A RAND NOTE

DEMAND AND SUPPLY INTEGRATION FOR AIR FORCE ENLISTED WORK FORCE PLANNING: A BRIEFING

S. Craig Moore

August 1981

N-1724-AF

Prepared For

The United States Air Force

Rand
SANTA MONICA, CA. 90406

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PREFACE

This Note documents the final briefing on Rand research on improved methods for integrating demand and supply factors in planning future work forces for Air Force enlisted personnel. The research is part of the Project AIR FORCE "Enlisted Force Management" project, undertaken for the Directorate of Manpower and Organization and the Directorate of Personnel Plans, DCS/Manpower and Personnel, Hq USAF. The objective of the project was to increase the operational capability and efficiency of the enlisted work force by improving the match between requirements for and actual supplies of enlisted manpower.

The research took the direction of developing a new strategy, one that goes beyond bending supplies to fit requirements. The new strategy, identified in the preceding Manpower, Personnel, and Training (MPT) Dynamics study,[1] determines how the requirements themselves can be changed to make the task of matching actual supplies more practicable. The purpose, of course, is to determine policies, plans, and programs that will continually shape the work force, efficiently adapting it to changing operational and external environments.

This briefing is being published to provide timely information to Air Force, other government, and private sector planners and researchers who have expressed interest in the new strategy. A more detailed report on relating productive capability to work force structure for Air Force enlisted manpower will be published subsequently.

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[1] That study's description and evaluation of the Air Force's MPT system are documented, respectively, in the following two Rand publications: B. E. Armstrong and S. C. Moore, Air Force Manpower, Personnel, and Training: Roles and Interactions, R-2429-AF, June 1980; and B. E. Armstrong, S. W. Chapel, and S. C. Moore, Air Force Manpower, Personnel and Training System: Volume II--Analysis of the Enlisted Authorization/Assignment and Manpower Requirements/Personnel Objectives Subsystems, N-1476-AF, May 1980.

SUMMARY

Up to now, Air Force enlisted manpower requirements (the "demand" for manpower) have been determined with little reference to the quantities of different types of people actually available (the "supply" of manpower). Consequently, recruiting, training, and various personnel programs (e.g., for reenlistment quotas, bonuses, promotions, and early-outs) are adjusted continually to try to achieve the "required" work force structure--specified quantities of people at each of numerous pay grades and skill levels within each occupational specialty. Such adjustments can introduce notable costs and policy turbulence and often fail to achieve the required work force structure in a timely manner. Hence, realization of the underlying requirements for operational capability can be jeopardized.

Achieving a required work force structure is somewhat like shooting at a moving target from a moving platform: Changes continue both in the operational programs (hence in the manpower requirements) and in the manpower supply environment (for example, because of shifts in youth demographics or the national economy). This Note proposes that the Air Force coordinate the movement of the target (manpower requirements) with the movement of the platform (manpower supply) while maintaining the target's integrity (the required operational capability). The result should be more capable work forces (more bull's-eyes), more efficiently obtained. In short, the explicit objective of personnel and training management can become that of providing a required work force capability rather than a required work force structure.

Fulfillment of this objective requires knowledge of the relationship between a work force's structure and its capability. The Air Force could use this relationship to identify alternative configurations of manpower that are capable of performing the same quantity and quality of work (a first proxy for work force capability) within individual work centers at individual Air Force bases. The alternative configurations may differ in the numbers of people employed in total, in different specialties, or in different categories of experience within specialties. Here we illustrate the identification of such alternatives for Aerospace Ground Equipment (AGE) maintenance work centers, using a practical analysis approach (activity analysis) and data (e.g., performance and supervision times) similar to those already used in the Air Force's Management Engineering Program. Several "practicing" AGE maintenance technicians and supervisors provided the data.

The approach emphasizes the capabilities of different types of people performing different types of work. For example, inexperienced people (on average) can require up to 2.5 times more time to accomplish fixed amounts of certain types of work than more experienced people. To accomplish representative mixes of several types of work, the total number of people required in the work center can vary by over 20 percent, depending on the types of people employed; and the number of

people required of each type (categorized here according to skill level and pay grade) can vary much more. The variety of alternative manning configurations that are practical for any work center is limited, of course, by organizational factors (due to deployment requirements, multiple-shift operating schedules, etc.) and work allocation constraints (to ensure job satisfaction, on-the-job training, etc.).

The briefing also illustrates how manning alternatives for a given type of work center can be aggregated across all Air Force bases that use that work center. The result is a large set of forcewide alternatives, each equally capable of performing the work required in the constituent locations.

These forcewide alternatives can be used to determine efficient ways of meeting changes in either the manpower supply or demand environment. For example, we estimate that (1) a five percentage point drop in the first-term reenlistment rate of AGE maintenance specialists, resulting in an immediate loss of about 50 fairly experienced mechanics, should require about 180 new school-trained mechanics to preserve the overall capability of the AGE maintenance occupation; and (2) a 10 percent across-the-board increase in AGE maintenance work load in a year's time should necessitate about a 17 percent increase in the size of the occupation, because only inexperienced people could be added in that short time. Further, the capability of the AGE maintenance work force should increase from 2 percent to 5 percent for each 10 percentage point increase in the fraction of the occupation consisting of careerists, with no change in the work force size.

Such results demonstrate the potential for improved personnel policymaking and programming associated with an ability to relate work force capability to structure. The next steps for the Air Force to consider are those of (1) extending this ability to other work centers and occupations, (2) extending the airman planning and programming systems to permit routine examination of alternative work force structures, and (3) examining the practical aspects of using such a revised set of tools in a new approach to MPT management.

ACKNOWLEDGMENTS

Thanks are due to Rand colleagues Stephen Drezner, Michael Rich, James Hosek, and Glenn Gotz, who assisted in refining this briefing, and to former colleagues C. Robert Roll and William Albright, who participated in the original definition of the concept and the research plan. Further, special credit must go to Bruce Orvis who insightfully and meticulously designed and executed the data collection mechanisms that made this briefing possible and who participated actively in the analysis described here. Assisting in the data collection itself were Donna Schwarzbach and Robert Sims. Fred Finnegan performed computer programming important to the overall data analaysis. In reviewing the draft, Brent Bradley made numerous valuable suggestions.

Invaluable assistance in developing the data collection design was contributed by numerous Air Force personnel representing the Human Resources Laboratory, the Management Engineering Program, and several major operating commands. (These individuals are singled out in a forthcoming report that documents this research in greater detail.) Aerospace Ground Equipment (AGE) maintenance specialists at March and Norton Air Force Bases provided the data used here.

DEMAND AND SUPPLY INTEGRATION FOR AIR FORCE ENLISTED WORK FORCE PLANNING: A BRIEFING

S. Craig Moore
Enlisted Force Management Project

CHART 1

ENLISTED FORCE MANAGEMENT PROJECT

Operational problem:

Personnel "supply" considerations exert practically no influence on manpower "demand" specification

Project thesis:

The problem can be resolved through relating work force structure and operational capability

Chart 1

For many years Rand researchers have been studying various aspects of the Air Force's Manpower, Personnel, and Training (MPT) system. About three years ago, after "dropping back" to obtain a wider view of the overall MPT system, we identified a broader problem for research. This briefing discusses the principal results of that research.

Briefly, the Manpower portion of the MPT system determines the targeted size and shape[1] of the enlisted work force and pays very little attention to problems the Personnel and Training parts of the MPT system may subsequently encounter in providing a supply of people to match the demand. Until fairly recently, this situation had not created major difficulties for the Air Force because total Air Force manpower strength had been declining steadily, there were generally enough people available to match new "demanded" work force structures (of about any shape, but reduced size), and the Air Force continued to provide training, employment, and compensation sufficient to attract and retain people in adequate numbers. But Air Force manpower strength is no longer declining, there have been some manpower shortages recently at both entry and more experienced levels, and continuation of current management practice, in my opinion, will lead to definition of impractical or even unachievable work force structure targets, necessary deviations of actual work force structures from these targets (probably with attendant losses in work force capability, hence mission capability), and unceasing pressure on the supply part of the system to deliver the "required" but difficult-to-provide combinations of people.

Rand undertook the Enlisted Force Management Project believing that the best way to resolve this problem would be to provide Air Force MPT system managers with convenient tools for identifying the relationship between a work force's size and shape and the work it can do (or, loosely, its operational capability). This would give the system the ability to identify practical and achievable work force structures that could provide the required operational capability--especially considering current personnel inventories and expected personnel supplies.

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[1] The "shape" of the enlisted work force connotes its constituent mix according to occupation and experience. Experience currently is designated primarily in terms of skill level and pay grade.

CHART 2

BRIEFING OUTLINE

- **Introduction:** Context and objectives
- **Technical methods:** Work center manning
- **Sample applications:** Occupation-wide manning
- **Conclusions:** Observations and next steps

Chart 2

The first part of this briefing describes the problem in more detail and a general strategy the Air Force can take to address it. To illustrate the strategy's potential, the briefing then briefly addresses its detailed treatment of manpower requirements at the level of individual work centers.[1] I then examine some associated occupation-wide implications indicating possibilities for evaluating combinations of policy options different from those that can be considered under the current system. I conclude with suggestions for next steps in developing the revised overall MPT system strategy.

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[1] "Work Center: A group of personnel that use similar machines, processes, methods, and operations, to perform homogeneous type work usually located in a centralized area. The term is used to identify a relatively small activity within a broad functional segment. Personnel within a work center perform work that basically contributes to the same end-product or result, and their duties are similar or closely related." (Air Force Regulation 25-5, Volume I, p. A2-5.)

CHART 3

MANPOWER-SPECIFIED "DEMAND" DICTATES WORK FORCE STRUCTURE PLANS AND SPURS PERSONNEL "SUPPLY" ACTIONS

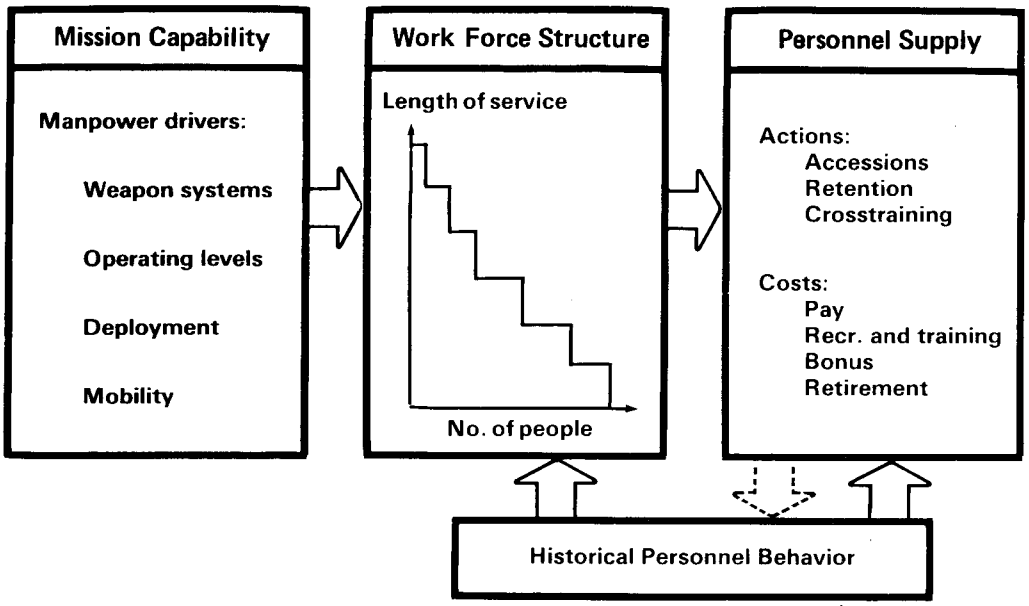

Chart 3

This diagram provides a simplified overview of the Air Force's Manpower, Personnel, and Training (MPT) system. Note the one-directional flow of influence. Everything begins with a desired mission capability and associated planned operating programs. With these are associated several characteristics that drive work force requirements. The Manpower component of the MPT system considers the specific jobs associated with the various operating programs, incorporates organizational considerations, and determines the quantities of personnel required in each specialty, skill level, and pay grade. These dictate the work force structure--the manpower demand--for each work center, each occupation, and for the overall enlisted work force.[1] To the extent that the supply side of the system (Personnel and Training) actually emplaces some different work force structure, the Air Force has no mechanism for determining the difference between the desired and the achieved work force capability. Because information is lacking on how capability changes as the work force structure changes, emphasis naturally falls on actually achieving the demanded work force structure--"matching faces to spaces."

The Personnel and Training components of the MPT system, then, take various actions and incur associated costs in attempting to achieve the targeted work force structures. Some of these actions, most notably those related to compensation, are designed to influence personnel behavior (usually enlistment and reenlistment behavior) in order to reduce or avoid deviations from the work force structure targets. These actions are represented by the dashed arrow. Personnel and Training must cope with two difficult types of dynamics: First, the work force structure targets change because operating program plans change; second, the supply environment changes. Examples of supply environment changes include the widely publicized decrease in the number of people in the primary enlistment cohorts (a demographic change) and a change in the attractiveness of Air Force enlisted employment compared with civilian employment (because the national economy changes, for instance). Clearly, the supply job can be difficult.

Of course the fact that the demanded work force structure can be impossible to achieve has not gone unnoticed within the Air Force MPT community. The "AFSC restructuring" effort currently underway is a one-time effort designed to remove some of the more pronounced infeasibilities in authorized work force structures. (For example, more senior level positions were authorized in some occupations than reasonably could be filled by people moving up through the authorized,

[1] For each enlisted occupation, the Personnel component of the MPT system applies historical retention and upgrade rates to the skill level and pay grade profiles authorized by Manpower and identifies work force structures of the form depicted in the center of this diagram.

prerequisite, junior level positions.) This is a positive first step in bringing supply concerns to bear on the establishment of work force structure targets, and much stronger links should be established among Manpower, Personnel, and Training so that supply concerns can be consistently and routinely brought into the demand specification process.

CHART 4

PERSONNEL "SUPPLY" CONSIDERATIONS SHOULD INFLUENCE WORK FORCE STRUCTURE PLANS SO THAT MISSION CAPABILITY IS ASSURED

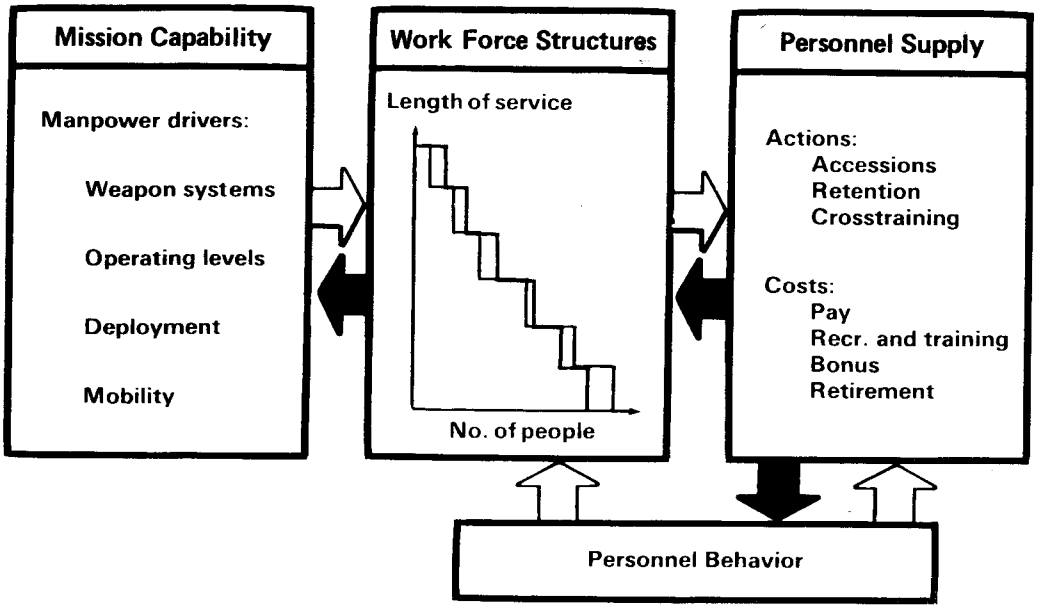

Chart 4

This diagram illustrates the additional links the Air Force MPT system needs to define work force structure targets that are consistent with the dynamics of the supply environment and that can perform the required work, thus providing the desired operational capability.

The new (darkened) arrow at bottom right reflects enhanced ability to estimate the effects of management options (such as compensation or promotion rate changes) on enlistment and retention behavior.[1] The dark arrow at the left of the diagram reflects an analytic ability to relate what a work force can actually do (what capability it can provide) to its size and makeup. The remaining new arrow, at the diagram's right, connotes an integrating capability, a system of models containing the relationships between, in turn, personnel policies and programs, work force structure, and work force capability. Such a system could incorporate the dynamics both in the demand for work force capability (because of mission and operating program changes) and in the supply environment (because of demographic, attitudinal, and economic changes) to determine an orderly sequence of work force structures that could actually be achieved and that could better provide necessary operational capabilities.

Although the theoretical appeal of an MPT management system of this nature has been recognized for some time, no practical method had been devised for the crucial task of relating work force structure and capability. Very little research exists regarding this relationship, and previous work embodies shortcomings sufficient to render the results unconvincing; certainly the methods and data are insufficiently credible to be useful in the Air Force's ongoing MPT management system. Thus we have concentrated most of our efforts so far in this research project on appropriate methods and data. Before illustrating the approach, I shall summarize the capabilities the Air Force MPT system would have if it used this strategy.

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[1] The retention part of this capability can be realized by extending the Rand models that predict Air Force officer retention under altered management policies.

CHART 5

KNOWLEDGE OF THE RELATIONSHIP BETWEEN A WORK FORCE'S STRUCTURE AND ITS OPERATIONAL CAPABILITY...

- Permits comparison of required and actual work force structure capabilities
  - Work-center level
  - Operating-unit level
  - Occupation-wide level
- Allows quantification of capability changes associated with work force structural changes induced through, e.g.,
  - Compensation
  - Promotion opportunity and timing
  - Recruiting and training

➡ Determine MPT policies, plans, and programs by dynamically evaluating alternative work force structures

Chart 5

The ability to relate a work force's capability to its size and constituent structure would have several important benefits. First, it would be possible to compare the required or desired and actual capability of a work force structure (or any projected structure) at the level of individual work centers, where the work is actually done and where the effects of any overall work force structure changes will be felt. By aggregating across work centers that support a particular operating unit, one can evaluate that unit's work force capability. Similarly, by aggregating across work centers that employ people in a particular occupation (specialty), one can compare the capability of the entire occupational work force with the corresponding requirement.

Second, if the effects on work force structure of personnel policies and programs can be projected (as represented by the darkened, bottom right arrow on the preceding chart), it is also possible to estimate the corresponding effects on work force capability.

Together, these analytic means would permit Air Force MPT planners to select the most desirable sequence of work force structures (and the associated management policies and programs) by evaluating a range of work force structures that could be achieved with various combinations of management options. This evaluation must be dynamic--consider an evolving situation--because both the operating programs and the supply environment will continue to change.

Not all of the analytic tools have been developed to demonstrate the whole potentiality of this overall strategy at this time. (But there is little doubt about their feasibility. Previous work regarding enlistment and reenlistment behavior and dynamic personnel flow models demonstrates that the necessary tools for these parts of the system are within the state of the art.) The remainder of this briefing describes and illustrates a practical technique for relating work force capability and structure at the work center level and then demonstrates the importance of this capability for analyzing policy and programming options for an entire occupation.

CHART 6

DEVELOP FORCEWIDE MANNING ALTERNATIVES USING WORK CENTER MANNING ALTERNATIVES

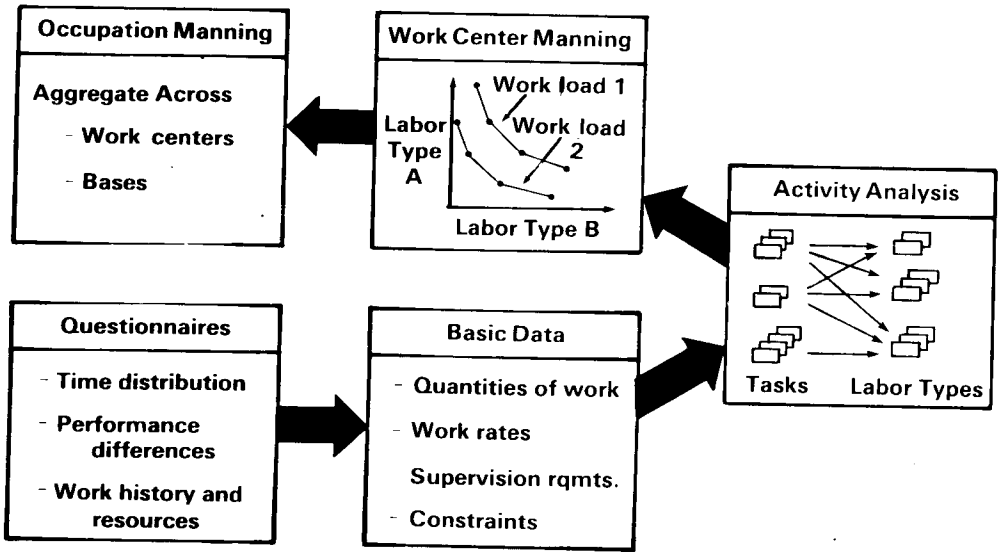

Chart 6

The manpower requirement within an occupation--the demand for people of varying levels of skill and experience--is determined by summing the requirements for such people across the individual work centers and bases where they are employed. Hence, to obtain alternative work force structures for entire occupations, it is necessary to identify alternative work force configurations for individual work centers at individual bases. (This approach parallels current Air Force methods for determining overall manpower requirements.) The "curves" in the top center box are abstract representations of alternative manpower configurations capable of handling a fixed work load. Here, work center manpower is divided into illustrative "Type A" and "Type B" occupational/skill categories, and any manning configuration corresponding to a point on or above one of these curves is capable of handling the designated work load. (Actually, manpower can be divided into many more than two categories, as will be seen below.)

"Activity analysis," another name for linear programming, is a readily available, inexpensive, easy-to-use method the Air Force can routinely use to identify alternative manning configurations at the work center level. The technique considers the array of tasks within the work center and the array of different types of manpower that can perform some or all of these types of work. The manpower types can be categorized according to occupational specialty, length of experience, skill level, pay grade, training, mental aptitude, etc. The required quantity of each manpower type is determined by the quantities of the various types of work allocated to it. Obviously, the more work allocated to a particular type of manpower, the more of that type of manpower is required. The activity analysis identifies different allocations of work, hence different mixes of manpower (alternative work force configurations) that can handle all the work. This analytic tool is driven by certain types of basic data that are closely akin, but not identical, to those currently collected within the Air Force's Management Engineering Program.

Air Force management engineers can use any of several methods to collect the necessary data; the data being considered here were collected using a battery of questionnaires developed at Rand over the last two years with considerable help from people in management engineering, the Air Force Human Resources Laboratory (HRL), and supervisors and workers in the prototype work centers in several major operating commands (MAJCOMs). The Directorate of Manpower and Organization, Hq. USAF, helped Rand to select two functional areas as broadly representative prototypes: (1) Aerospace Ground Equipment (AGE) Maintenance, employing more than 6000 enlisted technicians forcewide, and (2) General Accounting, employing nearly 4000 clerical personnel forcewide. The examples in the remainder of this briefing are based on the AGE Maintenance work center, manned mainly by personnel holding Air Force Specialty Code (AFSC) 423X5.

CHART 7

PROFICIENCY INCREASES WITH EXPERIENCE (AFSC 423X5)

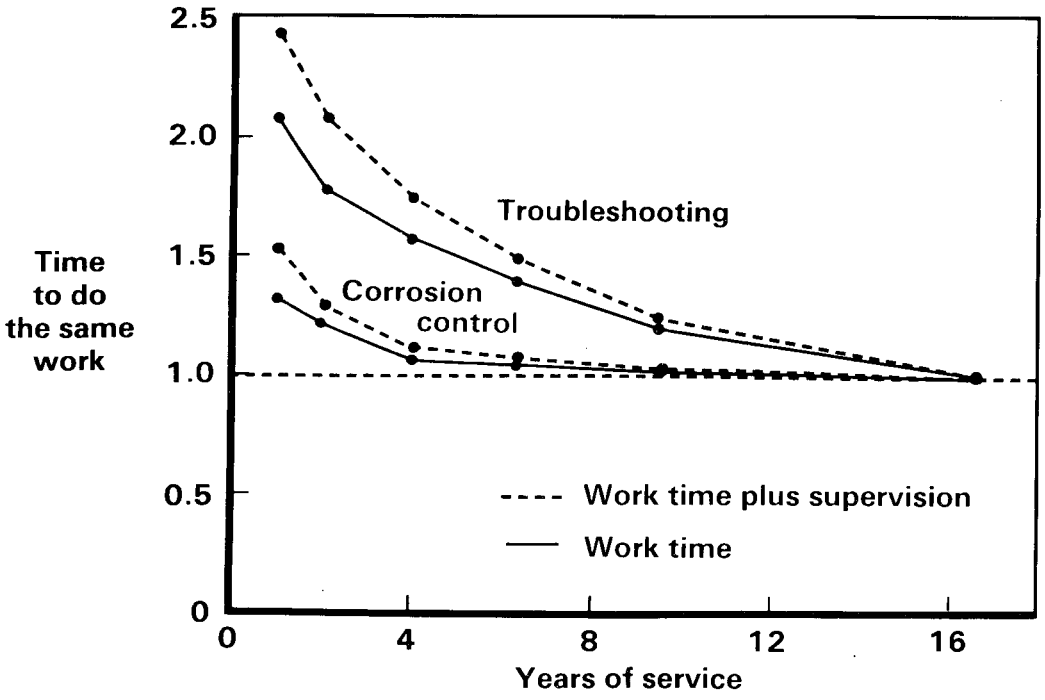

Chart 7

This chart depicts two sets of "learning curves," drawn from the actual data we collected, indicating how much less time it takes people to do fixed amounts of work as they gain experience. The upper solid curve reflects, on a normalized scale, the actual work time required to do a fixed amount of troubleshooting of a certain subset of AGE[1] subsystems (hydraulics and air conditioning, some of the more sophisticated maintenance work), and the space between that curve and the upper dashed curve reflects the additional time required for a supervisor to monitor, assist, and train while the work occurs and to check the work upon completion. Performance and supervision time included, the most junior personnel take an average of about 2.4 times more manhours to perform a fixed amount of sophisticated troubleshooting than people in the most senior manpower category.[2] As the bottom two curves indicate, the value of experience is considerably smaller in corrosion control, an activity requiring less technical training and experience.

These curves represent some 13 pairs of curves obtained from survey data collected at March and Norton AFBs.[3] Together these 13 categories represent about 75 percent of the work time spent by AGE technicians in this work center; the remaining 25 percent of the work falls into 13 other categories, and it would require data from only a few more bases to include them as well. Even such a partial data set can be quite powerful.

These curves illustrate that, depending on how much of a particular type of work is assigned to each category of technician, the number of manhours required can vary. If the work is to be done within the same elapsed time, the number of people required to do it can vary.

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[1] Aerospace ground equipment, also called powered ground support equipment, consists of such units as electrical generators, flood lights, heaters, air conditioners, hydraulic test stands, air compressors, and bomb lifters that are mobile, usually powered by their own gasoline, diesel, or turbine engines or electrical motors, and usually moved to the flightline by tow vehicles. AGE units are used by technicians who maintain aircraft, and they are maintained by AGE maintenance specialists in one or more "shops" established for this purpose.

[2] The six dots along each curve correspond to six combinations of skill level and pay grade held by people who perform this work at March and Norton AFBs. From left to right, these combinations are

Skill level:	3	5	5	5	7	7
Pay grade:	E-1 to E-3	E-3	E-4	E-5	E-5	E-6,E-7

Each point is located horizontally on the graph according to the average of its incumbents' years of service (as of September 1979).

[3] These data were provided by 24 AGE maintenance supervisors who evaluated some 90 individual technicians.

CHART 8

ACTIVITY ANALYSIS

- **Generates work center manning alternatives by identifying alternative work allocations**

- **Incorporates important practical constraints, e.g.,**
  - **Mobility requirements**
  - **Span of control**
  - **On-the-job training**
  - **Job satisfaction**

Chart 8

The data corresponding to curves of this nature are inputs to the activity analysis mentioned earlier. Activity analysis is a convenient tool for simultaneously manipulating the allocations of all the types of work among all the categories of people.

The method also provides ready means for incorporating numerous practical constraints that should realistically restrict both the range of manning configurations considered and the range of work allocation alternatives. Here, mobility requirements and span of control represent "organization structure" constraints that necessitate at least some supervisory personnel. On-the-job training and job satisfaction represent "work allocation" constraints that can be invoked to ensure that the various manpower categories are assigned work commensurate with their needs and expectations. Numerous other types of constraints can also be incorporated--e.g., lower limits on the number of supervisory personnel, perhaps because of multiple-shift operating schedules.

CHART 9

A LESS-EXPERIENCED WORK FORCE MUST BE LARGER (AGE MAINTENANCE WORK CENTER, NORTON AFB)

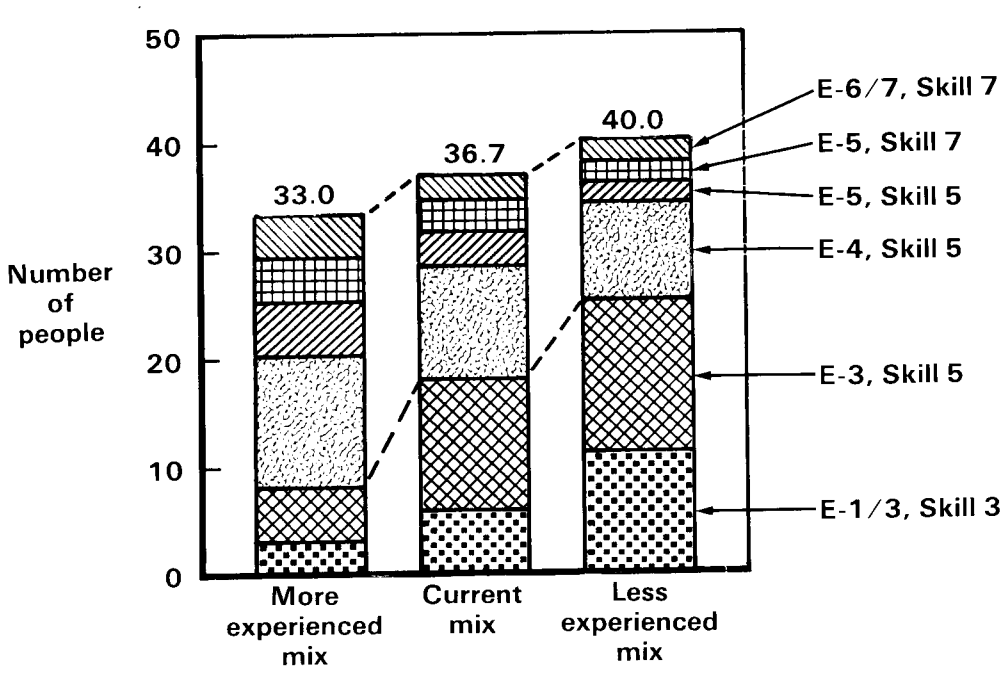


Chart 9

The data and analysis method just discussed can generate many work center manning configurations capable of accomplishing the same required work in the same elapsed time. Here are examples of three such configurations. The center bar represents the mix of people performing the 13 types of work at Norton AFB in January 1980. The bars on either side indicate that the total manpower requirement can vary considerably depending on the constituent experience mix--the less experienced the work force, the larger it must be.

The Air Force could also use this approach to determine, for example, how much more work could be done if additional people (any combination of types) were added to the work center. Alternatively, in case the work load were to change (increase, decrease, or change in its constituent mix of jobs), this method can identify how many more or fewer people would be required (depending on the types of people added or taken away).

But even if the work load is unchanged, this approach provides the capability to identify tradeoffs between manpower categories (the substitutability of one kind of manpower for another). For an illustration, consider the E-1/3, Skill 3 category versus the E-4, Skill 5 category. This selection is motivated by consideration of possible first-term reenlistment problems. Lower first-term reenlistment in the AGE maintenance occupation would result almost exclusively in the loss of E-4, Skill 5 personnel--who would be replaced primarily by new Skill 3 personnel, probably fresh from initial technical training.

CHART 10

ILLUSTRATIVE "EQUAL-CAPABILITY CURVES" AT THE WORK CENTER LEVEL (AFSC 423X5)

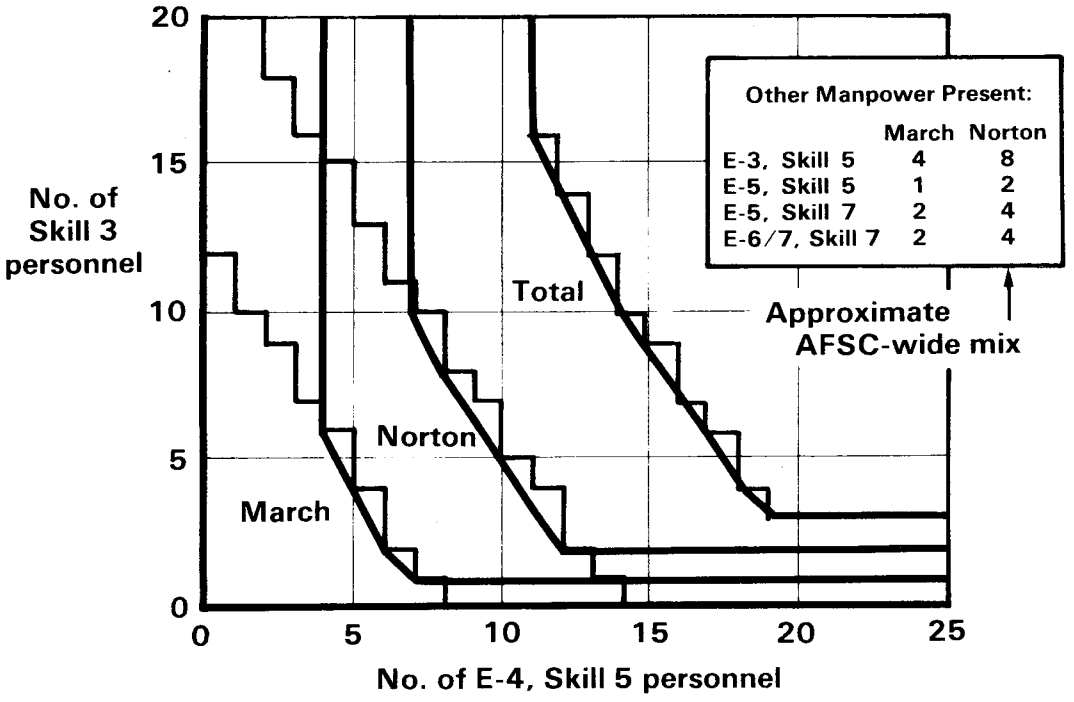


Chart 10

This diagram shows the "substitutability" (the tradeoffs) between these two manpower categories in the presence of the quantities of the other four types of manpower shown in the inset at the upper right. First examine the two stairstep curves at the diagram's left. At March AFB, for example, these data show that 12 Skill 3 personnel and zero E-4, Skill 5 personnel (together with nine people of the types indicated in the inset) could perform all the required work. At the other extreme, zero Skill 3 personnel and eight E-4, Skill 5 personnel (together with the nine others) also could perform all the required work. Clearly the tradeoffs are not one for one. Further scrutiny of these stairsteps reveals that when a manpower category is in short supply, it is worth relatively more in a tradeoff against another category (a version of the law of diminishing returns). As mentioned previously, certain organizational constraints can preclude some combinations of personnel in the work center; the vertical and horizontal segments of the "envelopes" or "equal-capability curves" containing parts of the stairstep curves are examples. These envelopes are concrete examples of the abstract curves depicted at the top center of Chart 6.

It is also possible to obtain aggregate manpower requirements by adding across different installations of work centers, as indicated in the diagram by the "Total" curve at the right. It is easy to imagine adding across the 150 or so AGE maintenance shops in the Air Force to obtain a corresponding curve (or set of curves, when the other manpower categories are considered) for the whole 423X5 occupation. In order to see the potential utility of data and analysis like those discussed so far, consider that curve (or set of curves) for the whole occupation. Because of the limited amount of data collected, the occupation-wide calculations that follow are based on an assumption that the example work included in these sample AGE shops at March and Norton AFBs represents all AGE work across the Air Force. The work load mix at these two bases differs noticeably, but the tradeoff patterns among the various manpower categories are quite similar. Hence, the assumption that these patterns will hold at other bases seems reasonable. Even so, the types of occupation-wide implications discussed below would still be present if the alternative work force structures were based on actual summations across the numerous bases where this work center is found.

CHART 11

SAMPLE OCCUPATION-WIDE APPLICATIONS

- Coping with low reenlistment
- Accommodating work load increase
- Justifying career force growth

Chart 11

The next several charts examine three examples of situations confronting the Air Force's MPT system that would benefit from use of the overall approach, data, and analytic tools discussed so far. The first is an example of a supply problem (a shortfall in a particular manpower category), the second is an example of a demand problem (an increase in work load because of flying rate increases, aircraft deliveries, or whatever), and the third is a policy question under recent discussion between the Air Force and the Office of the Secretary of Defense (OSD).

CHART 12

COPING WITH LOW 423X5 REENLISTMENT

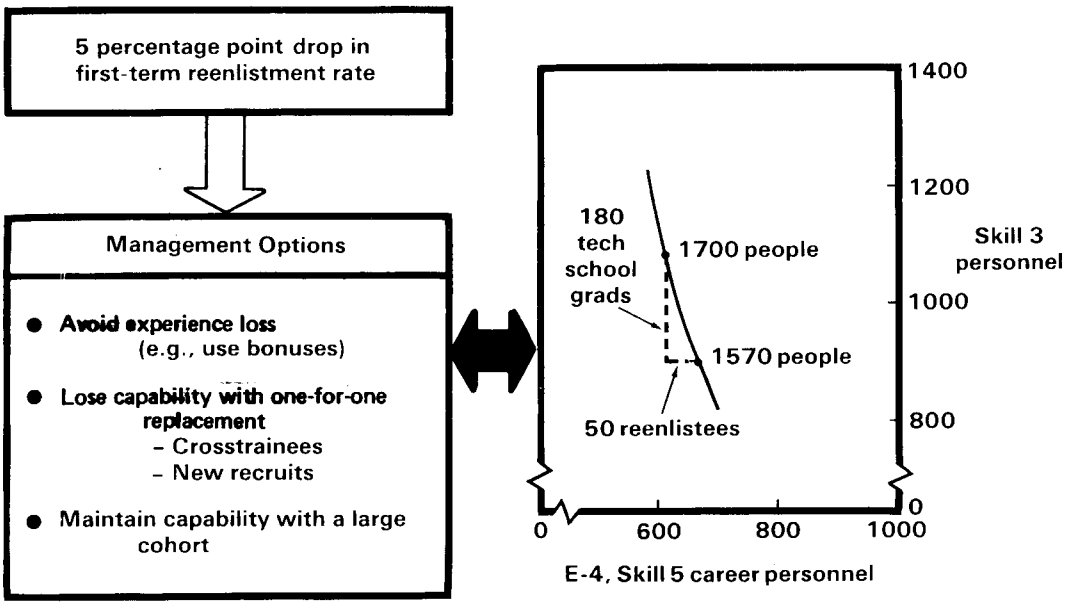


Chart 12

In 1979 the first-term reenlistment rate in AFSC 423X5 was approximately 35 percent. Here I assume the Air Force faces a sudden drop in this rate to approximately 30 percent.

The MPT system's typical first response to such a development is to try to hold the status quo, to avoid the loss of experienced personnel by offering reenlistment bonuses, enticing some to reenlist who would otherwise separate. To the extent that such an action is not taken or taken too late, or the bonus offered does not stem the tide of losses, the current system tries to replace the lost personnel with crosstrainees, prior service accessions, or new recruits. In fact, the main type of replacements would be new recruits, fresh from technical training school. The current system takes no account of the lower overall level of experience in the resulting work force and, as these data imply, the lower overall capability of that work force. The occupation-wide authorization structure remains unchanged, but many authorizations are filled with less experienced, less qualified people than before. Another option, requiring methods akin to those described above, is the preservation of work force capability by replacing the lost experienced personnel with greater numbers of new trainees.

These possibilities are depicted in the graph at the diagram's right. This is an "equal capability curve" for the whole occupation, indicating the quantity of Skill 3 personnel versus just the careerist portion of the E-4, Skill 5 personnel. The September 1979 Uniform Airman Record (UAR) for this specialty shows assignments of 900 of the former and 670 of the latter, a total of 1570 people. The plot shows that work force capability would decline if the approximately 50 E-4, Skill 5 people (who would be lost if the first-term reenlistment rate dropped five percentage points) were to be replaced one for one by only 50 Skill 3 people. Activity analysis can be used to quantify this capability loss. Approximately 180 Skill 3 people would be required to replace the 50 lost E-4, Skill 5 personnel in order to maintain the current capability.

The latter option would introduce a large first-year cohort in this occupation (about 15 percent larger than normal), causing a "blip" in associated recruiting and training and creating potential management problems in subsequent years. But whatever combination of management options the Air Force might choose to pursue, this type of analysis could help in quantitatively evaluating the alternatives and in justifying the selected management actions (and associated costs). The crucial difference from the current decisionmaking process is that work force capability can be considered explicitly.

CHART 13

ACCOMMODATING AGE MAINTENANCE WORK LOAD INCREASE

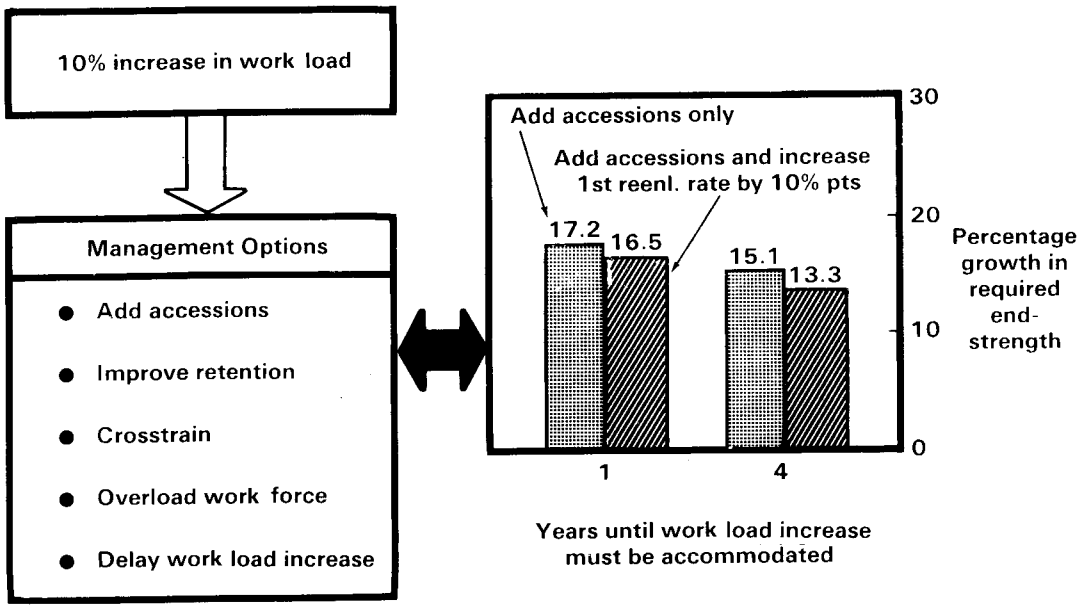


Chart 13

The next example involves an increase in the demand placed on a work force--more specifically, an increase of 10 percent in the amount of every type of work done in the work center. (It is just as easy to analyze work load changes including different increments for the various types of work.) Work loads may increase because of increased flying rates, deliveries of new equipment, or numerous other reasons.

Under the Air Force's current MPT system, Headquarters USAF and the affected operating commands would increase the "requirement" (and correspondingly, the authorizations) for the occupation through the application of program estimating equations, manpower standards, and subjective evaluations. The increase essentially would be uniform across the work force--for every combination of skill level and pay grade in the occupation--and it would probably be an increase of approximately 10 percent. Clearly, the resulting authorization structure represents a work force that is impossible to achieve in a short amount of time. In the short run, only a few of the many categories of manpower in the occupation actually can be augmented (e.g., through increased recruiting and training and higher retention). If the occupation's size is increased by approximately 10 percent and the new positions are filled by only (or even mainly) inexperienced personnel, then the amount of work the overall occupation can perform will increase by less than the desired 10 percent.

The techniques discussed here can be used to ascertain how many more people would be needed to accomplish the additional work, realistically considering the types of manpower that actually can be obtained. In the bar-chart portion of this diagram, the left bar indicates that the occupation's end-strength would have to be increased by over 17 percent if the additional capability is required in one year's time and is to be obtained only by adding new recruits. Obviously, the end-strength increase is considerably greater than 10 percent because the people being added are inexperienced; they take longer to do the work and they require substantial amounts of supervision. (Moreover, the supervision time is taken from time that more experienced, more proficient mechanics would otherwise spend performing actual maintenance.)

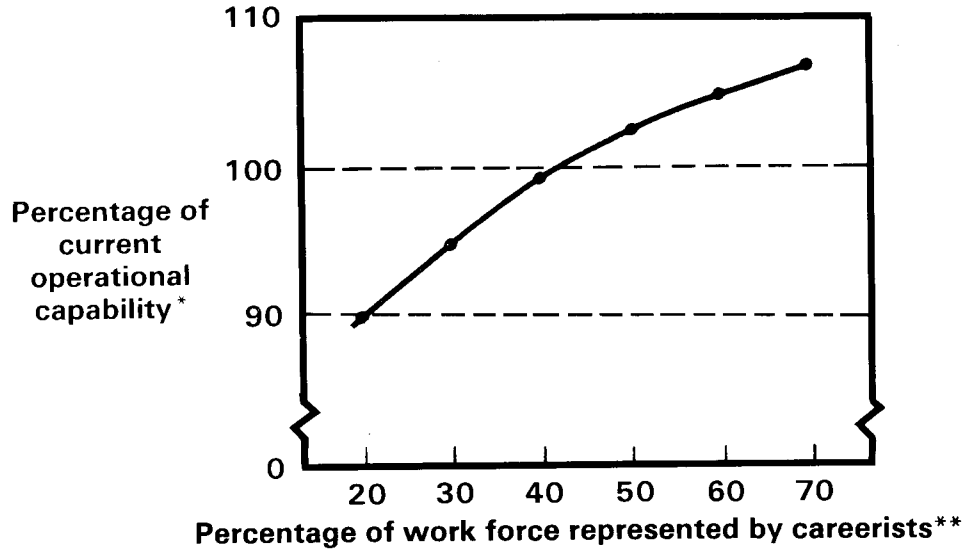
The next bar indicates that a smaller increase in the occupation's size is needed if the people added are a mixture of new trainees and experienced personnel, the latter obtained in this illustration by increasing the occupation's reenlistment rate to 45 percent from its previous 35 percent. In both of these cases the occupation's recruiting and training requirement would more than triple. The two bars to the right show the corresponding end-strength increases that would be required if the capability increase is to be achieved within four years. These increases are much closer to 10 percent because many of the people added through increased recruiting and training would have substantial work experience by then, and because four reenlistment cohorts would

have experienced the higher reenlistment rate. In the last case, the occupation's recruiting and training load would have to increase by less than 90 percent.

Numerous other combinations of programs, policies, and schedules also could be examined. Throughout such evaluations, again, the key is to be able to relate the work force's structure to what it can do.

CHART 14

JUSTIFYING 423X5 CAREER FORCE GROWTH



*Operational capability = "handleable work load"
**Work force size held constant, Sept. '79 skill-grade mixes in each component

Chart 14

Finally, let us turn to an example of a broad policy issue, in this case the fraction of the work force that should be careerists (personnel beyond their first enlistment term). In September 1979 careerists represented about 41.5 percent of the AGE Mechanic AFSC; it is that percentage (and the constituent skill-grade mix) that dictates the point of 100 percent of current operational capability plotted in this graph. The curve is obtained by holding the work force size constant, by maintaining the same skill-grade mixes within the first-term and career components that existed in September 1979, and by varying the fraction of the work force represented by each major component. As expected, the occupation's capability increases when its constituent manpower mix embodies more experience. Such specific quantitative information should be valuable in the deliberations between the Air Force and OSD regarding the first-term/career mix. (This is only one example of the type of occupational structure change for which capability implications can be examined. A complete evaluation would also emphasize the quantities and costs related to the associated changes in recruiting, training, reenlistment, retirement, etc.)

Of course the case for an increased career component would be strengthened by the development of such curves for many occupations. Further, we should expect the curves for various occupations to look quite different. Such curves would provide important information for the overall question of first-term/career mix, and the availability of different curves for different occupations would facilitate systematic analyses of how to distribute any additional resources among the occupations to help enlarge the career component of the enlisted work force.

CHART 15

IDENTIFICATION AND EVALUATION OF ALTERNATIVE OCCUPATION-WIDE MANNING CONFIGURATIONS SHOULD ENABLE...

- Near term: Better adjustment and justification of management controls
  - Recruiting and training
  - Crosstraining
  - Bonus allocation
  - Career force admittance
  - Authorization allocation

- Longer term: Evaluation and possible revision of institutionalized constraints
  - Grade constraints
  - Equal selection opportunity
  - Compensation
  - End-strength constraints
  - Manpower utilization
  - First-term/career mixes

Chart 15

These examples illustrate the potential usefulness of this strategy for MPT planning. The ability to focus near-term evaluations of policy and program alternatives on the capability of the resulting work force, considering the current work force and likely personnel supplies (as related to demographics, the civilian economy, etc.), should facilitate the adjustment and justification of management control policies like those listed here. These management controls are the "levers and dials" the MPT system handles annually, quarterly, and in some cases even monthly to shape the enlisted work force, occupation by occupation.

In the longer term, the Air Force should be able to use tools and analyses like these to evaluate the effects of broader management constraints that limit the shape that occupational and overall work force structures are allowed to assume. Some of these constraints may be costing a great deal in terms of both operational capability and dollars. These costs can be determined with this approach.

The examples presented in this briefing do not demonstrate the total analytic capability that would be required to manage a "capability-focused, supply-conscious" MPT system. Some additional tools are needed.

CHART 16

STEPS IN TECHNIQUE/SYSTEM DEVELOPMENT

- Develop methods for identifying manning alternatives
  - Work center manning
  - Occupation-wide manning
- Extend planning system to evaluate and select among occupation-wide alternatives
  - Reenlistment behavior
  - Demographics
  - Costs
  - Dynamics
- Assess implementation issues
  - Resource requirements
  - Organizational interactions

Chart 16

The task of developing such an MPT management system has three major components. The research discussed here has been directed toward the first: developing practical methods for identifying the relationship between work force structure and operational capability, thus permitting the identification of work center and occupation-wide manning alternatives. That was the area of greatest doubt in the beginning, but our results justify considerable optimism.

A second major development task would be to extend the Air Force's current planning system, essentially the TOPCAP (Total Objective Plan for Career Airman Personnel) system of models, to incorporate the aspects listed here in order to evaluate alternatives and select a sequence of work force structures--and of course the associated personnel policies and programs--that can actually be achieved and would best meet operational capability requirements. This would be a major effort, but most of the analytic underpinnings of such a system already exist (e.g., dynamic projection of work force structures and prediction of retention behavior as it relates to compensation packages and promotion opportunity), and many have been demonstrated by others. Thus, such a developmental effort could be undertaken with confidence.

Finally, and coincident with these two technically focused efforts, a great deal of attention must be paid to the practical aspects of using such a revised system of tools in a fundamentally altered approach to MPT management. The data collection and activity analysis tasks should be fairly easy for the Air Force's Management Engineering Program to assimilate. Because we have been working largely within the realm of Management Engineering to date, and because there was previously such uncertainty about the technical and practical feasibility of identifying acceptable manning alternatives, very little attention has focused on the altered interactions among the various organizational components that would be associated with such a revised MPT system. These interactions are crucial to the successful operation of such a system, and we are confident that satisfactory working modes and relationships can be developed. In our view the added work force capability and management control that could be achieved using this general conceptual approach certainly warrant the effort.

CHART 17

NEXT STEPS: DOCUMENT WORK TO DATE

- Development of manning alternatives
- Concepts for TOPCAP extension
- Implementation considerations and alternatives

Chart 17

The remaining step in the research on integrating demand and supply considerations in enlisted force planning is documentation. Much of this will be devoted to more detailed descriptions of activity analysis and other methods for relating work force capability to structure. In addition, the documentation will consider how the TOPCAP system of manpower and personnel planning and programming models might be revamped to take advantage of relationships between work force capability and structure; further, it will suggest ways the Air Force could adopt such a revised strategy for MPT system management.

The objective of the strategy remains, of course, to continually configure work force structure targets and personnel and training policies and programs so that manpower demand and supply match closely and efficiently and fulfill the underlying requirement for work force capability.