Opening Remarks
Space and Missile Systems Center

MONA: Framework for Leading Change

GSAW 2014

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SMC Chief Scientist
GSAW—Key Ingredient for Success

- Industry-wide ground architecture concepts
- Close to emerging space design innovations
- Experienced general space brain trust
- We are presenting:
  - Top Concepts
  - Vision, Urgency, Strategy
  - Broad based tasks and incremental steps, such as SNAP
- Initiating Productive Momentum
Leading Change

• Establish a Sense of Urgency
• Developing a Vision and Strategy
• Create the Guiding Coalition
• Communicating the Change Vision
• Empowering Broad Based Action
• Generating Short Term Wins
• Consolidating Gains and Producing more Change
• Anchoring New Approaches in the Culture
Establish Sense of Urgency

<table>
<thead>
<tr>
<th>USAF Chief Scientist</th>
<th>Policy and Law</th>
<th>GAO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development is drawn out, creates expensive programs</td>
<td>DoDI 5000.02: “Operation of the Defense Acquisition System”</td>
<td>GAO Report: Assessments of Selected Weapons Programs, Mar 2007*</td>
</tr>
<tr>
<td>Tightly integrated, one-of a kind systems further expensive to upgrade</td>
<td>DoDD 8320.02: “Data Sharing in a Net-Centric DoD”</td>
<td>GAO Testimony Before US Senate Subcommittee: Space Acquisitions, March 2008 (SBIRS)*</td>
</tr>
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<td>Poor ability to integrate different platforms and systems developed over time</td>
<td>CJCSI 6212.01F: “Net Ready KPPs”</td>
<td>GAO Report: 09-326SP Defense Acquisitions Assessments of Selected Weapons Programs</td>
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<td>Low Technical Agility/Resilience</td>
<td>WSARA 2009</td>
<td>GAO Report 10-477T DoD Persistent Challenges Remain in Developing Space Systems</td>
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</table>

*“The acquisition community has failed at delivering projects that meet cost, schedule and performance baselines:”*  
Major Systems Acquisitions must change.
Developing a Vision and Strategy

- MONA Vision: M->O->N Progression
  - Leverage Existing Investments in physical/electro mechanical Modularity
  - Grow Openness through carefully chosen interfaces and subsequent standards
  - Transition natl investments in Networked/IT systems for more rapid modernization
- “Step-In/Step Out” Strategy
  - Adopt and Tailor rather than re-invent
  - Join the consensus building and where appropriate nudge the process
  - Get onto the leading edge with DoD Architectural Concepts and Needs
  - Coordinate and Consult with Industry
  - Monitor Market Progress including civil, commercial and international
  - Then government “step out” and let industry “run with it”. Industry shall:
    - Develop and Maintain the Standards
    - Develop and Provide the Enabling Components
    - Develop and Provide the service to confirm MONA components adhere to stds

Examples: Funding railroads, highways, telephone infrastructure, electrification, internet.
Create the Guiding Coalition

• Government Investments brought down the bulk of the NRE:
  – AFRL SPA/MONARCH (2004… ~$130M) (DNA)
  – ORSO’s MSV (2006…~$50M)
  – DARPA F6 (2007… ~$70M)
• Natl Security Space coordination and collaboration through SUMO
  – Leveraging ~$2M in business case/ROI, architecting, standards
    • Business cases close with margin
• Industry working/steering groups
  – In formulation stage
• Professional societies for standards development and training
  – Working with AIAA and NASA CII approaches/strategy

Pulling together a group with enough power to lead change and getting them to work as a team
Communicating the Change Vision

• Workshops/Conferences/Associations
  – MONA/SNAP Workshops
  – AIAA SPACE 2014
  – IEEE Aerospace Conference 2014
  – Architecting Conferences (Ground Systems Architecture Workshops….)
  – Natl Defense Industry Association (NDIA)
• “Role Models/Pilot Programs”
  – ORS MSV
  – HPO HPIU
  – UAV/UAS/RPA /FLEX (Air and Munitions)
  – Possible Space Test Program option with SIV (modular developmental test)
• Develop Acquisition Workforce (STEM)
Empowering Broad Based Action

Software Modularity
- Hardware independent
- Adapts to changes with electronic ICDs
- Standard interfaces
- Fully reusable modules
- Software applications support different missions & payloads

Open
- License free standard
- Full insight into workings
- Improves interchangability

Physical Modularity
- Expandable
- Add future capability

Networked
- Decouples software from physical location
- Packetized (easy translation
- Enables security auditing
- MLS Foundation

Encourage Ideas, Activities and Actions to Lower Barriers to Entry
Generating Short Term Wins

- SPA/MONARCH: Validating viability of composable systems
- SNAP: Developing a MONA payload interface proof-of-concept demonstration (SMC XR with SDL Program)
- ORS/MSV: Validating viability of MONA bus architectures for DoD space applications (ORS Program)
- F6: Validating MONA for inter-platform and payload interface applications (DARPA Program)
- NASA CII: Common instrument interface guidelines
- SUMO: Validating business case for MONA and establishing a transition process (ODNI and Aerospace Corp Program); Industry Day in conjunction with National Space Symposium April 9-11
- MONA workshop @ NASA AMES 25 FEB 13 developed consensus on fundamental synergies among MONA activities and established desirability of ongoing technical interchange
**System F6 – SNAP Architectural Comparison**

**F6 applications**

<table>
<thead>
<tr>
<th>Application</th>
<th>Privileged services</th>
<th>Software Services</th>
<th>Naming, management, time</th>
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<tbody>
<tr>
<td>Presentation</td>
<td>F6MDK RMI</td>
<td>F6MDK pub-sub</td>
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<tr>
<td>Session</td>
<td>Authentication and labeling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>UDP</td>
<td>Routing, TCP, SCTP</td>
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<tr>
<td>Network</td>
<td>IPv4</td>
<td>IPSec, IPv6</td>
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</tbody>
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**Software Applications**

- **Software Services**
  - UDP
  - Naming, management, time
  - Networking

**Hardware Interface**

- **Physical**
  - F6WICS
  - SpeedPoint
  - 802.11
  - Ethernet
  - Spacewire

**Networks**

- **wired networks**
  - Ethernet
  - Spacewire

- **wireless networks**
  - F6WICS
  - SpeedPoint
  - 802.11

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**Characteristics of MONA**

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<th>SNAP</th>
<th>F6 Design</th>
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<tr>
<td>Modular Software (“Apps”)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Open (Physical &amp; S/W Stds)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Networked</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Common (e.g., PnP) H/W Stds</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>Spacecraft Drivers</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>Payload Drivers</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>Info Assurance</td>
<td>✓</td>
<td>✓*</td>
</tr>
<tr>
<td>Hardware Encryption</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>IPSEC</td>
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<td>✓*</td>
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<tr>
<td>MLS</td>
<td></td>
<td>✓*</td>
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<tr>
<td>Quality of Service</td>
<td></td>
<td>✓*</td>
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*Planned, not implemented

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Fundamentally, both SNAP and System F6 are instantiations of the MONA (Modular Open Network Architecture) approach.
Consolidating the Gains and Producing more Change

MONA Gains
- Technology for MONA is becoming available—Boeing Phantom Phoenix and NG Eagle M
- Government has ability to incentivize or influence MONA—creating a new market
- Industry is beginning to see cost savings and competitive advantages emerging with a MONA or similar approach
- MONA approach enables reduced timelines and costs savings

More Change
- Encryption/Information Assurance solutions
  - F6 residuals: MLS development
  - AFRL R&D and SBIRs
  - Potential SMC/XR-HPO SNAP follow-on effort
- Power management/control
- Develop additional enabling components called out in SUMO
- Standards development for Key Interfaces
  - Government Incentivized
  - Industry Developed
- Refine and Improve Requirements
  - Emerging/Refined HPO/HPIU requirements
  - Industry input from SNAP workshop—Survey
- Provide Training Through professional Societies / Open Forum

Developing the People with Additional Projects
Anchoring New Approaches in the Culture

• Continue MONA socialization
  – Industry working/steering group
  – SUMO engagement across NSS
  – Training, Training, Training

• Continue technology infusion
  – Step-in/step-out strategy
  – Tech demos, flight demos. standards
  – Broad collaboration: SMC/XR, HPO, ORSO, AFRL, DARPA, ODNI/SUMO, NRO, NASA, Industry

• Target operational on-ramps
  – Flight technology demonstrations/validations 2017+
  – POR infusion 2020+
    • Gives industry ample time to prepare to compete