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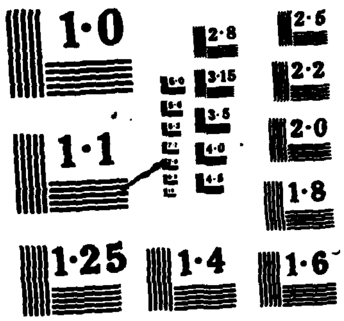
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A RAND NOTE

TOWARD ENHANCED INTEGRATION OF NAVAL AVIATION LOGISTICS

John B. Abell

September 1983

N-2045-NAVY

Prepared for

The Department of the Navy

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NAVAL AVIATION LOGISTICS

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35th Year Rand SANTA MONICA, CA. 90406

PREFACE

This Note reflects work undertaken by Rand under the sponsorship of the Assistant Secretary of the Navy (Shipbuilding and Logistics). It addresses a part of Rand's continuing research effort in naval aviation logistics that is intended to enhance the Navy's ability to determine its wartime and peacetime capability goals for support, determine the mix of logistics support resources needed to achieve those goals, and provide oversight of the total system to assure that capability goals are met.

This work, as well as other Rand work for the Navy that complements it, results from a review of the Navy's aviation logistics system that included intensive discussion with many elements of the Navy. Earlier drafts of this Note were also discussed with several agancies in the Navy. Suggestions regarding the substance and format of the earlier drafts have been incorporated in this version. Although the research is continuing, discussions are under way with other elements of the Navy with a primary interest in its contents. Thus the future course of the work and its detailed characteristics are likely to be affected by those discussions.

This Note should be of interest to logistics managers in naval aviation.

SUMMARY

The aviation logistics system supports worldwide aviation operations with a wide range of resources. It provides services to the operational force along functional lines--maintenance, supply, transportation, procurement, support planning, and many subordinate services. It is involved in every phase of the life cycle of a weapon system and in every facet of aviation operations.

In the face of this complexity, there is a need for enhanced integration across resource classes, functions, and weapon systems to ensure that the aviation logistics system delivers maximal peacetime readiness and combat sustainability with any specified level of resources. Moreover, resource allocations need to be consistent with the levels of readiness and sustainability reflected in the POM.

A basic purpose of the PPBS is to allocate the mix of logistics support resources needed to deliver specified levels of readiness and sustainability, and to specify those levels of readiness and sustainability in light of their costs. In this Note, the concept of the PPBS is extended to include budget execution and the day-to-day management of logistics operations because of the need for consistency in execution and management with the other stages of the process. The decisionmaking that takes place in the POM process results in resource allocations that can accurately be viewed as a plan. That plan needs to be "made good," so to speak; therefore, there is a need for consistency across subsequent stages of the resource allocation process. The use of integrated capability assessment tools at each stage of the process can help assure the consistency required by enabling decisionmakers to estimate military capability as a function of both planned and actual levels of logistics resources.

Capability assessments--i.e., estimates of capability given specified levels of logistics support resources, policies, and performance levels--are needed in the initial stages of resource requirements definition to estimate the levels of military capability that can be delivered by current levels of resources. Capability

assessments are also needed to help determine the effects on military capability of alternative resource allocations, from planning and programming through budget development and execution. The use of capability assessment in the day-to-day management of the aviation logistics system can identify deviations from the "plan" of the PPBS, critical resource shortages, and needed adjustments, thus identifying the management actions required to achieve planned levels of readiness and sustainability.

The spares requirements system is an important integrating mechanism because it plays a key role in several stages of PPBE&M. It is the vehicle for providing inputs to the POM; and, once programming and budgeting decisions are made, it is the basic vehicle for implementing those decisions. In principle, the requirements system should help POM decisionmakers set goals, and, given these goals, the requirements system is used to allocate resources. In effect, a plan and its implementation are implicit in these activities. Following the specification of peacetime and combat capability goals (and authorized changes to them as time passes), it is necessary to assure that those goals are translated into operational reality. This involves the direct measurement of particular factors in the day-to-day operation of the system, as well as the use of advanced capability assessment techniques.

Essentially, the research in which we are involved is intended to provide mechanisms that support the foregoing concepts. These mechanisms are then to be demonstrated so that the Navy might include them in their logistics management systems. Such implementation is likely to require technical support from the Navy as well as a close working relationship between the Navy and Rand. The areas include:

- **Development and demonstration of a method of incorporating an aircraft availability objective function in the spares requirements system in the near term--i.e., without extensive modification to existing software and without waiting for completion of resystemization, the Naval Supply Systems Command's effort to enhance its logistics management systems.**

- Implementation of a very responsive, aggregate method for estimating resource requirements as functions of specified changes in flying hour programs, aircraft availability goals, and other program variables. The method builds on a method developed under the sponsorship of the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics). It requires extensive modification to adapt it to the Navy. This technique would enable Navy programmers to explore a wide variety of program alternatives and levels of readiness. This and the previous would provide the means for specifying required levels of readiness and sustainability in the POM process that would guide resource allocation decisions.
- Initiation of first steps toward systemwide oversight through capability assessment techniques. This would begin to provide the Navy with the means for assuring that the "plan" implicit in POM decisionmaking is carried out.

ACKNOWLEDGMENTS

The author is indebted to Mr. Frank W. Swofford of the Office of the Assistant Secretary of the Navy (Shipbuilding and Logistics) for his encouragement and support; to Rear Admirals Virgil W. Moore, Jr. and Allen D. Williams, USN, for their thoughtful reviews of an earlier draft of this Note; to Captains Richard H. Cooke and Donald Taggart and Commander Stephen J. Riordan II, USN, for their constructive suggestions and support; and to his colleagues at Rand, I. K. Cohen, L. B. Embry, and T. F. Lippiatt, for their helpful comments.

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I. NAVAL AVIATION LOGISTICS

THE NEED FOR INTEGRATION AND OVERSIGHT

In recent years the Navy has experienced substantial cost growth in its aviation logistics operations. Navy leadership has naturally become increasingly concerned that this growth will "price naval aviation out of business." This concern has prompted serious self-examinations by the naval aviation logistics community, and functional area initiatives to improve performance.

One such initiative, in the Naval Supply Systems Command (NAVSUP), will upgrade current logistics management systems and the electronic data processing systems that support them. That initiative has two elements, *resolicitation* and *resystemization*. The former deals with acquisition of new hardware for the inventory control points (ICPs); the latter involves translation of existing logistics management systems from the old hardware to the new, and enhancement of those systems to improve their orientation and performance.

This Note is not comprehensive in its treatment of the entire naval aviation logistics system. Its primary focus is on component-related issues, but it discusses those issues in the context of the view of the system that is articulated in the discussion that follows. Furthermore, solutions to component-related problems may be relevant for other resources.

PLANNING, PROGRAMMING, BUDGETING, EXECUTION, AND MANAGEMENT

The Resources-to-Readiness Issue

This description of an idealized resource allocation process extends beyond the three stages of planning, programming, and budgeting to include budget execution--the allocation of budget resources to all echelons--and management, where management is concerned with the day-to-day operation of the logistics system. Thus the term PPBE&M will be used. This extension is made because of the need for consistency in execution and management with the other stages of the process. The logic that underlies the need for consistency is that every stage of the process should have the same objective--the allocation of the mix of logistics support resources needed to deliver specified levels of readiness and sustainability, and the specification of those levels of readiness and sustainability in light of their costs.

Apparent inconsistencies in requirements statements in the past have raised questions regarding the accuracy of the PPBS process in which a single requirement is computed ("the" requirement), rather than a range of alternatives each with an associated cost and capability level. Unfortunately, the Navy does not now have a convenient means for exploring a wide range of alternative levels of capability and investment without resorting to complex, costly, and time-consuming requirements computations.

In addition, the single requirement as now computed is not related to commonly understood measures of operational performance. Secondary measures now in use, such as supply fill rates or backorder objectives, cannot be related to measures of combat readiness or sustainability. The most compelling argument in favor of any statement of requirements is an explication of the relationship between the recommended requirement and the level of military capability it will deliver, thus making visible what changing or underfunding it will mean to the readiness and sustainability of the combat force.

The lack of mechanisms for assessing the capability that will be produced by specific mixes of resources, support structures, and policies given some scenario of interest, underlies many of the difficulties faced by the Navy in the PPBS process. For example, if there is no mechanism in requirements computation systems for relating requirements to capability, then the POM input is largely arbitrary in the sense that the requirements it reflects are based on some intermediate (or functionally oriented) performance goals that the system sets for itself, rather than meaningful measures of military capability.

Figure 1 illustrates the complexities of the PPBS in an idealized model. The role of planning is suggested by the block at the left. The defense guidance and force structure are exogenous inputs to the process insofar as logistics support resources are concerned.

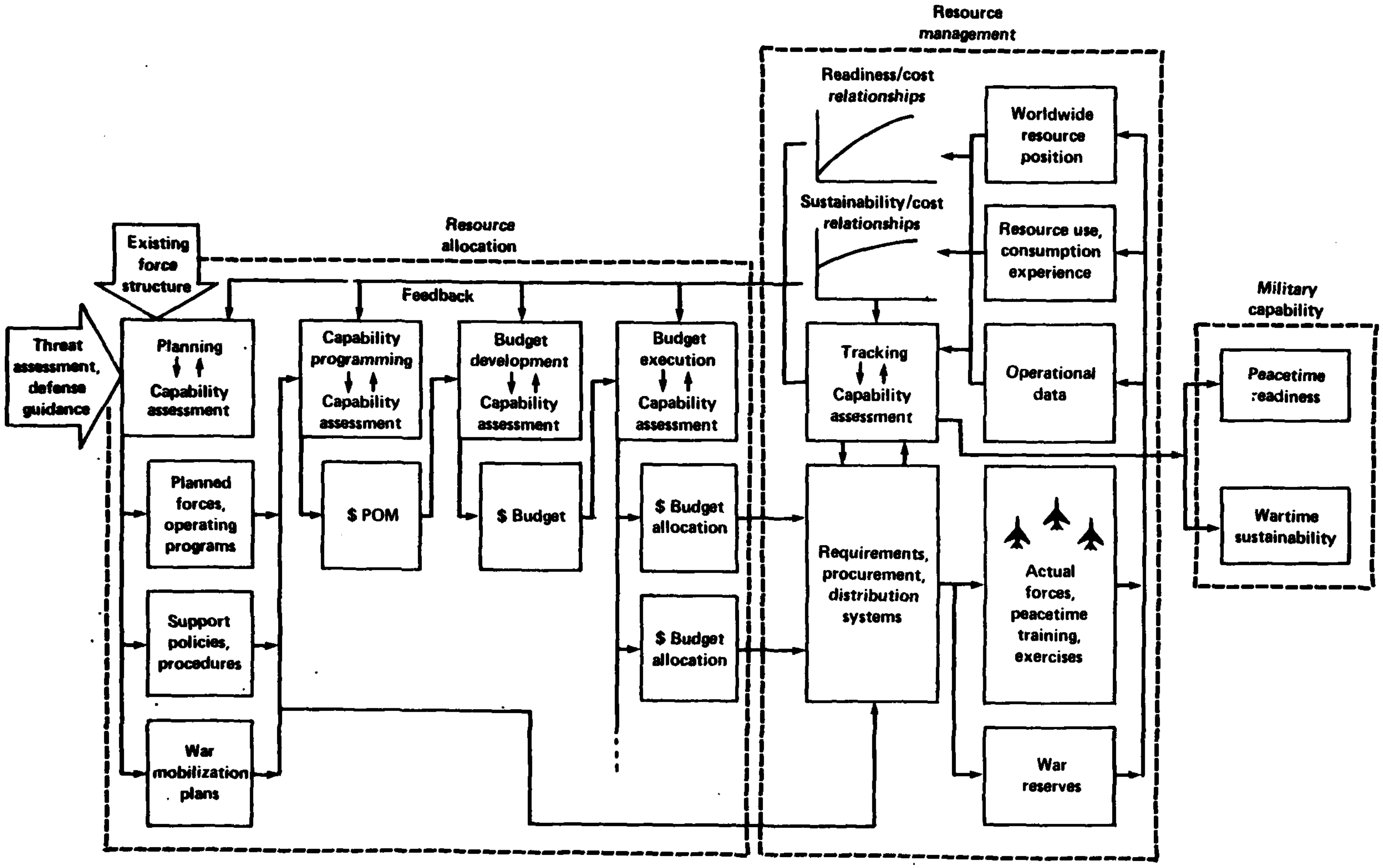

Fig. 1--A conceptual model of the Planning, Programming, Budgeting, Execution, and Management System

Capability assessment is the estimation of military capability given a scenario and a particular set of support resources, policies, and logistics system performance levels. The arrows within the five blocks representing planning, programming, budgeting, execution, and tracking portray the important role of capability assessment as an integral part of each stage. The decisionmaking at each stage should be consistent in terms of capability goals with the decisions made at every other stage. Capability goals are not explicitly represented as the product of any particular stage of the process; rather, the decisions made at each stage involve tradeoffs among resources, adjustments in investment levels, and reexamination of the balance among resources and the effect of such decisions on capability. Therefore, although capability goals might be thought of as emerging from the planning stage, they may be adjusted by subsequent decisions in later stages.

The dollar amounts that emerge from programming are eventually adjusted during budget development. During execution, budget resources are further partitioned so that meaningful operating targets are available for all appropriate functions, resource categories, and operational levels. Those targets guide the procurement, repair, and distribution of the resources required to support the peacetime readiness and combat sustainability of the operational force. Figure 1 also illustrates the management stage and feedback loops that should help maintain consistency throughout the total process and provide the basis for estimating the relationships between cost on the one hand and readiness and sustainability on the other. These relationships, in turn, support the capability assessment that is intrinsic to each stage of the process.

The Central Role of Requirements Systems in PPBE&M

Requirements systems have a central role in PPBE&M processes. A clear understanding of that role helps illuminate specific needs for enhanced integration, coordination, and control across all stages of the process as well as within each individual stage. Consider, for example, the aircraft spares requirements system. It operates on data from various sources that reflect a large number of "component" characteristics; however, what are typically referred to as "component" characteristics are in reality performance measures of the logistics system. Such data elements as failure rate and unit cost are largely functions of the component itself; but repair times, order-and-ship times, removal rates, and BCM rates are determined largely by the structure, policies, and performance of the logistics system. In fact, even unit costs can be influenced dramatically by spares acquisition strategies. Thus data that are typically viewed as descriptive of components have much broader meaning and implications to the military programmer.

To the extent that such data elements influence resource requirements, they should be the objects of management scrutiny, not just for the sake of accuracy, but to make them a realistic model of future logistics system performance. Moreover, management must ensure that the logistics system performs in ways that are *consistent* with that model, or that the inconsistencies and exceptions are made *visible* so that adjustments can be made in execution or operational management. The goal is to ensure that the military capability objectives intended in resourcing decisions are achieved in the operational environment.

In the case of aircraft spares, the logic of the requirements system is the same as the logic of the execution system. Therefore, decisions made in the POM process should be consistent with that logic. It would make little sense, for example, to compute fiscal resource requirements on the basis of aircraft availability goals specified by weapon system and subsequently spend the money on the mix of spares that maximizes supply fill rates. Goal congruence is needed across all organizations and echelons, and across all of the stages of PPBE&M.

The Navy's spares requirements system does not focus on aircraft availability as a goal; rather, it is oriented toward supply fill rates. The need for aircraft availability orientation in requirements computations is especially important. This need is addressed in Section II, as is the Navy's need for a convenient means to explore alternative levels of capability and investment, and its need for capability assessments in a variety of applications.

II. TOWARD ENHANCED INTEGRATION AND OVERSIGHT

This section describes research being undertaken at Rand that should provide the mechanisms to support enhanced integration of all stages of PPBE&M as well as the needed oversight of the aviation logistics system. The research includes:

- Adaptation to the Navy's aircraft spares requirements system of a very responsive, aggregate method for estimating changes in program requirements for aircraft repairable spares as functions of specified changes in program values (e.g., flying hour programs) or availability goals;
- Inclusion, in the very near term, of an aircraft availability objective function in spares requirements computations;
- Initiation of the use of capability assessments in naval aviation logistics to begin to provide the Navy with the means for assuring that the PPBS "plan" is carried out.

RESOURCES TO READINESS

In the past year, Rand undertook research that involved the development of a method for estimating the relationship between certain dependent variables, such as total dollar requirements for repairable aircraft spares, to selected independent variables--for example, flying hour program. Although its development is unfinished, the method, which is based on the use of partial derivatives, has been shown to be quite accurate for fairly substantial changes in program variables. In this application, a partial derivative is the instantaneous rate of change of a computed function of several variables, such as total dollar requirements for spares, per unit change in one of the independent variables such as depot repair time or flying hour program. The method is currently being enhanced to estimate weapon system availability in the computation.

This method will portray the resources-to-readiness relationship in a way that is consistent with the spares requirements system in the sense that it will incorporate the same logic and will be designed to "mimic" the requirements system.

The Aviation Supply Office (ASO) does not now determine requirements in support of aircraft availability objectives. Current techniques focus on supply materiel availability (SMA) rates--i.e., fill rates. However, the Navy's resystemization initiative is examining the incorporation of an aircraft availability objective function in requirements computations. Unfortunately, the resystemization effort will not be completed for perhaps three years. The problem, then, is how to take advantage of the estimating method in the near term, make it consistent with current ASO requirements computations, and still focus on an aircraft availability objective function rather than supply fill rates. The following discussion describes the characteristics of the estimating method and then the aircraft availability issue.

The method described here would allow a user to specify changes in several program variables and would estimate the value of each of several dependent variables that would result from a run of the requirements system's computational software, but without the need for an actual run. In other words, the estimating method would be able to tell a military programmer how the requirements system would respond to the program changes he specifies--e.g., changes in flying hour programs.

Examples of quantities that might be estimated in response to changes in program variables include:

- Total gross requirements ($);
- Dollar value of serviceable assets applied;
- Dollar value of intermediate-level repairs;
- Dollar value of depot-level repairs;
- Dollar value of due-in assets applied;
- Buy requirements ($) for items with one-year procurement lead time (PLT) or less;

- Buy requirements ($) for items with one- to two-year PLT;
- Buy requirements ($) for items with two- to three-year PLT;
- Cost of depot-level repairs.

As an additional product of the semi-annual requirements computation, the method would construct a small, simple data base that would reflect, in aggregate form, the characteristics of the data base actually used in the requirements computation. Thus, in estimating the effects on dependent variables of changes in program variables, the method would produce essentially the same result as rerunning the full-scale requirements computation. A prototype of this method has already been constructed, but it is limited to unique repairable weapon-replaceable assemblies (WRAs) whose requirements are demand-based. Only seven aircraft were included in the prototype data base. Thus there is substantial uncertainty regarding the difficulty of extending the method to the entire system and to all components. It is, nevertheless, a promising approach to achieving consistency across PPBE&M. Moreover, because it operates on a data base that is constructed from the actual requirements data base, it is consistent with the "bottom up" approach represented by the current system. "Bottom up" means that the requirement is based on a line-item-by-line-item computation rather than a macro-level estimating method, or "top down" approach.

Another feature of the method is its ability to aggregate over any subset of items in the system. For example, one might wish to aggregate items by weapon system, by cognizance code, or by some other component or system characteristic of interest, thus enabling the user to examine the effects of program changes within the context of the aggregation chosen. Moreover, the method is computationally efficient, so the desired estimates would be available in a few seconds on most modern electronic data processing systems.

The method can probably be adapted to the ASO spares requirements system. The first step in applying this technique to the resources-to-readiness problem is to determine the limitations of the ASO spares requirements data base. If it contains the information needed, adaptation could begin immediately, although the time required to complete a prototype will remain a matter of considerable uncertainty until after assessment of the data base. Furthermore, there are still technical issues to be resolved with the method itself with respect to common items and components other than WRAs.

Rand's research effort consists of several steps:

- Assessment of the ASO requirements system to determine the adaptability of the estimating method to the naval aviation environment;
- Development of a prototype system for Navy use that incorporates aircraft availability estimates;
- Evaluation and demonstration of the prototype;
- Exploration with the Navy of user-oriented features and possible enhancements in a Rand-Navy workshop;
- Modification of the prototype and delivery to the Navy of final prototype configuration, including documentation, for implementation, maintenance, and use;
- Support of the method as required to resolve data base problems and technical issues as they arise.

AN AIRCRAFT AVAILABILITY OBJECTIVE FUNCTION

The spares requirements system lies at the heart of PPB&E. It not only provides inputs to the process, it is also the execution system. For naval aviation it consists of several different computational systems, three of which are of primary interest here. [1, 2, 3, 4] These three distinct but logically equivalent systems are: Stratification (Strat); the Leadtime Computation, Demand Forecasting, Activity Stocking Criteria and Levels Computation (Levels); and Supply Demand Review (SDR).

Strat estimates requirements for POM and budget purposes and is a longer range computation than is the SDR. It is run semiannually.

A supporting system, the Computation and Research Evaluation System (CARES) simulates Strat and operates on a sample data base. It estimates spares procurement and repair requirements as functions of wholesale supply materiel availability (SMA) rates--i.e., item fill rates at the wholesale level--as Strat does. It is designed to help decisionmakers determine desirable values of input parameters to Strat and Levels.

The Levels computation is the second principal ingredient of the system. It is run quarterly to update estimates of component characteristics such as demand rates, resupply times, and pipeline values. It computes wholesale reorder levels.

SDR, the third major component of the system, computes requirements in the short term based on the Levels outputs--i.e., for actual procurement purposes rather than for POM input or budget planning purposes. It is run weekly for consumables and monthly for repairables.

The logic of all of these systems is similar. Each focuses on SMA rate at the wholesale level in computing the wholesale reorder levels that drive requirements. Retail level allowances are also computed using SMA rates as objective functions, but with different systems and processes from those discussed here.

Stockage policies throughout the aviation logistics system are essentially demand-based without explicit consideration of weapon system readiness or complexity or item essentiality. The objective function used in computing wholesale reorder levels, SMA rate, is also used as a performance measure throughout the inventory management system, at every echelon and location. Unfortunately, fill rates are not directly indicative of aircraft readiness; in fact, they can be seriously misleading. They fail to account for weapon system complexity; therefore, a weapon system that is complex in the sense that it consists of a fairly large number of components will suffer a lower level of readiness than one that has a fairly small number. Another result is that safety levels for spares are computed without regard for the effects of item shortages on readiness and sustainability. The implications of this orientation are that current levels of readiness could be provided for less cost than is now being incurred, and, conversely, greater levels of readiness could be provided for current levels of investment.

Another important characteristic of the current system is that it is partitioned in several ways that diminish its cost-effectiveness. The "wholesale" system is viewed as being separate and distinct from the "retail" system. When retail-level requirements are computed, the wholesale level is assumed to fill requisitions with certainty and without delay. However, wholesale requirements are computed to achieve a fill rate of 85 percent, given the availability of funds. Another way to articulate this kind of inconsistency more generally is to say that the requirements system does not have a *multi-echelon* orientation. It is well known that a partitioned allocation of stock levels between echelons in a multi-echelon system will deliver a level of performance that can be considerably improved upon without additional investment simply by reallocating the stock levels so as to account explicitly for the multi-echelon structure. Achievement of that multi-echelon orientation in logistics operations is not simply a matter of computational techniques. It has important management implications as well.

The Navy recognizes the importance of the fact that its requirements computations and stockage policies in naval aviation lack weapon system orientation. ASO recently realigned its item management functions somewhat along weapon system lines and is specifying use of differential fill rates across sets of weapon-system-peculiar items. Moreover, the Navy's resystemization efforts are a longer term strategy to improve the orientation of its requirements systems. Nevertheless, in both its organization and its systems, naval aviation supply is basically item oriented, and its orientation is toward fill rates in both requirements computations and system performance.

Some of the problems associated with changing this basic orientation are difficult, in both a technical and an organizational sense. This research effort is an attempt to help the Navy move toward a weapon system orientation.

Improving Requirements Computations

The single change to the current spares requirements system that would result in the most dramatic improvement would be the change of its objective function from fill rate to weapon system (or other end item) availability rate. It would enable military planners to specify weapon system availability goals with visibility of their costs and the requirements system to be tied to military capability goals.

Furthermore, the mere specification of those goals would provide an integrating mechanism across the partitions of the logistics system. Without such common goals and the mechanisms to compute requirements to meet those goals, the *implementation* of the kind of system integration needed is beyond reach.

Any hope for better integration of the PPBS process or, indeed, the logistics system, depends to an important extent on requirements computational objective functions and techniques that support that integration. The incorporation of an aircraft availability objective function in requirements computations, therefore, should be an important priority for naval aviation logistics management. Without it, even with the estimating method previously described, the Navy would only be relating investment levels to wholesale level fill rate.

The partitioned character of the current logistics system between "wholesale" and "retail" and the fact that Strat, Levels, and SDR operate essentially at the wholesale level mean that the decision variable involved in these computational mechanisms is the wholesale reorder level. But aircraft availability is constrained by retail level allowances even with unlimited wholesale stock. Therefore, what is needed is the ability to decide how best to allocate budget resources across echelons of the system to achieve the greatest capability.

The question of how to achieve an aircraft availability orientation in the requirements system without some very major effort, and without waiting for completion of resystemization, is made difficult by the wholesale-retail partitioning of the system. In the face of this partitioning, this research is only the first step toward bringing an aircraft availability orientation to the spares requirements system, starting with the computation of wholesale reorder levels. Rand has already begun to investigate the feasibility of computing item shortage costs in a preprocessor that would provide them to the existing requirements programs without the need for software modification beyond the accommodation of shortage costs specified by item. The shortage costs would be computed in a way that maximizes aircraft availability. Unfortunately, the decision variable may have to be the wholesale reorder level, clearly a suboptimal approach to the problem of maximizing aircraft availability in the face of an investment constraint. Even in this case, however, the resulting mix of wholesale reorder levels should be superior to those computed by existing systems.

Rand will complete the development of this computational technique, and, with the Navy's cooperation, demonstrate and validate it in the ASO environment.

The Outyear Requirements Forecasting Problem

The method described above shares a limitation of the current requirements system. That is the system's inability to forecast outyear program requirements accurately, a problem the Navy shares with other military departments. The Navy's current technique for estimating outyear requirements is based on the current and projected value of operational aircraft (VOAC). It has been suggested that a method based on flying hours would perform consistently better than VOAC. But what is actually needed is an approach that does not rely on a cost-per-flying-hour factor.

In the coming fiscal year, Rand will address the problem of outyear program requirements forecasting in the context of other defense research. The magnitude of this effort is still a matter of uncertainty, but it is an important issue and the results may be useful to the Navy. In the event that it is not adequately solved in the other research context, it would remain to be addressed in the future.

CAPABILITY ASSESSMENT

As pointed out in Section I, capability assessment has a vital role to play in every stage of PPBE&M. Its use by key planning and policymaking organizations throughout the system can help achieve:

- Enhanced orientation toward combat capability throughout the system;
- Consistency across all stages of PPBE&M, including the capability actually realized with the level of capability planned;
- Balanced support resource investments through identification of resources that constrain combat capability;

- Sound policymaking based on analysis of the effects of alternative policy decisions on combat capability;
- Greater credibility at the budget table through an ability to demonstrate the levels of combat capability that result from alternative resource allocations.

Capability assessment is obviously oriented toward weapon systems. It implies an integrated view of the logistics system--a view that cuts across resource classes, echelons, functional areas, and organizations. Moreover, it can help one assess capability as a function of programmed resources or actual resources, thereby reinforcing combat capability orientation throughout every stage of PPBE&M. It can serve as an oversight mechanism by helping assure that day-to-day management decisionmaking is consistent with the decisionmaking in the early stages of PPB&E, thus contributing to "making the plan good."

Rand is examining many aspects of the aviation logistics system for the purpose of determining the key decision points in every stage of PPBE&M. The objective is to understand better how capability assessment can be implemented in a way that is most supportive of the Navy's need for assuring that the PPBS "plan" is carried out.

The initiation of capability assessment could be undertaken in any one of several ways because it has so many potential users and applications. The weapon system orientation of capability assessment tools is obviously important to weapon system managers in NAVAIR and ASO. The knowledge gained through capability assessment can help support weapon system managers in justifying and acquiring resources.

There are several other obvious applications of capability assessment throughout the system. The question here is how best to approach the implementation of capability assessment in a way that:

- Quickly identifies what the key implementation issues are, e.g., data quality and accessibility;
- Supports aviation logistics planning in a useful and constructive application rather than just a research exercise;

- Demonstrates the ability of capability assessment techniques to make a genuine contribution to enhancement of aviation logistics system integration.

In Rand's past work with the Navy, [5] we used a capability assessment model, Dyna-METRIC (Dynamic Multi-Echelon Technique for Recoverable Item Control), to conduct the capability assessments involved. [6] Dyna-METRIC is an analytic model of the spares support system for aircraft repairable components that estimates aircraft availability as a function of dynamic flying rates, initial stockage position, scenario characteristics, etc. In short, it enables one to examine aircraft availability over time in dynamic combat scenarios (or in peacetime) as a function of a wide variety of scenario characteristics, policy variables, logistics system performance characteristics, and several different logistics support structures. Rand recently enhanced Dyna-METRIC to incorporate representation of the depot-level repair process.

In this project, with Navy cooperation and support, Rand is undertaking the following first steps toward enhancement of aviation logistics system integration and oversight through initiation of capability assessment:

- Selection of a weapon system or an important common subsystem that will soon undergo a Readiness Improvement Program (RIP) Review;
- Acquisition of data to support the assessment of both peacetime and wartime weapon system sortie generation capability, both afloat and ashore, or, in the case of a subsystem, the contributions of subsystem characteristics and support posture to the capability of its parent weapon systems;
- In concert with at least one TYCOM, the ASO weapon system management organization, and NALC-04, performance of the assessment described above;

- Analysis of the results of the assessment to identify resource constraints, problem parts and causes, and related policy issues, as well as technical problems in conducting the assessment;
- Based on successful completion of these initial tasks, recommendation of specific steps to be taken to implement capability assessment techniques in routine support of RIP Reviews;
- Additional technical support as required to assure a smooth transition to routine maintenance, support, and use of the techniques by the Navy.

This implementation strategy is only a first step in developing the level of capability and sophistication needed. Additional use of these techniques will emerge quite naturally from their use in the RIP Review process, which brings together representatives of several key organizations in the aviation community. Additional applications should also be generated from examination of the logistics system to identify key decision points where capability assessment could enhance system integration and oversight. Based on a successful outcome in the RIP application, Rand would support an AVCAL Conference in conjunction with ASO and TYCOM representatives as a logical next application.

Although the weapon system orientation implicit in capability assessment helps achieve a view of the aviation logistics system as an integrated whole, it is not without problems. For example, the item manager does not have visibility of the system as a whole, and, in fact, probably doesn't want such visibility. He is rewarded for "effective" management of a set of items in the inventory system. Thus, if the Navy were to manage toward aircraft availability goals specified by weapon system, it would be very important to make sure that the decisionmaking behavior of item managers was consistent with those goals, rather than suboptimal from the standpoint of aircraft availability. In other words, item-oriented decisions by item managers would no longer be "smart" in the sense of achieving the best balance of spares.

The item manager is only one example of many in the system whose functions and decisionmaking are being studied as part of the initiation of capability assessment as an integrating mechanism.

III. CONCLUDING REMARKS

This Note has tried to make the case for enhanced integration and oversight of naval aviation logistics and for greater consistency across the several stages of PPBE&M. Systemwide capability assessments oriented toward combat capability are important means for achieving these goals. Specific development and implementation work that will move the Navy toward an integrated support system includes a simplified means of exploring alternative capabilities and costs that supports a "bottom up" approach to POM input preparation. It also includes development of a technique to implement an aircraft availability objective function in the requirements system without waiting for resystemization. Rand is also supporting the implementation of capability assessment techniques systemwide to assure that the plans that emerge from the POM process are carried out as intended.

This work is intended to provide a major thrust toward integration. Obviously, the Navy needs to undertake cooperative and companion efforts to assure successful completion and implementation of the Rand work as well as to extend it. Such extension will be necessary, even within the limited scope of aircraft components. The framework provided for the functions covered by the work is likely to be applicable to many other logistics functions.

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