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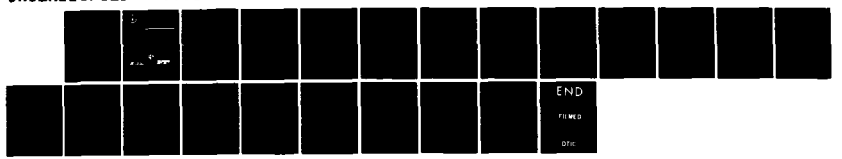

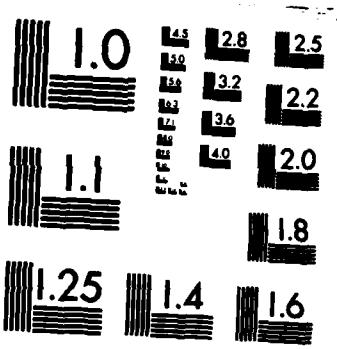

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ENLISTMENT EARLY WARNING SYSTEM AND ACCESSION CRISIS PREVENTION PROCESS

VOLUME I EXECUTIVE SUMMARY

JUNE 15, 1984

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This study examines the feasibility of developing and implementing 1) an automated information system (EEWS) for providing timely, credible evidence of impending enlistments shortfalls, and 2) a streamlined communication, programming, and budgeting process (ACPP) for responding to such evidence and reducing delays in the application of resources.

A thorough review of existing early warning systems and forecasting methodologies was conducted (Vols. II and III). Using regression analysis with national-level monthly data (1/76-3/83), preliminary forecasting models for each Service were estimated for high-quality enlistment contracts. A univariate ARIMA forecasting model for unemployment was estimated with national-level monthly data (1/72-3/83). In beyond-sample validation tests for the period 4/83-12/83, the models accurately forecasted enlistments and unemployment nine months ahead; they predicted the declines in enlistments experienced by the Services in late 1983, well before the actual declines occurred (Vol.IV). (continued on reverse)

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A preliminary design was developed for automating the generation of forecasts and the production of a monthly recruiting market assessment report, which would include tabular and graphical displays of forecasts and supporting data (Vol. V). (continued on reverse)

Advised by interviews with current and former senior-level government officials, the study team developed five innovative ACPP concepts for streamlining the programming and budgeting process: regular secretarial performance reviews, an improved PPBS Authorization and Appropriation Process, improved interlevel communications, an Offline Adjustment Process, and an Immediate Crisis Avoidance Authority. These concepts address fundamental problems causing system inertia, and are designed to help prevent shortfalls by (1) providing limited resources for immediate response to declines in the recruiting market, and 2) institutionalizing a streamlined process for considering requests for additional resources (Vol. VI).

The study concludes that the EEWS and ACPP are feasible and continued development is recommended. A research design for the next phase of the study is presented in Vol. VII.

ENLISTMENT EARLY WARNING SYSTEM
AND ACCESSION CRISIS PREVENTION PROCESS
PHASE I

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VOLUME I — EXECUTIVE SUMMARY;
Dr. Lawrence Goldberg, Dr. Richard Hunter, Sherry Andrews

VOLUME II — A REVIEW OF EARLY WARNING SYSTEM LITERATURE AND FORECASTING METHODS;
Dr. Peter Greenston, Dr. Lawrence Goldberg, Sigurd Hermansen, Sherry Andrews, Dr. George Thomas

VOLUME III — A REPORT ON THE INVESTIGATION OF FORECASTING METHODOLOGIES APPLIED IN THE ENGINEERING SCIENCES;
Gerald Yates, assisted by Carol Lavery

VOLUME IV — EEWS MODEL DEVELOPMENT;
Dr. Peter Greenston, Dr. Lawrence Goldberg, Sigurd Hermansen

VOLUME V — DESCRIPTION OF AN AUTOMATED ENLISTMENT EARLY WARNING SYSTEM;
Gerald Yates, Mark Mueller

VOLUME VI — THE ACCESSION CRISIS PREVENTION PROCESS; and
Dr. Richard Hunter

VOLUME VII — PHASE II IMPLEMENTATION PLAN.
Dr. Lawrence Goldberg, Dr. Richard Hunter, Gerald Yates,

Report Editor: Sherry Andrews

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

I. THE PROBLEM AND THE OBJECTIVE

Accession crisis is the major problem addressed in this work. An accession crisis occurs when a Military Service is unable to recruit either the necessary number of new accessions, or is unable to maintain the quality mix of accessions needed to meet its bona fide manpower requirements. Such a crisis occurred in the late 1970's when all four Services missed both their quantity and quality goals. Such a crisis could occur again.

The research reported in these seven volumes analyzes two major and four contributing causes for accession crises. All six of these causes are considered to be serious management problems in their own right. The two major problems are:

- Recognition lag, the inability of all levels in the decision pyramid to recognize changes in recruiting conditions when they occur.

- Resource delay, the inability of the resource allocation system to make timely adjustments in near-term resources in order to meet changing recruiting conditions when they are recognized.

Recognition lag and resource delay are caused in turn by contributing problems:

- Near-term forecasts of changes in recruiting conditions are inadequate or lack creduality;

- Interlevel communications are often slow and misunderstood;

- Adequacy reviews of current and near-term resource levels, are limited by incomplete documentation of the assumptions used in budget development and of the recruiting conditions that would

signal a crisis;

- The Services have limited authority to take immediate actions to avoid crisis while longer term solutions are being considered.

The objective of this study is to meet the need for timely, credible evidence of deteriorating conditions in the recruiting environment and streamlined processes by which to respond. To meet this need, we recommend developing and implementing a validated Enlistment Early Warning System (EEWS) and Accession Crisis Prevention Process (ACPP). With these tools, the danger of inadvertent accession crisis could be reduced greatly.

II. RESEARCH FINDINGS

The work undertaken in Phase I to achieve the study objective began with a review of existing early warning systems and methodologies and an exploration of the current budgeting/programming process. With the knowledge gained from the review, conceptual designs were formulated for the EEWS and ACPP. The remaining task of Phase I was to identify and assess questions of feasibility. System development and implementation remain for Phase II.

Five major feasibility questions were addressed in our research:

- Will data required for an EEWS be available in a timely fashion?

- Can forecasting models be developed that provide enough (at least four months) lead time for taking corrective actions?

- Can human assessment of computerized alerts be performed expediently?

- Is automation of the EEWS practical?

- Will the current budget/programming process accommodate the changes the ACPP would bring?

A brief description of the review, the conceptual designs, and our assessment of the feasibility questions follows.

A. Literature Review

Our first step in designing an EEWS was to undertake an extensive literature review. The focus of the review was on existing early warning systems and statistical forecasting methods. Broad coverage was achieved by using 25 automated data bases. This activity was supplemented by a library search of current articles and interviews with scientists, sponsors, and users (including the Services).

These activities yielded case histories of seven early warning systems dealing with the following problems: (1) energy shortage, (2) bank failure, (3) epidemics, (4) international crisis, (5) foreign investment risk, (6) droughts, and (7) global food shortage. The review also identified numerous methods for estimating forcasting models required to enable the EEWS to sound an alert.

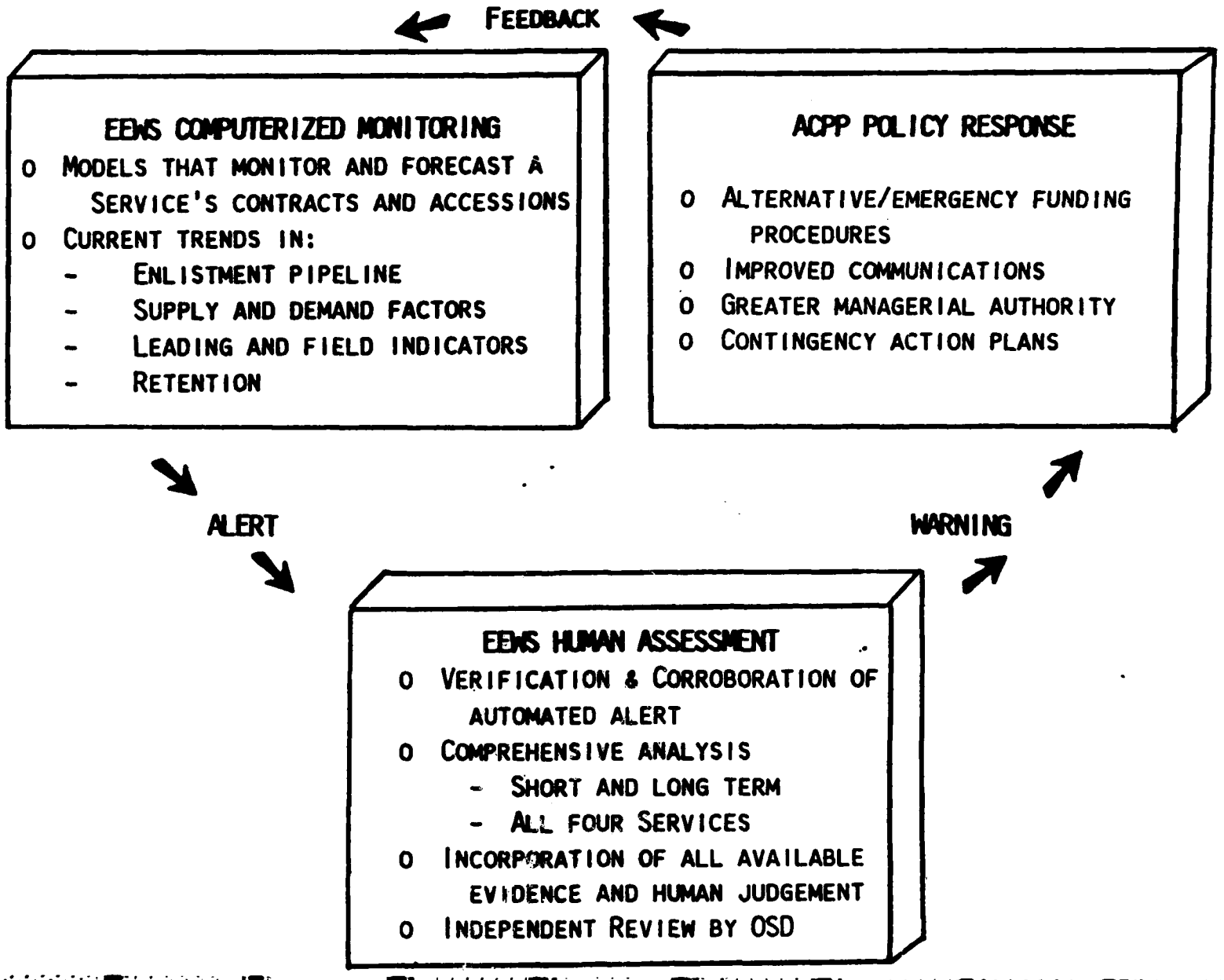
The existing early warning systems assessed in the literature review are different in many respects, but possess a basic similarity in design. All include three components: computerized monitoring, human assessment, and policy response. By signaling an alert, the computerized monitoring component provides the first indication of the possibility of a problem. The human assessment component undertakes a comprehensive analysis of the situation and sounds a warning if it is appropriate. The policy response component endeavors to prevent a crisis by implementing appropriate actions, e.g., the allocation of resources and issuance of directives.

B. EEWS/ACPP Conceptual Design

The three-component concept has been translated successfully into operational early warning systems which are timely, cost-effective, and credible. Accordingly, we have used it in the design of an EEWS (see Figure 1). The Computerized Monitoring Component would automatically

FIGURE 1

EEWS AND ACPP CONCEPTUAL FRAMEWORK



gather required monthly data on the enlistment pipeline -- leads, applicants, contracts and accessions. It would also collect data on supply and demand factors, leading economic indicators, and other data useful for a comprehensive analysis. The system would include monitoring and forecasting equations for high-quality contracts that would signal alerts when there was a significant risk that goal could not be achieved. It also would provide forecasts of unemployment generated by the system and outside sources.

Once an alert were sounded, the Human Assessment Group would meet to undertake a comprehensive analysis of the outlook for recruiting, both for the current year and the next five. Using all of the extensive data in the EEWS, other available information, POM planning models, and human judgement, the group would provide a complete, timely, and credible report analyzing the recruiting situation. If appropriate, the report would recommend using the ACPP to facilitate timely application of resources through reprogramming and budget increases.

C. Feasibility of Developing the EEWS

1. Will Data Required for the EEWS Be Available In a Timely Fashion?

Required data on the enlistment pipeline and supply/demand factors were identified and most were actually collected; those data that are not collected are available from the Services and OSD. We explored the availability of updates for these data on a regular monthly basis and identified no serious updating obstacles.

We conclude that it is feasible to collect the data required for an EEWS and update them in a timely fashion, i.e., four weeks.

2. Can Forecasting Models Be Developed That Provide Enough (At Least Four Months) Lead Time for Taking Corrective Actions?

Preliminary forecasting models for high-quality contracts

(HSDG's and seniors) were developed for each Service using regression analysis with monthly national-level data for the period CY 1976-83. Factors included in the regression models were pay, unemployment, recruiters, goals, GI Bill benefits, policies, and seasonality. Alternative specifications, subperiods, and estimation methods were considered, as well as other types of models, e.g., time-series models. Contracts were found to depend greatly on unemployment; so forecasting models for unemployment also were developed, using time-series methods with monthly national-level data for CY 1972-83.

Numerous unemployment and enlistment forecasting models were estimated. To choose among them, validation tests were conducted: models were estimated with data through March 1983; then, beyond-sample forecasting tests were carried out for the period April - December 1983. The tests identified forecasting models for both unemployment and contracts which successfully predicted the downturns that occurred in 1983. Together they enabled us to accurately forecast high-quality contracts nine months ahead.

Assume, for a moment, that the EEWS was in operation in April, 1983. What would one have viewed on the computer screen? Based on comparisons between forecasts and goals for high-quality net contracts, the message would have contained numerous alerts for the Navy, Air Force and Army concerning the period September-December 1983. For all the Services the system would have shown a decline in the probability of making goal. These signals would have initiated a Human Assessment Group meeting in April 1983 -- about nine months earlier than, in actuality, the Army warned that recruiting was down.

We conclude, in the light of these encouraging results, that useful models can be developed for monitoring and forecasting the recruiting market. In Phase II, those models developed in Phase I will be refined to provide even better results and installed in an automated system.

3. Can Human Assessment of Computerized Alerts Be Performed Expediently?

The Human Assessment Group would respond to alerts signalled by the Computerized Monitoring Component. The group would consist of knowledgeable working-level and senior-level personnel within each Service and OSD, and would perform a specific set of tasks. It would consider the forecasting results and supporting data provided by the automated EEWS and other sources, and would use the capabilities of POM planning models such as ESP (OSD), RPAM (Air Force), and RA (Army). The information from EEWS will be contained in a detailed Monthly Report on the Status of the Recruiting Market. We have developed a menu of components for this report from which the users can choose part or all. The categories of information include historical perspective, forecasts, trends in indicators, and supply/demand factors. All would be useful in an assessment, and in answering questions that might come from OMB, CBO, etc. With this information, the Human Assessment Group could complete an assessment of the short and long-term recruiting outlook within four weeks of an alert. Findings would be reported with a recommendation either to activate or not activate the ACPP. If activated, the ACPP would interface directly with the Human Assessment Group through common staffing. The staffing and administrative management organization of the Human Assessment Group remains to be worked out in Phase II.

D. Feasibility of Automating the Enlistment Early Warning System: Is it Practical?

The feasibility of automating the EEWS involves two distinct questions: (1) is it possible to automate the system? (2) is it practical to automate the system? The study team has demonstrated during Phase I that the algorithms and supporting methodologies of the EEWS can be applied to develop valid results. To demonstrate the practicality of automating the EEWS, we must show that we can design an automated system that provides the required/desired capabilities.

We have identified the required/desired system capabilities and appropriate automation objectives for the EEWS, and have established assumptions concerning system processing capabilities and constraints. Within the limitations imposed by these capabilities and constraints, we have developed a conceptual design that meets the required capabilities and objectives.

The required capabilities for the automated EEWS, as identified by the potential users, dictate that the system provide a great deal of flexibility in processing and reporting, and that it maintains the confidentiality of selected data elements. After reviewing alternative operating enviroment/system architecture combinations, we determined that an on-line Decision Support System (DSS) structure best satisfies the user's requirements. This structure also meets the automation objectives. In particular, it is adaptable and affordable.

The major disadvantage to the on-line DSS is that it cannot be designed in detail and developed within a short time-frame. Therefore, we suggest that an interim batch environment system, capable of producing standard reports, be established to service users until the on-line DSS is implemented. We propose a staged approach to development and implementation. Besides offering near-term support and a state-of-the-art system, this plan offers several other advantages. First, it will allow the Services to use the system and tailor it to their own requirements. Second, it will allow the system to remain closer to the state-of-the-art as new technology becomes available. Third, it will allow the system to be adapted or modified without disrupting the users. Fourth, individual user's own models or data base can be included in the system and remain transparent to other users. Finally, the staged implementation plan will allow users to decide at each stage whether they need and can afford further enhancement or revision of the system. In short, staged development provides the users greater degrees of flexibility and control in the development process.

During the design process, we have identified only two potential

problems. First, operating site locations have not been identified by the users. Knowledge of the site locations along with information on hardware/software available at the sites, are necessary to complete a detailed design of the system. Without a detailed design, estimates of life cycle costs have little validity. However, by using a staged implementation plan we will have the opportunity to refine cost estimations. Second, the EEWS alogrithms require the use of Statistical Analysis System (SAS) software. We do not believe that this problem is a significant limitation because SAS is available for use on most mainframe-computers and should soon be available for use on most mini-computers. If the SAS software were not available, the algorithms could be adapted to use another statistical package.

To assure the integrity of the system as it becomes operational, and to secure acceptance of the results produced by EEWS, we suggest two central management functions: one to ensure the validity of the data base, and one to maintain records of the system configuration at each processing site and to review and approve any changes in configuration. The responsibility for these functions could be held by a Central Data Manager and a Central Configuration Manager. We feel that these positions, either alone or in combination would require less than full-time employment. The functions could be assigned to either the same or different agencies without creating problems.

From the work we have accomplished during this phase of the study, we conclude that the automation of EEWS is feasible; it is both possible and practical. We recommend that EEWS be automated as a DSS structured system, and that it be developed and implemented using a staged approach.

E. Feasibility of Developing the ACPP

1. Components of the ACPP

The ACPP consists of five means with which to reduce resourcing delays:

a) Provide for Regular Secretarial Performance Reviews

Once or twice a year, as appropriate, The Assistant Secretary for Manpower, Installations, and Logistics would present a manpower review, including the status of the recruiting effort, the results of the then current forecasts of manpower requirements and supply projections, pay raise assumptions, and other manpower issues important to program operation and budget development.

b) Improve the Defense Planning, Programming and Bugeting System and the Congressional Authorization and Appropriation Process (PPBSAA)

The PPBSAA actions should include documentation of the assumed recruiting conditions that underlie the recruiting budgets as well as the preagreed conditions under which recruiting resource levels would be reviewed and additional crisis prevention authority would be activated.

c) Improve Interlevel Communications

Both the EEWS and the ACPP would greatly improve interlevel communications. Improved communications are essential to reducing recognition lag and resource delay.

d) Develop an Offline Adjustment Process (OAP)

Should the EEWS Human Assessment Group sound a warning that recruiting conditions exceed the preagreed limits, the Offline Adjustment Process would be activated. The OAP working-level committe would be composed of the members of the Human Assessment Group, other representatives designated by the Services, and action officer representatives from the OSD comptroller, the Program Analyses and Evaluation (PA&E)

Directorate, and the Office of Management and Budget (OMB). The working-level committee would review the resource levels and make recommendations to meet the unexpected conditions. These recommendations could be to bank or reprogram resources when recruiting is better than expected; or to accelerate spending, increase resources, use emergency funds or modify policy constraints when recruiting is more difficult.

Working-level recommendations would be considered by the senior-level committee chaired by the Assistant Secretary of Defense and composed of the Director of PA&E, the OSD Comptroller, the Associate Director of OMB, and the Assistant Secretaries for Manpower for each Service. This committee could act as a body or simply coordinate the actions that its membership must take in their respective positions. The result could be actions by the Service managers singly or in consort, appropriate support from OSD and OMB, timely consideration of key concerns at a Secretarial Performance Review, or a prompt request to Congress for necessary additional reprogramming authority or supplemental appropriations.

The two most important functions of the OAP are:

1) To ensure that when the preagreed limits are exceeded or at the call of a member, the appropriate management levels in the government reconsider the adequacy of accession policies and near-term recruiting resource levels in a timely and organized manner to prevent a potential accession crisis from becoming the real thing; and

2) To ensure that the actions of the several Services, OSD, and OMB are consistent and integrated as appropriate.

e) Develop an Immediate Crisis Avoidance Authority (ICAA)

The ICAA also is activated automatically based on EEWS data. As with the OAP, the conditions for automatic activation would be established annually during the PPBSAA processes. These conditions could be the same as for those of the OAP, but are likely to reflect the need for more urgent action. Although the ICAA would grant additional authority automatically, use of that authority would be a matter of human judgement by Service managers.

Because ICAA actions and triggers are included in the annual budget and are part of the authorization and appropriations, they are legitimate and can be activated without additional action. When preagreed conditions exist indicating that an accession crisis may be developing, the Services would have the additional authority and resources needed to take immediate action. The specific authority and resources as well as the specific conditions upon which they could be used would be established annually during the PPBSAA processes.

2. Will the Current Budgeting/Programming Process Accommodate the Changes The ACPP Would Bring?

As the above concepts were being developed, the research staff worked closely with the Service Advisory Group and the OSD staff. At each stage the feasibility of various ideas were considered. Where problems or concerns were found, accommodations were sought. Many different management procedures were considered that could be used to take advantage of an early warning from EEWS that recruiting conditions are changing.

Once the concepts were developed, a joint workshop was held to discuss the various concepts in detail, and, in one-on-one sessions,

raise feasibility questions. Subsequently, the results were briefed to OSD, OMB and Service Officials at various levels to verify feasibility and to assess desirability. No obstacles to feasibility were identified in this process.

There appear to be no legal impediments to implementing ACPP. The plan falls within the authority vested in the Secretary of Defense by the National Security Act of 1947 (61 Stat. 499) and are consistent with Section 125 of Title 10, U.S. Code, that directs the Secretary to take appropriate action to provide more effective, efficient, and economical administration and operation of the Department of Defense.

An ACPP could be developed that would include all or some of the five components mentioned above. Each is important and would help reduce resource delays and contribute to system effectiveness. There has been general support for at least some of the concepts throughout the Department of Defense. However, there have been some concerns as well: The OSD Comptroller questions the feasibility of obtaining preagreements and implementing the Offline Adjustment Process; the Services feel the ACPP may be susceptible to gaming and that it could be used by OSD, OMB, and the Congress for micromanagement. We are confident that these obstacles/concerns can be addressed satisfactorily. The potential for improvement offerred by the ACPP far outweighs any negative side effects that might result, and we urge that a working prototype be developed in Phase II.

III. THE FEASIBILITY VERDICT

The EEWS and ACPP are designed so that together they will provide early warning of changing recruiting conditions and will facilitate interlevel communications, recognition of potential accession problems, and readjustments in recruiting resources when recruiting conditions exceed preagreed limits.

Using a data base updated monthly, the automated EEWS will provide comprehensive monthly reports on the status of the recruiting environment. In the event of predicted downturn, alerts from the EEWS forecasting models will provide eight to nine months lead time for taking corrective action. The components of the ACPP are designed to focus on the appropriate level -- to ensure that action officers work together regularly, that the Senior Level Committee meets only when there are important issues to consider, that appropriate support is provided for Secretarial Performance Reviews of key manpower issues, and that specific procedures, triggers, and actions to be taken are reviewed and revised annually as part of the PPBSAA.

The EEWS and ACPP are feasible. Prototypes should be developed and tested through simulation as part of Phase II of this study. Bringing improvements on line as soon as they are workable will reduce the risk of an unforeseen accession crisis as the economy improves and the pool of eligible high school graduates begins to decline.

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