser range not fed to HUD through FCC.	Requires estimating range	<u>Instructor</u> : to target.	LASER FAIL appears on CRT. <u>Student</u> :: HUD indicates nonbased range supplied.
P AN/ASR 39 IND	#822	AN/APR 39 radar warning set gives erroneous test indications. In normal operation, no signals from left fwd quadrant.			<u>Instructor</u> : P AN/APR 39 IND appears on CRT. <u>Student</u> :: When tested, APR 39 gives wrong test indications.
PARTIAL HUD FAIL	1823	Partial failure of HUD symbology.	No floating reticle.	Switch mode to use stadiametric reticle for weapons firing.	<u>Instructor</u> : PARTIAL HUD FAIL appears on CRT. <u>Student</u> :: No reticle symbology in direct or indirect normal position.
G TOW BIT - MCA FAIL	1824	Upon completion of TOW BIT sequence, MCA fail indication appears.		Remove MALF, and re-initiate BIT.	<u>Instructor</u> : G TOW BIT - MCA FAIL appears on CRT. <u>Student</u> :: White MCA indication on TOW control panel.
G TOW BIT - EPS FAIL	1825	Upon completion of TOW BIT sequence or upon selection during use, EPS fail indication appears.	Remove MALF, and re-initiate BIT.	<u>Instructor</u> : G TOW BIT - EPS FAIL appears on CRT.	<u>Student</u> :: White EPS indication appears on TOW control panel.
G TOW BIT - SCA FAIL	1826	Upon completion of TOW BIT sequence, SCA fail indication appears.	Remove MALF, and re-initiate HSS BIT test.	<u>Instructor</u> : G TOW BIT - SCA FAIL appears on CRT.	<u>Student</u> :: White SCA indication appears on TOW control panel.
G TOW BIT - TSU FAIL	#827	Upon completion of TOW BIT sequence, TSU fail indication appears.		Remove MALF, and re-initiate HSS BIT test.	<u>Instructor</u> : G TOW BIT - TSU a% FAIL appears on CRT. <u>Student</u> :: White TSU indication appears on TOW control panel.

Table 7-3. Simulated Malfunction Details - Continued

Malfunction	CRT reference number	Aircraft indications and related effects	Effects sensed by <u>Student</u> :(s) if corrective action is not taken	Required corrective action	Indications presented to <u>Instructor/operator</u> and <u>Student</u> :
<u>800 WEAPONS SYSTEMS MALFUNCTIONS - continued</u>					
P HSS BIT - FAIL	1828	Upon completion of HSS BIT sequence, PLT lights, indicating failure in pilot helmet linkage. System cannot be fired with gunners HSS.		Remove MALF, and re-initiate HSS BIT test. Check pilot rails connected to bit position. Reinitiate HSS BIT test.	<u>Instructor</u> : P HSS BIT - FAIL appears on CRT. <u>Student</u> :: PLT illuminates on armament control panel.
G HSS BIT - FAIL	1829	Upon completion of HSS BIT sequence, GNR lights, indicating failure in gunner helmet linkage. System cannot be fired with gunners HSS.		Check gunner HSS rails connected to BIT position. Reinitiate a HSS BIT test.	<u>Instructor</u> : G HSS BIT - FAIL appears on CRT. <u>Student</u> :: GNR illuminates on armament control panel.
PHSS RETICLE FAIL	#830	During HSS reticle test, (pilot or gunner) reticle indicates failure of one filament.			<u>Instructor</u> : P or G HSS RETICLE FAIL appears on CRT.
G HSS RETICLE FAIL	1831				<u>Student</u> :: When HSS reticle test is conducted reticle goes out.
HSS BIT - EIA FAIL	1832	Upon completion of HSS BIT sequence, EIA lights, indicating a failure. System cannot be fired.		Reinitiate HSS BIT test.	<u>Instructor</u> : HSS BIT - EIA FAIL appears on CRT. <u>Student</u> :: EIA illuminates on armament control panel.

Section VI. CRT DISPLAYS

7-34. GENERAL. The CRT display system consists of two identical CRT consoles, one at each instructor station. The CRT display is formatted as shown in figure 7-36. Each section of the display format is devoted to certain tasks. Display selection at each CRT is under the control of the respective instructor or, in some cases, the student. Any display on the CRT can be stored in disk memory and printed out by the hardcopy printer for discussion with the pilot/gunner at the conclusion of the exercise. Twenty such recordings (shared by both cockpits) can be requested for printout by the instructor/operator(s) during a training exercise. The CRT display has controls for focus and intensity.

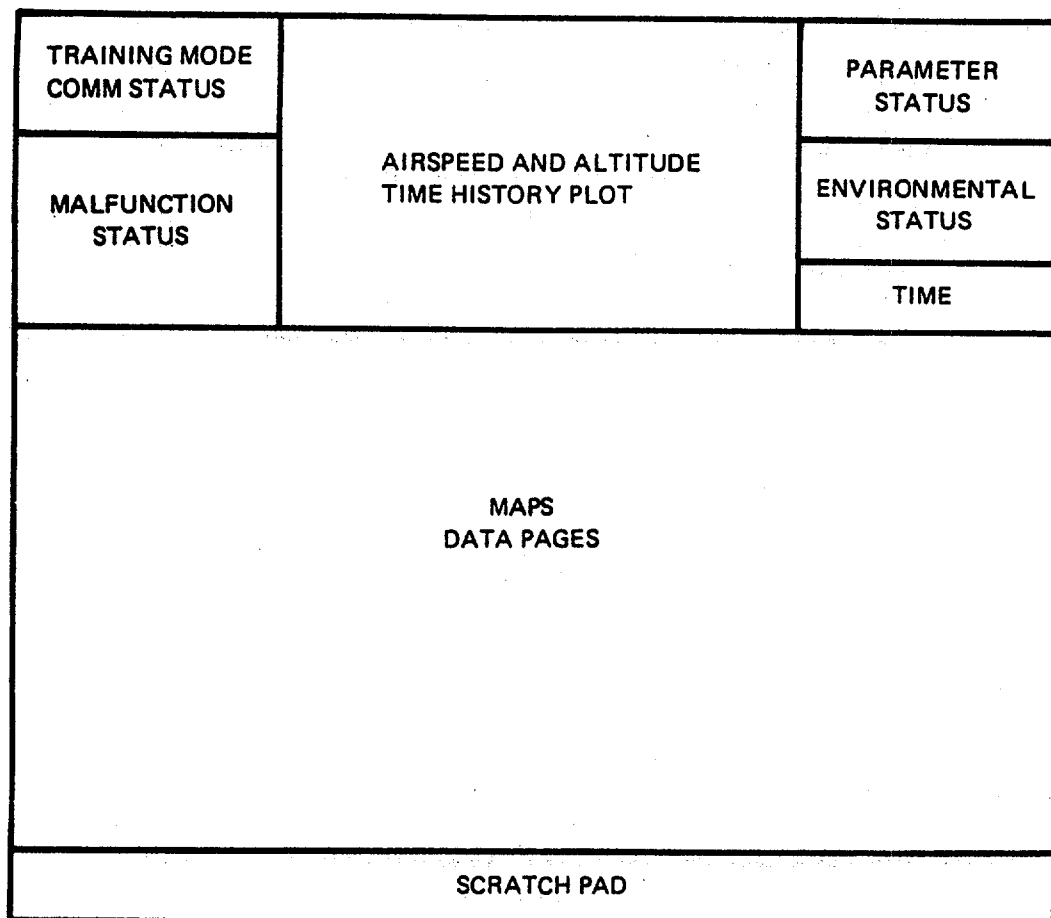
7-35. DISPLAY FORMATS. As shown in figure 7-36, each display is divided into two major areas. The upper 4- by 12-inch area of the display contains both graphic and alphanumeric data that provides status of the training exercise. The lower 12- by 12-inch area displays instructional text, parameter lists, maps, and data pages used to execute, monitor, and edit the training program.

a. The upper area of the display contains, in the center, a continuously updated graphic representation of the 12 preceding minutes of the helicopter airspeed and altitude data. The altitude scale can be set for either 0-2,000 feet or 0-to-4,000 feet. Immediately to the left, information is provided regarding the operating mode, freeze or crash indication, and the radio and frequency channel used to the last pilot/gunner transmission. Below this is a listing of the malfunction that can be currently selected on the console thumbwheel and a list of up to five active malfunctions previously inserted. On the far right is an indication of any parameters that are frozen or are out of tolerance. Frozen parameters are visually indicated with a brighter intensity level, and out-of-tolerance parameters blink. Immediately below are current environmental status, fuel information, and an indication of the number of plots stored. MET readout (in hours, minutes, and seconds) and a resettable timer (in minutes and seconds) are also provided.

b. The lower 12- by 12-inch area of the CRT can contain maps, instructional text, initial conditions and parameters, checkride and demonstrations, weapons control information, and data pages as called up by the instructor/operator. A CRT index display is available to present to the instructor a listing of the various pages of data available. The index shown in figure 7-2 is automatically displayed when the simulator is initially turned on or can be called up for display by simply depressing the ENTER key at the IOS console.

(1) Various displays presented in the lower portion of the CRT are grouped in to the categories listed in the CRT index page. Typical CRT display pages are shown throughout this chapter and are discussed in the applicable chapter/section referenced in the table of contents.

(2) In addition to the displays listed in the index, four miscellaneous instruction pages are available. These displays contain miscellaneous information messages relating to editing, freezing, NAV facilities, initial conditions, off-line mode, and integrated mode information. The instructions are incorporated throughout this manual as applicable. The information pages are not listed on the index page and are accessed by actuating the DISPL ADV switch light when the index is displayed. (These pages are shown in figures 7-4 through 7-7.)



10686

Figure 7-36. CRT Display Format

c. The bottom 1-inch strip is reserved as a scratchpad for edit and error messages on pages where editing is possible. panels, the Instructor can select and/or modify CRT page data. If the instructor enters a parameter or modification to the data that is not proper or is outside reasonable tolerances, one of several error messages appears at the bottom of the CRT as appropriate, prompting the Instructor/operator that the entry is not in effect. A few error messages are listed below for familiarity:

- INVALID LINE NUMBER
- INPUT EXCEEDS LIMITS FOR LINE
- GUNNER CANNOT EDIT THIS PAGE
- AUDIO NOT READY-REWINDING
- MUST BE IN FREEZE TO CHANGE MODE
- SNAPSHOTS REMAIN FROM PREVIOUS MODE

7-36. CONTROL/DISPLAY INTERRELATIONSHIPS. Both the keyboard and thumbwheel are available to the instructor for initiation and control of the automated training features:

- a. The keyboard is used to display and edit pages. The thumbwheel is used to insert/delete initial conditions, maps, malfunctions, demonstrations, and check-rides. Maps can be called up through either the keyboard or thumbwheel. Weapons configuration and ranges can be displayed only through the keyboard. Keyboard ENTER or ZERO, ENTER brings up the index page on the CRT. Then DISPL ADV steps through a series of instructions pages.
- b. The process of selecting a CRT page for inspection consists of typing on the keyboard the desired page number and depressing ENTER. Map pages, GCA displays included, can also be selected by setting the desired page number on the thumbwheel and depressing the INSERT switchlight. When the desired tabular data is displayed on the CRT, a line on any editable page can be modified at the IOS keyboard by typing (Line No.), space, (New Value), ENTER.
- c. Table 7-4 contains information related to the selection and editing of specific displays.
- d. Two displays can be alternately selected by use of the DISPL INTERCHANGE switchlight. Activation of the switchlight alternately displays the most recent selection in each of two groups. One group consists of area maps, and the other group consists of data pages, GCA, and weapon/target displays. Displays that appear on the CRT during the checkride mode are preprogrammed.

Table 7-4. IOS Control/Display Interrelationships

Display	Contents	Display callup
INDEX DISPLAY	Identifies 10 IC sets, approach maps, demos, checkrides, malfunction categories, weapon/target displays, and nav/comm radio data tables that exist in the computer and indicates thumb-wheel position required for selection of the displays. Thumbwheel position required for selections resides on malfunction category pages.	Type 0 on keyboard. Type ENTER. NOTE It may be necessary to depress INTER-CHANGE DISPL switch.
INSTRUCTION PAGES	Provides miscellaneous information plus editing, freezing, nav facilities, initial conditions, off-line mode, and integrated mode information.	Type 0 on keyboard. Type ENTER. Depress DISPL ADV. NOTE It may be necessary to depress INTER-CHANGE DISPL switch.

Table 7-4. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
1 thru 10 INITIAL CONDITIONS	Identifies conditions which represent each of 10 preprogrammed IC sets that can be assigned for trainer initialization or re-assigned to set 11 for modification.	Type 1-10 on keyboard. Type ENTER. Once IC set is displayed, it can be assigned to set 11 by typing 11, space, ENTER.
20 PARAM/FRZ/RNVIR (current conditions)	Identifies status of aircraft flight parameters (current value), aircraft location, aircraft weight and balance, weight of fuel, weapon configuration, and environmental conditions. When a parameter is frozen, an asterisk appears between the line number and test.	Type 20 on keyboard. Type ENTER. <u>To freeze parameter</u> On keyboard: Type LINE NUMBER Type SPACE Type * Type ENTER <u>To unfreeze parameter</u> On keyboard: Type LINE NUMBER Type SPACE Type ENTER <u>To edit parameter</u> On keyboard: Type LINE NUMBER Type SPACE Type DESIRED VALUE Type ENTER
21 VISUAL CONDITIONS (current conditions)	Provides status and control of additional visual parameters and conditions not found on the IOS visual system control panels. This CRT page covers atmospheric conditions, runway selection and lighting, hostile ground fire selection, and visual system configuration and assignment.	Type 21 on keyboard. Type ENTER. To edit or select a parameter On keyboard: Type LINE NUMBER Type SPACE Type DESIRED VALUE Type ENTER
23 TARGET ENGAGEMENT POINTS (TEP)	Informational list showing the latitude, longitude, heading, and altitude for each of the available TEP's. Also shows which of the 26 available targets are visible from the TEP's.	Type 23 on keyboard. Type ENTER.

Table 7-4. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
25 THREAT ARRAY	Provides two related configuration pages of 10 radar emitter threats.	Type 25 or 26 on keyboard. Type ENTER. <u>To edit or select a parameter</u> On keyboard Type LINE NUMBER Type COLUMN NUMBER Type SPACE Type DESIRED VALUE Type ENTER
26 THREAT WINDOW ARRAY	These pages provide the type, activity level, location, and scanning window parameters. Power status of the APR-39 system is also indicated.	
30 through 40 AREA MAPS	Selected game centered cross-country or approach maps are drawn in CRT display. The cross-country map represents a 128 x 128 nautical mile area. Approach maps represent a 32 x 32 nautical mile area.	Select desired map number on thumbwheel. Depress INSERT switchlight, or type desired map number on keyboard. Type ENTER.
EXPAND MAP	The map area can be expanded by a factor of 2X and 4X.	Depress PLOT CHANGE switchlight.
RECENTER MAP	Aircraft-centered plots can be selected. The center of the display is drawn at A/C location at instant of switch depression.	Depress ACFT CENTER switchlight.
45 GCA	Indicates aircraft track and profile, and provides information to instructor air traffic control. Assigns stylized glide-slope plot display for the landing approach.	Select 45 on thumbwheel selector. Depress INSERT switchlight, or type 45 on keyboard. Type ENTER.

Table 7-4. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
50 TACTICAL MAP	Provides tactical map display of the model board. Map indicates the location of 8 TEP's, 26 targets to be scored upon, 10 hostile ground fire locations, and 3 radar emitter threats. A small rectangle represents the model board airfield and a cross defines aircraft location. A flight track plot is provided to give current location of the aircraft.	Type 50 on keyboard. Type ENTER.
60 CONFIGURATION DISPLAY (weapons)	Identifies 10 different weapon loading configurations available for loading onboard.	Type 60 on keyboard. Type ENTER.
61 PERFORMANCE	Provides weapon scoring data for selected target range or area targets including target number, weapon type, range in meters, direction of hit from target, number of hits, and number of rounds fired. Weapon configuration, target selection, moving target, and other parameters can be edited on this page.	Type 61 on keyboard. Type ENTER.
62 STUDENT HISTORY	Provides summarized result of the pilot/gunner firing upon up to three targets with up to three different weapon configurations. (Quite often hardcopy printed for follow-up pilot/gunner evaluation.)	Type 62 on keyboard. Type ENTER.
70, 80, 90, and 100	Identifies four major checkrides and the segments within the checkrides that can be selected. Brief description of checkride segments is given.	Type desired display number on keyboard. Type ENTER.
MALFUNCTIONS 350 AVIONICS 400 CIRCUIT BRKRS 480 ELECT SYS 500 ENGINE INST 550 ENGINE SYS 600 FLIGHT INSTS 650 FLT CONT/HYD SYS 700 FUEL SYS 750 ROTOR/XMISSION 800 WEAPON SYS	Identifies all possible malfunctions and selection numbers for a particular system that can be selected for insertion during training.	Type malfunction page number on keyboard. Type ENTER.

Table 7-4. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
NAV/COM FACILITIES 910 LF/ADF 920 VOR 930 GCA 940 ILS-LOC 950 ILSROM 960 ILS-MM 970 FM	Identify radio facility data that can be inspected on subpages for each Nav station type and can be edited to disable/enable radio facility. Any facility that is disabled by insertion of an asterisk between the line number and the test.	Type FACILITY NUMBER on keyboard. Type ENTER. <u>To disable station</u> On keyboard: Type LINE NUMBER Type SPACE Type * Type ENTER <u>To enable station</u> On keyboard: Type LINE NUMBER Type SPACE Type ENTER
ALTITUDE AND AIRSPEED PLOT	A plot of altitude and airspeed performance during the preceding 12 minutes of flight. Both traces are plotted against a common reference. Elapsed time is along the horizontal dimension. The 12 minutes of history accumulates from right to left. The vertical dimension presents 0-180 knots of airspeed and 0-2000 or 0-4000 feet of altitude. The altitude scale plot is changed by depression of PLOT SCALE CHANGE switchlight.	Automatic (not freeze)
GROUND PLOT	A ground track plot on the selected cross-country, tactical, or approach map is produced as appropriate. A maximum of 20 linear inches of trace history in either cross-country or approach mode are plotted and retained for recall.	Automatic (not freeze)
TRACK HISTORY ERASE	Erases ground track at a constant rate. Erasure starts at oldest history on selected plots. Function of this option is to unclutter display. Selection of another scale or approach redraws all relevant track history.	Depress and hold TRACK ERASE switchlight.

Table 7-4. IOS Control/Display Interrelationships - Continued

Display	Contents	Display callup
CHECKRIDE EXERCISE LEG	During checkride, student performance values, including out-of-tolerance parameters, are displayed for each checkride exercise leg. Applicable conditions, parameter values, and tolerances that are checked by the computer are also displayed. This same information is made available automatically in hardcopy print-out form.	Automatic

Section VII. AUDIO RECORD/PLAYBACK AND PERFORMANCE RECORD/PLAYBACK

7-37. GENERAL. The audio and performance record/playback system is under instructor and/or computer control in both independent and integrated modes. The system provides: recording and playback for up to the last 5 minutes of elapsed time of pilot/gunner and instructor radio communication; automatic playback of prerecorded verbal commentary for preprogrammed flight demonstrations; and playback of prerecorded briefings during checkrides. Audio is stored on tape cassettes, and the flight performance in disk memory.

7-38. DYNAMIC RECORD/PLAYBACK. The FWS system can update and store 5 minutes of current performance history on computer disk. Synchronized audio is provided by 4 record/playback tape units (five for each cockpit). The tapes provide the last 1, 2, 3, 4, or 5 minutes of audio over the communications system. In the integrated mode, only the pilot record/playback equipment is operational.

- a. Audio is recorded automatically when the FWS is not in freeze and a micro-phone is keyed.
- b. Playback of synchronized audio and performance history can be initiated by depressing FREEZE and then the desired number (1 to 5 minutes) switchlight on the PERFORMANCE PLAYBACK panel. The FREEZE switchlights blink, and the FWS initializes to the conditions of the point selected. When ready, FREEZE switchlights illuminate steady. Depress FREEZE to extinguish switchlight and initiate playback.

7-39. DEMONSTRATION PLAYBACK. Twenty playback-only tape units provide demonstration audio; Each tape unit is available for playback to either the pilot or gunner in independent mode. Any one of the twenty tapes are available to both pilot and gunner in integrated mode. In the integrated mode, both receive the same demonstration audio. These playback-only units are synchronized with the playback of flight performance information from computer disk memory.

7-40. CHECKRIDE BRIEFING PLAYBACK. Four playback-only tape units are arranged in a common assembly for checkride briefings. In the independent mode, the four play-back-only units are available to the pilot only. In integrated mode, both pilot and gunner receive the same checkride briefing. Briefings are played back automatically when a checkride is initiated.

CHAPTER 8

OFF-LINE MODIFICATIONS OF FLIGHT SIMULATOR PROGRAMS

Section I. CHECKRIDE EDIT AND FORMULATION

8-1. GENERAL DESCRIPTION. To formulate or edit a checkride exercise, this section provides the detailed procedure necessary to create or make a revision. The checkride problem formulation operating system (PFOS) provides a means to describe, in terms familiar to instructor pilots, the performance parameters, etc., required to completely assemble a checkride. This is accomplished by formulating the entire checkride on a deck of punch cards. The scenario is divided into distinct parts or maneuvers called segments. These segments contain various aircraft maneuvers to be monitored, the values expected, and the conditions which must be met for the segment to end and advance to the next segment. As an example, assume that during a particular segment (# 008), the airspeed and rate of climb are monitored for acceptable values of 75 knots and 400 ft/min., respectively. When the aircraft has climbed to 1200 feet, the segment and monitoring of IAS and ROC will end, thereby beginning the next segment. On punch cards this would appear as:

```
008   CLIMB ALT > 200'   IAS   75+-10 KTS
```

8-2. PFOS SYSTEM DESCRIPTION. Figure 8-1 illustrates the pieces which make up the checkride PFOS system. The following briefly describe each block.

a. Inputs.

(1) NAVØ4Ø.CIL - RADIO STATION DATA FILE

This file provides a common data base containing the station parameters of all navigation facilities of interest. Within the file, each station's data set is identified by a station index number. This station index number is used to access the data for a particular station.

(2) PFOS.CDS - CHECKRIDE DATA DECK

This is the main input to the program, and the primary topic of this section. The format of information on these cards is shown in figure 8-2 and is described in detail in this section.

b. Processing. The CKRIDE program checks the data deck for conformity to the expectant structuring, compiles this data into a usable machine-coded format, and supplies a CRT display page file reflecting the data deck with syntax error reporting.

c. Outputs.

(1) YCR2Øn. DIR - EXERCISE FILE

This file assists the training mode checkride program in exercise control (n = Ø for VFR, n = 1 for WPNS).

(2) YCR2Øn. DIR - PROGRAM DATA FILE

This file contains the machine-coded parameters described in the data deck (n = 2 for VFR, n = 3 for WPNS).

(3) YCR2Øn. DIR - CHECKRIDE DISPLAY TEXT

This file contains the text to be displayed on the CRT during the execution of the checkride mode (n = 4 for VFR, n = 5 for WPNS).

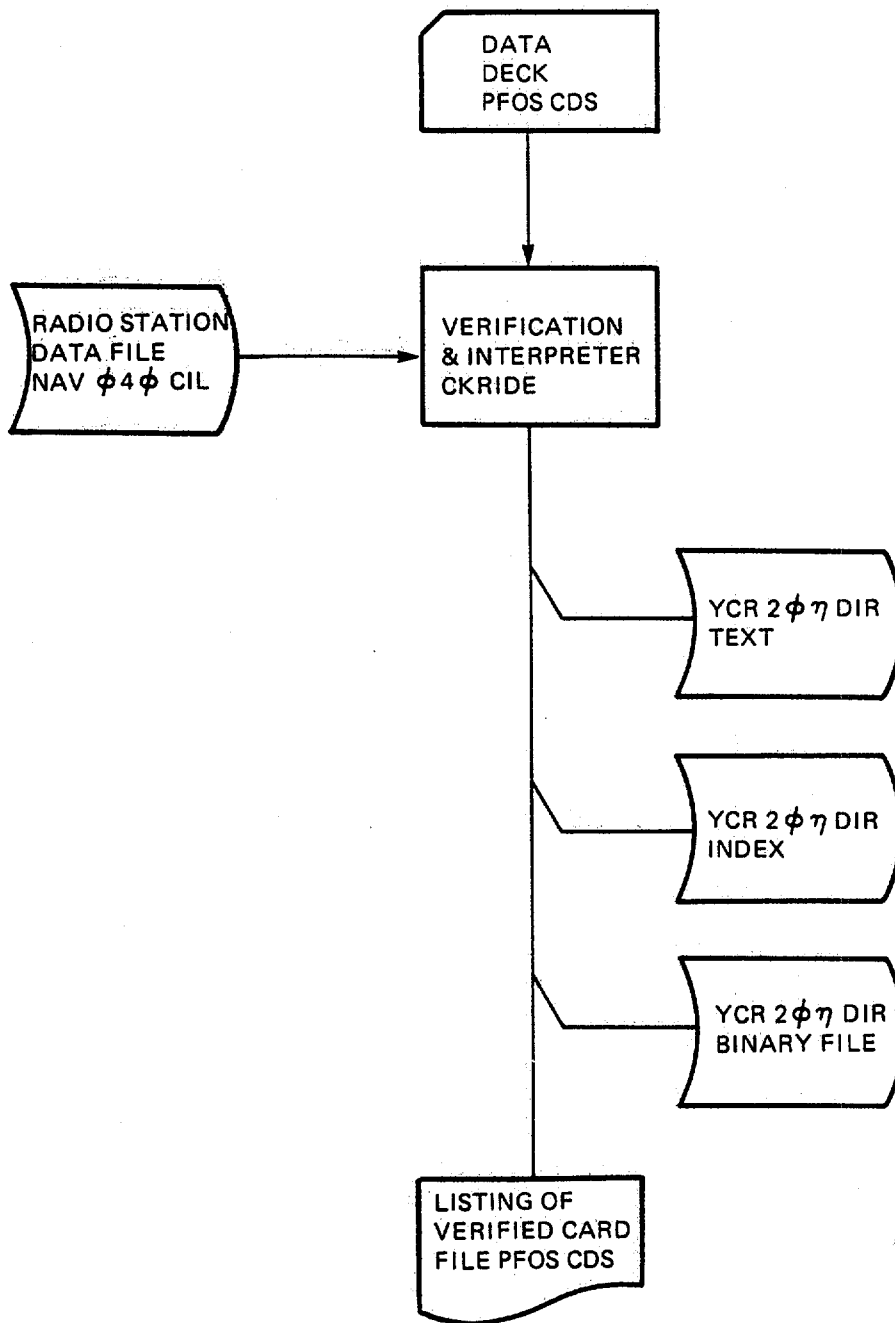


Figure 8-1. Checkride PFOS Functional Block Diagram

SEG										ACTION CUE										END CONDITIONS										MONITORED DATA										DESCRI																			
01-10					11-20					21-30					31-40					41-50					51-60					61-70																													
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
1. EXAMPLE ONLY										TRQ 73.4%										NONE										THIS TEXT																													
CDM 1										HDG 150+-1.0DEG																				MAN EXTEND																													
MALE 376										RPM 710.0ORPM																				ITSELF OVER																													
MAP 3.1																														THE ENTIRE																													
ALL																														SIXI CARDS																													
TEXT THIS ENTIRE CARD BECOMES A DESCRIPTION FIELD																																																											
2. EXAMPLE ONLY										TIM >7SEC										PIT 0+-5-1.5DEG										THE EXAMPLES																													
COMMENT ONLY																				ROT <.25DPS										SHOWN TO DIS																													
																				RADI 21+-5DEG 10ZR										OPTIONS AVAI																													
																				ALT 600 TO 700'										THE USER																													
																				AS 100 TO 70 KTS																																							
1.26 FLYOUT										TIME >30SEC																				CHECKRIDE ON																													
TEXT CHECKRIDE COMPLETED SYSTEM WILL RELEASE IN 30 SECONDS																																																											

Figure 8-2. Typical Checkride Data Input Keypunch Form

(4) PFOS.CDS - LISTING

Printed copy for immediate syntax error detection.

8-3. OPERATIONAL ENTRY AND CONTROL

a. To Formulate an Entire Checkride

(1) Review the data format part of this section (8-3c).

(2) Review the computer listing for an existing checkride. This will be the quickest way to get familiar with the format and technique.

(3) Plan the checkride on paper (figure 8-3) in detail as if it were going to be flown in the real aircraft. All parameters which are to be monitored during various phases of the flight should be noted.

(4) Break the checkride into exercises. A checkride can be made up of nine exercises, each of which may have its own initial conditions. The checkride begins with an exercise in the first segment. The exercise may be of any length and will end upon the selection of the next exercise or upon the end of checkride. In this manner no two exercises will be nested, overlaid or discontinuous in the checkride.

(5) Break the exercises into segments and define the conditions which determine the end of each segment. A segment of a checkride is usually any piece of the checkride during which time the desired value and tolerance for monitored parameters is constant. The best example of segment usage is a computer listing for the delivered checkrides. A segment can represent any length of time. Its end conditions can be timed-based, event-based, or a combination of time- and event-based. Segments do not have to monitor anything. They can be used to perform special instructor action such as:

- operate the STORE PLOT switch
- insert malfunctions
- select the gunner scoring display
- select a specific ATC comm scenario
- select a specific map or GCA display

(6) If there are portions of a checkride where no action is required or no parameters need to be monitored, a dummy segment can be inserted. A dummy segment would consist of a segment number and title. Its effect would be to put the monitoring system into an idle state until the dummy segment end conditions were met (i.e., time).

(7) After the complete content of the checkride segments have been defined, the data must be prepared for keypunching. Any standard 80-column keypunch form can be used. An example is shown in figure 8-2. Data is entered on the keypunch form adhering to the data format and syntax rules defined by this document. These keypunching forms are then punched up at the model 026 keypunch or equivalent. The deck of cards produced will be the checkride data deck. These forms should be kept on file to assist in any future update of the checkride scenario.

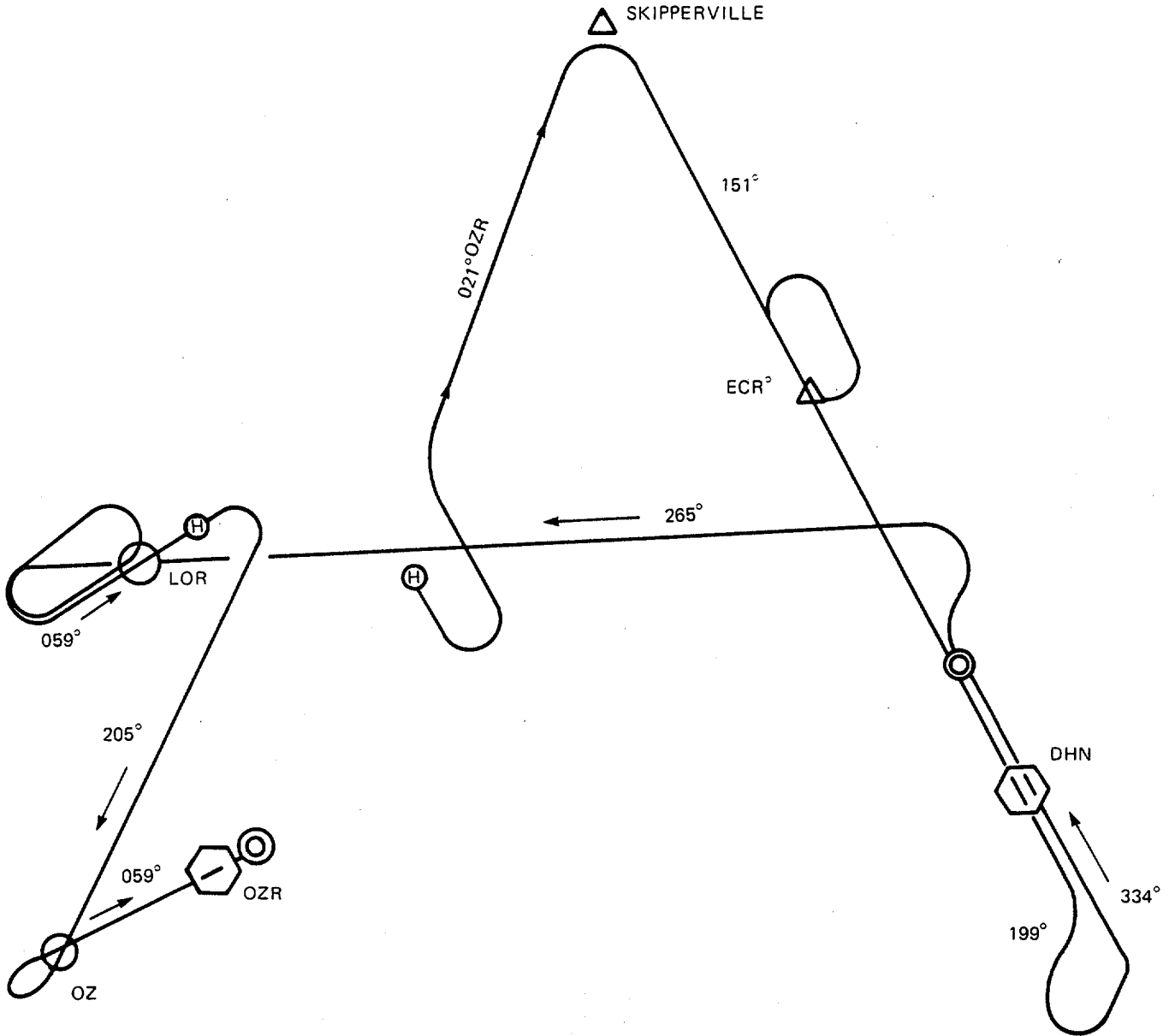


Figure 8-3. Possible Checkride Plan (Rough)

(8) The checkride data deck, once formed, is placed into the applicable job deck (one for VFR and another for WPNS) for checkride problem formulation. This job deck will be identified as CKRIDW (Weapons) or CKRIDV (Visual). See figures 8-4 and 8-5 for the appropriate job deck structure. This job deck is to be run while the simulator is off-line and the computer is in the Batch mode of operation. Upon completion of processing, a newly created checkride will be available for use during the next training session. The printed copy should be checked for syntactical errors that might compromise the effectiveness of the checkride. Refer to figure 8-6, Notes 1, 2 and 3, as an example of error notification.

(9) File Maintenance. The file space required to create a checkride has been allocated with enough reserve to allow for normal expansion of the checkride scenario. The available reserve is approximately 15% of the delivered checkrides.

b. To Revise an Existing Checkride. Whenever a checkride is to be revised in whole or in part the entire checkride data deck must, in the end, be processed. The need for change may be from a variety of reasons. It might be simply because the printed copy of the previous attempt to put together a checkride has shown an error in format which comprises the intent. Another reason would be because during the checkride mode of operation in the simulator the checkride did not "perform" as expected due to incorrect values or missing parameters. Still another reason for rewriting a portion of the checkride might be due to simplification of a set of maneuvers or a more comprehensive one. For whatever the reason, the rules to follow are the same.

(1) Identify the segment(s) in question.

(2) Using the data input sheets (figure 8-2) develop the segment in terms of end conditions and monitored parameters. Be sure to include the segment number appropriately.

NOTE

When adding/deleting a segment, the remainder of the checkride segment numbers must reflect the new segment ordering sequence. The deck of cards produced from these data sheets should now replace those in the original checkride data deck.

(3) This data deck must now be processed in a manner identical to the one described when creating a new checkride.

An example of changing an existing checkride using figure 8-6, Notes 2 and 3:

Segment 14 has been mispunched. Using a blank data sheet (Figure 8-2) rewrite the 1st line as:

014 CLIMB ALT > 2900' IAS 100+-10K CONTINUE CLIMB,

Rewrite the 3rd line as:

ROC 500+-100 FPM

```
1. $JOB CKRID 160.3!  
2. $RUN PIP  
3. #PFOS.BI BI:/FA  
4. (PLACE DATA STATEMENT CARDS HERE)  
5. $EOD  
6. #PFOS.CDS/CO PFOS.BI  
7. $RUN CKRIDE  
8. #YCR214.DIR, YCR212.DIR, YCR200.DIR PFOS.CDS, NAV040.CIL  
9. $RUN PIP  
10. #LP: PFOS. CDS  
11. #PFOS.*/DE  
12. $FIN
```

Figure 8-4. VFR Checkride Job Deck

```
$JOB CKRIDW 160.3!  
$RUN PIP  
#PFOS.BI BI:/FA  
(PLACE DATA DECK HERE)  
$EOD  
#PFOS.CDS/CO PFOS.BI  
$RUN CKRIDW  
#YCR215.DIR, YCR213.DIR, YCR201.DIR PFOS.CDS, NAV070.CIL  
$RUN PIP  
#LP: PFOS. CDS  
#PFOS.*/DE  
$FIN
```

Figure 8-5. Weapons Checkride Job Deck

	001 PRE-TAXI	TRQ >34%			
NOTE 1	→ MAP XX				
	002 TAXI	HDG 150+-10DEG		HDG 150+-10DEG	
	003 LIGHT ONGEAR	TRQ >44%		HDG 150+-10DEG	
	004 I.T.O. CLIMB	IAS >35K		AOB 0+-10DEG	
				PIT 0+.5-1DEG	
	005 I.T.O. CLIMB	IAS >75K		HDG 150+-10DEG	
				AOB 0+-10DEG	
	006 CLIMB	ALT >1000'		PIT 0+.5-2DEG	
				IAS 75+-10K	CLIMB ON RUNWAY HEADING
	007 CLIMBING TURN ANY	ROT >2DPS		HDG 150+-10DEG	
		HDG <105DEG		IAS 75+-10K	START 180 DEG LEFT TURN
	008 CLIMBING TURN	HDG 340+-1DEG		ROC 500+-100FPM	
				IAS 75+-10K	CONTINUE TURN
				ROT 3+-1DPS	
	009 CLIMBING TURN	ROT <.25DPS		ROC 500+-100FPM	
				IAS 75+-10K	ROLL OUT ON RECIPROCAL HEADING FROM TAKEOFF
				ROC 500+-100FPM	
	010 CLIMB	ALT >1900'		LTIM 60+-5SEC 5	
				IAS 75+-10K	LEVEL OFF AT ASSIGNED ALTITUDE (2000')
	011 LEVEL FLIGHT	IAS >90K		HDG 330+-10DEG	
				ROC 500+-100FPM	ACCELERATE TO CRUISE AIRSPEED
	012 LEVEL TURN	RAD 021+-5DEG OZR		HDG 330+-10DEG	INTERCEPT 021 DEG RADIAL CAIRNS VOR
				ALT 2000+-100'	START CLIMB TO NEW ASSIGNED ALTITUDE
	13C LIMB	ROC >400FPM		IAS 100+-10K	
				RAD 021+-5DEG OZR (3000')	
	14C LIMB	ALT >2900'		IAS 100+-10K	CONTINUE CLIMB, THEN LEVEL OFF
				RAD 021+-5DEG OZR	
NOTE 2	→ ROC 500+-100FPM			IAS 100+-10K	CONTINUE TO SKIPPERVILLE
NOTE 4	→ 015 LEVEL FLIGHT ANY	AOB >10DEG		ALT 3000+-100'	
		TIME >3SEC		RAD 021+-5DEG OZR	
	016 LEVEL TURN	DME <16NM DHN		IAS 100+-10K	TURN RIGHT TO INTERCEPT 331 DEG RADIAL DOTHAN VORTAC
				ALT 3000+-100'	CONTINUE TO ECHO
NOTE 3	→ 017 LEVEL FLIGHT ALL	AOB S10DEG		IAS 100+-10K	
		DME <9NM DHN		ALT 3000+-100'	
	018 LEVEL TURN ANY	ROT >2DPS		RAD 331+-5DEG DHN	START HOLDING PATTERN
		HDG <130DEG		IAS 100+-10K	
	019 LEVEL TURN	HDG 340+-1DEG		ALT 3000+-100'	CONTINUE FIRST 180 DEG TURN OF HOLDING PATTERN
				IAS 100+-10K	
				ALT 3000+-100'	
				ROT 3+-1DPS	
NOTE 5	→ 020 LEVEL TURN ALL	ROT <.25DPS		IAS 100+-10K	ROLL OUT HDG 331 DEG
		TIME >3SEC		ALT 3000+-100'	
	021 LEVEL FLIGHT ALL	AOB >10DEG		IAS 100+-10K	CONTINUE HDG 331 DEG
		TIME >3SEC		ALT 3000+-100'	
	022 LEVEL TURN ALL	ROT >2DPS		HDG 331+-10DEG	START 180 DEG TURN
				IAS 100+-10K	
	023 LEVEL TURN	HDG <160DEG		ALT 3000+-100'	CONTINUE TURN
				IAS 100+-10K	
				ALT 3000+-100'	
				ROT 3+-1DPS	
	024 LEVEL TURN ANY	RAD 331+-5DEG DHN		IAS 100+-10K	ROLL OUT ON 331 DEG RADIAL DOTHAN VORTAC
		ROT <.25DPS		ALT 3000+-100'	CONTINUE TO ECHO
	025 LEVEL FLIGHT	DME <9NM DHN		IAS 100+-10K	
				ALT 3000+-100'	
				RAD 331+-5DEG DHN	
				LTIM 240+-10SEC 17	
NOTE 1.	(LINE ITEM 001) INCORRECT MAP NUMBER MAP DISPLAY WILL NOT OCCUR.				
NOTE 2.	(LINE ITEM 14C) THIS ITEM IS PUNCHED IN WRONG COLUMNS. ROC WILL NOT BE MONITORED.				
NOTE 3.	(LINE ITEM 017) SYNTAX ERROR IN AOB >10DEG. AOB WILL NOT BE MONITORED.				
NOTE 4.	(LINE ITEM 015)				
NOTE 5.	(LINE ITEM 020)				

Figure 8-6. Typical Printed Page of a Checkride

Segment 17 has been mispunched. Using a blank data sheet rewrite the 1st line as:

017 LEVEL FLIGHT AOB > 10DEG IAS 100+-10K CONTINUE

c. Data Format. The checkride data input sheet (figure 8-2) divides the card into five fields:

<u>Field</u>	<u>Columns</u>	<u>Designation</u>
1	1 to 3	Segment Number
2	5 to 16	Title and Special Action
3	18 to 36	Segment End Condition
4	38 to 56	Monitored Parameter
5	56 to 80	Remarks

Field description (figure 8-2) is as follows:

(1) Field 1 - Segment Number: This field is used only to indicate the start of a segment. The valid range of numbers is from 1 to 999 and must be employed in a sequential, ascending order.

(2) Field 2 - Segment Title: This field, when associated with a segment number, may contain a brief text to provide a title for this segment.

(3) Field 2 - Special Action Cue: For other than the first card of a segment, this field may contain a special action cue which basically automates an IOS switch function (see table 8-1). These special action cues are limited to those listed in the table.

(4) Field 3 - Segment End Condition: This field contains a description of the aircraft parameter that, when met, will cause this segment to end, and the next to begin if any. See table 8-2.

(5) Field 4 - Monitored Parameter: This field contains a description of the aircraft parameter that, if exceeded, will be considered as pilot error and will be appropriately reported and recorded for overall evaluation. See table 8-2.

(6) Field 5 - Remarks: This field may be used to provide text in support of the entire segment. This text may be continued on all subsequent cards of the segment.

(7) Fields 3 and 4 - Syntax: These aircraft parameter fields will, for this description, be divided into two portions: the name and the value/units. The name will be taken from the allowable aircraft parameters listing given in table 8-2. The name will be separated from the value by a single blank column. The value shall be immediately followed (no blanks) by the units symbol. The value may appear in the following ways:

>(+)VU	Greater than
<(+)VU	Less than
(+)V+-TU	Value ±Tolerance (symmetric tolerances)
(+)V+T-TU	Value + Tolerance - Tolerance (asymmetric tolerances)
V to VU	Value to Value

Table 8-1. Permissible Special Action Cues Syntax

SPECIAL ACTION CUE	FUNCTION	LIMITS AND CONSTRAINTS
MAP XX	Selects specified Map Display	is limited to 30 to 40*
GCA 45	Selects GCA Display	
SCOR XX	Selects Scoring Display	is limited to 47, 48 or 49*, which further limits scoring sequence
MALF XXX	Inserts the specified Malfunction	is limited to 351 to 899*
COM XXX	Selects specified ATC Com scenario	is limited to 1 to 127
SNAP X	Operates Store Plot Logic	is limited to 1 or 2 which selects the display buffer: 1 = Page Buffer 2 = Map Buffer
MALD XXX	Deletes specified Malfunction	is limited to 351 to 899*
MOVE XX	Designates a Moving Tgt from Sequence	is limited to one of the possible 3 target sequences <u>previously</u> selected
THDG XXX	Moving Target Heading	is limited to 1 to 360 degrees
TVEL XX	Moving Target Velocity	is limited to 0 to 50
EXER XX, YY	Specifies beginning of an Exercise	is limited to: XX 1 to 9 specifying which exercise number YY 1 to 20 specifying which initial conditions to be employed
SEQ XX[,YY[,ZZ]]	Specifies Target Sequence from Scoring	are limited to 1 to 10 if SCOR = 47 11 to 20 if SCOR = 48 21 to 26 if SCOR = 49
TEXT	Signals the entire card contains an extended description or title	
ALL	Segment to End only when all End Conditions are met (default)	
ADV	Advance Target Sequence	
ANY	Segment to End when any End Condition is met	

*These limitations correspond to the IOS Panel thumbwheel select designations

Table 8-2. Allowable Aircraft Parameters

Name	Units	Description
ALT	FT or '	PRESSURE ALTITUDE (INDICATED)
AS	KTS	INDICATED AIRSPEED
TIM	SEC	TIME (IN END CONDITION OR SEGMENT TIME)
LTM	SEC S	TIME ELAPSED SINCE PREVIOUS SEGMENT ENDED
TRQ	%	ROTOR TORQUE
GS	KTS	GROUND SPEED
RP	RPM	ROTOR SPEED
EGT	%	EXHAUST GAS TEMPERATURE
VS	FPM	VERTICAL SPEED
.ROT	DPS	RATE OF TURN
DIS	NM XXX	DISTANCE TO ADF FACILITY
DME	NM XXX	DISTANCE TO NAVIGATION FACILITY
GSD	DEG XXXX	GLIDE SLOPE DEVIATION
LOC	DEG XXX	LOCALIZER DEVIATION
CRS	DEG XXX	COURSE TO ADF FACILITY (MAG)
BRG	DEG XXX	BEARING TO ADF FACILITY (MAG)
RAD	DEG XXX	RADIAL FROM NAVIGATION FACILITY (MAG)
HDG	DEG	HEADING (TRUE)
PIT	DEG	PITCH
YAW	BALL WIDTH	YAW (SIDESLIP)
AOB	DEG	ANGLE OF BANK (ROLL)
N1	%	GAS PRODUCER SPEED
RNG	M	RANGE TO TARGET (METERS)
HAG	FT	FIELD ELEVATION
ER	RPM	ENGINE SPEED

NOTE

Above mnemonics can be used for designation of end conditions or monitored parameters.

XXX radio station call letters are required.

S is segment referenced number.

V + TU	Value + Tolerance - 0
V - TU	Value + 0 - Tolerance

where: V = Value field; i.e., 123 or 1.23 or 0.123 (w/optional sign) U^r Units designator; i.e., KTS or FT or %, etc.

NOTE

The units field may be separated from the value or tolerance by one or more blanks or may even be absent if the parameter is not facility dependent.

Example of Field Entry Syntax: ALT 1700'
 HDG 120+-4.5DEG
 BRG 334 to 344 DEG OZR

d. Monitoring Elapsed Time Between Segments (LTM). The purpose of LTM is to monitor the pilot in the execution of a maneuver which transcends many segments (i.e., a holding pattern).

NOTE

LTM is not logically applicable as a segment end condition yet it is allowed.

When LTM appears as a parameter in a segment it will be ignored by the checkride program until the end condition is met and the segment ends (figure 8-4, segment 009). At this point the elapsed time since the end of the specified segment is computed and compared to the value and tolerances. Should the computed time fall outside the tolerances, an error is charged against the pilot. This error notice will appear on the hard copy error summary. An example of the use of LTM follows:

009 CLIMBING TURN ROT .25 DPS AS 75+-10K LTIM 60+-5SEC

In this example, when segment 9 ends, the elapsed time since the end of segment 5 is measured and must be 55 to 65 seconds or the pilot will be in error (tardy or premature).

e. Monitoring Event Time (TIM). When time appears in a segment as a monitored parameter (Field 4), the only logical application would be for determining when the pilot has too long remained in that segment. An example of this could be TIM <15 SEC. In this example the pilot would be allowed to maneuver in that segment for 14 seconds. Past this point he would be in error (tardy) and the checkride program would start accumulating error against the time parameter.

f. Time as an End Condition. When time appears in a segment as an end condition (Field 3), it may be applied in one of two ways. The first would be time since the beginning of the segment, and the second would be the time that one (or more) other end conditions must remain met. The distinction of which application is to be considered is declared in the special action due field (Field 2), by the occurrence of the key words any (Case 1) or all (Case 2). For example refer to figure 8-6, Note 4:

015 LEVEL FLIGHT AOB > 10DEG
 ANY TIM > 3SEC

That would be an application of Case 1 where either angle of bank or segment elapsed time would cause the segment to end. As a second example, refer to figure 8-6, Note 5:

021 LEVEL FLIGHT AOB > 10DEG
 ALL TIM > 3SEC

This would be an application of Case 2 where the angle of bank must be maintained for at least 3 seconds for the segment end.

NOTE

Both examples appear similar except for the special action cue ANY in the first example and "ALL" in the second example. The segment elapsed time is not a segment limiting factor in the second example as it was in the first.

It should be noted here that the usage of TIM and ALL have a special connotation which varies somewhat from the other usage of ALL vs. multi-end conditions. Refer to figure 8-6, Note 3:

017 LEVEL FLIGHT AOB O1DEG
 ALL DME 9NM DHN

In this case, angle of bank and the distance to Dothan create the end condition. They do not have to be met simultaneously. Once one has been met, it is no longer monitored leaving the other to trigger the actual segment end.

g. Checkride Data Deck Restrictions

- (1) A checkride shall not exceed 600 cards (1200 for two checkrides).
- (2) Any segment shall not exceed 6 cards (program controlled).
- (3) Any segment must therefore contain not more than 6 end condition parameters and not more than 6 aircraft monitored parameters.
- (4) A segment is limited to one occurrence of any particular special action cue.
- (5) Special action cues MAP, GCA and SCOR may not appear in the same segment (the latest entry would be applied).
- (6) Special action cues ANY and ALL may not appear in the same segment (the ALL condition would be applied).
- (7) Any number of parameters (Fields 3 & 4) of a segment may be radio facility dependent but the same facility must be referenced throughout that segment.
- (8) LTM is restricted to referencing a segment ended not more than 15 seconds prior; i.e., while in the 24th segment, the eldest segment which could be referenced would be 009 (24-15).

h. Error Notification

- (1) Error in Field 1: Segments not in sequence. Column 1 = *
- (2) Error in Field 2: Unidentifiable action or value outside acceptable limits. Column 4 = ;
- (3) Error in Field 3: Unidentifiable parameter, missing value or syntactically incorrect, missing station call letters. Column 17 = *
- (4) Error in Field 4: Same as for Field 3. Column 32 = *
- (5) Error in Card Count: Too many (more than 6) cards in this segment. Column 3 = ' on offending card(s).

Section II. DEMONSTRATION EDIT AND FORMULATION

8-4. GENERAL. To formulate or edit a demonstration, the objective is: 1) to record on disk a flight or mission profile, as performed by an expert Army aviator; then 2) to edit or record audio commentary on tape which will accompany the e-corded performance to be played back as a demonstration to a student pilot in the simulator. This section provides the procedures required to formulate, edit and playback check a demonstration.

8-5. DEMONSTRATION DESCRIPTION. The computer complex system records on disk all cockpit hardware inputs to the simulation computer as a function of time. For demonstration exercises, sufficient disk space is available to store 240 minutes (4 hours) total of dynamic profile which corresponds to MET.

a. When a RECORD DEMO mode is first selected, a block of initialization data is transferred to disk immediately. Sufficient data is recorded to completely reset the simulator to an arbitrary configuration. Within a single demonstration, nine maneuver marks can be recorded. A block of initialization data is recorded immediately on disk whenever a maneuver mark is inserted.

b. During playback, hardware inputs from the cockpit to the simulation computer are suspended. These inputs are replaced by disk resident data previously recorded. In playback, the computer controls and repositions throttle, cyclic, collective, and directional controls as they were recorded. The result of switch activation is played back, but switch position is not physically or automatically moved.

c. As a result of computer controlled playback, the simulator reflies the mission. All motions, sounds, instrument indications, and out-the-window scenes are recreated.

d. The simulator can exit a demonstration at any point during the demonstration, and the simulator can be manually flown from that point, or another mode of operation may be selected.

8-6. OPERATIONAL CONSIDERATIONS. The system provides for up to 20 demonstrations with synchronized audio commentary.

a. Each demonstration can be subdivided by up to 9 maneuver marks that provide intermediate entry points to specific maneuvers. An intermediate point can be played back with synchronized commentary once the audio tape is cued to the appropriate start point, or can be played back without audio immediately after replay setup completes.

b. Within one demonstration, therefore, several maneuvers can be presented. These maneuvers can be formulated so that the entire demonstration takes on a mini-mission contiguity or it can be formulated so that no contiguity exists (i.e., the demonstration consists of several unrelated maneuvers).

c. Each demonstration is limited in time to its audio tape length which is approximately 30 minutes. The total system capacity is limited to approximately 240 minutes or 4 hours of accumulated MET. Experience has shown that total mission elapsed time of approximately 20 minutes consumes approximately 30 minutes of wall clock time when the audio is edited over the recorded maneuvers of a demonstration.

Briefings, discussions, and pauses account for the difference in MET and wall clock time. Use of slow-time editing would further decrease the total MET.

d. Demonstrations are made in two parts - first, the aerodynamic maneuvers are recorded, reviewed, and, when found acceptable to the school standard, form the basis for the second operation: editing and recording audio.

NOTE

Audio is limited to 30 minutes per demonstration.

e. Demonstrations once recorded can be re-recorded from the very start or from any intermediate maneuver (i.e., when re-recorded, everything beyond the rerecord entry point must be re-recorded). Whenever any part of a demonstration is re-recorded, the entire audio editing for that demonstration must be re-recorded. To minimize this effect, it is suggested that each maneuver be reviewed prior to performing the next phase (maneuver) within any single demonstration. Although this process is time-consuming and frustrating, when a demonstration recording of aerodynamic maneuvers is completed, it will not have to be re-recorded. Audio reediting does not affect maneuvers recording.

f. At the IOS left console, the four switches left of the EDIT AUDIO RECORD switch on the Demo Control panel shown below may be used during formulation (recording aero profile).

Demo Control

RECORD	EDIT	FRZ ON	EDIT	EDIT	
MANEUV	MARK/	MANEUV	AUDIO	SLOW	
DEMO	MARK	PAUSE	MARK	RECORD	TIME

g. The RECORD DEMO switch is used in conjunction with the thumbwheel selector and INSERT switch to initiate demo formulation (aero record). Depression of the illuminated RECORD DEMO switch stops formulation at that point without deletion of the entire previously recorded demonstration (maneuvers).

h. Since freeze is not recorded during demo formulation, activities performed by the operator at the IOS during freeze, other than insertion of IC, should be curtailed. Do not target advance, insert malfunctions, or edit during demonstration freeze.

i. The RECORD MANEUV MARK function defines the end of one maneuver and the reentry point for the next maneuver. During a recording, depression of this switch marks a reentry point unless FRZ ON MANEUV MARK is simultaneously active. In this case, the trainer freezes once the mark is recorded. During a demonstration, only nine RECORD MANEUV MARK actions are allowed. When more than nine entries are made, the ninth entry is replaced by the last subsequent entry.

j. The EDIT MARK/PAUSE mark function is used during demo formulation to mark a point where, during playback, demo audio is desired to be inserted without continuing with aerodynamic maneuvers. This is a stop action in playback that allows long commentary to be presented or a prologue to be recorded during audio edit. Any number of edit pause marks may be used during formulation.

NOTE

EDIT MARK/PAUSE must not be entered concurrent with MANEUV MARK. Three seconds of mission elapsed time must separate a MANEUV MARK and an EDIT mark.

k. Demonstrations are formulated and edited in integrated mode. They can be played back in either integrated or independent mode. During independent playback, the result of actions not formulated within the playback cockpit cannot be seen. (In pilot independent playback, any weapons fired by the gunner are not seen.)

l. It is important to select a CRT page in both cockpits prior to formulation which, during playback, will give an observer the most useful information. Before formulation of a tactical weapons demo, select appropriate score page, target configuration, and weapons load. Formulate the demo by shooting at aim spot. Before formulation of demonstration of HSS, the HSS alignment in both pilot and gunner cockpits must be accomplished.

m. Before recording a demonstration at segment 0, perform DATA CLEAR prior to selection of RECORD DEMO. During demonstration formulation, the following actions are allowed:

- (1) Malfunctions can be inserted or deleted.
- (2) Targets can be advanced.
- (3) IC's can be inserted.

Actions NOT allowed during demonstration formulation and editing are:

- (1) No edit functions whatsoever are allowed to any CRT page.
- (2) Weapons configuration cannot be changed except by IC insert.
- (3) CRT page cannot be changed.
- (4) Targets cannot be redesignated.
- (5) Demo record in independent mode is not possible.
- (6) Formulation or editing cannot proceed until appropriate message appears on both pilot and gunner CRTs.
- (7) ICs and maneuver marks cannot be inserted closer than 3 seconds either side of each other.
- (8) No activities at IOS are recorded while in manually activated FREEZE except an IC.
- (9) EDIT PAUSE' and EDIT SLOW TIME cannot be used simultaneously.
- (10) EDIT PAUSE and EDIT SLOW TIME cannot be inserted closer than 3 seconds either side of each other, either side of an IC, or either side of a MANEUV MARK.

(11) EDIT MARK cannot be inserted closer than 3 seconds either side of an IC or either side of a MANEUV MARK.

8-7. SPECIAL CONSIDERATIONS. The targets to be designated as targets of interest cannot be redesignated within a demonstration. During any demo, only three targets can be selected, at one range, on one score page. DATA CLEAR does not completely clear all data on a score page.

a. If engine RPM audible warning is likely to occur during a demonstration, there are two circumstances when the RPM warning disable switch on the pilot's engine control panel should be kept from returning to the ON position. This can be accomplished with a rubber band or tape strong enough to overpower the spring load of the switch. Do not pull the RPM warning circuit breaker. The first circumstance is during formulation at user's discretion. It is not heard by the user, but the RPM warning will still be present during the demonstration playback. The second circumstance is during audio editing. The RPM warning must be disabled during audio editing to prevent a double playback of the warning sound.

b. During formulation, radios which are on or off, frequencies tuned or detuned, and radio volumes are all recorded. Receiver switch positions on the ICS units are not recorded. Although a radio cannot be heard because the receiver switch is off, the radio is played back if the radio was turned on during recording of the demo. Ensure that radio status is determined and switches are set before beginning formulation. During audio editing, always make sure receiver switches on all ICS units in both cockpits are turned off manually.

8-8. DEMONSTRATION FORMULATION PROCEDURE. Perform a dry-run of the flight dynamics following proper documented demo description/scenario until the experienced pilot is familiar with the intent of the demo. To record the demonstration perform the following:

- a. Ensure proper system operation and hydraulics available for motion and control loading both cockpits.
- b. Ensure that control loading is unlocked and gunner EMERG ELECT PWR switch is ON.
- c. Ensure that both simulators are occupied (IOS station and cockpit).
- d. Establish intercommunications.
- e. Select integrated mode.
- f. Establish communication of RADIO OVER RIDE and STUD MON in both cockpits.
- g. Turn COMM radios off.
- h. Turn NAV radios off.
- i. Establish initial conditions for start of demo; initiate data clear.
- j. Select appropriate weapons configuration, target select sequence, fuel loading, etc.
- k. Leave simulator in freeze.

- l. Ensure that correct CRT is displayed in both cockpits. Edit CRT page if required.
- m. Depress RECORD DEMO switch on DEMO CONTROL panel.
- n. Set thumbwheel to demo being recorded; i.e., 150. Check that MET time is reset to zero.
- o. Depress INSERT switch.
- p. Do not proceed until PROCEED WITH DEMO RECORD message appears in the edit area on both the pilot and gunner IOS CRT displays. If ENTRY ALREADY EXISTS message appears, a demonstration already exists for that thumbwheel number setting. If the old demonstration is to be erased and another one recorded in its place, depress INSERT switch a second time. The OFF LINE switchlight blinks while the system is preparing to record a demonstration.
- q. Alert all personnel that freeze is about to be removed; release PROBLEM FREEZE.
- r. From this point on, operator actions can be varied greatly in order to achieve the desired results. Follow steps s. and t. to fly a single maneuver and establish a new set of initial conditions for the second maneuver.
- s. Depress FRZ ON MANEUV MARK switch.
- t. When the pilot completes the flight portion of this maneuver, depress RECORD MANEUV MARK switch. The system will freeze automatically.
- u. Unfreeze and continue record for at least 3 seconds.
- v. If the demonstration scenario does not require a new IC, skip to step aa.
- w. Freeze simulator.
- x. Select desired IC 1-10 on thumbwheel selector.
- y. Depress INSERT.
- z. Upon conclusion of IC. when FREEZE indicator illuminates steadily, unfreeze to continue with record of next demo maneuver.
- aa. Again the operator actions can be varied to control the situation. Follow step ab. to perform some tricky maneuver that will require a high level of attention from the student when demonstrated and that must be slowed down or stopped entirely to allow the student to follow the action while being coached via prerecorded audio instruction.
- ab. When the pilot enters the tricky maneuver, momentarily depress EDIT MARK switch.

- ac. Upon completion of maneuver, depress RECORD MANEUV MARK. It is advisable to establish a maneuver mark at the end of every demonstration unless nine maneuver marks have already been used. This provides a point for reentry to record additional maneuvers at a later time.
- ad. Unfreeze and continue record for at least 3 seconds.
- ae. Freeze simulator.
- af. To exit demo record mode, depress RECORD DEMO switch. Demo record mode may also be exited by selecting recorded demonstration on thumbwheels and depressing delete switch.
- ag. The flight portion of a demo should be finalized before proceeding to the edit audio phase. If a maneuver is to be reformulated, the original maneuver and all subsequent maneuvers will be lost.

8-9. FORMULATION REVIEW/PLAYBACK. To review aerodynamic flight portion of demonstration previously recorded:

- a. Place simulator in integrated mode if gunner actions are a critical part of the demo.
- b. Leave simulator in freeze state.
- c. Set thumbwheels to demo being reviewed; i.e., 150.
- d. Alert pilot (and gunner) that an initial condition is about to occur. Depress INSERT switch.
- e. When FREEZE indicator stops blinking, remove problem freeze.
- f. The simulator recreates all pilot (and gunner) actions of the initial maneuver. As the maneuver completes, the simulator goes into a problem freeze automatically if the next maneuver begins with an IC. If there is no IC, skip to step i.
- g. The second set of initial conditions should be established in the system automatically.
- h. The demonstration automatically unfreezes when IC initialization is complete.
- i. Repeat step b. if there are additional maneuvers.
- J. The simulator drops out of the demo replay mode automatically. Additional information for demonstration playbacks appears in paragraph 8-10.
- k. At this point, the operator can select to replay the demo again in its entirety or from the last maneuver (i.e., 151) or, if an error in flight was discovered, the operator can choose to rerecord the demo beginning with the maneuver number that contained the error. When the demo is flown as intended, record the audio (edit).

8-10. AUDIO EDITING. Once the aerodynamic flight portion of a demonstration is complete, audio editing then takes place.

a. Ensure that the aerodynamic performance of the formulation is complete and meets the criteria of the school. Play back the entire demonstration several times and review the relationship of the script and MET. Enter playback at each maneuver mark and record the MET of each. Note on the script the start of each epilogue and annotate MET for the start of each at least 3 seconds before a maneuver mark. Details of when pauses are required and when slow edit is desired should be noted on the script (MET). Once a smooth delivery has been perfected, an audio recording can be undertaken.

b. Prior to editing audio for a demonstration, disable the seat shaker and motion system in both cockpits. Turn off all receiver switches on all ICS units in both cockpits. Disconnect all unused helmets and headsets in both cockpits. The EDIT AUDIO RECORD switch is used in conjunction with the thumbwheel selector and insert controls to initiate the demo edit mode. Depression of the illuminated EDIT AUDIO RECORD switch deletes the demo edit mode. During the demo edit mode, the sound level is automatically set to 0 to permit better audio recording. This zero sound level is not recorded as part of the final demonstration. Hopefully, the one edit session will produce an acceptable commentary for the previously recorded aero demonstration.

c. Experience shows that editing part of an audio tape is almost impossible. Re-recording from a maneuver mark is extremely difficult. This is due to the fact that, on rerecord, the original audio is not totally erased. During periods of desired silence, low-level background audio may be present.

d. During audio edit, two people are required in the pilot cockpit, one to speak the words, the second to cue the speaker and perform edit functions at the IOS. A set of communication hand signs should be developed so that non-verbal directions can be transmitted while voice recording continues. Speak only while the trainer is in FREEZE (not PAUSE mode). In addition, a third person is required at the audio recorder cabinet to cue up tapes, set and check modulation levels, and monitor recorder operation. When FRZ ON MANEUVR MARK switch is illuminated, the simulator freezes automatically whenever a previously recorded maneuver mark is encountered.

e. There is no real limit to the number of edit marks on a demo being formulated. These marks, temporary by nature of their function, cause the simulator to automatically freeze when encountered in the edit audio record mode. The purpose of these freezes is to give the operator the opportunity to activate the EDIT SLOW TIME and EDIT PAUSE functions while the simulator is in a total freeze. Until the edit mode is selected, EDIT PAUSE, FRZ ON MANEUVR MARK, and EDIT SLOW TIME are inactive. The EDIT SLOW TIME and EDIT PAUSE functions may be evoked a maximum of 20 times during a single demonstration.

f. Under no circumstances should SLOW TIME or PAUSE straddle a maneuver mark. Therefore, at initiation of PAUSE or SLOW TIME, MET should be at least 3 seconds away from maneuver mark. EDIT PAUSE, when selected, allows record of audio while aerodynamics remains frozen; i.e., stop action. Depression of the illuminated

EDIT PAUSE allows resumption of audio recording in synchronization with dynamic playback. It is suggested that freeze be active prior to selection of PAUSE.

g. Selection of EDIT SLOW TIME specifies playback of the aerodynamics in slow time (half speed). This allows commentary during a speedy maneuver to be made more comfortably without resorting to stop action. Depression of the illuminated EDIT SLOW TIME returns the simulator to normal action speed. It is suggested that the simulator be frozen prior to activation of slow time.

NOTE

Slow time and pause are mutually exclusive.

h. Synchronization of audio relies on data being recorded on disk as well as on audio tape. After a demonstration has been found totally acceptable, a backup of the disk should be made.

i. The following example is similar to the demonstration recorded in paragraph 8-8. Perform the following to edit into the flight perfected demonstration a series of programmed freezes and slow-times with continuous audio:

- (1) Place simulator in integrated mode.
- (2) Disconnect all unused helmets and headsets in both cockpits.
- (3) Turn off all receiver switches on ICS units in both cockpits.
- (4) Experience has shown it best to record audio from the pilot student location. Set pilot ICS transmit-interphone selector switch to hot mike. Set gunner ICS transmit-interphone selector switch to 4. Set both observer ICS transmit-interphone selector switches to 1.
- (5) Deselect all communication switchlights at both IOS.
- (6) Place 2-minute cartridge in pilot dynamic recorder No. 1. (It is assumed cued up to start of tape.)
- (7) Depress EDIT AUDIO RECORD switch.
- (8) Set thumbwheels to demo being edited; i.e., 150.
- (9) Alert pilot and gunner that an initial condition is about to occur. Depress INSERT switch.

NOTE

A cassette has two spools and is 3-15/16 x 2-1/2 x 5/16-inches.
 A type A cartridge has one spool and is 4 x 5-1/8 x 7/8-inches.
 A type B cartridge has one spool and is 6 x 7 x 7/8-inches.
 Only type B cartridges are used on this system.

- (10) When FREEZE indicator stops blinking:
 - (a) Actuate FRZ ON MANEUVER MARK switch.
 - (b) Check that RADIO OVERRIDE and STUDENT MONITOR have been automatically selected by demonstration.
 - (c) Activate EDIT PAUSE switch if a prebriefing is to be given; otherwise, skip to step (13) and continue with audio recording during aerodynamics.
- (11) Begin demo briefing message from any station, speaking into headset.
- (12) At end of message delivery, depress EDIT PAUSE switch (off). Problem freeze is removed by deletion of EDIT PAUSE. Continue with step (14).
- (13) Remove problem freeze.
- (14) The simulator recreates all pilot and gunner actions of the initial maneuver. If a post maneuver message is to be given without aerodynamics, it must occur at least 3 seconds before the MET of the maneuver mark which should have been noted on the script. A post maneuver message could go here if desired by depressing EDIT PAUSE switch and repeating steps (11) and (12). As the maneuver completes, the simulator goes into a problem freeze automatically. FRZ ON MANEUVER MARK is an indication by the system to let the operator know that no crucial actions were allowed to be recorded too close to the maneuver mark. During this freeze state, no audio is recorded and the actions to be taken during the next maneuver can be discussed.
- (15) Remove problem freeze. Simulator assumes second set of initial conditions automatically after 3 seconds have elapsed. When the set of initial conditions has been completed, problem freeze is removed automatically by the demonstration. Wait 3 seconds after removing problem freeze; then if a pre-maneuver message is required, depress EDIT PAUSE and repeat steps (11) and (12). In either case, then continue with step (16).
- (16) The simulator recreates all pilot and gunner actions of the second maneuver. When the playback comes to the point where, during demo record, the EDIT MARK switch was depressed, the simulator goes into problem freeze automatically.
- (17) Actuate EDIT SLOW TIME switch.
- (18) Remove problem FREEZE.
- (19) Resume aural description of the tricky maneuver while the simulator recreates it in slow (half) time.
- (20) At conclusion of this difficult maneuver, release EDIT SLOW TIME switch at least 3 seconds prior to the MET of the maneuver mark noted in the script. If a post-maneuver message is desired using EDIT PAUSE, EDIT SLOW TIME must be released at least 6 seconds prior to maneuver mark MET. This permits EDIT PAUSE to be inserted 3 seconds before the maneuver mark and 3 seconds after deletion of slow time.

- (21) At the end of the second maneuver, the simulator goes into problem freeze at the next and last maneuver mark.
- (22) Remove problem freeze. The simulator drops out of the demo replay mode automatically at the end of the demonstration.
- (23) Remove demo cassette from the pilot dynamic recorder and place it in the appropriate position in the demo playback audio cabinet unit 5. After the tape is cued up, it is ready for use in demonstration playback.

8-11. DEMONSTRATION PLAYBACK CHECK. To playback a demonstration perform the following:

- a. Attain either independent or integrated mode as desired.
- b. Set thumbwheels to demo/maneuver of concern; i.e., 151.
- c. The gunner student or instructor/operator can call a flight demo in independent mode for the purpose of having an autopilot (the flight portion of the demo) enabling him to manually control and use his weapons. This differs from a normal demonstration where the weapons would be controlled by the demo playback. The AUTO FLIGHT switch at the gunners IOS allows for this feature.
- d. Alert pilot/gunner that an initial condition is about to occur. Depress thumbwheel INSERT switch.
- e. The edit area on the IOS CRT shows at various times the status of the audio tape system with messages like:
 - AUDIO NOT READY: GOING TO PROPER MANEUVER
 - AUDIO NOT READY: REWINDING
 - AUDIO NOT READY: IN USE
 - AUDIO READY
- f. At other times, this edit area will be informative as to the status of the procedure being attempted by the operator, with messages like:
 - ENTRY ALREADY EXISTS
 - NO SUCH ENTRY EXISTS
 - WAIT FOR PROCEED
 - PROCEED WITH DEMO RECORD
 - DEMO -REPLAY ACTIVE
- g. When FREEZE indicator stops blinking, remove problem freeze. If an AUDIO NOT READY message is in the edit area when problem freeze is removed, no audio will be heard.
- h. The simulator recreates all actions of the demo, beginning at the selected maneuver. As the demo progresses, the briefing message is heard over the headsets; slow times and initial condition inserts are automatic.
- i. A demo replay may be terminated by the operator by activating the demo thumbwheel DELETE switch.

- j. When the demo plays to completion, the simulator freezes and drops out of the demo replay mode automatically.

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. Procedures for use during simulated malfunctions are contained in Chapter 7, paragraph 7-32.

9-1. EMERGENCY SHUTDOWN. Switches are provided throughout the complex for emergency shutdown of the complete simulator system, motion system only, or simulator system excluding the visual. Emergency shutdown can be accomplished at the following locations:

- a. Complete Simulator Complex. These locations shut down the entire simulator complex including the visual system:

Gantry tower assembly areas - Visual System - EMER STOP
Visual linkage cabinets - EMER STOP
Airport lighting cabinets - EMER STOP

- b. Motion System Only. MOTION OFF switches shut down only the associated (pilot or gunner) motion system:

IOS simulator control panels - MOTION OFF
Student control panels, - MOTION OFF
Motion cabinets - MOTION OFF

- c. Complex Excluding Visual. Switches at these locations shut down the simulator complex excluding the visual system:

Adjacent to IOS left console - EMER STOP
Student control panels - EMER STOP
Digital linkage cabinet - EMER STOP
Analog linkage cabinet - EMER STOP
Motion cabinets - EMER STOP
Motion pumps - EMER STOP
Power cabinet - EMER STOP

9-2. SYSTEM FAILURES. Should a failure be detected, use intercom to contact the computer room and request maintenance. If the system failure can not be cleared within 15 minutes, exit simulator. System failures can occur due to several sources:

Electronic failure
Hydraulic failure
Mechanical failure
Operator-induced failure

WARNING

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

9-3. FACILITY POWER FAILURE. Loss of facility power results in shutdown of the entire device. The following systems become deactivated:

- Cockpit illumination (Emergency light unit should activate)
- Intercommunication
- Motion
- Flight control

Section II. SAFETY

9-4. OPERATIONAL SAFETY. The FWS is designed for safe operation during all phases of training.

WARNING

Prior to the activation of motion, all occupants of the simulated cockpit and IOS (limited to three persons per flight compartment) are required to fasten seat belts.

- a. Each motion system employs numerous devices to ensure safe operation for personnel. Among these are 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.
- b. Entrance doors are equipped with safety interlocks that prevent motion activation until the door is secure.
- c. Motion equipment is located within a gated area with gate interlocks that prevent motion activation unless the gates are closed.
- d. Boarding ramps are equipped with sensing switches to prevent boarding ramp motion with additional weight (person) on the ramp. The motion system is not activated until the boarding ramp is completely raised.
- e. Normal activation and deactivation of each motion system is accomplished at the respective IOS. Motion for each flight compartment is controlled separately and is not mode-dependent.
- f. Fail-safe circuitry prevents erratic movement of the motion system when equipment malfunctions.
- g. Temperature sensors are located in each equipment cabinet. If the temperature reaches 100 degrees Fahrenheit or if adequate airflow is not maintained, visual and aural warnings activate in the computer room. At 110 degrees Fahrenheit, the entire complex automatically shuts down.
- h. Actuation of any EMERGENCY STOP switchlight results in the immediate shutdown of the entire complex and motion system. Once an EMERGENCY STOP switchlight has been actuated and the power shuts down, the main and linkage circuit breakers must be manually reset before power can be reapplied.
- i. In the emergency stop condition, a quick-settle control valve returns the motion platform to the settled position at the highest practical speed. The boarding ramp lowers under power of a reserve stored energy source. Personnel can safely egress to the access balcony in approximately 24 to 31 seconds, depending on the position of the motion platform at the time electrical power was cut off.
- j. An emergency escape ladder is provided should power failure or hydraulic failure prevent a boarding ramp from deployment.

WARNING

Do not discharge a CO₂ fire extinguisher in the confined cockpit.

k. Six fire extinguishers of the CO₂ type are located in central areas of the simulator complex. One in the visual room, one in the computer room, two in the simulator room, and one in each pump room. Two other CO₂ type extinguishers are located in the flight simulator compartments, forming a part of the normal AH-1S cockpit equipment.

l. The visual area is equipped with an intricate series of safety interlock devices, identification signs, and warning lights. A safety system is also provided to prevent physical probe contact with the model board.

GLOSSARY

A

AC	Alternating Current
A/C	Aircraft
ACQ	Acquire
ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
ADJ	Adjust
ADS	Air Data Subsystem
ADS	Airspeed and Direction Sensor
AGL	Above Ground Level
AI	Analog Input
ALT	Airborne Laser Tracker
ALT	Altitude
AM	Amplitude Modulation
AMP	Ampere
ANT	Antenna
AO	Analog Output
AP	Attack Point
APU	Auxiliary Power Unit
AR	As Required
ARM	Armed
ASSY	Assembly
ATC	Air Traffic Controller
AUTO	Automatic
AVAIL	Available
AVIM	Aviation Intermediate Maintenance
AVUM	Aviation Unit Maintenance
AZ	Azimuth

B

BAT	Battery
BFO	Beat Frequency Oscillator
BIT	Built-In-Test
BRG PTR	Bearing Pointer
BRT	Bright
BTU	British Thermal Unit

C

C	Celsius, Common
CARR	Carrier
CAS	Calibrated Airspeed
CAUT	Caution
CB	Circuit Breaker
CCW	Counterclockwise
CG	Center of Gravity
CHAN	Channel
CKPT	Cockpit
CL	Centerline, Control Loading
CLA	Confined Landing Area
CLLT	Closed-Loop Linkage Test

C - continued

CMS	Camera Model System
COMM	Communication
COMPTR, COMP	Computer
CONFIG	Configuration
CONN	Connector
CONT	Control, Continuous
CPU	Central Processor Unit
CRANS	Controllable Random Noise Synthesizer
CRT	Cathode-Ray Tube
CSL	Console
CT	Calibration Test
CUR	Current
CW	Clockwise
CYL	Cylinder

D

DC	Direct Current
DECR	Decrease
DELTA	Incremental Change
DEPR	Depression
DG	Directional Gyro
DI	Discrete Input
DIR	Direct
DRED	Daily Readiness Test
DSCRM'	Discriminator

E

ECS	Environmental Control System
EIA	Electronic Interface Assembly
EL	Elevation
ELEX	Electronics
EMER	Emergency
END	Endurance
EU	Electronic Unit

F

F	Fahrenheit, Increment of Equivalent Flat Plate Drag Area
FAT	Free Air Temperature
FCC	Fire Control Computer
FFAR	Folding Fin Aerial Rocket
FLT	Flight
FM	Frequency Modulation
FOD	Foreign Object Damage
FOV	Field-of-View
FPS	Feet Per Second
FRL	Fuselage Reference Line
FT	Foot
FT/MIN	Feet Per Minute
FWD	Forward
FWS	Flight Weapons Simulator

G

GACP	Gunner Accuracy Control Panel
GAL	Gallon
GAL/HR	Gallon Per Hour
GCA	Ground-Controlled Approach
GD	Guard
GHS	Gunner Helmet Sight
GND	Ground
GNR	Gunner
GRWT	Gross Weight
GS	Glidescope
GW	Gross Weight
GYRO	Gyroscope

H

HDG	Heading
HI/LO MAG SWT	Hi/Lo Magnification Switch
HIGE	Hover in Ground Effect
HP	Horsepower
HR	Hour
HS	Helmet Sight
HSI	Horizontal Situation Indicator
HSS	Helmet Sight Subsystem
HTR	Heater
HUD	Head-Up Display
HYDR	Hydraulic
HZ	Hertz

I

IAS	Indicated Airspeed
IC	Initial Conditions
ICDU	Integrated Control and Display Unit
ICE	In Ground Effect
ICS	Intercommunication System
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
IG	Image Generator
ILS	Instrument Landing System
IN.	Inch
INBD	Inboard
INCR	Increase
IND	Indication
IN.HG	Inches of Mercury
INOP	Inoperative
INTLK	Interlock
INV	Inverter
IOS	Instructor Operator Station
IR	Infrared
IRCM	Infrared Countermeasure
IU	Interface Unit

J

JTSN Jettison

K

KCAS Knots Calibrated Airspeed
 KHZ Kilohertz
 KIAS Knots Indicated Airspeed
 KM Kilometer
 KN Knots
 KTAS Knots True Airspeed
 KVA Kilovolt-Ampere

L

LAI Low Airspeed Indicator
 LB Pounds
 LB/HR Pounds Per Hour
 LHG Left Hand Grip
 LSIG Laser Image Generator
 LIM Limit
 LKD Locked
 LOC Localizer
 LOS Line of Sight
 LPN Link Part Number
 LTG Lights

M

M Modernized Cobra
 MAG Magnetic
 MAINT Maintenance
 MALF Malfunction
 MAN Manual
 MAX Maximum
 MB Marker Beacon
 MET Mission Elapsed Time
 MFD Multifunction Display
 MHF Medium-High Frequency
 MHZ Megahertz
 MIC Microphone
 MIN Minimum
 MM Millimeter
 MOD Modified
 MSI Missile Status Indicator
 MSL Missile
 M&T Maintenance and Test
 MTR Motor
 MUX Multiplexer

N

N/A	Not Applicable
NAV	Navigator
NO.	Number
NM	Nautical Mile
NOE	Nap-of-the-Earth
NORM	Normal
NVG	Night Vision Goggles
N1	Gas Turbine Speed
N2	Power Turbine

O

OAT	Outside Air Temperature
OBST HT	Obstacle Height
OFT	Operational Flight Trainer
OGE	Out of Ground Effect
ORIDE	Override
OUTBD	Outboard
OVRD	Override

P

PACP	Pilot Armament Control Panel
PAR	Precision Approach Radar
PCB	Printed Circuit Board
PFOS	Problem Formulation Operating System
PHS	Pilot Helmet Sight
PLT	Pilot
PLT ORIDE	Pilot Override
PMT	Photomultiplier Tube
PREM	Preliminary
PRESS	Pressure
PROG	Program, Progress
PSI	Pounds Per Square Inch, Pilot Steering Indicator
PVT	Private
PWR	Power
% Q	Percent Torque

Q

QTY	Quantity
-----	----------

R

R/C	Rate of Climb
RCVR	Receiver
R/D	Rate of Descent
RDS	Rounds
RDS RMNG	Rounds Remaining Indicator
REF	Reference
RKT	Rocket
RMI	Radio Magnetic Indicator

R - continued

RND REM	Rounds Remaining Indicator
RPM	Revolutions Per Minute
RMS	Rocket Management Subsystem
RTCL	Reticle

S

SAS	Stability Augmentation System
SAS	Stability Augmentation System
SCAS	Stability and Control Augmentation System
SEC	Second
SECU	Servo Electronic Control Unit
SEL	Select
SHC	Sight Hand Control
SIF	Selected Identification Features
SNG	Single Fire Mode
SPEC	Specification
SQ	Squelch
S/T/A	Stow, Track, Acquisition Switch
STA	Station
STBY	Standby
SW	Switch
SQ FT	Square Feet

T

TAS	True Airspeed
TCP	TOW Control Panel
TEMP	Temperature
TEP	Target Engagement Point
TGT	Turbine Gas Temperature
TML	TOW Missile Launcher
TMS	TOW Missile System
TOI	Target of Interest
TOW	Tube-Launched, Optically Tracked, Wire Command Link
T/R	Transmit-Receive
TRK	Track
TRQ	Torque
TRU	Transformer Rectifier Unit
TSU	Telescopic Sight Unit
TUR	Turret

U

UHF	Ultra-High Frequency
UTIL	Utility

V

VAC	Volts, Alternating Current
VCA	Voltage-Controlled Attenuator
VCO	Voltage-Controlled Attenuator
VDC	Volts, Direct Current
VFO	Variable-Frequency Oscillator

V - continued

VFR	Visual Flight Rules
VHF	Very High Frequency
VIGV	Variable Inlet Guide Vane
VOL	Volume
VOR	Visual Omni Range
VNE	Velocity, Never Exceed (Airspeed Limitation)
VSI	Vertical Speed Indicator
VV	Vertical Velocity

W

WAFWS	Wing Arm Fire Switch
WBOA	Wideband Operational Amplifier
WEG	Weapon Effects Generator
WG	Gross Weight
WG STA	Wing Station
WLC	Weapon Loading Configuration
WPN	Weapon
WPN CNFG	Weapon Configuration

X

XMSN	Transmission
XMTR	Transmitter
XPDR	Transponder

YZ

INDEX

Subject	Paragraph, Figure, Table Number	Page
<u>A</u>		
ABBREVIATIONS	1-4.	1-1
ACCESSORY SYSTEMS	2-26.	2-21
ARMAMENT SYSTEM	5-10., 2-34.	5-4, 2-22
AUDIO EDITING	8-10.	8-21
AUDIO RECORD/PLAYBACK AND PERFORMANCE RECORD/PLAYBACK		7-111
AUDIO SYSTEM	5-7.	5-2
AUTOMATED CHECKRIDE	7-20.	7-64
AVIONICS	5-2.	3-1, 5-1
Advanced Maneuvers	2-21.b.	2-13
Aircraft Sounds	2-27.a.	2-21
Allowable Aircraft Parameters	T8-2	8-11
Altitude Representation	6-7.f.	6-5
Ambient Light Effect	6-7.h.	6-5
Atmospheric Environment	2-22.d.	2-15
Automation of Instructional Function	2-24.e.	2-18
Avionics Systems	T3-1	3-1
<u>B</u>		
Basic Instruction Page 1	F7-4	7-65
Basic Instruction Page 2	F7-5	7-6
Basic Instruction Page 3	F7-6	7-7
Basic Instruction Page 4	F7-7	7-8
Basic Maneuvers	2-21.a.	2-13
Briefing	2-24.f.	2-19
<u>C</u>		
CAMERA MODEL SYSTEM	6-2.	6-1
CHECKRIDE	2-18.	2-12
CHECKRIDE BRIEFING PLAYBACK	7-40.	7-111
CHECKRIDE DISPLAY	7-21.	7-66
CHECKRIDE EDIT AND FORMULATION		8-1
CLEARING MALFUNCTIONS	7-31.	7-71
COCKPIT CIRCUIT BREAKERS	5-9.	5-3
COCKPIT INSTRUMENTATION SIMULATION	2-30.	2-22
COMMUNICATIONS EQUIPMENT	3-2.	3-1
COMMUNICATIONS FACILITY DATA	7-16.	7-59
COMPUTER SYSTEM	2-6.	2-4.1
CONTROL LOADING	2-33.	2-22
CONTROL/DISPLAY INTERRELATIONSHIPS	7-36.	7-105
CRT DISPLAYS		7-103
CRT Display Control Panel	F7-23	7-45

Subject	Paragraph, Figure, Table Number	Page
<u>C</u> - Continued		
CRT Display Format	F7-36	7-104
CRT MAP DISPLAY	7-13.	7-51
CULTURAL LIGHTING	6-4.	6-3
Cairns Approach Map Page 032	F7-26	7-53
Checkride Data Deck Restrictions	8-3.g.	8-13
Checkride PFOS Functional Block Diagram	F8-1	8-2
Communications Panel	F7-20	7-37
Complete Simulator Complex	9-1.a.	9-1
Complex Excluding Visual Configuration	9-1.c.	9-1
Confined Area Lighting	1-2.b.	1-1
'Critique	6-4.b.	6-3
Cross-Country Map Page 030	2-24.g.	2-19
Cueing	F7-25	7-52
Cultural Lighting	2-24.h.	2-19
	T6-1	6-3

D

DEMONSTRATION	2-19., 7-18.	2-12, 7-61
DEMONSTRATION DESCRIPTION	8-5.	8-15
DEMONSTRATION EDIT AND FORMULATION		8-15
DEMONSTRATION FORMULATION PROCEDURE	8-8.	8-18
DEMONSTRATION PLAYBACK	7-39.	7-111
DEMONSTRATION PLAYBACK CHECK	8-11.	8-24
DISPLAY FORMATS	7-35.	7-103
DYNAMIC RECORD/PLAYBACK	7-38.	7-111
Data Format	8-3.c.	8-9
Demonstration Control and Performance Playback Panel	F7-19	7-32
Dome Lights and Emergency Stop Control and Switches	F7-21	7-40

E

EMERGENCY PROCEDURES		9-1
EMERGENCY PROCEDURES AND SAFETY		9-1
EMERGENCY SHUTDOWN	9-1.	9-1
ENVIRONMENTAL CONDITIONS	7-24.	7-69
EVALUATION	4-4.	4-1
Editable Flight Conditions	5-8.c.	5-3
Emergency Maneuvers	2-21.c.	2-14
Environmental Conditions	5-8.a.	5-2
Environmental Sound Cues	2-22.f.	2-15
Error Notification	8-3.h.	8-14

Subject	Paragraph, Figure, Table Number	Page
<u>E</u>		
FACILITY POWER FAILURE	9-3.	9-2
FIELD-OF-VIEW (FOV)	6-5.	6-3
FORMULATION REVIEW/PLAYBACK	8-9.	8-20
FREEZE/CRASH OVERRIDE	7-27.	7-69
FWS TRAINING CAPABILITIES		7-50
Feedback	2-24.i.	2-20
Field-of-View	6-7.b.	6-4
Flight Control	2-24.b.	2-17
Focus	6-7.g.	6-5
Freezable Flight Conditions	5-8.b.	5-3
<u>G</u>		
GENERAL DESCRIPTION	2-7., 6-1., 8-1.	2-5, 6-1, 8-1
GROUND-CONTROLLED APPROACH DISPLAY	7-14.	7-51
Ground-Controlled Approach Page 045	F7-27	7-54
Gunner Flight Weapons Simulator Compartment	F2-3	2-7
Gunnery Maneuvers	2-21.e.	2-14
<u>H</u>		
Helmet Sight Subsystem Calibration	7-3.e.	7-15
<u>I</u>		
IC Listing Page	F7-3	7-4
ICING MALFUNCTIONS	7-33.	7-71
IFR Checkride Program Page 080	F7-9	7-11
INDEPENDENT MODE	5-12.	5-4

Subject	Paragraph, Figure, Table Number	Page
<u>L</u>- Continued		
INITIAL CONDITIONS		7-22
INITIAL PROCEDURES	7-1.	7-1
INITIALIZATION OF CHECKRIDE	7-4.	7-20
INITIALIZATION OF DEMONSTRATION	7-6.	7-21
INITIALIZATION OF NORMAL TRAINING	7-3.	7-9
INITIATION OF TRAINING		7-1
INSTRUCTOR INTERCOMMUNICATIONS SYSTEM	2-13.	2-9
INSTRUCTOR SEATS	2-10.	2-5
INSTRUCTOR STATION CONTROLS AND FUNCTIONS		7-23
INSTRUCTOR/OPERATOR STATIONS	2-3.	2-3
INSTRUCTOR/OPERATOR STATION DESCRIPTION		2-5
INTEGRATED MODE	5-13.	5-5
INTERCOMMUNICATION SYSTEM	7-23.	7-66
INTRODUCTION		1-1
IOS AREA LIGHTING	2-12.	2-5
IOS CONTROL PANELS	2-8.	2-5
IOS CRT CONTROLLABLE PARAMETERS	5-8.	5-2
IOS Control/Display Interrelationships	T7-4	7-105
IOS Visual System Panel	F7-18	7-29
Independent Mode	6-l.b.	6-1
Independent Training	2-17.a.	2-10
Index Page	F7-2	7-3
Initial Conditions Page 02	F7-1	7-2
Initialize to a Preprogrammed IC Set	7-3.a.	7-9
Initialize to a Preprogrammed Checkride IC Set	7-3.c.	7-9
Initialize to an IC Set Not Preprogrammed	7-3.b.	7-9
Inputs	8-2.a.	8-1
Instructor/Operator Station General Layout	F2-4	2-8
Instructor/Operator Tasks	2-24.d.	2-18
Integrated Mode	6-l.a.	6-1
Integrated Training	2-17.b.	2-10
Integrated/Independent Operation Features	T2-1	2-11
<u>J</u>		
<u>K</u>		
<u>L</u>		
Landing Areas	6-7.c.	6-4
Lighting	6-7.a.	6-4
<u>M</u>		
MALFUNCTION DELETION	7-30.	7-70
MALFUNCTION INSERTION	7-29.	7-70
MALFUNCTION LIST	7-32.	7-71

Subject	Paragraph, Figure, Table Number	Page
<u>M</u> - Continued		
MALFUNCTION SIMULATION	2-32.	2-22
MODEL BOARD	6-3.	6-1
MODES OF OPERATION		2-10
MOTION SIMULATION	2-28.	2-21
MOTION SYSTEM	2-4., 5-5.	2-3, 5-2
Malfunction List	T7-2	7-72
Malfunctions	5-8.e.	5-3
Miscellaneous Conditions	5-8.d.	5-3
Monitoring Elapsed Time Between Segments (LTM)	8-3.d.	8-12
Monitoring Event Time (TIM)	8-3.e.	8-12
Motion Cues	2-22.e.	2-15
Motion System Only	9-1.b.	9-1
<u>N</u>		
NAVIGATION EQUIPMENT	3-3.	3-2
NAVIGATION FACILITY DATA	7-17.	7-61
NORMAL OPERATING PROCEDURES		7-1
Nap-of-the-Earth Maneuvers	2-21.d.	2-14
Nav/Comm Radio	2-22.b.	2-15
Night Vision Goggles	6-7.k.	6-5
<u>O</u>		
OBSERVER SEATS	2-11.	2-5
OCCUPANCY	5-4.	5-1
OFF-LINE MODIFICATIONS OF FLIGHT SIMULATOR PROGRAMS		8-1
OPERATING LIMITS AND RESTRICTIONS		5-1
OPERATIONAL CONSIDERATIONS	8-6.	8-15
OPERATIONAL ENTRY AND CONTROL	8-3.	8-4
OPERATIONAL SAFETY	9-4.	9-3
OPERATIONAL SYSTEM	2-1.	2-1
Outputs	8-2.c.	8-1
<u>P</u>		
PARAMETER FREEZE	7-25.	7-69
PERFORMANCE MONITORED TOLERANCES	7-19.	7-64
PFOS SYSTEM DESCRIPTION	8-2.	8-1
PILOT/GUNNER CONTROL PANELS	2-9.	2-5
PILOT/GUNNER PERFORMANCE ERROR PRINT SYSTEM	7-22.	7-66
PLOT STORE	7-11.	7-50
PRINT PLOT	7-12.	7-50
Panel Lights and Intercom Panels	F7-16	7-24
Parameter/Freeze/Environment Page 020	F7-15	7-19
Performance Page 061	F7-13	7-16
Permissible Special Action Cues Syntax	T8-1	8-10
Pilot Flight Weapons Simulator Compartment	F2-2	2-6

Subject	Paragraph, Figure, Table Number	Page
<u>P</u> - Continued		
Pilot/Gunner Control Panel	F7-24	7-48
Pilot/Gunner Tasks	2-24.c.	2-17
Possible Checkride Plan (Rough)	F8-3	8-5
Probe Protection	6-7.i.	6-5
Problem Control, Timer, and IC/MAP/MALF/ DEMO/CHKRD Panel	F7-22	7-42
Processing	8-2.b.	8-1
<u>Q</u>		
<u>R</u>		
RADAR AND TRANSPONDER EQUIPMENT	3-4.	3-3
RADAR EMITTER THREATS AND WEAPON CONTROL	7-15.	7-55
RADIO COMMUNICATION AND INTERCOMMUNICATION		
SYSTEM SIMULATION	2-31.	2-22
REPORTING OF ERRORS	1-3.	1-1
Runway Acquisition Lighting	6-4.a.	6-3
<u>S</u>		
SAFETY		9-3
SCOPE	1-1.	1-1
SIMULATED MALFUNCTIONS		7-70
SIMULATION SYSTEM CAPABILITIES	2-22.	2-15
SIMULATOR COMPARTMENTS	2-2.	2-1
SOUND LEVELS	7-26.	7-69
SOUND SIMULATION	2-27.	2-21
SPECIAL CONSIDERATIONS	8-7.	8-18
SYSTEM DESCRIPTION AND OPERATION		2-1
SYSTEM FAILURES	9-2.	9-1
SYSTEMS SIMULATED		2-21
Seat Positions	2-22.g.	2-15
Simulated Aircraft	2-24.a.	2-17
Simulated Malfunction Details	T7-3	7-77
Simulation	1-2.a.	1-1
Simulator Control Panel	F7-17	7-25
Special Capabilities	2-22.h.	2-15
Special Effects	6-7.d.	6-4
Student History Page 062	F7-31	7-60

Subject	Paragraph, Figure, Table Number	Page
I		
TACTICS		4-1
TELESCOPIC SIGHT UNIT	2-5.1, 5-11.	2-4, 5-4
TEMPERATURE AND HUMIDITY	5-3.	5-1
TERMINATION OF CHECKRIDE	7-5.	7-21
TERMINATION OF DEMONSTRATION	7-7.	7-21
TIME REFERENCES	2-15.	2-9
TRAINING	4-3., 2-17.	4-1, 2-10
TRAINING CAPABILITIES		2-13
TRAINING OBJECTIVES	2-21.	2-13
TRAINING TASKS	2-24.	2-17
TSU MODES	2-19.1	2-12
Tactical Map Page 050	F7-30	7-58
Tactical Environment	2-22.c.	2-15
Tactical Instrument Checkride Program Page 100	F7-11	7-13
Tactical Weapons Checkride Program Page 090	F7-10	7-12
Target Engagement Points Page 023	F7-13.1	7-18
Target Selection	7-3.f.	7-17
Telescopic Sight Unit	6-5.b.	6-4
Threat Array Page 025	F7-28	7-56
Threat Window Array Page 026	F7-29	7-57
Through-the-Window Displays	6-5.a.	6-3
Time as an End Condition	8-3.f.	8-12
To Formulate an Entire Checkride	8-3.a.	8-4
To Revise an Existing Checkride	8-3.b.	8-6
Training Control and Monitor	7-3.h.	7-18.1
Typical Checkride CRT Display	F7-34	7-67
Typical Checkride Data Input Key punch Form	F8-2	8-3
Typical Error Printout Summary Page	F7-35	7-68
Typical Navigation Facility Page	F7-32	7-62
Typical Navigation Facility Subpage	F7-33	7-63
Typical Printed Page of a Checkride	F8-6	8-8
Typical Simulator and Computer Rooms of Q-to-S System Complex	F2-1	2-2
<u>U</u>		
V		
VFR Checkride Job Deck	F8-4	8-7
VFR Checkride Program Page 070	F7-8	7-10
VIBRATION SIMULATION	2-29.	2-22
VISUAL SIMULATION	4-2.	4-1
VISUAL SYSTEM	2-5, 5-6, 6-1	2-4, 5-2,
VISUAL SYSTEM CAPABILITIES	2-23, 6-7.	2-16, 6-4
Values Not To Exceed	T7-1	7-65

Subject	Paragraph, Figure, Table Number	Page
<u>V</u> - Continued		
Visual Area Navigation	2-22.a.	2-15
Visual Conditions Page 021	F7-14	7-18.2
Visual Room Layout	F6-1	6-2
Visual Selection	7-3.g.	7-17
Visual Transition	6-7.j.	6-5
<u>W</u>		
WEAPONS EFFECTS	6-6.	6-4
WORK SURFACE	2-14.	2-9
Weapon Loading	7-3.d.	7-9
Weapon Sounds	2-27.b.	2-21
Weapons Checkride Job Deck	F8-5	8-7
Weapons Configuration Page 060	F7-12	7-14
Weapons Effects	6-7.e.	6-5
<u>X</u>		
<u>Y</u>		
<u>Z</u>		
ZEROING (DATA CLEAR)	7-2.	7-1

By Order of the Secretary of the Army:

Official:

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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 = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 decagram = 10 grams = .35 ounce
 1 hectogram = 10 decagrams = 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

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

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

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

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