

# Strategies for Implementing a Product Line Approach to Software Reuse at the NRO

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# Purpose of Briefing

- Summarize and describe a study conducted to develop a business case for strategic software reuse within the NRO
- Summarize study's recommended implementation strategies for achieving a product line approach to software reuse within NRO
- Present some of the benefits of product line implementation as documented in study
- Present some of the business, technical and organizational issues and considerations addressed in study
- Summarize study conclusions and recommendations

# Business Case Study

- **Origin**
  - Acquisition Steering Group (ASG) action item was assigned to determine a business case for software reuse within the NRO
- **Purpose and Scope**
  - Determine degree of experience with strategic software reuse among programs and projects specific to various NRO directorates
  - Develop a business case for strategic software reuse at the NRO
- **Participants**
  - Former CCT program manager, SEI and Aerospace

# Terminology and Assumptions

- **Software Product Line:** Set of software-intensive systems sharing a common, managed set of features that
  - Satisfy specific needs of a particular market segment or mission
  - Are developed from a common set of core assets in a prescribed way
- Fielding a software product line involves
  - Core asset development (**domain engineering**)
  - Product development (**application engineering**)
- For each software product line there is a pre-defined guide or plan that specifies the exact product building approach
  - Predominant activity is integration rather than programming
- Software product line approach is strategic and systematic
  - Looks beyond a single product or contract
  - Value of core assets realized through the products developed from them

# NRO Acquisition Philosophy: **Current State**

- Define intelligence needs / mission requirements and trust contractor “community” to provide the “best” technical solution
- Perception that contractor is responsible for technical solution, and can be held accountable for not meeting mission requirements
  - In typical acquisition, Government liable for incurred costs
- Contractor community sensitive about sharing of technical data that is considered contractor “owned” or proprietary
  - Each contractor competes against the others for NRO business
  - Little sharing (exploitation of commonality) across NRO contractor base
  - Stovepipes discourage information and technology sharing
- Sense of technology reuse is left to the selected, individual contractor
  - Software reuse primarily “opportunistic” and left to contractor discretion
  - Contractor has little incentive to perform strategic reuse of software assets
  - Contractor increases value of his contract by “reinventing” the software

# Strategic Reuse through Software Product Lines within NRO: Preferred State

- Software product lines have been institutionalized
- Preferred state characteristics for software development / acquisition at NRO are realized
  - Reliable mission performance and operations (maintain or improve these)
  - Lower development, operations and maintenance costs
  - Lower costs for transition/readiness and system upgrades
- Business case contends that strategic reuse through product lines could effect a situation that delivers these preferred state characteristics
  - Cost justification specifics of NRO business case study are beyond the scope of presentation
  - Presentation focuses on strategies and considerations for implementing a product line approach to software reuse at the NRO

# Strategies for Achieving Preferred State

- Fund and acquire core assets
  - Core asset development
- Identify potential users and provide incentives for them to develop systems from core assets
  - Product development
- Provide the infrastructure to sustain the effort
  - Management of the product line effort
- Fund the sustainment of core assets and products
  - Long-term sustainment of the product line

# Fund and Acquire Core Assets

- Supports fundamental product line activity of developing core assets
- Important issues to address include:
  - Funding strategy for core asset development
  - Organizational structures and processes for core asset development and maintenance
  - Engineering or acquisition of the core assets
- Key question:
  - How will the product line assets be paid for equitably?

# Identify Users and Provide Incentives

- Supports product line activity of developing products from core assets
- Benefits realized from strategic reuse are strongly tied to the number of programs that participate
  - Important to proactively pursue potential users of core assets; make it easy for them to participate
  - NRO could provide incentives for compliance with product line effort, along with disincentives for non-compliance
- Important issues to address include:
  - Reuse liability
  - Asset ownership (including intellectual rights and artifacts)
  - Contracting
  - Seeking sponsorship by senior NRO leadership to make a product line approach a condition of participation
  - Organizational structures and processes

# Provide Infrastructure to Sustain Effort

- Supports product line activity of managing the product line effort
- Important issues to address include:
  - Incentives for government and contractor community to embrace strategic software reuse
  - Disincentives for non-compliance
  - Cross-organizational management practices (joint boards, joint RFCs, etc.)
  - Training and education programs for government and contractor personnel
- Training programs would include:
  - General advocacy training to provide basis for informed buy-in
  - Program management training for the acquisition office
  - Technical training for contractors, including general training in product line technology and training specific to the asset base

# Fund Sustainment of Assets and Products

- Supports product line activity of long-term sustainment of product line
- Important issues to address include:
  - Evolution of product requirements through the life of program
  - Impact of product requirements changes on the core assets
  - Identifying opportunities for improvements and additions to the core asset base as products are developed or acquired
  - Planning for the replenishment and maintenance of the core assets
  - Providing incentives to contractors to sustain and enrich the core asset base

# Possible Benefits of Preferred State

- Could reduce risks and costs of developing and maintaining systems
  - By focusing on a smaller set of proven solutions
- Reduces perception of overlap of systems
- Reduces political perception of “reinventing the wheel”
- Promotes adoption of best commercial practices
- Promotes alignment with standards initiatives
- Allows NRO to apply limited technical resources to the harder, mission-unique problems

# Some Issues and Considerations

- Business
  - Number of new starts subscribing to a software product line may be insufficient to offset the costs of building/maintaining product line
  - Incentives must be provided to the contractor community to engage in product line asset development
  - Contractor liability must be addressed and resolved
- Technical
  - Need for software engineering practices and processes that apply technology to create and evolve product line assets and products
  - Managing the evolution of product line architectures (new requirements)
- Organizational
  - Importance of infrastructure and cross-organizational cooperation
  - Need for strong, visionary management to invest resources into the development/sustainment of product line assets

# Study Conclusions and Recommendations

- Strategic software reuse, if planned and executed properly, can be of significant value to the NRO
- However, several issues exist that must be resolved before a product line can be successful in the NRO environment
- Strategic software reuse requires changes in the way software is developed, including acquisition practices
- Incentives and cross-organizational cooperation are essential