THE ARMY REUSE CENTER AND PROGRAM MANAGER SUPPORT

Software Reuse Implementation for PEO STAMIS

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Many program managers (PMs) have been absorbed by the debate about whether or not software reuse offers real benefits in terms of increased quality, lower cost and shortened schedules without major, up-front investment of scarce resources.

The Army Reuse Center (ARC) is in the business of making reuse beneficial by supporting PMs in integrating reuse into the software development life cycle (SDLC). In providing this support, the ARC has developed and maintained a full range of products and services geared toward assisting projects of all types and sizes. It has successfully initiated reuse activities that have taken Management Information Systems (MIS) software reuse from "concept" to "proof of concept" and realized actual cost savings/cost avoidance.

Real Reuse Successes

The ARC supported the Program Executive Office, Standard Army Management Information Systems (PEO STAMIS), in successfully achieving its FY-1993 reuse goals.

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Left to right: Roy Lloyd, Henry Marshall, Brenda Lawter and Debbie Laforme in front of the Army Reuse Center exhibit.

Reuse activities focused on establishing the infrastructure within PEO STAMIS essential for long-term systematic reuse, implementation of the FY-1993 Reuse Plan, and pursuit of continued FY-1993 cost avoidance.

The final cost avoidance estimates for the FY-1993 PEO STAMIS software reuse implementation effort show that a total of 10,473 lines of code were reused. Using the ARC cost model, the total FY-1993 cost avoidance for PEO STAMIS is estimated at $568,226. In addition to code components, the ARC certified and installed "Lessons Learned" and "Cookbook and Standards" IEF products. These reusable products will be useful in achieving technology transfer of the IEF software development methodology.

Another reuse success was realized by the Joint Operations, Planning and Execution System (JOPES) Scheduling and Movement (S&M) subsystem. The JOPES S&M software is designed to allow users with proper permissions access to a large-scale database of Department of Defense (DoD) operational plans

(OPLANs). The system incorporates features that are common to many other large information systems, including the generation of standard reports and *ad hoc* retrieval. The JOPES S&M designers felt that these common capabilities were good candidates for reuse.

The ARC recently certified and installed selected parts of the Standard Installation/Division Personnel System-3 (SIDPERS-3) software, an Army personnel system under PEO STAMIS, into the reuse library. The design of the SIDPERS-3 system emphasized a layered architecture. This approach contributed to the successful completion of the immediate development goals, and paved the way for future reuse of major portions of the SIDPERS-3 design and code.

Through advanced planning, JOPES developers knew that portions of the reusable code donated by the SIDPERS-3 system were a close match to their S&M requirements. In the final count, JOPES S&M reused more than 27,000 lines of Ada code from the SIDPERS-3 components. Through the ARC cost modeling, JOPES S&M realized an estimated cost avoidance of approximately $1.15 million in design and development costs. As a senior computer scientiest stated, "The reuse process was critical to provide JOPES with the necessary capabilities and stay within the budget and schedule constraints."

The Reuse Steering Committee encourages the exchange of information and ideas on current and planned software reuse initiatives within the Army and DoD.

Proven Products and Services

The ARC is a recognized leader in software reuse in the DoD MIS community and the primary focal point for implementation of software reuse within the Department of the Army (DA). It was established to support the development and fielding of reliable, high-quality systems, while reducing time and resources required to develop and maintain those systems. The ARC is a true reuse support center, providing a cadre of analysts, engineers, and trainers skilled in reuse identification, support and integration throughout the SDLC.

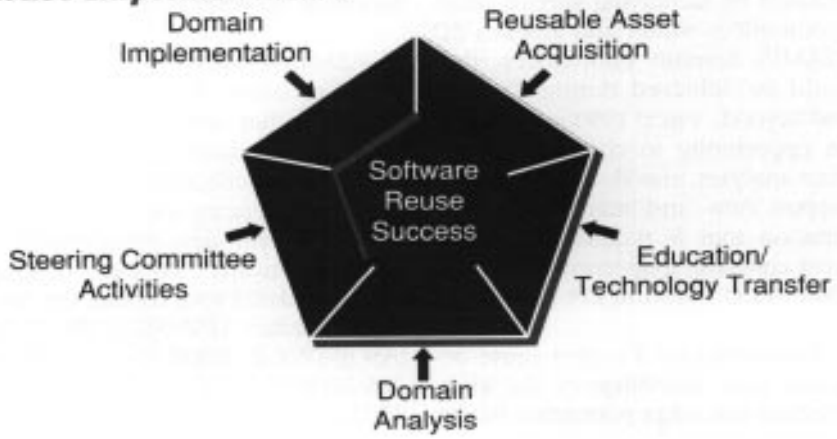
The FY-1993 reuse activities focused on critical aspects of the PEO STAMIS reuse program. These included management by the Reuse Steering Committee, Reuse Education and Technology Transfer, Domain Engineering and Reusable Asset Management. Figure 1 depicts this multifaceted approach.

Reuse Steering Committee. The Reuse Steering Committee is an executive-level management committee which guides and facilitates the incorporation of software reuse within PEO STAMIS. This committee provides a forum for identifying and discussing requirements, issues and opportunities associated with software reuse within PEO STAMIS. The Reuse Steering Committee encourages the exchange of information and ideas on current and planned software reuse initiatives within the Army and DoD.

Reuse Education and Technology Transfer. Since the reuse of software represents a radical transformation in software engineering practices and requires a dramatic change in skills required for the development of software, retraining personnel is necessary to ensure success and to develop a base of support among managers and developers for these new technologies. The ARC works in coordination with the PEO STAMIS to establish and implement short- and long-term reuse training goals to support this transformation for all levels of personnel from software engineers and support staff to managers, executives and software development trainers.

Domain Engineering. A domain is a family of systems that share a common mission, function or set of common capabilities and data. Domain Engineering is an evolving, state-of-the-art software engineering pro-

FIGURE 1. Multifaceted Approach to Software Reuse Implementation



cess for identifying modeling, building and verifying the commonality present among the different software systems within a domain. It identifies how systems relate to other systems that have been built, as well as how reusable software components (RSCs) providing capabilities common throughout a domain can be taken from one set of systems and reused and integrated into systems being built today and those in the future. Two major components of the ARC Domain Engineering method are *Domain Analysis* and *Domain Implementation*.

— *Domain Analysis*. Domain Engineering begins by identifying and bounding a particular domain. Domain analysts take this information and produce a model of the common requirements in the domain. This shows what is similar among systems and, just as importantly, exactly which aspects of each system are unique. Domain analysts then identify the high-demand components that have the greatest potential utility within an application area and provide guidance on how to adapt them if they do not meet requirements.

— *Domain Implementation*. Domain implementors then create (or obtain from the ARC library) the RSCs that fit the requirements specified in the domain model. Domain implementation consists of analyzing reuse opportunities, targeting specific RSCs and their donor/client systems, and providing guidance to systems developers in the building of reusable software. The second effort focuses on investigating alternative approaches for storage, display and reuse of the captured domain information. During this process, requirements analysts and functional experts will gain in-depth knowledge of multiple systems related to their development.

Reusable Asset Acquisition. Finally, the ARC engineering staff works with the project/product managers to certify and install donor system RSCs in the ARC library and to facilitate future reuse of those selected, high-demand components. The heart of this support is the ARC library of RSCs. The library system is an interactive, multiuser system that allows users to classify, store, analyze and retrieve RSCs. The faceted classification scheme used to search for needed components describes RSCs in domain-specific terms descriptive of the common components found within a domain. This process facilitates software reuse by offering developers the opportunity to match their applications needs with existing software products.

The ARC library is part of the Defense Software Repository System (DSRS), which provides ARC customers with access to similar libraries of RSCs at Defense Information Systems Agency/Center for Information Management (DISA/CIM) and other Service and agency support centers. As of 1 December 1993, the library contained more than 2,400 reusable design, code and document components — representing well over 2 million lines of quality code.

Plan for Future Reuse

To maximize the benefits of reuse within PEO STAMIS, a reuse infrastructure must be established to support aggressive pursuit of planned, systematic reuse at each phase of the SDLC. The FY-1993 reuse activities provided an opportunity to plan for coordinated reuse within PEO STAMIS by identifying specific reuse opportunities within and across PEO STAMIS domain boundaries, that could be achieved during FY-1994 and beyond. Fiscal 1993 was seen as an opportunity to conduct the domain analyses, provide education, and support intra- and inter-Service coordination that is required to implement cohesive, long-term reuse plans within PEO STAMIS, DA and DoD.

Recommended FY-1994 reuse activities take advantage of the infrastructure and other prior reuse investments to focus efforts on planned, systematic reuse within PEO STAMIS. The FY-1994 Reuse Implementation Plan (RIP) focuses on coordinated and mutually supportive reuse activities within PEO-STAMIS, on-site reuse engineering support for key programs, continued evaluation and incorporation of developing technologies, and planned reuse within PEO-STAMIS and across principal Army domains. Primary FY-1994 objectives are to complete the institutionalization of software reuse within PEO STAMIS and achieve significant, quantifiable cost avoidance/cost savings.

Return on Investment

In addition to other reuse benefits, the RIP targets short-term cost avoidance and longer-term cost savings. The reuse of software components within the SDLC can introduce savings, or cost avoidance, in terms of reduced time, resource and testing requirements. Cost equations and data points validated by the U.S. Army Cost and Economic Analysis Center (USACEAC) were used to project the short- and long-term software reuse benefits.

The estimated cost benefit for FY-1994 includes cost avoidance from opportunistic reuse and cost savings that could be achieved through aggressive planned reuse within PEO STAMIS. Actual cost avoidance and/or cost savings are highly dependent on PEO/PM support and implementation of recommended activities.

Although reuse will not solve all SDLC problems, it is one engineering approach that offers *proven* potential for increasing quality, productivity and programmer effectiveness while significantly reducing the costs and time associated with developing and maintaining software. To learn how the ARC can assist you, contact the Army Reuse Center, USAISSDC-W, ATTN: ASQB-IWE-R, STOP H-4, Ft. Belvoir, VA 22060-5456; (703) 285-6272; Fax (703) 285-6377.