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 announcements 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
AIRCRAFT SYSTEMS

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

CARGO FIRE

ENGINE
FIRE
HANDLES

APU

HYDRAULIC SYSTEMS

ELECTRICAL SYSTEMS

CABIN PRESSURE

ICE PROTECTION

FADEC

FUEL SYSTEMS

TEST/RESET

AIRCRAFT LIGHTING

ORIGINAL PAGE IS OF POOR QUALITY
ASC SYSTEM

AIRCRAFT SYSTEMS, ANALOG, DIGITAL, AND DISCRETE DATA

AIRCRAFT SYSTEMS CONTROLLERS (ASC)

AUTO A
AUTO B
MANUAL

AIRCRAFT SYSTEMS PANELS

CENTRALIZED FAULT DISPLAY INTERFACE UNIT (CFDIU)

ENGINE AND ALERT DISPLAY (EAD)
SYSTEMS DISPLAY (SD)

MAINTENANCE MULTIFUNCTION CONTROL AND DISPLAY UNIT (MCDU-3)

(AFT PEDESTAL)

ALERTING SYSTEM COMPONENTS

MASTER CAUTION AND MASTER WARNING LIGHTS

ENGINE AND ALERT DISPLAY (EAD)

SYSTEMS DISPLAY (SD)

SECONDARY ENGINE PAGE (ENG)
SUMMARIZED FAULT DATA
(GENERATOR BUS FAULT CONDITION ILLUSTRATED)

DC-10 CONTROL PANEL
ANNUNCIATOR LIGHTS

<table>
<thead>
<tr>
<th>Condition</th>
<th>DC-10 Concept Required Interpretation of Several Annunciations to Determine &quot;Root&quot; Cause of the Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMER AC BUS OFF</td>
<td>AC BUS TIE 3 ISOL + AC BUS OFF + GEN OFF LIGHT ON = GEN BUS FAULT</td>
</tr>
<tr>
<td>FUEL PMP 1 PRESS LO</td>
<td></td>
</tr>
<tr>
<td>EMER DC BUS OFF</td>
<td></td>
</tr>
<tr>
<td>UPR R AUX PMP PRESS LO</td>
<td></td>
</tr>
<tr>
<td>DC BUS 3 OFF</td>
<td></td>
</tr>
<tr>
<td>GEN 3 OFF</td>
<td></td>
</tr>
<tr>
<td>GALLEY POWER OFF</td>
<td></td>
</tr>
</tbody>
</table>

MD-11 PROVIDES SPECIFIC ANNUNCIATION OF THE PROBLEM

GEN BUS 3 FAULT

ENGINE AND ALERT DISPLAY (EAD)

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

DC-10 = 13-16

MD-11 = 0

ALERT LEVEL 2

SYSTEMS CONTROL PANEL (SCP)

1. MASTER CAUTION
   (ILLUMINATED AMBER)

2. SYSTEM CUE SWITCH/ LIGHT EXTINGUISHED

3. MASTER CAUTION
   (EXTINGUISHED)

ENGINE AND ALERT DISPLAY (EAD)

SYSTEMS DISPLAY (SD)

SECONDARY ENGINE PAGE (ENG)

AMBER MESSAGE AND BOX

HYDRAULIC SYNOPTIC PAGE (HYD)

AMBER MESSAGE AND BOX