

**REPORT TO CONGRESS
U.S. DEPARTMENT OF DEFENSE**

DoD SOFTWARE REUSE INITIATIVE

March 1994

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Appendix I: House Appropriations Committee Report on Software Reuse**19****EXECUTIVE SUMMARY**

Department of Defense (DoD) software costs are expected to grow from about \$30 billion in 1990 to \$42 billion in 1995. The Department of Defense agrees with the House Appropriations Committee that effective software reuse would reduce software life-cycle costs and improve the reliability of weapons, command and control, administrative, and other software intensive systems.

Accordingly, in response to the Committee's concerns, the Software Reuse Initiative (SRI) is being formalized under the auspices of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence, in coordination with the Under Secretary of Defense (Acquisition and Technology) (USD(A&T)), Director of Defense Research and Engineering and the Advanced Research Projects Agency (ARPA). Through the SRI, the Department plans to:

- Assign needed authority for DoD software reuse efforts by creating a more definitive organizational structure;
- Identify priorities for exploiting high leverage opportunities; and
- Prepare comprehensive plans for software reuse.

The mission of the SRI is to establish software reuse as an essential element of systems life-cycle management throughout DoD. This will be done in partnership with industry and academia. By accomplishing its mission, the SRI aims to increase software quality and reliability; improve management of technical risk; reduce system development and maintenance time; and increase productivity.

This mission encompasses three major goals that address both the technical and more challenging non-technical issues: first, transition reuse technology into the DoD mainstream; second, develop infrastructure that reduces the cost and risk of adopting and sustaining reuse; and third, effect paradigm shifts so that actions that increase effective software reuse are encouraged, rewarded and institutionalized.

The SRI will be guided by the following operating principles:

- Identify and support high-leverage software reuse opportunities;
- Demonstrate that software reuse provides compelling solutions for specific customer segments;
- Define clear, tangible goals and measurements;
- Deliver results by striving to provide whole solutions to customers;
- Assist organizations that are working to incorporate reuse and encourage those that are not;
- Measure results in terms of customers' success;
- Partner with and utilize existing capabilities of other government, industry and academic programs; and

- Foster and adopt industry standards and support common practices.

DoD's size and diversity coupled with the impact of downsizing, makes institutionalizing reuse a significant, yet compelling challenge. Formalizing the SRI and providing its leadership with the authority needed to oversee and coordinate DoD software reuse efforts addresses the Committee's concerns with DoD's current software reuse initiative, and will enhance DoD's ability to achieve the benefits of software reuse.¹

INTRODUCTION

1.1. Purpose and Scope

In response to concerns expressed by the House Appropriations Committee, this report describes the Department of Defense (DoD) plan to strengthen its software reuse efforts by formalizing its current Software Reuse Initiative (SRI) established under the Assistant Secretary of Defense for Command, Control, Communications and Intelligence, in coordination with the USD(A&T), Director of Defense Research and Engineering and ARPA. The SRI will be the central focus for DoD software reuse activities for all software-driven systems. The fiscal year 1994 House Appropriations Committee report acknowledged that DoD has demonstrated software reuse benefits and made progress toward implementation. However, the report asserted, and the Department concurs, that achieving the full benefits of software reuse requires the Department to assign authority for implementation, identify high priority opportunities, and prepare comprehensive plans for its software reuse efforts. The Department plans to:

- Assign needed authority for DoD software reuse efforts by creating a more definitive organizational structure with high-level, Department-wide commitment. Through the SRI, DoD will integrate software reuse activities and coordinate them with other DoD software and acquisition improvement efforts. This will eliminate current program fragmentation.
- Identify priorities for exploiting high leverage opportunities. The SRI will identify barriers and outline a comprehensive process for taking advantage of viable opportunities. This approach will focus resources where they are best used, while eliminating unnecessary redundancy.
- Prepare comprehensive plans for software reuse. As a result, the SRI will provide clear visibility over the total amounts spent on reuse, funding needed, and the status of ongoing software reuse efforts.

*... Reusing software components holds the most potential
for containing future costs....*

1.2. Background

Software, properly managed, provides key strategic and competitive advantages. Yet, while software is critical to the success of virtually all DoD systems, it is also proving to be a major cost driver. DoD software costs have outstripped the costs

proving to be a major cost driver. DoD software costs have outstripped the costs of military hardware and are continuing to grow. A 1991 report from the Defense Department's Inspector General stated:

...the cost of computer hardware components integral to weapon systems and other critical military and intelligence systems, are expected to remain stable at about \$6 billion annually between FY 1990 and FY 1995, while corresponding software costs are expected to grow from about \$30 billion to \$42 billion."Management of the Software Technology for Adaptable, Reliable Systems Program, Department of Defense Inspector General Audit 91-050, February 1991.

The major factors contributing to this growth of software cost are the continuing increase in the size and complexity of software systems and an international climate that calls for rapid adaptation to new situations. A 1991 Department study concluded that software reuse held the most potential for holding down future costs. Software reuse, broadly defined, is the practice of using existing software components in more than one system. Although applied on a number of defense systems, the practice of software reuse is far from widespread.

...DoD has taken important steps to advance software reuse....

DoD EFFORTS TO DATE

In 1991, DoD established the Software Reuse Initiative (SRI) to provide a single, consistent Department-wide software reuse strategy. DoD subsequently chartered the Software Reuse Executive Steering Committee, and its two supporting working groups, the Reuse Technical Working Group and the Management Issues Working Group. The latter two groups work in collaboration with other government agencies, industry and academia through organizations such as the Association for Computing Machinery (ACM), the Council of Defense and Space Industries Associations (CODSIA), and the Institute for Electrical and Electronics Engineers (IEEE).

In July 1992, the Department published the *DoD Software Reuse Initiative: Vision and Strategy*, which provided the initial framework for incorporating reuse as an essential element of systems life-cycle management. The document articulates a concept of reuse and charts ten strategic steps that together will bring about the necessary changes to make software reuse effective for DoD. The military departments are now in the process of developing and implementing plans to incorporate reuse into the way they do business.

The SRI was established as a voluntary, cooperative federation of individual DoD software reuse activities. The Department's three major software reuse programs have been active participants. These programs are: the Advanced Research Projects Agency's (ARPA) Software Technology for Adaptable, Reliable Systems (STARS) program, including Asset Source for Software Engineering Technology (ASSET); the Air Force Central Archive for Reusable Defense Software (CARDS); and the Defense Information Systems Agency (DISA) Software Reuse Program (SRP).

DoD reuse efforts have produced results and achieved a notable degree of cooperation. However, given the Department's size and its current massive restructuring and downsizing, the DoD presents a formidable challenge as well as a compelling opportunity to implement reuse. The Department agrees with

a compelling opportunity to implement reuse. The Department agrees with Congress that Department software reuse efforts need more visibility, support and central coordination.

2. SRI: MISSION, GOALS AND OPERATING PRINCIPLES

...The SRI will be redefined and restructured...

To exercise the level of coordination, oversight and direction required to advance its mission successfully, the Software Reuse Initiative is being redefined and restructured. It will no longer be a voluntary alliance, but rather all DoD components will have a role and accompanying responsibilities as defined in Section 3. Constituent organizations of the restructured SRI will have the responsibility, and authority needed, to define, manage, and implement a consistent DoD-wide strategy for institutionalizing software reuse. The SRI denotes the collective structure as discussed throughout this document. The Initiative will address equally the needs of all types of software-driven systems.

2.1. Mission

The SRI mission is to —

Establish software reuse as an essential element of systems life_cycle management within DoD, in partnership with industry and academia.

By accomplishing its mission, the SRI aims to increase software quality and reliability; improve management of technical risk; reduce system development and maintenance time; and increase productivity.

...The SRI will inject software reuse into the DoD mainstream....

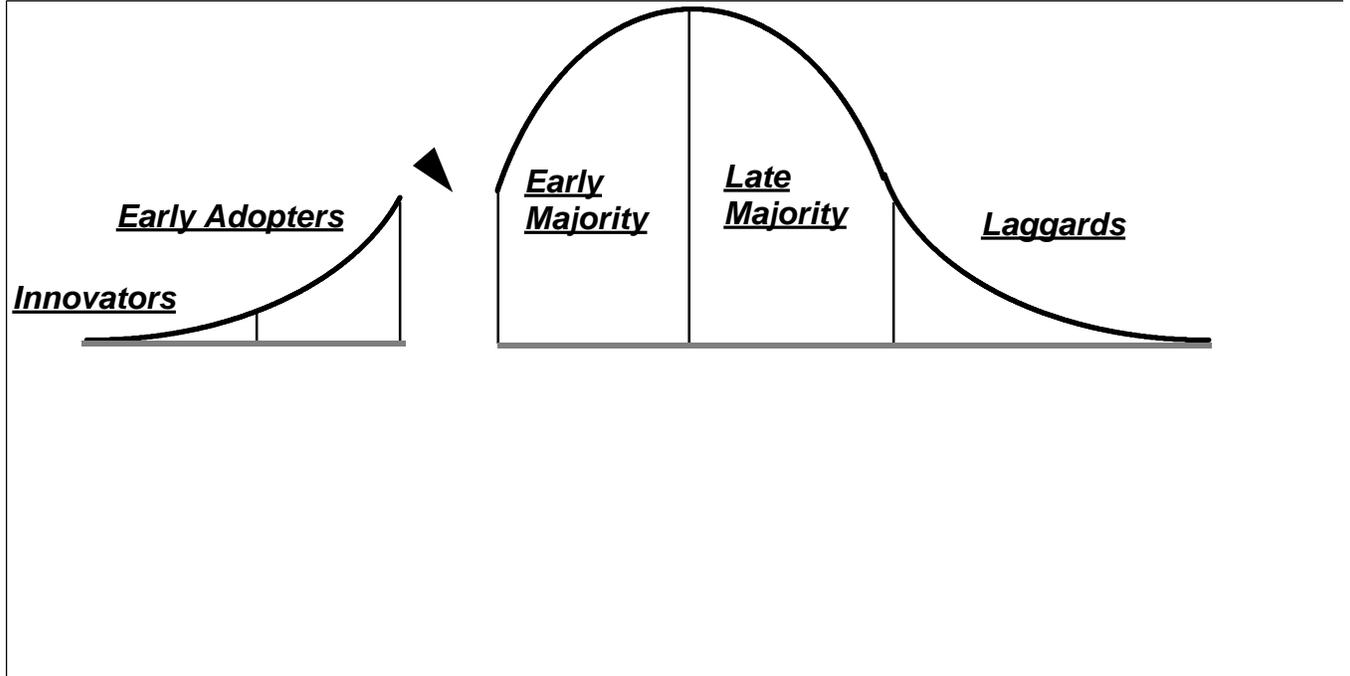
2.2. Goals

The SRI mission encompasses three major goals, namely to: transition software reuse technology into the DoD mainstream; develop an infrastructure that reduces the cost and risk of adopting and sustaining software reuse; and, as a result, effect paradigm shifts for those involved with DoD systems acquisition, development and maintenance. These goals are described below.

TRANSITION SOFTWARE REUSE TECHNOLOGY INTO THE HANDS OF PRACTITIONERS TO EFFECT ITS ROUTINE AND PRODUCTIVE USE

Industry and government experience shows that this is a formidable challenge. In recent years, studies have mapped out the process that organizations go through when they adopt new technology.

Promoters of new technology often assume wrongly that transition of new technologies, first embraced by innovators, to a much larger segment of the user population is automatic. However, Geoffrey Moore, an industry analyst, reports widespread and all-too-painful examples to the contrary. These indicate that there is a big gap between early adopters, who are willing to put up with immature technology, and mainstream users. This is depicted by Figure 1.



*Figure 1: Technology Adoption Life-Cycle as described by Geoffrey Moore.
Adapted from Crossing the Chasm, Harper, 1991.*

Mainstream users not only require proven, integrated solutions, but look to their peers for assurance before committing resources. Apple's Macintosh, for example, languished until, accompanied by Aldus and Adobe, the company offered a complete desktop publishing solution that was demonstrably better and cheaper.

While software reuse is a new technology that holds much promise, it has not yet entered majority practice at DoD. The SRI will expand reuse from pockets of utilization among innovators and early adopters, to the mainstream. To do this, the SRI will systematically identify high-leverage DoD customer segments, make reuse work in these segments, and foster majority adoption based upon customer successes.

BUILD AN INFRASTRUCTURE THAT REDUCES THE COST AND RISK OF ADOPTING AND SUSTAINING REUSE

The SRI will coordinate, advance and, where necessary, develop an infrastructure that reduces the cost and risk of adopting and sustaining software reuse. The SRI will support organizations that seek to implement reuse.

Similarly, the SRI will increase the impact of reuse by identifying, extracting, packaging and disseminating software components, best practices, and lessons learned, as well as innovative ways of conducting business, writing contracts or providing incentives for software reuse.

The SRI will also foster reuse infrastructure development within individual DoD organizations. The SRI will provide support to service and agency software reuse focal points and offices who will build infrastructure within their respective organizations.

...Treat software as an asset rather than a liability....

EFFECT PARADIGM SHIFTS TO INSTITUTIONALIZE PRODUCTIVE ACTION

Paradigm shifts -- fundamental changes in the rules by which groups of people view their work and gauge success -- will provide evidence of progress for the SRI. While some shifts will occur as a result of technology transition and infrastructure development, others will require additional, focused action.

For example, the current process for software acquisition encourages managers to build software systems from the ground up, even when many systems share a large set of common requirements. DoD claims all ownership of software products developed in this process, yet rarely views the end-products as assets.

The envisioned software reuse paradigm treats software as an asset rather than a liability. With this orientation, an organization *invests* in the creation of reusable software *assets* by building a domain-oriented architecture and common software to be used across a product line. This applies to both government and contractor organizations.

For example, a government organization may create a reuse architecture. This approach can reduce government and contractor effort in communicating and responding to requirements, lower overall cost, shorten development time and increase standardization of applications. As a result, applications can be developed by a number of different contractors, all based on the common architecture.

2.3. Operating Principles

The SRI approach builds upon the "best practices" of industry leaders in software reuse. It takes advantage of lessons learned from industry and from prior DoD technology initiatives. In this way, SRI will identify and avoid risks, maximize benefits and minimize waste.

...The SRI will build grassroots support by demonstrating results....

Operations of the SRI will be guided by the following principles:

- a) *Identify and support high-leverage software reuse opportunities* -- It takes substantial resources to gain critical mass in even one segment of mainstream use. The SRI will set priorities and focus resources to make reuse work in selected customer segments. Crossing the Chasm, p. 28
- b) *Demonstrate that software reuse provides compelling solutions for specific customer segments within DoD* -- Clear examples of reuse success will provide bases for referrals among managers who reference each other before making buying decisions. This will build "grassroots" support for reuse. Similarly, understanding why projects fail will help the SRI to communicate when, where and how to adopt software reuse.

- c) *Measure results in terms of customer's success* -- Customer success produces solid referrals, and customer referrals are the strongest way to diffuse technology. Defining success in customer terms will focus and integrate the activities of all SRI staff members.
- d) *Define clear, tangible goals and measurements* -- To assess progress against goals, and ensure that the SRI is accomplishing its mission. The SRI will adopt standard terminology and develop metrics to ensure that results are consistently measured across projects and over time.
- e) *Deliver results by striving to provide whole solutions to customers* -- Software reuse requires many technical and non-technical elements to succeed. These include well-defined architectures and development processes and appropriate acquisition models. Through its infrastructure, the SRI will provide the essential elements needed to make reuse work.
- f) *Assist organizations that are working to incorporate reuse, encourage those that don't* -- The SRI aims to produce the greatest positive effect in the shortest amount of time with the resources it commands. These resources, authority and influence are best used to remove barriers, and provide technology and limited support to programs that volunteer to participate.
- g) *Partner with and utilize existing capabilities, products and services of other government, industry and academic programs* -- Agencies such as NASA are addressing software reuse issues similar to those faced by DoD. Universities such as West Virginia University and the University of Houston, Clear Lake, are developing courses and conducting research on software reuse. Organizations such as IEEE and AIAA are focusing industry resources on developing software reuse standards so that off-the-shelf products will fit broad government and industry needs. The DoD will join forces with these and other external organizations to leverage on-going efforts.
- h) *Foster and adopt industry standards, and support common practices, where appropriate* -- Use of common standards and practices are key elements to systematic software reuse. As evidenced by the open systems world, this approach can increase overall efficiency, and promote vendor investment and open competition.

DoD's size and diversity, coupled with the impact of downsizing, makes institutionalizing reuse a significant, yet compelling, challenge. These factors strongly suggest that the SRI will be promoting software reuse to a diverse and changing marketplace rather than to a static organization. The goals of technology transition, infrastructure and paradigm shifts -- fixed by the preceding principles -- will maximize DoD software reuse results.**3. ROLES, RELATIONSHIPS AND RESOURCES**

Maximum results are obtained when all parties understand their role, relationship and importance to the mission's accomplishment. As the SRI is being redefined and restructured, it is even more important that these are clearly delineated. This section specifies roles necessary for executing this initiative; outlines collateral relationships; and discusses funding control, budget and staffing.

3.1. Roles

Pursuing this initiative requires three major roles be addressed: (1) policy and

Pursuing this initiative requires three major roles be addressed: (1) policy and direction setting; (2) planning and management; and (3) implementation. The Software Reuse Initiative is combination of these roles.

3.1.1 Policy and Direction Setting

The SRI will remain under the auspices of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD(C3I)). The ASD(C3I), in coordination with the USD(A&T), Director of Defense Research and Engineering (DDR&E) and ARPA, will be responsible for reuse policy, program direction and oversight. Having responsibility for software reuse policy and direction setting at the Office of the Secretary of Defense (OSD) level allows the DoD to capitalize on co-location with other software policy responsibilities of the ASD(C3I) and the DDR&E.

As sponsor of the SRI, the ASD(C3I) has overall responsibility for accomplishment of the software reuse mission and goals. That responsibility will be carried out in close coordination with the USD(A&T), DDR&E and ARPA to ensure accomplishment consistent with respective assigned areas of responsibility. Consistent with that coordination, the ASD(C3I) shall:

- a) Direct and oversee execution of the Software Reuse Initiative.
- b) Issue, in coordination with other parts of the Office of the Secretary of Defense, policies and procedures that support and enable software reuse within the DoD.
- c) Annually approve the SRI Software Reuse Plan and review SRI plans, objectives, activities and accomplishments at least semi-annually.
- d) Provide planning guidance and advocate SRI resource requirements during the planning, programming and budgeting process.
- e) Chair the Reuse Executive Steering Committee.
- f) Issue procedures and tasking as required to support program execution.

The SRI will provide a unified voice on the policies and implementation of software reuse. The ASD(C3I), in coordination with the USD(A&T), DDR&E and ARPA, has the authority to set policy and assess progress with regard to software reuse within the DoD components.

*...The ASD(C3I) will review and approve the annual
SRI Software Reuse Plan...*

The ASD(C3I) and the DDR&E, consistent with their respective responsibilities, have the authority to task or otherwise direct action by service or agency focal points (e.g., organizations, individuals, advisory boards) in pursuit of the SRI mission. Such tasking includes the review and approval of service or agency software reuse planning documents for purposes of presenting a more consolidated, coordinated approach to reuse. Likewise, they have the authority to task or otherwise direct the reporting, both format and function, of software reuse activities by any participants in DoD.

Appropriate adjustments to the responsibilities of existing organizations to coordinate with and report to the SRI in compliance with the authorities and tasking of the SRI leadership will be directed. The ASD(C3I) may delegate

tasking of the SRI leadership will be directed. The ASD(C3I) may delegate assigned authorities as appropriate. Direct communications among organizations will be authorized.

The ASD(C3I) shall coordinate with the DDR&E on reuse policy, program direction and oversight to ensure successful execution of this initiative, including issuance of appropriate direction and tasking to organizations under his/her areas of responsibility and support for SRI resource requirements during the planning, programming and budgeting process.

3.1.2 Planning and Management

A Program Management Office (PMO) will be responsible for planning and central management functions. The Defense Information Systems Agency (DISA) has been assigned responsibility for managing the SRI, developing and executing supporting plans, and coordinating and harmonizing the execution of supporting activities by the services and agencies. As the Program Management Office, DISA shall have as a principal duty the overall management of the software reuse affairs of the DoD. The PMO will establish a well conceived program for achieving the SRI mission.

... Principal duty of the Program Management Office is the management of the SRI...

The PMO shall:

- a) Organize and manage the SRI and all assigned resources consistent with the SRI mission.
- b) Define and implement a consistent, annual planning structure, and annually review, update, and submit to ASD(C3I) a consolidated Software Reuse Plan for approval .
- c) Serve as the primary focal point for the Department of Defense on software reuse matters; serve on boards, committees, and other groups in assigned functional areas; and represent the ASD(C3I) and the DoD on software reuse matters outside the DoD.
- d) Recommend to the ASD(C3I) policies and procedures that support and enable software reuse within the DoD.
- e) Establish procedures and reporting requirements, in coordination with the components, necessary for effective program management, prioritization, decision making and execution.
- f) Establish procedures and reporting requirements, in coordination with the components, to ensure visibility of resources required, planned, budgeted and spent.
- g) Report on DoD software reuse activities and achievements.
- h) Advise OSD on software reuse issues and relationships.

The PMO will also establish relationships with identified high leverage programs to assist in transitioning reuse technologies and processes into use. It will ensure that planning and management processes and procedures afford weapon system programs influence and consideration equal that of command and control, and management information systems. The PMO will consolidate DoD component

management information systems. The PMO will consolidate DoD component software reuse plan submissions prior to forwarding the plan for ASD(C3I) review and approval.

The DISA Center for Information Management will assume the management, planning and coordination activities required.

3.1.3 Execution

The execution or implementation role is assigned to the DoD components (Services and Agencies). Implementation of tasks that support technology transition, infrastructure development, and paradigm shifts will be accomplished by the DoD components, in coordination with the PMO and consistent with approved plans. As the execution arm of the SRI, they shall:

- a) Implement software reuse and participate in the SRI, in accordance with established procedures and the approved Software Reuse Plan.
- b) Annually review, update, and submit to the PMO that part of the Software Reuse Plan that addresses component activities, in accordance with established planning guidance.
- c) Plan for and provide necessary resources to effectively carry out component program responsibilities.
- d) Designate a software reuse focal point to act as primary interface with the PMO and to represent component interests to the SRI leadership.
- e) Provide an interface between component programs and the PMO to ensure synergy and sharing of information and reuse capabilities.

3.2 Relationships

General organizational relationships with/within the SRI are described below. The PMO will define the administrative and programmatic relationships in greater detail as required for effective management and full understanding of the role of each organization.

3.2.1. Software Reuse Focal Points within the Services and DoD Agencies

As the central DoD software reuse activity, the SRI will lead the drive to implement software reuse across DoD in a coordinated and integrated manner in part by establishing relationships with software reuse focal points (organizations or individuals) within the services and DoD agencies. A designated software reuse focal point will act as primary component interface to the PMO. The SRI will provide support to the software reuse focal points that will enhance their efforts against common DoD reuse goals and assist in the development and initiation of training.

*...The SRI does not manage Acquisition/PDSS programs,
or their reuse-related funding....*

3.2.2. Acquisition/Post Deployment Software Support (PDSS) Programs

The SRI does not manage or oversee acquisition or PDSS programs, nor is the SRI involved in their funding. The SRI will assist programs in gaining support for

SRI involved in their funding. The SRI will assist programs in gaining support for software reuse and will bring together programs with common goals and interests. The SRI will also strive to provide whole solutions to programs pursuing software reuse through development of the reuse infrastructure. The SRI may provide supplementary funding to package, promote or distribute products from acquisition/PDSS programs that have broad applicability or otherwise support SRI software reuse goals.

3.2.3. Reuse Technology Development and Adoption Programs

A number of efforts (e.g., ASSET, CARDS and the DISA SRP) that address reuse technology issues are underway within DoD. The SRI will build upon these efforts through strategic planning, to focus activities on coordinated, common goals. To this end, OSD will guide these efforts through validation of plans and oversight. The reuse technology development and adoption programs will continue to work closely with research and development efforts to take best advantage of those efforts.

3.2.4. Other Reuse R&D Programs

Other pure research and technology development efforts addressing software reuse techniques and transition methods will be covered by the overall software reuse plan as applicable. The PMO will establish and maintain a process to provide requirements for these programs, through the ASD(C3I), to the Director of Defense Research and Engineering. Where appropriate, other input may also be provided and closer collaborative relationships with the research community may be pursued. In particular, the SRI will work to facilitate transition of new technology into acquisition/PDSS programs or other component organizations.

3.2.5. Other US Government Agencies, Industry, Academia and International Organizations

Defense Department communications on software reuse with other government agencies, industry, academia and international organizations will be coordinated through the PMO. The SRI will maintain a collegial level of interaction where agreements will be reached to work together in advancing technology and sharing management strategies.

The PMO will be the focal point for all DoD communications relating to software reuse with international organizations. The SRI will establish an on-going commitment to advance communication and sharing on an international level, and the PMO will be the clearinghouse within the DoD for information on software reuse obtained from foreign sources.

...The SRI is structured to assume responsibility for DoD' s software reuse efforts...

The SRI is thus structured to: (1) assume responsibility for establishing, planning and leading DoD' s software reuse efforts; (2) establish realistic goals whose progress can be measured, documented and reported; and (3) identify and resolve competitive or duplicative efforts, promote coordination and develop approaches to software reuse that maximize the return on taxpayers' investments.

...The SRI requires an independent budget...

3.3 Resources

FUNDING CONTROL

The funding for software reuse technology and infrastructure development will be coordinated through issuance of resource planning guidance and review and approval of the Software Reuse Plan. Reuse-specific funding will be addressed at the DoD level through standard planning and budget mechanisms. The SRI will not control funding for software reuse activities planned within specific research and development, acquisition or PDSS programs.

BUDGET

To support technology transition, infrastructure development and paradigm change, and required program management activities, the SRI requires an independent budget, which will be included in an ASD(C3I) budget line. The resource requirements to be advocated by ASD(C3I) will be identified by the PMO, after coordination with the Services and DoD Agencies, and will supplement component activities to further the overall objectives of the SRI. The Services and DoD Agencies will also continue to plan and program resources necessary to effectively carry out their responsibilities as identified in approved plans. Thus, it is expected that the required funding will continue to come from a combination of sources in the Department. The PMO will also act as an advocate for reuse funding within DoD, assisting individual organizations or programs build the necessary case for software reuse efforts.

STAFFING

While much of the staffing will be provided through a matrix of resources across categories supported by expert assistance from industry and academia, the core of the personnel resources will be drawn from within the ranks of the existing cadre of DoD software professionals.

...The SRI will issue annual progress reports

4. TRANSITION PLAN FOR IMPLEMENTATION AND MATURATION

The Department of Defense intends to make software reuse an essential element for DoD systems life-cycle management. Its first step, in 1991, was to establish a Software Reuse Initiative. This cooperative alliance of software reuse activities has focused attention on the important opportunities afforded the Department by this paradigm shift. The steps described in this plan will further focus DoD efforts towards achievement of its vision.

As the SRI accomplishes its objectives, inhibitions to reuse will be reduced or eliminated. Software reuse will yield increased software quality for DoD customers. The transition to reuse should then gain momentum across customer organizations and segments. Bottom-line mission requirements for more reliable, highly adaptive, less expensive software will be powerful factors behind DoD's paradigm shift. Building upon positive, progressive activities to date, SRI will be the critical catalyst in this change.

4.1. Initial Objectives

The first milestone for the SRI is to develop a strategic plan which elaborates the DoD-wide strategy, with objectives and activities. Subsequent milestones related to organization building will be accomplished in short order, such as: resolution of collateral organizational (e.g., review and recommend what happens to existing working groups) and resource issues, and implementation of an operational management plan. Additionally the PMO will establish procedures and reporting requirements required for smooth functioning of the SRI. These will include:

- a) Uniform guidance for planning, reporting, and resource requirement submissions;
- b) Detailed administrative and programmatic relationships among OSD, the PMO, the Service and DoD Agency focal points, reuse working groups, programs, industry and academia; and
- c) Resource prioritization and decision making processes.

During this phase, the PMO will work with the components to ensure a smooth transition to the planning structure that will be defined. As service and agency reuse plans and activities already exist, the goal will be to provide a supportive environment that ensures continuance of worthy efforts while transitioning to a consistent planning base that supports prioritization and decision-making.

As the SRI matures while accomplishing its mission, DoD will review the organization's effectiveness. In addition to the semi-annual program reviews, each year, starting at the end of fiscal year 1995, the PMO will formally report on progress against the goals described in this report.

...The SRI is designed to change with the times...

The SRI will initially have three major objectives as follows:

1. Gather and synthesize information on reuse lessons-learned, technology, and infrastructure to meet the needs of DoD projects.
 - a) Acquire and review current service and agency software reuse plans.
 - b) Analyze and characterize software reuse activities across DoD; document and disseminate lessons learned from these activities.
 - c) Identify and characterize the in-place software reuse infrastructure, including its gaps and deficiencies; package and disseminate information on using this infrastructure.
 - d) Select the best products and practices supporting software reuse; promote or assist their introduction into DoD projects.
 - e) Identify ways to use the information to influence reuse investment decisions of independent projects or organizations (e.g., acquisition programs or Program Executive Officers).
2. Provide support for projects that provide high-leverage software reuse opportunities in the near-term.
 - a) Identify high-leverage software reuse opportunities within customer

- a) Identify high-leverage software reuse opportunities within customer segments.
 - b) Identify the customer goals for these projects; set priorities for addressing what the customer needs to achieve these goals.
 - c) Apply resources to assure the success of software reuse on these projects; provide solutions to customer needs.
3. Develop the relationships both inside and outside the DoD necessary to carry out the SRI mission.
 - a) Identify, characterize and, where appropriate, build relationships to leverage resources (e.g., infrastructure, experience, abilities).
 - b) Form relationships with existing government/industry/academic organizations.

The SRI objectives will be revisited as the Initiative receives feedback from Congress, DoD, and the software engineering community at large.

...Criteria for selecting opportunities are based on broad government/industry experience....

4.2. Selection of High Leverage Opportunities

The SRI approach to ensuring widespread software reuse will entail understanding a customer segment and delivering solutions, like a business. It also involves picking winners -- high leverage opportunities for application of SRI resources. This is often risky for government enterprises. To mitigate risk, and manage expectations for success, the SRI will work within the context of criteria that identify prerequisites for successful software reuse. The initial criteria are listed below. *Implementing Model-Based Software Engineering in Your Organization: An Approach to Domain Engineering*, Draft SEI Technical Report, November 1993, p. 14. The criteria will evaluate ***the degree to which*** the project, program or activity is:

- Providing an opportunity for transition of technology to additional customers in the same well-defined customer segment
- Common across DoD services and agencies (potentially with other government agencies and commercial organizations)
- Motivated to change -- serious problems make the case for change compelling
- Willing and able -- volunteers to work with SRI and is ready to commit resources
- Committed to quality -- has a well defined software process and a measurable set of expected results from adopting reuse; has a broad-based continuous improvement program in place
- Within a domain that is clearly defined, long-lived and stable
- Planning to build additional systems in the subject domain
- Experienced in building systems in the subject domain
- Adept at integrating new technologies
- Essential to DoD mission and goals

In addition, all elements of the solution and resources to provide them must be available.

APPENDIX I: HOUSE APPROPRIATIONS COMMITTEE REPORT ON SOFTWARE REUSE 103RD CONGRESS 1ST S
SESSION; HOUSE OF REPRESENTATIVES, REPORT 103-254: DEPARTMENT OF DEFENSE APPROPRIATIONS BILL, 1994, REPORT OF THE COMMITTEE ON A
PPROPRIATIONS [TO ACCOMPANY H.R. 3116]; U.S. GPO, SEPTEMBER 22, 1993, PP. 258-259.

DoD estimates that expenditures for developing and maintaining software for its weapon systems, command and control, and administrative systems exceed \$24 billion annually. Software reuse provides an important opportunity to leverage this investment by offering potentially substantial cost savings and improvements in reliability and maintainability. This potential has already been demonstrated in industry and on the Navy's Restructured Naval Tactical Data System. Additionally, the Army expects significant benefits from the use of this technology in its Army Tactical Command and Control System program. In a December 1991 study, Defense determined that software reuse was the number one technique to reduce the Department's software costs. For example, the study estimated that in fiscal year 1994 reuse could help Defense save \$1 billion of an estimated \$24 billion in software expenditures.

Although software reuse potential is significant, software experts caution that technical, organizational, and legal issues must be resolved to attain its full benefit. To address these issues, Defense has established its Software Reuse Initiative. The Defense initiative, with a steering committee and working groups, has developed a high-level Vision and Strategy and has identified an approach for software reuse.

While Defense's initiative has made some progress toward implementing a software reuse capability in the Department, continuing with its current approach makes achieving the full benefit of reuse uncertain. Specifically, Defense has brought together a collection of organizations to participate in the initiative, which has fostered a cooperative environment, but none of them have the authority or clout government and industry experts agree is needed to implement the initiative. As such, Defense can not effectively manage and oversee the initiative and does not know how much has been spent on, funding and resources required for, and status of the various reuse efforts within the federation of programs and throughout the entire Department.

Additionally, Defense has not properly identified the high priority reuse opportunities and associate obstacles or assessed the software development and maintenance processes in these areas to determine their capability for reuse practice as government and industry experts agree is needed. Therefore, the Department, with its decentralized approach, runs the risk of permitting the many organizations participating in the reuse initiatives to misdirect or duplicate reuse effort.

Further, while the Department will centrally prepare several plans for its reuse initiative, these plans currently will not be comprehensive or based on an assessment to identify the high priority reuse activity areas. Implementing software reuse will require a number of fundamental changes in the way the Department plans, develops and maintains software that will need to be coordinated. Government and industry experts state that a comprehensive plan targeting high priority reuse activities is critical to the Department's effort to successfully implement its reuse initiative.

Numerous GAO and Defense studies have highlighted the Department's software management problems. Though the Department, since 1990, has prepared several plans to address these problems from a DoD-wide perspective, Defense has not finalized one of them and continues to work the problems in a fragmented manner, as illustrated by its approach for software reuse.

In light of these concerns, the Committee directs the Department to establish a more formal program for this initiative, addressing the above concerns on central management and oversight, program scope and direction, and transition plans. Additionally, the Committee directs the Department to provide a plan, which discusses how Defense plans to reorganize the initiative and address these concerns. The Department shall submit this plan to the Committee by March 1, 1994.