

# **GSAW 2002 COTS Integration Breakout Session Summary**

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## **COTS Integration: How Far Have We Come? Problems and Solutions in 2002**

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# Breakout Session Goals

- **View the topic of COTS integration from multiple perspectives**
  - ❖ Integrator
  - ❖ Vendor
  - ❖ Cost
  - ❖ Participants
- **Identify solutions and successes**
  - ❖ What factors contributed to the successes?
- **Identify ongoing and new problems and issues**
  - ❖ What factors contributed to the problems?
  - ❖ How can the problems be reduced or eliminated in the future?
- **Update survey on COTS upgrade release frequency**

# What Happened

- **Introductions**
  - ❖ Session participants included Aerospace, industry, academia, acquirers, users, and cost estimators
- **Integrator perspective**
  - ❖ "Integration and Maintenance with the COBRA Architecture" - Tim Spinney, The Aerospace Corporation
- **Vendor perspective**
  - ❖ "Integration: Reinventing an Expensive Wheel" Larry McQueary, Talarian
- **Cost perspective**
  - ❖ "Costing COTS Integration" - Marilee Wheaton, TRW
- **32 participants with lively discussion**
- **Collected data for COTS upgrade release survey**

# “Integration and Maintenance with the COBRA Architecture” -- Tim Spinney

- **Maintenance paradigm not updated to reflect new realities of COTS-Based System (CBS) sustainment**
  - ❖ Insufficient funds budgeted for COTS upgrades
  - ❖ Management reassigns COTS upgrade budgets to efforts considered higher priority
  - ❖ License costs are a large portion of minimal maintenance budget
- **Solutions:**
  - ❖ Middleware-based architecture with loose coupling of functional areas
  - ❖ Small number of COTS products
  - ❖ Written back-out plan for every COTS product upgrade

# “Integration: Reinventing an Expensive Wheel” -- Larry McQueary

- **Solutions:**

- ❖ Don't overlook or underestimate the infrastructure of the software architecture
- ❖ Use loosely coupled components
- ❖ Adhere to standardized interfaces
- ❖ Thoroughly evaluate COTS products (including possible vendor relationships)
- ❖ Prototype use of COTS products
- ❖ Enter into a partnership with the vendor and communicate
- ❖ Utilize vendor training and consulting capabilities
  - ❖ Don't develop in a vacuum
- ❖ Buy the maintenance that you need (e.g., 24/7 support)

**“Despite discussion to the contrary, using COTS is still cheaper and more effective than building”**

# “Costing COTS Integration” -- Marilee Wheaton

- **Use lessons already learned**
- **Use cost risk analysis to estimate cost of uncertainties in CBS development**
  - ❖ Define, estimate and analyze risk in each component
- **Use cost models that incorporate COTS-related costs (e.g., COCOTS, SEER-SEM)**
- **Need to estimate size of COTS (not just SLOC), amount of functionality used, and COTS cost drivers**
- **Collect COTS integration data to provide a historical basis for better estimates**
  - ❖ Calibrate the cost models with your data

# “Costing COTS Integration” -- Marilee Wheaton

- **Be sure to include all COTS-related costs, especially those not included in the cost model estimates (e.g., licenses, training)**
- **Expect glue code to have a lower productivity than custom software**
- **Cost of COTS versus custom development needs to be evaluated for the full life cycle (not just development)**
  - ❖ **Distribution of costs will be different for COTS and custom development projects**

# Conclusion

- **CBS development and sustainment has inherent uncertainties beyond the control of the acquirers, developers and users**
- **Effective CBS development and sustainment requires a change of processes and attitudes across the entire life cycle and among all parties**
  - ❖ Acquirers
  - ❖ Developers
  - ❖ Users
  - ❖ Integrators
  - ❖ Procurement
  - ❖ Contracts

# Survey on COTS Upgrade Release Frequency

## 1. In your experience, what is the average duration between releases of a given COTS Product?

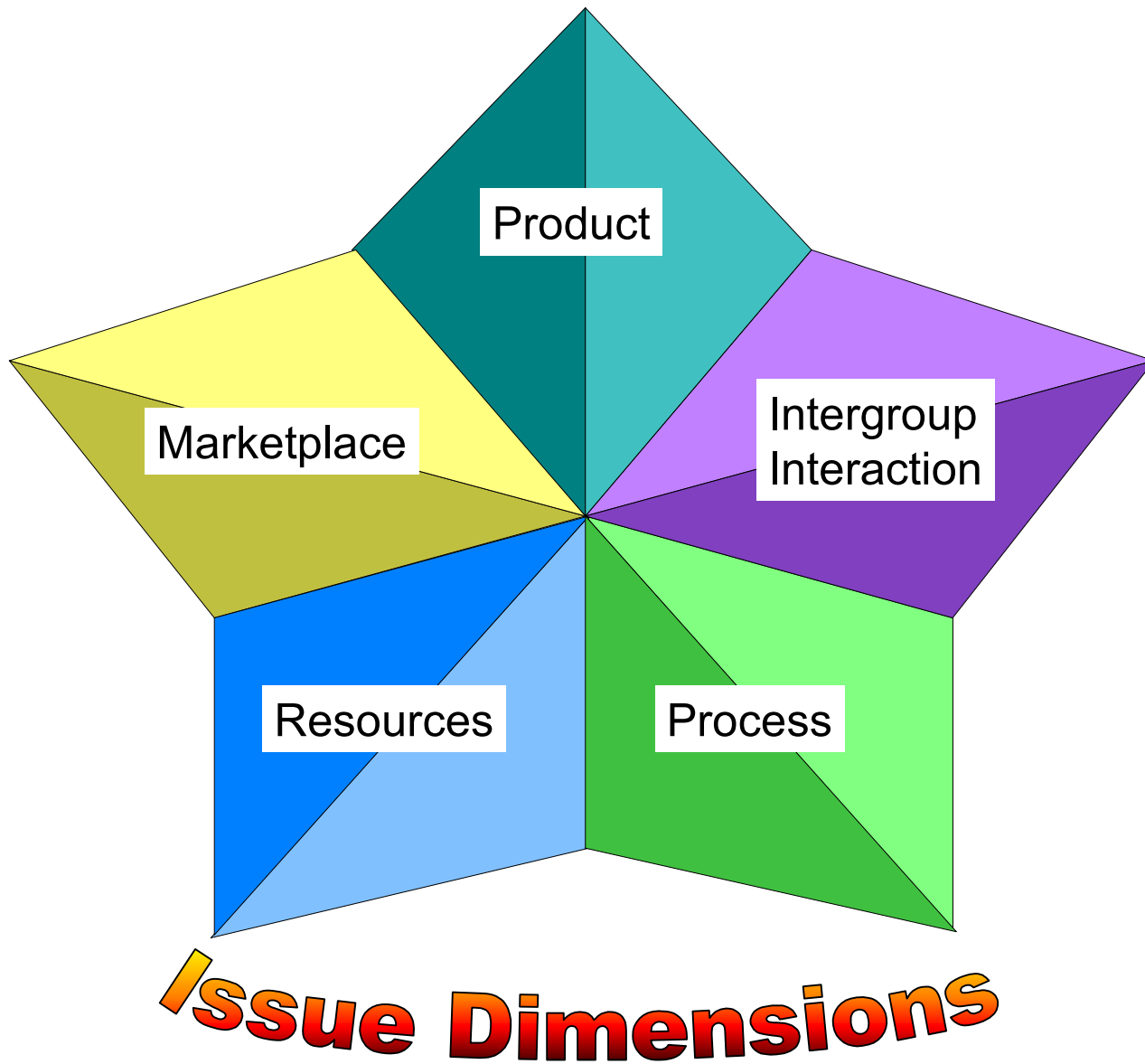
- ❖ GSAW 99 = 6.3 months
- ❖ GSAW 00 = 8.5 months
- ❖ GSAW 01 = 8.75 months
- ❖ GSAW 02 = 9.6 months (range: 6 to 18)

## 2. For system(s) with which you have experience, how frequently are system upgrades released that incorporate COTS software upgrades?

- ❖ GSAW 02 = 20.5 months (range: 4 to 70)

# Backup Charts

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**Key for following charts:**

- “Gn” indicates GSAW 2001 issue and ranking
- “A” indicates 2000 Aerospace study issue

# Product Issues

- **Requirements vs. COTS capabilities (G1)**
- **Integration of**
  - ❖ Multiple COTS products (G2)
    - ❖ Incompatibilities among COTS products (A)
  - ❖ COTS products with new/reuse software (G5)
- **COTS independent architecture (G3)**
  - ❖ Designing architectures for COTS evolution (A)
  - ❖ Designing in safety, security, supportability (A)
- **Mission risk (G6)**
- **Cross platform portability (G11)**
- **Standards: good, bad, ugly? (G14)**
- **API breakage (“unplug and replay”) (G15)**
- **Dormant functionality or features (G18)**
- **Adverse effects of product upgrades on system (A)**

# Process Issues - Developer

- **Robust initial and periodic COTS product evaluation (A)**
- **Prototyping in a system context (A)**
- **Testing in operational context (G12)**
  - ❖ Regression testing of upgrades in system context (A)
- **Adapting software and systems engineering processes for CBS development and maintenance (A)**
- **Still need systems and software engineering (A)**
- **Need enhanced CM processes (A)**
- **Planning for COTS upgrades and evolution during development and maintenance (A)**
- **Selection of hardware platforms with availability of COTS software as key criterion (A)**

# Process Issues - Customer and User

- **Acquisition and support strategies (G16)**
- **Adapting customer/user processes to CBS acquisition, operations and maintenance (A)**
- **Processes for trading cost, schedule, requirements, and O&M concepts (A) against COTS capabilities**
  - ❖ **Need requirements prioritization (A)**
- **Need contracts compatible with CBS development and maintenance (A)**
- **Standardized processes for safety certification and security accreditation of CBS needed (A)**
- **Standardized license processes to ensure suitability of licenses and maintaining currency (A)**

# Resource Issues

- **Cost vs. benefit of upgrading (G7)**
- **Acquiring and maintaining CBS skills (G9)**
- **Accurately costing all aspects of CBS development and maintenance (A)**
- **Optimal scheduling of upgrades (A)**
- **Increased computer resources for upgrades (A)**
- **Modifying COTS is a BAD idea! (A)**
- **Need cost and schedule management reserves (A)**
- **Reallocating time and effort across life cycle (A)**
  - ❖ **More time for evaluation, prototyping and analysis (A)**
  - ❖ **Less time for implementation; more time for integration (A)**

# Marketplace Issues

- **Product maturity (G4)**
  - ❖ Dropped or de-emphasized platforms and products(A)
  - ❖ Changes in fees and fee structure for licenses and services (A)
- **Marketplace maturity (G8)**
  - ❖ Vendor volatility (A)
- **Vendor responsiveness (G17)**
  - ❖ Changes in type and quality of vendor support (A)
- **Definition of COTS (=“for sale”) (G19)**
- **Suitability of licenses for user application (e.g., expiring keys, export restrictions) (A)**
- **Release schedule, content and quality unpredictable (A)**
- **Rapid technology turnover and limited support of past releases (A)**

# Intergroup Interaction Issues

- **Customer resistance to COTS--NIH (G10)**
- **Excessive customer bias toward COTS (A)**
- **Vendor relationships (G13)**
- **Establishing and maintaining active partnership between customer, developer and user (A)**
- **Need flexible and efficient responses to unexpected impacts by customer/user (A)**

# Resources

- **CeBASE COTS**
  - ❖ <http://www.cebase.org/>
  - ❖ <http://www.cebase.org/www/cots/index.html>
- **CeBASE COTS Lessons Learned site**
  - ❖ <http://fc-md.umd.edu/ll/index.asp>
- **SEI's COTS-Based Systems Initiative**
  - ❖ <http://www.sei.cmu.edu/cbs/>
- **International Conference on COTS-Based Software Systems (ICCBSS - “ice cubes”)**
  - ❖ <http://seg.iit.nrc.ca/iccbss/>

# Aerospace Publications

- **Richard J. Adams and Suellen Eslinger, “Lessons Learned from Using COTS Software on Space Systems,” *CROSSTALK* (Vol. 14, No. 6), June 2001, pp. 25-30.**
  - ❖ Available from <http://www.stsc.hill.af.mil/>
- **Richard J. Adams and Suellen Eslinger, “COTS-Based Systems: Lessons Learned from Experiences with COTS Software Use on Space Systems,” *Software Technology Conference (STC) 2001 Proceedings*, May 2001.**
  - ❖ Available from <http://www.stsc.hill.af.mil/>
  - ❖ Includes paper and briefing charts

# Aerospace Publications (Continued)

- **Suellen Eslinger, “Software Acquisition and Software Engineering Best Practices,” Aerospace Technical Report No. TR-2000(8550)-1.**
  - ❖ Available on-line at  
<http://www.aero.org/publications/papers/tech-reports.html>
- **Richard J. Adams and Suellen Eslinger, “COTS-Based Systems: Lessons Learned from Experiences with COTS Software Use on Space Systems,” Aerospace Technical Report No. TR-2001(8550)-01, September 2001.**
  - ❖ Available on-line at  
<http://www.aero.org/publications/papers/tech-reports.html>