DEFENSE MAINTENANCE AND REPAIR TECHNOLOGY (DMART) PROGRAM

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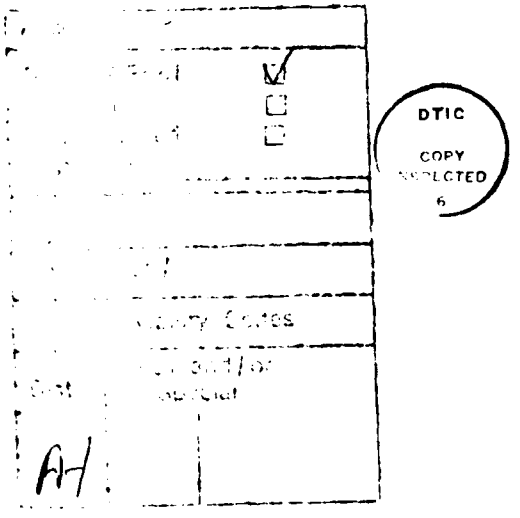

DEFENSE MAINTENANCE AND REPAIR TECHNOLOGY (DMART) PROGRAM

INTRODUCTION

In September 1985, the Assistant Secretary of Defense (Acquisition and Logistics) [ASD(A&L)] charged the Director, Maintenance Policy, to establish a maintenance research and development (R&D) program aimed at stemming or reversing Department of Defense's (DoD's) escalating maintenance burden. In response to that charge, the Maintenance Directorate developed the Defense Maintenance and Repair Technology (DMART) Program. It is designed to reduce the field maintenance cost of weapons systems by exploiting advances in repair technologies and processes, modernizing maintenance facilities and equipment, improving utilization of support resources, and promoting prime equipment reliability and maintainability (R&M) improvements.

As Secretary of Defense Weinberger points out in his most recent *Annual Report To The Congress*, the DoD already has had to scale back its objectives for depot- and field-level maintenance in fiscal year 1987 because of fiscal constraints. As a result, the DoD must take advantage of the latest technological developments to assure that weapons systems readiness and sustainability do not suffer inordinately from those constraints. The DMART Program is one of the ASD(A&L) initiatives that support Secretary Weinberger's position.

PROGRAM DESCRIPTION

Program Objectives

The objectives of the DMART Program are to:

- Increase management emphasis on reducing support costs of fielded weapons systems,
- Strengthen postdeployment integrated logistic support throughout the DoD, and
- Stimulate application of advanced maintenance and repair technology to improve productivity, quality, and efficiency of field maintenance.

- Improve maintenance technology transfer throughout the DoD.

Program Structure

The DMART Program is designed to achieve its objectives through the following three processes:

- Systematic identification of opportunities for field maintenance improvements,
- Selection and funding of projects to implement those improvements, and
- Dissemination of maintenance technology information, including the results from implemented projects.

A brief description of each of these processes follows.

Identification of Opportunities

Opportunities to reduce weapons system support costs are identified by a combination of three activities: (1) conducting weapons system maintenance reviews, (2) screening maintenance-related technology information, and (3) soliciting ideas on needs and opportunities from field maintenance activities.

Maintenance reviews focus on major weapons systems that have been deployed for several years. (Appendix A presents a discussion of DoD policy on weapons system maintenance support, and Appendix B, the results of several recent studies that recommended logistic reviews of fielded weapons systems and a format for conducting the reviews. All appendices are in Volume II of this report.) Such maintenance reviews should be scheduled on the basis of several factors (acquisition program production status, interim contractor support, mission criticality, support problems, and available resources for analytic support needed to conduct such reviews), but normally the first review of a major weapons system should occur within 5 years after its initial operational capability (IOC). One of the objectives of the reviews should be to identify how application of new maintenance and review technology can substantially improve the weapons systems' support. Specific applications would be candidate projects for the DMART Program. The projects may include, for example, R&M-related product improvements, modernization of field maintenance support equipment, installation of improved maintenance management systems, changes in maintenance concept, improvements in technical data and in test program software, replacement of ineffective training equipment, or any of a

host of other potential solutions to improve maintenance while reducing overall support cost.

The screening of maintenance-related technology information is designed to identify new technologies, developed and demonstrated under a variety of programs or by private industry, that may be applicable to field maintenance activities in support of fielded weapons systems. The purpose is to provide information on those technologies to the potential users, thereby fostering transfer of technology among the Military Services and between the private sector and field maintenance activities and providing a source of ideas for project proposals.

The solicitation of ideas from field maintenance activities on needs and opportunities is designed to directly involve the end users of maintenance and repair technology in the program. Those users are ultimately the best sources for identifying the needs for, and the impediments to, improved maintenance productivity, quality, and efficiency. To establish this communication channel, each of the Military Services should establish a network of DMART coordinating offices extending from the Systems or Materiel Commands, through the Major Commands/ Type Commanders, to the subordinate field maintenance activities, building on existing, informal networks.

Project Selection and Funding

After the opportunities to reduce system support costs are identified, the next step is to select and fund projects to implement them. The criteria for that selection should include such factors as eligibility for other programs, technical risk, potential for transfer (i.e., generic applicability vice weapon-system specific projects), return on investment, and criticality of the support. Importantly, the DMART Program should supplement existing programs so that projects eligible for support through any other program would not be supported by DMART. (Appendix C describes other DoD programs that are aimed at improving productivity, modernizing equipment, and enhancing industrial-type processes.) By the same token, the eligibility criteria for DMART-funded projects should differ from those for other DoD programs. For example, the DMART Program should not support depot maintenance equipment modernization, which is normally funded through the Asset Capitalization Program. Similarly, the program should not support R&D-type projects, although projects

sponsored under those types of program, for example, might be implemented under the DMART Program after they have been successfully demonstrated.

DMART projects typically should be low risk. Consequently, user commitment is a mandatory requirement for any project supported by DMART. The program should be limited to projects that have measurable savings (even when such savings may not be the primary objective of some projects); the program should require, whenever possible, a "gain-sharing" arrangement for any supported project. Under this arrangement, a DMART revolving fund would be reimbursed for its capital investment from the savings achieved in the project outyears, based either on an agreed payback formula or audited savings. In this respect, the DMART Program would be similar to the Industrial Modernization Incentives Program.

Disseminating Information

Implemented projects should be monitored and audited to validate prior estimates of project benefits, to adjust payback formulas as appropriate, and to identify the most promising projects for large-scale implementation DoD-wide. Information on implemented projects along with information on candidate maintenance technologies used in identifying opportunities (see above) should be disseminated: (1) through the maintenance technology information network consisting of an online information system linking field and depot maintenance activities and management echelons, and (2) through other media (newsletters, conferences, and workshops).

JUSTIFICATION FOR THE DMART PROGRAM

There is both a need and an opportunity to reduce the DoD maintenance burden for fielded weapons systems. The need arises principally from tightened fiscal constraints that already are causing readiness and sustainability shortcomings in field maintenance performance. The opportunity arises from the benefits that can be realized by exploiting advancements in maintenance and repair techniques, processes, and equipment.

The Need

Although several DoD programs already are designed to reduce weapons system ownership costs, none addresses the modernization of field maintenance and repair technology. As a result, the productivity, efficiency, and quality of field maintenance activities often suffer from obsolete or outdated technology. (One of the

best indicators of that situation is the high rate of unnecessary removals of assemblies and components currently being experienced by the Military Services. Appendix D discusses those rates in more detail and makes the case that substantial improvement is required.) For the most part, DoD's existing maintenance management process simply overlooks the need for a systematic approach to modernizing field maintenance and repair technology. While the DoD invests in the development of such technology, supplementing developments in private industry, advanced maintenance and repair technologies are typically fielded only with new major weapons systems; those technologies are then limited to the support specific to that new weapons system. Seldom are the advantages of applying those same maintenance and repair technology advances to fielded weapons systems assessed. As a consequence, modernization of the support technology for weapons systems that may have been fielded as long ago as 20 or 30 years is the exception, not the rule.

The DMART Program is designed to fill this management void. It does not duplicate any existing DoD-wide program; rather, it supplements those programs by offering: *systematic transfer (i.e., application) of advanced technology into field maintenance activities*. As such, the DMART Program fosters or sponsors application of maintenance technologies that have already been developed and demonstrated, either under DoD sponsorship [such as the Manufacturing Technology (ManTech) or Logistics R&D] or by private industry.

The DMART Program supports Executive Order 12552, "Productivity Improvement Program for the Federal Government," 25 February 1986, which is an integral part of the President's Management Improvement Program, "Reform 88". This productivity improvement program [as outlined further in Office of Management and Budget (OMB) Bulletin 86-8, 28 February 1986] sets a goal of 20 percent improvement in productivity by 1992 for all executive agencies, including the DoD. Among the methods and techniques suggested in the OMB Bulletin to improve productivity are technological enhancements, structural and organizational streamlining, method/process improvements, and human resource improvements.

The DoD's Productivity Enhancing Capital Investment (PECI) Program is currently the single major funded program for productivity improvements, but it is focused on substituting capital for labor (primarily in base support operations). As a result, only a few projects sponsored by the PECI Program are aimed at enhancing field maintenance performance. Although the DoD Task Force on Productivity in

Support Operations[1] recommended significant increases in the PECI Program and invigoration of the Value Engineering Program, we believe that the DMART Program is better suited to meeting the weapons support demands than either of those programs. As such, it can be an integral part of DoD's productivity improvement initiatives mandated by OMB and supported by the U.S. Congress.

The Opportunity

Many opportunities exist for improving the productivity, efficiency, capability, and quality of field maintenance. In many areas, however, available technological advancements are not finding their way into the DoD, while in others, the requirements for such advancements are not being surfaced to the appropriate management level. The examples that follow illustrate just a few of the newer technologies with the potential for substantially upgrading field maintenance within the DoD.

Maintenance-Aiding Technology

Various types of electronic maintenance aids have been developed to compensate for shortfalls in built-in automated diagnostics and limitations in technical manuals and facilitation of rapid and accurate fault isolation. Conceptually, those aids may be divided into *prescriptive* aids, which tell the technician what to do; *deductive* aids, which provide the technical information needed by the technician in the decision process associated with troubleshooting; and *hybrid* aids, which include both prescriptive and deductive characteristics. Such aids have been demonstrated successfully for many years, but have not been procured and fielded by the Military Services. Two examples of such aids are described below:

- *NOMAD (Navy On-board Maintenance Aiding Device).* This minicomputer-based system was demonstrated for 18 months aboard the DD-965, during 1981/1982 in support of the Mk 86 Gun Fire Control System. Evaluations by both the Naval Sea Systems Command and the Board of Inspection and Survey were highly favorable (repair times reduced by factor of 2, positive technicians' attitude, considerable potential for improving fleet maintenance performance), but the program was terminated because of lack of funding. A more-advanced microcomputer-based version of NOMAD was subsequently developed by the manufacturer using its own funds, but it has thus far not been bought by the DoD.

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[1]Institute for Defense Analyses, *Report of the DoD Task Force on Productivity in the Support Operations*. 2 vols. August 1986.

- *LOGMOD (Logic Model).* This small, portable device, which uses proprietary software for generating and processing the maintenance dependency chains defined by a hardware design specification, has been demonstrated since the mid-1970's in all Military Services for a variety of weapons systems and subsystems. Those demonstrations invariably showed much improved fault isolation (accuracy and speed), but the aid has not been procured. The powerful software, however, is used by several weapons system contractors for testability analysis applications. DoD-sponsored R&D is in process to develop tutorial software in order to increase the utility and effectiveness of this aid.

Although maintenance-aiding technology has been a favorite R&D topic in the DoD personnel and training community for many years, more emphasis apparently needs to be placed on applying the new technologies.

Information Technology

The automation of technical data "from cradle to grave" (i.e., design, logistics support analysis, technical manuals) is being aggressively pursued under various programs [Logistics R&D, Computer-Aided Logistic Support (CALS), and Military Service-specific programs]. Progress continues to be slow, however. To illustrate, the Navy's R&D program for the automation of technical information (computer-based authoring, distribution, and updating of technical manuals) dates back to 1973, but still has not progressed beyond test and evaluation. Meanwhile, many other opportunities are available to improve the collection, processing, and presentation of maintenance data to enhance maintenance performance. Those opportunities include the following:

- *Maintenance history information.* Providing technicians with convenient and timely access to the maintenance history of supported items can result in significant maintenance performance improvements as demonstrated by the Military Airlift Command's experience with the Automated Maintenance System. Such a system also permits better work scheduling, resulting in improved utilization of maintenance personnel and increased productivity. This potential has been recognized at several intermediate maintenance activities in the other Military Services as well, resulting in local initiatives to install personal computer-based systems to meet local needs. Since no institutional mechanisms for exchanging information on, and exporting the products of, such local initiatives exist, there is much duplication of effort (software design and development) and uneven use of available technology (some systems are more effective than others).

- *Monitorship of ATE status and performance.* Automated test equipment (ATE) and test program sets (TPSs) are expensive maintenance tools that are subject to many performance problems. Close monitoring is required to identify those problems, diagnose causes, and implement corrective actions. The ATE computer can be used for this purpose because its utilization, at least that of the large-scale ATE typical of the intermediate maintenance activities in the DoD, is low. Thus, that computer can generate a daily log of ATE status and TPS performance as an input into a centralized ATE management system. None of the Military Services, however, has installed such a system.

- *Modernization of calibration system administration.* Administering the calibration of test equipment is a large enterprise that has been partially automated in each of the Military Services. That automation includes the establishment of data bases, the generation of recall schedules, and the feedback of calibration results to update calibration intervals. Further improvements, however, are possible by replacing the calibration labels with erasable, programmable read-only memory (EPROM) chips that contain the identification and relevant history of each test instrument. That technology has been available for some time.

Nondestructive Evaluation Technology

Nondestructive evaluation (NDE) technology refers to the techniques and methods used for evaluating the "health" of a piece of equipment or materiel. It is also essential to the effective implementation of reliability-centered maintenance. Many conditions indicate that the NDE technology in the field today needs to be modernized to stem the evacuation (to higher maintenance echelons) or throwaway of good parts, to reduce maintenance burden (by lengthening inspection intervals and reducing inspection time), and to improve maintenance effectiveness and efficiency. Three examples follow:

- *Wear metal detection (on-equipment).* The standard system for monitoring the condition of oil-wetted components installed in all aircraft and helicopters consists of filters, chip detectors, and cockpit-mounted warning indicators. The system installed in the Army's helicopters has several shortcomings (Appendix D presents more details). A much-improved system (using different filtration and "burn-off, flow-through" chip detectors), developed and tested by the Applied Technology Laboratory, resulted in the elimination of "false alarms," but the improved system has not been installed.

- *Wear metal analysis (off-equipment).* Spectrometric and ferrographic oil analysis is a standard DoD-wide NDE technique for the periodic inspection and analysis of oil in oil-wetted components (engines, transmissions,

gearboxes) to provide timely warning of pending failures. One longstanding problem with this type of analysis is that it is performed at only a few fixed-site oil analysis laboratories in each Military Service, often with excessive turnaround time. The Air Force and the Navy jointly sponsored development of portable metal analyzers for use on-site at intermediate maintenance activities. The Air Force has programmed a buy of 200 of those analyzers; the Army, which stands to gain the most from such a capability, has not yet programmed purchase of this equipment.

- *Metal fatigue detection.* Many of the available techniques for detecting fatigue cracks at intermediate maintenance activities are inadequate. New and proven techniques, such as ultrasonics, are readily available. They also have the potential for eliminating unnecessary returns to depot maintenance, extending equipment operating time, and preventing equipment damage or accidents.

Repair Technologies

Continuous advances are being made in repair technologies in all areas (metal, electronics, composites, mechanical, materials), but their applications lag in the DoD. Two examples are:

- *Laser technology.* After many years of R&D, laser technology has sufficiently advanced to be suitable and affordable for use in repair applications. Lasers are primarily used for cutting, drilling, welding, and surface heat treatment. Some applications are just beginning to be introduced at the depot level, but none is currently planned or programmed for the intermediate level even though the laser equipment is now available in a format suitable for the field (small dimensions, truck-mountable). Furthermore, the technology shows considerable potential for battle damage repair applications in the Army and Navy.

- *Shape memory metal.* This material was rediscovered under the Air Force's Logistics R&D Program, which is currently promoting its application both to field expedient repairs (e.g., tube fittings and connectors) and in original equipment design.

STRUCTURE OF THE DMART PROGRAM

Program Focus

The DMART Program is designed to stimulate the Military Services to implement field maintenance improvements. It does so by overcoming the two major impediments to making the improvements: *lack of information* and *lack of funding*.

The first impediment, lack of information, is characteristic of the present conditions under which field-level maintenance is performed. With few exceptions, maintenance performance systems focus on end-item deficiencies, not repair technology shortfalls. As a result, needed improvements in maintenance and repair technologies are either not recognized by the performing activities or not communicated to higher levels. Furthermore, there is no DoD-wide system or mechanism for systematically identifying maintenance technology advances that are applicable to DoD field maintenance activities.

Lack of funding is characteristic of the low-priority accorded weapons system support in the planning, programming, and budgeting process. In that process, readiness and sustainment budgets typically do not receive the same level of support as new weapons system acquisitions.

The DMART Program approach to alleviating these two fundamental impediments is to establish: (1) a maintenance technology information network that provides information on maintenance technology opportunities and needs, and (2) a fenced pool of funds to pay for selected field maintenance technology modernizations. The balance of this chapter presents the DMART Program management structure needed to eliminate the two major impediments.

Management Structure

To meet the day-to-day management, execution, and promotion responsibilities of the DMART Program, a separate program office is required. The program office should be staffed by a director and six full-time staff members, with the program director reporting to the Director, Maintenance Policy, under the overall guidance of the Deputy Assistant Secretary of Defense (Logistics) [DASD(L)].

The DMART Program Office, in coordination with Defense Agencies, Military Services, and Joint Service organizations, should be charged to seek information on new maintenance technologies, identify implementation opportunities from development and demonstration efforts under other programs, and avoid duplication of effort and projects. Additionally, it should establish communication channels and coordination procedures with the DMART coordinating offices established in the Military Services to ensure effective coordination, facilitate technology information

dissemination, and expedite project identification and implementation. The various lines of coordination are shown in Figure 1.

Since the cooperation and participation of the Military Services are crucial to the success of the DMART Program, the Military Services should be given a key role in the development of DMART Program policies and procedures. Their cooperation and participation might be best ensured by having DMART Program policies and procedures developed by the Defense Maintenance Action Group and reviewed/ approved by the DoD Maintenance Review Council in accordance with the provisions of DoD Instruction 4100.40.

Weapons Systems Maintenance Reviews

The maintenance reviews of fielded weapons systems represent a key vehicle for the DMART Program to identify opportunities for maintenance improvements. As described in Appendix B, current procedures for the integrated logistic support (ILS) review of a new weapons system during acquisition are well established, but further review seldom occurs after the system is fielded. The maintenance review process for the DMART Program thus entails a significant departure from current practices. To ensure its success, the benefits of the reviews must be constantly emphasized, i.e., improvement opportunities for potential sponsorship by the DMART Program must be identified.

Although the Weapon Support Improvement Group (WSIG) has the lead responsibility within the Office of the Secretary of Defense (OSD) for ILS review of new weapons systems, the maintenance reviews of fielded systems should be the primary responsibility of the Maintenance Directorate (MD). The DASD(L) should establish the formal working relationships and interface between WSIG and MD, including a formal "hand-off" of weapons system maintenance support oversight analogous to that which occurs in the Air Force. The same office that provides analytic support to WSIG, the Weapon Support Improvement and Analysis Office, should provide similar support to MD as needed for weapons system maintenance reviews. The DMART Program Office should be involved in the process only when questions of maintenance technology are raised.

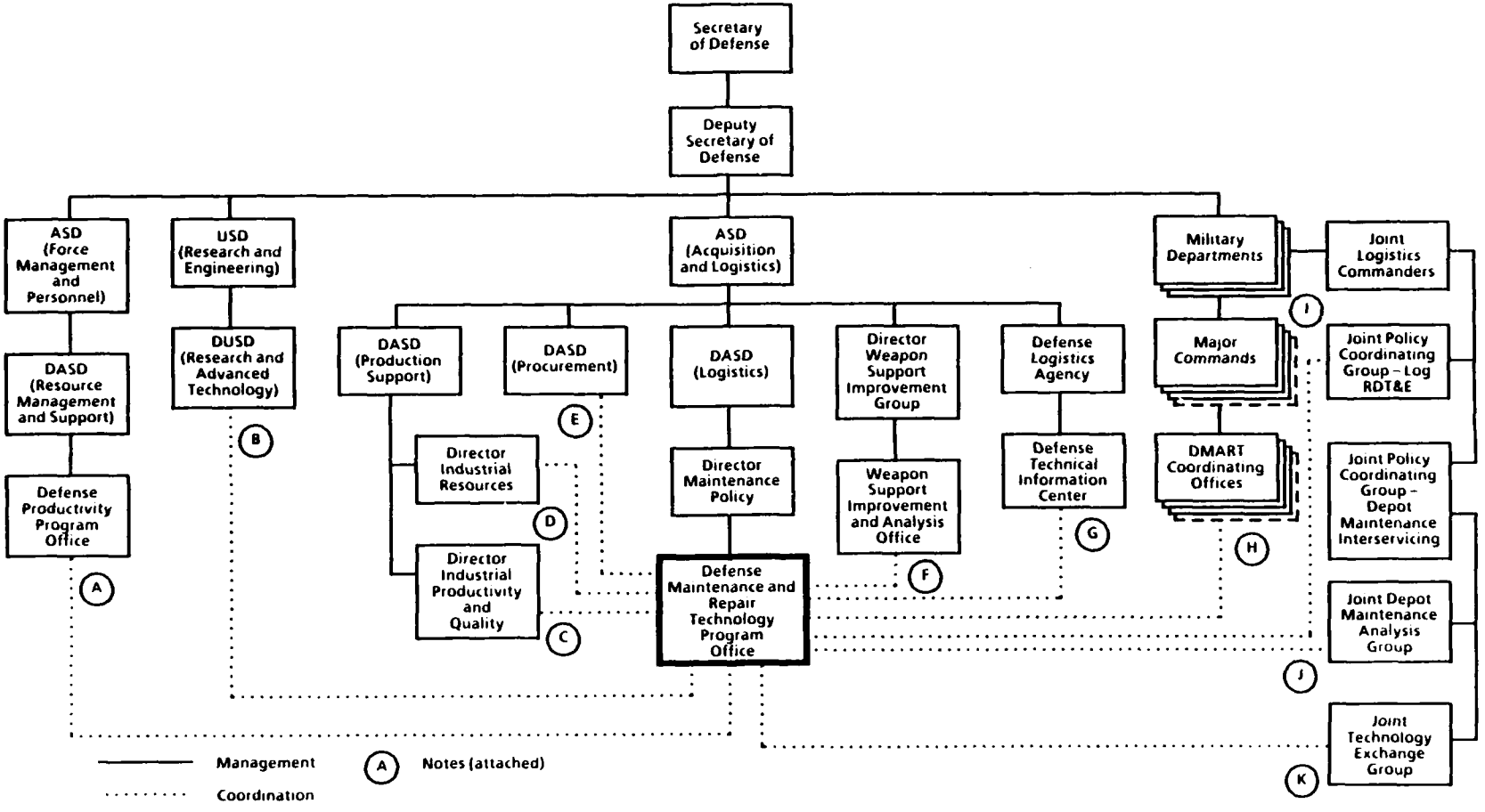

FIG.1 DMART PROGRAM OFFICE RELATIONSHIPS

Notes on DMART Program Office Relationships (Fig. 1)

A – Coordination required with the Defense Productivity Program Office to avoid duplication with projects funded under the Productivity Enhancing Capital Investment Program.

B – Coordination required with the Deputy Under Secretary of Defense (Research and Advanced Technology) to keep abreast of developments in the Very High Speed Integrated Circuit Program so the maintenance implications of these developments can be exploited early; to obtain Independent Research and Development technology information about potential ideas for maintenance improvements; and to identify ideas from the Software Technology for Adaptable, Reliable Systems Program which may have applicability to software maintenance.

C – Coordination required with the Director, Industrial Productivity and Quality to take advantage of those production technologies implemented by the Industrial Modernization Incentive Program which have applicability to repair processes; to keep abreast of relevant initiatives of the DoD/Defense Industries Quality Excellence Program; and to ensure that DMART and Value Engineering Programs remain complementary.

D – Coordination required with the Director, Industrial Resources to identify emerging depot-level manufacturing and repair technologies developed under the Manufacturing Technology Program which have applicability to field-level maintenance (includes coordination with the Manufacturing Technology Advisory Group).

E – Coordination required with the Deputy Assistant Secretary of Defense (Procurement) to identify ideas developed under the Small Business Innovative Research Program which could be implemented in the field maintenance environment.

F – Coordination required with the Weapon Support Improvement and Analysis Office to identify and implement advanced technology ideas, developed and demonstrated under the Logistics R&D Program, with application to field maintenance diagnostics, automated technical information, and logistics systems.

G – Coordination required with the Defense Technical Information Center to take advantage of its technology collection, cataloging, abstracting, and dissemination capabilities.

H – Coordination required with DMART Coordinating Offices to facilitate technology dissemination, field-generated project proposals, and other DMART Program communications.

I – Coordination required with the Joint Policy Coordinating Group – Logistics RDT&E [Research, Development, Test and Evaluation] to identify and implement ideas, developed under the Military Services' Logistics R&D programs, applicable to field maintenance.

J – Coordination required with the Joint Depot Maintenance Analysis Group to facilitate communication on depot maintenance analysis and to keep abreast of emerging technologies with future potential application to organic depots.

K – Coordination required with the Joint Technology Exchange Group to identify near-term ideas from the Technology Information System which may have applicability to field maintenance.

With regard to procedural aspects of the reviews, the following steps are necessary:

- The DASD(L) should request the Military Services to assess their current procedures for the logistic review of fielded weapons systems and to broaden the scope of those procedures to include a persistent search for product and support improvements to increase the combat potential of fielded weapons systems. [The Air Force's recently developed weapons system master planning process (see Appendix E) may serve as a model for the reviews.]

- As chair of the DoD Maintenance Review Council, the DASD(L) should invite the Military Services to join in the establishment of a DoD task group to develop guidelines for the quantitative measurement and assessment of maintenance performance.

- In the development of those detailed guidelines, MD should conduct a series of pilot reviews employing various maintenance performance criteria and evaluation measures and soliciting comments and ideas from weapons system managers. (An outline of such a pilot review is provided in Appendix B.)

- Following approval and promulgation of the maintenance performance measures (possibly in the form of a DoD manual), MD should conduct the maintenance reviews on the basis of an annually published schedule, prepared in coordination with the Military Services.

In the long run, OSD should reevaluate the need for those maintenance reviews. Right now, they are necessary because postdeployment logistics support management has been neglected. Once the review process has become institutionalized as a standard operating procedure with the requisite scope and level of detail, there may no longer be a need for OSD reviews. The maintenance review will simply evolve into a procedure whereby the Military Services identify support improvements and nominate candidate projects for DMART to implement those improvements. Thus, while the need for the DMART Program as a technology transfer management tool will still exist, the maintenance review process, as an integral component of that program, should be deemphasized once it has been successfully implemented.

Technology Information Exchange Network

Since the DMART Program Office will serve as the DoD focal point for field maintenance and repair technology information and transfer, it should have the following capabilities:

- Access to maintenance-related technology information
- Dissemination of that information to potential users
- Coordination of information on technology needs from users.

The first capability can be achieved by establishing an information-processing system with access to the multiple data bases that include maintenance-related technology information. Most of those data bases, such as the Defense RDT&E On-Line System and DoD Information Analysis Centers,[2] may be accessed through the Defense Gateway Information System, an "intelligent gateway" processor for bibliographic retrieval and processing, recently established and operated by the Defense Technical Information Center. The DMART Program Office requires an information processing system that parallels the Technology Information System being developed for the Joint Depot Maintenance and Analysis Group (JDMAG). Although the focus of the DMART Program is on field maintenance and that of the JDMAG is on depot maintenance, their efforts should be combined to capitalize upon the overlap in technologies.

The second capability, dissemination of technology information, can be achieved by establishing DMART coordinating offices at the various echelons of maintenance management within the Military Services and establishing communication channels between the DMART Program Office and the coordinating offices as well as among those offices. This communication does not need to be online. For example, summary descriptions of suitable maintenance technologies, screened by the DMART Program Office, could be circulated in hard-copy format.

The third capability, coordination of information on technology needs, can be achieved by utilizing the same network of DMART coordinating offices as that used for technology information dissemination, but in the opposite direction. Thus, the

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[2]The DoD currently has 12 information analysis centers: metals and ceramics, metal matrix composites, nondestructive testing, plastics, guidance and control, chemical propulsion, survivability/vulnerability, manufacturing technology, reliability, software, infrared, and high-temperature materials.

DMART Program Office would distribute information on maintenance technology needs to the appropriate R&D programs, such as Logistics R&D Program, Small Business Innovative Research Program, ManTech, and Value Engineering.

Centers of Maintenance Technology Expertise

To facilitate the transfer of maintenance technology from the laboratory to the field, the concept of "center of expertise" should be applied. Under that concept, maintenance technologies would be grouped into technology areas, with DMART coordinating offices assigned lead responsibility for specific technology areas. That responsibility should include monitoring developments as well as needs in the assigned technology area and becoming the DoD-wide expert in that technology area, tapping the expertise from industry and academia as needed. This approach frees the DMART Program Office to focus on program and project advocacy, coordination, project selection, project implementation monitoring, and information dissemination on project results. DMART coordinating offices should be primarily responsible for tracking maintenance technology, disseminating information on emerging maintenance technologies, collecting information on technology needs, and proposing candidate projects for implementation under DMART sponsorship.

NEXT STEPS

This section outlines the steps necessary to implement the DMART Program.

Acting on Implementation

Successful implementation of the DMART Program will require a strong commitment from OSD and the Military Services. The implementation steps are numerous and varied. They include:

- Issuing a charter for the DMART Program and an implementing a DoD Instruction
- Establishing organizational responsibilities and working relationships among DMART Program Office, other DoD programs, JDMAG, and DMART coordinating offices within the Military Services
- Revising DoD policy to formalize a systematic review process for fielded weapons systems

- Developing a DoD manual on the quantitative measures for assessing maintenance performance
- Providing the resources to execute the program, including staffing the program office and decentralized coordinating offices, developing the information systems, and preparing the technology transfer consulting arrangements
- Developing a DMART Program Guide setting forth the operating procedures, project eligibility and selection criteria, monitoring methods, and project evaluation documentation requirements.

We recommend that OSD evaluate the DMART Program over a 3-year trial period. That period should be adequate to refine policies and procedures, to resolve funding problems, to phase in program staffing, and to get a better insight into the organizational structure and working relationships best suited to effective technology transfer. The trial will also provide a quantitative benchmark of the cost reduction achievable from exploiting advanced maintenance and repair technology. In order to generate valid and reliable results, the program should focus upon a specific weapons system commodity. We recommend the pilot test of the DMART Program be restricted to aircraft, with the purpose of the test ("assessing the effectiveness of the program as an overall strategy for exploiting opportunities offered by advancing, 'off-the-shelf' maintenance technologies to reduce the support costs of fielded weapons systems") clarified at the outset.

Obtaining Top Management Support

To be successful, the DMART Program must be supported strongly by the top levels of OSD. As an expression of that support, we recommend the DMART Program be launched through a memorandum signed by the Deputy Secretary of Defense.

Building a Constituency for the Program

An equally vital step is selling the program to the Military Services in order to develop a cooperative attitude toward the program among the various echelons of maintenance managers as well as its potential users. Without that constituency, the program will fail even if it gets top-level management support.

We recommend an early involvement of the Military Services in the development of plans, policies, and procedures for program implementation. In particular, four issues should be determined largely on the basis of joint-Service review and analysis:

- Identification of maintenance technology areas and assignment of associated centers of expertise
- Development of guidelines for quantitative maintenance performance measurement and assessment
- Establishment of a standard process for reviewing the maintenance support of fielded weapons systems
- Agreement on DMART project eligibility criteria.

A suitable format for such joint efforts might be the formation of working groups tasked by the Defense Maintenance Action Group, as established by DoD Instruction 4100.4.

Resolving the Funding Issue

The DMART Program should be a funded program. However, it should not be permitted to evolve into a program that is routinely tapped for the replacement or modernization of support equipment. Similarly, it should not be an R&D program to demonstrate new repair technologies; implementing those technologies is DoD's problem. Thus, the DMART Program should be focused on sponsoring the implementation of selected new repair technologies with significant potential for reducing maintenance burden (support cost and/or maintenance manpower) as well as enhancing maintenance productivity.

We believe that the best long-term solution to the funding issue is the establishment of a separate fund for the DMART Program, whereby the Military Services reimburse the program, whenever practical, for the up-front investment from achieved savings, based either on audited savings or on a standard payback formula. This approach would limit program sponsorship to useful projects, ensure user commitment to implementation, and provide a built-in incentive to monitoring implementation and evaluating project results.

In the near term, however, we recommend that funding for the DMART Program be pursued through the PECI Program. Although the objectives of the

PECI Program are similar to those we propose for the DMART Program, the PECI Program supports only a few field maintenance projects. We believe this oversight needs to be corrected. One way to do so would be to examine the feasibility of setting aside a portion of PECI funds for field maintenance projects, with the DMART Program Office coordinating the allocation of those funds.

Getting Organized

Many of the DoD programs aimed at reducing weapons system ownership costs include projects or ideas that are of potential interest to a wide range of organizations (including maintenance activities). The coordination among the many programs and the dissemination of information from those programs need continued management emphasis. The DMART Program will help alleviate this problem by including the various program data bases (in computer-based form and/or hard-copy format) in its technology information exchange network.

Within OSD, MD should brief the DMART Program to all DASDs who sponsor similar programs, including ManTech, Value Engineering, Small Business Innovative Research, PECI, and Logistics R&D, to mention the most relevant ones. Further, MD should become more involved in those programs as a champion for maintenance productivity.

To develop the required communication channels with maintenance management and maintenance engineering organizations within the Military Services, MD should work through the Joint Logistics Commanders and the various Joint Policy Coordinating Groups to establish a network of DMART coordinating offices and to develop procedures for DMART Program administration and management. MD should also revise DoD Directive 4151.16 and DoD Instruction 4000.26, in particular, to establish the maintenance review process and procedures for fielded weapons systems and to detail the quantitative measures for assessing maintenance performance.

The first task of the DMART Program Office should be preparation of a DMART Program Guide outlining the management and administration of the program, including project eligibility, selection criteria, and reporting requirements.

Conducting the Trial Program

All of the above actions are in preparation for launching the program. They should be completed before the 3-year trial period begins so that no further delays are incurred in executing the program. During the first year, a number of maintenance reviews should be conducted to refine the maintenance review process and to initiate the systematic generation of candidate projects. Those reviews should be supplemented with proposals generated through the DMART coordinating offices. The most promising candidate projects should be selected for DMART support and implemented as expeditiously as possible, given the available funds. During the next 2 years, additional projects should be implemented and the benefits of earlier projects monitored. The DMART Program Office should also implement the procedures established for maintenance technology review and dissemination and broker the information on maintenance technology needs to the various R&D programs designed to address them.

At the end of the trial period, the DMART Program should be evaluated for the ASD(A&L). We believe that the evaluation should be in two parts. One part, the responsibility of the DMART Program Office, should summarize the quantitative results of the program, based on an economic analysis of the projects that have been implemented. The second part, the responsibility of the Military Services, should present a qualitative assessment of the program, i.e., the effectiveness of the program as an overall DoD strategy for maintenance technology transfer.

Based on that two-part evaluation, the DMART Program should either be terminated or transitioned into a permanent program with appropriate resources and staffing.

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In September 1985, the Assistant Secretary of Defense (Acquisition and Logistics) charged the Director, Maintenance Policy, to establish a maintenance research and development program aimed at stemming or reversing Department of Defense's escalating maintenance burden. The Defense Maintenance and Repair Technology (DMART) Program was developed in response to that charge.

The DMART Program is designed to reduce the field maintenance cost of weapons systems by exploiting advances in repair technologies and processes, modernizing maintenance facilities and equipment, improving utilization of support resources, and promoting prime equipment reliability and maintainability improvements. Its principal features include systematic identification of opportunities for field maintenance improvements, selection and funding of projects to implement those improvements, and dissemination of maintenance technology information, including the results from implemented projects.

Volume I of this report presents an overview of the DMART Program; describes why such a program is needed, and identifies the steps to implement the program. Volume II provides background material and supporting documentation for the DMART Program.

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