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DEFENSE SYSTEM SOFTWARE MANAGEMENT PLAN

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Assistant Secretary of Defense
(Installations and Logistics)
Washington, D. C.

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The sharply rising costs of software programs in the Defense System acquisition process, with respect to acquisition procedures, development and maintenance of such software, and the increasing importance of the software roles in the overall mission effectiveness of major Defense Systems constitute serious technical and management problems that must be solved if we are to have the Defense Systems that are needed for our national security.

In an effort to provide solution to some of the key problems underlying Defense
(Cont'd on reverse side)

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System software acquisition, management, coordination, and control, the DoD
Software Management Steering Committee has formulated a comprehensive plan
comprising policy, practice, procedure, and technology initiatives. The plan
is described in detail in this document.

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DEFENSE SYSTEM SOFTWARE
MANAGEMENT PLAN

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DoD Defense System Software Management Program

Introduction

The sharply rising costs of software programs in the Defense System acquisition process, with respect to acquisition procedures, development and maintenance of such software, and the increasing importance of the software roles in the overall mission effectiveness of major Defense Systems constitute serious technical and management problems that must be solved if we are to have the Defense Systems that are needed for our national security.
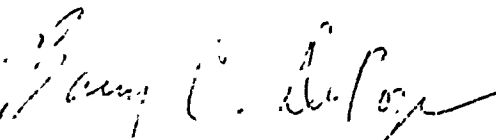
In an effort to provide solutions to some of the key problems underlying Defense System software acquisition, management, coordination, and control, the DoD Software Management Steering Committee has formulated a comprehensive plan comprising policy, practice, procedure, and technology initiatives. The plan, described in detail in the attached paper, is divided into the following Sections:
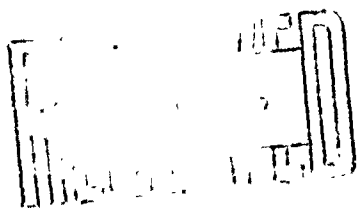
> Part One   Policy, Practice, Procedure, Technology Elements
> Part Two   Implementation Brief
>
> >   I.   Action Vehicles and Resources Estimates
> >   II.   Organizational Roles, Responsibilities and Interactions

The DoD Software Management Steering Committee intends to carry out the actions described in this plan, and to seek the support of the Service Components, Federal Contract Research Center, and Industry in so doing.

Comments or questions regarding material contained in this paper should be addressed to Mr. B. C. De Roze, OASD(I&L), Room 2A318, Pentagon. The appropriate telephone number is 695-0121.

BARRY C. De ROZE

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PART ONE

<u>Policy, Practice, Procedure, and Technology Elements</u>

- Problems Addressed

- Action to be Taken

DoD Software Program Elements

I. Management Policy

A. Software Visibility in Embedded Computer Sy.   Acquisition

1. Problem/Issue Summary

, Inadequate Requirement Analyses

. Inadequate Interface Management

. Inadequate Documentation

. Lack of Transferability

. Inaccurate Cost/Schedule Projections

. Low Quality

. Inconsistent Application of Tools and Procedures

. Management Prerogatives Pre-empted

2. Actions to be Taken

a. Management policies will be developed and emphasized to ensure that the same attention is given to software requirements analysis, planning, and design as hardware during the Concept Formulation and Program Validation phases of system development, prior to the DSARC II (or equivalent). Such policies will ensure that software is addressed in ROC's, SOR's, DCP's, and all other appropriate planning documents and enforced through system design reviews.

> Estimated time to complete (years): <u>0.8[1]</u>
> Estimated total cost (thousands of dollars): <u>0[2]</u>
> Action Vehicle: <u>DODD XX, DODD 500.2</u>
> Office of Primary Responsibility: <u>OSD</u>

b. Planning and management directives for embedded computer systems will treat software components as configuration items. All relevant DoD directives, such as DODI 4104.65, ASPR Case 70-83, and MIL-STD-881 on work breakdown structures, will be revised to reflect this change.

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[1]Time to complete from date of this paper. No connotation of manpower level of effort, nor of specific task duration.

[2]External fiscal resources only. Figures do not include costs associated with DoD Civilian or military personnel.

Estimated time to complete (years): 1.0
Estimated total cost (thousands of dollars): 0
Action Vehicle: DODD XX, DOD, MIL-STD, ASPR
Office of Primary Responsibility: OSD

c. A computer resource plan will be developed prior to DSARC II (or its equivalent) and maintained through the life cycle. The purpose of this plan is to identify the important embedded computer system resource acquisition and life cycle planning f~ cors, and establish specific software guidelines to ensure that these factors are adequately considered in the acquisition planning process.

Estimated time to complete (years): 0
Estimated total cost (thousands of dollars): 0
Action Vehicle: DODD XX, Service Directives
Office of Primary Responsibility: OSD, Services Respectively

d. Support items required to cost, effectively develop and maintain the delivered software over the system life cycle will be specified as deliverables with DoD acquiring rights to their design. Examples of such support items are compilers, environmental simulators, documentation, test case analyzers, test data management systems, system exercisers, standards generators and enforcers, and training airds. As with all deliverables, procedures will be developed for establishing and performing effective acceptance tests for deliverable support software, standards, training, and documentation. Also, appropriate procedures will be established for handling proprietary support software.

Estimated time to complete (years): .5
Estimated total cost (thousands of dollars): 0
Action Vehicle: DODD XX, Service Directives
Office of Primary Responsibility: OSD, Services Respectively

e. Specific milestones to manage the life cycle development of software will be used to ensure the proper sequence of analysis, design, implementation, integration, test and review. These milestones will include specific criteria that measure their attainment. MIL-STD-483, MIL-STD-490, and AFR 800-14 will be used as a baseline, but they will be expanded to define work to be accomplished, products to be delivered, and quantitative demonstration criteria.

Estimated time to complete (years): 1.0
Estimated total cost (thousands of dollars): 0
Action Vehicle: DODD XX, Service Standards and Regulations
Office of Primary Responsibility: OSD, Services Respectively

B. Software Language Standardization and Control

    1. Problem/Issue Summary

       Language Selection

- Lack of correlation between MOL language and engineering problem

- Lack of visibility into design

- Excessive machine dependent characteristics of MOL

       Language Proliferation

- Language Learning Process Difficult

- Discourages Development of Test and Support Tools

- Reduction of ma 'gement visibility and control over software design and development

- Complication of institutional control over language features

- Magnification of documentation, training, and other costs in proportion to number of languages in use

    2. Actions to be Taken

       a. Management policy encouraging the use of app 'ed Higher Order Language (HOL) by restricting the use of machine] (coding unless it is conclusively demonstrated that a HOL cannot used. Rigorous documentation (during program development) for all mach level coded programs to the algorithm level will be required.

           Estimated time to complete (years): <u>0.5</u>
           Estimated total cost (thousands of dollars): <u>0</u>
           Action Vehicle: <u>DODD XX, DODI XX</u>
           Office of Primary Responsibility: <u>OSD/DDR&E</u>

       b. Discourage the proliferation of HOL's currently being used in the Services, but encourage computer language R&D to enhance software visibility, quality and reliability.

           Estimated time to complete (Years): <u>0.5</u>
           Estimated total cost (thousand of dollars): <u>0</u>
           Action Vehicle: <u>DODD XX, DODI XX</u>
           Office of Primary Responsibility: <u>OSD/DD'&E</u>

c. Management policy directive will assign each DoD authorized
HOL to a control agent that will be responsible for assuring the stability
of the language, certifying all implement·tion, gathering data as to the use
of the language, and for disseminating information, compilers, and tools.

Estimated time to complete (years): 3 (then recurring)
Estimated total cost (thousands of dollars): 2,000/year
Action Vehicle: DODD XX, DODI XX
Office of Primary Responsibility: OSD/DDR&E

C. Software Quality Assurance and Control

1. Problem/Issue Summary

. Lack of management monitoring of software reliability

. Lack of formal software reliabili,y/quality assurance discipline

. Lack of quantitative data base for feedback of "lessons learned"

2. Actions to be Taken

a. Service policies will be encouraged to require experienced
personnel with software project background, and recent computer science
experience to be assigned to augment existing reliability/maintainability/
quality assurance organizations at the Service and program management
levels. The software role will include th . acquisition and use of existing
tools or the development of new tools for accomplishing reliability and
quality assurance functions (e.g., code auditors, test case generators/
analyzers, guidelines and handbooks, etc.).

Estimated time to complete (years): 0.5
Estimated total cost (thousands of dollars): 0
Action Vehicle: DODD XX, Service Policies
Office of Primary Responsibility: OSD, JLC/JTCG (ESR)
                                                Respectively

b. Establish a uniform software error data collection and analysis
system without delay. These data will be gathered from many programs in
order to develop genera' methods/analysis, and to predict the amount of
development effort needed to correct errors on specific programs, as well
·as the operational reliability/availability of the software.

Specific Tasks - the steps required under this task are:

(1) Convene a JLC panel under the JTCG-ESR of software
     reliability technologists

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(2) Charter the panel to set forth requirements for error data collection based on appropriate error classifications

(3) Derive formal definitions of terms within the data requirements list with emphasis on application boundaries, applicable life cycle phases, and usage oriented metrics

(4) Produce an exhibit of agreed upon data to be collected with associated definitions, metrics, and boundaries ready for attachment to RFP's

(5) Reflect these data requirements in a computerized software data repository for dissemination across DoD

Estimated time to complete (years): <u>1</u>
Estimated total cost (thousands of dollars): <u>0</u>
Action Vehicle: <u>Contract Exhibit</u>
Office of Primary Responsibility: <u>JLC/JTCG (ESR)</u>

II. Management Practices and Procedures

A. Software Acquisition Management Standards

1. Problem/Issue Summary

. Lack of standard terminology governing software acquisition and management

. Lack of established common standards

. Lack of consistent policy and planning guidance (via standards, regulations, instructions)

2. Actions to be Taken

a. Formalize a complete set of definitions for embedded computer system resources for adoption as a working standard in the DoD.

> Estimated time to complete: 0.5 years
> Estimated total cost (in $K): 0
> Action Vehicle: DODD XX, DODD 5100.40
> Office of Primary Responsibility: OSD, OSD(C) Respectively

b. Formalize a consistent set of definitions to reconcile computer and software system needs in weapon system, telecommunications, intelligence, and ADP areas of the DoD.

> Estimated time to complete: 1.0 years
> Estimated total cost (in $K): 0
> Action Vehicle: MIL-STD - XX, JCS PUB. 1
> Office of Primary Responsibility: OSD

c. Review all DoD and component Service regulations, directives, and standards to:

(1) Identify and correlate the various sources of information describing hardware and software acquisition and life cycle management.

(2) Identify those existing hardware and software regulations, directives, and standards which must be modified to provide consistency and coverage.

(3) Identify additional regulations, directives, and standards which are needed to adequately address software areas not covered.

Estimated time to complete: 0.5 years
Estimated total cost (in $K): 50
Action Vehicle: Study Report
Office of Primary Responsibility: OSD

d. Generate and promulgate the necessary modifications to and/or the new regulations, directives, and standards identified in c.(2) and c.(3) above.

Estimated time to complete: 2.5 years
Estimated total cost (in $K): 250
Action Vehicle: DODD, DODI, MIL-STD Service Directives, Regulations, Instructions
Office of Primary Responsibility: OSD and Services Respectively

e. Cancel any existing regulations, directives and standards no longer required as a result of d. above.

Estimated time to complete: 3.0 years
Estimated total cost (in $K): 0
Action Vehicle: DODD, DODI, MIL-STD, Service Directives, Regulations, Instructions
Office of Primary Responsibility: OSD, Service Respectively

f. Establish a qualified Office of Primary Responsibility within each Service to process additions and changes for consideration and inclusion in the standard definition list, regulations, directives, and standards.

Estimated time to complete: Recurring
Estimated total cost (in $K): 100 annually
Action Vehicle: Service Instructions
Office of Primary Responsibility: Services

B. Software Acquisition, Management, Development, Operation, and Support Guides

1. Problem/Issue Summary

   . Insufficient understanding by managers

   . Lack of planning and operation guidance in day-to-day operations

   . Lack of systems engineering methodology and discipline

   . Lack of technology transfer into application domain

   . Lack of personnel skill continuity over life cycle

2. Actions to be Taken

a. Prepare a series of guidelines, checklists, handbooks, examples, and other "how to do it" data within the areas of software development, acquisition, operation, and support for use by program managers and their staffs. A typical (although not complete) list of topics to be addressed are:

    (1) Formulating a life cycle plan

        (a) The planning activity

        (b) Cost and resource estimation

    (2) Specification and contracting

        (a) Requirements specification

        (b) Concept validation

        (c) Contracting

            SOWs and RFPs

    (3) Computer resource development plan review

    (4) Development visibility and control

    (5) Support facility plan evaluation

    (6) Product control

        (a) Documentation requirements

        (b) Configuration management

    (7) Quality assurance plan evaluation

        (a) Design validation

        (b) S/W verification

        (c) S/W validation and certification

    (8) Maintenance

(9) Synopsis of regulations, specifications, and standards

    Estimated time to complete: <u>3 years</u>
    Estimated total cost (in $K): <u>500</u>
    Action Vehicle: <u>Service Handbooks</u>
    Office of Primary Responsibility: <u>Service Components</u>

    b. The products of this program will be disseminated to DoD and
component Services in order to evaluate their value and identify where they
could be improved. Feedback from the field will be incorporated in updated
versions of the guidelines and a continued maintenance effort will be
established.

    F imated time to complete: <u>Recurring</u>
    estimated total cost (in $K): <u>50 (Annual)</u>
    Action Vehicle: <u>Service Handbooks</u>
    Office of Primary Responsibility: <u>Service components</u>

C. <u>Personnel Development and Training</u>

    1. <u>Problem/Issue Summary</u>

        . Software engineering as a scientific discipline has not been
          clearly and formally established

        . Shortage of practitioners

        . Lack of career incentives

        . Lack of relevant academic curricula

    2. <u>Actions to be Taken</u>

        a. Recommend that the Service Logistics Commanders establish
offices of primary responsibility (OPRs) for the promotion, coordination and
direction of the efforts to develop high level software professionals. These
OPRs should reside in AFSC (Air Force), NMC (Navy), AMC (Army) with
coordination between these groups by a JLC Joint Technical Coordinating
Group. The individuals selected for this OPR function should be of high
caliber who are (a) intimately familiar with current state of the art in this
area; (b) aware of the needs and problems of software in military systems;
and (c) represent the formal engineering, programming, mathematical, and
educational sciences.

Estimated time to complete: 0.5 years
Estimated total cost (in $K): 0
Action Vehicle: Service Instructions
Office of Primary Responsibility: JLC/JTCG (XX)

b. Recommend that the Service Logistics Commanders, through the OPRs, establish an exchange or rotational program to give university level instructors an exposure to the DoD needs. This program should include summer (or equivalent period) assignments to organizations involved in state of the art architecture studies, design, maintenance, etc., e.g., Data Systems Design Center, AF Systems Command, Army and Naval Materiel Commands, operational commands, Federal Contract Research Centers, etc. Educational institutions should include Air Force Institute of Technology, Naval Post Graduate School, Military Academies, and selected civilian universities.

Estimated time to complete: 1.0
Estimated total cost (in $K): 0
Action Vehicle: Service Instructions
Office of Primary Responsibility: JLC/JTCG (XX)

c. Recommend that the Service Logistics Commanders, through the OPRs, establish an apprenticeship program for qualified and promising military and civil service software engineering candidates.

Estimated time to complete: 0.8
Estimated total cost (in $K): 0
Action Vehicle: Service Instructions
Office of Primary Responsibility: JLC/JTCG (XX)

d. Recommend that the Service Logistics Commanders, through the OPRs, establish a general definition of what constitutes a good software engineer (professional profile) thereby establishing specialty codes and career fields. This definition of the profession should carefull delineate educational and experience requirements for various levels of proficiency.

Estimated time to complete: 0.8 years
Estimated total cost (in $K): 0
Action Vehicle: Professional & Career Profiles
Office of Primary Responsibility: JLC/JTCG (XX)

e. Recommend that the Service Logistic Commanders, through the OPRs establish an effort to incorporate software engineering into the background of computer scientists and engineers. A practical goal would be to establish regular graduate courses at the Air Force Institute of Technology, Naval Post Graduate School and civilian universities. Discretionary funding to civilian universities should be used to establish the graduate level courses and additionally to establish elective junior and senior level undergraduate courses.

> Estimated time to complete: 1.3 years
> Estimated total cost (in $K): 500
> Action Vehicle: Curriculum Plans and Course Outlines
> Office of Primary Responsibility: JLC/JTCG (XX)

f. Recommend that the Service Logistics Commanders, at one or more universities special training programs tailored for the joint Service software personnel. These programs can vary in length (3 months to a year). They should be aimed at those software personnel who have a fair amount of experience and some management responsibility. These programs would be intended to provide an in-depth exposure to new developments in software engineering.

> Estimated time to complete: 1.6 years
> Estimated total cost (in $K): 500
> Action Vehicle: Curriculum Plans and Course Outlines
> Office of Primary Responsibility: JLC/JTCG (XX)

g. Establish the addition of software acquisition/life cycle management practices to the Defense Systems Management School (DSMS) curriculum at the next DSMS Policy Guidance Council meeting. The initial course material could be in the form of readings and/or guest lecturers and be expanded as handbooks and technical guidance becomes available. The course content will be developed by the DSMS faculty with support from OSD and the Services.

> Estimated time to complete: 0.2 years
> Estimated total cost (in $K): 0
> Action Vehicle: DSMS Policy Guidance
> Office of Primary Responsibility OSD

D. Software Quality Specification and Trade-Offs

1. Problem/Issue Summary

   . Lack of system optimization with respect to both hardware and software

   . Lack of quantitative quality, reliability goals and objectives

   . Lack of quantiative test standards

. Lack of test and support software incentives

2. Actions to be Taken

a. Specifications for embedded computer systems should contain specific reliability requirements along with the functional and performance requirements. These should be quantified with respect to operational objectives (e.g., system or subsystem downtime), and used to drive the design, development, and testing of embedded software systems.

Estimated time to complete (years): 1.0
Estimated total cost (thousand of dollars): 0
Action Vehicle: System Requirements Specifications Entry
Office of Primary Responsibility: JLC/JTCG (ESR)

b. Hardware design guidelines (within category of embedded computer systems) should be established to allow inclusion of:

> Reliability-enhancing procedures and tools such as higher er languages and structured code, test drivers, and monitors.

use of microprogramming and microprocessing capabilities to aid in self monitoring and diagnosis.

(3) Monitor registers and accessible hardware monitoring probe points to facilitate external monitoring and diagnosis.

Estimated time to complete: 1 year
Estimated total cost: $750K
Action Vehicle: System Design Specifications
Office of Primary Responsibility: JLC/JTCG (ESR)

III. Technology

A. Coordinated Software Research and Development

1. **Problem/Issue Summary**

   - Lack of focus in software R&D, study and pilot programs

   - Lack of technological base to implement desired policy, practices, and procedure initiatives

   - Obscure relevancy of many R&D efforts to real improvements in software management policies, practices, and procedure techniques

   - Redundancy and duplication of R&D programs

2. **Actions to be Taken**

   a. A coordinated R&D program will be initiated to supply the technological base needed to support the management policy, practice and procedure initiatives cited in Sections I and II of the DoD Software. Table III-1 indicates the R&D thrusts required. Specific task areas underlying these initiatives are currently being developed.

   Estimated time to complete: <u>8 years</u>
   Estimated total cost (thousands of dollars): <u>38,000</u>

   b. A mechanism will be established for reviewing all technology elements of the DoD Software Program with respect to "prototype or experimental proofing" prior to full scale technology transfer to on-going system applications.

B. Transferability of Software Support Aids

1. **Problem/Issue Summary**

   - No reuse or transferability of software support aids

   - Procurement and Development Redundancy (Excessive Costs/ Low Quality Products)

   - Low Development Incentive for Support Aids

2. Actions to be Taken

a. A repository will be established within DoD responsible for maintenance and institutional control of support aids for development, test, analysis, and maintenance of computer programs. In support of this action, the following typical activities will be undertaken:

(1) All aids placed into the physical inventory should be screened, validated and documented according to a certain set of standards. The standards would be developed as part of this project.

(2) The user must be assisted in determining what aids are applicable to development and in using the aids (in-house or contractually). Guidelines for the use of the aids must be written and a staff of personnel knowledgeable in all facets of computer program development, test, analysis and maintenance must be available to manage the inventory and serve as consultants.

(3) Policy will be instituted which requires all DoD organizations procuring original software for which support aids will be required to query the repository in advance to ascertain whether existing, Government owned tools could be applied to the particular project, or to justify why this cannot be done.

Estimated time to complete: 4 years
Estimated total cost (thousands of dollars): $1000
Action Vehicle: DODD XX
Office of Primary Responsibility: OSD

b. Procurement vehicles (such as directed licensing, royalty payments) will be developed and injected into the contract structure to allow and encourage industry interest in development of transferable tools.

Estimated time to complete: 2 years
Estimated total cost (thousands of dollars): 0
Action Vehicle: Procurement Research
Office of Primary Responsibility: OSD, Services

DoD Software Management Program

PART TWO

Implementation Brief

Section I

Action Vehicle and

Resource Estimate

MANAGEMENT POLICY

The action vehicles envisioned for carrying out the management policy
initiatives of the DoD Software Management Program are identified in
Table I-1, along with a designated Office of Primary Responsibility
(OPR). The designated OPR shall take the lead in preparing and coordinating the cited vehicle. The OPR will be supported in this activity by the
Software Management Steering Committee, its technical and procurement
panels, the Service Logistics Commanders, Service components, and FCRC
contract efforts.

Required resources to effect the action are also cited in Table I-1 in terms
of both time and money. The time entries represent calendar time for
completion starting from the date of this brief. It does not represent the
duration of any specific task. Fiscal resources depict only those services
which must be procured under contract funding. The cited entries do not
include the salary and overhead associated with DoD Civilian or Military
personnel.

Table I - 1a

Software Visibility in Weapon Systems Acquisition

IMPLEMENTATION OF POLICY ACTIONS

ACTION	VEHICLE	OPR	TIME (YEARS)	$ K REQUIRED RESOURCES
ANALYSIS AND VALIDATION OF SYSTEM REQUIREMENTS	DC _ - XX DODD 5000.2	OSD	0.8	-- --
SOFTWARE AS CONFIGURATION ITEM	DODD XX ASPR MIL-STD	OSD	1.0	-- --
COMPUTER SYSTEM	DODD XX SERVICE DIRECTIVES, INSTRUCTIONS, STANDARDS	OSD SERVICES	0.5	-- --
SUPPORT SOFTWARE AS DELIVERABLE	DODD XX SERVICE DIRECTIVES, INSTRUCTIONS	OSD SERVICES	0.5	-- --
MILESTONED DEVELOPMENT PLAN	DODD XX MIL-STD-XX	OSD JLC	1.0	-- --

* DOD XX = CAPSTONE DIRECTIVE TO SUPPLEMENT AND AID IN THE APPLICATION OF MANAGEMENT PRINCIPLES ESPOUSED IN DODD 5000.1 AND 5000.2, AS THEY RELATE TO COMPUTER RESOURCES IN SYSTEMS.

Table I - 1b

Software Language Standardization & Control

IMPLEMENTATION OF POLICY ACTIONS

ACTION	VEHICLE	OPR	TIME (YEARS)	$ K REQUIRED RESOURCES
MOL SUPPRESSION	DODD XX	OSD	0.5	- -
ESTABLISHMENT OF APPROVED HOL				
INTERIM STANDARDS	DODI XX	OSD	0.5	- -
LONG TERM STANDARDS	DODI XX	CSD	3.0	$ 14,000
HOL CONTROL FACILITY	DODD XX DODI XX	OSD	3.0	$2M/YR

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Table I - 1c

Software Quality Assurance and Control

IMPLEMENTATION OF POLICY ACTIONS

REQUIRED SOURCES

ACTION	VEHICLE	OPR	TIME	$ K
SOFTWARE QA ORGANIZATION AND PROGRAM PLAN	SERVICE INSTRUCTION MIL-STD	JLC/JTCG (ESR)	0.5	- -
SOFTWARE ERROR DATA COLLECTION & ANALYSIS	CONTRACT EXHIBIT	JLC/ JTCG (ESR)	1.0	- -

II-5

MANAGEMENT PRACTICE AND PROCEDURE

The action vehicle envisioned for carrying out the management practice
and procedure initiatives of the DoD Software Management Program are
identified in Table I-2, along with a designated Office of Primary Respon-
sibility (OPR). The designated OPR shall take the lead in preparing and
coordinating the cited vehicle. The OPR will be supported in this
activity by the Software Management Steering Committee, its technical and
procurement panels, the Service Logistics Commanders, Service components,
and FCRC contract efforts.

Required resources to effect the action are also cited in Table I-2 in
terms of both time and money. The time entries represent calendar time
for completion starting from the date of this brief. It does not
represent the duration of any specific task. Fiscal resources depict
only those services which must be procured under contract funding. The
cited entries do not include the salary and overhead associated with DoD
Civilian or Military personnel.

Table I - 2a

IMPLEMENTATION OF PROCEDURE ACTIONS

ACTION	ACTION VEHICLE	OPR	REQUIRED RESOURCES	
			TIME TO COMPLETE	$ K
FORMALIZE W's DEFINITIONS	DODD XX	OSD	0.5	- - -
FORMALIZE DEFINITIONS ACROSS W. TELECOMM., INTELL., AND ADP	MIL-STD-XXX	OSD	1.0	- - -
REVIEW OF EXISTING REGULATIONS, DIRECTIVES AND STANDARDS	STUDY REPORT	OSD/ SERVICE	0.5	$ 50 K
MODIFY OR ADD REGULATIONS DIRECTIVES AND STANDARDS	DODD, DODI, MIL-STD, SERVICE INSTRUCTIONS, STANDARDS, REGULATIONS (NEW AND REVISED)	OSD, SERVICE LC	2.5	$ 250 K
CANCELLATION	DIRECTIVE, REGULATION, AND STANDARD CANCELLATION	OSD, SERVICE LC	3.0	- - -
MAINTENANCE OPR	SERVICE COMPONENT INSTRUCTIONS	SERVICE LC	RECURRING	$ $ 100 K/YR.

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Table I - 2b

IMPLEMENTATION OF PRACTICE & PROCEDURE ACTIONS

ACTION	ACTION VEHICLE	OPR	TIME (YEARS)	$ K REQUIRED RESOURCES
SOFTWARE GUIDELINES, CHECKLISTS, HANDBOOKS	SERVICE MANUALS SEMI-ANNUAL USER REVIEWS	SERVICES	0.3	$500/YEAR
DESIGNATED PROFESSIONAL DEVELOPMENT OPRs	SERVICE DIRECTIVE	OSD/JLC	0.5	--
ROTATIONAL PROGRAM FOR INSTRUCTORS	SERVICE DIRECTIVE	SERVICES	1.0	--
APPRENTICESHIP PROGRAM	SERVICE DIRECTIVE	SERVICES	0.8	--
SPECIALTY CODES/CAREER PATHS	SERVICE DIRECTIVE	SERVICES	0.8	--
CURRICULA MODIFICATION	SERVICE DIRECTIVE/ ACADEMIC GRANTS	SERVICES	1.3	--
IN-SERVICE TRAINING PROGRAMS	SERVICE DIRECTIVE	SERVICES	1.6	--

Table I - 2c

Software Quality Specification and Trade-Offs

IMPLEMENTATION OF PROCEDURE ACTIONS

| | | | REQUIRED RESOURCES | |
ACTION	VEHICLE	OPR	TIME	$ K
QUALITY REQUIREMENTS SPECIFICATION AND TEST	REQUIREMENTS SPECIFICATION	JLC/ JTCG (ESR)	1.0	--
DESIGN GUIDELINES FOR SOFTWARE QUALITY ENHANCED	REQUIREMENTS SPECIFICATION	JLC/ JTCG (ESR)	1.0	$750 K

TECHNOLOGY

The action vehicles envisioned for carrying out the technology initiatives of the DoD Software Management Program are identified in Table I-3, along with a designated Office of Primary Responsibility (OPR). The designated OPR shall take the lead in preparing and coordinating the cited vehicle. The OPR will be supported in this activity by the Software Management Steering Committee, its technical and procurement panels, the Service Logistics Commanders, Service components, and FCRC contract efforts.

Required resources to effect the action are also cited in Table I-3 in terms of both time and money. The time entries represent calendar time for completion starting from the date of this brief. It does <u>not</u> represent the duration of any specific task. Fiscal resources depict only those services which must be procured under contract funding. The cited entries do not include the salary and overhead associated with DoD Civilian or Military Personnel.

Table I – 3a

Coordinate Software Research & Development

IMPLEMENTATION OF TECHNOLOGY ACTIONS

ACTION CODE	ACTION VEHICLE	OPR	REQUIRED RESOURCES	
			TIME TO COMPLETE	DOLLARS
COORDINATED R&E	SERVICE COMPONENT R&D PROGRAMS	DDR&E/ SERVICES	8	$38.1 M
PROTOTYPE PROOFING	PROTOTYPE SELECTION/ MONITORING	JLC	--	--

Table – 3b

IMPLEMENTATION OF TECHNOLOGY ACTIONS

ACTION	VEHICLE	OPR	REQUIRED RESOURCES	
			TIME	DOLLARS
SUPPORT SOFTWARE REPORTING	DODD AND ACCOMPANYING SERVICE DIRECTIVES	OSD JLC	4	$ 1.M
PROCUREMENT VEHICLE DEVELOPMENT & USE	PROCUREMENT POLICY	OSD 1/	2	--

NOTE: 1/ VIA PROCUREMENT PANEL OF SMSC

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DoD Software Management Program

PART TWO

Implementation Brief

Section II

Organizational Roles, Responsibilities, Interactions

MANAGEMENT POLICY

The organizational interactions necessary for implementation of the management policy portion of the DoD oftware Management Program are illustrated in Figure II-1.

For both new policy initiatives and changes to existing policy, the following roles shall generally apply:

a. Steering Committee - OPR

1. Review existing policies for coverage, adequacy, realism and auditability.

2. Determine need for new policy, modified policy, or "no change" action.

3. Draft policy and coordinate within OSD/Services - include audit standards.

4. Assess impact of new or modified policy.

5. Brief DSARC on position, ensuing impact, areas of applicability, exclusions, and expected benefits.

6. Finalize policy and establish necessary audit mechansim and reporting structure.

7. Continuously monitor corresponding service policies, procedures, regulations as well as OSD actions in definitional areas and ADP.

8. Prepare DSARC checklist to assure program consistency with in force policies, new or modified.

9. Monitor impact of policy to determine if it produces desired results.

b. Role of Panels and Panel Members

1. Technical and management advisory role.

2. Policy impact assessment and analysis.

a. Technological

b. Economic impact

c. Procurement impact - industrial motivation

3. Surface additional inadequate existing directives, instructions, and standards.

c. Role of Services

1. Comment on OSD policies during formulation.

2. Prepare accompanying regulations, instructions, and standards for Service components.

3. Carry out policy and accompanying audit mechanism; review with OSD periodically to assess resulting gains and losses.

Specific responsibility and action items with respect to each of the DoD Software Management Program elements are delinated in Table II-1.

Figure II-1

ORGANIZATIONAL INTERACTIONS
POLICY INITIATIVES
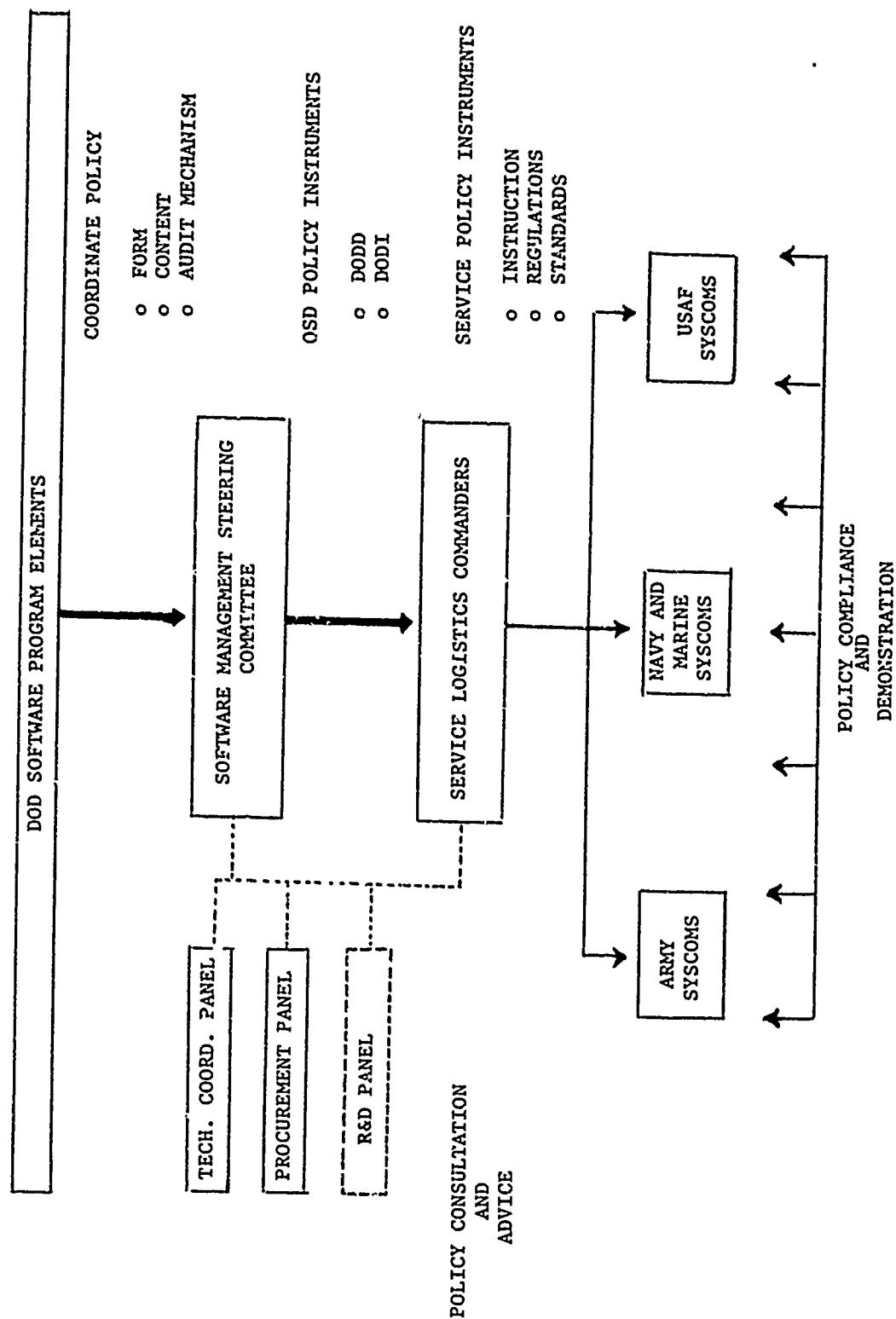
Table II-1

Responsibility and Action Summary – MANAGEMENT POLICY

| | OSD | | PANELS | SERVICE LOGISTICS COMMANDERS | |
	SMSC	FCRC		SERVICE COMPONENTS	JTCG/ESR
A. Software Visibility in WS Acquisition					
a. Requirements Validation & Analysis	P	A	S	I	S
b. Software as Configuration Item	P	A	S	I	S
c. Comp. System Resource Plan	S	A	P	I	A
d. Support Software as Deliverable	P	A	S	I	A
e. Milestone Guide & Evaluation Criteria	S	A	P	I	S
B. Software Language Standardization & Control					
a. MOL Suppression	P		S	I	
b. Establishment of Approved HOL	P		S		
c. HOL Control Facility	P	A	S	I	
C. Software Quality Assurance & Control					
a. Software QA Organization	S		S	I	P
b. Software Data Collection & Reporting System	S	A	S	I	P

Code: P = Primary or Lead Responsibility
S = Support Responsibility
A = Advisory Responsibility
I = Implementation Responsibility

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MANAGEMENT PRACTICE AND PROCEDURE

The implementation of management practice and procedures portions of
the DoD Software Management Program involves a merger between policy
and technology initiatives. In those areas where directives, standards,
instructions are involved, the organizational interactions are identical
to those prescribed in the policy domain. In those areas where technology
provides the primary impetus for practice and procedural steps, the
organizational interactions will follow that prescribed in the technology
domain.

Specific responsibility and action items with respect to each of the DoD
Software Management Program elements are delinated in Table II-2.

Table II-2

Responsibility and Action Summary – MANAGEMENT PRACTICE & PROCEDURE

PRACTICE AND PROCEDURE	OSD			SERVICE LOGISTICS COMMANDERS	
	SMSC	FCRC	PANELS	SERVICE COMPONENTS	JTCG
A. Software Acquisition Management Standards					
a. Formalize WS Definitions	P	A	S	S	
b. Formalize Definitions Across WS Telecommunications Intelligence and ADP	P	A	S	S	
c. Review of Existing Regulations, Directives, and Standards	S	P	S	S	
d. Modify or Add Regulations, Directives, Standards	P	A	P	S	
e. Cancel Inappropriate Regulations, Directives, Standards	P	A	P	S	
f. Establish OPR for Maintenance of Regulations, Directives, Standards	P		S	P	
B. Software Acquisition, Management, Development, Operation and Support Guides					
a. Preparation of Guidelines, etc.	S	S	P	P	S
b. Guide Dissemination and Feedback	S	S	P	P	S
c. Personnel Development and Training	P	A	P	I	
C. Software Qualify Spec. and Trade-Offs					
a. Specification of Quantitative Rel Objectives	S	S	S	I	P
b. Hardware Design Guidelines for System Level Balance	S	S	S	I	P

TECHNOLOGY

The organizational interactions necessary for implementation of the technology portion of the DoD Software Management Program are illustrated in Figure II-2.

For new technology programs and initiatives, the following roles shall generally apply:

a. Service Components

1. Originate ideas in technological areas of interest

2. Review program proposals; technical approval or rejection

3. Budget request or reprogramming of funds

4. Provide technical and fiscal management of programs

5. Appraise Software Management Steering Committee of meaningful findings, results, and product developments

b. Role of Panels and Panel Members

1. Originate ideas in technological areas of interest

2. Coordinate technology efforts among Services; evaluate programs for transferability

3. Technical advocacy in respective Services

4. Brief Software Management Steering Committee of meaningful finuings, results, and product developments; provide policy impact assessment

5. Publicize technological developments throughout DoD and industry; interface with other DoD Software Groups, e.g., (ESR, NLCC, etc).

c. Role of Software Management St er u1 'ommittee

1. Review technology programs for poli , c:ons'stency, relevancy, and impact

2. Update policy and audit mechanisms to exploit "enabling technology"

3. Brief DSARC on promising developments, and on imminent improvements resulting from technology

4. Publicize technolog.. ~l developments and their ensuing impact on policy through DoD and industry

5. Advise DDR&E on software technology programs

Specific responsibility and action items with respect to each of the DoD Software Management Program elements are delineated in Table II-3.

For on-going technology programs, the roles of the Service Components and the Software Management Steering Committee are the same as cited above. The role of the Panels and Panel Members is slightly modified to include:

1. Review and coordination of objectives, goals, and implementations

2. Identify strengths and weaknesses in a tri-service context

3. Identify areas of transferability across service lines·

4. Identify areas of R&D transfer to contemporary programs

5. Advise and consult with cognizant sponsor organization

6. Brief Software Management Steering Committee and DDR&E on meaningful findings, results, and product developments; provide policy impact assessment

FIGURE II-2

ORGANIZATIONAL INTERACTIONS TECHNOLOGY INITIATIVES

DDR&E PROGRAM APPROVALS

ADVISORY

SOFTWARE MANAGEMENT STEERING COMMITTEE

POLICY, PRACTICE, PROCEDURE TECHNOLOGY AND COORDINATION

TECH. COORD. PANEL

R&E TECH. PANEL

PROC. PANEL

TECH ADVISORIES AND COORDINATION

ARMY SYSCOMS

NAVY AND MARINE SYSCOMS

USAF SYSCOMS

SERVICE TECHNICAL COMPONENTS

DOD SOFTWARE PROGRAM ELEMENTS AND PUBLICITY

TECHNOLOGY PROGRAMS
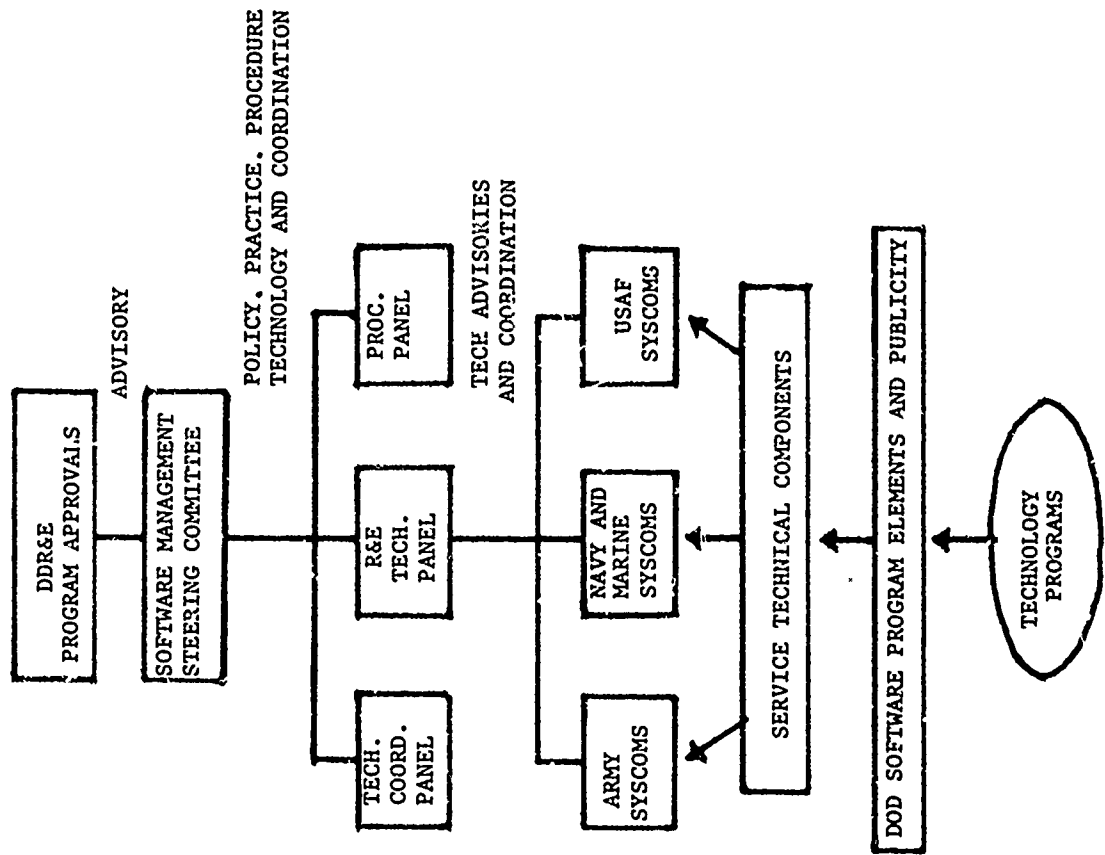
Table II-3
Responsibility and Action Summary — TECHNOLOGY

ACTION	OSD			SERVICE LOGISTICS COMMANDERS	
	SMSC	FCRC	PANELS	SERVICE COMPONENTS	ESR
A. Coordinated Software R&D	S	S	P	S	S
B. Transferability of Software Support Aids					
a. Support Software	P	A	S	I	
b. Procurement Vehicles	P		S	I	

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Software Management Steering Committee

Statement of Principles

CAPSTONE DIRECTIVE

I. Management Policy

<u>Software Visibility in Weapon System Acquisition</u> - Computer resources
in systems are managed as elements or subsystems of major importance
during conceptual, validation, full-scale development, production,
deployment, operation and support phases. The purpose of the Directive
is to supplement and aid in the application of the management principles
espoused in DODD 5000.1 and DODD 5000.2 as they relate to these
resources.

1. Software requirements and risk analyses, planning, preliminary
design, and interface control and integration will be conducted during the
Concept Formulation and Program Validation phases of system development,
prior to the DSARC II. Ease of maintenance and modification will be major
considerations in the initial design.

2. Planning and management directives for embedded computer systems
will treat software components as configuration items.

3. A computer resource plan shall be developed prior to DSARC II and
maintained through the life cycle. The purpose of the plan is to identify
the important embedded computer system resource acquisition and life cycle
planning factors, and establish specific software guidelines to ensure that
these factors are adequately considered in the acquisition planning process.

4. Support items required to cost effectively develop and maintain the
delivered software over the system's life cycle will be specified as deliverable
with DoD acquiring rights to their design. Examples of such support items
are compilers, environmental simulators, documentation aids, test case
generators and analyzers, test data management systems, system exercisers,
standards enforcers, and training aids.

5. Specific milestones to manage the life cycle development of software
will be used to ensure the proper sequence of analysis, design, implementation,
integration, test, operation and maintenance. These milestones will include
specific criteria that measure their attainment.

6. Technical and managerial personnel with embedded computer system
experience will be assigned responsive to program management organizations.

7. DoD approved Higher Order Languages (HOL) will be used to develop embedded computer systems unless it is conclusively demonstrated that the approved HOL is not cost effective over the system life cycle. Any DoD approved HOL will be assigned to a designated control agent who will be responsible for assuring the stability of the language, certifying all implementations, gathering data as to the use of the language, and for disseminating information, compilers, and tools.

II. Management Practices and Procedures

A. Software Acquisition Management Standards

1. Standard terminology is essential for the management of embedded computer system resources throughout the DoD. Definitions listed in Attachment A will be used as standards throughout the DoD and by DoD contractors in the implementation of DoDD 5000.1 and 5000.2.

2. Review all DoD and component Service regulations, directives, and standards to:

(a) Identify and correlate the various sources of information describing hardware and software acquisition and life cycle management.

(b) Identify those existing hardware and software regulations, directives, and standards which must be modified to provide consistency and coverage.

(c) Identify additional regulations, directives, and standards which are needed to adequately address software areas not covered.

3. Generate and promulgate the necessary modifications to and/or the new regulations, directives, and standards identified in II.A.2. above.

4. Cancel any existing regulations, directives, and standards no longer required as a result of II.A.2. above.

5. Establish a qualified Office of Primary Responsibility within each Service to process additions and changes for consideration and inclusion in the standard definition list, regulations, directives, and standards.

B. Embedded Computer System Resource Acquisition, Management, Development, Operation and Support Guides

1. The DoD will develop a coordinated embedded computer systems software engineering methodology and discipline to improve the quality of software and provide for the effective management control of its development. To achieve these objectives, the Services shall:

(a) Prepare and maintain guidelines, checklists, handbooks and examples covering development, acquisition, operation and support. These are intended for day-to-day use by program managers and their staffs.

(b) Establish appropriate education, training or experience career paths with accompanying career incentives to foster the development and retention of professional embedded computer system software engineers.

(c) Initiate a coordinated Research and Development Program to identify and supply the technological base needed to support the policy, practice, and procedure initiatives cited in this Directive.

2. Further, DoD will establish an inventory of embedded computer system hardware, software, and support facility resources.

DEFINITIONS

Computer Data Basic elements of information used by computer equipment in responding to a computer program.

Computer Equipment: Devices capable of accepting and storing computer data, executing a systematic sequence of operations on computer data or producing control outputs. Such devices can perform substantial intrepretation, computation, commensuration, control, and other logical functions.

Computer Firmware: The logical code of computer equipment which interprets the control functions of that equipment.

Computer Program: A series of instructions or statements in a form acceptable to computer equipment, designed to cause the execution of an operation or series of operations. Computer programs include operating systems, assemblers, compilers, interpreters, data management system, utility programs, and maintenance/diagnostic programs. They also include application programs such as payroll, inventory control, operational flight, strategic, tactical, automatic test, crew simulator, and engineering analysis programs. Computer programs may be either machine dependent or machine independent, and may be general purpose in nature or be designed to satisfy the requirements of a specialized process or a particular user.

Computer Resources: The totality of computer equipment, computer programs, computer data associated documentation, personnel, and supplies.

Computer Software: A combination of associated computer programs and computer data required to command the computer equipment to perform computational or control functions.

Embedded: Objective modifier; integral to, from a design, procurement, and operations point of view.

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SOFTWARE MANAGEMENT PROGRAM REVIEW

PRESENTATION TO DEFENSE SCIENCE BOARD

SOFTWARE TASK GROUP

25 JULY 1975

1

PRESENTATION OUTLINE

I   BACKGROUND AND INTRODUCTION

II NATURE OF PROBLEM

III OBJECTIVE OF DOD SOFTWARE MANAGEMENT PROGRAM

IV POLICY INITIATIVES

V   PRACTICE AND PROCEDURE INITIATIVES

VI TECHNOLOGY INITIATIVES

VII ORGANIZATIONAL INTERACTIONS

VIII SUMMARY

2

BACKGROUND & INTRODUCTION

ANNUAL WEAPON SYSTEM SOFTWARE COST ESTIMATE — —
> $1.4 BILLION

- ● DIRECT COSTS ONLY

- ● EXCLUDES INTELLIGENCE, NON-TACTICAL C^3, LOGISTIC APPLICATIONS

- ● CONSERVATIVE ESTIMATE

WEAPON SYSTEM INVOLVING SOFTWARE — — 115

- ● APPROX. 50% IN DEVELOPMENT

- ● APPROX. 50% IN O&M

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BACKGROUND & INTRODUCTION (CONT'D)

ROLE OF SOFTWARE IS INCREASING — — IT IS NOW
HIGH LEVERAGE ITEM

MANAGEMENT PROBLEM INVOLVES — —

- ORGANIZATIONAL FOCUS WITHIN DOD

- COORDINATED POLICY

- COORDINATED PRACTICE/PROCEDURE

- COORDINATED TECHNOLOGY

- DISCIPLINE & RIGOR

- QUALITY IMPROVEMENT

- MANAGEMENT INTERACTION IN DECISION
  PROCESS

4

Interrelationship of Software Acquisition Study Findings
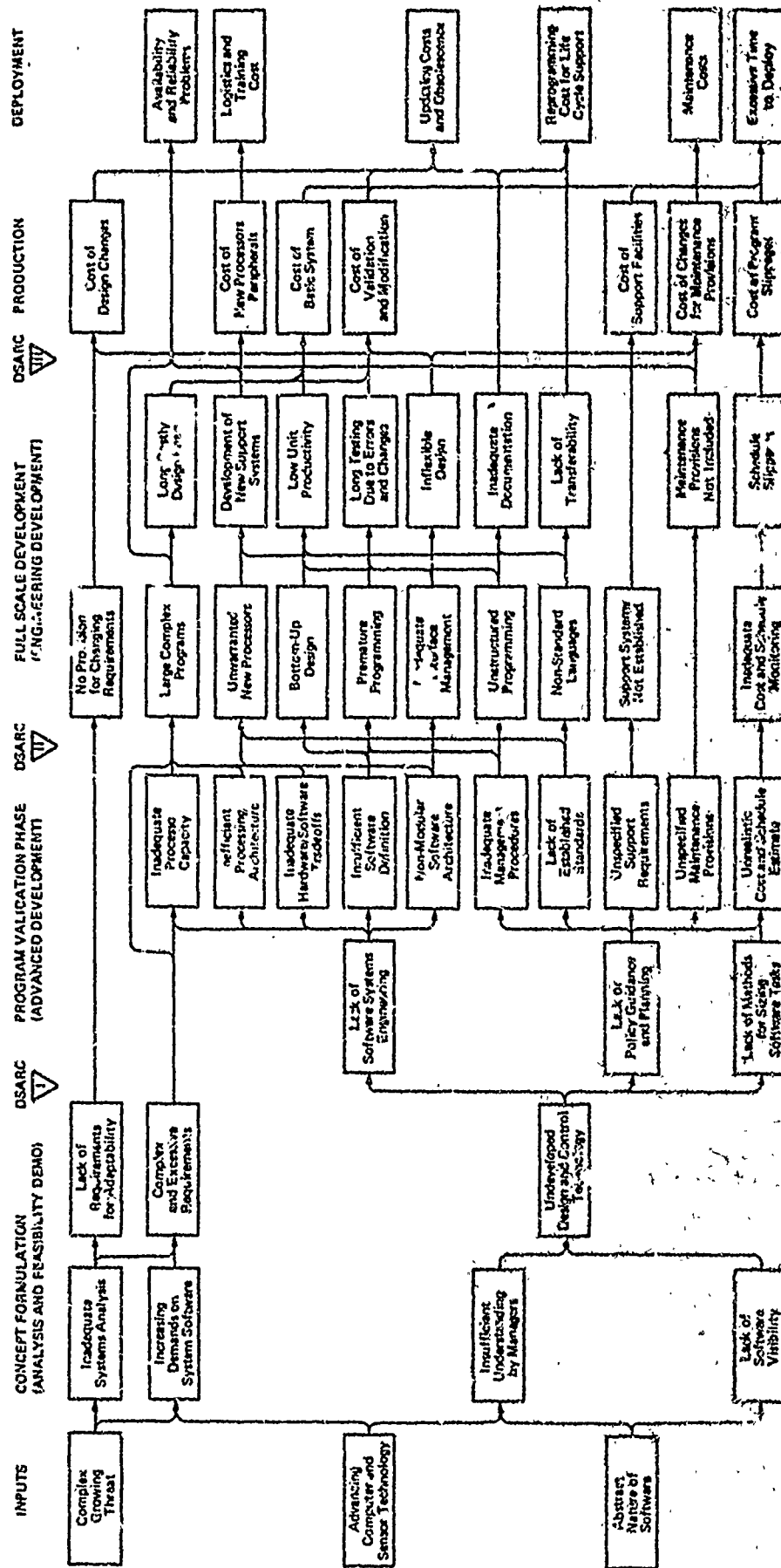
DOD FOCAL POINT WEAPON SYSTEMS SOFTWARE

POLICY
PRACTICE/PROCED.

TECHNOLOGY
TECHNOLOGY TRANSFER

ASD (I & L)

ASD (C)

DDR & E/DARPA

DTACCS

SOFTWARE MANAGEMENT
STEERING COMMITTEE
(WEAPON SYSTEMS)

ARMY (R & D, ACQ, LOG.)

NAVY/   (R & D, ACQ, LOG.)
MARINE CORPS

AIR FORCE (R & D, ACQ, LOG.)

CONTRACTUAL &
LEGAL RESEARCH

ACQUISITION PLANNING &
PROCEDURE COORDINATION

R & D PLANNING
AND COORDINATION

PROCUREMENT
PANEL

TECHNICAL
COORDINATING
PANEL

RESEARCH &
DEVELOPMENT
COORDINATING
PANEL

ASD (I & L)
AFSC AMC
AFLC M.C.
NAVMAT

JLC REPS.
AFSC AMC
AFLC M.C.
NAVMAT

DDR & E/DARPA
ARMY, NAVY, AIR FORCE
LABS/R & D CENTERS
AFSC   AFLC
AMC
NAVMAT

DOD SOFTWARE PROGRAM MILESTONES

	MAY	JUNE	JULY	AUGUST	SEPTEMBER
SUPPORTING MILESTONES	DA BRIEFING TO STEERING GROUP; ATE BRIEFING TO STEERING GROUP; RAND MID-POINT BRIEFING	JLC SOFTWARE REPORT	PRELIMINARY REQUIREMENTS HIGHER ORDER LANGUAGE WORKING GROUP (DDR&E/SERVICES); CONTRACTORS JOINT ANALYSIS; DOD AUTOMATION OBJECTIVES REVIEW (COMPTROLLER)	RAND CONCLUSION REPORT	RECOMMENDATIONS OR HIGH ORDER LANGUAGE REQUIREMENTS (DDR&E/SERVICES)
PLANNING-STAFFING MILESTONES	AIA REVIEW OF CONTRACTOR'S REPORTS; SERVICES REVIEW OF CONTRACTOR'S REPORTS	STEERING GROUPS PREPARATION OF DOD SOFTWARE PROGRAM	BRIEFINGS TO KEY OSD/SERVICE ORGANIZATIONS	REVIEW OF DOD SOFTWARE PROGRAM BY DEFENSE SCIENCE BOARD	BRIEFING TO DSARC PRINCIPALS
ACTIONS COMPLETED MILESTONES	PRELIMINARY CONTRACTORS' REPORTS RECEIVED; FINAL CONTRACTORS' REPORTS RECEIVED; LETTERS TO AIA AND DSB FOR FORMAL REVIEW	AIA RECOMMENDATIONS	PRELIMINARY DRAFT TO DOD SOFTWARE PROGRAM; REVISED DRAFT OF SOFTWARE PROGRAM		RECOMMENDATIONS OF DEFENSE SCIENCE BOARD

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DoD WEAPON SYSTEM
SOFTWARE MANAGEMENT PROGRAM

OBJECTIVE: TO DERIVE AND CARRY OUT A COMPREHENSIVE

AND INTEGRATED SOLUTION TO THE PROBLEMS

OF EMBEDDED COMPUTER SYSTEM RESOURCE

ACQUISITION, MANAGEMENT, AND USE. UNDERLYING

THEMES ARE:

- DISCIPLINE AND RIGOR

- MANAGEMENT VISIBILITY

- COST CONTROL

- SCHEDULE CONTROL

- IMPROVED QUALITY

DoD WEAPON SYSTEM
SOFTWARE MANAGEMENT PROGRAM
(CONT'D)

SCOPE:

- POLICY INITIATIVES

- PRACTICE AND PROCEDURE INITIATIVES

- TECHNOLOGY INITIATIVES

EMBEDDED COMPUTER SYSTEM CONCEPT

EMBEDDED COMPUTER SYSTEM — —

IS INTEGRAL TO AN ELECTRONIC OR ELECTRO-MECHANICAL SYSTEM (e.g. COMBAT WEAPON SYSTEM, TACTICAL SYSTEM, AIRCRAFT, SHIP, MISSILE, SPACECRAFT, COMMAND, CONTROL, AND COMMUNICATIONS SYSTEMS) FROM DESIGN, PROCUREMENT AND OPERATIONS VIEWPOINT

KEY ATTRIBUTES — —

DEVELOPED, ACQUIRED, OPERATED UNDER DECENTRALIZED MANAGEMENT (DODD 5000.1 & 5000.2)

PHYSICALLY INCORPORATED INTO LARGER SYSTEM WHOSE FUNCTION IS NOT DATA PROCESSING

INTEGRAL TO, OR SUPPORTS A LARGER SYSTEM FROM DESIGN, PROCUREMENT, OPERATIONS VIEWPOINT

OUTPUTS INCLUDE INFORMATION, CONTROL SIGNALS, AND COMPUTER DATA

EMBEDDED COMPUTER SYSTEMS
DETAILED CHARACTERISTICS

- SIMULTANEOUS HARDWARE AND SOFTWARE DEVELOPMENT

- TRANSPORTABLE/DEPLOYABLE (GENERALLY MILITARIZED)

- SPECIAL PURPOSE OR ONE-OF-A-KIND

- PROGRAMS MACHINE DEPENDENT

- DESIGNED TO FIT INTO LARGER, NON-ADP SYSTEM

- TAILORED PROGRAMMING LANGUAGES

- SPECIALIZED COMPUTER EQUIPMENT

- DEVELOPMENT/ACQUISITION/SUPPORT AS A CONFIGURATION ITEM

- NEED HIGH RELIABILITY SOFTWARE

- EXTENSIVE/EXPENSIVE TEST PROGRAMS

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EMBEDDED COMPUTER SYSTEM RESOURCES

COMPUTER EQUIPMENT	PERSONNEL	COMPUTER SOFTWARE		COMPUTER SYSTEM DOCUMENTATION
		COMPUTER PROGRAMS*	COMPUTER DATA*	
CENTRAL PROCESSORS	SYSTEM ARCHITECTS	APPLICATIONS	DATA BASES	SPECIFICATIONS
TERMINALS	SYSTEM ANALYSTS	COMPILERS	TABLES	PROGRAM LISTINGS
PRINTERS	PROGRAMMERS	OPERATING SYSTEMS	SENSOR SIGNALS	SCHEMATICS/DRAWINGS
POWER SUPPLIES	COMPUTER OPERATORS	DIAGNOSTICS	SWITCH POSITIONS	REGULATIONS
TAPE DRIVES	SYSTEM DESIGNERS	SIMULATORS	LABELS	STANDARDS
DISKS/DRUMS	MANAGERS	INPUT/OUTPUT	KEY SEQUENCES	PROPOSALS
COMM PROCESSORS	KEYPUNCHERS	ALGORITHMS	CONSTANTS	ROCS/DARS/CEIPS
A/D CONVERTERS	ELECTRICIANS	AUTOMATIC TEST	PARAMETERS	CONTRACTS
SUPPLIES:	SYSTEM USERS	ANALYZERS	FILES	HANDBOOKS/MANUALS
CARDS	MAINTAINERS	REPORT GENERATORS	ADDRESSES	TECH ORDERS
TAPES	SCIENTISTS	UTILITY	ACCESS CODES	MANAGEMENT DATA
PAPER	ENGINEERS	MAINTENANCE	FLAGS	PERFORMANCE DATA

*CONFIGURATION ITEMS-- SATISFY AN END USE FUNCTION AND THEREFORE DESIGNATED BY THE GOVERNMENT FOR CONFIGURATION MANAGEMENT.

PROGRAM ELEMENTS
POLICY INITIATIVES

- SOFTWARE VISIBILITY IN EMBEDDED COMPUTER SYSTEMS ACQUISITION

- SOFTWARE LANGUAGE STANDARDIZATION & CONTROL

- SOFTWARE QUALITY ASSURANCE AND CONTROL

SOFTWARE VISIBILITY IN EMBEDDED COMPUTER SYSTEM ACQUISITION

PROBLEM SUMMARY

- INADEQUATE REQUIREMENT ANALYSIS
- INADEQUATE INTERFACE MANAGEMENT
- INADEQUATE DOCUMENTATION
- LACK OF TRANSFERABILITY
- INACCURATE COST/SCHEDULE PROJECTION
- LOW QUALITY
- INCONSISTENT APPLICATION OF TOOLS AND PROCEDURES
- MANAGEMENT PEROGATIVES PRE-EMPTED

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SOFTWARE VISIBILITY IN EMBEDDED COMPUTER SYSTEM ACQUISITION

POLICY ACTIONS TO BE TAKEN

- ANALYSIS AND VALIDATION OF SYSTEM REQUIREMENTS - PRIOR TO DSARC II

- SOFTWARE TO BE TREATED AS CONFIGURATION ITEM - ACCOMPANYING CONTROLS

- COMPUTER SYSTEM RESOURCE PLAN REQUIRED

- SUPPORT ITEMS AS CONTRACT DELIVERABLES - RIGHTS TO DESIGN

- MILESTONED DEVELOPMENT PLAN AND DEMONSTRATION CRITERIA

IMPLEMENTATION OF POLICY ACTIONS

ACTION	VEHICLE	OPR	TIME (YEARS)	$K REQUIRED RESOURCES
ANALYSIS AND VALIDATION OF SYSTEM REQUIREMENTS	DODD XX DODD 5000.2	OSD	0.8	---
SOFTWARE AS CONFIGURATION ITEM	DODD XX ASPR MIL-STD	OSD	1.0	---
COMPUTER SYSTEM RESOURCE PLAN	DODD XX SERVICE DIRECTIVES, INSTRUCTIONS, STANDARDS	OSD SERVICES	0.5	---
SUPPORT SOFTWARE AS DELIVERABLE	DODD XX SERVICE DIRECTIVES, INSTURCTIONS	OSD SERVICES	0.5	---
MILESTONED DEVELOPMENT PLAN	DODD XX MIL-STD-XX	OSD JLC	1.0	---

* DODD XX = CAPSTONE DIRECTIVE TO SUPPLEMENT AND AID IN THE APPLICATION OF MANAGEMENT PRINCIPLES ESPOUSED IN DODD 5000.1 AND 5000.2, AS THEY RELATE TO COMPUTER RESOURCES IN SYSTEMS.

ACTION VS. PROBLEM MATRIX

ACTION	INADEQUATE REQUIREMENTS ANALYSIS	INADEQUATE INTERFACE MANAGEMENT	INADEQUATE DOCUMENTATION	LACK OF TRANSFERABILITY	INACCURATE SIZING, COST & SCHEDULE PROJECTION	LOW QUALITY	INCONSISTENT APPLICATION OF TOOLS & PROCEDURES	MANAGEMENT PREROGATIVE PREEMPTED
REQUIREMENTS VALIDATION AND ANALYSIS	X	X			X	X		X
SOFTWARE AS CONFIGURATION ITEM	X	X	X			X		X
COMPUTER SYSTEM RESOURCE PLAN			X		X		X	X
SUPPORT SOFTWARE AS DELIVERABLES			X	X			X	
MILESTONE GUIDE AND EVALUATION CRITERIA			X		X			X

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SOFTWARE LANGUAGE STANDARDIZATION AND CONTROL

PROBLEM SUMMARY

LANGUAGE SELECTION

- LOW CORRELATION OF MOL TO ENGINEERING PROBLEM
- LACK OF DESIGN VISIBILITY
- MACHINE DEPENDENCE

LANGUAGE PROLIFERATION

- DIFFICULT LEARNING PROCESS
- DISCOURAGES DEVELOPMENT OF TEST AND SUPPORT TOOLS
- REDUCED MANAGEMENT VISIBILITY
- COMPLICATES INSTITUTIONAL CONTROL
- COST MAGNIFICATION

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POLICY ACTIONS TO BE TAKEN

- **RESTRICT USE OF MACHINE ORIENTED LANGUAGES**

- **ESTABLISH FAMILY OF APPROVED HIGHER ORDER LANGUAGES FOR USE IN DOD WEAPON SYSTEM APPLICATIONS**

  - **LONG TERM STANDARDS**

  - **INTERIM STANDARDS WITHIN SERVICES**

- **ENCOURAGE LANGUAGE R&D BUT STRICT LIMITATIONS AND CRITERIA FOR TRANSITION**

- **ESTABLISH HIGHER ORDER LANGUAGE CONTROL FACILITY FOR AUTHORIZED LANGUAGE**

  - **LANGUAGE STABILITY**

  - **CERTIFICATION OF IMPLEMENTATIONS**

  - **USAGE DATA**

  - **DISSEMINATION OF INFORMATION, COMPILERS, SUPPORT TOOLS**

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IMPLEMENTATION OF POLICY ACTIONS

ACTION	VEHICLE	OPR	TIME (YEARS)	REQUIRED RESOURCES $K
MOL SUPPRESSION	DODD XX	OSD	0.5	--
ESTABLISHMENT OF APPROVED HOL				
INTERIM STANDARDS	DI XX	OSD	0.5	--
LONG TERM STANDARDS	DODI XX	OSD	3.0	$14,000
HOL CONTROL FACILITY	DODD XX DODI XX	OSD	3.0	$2M/YR

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ACTION VS PROBLEM MATRIX

PROBLEM ⟋ ACTION	LANGUAGE SELECTION			LANGUAGE PROLIFERATION				
	CORRELATION BETWEEN LANGUAGE AND PROBLEM	LACK OF DESIGN VISIBILITY	MACHINE DEPENDENCE	DIFFICULT LEARNING PROCESS	DIS-COURAGE TEST & SUPPORT TOOLS	MANAGEMENT VISIBILITY	COMPLICATION OF INSTITUTIONAL CONTROL	COST MAGNIFICATION
USE OF HOL'S	X	X	X					
REDUCE PROLIFERATION				X	X	X	X	X
LANGUAGE CONTROL FACILITY			X	X	X	X	X	X

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SOFTWARE QUALITY ASSURANCE AND CONTROL - - SERVICE ACTION

PROBLEM SUMMARY

- LACK OF MANAGEMENT MONITORING OF SOFTWARE RELIABILITY

- LACK OF SOFTWARE RELIABILITY/QUALITY ASSURANCE DISCIPLINE

- LACK OF QUANTITATIVE DATA BASE

POLICY ACTIONS TO BE TAKEN

- AUGMENT QA ORGANIZATIONS WITH SOFTWARE PERSONNEL - SERVICES, PM LEVELS

- FORMAL SOFTWARE QA PROGRAM - - ACQUISITION OF TOOLS

- SOFTWARE ERROR DATA COLLECTION AND ANALYSIS

IMPLEMENTATION OF POLICY ACTIONS

REQUIRED RESOURCES

ACTION	VEHICLE	OPR	TIME	$K
SOFTWARE QA ORGANIZATION AND PROGRAM PLAN	SERVICE INST. MIL-STD	JLC/JTCG (ESR)	0.5	--
SOFTWARE ERROR DATA COLLECTION & ANALYSIS	CONTRACT EXHIBIT	JLC/ JTCG(ESR)	1.0	--

ACTION VS PROBLEM MATRIX

PROBLEM / ACTION	LACK OF MANAGEMENT MONITORING OF RELIABILITY	LACK OF FORMAL SOFTWARE RELIABILITY/QA DISCIPLINE	LACK OF QUANTITATIVE DATA BASE
SOFTWARE QA ORGANIZATION AND PROGRAM PLAN	X	X	
SOFTWARE DATA COLLECTION AND REPORTING SYSTEM	X	X	X

PROGRAM ELEMENTS
PRACTICE & PROCEDURE

INITIATIVES

- SOFTWARE ACQUISITION MANAGEMENT STANDARDS

- SOFTWARE ACQUISITION, MANAGEMENT, OPERATIONS, SUPPORT GUIDELINES INCLUDING PERSONNEL DEVELOPMENT AND TRAINING

- SOFTWARE QUALITY SPECIFICATIONS AND TRADE-OFFS

SOFTWARE ACQUISITION MANAGEMENT STANDARDS

PROBLEM SUMMARY

- LACK OF STANDARD TERMINOLOGY GOVERNING SOFTWARE ACQUISITION AND MANAGEMENT

- LACK OF ESTABLISHED STANDARD

- LACK OF CONSISTENT POLICY AND PLANNING GUIDANCE (VIA STANDARDS, REGULATIONS, INSTRUCTIONS)

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ACTIONS TO BE TAKEN

● FORMALIZED DEFINITIONS FOR WEAPON SYSTEM SOFTWARE

● FORMALIZE DEFINITIONS TO RECONCILE WEAPON SYSTEM, TELECOMMUNICATIONS, INTELLIGENCE, AND ADP SOFTWARE NEEDS

● REVIEW ALL DOD AND SERVICE COMPONENT REGULATIONS, DIRECTIVES, STANDARDS

● CORRELATE DESCRIPTION OF HARDWARE, SOFTWARE, SYSTEM ACQUISITION AND LIFE CYCLE MANAGEMENT

  ● ENHANCEMENT, CLARIFICATIONS

  ● ADDITIONS

  ● MODIFICATIONS

  ● CANCELLATIONS

● ESTABLISH OR ASSIGN OPR FOR MAINTENANCE

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IMPLEMENTATION OF PROCEDURE ACTIONS

ACTION	ACTION VEHICLE	OPR	TIME TO COMPLETE	REQUIRED RESOURCES
FORMALIZE WS DEFINITIONS	DODD XX	OSD	0.5	--
FORMALIZE DEFINITIONS ACROSS WS TELECOMM., INTELL., AND ADP	MIL-STD-XXX	OSD	1.0	--
REVIEW OF EXISTING REGULATIONS, DIRECTIVES AND STANDARDS	STUDY REPORT	OSD/ SERVICE	0.5	$50K
MODIFY OR ADD REGULATIONS, DIRECTIVES AND STANDARDS	DODD, DODI, MIL-STD, SERVICE INSTRUCTIONS, STANDARDS, REGULATIONS (NEW AND REVISED)	OSD, SERVICF LC	2.5	$250K
CANCELLATION	DIRECTIVE, REGULATION, AND STANDARD CANCELLATION	OSD, SERVICE LC	3.0	--
MAINTENANCE OPR	SERVICE COMPONENT INSTRUCTIONS	SERVICE LC	RECURRING	$100K/YEAR

ACTION VS PROBLEM MATRIX

ACTION/PROBLEM	LACK OF STANDARD TECHNOLOGY	LACK OF ESTABLISHED STANDARDS	LACK OF CONSISTENT POLICY & PLANNING GUIDANCE
FORMALIZE WS DEFINITIONS	X	X	
FORMALIZE DEFINITIONS ACROSS WS, TELECOMMUNICATIONS, INTELLIGENCE, AND ADP LINES	X	X	
REVIEW OF EXISTING REGULATIONS, DIRECTIVES, AND STANDARDS		X	X
MODIFY OR ADD REGULATIONS, DIRECTIVES, STANDARDS		X	X
CANCEL INAPPROPRIATE REGULATIONS, DIRECTIVES, STANDARDS		X	X
ESTABLISH OPR FOR MAINTENANCE OF EACH REGULATION, DIRECTIVE, AND STANDARD		X	X

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SOFTWARE ACQUISITION, MANAGEMENT, OPERATIONS, AND SUPPORT GUIDELINES

PROBLEM SUMMARY

- INSUFFICIENT UNDERSTANDING BY MANAGERS

- LACK OF PLANNING AND OPERATIONAL GUIDANCE IN DAY-TO-DAY OPERATIONS

- LACK OF SYSTEMS ENGINEERING METHODOLOGY AND DISCIPLINE

- LACK OF TECHNOLOGY TRANSFER

- LACK OF PERSONNEL SKILL CONTINUITY OVER LIFE CYCLE

- LACK OF PERSONNEL DEVELOPMENT AND TRAINING

  - SHORTAGE OF PRACTITIONERS

  - LACK OF CAREER INCENTIVES

  - LACK OF RELEVANT ACADEMIC CURRICULA

ACTIONS TO BE TAKEN

- PREPARE A SERIES OF GUIDELINES, CHECKLISTS, AND HANDBOOKS FOR

  - SOFTWARE DEVELOPMENT

  - SOFTWARE ACQUISITION

  - OPERATIONS

  - SUPPORT

- TO BE USED BY PROGRAM MANAGERS AND THEIR STAFFS AND TO BE REFLECTED IN DSARC REVIEW PROCESS

- ESTABLISH EDUCATION, TRAINING, OR EXPERIENCE CAREER PATHS - PERSONNEL DEVELOPMENT

  DSMS   CIVILIAN INSTRUCTIONS

  AFIT   SERVICE ACADEMIES

  NPG SCHOOL

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IMPLEMENTATION OF PRACTICE & PROCEDURE ACTIONS

ACTION	ACTION VEHICLE	OPR	TIME (YEARS)	$K REQUIRED RESOURCES
SOFTWARE GUIDELINES, CHECKLISTS, HANDBOOKS	SERVICE MANUALS SEMI-ANNUAL USER REVIEWS	SERVICES	0.3	$500/YEAR
DESIGNATED PROFESSIONAL DEVELOPMENT OPR'S	SERVICE DIRECTIVE	OSD/JLC	0.5	--
ROTATIONAL PROGRAM FOR INSTRUCTORS	SERVICE DIRECTIVE	SERVICES	1.0	--
APPRENTICESHIP PROGRAM	SERVICE DIRECTIVE	SERVICES	0.8	--
SPECIALTY CODES/CAREER PATHS	SERVICE DIRECTIVE	SERVICES	0.8	--
CURRICULA MODIFICATION	SERVICE DIRECTIVE/ ACADEMIC GRANTS	SERVICES	1.3	--
IN-SERVICE TRAINING PROGRAMS	SERVICE DIRECTIVE	SERVICES	1.6	--

ACTION VS PROBLEM MATRIX

ACTION	INSUFFICIENT AWARDING BY MANAGERS	LACK OF DAY-TO-DAY PLANNING AND OPERATIONS GUIDANCE	LACK OF SYSTEMS ENGINEERING METHODOLOGY AND DISCIPLINE	LACK OF TECHNOLOGY TRANSFER TO APPLICATION	LACK OF PERSONNEL SKILL CONTINUITY	LACK OF PERSONNEL DEVELOPMENT AND TRAINING
PREPARATION OF GUIDELINES, CHECKLISTS, HANDBOOKS, EXAMPLES, AND GUIDE DISSEMINATION AND FEEDBACK	X	X	X	X	X	
DESIGNATE CPRs FOR COORDINATION/ DIRECTION OF PROFESSIONAL DEVELOPMENT PROGRAM	X	X		X	X	
ROTATIONAL PROGRAM FOR INSTRUCTORS	X	X	X	X	X	
APPRENTICESHIP PROGRAM	X	X		X	X	
SPECIALTY CODES/CAREER PATHS	X	X	X	X	X	
CURRICULA MODIFICATION	X	X		X	X	
IN-SERVICE TRAINING	X	X	X	X	X	

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SOFTWARE QUALITY SPECIFICATION AND TRADE OFFS

PROBLEM SUMMARY

- LACK OF SYSTEM OPTIMIZATION

- LACK OF QUANTITATIVE QUALITY GOALS AND OBJECTIVES

- LACK OF QUANTITATIVE TEST STANDARDS

- LACK OF TEST AND SUPPORT SOFTWARE INCENTIVES

ACTIONS TO BE TAKEN

- QUANTITATIVE MEASURE OF SOFTWARE QUALITY DERIVED - - SPECIFICATIONS TO CITE QUANTITATIVE GOALS AND OBJECTIVES - - TESTING TO DEMONSTRATE LEVEL ACHIEVED

- HARDWARE DESIGN GUIDELINES FOR INCLUSION OF SOFTWARE QUALITY ENHANCEMENT

IMPLEMENTATION OF PROCEDURE ACTIONS

ACTION	VEHICLE	OPR	REQUIRED RESOURCES	
			TIME	$K
QUALITY REQUIREMENTS SPECIFICATION AND TEST	REQUIREMENTS SPECIFICATION	JLC/ JTCG (ESR)	1.0	- -
DESIGN GUIDELINES FOR SOFTWARE QUALITY ENHANCED	REQUIREMENTS SPECIFICATION	JLC/ JTCG (ESR)	1.0	$750K

ACTION VS PROBLEM MATRIX

ACTION/PROBLEM	LACK OF OPTIMIZATION AT SYSTEM LEVEL	LACK OF QUANTITATIVE SOFTWARE RELIABILITY OBJECTIVES	LACK OF QUANTITATIVE TEST STANDARDS	LACK OF TEST AND SUPPORT SOFTWARE INCENTIVES
SPECIFICATION AND TEST OF QUANTITATIVE RELIABILITY OBJECTIVES		X	X	X
HARDWARE DESIGN GUIDELINES FOR SOFTWARE QUALITY ENHANCEMENT				
AND SYSTEM LEVEL BALANCE	X			X

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PROGRAM ELEMENTS

TECHNOLOGY INITIATIVES

- COORDINATED SOFTWARE RESEARCH AND DEVELOPMENT

- TRANSFERABILITY OF SOFTWARE SUPPORT AIDS

COORDINATED SOFTWARE RESEARCH AND DEVELOPMENT

PROBLEM SUMMARY

- LACK OF FOCUS IN SOFTWARE R & D, STUDY, PILOT PROGRAMS

- LACK OF TECHNOLOGY BASE

- RELEVANCY OF R & D TO IMPROVEMENTS IN POLICY, PRACTICES, AND PROCEDURES

- REDUNDANCY AND DUPLICATION IN R & D

ACTIONS TO BE TAKEN

- COORDINATED R & D
  - SUPPORT POLICY INITIATIVES
  - STATE OF ART ADVANCEMENT
    - SOFTWARE DEVELOPMENT METHODOLOGY/COST ESTIMATION AND SIZING
    - SYSTEM ARCHITECTURE
    - FUNDAMENTALS AND CONCEPTS OF SOFTWARE ACQUISITION, MANAGEMENT, QUALITY AND CONTROL

- PROTOTYPE PROOFING

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R & D THRUST

PROGRAM ELEMENT	R & D THRUST
REQUIREMENTS ANALYSIS & VALIDATION	COMMUNICATION AND VALIDATION OF REQUIREMENTS AND HIGH-LEVEL DESIGN
	COST ESTIMATION AND SIZING
	DESIGN FOR MAINTAINABILITY AND MODIFICATION
	RISK ANALYSIS
	EFFECTIVENESS MEASURES (FOR EXPRESSION OF REQUIREMENTS)
SOFTWARE AS CONFIGURATION ITEM	DESIGN AND CONFIGURATION ITEM DESCRIPTION
	FUNCTIONAL PARTITIONING
	CHANGE IMPACT ANALYSIS
COMPUTER RESOURCES PLAN	N/A
SUPPORT SOFTWARE AS DELIVERABLE	LEGALITY, DEVELOPMENT INCENTIVES, PROCUREMENT VEHICLES
	TRANSFERABILITY
	IMPROVEMENTS IN SOFTWARE SUPPORT VS TOOLS
	CRITERIA FOR COST/EFFECTIVENESS JUDGMENT
	CATALOG AND DISTRIBUTION REPOSITORY
MILESTONES AND CRITERIA FOR ACCOMPLISHMENT	QUANTITATIVE CRITERIA TO ACHIEVEMENT
	MILESTONE DEFINITION AND SEQUENCING
LANGUAGE STANDARDIZATION AND CONTROL	LANGUAGE CHARACTERISTICS AND SELECTION CRITERIA
	COMPILER CONSTRUCTION
	TRANSFERABILITY
	LANGUAGE CONTROL AND CERTIFICATION MECHANISMS

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IMPLEMENTATION OF TECHNOLOGY ACTIONS

ACTION CODE	ACTION VEHICLE	OPR	REQUIRED RESOURCES	
			TIME TO COMPLETE	DOLLARS
COORDINATED R & D	SERVICE COMPONENT R & D PROGRAMS	DDR & E / SERVICES	8	$38.1M
PROTOTYPE PROOFING	PROTOTYPE SELECTION/ MONITORING	JLC	- -	- -

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ACTION VS PROBLEM MATRIX

ACTION/PROBLEM	LACK OF FOCUS IN SOFTWARE R & D, STUDY, AND PILOT PROGRAMS	LACK OF TECHNOLOGICAL BASE TO IMPLEMENT POLICY, PROCEDURES	OBSCURE R & D RELEVANCY TO SOFTWARE MANAGEMENT, POLICY PRACTICES AND PROCEDURES	REDUNDANCY AND DUPLICATION OF R & D PROGRAMS
COORDINATED R & D PROGRAM	X	X	X	X
PILOT, PROTOTYPE MECHANISM		X	X	

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TRANSFERABILITY OF SOFTWARE SUPPORT AIDS

PROBLEM SUMMARY

- **LITTLE REUSE OF SUPPORT AIDS**

- **PROCUREMENT & DEVELOPMENT REDUNDANCY**

  - **EXCESSIVE COSTS**

  - **LOW QUALITY**

- **LITTLE DEVELOPMENT INCENTIVE**

  - **GOVERNMENT**

  - **INDUSTRY**

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ACTIONS TO BE TAKEN

- **ESTABLISH DOD REPOSITORY FOR MAINTENANCE AND INSTITUTIONAL CONTROL OF AIDS**

  - **SCREENING, VALIDATING, DOCUMENTATION**

  - **USER ASSISTANCE**

  - **PUBLICITY**

- **PROCUREMENT VEHICLE TO ENCOURAGE TRANSFERABILITY**

  - **DIRECTED LICENSING**

  - **ROYALTIES**

  - **WARRANTIES**

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IMPLEMENTATION OF TECHNOLOGY ACTIONS

ACTION	VEHICLE	OPR	REQUIRED RESOURCES	
			TIME	DOLLARS
SUPPORT SOFTWARE REPORTING	DODD AND ACCOMPANYING SERVICE DIRECTIVES	OSD JLC	4	$1.M
PROCUREMENT VEHICLE DEVELOPMENT & USE	PROCUREMENT POLICY	OSD[1]	2	-

NOTE: [1] - VIA PROCUREMENT PANEL OF SMSC

ACTION VS PROBLEM MATRIX

ACTION/PROBLEM	LACK OF TRANSFERABILITY	PROCUREMENT AND DEVELOPMENT REDUNDANCY	LOW DEVELOPMENT INCENTIVES
A) SUPPORT SOFTWARE REPOSITORY	X	X	X
B) PROCUREMENT VEHICLE DEVELOPMENT & USE	X	X	X

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ORGANIZATIONAL INTERACTIONS

Figure II-1

ORGANIZATIONAL INTERACTIONS
POLICY INITIATIVES

DOD SOFTWARE PROGRAM ELEMENTS

COORDINATE POLICY
- FORM
- CONTENT
- AUDIT MECHANISM

OSD POLICY INSTRUMENTS
- DODD
- DODi

SERVICE POLICY INSTRUMENTS
- INSTRUCTION
- REGULATIONS
- STANDARDS

SOFTWARE MANAGEMENT STEERING COMMITTEE

SERVICE LOGISTICS COMM.

TECH. COORD. PANEL

PROCUREMENT PANEL

R&D PANEL

POLICY CONSULTATION AND ADVICE

USAF SYSCOMS

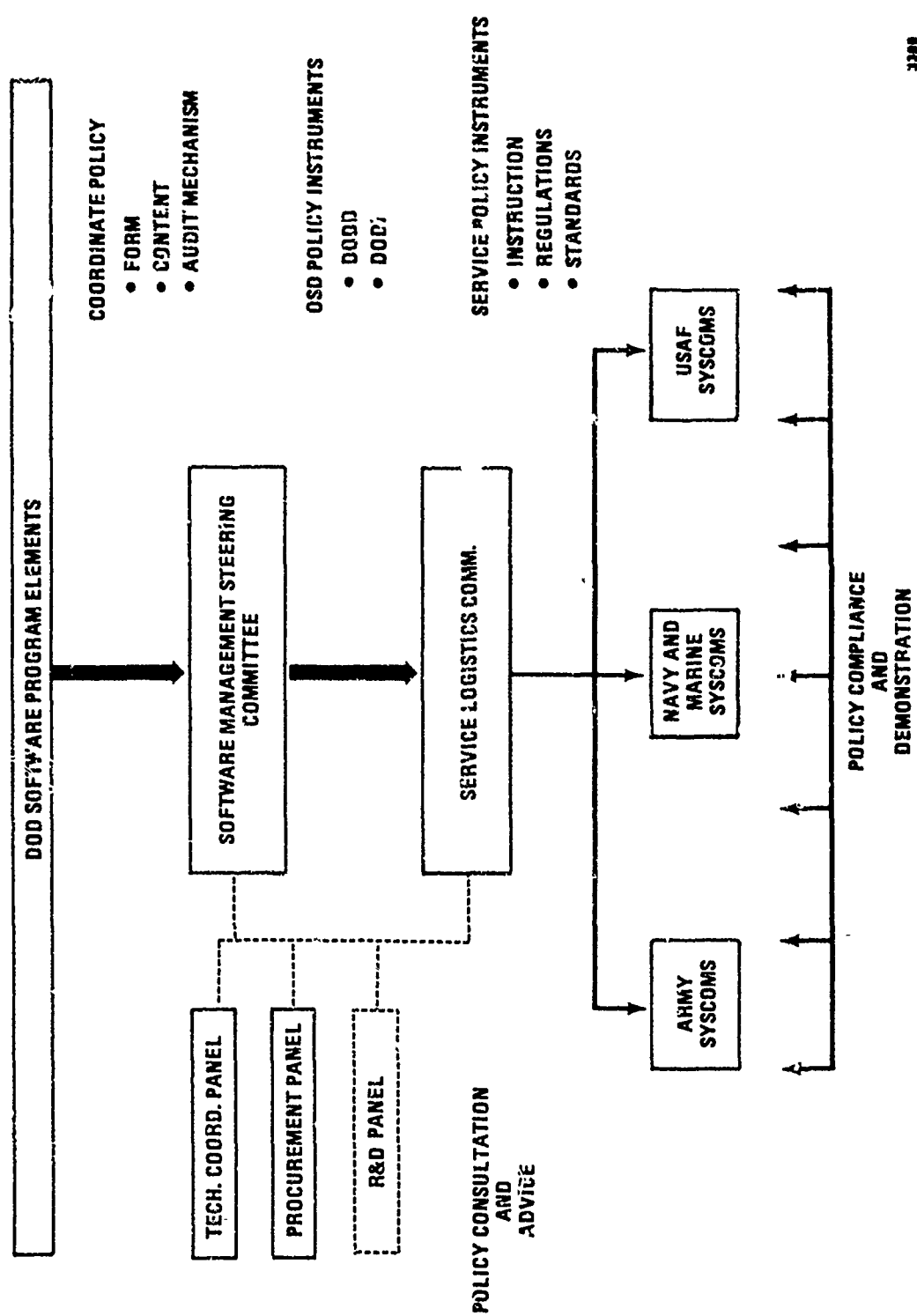NAVY AND MARINE SYSCOMS

ARMY SYSCOMS

POLICY COMPLIANCE AND DEMONSTRATION

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Figure II-2

ORGANIZATIONAL INTERACTIONS TECHNOLOGY INITIATIVES

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