Government as Integrator of a Large Scale Modernization Effort: A Systems Engineering Approach to Balancing Stakeholder Needs

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Overview

- What is ISPAN and the ISPAN Increment 4 modernization?
  - Integrated Strategic Planning and Analysis Network
  - System of systems
  - Agile Strategies

- The Government as the Integrator
  - Development Approach
  - Integration Activities
  - Balancing Stakeholder Needs
  - Benefits of Integration

- Results

- Enablers
ISPAN Mission Planning and Analysis System (MPAS)

- Increment 4: ACAT IAM, $162M modernization of MPAS
- MPAS supports USSTRATCOM’s UCP responsibilities for strategic deterrence planning and Global Strike
  - Nuclear targeting and sortie development
  - Conventional kinetic and non-kinetic planning
- Comprehensive system for developing “level 4” nuclear plans and options
• Large, aging, costly to maintain system
• Inflexible, cutovers cost 6-8 days/year, ~20 emergency patches/year, 35% backlog of software deficiencies
• Over 1.5M lines of Ada and Fortran (over 10%)
• Manpower intensive, 6-18 months to train APS planner, 4 FTE Pro-tool operators, $135K/year for contractor training (just for APS)
• Support provided by five competitively awarded IDIQ/CPIF contracts
System of Systems

- The top-level requirements describe system level capabilities
- Coordinated development across contracts
  - Five software development contractors
  - Infrastructure contractor
- Some legacy systems
  - Undergoing development - 5
  - Continuing in sustainment - 3
- Some new systems - 4
  - Plan Manager
  - Attack Structure Manager
  - Analysis Tool Service
  - Data Federation Service
The Future ISPAN Platform

Complementary Developer Components

Targeting Services
Air Vehicle Services
Ballistic Missile Services
Quality Control Services
MPAS Common Services
Analysis Services
Decision Support Services
COA Planning Services

SOA Middleware
General Purpose

Domain Data Services
Differentiated C4 Services

Common Services
Differentiated C4 Services

Virtualized Computing & Storage
General Purpose

NextGen C4 Platform Technology Stack
Guiding Principles/Values

- Own the Technical Baseline - No shortcuts
- Prepare for Change
  - Create options for decision makers to consider
- Engage users throughout development
  - Revector as needed and as early as possible
- Create mechanisms to manage the baseline
  - Structuring and aligning work is key
- Create transparency
  - Make recommendations in an observable/reviewable manner
- Create feedback
  - Create opportunities and value the problems found early
Agile Strategies
Applied at a higher level of abstraction

- Each spiral includes design, code, integration
  - Each spiral targets a viable product
- Requirements elicitation capturing user stories
  - Adds life into requirements and realism into verification
- Create feedback opportunities
  - During design – interface design processes
  - During development – opportunistic checkout

We are executing a hybrid approach drawing from traditional and agile methods
Development Approach

Leverage Enhanced CONOPS

Elicit User Stories
As a (USER)
I want to (DO THIS)
so that I can (ACHIEVE THAT)

Create Work Packages

Phase Work Packages

Frequent Integration
Integration Activities

- Interface Control Working Groups
- SRRs/CDRs
- Use of Mock Services
- Opportunistic Interface Checkout

- Release 1 User Engagement Integration Event
- Developer Exchange
- Release 2 User Engagement Integration Event

Program invested in the NIF to support development, integration, and test without operational network limitations.
Balancing Stakeholder Needs
(5 years is a long time)

- Must own the baseline
- Take advantage of “new” approaches (IT Box, DoD 5000.02, etc)
- FMs must retain the ability to tradeoff capabilities
- PMs must retain the ability to efficiently react to changes
- Engineers need to enable the programmatic options
Integration with Benefits

Requirements

Interacts with
- GUI
- Functions
- Checklists

NC3 Integration Facility (NIF)

Interacts with
- GUI
- Functions
- Checklists
- Operational Data

Assess Interfaces

Integration Team

PMO

During CUT

FM's

Users

Better SW/Less Cost

Capability

Software Developers

Observations

Work
Results

- Surrogate deployment environment for partially developed code
  - 98% of observations in NIF resolved with next deployment
- Low-Threat environment for developers to interact with other developers, FMs, and Users—unprecedented contractor collaboration
- Demo space for users to view and interact with capability releases of code in development
- NIF is key component of actual/expected 73% reduction in DRs
  - Rework/future work avoidance of ~$7.5M based on avg DR cost

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* CAT I Emergency, CAT I Urgent, CAT II Urgent
Enablers

- Stakeholders are in one building/location
  - Functional Management Office
  - End Users
  - Program Management Office
- Most developers are within 5 miles
  - Most in local area – face-to-face short-notice engagement possible
- NC3 Integration Facility (NIF)
  - Government-owned facility to support system integration during software development
- Strong backchannel opportunities – transparency
  - Open communications
  - Immediate feedback and corrective actions
  - Responsive to changes
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BACKUP
Purpose of the NIF

Environment enabling government/developer collaboration

- Provide a production-like environment to verify deployment procedures
- Allow developers to run subsystems in conjunction with other subsystems (prior to formal test) to discover issues in time to take cost effective action
- Verify ICD compliance (prior to formal test) to gain early feedback
- Provide the testers with an early look at the software as it is being developed to improve test readiness
- Provide early deployment opportunities to improve likelihood of smooth transition into test
Teaming approach in the NIF

NIF administrators
- Focus on providing a production-like environment
- Ensure availability for Integration Team and Developers

MPAS Integration Team
- Host deployment, software and functional integration activities
- Provide observations to the developers
- Identify integration opportunities across subsystems

Developers
- Deploy to gain experience and to receive feedback
  - Minimal deployments required by PWS
  - Additional deployments encouraged to further reduce risk

Product IPTs
- Coordinate of integration activities
- Receive observations
- Host user community for user story demos
Government as Integrator

- Risk Reduction
  - Encouraging Contractor Collaboration

- Direct and Indirect Contractor Collaboration
  - Direct
    - Interface Control Working Group processes
    - Interface requirements, design, change management
    - Informal, direct backchannel among developers
  - Indirect
    - Developers’ subsystems benefitting from early interaction with others’ subsystems during CUT
    - Awareness of system progress to highlight integration opportunities

- Demonstration of operational functionality
  - Gaining feedback on the integrated system from actual users
    - User validation that the development is on track (visualization, design features)
  - Leveraging subsystems in development phase
Observations
What are they and how do they work?

- Feedback provided by the Integration Team prior to formal testing
  - Observations routed from Integration Team to Developer via IPT

- Observations are not DRs
  - Idea is to provide a source of feedback with no strings attached
  - Observations that are not addressed could be captured as DRs by testers during formal test

- Observations following a deployment activity (Infrastructure Integration) may address procedures and compatibility issues with the integration baseline

- Observations following interface verification (System Integration) may address compliance with the ICD or other compatibility issues with other subsystems

- Observations following a user story demonstration (Functional Integration) may address user feedback regarding user interfaces and other user facing design features
Benefits to Date

- Sharing best practices
  - Automated deployment tools

- Early verification of ICDs and ICD compliance
  - Two subsystems from different developers gaining actionable feedback from an integration activity during CUT
  - Precipitated needed ICD revisions early

- Allows the developer and the IPT to get early feedback, enabling cost-effective corrective actions to improve system functionality

- Provided developers with a preview of what it takes to deploy onto computing resources shared by multiple subsystems

- Developers found out that their subsystems will be deployed to the same managed server, so they need to adjust their deployment scripts to accommodate

- Fail fast, meaning learn lessons early before they become a crisis