

**DOUGLAS FLIGHT DECK DESIGN
PHILOSOPHY**

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AIRCRAFT SYSTEMS

The systems experience gained from 17 years of DC-10 operation was used during the design of the MD-11 to automate system operation and reduce crew workload. All functions, from preflight to shutdown at the termination of flight, require little input from the crew.

The MD-11 aircraft systems are monitored for proper operation by the Aircraft Systems Controllers (ASC). In most cases, system reconfiguration as a result of a malfunction is automated. Manual input is required for irreversible actions such as engine shutdown, fuel dump, fire agent discharge, or Integrated Drive Generator (IDG) disconnect. During normal operations, when the cockpit is configured for flight, all annunciators on the overhead panel will be extinguished. This "Dark Cockpit" immediately confirms to the crew that the panels are correctly configured and that no abnormalities are present. Primary systems annunciations are shown in text on the Alert Area of the Engine and Alert Display (EAD). This eliminates the need to scan the overhead.

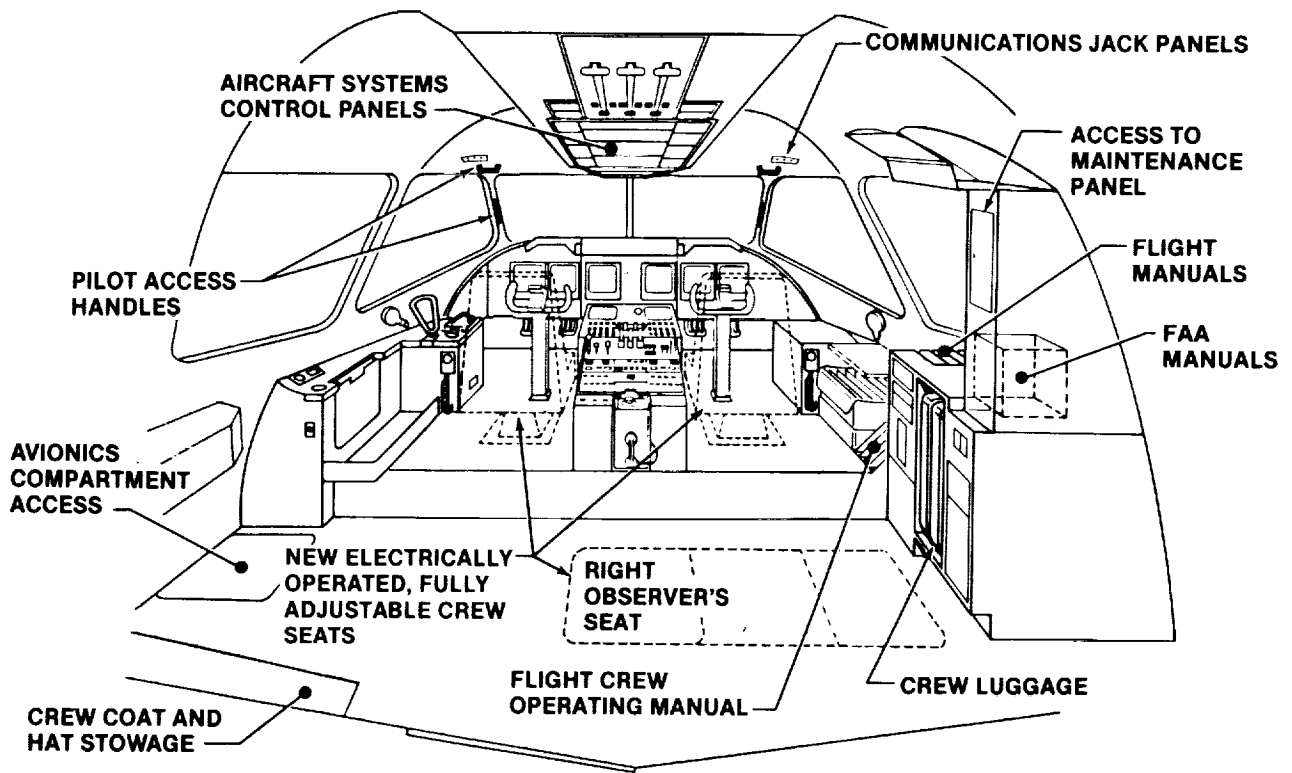
The MD-11 aircraft systems can be manually controlled from the overhead area of the cockpit. The center portion of the overhead panel is composed of the primary aircraft systems panels, which include FUEL, AIR, Electrical (ELEC) and Hydraulic (HYD) systems, which are easily accessible from both flight crew positions. Each aircraft system panel is designed in such a way that the left third of the panel controls the No. 1 system, the center portion controls the No. 2 system, and the right side controls the No. 3 system. For quick reference, they are lined up directly with the No. 1, No. 2 and No. 3 engine fire handles. The most used panels are located in the lower forward area of the overhead; the lesser used panels are in the upper aft area. Each aircraft system panel has a pictorial schematic of that system on the light plate that symbolically connects the various systems and controls on that panel. This schematic closely resembles the System Synoptic shown on the Systems Display (SD).

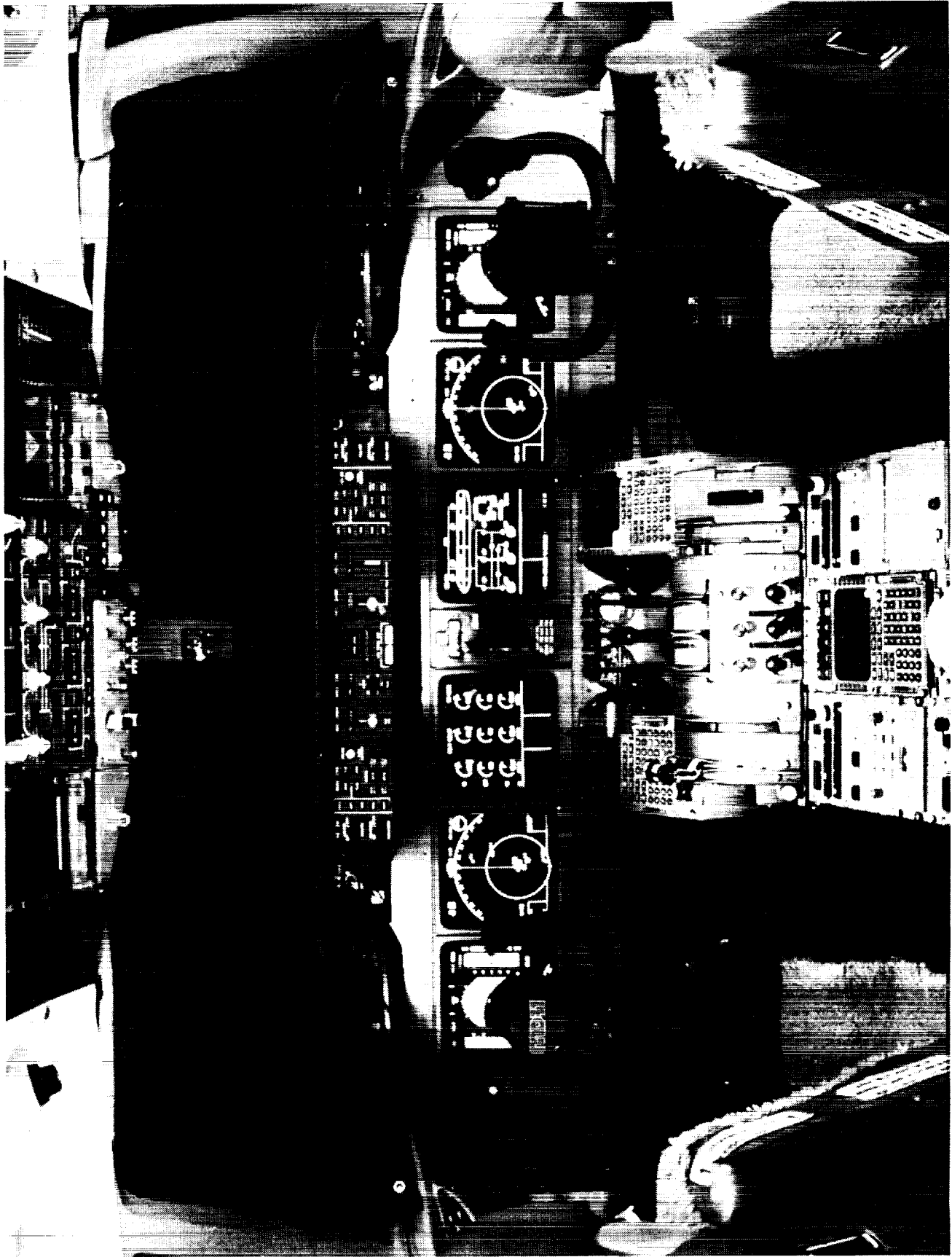
Each Aircraft Systems Controller (ASC) has two automatic channels and a manual mode. Should the operating automatic channel fail or be shut off by its protection devices, the ASC will automatically select the alternate automatic channel and continue to operate automatically as required for that particular flight condition (manual selection of the alternate channel is also possible). Should both automatic channels fail, the controller will revert to manual operation and reconfigure the aircraft to a safe condition. The crew would then employ simplified manual procedures for the remainder of the flight for that system only.

All rectangular lights are annunciators. All square lights are combined switches and annunciators called switch/lights. Red switch/lights on the overhead (Level 3 alerts) are for conditions requiring immediate crew action. Amber (Level 2 or Level 1 alerts) indicates a fault or switch out of position requiring awareness or crew interaction. Overhead switches used in normal operating conditions will illuminate blue when in use (Level 0 alerts) such as WING ANTI-ICE — ON.

An overhead switch/light with BLACK LETTERING on an amber or red background indicates a system failure and that crew interaction is required. A switch/light with blue or amber lettering and a BLACK BACKGROUND indicates a switch out of normal position and that crew action is necessary only if the system is in manual operation.

MD-11 FLIGHT COMPARTMENT



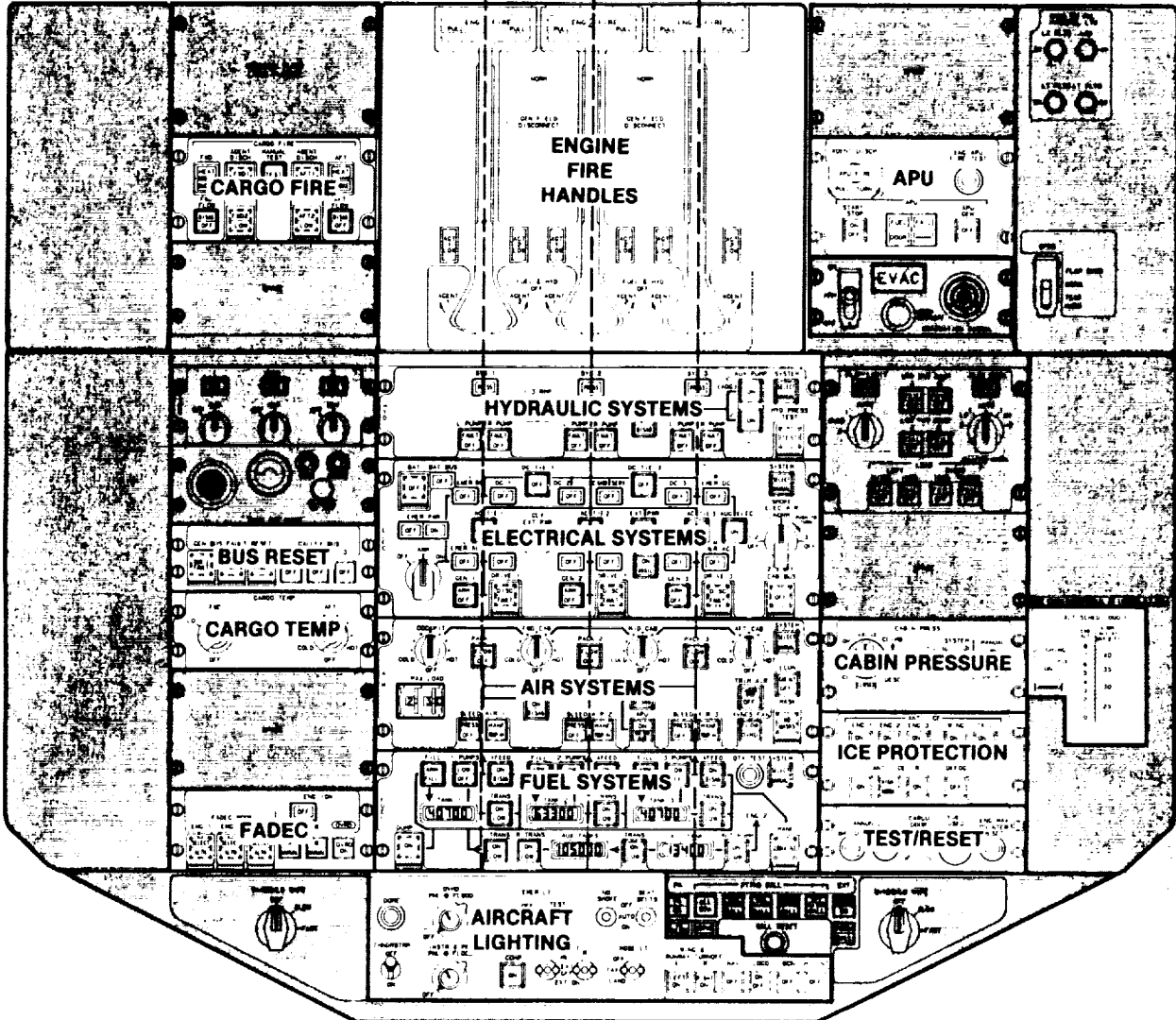


ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

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OF POOR QUALITY

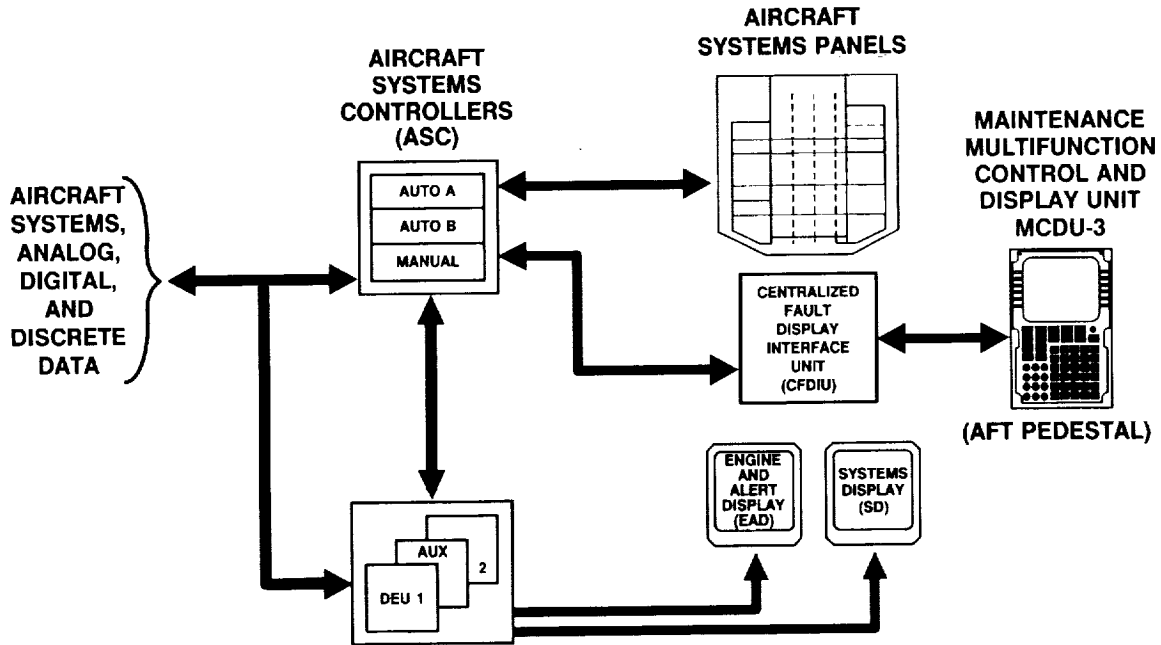
MD-11 AIRCRAFT SYSTEMS

SYSTEM SYSTEM SYSTEM
NO. 1 NO. 2 NO. 3

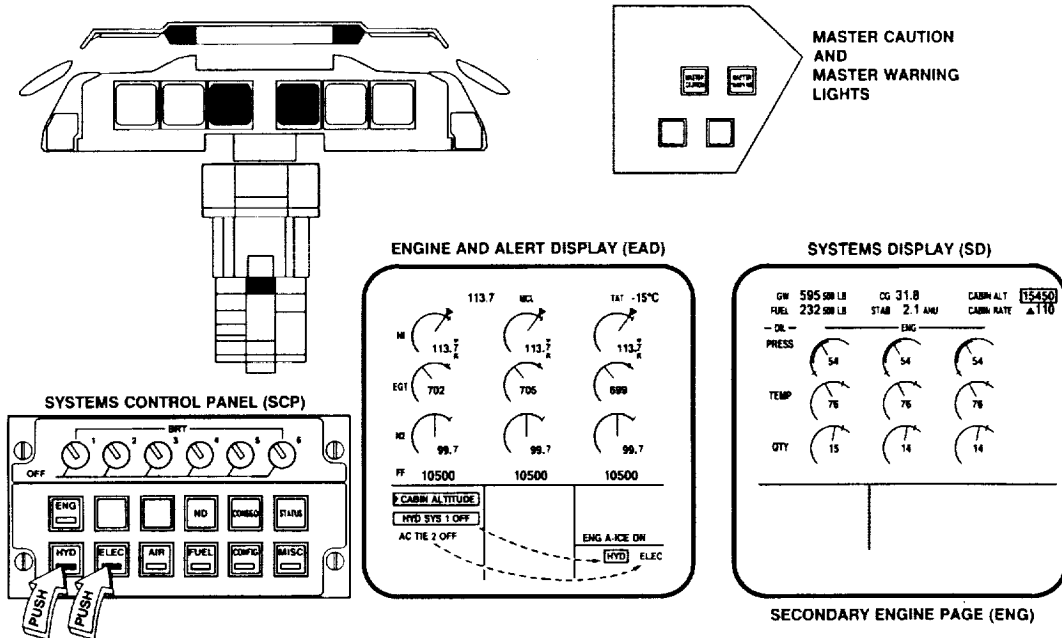


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ASC SYSTEM



ALERTING SYSTEM COMPONENTS



SUMMARIZED FAULT DATA

(GENERATOR BUS FAULT CONDITION ILLUSTRATED)

DC-10 CONTROL PANEL
ANNUNCIATOR LIGHTS

R EMER AC BUS OFF	FUEL PMP 1 PRESS LO
R EMER DC BUS OFF	UPR R AUX PMP PRESS LO
DC BUS 3 OFF	ENG 3 ANTI ICE DISAG
AC BUS TIE 3 ISOL	
AC BUS 3 OFF	
GEN 3 OFF	
GALLEY POWER OFF	

MD-11 PROVIDES SPECIFIC
ANNUNCIATION OF THE
PROBLEM

GEN BUS 3 FAULT

ENGINE AND
ALERT DISPLAY (EAD)

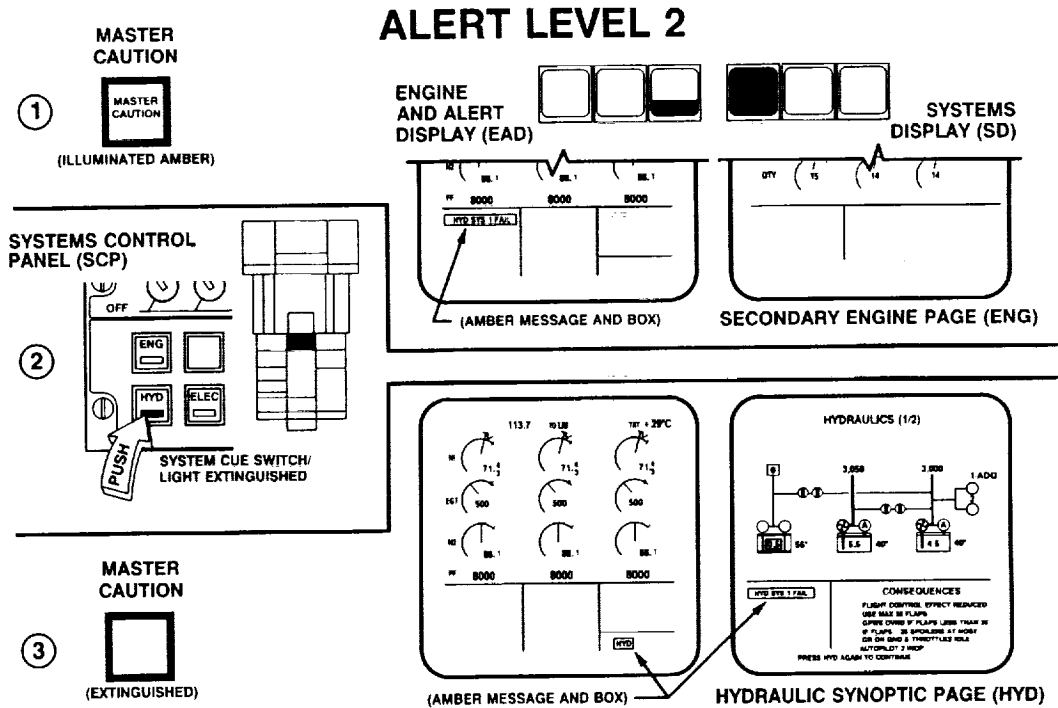
DC-10 CONCEPT REQUIRED INTERPRETATION
OF SEVERAL ANNUNCIATIONS TO DETERMINE
"ROOT" CAUSE OF THE PROBLEM

AC BUS TIE ISOL + AC BUS OFF +
GEN OFF LIGHT ON = GEN BUS FAULT

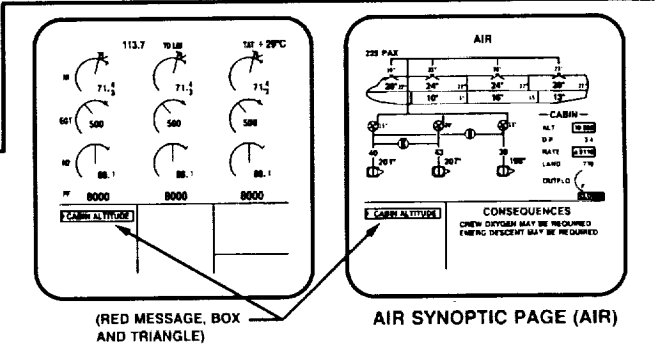
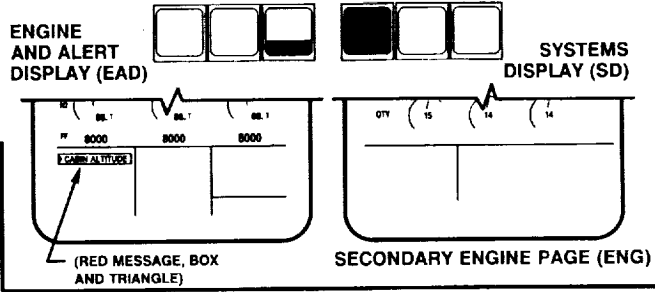
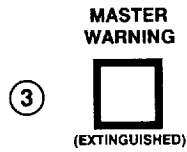
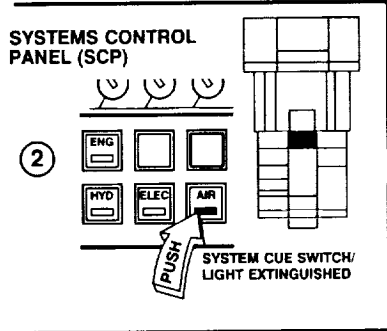
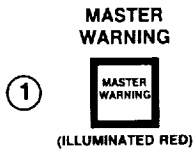
PROCEDURAL STEPS REQUIRED TO EXECUTE THE PROCEDURE (MD-11 AUTO MODE)

DC-10 = 13-16

MD-11 = 0



ALERT LEVEL 3



1. The first part of the document discusses the importance of understanding the underlying principles of a system rather than just its surface-level components. This is particularly relevant in the context of complex systems where the interactions between different parts can be highly non-linear and emergent.

2. The second part of the document explores the concept of 'emergent properties' and how they arise from the collective behavior of individual components. This is a key concept in fields like complex systems, biology, and social sciences.

3. The third part of the document discusses the challenges of modeling and simulating complex systems. It highlights the limitations of traditional reductionist approaches and the need for more holistic and multi-scale modeling techniques.

4. The fourth part of the document discusses the implications of complex systems for various fields, including engineering, economics, and social sciences. It emphasizes the need for interdisciplinary collaboration and the development of new tools and methods to study these systems.

5. The fifth part of the document discusses the role of complexity in the design of resilient and adaptive systems. It argues that understanding the principles of complex systems can help us design systems that are better able to cope with uncertainty and change.