

**ASSESSMENT OF UNITED STATES ARMY ENVIRONMENTAL QUALITY  
RESEARCH, DEVELOPMENT, AND ACQUISITION (EQ RDA)  
Application of Opportunities from Defense and Army Acquisition Reforms**

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## 1. ABSTRACT

Over the next six years the Army expects to pay more than \$8.7 billion dollars to remediate contaminated lands and to mitigate outdated industrial and troop installation operations. These high costs have had and will continue to have significant impact on the availability of resources for operations, modernization and procurement of critical warfighting materiel, and training lands. Environmental costs therefore represent significant opportunity losses for Army Readiness.

The Secretary of the Army and the Chief of Staff of the Army promulgated the "Army's Environmental Strategy into the 21st Century" to drive environmental sustainability as a tool for maintaining Army Readiness. However, serious limitations of available environmental technologies are hampering that Strategy. The Army has invested substantially in environmental quality research, development, and acquisition (EQ RDA) to modernize its environmental technologies. Unfortunately, that effort has had little strategic pay-off and the Army remains far from reaching its goal of environmental sustainability.

This study represents a comprehensive assessment of the management practices the Army has used in the past to conduct EQ RDA. It contains the perspectives of key stakeholder elements of the Army Secretariat and Army Staff. Additionally, conclusions draw on the expertise available in the Tri-Service EQ RDA arena, the Defense Acquisition University, and the Office of the Deputy Undersecretary of Defense for Environmental Security. Several useful management tools proven highly effective in Defense and Army Systems RDA programs are recommended for EQ RDA implementation. These tools will ensure greater returns on Army R&D investments and facilitate meeting Army sustainability goals.

## 2. ACKNOWLEDGMENTS

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The views presented in this document do not necessarily reflect the policies or views of the respective institutions or staffs cited above or in the text of the report.

### 3. EXECUTIVE SUMMARY

#### 3.1 Statement of the Problem

The Army Environmental Program expects its costs to be more than \$8.7 billion dollars over the next 6 years for mandatory environmental cleanup and compliance actions. These costs will likely escalate over the longer term due to unprogrammed needs for staff and resources that arise from changing environmental and operational conditions. These high costs have had and will continue to have significant impact on the availability of resources for operations, modernization, and procurement of critical warfighting materiel, and training lands. Environmental costs represent significant opportunity losses for Army Readiness. Recently, the Army's Senior Environmental Leadership challenged environmental policy-makers and managers at all levels of the Army to implement strategies to prevent or mitigate the continuing effects of these environmental costs.

The Army's 1992 Environmental Strategy for the 21st Century set goals and objectives for the Army Environmental Program. Modernization of environmental technology to reduce costs and 'greening' of Army industrial operations are key aspects of the Army's strategy to reduce environmental costs, improve environmental health and the health of Army communities, and sustain Army Readiness.

The Army manages its EQ research, development, and acquisition (EQ RDA) mission very differently from nearly every other type of modernization program. Existing Systems acquisition policies prescribe doctrine for centralized program management of research and development (R&D) to ensure streamlined operations, effective risk management, and strategic outcomes that provide the essential enhancements to warfighting capabilities. In contrast, EQ RDA has largely been managed from a more tactical, or site-by-site, approach. This has worked satisfactorily for relatively low risk proven technologies. However, the increasing need for innovative, unproved technologies and associated uncertainties regarding costs, benefits, and liabilities have made this decentralized management approach untenable and unresponsive to the Army's needs.

Management of EQ RDA programs by DoD and the Services was the subject of several past audits by the General Accounting Office and the Defense Science Board. Recommendations focused on organizing for efficiency, improving strategic planning, and consolidating program management. These recommendations reflected agreement that acquisition and implementation of environmental technologies have not met DoD's needs. The Office of the Secretary of Defense (OSD) since has consolidated Tri-Service environmental technology RDA and installed specific program directors and management committees to manage technology base and Demonstration and Validation EQ R&D. The Army enhanced its Environmental Quality Technology (EQT) Program to provide more effective oversight and direction of technology base R&D. In addition, it indicated its broad intent to foster technology demonstrations and implementation.

This study was conducted to assess possible causes of past limited successes by the Army to research, develop, and implement innovative environmental technologies.

Application of policy, management, and acquisition strategies guided the investigation specifically. Policy recommendations to the Army Secretariat to realize accelerated and cost-effective EQ RDA was a primary objective.

### 3.2 Approach

The approach taken for this study used organizational interviews and conferencing techniques to obtain mission and process-oriented information. Questions were developed to identify conditions under which the Army (historically and presently) defines strategic environmental technology needs and then plans, programs, and executes missions to resolve those needs. Work groups of stakeholder representatives then identified major shortfalls and assisted in the development of policy options and recommendations to fix those shortfalls. As a benchmark of efficient and effective RDA, this study used Army Acquisition Policy and its established practices and outcomes of the recent Defense Acquisition Reform initiative.

Data sources included Government reports, testimonies, and publications; regulations and other policy documents; and interviews with leaders of stakeholding organizations. Department of the Army (HQDA) stakeholders were identified as the Office of the Assistant Secretary of the Army for Installations, Logistics, and the Environment (OASA(IL&E)), the Office of the Assistant Secretary of the Army for Research, Development, and Acquisition (ASA(RDA)), the Office of the Assistant Chief of Staff for Installation Management (OASCIM) and its Field Operating Agency, the U.S. Army Environmental Center, the United States Army Corps of Engineers (Military Programs) Directorate of Research and Development, and the United States Army Acquisition Pollution Prevention Support Office.

### 3.3 Major findings and conclusions

Findings of this study indicate a need to improve several of the practices the Army currently uses to manage EQ RDA if it is to meet key strategic environmental objectives. Past enhancements to the EQT Program, while beneficial, have not provided the incentives and strategic planning tools needed to ensure positive and strategic EQ RDA outcomes.

3.3.1 Finding 1. Management of strategic EQ RDA remains fragmented across multiple and largely autonomous Army organizations and funding programs. This decentralized management paradigm has established both reward and command and control incentives for EQ RDA performers that favor strongly the accomplishment of local, lower priority tasks instead of strategic, higher priority ones. The present Army EQT Program, while being the Army's only strategic platform for EQ RDA, is encumbered in its ability to leverage these organizations and funding programs to effect strategic Army outcomes.

3.3.2 There are significant ramifications and implications of this situation.

- The EQT Program clearly does not guide, direct, or oversee all of the EQ RDA missions and organizations the Army now sustains and supports.

- Due to existing reward incentives, EQ RDA organizations will remain responsive to the needs of external customers instead of the strategic needs and priorities of the Army EQT Program. The needs of those customers are not coincident with the highest priority needs of the Army. Absent strategic command and control incentives, namely centralized program authorities, EQ RDA progress will likely follow the intents and directions of a multitude of decentralized, operational commands.

- Without substantial and immediate improvements in EQ RDA management, the Army will not achieve satisfactory payoffs of its R&D investments. Consequently, it very likely will fail to meet technology objectives prescribed in its Environmental Strategy and as recently emphasized by the Army's Senior Leadership.

3.3.3 Finding 2. Present EQ RDA practices currently do not drive the minimum strategic analyses and decisions needed to effectively manage risks and ensure maximum return on the Army's RDA investments. Building programs that are well defined, efficiently structured, and adequately designed is required.

### 3.4 Recommendations

- Enable strategic EQ RDA outcomes by applying proven incentives that reward and compel RDA performers to concentrate efforts on the Army's highest priority EQ needs. The intent of this recommendation is to consolidate program management and funding authorities. Consolidation is necessary to provide explicit responsibilities and authorities for exploiting science and technology outcomes in a manner that ensures efficient and effective implementation of strategic EQ solutions.

- As a way to establish and sustain greater returns on RDA investments and meet Army user needs, implement strategic program and investment planning concepts, ensuring integrated approaches to program definition, structure, and design. The intent of this recommendation is to establish and sustain comprehensive, integrated planning, programming, and execution of EQ RDA with continuous participation by all stakeholders.

### 3.5 Summary

Current practices and processes for accomplishing EQ RDA need to be improved if the Army is to meet objectives of its Environmental Strategy and those of the Army Senior Leadership. Technology acquisition is a highly complex, high-risk venture that requires maximum integration among a great number of functions. This is particularly critical if those functions are performed by a number of different organizations.

Strategic outcomes require special technology acquisition management tools. Such tools are available for defining and calibrating operational requirements, for structuring technology development programs to succeed despite numerous inherent risks, and for designing these complex programs such that key stakeholder perspectives are 'built-in.' In fact, refinement of many of these tools was the objective of recent reforms in the Defense Acquisition community and its driving policies.

Implementation and tailoring of these tools for use by the Army's EQ RDA process could mitigate current technology implementation risks as well as other risks to strategic outcomes. Without improvements in the processes the Army now uses to manage EQ RDA, strategic outcomes prescribed by the Army's Environmental Strategy and its Senior Environmental Leadership are not achievable.

Recommendations developed by this study focus on consolidating the management and authority over tasks and funding to establish incentives that compel RDA performers to concentrate on strategic Army needs. In addition, the Army EQT Program needs to implement strategic planning practices as way to ensure effective risk management and mitigation. Reasonable approaches to improving current EQ RDA conditions are possible. Defense and Army acquisition policies and practices offer several well-established practices and management concepts that are proven effective and efficient. Failure by the Army to take meaningful action will likely sustain management approaches under which outcomes do not justify continued R&D investment. Such *status quo* approaches will result in increased risk that the Environmental Program will fail to meet DoD and Army strategic goals.

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## 6. LIST OF ACRONYMS

AAPPSO	US Army Acquisition Pollution Prevention Support Office
ACSIM	Assistant Chief of Staff for Installation Management
AEC	Army Environmental Center
AEPI	Army Environmental Policy Institute
AMC	Army Materiel Command
APB	Acquisition Program Baselines
AR	Army Regulation
ARDEC	Armaments Research Development and Engineering Center
ARL	Army Research Laboratory
ARO	Army Research Office
AS/IRP	Active Site Installation Restoration Program
ASA(RDA)	Assistant Secretary of the Army for Research, Development, and Acquisition
ASA(IL&E)	Assistant Secretary of the Army for Installations, Logistics, and Environment
BRAC	Base Realignment and Closure
CAC	Command and Control
CE	Civil Engineering
CoE	Army Corps of Engineers
DAU	Defense Acquisition University ,
DEMVAL	Demonstration/Validation
DEP	Director, Environmental Program
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program ,
DoD	Department of Defense
DoDI	Department of Defense Instruction
DSB	Defense Science Board
DSMC	Defense Systems Management College
DUSD(ES)	Deputy Under Secretary of Defense (Environmental Security)
EG&S	Environmental Good and Services

EQ RDA	Environmental Quality Research, Development, and Acquisition
EQ/CE	Environmental Quality/ Civil Engineering
EQSMO	EQ Systems Management Office
EQSOM	Environmental Quality Systems management Office
EQT	Environmental Quality Technology
ESTCP	Environmental Security Technology Certification Program
ETIP	Environmental Technology Implementation Program.
FORSCOM	U.S. Army Forces Command
FUDS	Formerly Used Defense Site
FY	Fiscal Year
GAO	General Accounting Office
HQDA	Headquarters, Department of the Army
IPPD	Integrated Product and Process Development
IPR	In-Process Reviews
IRP	Installation Restoration Program
IPT	Integrated Product Team
JEMP	Joint Engineers Management Panel
MACOM	Major Command
MDA	Milestone Decision Authority
MDEP	Management Decision Package
MNS	Mission Needs Statement
NDCEE	National Defense Center for Environmental Excellence
O&MA	Operations and Maintenance, Army
OASA(IL&E)	Office of the Assistant Secretary of the Army for Installations, Logistics, and the Environment
OASA(RDA)	Assistant Secretary of the Army for Research, Development, and Acquisition
OASCIM	Office of the Assistant Chief of Staff for Installation Management
ODEP	Office of the Director of Environmental Programs
OEW MCX	Ordnance and Explosives Waste Mandatory Center of Expertise

ORD	Operational Requirements Documents
OSD	Office of the Secretary of Defense
OT&E	Operational Testing and Evaluation
PEP	propellents, explosives, and pyrogenics
PM	Program Manager
POM	Program Objective Memorandum
PPBS	Planning, Programming, and Budgeting System
PTT	Pillar Technology Teams
R&D	Research and Development
RDEC	Research Development and Engineering Centers
RDTE	Research, Development, Test and Evaluation
RI/FS	Remedial Investigation/Feasibility Study
ROI	Return on Investment
RPM	real property maintenance
S&T	Science and Technology
SBA	Small Business Administration
SCAPS	Site Characterization and Analysis Penetrometer System
SERDP	Strategic Environmental R&D Program
SMO	Systems management office
T&E	Testing and Evaluation
TECOM	Army Test and Evaluation Command
TMP	Technology Monitoring Program
TNS	Technical Needs Survey
TRADOC	U. S. Army Training and Doctrine Command
USABRDL	US Army Biomedical Research and Development Laboratory ,
USACHPPM	US Army Center for Health Promotion and Preventive Medicine
USAF	United States Air Force
USN	United States Navy
UXO	Unexploded Ordnance
VENC	Environmental Program Account for Compliance
VEPP	Environmental Program Account for Pollution Prevention

## 7. INTRODUCTION

### 7.1 Statement of the Problem

The Army Environmental Program expects its costs to be more than \$8.7 billion dollars over the next 6 years. These costs are programmed to mitigate environmental risks associated with restoration of contaminated lands, compliance with environmental regulations, and achieving environmental quality and sustainability. Most of these costs are mandatory and represent significant opportunity losses for Army Readiness.

Environmental Quality technology modernization, including research, development, and acquisition (EQ RDA) is a critical aspect of the Army's strategy for reducing environmental costs and sustaining Readiness. However, success of EQ RDA in the past for innovative technologies has been limited largely to discrete solutions implemented at discrete sites. Many more 'potential solutions' have failed to move decisively from the technology base, through advanced development, and be implemented Armywide.

### 7.2 Sponsors

The sponsors of this work include the United States Army War College and the Assistant Secretary of the Army for Installations, Logistics, and the Environment (ASA(IL&E)), including its Staff Support Agency, the United States Army Environmental Policy Institute (AEPI). This study report represents the major product of the author's Senior Service College Fellowship to the AEPI, which occurred between August 1995 and June 1996.

### 7.3 Objective

This study was conducted to assess possible causes of past limited successes and to analyze and develop specific policy options for the Army Secretariat to implement EQ RDA management improvements. Benchmarks for success were taken from Defense and Army Acquisition policies and models.

### 7.4 Methodology

This study used various approaches to collect and evaluate data and to develop and analyze recommendations.

Background readings and interviews were conducted between September 1995 and November 1995 to become cognizant of the various Army and DoD EQ RDA participants. Written sources of information included reviews and audits by GAO, Defense Science Board (DSB), Government- contracted and private analysts and authors, and organizational annual reports and numerous internet publications. Interviews were held with knowledgeable representatives of the following organizations: Major Command (MACOM) and Installation Environmental offices (specifically U.S. Army Materiel Command (AMC), U.S. Army Forces Command (FORSCOM), U. S. Army Training and Doctrine Command (TRADOC), Aberdeen Proving Ground, Maryland and Fort Detrick, Maryland) and the Program Management Office at Rocky Mountain Arsenal, Colorado. Interviews were also held with the following Government environmental

technology program activities: Director and staff of the Research and Development Directorate, Army Corps of Engineers (CoE); various CoE past and current R&D investigators and managers; and the Director and managers in the Environmental Technology Division, Army Environmental Center (AEC). Also interviewed were directors and selected staffs of the following organizations: AEPI; Army Pollution Prevention Program, U.S. Army Industrial Ecology Center; Strategic Environmental Research and Development Program (SERDP), the Environmental Security Technology Certification Program (ESTCP); Innovative Technology Program, Huntsville Division and Ordnance and Explosives Waste () Mandatory Center of Expertise (OEWMCX); and the Army Acquisition Pollution Prevention Support Office (AAPPSO). Selected EQT Pillar Technology Team members as well as the following leaders and staffs of Army Secretariat and Army Staff organizations were interviewed: Deputy Assistant Secretary for Environment, Safety, and Occupational Health (DASA(ESOH)) and the Director for Research in the Office of the Assistant Secretary of the Army for RDA (OASA(RDA)); the Acting Director, Environmental Program and Associate Director for Environmental Quality; and the Chief of Requirements, Plans and Priorities, Office of the Deputy Chief of Staff for Operations and Plans. Finally, mission information was obtained from the following organizations through personal interviews: Joint Engineers Management Panel (JEMP), Defense Acquisition University (DAU), the U.S. Army Medical Research and Materiel Command (USAMRMC) and the Medical Systems Integration Office, Fort Detrick, Maryland.

Two off-site group conferences were held in March and April 1996. Conferees collectively reviewed findings of the study, assisted in developing and analyzing various solutions; and assisted in developing proposed recommendations to the Army Secretariat and appropriate Army Staff.

### 7.5 Limitation of work

The following limits to the scope of this study apply:

- This study did not assess the effectiveness of localized, installation-based RDA activities to either resolve local needs or to contribute to the strategic needs of the Army.
- The Office of the Secretary of Defense (OSD) as well as the Departments of the Navy (USN) and Air Force (USAF) each conducts their respective EQ RDA programs. Like the Army, these programs are integrated under the Defense RELIANCE Program. This study made no effort to compare the effectiveness of those programs with that of the Army's or specifically to leverage those programs to improve Army EQ RDA.
- This study did not attempt to baseline the current program to quantify past payoffs and predict future payoffs of environmental technology applications. As reported earlier by other reviews, decentralized and multiple funding and accounting approaches hamper accurate quantitation of resources now expended across individual EQ RDA projects.
- This study did not develop detailed implementation instructions. However, sufficient guidelines, training opportunities, and regulations are available through Army

and Defense Acquisition Policy and through the Defense Acquisition University to afford appropriate implementation information and guidance.

## 7.6 Delineation of Chapters

The Army leadership has challenged the environmental technology community to solve several fiscal and operational needs facing the warfighters. Environmental quality technology research, development, and acquisition (EQ RDA) must be effectively engaged to meet those challenges. Section 8. Background introduces these factors and briefly describes policies, organizations, resources, and processes now in place to accomplish EQ RDA.

Trends and conditions extant in the environmental technology regulatory and business arenas have profound implications on Army capabilities to resolve its users' needs in a cost-effective and timely manner. These trends and conditions are described in Section 9.

Over the past two years, the Defense acquisition community studied extensively, and modernized accordingly, the basic rules it uses to conduct RDA business. Revision of Defense Acquisition Policy and a new toolbox of program management guidelines for accomplishing simplified and streamlined acquisition resulted from this Reform initiative. Section 10 describes outcomes having relevance to this study. Section 11 identifies and describes key findings of this study and links existing EQ RDA practices with benchmark practices used in the Defense and Army Acquisition arenas. Section 12 provides principal recommendations, and possible ways to meet those recommendations, developed from the analysis of the findings of this study.

## 8. BACKGROUND

### 8.1 Environmental Quality Research, Development, and Acquisition (EQ RDA): The Army's environmental technology business

Modernization of defense technologies is intensively managed within the Army. Providing new technologies to the warfighters includes identifying modernization needs, executing R&D if available technologies can not meet the specified needs, producing and fielding resulting systems, and sustaining systems operation (DoD Directive 5000.1). This process of providing new technological capabilities to the warfighters is termed research, development, and acquisition (RDA).

Environmental stewardship and regulatory compliance are becoming major drivers of corporate decisions in American industry. This is true whether a company is a major manufacturing firm, an owner or caretaker of a Superfund site, a major land holder and natural resources consumer, or a corporation that provides Environmental Goods and Services (EG&S) (Piasecki 1995). The U.S. Army is all of the above. In fact, it is one of the country's largest -- in all categories. The Army has an Operations and Maintenance (O&M) budget for FY96 of over \$18 billion. It will procure over \$6 billion in weapons systems, and it will construct over \$470 million in real facilities (Army Budget Office 1995). Army installations are caretakers of over 12.5 million acres of land worldwide and are situated in 578 real properties in the continental United States alone (HQDA 1995). Most importantly from an environmental standpoint, the Army uses those lands in ways that significantly impact associated habitats and physical integrity. Among the larger Army environmental programs is the Installation Restoration Program (IRP), which includes Active Site and Base Realignment and Closure (BRAC) missions. Also quite substantial is the program that funds corrective actions to ensure compliance with anti-pollution, environmental protection, and natural resources conservation laws.

Because of the effect Army operations can have on our environment, costs and investments to improve and maintain environmental quality are not trivial. This year environmental costs are expected to be over \$1.7 billion, or more than 3% of the Army's Total Obligation Authority. Over the period FY96 to FY01, the total restoration and compliance bill to the Army Environmental Program is expected to exceed \$8.7 billion. Over this same period of time, the Army has programmed investments of approximately \$210 million for Research, Development, Testing and Evaluation (RDTE) to accomplish Environmental Quality Research, Development, and Acquisition (EQ RDA).

Environmental technology is a relatively new industry; one expected to reach world-wide sales of \$427 billion by next year (Small Business Administration 1994). This growth in environmental technology business will offer significant opportunities to both mitigate and exploit regulatory and economic impacts on Army readiness. However, these opportunities will appear only if the Army can successfully modernize its environmental technology capabilities. The processes and systems it employs in its EQ RDA programs will determine success or failure in exploiting those opportunities.



## 8.2 Executing the Army's Environmental Strategy for the 21st Century will require efficient and effective EQ RDA for its success.

In 1992, the Army produced its first corporate vision and strategy for environmental quality stewardship and compliance. This U.S. Army Environmental Strategy for the 21st Century has as its desired end-state major improvement in each of four thrust areas, or pillars: environmental compliance, lands restoration, pollution prevention, and resources conservation (Sullivan and Stone 1992). The Strategy defines Army goals and objectives for each pillar, the accomplishment of which largely will be contingent on effective and efficient modernization of current technological capabilities.

According to several sources, including the General Accounting Office (GAO 95-121), current environmental technology limitations impede safe, timely, and cost-effective restoration and compliance actions by DoD. For instance, established 'pump and treat' approaches to eliminating groundwater contamination and manual characterization and removal of contaminated soils are considered too labor intensive, inefficient and ineffective, and expensive. These approaches are expected to drive remediation life-cycle costs upward and schedules outward (GAO 1995b, 1995c, 1995d). Lead-based paint abatement measures and Unexploded Ordnance (UXO) removal can be dangerous operations using existing technologies alone; and manufacture of ammunition and propellants, explosives, and pyrogenics (PEP) is becoming increasingly costly and environmentally unacceptable. Disposal technologies that yesterday we considered 'state of the art' are now becoming increasingly difficult to license with regulators. Surely many of these will go the way of "innovative technologies" of the past, such as the ubiquitous smokestack and the dispensing of hazardous wastes and sewage directly into the nation's waterways.

Because of the impact environmental stewardship and compliance can have on the Nation's military readiness, management of Army environmental programs continues to receive the attention of both external auditing agencies and the Army's senior leadership. The General Accounting Office (GAO) and the Defense Science Board (DSB) recently raised issues about DoD's and the Services' abilities to meet their environmental quality goals. Many of their concerns related to the management of the processes available to modernize environmental technologies (Fields 1995; GAO 1994; GAO 1995b, GAO 1995c, GAO 1995d). While these recommendations were not specifically addressed to the Army, they contained clear implications about the Army's need to improve practices. Specifically:

- Improve management practices by focusing on military-unique R&D needs and developing strategic plans to meet those needs.
- Consolidate management under a single entity.
- Improve coordination of work to prevent conflicts and duplicative efforts.
- Improve stakeholder involvement.
- Set clear roles and responsibilities and leverage performers more effectively.

- Both the GAO and the DSB addressed funding implications. Briefly, significant increases in funding for R&D are unlikely; however, the Services should expect additional escalation of “must pay” bills. Also, while dollars available for programs are diminishing, stable funding will be essential to future success of environmental missions. The GAO also criticized the multitude of accounts available for environmental funding and the difficulty this poses for measuring program outcomes and the cost of those outcomes (GAO 1994).

### 8.3 The Army Senior Environmental Leadership has called for change.

In November 1995, the Assistant Chief of Staff for Installation Management (ACSIM) hosted members of the Army Senior Environmental Leadership at an Environmental Program Review (Finch 1995). This Review gave Major Command commanders an opportunity to brief their programs and issues and provided the Vice Chief of Staff of the Army a forum for expressing policy guidance. Several challenges were issued that had significant EQ RDA implications.

Over 94% of the Army’s environmental budget for FY96 includes costs required to cover “must pay” bills imposed by law and regulations, and therefore are not available to sustain readiness of the Army. This picture remains relatively constant through Fiscal Year 2001. The Army Vice Chief of Staff told the Army’s Senior Environmental Leadership recently that this situation must be fixed in order to adequately resource Army readiness needs (Finch 1995).

Other Leadership challenges will require the Army change its business approaches:

- Army environmental funding priorities must move from a reactive compliance and restoration focus to a proactive conservation and pollution prevention focus. Spending \$900 Million on installation restoration and paying \$2.5 Million in environmental fines on Army installations annually represent significant opportunity costs to Readiness.
- With Executive Order 12856, Pollution Prevention has now become a “Must Fund” item (Finch 1995). Meeting the objectives of the Executive Order will require more efficient implementation of ‘green’ technologies in our industrial and installation operations.
- The Army’s Environmental Program needs streamlined management practices; Environmental Programs cannot succeed as stovepipes and must be integrated across the Army.
- The Army must enhance mission effectiveness and productivity by ensuring availability of operations and training lands and protecting our cultural resources.

Incorporation of ‘green’ technologies into our weapons systems and implementing cheaper and faster technologies to achieve its compliance and cleanup objectives are credible goals. However, meeting the Senior Environmental Leadership challenges for EQ RDA will be difficult without recognizing and hurdling the many obstacles in the path to success. One major obstacle is an environmental technology industry that does not now favor technological innovation and commercialization. Another obstacle is the continuing

approach by the Army to rely on decentralized, installation-based real property maintenance approaches to resolve its strategic environmental technology needs.

#### 8.4 The Army Environmental Quality Technology Program is a strategic EQ RDA platform

While environmental regulations and economics are certainly management drivers at the facility or installation level, collectively they also have strategic and extremely important Armywide effects. This is not only true in the Army; Strategic Environmental Management (SEM) is increasingly becoming a key aspect of many CEOs' jobs (Piasecki 1995).

Headquarters, Department of the Army (HQDA) in 1993 redesigned its Environmental Quality Technology (EQT) Program as a strategic EQ RDA platform (EQT Program 1995). Its charter was to:

- Review and approve the Army EQ Science and Technology (S&T) program,
- Improve coordination and cooperation between Army EQ S&T, Army acquisition organizations, and Army installation technology users, and
- Assist in establishing overall program objectives, including refinements to the EQ RDA process.

The EQT Program management structure revolves around four Pillar Technology Teams (PTT), an Executive Secretariat Working Group, and a senior level Steering Committee (EQT Program 1995a). This design provided a venue for strategic teaming among the principal RDA stakeholders (that is, technology developers and technology users).

Senior representation on the EQT Executive Steering Committee now includes the Deputy Assistant Secretary for Research and Technology (co-chair), the Assistant Chief of Staff for Installation Management (ACSIM) (co-chair), the Deputy Assistant Secretary for Environment, Safety and Occupational Health, the Deputy Chief of Staff for Operations and Plans (Force Development), and the Deputy Assistant Secretary for Combat Services Support. The Executive Secretariat comprises staff elements of the above organizations, but also includes the Director for Research and Development, U.S. Army Corps of Engineers, and the Director, Army Acquisition Pollution Prevention Support Office.

There have been many accomplishments of the EQT Program to date. Recent initiatives promise to continue that progress. Notable successes include:

- Identification and prioritization of Army user needs (Andrulis Research Corporation 1994),
- Improved scientific oversight and peer review of the Army's EQ Basic Research Program (Army Research Office 1995),
- Redirection of S&T investments on priority tasks (EQT Program 1995b), and
- Enhancement of pollution prevention R&D funding (EQT Program 1996).

The Army Staff in 1993 produced its first comprehensive, prioritized listing of its user needs (Andrulis Research Corporation 1994) and translated those needs into operational and technical terms. This listing was developed, primarily by field environmental staff from approximately 50 installations across the U.S., and then validated and integrated by ODEP and selected MACOM representatives. A listing of 200 separate user technology needs was derived: 50 for restoration, 44 compliance, 66 pollution prevention, and 40 conservation technologies.

Several organizational initiatives among participants of the EQT Program will benefit further the goals of the Program. Examples include the initiative by the Army Material Command (AMC) to acquire baseline information on the magnitude of Army industrial operations waste streams and to identify high-payoff pollution prevention technology R&D thrusts (Scola 1996).

Maintaining the Army's user needs listing in a progressive and iterative fashion to ensure currency has been problematic. However, HQDA is taking steps to improve this situation. For instance, ODEP and AEC currently are participating with Defense RELIANCE partners to standardize the process of EQT requirements generation and management. The expected result will be an automated Technical Needs Survey (TNS) that will facilitate objective determination of needs and monitoring of R&D progress on resolving those needs. Also, improved integration of industrial pollution prevention and industrial compliance needs definition and R&D activities is the focus of a June 1996 conference sponsored by ACSIM.

The AEC has initiated several important partnerships that promise to enhance its communication and coordination with technology base laboratories and other Government technology evaluators. Through its Technology Monitoring Program (TMP), it and the technology base researchers, other CoE technology evaluators, and regulators will be able to better develop demonstration and technology transfer protocols. Finally, recent reorganization by the Office of the Director of Environmental Programs (ODEP) should enhance success of the Army's EQ RDA mission area consequent to better integration and planning of its Environmental Quality and Readiness missions (Finch 1996).

8.5 Army acquisition policies have guided EQ RDA missions differently than other RDA modernization missions.

Two Army Regulations (AR) are particularly relevant to the topic of this study: AR 70-1 and AR 200-1. The former defines Army acquisition policy while the latter defines environmental protection and enhancement policy, including definition of EQT Program roles in acquiring technology. Army acquisition policy prescribes guidance and responsibilities for identifying and resolving strategic warfighting (and support) capability needs through RDA. The Army places responsibility for the success of acquisition programs with the ASA(RDA), who serves as the Army Acquisition Executive (AAE) (AR 70-1). Without exception, the Army develops its major systems through formal, centrally-managed acquisition programs that employ life cycle and systems engineering

approaches. It is incumbent on Program Managers to define, structure, and design these programs in ways that ensure Armywide application and maximum benefit to the warfighters.

Unlike other Army RDA missions, the Army has not applied its acquisition policy wholly to its EQ RDA missions. Instead of establishing centralized acquisition programs to manage demonstration, validation, and implementation of new EQ technological capabilities, the Army uses a management approach more resembling those used for local construction and civil engineering acquisitions. The exception to this generalization is the Army's industrial pollution prevention S&T mission. Research of those technologies by the AMC technology base parallels closely the science and engineering approaches taken for other military technologies.

Historically, the acquisition strategy for most environmental technologies has been to transfer Army technology to the private sector and when successfully commercialized, acquire it as necessary to resolve Base Operations environmental problems. For a variety of reasons, most past environmental technology implementations were associated with cleanup missions, which largely implicated the need for Civil Engineering (CE) solutions on Army installations. Army acquisition policy applies to all personnel conducting RDA of all types of Army materiel, but it specifically excludes materiel acquired as "base-level commercial equipment."

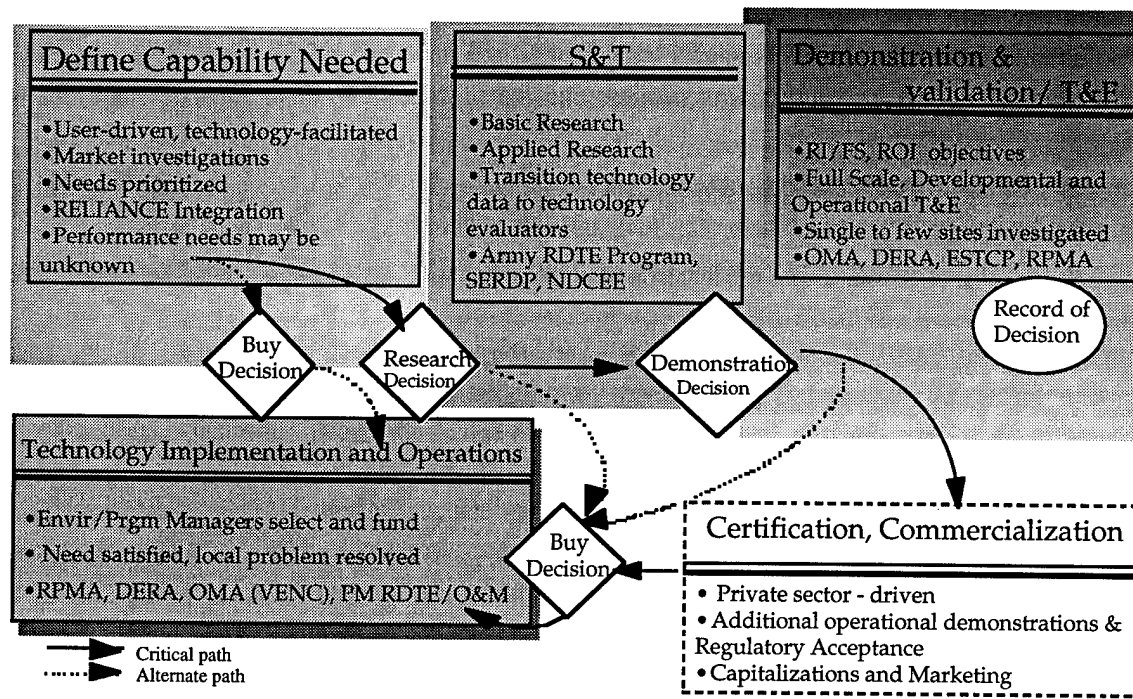
An extensive science and engineering network equips the Army with full RDA capabilities. The center of these capabilities has been CE community residing in the Army Corps of Engineers. Only in the past several years has the AMC community emerged as an important center for environmental R&D. That emergence coincided with the emerging importance of pollution prevention and compliance in industrial operations.

The CE capabilities of the CoE are provided by R&D laboratories, engineering offices and analytical laboratories, and a Center of Expertise in restoration technologies residing within the Corps. The Corps' restoration programs alone are sizeable and include the Installation Restoration Program (IRP), the Air Force IRP Formerly Used Defense Sites program, EPA Superfund program, Base Realignment and Closure (BRAC), and Department of Energy and Other programs. Together, funding for these programs for FY94 alone totaled over \$1.3 billion (Jones 1995). In addition to restoration technologies and solutions, the CoE R&D laboratories provide capabilities for EQ RDA of pollution prevention, compliance, and natural and cultural resources conservation technologies.

The dominant focus on CE and on restoration needs specifically have implications for the current approaches for EQ RDA. These approaches can be characterized as essentially Installation-focused and driven by real property maintenance (RPM) needs. Consequently, solutions have tended to be of a focal nature and associated with CE technological capabilities. This historical CE dominance may explain the differences in approaches to RDA taken in the past by the EQ and systems acquisition communities.

8.6 The current model of the EQ RDA process, its resources, and its desired outcomes suggests a need for intensive management.

Figure 8-1 below introduces the general phases, purposes, resources used, and outputs of the Army EQ RDA process. Briefly, RDA culminating with implementation of a new environmental technological capability can require a critical path comprising many phases of development, many different organizations and missions, and many decisions that affect successful implementation. Shaded boxes in the model represent different functional domains.



**FIGURE 8-1. CURRENT MODEL OF ARMY ENVIRONMENTAL QUALITY RESEARCH, DEVELOPMENT, AND ACQUISITION (EQ RDA)**

8.6.1 The Army EQ RDA process depicted above is flexible and operates at all mission levels having technology acquisition requirements. For instance, this model applies to local Army installation RDA activities as well as more strategic RDA conducted by the EQT Program.

Regardless of the operational level, the EQ RDA process begins and ends with technology end-users. At local levels, installation environmental managers determine local needs and then budget accordingly to effect resolution. Most often, this merely involves identification of sources of commercially available technologies, procurement of such, and local implementation. However, when commercial products are not available, or if regulatory acceptance of chosen technology alternatives is required, the process becomes complex and higher risk. Definition of Army strategic needs is made by user representatives at HQDA or Major Command (MACOM) environmental offices instead of individual end-users. These representatives assist the EQT Program in determining

significant problems and prioritizing technological approaches to resolve those problems. Specifically:

- *Needs Definition.* As applied by the EQT Program, definition and prioritization of user needs is the responsibility of the ACSIM. The user needs definition step is critical to satisfying environmental objectives because it guides subsequent progression through EQ RDA.

- *Science and Technology (S&T).* Technology base laboratories having RDTE missions conduct research and bench- to pilot-level demonstrations of technology. These activities are done as part of the EQT Program technology base mission as well as to satisfy other customers' EQ missions. Outputs of S&T enhance technical knowledge as well as mature concepts into prototypes or testbeds that are suitable for more definitive evaluation.

- These first two domains of the EQ RDA model are those for which the EQT Program has assumed oversight and approval responsibility.

- *Demonstration & validation / Test and Evaluation (T&E).* Definitive demonstrations, validations, and T&E provide information needed by private contractors to obtain regulatory acceptance and successfully commercialize the technology. These definitive data also guide Government managers responsible for making implementation decisions. The Demonstration & validation phase targets development of Remedial Investigation/Feasibility Study (RI/FS) information, Return on Investment (ROI) data, and other operational information. This domain is managed by a variety of Army organizations having mission or business partnership responsibilities to an end-user, including installations themselves, the U.S. Army Environmental Center (AEC), the technology base laboratories, and CoE District offices, and Acquisition Program Managers (PM). The EQT Program responsibilities defined by the draft AR 200-1 (1996) for demonstration and implementation of technologies is limited to fostering of these activities.

- *Regulatory Acceptance and Commercialization.* These steps are on the critical path to implementation of some innovative technologies, specifically those satisfying restoration and compliance needs. Success of this phase therefore is dependent largely on private contractor success in the private marketplace and in moving through the regulatory maze. The EQT Program has no direct responsibilities for this phase of the EQ RDA process.

8.6.2 Resources used to accomplish EQ RDA are provided by a number of general organizational levels and funding programs. Table 8-1 below lists the major organizations, RDA functions they perform, and funding programs used to accomplish these functions.

The EQT Program includes RDTE program support for S&T only. Specifically, this includes funding for basic research and exploratory research in all four of the Army's environmental strategy pillars. Unlike other Army RDA missions, however, the Army's RDTE program does not support EQ RDA beyond exploratory research.

To accomplish those missions, the Army relies on three supplemental programs managed by the Office of the Secretary of Defense (OSD). These advanced development programs are the Strategic Environmental Research and Development Program (SERDP), Environmental Security Technology Certification Program (ESTCP), and the Defense Environmental Restoration Program (DERP). Additionally, the DoD has charged the Army with the lead responsibility for managing the National Defense Center for Environmental Excellence (NDCEE) in Johnstown, Pennsylvania.

The SERDP manages projects that research and test concepts through exploratory development, including bench-level demonstrations. The ESTCP was established by the DoD in December 1993 to manage more definitive studies and pilot demonstrations through Demonstration/Validation (DEMVAL).

According to information provided on the internet (<http://www.pica.army.mil/orgs/eto/programs/estcp>), the ESTCP responds to the following drivers:

- “Congressional concern over the slow pace of remediation of environmentally polluted sites on military installations,
- Congressional direction to conduct demonstrations specifically focused on emerging new technologies,
- Executive Order 12856 which requires Federal agencies to place a high priority on obtaining funding and resources needed for the development of innovative pollution prevention programs and technologies for installations and in acquisitions, and The need to improve defense readiness by reducing the drain on the Department's operation and maintenance dollars caused by real world commitments such as environmental restoration and waste management.”

Since its establishment, the ESTCP has provided funding to EQ RDA performers from all three military Services to conduct DEMVAL on Tri-Service requirements. According to literature available on the internet (<http://iridium.nttc.edu/env/dod/ddestcp1.txt>), the DoD is now taking steps to expand the scope of the ESTCP to include testing of technologies developed by the Department of Energy (DoE). This expansion infers a growing customer base for the ESTCP that may dilute its efforts away from DoD, specifically Army, DEMVAL needs.



**TABLE 8-1. ARMY EQ RDA ORGANIZATIONS, RDA FUNCTIONS, AND SPONSORING PROGRAMS**

<b>Organizational Level</b>	<b>RDA Function</b>	<b>Mission Funded Program</b>	<b>Reimbursable Funded Program</b>
Acquisition PMs	Demonstration	RDTE (Systems)	
Army Technology Base Laboratories			
<i>AMC</i>	S&T	RDTE (EQT, Other)	RDTE (Systems), O&MA, SERDP,
	Demonstration / T&E	RDTE (EQT, Other)	NDCEE, ESTCP, RDTE (Systems)
<i>CoE</i>	S&T	RDTE (EQT)	SERDP, RELIANCE, Other labs
	Demonstrations / T&E		RPMA, DERP, VENC, NDCEE, ESTCP
<i>MEDCOM</i>	S&T	EQT (RDTE)	
CoE District & OEW MCX	Demonstration / T&E		DERP, RPMA
	Implementation		DERP, RPMA
AAPPSO	Demonstration / T&E		RDTE (Systems)
AEC - Technology Program	Demonstration / T&E	VENC, DERP	SERDP, ESTCP, NDCEE, RPMA, RELIANCE
AEC - Operations	Implementation	VENC, DERP	VENC, DERP, RPMA
Installations	Demonstration	VENC, RDTE	DERP, VENC
	Implementation & Operations	VENC, RPMA, RDTE(BaseOps)	DERP

The Army has been fairly successful in competing with other customers for SERDP and ESTCP resources. The SERDP budgeted \$15.9 million for FY96 to support Army-

sponsored projects and has programmed \$32.9 million against Army S&T proposals over the period FY96 to FY01 (SERDP 1996). The ESTCP is budgeted to a level of approximately \$15 million annually for its DEMVAL mission. In the past, the Army competed successfully for nearly \$5 million of that ESTCP business.

While the ESTCP is claimed to be the principal Tri-Service capability for DEMVAL needs, its present funding of \$15 million per year is well below that needed to satisfy the needs of its customers. The DoE recently determined benchmark cost data for advanced development (that is, equivalent to DEMVAL and T&E and other advanced pre-commercial activities) based on past federal R&D spending (DoE 1995). That benchmark indicates that investments sufficient to accomplish what the ESTCP is attempting to do for the Army would be approximately \$110 million annually, or more than 20 times the \$5 million the Army has obtained in the past through the ESTCP.

The DERP provides centralized management over DoD's environmental restoration program. It is primarily driven by actual clean up needs and not R&D needs. However, as part of the regulatory acceptance and implementation process, this Program accomplishes Remedial Investigation and Feasibility Studies (RI/FS). Technical approaches to FS can resemble common operational T&E approaches, and therefore can provide supplementary technical and performance information useful for EQ RDA purposes. According to the OASA(IL&E), past funding of such studies was as much as \$6 million annually.

In 1990, the DoD established the NDCEE to lead and support DoD facilities and the associated industrial base in adopting a comprehensive approach to pollution prevention. According to its literature on the internet, the NDCEE's primary mission is to identify, evaluate, demonstrate, and transition environmentally-acceptable manufacturing processes to its client base. This client base includes not only Army RDA performers but those from other Services, DoD, and private industry and academia.

The NDCEE is contractor-operated; the Army Industrial Ecology Center at Picattiny Arsenal has management responsibility. Funding for the Center is through the Army RDTE program, and monitored by the EQT Program. Levels of funding provide the capability for testing only (that is, infrastructure and personnel). RDA outcomes therefore will depend on the Center's success in commercializing its capability.

In addition to supplementation of advanced development requirements by OSD programs, the Industrial Ecology Center recently reported supplementation to the Army Pollution Prevention Program by AMC RDTE and O&M programs (Scola 1996). The summarized results of that the report are shown in Table 8-2.

**TABLE 8-2. SUPPLEMENTATION OF POLLUTION PREVENTION EQ RDA BY ARMY MATERIEL COMMAND PROGRAMS.**

<b>Type of Funding</b>	<b>FY95/96 (\$ million)</b>	<b>Future years (\$ million)</b>
Army RDTE Program	<b>56.5</b>	<b>39.9</b>
DOD Tri-Service EQT	<b>5.4</b>	<b>1.2</b>
<b>AMC Mission Total</b>	<b>56.9</b>	<b>102.5</b>
O&MA	19.2	34.7
Wheeled Track Combat Vehicle Program	15.1	33.6
Manufacturing Science and Technology (MST)	2.0	1.4
Mission R&D	7.0	5.4
Rocket and Conventional Ammo Demilitarization	4.3	1.2
Other	12.0	26.2

While not precise, estimates of Army RDTE, OSD supplementation, and AMC supplementation of Army EQ RDA missions indicate that approximately \$90 Million dollars are being invested for FY96 for activities supporting S&T, Demonstration and validation, and T&E. This amount is about 2.0% of the Army's total RDTE budget.

8.6.3 The current paradigm for accomplishing EQ RDA by the Army can be modeled simplistically (Figure 8-1). Army Systems RDA relies on consolidated management of organizations and programs and simple business approaches, EQ RDA does not. Instead, EQ RDA employs multiple management lines and multiple funding programs. Many of these programs are only partially planned, programmed, and directed by Army organizations (Table 8-1).

## 9. TRENDS AND CONDITIONS AFFECTING THE AREA OF STUDY

9.1 The following trends and conditions in the environmental technology industry have affected, and will continue to affect, the Army's success in modernizing its environmental quality technological capabilities.

9.1.1 The environmental technology industry, barely 20 years old, is currently a \$200 Billion dollar industry worldwide and is expected to grow to \$300-500 Billion industry by the year 2000 (Moore and Miller 1994). The United States is not leading this growth. In fact, growth of the environmental technology industry has stalled in the United States. Growth continues to escalate rapidly in Europe and Japan, however (Small Business Administration 1994; Moore and Miller 1994).

- According to the Small Business Administration (1994), only 5% of U.S. venture capital firms invest in environmental technology. Worse, the trend between 1992 and 1994 was toward greater deferment of investments until later in the revenue earnings phase.
- Important reasons cited to explain lacking private sector investments in environmental technology in the United States include: (a) market fragmentation due to multiple levels of regulatory bureaucracy, (b) high costs and high risks in managing regulatory uncertainty, (c) lack of testing venues for demonstrations, (d) tremendous market barriers caused by customer reluctance to use innovative technologies and (e) absence of compelling cost-benefit information.
- The technology stall in the U.S. has serious implications for the Army, since current acquisition approaches for many technologies put commercialization on the critical path to implementation. Few Government dollars are available to support comprehensive demonstrations required for successful regulatory acceptance and commercialization.

9.1.2 While federal environmental regulatory growth has stabilized, that trend is countered by increasing growth since 1991 in state and local government environmental programs. Spending by these programs over the past decade has more than doubled (Life Systems, Inc. 1996). Also, federal enforcement actions have increased since 1994, not decreased.

- According to the American Enterprise Institute, public opinion polls currently reflect a strong will of the American public to oppose return of policies that threaten the environment (Bowman 1995).
- These regulatory trends suggest future shifts from federal to state emphasis will increase further market fragmentation of regulated technologies, inhibiting investments in this 'growth' area even more.

9.1.3 There is a growing call for the proven Defense systems RDA capabilities to resolve national public and private environmental technology gaps (Miller and Moore

1994). There are several examples of federal programs established over the past few years to specifically leverage Defense technology development capabilities. These include: the Strategic Environmental R&D Program, the Environmental Security Technology Certification Program, the Western Governors Association "Demonstrate On-Site Technologies Now" Program, and the National Defense Center of Environmental Excellence. Continuing movement in this direction could divert Army resources from technology requirements it considers to be of highest priority.

9.1.4 Commercial manufacturing industries worldwide continue to voluntarily 'green up' as their stockholders force them to adopt more integrated, strategic environmental quality management practices (Piasecki 1995; Life Systems, Inc. 1996). Several recent initiatives could increasingly influence Army management decisions regarding its environmental strategies. Examples of such include: the National Performance Review, the Government Performance and Results Act, International Standardization Objectives (ISO) 14000, Global Environmental Management Initiative, and the Coalition of Environmentally Responsible Economies and other organizations advocating environmental codes of conduct.

9.1.5 Decreasing Defense and Army funding for the environment will pose major risks to meeting environmental program performance, cost, and schedule objectives; resource shortfalls will present significant risk management challenges (Fields 1995).

Existing trends strongly indicate that environmental regulatory forces -- both internal and external to the Army -- and industry market forces in the U.S. are continuing to work against each other.

Certainly, there are many parallels between the conditions noted in the private sector and those under which the Army now operates. Thus, there is a substantial risk that the same adverse conditions hindering successful commercialization and implementation of innovative technologies in the private sector will impede the Army's strategic environmental objectives. This risk deserves intense management.

As in the recent past, the Army's ability to respond to these management and leadership challenges will be of interest to the Congress and to the Army Leadership. Even now, renewed interest in its environmental progress is evident: new investigations of the Army's environmental technology program were announced by the Army Audit Agency last Fall and by the General Accounting Office and the House Appropriations Committee in February 1996.

## 10. DEFENSE AND ARMY ACQUISITION REFORMS

10.1 In March 1996, the Under Secretary of Defense for Acquisition and Technology published a new, reformed acquisition policy, DoD Directive 5000.1. This reformed policy will have a significant impact on the effectiveness and efficiency of Army systems acquisition programs.

Emerging RDA business conditions through the 1980s prompted a management study by the Defense Systems Management College (DSMC). The specific purpose of that study was to identify management practices that hindered the "proper exercise of responsibilities" and that "undermine DoD's mission to deliver satisfactory weapons systems on a timely and cost-effective basis." (Fox *et al* 1994).

The DSMC study contributed to a major reform of the processes the DoD and the Services used to manage and oversee Major Defense Acquisition Programs. From that reform have come substantial, and beneficial, ripple effects to smaller acquisition programs, such as medical defense systems, information systems, and other systems.

Unquestionably, the Defense Department and the Department of the Army have been extremely effective at fielding innovative and superior warfighting technologies in the past. Also unquestionably, that success was at great cost of time and money. Those costs became unacceptable under the more austere business environments of the 1990s and therefore demanded change and reengineering.

10.2 Lessons learned from the Defense and Army acquisition reengineering directly apply to the current study of the processes the Army uses to acquire innovative environmental technologies. Specifically, major policy implications having relevance to this study can be summarized as follows:

10.2.1 Defense and Army acquisition policy provides guidance for clear, unambiguous responsibilities and authorities.

Under Army policy, acquisition program accountability for cost, schedule and performance is consolidated under a single and dedicated systems manager accountable to the Army Acquisition Executive (AAE) (AR 70-1). Because of binding policy, the PM can depend on Army materiel developers, such as Army Materiel Command (AMC) and the Army Corps of Engineers (CoE), for matrix support.

Explicit partnerships are formed whereby a unique manager provides incentives and leverages available expertise to effect strategic outcomes. Under this management paradigm, roles and responsibilities are explicit. Thus, acquisition programs are organized for successful, streamlined, business operations.

10.2.2 Defense and Army acquisition policies also provide tools and guides for conducting strategic planning and risk management. These policies prescribe the use of specific approaches to ensure effective program definition, program structure, and program design.

Guidance regarding program definition prescribes determination of clear technology performance objectives, assurances of affordability, and building programs for which the leadership can commit to full-funding early in the acquisition process. Clear statements of mission needs and operational requirements compel technology developers to deliver what the customer needs, when they need it, cost-effectively. These strategic documents are prepared early in the program; definitive plans and agreements are made before making significant commitment of Acquisition Program resources.

Guidance related to program structure ensures "...a logical progression through a series of phases designed to reduce risk, ensure affordability, and provide adequate information for decision-making" (Kaminski 1996). Program structure is the essence of strategic planning and execution and provides the stability required for success of the program. Meeting this guidance establishes streamlined processes to meet the users' needs in the shortest possible time. Fundamental mandatory guidance to PMs promulgated by DoD 5000.1 includes:

- Establish and identify the most important cost, schedule, and performance parameters and document these in a program baseline;
- Develop an Acquisition Strategy that addresses potential sources, risk management, cost-setting, and management approach;
- Develop a Test and Evaluation (T&E) strategy that describes the salient elements of the test program;
- Develop a life-cycle cost estimate of the program.

Defense Acquisition policy for program design provides the driver for comprehensive, integrated, and disciplined approaches to satisfying user requirements. The fundamental tenet of program design is the use of Integrated Product and Process Development (IPPD) and Systems Engineering. This new management practice was implemented by DoD and the Army to ensure continuous and active stakeholder participation as essential members of Integrated Product Teams (IPTs). Under IPPD, stakeholders jointly develop issues and resolve them 'on-the-fly.' Issues are not allowed to languish.

10.2.3 Army acquisition policy related to issues resolution depends on effective operational problem solving techniques and strategic decision-making. Explicit decision authorities and decision support systems are prescribed by AR 70-1 for other Army RDA processes.

- Guidance in AR 70-1 describes the appointment and roles of Milestone Decision Authorities (MDA) to strategically validate program decisions or resolve issues raised among program stakeholders. Expectedly, vested and organizational issues can not be resolved consistently through consensus.
- Stakeholders address issues collaboratively and make recommendations to the MDA for resolution or approval. The forum for this action is the In-Process Review (IPR) prescribed by AR 70-1 and DoD 5000.2-R.

10.2.4 The Army acquisition community's role in Defense acquisition reform was collaborative, positive, and important. Even though AR 70-1 is still being revised, implementing directions on most of the reformed Defense policies already have been issued to the field. The Army is committed to making extensive changes that will make systems RDA simpler, faster, cheaper, and more responsive to the warfighters (Charles 1995).



## 11. FINDINGS AND CONCLUSIONS.

11.1 Findings of this study indicate a need to improve several of the processes the Army currently uses to manage EQ RDA if it is to meet key strategic environmental objectives. Improvements will permit greater leveraging of existing resources and increase returns on RDA investments.

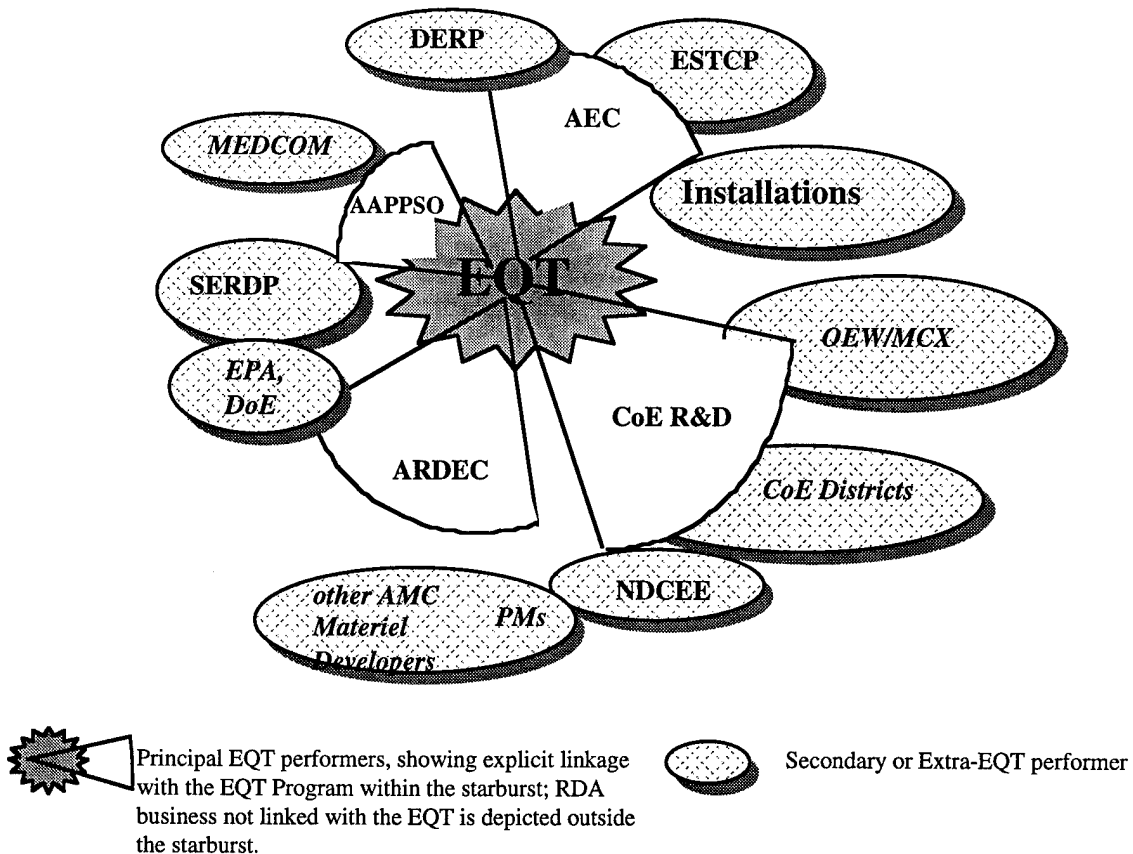
Major findings and conclusions of this study were:

- Management of strategic EQ RDA remains fragmented across multiple and largely autonomous Army organizations and funding programs. This decentralized management paradigm has established both reward and command and control incentives for EQ RDA performers that strongly favor the accomplishment of local, relatively lower priority tasks instead of strategic ones. The present Army EQT Program is limited in its ability to leverage these organizations and funding programs to effect strategic Army outcomes.
- Current EQ RDA practices do not drive the minimum strategic analyses needed to effectively mitigate risks and ensure maximum return on the Army's RDA investments. There is no evidence that current programs are defined, structured and designed sufficiently to identify and mitigate life-cycle risk to cost or performance.

11.2 Finding 1: Strategic EQ RDA remains fragmented across multiple and largely autonomous Army organizations and funding programs. This paradigm establishes incentives that impede strategic success and preclude efficient integration of organizations, functions, and goals.

11.2.1 Among the many organizations performing Army EQ RDA, there exists a full complement of capabilities to research, develop, demonstrate, and transfer technology to the private sector or Government users. Organization of these capabilities to effect acceptable strategic payoff to the Army was not evident, however. Organization of EQ RDA performers largely exists as many decentralized, short-term partnerships. Only some of these partnerships are accountable to the EQT Program leadership directly. The EQT Program has no official oversight responsibility for many others.

The EQ RDA organizational paradigm is depicted qualitatively in Figure 11-1. In this depiction, principal organizations, that is, CoE Military R&D Program (managed by the Director for Research and Development), AEC, ARDEC, and AAPPSO, are explicitly linked to the EQT Program through membership on its Executive Secretariat. Principals are shown as intersecting in the gray starburst labeled *EQT*. Besides the principals, there are several organizations engaged in EQ RDA that are not linked explicitly to the EQT Program. These organizations are represented as shaded ovals. Linkage of these secondary, or extra-EQT, organizations to the EQT Program is predominantly through specific business arrangements with the EQT principals. There exist a multitude of possible business relationships that can form among these performing RDA organizations; many of these business relationships exist exclusive of the EQT Program.



**FIGURE 11-1. DEPICTION OF ARMY EQ RDA ORGANIZATIONS AND RELATIONSHIPS WITH THE EQT PROGRAM**

Even among the principal organizations, there is substantial EQ RDA business that is not explicitly linked with the EQT Program. For instance, CoE laboratories provide R&D services not only to fulfill mission requirements of the EQT Program but also independently to Tri-Service customers, Army installations, other Government agencies, CoE Districts, and other CoE laboratories. Similarly, the AEC, the CoE laboratories, and AMC Materiel Developers each provides evaluation services not only to the EQT Program but also directly to Army installations or to the OSD programs, SERDP and ESTCP.

11.2.2 It is apparent that incentives -- both reward and command and control (CAC) types -- to EQ RDA performers currently favor accomplishment of lower priority tasks instead of strategic, higher priority ones.

Reward incentives typically are provided by funds (internal or external to the organization's chain of command) that support organizational infrastructure and generally promote organizational success. As discussed in Section 8 of this report, among EQ RDA performing organizations, decentralized external programs provide a major part of their total 'revenues.' This is especially predominant for advanced development activities such as demonstration and validation and T&E (Table 8-1).

Unequivocally, these 'paying' customers have their own EQ RDA missions and goals and it is for the accomplishment of these goals that payments are made. These local goals may not coincide with the strategic goals of the Army. It was reported in this study that it is frequently incompatible for Army EQ RDA performers to compete successfully for these external dollars and address the Army's highest priority needs at the same time. Illustrative of this dichotomy is the following example.

During FY96, funding delays in the DoD permitted the ESTCP to fund its highest priority projects only; a priority release of funds went to six military projects in March 1996. Among these six priority-funded projects were two Army proposals. The first proposed a demonstration of recycling wastes from Small Arms ranges. The other proposed a demonstration of the Enhanced Site Characterization and Analysis Penetrometer System (SCAPS). Small arms range waste recycling technologies appears to best support priority number 14 of 44 specified needs in the Compliance Pillar. The SCAPS appears to best support priority number 20 of 50 specified needs in the Restoration Pillar.

Other priority ESTCP demonstration projects selected were Navy or Air Force projects. These included:

- A chromate replacement process (supporting Army Pollution Prevention Pillar priority number 10 of 66),
- A metal analyzer for lead in drinking water (not an Army-defined need), and
- Alternatives to 'Pump and Treat' approaches (Army Restoration Pillar priority number 10 of 50).

Given this particular example, it appears that reward incentives provided to Army EQ RDA performers favor accomplishment of tasks that are of lower priority. Reportedly, this is not uncommon and the example above is representative. Army RDA managers reported a personal choice to satisfy Army needs exclusively. However, reward incentives compel them to propose studies specifically to satisfy the priorities of 'paying' customers instead.

11.2.3 The EQT Program has not established CAC incentives, such as policies or central authorities, that sufficiently compel EQT performers to consolidate or integrate their independent RDA activities or concentrate efforts on Army strategic needs.

According to existing policy (AR 200-1), the EQT Program has played a small role in overseeing post-S&T phases of EQ RDA. Specifically, the EQT Program has not included such advanced development tasks as technology demonstrations, validations, and T&E under its oversight as it has Army EQ S&T Programs. Therefore, Army policy does not provide incentives for EQ RDA performers to organize or manage differently to drive accomplishment of the highest priority Army tasks. Decentralized RDA activities are not fully coordinated and may be redundant. Decentralization of RDA operations thus misses opportunities for cooperation and synergy among individual operational organizations doing similar RDA activities.

For instance, some MACOMs and installations have begun EQ RDA projects independent of the EQT Program. For example, U.S. Army Test and Evaluation Command (USATECOM) recently established the Maryland Environmental Testing and Demonstration Center. This Center has become a distinct business unit and facilitates partnering between USATECOM organizations, regulators, industry, and other Army organizations. Similar installation RDA activities in the restoration and conservation areas are not uncommon. Unfortunately, there is evidence that such local activities are not consistently integrated with those performed under the auspices of the EQT Program. One installation environmental manager currently engaged in an innovative technology demonstration reported that installations are not compelled, by policy or otherwise, to coordinate with HQDA on such RDA activities. Given appropriate incentives and opportunities, decentralized installation RDA activities such as this could benefit the strategic needs of the EQT program.

Effective leveraging of EQ RDA performers through either Program authority or Command authority is not possible, from an EQT Program perspective. Without changing this paradigm, organizations likely will continue to follow their individual mission intents and directions.

11.2.4 There are significant ramifications of this decentralized management paradigm.

- The EQT Program clearly does not guide, direct, or oversee all the EQ RDA missions and organizations the Army now sustains and supports. This leaves much of the Army's EQ RDA out of the EQT Program's span of control, guidance, oversight, or monitoring. Consequently, effective integration of decentralized activities with those of the EQT Program is not likely. This is particularly true for advanced development activities that lead directly to strategic implementation. Demonstration, validation, T&E, and implementation activities are the most decentralized EQ RDA functions.
- Army performing organizations are rewarded by satisfying the needs and priorities of external program sponsors. Those priorities are not always consistent with the Army's highest priority needs.
- Without better command and control incentives, progress with EQ RDA will be dependent on decentralized and largely autonomous organizational intents and directions.

11.2.5 The Army EQT Program needs to establish better incentives for driving accomplishment of the Army's highest priority needs. Continued reliance on relatively autonomous activities responding to decentralized program and command authorities to achieve strategic success is an unreasonable expectation.

11.3 Finding 2: Current EQ RDA practices do not drive the minimum strategic analyses and decisions needed to effectively manage risks and ensure maximum return on the Army's RDA investments.

11.3.1 Evidence of lacking strategic analysis and planning includes:

- Absence of clearly defined acquisition programs resulting from appropriate front-end analysis,

- Workplanning that lacks integration across operational organizations and phases of development and lacks clear event-oriented management,
- Existence of a number of important, unmitigated risks to successful Armywide implementation of new technologies.

11.3.2 Three tenets related to strategic RDA planning are provided as part of the sets of mandatory guidance issued in the reformed acquisition policies. These tenets relate to program definition, program structure, and design of successful programs.

*Program definition.* Program definition refers to building affordable programs that fully meet the operational performance and schedule requirements of the end users. Definition requires initial analysis to verify the need for technologies and then continuing, iterative, maturation of those requirements as development advances.

Front-end analysis during EQ user needs definition has not developed to the extent necessary for technology developers and evaluators to develop their acquisition programs. Well-defined programs are characterized by definitive cost-performance trade-offs, determination and assurances of technology affordability, and setting of critical threshold objectives. Defining RDA programs effectively is critical to success. Most importantly, clear definition of users' needs will compel technology developers and other acquisition professionals in the Army to act most responsively.

Fundamental definitions of Army warfighting technologies are readily available in the Army Science and Technology Base Master Plan (ASTBMP) (Sullivan and Stone 1994). Army EQ RDA objectives are not identified in a similar Master Plan format. This is an important finding because the ASTMB is a technology derivative of the Army Modernization Plan. The Army Modernization Plan is the strategic plan that the Army Staff uses to communicate its long range equipment modernization goals to the ASA(RDA) and other technology communities. The ASTBMP, prepared by the ASA(RDA), then links operational modernization goals to Army S&T objectives. Further, the ASTMBP establishes linkage from technology products to new warfighting capabilities. Because the ASTMB is driven by operational needs, it compels the efficient and effective transition of technologies from the Army's technology developers to its customers, the warfighters. A comparable corporate plan for EQ RDA objectives does not exist.

*Program structure.* There is no evidence that current programs are structured sufficiently to identify and mitigate life-cycle risk to cost or performance. Program structure benchmarks (DoD 5000.1) refer to strategic planning considerations made by Program Managers regarding cost, schedule, and performance baselines and objectives. Structure includes acquisition strategy development, development of T&E strategies, and life-cycle cost estimation. Underpinning these considerations is effective risk assessment and management, particularly regarding available means to fund essential RDA activities.

Against the benchmark provided by Army and Defense acquisition policy, this study found a number of unmitigated risks that implicate inadequate strategic planning. Specific unmitigated risks were:

- The EQT Program has not programmed funds to accomplish R&D, T&E, and implementation of innovative technologies, even for most of the Army's highest priority needs. Current Army RDTE investment strategies do not extend into advanced development, specifically Program Elements (PE) 6.3 (Technology Development), PE 6.4 (DEVAL), PE 6.5 (Engineering and Manufacturing Development), or Production and Deployment/Operations and Support (PD/OS). To fund these necessary activities, RDA performers have relied on acquiring funds from external funding sources. Funding for technology implementation is typically acquired by installation managers through Base Operations or Real Property Maintenance Activities (RPMA). Typically, these external customers also manage their RDA programs absent strategic planning, especially as it relates to the testing and implementation of innovative technologies.
- The EQT Program has not addressed serious risks to commercialization. This is important, since commercialization is on the critical path for many innovative technologies the Army is now developing. For such technologies, commercialization requires extensive validation and T&E to secure regulatory acceptance and compel environmental managers to buy the technology (Small Business Administration 1994). Still, the typical approach is to acquire these data through single (or very few) demonstrations for a variety of technologies. An alternate approach would be to demonstrate a single technology concurrently at a number of sites. Even though more expensive, the latter approach reduces commercialization risks by providing compelling cost-effectiveness data (Small Business Administration 1994).
- Work planning to accomplish cost, schedule, and performance objectives (except for the most mature technologies) did not document, or favor, timely and efficient transition of technologies. Criteria for making 'buy' decisions, transition decisions or for advancing technologies through the RDA process are not clear. Therefore, development is more likely to be delayed or abandoned.
- Documentation of senior leader commitment, such as program baseline agreements, are not used for EQ RDA. Such 'contracts,' as applied elsewhere in the Army, establish cost, schedule, and performance objectives that communicate commitment at all levels of acquisition management. Illustrating the importance of these commitments, development of Acquisition Program Baselines emerged from the recent Defense and Army acquisition reforms as mandatory for all major systems.
- Presently there is lacking commitment by end-users to implement technologies once developed (or commercialized). End users and installation decision-makers present a significant risk to ultimate implementation of new technologies. Unless given comprehensive technical information on cost, performance, and liability risks, installation environmental managers have been unprepared in the past to implement innovative technologies. Consequently, the only outcomes assured at present are technical

papers or similar reports that document completion of studies for various technology transferees.

*Program design.* The third tenet of strategic planning is to ensure effective program design. Program design of EQ RDA projects is effective; yet improvements will reduce implementation risks. Program design refers to the assimilation of stakeholder expertise necessary to effect a life-cycle, systems engineering approach to RDA (DoD Regulation 5000.2-R).

Using the recent Acquisition Reform initiative as a benchmark, this study found that many of the practices for successful program design already are in place in the EQT Program. It currently prescribes integrated teams to accomplish Integrated Product and Process Development (IPPD) for work planning and management within its Pillar Technology Teams and Executive Secretariat.

While aspects of systems engineering exist in the EQT Program, certain shortfalls in guidance and policy for its functional elements limit the effectiveness of the integrated approach and of the EQT Program. Specifically:

- The EQT Steering Committee has not yet defined missions or authorities to the Pillar Technology Teams. There is evidence of independent and disparate evolution among those teams that has hampered their success. Common issues regarding leadership and proponency, organizational workplanning, team constituency, and team accountabilities are particularly at issue.
- The EQT Program apparently has excluded key stakeholders in its Pillar Team or management structure. In March 1994, HQ FORSCOM proposed active involvement of MACOMS in the EQT Program (Hope 1994). That proposal was not widely implemented across all EQT Pillar Teams, however. Additionally, RDA performers in the CoE's FUDS program are not actively represented in the appropriate EQT Pillar Teams. As discussed above regarding this situation as an unmitigated risk to success of the Program, these organizations and their perspectives are critical to implementation of innovative technologies. Installation managers in the past have not been willing to risk failure by employing innovative technologies. Corps Districts frequently provide the first line of advise to these installation managers. Early and continuous involvement will be critical to successful strategic implementation of these technologies.

11.4 The present study generally confirms earlier findings of previous investigations, but identifies more specifically several obstacles to efficient acquisition of EQ technologies by the Army. Namely:

- Army EQ RDA is fragmented across multiple and largely autonomous organizations and funding programs. Existing incentives favor and compel performing organizations to accomplish lower priority tasks instead of the Army's most important ones.

- Policies and practices currently do not compel the minimum strategic analyses and subsequent planning and programming decisions needed to effectively accelerate acquisition, manage risks, or ensure acceptable returns on the Army's RDA investments.

11.5 The conclusions of this study are that the Army's EQT Program needs to establish incentives that drive accomplishment of the Army's highest priority needs. Continued reliance on decentralized and autonomous authorities to effect strategic outcomes is unlikely to succeed. The Army's EQT Program needs to implement more effective tools and procedures for designing its programs, structuring them in a manner conducive to risk mitigation, and designing programs that ensure inclusive and continuous stakeholder involvement.



## 12. RECOMMENDATIONS

12.1 Recommendation 1: Enable strategic EQ RDA outcomes by applying proven incentives that reward and compel RDA performers to concentrate efforts on the Army's highest priority EQ needs.

12.1.1 This will require consolidation and centralization of program management and funding authorities to provide explicit responsibilities and authorities for the following essential functions:

- Exploiting S&T outcomes and accelerating management decisions that drive accomplishment of demonstrations, validations, T&E, and implementation of strategic EQ solutions.
- Managing all operational and programmatic aspects of demonstrating, validating, evaluating, and strategically implementing innovative technologies for which the EQT Program has established a strategic need.
- Providing strategic guidance, setting strategic objectives, and making measurements and corrections for Army EQ RDA missions.

12.1.2 Specific recommendations include:

- The ASA(IL&E) and ASA(RDA) should centralize management of strategic EQ RDA tasks, processes, and programs under a single, central program authority. Consolidation of program management should occur under the ASA(RDA) for planning, programming and evaluation to effect accomplishment of all strategic RDA objectives.
- The Army Secretariat should establish policies that ensure maximum strategic benefit of RDA investments. Consolidation should include those funds in the RDTE, DERP, VENC, and RPMA accounts programmed to meet strategic EQ RDA needs. The central program authority should manage these resources coincident with EQT Program priorities, direction, and oversight.
- It is advised that the operational design of centralized management must maximally leverage existing policy, oversight, and staff capabilities of the EQT Program. Leveraging must not compromise, however, the authority's program management responsibilities.
- The central program authority should assume the Army lead responsibility for integrating, prioritizing, and approving the application of non-Army funding intended to satisfy strategic EQ RDA needs. Current execution authorities should retain these responsibilities for technologies under basic research or exploratory research and for technologies not identified by the EQT Program as having strategic significance.
- The central program authority will require a full-time, dedicated acquisition staff capable of conducting strategic planning and programming, managing systems and life cycle risks, and conducting performance evaluations and analyses for the ASA(RDA). Ideally, OASA(RDA) should assume command and control over the program authority. This relationship best leverages the acquisition expertise, training, and capabilities of the OASA(RDA) needed to succeed in the full scope of these recommendations.

- Implementation of a central authority expectedly may supplant some, but not all, of the present functions performed by the current EQT management structure. The EQT Executive Steering Committee should redefine the responsibilities of the EQT Program consistent with implementation of these recommendations. Specifically, roles and missions assigned to the EQT organizational elements, that is the Pillar Technology Teams, Executive Secretariat, and Steering Committee, and the central program authority should be explicit.

- The EQT Executive Steering Committee should assume lead responsibility as an EQT Oversight and Review Forum, as described in AR 70-1, and recommend to the AAE a suitable Milestone Decision Authority for EQT.

- The central program authority should establish formal conditions and criteria under which it will: (a) recommend EQT programs, (b) implement management and matrix support planning for EQ RDA, (c) appoint managers, (d) finance its operation, (e) leverage the EQT Pillar Technology Teams, and Executive Secretariat, and the Steering Committee, and (f) interface with and leverage other Army modernization proponents within OASA(RDA). Consolidation of RDA tasks under the central program authority should be based on a user needs analysis that documents appropriate payoffs to the Army.

- The stakeholders having EQ RDA execution authority currently should establish and monitor policies that ensure maximum participation, collaboration, and compliance by its subordinate organizations with enhanced EQ RDA missions *and* objectives.

12.1.3 Two options for managing a consolidated, centralized EQ RDA program are offered.

Recommended option: Operationally, the consolidated RDA program should be assigned to a dedicated EQ Systems Management Office (EQSMO). A strawman management organization is shown in Figure 12-1.

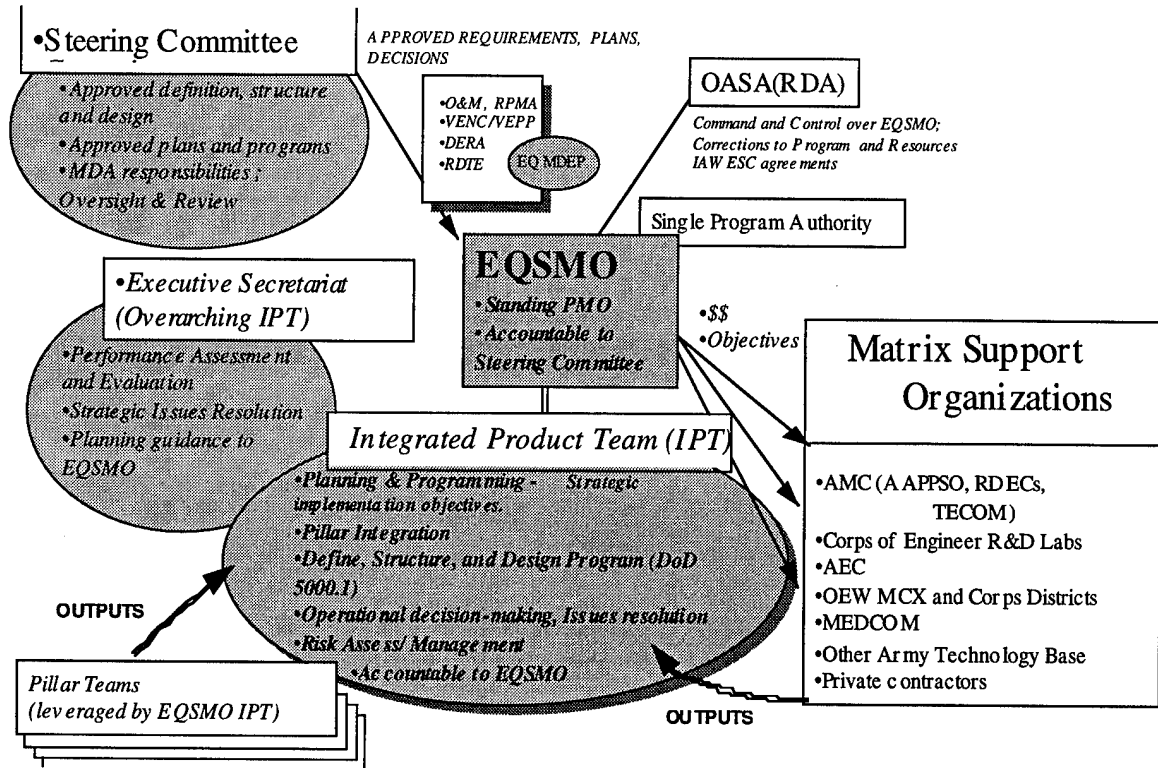
Advantages of the recommended option (EQSMO concept):

- Establishment of an EQSMO as a single and unique program authority follows proven systems management practices and is compatible with Defense and Army Acquisition policies. Being an ‘off the shelf’ solution, very little additional modeling or analysis would be required for applying this structure to EQ RDA. Because it relies on proven Army acquisition management practices, it has little risk of failure, once established.

- Consolidation under a single entity like the EQSMO appears to fully meet the intent of the recommendations provided earlier by the GAO and DSB.

- Implementing the management structure shown in Figure 12-1 fully exploits the EQT Program’s oversight and review capabilities without requiring its Executive Secretariat or Steering Committee to become involved in operational issues. The EQSMO would be responsible for operational issues and be accountable to the EQT Program.

- It facilitates and justifies the establishment of a specific Management Decision Package (MDEP) for EQ. This will better track planning, programming, and monitoring resource utilization for EQ RDA.



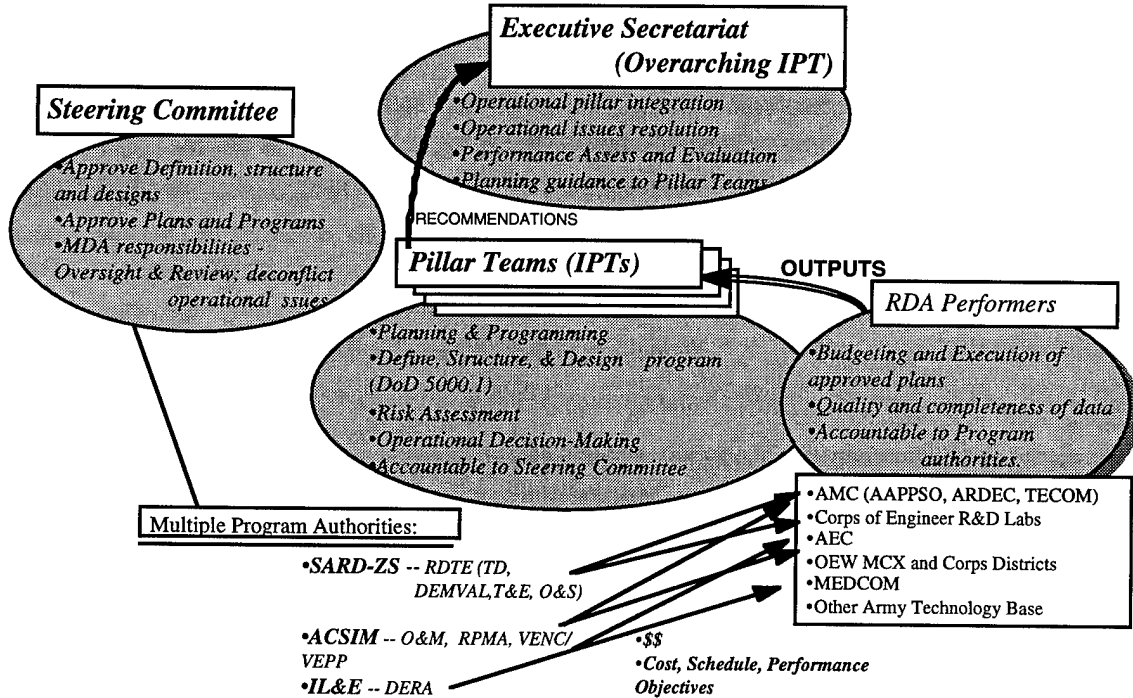
**FIGURE 12-1. RECOMMENDED MODEL FOR CENTRALIZING AND CONSOLIDATING EQ RDA MANAGEMENT**

Disadvantages largely rest with the establishment of a new “program office” and funding its operations:

- According to the Director, Research in OASA(RDA), establishing a new program office is not feasible. The Army is downsizing its management infrastructure and resourcing, establishing a new office counters that direction. Also, it appears to add a layer of management to the existing structure.
- It is reasonable to expect that additional funding may be required to complete strategic development and implementation, even though cost estimation for resolving the Army’s highest priority needs has not been completed. However, it is also reasonable to expect that leveraging existing assets and resources will offset those additional costs, perhaps totally. This is especially likely if EQSMO missions and staffing are established with affordability as a constraint.
- A new program for demonstrating, evaluating, and implementing EQ technologies may be considered redundant with the SERDP or ESTCP programs managed by OSD. As

reported, the ESTCP is not fully funded, does not have the same drivers and objectives as the Army does, and does not engage in life-cycle or strategic planning to ensure implementation of the technologies it demonstrates. Its mission is substantially different from the mission being prescribed for the EQSMO. A related argument may be made for the SERDP; the same counter arguments apply.

12.1.4 Other options exist that could succeed in meeting the intended objectives of program consolidation, but with greater risk of failure. Figure 12-2 shows an alternate management structure.



**FIGURE 12-2. ALTERNATE MODEL FOR CENTRALIZING AND CONSOLIDATING EQ RDA MANAGEMENT**

Contrasting the alternate structure to the EQSMO, the alternate structure is characterized as follows:

- Four Pillar Teams exist instead of a single systems management office. The central program authority is either assumed through the EQT Program leadership or devolved to the Pillar Teams (not yet determined).
- Pillar Team membership retain their organizational ties to operational units and HQ elements and remain administratively accountable to the EQT Program. No command and control incentives are placed over the Pillar Teams.
- Instead of a single funding authority provided through the EQSMO, funding authorities remain distributed across operational chains of command. Incentives for performers are applied along these operational command and control lines.

- Pillar integration and operational issues resolution requires explicit involvement of the EQT Program management structure.

Advantages of the alternate model:

- According to the Director, Research (OASA(RDA)) this management scheme would be easier to implement, since it does not counter the Army's initiative to downsize infrastructure.
- Under the alternate structure, 'collective' program authority might be vested in the three principals of the Executive secretariat. Each principal retains program authority over their respective program, such as the ASA(RDA) over the RDTE program and ACSIM over the O&M program. This paradigm is advantageous because it avoids administrative reprogramming of funds or ng a specific EQ MDEP. Consolidation of funding priorities and responsive administrative and programmatic corrections would depend on agreements reached among the principals of the EQT Program.
- Pillar Teams would be empowered similar to the EQSMO, but without additional infrastructure costs. Pillar Team costs would continue to be paid by individual organizational accounts unless a separate General and Administrative account for the EQT Program were established.

Disadvantages of the alternate model:

- The alternate scheme is not a proven corporate acquisition management scheme. Its implementation could require additional modeling and analyses before assurances are obtained that significant improvements over the current management structure can be realized. This imparts greater risk to success.
- It is not clear how this scheme will apply the necessary incentives to the Pillar Teams and to the multiple program authorities to put the strategic needs of the EQT Program as first priority. As long as the assets and funding stovepipes exist, decisions and actions likely will follow those stovepipes.
- To be effective, integration and operational issues resolution across Pillar Teams and Programs would require significant management by the EQT Program Executive Secretariat. Such operational demands on the Secretariat carry high risk. This use of the EQT Program as a principal operator of EQ RDA may also conflict with its role as an oversight and review entity.
- It is not clear that this scheme is consistent with previous recommendations of the GAO or DSB.

*12.2 Recommendation 2: As a way to establish and sustain greater returns on RDA investments and meet Army user needs, implement strategic program and investment planning practices, ensuring integrated approaches to program definition, structure, and design.*

12.2.1 The principal recommendation is to tailor the application of AR 70-1 and DOD Regulation 5000.2-R to EQ RDA. It is recommended to specifically implement practices

already proven effective for defining, structuring, and designing acquisition programs. The intent of this recommendation is to establish and sustain comprehensive, integrated planning, programming, and execution of EQ RDA with continuous participation by all stakeholders.

#### 12.2.2 Specific recommendations follow:

- Successful implementation of this recommendation will be contingent on the EQT leadership identifying from among the 200 total user requirements those having strategic significance. Therefore, ACSIM should review and revise the user needs listing (Andrulis Corporation 1994) for currency and strategic significance. Reasonable consideration should be given to aggregating individual user needs if payoffs from some are needed to accomplish others efficiently. This recommendation does not extend to lower priority user needs or those having limited, or localized, payoff.
- The ACSIM should assure development of additional information needed for sound program definition. Essential information includes: clear knowledge of specific environmental cost drivers (that is, environmental problems), technology solutions intended to mitigate those drivers, and minimum acceptable performance thresholds. Further, mechanisms should be employed to use this information to ensure affordability of technologies under fully-funded and fully-implemented conditions. Implementation of the essential elements of Mission Need Statements (MNS) and Operational Requirements Documents (ORD) (DOD Regulation 5000.2-R)(??) processing is advised.
- The ACSIM should accelerate assessment of operational risks in not meeting environmental technology user needs Armywide. This 'threat' information is required by OASA(RDA) to enable cost-to-resolution analyses and programming of developmental and operational T&E and full implementation.
- Strategic planning for EQ RDA should be the responsibility of a single entity and include those elements prescribed by DOD Regulation 5000.1, specifically the Acquisition Program Baselines (APB) and Acquisition Strategy. In developing strategies, it is recommended that commercialization not occur on the critical path to implementation, but instead be considered a secondary objective of the EQ RDA process.
- The EQT Pillar Technology Teams should be configured as operational IPTs or, when reasonable, combined as operational or Overarching IPTs servicing the EQT Executive Steering Committee.
- The EQT Program leadership should establish conditions and criteria under which it will designate materiel developers, logisticians, or trainers for particular EQ RDA projects, ensuring responsibilities identified in AR 70-1 are assigned.
- The OASA(RDA) should lead the EQT Program leadership to implement tailored, streamlined practices for developing program structures. These structures should incorporate planning and event-driven models prescribed by DoD Regulation 5000.2-R.
- Prior to defining EQT Integrated Product and Process Development (IPPD) practices, the OACSIM should revalidate the adequacy of its representation of MACOM

or Installation needs on EQ RDA matters. Adopted practices must ensure those users remain directly involved and committed to EQ RDA.

The OASCIM should incorporate EQ modernization needs in an EQ Annex to the Army Modernization Plan. This will enable OASA(RDA) to fully respond to EQ RDA needs. The OASA(RDA) then should incorporate EQ modernization objectives into the Army Science and Technology Base Master Plan to facilitate communication of those objectives and their impact on Army operations.

### 13. REFERENCES

- Andrulis Research Corporation. 1993. *U.S. Army environmental reseearch and development requirements: Final report*. Washington, D.C.: HQDA, Directorate of Environmental Programs (DAIM-ED).
- Army Budget Office. 1995. *The Army budget: 1996/1997 President's budget*. Assistant Secretary of the Army for Financial Management. Washington, D.C.
- Army Corps of Engineers (CoE). 1996. *Long range research and development plan*. Washington, D.C.: Military Programs Directorate of Research and Development.
- Army Environmental Center (AEC). 1994. *Environmental quality technology development, demonstration and transfer activities: FY93*. Aberdeen Proving Ground, Maryland: Environmental Technology Division.
- Army Environmental Center (AEC) Workplan. 1996. Aberdeen Proving Ground, Maryland: Environmental Technology Division.
- Army Pollution Prevention Program. 1995. *Environmental Technology Program*. U.S. Picatinny Arsenal, New Jersey: Army Armament Research Development and Engineering Center.
- Army Regulation (AR) 200-1, Environmental Protection and Enhancement (Draft), October 1995.
- Army Regulation (AR) 70-1, Research, development and acquisition: Army acquisition policy. March 1993.
- Army Research Office. 1995. *Peer Evaluation of the Army Environemtnal Quality Basid Research Program*. U.S. Army Corps of Engineers (Military Programs), Directorate of Research and Development.
- Bowman, Karlyn Keene. 1995. The Environment, Poliitcs, and Public Policy: The Changing Moods of America. Talk presented to the Executive Environmental Issues Awareness Seminar, 28 - 30 November, Washington, D.C.
- Charles, Keith. Deputy Assistant Secretary for Plans, Programs, and Policy. 1995. Memorandum announcing reengineering of the acquisition oversight and review process. 11 May.
- Defense Environmental Restoration Program. 1995. *Annual Report to Congress for Fiscal Year 1994*. Washington, D.C.: Office of the Secretary of Defense.
- Department of Defense (DoD) Directive 5000.1, Defense acquisition, March 1996.
- Department of Defense (DoD) Regulation 5000.2-R, Mandatory procedures for major defense acquisition programs (MDAPs) and major automated information systems (MAISAPs). March 1996.



- Department of Energy. 1995. *Energy R&D: Shaping our nations's future in a competitive world: Final report of the Task Force on strategic engery research and development*. Washington, D.C.: Secretary of Energy Advisory Board, U.S. Department of Energy.
- Department of the Army (HQDA). 1995. *Organizations and Functions Manual for the Deputy Assistant for Resource Analysis and Business Practices*. Washington, D.C.: Assistant Secretary for Financial Management, Comptroller.
- Department of the Navy. 1995. *Tri-Service Environmental Quality Research and Development Strategic Plan*. Alexandria, Virginia: Naval Facilities Engineering Command.
- Environmental Quality Technology (EQT) Program 1996. *Army Environmental Quality Technology Program: Minutes of 6 March 1996 meeting*. Washington D.C.: Assistant Secretary of the Army for Research, Development, and Acquisition.
- Environmental Quality Technology (EQT) Program. 1995a. *Environmental Quality Research, Development, and Acquisition Charter: Minutes of September 1995 meeting*. Washington D.C.: Assistant Secretary of the Army for Research, Development, and Acquisition.
- Environmental Quality Technology (EQT) Program. 1995b. *Army Environmental Quality Technology Program: FY96 and outyear program: Minutes of September 1995 meeting*. Washington D.C.: Assistant Secretary of the Army for Research, Development, and Acquisition.
- Fields, Craig I. Chairman Defense Science Board (DSB). 1995. Memorandum issuing the report of the DSB Task Force on Environmental Security. 17 May.
- Finch, Frank R. Director, Environmental Programs. 1995. Memorandum distributing the proceedings of the 1995 Army Senior Environmental Leadership Review. 1 December.
- Finch, Frank R. Director, Environmental Programs. 1996. Reorganization Memorandum. 7 October.
- Fox, Ronald J., Edward Hirsch, George Krikorian, Mary Schumacher, and Janice Baker. 1994. *Critical Issues in the defense acquisition culture: Government and industry views from the trenches*. Defense Systems Management College Executive Institute. Fort Beloir, Virginia.
- General Accounting Office (GAO). 1994. *DoD's new environmental security strategy faces barrier: GAO/NSIAD-94-142*. Washington, D.C.: GAO.
- General Accounting Office (GAO). 1995a. *Pollution prevention: Status of DoD's efforts: GAO/NSIAD- 95-13*. Washington, D.C.: GAO.
- General Accounting Office (GAO). 1995b. *Environmental protection: Challenges in defense environmental program management: GAO/NSIAD- 95-121*. Washington, D.C.: GAO.

- General Accounting Office (GAO). 1995c. *Unexploded ordnance: A coordinated approach to detection and clearance is needed: GAO/NSIAD- 95-197*. Washington, D.C.: GAO.
- General Accounting Office (GAO). 1995d. *Military bases: Environmental impact at closing installations: GAO/NSIAD- 95-70*. Washington, D.C.: GAO
- Headquarters, Department of the Army (HQDA). 1994. *Army science and technology base master plan: Fiscal year 1995*. Washington, D.C.: Deputy Assistant Secretary for Research and Technology.
- Hope, Robert L.. Chief, Engineer Division Headquarters, Forces Command. 1994. Memorandum on R&D Focused on User Input, 22 March.
- Jones, Cary. Chief, Environmental Restoration Division, Directorate of Military Programs. 1995. *Annual Report for 1994*. Washington, D.C.: U.S. Army Corps of Engineers.
- Kaminski, Paul. Under Secretary of Defense (Acquisition and Technology). 1996. Memorandum for the Defense Acquisition Community. 15 March.
- Life Systems, Inc. 1996. *1995 Environmental trends update: Main report (draft)*. Atlanta, Georgia: U.S. Army Environmental Policy Institute.
- Moore, Curtis and Alan Miller. 1994. *Green Gold*. Boston: Beacon Press and Miller.
- Office of the Assistant Secretary for Research, Development, and Acquisition (OASA(RDA)). 1996. *Consolidation and collocation of similar program offices*. The Bulletin, Deputy Assistant Secretary for Plans, Programs, and Policy. 15 May.
- Ordnance and Explosives Waste Mandatory Center of Expertise and Design Center (OEW MCX). 1995. *Annual Report for 1994*. Huntsville, Alabama: U.S. Army Corps of Engineers.
- Piasecki, Bruce W. 1995. *Corporate environmental strategy. An avalanche of change since Bhopal*. New York: John Wiley and Sons, Inc.
- Scola, Robert E. 1996. U.S. Army Materiel Command Pollution Prevention Analysis Survey. Study reported to the Environmental Quality Technology Executive Secretariat, February 9 at Washington, D.C.
- Small Business Administration. 1994. *Bridging the valley of death: Financing technology for a sustainable future*. Washington, D.C. U.S. Environmental Protection Agency.
- Strategic Environmental Research and Development Program (SERDP). 1996. *1995 annual report and five-year (1995-1999) strategic investment plan*. FY95 Annual Report. Arlington, Virginia: DoD.
- Sullivan, Gordon and M.P.W. Stone. 1992. *U.S. Army environmental strategy into the 21st Century*. Washington, D.C.: Atlanta, Georgia: U.S. Army Environmental Policy Institute.