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FAA Portfolio Management: Lessons Learned from the SWIM Program

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Introduction

Portfolio Management is the management of selected groupings of investments using integrated strategic planning, integrated architectures, measures of performance, and risk management techniques across multiple investments. In the Federal Aviation Administration (FAA), IT Portfolio Management is performed by the FAA's Joint Resources Council (JRC); they alone have the authority to add or remove IT investments from the FAA's Portfolio based on the program's performance against planned cost, schedule, and performance goals. In this regard, the Capital Investment Plan (CIP) represents the FAA's complete investment portfolio, and the JRC manages the components based on program performance and the associated business case.

However, Portfolio Management techniques can be applied at other management levels within the Agency. Several examples come to mind: (1) all programs within an Air Traffic Organization (ATO) Service Unit could be considered as members of a Portfolio, or (2) a single program in a Service Unit with multiple capabilities that are planned to be individually developed and deployed could be considered a Portfolio, or (3) programs from across multiple Service Units that are strongly linked to a common goal may comprise a portfolio. In addition, the FAA is reviewing portfolio management concepts at the NextGen Solution Set level to support and foster engineering solutions and coordination across programs and projects that may serve as platforms for NextGen capabilities.

A portfolio can be defined in a number of ways; by investment strategy, by capability, or by organization. To be a Portfolio, there needs to be a single management focus on the group, with the authority to move resources between programs in the group as problems arise, responsibility for reporting on the group's key metrics, and common management governance applied to each member of the group. In other words, the management approach makes the difference between managing multiple programs and managing a portfolio, and that is this paper's focus.

Figure 1 illustrates various opportunities for Portfolio Management within the FAA. The individual ATO organizations are on the far left. ATO programs in total are managed as the FAA's CIP Investment Portfolio by the Executive Council (EC) and JRC. The colored rectangles in the center of the Figure represent individual programs assigned to ATO organizations by the JRC: these may or may not be managed as a Portfolio by each Service Unit. They are collections of programs within one FAA Service Unit, managed by that Service Unit. At the far right is a collection of programs from a variety of Service Units that are collected into a single entity and managed as a Capability Portfolio by one organization. An example of this is the System Wide Information Management (SWIM) Program, which is managed by ATO-Technical Operations Services (AJW). SWIM has program participation from En Route and Oceanic Services (AJE), from System Operations Services (AJR), from Terminal Services (AJT), and from AJW, which manages the weather programs in the SWIM Portfolio.

This paper focuses first on the third level of portfolio management shown in Figure 1, to describe management practices that have worked on the SWIM Program, successfully. The final sections of the paper look at ways these "lessons learned" might be applied to other Portfolios in the FAA; specifically, it focuses on the NextGen Solution Sets and proposes an approach to defining and managing

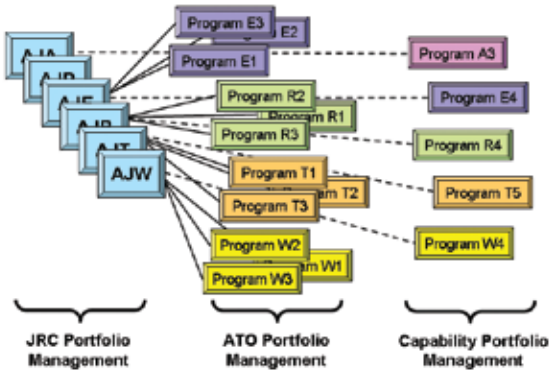

Figure 1. FAA Hierarchical Portfolio Management

Capability Sub-Portfolios that will successfully deliver NextGen functionality.

Throughout, this paper borrows the term "Capability Portfolio Management" from the DOD Directive 7045.20 [1]. This DOD Directive captures much of the management approach used on the SWIM Program, although it was not the basis for SWIM's development and implementation of portfolio management strategies.

What is SWIM's "Capability Portfolio Management" and how does it differ from the IT Portfolio Management performed by the FAA's JRC?

The answer to this question lies in the management authority for programs at this level. ATO Program Managers have certain responsibility and authority granted to them in managing a portfolio, including the following:

- Managing multiple capabilities toward delivery of common JRC approved goals
- Measuring the progress toward delivery of the goals
- Measuring progress toward meeting requirements approved by the ATO – NextGen and Operations Planning Business Unit (AJP)
- Regularly analyzing actual progress versus planned progress by measuring actual cost and schedule versus planned cost and schedule
- Balancing the requirements of multiple, parallel capability developments
- Applying one uniform set of management oversight to all capabilities that is transparent to the individual capabilities' program management methods
- Applying uniform technical standards to all capabilities

The last two bullets are two instances of program "Governance", which is a key element of Capability Portfolio Management.

FAA Portfolio Management Guidance

In July 2008, the FAA's Acquisition Management System (AMS) was updated to include a Portfolio Management definition. Per this guidance, Portfolio Management is performed by the FAA's top-level management group – the JRC. Individual organizations bring their prospective Business Case(s) to the JRC, which then decides if the proposed project should be added to the FAA's Portfolio. In many cases, the Business Case brought to the JRC comprises specific capabilities that are being developed to provide NextGen Operational Improvements (OIs); together, these can be considered a Capability Portfolio (as in the case of SWIM), although more often they are considered a single program. In November 2009, the FAA published new guidelines for Portfolio Management, as part of the AMS [2]. These new guidelines identify Portfolio Selection Criteria, and also identify several levels of FAA Portfolio Management, including the following:

- Corporate Portfolio (managed by the JRC)
- Service Portfolio (managed by each Service Unit)
- Line of Business Portfolio (service portfolios within FAA service units)
- Functional Portfolios (investment packages that cut across service organizations to provide fully integrated functional capability for the National Airspace System in such areas as weather, surveillance, communications, automation, and navigation.

SWIM – Using Capability Portfolio Management

The SWIM Program Portfolio was developed by collecting related capabilities that will provide the FAA with initial services in several key areas, including: Flight Data Services, Flow Data Services, Aeronautical Information Data Services, Terminal Data Services, and Weather Product Services. As currently defined by the AMS, SWIM fits the category of "Functional Portfolio." AJW is working with seven Program Offices from four ATO Service Units (AJW, AJT, AJE, and AJR) to develop nine NextGen capabilities. These nine capabilities encompass the new SWIM services identified above, and were the basis of the Business Case taken to the JRC. The SWIM Program Manager is required to report the status of each capability to the JRC.

Each of the seven program offices working with SWIM has identified a lead responsible for the development of their assigned SWIM capability(ies). This lead is referred to as the SWIM Capability Manager (SCM). The SCM works within his "home service unit" (AJE, AJT, AJR, or AJW) to establish a contract with a development contractor for developing, testing, and deploying the assigned capability. The SCM serves as the single point of contact between the service unit and the SWIM Program team, and is responsible for developing the assigned capability within the JRC approved cost and schedule.

Within the budget provided to SWIM each year, the SWIM Program Manager's task is to allocate budget appropriate to each capability in accordance with several criteria:

- Budget request of the individual SWIM Capability Manager's (SCM) Program Office as defined in the SWIM Business Case,
- Agreement of the SCM to the SWIM Program Level Agreement (PLA), indicated by the SCM's Program Office signature on the PLA, and
- Ability of the capability to support the SWIM Program goals (tied to meeting NextGen Operational Improvements (OIs)).

Once the SWIM PM provides funding to the SCM's Program Office, that organization has an obligation to complete work per the agreements documented for the fiscal year(s) in the signed PLA. The PLA is the single most important management tool for the Capability Portfolio – it defines what each SCM must deliver by identifying the appropriate requirements documents, the delivery schedule, the budget, and SWIM Governance Policies and Procedures Documents that apply.

Based on the controls defined in the PLA, the SWIM Program Office monitors the development of each capability in the Portfolio to ensure that costs and schedule are consistent with JRC commitments. Without adequate monitoring and control, it is impossible to provide accurate feedback to the JRC or allow a valid FAA Investment Portfolio health assessment. An overview of this process is depicted in Figure 2.

Figure 2. Portfolio Process Overview [3]

Service Level Agreements (SLAs) to PLAs

Initially, SWIM used Service Level Agreements (SLAs) to document agreements with the SCM Program Offices. These SLAs provided broad goals, working schedules, and costs with generally defined SCM responsibilities regarding reporting cost, describing progress, and delivering required artifacts. However, SWIM discovered that general SLAs were not practical for managing the portfolio capabilities. The SWIM experience identified several Portfolio management lessons learned necessary for successfully meeting the JRC objectives of the Portfolio:

- Program "buy in" at the highest level of each Service Unit,
- Means to measure actual technical progress against planned cost and schedule, for the SWIM PMO to report back to the Executive Council and to OMB (for purposes of completing the OMB Exhibit 300 and other reports),
- Clear guidance on standards to be followed, as well as clearly defined Governance Policies and Procedures for participants,
- A common denominator for Program Control functions, and
- Frequent communication between the participating programs and the SWIM PMO.

Therefore, SWIM developed more detailed PLAs for use after the first year of the Program. The SCM and the Director within the SCM's organization review and sign the PLA.

The PLA requires that each SCM provide regular reporting of specific progress against the planned budget and schedule. That is not to say that the SWIM Program mandates fixed management reporting formats for all participating programs. Rather, SWIM has embraced the differences in style of the SWIM participants, from a management perspective. Analysis by the SWIM Program Office determined that the cost of requiring all participating programs to use common management tools and employ a common development environment was not worth the cost associated with converting and training the various Service Unit support and development contractors to a new way of doing business. With the JRC's permission, each SCM manages his respective capability in accordance with established management and engineering techniques already in use by his Program Office. Deciding which processes were to be common among all SCMs and which could be delegated to the SCMs was a decision made jointly with the various Service Units during the process of building the SWIM Business Case and estimating the associated costs

of developing the nine capabilities. The responsibilities delegated to the Service Units supporting SWIM include the following:

- Identification of appropriate Software Development Practices
- Application of Configuration Management and Quality Assurance for developed items
- Conduct of Operational Test and Evaluation, following FAA acceptance testing
- Responsibility for meeting FAA safety and security requirements
- Capability Deployment and any associated training
- In-Service Decision and In-Service Review Checklist
- Conduct of Post Implementation Reviews

While each of the above is the responsibility of the Service Unit, the SWIM Capability Portfolio Manager has the responsibility to monitor each activity and to participate in all capability development contractor reviews, tests, and decisions, as an advisor. Participation in the reviews as well as review of development contractor produced CDRLs and technical papers by the SWIM Program staff helps to ensure the capabilities are being developed in accordance with SWIM requirements and Governance. Per the PLA, continued funding by the SWIM Program Office is contingent on the SCM building the SWIM capability in accordance with SWIM mandated requirements and Governance Policies and Procedures.

Balancing Management Authority Among Portfolio Participants and the Portfolio Manager

In order for the Capability Portfolio management to be successful, the SWIM PMO centrally manages certain activities, shown in Figure 3.

The first, Requirements Management, is an obvious candidate for management by the Capability Portfolio Manager (CPM). Clearly defined requirements – sufficient to communicate the capability without limiting the design – must be documented and agreed to between the CPM and the SCMs. The requirements are the basis for the cost estimate and program schedule, and were defined at the time the Final Investment Decision was approved by the JRC. An important management metric for the CPM is measuring progress toward satisfying requirements in accordance with the overall program cost and schedule, as well as measuring the same for each capability.

ATO Finance provides program funding to the CPM, who in turn allocates it to SCMs in accordance with the budgets established at the Final Investment Decision. In turn, the CPM is required to do financial reporting back to Finance, as well as to various external Agencies. SWIM works with SCMs that use EVM and SCMs that do not. SWIM works with each SCM, using existing financial reporting capabilities the SCM has established with its contractors, to plan work and to report work accomplished following the intent of EVM without imposing the burden of a full EVM certified system.

SWIM assumes responsibility for putting all the financial inputs together in order to satisfy FAA reporting requirements. This includes developing the OMB Exhibit 300 for the SWIM Capability Portfolio. All sections of the Exhibit are developed for the collection of nine SWIM capabilities, and no participating program includes this data in their respective Service Unit's Exhibit 300 or other financial reports.

Along with Requirements Management, the CPM must be responsible for negotiating points of interface between all the participating Service Units. The SWIM CPM must also resolve conflicts between SCMs when more than one wants to offer competing or overlapping services. In the case of SWIM, this includes reaching out to the NAS Enterprise Architecture Board (EAB) and Technical Review Board (TRB), as necessary. The CPM must also balance the costs for a particular SCM to provide specific data, in a specific format against the cost of other SCMs to consume the data. Typical for a Service Oriented Architecture, individual services may be more costly to develop than a single point-

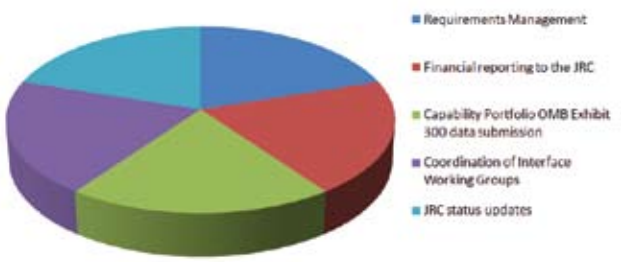

Figure 3. Centrally Managed Portfolio Activities

to-point interface, but as more service consumers take advantage of the service, the per unit costs decrease. Thus, these technical decisions have to be centrally managed by the CPM, who has the ability to weigh the total cost versus total potential benefit.

Finally, the CPM has the responsibility to report status on the Capability Portfolio to the Executive Council and to the JRC. This reporting can only be done by the Portfolio Manager.

Communication

Key to SWIM Capability Portfolio management is communication with all participants. Several actions have been taken to promote communications between the SWIM PMO and the SCMs, as well as among the SCMs. They include:

- Regular technical and monthly status reporting meetings, as defined in the PLAs
- Promotion of document exchange, through a Knowledge Services Network (KSN) established document Library
- Publication of SWIM standards and governance, through the KSN SWIM Library
- Establishment of a SWIM Wiki on the FAA's administrative LAN, which promotes participation by all development and support contractors, as well as FAA members
- Development of a semi-annual SWIM Newsletter
- Establishment of a SWIM external website (www.swim.gov)

Communication among the participating programs has resulted in common understanding of SWIM Governance, SWIM tools, and SWIM Core Services that has resulted in software reuse and improved productivity for the participating FAA development contractors.

Participating Program Challenges

Capability Portfolio Management consists not just of the Service Unit managing the portfolio, but just as importantly, it includes the participating programs responsible for developing the specific capabilities. These programs must adjust their own management practices in response to being participants in FAA Portfolio Programs. These Participating Programs face several challenges, including:

- Competition for program resources
- New schedule dependencies between multiple programs and multiple Portfolios
- Multiple "bosses", each having his/her own set of commitments and priorities
- Additional reporting requirements
- Additional pressure on internal infrastructure, including the quality assurance organization, configuration management organization, and program control offices
- Variance in technical standards and technical approaches for requirements engineering, software development, program documentation, and testing across multiple Portfolios in which the Service Unit is participating

It is easy for the participating program to under-estimate the effort required to deal with Capability Portfolio Management overhead. Not only must the participating program develop the capability in accordance with the technical standards sometimes unique to a particular Portfolio, there also may be separate reporting requirements that are not synchronized with existing processes. Unique technical aspects of specific Portfolios may require separate expertise within a Service Unit, making acquisition of new staff or training of existing staff a necessity. The challenge is to manage staff priorities to ensure there are enough resources to handle all the requirements of the various programs.

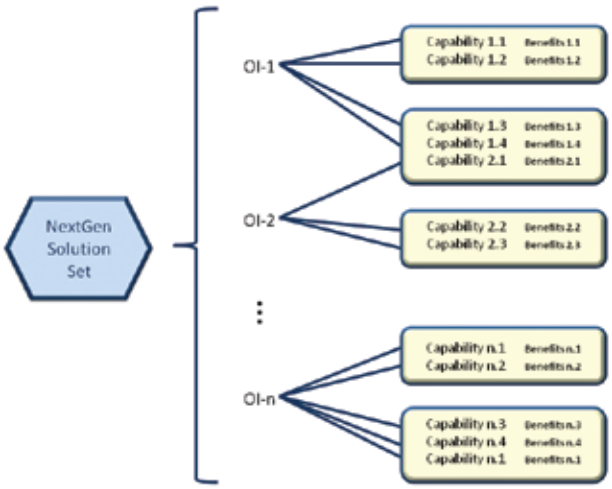

Figure 4. Decomposing Solution Sets into Manageable Sub-Portfolios

NextGen Portfolio

As stated at the beginning of this paper, the emphasis herein has been on an AMS defined "Functional Portfolio". However, another important Functional Portfolio for the FAA is the NextGen Portfolio. It is organized into seven solution sets, each focusing on a series of related operational capabilities that together will bring about the NextGen mid-term system. The solution sets are:

- Trajectory Based Operations (TBO)
- High Density Airports (HD)
- Flexible Terminals and Airports (FLEX)
- Collaborative Air Traffic Management (CATM)
- Reduced Weather Impact (RWI)
- Safety, Security and Environment (SSE)
- Transform Facilities (FAC)

Each of these solutions sets is comprised, in turn, of several Operational Improvements (OIs), each of which has multiple NextGen capabilities to be developed that contributes to the overall success of the OI, and in turn, the Solution Set. Typically, each Solution Set has elements from multiple Service Units. Per the November 2009 guidance from FAA FAST [2], the NextGen and Operations Planning organization oversees investment packages that cut across service organizations to provide fully integrated functional capability for the National Airspace System in such areas as weather, surveillance, communications, automation, and navigation. More than one service organization will be involved with implementation and in-service management of these investment packages.

Which of the SWIM lessons learned can be applied to managing the NextGen Portfolio? We propose that the following may be considered by the FAA in managing the NextGen Portfolio Solution Sets.

In terms of approaches to organizing the work, we would suggest that many of the Solution Sets are too large to be executed as a single program. In fact, many of the OIs may also be so large that the FAA may benefit from breaking them into more manageable increments, to reduce cost, schedule, and technical risk to the Agency of implementing very complex capabilities as a single program effort. We suggest that the Solution Sets be decomposed into Sub-Portfolios that are a manageable size in terms of cost, schedule, and external dependencies. It would be the responsibility of the assigned Sub-Portfolio Capability Manager to develop the Business Case for JRC approval, but it would be the responsibility of AJP to provide identification of benefits for each Solution Set that would lead to a successful Business Case.

- Criteria for selecting the elements of a Sub-Portfolio might include the following:
- Ensure loose coupling between sub-portfolios, to avoid building in dependencies that add risk to program execution
- Ensure that Solution Set capabilities do not cross sub-portfolios (group capabilities within sub portfolios)
- Select members of the Sub-Portfolios such that there is a positive business case with measureable outcomes
- Ensure that each Sub-Portfolio delivers a complete functional thread – this relates to avoiding having functionality in other Sub-Portfolios that creates dependencies and increases program execution risk
- Sub-portfolios should be a manageable size and complete within 3-4 years of JRC approval of the Business Case.

OI capabilities may be distributed over multiple Sub-Portfolios based on the above criteria, as shown in Figure 4.

Other lessons learned from SWIM that might be applied to the management of the Sub-Portfolios include the following:

- Proactively define Governance needed at the NextGen Portfolio level, as well as at the Solution Set level – it will be different at each level of portfolio management
- Confirm that elements of each solution set can be developed together, to the benefit of the solution set (confirm that there is a balance of technical compatibility as well as schedule compatibility among the members)
- Define an approach to reporting on the entire portfolio, as well as on each Solution Set Portfolio
- Establish a PLA with each Solution Set Manager that results in successful reporting of cost, schedule, and metrics that measure progress toward completion and performance metrics that measure the Solution Set's overall success, as components are individually deployed
- Identify the minimum necessary documentation needed between members of the Solution Set Portfolios (e.g., IRD, NLS, WSDD, Test Plans)
- Establish and manage the management reserve, to ensure the reserve is shared across the portfolio
- Balance commitments within the Portfolio with those made by participating programs, outside of the Portfolio

- Maximize the use of prototyping and conduct combined testing that includes "developer to developer" tests to reduce risk, particularly when deployment schedules within a single functional thread have time gaps.

Summary

Capability Portfolio Management is possible within the current FAA AMS and JRC Guidelines. Over the last three years, lessons learned in Capability Portfolio Management include the importance of:

- Clearly defined tasking and schedules captured and agreed upon in signed PLAs,
- Well defined requirements, consistent and traceable to the JRC approved Final Requirements Document,
- Buy-in to the Portfolio goals at the VP level of each ATO Service Unit, and
- The willingness and flexibility of participants to work with Portfolio members' existing program management, engineering, and development strategies.

Challenges that remain include balancing management and contractor resources among all FAA programs. Finding adequate resources will be one of the challenges the FAA must meet to successfully develop and deploy NextGen programs on time and within cost constraints.

References

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About the Author

Anne Wells is currently a senior System Engineer with TASC, Inc. She has been supporting a variety of FAA programs for the past twenty years, and is presently supporting several of the FAA's NextGen Programs including the SWIM Program, the En Route Automation Modernization Program, and the National Airspace System (NAS) Voice Switch Program. She previously worked on developing a modernized architecture for computing resources to support the U.S. Government, was responsible for developing a signal acquisition and processing system for the Army, and managed the development of an Air Force Test Bed in support of various military communications and radar systems. She has Bachelor's degrees in mathematics and chemistry from Coe College, and a Master's degree in Applied Mathematics from Purdue University.