Avionics Upgrades RNLAF (K)DC-10

Royal Netherlands Air Force

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Introduction

• Ltcol Hielke Bosma
• Senior Certification Specialist MAA

• Flight Test Engineer (fixed wing)

• Technical specialist (K)DC-10 CUP Program
Content

- Background

- Cockpit Upgrade Program (K)DC-10
  - Drivers
  - Program Schedule
  - Program Management
  - Certification

- Systems overview

- Successes & Technical issues & Lesson Learnt

- Questions
Since 1995 the RNLAF operates two KDC-10 (tanker) aircraft

Originally Boeing DC-10-30CF, modified to tanker (AAR)

Combi configuration (cargo & pax)

Utilization: 1000 FH per year

In 2005 RNLAF procured one DC-10-30CF (cargo configuration)
Top Level Objectives Plan

- Operational until 2025
- Strategic (NATO) operations
- Comply with civil regulations (as far as practical)
- Comply with military operational standards
- Standardization with other military (NATO) operators
Drivers for a Cockpit Upgrade

• Comply with New Civil Rulemaking (or growth)
  • Communications: VDL mode 2 (-3, FANS-1, CPDLC)
  • Navigation: PRNAV
  • Surveillance: Enhanced Mode S, ADS-B
• Maintainability
  • Obsolescence avionics components
  • Maintainability electromechanical instruments
  • Decreasing amount of DC10 operators
• Military Operational Requirements
  • Link16
  • Secure Voice
  • Military GPS
  • IFF Mode 4 (with growth to 5)
Program Schedule

- 2004, SOW, RFO, 2 proposals
- 2005, signed contract with Fokker
- 2007, start installation on first Aircraft
- 2008, first flight
- 2010, last test flight
- 2011, certification and OT&E
- 2012, first operational mission, delivery of 2nd aircraft
- 2013, delivery of 3rd aircraft
Program Management

- Main Contractor: Fokker Services (FS), NL
  - Program Management
  - Installation
  - Certification

- FS Sub-Contractor: Boeing IDS
  - Design
  - Engineering
  - Main supplier
Certification

- Used FAR 25 as the certification basis
- RNLAF/DMO applies for Military Type Certificate
- Fokker issued a Certification Plan (CP) including Means of Compliance
- Boeing IDS is responsible for the compliance plans/reports and substantiation data (SME approved data)
- Fokker Services is responsible for the verification (CVE approved data)
- Military Certification by the NL Military Airworthiness Authority (NL-MAA)
Classic Cockpit KDC-10
CUP Cockpit DC-10
CUP Systems (1)

Communication
- UHF/VHF Communication (ARC-210)
- Secure Voice System
- Civil SATCOM (MCS-4000)
- ACARS (VDR – RTA-50D)
- Military UHF SATCOM
- Link-16
- Interphone System
CUP Systems (2)

Navigation
• Flight Management System (CMA-900)
• Scanning DME (DME-442)
• Military Global Positioning System (TA-12S)

Surveillance
• Enhanced TCAS (ACAS II ch 7)
• ATC IFF/Mode S Transponder (APX-119)
CUP Systems (3)

Displays and Instruments
- TFT Primary Flight Displays
- Engine Instrument Display System (EIDS)
- Standby Instruments
- Flight Control Indicators
Digital Instruments
Aft Pedestal
Link 16 integration

- Based on Panasonic CF-18 ruggedized laptop
- Carry-on carry-off equipment
- Special handling for operational security (OPSEC)
Successes

- Operational
  - FMS
- SATCOM/
  - ACARS
- PBN
  - capability
- Reliability/maintainability
- Short Aircrew Conversion
- Operational Test & Evaluation
Technical issues

- Amber Band
- Mag/True
- FMS Database
- SATCOM
Amber Band

- Fast Slow Indicator
  - V2 (+ 10)
  - Awareness
- Amber Band
  - Initially not related to V2
  - During TO based on Alpha speed
  - Signal from AT/SC
  - Flashing speed indication
  - Complex algorithm (TO and GA)
  - Awareness
  - Checklist item
- Simple DC-10 design
- Complicated integration
  - FMS switches automatically above N73/S60
  - ILS/VOR provides just bearing signal
  - System corrects variation twice
- Approach Thule, Greenland
- Procedural solution
- Understanding system
FMS Database

- Jeppesen based
- Entire world – 10 pieces
- FMS memory size (only 4 Mb!)
- CMC – RNLAF – KDC-10 Dataloader – FMS
- Database integrity
- Database content

- Manpower
- Procedures
- Contract
Backup for HF
Geostationary satellites
Automatic handover
Trip from Middle-East to Australia

Settings
Configuration
Service provider
Lessons Learnt

- Program Management
  - Fokker contractor - Boeing subcontractor
  - RNLAF team size

- Complexity of design, level of integration
  - Underestimating flight test effort
  - Software design of DCU complicated

- Certification – contract
  - Acceptance – certification
  - Civil - Military

- Processes behind new systems
  - Database management
  - Organizational issues

"Dad, why are there always two pilots?
One has to prevent the other from doing stupid things
Which one is doing the stupid things?"
Questions?