BIOGRAPHY

ROGER COOLEY

Roger Cooley is a Computer Scientist with the Federal Aviation Administration in Washington D.C. He is currently serving as an Assistant to the FAA's Chief Scientist for Software Engineering. While serving in this position for the past 2 years, he has assisted in the establishment of a multi-year software engineering improvement program for the FAA. This program includes major initiatives for improving both systems engineering and software engineering processes, and is based substantially on the Software, Software Acquisition and Systems Engineering Capability Maturity Models. The software engineering program also includes initiatives to support the development of a National Airspace Systems Architecture, and the improvement of processes used in the certification of aviation and air traffic control safety-critical software.

During the past 8 years, Mr. Cooley also has served in other positions at the FAA, both as a division manager and program manager. His career over the past 30 years has included managerial and technical leadership positions as an electronics engineer and computer systems analyst with the Department of the Interior, Department of the Army, and the Naval Research Laboratory.
STRATEGIES FOR COTS/NDI SOFTWARE USE IN THE FAA

ROGER COOLEY

March 7, 1995

AGENDA

• FAA Environment
  - Current Environment
  - Changes Underway
  - New Directions
• Views of COTS/NDI
  - Terminology
  - Benefits, Risks and Tradeoffs
• Strategies for Using COTS/NDI
FAA ENVIRONMENT

FAA ENVIRONMENT - CURRENT

- Organization and Resources
  - FAA Organized into 7 Lines of Business
  - 48,000+ Employees Located in 2000+ Facilities
  - Major Funding Sources are Aviation Trust Fund and Direct Appropriations

- Technical and Operational Environment
  - Multitude of Custom-built Real-time ATC and Support Systems which Comprise the National Airspace System
  - Current National Airspace System is Primarily Groundbased - Implemented Over Several Decades
  - Maintenance Costs Are Becoming Unacceptably High
FAA ENVIRONMENT - CHANGES UNDERWAY

- **Organization and Resources**
  - Organizations and Budgets BeingDownsized
  - Major Reforms in Acquisition, Personnel and Finances
  - Integrated Product Teams Established

- **Technical and Operational Environment**
  - Replacement of Aged Systems is Beginning
  - Migration to GPS for Navigation and Landing is Beginning

The NAS is Aging: Major In-Service & Replacement Systems
FAA ENVIRONMENT - NEW DIRECTIONS

THE CHALLENGE

- US. Aviation is Growing Rapidly
  - 4% Anticipated Annual Growth in Aircraft
  - 1.5% Annual Increase in Aircraft Operations
  - 20+ Airports are at or Near Their Capacity
- Airspace Management and Aviation Technology are becoming more complex
  - Airways are Becoming Congested
  - Growth in Software Size/Complexity in Aviation Systems is Outpacing Capabilities to Test/Certify

MAJOR THEMES

- Continue Modernization of Systems
- Increase Airspace Capacity with Enhanced Safety
- Reduce Acquisition and Maintenance Costs
- Increase Maturity in Systems/Software Engineering and Acquisition Practices
- Make Greater Use of COTS/NDI in ATC Systems
OVERARCHING CONSIDERATIONS

It is imperative that the FAA make greater use of COTS/NDI, but must ensure that:

- Safety is not jeopardized
- Performance levels are acceptable (e.g., real-time accuracy, integrity, reliability, availability requirements are met)
- Systems can be economically maintained and evolved over time

VIEWS of COTS/NDI
**TERMINOLOGY**

**NON DEVELOPMENTAL ITEMS (NDI)**

<table>
<thead>
<tr>
<th>NON SOFTWARE/REUSABLE SOFTWARE PRODUCTS</th>
<th>NON HARDWARE/REUSABLE HARDWARE</th>
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<tbody>
<tr>
<td>CCIS</td>
<td>Other Reusable Hardware</td>
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<tr>
<td>Commercial (Off-the-Shelf)</td>
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<tr>
<td>Software Products</td>
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<td>GOTHS</td>
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<td>Other Reusable</td>
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<td>Services</td>
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**BENEFITS AND RISKS**

- Lower cost and shorter developmental cycle
- Can significantly reduce development costs
- Early demonstrations and test runs
- Involves less risk
- Critical airframe systems
- Typical aerospace environment
- High reliability
- High demands for quality
- Strong government support
- No software/REUSABLE SOFTWARE PRODUCTS
- No non-NDI hard웨어/REUSABLE HARDWARE
- Early ceremony
- Involves less risk
- Critical airframe systems
- May be bought into multiple programs
- May be integrated into multiple programs
- May be bought into multiple programs
# TECHNICAL AND ECONOMIC TRADE-OFFS

<table>
<thead>
<tr>
<th>Issues</th>
<th>Optimize</th>
<th>Systems Solutions</th>
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<tbody>
<tr>
<td>Economic Integration</td>
<td>Functionality</td>
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<td>Performance</td>
<td>Schedule</td>
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<tr>
<td>Mission Criticality</td>
<td>Quality</td>
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<td>Modification</td>
<td>Supportability</td>
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<tr>
<td>Safety/Security</td>
<td>Lifecycle Cost</td>
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<tr>
<td>Reliability</td>
<td>Risk</td>
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<tr>
<td>Lifecycle Management</td>
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<td>Configuration Management</td>
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<td>Migration</td>
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# STRATEGIES FOR USING COTS/NDI

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COTS/NDI STRATEGIES

For FAA, Successful Application and Sustainment of COTS/NDI in the National Airspace System will require:

- A Well Defined and Managed Systems and Technical Architecture Partitioned into Multiple Levels of Safety Criticality
- An Acquisition Lifecycle Risk Management Plan to Identify and Mitigate Risks Associated with the Use of COTS/NDI
- An Enhanced Configuration Management Process Operating at Multiple Systems and Organizational Levels
- Acquisition, Testing and Maintenance Guidance for IPTs and Systems Support Organizations
- Partnerships with our Major Suppliers to Mitigate Risks and Optimize Systems Evolution over the Lifecycle
ACTIVITIES UNDERWAY

- An Initial NAS Systems Architecture has been Developed (Version 3.5 is currently under development)
- Initial Acquisition and Lifecycle Guidelines for Using COTS/NDI have been Drafted
- Work on Development of Detailed Implementation Guidelines for COTS/NDI Including Testing will commence this Fiscal Year

THE OPTIMUM FOR FAA - LEVELS OF REUSABLE NDS

<table>
<thead>
<tr>
<th>FAA Specific/could be COTS, Other</th>
<th>Countries' ATS Systems</th>
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<tbody>
<tr>
<td>Domain</td>
<td>National Air Space System, Business/Administrative, Airports</td>
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<table>
<thead>
<tr>
<th>Non FAA Specific (could be COTS, GOTS, Other)</th>
<th>SW Engineering Tools</th>
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<tr>
<td>Function</td>
<td>Project Management</td>
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<tr>
<th>Infrastructure (Open Systems)</th>
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<tr>
<td>OS, CHI, DBMS, Networks, Security, Data Interchange</td>
<td>CASE</td>
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<th>Code Generation</th>
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<td>Etc.</td>
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