

Transatlantic Development of COTS Products

John Masiyowski
Raytheon

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Agenda

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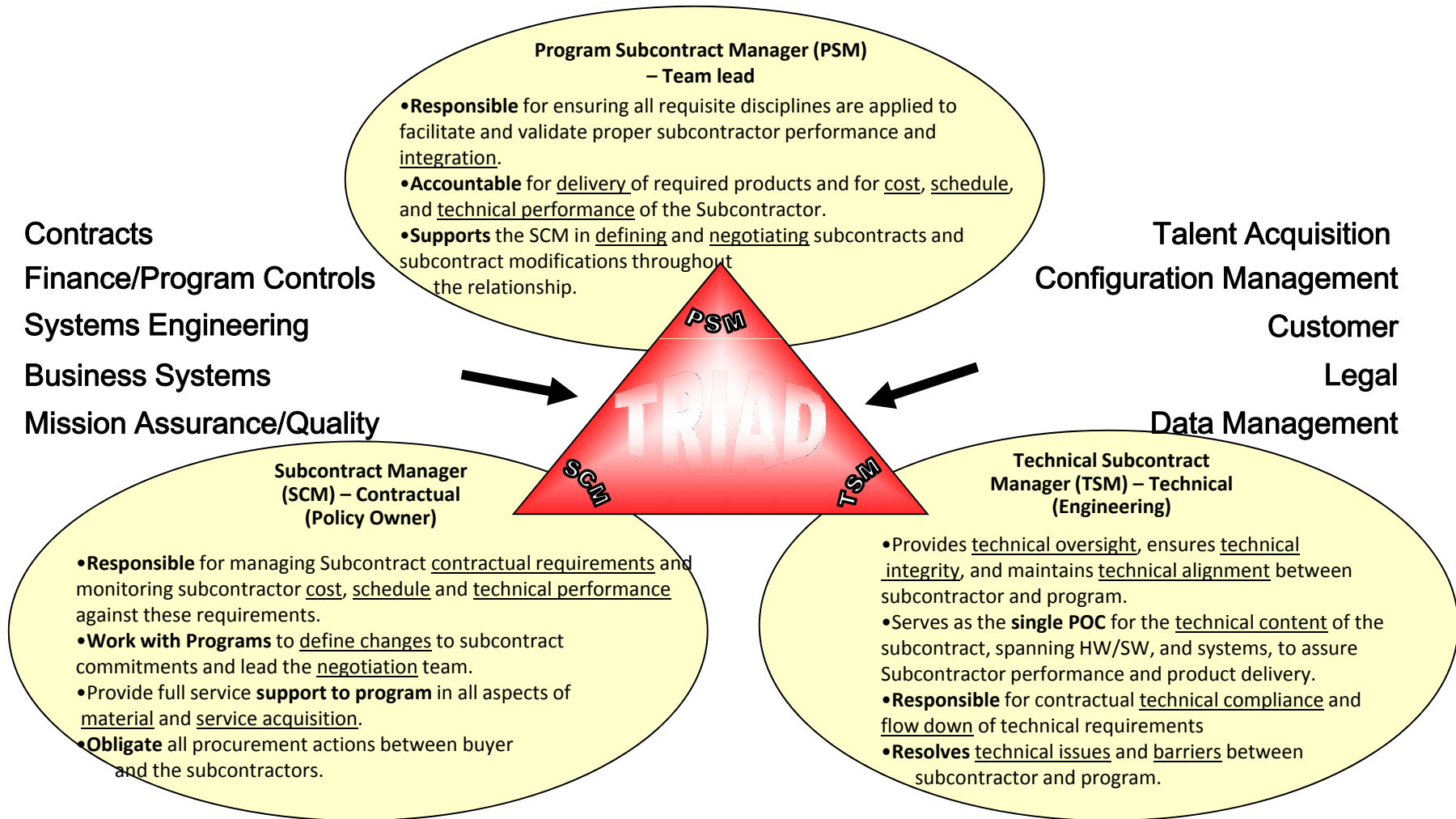
Project Proposal Background

- Propose a Complete System Solution in response to an RFP
- Requirements Excerpts
 - ALL System Requirements MUST be Met 100% - no exceptions
 - Key requirement → Maximum use of COTS products (HW & SW)
 - All modifications to product → COTS
 - Others were very specific to end-user operations (not found in COTS)
 - **Led to a modest amount of NRE to a key COTS product**
- **Unable to visit Vendor facility for on-site evaluation of capabilities and maturity prior to subcontract award**
- Execution Constraints
 - Must field system at first location in ~ 9 months ARO
 - Quick proposal turnaround ~ 3 weeks



Key Subcontract Deemed Moderate Risk – Monitor Very Closely

Subcontract Management TRIAD Model



Triad provides a structured and integrated subcontract management approach

Supplier Business Practices Discovered

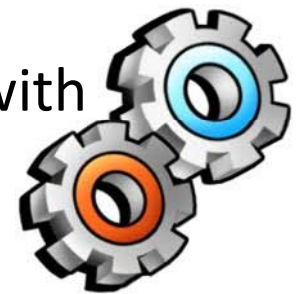
- Small company - limited resources to respond to constant changes
- Limited understanding of developing and testing to requirements
- Supplier does not use CMMI equivalent processes
- Supplier does not have written product specifications or current product user documentation
- Supplier does not have a mature development organization
 - No formal product QA acceptance testing
 - Limited engineering testing (C&UT)
 - No formal product defect tracking and resolution



Commercial Suppliers are not the same as Top Tier Defense Contractors

Subcontract Dynamics

- Constant change driven by Prime being subject to continual change by evolving and changing requirements
- Conflict between supplier's COTS product and the changes required for security accreditation [and operations]
 - The COTS product did not "fit" end system exactly → an unexpected high degree of customization resulted (evolving & unique requirements)
 - Goal of maintaining a COTS product offering that meet the specific and unique needs
- Required Constant and Continuous Technical Oversight with active involvement of the SCM TRIAD and TSM
- Fixed Priced Subcontract; no PM reserve available for Δ s



Expect Change To Occur and Plan Accordingly From the Start

Custom Off-The-Shelf

- COTS
 - Buy a product off-the-shelf and use “as is”
 - Some products are tailored to meet the user needs
 - Product may allow user to customize the product to needs of each individual
 - Many variants of a basis product are available to cover a wide market
 - Becomes expensive and complex to support many product variants
- End-User wants basic capabilities with lots of options to customize their products at an affordable price
- Why is the government pursuing COTS?
 - Customize the purchase with the desire to obtain an affordable price
 - Belief that COTS will speed up the acquisition process
 - Save \$ in the short/long run



*Source: COTS: Commercial-of-the-Shelf or Custom Off-the-Shelf
Wiley F Livingston, Jr., Crosstalk, June 2007, p31*

Product Evolved from a Basic Enhancement into to Highly Customized

Key Practices to Enable Success

- Comprehensive Subcontract Statement of Work (SOW)
 - Detailed Subcontract Data Requirement List (SDRL)
 - Use SOW Checklist and standard templates as a starting point
- Comprehensive and detailed Technical Specification
 - “Good” Requirements – takes time to develop and write'em
- Insist on complete engineering development process
 - Requirements → Design → Implementation → Verification → Validation
 - Produce Objective Evidence and Artifacts as process outputs
 - Formal Review Cycle with Buyer Approvals
- Detailed Integrated Master Schedule (IMS)
 - Milestones, SDRL, dependencies, resources, critical path, inch stones
- Perform Project and Risk Management
- Implement and use a Change Request Process
- Subcontract TRAID is effective and a Best Practice



Apply CMMI/Standard Processes/Practices Tailored to the Supplier

Documentation Differences

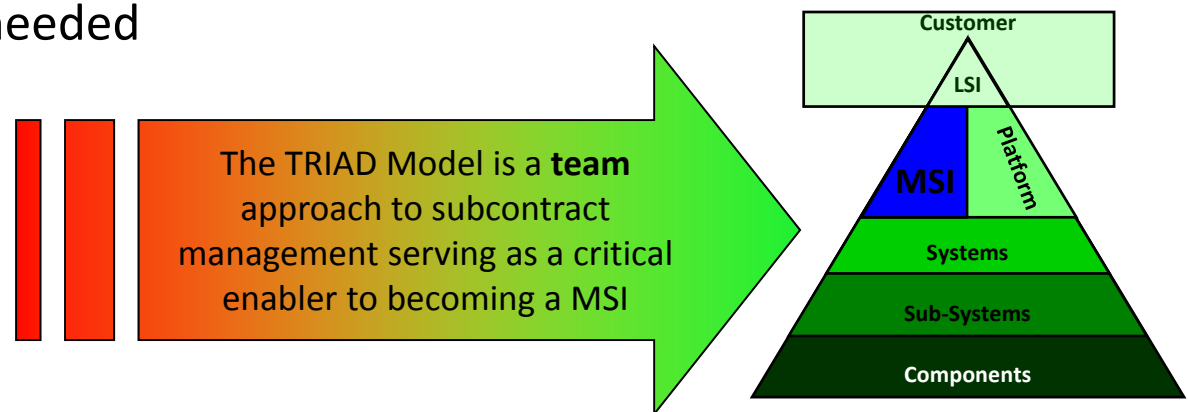
Document Type (Buyer)	Document Type (Supplier)
Hardware Requirements Specification	Functional Specification
Software Requirements Specification	Functional Specification
Software Top Level Design	Design Proposal
Software Detailed Design	N/A
Software Code and Unit Test	N/A
Product Level Test Plan	High Level Test Plan
Product Level Test Procedure	Acceptance Test Procedure



Cultural and Standards Differences → Both Nomenclature and Content

Lessons Learned

- The Subcontract Management Triad Model – An Essential Tool
- Must visit supplier prior to final selection – requires face to face discussions
- Supplier capabilities must be assessed in advance of decision
- Escrow of design and software with validation to ensure completeness
- ‘Build One’ is important to protect against vendor disappearing
- Supplier must have a dedicated program manager
- We must understand supplier development process/documentation
- Regular telecons – monthly on-site visits an absolute MUST
- Requirements creep is damaging, but evitable. Plan for change !
- A US-UK dictionary is needed
 - Engineering
 - Business
 - Culture
 - Practices
 - Laws



Conclusions

- Cannot expect a small commercial supplier to have mature and disciplined processes at the same caliber that of a defense contractor
- Cannot expect a commercial supplier to just "know" what the buyer wants – they don't
- Do not make shortcuts on project management and engineering development processes and practices
- Incorporate subcontract incentives with proper use of penalty clauses
- If it's not in the SOW, Spec or a SDRL, then you won't get it
- Expect that the scope will increase – do not underestimate !
- Insist on development and management processes – these work when properly tailored and used
- Make No Assumptions !!!

Trust but Verify
-President Ronald Reagan



Trust and Verify with Validation using Objective Evidence

Questions



About the Author

John Masiyowski, jmasiyowski@raytheon.com

Is a Systems Engineering Fellow at Raytheon and has an extensive background in computer based systems, software, and networking technologies. Presently, he is the System Architect and lead Systems Engineer on the VoIP enterprise project. John principal duties are lead technical engineer, system architect, security architect, and technical subcontract management. Recently he was the systems engineer for an embedded network-oriented project, conceptual development of system and network architecture for the delivery of real-time data over homogeneous links, including evaluation of VoIP-based implementations, trade studies on cryptographic algorithms and devices. John has a M.S. in Software and Systems Engineering from George Mason University, John is an adjunct professor at GMU where he teaches Computer Security and Privacy, and Network Security and Cryptography in the Telecommunications program in the Electrical and Computer Engineering department.



BACKUP

Acronyms (1)

- ARO After Receipt of Order
- CMMI Capability Maturity Model Integration
- C&UT Code and Unit Test
- COTS Commercial-off-the-Shelf
- COTS Custom-off-the-Shelf
- GMU George Mason University
- HW Hardware
- ICOM Intercom
- IMS Integrated Master Schedule
- INCOSE International Council on Systems Engineering
- IoIP Intercom over Internet Protocol
- LSI Large Scale Integration
- MSI Medium Scale Integration
- MSI Mission Systems Integrator
- N/A Not Applicable
- NCOSE National Council on Systems Engineering

Acronyms

- NRE Non-Recurring Engineering
- PM Program Management
- QA Quality Assurance
- RFP Request for Proposal
- SCM Supply Chain Management
- SDRL Subcontract Data Requirement List
- SEI Software Engineering Institute
- SOW Statement of Work
- SW Software
- TR Technical Report
- TSM Technical Subcontract Manager
- UK United Kingdom
- US United States
- VoIP Voice over Internet Protocol

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