



Software Sustainment Challenges in Defense Acquisition

April 2009

AIAA Engineering Conference

Scott Lucero

Office of the Deputy Undersecretary of Defense (Acquisition and Technology)



DoD Cost Growth and Results

- **Acquisition cost growth over 11 years (Selected Acquisition Report data FY 1995–2005):**
 - Estimation changes: \$201B
 - Engineering changes: \$147B
 - Schedule changes: \$70B
- **Over the past 10 years, DoD systems have experienced a 33% cost growth due to “RDT&E mistakes”***
- **DoD IOT&E results, FY2001-2006**
 - 29 systems; mix of ACAT II, 1C, 1D across 3 Services
 - Approx. 50% were deemed “Not Suitable”, or partially NS
 - Approx. 33% were deemed “Not Effective”, or partially NE

*Source: DoD Cost Avoidance Study (CAIG) 10 year ongoing



Software Industrial Base Study

- Demand Findings / Conclusions
 - DoD's dependence on larger, more complex software is increasing the risk of failing to deliver systems on schedule and within budget
- Supply Findings / Conclusions
 - There is a choke-point in the top-tier software program managers, architects and domain experts
 - About 500-600 "elite" individuals in the nation
 - Supply of sufficiently trained software developers is inadequate near-term
 - Demand outpaces degrees granted by 2 to 1
 - Software development jobs being filled with staff lacking formal training
 - Current and projected enrollment in software-related academic majors will not meet demand

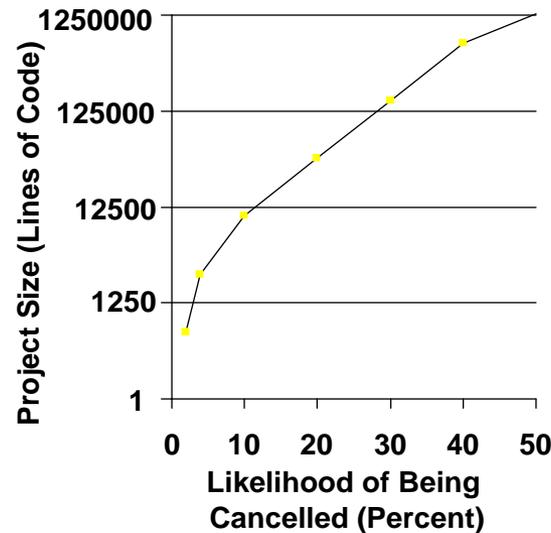
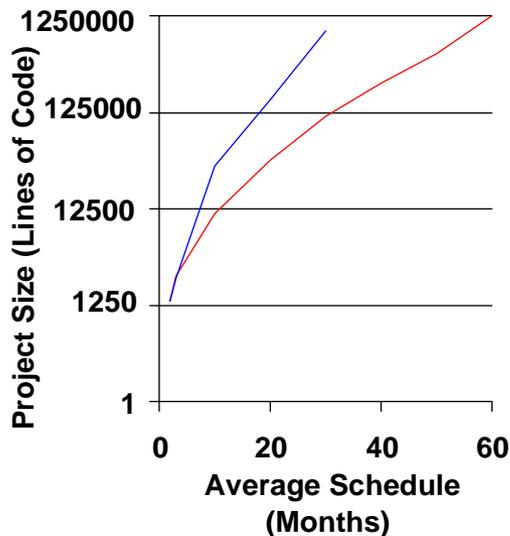


DoD Software Demand System Size and Complexity

Findings

- Increasing dependence on software to deliver capabilities ¹
- As software development gets larger, programs are more likely to fall behind schedule, or get cancelled ²

Platform	Year	% of Functions Controlled by SW
F-4	1960	8%
A-7	1964	10%
F-111	1970	20%
F-15	1975	35%
F-16	1982	45%
B-2	1990	65%
F-22	2000	80%

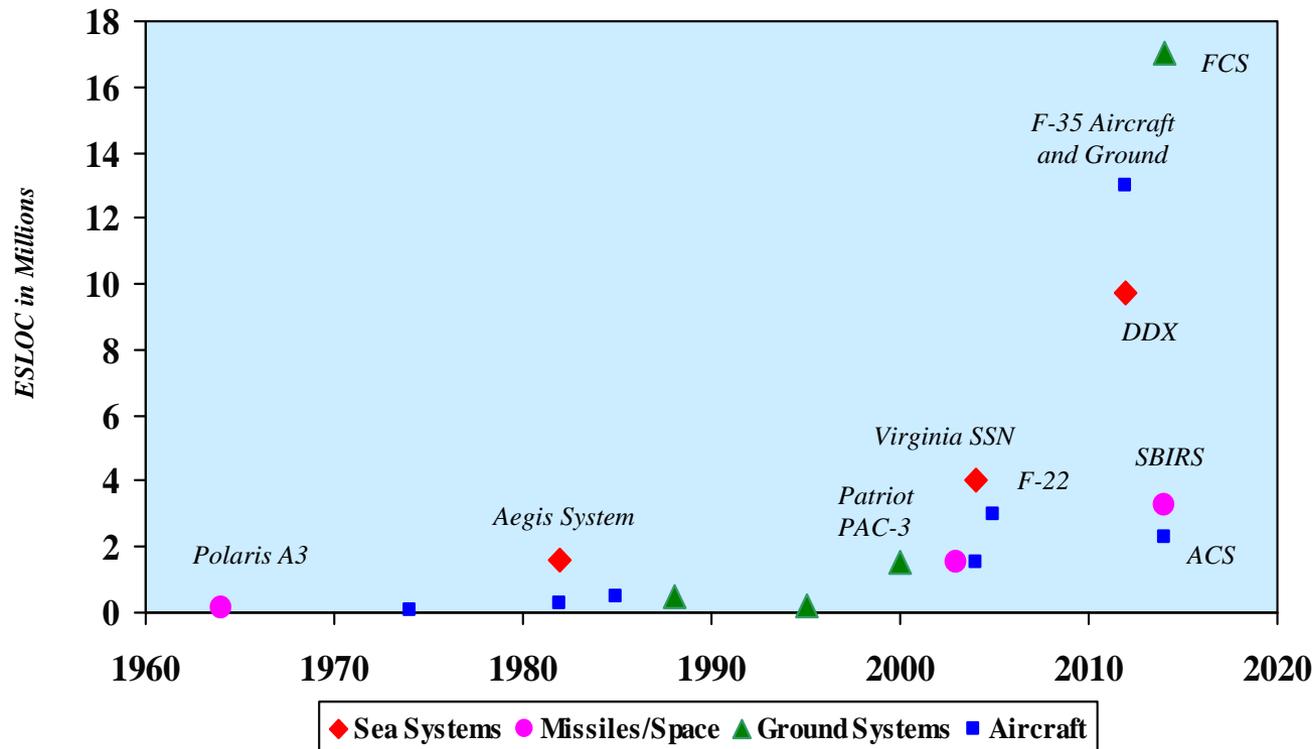


1. SWIB Phase I citing Defense Science Board
2. Software Productivity Research



DoD Software Demand System Size and Complexity (continued)

Software Content of Sample Major DoD Weapon Systems 1960 - 2020



Sources: CARD Data, SEI, CSIS Analysis

DoD's dependence on larger, more complex software increases the risk of failing to deliver systems on schedule and within budget



Acquisition Reform

- Mid 1990s
 - Shift to commercial vice military specifications
 - Federal Acquisition Reform Act eliminated 15,000 of the Defense Acquisition Workforce
 - Emphasis shifts from engineering to acquisition
- Systems increased in size and complexity
 - Greater cost, schedule, performance impacts
- 2003 – Revitalization of systems engineering
- 2009 – Updates to acquisition policy
 - Encourages preliminary design reviews prior to start of system acquisition
 - Requires competitive prototyping in technology development



Concurrent Planning, Development and Sustainment

- Software intensive systems encourage:
 - Build-a-little, test-a-little, field-a-little risk reduction
 - Incremental and spiral development efforts
 - Concurrent planning, development and sustainment activities
- No longer a natural 'break point' where software development can be transitioned to a sustainment organization
 - Technical capability of Government sustainment organizations reduced due to acquisition reform
- Planning for software sustainment now a lost art
 - Acquisition programs no longer produce MIL-HDBK 347 Computer Resource Life Cycle Management Plans

Better planning needed to partition software work among multiple developers and increase competition



Technology Development

- Software technology readiness levels problematic
 - If software is left to be developed, how can it be used in an operationally relevant environment?
 - Risk reduction may be better focus for software during technology development
- Competitive prototyping, preliminary design review during technology development may encourage well-defined software architectures
 - Government control of architecture allows for competition, e.g., Navy Open Architecture
 - Allows work to be partitioned among multiple organizations



Software Human Capital

- DoD has two significant software human capital initiatives:
- Graduate Software Engineering Reference Curriculum:
 - Better define what it means to be a software engineer
- Software Acquisition Training and Education Workgroup
 - Define software competencies for the 13 DoD acquisition career fields



Conclusions

- Growing importance of software often:
 - Creates parallel planning, development & sustainment efforts
 - Adds complexity to crafting acquisition strategies that promote competition for software development.
- DoD can enhance competition in software development by emphasizing:
 - Government control of system architectures
 - Better planning for software sustainment
- Shortages of top-tier software engineering talent will likely impact DoD acquisition
 - DoD initiatives to address human capital shortfalls should eventually address these issues

Questions/Discussion

