Retrofit Solutions for Flight Inspection Aircraft

June 23, 2008

Rockwell Collins

Agenda

- Overview of current Rockwell Collins' retrofit aircraft
- Overview of current Rockwell Collins'/FAA programs
- Overview of Rockwell Collins' NAV GPS / FMS products
- WAAS development status
- Roadmap for WAAS implementation
- National flight database

FAA King Air 300 Cockpit

New King Air 300 Cockpit

- King Air B200, 350 and FAA KA300
  - Dual Rockwell Collins FMS
  - Engine indication
  - Triple LCD displays
  - Charts on MFD
  - New digital autopilot
  - Multipoint VNAV
  - WAAS/LPV
  - New sensors
  - New AHRS
  - New wiring
  - Increased MTBF
  - Growth paths

Current Pro Line 21 Major Retrofit Certifications

- Challenger 601
  - Dual Rockwell Collins FMS
  - (4) LCD displays
  - Charts on MFD
  - New digital autopilot
  - Multipoint VNAV
  - WAAS/LPV
  - Increased MTBF
  - Growth paths
  - Graphical Weather
  - Data link capability
  - Decreased weight by 500 lbs
  - All new wiring

Current Pro Line 21 Major Retrofit Certifications

- Dassault Falcon 20
  - Dual Rockwell Collins FMS
  - Triple LCD diplays
  - New digital autopilot
  - Charts on MFD
  - Multipoint VNAV
  - WAAS/LPV
  - Increased MTBF
  - Growth paths
  - New wiring
  - New AHRS
  - New sensors

Current Pro Line 21 Major Retrofit Certifications

- Dassault Falcon 50
  - Dual Rockwell Collins FMS
  - Four LCD diplays
  - New digital autopilot
  - Charts on MFDs
  - Multipoint VNAV
  - WAAS/LPV
  - New wiring
  - Increased MTBF
  - Growth paths

GARRETT AVIATION SERVICE CENTERS
A WHOLLY OWNED SUBSIDIARY OF GENERAL ELECTRIC COMPANY

Pro Line 21 Major Retrofit

- Other existing flight inspection service providers can benefit by incorporating the same functionality as the FAA with the installation of a Pro Line 21 avionics retrofit
- Current aircraft performance meets or exceeds mission needs
- Airframe has not exceeded its useful life limit
- Personnel familiar with aircraft – maintenance and pilots
- Significantly reduces the investment versus new aircraft purchase

Potential Aircraft Issues

- Avionics parts obsolescence – becoming more frequent
- Repair costs - increasing
- Dependability and parts obsolescence issues
  - Mechanical instruments
  - CRT displays
  - Autopilot
  - Inertial reference units – repairs can exceed 80k
  - Radar – wave guide expensive to maintain
  - Radios – communication, navigation
  - Wiring – does not meet current "new" aircraft specifications
- Regulatory compliance
  - Air data system – RVSM compliancy could be expensive to maintain
  - Current flight management systems might need to be upgraded for:
    - AC 90-100, WAAS capability, PRNAV, coupled VNAV (AC 90-97), etc.

Why Retrofit with Proline 21?

- Purchasing a new aircraft to replace the current one is significantly more expensive
- Proven Pro Line 21 integrated system
  - Current customer base -- low risk solution with multiple commercial STCs to date
  - Currently, over **400** new aircraft per year produced with Pro Line 21
  - Pro Line 21 stationary simulator available today for training
- System growth potential
  - Roadmap for enhanced Pro Line 21 features aligned with upcoming regulations (CNS/ATM) and customer demand
  - Integrated Rockwell Collins avionics solution built for long term growth
- Decreased operating costs
  - Solid state design technology
  - Higher reliability / dispatchability and reduced maintenance
  - Digital technology results in reduced weight and power requirements

Pro Line 21
Typical Retrofit Comparison

	Legacy Sys	Pro Line 21	Improvement
LRUs	88	73	15
Weight (lbs)	850	304	>348
Power (Watts)	1600	1152.2	>400
Volume (cu ft)	8.38	6.01	2.37
MTBF (System)	95.0	159.0	67%
Display Area	62.08	191.04	128.96

Pricing/Schedule

- Estimated installation timing could be as little as three months, but is highly dependant upon STC deviations
- Current, "Off the Shelf" OEM solution installed by a capable Rockwell Collins dealer pricing estimate:

  $1,200,000 - $2,000,000
- Equipment variations, STC modifications for King Air type, etc. will Depend Upon additional customer requirements

FAA King Air Upgrade Benefits

- Growth path for avionics
  - Future updates to be mostly software driven
  - WAAS/LPV – 4th quarter 2008
- Significant cost savings (58 million to FAA) vs. new
  - https://employees.faa.gov/news/focusfaa/story/index.cfm?newsId=51375
- One system to troubleshoot when issues occur
- Several control heads integrated into FMS CDU
- Integrated Flight Information System (IFIS) provides Jeppesen charts on the multi-function display with the geo-referenced aircraft symbol, which can help prevent runway incursions
- Solution very similar to OEM solution
  - Pilot and maintenance training for Pro Line 21 King Airs is offered by multiple providers

King Air Overview

- Rockwell Collins owns the Pro Line 21 STC for the King Air B200, 300, and 350 (aka B300)
  - These are complete retrofits, with new wiring and digital autopilot installations that were performed by Rockwell Collins Certification Center in Cedar Rapids, Iowa
  - Unless the exact package was accepted for a King Air 300, RCI would have to amend the aircraft STCs to meet other requirements, most likely at the Rockwell Collins Certification Center
- King Air 300 STC is flight inspection specific
  - Rockwell Collins provided a 'turn-key' solution to the 1st aircraft including teardown, installation, STC + Kit definition
  - Solution based on the existing Raytheon King Air production
  - Worked with FAA engineering to define FIAS provisions
- FAA's goal is to have all TSO'd equipment providing information to the pilot.
  - For example: The PFD displaying ILS and another annunciation indicating GLS was unacceptable

FAA Overview

- Project details – FAA King Air 300
  - Equipment modified
    - AFD - Add LAAS NAV (GLS) source, B300 V-Speeds
    - FCC - Modify gains for B300 Model
    - ADC - SSEC curve update for B300
    - MDT - Modify maintenance table to add GNLU
    - IOC - Modify label mapping
    - FMC – Standard search pattern version, add IRU integration
    - Add VHF data link solution to configuration – CMU-4000 can also utilize satcom or HF

FAA Overview

- Project details – FAA King Air 300
  - Ground communication when avionics master is off
  - Provisions for satcom and 3rd comm on new audio control panel
  - Provisions for 2 additional audio control panels in cabin
  - Provisions for flight inspection equipment
  - Provisions for CVR
  - Added GPS-4000S WAAS receiver
  - Added GNLU-955M for GLS
  - CDU tunes Bendix King IFF transponders
  - Mark V EGPWS w/RAAS

Rockwell Collins FMS Services

- Rockwell Collins is currently providing a custom FMS database to a non-US customer where "unapproved" Jeppesen data is combined with the DO-200A "approved" database for flight inspection purposes
  - This allows the flight inspection provider to use the FMS for standard transient flights as well as flight inspection without having to stop and change databases

Flight Inspection Overview

- Potential enhancements
  - HF tuning by the FMS CDU (Rockwell Collins HF)
  - ILS offset – utilizes BCU-4000 to PFD (requires additional wiring)
  - Custom search patterns for flight inspecting glide slope, 10 mile arc developed 35 degrees each side of localizer
  - TACAN ARN-153 (TCN-500) - Control not integrated
  - TACAN ARN-154 (L3) - Control not integrated
  - Mode 4 transponder – Control not integrated
  - 3rd GPS – PY code
  - MLS integration has been developed for PL21, but not tested
  - Potential for different search radars

Potential Functionality

- Video/EVS displayed on MFD

Contact Information

Carey Miller

Rockwell Collins

319-447-1313

cemiller@rockwellcollins.com

Back-up Information

Current Rockwell Collins FAA FIAS Programs

- Challenger 604 – MMR (Multi-mode Receiver) integration, WAAS/LPV development and FMS modifications
- King Air 300 – Complete Pro Line 21 retrofit with MMR and IRU integration
- Lear 60 – MMR integration
- Challenger 601 – MMR integration
- National flight database – Integration of FAA flight inspection database with current FMS database within the Rockwell Collins FMS

Multi-mode Receiver

- GNLU-930 (PN 8221236130FC033) red label unit
  - Red label unit, black label TSO TBD
  - GNLU will have full SBAS / GBAS functionality
    - Also includes strappable FIS "MSG type zero" over-ride capability to use satellites in test modes
    - Also includes VDB AGC capability for GLS approach VDB field strength monitoring
  - Test override functionality for both SBAS and GBAS broadcasts allows processing of message type 0 SBAS broadcasts as type 2 messages, and processing of VDB messages broadcast with Message Block Identifier (MBI) set to test for GBAS (includes also maxing the alert limits and setting Dmax to zero to allow maximum usable range of the broadcast)
  - Latest SBAS/GBAS code
    - SBAS TSO C145b and C146b compliant
    - GBAS TSO C161 and C162 compliant

Multi-mode Receiver

- GNLU-930 (pn822-1236-130FC033) red label unit
  - Digital and analog interface support
  - GNLU-930 CMM 523-0807177 can be ordered free of charge for each flight inspection company upon request through cemiller@rockwellcollins.com
  - All other functionality per e-Cat for 822-1236-001
  - GNLU-930 requires external input for approach selection (tuning) and Final Approach Segment path definition (FAS Block)
    - The FAA current uses a laptop for this purpose
      - Original SBAS plan was for this WAAS Delta functionality to be implemented in FMS, but not currently in development
    - Current King Air plans are to use GPS-4000S / FMS in WAAS Beta mode for LPV flights
    - GNLU will be used only for GBAS approaches using laptop
  - No MLS
  - No marker beacon

Overview

- FMS enhancements (ver.4.0 4th Qtr 2008)
  - SBAS (WAAS) and LPV
  - XYZ approaches
  - RF legs
  - Dataload improvements (see DBU-5000 section for details)
    - 15 Minute dataload for world database (requires DBU-5000 and V4.0)
  - Step down fixes after FAF
  - Other minor improvements
    - Display flight log page on landing
    - Automatic FMS Pos Init to GNSS position, with pilot confirmation
    - Specific fuel range using TAS on FUEL MGMT 1/3
    - Increase number of CDU FIX INFO pages
    - FMS capability for third GPS installations