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The Reserve Forces in the 1990's

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Reserve Forces Policy Board
Office of the Secretary of Defense
Pentagon, Washington, D.C. 20301

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Volume 1
Executive Report

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DECEMBER 1980 83 08 26 027 .



OFFICE OF THE SECRETARY OF DEFENSE
RESERVE FORCES POLICY BOARD
WASHINGTON, D.C. 20301

LETTER OF TRANSMITTAL

"The Reserve Forces in the 1990's"

The 1990's Study Group was constituted by the 1990's Committee of the Reserve Forces Policy Board, Office of the Secretary of Defense to attempt to develop insights into the probable makeup of the Guard/Reserve in the decade of the 1990's. The Study Group was to suggest techniques to achieve Guard/Reserve mission objectives in the decade of the '90s; to identify the material resources and funding which would be needed by the Guard/Reserve to enable them to achieve and maintain required readiness levels and to perform their assigned roles and complete designated missions during the period of interest; and to weigh the ability of the Guard/Reserve to obtain, retain and train the numbers and types of personnel dictated by their assigned roles and mission in the '90s.

A preliminary investigation early in FY 80 revealed the likelihood of particularly strong correlations between the Reserve Forces of the future and currently predictable technology and demographic developments. A growing awareness of the rapidity, degree and interdependence of changes in the environment coupled with a concern about probable effects on the makeup of the Guard and Reserve resulted in the Board's decision to undertake this study. Thus, the two factors initially selected as major elements for investigation were technology and demography.

The study design was initiated with an examination of general technological and demographic trends likely to impact on the military. As the study progressed during the summer of 1980, it became evident that the best approach to an understanding of the Reserve Forces of tomorrow was to examine the equipment/platforms currently in the Active Forces or to be introduced over the next five years. A combination of literature research and discussions with personnel in the Pentagon and the field produced insights concerning the forces and directions of change within the Active Forces and the subsequent probable effects on their Reserve counterparts.

The Study of the Reserve Forces in the 1990's discusses several key variables that are viewed as likely to result in increasing stress on the Active Forces. One category is equipment-related such as technological introductions, acquisition cycles, system complexity, life cycle costs, maintenance, reliability and affordable force levels. Another is personnel-associated and is concerned with the number and attributes of the manpower pool, changing attitudes, and the likely dynamics of the job market.

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The study then proceeds to examine likely effects on the Reserve Components such as: limits to new equipment procurement, equipment obsolescence and non-replacement, inability to attract prior-service personnel and an aging membership. Accompanying these trends are already observable increases in equipment and skill differentials between the Active and Reserve Forces. The eventual result could be a level of incompatibility that would seriously undermine the relevance of the Reserve as a Total Force member.

The study points to a growing dilemma. On the one hand, technological and demographic influences will place increasing monetary and personnel related stresses on the Active Forces and, in turn, raise the significance of the Guard and Reserve as cost effective alternatives. On the other hand, it appears likely that strong pressures will be exerted to maintain Active Force levels with potentially sacrificial consequences for the Reserve. The study suggests that a rational Total Force approach is required that considers the long-term ramifications of any resource allocation decision on Active/Reserve team effectiveness. This would mean the continued development of well defined roles and a sensible assignment of equipment buys and support funding combined with cooperative efforts to identify, recruit, train and manage the best possible mix of personnel assets.

Given the present level of interdependence and the cost effectiveness of the Reserve Components, the Board believes that any resolution to the current and developing situation will best be accomplished through joint and coordinated efforts. The Board also believes that the Study of the Reserve Forces in the 1990's is a significant step in the development of insights and will aid in seeking sound long-term solutions to the emerging environmentally induced challenges.

The Study of the Reserve Forces in the 1990's is published in two volumes both of which are available through this office. Volume 1, entitled Executive Report, contains an abbreviated summarization of the study. Volume 2, the technical report, entitled Technology, Demography, Field Study Report, and Datum Force contains the in-depth data of the study.

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Louis J. Conti
 Louis J. Conti
 Chairman



The Reserve Forces in the 1990's

Volume 1

Executive Report

This report represents the view of the members of the Reserve Forces Policy Board and does not necessarily reflect the official opinion of the Department of Defense or any other department or agency of the United States government.

December 1980

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EXECUTIVE SUMMARY

Introduction

The Secretary of Defense, Melvin R. Laird, set forth the Total Force Concept on August 21, 1970, and since that announcement the Reserve Components (which include both the Guard and Reserve) of the Military Departments have in varying but inexorably increasing degrees been integrated into the plans and operations of the Active Components. Although qualitative and quantitative differences exist between the Services and between different functional areas within each Service, the homogenization of the Active and Reserve Components dictated by the Total Force Policy has been achieved. Unless some future drastic policy change alters this intimate relationship, the character of the equipment and personnel of the Reserve Components will continue to be a strong reflection, indeed in many cases a mirror image, of the materiel and personnel of their respective Active Component counterparts. Such a dramatic policy realignment is so improbable that any study of the characteristics of the Reserve Components in future years must of necessity be an examination of the essential nature of the Total Force in the period of interest.

Mindful of this doctrinal imperative of the Total Force Policy, the 1990's Committee of the Reserve Forces Policy Board, Office of the Secretary of Defense, constituted the 1990's Study Group to develop insights into the probable composition of the Guard/Reserve (G/R) in the decade of the 1990's. The Study Group was directed to suggest techniques to achieve G/R mission objectives in the decade of the '90s; to identify the material resources which would be needed by the G/R to enable them to achieve and maintain required readiness levels and to perform their assigned roles and complete designated missions during the period of interest; and to weigh the ability of the G/R to obtain, train and retain the numbers and types of personnel dictated by their assigned roles and missions in the '90s.

Limitations of time and available personnel prevented the collection and analysis of data on all the factors that could conceivably impact on the structure of the G/R during the '90s. As a consequence, the Study Group concentrated on two factors which would have the most significant impact on the structure of the G/R in the '90s: technology* and the demography of the United States in the period of interest. This report outlines some of the preliminary and most obvious implications of these two factors. Subsequent and related further study by the Board will be carried out at a later date.

The decision to focus upon these two determinants assumed that, for the Department of Defense at least, technology dictates personnel requirements, tactics, strategy, equipment acquisition, maintenance

* For this purpose, a working definition of technology is: products which are the manifestation of science (the basic understanding) and which appear in the form of hardware, software, or sub-units of larger operational systems.

techniques and the like. The Study Group believed that, if the technology available to the Department of Defense through the '80s and '90s could be forecast, then the type and characteristics of the equipment most likely to be utilized by the Total Force in the '90s might be identified. This knowledge would generate insights into the required personnel makeup of the Total Force in this decade, from which the personnel structure required by the G/R might be deduced. The personnel pool which would be the source of the individuals who were to constitute that G/R force of the '90s would be described in number, quality and geographic distribution by the forecasted United States demography between 1990 and the year 2000. For study purposes, it was assumed, among other things, that the current United States general purpose force structure and the currently perceived global threat environment would remain substantially constant. However, an increase in force structure may be required because of the growing threat of low level conflicts and terrorism throughout the world.

Making maximum use of secondary sources (current studies, references, articles, data and expert opinion) the Study Group first identified the deployed technology (military equipment) in use by the various Military Services in 1980 (the "existing force"). The existing force was forecast through the decade of the '90s adding expected new weapons systems, subtracting weapons systems expected to be phased out of the inventory and subjecting the remainder to expected major modifications. This "'90s forecast force" was varied by applying new, especially radical "breakthrough" technologies to produce the "'90s probable force."

United States Technology in the Decade of the '90s

Research led the Study Group to the conclusion that in the decade of the '90s the military forces of the United States will most likely be armed with a mixture of equipment, consisting of those major weapons systems which are now deployed and in use, those major weapons systems which are currently under development and those which will be placed under development within approximately the next five years. It is probable that all of these systems will be subjected to major modifications up to and through the '90s by extensive, incremental improvements of the electronic systems and subsystems especially and to a lesser degree of the weapons systems platforms as well. However, these modifications will provide enhanced system capability through the incorporation of normal evolutionary, rather than revolutionary, developments in the technological state of the art.* Future quantum improvements in weapons systems resulting from "breakthrough" advances in technology, advances which the Study Group does not now foresee, could alter this conclusion but only if such advances were to be implemented by decisions of the Congress and the Executive Branch including the provision of adequate funds. The key determinants of this conclusion

* Especially in the fields of firepower; command, control and communications; fuel efficiency; data processing, analysis and display; sensing, locating, identifying and targeting of adversaries under adverse ambient conditions; and platform/subsystem maintenance and repair.

are believed to be the procedural inertia, costs, required time, and other constraints to the rapid deployment of available technology in the form of weapons systems which are inherent in the existing acquisition process. From the vantage point of this conclusion, the middle portion of the '90s is separated from the present by the length of the acquisition cycle of a major weapons system.

Many of the current major systems of the Army, Navy, Air Force and Marine Corps, and probably all of the future systems, utilize modularized and highly integrated electronic components and computers to achieve enhanced performance capabilities. These Line Replaceable Units (LRUs) are logistically supported by a three-tier maintenance system (Operational Level, Intermediate Level and Depot Level). At the Operational Level ("line") the integrity of modularized components is checked using test equipment internal to the weapons system and a remove and replace (R2) strategy. At the Intermediate Level ("shop") the modules are diagnosed utilizing Automatic Test Equipment (ATE) with the intent to repair and return them to inventory, if possible. Major rework and overhaul of equipment is performed at Depot Level.

Although these high technology modules are comparatively easy to work with at the Operational Level, the Intermediate Level difficulties are the counterpoint to the ease with which the R² line maintenance is accomplished. There is some concern that the R² organizational maintenance may not be as simple as contemplated due to inadequate performance of built-in test equipment in the weapons systems. This may require some movement of skilled personnel back to the organizational level to supervise system troubleshooting due to excessive module removals for false indications of failure.

The Automatic Test Equipment (ATE) at the Intermediate Level makes extensive use of computers and their associated software. Consequently, the maintenance and operation of the ATE requires the employment of highly intelligent personnel possessing high skill levels in technical career fields and a degree of competence which can be acquired only through expensive training and extensive experience.

The expertise and experience of these military technologists is also in great demand by private sector employers that provide service to military as well as to burgeoning numbers of civilian customers. These contractors are offering material benefits and a quality of life which surpasses that which the Military Services can presently offer. As a result, a disquietingly large number of these technologists are leaving the military. The proximate result has been that the readiness of weapons systems is affected and a heated debate has developed around the pros and cons of using high technology weapons systems (the "complexity" issue or the "quality vs quantity" conundrum).

Whatever the outcome of this rhetorical battle, it is deemed extremely unlikely to result in the disappearance of modularized components,

three-tier maintenance, ATE or the critical need for technologists to ensure the smooth functioning of the maintenance management and logistic systems. The trend toward a requirement for increasing numbers of military technologists within a generally constant size Total Force can be expected to continue and to intensify in all of the Services. Further study may indicate that more technologists are required than presently programmed. The military requirement competes with the expanding needs of the private sector which can offer material enticements to the technologists beyond that which the military can presently match. The result in recent times has been an exodus of these technologists from the military to the private sector although some of these personnel have been immediately returned to the service of the military as civilian contract personnel supporting military weapons systems. Those who continue to work in their field of expertise as civilians outside the military environment experience a degradation of their weapon system-unique skills to non-utilitarian levels within months or years, depending on the particular skill. The talents of these latter individuals are thus totally lost to the Military Services. Within a relatively short period of time these individuals do not even theoretically contribute to a surge capability because of the erosion of their skills due to lack of practice and currency of knowledge.

The military has compensated for the inability to retain these technologists in service by an increasing reliance on contract civilian personnel (technical representatives) to perform the function of the departing technologists. In addition, traditionally there has been a need for civilian technical representatives to ease the introduction of new weapons systems into the military inventory but in recent times these civilian technical representatives have become an integral part of the maintenance/logistics system and the possibility of their refusing to accompany the weapons systems during a crisis deployment is a grave concern of military planners. Additionally, the legal status of these contractor personnel, ostensibly civilians, but who play a key military role in maintaining the combat readiness of weapons systems is, under international law, ambiguous at best. The use of Civil Service personnel instead of contractor personnel addresses only the issue of cost and does not deal with the panoply of problems entailed in the use of civilian technologists in a military combat setting.

United States Demography in the Decade of the '90s

There is insufficient evidence to forecast any significant decrease in the foreseeable future in the approximately 400,000 new personnel needed annually to maintain the force. These accessions in the past have come from a quite narrow age group (17-21 years) of males--the male military age cohort. From a peak number of almost 11 million in 1980, this cohort is forecast to dwindle to approximately 9 million by the early 1990's, a reduction of 20-25% depending on the assumptions used. Following this numerical trough, the cohort is forecast to increase as a second generation consequence of the post World War II "baby boom."

This reduction of the size of the male military age cohort is believed to be the result of a decline in the United States birth rate which began in 1960. The consequence of a complex interaction of social, economic and philosophic factors, the decline in fertility has also affected United States allies and is expected to remain low for the foreseeable future.

Although the current United States population is relatively youthful in structure, the current birth rate (1.8) is below the population replacement rate (2.1 births per woman 15-44 years old). However, it will require some decades for the population to reach and stabilize at a maximum number. By the year 2000, the total United States population is forecast to reach 246-283 million.

The minimum number of individuals in the male military age cohort forecast for the early 1990's still exceeds the total number of males in the military age cohort group of the '50s and '60s when the military was still able to man the required force. The forecast reduction in the cohort size is of military significance, however, in light of the current difficulties in obtaining a sufficient number of mentally and physically qualified recruits for the All-Volunteer Force. In a social environment as disciplined as that of the '50s and '60s, even the minimum size cohort expected in the '90s should contain enough males to meet military requirements. Whether sufficient accessions are provided due to money or conscription remains to be seen.

The physical fitness and general health of the members of the cohort are not expected to change appreciably through the mid-90s. However, the members of the cohort are expected to be somewhat more "narcissistic" with less tolerance for discomfort and a diminished capacity to accept demands for sustained physical performance. These attitudinal consequences of membership in an affluent society are also expected to result in demands for more individual benefits and in increasingly independent attitudes in general.

Fewer members of the cohort are forecast to complete high school, the nadir coming in the mid-90s at a level comparable to that of the early 1970's.

In 1980, the estimated percentage of blacks and other ethnic minorities in the shrinking cohort will be 15%, rising to 19% in 1995, although the total number will remain approximately the same.

The number of women in the labor force in 1977 was 40 million or 41% of the force (49% of all women 16 or older). The 1990 projection is for 48.5 million. In 1970, the expected work life of women in the labor force was 22.9 years (compared to 40.1 years for men), a figure that can be expected to continue to rise in the future. The numerical trend in the female military age cohort is generally similar to that of the male cohort.

A greater number of people are forecast to be in the total labor force in the decade of the '90s. The total labor force will also

contain a greater number of fully integrated women in the 21-55 year age bracket. The median age of the population is expected to be between 32-37 years old by the year 2000. These older workers are expected to possess a high level of experience and training as well as greater attitudinal stability. The desirability of these more mature workers as employees may reduce the degree of competition between the military and civilian employers for members of the male military cohort. Possible shortfalls in recruiting male members of the military age cohort could in theory be offset by accession from the female cohort.

An increase in the number of couples in which both spouses are pursuing careers is expected. The flexibility and mobility of both spouses will consequently be influenced with ramifications for military recruiting.

The forecast increase in the numbers of single parents and married families living apart will continue and perhaps increase the need for child care centers. Management of the centers by the military may be required.

Two factors, other than the declining birth rate, which contribute to the growth of population are the death rate and net immigration. The death rate in industrialized nations has been minimized for the present; however, the decline in the birth rate has increased the contribution of net immigration, legal and illegal, to population growth. Net legal immigration to the United States has for decades been 300,000 to 400,000 annually. There are no reliable figures on the dimensions of illegal immigration. Due to the political instability of other nations, the forecast liberalization of United States immigration policies and the expected continued "blurring" of United States borders, immigration (both legal and illegal) is expected to become an increasingly important factor in population growth. Immigrants from Central and South America are especially important in this regard.

Internal migration has magnified, as well as nullified, the effect of declining fertility for various areas of the United States. Net migration trends, especially at local level, cannot be precisely forecasted due to the influence of improbables such as economic fluctuation, but general migration patterns are evident. The decline of population growth in metropolitan areas and in the Northeast has been intensified by migration away from those areas. On the contrary, the effect of the decline has been diminished or nullified by migration to non-metropolitan areas and the South. The trend toward urbanization is reversing but the stability of the reversal is unknown. A strengthening of the economy could cause yet another turn-around. At present, however, internal migration is from the cold to the warm areas, from the Central and Northeast sections to the South, Southwest and West and from metropolitan to non-metropolitan areas.

The decline in the birth rate has been paced by a fragmentation of the population into a larger number of separate households. This is the result of more youngsters leaving home at an earlier age, fewer adults living with relatives and fewer parents living with adult children. The phenomenon is sensitive to economic strength and there is some evidence of a current reversal especially in the most economically depressed areas such as the Northeast.

Conclusions and Recommendations

The 1990's Committee has developed conclusions and recommendations based upon the findings of the 1990's Study Group in five areas: the continued loss of military technologists; the military "youth orientation" (review of the personnel requirements of military occupational specialties); identification of inherently "part-time" Active Force military tasks; military ramifications of an increasingly narcissistic society; and the impact of increasing numbers of single parents in the military.

1. Continued Loss of Military Technologists

With the exception of those separating military technologists who return to military work as civilian contract personnel, the talents of substantial numbers of those technologists leaving active duty are currently being lost to the military service. Unless these individuals have regular hands-on experience, their weapon system-unique skills deteriorate at varying rates even if they work in military related civilian technical fields. The Reserve Components of the Military Services can be utilized to save these talents for the military.

Recommendations:

a. Create a High-Technology Unit Guard/Reserve Program.

The most beneficial method of recapturing the talents of technologists who separate from the Active Force is the equipping of units within the Reserve Components with state of the art weapons and recruiting these technologists for service with these high-technology units, e.g., Guard/Reserve F-14, F-15 and F-16 squadrons and XM-1 tank battalions. The skills of military technologists are system-unique and degrade steadily at varying, skill dependent rates in the absence of continuous hands-on experience with the equipment. Therefore, unless the G/R become the beneficiaries of a unitary purchase of the latest equipment, the only technologists who could in the future be accommodated by the G/R would be non-unit MA's -- fillers for the active duty forces in time of emergency.

The unit mode of operation would permit the development of the same stable, experienced, highly competent cadre of technical personnel for the "new" high-technology weapons systems that have become the hallmark of G/R units equipped with the older but still sophisticated technology.

The simultaneous equipping of G/R and Active Force units with high-technology weapons systems would permit future use of the very experienced G/R operations and maintenance personnel to conduct OJT of junior officers and enlisted personnel of the Active Force. The experience and expertise of G/R maintenance and operations personnel continues to grow in units equipped with "mature" technology weapons systems such as F-4's, A-10's, KC 135's, and C-119's. There is no reason why this historical trend should not be replicated by G/R units equipped with the newer high-technology weapons systems. This G/R expertise could be used as a training base for new Active Force personnel scheduled for subsequent assignment to regular units with similar equipment. The expertise of Active Force personnel would be "stiffened" by an exchange program under which these personnel might spend 1-2 years as a member of a G/R unit.

Finally, it is suggested that current trends are such that in the absence of a unitary purchase of high technology equipment for the G/R and the Active Force, as older weapons systems are phased out with no replacements, the eventual disappearance of many hardware related G/R unit programs must be considered an alarming probability.

- b. Create a Technologist Mobilization Augmentee (MA) Type Guard/Reserve Program.

A significant method by which the talents of separating technologists could be conserved for the military would be the creation of a special MA type program for technologists or an expansion of existing programs. Under the aegis of an MA program, the expertise of such personnel could be maintained at a high level of proficiency by training (OJT, correspondence and resident) and continued hands-on exercise of their system-unique skills. Because the latter is so important to skill retention, this type of MA program probably should include government paid travel for these personnel on training weekends to the nearest (but possibly still distant) military unit equipped with the weapons system for which their skills are unique. Such a program could presumably be initiated relatively rapidly.

- c. Emphasize Guard/Reserve Technologist Recruiting Program.

In conjunction with either or both of the foregoing G/R program possibilities, the pursuit of a more aggressive G/R recruiting program aimed primarily at technologists separating from the Active Force is recommended. This effort should be a full partnership of Active Force and Reserve Component personnel. The primary objective should be to identify those technologists who have definitely decided to separate and recruit them into the Reserve Components prior to their separation. Failing that, the secondary objective should be to

track these individuals into civilian life and continue vigorous G/R recruiting efforts as long as they retain militarily significant, system-unique skill levels.

To achieve the secondary objective, some means of tracking consistent with current laws and regulations must be provided. One method would be to place these separating individuals in the Individual Ready Reserve (IRR) and pay them an adequate amount for this minimal membership. Payment would be made in several installments mailed to the individual's home address. This method provides an adequate incentive to the individual to voluntarily keep the military informed of his location.

d. Appoint Civilian Technical Representatives to Selected Reserve Positions.

As long as the military must offset the loss of military technologists by reliance on civilian personnel (contractors/technical representatives or Civil Service), the inability or refusal of key civilian personnel to accompany the weapons systems on a crisis deployment remains a possibility. This possibility can be obviated by providing legal means to require these civilian technologists to comply with deployment requirements, if necessary.

One method would be to require a contractual commitment for deployment of all civilian technologists employed by the military. However, a civilian employee could breach such a contract and refuse to deploy. The possible legal sanctions against the individual for such a contractual breach would do nothing to maintain the combat capability of a crisis-deployed weapons system.

A more utilitarian approach would be to convert these civilian technologist positions into "quasi-technician" positions by making the acceptance of a position (enlisted, warrant or commissioned) in the Selected Reserve a condition of employment. In the event of emergency these individuals could be mobilized and deployed involuntarily by a Presidential Executive Order. An alternative approach would be to convert those key technologist positions which could not be kept manned by military personnel into Reserve technician positions.

The publicized major reason for the inability to retain most separating military technologists is the lack of comparability between the material benefits in the military and the private sector. If some effective means of retention is not found to stem the exodus, consideration should be given to transferring technologists after a first term of enlistment to the Civil Service in a grade level which commands a salary comparable to that paid by private industry for an individual of equal skill and experience. The possibility that these individuals could refuse to deploy for a crisis should be handled by mandatory appointment in the Selected Reserve.

2. The Military "Youth Orientation"

Historically the prime personnel pool from which the military currently recruits its members has been males in the 17-21 year age group. This "youth orientation" may be more a residual habit fostered by the past easy availability of young draftees than a task-related imperative. This attitude must be re-evaluated in light of the expected decrease in the size of the male military age cohort. A detailed analysis of current military occupational specialties may reveal that many military positions could or should be filled by older and/or less physically qualified individuals than is now thought possible.

Recommendation:

Analyze all current military occupational specialties to determine the maximum age and the minimum physical and mental attributes required to perform each job in an attempt to enhance flexibility in matching personal capabilities to job requirements.

3. Identify Inherently "Part-time" Active Force Military Tasks

The expected decrease in the number of males in the military age cohort may require the Active Force in the event of personnel shortfalls to put available people into the most critical Active Force positions and depend on the Reserve Components to make up the deficit.

Recommendation:

In conjunction with the analysis of Active Force military occupational specialties recommended above, an attempt should be made to identify those active duty military tasks which can be performed at or near full proficiency by persons who work at the job part-time. These positions along with those which have close parallels in the civilian community could be identified as "inherently part-time" jobs in the Active Force and an attempt made to maintain a sufficient pool of G/R personnel proficient in these specialties to support the needs of the Active Force. This would allow the Active Force in time of personnel shortage to fill the most critical positions with available individuals and depend upon the G/R to fill the "inherently part-time" positions with qualified personnel in time of need.

4. Analyze the Impact on the Military of the Narcissistic Society

Demographic forecasts of the 1990's indicate that American society will become even more narcissistic than it is currently. The current junior officers and NCO's in the Reserve Components will be the leaders of the G/R in the decade of the '90s. These individuals

should be given training in the leadership and management techniques which will be effective in the forecast attitudinal environment.

Recommendation:

Conduct a study to identify the communication techniques and methods of leadership and management that will be most effective in the forecast attitudinal environment. Develop a curriculum to train the Reserve Component leadership to cope with the attitudes of an increasingly egocentric society.

5. Analyze the Impact of Recruiting "Single" Parents with Small Children

The demographic forecast is for a greater incidence of single parents in the future labor force. It is likely that this increase in the number of single parents will be evident in new accessions to the Active Force and will be reflected in the Reserve Components as well. The number of current military personnel with sole responsibility for small children has resulted in a burgeoning demand for military child care centers. This development is having an increasing impact on G/R mobilization and readiness.

Recommendation:

The impact of increasing numbers of single parents with small children in the Reserve Components should be studied, problems identified and solutions devised.

EXECUTIVE REPORT

GENERAL

Motivated by a burgeoning recognition of significant predicted changes in the future operational environment of the Guard/Reserve (G/R) - an environment composed of increasingly sophisticated and interdependent parameters and characterized by parametric changes accelerating in rapidity, as well as quantitative and qualitative scope - the 1990's Committee of the Reserve Forces Policy Board, Office of the Secretary of Defense, mandated the initiation of a study of the probable personnel and materiel composition of the G/R in the decade of the '90s. Since a myriad of environmental parameters could have some impact on the G/R in the period of interest, the initial problem was to define the objective of the intended study and a feasible methodology to achieve the formulated goals.

Mindful of the degree of homogenization of the Active and Reserve components which has been wrought in the Military Departments by the Total Force Policy, it was obvious that absent some massive, and presently unforeseen, shift in military policy, any study of the future nature of the Reserve Components must entail a scrutiny of the characteristics of the Total Force in the period of interest. Consequently, the 1990's Study Group was constituted with the mission of developing insights into the probable composition of the G/R in the decade of the 1990's and, specifically, it was charged to suggest techniques to:

- Achieve G/R mission objectives in the 1990's;
- Identify the material resources the G/R would need to achieve and maintain required readiness levels, to perform assigned roles and complete designated missions in that period; and
- Weigh the ability of the G/R to obtain, train and retain the quantity and quality of personnel mandated by roles and missions assigned to the G/R in the '90s.

A preliminary survey of the unclassified literature indicated that an unrestricted study of all of the parameters that could possibly affect the global environment during the '90s would result in an examination of numbers of research areas, professional subjects, academic disciplines, and documents beyond the realm of feasibility within the time designated because of the limited number of research personnel available. Consequently, the Study Group focused its efforts on the two factors expected to have the most significant impact on the structure of the Total Force and hence of the G/R in the '90s: United States technology and demography in the period of interest. For purposes of this study, the term "technology" was defined to refer to that specific type of cognition ("know-how") that utilizes science to achieve industrial/commercial objectives. Technology in this sense is the ability to convert a basic understanding

(science) into products such as hardware, software or units of operational systems.

Underlying the selection of technology as one parameter for study was the assumption that the technology available to the military at any particular time would determine military tactics, strategies, hardware demands and personnel requirements for that period. If that assumption is valid, by forecasting the technology available to the DoD during the '90s, the Study Group could develop an insight into the required personnel structure of the Total Force and deductively into the personnel structure required by the G/R. To suggest strategies to recruit the numbers and types of individuals required by the identified future G/R personnel structure, the forecast demography of the United States in the '90s would provide an insight into the quality, quantity and geographic distribution of the extant personnel pool (military cohort) in the decade of the '90s.

From its inception the study was intended to be a judgmentally reinforced synthesis of secondary data gleaned from the literature and from experts in the Pentagon and in the field by a team of four O-6 grade individuals drawn from the Reserve Components of the Army, Navy, Marine Corps, and the Air Force. Field studies were conducted both to test hypotheses and to identify current hardware-oriented decisions which could induce long term rigidities in military capability and thereby dominate the composition of the future force structure.

The team attempted to forecast the nature, exhibited characteristics and the characteristic associated probability of specific militarily significant technologies likely to reach maturation in the '90s. The technologies selected were computers (hardware and software); distributed information and control networks; automation; materials; all-weather sensors; energy generation and utilization; those technologies infrequently studied, such as CBW and equipment maintenance; and those associated with an alteration of human characteristics, such as IQ enhancement and genetic modification. The intent was to identify technologies capable of military exploitation and determine feasible development rates and unexceedable limits of those technologies in order to suggest alternative courses of action and to establish a standard datum for analysis and planning.

For purposes of the study, it was also assumed that the current U.S. relative strategic and conventional response capability would remain constant though the precise composition of Active and Reserve Components in the Total Force might vary. It was also assumed that the current global threat environment would remain relatively unchanged. It was further anticipated that there will be an increasing need to meet the challenge of terrorism and low-level conflict in the 1980's. The methodology employed was to first establish the composition of the deployed technology (military equipments) of the Military Departments (Active, Reserve and Guard) for 1980. This "existing force" was forecast through the

decade of the '90s by adding expected new weapons systems, subtracting weapons systems likely to be phased out and subjecting the remainder to expected major modifications. The resultant of this forecast, the "'90s Forecast Force" was then varied by applying new especially radical "breakthrough" technologies to identify the equipment composition of the "'90s Probable Force." From a knowledge of the composition of the probable Total Force of the '90s, it was expected that the equipment relationship between the Active and G/R Components could be deduced and consequently their personnel relationships as well.

THE 1990'S ENVIRONMENT--TECHNOLOGY

The weapons/equipment of the '90s will be those now deployed and currently or soon to be under development with incremental improvements in both systems and platforms. Modifications will provide enhanced capability, but changes traditionally have been evolutionary rather than revolutionary, and there is little reason to expect the pattern to change. Quantum improvements through technology breakthroughs are certainly possible, but few are foreseen at this time. Because of the constraints of the present acquisition cycle in the form of system inertia, costs, funding, and executive decision, it is possible that even breakthroughs could not be utilized for weapon purposes.

Automation Technology and Remotely Manned Systems

Remotely Manned Systems (RMS) permit human direction of an unmanned vehicle by means of a communication link that is generally electromagnetic when the vehicle is operating on the surface of the earth, in the atmosphere, or in space, and is acoustic when under water. Remotely Piloted Vehicles (RPV) evolved from radio controlled model airplane technology, the larger command-guided drones, and air-to-surface or surface-to-surface missiles with a command guidance option. Examples are cruise missiles, torpedoes and mobile mines, and unmanned vehicles for exploration.

It is generally desirable and currently feasible technologically to automate and pre-program remote vehicles or robot type machines almost in toto. This allows the remote operator, if one is required at all, to concentrate on functioning as a combat system manager rather than as a remotely located vehicle pilot. The principal advantages of the military RMS or RPV can be divided into three general categories:

a. Ability to perform hazardous or politically sensitive missions without human exposure. The absence of the man in the vehicle reduces its size, cost, and vulnerability.

b. Enhanced effectiveness of manned vehicles in a high attrition environment through the use of RPV's for target acquisition and designation, defense suppression, including harassment, dilution (decoys) and active electronic countermeasures (jamming).

c. Lower life cycle cost than manned vehicle systems for some missions, particularly in high attrition environments.

The essential technologies for RMS or robotology are well advanced. Japan is the leader in civilian industrial use of robots with their newest automotive assembly lines almost 100% automated with multi-purpose robots. The United States has converted the F-15 to an RPV for specialized testing. The United States is currently producing

about 1,850 robots per year but should have the capability of 200,000 per year by 1990. The military is not utilizing robotology to a large degree currently.

Potential military uses include:

- a. reconnaissance and surveillance
- b. target destruction
- c. electronic countermeasures
- d. air-to-air combat

The principal component technologies that contribute to the synthesis of the RPV system include: airframe, propulsion and control technology, launch and recovery techniques; communications for command and control; navigation and guidance; control system design including the man-machine interface; mission oriented sensors for reconnaissance, target acquisition, and/or weapon delivery. Progress in the RPV capability is expected to increase with the application of large scale integration (LSI) microelectronic components, microcomputer elements (microprocessor and memory), and advanced sensors. Major advances in solid state electronics over the last decade have resulted in this large scale integration of electronic components.

The dramatic reduction in size, complexity, and failure rate caused by the new technology has been paralleled by a phenomenal reduction in cost. Computer costs have been reduced by several orders of magnitude and the costs of a sensory array and its associated processing have been reduced a hundredfold. Currently the cost of a device can be measured in terms of less than one cent per functional element.

These developments will allow for systems and approaches which have previously been impossible in the RMS field. There remain a multitude of questions about trade-offs with manned systems, reliability and vulnerability to jamming and deception. Cumbersome field support also remains a drawback. The technical and physical problems will be alleviated eventually but since development programs require advocates to survive, the future of these devices depends upon the support they receive from the leadership involved.

Chemical/Biological Warfare

Technology for production and delivery of chemical and biological agents exists in all major powers today and could be easily developed by the Lesser Developed Countries (LDC) which may or may not now possess it. It is estimated that approximately one-third of all Soviet artillery munitions contain some form of chemical warfare material. General George S. Brown, former Chairman of the Joint Chiefs of Staff, stated in 1976 that the Soviet armed forces were probably the best trained and equipped forces in the world for operating in a Chemical-Biological-Radiological (CBR) environment. Although the United States has made progress in both the

detection and protective equipment and training in recent years, much remains to be done before American armed forces will be adequately prepared for CBR warfare. Current United States policy regarding chemical warfare is: no first use of CW; willingness to negotiate a CW ban; ability to retaliate in kind; and the ability to defend against CW. The United States armed forces today possess only limited capability to accomplish the last two policies.

Computers

The growth in the number of computers, their capability and their application within the military has been exponentially upward since their introduction in the '60s. Approximately 6,000 to 7,000 computers existed in the Department of Defense in 1970. In 1980 there are between 27,000 and 30,000, and it is estimated that by 1990 there could be from 140,000 to 200,000. Care must be taken in the interpretation of these numbers since they include a wide variety of computers such as large commercial Automatic Data Processors (ADP) and strategic data systems, intermediate ADP systems for use at the battalion, ship or squadron level, and small hand held devices such as position locating devices. The numbers do indicate the increasing impact of computer technology on the military. The growth in the numbers of computers has been accompanied by similar increases in the number of computer applications both managerial and tactical. The Army has nearly 120 computer related tactical systems under study or development and the Air Force is currently working on approximately 120 major management and information analysis systems that are or will be implemented in from one to fifty sites throughout the world within the next five years.

The use of computers and modularized components in weapons systems, while requiring fewer personnel at the using unit level, has invariably increased the number of technical personnel required overall, both in actual numbers and in expertise. A three layered maintenance system has developed around these complex weapons systems: the line or operational level, the intermediate level, and the depot level of maintenance and repair.

Currently neither adequate numbers of replacement "Black Boxes" nor sufficient numbers of properly trained personnel are available to support many of the highly technical weapons systems. These modular electronic components are designed to be removed from the weapons systems when inoperable, replaced by a functional component immediately, and repaired at another level, with no lost time while the item is being repaired. They greatly enhance the capability of the weapons systems but the weapons are often non-operational either because of actual failure of the components or failure erroneously indicated by automatic test equipment.

The need for expertise and the expense of developing highly trained technicians to maintain and repair similar systems is equally great

in the civilian sector and the exodus from the military to the civilian sector of these technologists from all branches is an increasing problem. This problem has been partially offset in the Services by use of civilian technicians and technical representatives. Most of these individuals received their training in the military. Today's military establishment cannot meet its commitment without these civilian personnel. Use of these individuals further compounds the problem for the Services with increased costs, reliability or availability of non-obligated personnel in time of emergency, as well as the ramifications of their legal status under international law in case of war or deployment.

DNA Techniques and Genetic Modifications

Current techniques of genetic modification are the result of specific deoxyribonucleic acid (DNA) transplants from one species/strain to another and have only been successful in lower organisms, e.g., viruses and bacteria, and mutants induced by chemical or radiological means such as those induced crop improvements practiced for the past 35 years. Transplanted DNA materials, as well as induced mutations, may cause structural, behavioral or metabolic changes or all three. Nothing in the literature suggests early application to human beings except within the field of medical treatment of diseases. Recent court decisions have upheld the patentability of "living inventions" and this will undoubtedly lead to further research along this line.

Mutant pathogenic organisms would be reasonably easy and inexpensive to develop and produce for use as biological agents but will probably receive no more attention in the near future than they have in the past. The arguments for or against military use of such agents are the same as they have been in the general chemical/biological debate.

Energy

The cost of energy clearly has had and will continue to have a marked influence on the expenditure decisions of the Department of Defense. In 1973 energy expenditures represented slightly less than 2% of the Department of Defense budget. In 1980 it represents over 5% and, if the trend continues, by 1987 it will represent 9%. This prediction includes the assumption of further reductions in energy consumption of about 25% of the 1980 usage.

Aircraft generally account for about 60% of all military use of petroleum products and about 40% of the total energy consumption. Obviously the quickest short term reduction in energy usage can be made by reducing operations in this area and the Services have done so, the Air Force having reduced aircraft fuel consumption between 1973 and 1979 by 38%. In non-operational areas the Air Force has managed an amazing 27% reduction. The important point here is that energy consumption impacts directly on operational readiness.

Energy management has two major facets: insuring supply and reducing costs. Action is under way to make the military a more desirable customer to the suppliers and to increase war reserves. Training has been markedly influenced by increasing energy costs. Two approaches to solving the problem are: (1) better training management; and (2) the use of simulators. The Army, Navy and Air Force all agree that simulators are not cost effective for small craft simulation but are cost effective for large platform training. Most acquisition strategies now require that energy availability, cost, and effect on the equipment capability be studied and the results used as inputs for design decisions.

Past history reveals a tendency to underestimate actual energy costs which has led to budgetary shortfalls but it is now recognized throughout the Department of Defense that the energy problem is not temporary and that increased funds alone may not solve the problem in the future.

The long term effects could have positive influences on the viability of the Guard/Reserve since the Army National Guard contains over 35% of the Army's combat forces but accounts for only about 4% of its energy consumption.

I.Q. Enhancement

Historically man has attempted to increase/alter his mental abilities through both chemical and physical means; and although there is research being conducted currently in these areas, there is nothing in the literature to lead one to believe that a breakthrough in this area is imminent. Widespread acceptance of research along this line with mammals/humans is not indicated at this time.

Materials Technology

Materials development effort is directed at a variety of objectives such as improvements in strength, hardness, resiliency, reduction in cost and weight, ability to withstand environmental extremes, and increasing the provision of substitutes for scarce materials. To a considerable degree materials development is driven by need but quantum progress has sometimes been realized as a result of opportunity driven research.

The development of silicon crystals and fiber optic technology has revolutionized the communication and computer industries. Other efforts such as in composite materials, special alloys, and electromolecular chemistry are directed at achieving improvements in energy generation and propulsion systems as well as in platform construction.

Military emphasis is similar to that of civilian industry in most respects but extends to special consideration of better materials in both armor and armaments. Future advances in power drives for ships, heavy vehicles, aircraft and missiles offer the potential for major size and weight reductions, lower fuel consumption, and greater flexibility in acceleration and speed reversal.

The successful development of high-current density current collection systems for SEGMAG (Segmented-Magnet Electric Propulsion) and superconducting-electric machines will make possible several technical advances in military systems in the '90s such as vehicle electrical drive transmissions, electromagnetic launchers for aircraft, drones, cruise missiles and pulse power sources, and high energy storage machines for use with laser and particle beam weapon systems.

In recent years a variety of new materials and filaments have been emerging with highly desirable properties for advanced high kinetic energy, long rod penetrators; high rate-of-fire light-weight armor penetrators; and advanced armor systems. These materials include high specific strength fibers, high penetration resistant ceramics, and stronger alloys of aluminum, titanium, and iron.

The structure-property relationships of single-phase piezoelectric (pressure induced electricity) materials are now largely understood and application as hydrostatic sensors is probably only a matter of time. Also included in the materials classification are methods for joining and treating materials such as welding lamination, laser-glazing, pulse annealing, and ion-implantation.

It is anticipated that materials research and development will have an even greater impact on military equipment developments in the '90s than in the past.

Nuclear Technology

Practical application of nuclear technology to energy generation and to propulsion systems will probably continue to expand especially in light of diminishing petroleum supplies throughout the world but political decisions and public opinion could very well change the direction and rate of development in this area.

In addition to variations of standard nuclear weapons currently possessed by the major powers, nuclear weapon proliferation to other nations will undoubtedly continue, probably at an accelerated rate and possibly even include some underdeveloped nations.

Although the United States at this time has foregone the development of the next logical weapon, the enhanced radiation weapon or the neutron bomb, other nations evidently are continuing research work along this line and it is reasonable to assume that a weapon of this type, with little residual radiation effect, certainly will be produced within the next 10-20 years, if not sooner.

All-Weather Sensors (see Classified Appendix)

Military research and development efforts are particularly strong in the area of sensors. Sensors fall into several classes: temperature, pressure, chemical, light, electrical, electromagnetic, radiation, and biological. Applications vary widely from the simple hot water thermostat of the automobile engine to the sophisticated monitoring/control system for an entire oil refinery, etc. Military research efforts in radar, sonar, infrared, electronic countermeasures as well as numerous traditional control sensors are being continued vigorously. Acoustical devices are used not only in underwater search, acquisition and targeting systems, but also on land as sentry and targeting mechanisms. Infrared is used by all the Services to find, identify, and to home on targets. Work is under way to develop better sensors for chemical/biological agents. Celestial and electronic navigation by way of both land and satellite stations continues to be a key development area.

It is believed that sensor development will impact during the '90s not only on military equipment and capability but also on strategy and tactics.

Space Shuttle (see Classified Appendix)

Future space systems portend a continued evolution toward real time military support. This includes employment in areas of surveillance targeting, cueing, navigation and C³ for strategic and tactical weapons systems. The space shuttle will play a significant role in all of these applications. When on line, the space shuttle will permit military men to proliferate C³ satellites, conduct sophisticated RDT&E, conduct construction and technical operations, and repair, maintain and refurbish vehicles in space without deorbiting or replacing.

THE 1990'S ENVIRONMENT--DEMOGRAPHY

History of the American Population

Throughout its history the population of the United States has increased but the growth rate has exhibited a long term decline. The current United States population has a relatively high proportion of persons in the prime child-bearing age bracket yet it exhibits a historically low growth rate.

The growth rate of a population is the net result of the birth rate, the death rate, and the net migration. Birth rates are difficult to predict because of their sensitivity to currently unpredictable social and economic factors. The death rate at present remains relatively constant with minor variations caused by increased longevity due to improved medical care. Net immigration should be easily predictable based upon governmentally established quotas, but in recent years changes in national policy, coupled with ease of illegal entry, has not only greatly increased the importance of this factor but has made it more difficult to predict.

The fertility rate is defined as the average number of births per woman and in the United States currently stands at about 1.8. With the population replacement rate at about 2.1, the United States and most of Western Europe currently exhibit a fertility rate below that required for zero population growth. At present rates, the actual total number of people in Europe will decline. The industrial nations can be expected to cope with a slow drop in fertility rates without major difficulties; but, if the decrease is too rapid, societal disruptions are likely to ensue.

Projection

The Military Age Cohort:

If current conditions continue, the annual population growth rate will increase to 0.9% during the '80s and then decline to about 0.6% at the end of the century. Eventually, the growth rate should converge on, but never reach, zero. By the year 2000, the total population of the United States is projected to number between 246-283 million, a growth of between 14 and 32%.

The ever increasing pool of 17-21 year old males appears to be at an end for all of the developed nations. The size of this cohort is of significance in light of the difficulties encountered in obtaining a sufficient number of qualified first-term personnel for the All Volunteer Force. The reduced number of males in the 1990's cohort will still exceed the total number in that age group throughout the '50s and '60s.

The reduced 1990's cohort should still contain enough males to meet military requirements if a draft is reinstated or if

adequate enlistment incentives are extended and if a greater number of individuals can be persuaded to remain in the Services after their initial enlistment.

a. The Minority Profile: The total number of minorities in the 1990's cohort will remain constant but, because of the reduced size of the total group, the percentage of minorities will rise from a current 15% to over 19% by 1995.

b. Fitness and Health: No appreciable change in the physical fitness and general health of the military age cohort is expected through the mid-90s. Many predict that the cohort will have a lower tolerance for discomfort and a reduced capacity to accept demands for sustained physical performance, not because of any diminution of physical abilities but because of attitudes fostered by membership in an affluent society. Sociologists predict increasingly independent attitudes and a greater demand for individual rights and prerogatives with a greater degree of relaxation-oriented self-centeredness.

Although the male cohort is projected to be 11% smaller in 1990 than in 1975, the male high school graduate population is expected to be only 4% smaller. Present experience indicates that high school graduates are more likely to be quality accessions than non-high school graduates regardless of mental group status.

The Impact of Migration and Immigration:

a. Immigration: Net legal immigration to the United States has been between 300,000 and 400,000 annually for the past several decades. The latest official census projections assume a net immigration level of 400,000 per year. No allowance has been made in these assumptions for illegal immigration ostensibly because of a lack of reliable data. Illegal immigration could become an extremely important component of future population growth due to declining fertility rates, especially if the illegal immigration rate continues to increase, because immigrants are usually young adults and their offspring. Barring some international cooperative effort to control and direct the flow of immigrants, present patterns are expected to continue and to magnify. Unilateral national legislation to stem the flow will be of doubtful utility in light of present pressures on immigrants to flee the uncertainties of their homelands to the United States.

b. Internal Population Migration: Changes in population do not occur uniformly throughout the nation or within age groups. Shifts in population from one region to another may intensify the birth rate decline in one area while it may nullify it in another sector. Long term net migration between sections within the nation is difficult to predict but the present trend appears to be from the metropolitan areas of the Northeast toward the South and the West. Net migration increased Florida's population by 22% between

1970 and 1976. The South, as a whole, increased by 5.1 million during this same period. The experience in California and the West in general has been similar. These trends may have been atypical, however, since the patterns appear to coincide with an economic depression. The 1980 census data may verify this pattern or establish different trends.

The Proliferation of Households:

Generally, the gradual increase in overall population has been accompanied by a growing number of separate households. In the past few years there has been a tendency for young people to leave the parental home at an early age and for fewer adults choosing to live with relatives. A worsening economy may alter this trend, but since 1975 it appears that fewer families of all ages have been doubling up. Between 1955 and 1965 the household annual rate of increase was 1.8% but increased to 2.2% between 1970 and 1977.

This household forming tendency appears to be sensitive to the economy, especially to the housing market. In July of 1980, a survey indicated a decline of 1.6% in total number of households. This is the sharpest decline in a single month since World War II and is thought to be the result of young married couples doubling up with the parent of one spouse as well as elderly parents moving in with grown children. This contraction was greatest in the Midwest and the Northeast where the recession has been most serious with Ohio, Michigan and New Jersey losing the most. Least affected has been the Southwest.

The Composition of the Labor Force:

The total labor force of the '90s is projected to contain more women and a larger number of individuals between 21 and 55 years of age, while the number between 17 and 21 will diminish. It is expected that in many families both spouses will pursue careers that will affect the flexibility and mobility of the family. More married couples and families are expected to be living apart and the incidence of single parents is expected to increase.

Women are expected to be fully integrated into the work force. Both minorities and women will be more representatively distributed throughout middle and higher management positions.

The total work force will include more older people and in light of the decreasing numbers forecast for the young male military cohort, the emergence of this older work force has consequences and perhaps hidden opportunities for the military. The greater availability of older, more experienced and presumably more stable personnel in the work force may result in a reduction of civilian economic opportunities for the members of the military age cohort. These young individuals may then turn to the military for employment. However,

in light of the need for increased skills within the military, older recruits with more stability may be more attractive and the recruitment from groups older than 21 years may even become a necessity.

The Aging Population:

Current trends indicate increased numbers of older persons in the work force with a simultaneous decrease in the 17-21 age group. The largest single change will be in the 35-44 year old age group which will increase by about 18 million by the year 2000. By the year 2000, the median age is expected to be between 32 and 37 years old. The 65 year old group is expected to increase by more than 20%.

The Female Component:

By mid-1977, 40 million females were in the labor force of the United States. These women comprised 41% of the nation's entire labor force and 49% of all women 16 years of age or older. By 1990 it is projected that over 48.5 million women will be in the labor force, or one of every two who are 16 or older. By 1990, 12 million additional women, primarily in the 25-54 age bracket, are projected to be added to the labor force. The number of women in the armed forces has risen dramatically in the past ten years and is expected to continue to increase.

Some Consequences of the Dwindling Cohort

No forecast by knowledgeable individuals suggests that the United States may be able to reduce the size of its military establishment in the near future. Current manning levels and attrition rates require almost 400,000 new accessions each year to maintain our present force levels. The Military Services have traditionally relied almost entirely on a quite narrow age group, 17-21 year old males, for new accessions and this source is projected to diminish by all forecasters. This military reliance on young men may be the result of the existence of a draft for over 30 years which seems to have fostered a reliance on a plentiful supply of relatively cheap first-termers in lieu of more experienced and costlier career personnel who were used only when experience was absolutely essential, e.g., in supervisory roles.

Results of the youth orientation include a very junior mix of personnel in the enlisted force and short (by private sector standards) careers after World War II for both enlisted and officers. In the full career category, 90% of the enlisted and more than 60% of the officers serve 25 years or less.

Population trends in the future will most likely increase competition for young males between the military and the civilian sectors,

especially for those individuals with a high school diploma. The competition will not only pit the military against private industry, academia, and welfare rolls, but each Service against the other. The situation will be exacerbated not only by the decreasing size of the cohort but by the forecast decrease in the educational level of the future labor pool. These two features, coupled with the increased sophistication of many of the weapons systems, lead to an expectation of increased training costs.

Forecasts based on present and past trends need not necessarily develop. Although in part they are the result of uncontrollable circumstances, they also depend upon future decisions made to ameliorate projected problems. These forecasts, however, should be considered as an indication of possible serious future problems for the military, e.g. (1) an inability to achieve accession goals voluntarily; (2) a decline in the intellectual achievement level of new accessions; (3) an unbalanced racial composition of the force unrepresentative of society in general; and (4) an inability to retain highly skilled, critically needed personnel in technical career fields.

Possible Coping Strategies

Three strategies have been suggested to cope with the forecast decrease in the numbers of the male, military age cohort:

- a. Maintain the quantity of personnel and accept lower quality.
- b. Maintain the quality of personnel and accept lower quantity.
- c. Maintain both the quantity and the quality of the personnel.

Each of these strategies will entail probable cost increases which can be identified if not quantified.

Consequences:

a. Consequences of Maintaining Quantity with Reduced Quality:

- (1) Increased training costs
- (2) Possible decrease in readiness
- (3) Increased disciplinary problems
- (4) Changes in recruiting inducements
- (5) Changes in discharge policies
- (6) Simplified weapons systems requirements
- (7) Increased numbers to perform the same tasks
- (8) Increased numbers of older recruits

b. Consequences of Maintaining Quality with Reduced Quantity:

- (1) Emphasized reliance on technology
- (2) Increased civilianization
- (3) Increased demand for productivity
- (4) Increased demand for retention
- (5) Reduced international commitments
- (6) Possible reduced combat effectiveness
- (7) Aging force

c. **Consequences of Maintaining Both Quality and Quantity:**

- (1) **Increased recruiting costs**
- (2) **Increased need to improve quality of service life**
- (3) **Decreased funds for O&M, R&D and acquisitions**
- (4) **Increased recruitment of women, older personnel,
and prior service personnel**

THE 1990'S RESERVE FORCE

Introduction

The Total Force Policy which now governs the military dictates that in the future the equipment problems of the Reserve Forces will at least be very similar, if not identical, to those of the Active Forces and that the personnel problems, though similar, will not as closely parallel those of the Active Forces.

The Reserve Forces have historically been equipped with weapons systems that were either no longer needed by the Active Forces or with systems that were in excess of the Active Force requirements.

Currently however, pursuant to the Total Force Policy, the Services are attempting to equip the Guard/Reserve (G/R) with equipment currently in use by Active Forces. Examples of this are the unitary equipment buys by the Air Force (e.g., A-10) and the near mirror image of the 4th Marine Division. The most obvious advantage of expanding this approach to national defense is the reduction in unit cost of major items realized by increasing the original purchase to include sufficient numbers to equip the Guard/Reserve. If the Guard/Reserve are to continue as a viable part of the Total Force, ready for early deployment in both combat and support roles, then the concept of unitary equipment buys including sufficient spares, mirror image organization and identical equipage must be expanded and accelerated.

The personnel problem of the Guard/Reserve is slightly different from that of the Active Force perhaps because the overall composition of the G/R probably is a closer reflection of the overall population of the country--physically, intellectually, religiously and ethnically.

Since World War II the G/R has aptly demonstrated that they can operate and maintain any of the sophisticated high technology equipments and in a very cost effective fashion. Nevertheless, concern has once again recently been expressed in some circles that the G/R may be incapable of adequately maintaining and operating the newer generations of sophisticated, modularized and computerized weapons systems. These concerns are diametrically opposed by historical fact and present trends. The Reserve Forces of all Military Departments possess a wide spectrum of expertise in all phases of operations and support. The only obstacles to proper utilization of sophisticated equipment/weapons systems by the G/R are the same ones found in the Active Force: adequate initial funding and unit procurement, sufficient spare parts, and an adequate operational and maintenance budget including funds for recruiting, training and retaining. The G/R does, in fact, represent a unique mechanism for maintaining within their various programs skilled technicians at a relatively modest price, for military utilization during a national

emergency. Although the degradation of specific system-unique skills varies depending upon the individual, the skills and the particular assignment, these skills are viable for some period of time and could be, in many cases are, periodically updated. During the '90s the Forecast Forces in the G/R are projected to remain relatively stable in manning but the age of equipments/weapons systems will increase significantly. Technological sophistication and multi-role requirements are likely to increase.

Army

The Army Reserve Forces in the 1990's will utilize those systems now in place or currently under development. Current Army G/R Forces do not suffer as dramatically from a shortage of highly trained technical people as much as they need individuals to fill and to replace combat arms personnel. The need today is for people to handle rifles, tanks and artillery pieces. By the 1990's, as equipments and management become more sophisticated the problem will probably be complicated by a spiraling need for additional intelligent, highly trained technologists to handle the "Black Boxes". Changed recruiting and retention incentives will be required to properly man the Army G/R.

During the decade of the '90s, it is projected that a greater emphasis will be placed on equipment, full-time personnel, and training for the Army G/R. Increased emphasis will also be given to service and support units to supply highly skilled technicians during a period of mobilization. To accomplish these objectives it will be necessary to continue equipment/weapons systems procurement and service life extension programs specifically for the G/R. Alterations in recruiting and retention incentives will be required to attract more and better quality personnel, both prior and non-prior service individuals, especially those with critical skills.

Navy

Historical data indicates that there has been an apparent reluctance to equip the Reserve Forces of the Navy with technologically advanced systems. An example is the submarine program, when the diesels were replaced by nuclear boats. This reluctance was also manifested by the hesitation and concern evident in the decision to give jet fighters to the Naval Air Reserve. Although the use of jet aircraft by the Reserve proved successful, the incident illustrates present perceptions of the Active Force Navy about the ability of the Naval Reserve to operate and maintain advanced systems. Recent decisions show a tendency to add platforms to the Reserve that are relatively stable and supportive in nature. Examples are mine sweeps, riverine craft, cargo planes and special warfare helos.

Current growth areas for the Reserve appear to be amphibious forces and support auxiliaries. Future growth will probably take the form of augmentation teams for surface combatants as well as activities characterized by management by a relatively small number of people interfacing with computer management systems.

Shortages of highly trained technologists will exacerbate the equipment limitations if positive steps are not taken to attract high quality, first-term enlistees, to retain experienced personnel in the Reserve, and to attract into the Reserve that type of individual leaving the Active Force, especially highly trained technicians.

Air Force

More so than any of the other Services, the Air Force has aggressively embraced the Total Force Policy and currently buys high technology equipment simultaneously for both Active and Reserve Forces ("unitary buy"). As the Air Reserve Forces continue to receive sophisticated high technology equipments directly from the factory, they become vulnerable to systemic anomalies in maintenance management. Total aircraft numbers within the Reserve are expected to remain relatively constant throughout the 1990's but as the sophistication level continues to rise, the requirement for highly trained, experienced technicians will also grow. The Air Reserve Forces will need increased enlistment and retention inducements during this period if they are to meet the challenge of maintaining and operating the equipment/weapons systems. Up front monetary rewards are only part of the overall package.

Increased efforts to recruit departing technicians from the Active Forces into the G/R and to keep their skills viable for extended periods of time through periodic up-dating and active duty for training will be imperative. Increased usage must be made of older non-prior service personnel with related civilian occupational specialties who, with very little extra training, could contribute appreciably to the overall readiness capability.

Essential equipment and necessary trained personnel constitute only two sides of the triangle. Without adequate operational and maintenance funding, based on annual political budget decisions, the operational readiness and reliability of the Air Reserve Forces will degenerate into an unusable mixture of people and hardware.

Marine Corps

The Marine Corps' Reserve ground forces in both the 4th Division and the 4th Force Service Support Group will be essentially the same in the '90s as they are today but will represent an even better mirror image of the Active Marine divisions and support elements.

The 4th Marine Air Wing, though similar to the Active Force Wings, is less of a mirror image today than the ground counterparts and

unless current trends are changed will continue to harbor serious deficiencies compared to the Active Wings.

In the 1990's, the Marine Corps Reserve, like the Active Force, will possess greater ground combat, combat support and support capabilities. Service life extension programs will increase the usable life span of major equipment items and weapons systems but difficult tactical and administrative problems may arise unless there are unitary purchases for the Active and Reserve Forces in the command, control, communications and computer (C⁴) area.

Personnel problems plaguing the other Services have not been as extensive in the Marine Corps or the Marine Corps Reserve but do exist in some specific technical areas. There will probably be an increase in these problems. Although the total number of personnel required will remain relatively constant, significant fluctuations in skill requirements are expected primarily in aviation and areas utilizing sophisticated high technology equipment.

Surge capability requirements of the Marine Corps Reserve will be enhanced in the 1990's by increased efforts to enlist personnel leaving the Active Force into an appropriate Reserve Component, better usage, assignment and training of individuals in the Individual Ready Reserve (IRR) and by increased funding for Reserve training, operation and maintenance, and providing for enhanced participation by individuals and units in training exercises.

Summary

Problems of equipment, personnel, and funding are essentially similar but vary in degree within all the Services and areas of the Guard/Reserve Forces. Examination of the entire Guard/Reserve program of each of the Services leads inevitably to the following conclusions:

a. Sufficient, adequate equipment must be provided to and maintained within the Guard/Reserve to provide appropriate surge capabilities. Within the Total Force Policy this is best accomplished by unitary equipment buys. Guard/Reserve equipment and procedures must be standardized and compatible with the Active Force.

b. Sufficient numbers of qualified individuals must continue to be procured and trained to man the Guard/Reserve equipment and to provide both units and individuals needed in a surge situation. The personnel will most likely include more older individuals and more women.

c. Adequate funding must be provided to the Guard/Reserve programs for recruitment and retention, training, operation and maintenance, and increased time allocated for training under field conditions.

CONCLUSIONS

In the decade of the '90s, the Total Force will probably be armed with a mixture of two categories of equipments: major weapons systems which are now deployed and in use; and major weapons systems currently under development and those which will be placed under development within approximately the next five years. Both categories of weapons systems will most certainly be subjected to a number of major modifications through the '80s and '90s. These modifications are expected to be extensive with incremental improvements to and enhancement of the electronic systems and subsystems in particular and to a lesser extent of the weapons systems platforms as well. These modifications will provide enhanced capabilities to the weapons systems through the incorporation of evolutionary rather than revolutionary improvements in the technological state of the art. The most likely areas of such improvement include command, control and communications; fuel efficiency; data processing, analysis and display; sensing, locating, identifying and targeting adversaries under adverse environmental conditions; and platform/subsystem repair and maintenance. Quantum improvements in weapons systems in the future could result from "breakthrough" advances in technology and could render this conclusion totally erroneous. However, no such radical breakthrough is thought probable and, even if it were to occur, could alter this conclusion only if such technological miracles were to be implemented by Congressional and Executive decision, including the dedication of sufficient funds for exploitation of the new knowledge.

This conclusion is thought to be mandated by the procedural inertia, costs, time involved and other constraints to the rapid deployment of available technology in the form of weapons systems which are inherent in the existing acquisition process. As a consequence of the constraints placed on military exploitation of available technology by the institutionalized acquisition system, the decade of the '90s is separated from the present only by the length of a single acquisition cycle of one major weapon system.

Although the existing acquisition system mandates that at the instant of deployment, a new weapons system will utilize technology that may be ten years behind the defense technological state of the art and as much as twenty years behind the non-defense technological state of the art, perceived difficulties in maintaining weapons systems has generated a heated debate over the utility of "complex" weapons. Opponents of "complexity" have indicted the incorporation of advanced technology into weapons systems as a source of system unreliability, severe problems in maintenance and a consequent reduction in combat readiness. "Complexity" opponents are usually proponents of "quantity" when engaged in the "quantity vs. quality" argument and advocate "simpler" weapons at lower unit cost permitting purchase of greater numbers.

This study can offer no solution to the "quantity vs. quality" controversy except the truism that the degree of technological

sophistication of any weapons system should not exceed that which is absolutely essential to the achievement of its assigned and prospective missions. However, the belief that past purchasing practices have provided insufficient numbers of weapons and spares of all kinds to the Total Force, not just to the G/R, is pervasive in the military community. Whatever the merits of the respective positions of the "quantity vs. quality" controversy, the character of the response to the perceived paucity of military hardware will be directly influenced by the outcome of the debate.

The resolution of this philosophical combat is unlikely to drastically alter the symbiotic relationship which exists between current high technology weapons systems and the three-tiered maintenance system which has become common in all Military Services. Many current major weapons systems do and probably all future systems will utilize modularized and highly integrated electronic components and computers to achieve enhanced performance capabilities and are supported by the three-tiered maintenance system. Although the adoption of high technology weapons systems has not generally resulted in any increase in the total number of personnel required to maintain them, neither has there been a resultant decrease in the total number of military personnel that many planners had expected. The critical dependence of the three-tiered maintenance system on Automatic Test Equipment (ATE) does require the services of increased numbers of highly skilled technologists to operate and maintain the ATE. This trend toward an imperative requirement for increasing numbers of military technologists possessing ever greater intellectual abilities within a Total Force of constant size is expected to continue and intensify in all of the Military Services.

The study highlighted the existence of an increasingly severe personnel problem: critically needed military technologists, possessing a degree of competence that can be acquired only through expensive training and extensive experience, are steadily leaving the Military Services in alarming numbers. As an employer the Military Services must now compete with private sector employers for the services of these technologists. Yet the military can offer them material benefits and a quality of life that does not match that which can be offered by private sector employers. One obvious consequence of this exodus from the military is a denigration of the current combat readiness of high technology weapons systems. Another consequence is additional costs to the military not only in increased recruiting and training expenditures but in increased payments to private contractors for the services of civilian technologists, many of whom are former military technologists hired away from the Services, to support high technology weapons systems. It is estimated that the Department of Defense is currently using civilian contractors for services of all types that would otherwise require 135,000 Federal employees, civilian or military. The use of civilian contractors to maintain military weapons systems is alleged to have reached the stage of absolute necessity and may portend a future shift of most of the military maintenance burden to civilians.

This integration of civilian contract personnel into the military maintenance/logistics system raises a possibility of grave concern to military planners: that during a crisis deployment of high technology weapons systems these now indispensable civilian contract technologists will refuse to accompany the weapons systems. The legal status of civilian technologists who, although nominally civilians and therefore non-combatants, play a key role in maintaining the combat readiness of high technology combat systems is ambiguous at best under the international law of armed conflict. The use of Civil Service personnel instead of contractor personnel may ameliorate the very high costs of utilizing civilian contractors but does not erase the other problems which are the consequence of using civilian personnel in a military combat setting.

The three-tiered maintenance system was designed to operate efficiently in an environment in which there was a sufficient number of spare modular units available to fill the logistics pipeline. However, there is currently a lack of sufficient spares for various reasons, many of which are related to funding, and as a consequence the intended maintenance strategy of "remove and replace" (R^2) defective modular components has of necessity been perverted into an ad hoc "remove, repair and replace" (R^3) system that degrades weapons system readiness. This problem has been magnified by successive and relatively rapid weapons system modifications. Additionally, problems created by this shift to an R^3 mode have frequently been solved by placing a greater work load on military technologists thereby further denigrating their quality of life and providing them with an even greater incentive to join the exodus from the military.

The ATE is extensively computerized and requires the development of compatible software. There has also been a proliferation of computers of varying size to support, and also as intrinsic components of, weapons systems. This trend has created new system vulnerabilities, delays, an increasing need for technologists and burgeoning DoD software production costs, now estimated at about \$3 billion annually.

There is a respectable school of thought which claims that the technological superiority of the United States, its qualitative lead, in weapons systems is rapidly fading. Qualitative differences between weapons systems are predicted to become ever more marginal and will depend heavily on a decreasing number of technological breakthroughs. International technology is expected to inexorably equalize, casting doubt on the ability of this nation to offset Soviet quantitative advantages in weapons with United States systems of better quality. This development will require a United States maximization of weapon quantity by limiting technological sophistications to those performance capabilities absolutely required to meet and defeat the predicted threat. The use of high technology in weapons systems increases unit cost (development, acquisition, and operational) in many cases, exponentially at 2-3 times the inflation rate.

Technological improvements have burgeoned in a wide variety of fields. In many of these fields the military and civilian sectors have a common interest and therefore each could benefit from a broad array of compatible, if not mutual, development programs. In a time of crisis requiring enhanced technical support to the military the similarity between these technological endeavors will enable the civilian sector to provide the necessary resources. However, this technological symbiosis means that in stable periods the military and civilian sector will be in direct competition for the human and material resources needed to pursue similar technological goals.

This likely competition will be conducted in a personnel environment in which the number of young, well-educated, indigenous males will be declining annually. Simultaneously the number of females, minority members, aliens, less-educated individuals, single parents and those with other dependents will increase. Under economic conditions similar to those which now prevail, a major percentage of the first group will gravitate to the civilian sector while the military sector may have to rely primarily on the second category as the source of new accessions. This suggests that the Total Force including the G/R will have to deal with the pressures created by an increasingly heterogeneous membership.

It is expected that increasing numbers of military personnel will have dependent responsibilities, either as married or single parents. The needs of these dependents will increasingly influence the decisions of these individuals. It can be expected that increasing pressures to leave the military will be generated by family maturation entailing perceptions of transfers and separations as disruptive of relationships. Relocation expenses, including the costs of selling and buying housing, career-oriented spouses and other problems will influence decisions about the military as a career. Under present circumstances, it is likely that increasing numbers will leave the military prior to or at mid-career. This retention problem will be exacerbated by the high civilian demand for certain technical skills and will lead to a paucity of mid-level managers and supervisors in high technology military specialties.

The quality of life for those resisting the temptation to join the civilian community has been adversely affected by high technology weapons systems. The high cost of these systems is an incentive to reduce the level of funding for support functions to the lowest level permitted by optimism. The consequence has frequently been the creation of systems implementation problems and resultant increases in the strain placed on critical military technologists. The loss of technologists for this and other reasons increases the difficulties of routinizing new high technology systems and further increases the strain on personnel who remain in the service. The latter then have a reason to continue and intensify this reiterative cycle of erosion. Successive generations of weapons systems, designed to ameliorate in part the personnel retention

problem, follow a tendency toward more complex combinations of technology, which result in higher costs and thereby launch another iteration of personnel perturbation.

Because the Reserve Forces, at least until recent years, historically received only mature weapons systems, which had been thoroughly tested and proven by the Active Forces, they have so far not been subjected to these same personnel perturbations. There has also been available to the Reserve Forces a sufficient number of operational and maintenance personnel to support these mature weapons systems extremely well.

Despite the impressive readiness history of the Reserve Forces Active Force personnel are inclined to believe that the Reserve Forces could not cope with the latest high technology systems. This sceptical attitude is probably the result of a lack of experience with and knowledge of Reserve capabilities and accomplishments and may be magnified by the stresses caused by the absorption of such systems into the Active Force.

The length of the weapon systems acquisition period also is an obstacle to equipping the Reserve Forces with high technology weapons. As that cycle is attenuated, the Active Forces will have a tendency to retain the older systems longer and many systems may wear out or become obsolete before going into the Reserve Forces. Concomitantly, current Reserve Force weapons systems may wear out before they are replaced.

Spiraling costs of high technology weapons systems almost certainly will cause some reluctance to equip the Reserve Forces with these devices concurrently with the Active Forces or perhaps at all. However, lengthening acquisition cycles and the goal of reducing the unit cost may militate toward a policy of first fully equipping the Active Forces which would then transfer earlier models of a weapons system to the Reserve Forces. Although this technique would eventually lead to more materiel and personnel compatibility between Active and Reserve Components, a more immediate compatible capability could be achieved by equipping both Components simultaneously and pro rata (e.g., 80% Active and 20% Reserve or some other carefully determined mix).

Despite the obstacles to equipping the Reserve Forces with high technology weapons systems, it is obvious that unless they are provided with the contemporary tools of warfare, sooner or later they will become unarmed pools of replacements without the technical expertise to support the Active Force weapons systems. Individuals with expertise and experience gained and practiced in the civilian community would be an exception and could not be long retained in such an organization.

Despite the demonstrated ability of the Reserve Forces to operate and maintain high technology weapons systems, even those which the

Active Force thought beyond the capability of the Reserve Forces, there are unexceedable limits beyond which the personnel stability, high motivation, great experience and expertise, and cost effectiveness of the Reserve Forces will no longer meet the demands made upon them. Those limits are not equipment related but rather are related to organizational size and complexity. The Reserve Forces should not be allowed or encouraged to grow until the nation possesses a part-time equivalent of the Active Forces. The truisms of marginal profit illustrate the folly of such a course in a high technology environment. But a significant modern capability of the Total Force should for economic and political reasons reside in the Reserve Forces.

The only question is the number of weapons needed by the Total Force and the relative distribution between and delivery time to the Active and Reserve Components of high technology weapons systems.

GLOSSARY OF ACRONYMS

ADP	Automatic Data Processor
ACF	Advanced Counterair Fighter
AFSC	Air Force Specialty Code
AIS	Advanced Intermediate Shop
ALCM	Air Launched Cruise Missile
ATE	Automatic Test Equipment
ATF	Advanced Tactical Fighters
C ³	Command, Control and Communications
C ⁴	Command, Control, Communication and Computers
CBR	Chemical-Biological-Radiological
CBW	Chemical Biological Warfare
CCP	Civilian Contract Personnel
CEP	Circular Error Probable
CFV	Cavalry Fighting Vehicle
COMSEC	Communications Secure (device)
CW	Chemical Warfare
CRAF	Civil Reserve Air Fleet
DAR	Defense Acquisition Regulations
DNA	Deoxyribonucleic Acid
DoD	Department of Defense
ECM	Electric Counter Measures
EW	Electronic Warfare
G/R	Guard/Reserve
HSG	High School Graduate

IFV	Infantry Fighting Vehicle
IOC	Initial Operating Capability
IQ	Intelligence Quotient
IR	Infra-red
IRR	Individual Ready Reserve
LCAC	Landing Craft, Air Cushion
LDC	Lesser Developed Country(ies)
LRU	Line Replaceable Unit (black boxes)
LSI	Large Scale Integration (electronics)
MA	Mobilization Augmentee
MOS	Military Occupational Specialty
MILSPEC	Military Specification
MRA&L	Manpower, Reserve Affairs, and Logistics
MSC	Military Sealift Command
MTBF	Mean Time Between Failure
NCO	Noncommissioned Officer
NHSG	Non-High School Graduate
OASD	Office of the Assistant Secretary of Defense
OJT	On the Job Training
O&M	Operation and Maintenance
PMB	Penetrating Manned Bomber
POL	Petroleum, Oil, and Lubricants
QMA	Qualified Military Availables
R ²	Remove and Replace
R ³	Remove, Repair, and Replace
R&D	Research and Development
RMS	Remotely Manned Systems

RPV Remotely Piloted Vehicle
RDT&E Research, Development, Test and Evaluation
SAM Surface to Air Missile
SEGMAG Segmented-Magnet Electric Propulsion
SMSA Standard Metropolitan Statistical Area
SPO Senior Petty Officer
SSBN Nuclear Ballistic Submarine