Open Systems Architecture - A Boeing Enterprise Perspective

Don C. Winter
Open Systems Architecture
Phantom Works
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<td>Open Systems Joint Task Force (OSJTF)</td>
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<tr>
<td>1931 Jefferson Davis Highway</td>
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<tr>
<td>Crystal Mall 3, Suite 104</td>
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A “One Company” Affordability Strategy:

- Reduce Flyaway Cost by 50%
- Reduce Development & O&S Costs by 60%

Leveraging:

- Commercial Technology Insertion
- Enterprise Product Application
- Process Redesign & Acquisition Reform
Open Systems Thrust Areas

Common Software Architecture

An Avionics Architecture Strategy

- Enterprise Roadmaps
- Leverage
- Affordability Redesign
- COTS Exploitation
- Strategic Application
- Product Transition
VISION - Affordability Leverage

An Enterprise Avionics Affordability Strategy
The Aging Aircraft Avionics Issue

Extended Service Life Coupled with Declining Military Budgets and a Dwindling Supplier Base, Challenges the Effectiveness of Today’s Front Line Weapon Systems

- Parts Obsolescence - 1970/80 Hardware
- Unique Avionics Architectures
  - Piecemeal Upgrades
  - Development Cost & Schedule
- Software Upgrades
  - Cost to Maintain
  - Cost to Upgrade
  - Verification/Validation

The Challenge: Provide Affordable & Rapid Options to Retaining The Effectiveness of Legacy Systems
Technology Trends

Technology - The Growth Stock!

- Rate of Growth/Year = 40%
  - Doubles Every 2 Years
  - Cost/Part Decreases

10,000 : 1 Growth in 20 Years

Device Density

1B
100M
10M
1M
100,000
10,000
1,000

Microprocessor
Memory

Processor Chips
Memory Chips

- 8008 8080 8085
- 80486 80860
An Architectural Framework for Affordability

These Standards Establish an Architecture Framework & Enable Interoperability

A Foundation in Long Lived Standards

- Components
- Processors
- Board Level Products
- Software Tools
- Interfaces (H/W & S/W)
- Software Language

These Implementations Need to Evolve with Technology

These Standards Establish an Architecture Framework & Enable Interoperability

Time to Obsolescence (Years)

Source TI Presentation
Define Boeing’s Enterprise Strategy for:

- Avionics Systems Affordability
- Open Systems Architectures

And Then…

TRANSITION
Affordability Leadership

- 50% Reduction in Flyaway Costs
  - COTS Technology Insertion
  - Streamlined Affordability Processes
  - Acquisition Reform

- 60% Reduction in Development Costs
  - Common Building Blocks
  - Reuse in Hardware & Software Architecture
  - Leveraged Developments Across Platforms

- 60% Reduction in Operations & Support Costs
  - Two Level Maintenance of Hardware
  - Object Oriented Software Design
  - Improved Diagnostics & Open Architecture
Open System Leadership

- Enterprise Transition Opportunities
  - Program Roadmaps
  - Leveraged Developments
  - Rapid Prototyping

- An Extensible Open System Architecture
  - Module Level Architecture
  - Object Oriented Software Architecture
  - Unified High Bandwidth Networks
  - Commercial Technology Transition

- Advanced Tools & Processes
  - Advanced Algorithms
  - Automatic Code Generation
  - Commercial Software Tools
Program Execution

One Enterprise
Open Systems Avionics Architecture

BOLD STROKE
IPTs
Common Elements
Tools & Process

Enterprise
Funded Development
Above & Beyond
Program Requirements

Leveraged
Program Development

F/A-18
F-15
AV-8B
JSF

C-17
AH-64

Integrated Core
Processing

Integrated RF Sensing

Integrated EO Sensing

Unified Avionics Interconnect

Vehicle Management

Stores Management

PVI

Common Elements

Tools & Process

Above & Beyond
Risk Reduction Demos - Key to Transition Success

- **AV-8B**
  - Original XN-6 Mission Computer
  - Modified XN-6 Or All-COTS MC

Mission Computer
- **PowerPC Processor**
  - AV-8B OFP (C)
  - Wrapper (C++)
    - Put
    - Get
  - Common OFP
    - Ballistics (Ada95)
    - Navigation (C++)
    - Radio (C++)
    - ORB (IDL)

OSAT I Software
- Legacy OFP
- Legacy Wrapper
- OSAT I Software

OSAT II Software
- Second Processor
  - Second OFP
    - A/A Launch Zone
    - ORB (IDL)
- POSIX API

POSIX Application Program Interface

1 COTS Module With PowerPC Replaced 8 Original Modules
Add Second COTS Module For OSAT II
Reuse - A Key Open Systems Benefit

F/A-18C/D (Lot 14 and Up)
250 Aircraft

Commercially Based Core Processor

Legend
- Bold Stroke Module
- F-15 Module
- AV-8B OSCAR Module

GPP = General Purpose Processor
IPM = Image Processor Module
FCM = Fibre Channel Module
IOM = Input / Output Module
VIM = Video Input Module
PSM = Power Supply Module

F/A-18E/F
50 Aircraft

F/A-18C/D
(Lot 14 and Up)
250 Aircraft

F-15E
221 Aircraft
A Fundamental Change in the Way We Design, Build, and Field Avionics Systems

- **People**
  - True IPD Teams
  - Realignment of Responsibilities
  - Risk Sharing

- **Process**
  - Levels of F3I Mgmt
  - New Business Practices
  - System Level Solutions
  - System Support Plan
  - Test & Evaluation

- **Technology**
  - Real Time Performance
  - Packaging OTS
  - Environment
  - Technology Roll
  - Future Forecast
  - Military is Follower

---

**AFFORDABILITY**

- 50% Cost Reduction
- Substantial LCC Payoff
- Environment => Cost
- Contain Requirements