Philadelphia, PA
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Portfolio Management(PfM) Overview

The SI Organization, Inc.

pritchett.a.harris@thesiorg.com

Based on *Portfolio Management Overview* paper submitted to INCOSE by

Thomas.j.Schellenberg ● Kristen.k.Weghorst ● Phillip Cahill

Introduction

Ongoing global economic challenges, pressure managers to efficiently allocate resources (e.g., budget, personnel, physical)

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PRODUCT PORTFOLIO AND PROGRAM MANAGEMENT (PPM)

is the continuous cultivation of a product set and the set of capabilities to prioritize and manage product development programs

– Gartner IT Glossary

With our current challenges — declining budgets, resource competition, growing security threats, commercial competition — we must provide more value to our customers and accomplish our mission sets better and faster with less money

– Letitia A Long, NGA Director on Jan. 28, 2013

This investment management process takes aggressive steps to ensure that the Department continues to make investments that align to mission priorities, eliminate legacy systems that are no longer required, enhances interoperability, and help the Department to transform to an environment where business applications are able to be rapidly deployed on a common computing infrastructure. Please provide the widest distribution possible for this.

– Elizabeth A McGrath – Defense Business Systems Investment Management Program Guidance Memo 4-9-2013

Portfolio Management (PfM) provides decision makers with a holistic approach to optimize resource utilization and maximize value of all potential outcomes

Definitions and Distinction

- PfM activities are fundamentally the same, regardless of relative size, cost, or hierarchal abstraction of projects in a given enterprise.
- Hence, the term *project* is used to reference both program and project regardless of size or scope inferred by any individual's perspective.

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INCOSE Definition:

The purpose of the **Project Portfolio Management** Process is to initiate and sustain necessary, sufficient and suitable projects in order to meet the strategic objectives of the organization.[1]

WHAT and WHY addressed, but no context as to HOW

the SI definition:

Portfolio Management involves the selection and management of investments and resources to achieve strategic objectives through optimization of cost, schedule, technical performance, and associated risks.[2]

Relates PfM Outcomes to Cost, Schedule, Risk, and Performance constraints

This Portfolio Management definition is intended to inform strategic decision making by relating back to discrete SE information needed to make decisions (Business Intelligence applied to System Engineering data).

1. Haskins, C., ed. 2007. Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities. Version 3.1. Revised by K. Forsberg and M. Krueger. San Diego, CA (US): INCOSE.
2. SI Portfolio Management Working Group Definition, citation from SI PfM WG MS SharePoint site, posted August 2011

PfM Features and Benefits

Enterprises react to internal and external changes. This PfM approach leverages analytic methods to inform decision makers on the most efficient adjustments to react to such changes. Benefits of a comprehensive Portfolio Management approach include:

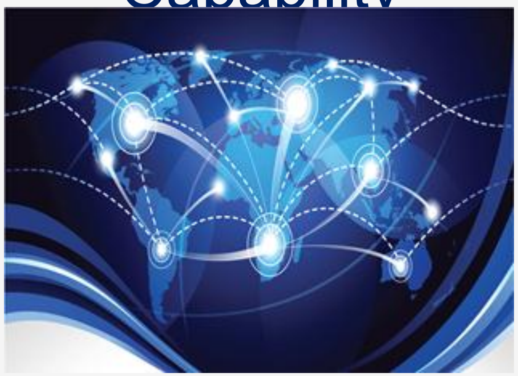
Features	Benefit
Structured and repeatable methodology	• Enables customers to make informed and timely decisions • Drives customer needs into candidate solutions • Adaptable to meet Federal and Industry standards for analysis and decision milestones
Traceable and measurable results	• Defensible decisions traced to analysis results • Evaluates perspectives of cost, schedule, risk and performance
Proven decision analysis techniques	• Recommendations and project priorities tied back to strategic intent • Identifies gaps and unnecessary redundancies in the current portfolio • Facilitates cross-portfolio analysis to reduce duplicative functionality and infrastructure

A valuable PfM approach is designed to inform and justify customer decisions to manage capability, acquisition, and technology portfolios

Types of Portfolios

To fully account for all aspects of an enterprise as they become more sophisticated, projects must be delineated into appropriate portfolio types

Capability



The set of capabilities a given customer's enterprise is responsible for developing, operating, and sustaining to achieve strategic objectives.

Acquisition

The set of acquisition projects that enable capabilities including maintenance and sustainment projects.

Technology

Supporting technology research projects that may enable new capabilities or realize efficiency across existing capabilities & acquisition projects

Successful PfM requires balanced decisions across three interrelated portfolio types

PfM Key Concepts

Successful PfM Execution requires application of the following key concepts:

Portfolio Management

Governance

- Framework by which data is gathered and decisions are made with respect to realizing strategic objectives
- A good PfM approach defines and enforces Governance

Cultural Understanding

- Organizations form unique cultures, value structures, priorities, and business practices to accomplish strategic objectives
- Successful PfM adoption minimizes cultural impacts

Collaboration Environment

- Collaboration environments facilitate communication across geographically diverse organizations
- Dissemination of information and data is required for advanced PfM analysis

Integrated Data Management

- Integrated, accurate, and current information is crucial for sound, data-driven decision making
- PfM should incorporate existing data sources and adopt associated configuration controls and responsibilities.

Implementation of all key concepts together does not guarantee success.
Ignoring any key concept guarantees failure.

PfM Approach

Depending on the scope and what the customer needs, this PfM approach involves coordinated application of one or more steps:

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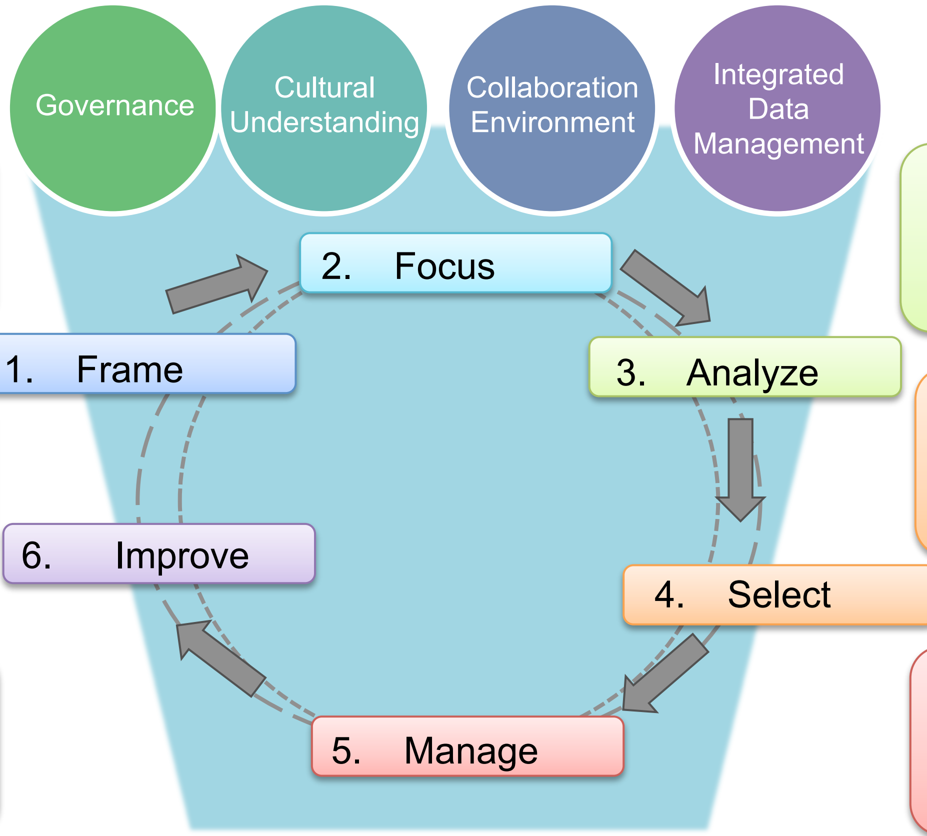
- Establish a baseline of projects
- Determine number/frequency of decisions
- Establish assessment criteria & alternatives

- Understand, assimilate & normalize
- Develop Value Model to prioritize
- Establish metrics to assess progress
- Establish governance model

- Assess overall performance
- Initiate process improvement activities



- Address each decision trade
- Determine criteria & method
- Perform analysis
- Rank alternatives against criteria

- Aggregate all decisions
- Determine impacts to the portfolio
- Implement resulting decisions

- Monitor performance metrics
- Redirect projects as needed
- Initiate new decision trades

inputs

- Organizational Priorities
- Operational Context
- Mission Needs

outputs

- Requirements Definition
- Data Driven Decisions
- Enterprise Strategy/Roadmaps
- Process Improvements

PfM Approach Results

Successful Portfolio Management(PfM) execution allows portfolio managers to do the following:

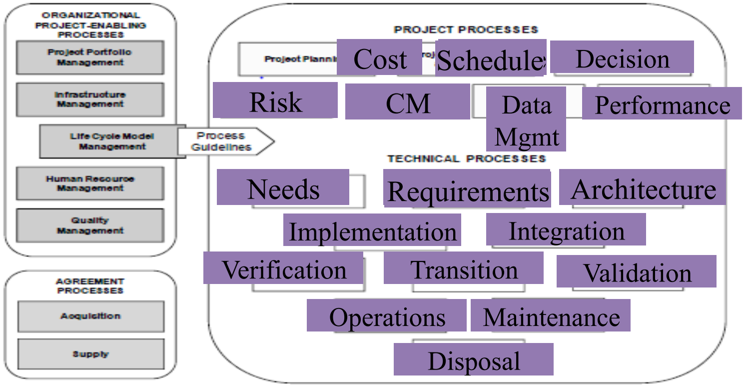
- Defend decisions based on traceable and measurable results
- Drive customer needs into candidate solutions
- Make informed and timely decisions based on a structured, repeatable methodology
- Identify gaps in the current portfolio that may otherwise limit success
- Leverage PfM results and analysis to support decision milestones activities
- Facilitate cross-portfolio discussions to promote SW/HW convergence (e.g. SOA and Cloud adoption)
- Evaluate and measure cost, schedule, risk and technical performance metrics
- Manage current strategy using proven decision analysis techniques which can assign relative priority to items in a given portfolio
- React to adversarial capabilities or technological changes that impact the enterprise's operating environment

Successful PfM requires balanced decisions across three interrelated portfolio types

PfM Implications for INCOSE SE Handbook

Execution of PfM requires coordination of most—if not all—systems engineering and program processes, as described in the INCOSE SE Handbook.

key guidance recommendations:



- Traceability between Customer Needs, Requirement Specifications, and Architectural elements is key for understanding how impacts affect an enterprise.
- Impact assessment is greatly improved by traceability between the requirements and architecture elements. Architecture configuration changes, planned or otherwise, can have adverse impacts towards achieving strategic objectives.
- Coordination of integration, verification, transition, and validation events can illuminate critical paths towards achieving strategic objectives. Failure to pass minor events can lead to schedule impacts.
- Operational Capabilities are realized by interrelationships between architecture elements (functional, structural, interface, performance, standards, etc.). Understanding of these interrelationships are key to understanding impacts and making portfolio decisions
- Requirements at one level are derived from objectives at a higher level. These relationships give rise to a competition for resources necessitating decision trade analysis to balance system solutions and optimize the enterprise.
- Risks establish understanding of cost, schedule, and/or performance uncertainty toward achieving strategic objectives which is key for informing trade decisions.
- Every project (capability, acquisition, and technology) should have quantifiable measures for success

PfM Application Exemplars (1)

Communication Satellite Feasibility & Affordability Trade Study

Challenge

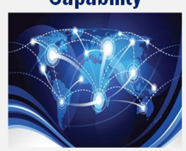
Proposed government satellite communication constellation procurement strategy required a trade study of cost, schedule and performance to determine feasibility, affordability and related impacts to existing assets and end users.

PfM Steps Exercised:

- ~~1. Frame~~
- 2. Focus
- 3. Analyze
- 4. Select
- 5. Manage
- 6. Improve

Portfolio Types Analyzed:

Capability



The set of capabilities a given customer's enterprise is responsible for developing, operating, and sustaining to achieve strategic objectives.

Acquisition

The set of acquisition projects that enable capabilities including maintenance and sustainment projects.

Actions

- Performed analysis to create traceability and performance data required to make informed decisions
- Provided an independent assessment of architecture alternatives, predict future availability, justify procurement schedules, protect budgets, and recommend end state configuration.

RESULTS

- **Savings provided by the proposed strategy was greater than $500M (including development and launch costs)**
- **Analysis supported a defendable and justifiable procurement plan**
- **Analysis integrated into customer governance, and evolves as customer adapts to changing threats, constrained budgets, and new system requirements.**

PfM Application Exemplars (2)

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Facility Upgrades Portfolio Analysis

Challenge

Customer received $300M for immediate execution across 161 different infrastructure projects. One project, A $250M data center, had no documented requirements with start date 18 months away.

PfM Steps Exercised:

1. Frame
2. Focus
3. Analyze
4. Select
~~5. Manage~~
6. Improve

Portfolio Types Analyzed:

Actions

- Developed new governance processes
- Built schedule & interface tools to support assessments
- Led site leadership through requirement development process and trade studies

RESULTS

- **All 161 projects successfully completed on time**
- **Data center completed within cost and on schedule / No impact to mission operations**
- **Corrected schedule disconnects which saved $30M**

PfM Application Exemplars (3)

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Data Center Requirement Analysis

Challenge

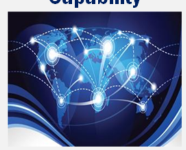
Customer developed a System Requirements Document (SRD) for a large data archive program that did not include any storage or retention requirements necessary to drive sizing of the archive. The customer then received an oversight action to determine total data ingest volume and annual storage due to predict ingest through the year 2020.

PfM Steps Exercised:

1. Frame
2. Focus
3. Analyze
4. ~~Select~~
5. Manage
6. ~~Improve~~

Portfolio Types Analyzed:

Capability



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Actions

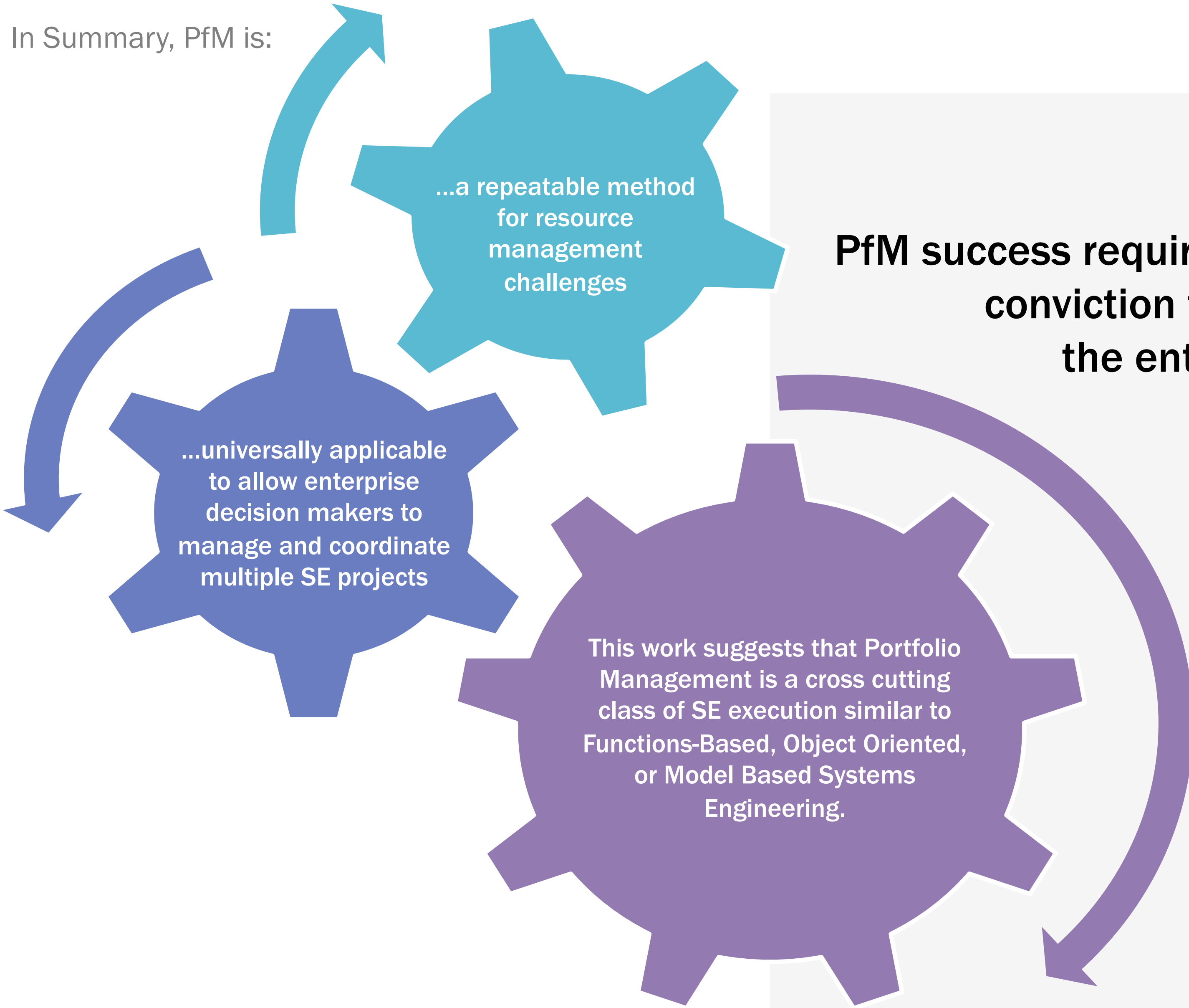
- Established unified data taxonomy to categorize data volumes.
- Leveraged extensive modeling & simulation-based data volume predictions along with SME coordination established a consolidated view of predicted ingest rates of nearly 340 different data source types.
- Proposed alternatives to reduce duplicative storage driven by the initial architecture

RESULTS

- **Analysis effort provided an accurate forecast of storage volumes based upon policy interpretations and evolving architecture missions forming the foundation for accurate decision making**
- **Shaped future storage policy to enhance affordability and mission performance**
- **Achieved a cost avoidance of more than $300 million over initial planning and budgeting**

Conclusion

In Summary, PfM is:



PfM success requires discipline and conviction that the needs of the enterprise outweigh the needs on individual projects.

*This PfM Approach is intended for organizations with complex, interrelated portfolios of capability, acquisition, and technology research projects.

Detailed PfM Guidance for INCOSE Handbook

Execution of PfM requires coordination of most if not all systems engineering and program processes described in the INCOSE SE Handbook

SE Processes	Enterprise Portfolio Management Guidance
Stakeholder Requirements Definition	Stakeholder Requirements for an Enterprise should be derived from all applicable Strategic (i.e., DoD Joint Capability Documents) or Policy documents (i.e., Federal Cloud Computing Strategy).
Requirements Analysis	Traceability between layers of abstraction in a specification tree across an enterprise is key for understanding how impacts traverse across an enterprise. Sets of requirements should be traced scheduled integration, verification, and transition events for a given acquisition to understand the lifecycle maturity of a requirement from inception to fruition of a capability.
Architectural Design	PfM impact assessment is greatly improved by traceability between the four fundamental types of requirements (functional, performance, interface, and standards), and architecture elements (system functions or services, performance metrics, data flows, and applicable technology standards). Architecture configuration changes, planned or otherwise, can have adverse impacts towards achieving strategic objectives.
Implementation	One layer's capability can be a higher layer's basic function. Just as an acquisition at one level can lead to multiple sub contracts at another. Careful allocation of requirement and project traceability is key for establishing PfM across multiple levels of abstraction.
Integration, Verification, Transition, and Validation	Coordination of integration, verification, transition, and validation events can illuminate critical paths towards achieving strategic objectives. Failure to pass minor events can lead to significant capability slip impacts.
Operation, Maintenance, and Disposal	Systems can only support capabilities as long as are operational and properly maintained. Outages and end of life conditions for systems should be traceable to affected requirements and higher order strategic objectives.
Modeling, Simulation, and Prototyping	Models establish interconnectivity of system configurations. Simulation predicts expected performance of system configurations. Prototyping can establish operation of small scale system configuration. Each of these approaches can contribute significantly to the success of achieving strategic objectives.
Functions Based or Object Oriented SE Methods	Capabilities are realized by interrelationships between architecture components (functional, structural, interface, performance, standards, etc.). Understanding of these interrelationships are key to understanding impacts and making portfolio decisions
Project Planning	New projects interrelationship to existing projects is important to assess how all projects come together to achieve strategic objectives.
Project Assessment and Control	Knowledge of project execution is key to informing and making resource allocation decisions for achieving strategic objectives. If program metrics indicate a project is struggling, portfolio managers must balance the risk of failure vs. the benefits of success for continued funding.
Decision Management	Requirements at one level are derived from objectives at a higher level. These relationships give rise to a federation of relationships between goals, objectives, capabilities, and requirements which at lower levels are competing and contradictory necessitating decision trade analysis to yield optimized system solutions.
Risk Management	Risks establish understanding of uncertainty toward achieving strategic objectives. Understanding the relationships of risks to cost, schedule, or technical performance is key for informing trade decisions
Configuration Management	Knowledge of system configuration is key to making decisions on how to make plans to evolve systems to meet strategic objectives. You can't know where you are going unless you know where you are at.
Information Management	As discussed above in key concepts, the information management infrastructure used to manage or correlate data and enable collaboration among systems engineers is a key component to optimized resource allocation to achieve strategic objectives
Measurement	Every project, capability, acquisition, and technology, should have quantifiable measures for success. These measures need to be reflected in requirements up and down the specification tree.

Survey

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www.incose.org/symp2013/survey

Meet the Authors

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Thomas Schellenberg

- Senior Staff Systems Engineer at the SI
- 13 years of systems engineering experience including Project Lead and Chief Architect positions on Systems Integration programs, and Chief Engineer for several proposals
- Achieved the Federal Enterprise Architecture Certification (FEAC) in fall of 2002, and the INCOSE Certified Systems Engineering Professional (CSEP) in August of 2012

Kristen Weghorst

- Staff Systems Engineer at the SI
- Performs strategic business development including market entry assessment, opportunity pipeline identification, business model scaling, and capture management.
- Over 11 years' experience in systems engineering, project engineering, and project management
- PMI certified Project Management Professional

Phil Cahill

- Retired as a Fellow from the SI in November 2012
- Over 30 years of experience in System of Systems Architecture, Systems Engineering and Integration, Software Development, Program Management, and Consulting
- Performed as Technical Director and Chief Engineer on several major Government and Commercial programs