



Evolution in Regional Aircraft Avionics

November, 2008

***Rockwell
Collins***

Agenda

- Evolution in Requirements from Takeoff to Touchdown
- Flight Deck Evolution Overview
 - Communication
 - Navigation
 - Surveillance
 - Displays and Situational Awareness
 - Avionics Architecture
 - Information Management
- Summary

Regional Aircraft Requirements from Take-Off to Touchdown

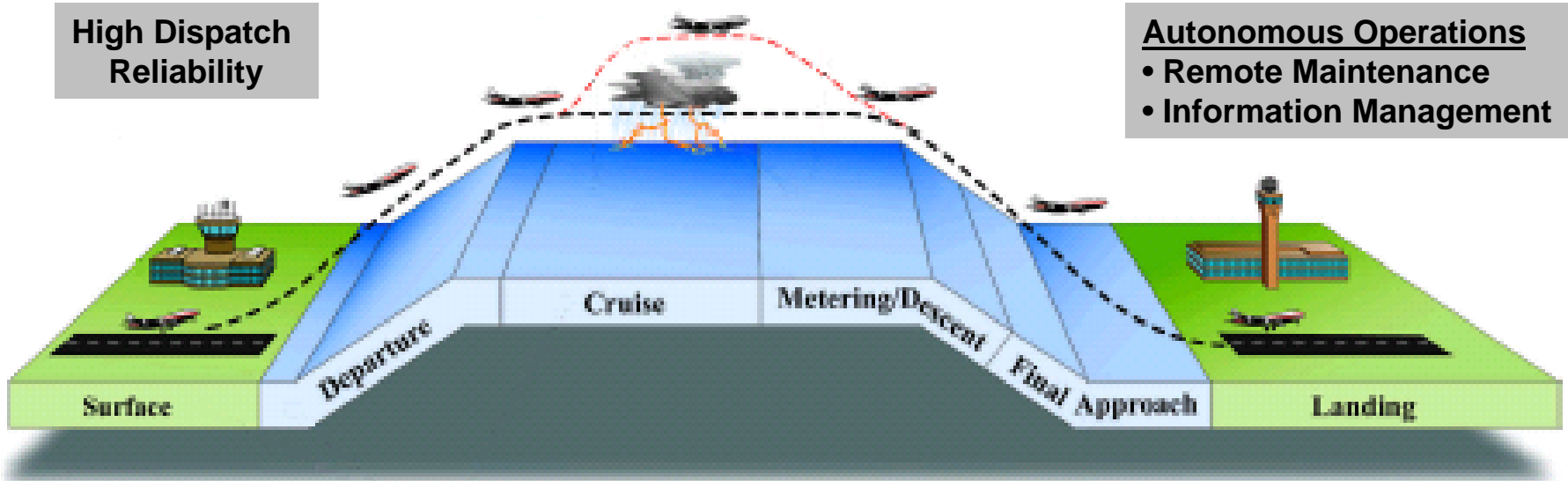
“Green” Operations

- Low Fuel Consumption
- Low Emissions
- Efficient Operations

Efficient Operations

- Required Communication Performance (CPDLC)
- Required Navigation Performance (RNAV, RNP)
- Required Surveillance Performance (TCAS, ADS-B)
- Situational Awareness (Terrain, Traffic, WxR)
- All Weather Operations

High Dispatch
Reliability



Autonomous Operations

- Remote Maintenance
- Information Management

Regional Aircraft Flight Deck Evolution



Beech 1900

- CRT EFIS
- Federated LRUs and System Indications



CRJ-200/700/900

- Digital Integrated System
- Modular Avionics Cabinet
- Flight Management System
- CRT Displays
- Engine Indications and Crew Alerting System
- System Synoptics
- Aircraft Maintenance System



ARJ21

- Liquid Crystal Displays
- Partitioned Processing
- Higher Performing Processors
- High Bandwidth Databus
- Hardware-Software Independence
- Open Architecture
- Enhanced FMS, EICAS, System Synoptics, Central Maintenance System

Communications - Trend Towards Data Communications

- ACARS in Use for Airline Operations Control
- Air Traffic Control Use Set to Expand
- Controller-Pilot Datalink Communications
 - E.g. Confirm Assigned Level, Estimate Time Arrival (ETA), Descend to XXX Ft
 - European Mandate January 1, 2011 for Forward Fit Aircraft

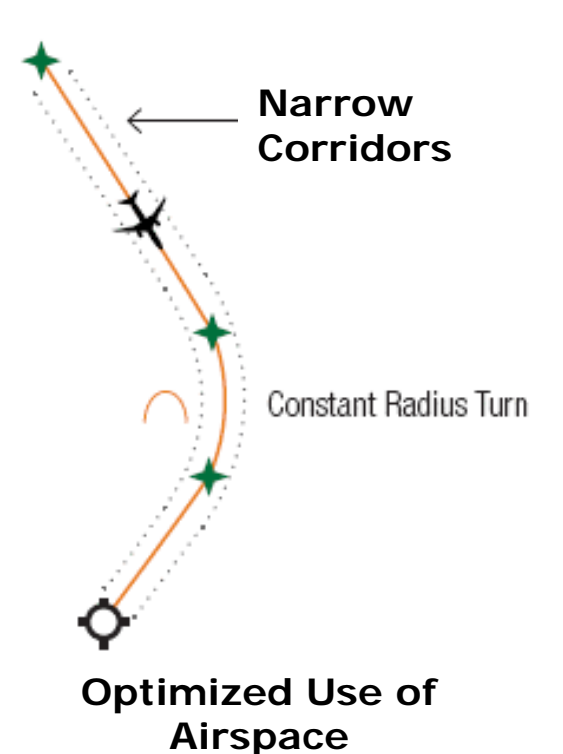
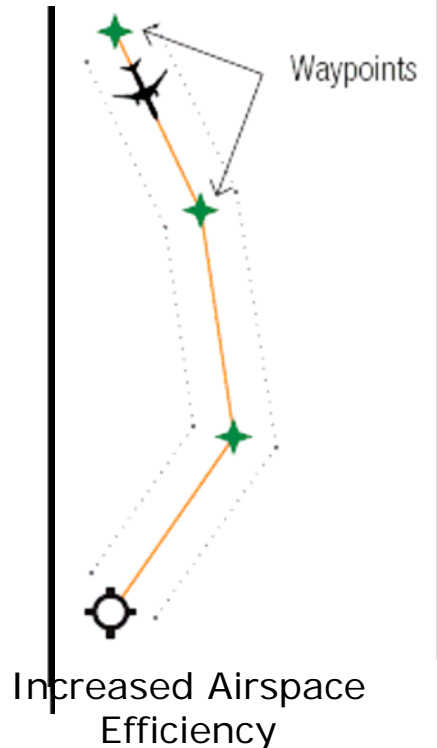
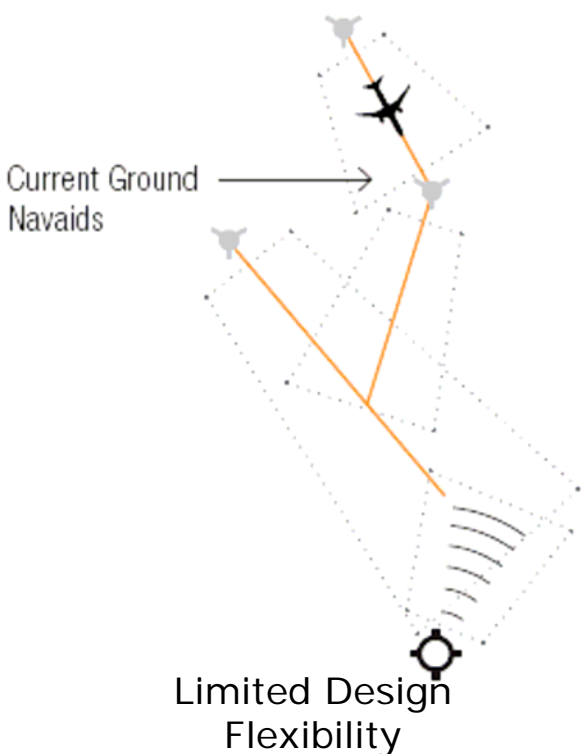


Navigation - Trend Towards Performance-Based Procedures

Conventional Routes

RNAV

RNP

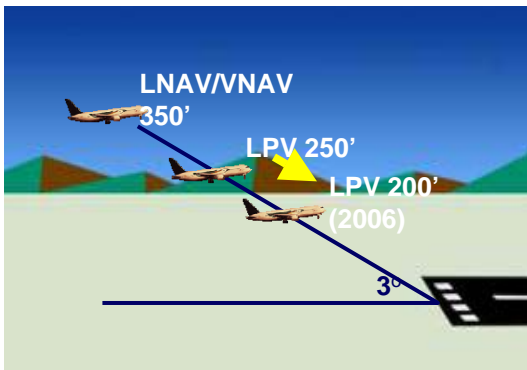


Aircraft and Avionics have to Demonstrate Required "Performance" For Future Airspace Requirements

Navigation – Trend Towards Satellite-Based Navigation

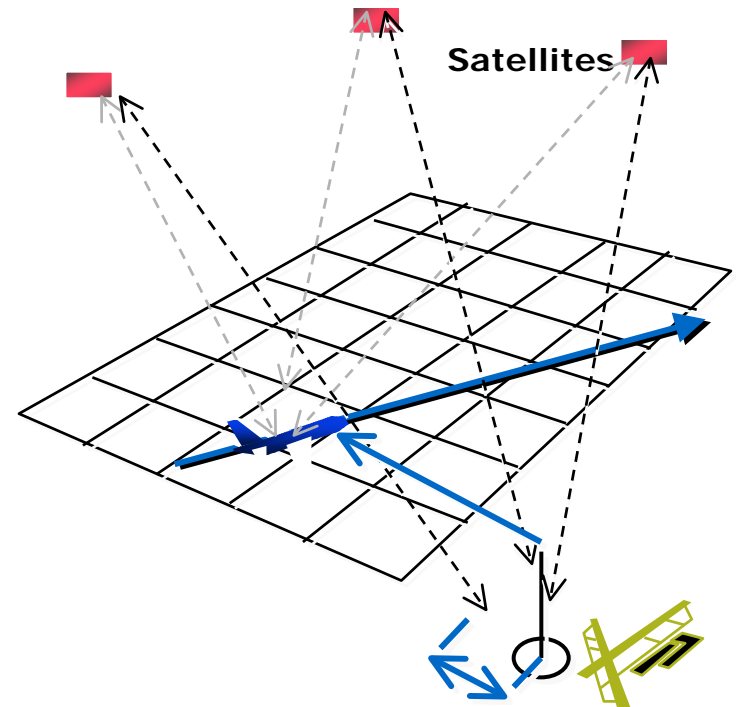
Space-Based Augmentation System

- Qualified for Sole Means Navigation
- LPV Approach Decision Altitudes as Low as ILS Cat I (200 feet)
- Requires GPS-SBAS Receiver, Appropriate FMS, and Displays



Ground-Based Augmentation System

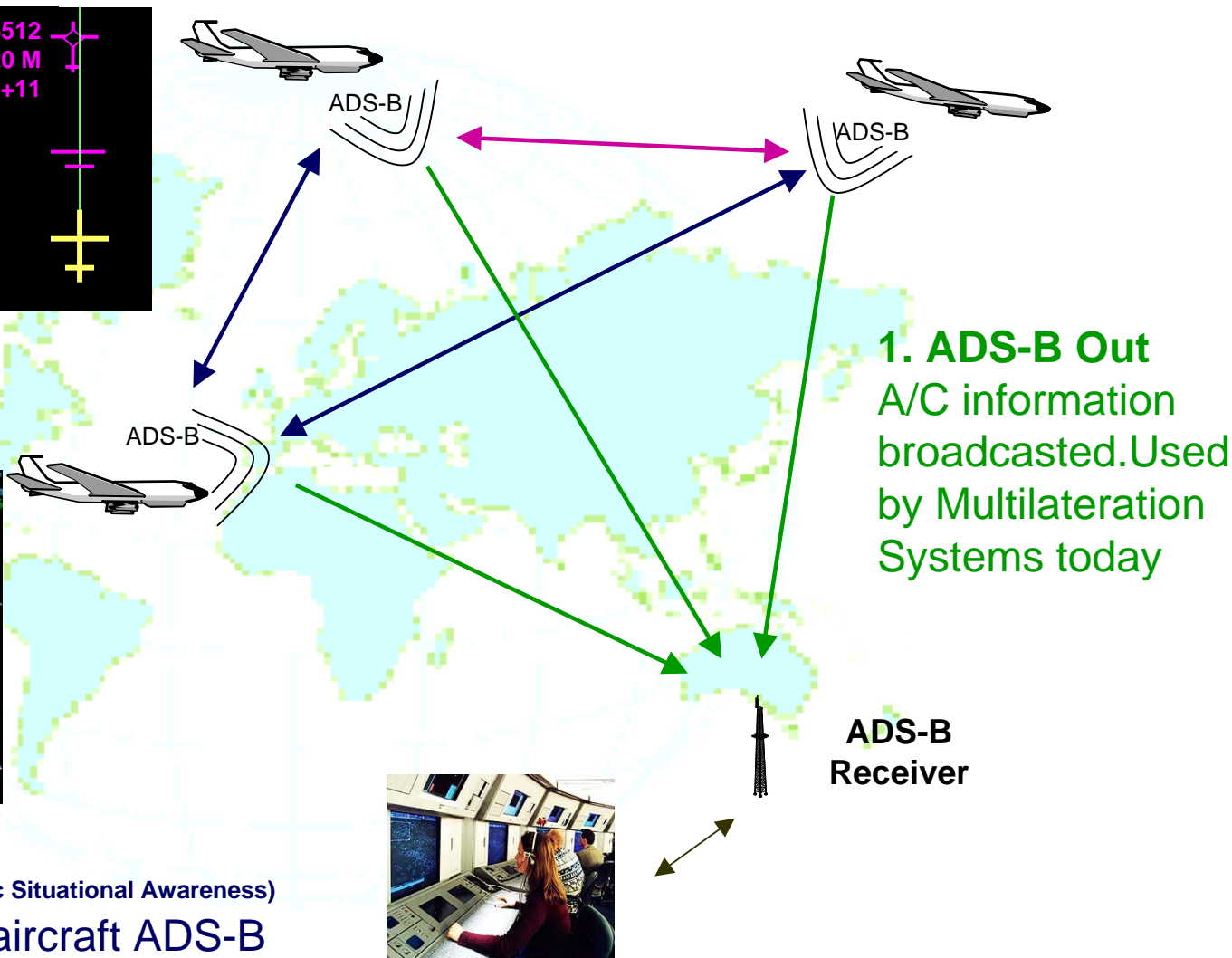
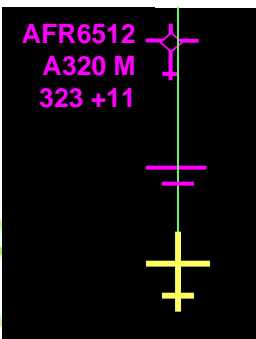
- Potential for Cat II & III Decision Altitudes



Traffic Surveillance – Trend Towards Phased Implementation of ADS-B Technology

3. SPACING

A/C instructed to maintain spacing with target aircraft



Air Traffic Control

2. ATSAW (Air Traffic Situational Awareness)

Display of other aircraft ADS-B Info in the cockpit

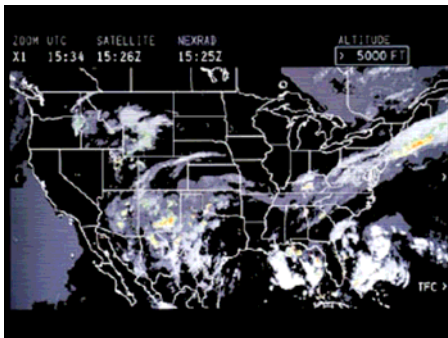
Weather – Trend Towards Integration of Uplinked Weather with Weather Radar

Datalink and Satellite Broadcast Weather

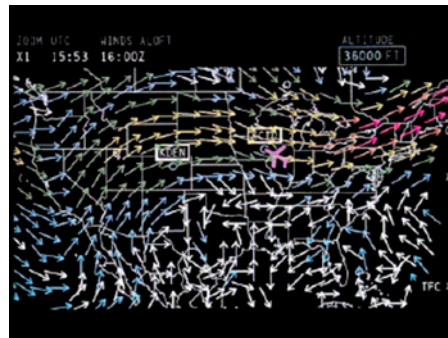
- Strategic Weather Information from Ground-Based Sources



Nexrad



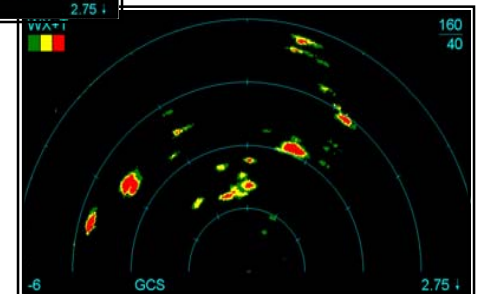
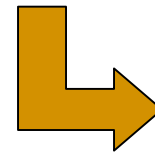
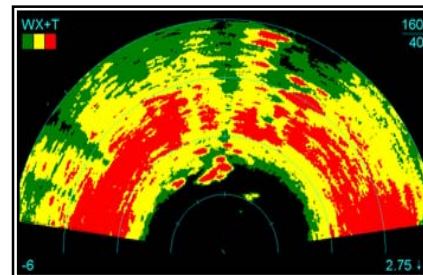
Satellite Imagery



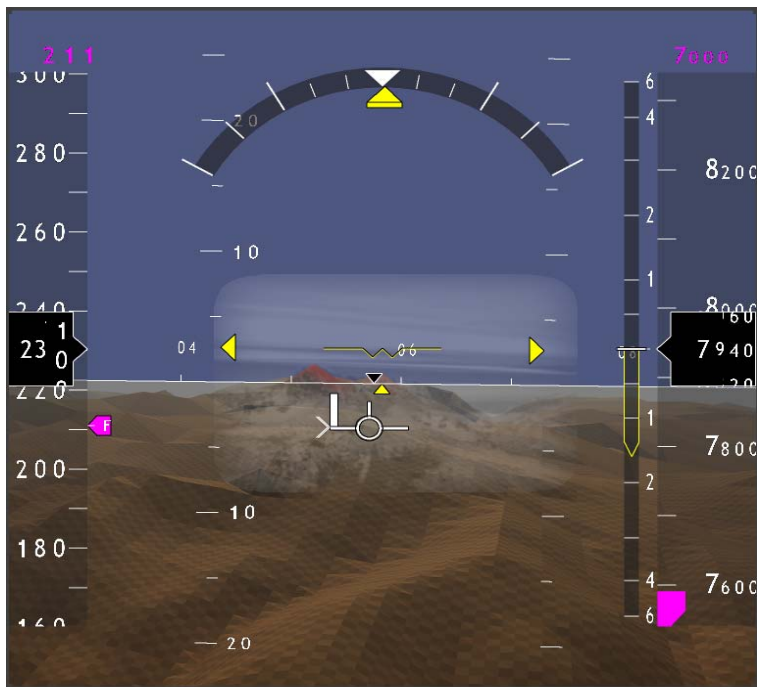
Winds Aloft

Weather Radar

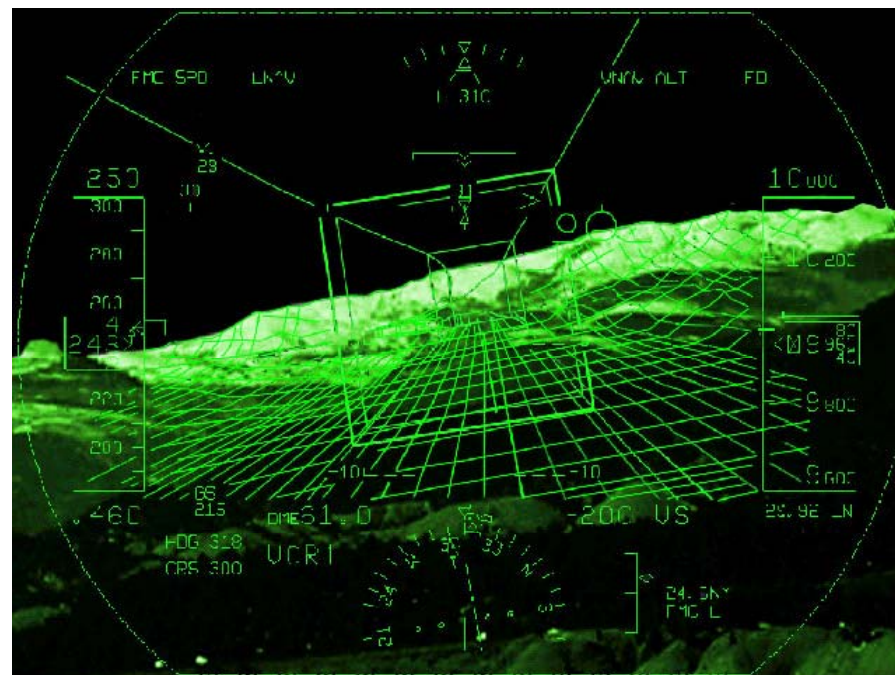
- MultiScan™ Technology
- Digital Signal Processing Eliminates Ground Clutter
- Automated Operation
- World-Wide Geographic Weather Correlation



Displays and Situational Awareness – Trend Towards Synthetic and Enhanced Vision



Head Down SVS PFD
w/EVS Inset Image

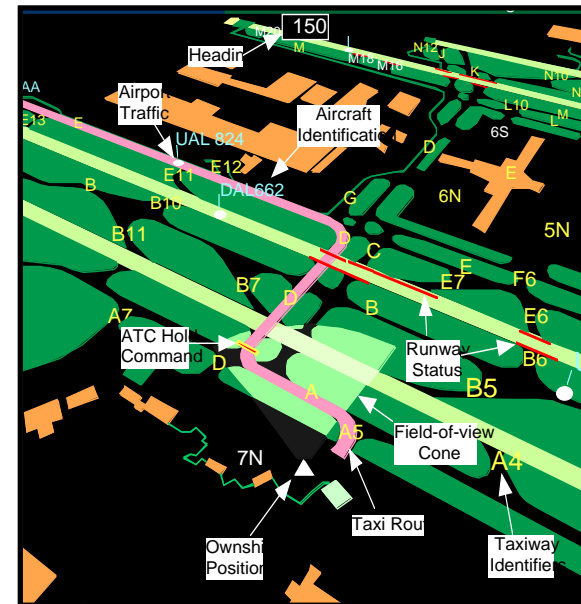


Head Up Display
w/Wireframe SVS and EVS

Opportunity for “Equivalent Visual Operations”

Displays and Situational Awareness – Surface Operations

- Head-up and Head-down Display Synergy for Surface Operations
- Reduced Surface Navigation Error; Fewer Taxis Errors and Runway Incursions
- Enhanced Airport Throughput



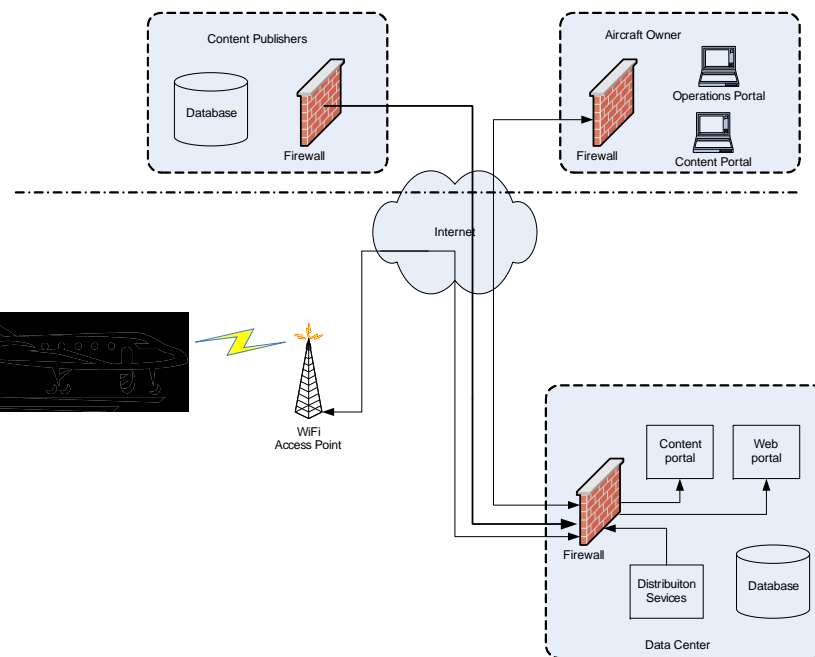
System Architecture – Trend Towards Open System Architecture

- Open Architecture
 - Standard Interfaces For I/O, Hardware And Software Touch Points (ARINC 661, ARINC 664, ARINC 653)
 - Non-Proprietary Operating System
- Life Cycle Benefits
 - Eases Growth / Upgrades For Future Functionality And Requirements
 - New Features
 - Next Generation Airspace
 - Enables Future Technology Insertions
 - Faster Processing And Input/Output
 - Enhanced Graphics
- Training Support

Smart Integration Providing Flexibility & Growth To Meet Future Challenges

Operations – Trend Towards Integrated Information Management

- Networked System
 - All Systems Information Continuously Available Throughout System
 - Interoperability With Ground Networks Easing Maintenance And Operations Tasks
- Maintenance Operations Streamlined
 - Automated Database Loading - On Request
 - Direct Transfer Of Maintenance Status To Management Systems
- Improved Dispatchability
 - Advanced Deployment Of Spares
- Operations Flexibility



Right Information At The Right Time To Improve Operational Efficiencies

Summary

- Regional Aircraft Avionics has Seen Significant Progress over the Past 20 Years
- CNS/ATM is Slowly Becoming Reality
 - Aircraft: Enhance Operational Efficiency
 - ATC System: Enhanced System Throughput
- Advanced Architectures and Information Management will Further Streamline Avionics Update and Airline Operations
- Advanced Display Features Such as Synthetic and Enhanced Vision will Potentially Enable Equivalent Visual Operations under Adverse Weather Conditions; Further Enhancing System Throughput and Safety