MAIS HW & SW Cost Development 101

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Ohio Class Specifications

 Builders: General Dynamics Electric Boat Division. **Power Plant:** One S8G nuclear reactor core reloaded every nine years; two geared steam turbines, one shaft, output of 60,000 hp
 Length: 560 feet (170.69 meters) **Beam:** 42 feet (10.06 meters)
 Displacement: Surfaced: 16,764 tons; Submerged: 18,750 tons
 Speed: Official: 20+ knots (23+ miles per hour, 36.8 +kph);
 Operating Depth: Official: "greater than 800 feet"
 Armament: 24 - tubes for Trident II Missiles; 4 - torpedo tubes for **Mk48 Torpedoes**
 Sensors: BQQ-6 Bow mounted sonar
 BQR-19 Navigation
 BQS-13 Active sonar
 TB-16 towed array
 Crew: 15 Officers, 140 Enlisted

 Unit Operating Cost Annual Average $50,000,000 [source: [FY1996 VAMOSC]] Date First Deployed: November 11, 1981 (USS Ohio; SSBN 726)
So We Learn About the Environment First; in this case, the SSBN 726

• Command and Control System (CCS)
  – Defensive Weapons System (DWS)
  – Sonar (BQQ-6)
  – Integrated Radio Room (IR2)
  – Own-Ship Monitoring (OM)
  – Ship Control (SC)

• Interfaces
  – Torpedos
  – Etc.

• Requirements
Second; We Decide How We Wish to Break the Subject Down

- Commands look at the National Security Directives and Military Security Directives (e.g., ocean water patrol sectors)
- A Sub driver looks at the functions supported on the sub (e.g., ship control and sonar)
- Computer Techies look at the computer suite (Computer Hardware, Computer Software, interfaces)
- Budget people look at appropriations
- Cost people need to develop a work breakdown structure that fits Mil-Std-881C and fits the specific cost project requirements (e.g., PLCCE, CCE, SCP, ICE)
What Did Trident PM Do?

• Top Level was the Ship Driver View; while supporting the Command View
• Next Levels down looked from the Techie View
• The Budget/Appropriations View was supported through references, indices, colors
• Mil-Std-881 (of that time) was followed
• We made a translation table from CWBS’s to (Gov’t) WBS
Difficulties?

• The top level was very straight forward, once we decided that the Ship Driver View was the top level (it took us a while to come to this)

• The Techie view was more difficult because different Techie SMEs viewed the “system” differently

• The budget/appropriations divides were pretty easy to determine

• The 881 WBS and CWBS to WBS was fairly straight forward after the Techie SMEs agreed
IT/MAIS/SW Development Cost Issues/Dependencies

- Testing and Certifications
- Legislation
- Standards (Mil and Commercial)
- Policies (IRMs, CIOs,...)
- Architecture & Data Management
- Development Environment
- Development Methodology
- Developer Productivity
Testing and Certification Issues

• Issues
  – Human Safety
  – Nuc
  – C&A and IA (was handled differently back then)
  – Involved costs

• Agencies involved
  – OPTEVFOR
  – Nuc/Energy/...
  – NSA (now NIST gets involved)
Legislative Issues

• Procurement Rules like the old Brooks Act
• Cloud First “guidance”
• Data Center Consolidation
• ...

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“Standards”

- Language (e.g., CMS-2, ADA, C, C++)
- 7 Layer Model (OSI Model), ISO, TCP/IP
- MIL-STD-1553, NTDS-Slow, NTDS-Fast
- Waterfall, Spiral, Concurrent, MDA, Agile
- DODAF
- CMMI
- ...
Software Language Usage

Notice:
1. Downward trend for most.
2. Objective-C is on an up-tick (Apple)
3. Languages like ADA, Fortran, Cobol, etc are missing.
System Architecture

- Mainframe
- Timesharing (one to many connections)
- Client-Server
- Net Centric
- Internet Protocol/HTTP/HTTPS/FTP
- SOA
- Timesharing (IaaS, PaaS, SaaS, Cloud)
- Centralized (Mainframes) versus De-Centralized
Policies (Constantly Changing)

- Use Mil Gear
- Use COTS (Still Mil grade) gear
  - New at one time: COTS for development with cross-compilers, and mil gear on-board platforms
- Use (COTS) Commercial grade devices
Development Environment

• Develop and run on the same machine
• Develop on one machine and run on another
• Cross Compilers
• Programming Language versus Customizable Product (e.g., MRP, ERP)
• Development Tool Aids (e.g., for CM and test)
• Complex versus simple
Data Management

• Data in the programs
• Data in flat files
• DBMS (hierarchical, network, relational)
• Very Large Data Bases
• Data Marts and Data Warehouses
• Data Mining and Business Intelligence’
• “Big Data”
Development Methodology

- Waterfall
- Spiral
- Concurrent (Developing for Multi-CPUs)
- Fast Prototyping with Quick Increments
- Model Driven Architecture Development
- Agile
Developer Productivity

• There is a huge difference in developers
• Developer Experience
  – Time with the subject domain (e.g., fire control)
  – Time with the computing hardware
  – Time with the software languages
  – Time with the data languages
  – Time with the customizable products
• HW and SW Tools given to the developers
Questions?

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• Thank you for attending today
• I hope this has been helpful
• Sorry I have to leave on time today
• Any other questions I do not get to answer, please email me and I will give you an answer.