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NOVEMBER-DECEMBER 1970

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THE FUTURE

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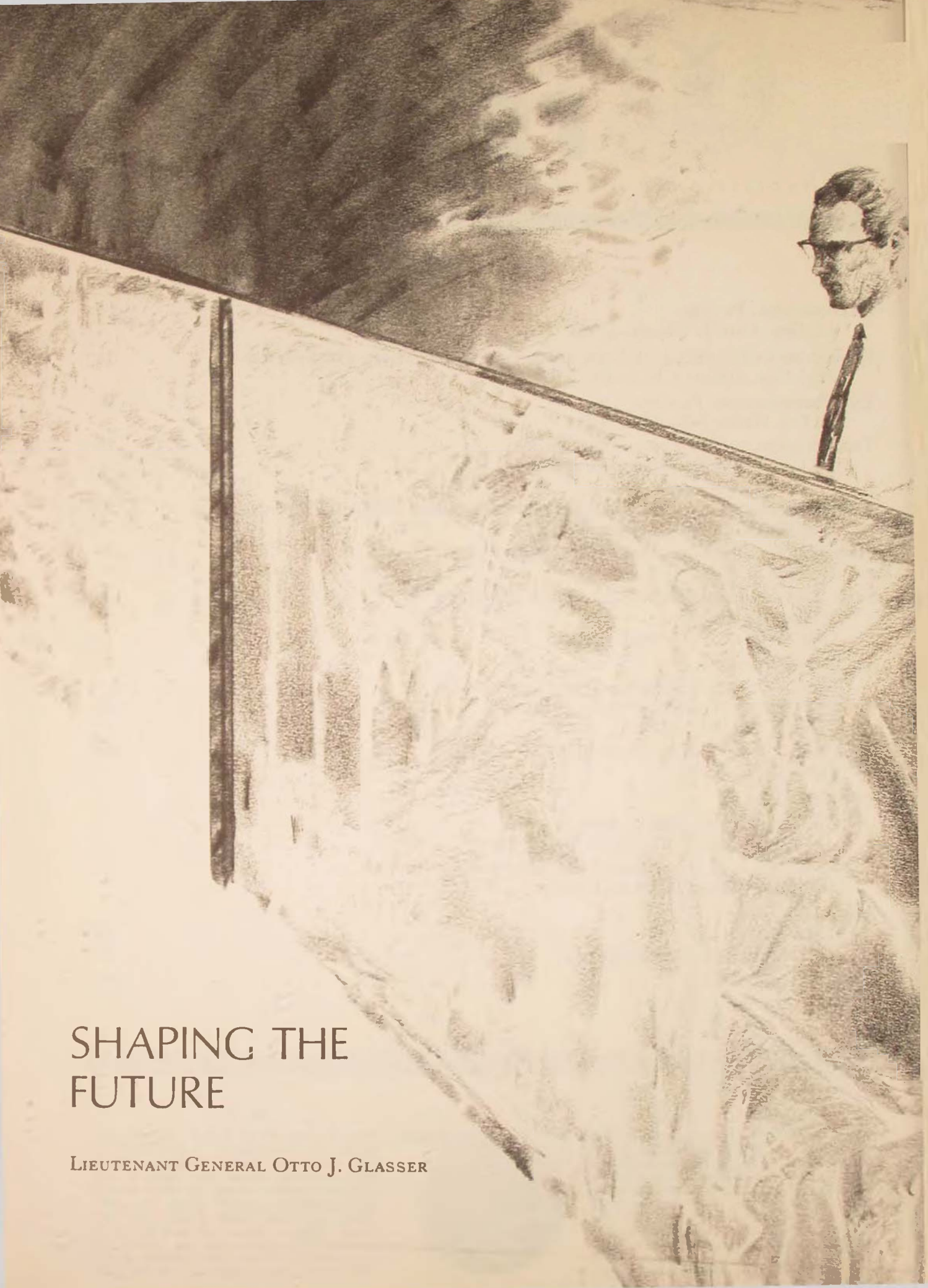
the cover

Since the days of the medieval alchemist, the alembic has been symbolic of man's quest for the unachieved. Despite budgetary cutbacks and inflationary trends that result in less yield from available funds, Air Force research and development programs pursue this quest, shaping our future defense posture. Lieutenant General Otto J. Glasser and members of his Air Staff Deputate/Research and Development tell of the Air Force R&D program, in this last of the *Review* series on the Air Staff.



SHAPING THE FUTURE

Lieutenant General Otto J. Glasser

THE business of identifying, developing, and acquiring new weapon and support systems is an endeavor which focuses on the future. To be sure, its day-to-day demands become very definitely matters of the moment, but it is the future on which our sights must constantly be fixed.

If we have learned anything from human experience, it is that the future cannot be predicted with certainty. On the contrary, it is fraught with uncertainties—some of the next hour and some of the next decade, some incidental and some critical. One of the more hopeful characteristics of Western man has been an underlying faith that he can help shape his future. As inheritors of that tradition, we in the United States believe we can reduce and channel the uncertainties and thus render the situations they create more manageable.

In a sense, the requirements, development, and acquisition activities in Headquarters USAF are designed to shape our nation's future. Our article of faith is that by providing the right assortment of systems and technologies, we may enable the Air Force to avoid some of the uncertainties that seem so threatening when contemplated in the abstract. In particular, we believe that if we provide the right kind of military capabilities, we may discourage any other governments from making the kinds of decisions that would damage our nation's vital interests.

One reason for this belief is that for some time now the threat of technological surprise has been neither real nor likely. This is true because the United States has maintained world technological leadership in both military and economic terms. Our capabilities have continually been superior to and timely enough to cope with those of our potential enemies. This relative advantage has enabled the U.S. to contribute significantly to world peace and maintain our own national security.

Our technological leadership has resulted from a vigorous program of research and development (R&D), coupled with a healthy technical manufacturing capability. This combination is the mainspring of our nation's ability to have on hand appropriate weapons and technologies when needed. Thus we have had in readiness both plans and hardware for the weapons and systems required to meet challenges as they have arisen. Through this combination we have been able to improve the military alternatives available to our national leaders and to provide them a foundation for understanding the implications of foreign technological advances. Within the limits of the resources available to us, we of the office of the Deputy Chief of Staff, Research and Development, endeavor to continue these services.

Maintaining technological leadership is becoming increasingly difficult. A few years ago our funding for military R&D was almost twice that of our closest competitor, the Soviet Union. By the mid-seventies, if the current trend continues, we will be doing considerably less defense-oriented R&D than they. Whereas on the surface this situation might be justified in the interest of governmental economy, it nevertheless represents a slow erosion and decay of the technological advantage which has allowed us to maintain a comfortable margin of national security through the years.

Part of the reason for this declining trend is that the military is facing constraints as perplexing as any faced before in our national history. First of all, military preparedness and planning have proved so successful that the threat to national security is no longer as visible as it was after World War II. The tremendous costs of advanced systems, such as the C-5, and the technical difficulties encountered with complex technologies, such as the F-111, have served to increase public and Congressional concern over defense spending. This concern has contributed to the overriding issue of national priorities. Increasing attention is being given to questions of how our public resources should be allocated, as among

military and a variety of domestic programs. Some influential figures apparently believe we can satisfy domestic requirements by cannibalizing the defense budget. Yielding to this inclination, however, could greatly accelerate the decline of the secure environment, which contributed to the problem in the first place.

While our current request for research, development, test, and evaluation (RDT&E) funds represents a reasonable share of the overall proposed defense budget, it is less than we honestly feel is needed to prepare for future defense requirements. Planned reductions for fiscal year 1971 lower our overall defense spending to seven percent of the gross national product. This represents the smallest amount of purchasing power that we have had for defense in twenty years. Inflation has also taken its toll. The 72 billion defense dollars proposed for FY 71 will buy only 55 billions' worth in terms of the dollars of seven years ago. Using the same discounting formula, our current request of $2,910,000,000 for RDT&E is the equivalent of only $2,210,000,000 in 1964 dollars; by contrast our appropriation for that year was $3,630,000,000. Faced with reduced levels of support, we have had to eliminate some efforts entirely and reduce others to a minimum.

So far, by sacrificing what we believe in for what we must have, we have been able to maintain a high level of capability. This has required a number of trade-offs, in varying degrees tolerable to both the concerned public and a continuously healthy R&D community. For example, we have sacrificed the Manned Orbiting Laboratory but maintained our insistence on more urgent programs such as the F-15 Air Superiority Fighter and the B-1 Advanced Bomber. However, we are also encountering the necessity for different sorts of trade-offs, like operations and maintenance costs versus RDT&E and new acquisitions. We are caught in an increasingly tight squeeze between the demands for current performance and demands for future capabilities.

As our dollar resources diminish, our research, development, and acquisition flexibility becomes increasingly limited. All our efforts are designed to alleviate current and anticipated operational deficiencies—to fill important gaps in our capabilities to cope with reasonable eventualities. Unfortunately we cannot wait until the need for a particular system becomes crystal clear. Necessarily long development lead times of five to ten years for new systems demand that we anticipate future required capabilities and employ a variety of measures to acquire them. Thus we believe it important to have under way simultaneously at any point in time programs to improve existing systems, to develop totally new weapons and equipment, and to explore potentially useful technologies. Declining resources mean constraining our ability to maintain such efforts in essential areas. This concerns us greatly because without the flexibility to develop alternative technologies and systems our capacity to shape a secure future will diminish.

Air Force research, development, and acquisition efforts are administered by a vast and multilayered community. At the uppermost level of management and policy determination is the Office of the Secretary of Defense (OSD), with the Director of Defense Research and Engineering exercising continuous detailed review of Air Force proposals and annual programs. At the working level are the laboratories of the Air Force Systems Command and various university and industrial contractors. Operating at the upper-middle management levels are Headquarters Air Force Systems Command and its subordinate field divisions. In effect, the Deputy Chief of Staff, Research and Development, Hq USAF, is the agent of the Chief of Staff, serving as a management link between the program approval authorities, which are the Secretaries of Defense and Air Force, and the Air Force field organization that directly administers the research and development efforts.

The DCS/R&D contribution derives from three primary activities: analysis, advocacy, and management. Stated or conceptualized needs are examined critically and from the standpoint of identifying systems and technology areas where development work is particularly needed. Through program reviews and interagency discussions, we advocate these needs and our proposed development programs to solve them to OSD. The advocacy continues through subsequent Congressional budget hearings, annual program requests, and as long as the Air Force must justify its need for the system. Our broader management tasks involve shaping contract policies, designing development and acquisition programs, participating in Air Force budget formulations, and accommodating policy directives from higher authority. The articles that follow will describe in detail our objectives and problems in some of these areas.

THE research and development programs managed by the DCS/R&D are identified in five categories, each signifying a different level of activity: research, exploratory development, advanced development, engineering development, and operational systems development.

research—effort to acquire increased knowledge of natural and behavioral phenomena needed in solving military problems. It is distinguished from other laboratory and study effort in that it is not designed for application to specific technology objectives.

exploratory development—effort to resolve specific military problems ranging from fundamental applied research through development of feasibility demonstration hardware. It also includes specific development projects for which funding levels are too low to warrant identification separate from their parent technology area.

advanced development—individual hardware development projects designed for purposes of testing and experimentation. Even though they may represent either technology or subsystem programs, advanced development hardware items are not intended for eventual operational testing and service use.

engineering development—system and component programs engineered for direct service use but not yet approved for production.

operational system development—continued development, engineering, and testing of systems approved for production.

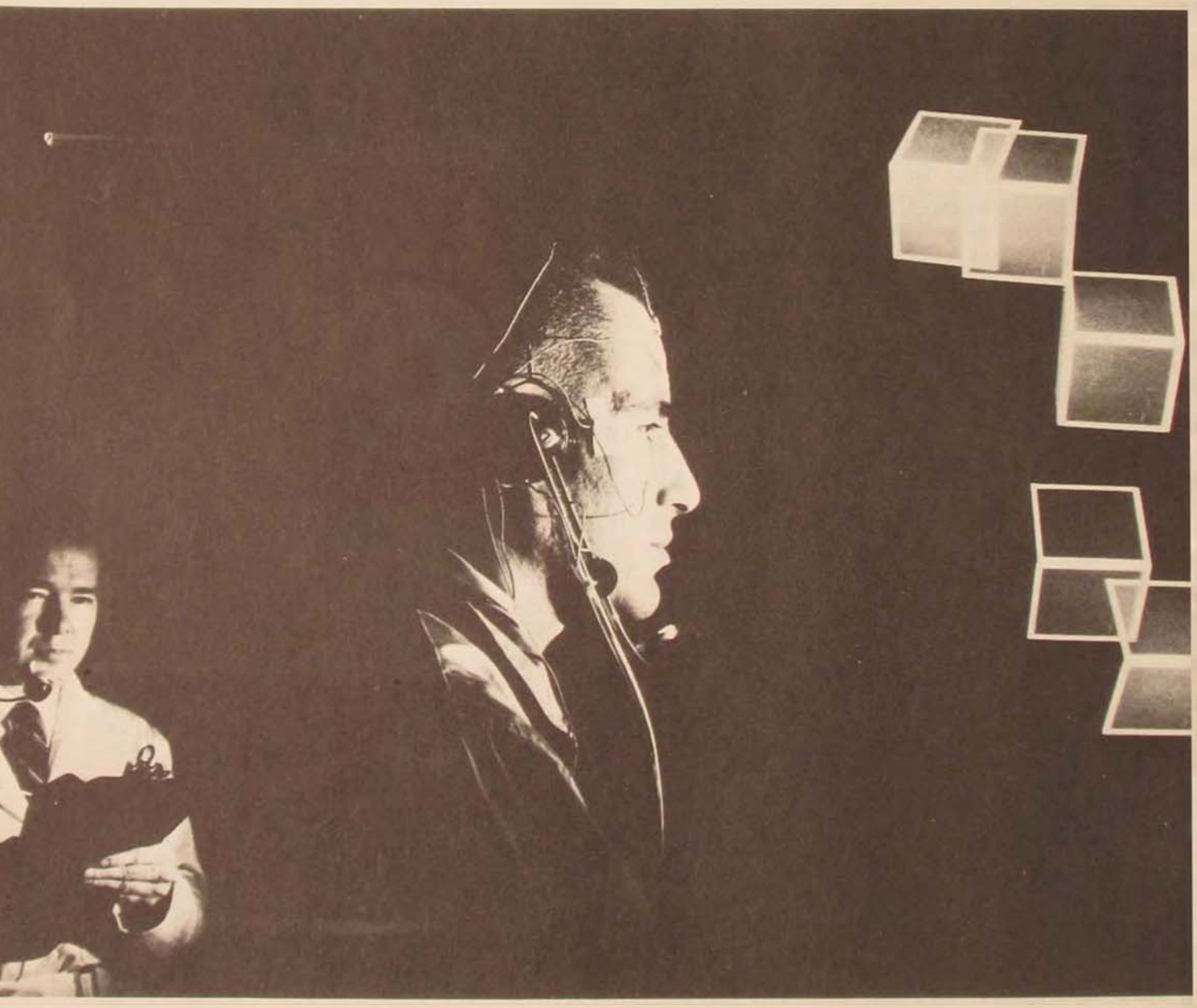
The work of the DCS/R&D is initiated in a variety of ways. Theoretically, research and development efforts which culminate in a piece of hardware move successively through each of the categories and then into production. Actually, they may begin in any category other than operational system development. They may also begin, regardless of category, either as the result of a formal request for development of a particular capability or as a derivative of ongoing research and technology efforts. In the latter case, work in one area may lead to the emergence of promising technological growth or even an interesting system concept. Formal requests for development efforts usually come from the field, among the using commands; some also originate in the Air Staff. Proposals growing out of other research and development programs may be initiated by our in-house laboratories, by contractors, or by Air Force management elements.

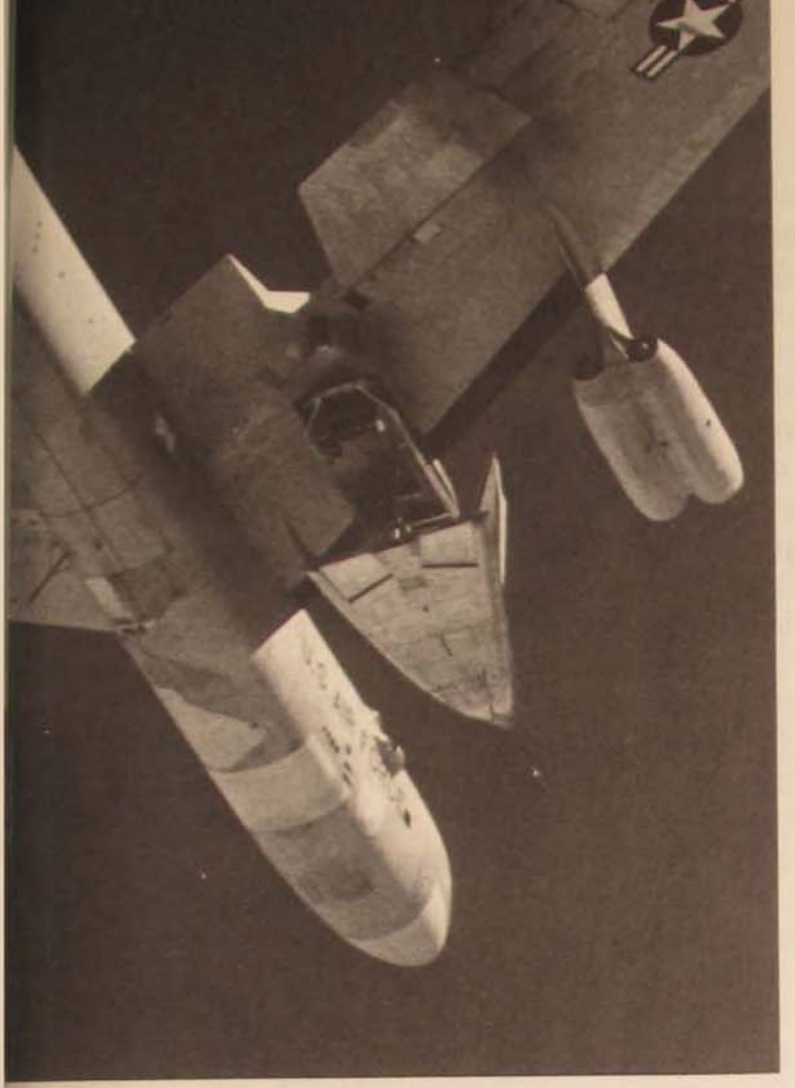
What the DCS does concerning these programs depends on what category they fall in at the time. All research and exploratory development and some advanced development comprise what we call our "technology base." Individual research and development efforts are administered as projects, grouped under descriptive elements of the overall program. These larger elements appear as separately identified line items in the R&D budget. For example, projects in "surface finishes" and "aerospace lubricants" are administered under

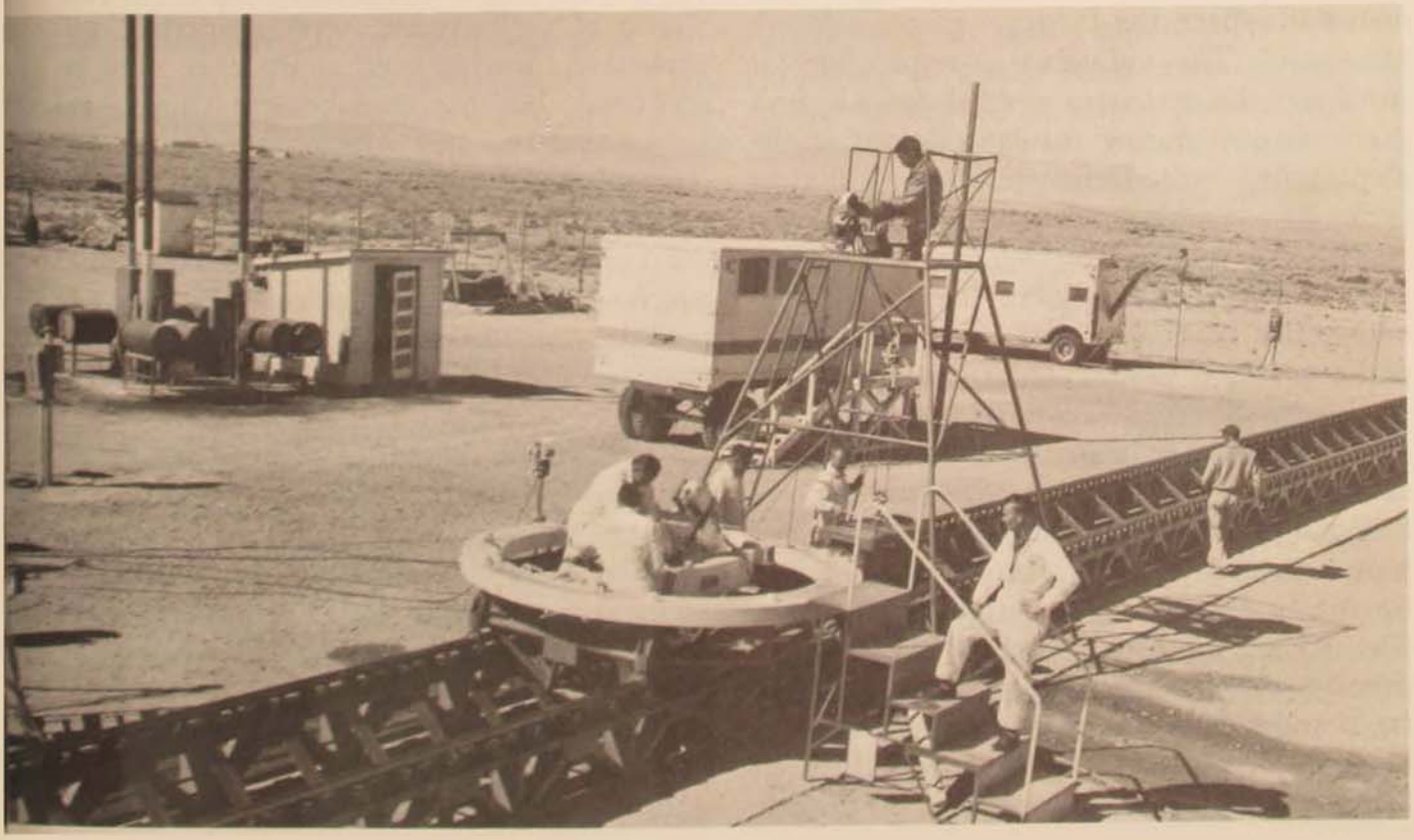
Continued on page 8

Space-age Development

Space stations revolving to create artificial gravity may disturb delicate balance of the semicircular canal in the inner ear, resulting in optical illusions—as when a man in a revolving simulator turns his head quickly and a lighted plastic box on the wall appears to move. Electro-oculogram sensors rigged to his head enable aerospace medical researchers at General Dynamics/Astronautics, San Diego, to study this life science problem encountered in designing space stations. . . . A research and development lifting body, the HL-10, with a B-52 at Air Force Flight Test Center, Edwards AFB, California . . . Tropic Moon I, a specially equipped A-1E for demonstrating use of low light level television for night reconnaissance and attack . . . Bopper sled for testing Apollo subjects on short "Daisy" track at Holloman AFB, New Mexico.







the program element Materials; projects in "nuclear radiation hazards" and "combined stress in aerospace environments" are under the program element Aerospace Biotechnology.

For program elements in the technology base, the responsible DCS/R&D office performs a variety of supporting services. It provides Air Staff supervision of related in-house laboratory and contracted work. It continually reviews these elements and projects in the context of others to assure balance and proper emphasis among technology base activities. Staff offices provide essential documentation and Air Staff review of proposals for new projects within a particular program element. Overall, the staff emphasis is to be alert for and provide particular support for those projects which promise significant advances in the technology areas essential for system applications.

Advanced development programs on subsystem hardware and all engineering development programs are handled somewhat differently. Each program is carried as a separate budget line item and is administered by its own staff officer, the Program Element Monitor (PEM). This individual is responsible for justifying the resources needed for his program element during regular portions of the Department of Defense program/budget cycle. By assembling relevant data, preparing written reports, and providing formal briefings, he continually explains, defends, and advocates his program before various Air Staff and OSD review groups. These officers prepare the formal documents required under the Program Budget System, including Program Change Requests (PCR) and Program Change Summaries (PCS). They also periodically prepare action directives to the field as required by Air Staff and higher authority decisions. The driving motivations behind the staff actions for programs in these advanced development and engineering development categories are to achieve timely application of advanced technology to new systems and to provide fully adequate development and testing of approved hardware items.

Before entering these more advanced development categories, however, each program and project must achieve formal recognition as a separate piece of required development work. This recognition can be obtained only through approval of the detailed program and allocation of the necessary funds by OSD. Recognition is preceded by a series of studies and analyses to determine the best ways of alleviating specific operational or technical deficiencies. Depending on the nature of the problem, these may include parametric system design studies, cost and feasibility studies, military mission analyses, and studies to determine optimum applications for specific technologies. Some of these activities are conducted within the R&D Deputate, some in other parts of the Air Staff, some by Air Force Systems Command, and some by contract—for instance, by the RAND Corporation and Analytical Services, Inc. (ANSER), which are Federal Contract Research Centers largely supported by Air Force R&D funding. In the course of such studies, several suitable concepts and development approaches may be identified, but the management climate requires that one best solution be determined. This solution must then be proposed, justified, and sold by DCS/R&D staff officers to higher Air Force authority and thence to OSD. Initial success in this process is indicated by only one measure: whether or not our proposed program is added to DOD's Five Year Defense Plan (FYDP).

Systems that reach this point in the development cycle have successfully completed the phase of Concept Formulation. Although this is a significant step in the life of a system, it is really only the beginning. Each system must pass many more tests, and the responsible PEM must continue to shepherd his program element through several more phases and critical reviews before it can attain production status. Without getting into the detailed pro-

cedures and documentation required for successful passage through these subsequent phases, it is well at least to identify them.

Concept Formulation is followed by Contract Definition, during which two or more contractors prepare detailed technical, management, and cost proposals for completion of engineering development. At completion of the Contract Definition Phase a winning contractor is selected, and a development contract is negotiated. At some time after engineering development begins, usually after full-scale development experience and testing indicate that the design is feasible, a decision to produce the system must also be made. With the signing of the engineering development contract, the system enters the Acquisition Phase, which continues until the system is no longer being produced. Through each of these phases, the DCS/R&D staff must continually keep abreast of the specific progress of the system and its general climate of acceptance. Accordingly, we must maintain an effective campaign of advocacy at several levels of review.

One of the processes in which the management and advocacy activities converge most dramatically is the annual defense of our proposed RDT&E and procurement programs before the Congress. By virtue of its control of the purse strings, Congress plays an increasingly critical role in the drama by which Air Force programs progress from paper proposals to productive efforts. Always concerned about the budgetary implications of our programs, the Armed Services and Appropriations Committees reflect increasing public concern over military spending by probing deeply into our development and procurement program accounts. To support our proposals effectively, therefore, we must be able to demonstrate that our management controls prune out duplicative work and that available resources have been expended prudently. In addition, within the present climate of concern over national military commitments, we are being asked to justify much more explicitly than before our need of the systems for which we are requesting development and production funds.

As of this writing, it is still too early to evaluate the success of our current year's appeal to the Congress. The Armed Services Committees of the two houses have not yet gone into conference on the authorization bill, and appropriations bills have not yet been drafted. Last year, however, our system requests were subjected to the closest scrutiny to date as to their intended use and political utility. Particularly on the Senate floor, critics questioned the need not only for a new bomber, the B-1, but for any bombers at all. They wanted to know specifically what foreign policy commitments necessitated another squadron of C-5s and why only this system would suffice. It is clear that we must be certain that our program requests are grounded on explicit rationale and firm justification.

THE various constraints acting on the systems acquisition community have encouraged us at Headquarters USAF to review critically our past procedures and to introduce more economical practices. For example, we are introducing more flexibility into our contracting policies. Increasingly prevalent in the recent past was the practice of competitively selecting a source based on contract definition proposals and a contract for the complete development and acquisition of the system. The C-5 and the Short Range Attack Missile (SRAM) are examples of this total package procurement approach. Unfortunately, this approach committed the Air Force to an untested and unbuilt idea—in short, to a pile of well-analyzed paper. The drawbacks are obvious: we are buying state-of-the-art technology years before production, and later on we have to pay the price of modification if we want the most advanced equipment. Consequently we now tend to contract separately for system development and for procurement.

Moreover, we frequently employ cost reimbursement contracts for the early phases of our programs, to provide needed flexibility and the opportunity for a closer participation by Air Force agencies.

We have also begun improving R&D contract procedures by a provision called "milestoning." Under this procedure a system developer must demonstrate that he has accomplished a particular stage of the development on schedule before continuing. This, hopefully, will help prevent the costly mistakes so often encountered when a program moves too far, too fast. This approach is being applied in ongoing programs for the B-1 Advanced Bomber and the F-15 Air Superiority Fighter.

As still another means of improving our acquisition process, requirements, development, and acquisition people are giving a hard look at the long-neglected concept of prototyping. We believe that with some systems we could benefit greatly by proceeding from advocacy to a form of contract definition that would require competitive development of a prototype: a "fly before you buy" approach. In this way the acquisition decision could be based on more positive knowledge of the system we would be buying. In addition, experienced production and manufacturing teams would lessen our initial risks. This idea has been approved for use with the proposed A-X Close Support Fighter because it is essentially a state-of-the-art aircraft with no new technologies needed.

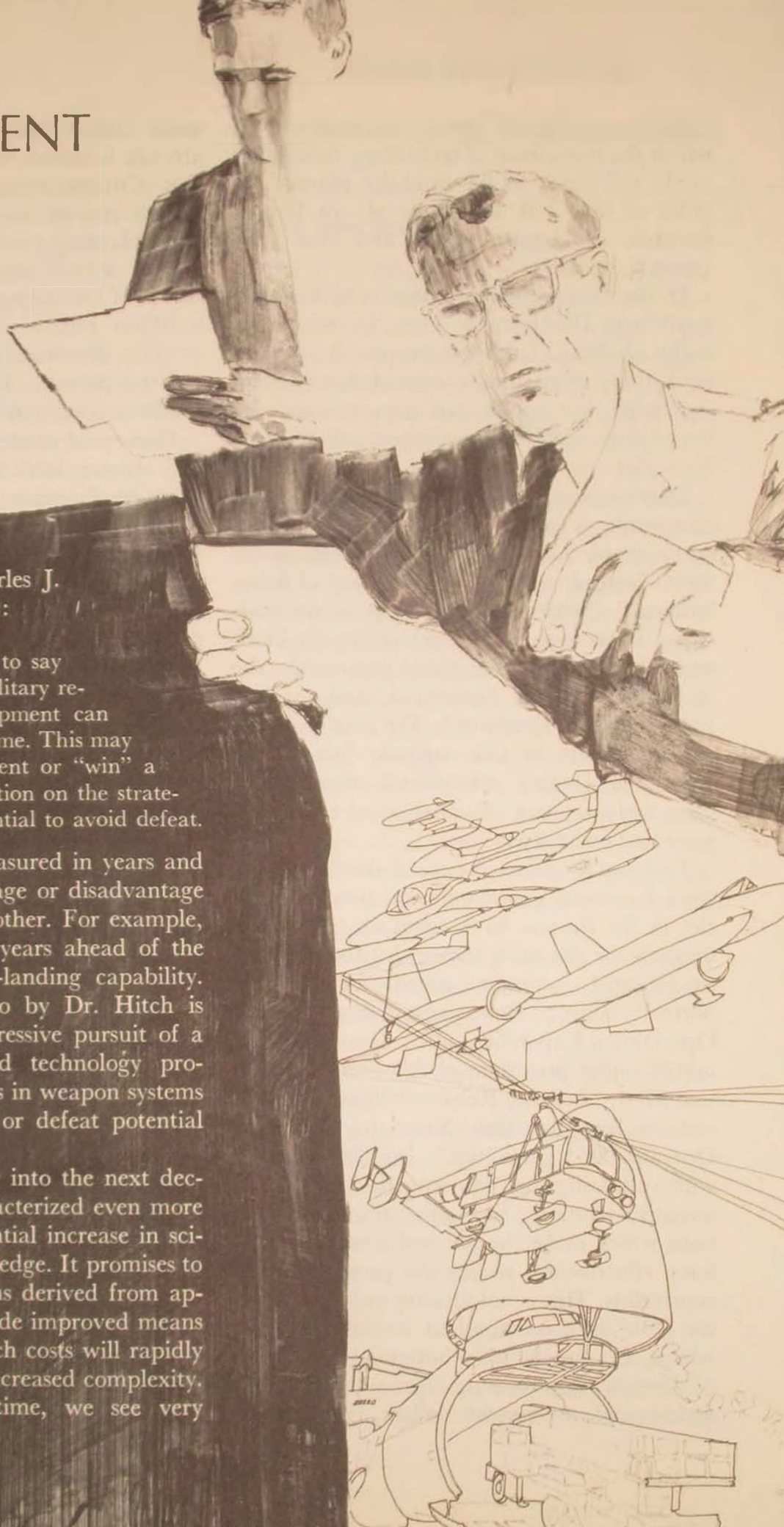
Unfortunately, there is no assurance that these and other steps we are taking will eliminate all research, development, and acquisition problems. Nor will these steps necessarily guarantee our future security. We are confident, however, that they will help eliminate some of the uncertainties about systems under development and, in turn, some of the uncertainties about our future capabilities. This, we believe, will increase the probability of our nation's being able to manage its future and preserve the vital interests of its citizens.

Hq United States Air Force

DEVELOPMENT PLANNING

a link between requirements and systems

MAJOR GENERAL
DONAVON F. SMITH



THE Honorable Charles J. Hitch wrote in 1960:

> It is misleading to say that primacy in military research and development can give us only lead time. This may be enough to prevent or "win" a war, and, for a nation on the strategic defense, is essential to avoid defeat.

Lead time is normally measured in years and infers a capability advantage or disadvantage of one nation vis-à-vis another. For example, the United States is "x" years ahead of the Soviet Union in a moon-landing capability. The lead time referred to by Dr. Hitch is acquired through the aggressive pursuit of a sophisticated research and technology program, which in turn results in weapon systems with capabilities to deter or defeat potential enemies.

Ten years later, looking into the next decade, we see a period characterized even more by the continuing exponential increase in scientific and technical knowledge. It promises to be an age in which systems derived from applied technology will provide improved means of waging war but in which costs will rapidly accelerate, reflecting the increased complexity. However, at the same time, we see very

clearly a projected fiscal environment in which the harnessing of technology to military needs will have to be carefully planned in order to take full advantage of our limited research, development, test, and evaluation (RDT&E) resources.

In the Directorate of Operational Requirements and Development Plans we see as our major challenge today the process of advocating and initiating development of those systems that satisfy our operational requirements over the next decade. That process we call development planning.

Development planning as performed in this directorate is neither a mechanized process nor a simple one described in a single document. Instead, we view it as "a way of doing business." Development planning as we envision it involves every element of the Air Staff, each of the major operational commands, the Air Force Systems Command, and the Air Force Logistics Command. The genesis of our activity occurs in two separate but related areas: (1) stated operational requirements from the users and (2) analyses of current or projected force capabilities.

First, we are keenly aware of the "needs" of the operational commands. As previous articles in the *Review* have described, this directorate is the Air Staff focal point for all activity to satisfy command-stated needs.[1] These normally come to Headquarters as a Required Operational Capability (ROC) document, submitted under provisions of Air Force Regulation 57–1, "Policies, Responsibilities, and Procedures for Obtaining New and Improved Operational Capabilities." We are charged with validating the requirement, weighing alternative solutions, and advocating those solutions which make the greatest contribution to force effectiveness within the projected fiscal constraints. This is not an easy task. Currently we have over six hundred individual ROC's, which, if programs were initiated to satisfy all of them, would cost several times the available RDT&E and investment dollars. The task is made more formidable by the fact that these are not frivolous "wish lists" but deficiencies that a major air commander has considered serious enough to document. Our development planning provides the basis for responding to stated requirements; it provides a means of evaluating alternative RDT&E and acquisition programs, with their concomitant costs, to determine those areas which offer the greatest potential for maintaining or increasing force effectiveness.

Command statements of need are not the only driving force leading to new system development programs. The statement of Air Force objectives in the USAF Planning Concepts, mission evaluation studies such as those conducted by the Assistant Chief of Staff for Studies and Analysis and by industry, and studies of future technological trends and options—all these can lead to RDT&E programs that address projected force deficiencies. These studies are more closely associated with identifying RDT&E programs that can culminate in acquisition of weapon systems five to ten years in the future. On the other hand, the inputs from major air commands are more clearly correlated with near-term RDT&E. There is need for a link between the two inputs, to provide an efficacious generation of RDT&E programs. We are looking forward to the TAC 85 study currently under way in the Tactical Air Command as a major contributor to defining where we should be going in long-range tactical force development.

Methodology

Development planning provides a framework for selecting the studies and hardware programs to be pursued over the next ten to fifteen years. Hence, our development planning efforts form the basis for most RDT&E and acquisition activities.

The general methodology we employ to support effective advocacy of solutions to required operational capabilities is based on an

understanding of development planning as an iterative process within and between the Air Staff and the major air commands. The development planning structure is directly related to mission areas.

the iterative process

When I speak of development planning as an iterative process within the Air Staff, I am addressing those specific staff functions which directly affect and control the development of the Air Force of the future. There is no one function that comes first, since all of these functions relate to and depend upon one another. We look to the USAF Planning Concepts to set the stage for developing an objective force structure and for comparable planning efforts by the major commands. Forces derived on the basis of threat estimates and doctrine alone are not practical because of the impossibly high requirements for fiscal resources as well as technical advancements; therefore, USAF Planning Concepts also includes the implications of technology and alludes to our fiscal constraints. In addition, the Air Staff conducts program and budget exercises designed to tailor our forces within the DOD fiscal guidance; however, these efforts are meaningful only if there is some overall planning framework within which the program decisions can be compared. Our planning methodology provides such a framework, in effect closing the gap between the broad guidance found in the USAF Planning Concepts document and the hard-core realities of fiscal and force exercises. The final element of the iterative process is the forecast and pursuit of the technology which provides effective development options for the next decade.

Thus, development planning represents a continuous dialogue among planning concepts, force structure analyses, program and budget exercises, and analyses of those technologies and weapon systems developments which offer the greatest contribution to the Air Force.

mission area framework

In accomplishing this iterative process, we have begun to utilize an ordering of standard Air Force mission areas. Quite simply, the mission area approach consists of arranging the parts of the development planning problem according to aggregations of Air Force tasks. This serves several purposes. First, mission areas provide perspective on the USAF "job." They provide an interface and transition between the broad mission categories in the program-budget system and the detailed task descriptions found in USAF manuals. Second, mission areas provide a basis for analysis of requirements and assessment of alternatives. This basis is essential to laying out the various decision elements, such as cost schedules and force impacts, for the decision-makers. Finally, mission areas contribute to the dialogue between various staff agencies and major air commanders by establishing a common framework of requirements, analysis, and decision elements against which programs can be formulated and the constraints and risks can be evaluated.

The mission areas being used in our current development planning efforts are as follows:

- Strategic offense
- Strategic defense
- Command and control communications
- Reconnaissance and surveillance
- Intelligence
- Training
- Air superiority
- Interdiction
- Close air support
- Special operations
- Airlift
- Rescue
- Mission support, including base security, navigation and landing aids,

weather systems support aircraft, etc., which provide across-the-board support of the other missions.

These mission areas were not selected casually. They are representative of the jobs the Air Force has to do. Their basis can be found in the USAF Planning Concepts, force structure studies, roles and missions documents, and Air Force manuals. The mission areas give recognition to the tasks assigned to the Air Force and, at the same time, represent a way of categorizing the initiation, validation, and resolution of the major air command ROC's. Furthermore, the mission areas have proved to be a useful means of grouping RDT&E programs and statements of requirements so that their total impact can be directly compared.

Within each mission area it was necessary to further define the job to be done in order to provide a basis for analysis. Hence a number of subtasks were identified. The tasks or functions are unique to each mission area and further structure the job to be done as a basis for evaluating system effectiveness. An example of the task breakout of the strategic offensive area is as follows:

Launch readiness and prelaunch survivability
Launch survivability
Penetration of area defenses
Penetration of terminal defenses
Weapon delivery
Command and control communications.

Moreover, in this particular mission area, strategic offense, the tasks are further divided into manned and unmanned capabilities.

Having identified the specific requirements for each mission area, we must delineate those basic technology efforts needed to provide specific weapon system capabilities in one or more mission areas. The development planning process can be used to formulate guidance as to what technology efforts need to be pursued. Guidance is provided on research, exploratory development, and nonsystems advanced development, with particular emphasis on space technology.

mission area approach

The mission area approach to development planning focuses on four simple questions:

What is the job to be done?

What is our current capability to do the job?

What are our required operational capabilities?

What are our program solutions?

The job to be done is defined by investigation of the objectives of our forces within each mission area. These objectives can be derived from a review of the strategic and tactical guidance as stated in the Joint Strategic Objectives Plan or other sources, e.g., Fiscal Guidance, where national policy and objectives are enunciated. After obtaining an understanding of objectives and considering the rationale for these objectives, we can derive specific tasks for each mission area. Additionally, the estimated threat for each mission area is identified as a means of evaluating our ability to accomplish our mission objectives.

Our current ability to do the job is determined by study of our present and programmed systems and how they would operate in a variety of operational situations. Major air command ROC's also provide the commander's viewpoint of his existent operational capability. A thorough review of operational test and evaluation exercises, as conducted on individual weapon systems or joint test, further illuminates the current capability. And Air Staff personnel have a wealth of operational experience with which to support the evaluation of our existing capability.

The next step is a comparison of the job to be done and existing capabilities. The comparison will be sensitive to the measures of effectiveness used, i.e., tanks destroyed per sortie, expected fatalities, etc. It is incumbent upon us to obtain the most practical measures

of effectiveness. To this end we look to other Air Staff elements, such as the Office of the Assistant Chief of Staff for Studies and Analysis, for aid in developing useful criteria. The deficiencies between our existing capabilities and the job to be done define our required operational capabilities.

With a definitized statement of need, we then turn our attention to the alternative means of meeting the requirement. We seek to identify all conceptual systems that can provide the required capability for each mission area. The modifications of existing systems are also considered. After an exhaustive search to identify all possible alternatives, the development of a program solution can be initiated. This is a most complex task, for it not only must seek the optimum solution within each mission area but also must identify the best solution for the total Air Force mission. Again the identification of the optimum solution is accomplished through appropriate criteria. The development planning effort places the total Air Force mission solutions in perspective with the resources required. Advocacy of the final product will address all the factors of technological risk—cost, time, planning, doctrine, force structure, and total budget—thus permitting an effective bridging of the gap between operational requirements and operational systems.

an analytic model

We have formulated a symbolic model representing the essential elements that must be treated explicitly (and perhaps analytically) if we are to establish a complete understanding of the relationship between expected capabilities and requirements for new developments. In the model (Figure 1) we depict the effectiveness of a force comprised of specific systems to achieve a given objective over time. The measure of effectiveness is described in quantifiable terms on the vertical axis with the desired level indicated by the horizontal line near the top. Deviations from this desired level of effectiveness are depicted by the force "drawdown" curve, which traces the extent of our expected operational deficiency year by year. Variations in operational deficiencies could occur as a result of several major factors, e.g., an increased threat, a changing mission requirement, obsolescence of the force. The dashed line on the chart depicts the improved force effectiveness available with the introduction of a new capability. This is achieved through RDT&E efforts leading to an initial operational capability (IOC) for a new system or modification which corresponds to the point in time at which the improvement curve begins its rise (see horizontal lines near bottom).

To meet our desired operational objectives and thus eliminate major deficiencies, we must evaluate the increased effectiveness provided by the introduction of a new system or capability into the force. Those RDT&E programs which lead to systems giving us the greatest overall improved mission effectiveness and which can be carried out within our technological and fiscal constraints are selected as our desired program alternatives. This kind of mission area analysis provides a way of thinking through our requirements problem. It is essential not only in understanding the effectiveness of our force in an entire mission area but also in evaluating the contribution of alternative systems to that force.

One final element of the mission area framework that deserves further discussion is the need to develop meaningful and agreed-to measures of effectiveness within each of the mission areas. Currently only the strategic offense, strategic defense, and the strategic task within airlift have well-defined quantitative criteria for evaluating our capability to meet specific mission objectives. Current mission area studies have identified a wide range of criteria used in individual studies, and yet these different criteria do not provide the desired insight to overall force effectiveness

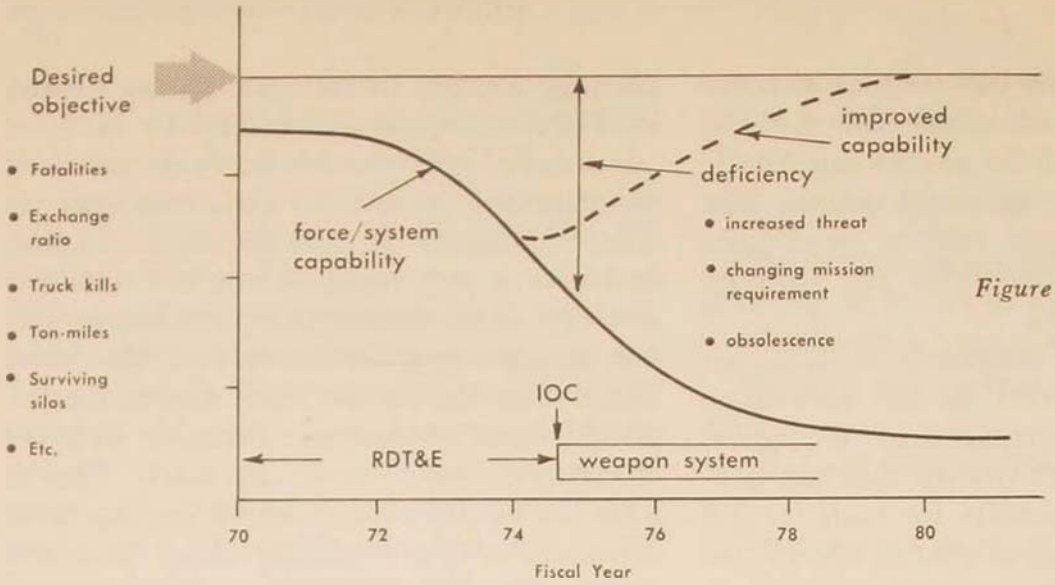


Figure 1. Mission area analysis

across the entire mission area spectrum. We will continue to focus some of our development planning studies onto the need for more useful measures of effectiveness, especially in the tactical mission areas.

While I have characterized this discussion with the term "methodology," in simplest terms what I am describing is a working process in which we are ordering our requirements and their program solutions to lend perspective to our development planning efforts. It is this perspective which I consider to be the significant gain from our current way of doing business.

Development Planning Activities

To put the mission area planning process into operation, we have taken a number of specific actions. While the primary emphasis is on structuring a framework for consistent logical analysis of future program needs, certain products are utilized on a continual basis as planning and guidance tools.

mission area studies

For each of the thirteen mission areas, we are formulating a study that is intended to be relatively long-range and enduring in nature. The purpose of these studies is to provide an overview of each mission area as the perspective for formulating specific concept studies, capability master plans, and program guidance. These are primarily in-house efforts and are accomplished by the Directorate of Operational Requirements and Development Plans (AFRDQ) and personnel from our Federal Contract Research Center, Analytic Services Inc. (ANSER). The outline for these studies follows much the same analysis format shown earlier, in that each concentrates on the job to be done, the current ability to do the job, required operational capability, and proposed solutions. The emphasis is on macroanalysis and the interrelation of the various tasks to be accomplished. Three of the prime features of these papers are

—the attempt to synthesize a basic measure or measures of merit for each mission area,

—the synthesis of many studies that have already been accomplished for each mission area, and

—the accumulation of data that can be consistently used for analysis and planning.

These studies are intended to identify broad areas of deficiencies and provide the means to interrelate proposed concepts and programs that address the deficiencies.

The mission area studies are iterative in nature in that they provide a framework and the guidance for detailed analysis and programs in each mission area and in turn use these efforts as inputs for reaccomplishing the mission area study. Some unique display techniques for providing perspective across several of the tasks and systems in a mission area have been developed by the ANSER team. The life cycle of these studies as a formal document is in tune with the budget/program requirements; however, a majority of them will remain in the draft stage, useful as overview and as guidance documents but not recognized as official Air Force positions. Even in this form, they are absolutely essential to formulating the specific products that follow.

system and capability concept studies

System and capability concept studies are accomplished primarily to define *how* we should satisfy a deficiency. They normally follow a mission evaluation that defines *what* must be done, or they may be undertaken directly in response to a formal statement of required operational capability. We rely primarily on the Air Force Systems Command to accomplish these studies in response to guidance provided by Hq USAF. These studies, formulated within the overall mission area framework, are intended to be more specific than the mission area studies and to address specific alternative solutions to projected problem areas.

Related efforts not directly a part of the development planning framework include:

(1) Concept Formulations/Technical Development Plans. This document compares alternative concepts and provides the rationale for selecting the preferred alternative by use of accepted measures of effectiveness.

(2) RDT&E Program Summary (Form 1634). This document identifies proposed and ongoing technological efforts at Air Force Systems Command and provides the development planner with current status of technology, which he can feed into the planning process.

(3) Cost and Feasibility Studies. These studies relate to specific program proposals by identifying the resources needed to develop and acquire the proposed program and providing a firm indication of the technical feasibility of accomplishing the proposed program.

Air Force Systems Command also conducts presystem, system, and technological application studies that contribute directly to the overall development planning effort.

capabilities master plans (CMP)

In addition to the concept studies that are primarily designed to identify new or improved capabilities, we are generating a series of documents to provide specific development planning information for individual systems, such as the F-4, B-52, etc. These functional CMP's also address system categories such as air intercept missiles or air-to-ground missiles. They may be thought of as second-level planning documents. The Capabilities Master Plan is formalized to the extent of attaining Air Staff and major command recognition of the basic direction in which we are moving with each of our major system or systems capabilities. The CMP is intended primarily for use with inventory systems; however, it is formulated to include a part of what is expected in new force applications. The CMP is developed with regard for real cost constraints and provides a means to structure an orderly and consistent program for improved capability within the mission area framework. It is not only a planning document but serves the added purpose of being a program management tool. It assists in structuring modification programs for existing systems and aids in the comparison of alternative systems. All this leads to an improved capability that can be related to other mission area requirements.

The old bugaboo of fiscal constraints is an extremely important factor in each master

plan. If all the desired modifications to all systems were to be accomplished, the required funding would far exceed any reasonable projection of available modification funds. The individual master plans formulated within the mission area framework provide a means of measuring the total requirements against project funding and of trading off alternatives within and between mission areas.

Force and Program Guidance

The goal of our development planning efforts is to provide force and program inputs; that is, dollars must be allocated to RDT&E and procurement programs in order to bring into being any of the capabilities advocated in our development planning activities. I want to emphasize that we see program guidance as an end product of our efforts, not as the input. Our whole methodology is based on the premise that we can measure, even if only qualitatively, the force impact of structuring RDT&E, new system acquisition, and modification programs; hence, we are able to provide the guidance leading to the most cost-effective force. Primarily we are concerned with the out-year capabilities we will have in the force as the result of those hard decisions we must make today.

We propose not only alternative programs but alternative funding levels and the force capability impact of each. These are structured within the mission framework and based on the best analysis we can bring to bear in our mission area studies, concept studies, and master plan efforts.

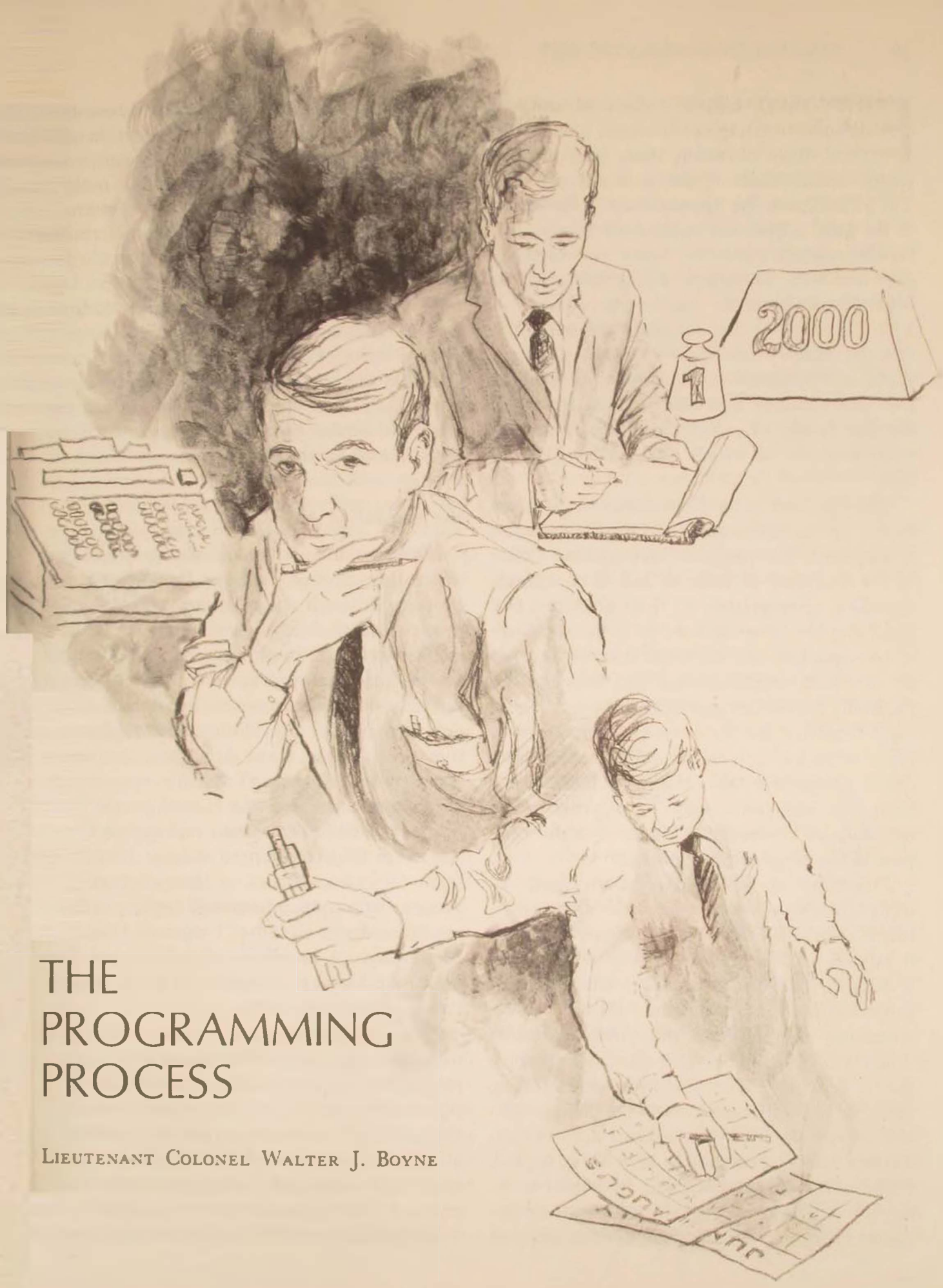
Our participation in the various decision elements—such as the Force Structure Committee, Program Review Committee, and Air Staff Board and Panel—provides the means for implementing our way of doing business. What we bring to these groups is a framework for decision-making. In turn, we receive guidance based upon an examination of the whole force problem, rather than merely a chain of decisions on individual programs. This increases the perspective which we bring to bear on our mission area analyses. Not only are immediate force implications developed; long-range force and fiscal implications are brought more clearly into focus through these development planning efforts.

In his cited article, Major General William G. Moore, Jr., cautioned against the belief that "black magic" is involved in our development and acquisition sequence. I too want to make it clear that we are not attempting to pull rabbits out of a hat. What I have been talking about is a process, a way of doing business, that involves every element of the Air Staff and each of our major commands. Ours certainly is not a new attempt, for we have embarked on our course in development planning fully aware of the many studies and attempts that have preceded us. I see our approach as a viable means to making some sense out of the "requirements jungle." It is one in which we must inject some order if the Air Force is to move out in the decade ahead with weapon system capabilities that make major contributions to force effectiveness. It is a process that can add perspective for the "blue suit" decision-makers who must make the hard decisions that face us in the fiscal environment projected for the next five to ten years. This approach is well under way, and through it I feel we in the research, development, and acquisition community can, along with our Air Force-wide counterparts, make a dynamic contribution to future Air Force effectiveness.

Hq United States Air Force

Note

1. Colonel Geoffrey Cheadle, "What Is an Operational Requirement?" *Air University Review*, XIX, 2 (January-February 1968), 44–50; and Major General William G. Moore, Jr., "Equipping Tomorrow's Force," *Air University Review*, XXI, 1 (November-December 1969), 69–76.



THE PROGRAMMING PROCESS

LIEUTENANT COLONEL WALTER J. BOYNE

FIFTY-TWO billion dollars is still an almost unimaginable sum, even in these days of moon shots and a forecasted trillion-dollar gross national product. Yet 52 billion is the approximate dollar value of the total acquisition costs of all aircraft and missile systems currently being procured by the Air Force. The scope of this vast procurement ranges from the routine purchase of an $18,000 single-engine training aircraft for a friendly country's air force under the Military Assistance Program to the enormously expensive and complex task of procuring the Minuteman family of missiles, the life-cycle procurement cost of which approaches $17 *billion*.

The Air Staff gives dimension and direction to this procurement activity. On the one hand it shepherds the program through the Office of the Secretary of Defense and Congress, responding appropriately to their guidance and justifying the program's share of the resources to be expended. On the other it must transmit to the field implementing instructions that faithfully follow this guidance yet permit sufficient flexibility for the operational elements to react to changing conditions. Providing adequate perspective on which to base these instructions and from which to respond to the demands of reviewing authorities is the purpose of the programming process.

Programming is basically simple and orderly when viewed apart from the almost continuous series of changes and exercises that constitute the facts-of-life environment. Programming consists of deciding what the appropriate production schedule should be, determining the cost of the weapon system under this schedule, and balancing the programs to achieve a feasible fiscal year funding pattern. In a laboratory situation this presumably would be done once a year, and weapon systems would issue forth in a tidy, logical, economically funded stream. In actual practice the stresses of the real world upset the laboratory ideal, and thousands of combinations of schedules and costs must be prepared to anticipate problems arising from changes in the economy, shifts in military requirements, or new political decisions. The recent budget cuts are a case in point; a number of alternative programs had to be explored to determine what the optimum procurement program for the Air Force should be.

The basic planning papers that result from the procurement programming process provide a series of bench marks against which alternate procurement programs can be measured. They assist decision-makers in reducing what is desirable to what is possible in terms of time, money, and production capability.

the scheduling process

Ultimate procurement is always considered in the planning of even the most exotic R&D project, although the mundane constraints of material availability, production capability, and financial feasibility may not intrude until the project develops more fully. It is not until the aircraft or missile system becomes a candidate for inclusion in formal force planning that the planners must determine the actual numbers to be procured and the annual buying increments. The first formal presentation of a proposed force element will appear in the Air Force Objective Force and the Joint Strategic Objectives Plan; as the program progresses, the proposed force will appear, often in modified form, in the Program Objective Memorandum, the Force and Financial Program, the Five Year Defense Program, and, of course, the budget.

One essential basis for these documents is the production schedule, which is simply a proposed plan for building the system at a certain rate over a certain period, to deliver the previously determined number of weapons at a certain time. All aircraft and missiles have such schedules, which are used at all levels of the Air Force for planning purposes.

Early efforts to develop a production sched-

ule are usually geared to the tentative Initial Operational Capability (IOC) of the system. The IOC is the target date when the first operational unit is expected to receive a sufficient number of weapons to undertake its mission. Many factors determine the target IOC, including the degree of research and development still required, contractor success in meeting project milestones, fiscal year funding considerations, and the production capability available. Any of these could cause a shift in the IOC, with immediate impact on both schedules and costs.

The production schedule itself is determined by several variables: the type of system, the nature of the contract, lead time requirements, the production rate decided upon, and the priority assigned to the project. Of course the more complex a system is, the more likely the duration of production is to extend the schedule.

The type of contract and the conceptual approach to the weapon system also affect the production schedule. A high-risk system might call for a cost-plus-incentive-fee contract, and a production scheduler would be inclined to start production at a low rate and allow it to build up gradually. Thus any unexpected difficulties could be resolved at minimum cost. A lower-risk system (an off-the-shelf aircraft, for example) might be procured with a firm fixed-price contract, and the schedule would be determined by other factors. For very advanced systems, a "fly before you buy" plan is sometimes used. With this plan, more time is required prior to beginning production than with a concurrent development system, where production can be undertaken prior to completion of R&D. In the former case, production rate may be accelerated earlier after production commences, because of the confidence established by the prototype's flight-test program; in the latter, the production tempo may be restrained to insure that R&D developments can be incorporated at minimum cost.

The lead time requirements for the production schedule vary directly with the sophistication of the system and its size and intended life cycle. A purely state-of-the-art aircraft usually can be assumed to have an 18- to 24-month lead time. An advanced system—the B-1, for example—may have a longer lead time, and certain of its components, such as avionics, landing-gear forgings, and the like, may have even longer lead times than the weapon system itself.

These items are accommodated to the schedule by means of an advance buy. This is a request in the President's budget for money in advance of the fiscal year in which the weapon system will be purchased, to be used for those specific line items of equipment that have the longer lead times. This method permits adherence to the concept of full fiscal year funding without tying up the entire program's funds for the time required to obtain the pacing items.

Production rate is a product of many factors. Physical circumstances—the size of the system, plant, and work force—determine the upper limit of production rate in some instances, while available finances determine it in others. At the other end of the continuum, rates must be at least high enough to enable the contractor to retain a reasonable work force, establish economic working relations with subcontractors, and so forth. Ideally the rate will begin slowly, to minimize the inevitable interruptions incidental to training a work force, processing new materials, and insuring supplier deliveries. It will then build to an optimum rate that will achieve the adjusted IOC at the least cost, by using the plant at its most efficient level of production.

Sometimes the urgency of the requirement for the system to meet a projected threat overrides cost considerations, and a higher-than-optimum production rate will be called for to advance the IOC. (Obviously, production rate is not the only means for accelerating production; procurement concepts can be revised, contract provisions can be altered, higher

priorities can be assigned, and so on.) Conversely, financial constraints sometimes overbalance the requirements for a specific IOC, and the delivery schedule is reduced accordingly.

Once the production schedule is decided upon, the quantities to be procured in each fiscal year can be determined. This is a mechanical process, colloquially called "ticking." To illustrate, assume that procurement action for a certain aircraft or missile is initiated in FY 1972. If the system has a typical lead time of 24 months, the production schedule will show deliveries beginning in FY 1974. (By convention, new systems are assumed to begin production on 1 October rather than 1 July of the fiscal year, to allow some tolerance for the time required to achieve a "go ahead" from Congress.) The number of aircraft procured from FY 1972 funds will be the number delivered from October 1974 to September 1975; the aircraft procured from FY 1973 funds will be those delivered from October 1975 to September 1976, and so on.

Of course, if the appropriation is less than that requested, the quantities procured during that year will be reduced. Moreover, depending upon Congressional attitudes toward the overall program, the intended production schedule may be either curtailed or stretched out over a longer period of time to achieve the ultimate quantity desired. This process makes clear the numbers to be procured in each fiscal year and indicates the impact of the system on the future budget years.

the costing process

Costing is much more complex than the scheduling process. With a sophisticated new system, it is perhaps more an art than a science. Fundamental to this process is the use of parametric studies that determine the probable envelope of costs for a system postulated to have certain capabilities and characteristics. These studies are based on both experience and judgment and make use of cost data accumulated from earlier procurement cases. They serve as a vehicle for considerable discussion and planning during the RDT&E phase of the program. The methodology for creating a parametric study is well established, and a considerable body of literature on costing is available.

Initial costing is normally performed for the Air Staff by Air Force Systems Command (AFSC). Revisions to the predicted costs are forwarded to the Air Staff as more is learned of the system. In past years these cost studies and reports were based primarily on contractor inputs, but recent emphasis has been placed on developing an independent cost-estimating capability within AFSC.

The requirement for cost information is acute at all stages of a system's development, but it becomes even more urgent as the system matures in the acquisition cycle. Should the program come under fire for cost growth or performance deficiency, the details and history of the costing become absolutely critical.

The basic costing data are developed by the field from many varied sources—records of direct labor/hour costs, estimates of machining exotic metals, examination of contractor records, and so forth. The information is presented to the Air Staff in various formats, including AF Form 1037 and AF Form 1537. For most costing purposes, the data are synthesized into a costing worksheet. Totals and subtotals are extracted from the worksheet to provide information for a variety of management reports, briefings, memorandums, and so forth. Most commonly used of these are

Unit Recurring Flyaway Cost
Gross Flyaway Cost
Gross Weapon System Cost
Unit Production Cost
Unit Program Cost.

Figure 1. A hypothetical costing worksheet

The *Unit Recurring Flyaway Cost* shows the cost of the airframe, propulsion, armament, electronic fire control, and similar air-vehicle items. Airframe is usually the most significant cost element, and initial cost studies are frequently based on the aircraft's AMPR weight (for *A*eronautical *M*anufacturer's *P*lanning *R*eport).* This weight is multiplied by a dollar factor that is usually based on historical data of recent similar airframes. Yet another factor based on aircraft size, type, and capability is multiplied by this AMPR weight/dollar figure to compute an initial cost starting point.

The remaining items of recurring flyaway cost are estimated independently of AMPR weight. Engine costs are usually easy to develop, as the manufacturers generally have anticipated requirements and have an estimate based upon a comprehensive data base.

Unfortunately, this sequence does not apply to avionic and electronic subsystems, the development of which usually parallels the airframe development. Sufficient historical data exist to permit crude cost estimates on a "per pound" basis, but they may be several hundred dollars off per pound on an existing production unit and tens of thousands of dollars off per pound on a purely experimental

* AMPR weight: The empty weight of the aircraft less the (1) wheels, brakes, tires, and tubes; (2) engines; (3) starters; (4) cooling fluid; (5) rubber or nylon fuel cells; (6) instruments; (7) batteries and electrical power supply; (8) turret mechanisms; (9) remote sighting units; (10) air-conditioning units; (11) auxiliary power plant; (12) trapped fuel and oil. Engine manufacturers have historically developed products in advance of military requirements, either through independent research or for the civilian market.

WEAPON SYSTEM A-9				ULTIMATE FORCE AND UE 8 SQ / 24 UE				REF FY 72 OSD BUDGET		DATE 10 JULY 70
	FY 72	FY 73	FY 74	FY	FY	FY	FY	FY	FY	TOTAL
QUANTITY	50	120	110							280
UNIT AIRFRAME	2.070	1.290	1.010							1.319
UNIT PROPULSION (SHIPSET)	.370	.290	.260							.293
UNIT ELECTRONICS	.420	.370	.350							.371
UNIT ARMAMENT	.040	.035	.033							.035
UNIT OTHER	–	–	–							–
%/UNIT COST	8 .232	6 .119	4 .066							5.8 .118
UNIT REC FLYAWAY	(3.132)	(2.104)	(1.719)							(2.136)
TOTAL REC FLYAWAY	156.6	252.5	189.1							598.2
NON-RECURRING	50.0	25.0	5.0			UNIT EQUIPAGE (UE)		192		80.0
GROSS FLYAWAY	206.6	277.5	194.1			TRAINING AIRCRAFT		30		678.2
(UNIT GROSS FLYAWAY)	(4.132)	(2.312)	(1.765)			COMMAND SUPPORT ACFT		22		
MOBILE TRAINING SET	(10.0)	(9.0)				ATTRITION AIRCRAFT		36		(19.0)
(QUANTITY/UNIT COST)	1 10.0	1 9.0				TOTAL		280		
SIMULATOR	(12.0)	(10.0)	(3.2)							(25.2)
(QUANTITY/UNIT COST)	2 6.0	2 5.0	1 3.2							
OTHER DEVICES	(1.0)	(.9)	(.8)							(2.7)
SETS										
OTHER										
TOTAL TRAINING	23.0	19.9	4.0							46.9
DEPOT AGE	(10.0)	(3.0)								(13.0)
SQUADRON AGE	(10.0)	(20.0)	(10.0)							(40.0)
OTHER	(5.0)	(5.0)								(10.0)
TOTAL AGE	25.0	28.0	10.0							63.0
TECH ORDERS & MANUALS										
ENGINEERING MGMT DATA										
OTHER										
TOTAL TECH DATA	10.0	4.1	3.8							17.9
TOTAL PECULIAR SUPPORT	58.0	52.0	17.8							127.8
GROSS WEAPON SYSTEM	264.6	329.5	211.9							806.0
(UNIT GROSS WEAPON SYSTEM)	(5.292)	(2.746)	(1.926)							(2.879)
FY ADVANCE BUY CREDITS		-21.8	-18.6							-40.4
NET WEAPON SYSTEM	264.6	307.7	193.3							765.6
ENGINE	(14.8)	(11.6)								
(QUANTITY/UNIT COST)	40 .370	40 .290								
OTHER	(7.0)	(7.0)								
ADVANCE BUY	21.8	18.6								40.4
TOTAL AFSC REQUIREMENTS	286.4	326.3	193.3							806.0
INVENTORY CREDITS										
OTHER ADJUSTMENTS										
TOTAL AFSC FINANCING	286.4	326.3	193.3							806.0
INITIAL PROC SPARES	21.6	46.9	30.5	7.1						106.1
TOTAL	308.0	373.2	223.8	7.1						912.1

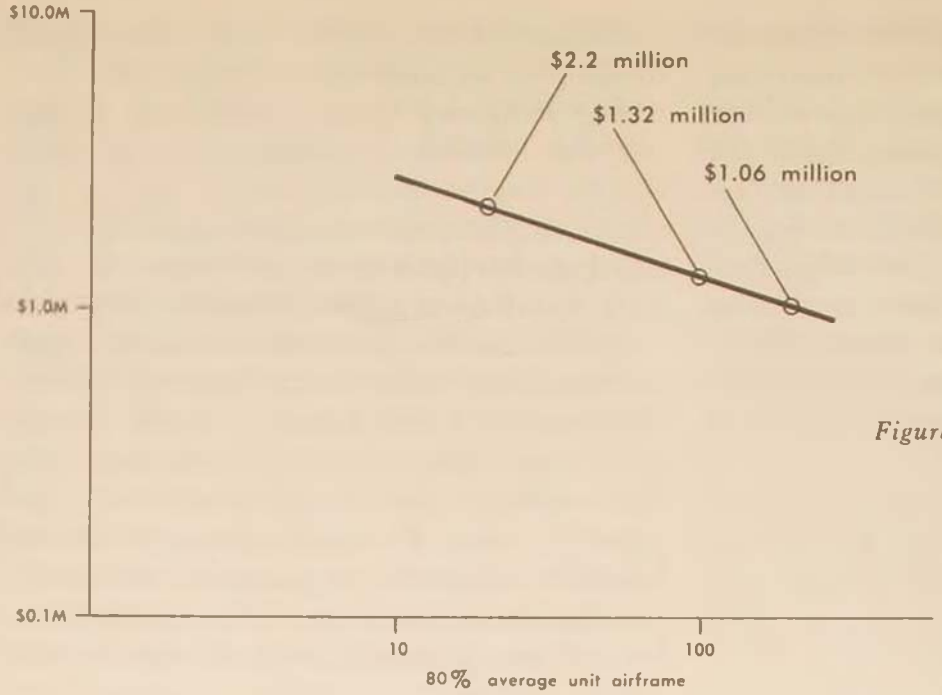


Figure 2. Eighty percent learning curve

item. For example, a new radio receiver might be estimated to weigh 15 pounds; because it is a relatively simple system, its cost might be estimated at $900 per pound, or $13,500. On the other hand, a classified system of great complexity might weigh 150 pounds and its cost estimated at $15,000 per pound. The cost analysts realized how important it is to achieve greater accuracy, and they continually refine estimates as hard data become available. However, intuitive judgment frequently assumes paramount importance.

"Nonrecurring" costs, the costs not considered to be related to production quantity variation, are based on contractor capability, AMPR weight, ultimate tooling requirements, and historical data. They are computed next and added to the recurring flyaway cost to determine the *Gross Flyaway Cost*.

Other elements of cost—peculiar aerospace ground equipment (AGE), publications data, training—are initially developed as a percentage breakout of the development and production cost, based on experience and refined with empirical data. Together they constitute the cost element labeled "Peculiar Support," which, when added to the Gross Flyaway Cost, results in *Gross Weapon System Cost*.

Unit Production Cost is made up of the Gross Weapon System Cost plus the cost of initial spare parts, divided by the total number of production items. *Unit Program Cost* is made up of the costs of the gross weapon system, initial spares, research and development, and military construction, divided by the total number of production and R&D items.

One other costing element that is important to aircraft and missile procurement is the impact of production experience on the unit cost of the system being produced. There are economies to be achieved in series production, of course, and the 100th production article can be expected to cost less than the 50th, the 200th less than the 100th, and so on. About 35 years ago T. P. Wright, an engineer and executive with the Curtiss Aeroplane and Motor Company, formulated the idea of decreasing direct labor costs with an increase in the number of airframes produced.[1] Extensions of this concept have since gained almost universal acceptance in the aircraft and missile industry under the popular term "learning curve."

A plotted learning curve may show that as the quantity of units is doubled, the cost de-

clines to 80 percent of the previous cost. For instance, at 100 airplanes the unit average cost may be $1.32 million, while at 200 airplanes the unit average cost may be $1.06 million.

If the program should be curtailed to 20 aircraft, the unit average cost may shoot up to $2.2 million. This relatively simple fact of life has occasionally been the cause of much concern and has puzzled planners when a drastic cut in procurement quantities did not result in a large saving in production costs.

The learning curve is used with other data in the costing process to determine by an iterative process the costs of alternative buy programs.

the end result

The scheduling and costing activities that make up the procurement programming process directly support the overall planning, programming, and budgeting (PPB) cycle. Initial efforts for the very long-range planning of the Joint Strategic Objective Plan are limited in accuracy to the data available and to the degree that proposed systems have been defined.

As the PPB cycle progresses, so does the system, and successive requirements for more accurate data are matched by development of new inputs from the field. During this period these inputs are used in the hundreds of alternative programs which the Air Staff prepares to meet contingency and emergency situations. As competition for scarce budget dollars in a particular fiscal year intensifies, the competing systems must show cost effectiveness in briefings and reviews where successful demonstration depends in large part on the quality of the cost estimates. Where a "micrometer on a dough ball" may have been all that was possible at the earliest stage of a program, the later presentations must be as accurate as humanly possible, and all doubtful areas must be signaled with the appropriate caveats.

The moment of truth for the whole procurement planning cycle occurs before the House and Senate Authorization and Appropriation Committees. It is here that the changes in costs and schedules must be explained in depth and detail. There must be a clear path from decision point to decision point. All the prior efforts of the Air Force, the Department of Defense, and the Office of Management and Budget must bear the examination of the seasoned experts of the Congressional staff.

Not only must the proposed procurement program be explained and defended; the rejected alternatives must also be described in detail, including the rationale for their rejection. All of the voluminous supporting material must be consistent and credible and must have a clear audit trail.

The procurement programming function, simple in concept, is complex in execution, for it must provide forward planning and in addition maintain a clear record of past decisions. It is the handle by which the Air Staff grips the conglomerate mass of decision factors to arrive at orderly programs. It is a prime factor in all procurement decisions, serving both as a data source and as a communication link within the Headquarters.

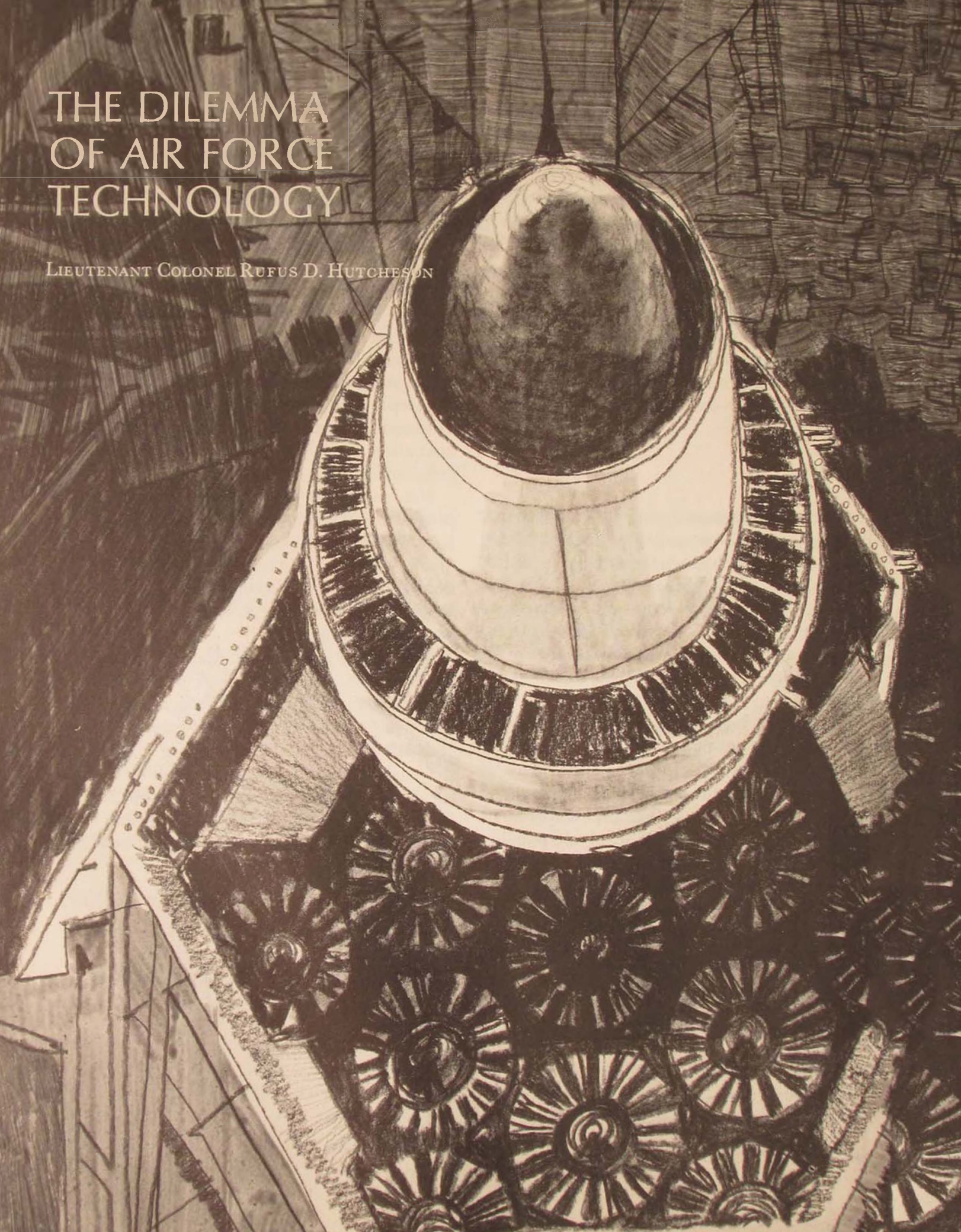
Hq United States Air Force

Note

1. T. P. Wright, "Factors Affecting the Cost of Airplanes," *Journal of Aeronautical Sciences*, vol. 3, February 1936, pp. 122–28.

THE DILEMMA OF AIR FORCE TECHNOLOGY

Lieutenant Colonel Rufus D. Hutcheson



As Secretary of Defense Melvin R. Laird told congressional committees in February and March 1970, one of the most serious threats to the United States is posed by the large and growing military research and development program of the Soviet Union. Of course, the specific impacts of this program on our future security are not known, but it is evident that the Soviet government is investing heavily to develop capabilities that threaten us, whatever its intentions may actually be. In fact, in recent years Soviet military technology efforts have been growing at a more rapid rate than ours. A dramatic reminder of this is being provided on a daily basis in Vietnam, where the technical superiority of our weapons so evident twenty years ago in Korea is now no longer apparent.

Reversing this unfavorable trend in selected areas of the relative U.S.–Soviet technological strengths is one objective of the Air Force technology program. With all basic research, exploratory development, and the non-systems-oriented advanced development incorporated in the program, it comprises our "technology base," from which future systems and improved component technologies can be constructed. At Headquarters USAF the fiscal programming and overall resource management for this base are accomplished with assistance from specialists who have spent most of their professional lives in the technology program. The work of these staff members is paced by the realization that our technology base must expand in those areas critical to the relative capabilities available to the United States and her most likely enemies. Only by this means can we be assured that our future weapon systems will be of sufficient quality and timeliness to counter any threatening enemy innovations.

purposes of technology

Our technology base is expanded in two ways—or, more properly, in pursuit of two purposes. The first is to satisfy near-term needs for particular capabilities, either through engineering support to systems and subsystems or through advancing technology that improves the capability of a system already in operation or under development. For example, once the feasibility of the oxygen concentrator had been proved during exploratory development, the program progressed into engineering development under the Life Support System Program Office. The oxygen concentrator is a device that produces breatheable oxygen during flight and therefore eliminates the need for all the ground support equipment currently used to provide breatheable oxygen for crew and passengers. Additional development is currently under way to apply the oxygen concentrator to existing aircraft systems.

The second way of expanding our technology base is through efforts to achieve long-term incremental gains in fundamental technology areas which give promise of future utility. Thus, not intended to augment a potential system, this work is undertaken because experience has shown that advancements in these areas are likely to have application to future systems, as yet undefined. In actuality, however, one process supports the other; today's long-term efforts make possible tomorrow's short-term programs.

The turbine engine technology program is an example of this interaction. Many years ago one of the world's outstanding scientists determined what was needed to improve the thermal efficiency of our heat engines. Three things were necessary: (1) to increase the pressure ratio; (2) increase the operative temperature of the cycle; and (3) improve the efficiency of the components. These elements are shown in Figure 1, where each cycle operating temperature line represents a series of engine designs with the assumed component efficiencies but at different cycle pressure ratios. The shape of the curves is a function of

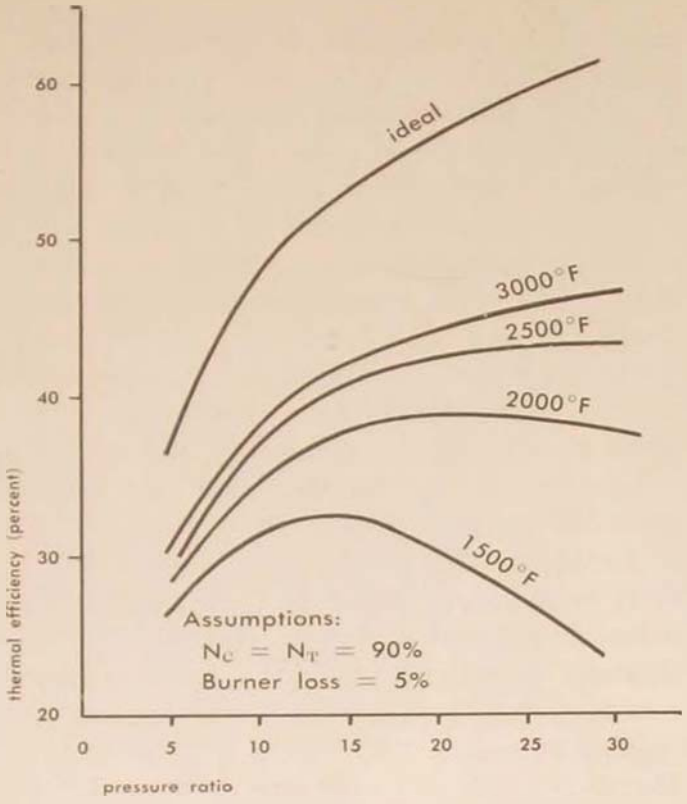


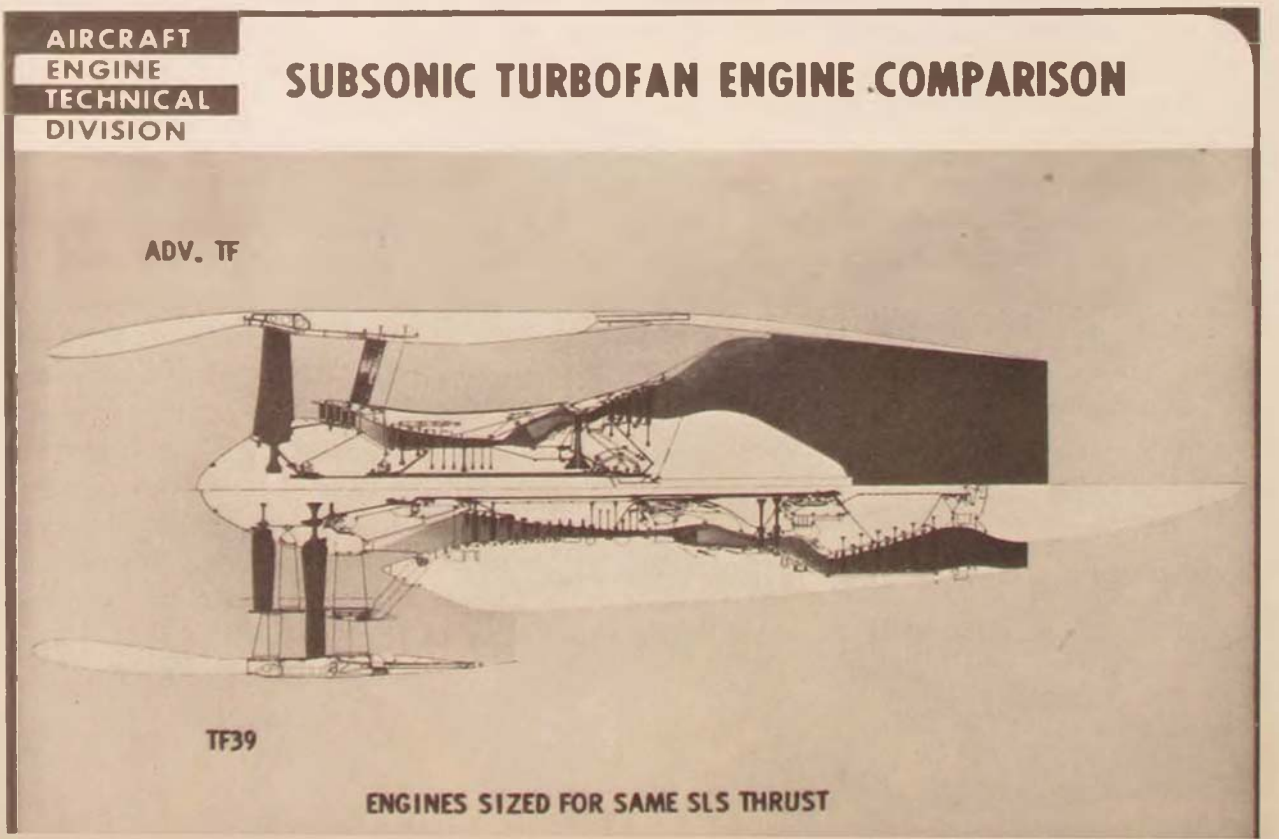
Figure 1. Improving thermal efficiency of engines

component efficiency, and the ideal line represents 100 percent component efficiency.

In the 1950–55 time period the metallurgical temperature limit of the turbine was believed reached, and a plateau for efficiency improvement was acknowledged. This plateau existed, with only slight engine performance improvements, through 1965. In the meantime turbine technology effort continued in the area, among others, of heat transfer in turbine components. It had proceeded far enough by 1965 to support the decision to develop a new-technology C-5A engine with an air-cooled turbine. With acceptance of the cooled turbine, a completely new and very exciting exploitation of gas-turbine technology was made possible. Currently, we have identified and documented enough new high-payoff efforts needing demonstration to use up our projected resources for the next ten years.

Other areas of gas-turbine technology have also moved forward to the point where engine application is now possible. For example, Figure 2 shows a line drawing of two different

Figure 2. Advanced gas-turbine technology is incorporated in the paper-design engine (shown above center line) to improve specific fuel consumption, among other things. If built and installed in the C-5A in place of the TF39 engine (shown below line), it is calculated to reduce the weight by 100,000 pounds.



engines. The top engine represents a paper design. The bottom one represents the TF39, which was developed for the C-5A. The TF39 engine had its component performance technology frozen in 1965 to allow for the development of an engine. In January 1970 we asked General Electric to paper-design a new engine for the C-5A aircraft. That is the engine drawn above the center line. In five years, fan technology has advanced so that we can now do the job in one stage instead of one and a half; we can have an 11-stage compressor instead of one of 16 stages; we can also use a shorter combustor, a one-stage high spool turbine instead of two, and a three-stage power turbine instead of six. If this advanced paper-designed turbofan engine were to be built and installed, with its improved specific fuel consumption and lighter weight, rough calculations indicate that the aircraft would weigh 100,000 pounds less at maximum gross weight than the current C-5A. This new, improved technology base is available for the short-term development of all gas-turbine propulsion systems and is being used in the F-15 and B-1 propulsion systems.

source of the dilemma

While the current long-term efforts serve eventually to support future short-term programs, the existence of these two purposes for our technology program is the source of an inherent conflict. The competition between long-term and short-term interest for available resources intensifies the conflict. The problem is how to accommodate one adequately without damaging or mortgaging the other. It is not a new problem. Ten years ago the solution was to separate in-house laboratories into organizations of their own, in which the immediate pressures of systems support would not submerge the technology efforts for the future.

During the recent period of reduced defense spending on technology, the viability of this solution has been questioned. The Director of Defense Research and Engineering, Dr. John Foster, recently expressed "serious concern that the DOD in-house laboratory technical expertise is not being applied in full measure to the technical problems which are encountered during the development of new operational systems." Assistant Secretary of the Air Force (Research and Development) Grant L. Hansen pointed out in response to Dr. Foster's concern that there are still serious problems in transferring technology into operational systems and in bringing expertise to bear upon the problems of systems acquisition.

Therein lies the dilemma: To what extent should we direct our limited resources toward near-term systems work, realizing that in doing so we are detracting in some measure from technology that could have significant long-term impact? The choice hinges, among other things, on the time we are willing to invest before our operating forces receive a direct benefit from our technology program. The nature of this choice is sometimes difficult to determine. Frequently, for a new system, the Initial Operating Capability (IOC) date and the date when component design is frozen vary with national priorities and funds available; moreover, the date when new technologies will be available for systems use is largely dependent upon the effort expended. Thus, we often find that through greater effort on new and promising technologies we may be able to incorporate them into our newest systems.

current opportunities for system application

There are several areas of technology that currently offer significant opportunities for further exploration and application to systems engineering. One area that could pay off dramatically for future applications is laser technology. A decade ago, breakthroughs in lasers touched off intense effort directed towards finding applications for this newfound technology while simultaneously attempting to im-

prove the efficiency, expand the choice of frequency spectrum by use of new materials, and increase the power of these devices. The entire world became aware of one laser application when the astronauts placed reflectors on the moon and scientists successfully received the reflected light and made accurate distance checks. Military uses of this new technology are, for the most part, highly classified, but it is evident that the technology will find its way into future weapon, communication, and reconnaissance systems as well as numerous support functions.

Technology already having application in system development is exemplified by composite materials using boron or graphite fibers. This may be the most significant materials development in recent years. Successful static and fatigue tests on the F-111 stabilizer, which uses this technology, indicate that full demonstration of advanced composites is possible in flightworthy hardware. The success of this program has led to the prediction that weight savings of 30 to 50 percent may be possible in some aircraft by 1980. It must be remembered, however, that several years ago a decision was made to press on with the composite program at the expense of a program in beryllium structures because composites appeared to provide more options to the system designer.

A technology needing an equally committing decision now is the fly-by-wire approach. Since the start of the air war over North Vietnam, considerable technical effort has been given to the problems of aircraft survivability. On 12 December 1967 the first successful test flight of a single-axis, fly-by-wire system was completed on a B-47 aircraft by the Air Force Flight Dynamics Laboratory (AFFDL). Fly-by-wire means the complete replacement of the mechanical linkages between the pilot's stick and the control surface actuators by electrical signal wires. Its advantages are many: decrease in vulnerability and increase in flight control system reliability, design and installation savings, weight savings, volume savings, reduction in maintenance, and immunity to aircraft structural changes due to flexing, bending, and thermal expansion. Technically and operationally there seem to be no disadvantages. Reluctance to change appears to be the major obstacle to applying fly-by-wire technology in new systems.

constraints on technology development

There is little question that tomorrow's Air Force will be built on technology being developed today, regardless of the purposes for which the technology effort was originated. However, while this has become recognized almost as a truism, it does matter considerably how that effort is designed and directed. In particular, as we carry out a useful and comprehensive program to build our technology base, we must be conscious of certain real and powerful constraints.

First, we need to keep in view the distinction between knowing "what to do" and determining "how to do." In the example of the gas-turbine engine, even though we knew "what to do" to improve thermal efficiency, it took many years to learn "how to do" it in a manner amenable to the production of aircraft engines in quantity. In most technical areas which the Air Force has examined, the "what to do" is a well-established part of human knowledge, whereas the accessibility of "how to do" is largely a function of how intensely our resources are applied.

We also need to recognize that even new technology has limitations. Continuing with the turbine engine example, the gas-turbine cycle has real technical limitations. We are rapidly (perhaps within 10 years) approaching stoichiometric temperatures for hydrocarbon fuels, and if another cycle and fuel are not identified another technological plateau will be reached. Even though the need is 10 years away, we must be looking for the answer and conducting the necessary experiments to define the potential candidates. It should be re-

membered that it has taken almost twenty years to bring the air-cooled turbine technology from basic research through engineering development. It will not become old technology until we complete five to ten years of service operation and accumulate millions of hours of service.

When a technological barrier or plateau is reached, we need to be able to pursue effective alternatives. For example, since 1961 rocket-propulsion chemists have been attempting to add hydrogen to fuels and fluorine to the binder systems of solid propellants in order to continue the upward trend in specific impulse. They have met with only limited success in their attempts to characterize a new, widely usable, high-energy propellant. No major breakthroughs are on the horizon. Researchers are probing the frontiers of knowledge, expanding our technology base in the chemistry of rocket propellant propulsion, searching for something that would make possible more than incremental gains. But weapon systems cannot wait for possible breakthroughs, or even incremental advancements. For this reason, a second front has been opened to skirt the propellant specific-impulse problem and attack rocket hardware as a means of improving the systems. The point is that, when an area of technology appears to be up against a technological barrier or seems to be on a technological plateau where large resources will be needed to produce incremental gains, then coordinated technology programs are needed to probe the most likely avenues through the barrier, while supporting the development of alternate approaches to the solution of the problem. The "brute force" approach to systems development is defensible only when time has run out, when our technology base is inadequate, and when national survival may depend on the system operation.

Last, but not least, we need to deal effectively with reduced fiscal support. For the foreseeable future this will present a problem of major consequence and one which cannot be avoided. Although not all the problems harassing today's Air Force technology program stem from recent funding trends, the management and execution of the program depend heavily upon the dollars available. The program has suffered from major funding reductions in recent years. These reductions become even more noticeable when the totals are corrected for inflation.

The research program has suffered proportionately the least reduction in recent years. It also seems to have considerable national support. For example, President Nixon's task force on science policy has recommended "a near-doubling of the nation's basic science research budget and new emphasis on defense research even at the expense of current military hardware development." Even if scientific and technological competence must be financed at the expense of current weapons procurement, the panel felt that probable long-range gains would be worth the short-range risks. This kind of support for military research, combined with the growing interest in increasing the efforts of the National Institutes of Health and the National Science Foundation, should help to maintain a healthy foundation of scientific research on which technological exploration can be based.

By itself, however, scientific research does not assure us of the capability to react to technological advancements displayed by the enemy or to initiate technological advancements of our own. The exploratory development program is primarily responsible for these technological advancements.

It is interesting to examine what we have done with the approximately $230 million allocated during each of the last four years to exploratory development. This year about $100 million will be used for civilian personnel payroll, benefits, travel, and laboratory housekeeping. And $12 million will support laboratory efforts at Arnold Engineering Development Center, where laboratory products

undergo environmental tests in wind tunnels and space chambers. The remaining funds, slightly over $100 million, are available for contract with industry, universities, and other organizations possessing R&D capability. Five years ago more than twice this amount was available for contracts. To accommodate this reduction, there has been a general elimination of funds for the more speculative, long-term endeavors which are not directly tied to a projected weapon system but which are necessary for the advancement of our technology base. In addition, the laboratories have nearly eliminated several areas of technology, such as hypersonic vehicle technology, ground and space support equipment, liquid rocket propulsion for air-launched missiles, space environment measurements, and many more.

Of the three technology program categories, advanced development programs have received the most severe reductions in recent years, and these reductions may hold a key to the dilemma of today's technology program. There are two general classes of advanced development programs: technology-oriented and systems-oriented. The technology-oriented advanced development programs bridge the gap between component demonstration in exploratory development and concept formulation in systems-oriented advanced development programs. In many exploratory development efforts, such as the ramjets, air-cushion landing gear, aircrew escape and rescue, and controllable solid rocket motor, feasibility has already been demonstrated. Furthermore, it appears that system developers are aware of the performance potential that has been offered.

resolving the dilemma

One may reasonably question why advances in technology already demonstrated have not been used in system development programs. As usual, there is no simple answer, and the solutions provided by managers of technology programs would probably differ considerably from those developed by systems acquisition managers. The answer may sometimes lie in the fact that, although some part of a system has been demonstrated, the entire system may not have been adequately demonstrated. In other instances, demonstrated capabilities may not be used because of more nebulous questions, such as those pertaining to roles and missions, disarmament, or international political developments.

One related factor affects all programs—it might be called an economic deterrent to innovation. System program directors, who have the primary responsibility for new systems acquisition in the Air Force, are under growing pressure to perform on time and within their allocated funds. Hence, cost growths resulting from improved capabilities, increased development time, or program expansion are studiously avoided, and system program directors are constrained not to incorporate anything new unless it is absolutely necessary, and then only if the new technology has been amply demonstrated in a near-operational environment.

This economic deterrent to innovation would not, under normal circumstances, be a major deterrent to the incorporation of the latest technology. An aggressive, well-funded, technology-oriented advanced development program would bridge the gap between technology and new weapon system development. For example, the Advanced Turbine Engine Gas Generator (ATEGG) program has demonstrated, in a true propulsion systems environment, the advanced turbine engine components already described. It has thereby permitted the use of this advanced technology for the F-14, F-15, and B-1 development programs. Unfortunately, equivalent programs have not been established in other technical areas, and usually system program directors are faced with the dilemma of developing their systems by using components and subsystems that are either well demonstrated but obsolescent or undemonstrated but innovative.

Exploratory Development

Among the many products of exploratory development that have demonstrated feasibility are the air-cushion landing system (shown in takeoff of LA-4 aircraft, above) and an apparatus for aircrew escape and rescue (shown in artist's concept at left). Their use in operational systems may depend on solving various problems that constitute the technology dilemma.

It is evident that the technology dilemma is aggravated significantly by reductions in the research, development, test, and evaluation (RDT&E) budget. What, one may well ask, is resource management doing to cope with this situation? Briefly, we are reducing our in-house operating overhead, concentrating our efforts, and applying available contract resources to the areas of maximum payoff—trying to make every nickel in the technology program count. We are engaged in a variety of management efforts to get the most from the technology dollar.

The relevancy of research to future systems has been strengthened by the recent reorganization which brought the Office of Aerospace Research (OAR) under Air Force Systems Command. In the past, the OAR laboratories have maintained close liaison with the AFSC product divisions and system program offices (SPO's) by (1) a reporting procedure for describing the planned research program, the research objectives, résumés of research under way, and outstanding results; (2) formal coupling meetings, in which AFSC divisions make their needs known to the laboratories; and (3) developing Research Planning Objectives by mission area, based upon Air Force tasks and functions. In the future, close coupling at the headquarters level will increase the liaison be-

tween research laboratories and SPO's.

Of course, this liaison is not without danger to the viability of the research program. Whereas in the past, through its autonomy, OAR has been able to pursue programs based on an objective analysis of the technology involved, the increased headquarters coupling of labs and systems could tend to submerge the research program and turn it into a system support program. Although this would tend to bolster near-term systems acquisition, it could be detrimental to the advancement of technology useful in systems twenty years from now. We will attempt, therefore, to guard against such an excessive swing of the pendulum.

In the exploratory development area, we have initiated Project REFLEX, facilitating expenditure of resources in those areas considered by the laboratory directors to have the greatest payoff. This project resulted from Deputy Secretary of Defense David Packard's 30 December 1969 request for a demonstration whereby selected DOD laboratories would test the concept of using only fiscal controls instead of the combined fiscal and manpower controls now used to manage their operations. Our intent is to augment the continuing effort to get more technology for the dollar.

To date efforts to bolster the lagging non-systems-oriented advanced development have been marginal. Air Force Systems Command has developed and published the Director of Laboratories (DOL) Plan, which identifies exploratory and advanced development efforts required to meet projected Air Force needs through 1985. In this plan the technical need for several as yet unfunded advanced development programs was identified. Each spring a Joint USAF/AFSC evaluation group reviews and ranks all advanced development programs to make certain that only the most critical are funded, but the new starts that remain unfunded comprise an impressive group. Individual laboratory efforts to keep technology moving ahead include conducting an in-house demonstration of advanced ramjet technology, joint efforts with the Navy to demonstrate thrust vector control for air-launched missiles, and negotiations with the Canadians to provide a C-8 aircraft for demonstration of the air-cushion landing gear. There remains available an important opportunity for management innovations to smooth the transition of new programs from exploratory development into advanced development on a coordinated, technology-wide basis.

An ideal means has not yet been found, but is being sought, to resolve the conflict between near-term needs and long-term goals. Action now under consideration involves relocating certain functional engineers (e.g., avionics, propulsion, structural) who are not directly involved in systems integration and assigning them to the appropriate laboratories. The association of engineers engaged in system support with engineers engaged in exploratory and advanced development would do much to bridge the gap between technology and new operational systems.

As we approach a period in our history marked by reorienting national priorities, decreasing dollars for defense, and rebuilding national confidence in the military R&D community, we must constantly search for the equitable balance between resources for solution of near-term problems and fulfillment of long-term goals. For each system development we must determine whether national goals will be better served by selecting well-established technology that must be extended to its limit to achieve adequate system performance or by encouraging new technology that can be applied more conservatively for equivalent performance. We must also find a way to bridge the gap between technology and future weapon systems so that future programs will show increased responsiveness to the needs of the operating forces.

Hq United States Air Force

A REALISTIC LOOK AT USAF MILITARY ASSISTANCE AND FOREIGN MILITARY SALES

BRIGADIER GENERAL DONALD F. BLAKE

CONGRESS has declared that U.S. freedom, security, and prosperity are best sustained in a community of free, secure, and prospering nations. In enacting both foreign assistance and foreign military sales legislation, that body intended to promote world peace and U.S. foreign policy. It hoped to foster an improved climate of political independence and individual liberty and to improve the ability of friendly countries and international organizations to deter Communist aggresssion. To achieve these goals, Congress required that priority be given to countries in danger of Communist or Communist-supported aggression, and the legislation enacted has proven effective in furnishing equipment, training, and related support to the armed forces of friendly countries.

Following World War II the United States became an active participant in several collective security organizations formed to stop further Communist aggression. As part of this effort U.S.-sponsored programs of military and economic assistance were designed to assist the recipient nations in achieving the stability needed to preclude collapse, as the U.S.S.R. had seized eastern Europe and was threatening Berlin, the Middle East, and western Europe. Moreover this Soviet threat was compounded by the Communist Chinese take-over of mainland China in 1949 and Red China's emergence as a virulent and aggressive proponent of Communism.

In this world climate, President Truman's 1947 response to the Soviets' attempt to communize Greece and Turkey is recognized as a landmark in American foreign policy.

The European Recovery Program, more commonly known as the Marshall Plan, was developed in response to a major crisis—western Europe was on the verge of economic and political collapse and therefore vulnerable to Communism. Though the Marshall Plan was purely economic in nature, it advanced the development of a Free World military posture. It did so by laying the foundation for the revival of a European self-defense effort. Allied rearmament on the scale undertaken after 1950 would have been impossible without the concurrent economic recovery fostered by the Marshall Plan and the critical margin of military support furnished by the U.S. Military Assistance Program (MAP). Since the inception of MAP in 1950, the United States has provided equipment, services, and training to a total of 80 allied and friendly nations.

MAP's role in building Free World air forces

By strengthening the armed forces of friendly countries, U.S. military assistance also strengthens their resolve to provide more effectively for their own defense and internal security. It permits them to make a greater contribution to Free World collective security. Except for Cuba, no nation that has received U.S. military assistance since the inception of MAP has been brought under the direct control of either the Soviet Union or Communist China by force or subversion. Despite this record, there has been a steady reduction in military assistance worldwide. This reduction has produced some very hard choices in our meeting priority requirements. Nevertheless, we have met them, on the whole, because of the economic recovery and growth in a number of recipient countries. Further, in some cases the success in reducing threats to internal security has permitted affected countries to assume greater financial responsibility for supporting their own defense establishments.

The impact of this move from dependence on military assistance toward military self-reliance is substantial and measurable. Eight West Europe NATO nations with programs totaling almost $11.5 billion between 1950 and 1967 now provide entirely for their own defense requirements. Furthermore, since FY 1962 they have purchased $6.9 billion worth of U.S. military equipment.

The FY 1970 MAP budget request of $425 million for strengthening the internal and

external security of the carefully chosen recipient nations reflected two major factors: (1) support of the popular desire for economy in allocating national resources to a wide variety of competing programs; and (2) the relative priority that may properly be assigned to military assistance among the several similar or complementary instruments of U.S. security and foreign policy. Application of these criteria has produced a program designed to insure support of approved and authorized program objectives.

Since the start of the Military Assistance Program, the USAF has provided or programmed approximately 16,750 aircraft to 55 countries, including bomber, fighter, transport, helicopter, observation, patrol, trainer, and utility types. Acquisition of these aircraft, along with the associated support equipment and training, has assisted these countries in developing capabilities ranging from the maintenance of internal security to a more modern, efficient, and effective air force.

Very often one hears that military purchases are jeopardizing economic growth and fomenting arms races among underdeveloped nations. The fact that a very low percentage of total sales orders has been placed by underdeveloped countries refutes this persistent claim. For example, developed countries in Europe account for 64 percent of all military sales orders since 1962, while only 1 percent is attributable to Africa and 2.5 percent to Latin America. For years our military missions have been quite successful in persuading governments in Latin America and other parts of the world not to purchase sophisticated military hardware with funds vitally needed for development of the private sector of their economy.

Military Assistance

What it is	*What it is not*
• a key instrument of U.S. foreign policy	• economic aid
• an extension of U.S. defense posture	• development loans
• a program for providing military equipment and training	• technical grants
• a program predominantly in our own national self-interest	• food for peace
	• handout of money
	• Peace Corps
	• giveaway of obsolete equipment

foreign military sales

Foreign military sales (FMS) must be accomplished within the context of a U.S. policy of controlled and restrained minimum essential arms transfers to our friends and allies. Since one objective of U.S. policy is to accomplish a gradual transition from grant aid to sales, the military departments must not promote sales for the sake of sales either commercially or by the government. Unless specific government-to-government agreements or understandings exist, sales targets or goals are not to be established. USAF will continue to

provide, upon request of the foreign government, advice and assistance in the identification and fulfillment of valid requirements. However, specific sales proposals will be made only in response to the foreign country's request.

To the extent practicable, sales must be made through U.S. private or commercial (industry-to-government) channels. USAF's role is to assist both buyer and seller in reaching an equitable arrangement. If such arrangement is demonstrably not in our best interests, the purchase request will be considered by the Office of the Secretary of Defense (OSD) for an FMS case as an exception to this policy.

cooperative logistics

Cooperative logistics, as the term implies, is a cooperative effort of the foreign customer countries and USAF to effect follow-on spares support to participating customer countries. This must be done in a manner closely aligned to the method employed in the support of U.S. forces. We currently provide support to 12 countries under this method of FMS.

The method, approved by OSD, overcomes one big hurdle in that country-owned assets (called "equity" in the USAF inventory) can be procured and stocked for the support of one or more weapon systems. Prestockage for the purpose of sale is not authorized under other methods of support by the Foreign Military Sales Act. The prestockage feature of cooperative logistics gives it a big advantage. All aspects of support, i.e., stock level, drawdown, storage, and modification, are covered by appropriate Foreign Military Sales orders or cases.

Vietnamization

"Vietnamization" of the war has led to an enlarged and accelerated training program for members of the Vietnamese Air Force (VNAF) and to much larger materiel deliveries.

During FY 1969 plans were developed to accelerate the modernization and improvement of the VNAF as part of the present effort to Vietnamize the war. In fact, the first major step occurred earlier—in FY 1968—with the conversion of a conventional aircraft squadron to a jet aircraft squadron. During calendar years 1968 and 1969, other squadrons were converted to jet aircraft. In addition, conversion of old-type helicopters to a more modern type began.

Plans to accelerate the VNAF improvement and modernization program encompass the addition of new VNAF squadrons for increased airmobile operations, close air support, and tactical airlift. This addition of new squadrons is part of the overall U.S. plan to provide a balanced and self-sufficient VNAF force structure capable of maintaining South Vietnam's internal security. In part, these squadrons will be equipped by the turnover of aircraft and supporting equipment from U.S. units presently in South Vietnam, which will greatly decrease the cost of the improvement and modernization program. In addition, an accelerated training program was initiated in FY 1969 to enable the VNAF to maintain and operate the new equipment. By far the largest part of the training program is geared to maintaining and flying the new helicopters.

from rice paddy to cockpit

As early as October 1952, the USAF had a training mission for Vietnam. This was when the Military Assistance Advisory Group (MAAG) first assisted the French Air Force through C-47 on-the-job training for all combat squadrons. The training effort for the VNAF began with this early assistance to the French Air Force, and thus began the evolution of our training program.

With USAF assistance, the VNAF has grown from an organization with little combat capability and relatively few personnel to an efficient and viable air force with a jet-aircraft combat capability. The aircraft types range

from F-5 jet fighters, A-1 conventional fighters, and O-1 liaison planes to C-119 and C-47 cargo aircraft and jet-powered helicopters, all of which are operated and maintained by the VNAF. The support base for this force includes the Air Training Center with eight schools at Nha Trang and what is now the Air Logistics Command at Bien Hoa.

The present impetus to Vietnamize the war has led to plans for a considerable increase in the VNAF force structure. The training to support this increase is being accomplished in CONUS and Vietnam. VNAF students are given English language training in Saigon to prepare them for flying and technical training in the U.S. When they attain English language proficiency, they go to CONUS for training in the flying or technical skills needed by the VNAF in its expansion. During FY 1970 it is anticipated that some 3000 VNAF students will enter the various CONUS courses. This number will drop sharply as the VNAF expands its own schools.

It is worth pointing out here that all VNAF officers *and airmen* are volunteers. Educational requirements are 11 years' schooling for flying training, 12 years for officer technical training, 11 years for NCO's, and 9 years for airmen. These men represent a proud, determined people, and with U.S. assistance and training they are building a larger and more effective air force.

The final product of the expansion now taking place will be an air force rather heavily oriented toward helicopters. The VNAF has the air mobility mission to support the Army of Vietnam. Flying and technical training to prepare for this mission is being furnished by the U.S. Army, both in its CONUS schools and through on-the-job training in Vietnam.

internal security and counterinsurgency

In Latin America our sole interest has been in improving each country's capability to maintain its own internal security and subdue insurgent movements detrimental to the well-being of the country and its people. All our materiel and training resources have been pointed in this direction.

U.S. policy encourages Latin American armies to emphasize internal security and holds that sophisticated weapons such as jet planes, tanks, and warships are an unnecessary luxury. World War II vintage F-51 Mustang aircraft were renovated and provided under grant aid to the Bolivian government, where they have proven well suited to employment in a counterinsurgency role. Special counterinsurgency training was also made available to Bolivia. These efforts may well have helped Bolivia on her own initiative to overcome the insurgent movement led by Che Guevara. This is only one example of the results achieved by our military assistance throughout Latin America.

A Communist-led insurgency movement, supported by the North Vietnamese and the Communist Chinese, broke out in 1965 in northeast Thailand and in 1967 in north Thailand. Since 1 July 1967 U.S. military assistance to Thailand has been funded from the budget for the U.S. military services. Much of the support provided has been designed to improve internal security and has included T-28s and helicopters for the Royal Thai Air Force and Royal Thai Army.

Similar programming from the military services' budget has enabled the United States to continue meeting the requests of the Royal Lao government for T-28s and other military supplies necessary to preserve its neutrality in the face of North Vietnamese invasion.

legislative and budgetary restrictions

We operate and program military assistance and conduct foreign military sales in accordance with numerous restraints, Congressional and monetary, imposed by the annual authorization and appropriation legislation. To discourage developing nations from expending

The Republic of Vietnam Air Force is an efficient organization with jet combat capability, thanks in part to USAF assistance in equipment and training dating back to the early fifties. A C-47 of the RVNAF at Tan Son Nhut Air Base (1964) . . . an A–1H Skyraider over South Vietnam . . . an F-5A on a strike mission over the Mekong Delta.

Republic of Vietnam Air Force personnel of the 41st Tactical Wing install a rotor head and blade assembly on a UH-1 Huey helicopter. They are assisted by members of U.S. Air Force Advisory Team 5. . . . The security training conducted by USAF 366th Security Police Squadron for RVN Air Force police at Da Nang Air Base includes fundamentals of the M-16 rifle.

limited funds for sophisticated or unnecessary military equipment at the expense of needed development projects, the Foreign Assistance Act and/or the Foreign Military Sales Act:

—prohibit financing of sophisticated military equipment such as jet aircraft to underdeveloped nations; and

—require reduction of grant economic aid in an amount equivalent to the money spent by underdeveloped nations to purchase sophisticated equipment from any country.

Annually, legislation has reduced military assistance budget requests on an increasing scale. Regional dollar limitations on the total amount of grant aid and foreign military sales and credits are imposed—$75,000,000 for Latin America and $40,000,000 for African nations.

Additionally, country restrictions apply; funds made available for military assistance (other than for training in the continental United States) shall not be used for more than forty countries in any fiscal year. Aid to Africa is limited to internal security items. The recent Fulbright-Church Amendment limits the number of MAP-financed students brought to the U.S. in any fiscal year to the number brought in the previous fiscal year under the Mutual Educational and Cultural Exchange

Act of 1961. Furthermore, a recipient country must prevent ships or aircraft under its registry from transferring to or from Cuba or North Vietnam any equipment, materiel, or commodities. What the recipient can or cannot do with the military assistance articles is restricted. Finally, military assistance must be progressively reduced—if possible, eliminated. This latter provision will be accomplished eventually by progressive reduction in appropriations.

On the positive side, however, there are provisions within most of the restrictions which allow the President to waive restrictions on a case-by-case basis when he determines that such action is important to the U.S. national interest or would promote world peace.

the future of military assistance and sales

As to future trends in military assistance and foreign military sales, I believe that

—Grant aid will level off at the FY 1969 budget level and in the early 1970s will hold at about $350 million annually.

—Sales to highly developed countries will probably further decline as these countries strive to establish licensing arrangements for coproduction of their own military equipment. (Sales to such countries have already declined from 97 percent of the total amount of sales in FY 1962 to 68 percent in FY 1968.)

—Sales to less-developed countries will probably increase somewhat. (Such sales will probably be comprised of complete end items and systems with increased emphasis on coproduction.)

—Technical components and know-how are likely to represent a major portion of sales to highly developed countries.

I believe the public is generally receptive to military assistance, although there is reason to believe that the public does not differentiate between grant aid and foreign military sales—they are both considered a gigantic giveaway. It is also doubtful that there is an awareness of the actual impact of the military assistance and sales programs on U.S. foreign policy and on our economy. Far too often these programs are regarded as a tax burden rather than a deterrent to Communism.

The attitude of Congress is one of reaffirmation of U.S. policy to achieve international peace and security. It is recognized that world peace and U.S. security are endangered so long as Communist countries continue, by threat of military action, use of economic pressure, internal subversion, or other means, to attempt domination of peoples now free and independent. Nevertheless, the current level of U.S. funding to support this thesis remains at less than one-half of one percent of our gross national product.

Despite the grim history of Communist aggression, the future of military assistance, both grant aid and foreign military sales, grows bleaker each year. We Americans, faced with the high cost of the Vietnam war effort and seeing taxes and inflation on a continuing upward spiral, object to the expenditure of funds for foreign assistance. Some seem not to be cognizant of the value received by the U.S. from foreign military assistance. They also seem not to rationalize the higher cost of sending and maintaining U.S. forces in foreign peripheral defense areas compared with the expenditure in aid which enables foreign forces to defend themselves and stabilize the area, thus providing the needed peripheral defense. These attitudes indicate a probable direction for military assistance appropriations —downward.

Planners of U.S. military assistance seek that mix of funds among a restricted number of recipient countries which optimizes U.S. objectives and interests. Heavy responsibility for military assistance planning rests with the Secretary of State.

The bulk of our current grant assistance is allocated to support the armed forces of the forward defense countries—Greece, Turkey,

and the Republics of Korea and China. The first three countries maintain defense establishments which they could neither completely equip nor adequately support without serious detriment to their economic development. In the Republic of China, which boasts one of the economic success stories of modern Asia, grant military assistance, though it has declined considerably in the last two years, still assists that country to channel funds toward economic investment needed to maintain the rapid pace of economic development.

A slice of the remaining funds goes to other countries that make important bases available to us.

The marginal amount of funds remaining after all these needs are satisfied precludes the provision of any substantial amount of aid to other recipient countries. The amount provided is naturally less than they wish. Nevertheless, the military assistance proposed for them is important to U.S. security and political interests.

recommended future approach

The new administration in 1969 placed emphasis on efforts to enhance development of an international attitude of progress through cooperation and mutual respect and development of self-reliance minus grant aid.

In the development of self-reliance without grant aid we have already made great strides, but much more remains to be done. We foresee that all grant aid countries will be receptive, even eager, to shift from external reliance to self-reliance. The challenge here is to jointly develop feasible and mutually agreeable plans and programs to effectuate the transition.

Beyond this, the future approach to military assistance will also be greatly influenced by international events. The situation in the less-developed areas of the world is not likely to change in the near future. These areas will contain the great majority of the world's peoples and will remain generally unstable politically. Thus, they will remain Communist targets. Consequently, the policy guidelines under which future military assistance programs are framed must include enough flexibility to enable the USAF to respond quickly in the national interest.

Future military assistance should continue to be given in a way that will not disrupt a nation's economic, political, or social structure. It should have a definite, identifiable mission and a time limitation to insure that the recipient does not become dependent on it. Above all, military assistance should be given in a way that will not damage the recipient's national pride and unity.

Self-help programs should be especially encouraged. In this connection, the recipient country should determine its maximum contribution to its common defense, and it must do so in relation to other national priorities such as fiscal policy, foreign exchange, education, and national welfare.

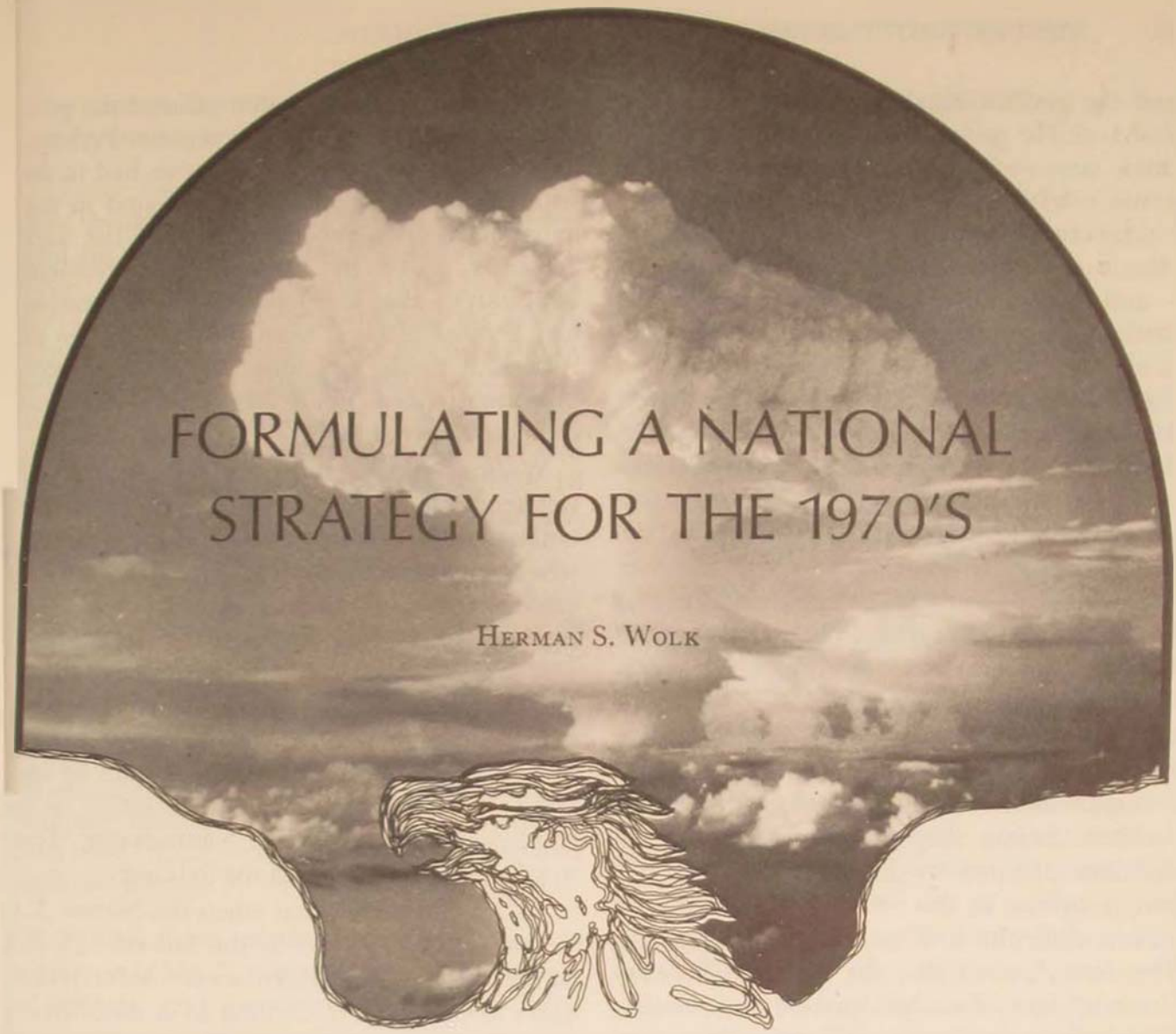
In looking at the whole picture, we draw the conclusion that the expected gains from military assistance are very difficult—sometimes impossible—to predict. In the past, the program has been overpublicized. When nations did not become militarily secure, independent, economically viable, and democratic, as our aid was supposed to make them, the public and Congress became dissatisfied. In short, the expected results from military assistance were painted too bright.

On the other hand, there is little doubt that military assistance has preserved the independence of a number of countries and has assisted greatly in spurring the economic development of others. Actually, most of the lasting and worthwhile gains from military aid involve very slow processes without immediate and obvious achievements. This should not be difficult to understand when one recognizes that nothing less than nation-building is involved. In this difficult and complex world, modest gains cannot be overlooked.

Working within the broad philosophy of enlightened national self-interest in assisting nations to meet external and internal threats, the future of USAF assistance must be geared to a more critical and perceptive review of all its various programs. And once USAF has embarked on a program, it should be carried out in a true spirit of partnership and self-help.

The luxury of decision-making and administration in a totalitarian state, where press and parliament are strictly controlled and the public voice is muted, cannot be ours. We in our democracy pay the price for this and reap the benefits from it, and one need not look far to know this. Our form of government, which gives so unprecedentedly much to so many, is being put to a test probably greater than it has ever faced in its 194-year history. The enemy has never been so strong nor had so many voices within our gates wittingly and unwittingly doing its bidding and trying to foster its aims. I think the great majority of Americans realize this and are committed to support of our national policy.

Hq United States Air Force



FORMULATING A NATIONAL STRATEGY FOR THE 1970'S

HERMAN S. WOLK

NOW that President Nixon has been in office for nearly two years it seems appropriate to consider what changes he has made in our foreign and military policies. The most recent significant transition occurred when President John F. Kennedy and his Secretary of Defense, Robert S. McNamara, made important changes to what had been the national strategy of the Eisenhower Administration.

At the outset, it seems fair to say that whereas the Kennedy and Johnson Administrations dressed up their policies with a good deal of ideological fervor and flamboyant grand design, the present administration has been—for the most part—bereft of the grandiose, preferring instead a more cautious approach.

Whatever Mr. Nixon's judgment in the 1950s and early 1960s with respect to U.S. Vietnam policy, as President he moved early to change fundamentally both the policy itself

and the governmental process that had fashioned it. He proceeded on the premise that there were existing organizational (bureaucratic) defects along with significant policy (intellectual) misconceptions which if left uncorrected were likely to generate new disasters —and sooner rather than later. In his lengthy foreign affairs message submitted to the Congress on 18 February 1970, titled "United States Foreign Policy for the 1970's: A New Strategy for Peace," the President made abundantly clear his dissatisfaction with both the substance and machinery of U.S. foreign policy as he found them on his accession to the Presidency.

President Nixon's first step, therefore, was to initiate a basic overhaul of the policy *process*. While admonishing that "efficient procedure does not insure wisdom in the substance of policy," Mr. Nixon observed that creative and farsighted policies can only be formulated *systematically*. "We must," he noted, "master problems before they master us." Piecemeal decisions dictated by the pressure of events had too often in the recent past led us into serious difficulties. Thus, at the outset, the President directed that the National Security Council (NSC) be revitalized as the primary vehicle for consideration of national security issues. This move was a natural one for the President because he had been intimately involved with the NSC as Vice President under Eisenhower; he has always been comfortable with procedural orderliness; and it has been no secret that he was aghast at the disparate manner in which policy had been fashioned under Presidents Kennedy and Johnson.

Obviously, Mr. Nixon felt that Vietnam marked a striking failure of the mechanics of the foreign policy process. By resuscitating the NSC and establishing a new system of groups to support it, he felt that the inadequacies of our foreign policy methods could be remedied. Only time and events will tell, of course, but there is some evidence for believing that the Nixon approach has already corrected the most glaring deficiencies that afflicted the previous administration's policy process. Perhaps the most serious of the inadequacies had to do with the dearth of options to be found in the national security process and with the fact (recently stated by former Vice President Humphrey) that the Johnson Administration had become isolated from the major tides of American public opinion. Mr. Nixon recognized that either one of these crucial deficiencies could prove fatal.

Without getting down to the specifics of weapon systems, one can consider the broad outline of Mr. Nixon's national defense policy, which was formulated after perhaps the most exhaustive review of the nation's security since the early days of the first Eisenhower Administration. It is well to remember that President Eisenhower's first priority was to end the Korean War. Similarly, Mr. Nixon is now in the process of extricating us from Vietnam by intensively supporting "Vietnamization," which emphasizes training South Vietnamese forces to take over the burden of the fighting.

It will be recalled that when the New Look defense policy evolved in the fall of 1953 it complemented the Eisenhower Administration's overall policy. Coming as it did on the heels of the Korean War, the New Look involved substantial reductions in conventional ground forces and a concomitant emphasis on the strategic nuclear deterrent. In his *Mandate For Change,* Mr. Eisenhower explained that

> . . . the United States would not employ the same policies and resources to fight another war as were used in the Korean conflict. I saw no sense in wasting manpower in costly small wars that could not achieve decisive results under the political and military circumstances then existing. I felt that this kind of military policy would play into the hands of a potential enemy . . . We should refuse to permit our adversary to enjoy a sanctuary from which he could operate without danger to himself; we would not allow him to blackmail

> us into placing limitations upon the types of weapons we would employ. (p. 454)

As the New Look was a special reflection of the thought and philosophy of Eisenhower and his close aides (especially George Humphrey and John Foster Dulles), the Nixon defense policy undoubtedly reflects the President's values and goals—which, interestingly, are reminiscent of Eisenhower's. Like General Eisenhower in the backlash of Korea, President Nixon's national security policy has had to come to grips with Vietnam. In his 18 February message, he said that we cannot expect

> . . . U.S. military forces to cope with the entire spectrum of threats facing allies or potential allies throughout the world. This is particularly true of subversion and guerrilla warfare or "wars of national liberation." Experience has shown that the best means of dealing with insurgencies is to pre-empt them through economic development and social reform and to control them with police, paramilitary and military action by the threatened government.

As far as a direct role for American forces was concerned, Mr. Nixon noted that such a situation might arise "when insurgency has shaded into external aggression" or when there is a conventional attack. Should either contingency develop, the U.S. would then consider its interests and obligations and the "efforts of our allies, in determining our response." Thus overall, like the New Look, President Nixon's military policy seems certain to be distinguished by retrenchment in nonnuclear forces.

This represents a significant shift from the Kennedy and Johnson policies. Whereas Eisenhower stressed strategic nuclear retaliatory power, John F. Kennedy took office determined to put "the nuclear genie back in the bottle." President Kennedy felt that the primary danger was the corrosive effect of limited local wars or what Soviet Premier Khrushchev had described as "wars of national liberation"—*precisely the kind of wars that cost the Soviets very little.* Now, reacting to the Kennedy-Johnson policy which culminated in the war in Vietnam, President Nixon seems determined to withdraw (at the least) most of our ground forces from Vietnam and to pare down substantially our general-purpose forces.

Striking semantic similarities are apparent in a comparison of the Eisenhower and Nixon approaches to the strategic nuclear deterrent. Mr. Nixon's proclaimed goal of a strategic posture of "sufficiency" recalls the doctrine of sufficiency expounded in August 1956 by Secretary of the Air Force Donald Quarles. There comes a time in the course of increasing our power, said Quarles, "when we must make a determination of sufficiency." It should be noted that the Quarles statement marked the beginning of a turn in the Eisenhower Administration away from substantial superiority towards sufficiency. During 1953–55 the Administration insisted on maintaining the American lead in air power and the technology producing it. But between 1956 and 1960 the policy changed to one of adequacy, reflecting the forceful and insistent pressures for economy within the Administration. Adequacy or sufficiency had to be maintained at reasonable cost. The cost of overwhelming superiority was becoming too great to keep up. As Secretary Quarles expressed it, superiority could not guarantee immunity from nuclear catastrophe. The evolving determinant was the U.S. capacity to launch devastating retaliation upon the Soviet Union. In the late 1950s, therefore, assured destruction was well on the way to becoming the keystone of American nuclear strategy.

Interestingly, President Nixon first used the word "sufficiency" in his initial press conference, on 27 January 1969. "Our objective," he said, "is to be sure that the United States has sufficient military power to defend our interests and to maintain the commitments which this administration determines are in the interest of the U.S. around the world." He

added that he thought "sufficiency" was a better word than either "superiority" or "parity."

Then, to further make the point, in his 18 February 1970 message he indicated that he would not either sharply reduce or increase American strategic programs or deployments. Significant reductions would mean that the criteria for sufficiency of the deterrent force could not be met and also might provoke a Soviet reaction. On the other hand, a very substantial increase in strategic power might not only produce a response in the Russian defense budget but also dim prospects for an agreement to limit strategic weapons. In general terms—and the President's February message was very general—these strategic goals fit well into the Nixon philosophy of moving "from an era of confrontation to one of negotiation."

Nevertheless, because total war is the one kind of war we cannot afford to have, it must still continue to claim first priority on our resources. The strategic nuclear deterrent, as Bernard Brodie once put it, "will have to remain as the Constant Monitor and its efficiency in that role should never be subject to doubt." And as one of the Nixon Administration's strategic planners observed: "If we miscalculate by having too few general purpose forces the result can hardly be calamitous. But if we err on the side of too little in the strategic field, it could be fatal." For the Nixon Administration, therefore, *sufficiency does not mean parity*. Thus, the question becomes how much counterforce to add to the assured-destruction force.

The Administration is aware that it must guard against a loss of the American strategic nuclear edge. Our lead, Mr. Nixon frequently has pointed out, has been diminishing. Such a diminution in our position might encourage a more aggressive Soviet global policy. The Russians have always been sensitive to the international leverage inherent in strategic power —and also in space technology, it might be added. In contrast to the philosophy of strategic parity, the Nixon Administration does not want to see the Soviets pull up to (or ahead of) us because—among other considerations—we cannot be certain how it would affect the Soviets' behavior, since they have never actually enjoyed parity. Contrary to what has become a popular theory (a shibboleth, really) among present-day strategic thinkers, parity might well induce instability in the relations between the two nuclear giants rather than the hoped-for stability.

Within the United States, in the meantime, there is ample evidence that we are well into a debate over the composition of the American strategic nuclear force for the 1970s and beyond. The issues are similar to those advanced during the "great strategic debate" of the late 1950s and early 1960s. Not surprisingly, the semantics also strike a familiar note.

In the 1950s the Air Force advocated counterforce doctrine, and the Navy countered that this smacked of a first-strike concept—a strategy that had been ruled out by our national policy. Opposing the Navy's finite deterrent or "city-busting" concept, the Air Force observed that this made no provision for the gradations of warfare—it was all or nothing. Historically (or, as some would put it, with the precious advantage of hindsight), it can be said that in large measure the issue as it was thus presented (either/or) was a false one. The U.S. could not adopt one strategy to the exclusion of the other. Thus, we adopted neither totally but instead opted for a combination. Based on the evidence to date, it would be surprising if the present debate turned out to be substantially different from the one of a decade ago.

This new controversy rests on the assumptions that U.S. policy will be guided in large part by the public's desire for less foreign involvement and more emphasis on ameliorating domestic problems; that the Soviets will continue to deploy the SS-9 ICBM; and that the defense budget might well continue to shrink substantially in the immediate future.

The Navy has moved quickly to argue the need for a larger sea-based nuclear deterrent that would feature the undersea long-range missile system (ULMS).[1] This system is still in the early planning stages. The SS-9, according to the Navy, makes the USAF's land-based Minuteman ICBM increasingly vulnerable. The Air Force, on the other hand, notes that antiballistic missile (ABM) deployment will afford a greater measure of protection for its hardened Minuteman sites and that the Minuteman could be made mobile. Too, the Air Force has continued to make a strong case for the B-1 Advanced Strategic Bomber.[2]

In all likelihood, the strategic debate this time around will be somewhat muted—at least publicly. The great dialogue of the late 1950s and early 1960s featured Albert Wohlstetter, Klaus Knorr, Bernard Brodie, Henry Kissinger, Oskar Morgenstern, Herman Kahn, and others. But the conditions are quite different now, and many of the earlier participants seem to be preoccupied with other concerns, ranging from the plight of our cities to scenarios on the year 2000. Also, as Bernard Brodie observed, some of them got burned with Vietnam and have little stomach left for a new round. And, of course, Henry Kissinger is now President Nixon's Assistant for National Security Affairs and has therefore removed himself from the ranks of the commentators.

Furthermore, we are still fighting a war in Vietnam, and while the Nixon Administration has made it clear that the process of Vietnamization is "irreversible," it seems reasonable to assume that the process will take some time. Beyond the fact of the war itself, Vietnam has smashed some widely held beliefs and strategies, primarily those associated with the "flexible response" philosophy of the Kennedy-Johnson years. It remains to be seen whether this administration or some regime in the future will revert to a strategy grounded on a "no land war in Asia" policy featuring strategic deterrence and a top priority to European affairs. At any rate, so long as the war and the casualties continue (even at a reduced level), there seems little hope that our focus and our energies can be given over wholeheartedly to concerns elsewhere. The debate of the late 1950s evolved against a more quiescent domestic background and was fueled by the launch of Sputnik I and the bursting of the ICBM revolution.

But there seems to be a deeper and more fundamental reason for the suspension of informed, critical analysis—for the malaise in stimulating commentary, if you will. The pace of our technology has not only outstripped our ability to cope with our daily lives (especially in the great metropolitan areas), but it seems to have ground down our capacity to think in coherent geopolitical, strategical, historical, and philosophical terms. The compulsion—indeed, the necessity—to frame our thoughts in numerical analysis has apparently all but obviated the need for a larger and more meaningful frame of reference. We are all the poorer for this debilitating onslaught of statistical hocus-pocus—a veritable cacophony that seems to paralyze our critical judgment. This trend appears to have been accelerated by our experience in Vietnam.

The British historian H. A. L. Fisher once said that the only safe rule to follow was to be ready for the unforeseen contingency. This is good advice. For despite the immense technology we have at hand, we are still unable to see into the future with anything approaching certainty. Nevertheless, it is necessary to plan as best we can based on our very limited perspective at any given point in time. It does seem safe to say that the end of an era seems to be at hand. This period was marked by the failure of the strategy of controlled and flexible response that came into being with the Kennedy Administration and subsequently was applied to the fullest by President Johnson. With its obvious legacy from two Eisenhower Administrations, the Nixon regime is unlikely to make the fatal error that Lyndon

Johnson did—*that of adopting a policy for which there was a disinclination to pay in terms of military power and domestic economic adjustment.* Also, the President is obviously cognizant of Eisenhower's success in deterring both large- and small-scale Communist aggression during the 1950s.

However, it should be observed that it is difficult to generalize about Vietnam. Although the U.S. went a long way in observing self-imposed restrictions, there remains no absolute assurance that in different circumstances at another time (e.g., when our own vital interests are more clearly in jeopardy) we would not intervene in a substantial way. Today's reaction to Vietnam does not necessarily provide us with firm clues as to future behavior. But implicit in what Mr. Nixon has already outlined in the so-called Nixon Doctrine enunciated at Guam and in his foreign policy message is the conviction that a sense of proportion must be reintroduced into American policy. A balance must be struck between excessive intervention on the one hand and an excess of isolation on the other. Reliable foreign and military policy is rarely made in the emotional backlash of something like the "no more Vietnams" dictum.

If we are to give critical attention to our national priorities, it is necessary that our foreign and military affairs be in good order. President Nixon is saying that in any particular part of the globe we must think through the American national interest very carefully. Although we shall continue to play an active role internationally, it is absolutely necessary to our well-being that we be much more selective in the use of American power. *And when our power is applied it must be done quickly and effectively.* Writing to Dr. Theodore von Kármán in November 1944, General H. H. ("Hap") Arnold observed: "It is a fundamental principle of American democracy that personnel casualties are distasteful."

Yet it remains true that no administration can start from scratch with completely brand-new ideas, free from constricting policies of the past. Our strength is not infinite; even our resources are limited; there are things we might wish to do that we cannot do; even a President's judgment is apt to be wrong; and events and historic currents may conspire against us. Nevertheless, national strategy must always be dictated by national factors—by the structure, values, and aims of our society. These flow from the very character and psychology of our people. It is in part an outlook, what the Germans call *Weltanschauung.* Our policies must spring from the nature of our institutions and from our national tradition.

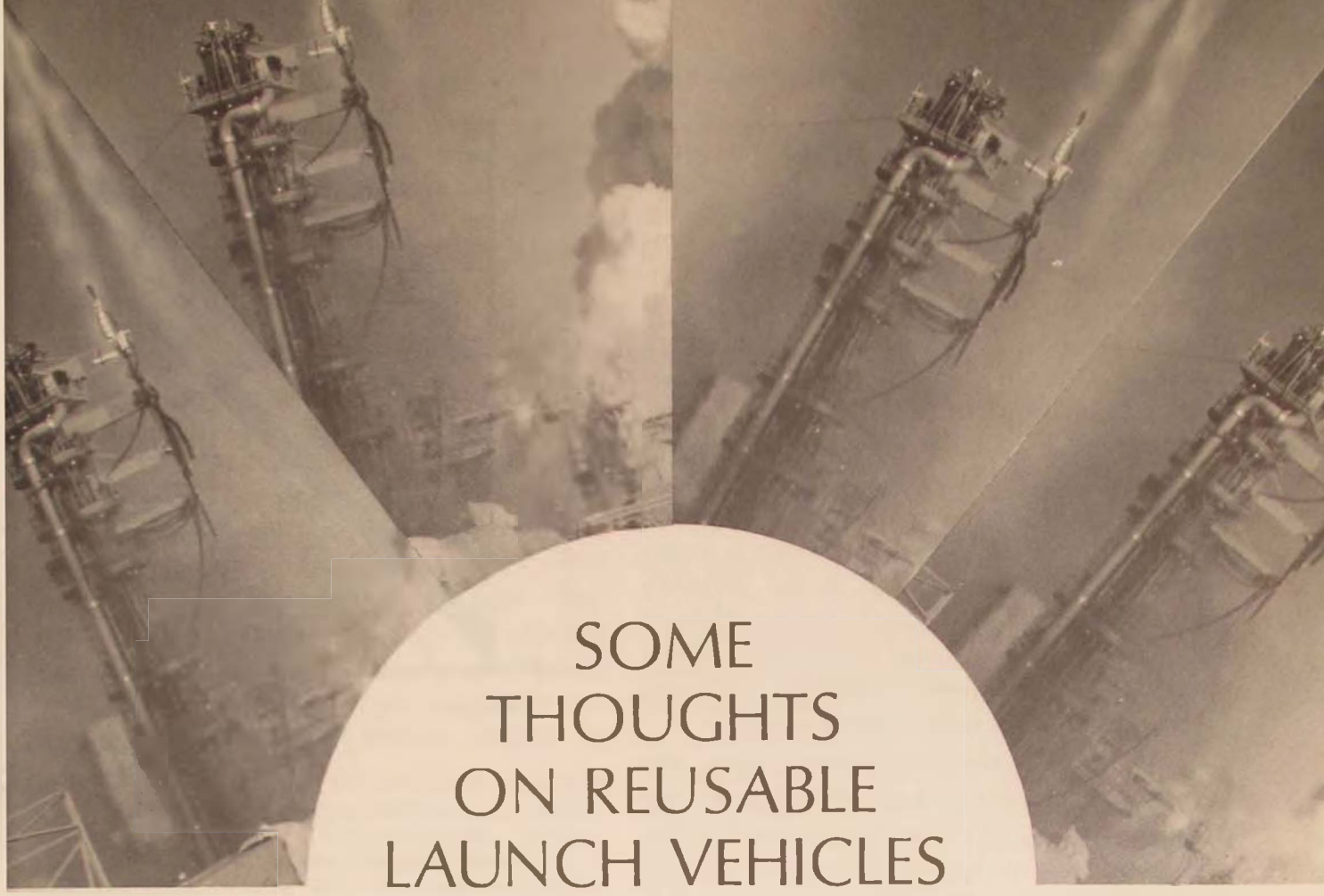
When they do not, we are apt to get into trouble.

Silver Spring, Maryland

Notes

1. See the statement by Navy Secretary John H. Chafee in the *Navy Times*, 14 January 1970; editorial, "We Must Move Our Nuclear Deterrent to Sea," *Navy Magazine*, February 1970; William McGaffin, "Navy Pushes Undersea-Missile Plan," *Chicago Daily News*, 8 January 1970; and Captain Ralph E. Williams, Jr., USN (Retired), "After Vietnam," United States Naval Institute *Proceedings*, April 1970. In his article, a First Honorable Mention Prize Essay for 1970, Captain Williams says: "The proposal here is to move our strategic nuclear striking force to sea. Let us put *all* of it to sea."

2. For a consideration of how the B-1 might fit into American deterrent strategy, see John L. Frisbee, "The B-1—Blue Chip in the Deterrent Stack," *Air Force and Space Digest*, April 1970, pp. 45–48. Also see Frisbee for a reasoned case against Polaris as the sole American nuclear deterrent in "Let's Have Three for Deterrence," *Air Force and Space Digest*, June 1970, pp. 28–31.



SOME THOUGHTS ON REUSABLE LAUNCH VEHICLES

WILLIAM G. HOLDER

CAPTAIN WILLIAM D. SIURU, JR.

THE Apollo successes have vividly dramatized the magnitude, sophistication, and capability of the U.S. space program. The gigantic Saturn V/Apollo combination represented the culmination of seven years of technological aerospace advances made by literally hundreds of aerospace companies and government agencies. Unfortunately, the Saturn launch vehicle—worth about $100 million—can be used only once, a fact which, when coupled with the increasing domestic demands on the U.S. budget, threatens the continuation of a vigorous space exploration program. The realistic solution to the economic squeeze is to develop a reusable launch vehicle (RLV).

The cost per pound of payload delivered to low earth orbit by today's launch vehicles runs from $400 to $2500, not including the elaborate prelaunch assembly and checkout procedures. To achieve our ambitious future space objectives with the limited dollars available, the cost and complexity of launch vehicles must more nearly approach the cost and complexity associated with aircraft operations. A payload delivery cost of $40 to $125 per pound delivered to orbit is a realistic and reasonable goal to strive for in a first-generation RLV. The maintenance and launching of such a vehicle should, ideally, require no more than a pilot, a copilot, a crew chief, and a few ground personnel.

Let us now consider how much the U.S. could afford to invest in developing an RLV and some of the benefits other than economic that might result if an RLV were developed.

economic implications and factors

Probably the simplest way to illustrate the economics of reusable systems is to show how many launches of an RLV are required to amortize investment costs for development, initial inventory, and facilities. The number of launches after amortization represents savings over a comparable expendable system. Three payload classes of launch vehicles are shown in Figure 1, the smallest equating in capability and cost to the Titan IIIM and the largest to the Saturn V class. Between the two is a median vehicle with a payload in the 100,000-pound category. All payloads are to orbits of 100 nautical miles. A band of allowable investments is given, representing savings of 75 and 90 percent over the expendable system.

Several points should be noted. First, the investment costs for an RLV are not really tremendous compared to the huge investment involved in a system like the Saturn V. Second, the number of launches before savings result is relatively small, considering that there have been at least 50 space launches of all payload sizes per year in the last five years.

Obviously, in justifying an RLV, the planner must maximize the achievable savings and minimize the investment required. To obtain greatest usage and thus savings, any new launch system must be flexible enough to encompass a wide range of payload weights delivered to varied orbital and interplanetary destinations. What is proposed is a whole new concept in launch operations. This concept envisions the use of a "space truck," as opposed to the "special vehicle for each mission" concept of today's space operations.

An attractive future launch capability is one of about 50,000 pounds delivered to low earth orbit. Referring to Figure 1, one can see at a usage rate of 50 launches per year and for an investment of about $4 to $6 billion, an RLV could be amortized over a four-year period. The $4 to $6 billion investment is probably more than required for the job, so amortization could occur somewhat earlier. A launch rate of 50 per year is also reasonable, since this vehicle could be used to shuttle men and supplies to our future space stations, perhaps on a monthly or even biweekly basis. In addition, this vehicle could encompass most of the missions now performed by the Saturn, Titan, Atlas, and perhaps even the Thor family of launch systems.

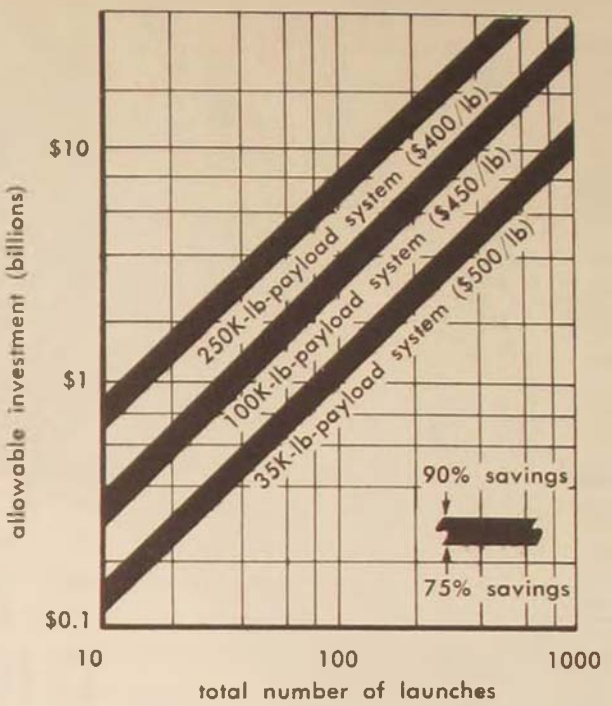


Figure 1. Economics of recovery. Example: For a 35,000-pound-payload system and a projection of 80 launches, approximately $1 billion could be invested in a reusable launch vehicle (RLV) with savings achievable after the 80th launch. Since the RLV costs only 10 to 25 percent of the cost for a comparable expendable system (i.e., $2 to $4 million per launch versus $17.5 million per launch), the RLV could perform the missions of smaller, yet more costly, expendable launch vehicles. Such a 35K-lb-payload RLV could be used in place of all vehicles between the Thor and Saturn IB, and thus the 80 launches could be accumulated in a relatively short time, with significant savings in subsequent years.

An added feature of low-cost launch vehicle is its ability to create new uses. That is, as launch costs diminish, it becomes more practical to use space for additional endeavors, giving an added base for investment amortization and thus further increasing the savings per

launch. Additionally, an RLV which is designed with growth potential in mind provides a longer operating life span and therefore allows a greater number of years of use after the investment costs have been paid off.

Since projected launch rates now appear to be lower than those projected by studies in the early 1960s, the potential amount of savings achievable with reusable launch systems has decreased. Early studies assumed launch rates in the hundreds per year, which would make even the most "way out" RLV system appear attractive. Today's launch rates account for fewer than 50 launches of medium- and large-sized vehicles per year. This reduction in launch rate requires a decrease in the allowable investment, and the actual recoverable systems proposed have to be more realistic in their design and technology.

advantages—other than economic

In addition to the economic benefits of recoverable boosters, there are several fringe benefits to be derived. Many recoverable concepts allow a mission abort and recovery of the payload, an especially attractive feature for manned or other particularly high-value payloads.

The flight-test program for an RLV is similar to that for an aircraft in that it can be conducted in a stepwise manner with a minimum of test hardware. A vast amount of operating experience and "shakedown" testing can be accumulated before the first payload is launched. Unlike the totally expendable launch vehicles, the RLV can be flight-tested without incurring more than the cost of the expended propellants and the flight-to-flight maintenance.

One of the constraints that has limited the U.S. to only two space bases capable of launching major payloads is the vehicle overflight problem. The U.S. cannot launch rockets over populated areas for fear of debris jettisoned during the normal flight profile or fear of failure. A reusable vehicle with aerodynamic return capability could overcome this problem, since the launch vehicle would be little different from an airliner flying over a city, provided a flight trajectory was chosen so as to minimize ground noise from the propulsion system. An RLV with man aboard could alleviate many of the situations where the launch vehicle has to be destroyed because of minor malfunction. This alleviation of overflight restrictions could allow more launch sites to be developed or take advantage of heretofore unusable facilities, a feature highly desirable for military missions.

Another desirable feature of most RLV concepts would eliminate some of the transportation problems from manufacturing site to launch site. The RLV with aerodynamic qualities could be ferried from the manufacturing site to the launch site and thus eliminate the special carriers in use today, such as Guppies and special booster barges.

The large booster concepts (boosters larger than the Saturn V) have been mentioned as possible contenders for a considerable portion of future space research money. However, a relatively small RLV could accomplish the missions projected for these large boosters through the assembly-in-orbit concept. While a very large launch system would have very limited application, perhaps less than one launch per year (witness experience with the large Saturn vehicles), a moderately sized RLV could take on the job of the large booster as well as many other smaller missions. An inherent feature of the assembly-in-orbit concept is that a single launch failure does not destroy the entire payload, whereas with the large single-vehicle launch a failure could cause complete destruction of the payload and possibly the whole program. Most of the large-payload concepts already consider some type of resupply and crew rotation capability. An RLV could provide both of these functions in addition to establishing the space station in the first place. A very large booster would certainly require advances in

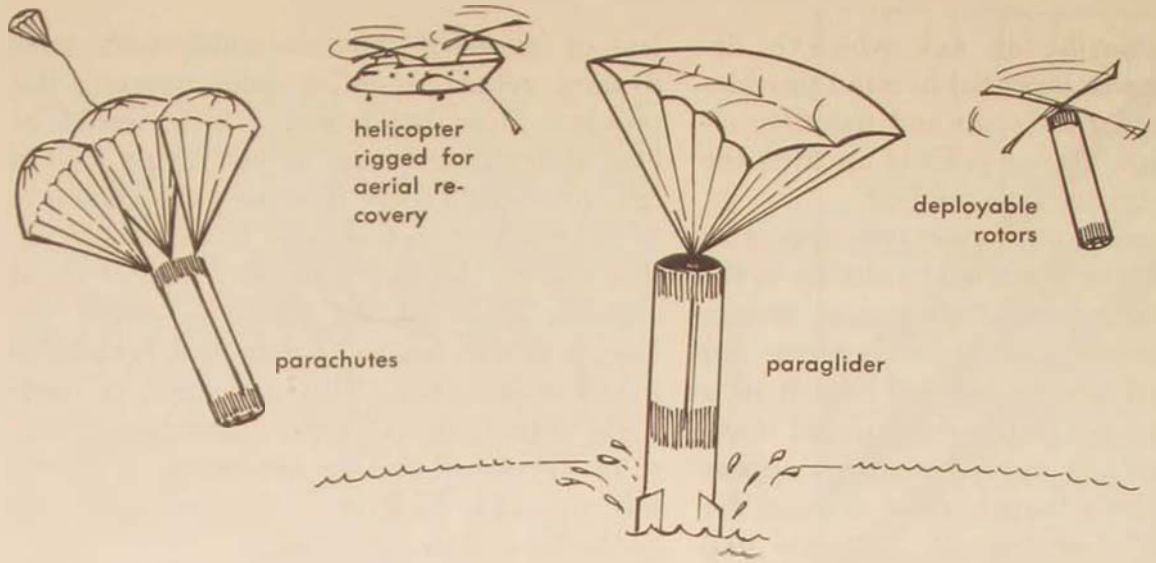


Figure 2. Vertical takeoff and vertical landing recovery (VTOVL)

technology and of course new and quite expensive launch facilities, while an RLV could be built with currently available technology and launched from existing facilities usually with only minor modifications.

Today the payload planner is constrained by the maximum payload capability of the largest launch system he can afford. If a single RLV were developed with a constant cost, regardless of payload, he might see payload growth towards the maximum capability of the RLV. If this cost was constant at a value less than for equivalent expendable systems, he would be able to use the maximum payload weight consistent with his particular mission. This in itself could lead to lower costs, since the spacecraft would not have to use such expensive techniques as miniaturization of components and could benefit from such concepts as increased redundancy and longer life components. Of course, it goes without saying that this additional capability could also be used to broaden the mission capabilities of the spacecraft itself.

concepts

Now that the benefits to be derived from the RLV have been established, some of the various concepts will be discussed. A surprising number of recovery concepts have been suggested by both the government and industry, employing every conceivable technology. These concepts range from the minor modification of existing hardware to those based on the greatest advances in technology. In line with today's realistic outlook, the discussion will be limited to those systems which represent an evolution from the systems of today, rather than the more revolutionary concepts.

The simplest RLV techniques involve the recovery of currently used expendable stages. These schemes usually fall into the class of systems known as vertical takeoff and vertical landing (VTOVL) and are primarily designed to recover the first stage. (Figure 2) This stage is the easiest to recover because its impact point will probably not be farther than 300 miles downrange and it will be subjected to the least severe environment. Recovery devices most frequently proposed are parachutes, paragliders, and deployable rotors.

While these methods represent the first step in the evolution of recovery technology, they are neither operationally nor economically attractive. First of all, if an expendable stage were adapted for reuse, the number of reuses would be very limited and the refurbishment costs high, since the systems and subsystems were originally designed for only one flight.

This type of recovery usually involves landing the stage in water or, in the case of smaller stages, using an aerial snatch technique. As everyone has seen in the Apollo program, the operational problems associated with water retrieval preclude its being an everyday operation. Additionally, landing a piece of aerospace hardware in the ocean can quickly cause corrosion and make refurbishment expensive.

However, water recovery might have limited application in reducing the cost of reuse of very large boosters with low launch rates, e.g., Saturn V. It might also be profitable to recover a stage for research purposes, to determine how it withstood its portion of powered flight. These data could tell the designer if the system was overdesigned and where.

It might be worthwhile to recover only the most expensive elements of a launch vehicle, for example, the propulsion and electronic components. This would require packaging these elements so that they could be separated from the rest of the expendable system and thus be recovered separately.

As for the propulsion system, the rocket engine still appears to be the most practical propulsion unit at least for a first-generation RLV. With this assumption, it is almost mandatory that takeoff occur vertically. Recovery is best accomplished by an aircraft-type configuration, which dictates horizontal landing. This, then, presents a most attractive class of reusable launch systems—vertical takeoff and horizontal landing (VTOHL). Within this class of vehicles can be included partially and totally recoverable systems. In the evolutionary approach to recovery, one may start at the uppermost stage or the lowermost stage.

The first VTOHL vehicle would have a recoverable upper stage/spacecraft launched by expendable lower stages. (Figure 3a) This concept could be readily developed if the U.S. decided to pursue the creation of a maneuverable, reusable spacecraft. The technology from the reusable spacecraft would allow an easy development of a reusable upper stage.

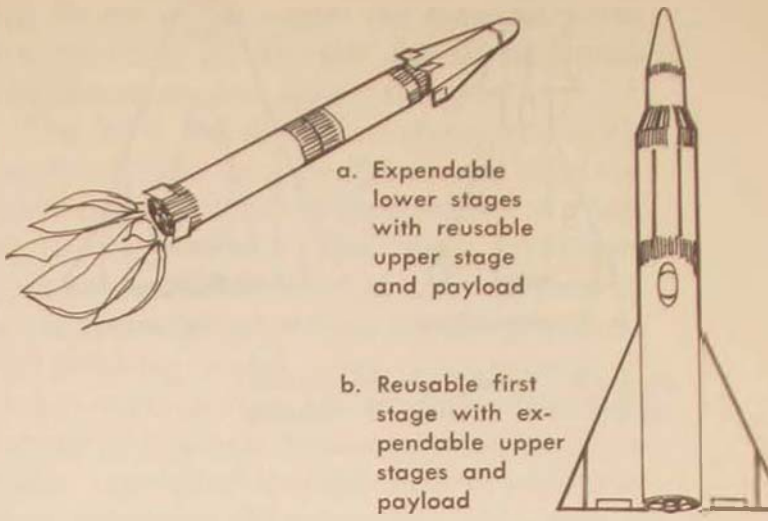
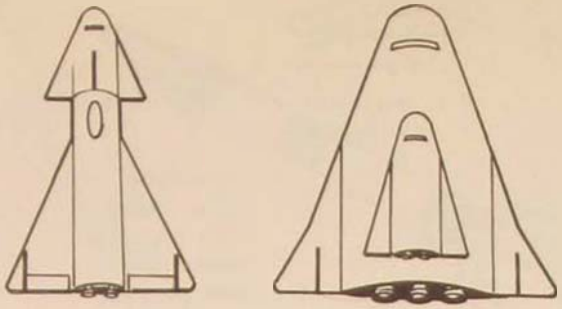


Figure 3. Partially recoverable vertical takeoff and horizontal landing (VTOHL)

The second VTOHL vehicle, consisting of a reusable first stage and expendable upper stages, would be the easiest to obtain if a reusable spacecraft were not developed. (Figure 3b) Such a system could be developed by mating rocket engines with aircraft hardware. Since the severity of the flight environment for such a first stage would be minimal, exotic materials and structural techniques would probably not be required.

The next logical step is a totally reusable system. The choice of staging technique is very important. Both tandem and parallel staging have their strong and weak points. Tandem staging (Figure 4a) allows greater flexibility in the various payloads and upper stages that can be accommodated, since the upper stage/payload can be mounted atop the first stage as with today's expendable stages. With parallel staging, the payload upper stage must be aerodynamically integrated with the first-stage body, somewhat limiting mission flexibility. (Figure 4b)

A class of launch vehicles using a common first stage but a variety of upper stages could provide a wide range of payload capability, with a commensurate range of payload delivery costs. For example, the first stage could be



a. Tandem-staged b. Parallel-staged

Figure 4. Totally reusable vertical takeoff and horizontal landing

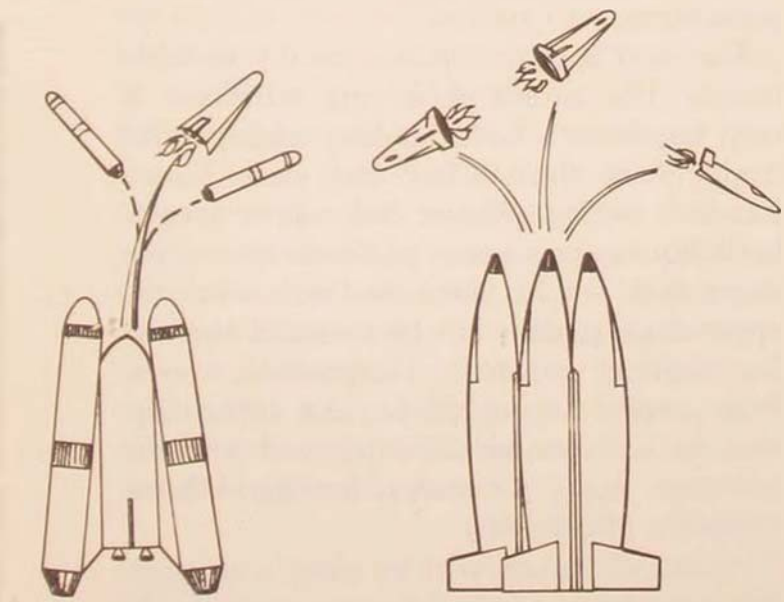
offloaded, and the second stage could be a small upper stage delivering, say, 15,000 pounds to low earth orbit. The same vehicle when fully loaded could use a large upper stage or stages and provide payloads in the 50,000-pound class.

A tandem-staged vehicle could be initially designed to use expendable upper stages; then at a later date a reusable upper stage/payload could be incorporated. A parallel-staged vehicle requires the whole system to be designed as an integral package because of the aerodynamic interfaces between the various stages. This makes it more difficult to use with a wide range of payloads/upper stages.

Parallel staging does, however, reduce some of the loads and bending moments due to wind load while on the pad and during the early phases of flight because the parallel-staged vehicle is usually squatter than the tandem-staged vehicle. This factor is especially important if the payload/upper stages include wings.

A final VTOHL system would employ expendable outboard propellant tanks that are jettisoned once their load has been consumed by a reusable combination spacecraft/launch vehicle in the center. (Figure 5a) Long engine burntimes and payload envelope constraints present the major problems with this technique. The outstanding advantage is that it allows a reusable system to be developed for a minimum cost, since only one reusable system is involved—the center body.

A derivative of this last technique involves recovering not only the center section but also the outboard tanks. (Figure 5b) This could be accomplished with only one development program, since the center vehicle and the outboard vehicles could be identical in design. This system incorporates an inherent building-block capability. For example, for quite small payloads it might be necessary to launch only the center portion of the vehicle, while for very large payloads a number of the vehicles could be clustered together. This building-block approach already has been used with current expendable systems, e.g., the Titan family.



a. Partially reusable b. Totally reusable

Figure 5. "Drop-tank" vertical takeoff and horizontal landing

The third type of RLV employs horizontal takeoff and horizontal landing (HTOHL) and is thus most like an aircraft. (Figure 6) This arrangement requires the use of an advanced air-breathing propulsion system in the first stage or, alternatively, a rocket-propelled first stage used in conjunction with some type of sled launch device.

There is one important advantage that can

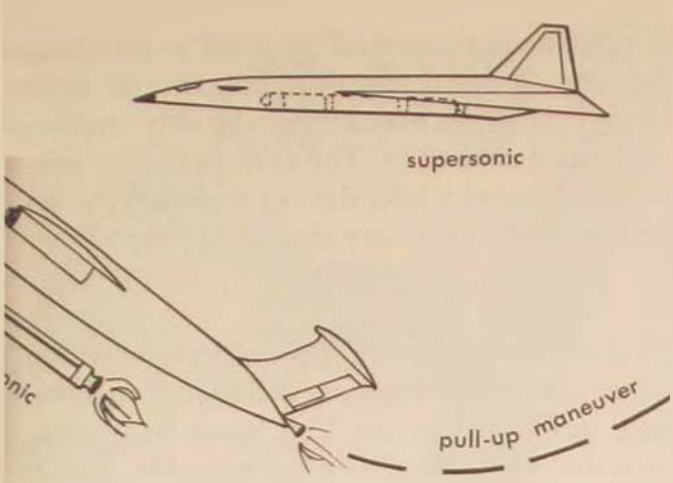


Figure 6. Current-technology horizontal takeoff and horizontal landing (HTOHL)

be obtained from an HTOHL system: the ability to provide an offset launch capability. (Figure 7a) In other words, the launch vehicle can be flown from the takeoff site to the point on the earth under the desired orbit, alleviating any requirement for plane changes or for orbital phasing. This is a particularly attractive advantage for missions employing an orbital intercept, such as space rescue and satellite inspection. An additional advantage of this kind of system over a rocket-propelled VTOHL is that the same air-breathing engines could be used during both the launch and the flyback phases, thus enabling a lighter overall system. (Figure 7b) In the rocket system the flyback engines just "go along for the ride" during the launch and thus represent a deadweight penalty.

The B-70, the supersonic transport (SST), the C-5A, and new configurations based on this technology have all been studied as possible launch platforms. Their flight profiles require the use of untried flight maneuvers such as parallel staging, perhaps a pull-up maneuver involving rocket assist, and ignition of rocket stages after a few seconds of freefall, sometimes in a near-horizontal position. These studies concluded that the high development costs and risks were not warranted in view of the small amount of energy that this type of reusable first stage contributed to the whole mission. More advanced air-breathing propulsion systems such as ramjets and supersonic combustion ramjets (SCRAMJET), in combination with rockets and turbojets, could allow application of this concept with rather dramatic increases in payload over rocket systems for a given takeoff weight.

operational considerations

The development and use of a reusable launch vehicle require adherence to certain principles. For example, to minimize investment costs, the new system should be adaptable to our current launch facilities at the East-

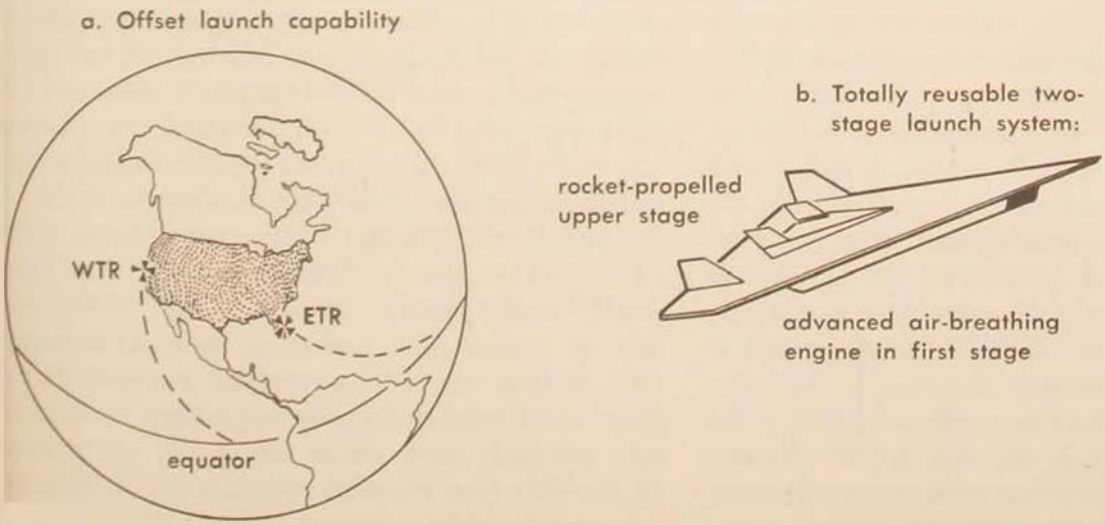


Figure 7. Advanced-technology horizontal takeoff and horizontal landing

ern Test Range (ETR) and Western Test Range (WTR). At both sites there are existing facilities that could be adapted for an RLV: the Saturn pads at the ETR and the Titan facilities at the WTR and ETR.

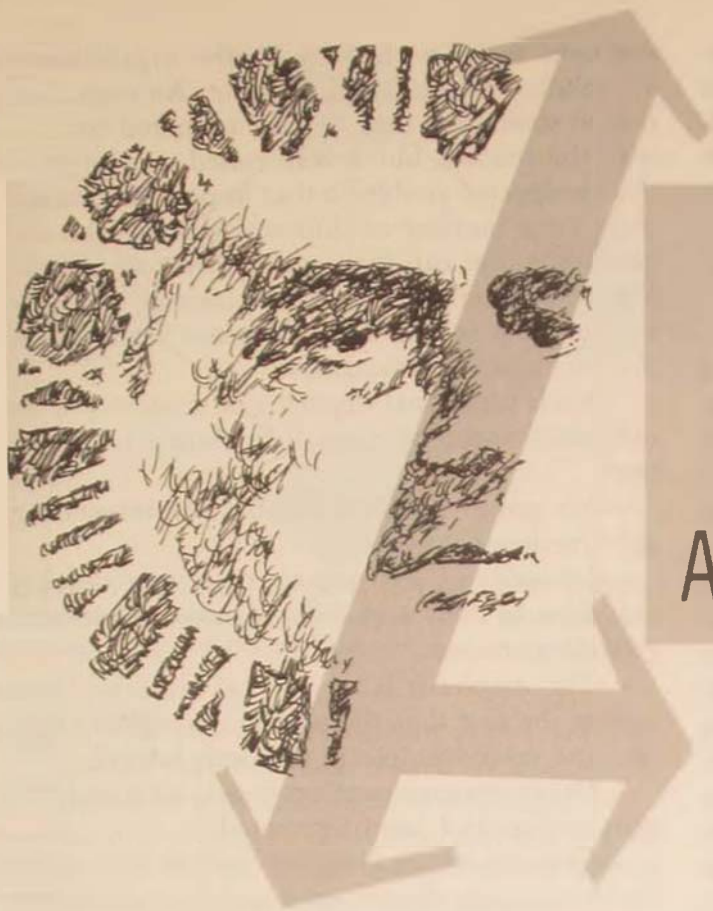
Another very important consideration concerns standardized payload interfaces. To make an RLV work, the payloads must be designed around the launch system characteristics, rather than the launch vehicles' being adapted to payload interface requirements, as is often presently done. Included in payload consideration is the requirement that minimum time be devoted to on-pad assembly and checkout because of the high frequency of launches and the limited number of pads. For example, if the 48 launches in 1968 were accomplished by an RLV from only two launch pads, this schedule would allow an average of about two weeks for pad refurbishment, vehicle loading, and preflight between launches.

One constraint for this type of system would be a standard launch profile for all launches. This might require ballasting, offloading of propellants, and, since the system will be man-rated, throttleable engines in order to provide a launch system with a flexible payload weight capability.

If the U.S. builds a fleet of RLV's, it should not be overconservative in the actual number of vehicles purchased. Too small a purchase and one or two complete failures, or even normal attrition, could significantly reduce our launch capability. The reinstitution of production lines at a later date to replenish the inventory is always a very expensive proposition.

TO ACHIEVE our future space objectives within severe budget restrictions, the *next* launch vehicle developed in the U.S. must be at least partially *reusable*. Such a reusable system could be used through the 1970s and into the 1980s, just as our Thor, Atlas, and Titan have been used in the 1950s and 1960s. The other features, such as mission abort, offset launch, alleviation of overflight problems, and "man in the loop," found in some or all of the concepts, are added benefits resulting from a reusable launch vehicle. An additional incentive for initiating development of an RLV is the technical challenge itself. The payoff for pursuing such a challenge will probably be greater than the benefits derived from exploratory trips to Mars and Venus. It would provide a flexible "space truck" that could economically open the vast reaches of space for military, commercial, and scientific purposes.

Foreign Technology Division, AFSC



Air Force Review

NEW DIRECTIONS FOR AIR FORCE LEADERSHIP

Design for Organizational Renewal

Dr. David C. Korten

THE normal condition facing Air Force managers is change. Dealing with the new and unexpected has become routine, while the problem that can be solved in the same way as yesterday's problem is the exception. The only certain prediction that can be made for the future is that rates of change will increase while permanence—in technologies, skills, jobs, organizational relationships, and missions—will decrease.

Most observant Air Force officers recognize that rapid change and increasing complexity are and will continue to be the dominant feature in the daily life of the Air Force officer. Since organizations must reflect the nature of the work they are performing, it is not surprising to find that the organizational relationships with which the Air Force leader must deal are also becoming increasingly complex and difficult to manage. This creates many problems common to all large, complex organizations, such as rapid profileration of levels of review, unclear assignment of responsibility, geographical dispersal of operations, and the near impossibility of maintaining essential face-to-face, person-to-person communication.

Top management increasingly finds it necessary to raise key questions that have the most profound implications for the way the Air Force does business. Will major organizational changes be required to make full use of the computer as a management tool? How can managerial control be maintained over systems development and procurement? How many levels of review should there be for various Air Force activities? How can excessive review be avoided while still insuring coordination and necessary control? What are the implications of either centralizing or decentralizing functions such as base support facilities and research management? How can such centralization or decen-

tralization best be accomplished? These are critical questions, increasingly difficult to answer because of the complexity of Air Force operations. Approaches to leadership and organization must be compatible with the task to be performed.

traditional vs. modern views of the organization

In the context of major change, often the methods of operation that proved effective with past problems rapidly become obsolete. The military organization of the past relied heavily on tradition, standard operating procedures, and clear lines of hierarchical authority for effective functioning. These are organizational characteristics that are well suited for operation with simple technologies in relatively stable environments. By contrast, an organization operating with complex technologies in an ever changing environment, as does the modern Air Force, must be geared to renewal, creative problem-solving, and highly flexible lateral communication and coordination. Recognition of inconsistencies between present practice and present need is stimulating a good deal of self-examination among more progressive Air Force leaders.

Much past thinking about Air Force organization has been heavily influenced by the conventional image that most managers have of the basic nature of an organization. The classic image of the organization consists of a number of boxes connected by lines, representing authority relationships from the top down. Within this classic perspective, a first concern in organizing is to break the work down into a series of units, each to be carried out according to standard procedures and policies through clear assignment of authority and responsibility to a specified group of individuals shown in a box on the chart. This view of the organization is basic to many of the classic principles of organization—unity of command, span of control, authority equal to responsibility, functional autonomy—principles which are outlined in Air Force Manual 26-2, *Organization Policy and Guidance,* and familiar to most Air Force officers.

Current research and experience highlight the fact that this approach to organization is dependent on a rather significant assumption: that the tasks to be performed by the organization are relatively simple and constant. An organization so structured may be well prepared to deal with the routine, but it is ill suited to deal with the unexpected problems that impact simultaneously on a number of different units of the organization and call for sophisticated and coordinated judgments in decision-making. The following are a few of the weaknesses often found in such classic organizations:

—Each functional department tends to put its own goals ahead of those of the larger organization.

—No group feels responsible for integrating the functional activities.

—Lower-level experience does not develop the point of view and skills required to develop general managers.

—The emphasis is on vertical relations, neglecting the fact that the middle manager's activities and relationships are primarily lateral.

—Other management processes, such as planning and control, are fragmented.

—Cross-functional understanding and communication are discouraged and functional conflicts are encouraged.

—Self-perpetuation of functional activities and resistance to change are encouraged.

—Problems of integration result, causing top management to direct its attention almost exclusively to internal relations while neglecting the organization's relations to its environment.[1]

This modern world requires a more dynamic *systems* view of the organization as an interaction between people and technology, linked by organizational structure and information flows and engaged in continual exchange with an ever changing environment. The nature of the interaction between people, technology, organizational structure, and environment determines the effectiveness and efficiency with which the organization fulfills its mission. (Figure 1)

The organizational system has many parallels to a biological system with its highly complex and interrelated flows and regulatory systems. The same criteria of health or sickness normally applied to a plant or an animal can also be applied to organizations. The organizational system that is vital, regenerating, efficient, adaptable, continually growing in capability, and in

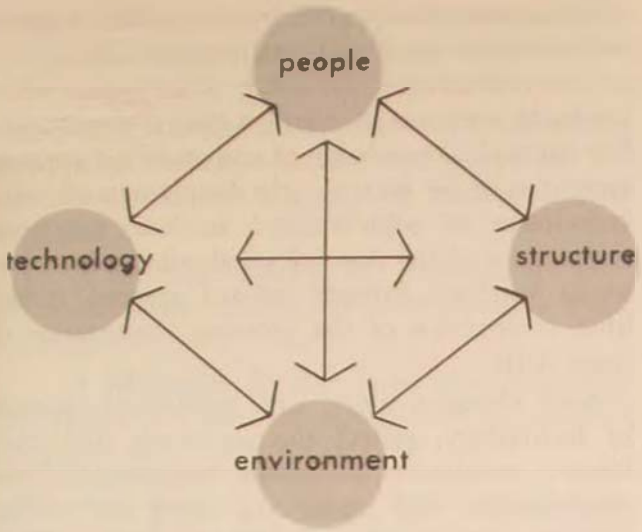


Figure 1. Systems image of organization. Dynamic environments create a requirement for a more adaptive systems image of the organization and its functioning.

touch with and realistically responsive to its environment may be characterized as healthy. An organization is basically sick if it is rigid, unresponsive, and tired; if it suffers from loss of ability to function and tends to lose contact with its environment and become unresponsive to it.

Insuring the healthy, self-renewing functioning of the Air Force is one of the most important responsibilities of top-level Air Force managers. It is impossible to prepare and plan specifically for every possible future contingency. It is, however, possible to build an organization that will be maximally flexible and adaptive in dealing with a very wide range of contingencies.

Designing and maintaining organizational self-renewal requires both self-renewing organizational structures and self-renewing leadership. The technologies necessary both to design self-renewing organizations and to develop self-renewing leaders are already available through developments in the behavioral and social sciences, though their application remains somewhat limited.

Organizations change because their environments change. Before we look in more detail at the nature of the new technologies available for organizational self-renewal, a review of some of the more important environmental changes facing the Air Force will help place the discussion in clearer perspective. In thinking of the Air Force as a system interacting with its environment, one can see the Air Force as dependent upon resources provided by the environment, in return for which the environment requires certain mission outputs.[2] Both inputs and outputs are in constant change, thus requiring constant change in Air Force operating and support systems.

For example, the people who are the human resource inputs to the Air Force are the products of a rapidly evolving social climate. Thus these inputs are changed in very significant ways.[3] Present recruits are better educated and more inclined to question convention than were their predecessors. They are not willing to follow orders blindly and accept tradition or Air Force convenience as acceptable reasons for trivial work or arbitrary rules. Money and conventional patriotism have less appeal for today's top graduates. Implementation of an all-volunteer force may remove the draft as a recruitment incentive. The implications of these changes for the Air Force organizational system are quite clear. Rather than rely on the environment to send people into the system, the Air Force must win and hold top talent by maintaining an attractive organizational climate and by providing jobs that are challenging and meaningful within the context of modern values.

Canada offers a potentially instructive lesson. There is indication that the combination of a volunteer force, antimilitary sentiment in the press, and an affluent economy has had an impact on retention that is seriously detrimental to Canada's armed forces. According to figures reported by Lieutenant General E. M. Reyno, Vice Chief of the Canadian Defense Staff,[4] these retention problems have become so severe that between 1958 and 1968 manpower costs increased from 41 percent of the Canadian defense budget to 67 percent. This has forced a reduction in outlays for equipment and facility replacement down to 13 percent of the budget and resulted in cancellation of operational exercises and unit moves.

In the United States, growing racial tensions have carried over into the military and created a threat to command structure. Spurred by directives from Secretary of Defense Melvin R. Laird, many constructive actions are being taken throughout the military forces to promote

racial harmony. Some experts believe, however, that many tensions such as those experienced by the military result not so much from racial sensitivities as from a more general resentment among those without power against arbitrary and dehumanizing rules, discipline, and conditions over which they have no control. Thus the implications of present racial tensions in the military may reach further than many people presently recognize.

Another important change affecting the Air Force is the strong effort on the part of Congress to reduce the input of money and manpower into military applications, while requiring that the output of national security remain at least constant. The Air Force can be responsive to this demand only through more effective organization. It may mean greater flexibility in the use of resources. It may mean elimination of nonessential functions. It may mean a general shifting away from labor-intensive work methods, including implementation of wholly new concepts of organization based on full exploitation of modern information-processing technology.

Other critical changes in both the input and output of the system are creating marked changes in the types of skills required to operate the internal organization system. For example, increasingly sophisticated technology has resulted in an organization in which the need for the traditional combat hero is less central to effective performance than the need for technology managers who are aware of operational needs. Only about six percent of Air Force active duty personnel are actually assigned to weapons application units. Yet Air Force organization and policies apparently remain geared primarily to the combat hero (as will be discussed later in greater detail). Further, in a dynamic changing world, new knowledge about the possibilities of the future is becoming increasingly more valuable than experience with solutions that were adequate for the problems of the past. Yet present personnel policies almost exclusively reward experience over ability, education, and performance, and some senior officers continue to feel that the talented young man who gets impatient with the strict seniority system is simply not proper Air Force career material.

Changes in the types of missions the Air Force performs are significant well beyond the change in the technologies involved. Many times it is the basic concepts of warfare that must change. For example, knowledge of conventional combat tactics must be increasingly supplemented with knowledge of sophisticated nuclear deterrent strategies and the psychological subtleties of political warfare. Present reward systems reflect little recognition of the growing importance of these skills.

Such changes, along with significant changes in technology, reflect developments that may force a revolution in defense management and organization and create the need for serious focus on the needs for organizational self-renewal. A few of the changes called for by this revolution may be reduction of levels in the hierarchy, implementation of systems management with reduced reliance on formal functional authority, organization around information systems, widespread elimination of routine jobs, changes in the kinds of skills most highly valued and rewarded, upgrading of responsibility, and a greater concern for the individual in personnel policies.

designing the organization for self-renewal

Self-renewing organizations must be designed to accomplish the following:

- Facilitate rather than restrict flexible reallocation of resources.
- Develop and reward creative, innovative, self-renewing individuals over reliable, consistent, disciplined, and tradition-oriented individuals.
- Insure the flow of new information into the organization from its environment and remove barriers that isolate the organization from new information.
- Develop a change-oriented concept of mission and organizational identity, rather than a mission concept that focuses on a highly specific output and an organizational identity that emphasizes tradition.
- Stimulate new ideas and facilitate change by minimizing controlling mechanisms and levels of review and by making sure that

authority exists to approve and implement new ideas at the appropriate levels in the organization.

- Encourage the free flow of information throughout the organization and avoid the restriction of information flow to clearly defined channels.
- Reward intelligent risk-taking performance more than strict adherence to rigid procedures.
- Minimize formal rules and reporting procedures and increase reliance on self-control relative to formal control systems.

All the above operating procedures can be accomplished by conscious and purposeful design choices and managerial actions. The result is generally an organization that is not only more effective and adaptive in dealing with change but also more satisfying and stimulating to its members. Such an organization finds it relatively easy to attract and retain creative, high-level talent.

A detailed treatment of organizational design techniques is beyond the scope of this article; however, a brief treatment of some key concepts, such as differentiation and integration, may be useful in demonstrating those integral relationships between the organization and its environment with which the designer must be prepared to deal.[5]

differentiation

For some years the task of differentiating the organization was looked on as one of dividing the work to be done into areas of responsibility and assigning them to individual offices related to each other by lines of authority as shown on an organization chart. Paul Lawrence and Jay Lorsch, in their research at the Harvard Graduate School of Business, are finding, however, that the task of differentiation is much more complex than this. In the most effective organization, offices are differentiated not only with regard to the responsibilities assigned to them but also in terms of time perspective, goal orientation, formal structure, and interpersonal styles. The more dynamic the environment, the more differentiated the organization must be in these terms to be optimally effective.[6]

The basic findings developed by Lawrence and Lorsch can be readily related to the Air Force. The personnel system within the Air Force has characteristically recognized three basic career categories: operations, administrative, and research and engineering. These categories reflect the three basic activities essential to carrying out the work of the Air Force as well as the corresponding career orientations.

Figure 2 suggests some of the implications of organizational differentiation for the operating levels of the Air Force; reality is, of course, much more complex and perhaps less extreme.

The column labeled "Operations" refers to the combat arm of the Air Force, and the relevant environment for operations activities is combat. Within this environment, time perspective tends to be very short. When a pilot is flying a mission, the relevant time frame may be measured in minutes or even seconds. The feedback on his performance is often instantaneous and final. The result is that the operations organization must be geared to instantaneous re-

	Operations	Administrative	Research and engineering
Time perspective	short	intermediate	long
Goal	effectiveness	efficiency	innovation
Symbol of authority	rank	office	technical competence
Management style	command	bureaucratic	participative

Figure 2. Differentiation and Air Force environment. Each of the different environments in which the Air Force operates has very different characteristics, which in turn require distinctly different approaches to organization for task performance.

sponse. It must be extremely flexible and contingency-oriented. Within this context, in part because of the short time frame and in part because of the finality of the results, the overriding goal must be effectiveness. Neither cost nor efficiency is a relevant consideration in a life-or-death situation. Time and circumstances do not allow time to think the problem through to a solution that is best or most productive. An immediate and adequate solution, though not necessarily the best, must suffice. Simple adherence to standard procedures may be necessary.

Within the administrative function, a more intermediate time perspective is generally appropriate. Split-second action is rarely relevant to the administrator's job. Very tight time constraints on occasion may involve a time span of a few hours, more likely a few days. The general operating perspective of the administrator is more ideally in a time frame of months or the one-year budget cycle. The feedback on the success of his efforts may frequently cover a time frame anywhere from a year to perhaps five years. Much of the administrator's concern is with the attempt to develop efficiency within his operation. The economic use of resources and the smooth flow of work with minimum abnormal disruption are often appropriate concerns. Even where there is concern for creativity and change, it is normally desirable that the routine work be accomplished on a smooth, efficient basis.

Within the research and engineering environment, a much longer-range time perspective is usually appropriate. On the basic research end of the research spectrum, the time perspective may be as long as five to ten years. Very rarely is a research effort, if worthy of the name, concerned with a time frame of less than six months to a year. Research by its very nature deals with innovation, and the goal is generally in terms of a best or most creative solution. The longer time perspective is needed to provide the flexibility and the time for experimentation and search for a best or most creative idea. If a project is properly organized and is a true research activity, the allowable amount of operating routine is minimal. This makes conventional concepts of efficiency somewhat difficult to apply.

Consistent with the differences in the nature of the work and the types of environment of the three areas, the appropriate basis of formal authority also varies in each area. Within the operations area, formal authority is generally invested in rank. Given the need for immediate response to orders under adverse circumstances and the high likelihood of members of the command structure being incapacitated without warning, a clear, visible, and unambiguous authority structure is probably necessary. The use of clear, visible rank serves a useful function within this context. If one individual becomes incapacitated, it is immediately clear who is next in charge.

Within the administrative functions, formal authority is ordinarily vested in office. A given individual has his authority because he is the Director of Personnel or the Director of Manpower or the Director of Operations. Thus, his authority is defined not only in terms of a level of authority in the organization but also in terms of a functional area of responsibility. Normally his formal authority does not extend beyond the range of his functional assignment. When the authority of rank is superimposed on the authority of office, this distinction sometimes becomes confused and may interfere with the rational functioning of the administrative structure.

In dealing with research and engineering, the critical questions are generally of a technical rather than an administrative or operational nature. Neither formal rank nor office is especially relevant. The man with the greatest recognized, specialized, technical competence relevant to the problem is accepted as the authority, and authority may shift freely from one individual to another based on the nature of the problem at hand. Free and open participation is usually the best way to define and evaluate solutions to research problems. Deference to formal rank can seriously interfere with this process and impair effective decision-making.

The same types of concepts apply to vertical differentiation of the organization as apply to the horizontal differentiation. It is generally appropriate for managers or commanders at lower levels of the organization to have a relatively shorter time perspective. Less breadth of view is required. Especially in administrative tasks,

many of the decisions are routine and can be made according to established rules or precedents. Decisions at higher levels are seldom routine; they require more analysis and much greater personal judgment. Less time is devoted to operational control at higher levels, while increasingly greater time is devoted to planning. Higher-level management must give more attention to the organization's relations with its external environment. Middle management personnel must be skilled in coordination and in maintaining lateral liaisons throughout the organization.

The major point of this discussion of differentiation is that the organization must be appropriate to the work being performed in order to achieve optimum productivity. This means there are no universal principles of organization that apply in all contexts. The more complex and dynamic the environment, the more differentiated the organization must be to achieve optimal performance.

integration

Providing for appropriate differentiation in the organization does not in itself guarantee effective performance. It is also necessary to provide effective mechanisms for integrating or coordinating activities between the subelements of the organization. Though given little explicit recognition in conventional organization charts or manuals, the significant work of the organization takes place in the form of flows.[7] These include flows of people, information, money, materials, and capital equipment. The fact that different managers are acting on different parts of the same flow, or on flows which intersect at some point in time, creates the need for coordination between their activities. Effective organizational performance requires that all flows be kept in balance with one another.

The more sharply the organization is differentiated, the greater become the problems of communication between subunits and, of course, the more difficult the task of integration. This is of significant current interest to organizational designers.

There are many trade-offs involved in organizational design decisions. This is especially evident in dealing with the problem of integration. For example, there are at least three basic ways to achieve integration or coordination in an organization, each with its own advantages and limitations.[8]

1. By the use of standardized rules and procedures to coordinate actions. This is the traditional approach. The shared superior is responsible for resolving disputes between subordinate units. Where flows are stable and the need for innovation is limited, this can be the most effective and efficient mechanism for integration.

2. By the use of an information system to provide coordination. A classic example is the airline reservation system whereby the activities of hundreds or even thousands of individuals are coordinated through interaction with a central computer. This is very useful where the information involved readily lends itself to computer processing.

3. By the use of interaction among people as the primary coordinating device. This may involve committees, task forces, or assignments of individual integrator roles whereby one individual is responsible for communication among many activities for exchange of information and for coordination. Use of interpersonal mechanisms for integration is the most flexible and adaptive option, but it may also be less reliable.

As the need for organizational responsiveness to change increases, relatively greater reliance must be placed on information systems and the use of integrator roles to provide for needed lateral coordination. Both require a fresh look at the way organizations are designed.

Greater reliance on information systems to provide for coordination means that information systems, rather than formal lines of authority, become the most critical element in the design of the organization. Thus an organization designed around an information system may be more effective than one designed around reporting relationships and functional groupings.

When integrator roles are used for coordination, it becomes immediately important to distinguish between two different types of leadership roles requiring somewhat different types of skills and organization. These are the functional manager roles and the integrator manager roles. One specializes in management of functions, the other specializes in the integration of functional

activities. Functional roles, as discussed earlier, should be differentiated in terms of the time perspectives, goal orientations, formal structure, and interpersonal styles involved. An effective functional manager adapts the style and point of view appropriate to his function; he may be relatively specialized. In contrast, the effective integrator must have especially well-developed interpersonal skills and must assume a perspective and style that strikes a balance between the extremes of the members of the functional activities he is integrating, i.e., he must be able to "speak the language" of each group of specialists. The integrator must carefully avoid a specialized functional orientation.[9]

implications for leadership and career development

The foregoing concepts have many practical implications for Air Force managers, both in a somewhat personal sense and in making broader policy decisions relating to organizational design.

The need for differentiation in leadership styles requires that each Air Force leader continually examine his own leadership style in the context of the type of work he is managing. For the individual leader, sensitivity to the demands of the situation and flexibility to adapt his own leadership style to these demands should be a constant goal in self-development. Likewise, it is important that the Air Force review the content of its leadership training programs. Research in industry suggests that the same leadership training course may improve the performance of one manager while detracting from the performance of another, depending on whether the styles taught are appropriate to the predominant style of the organization to which the man is assigned.[10] This means that training in command styles of leadership may be detrimental to a man assigned in a participatively managed R&D unit but helpful to a man in some other unit. It is important that this be considered in the design of leadership training efforts and in the programming of officers for training.

Both the individual and the organization must be conscious of the different needs of functional manager roles and integrator manager roles. They require different points of view and different skills. Assignment rotation between functional roles without appropriate orientation to the different leadership demands of the function may create only confusion and impairment of performance rather than the intended career broadening experience. The desired broadening of perspective sought as preparation for high-level management responsibility is most effectively provided through assignment to integrator roles where the requirement for cross-functional perspective is inherent in the job. Likewise it should be recognized that one individual may be well suited to career progression within a given functional area, yet not have the potential for effective performance in roles that require the integration of functions.

responsibility for organizational design

Many different organizations within the Air Force have responsibility for making design decisions relating to organizational structures, information systems, and policies concerning management, personnel, and training. Though it should be clear from this discussion that these decisions are closely interrelated, this interdependence is in reality often neglected. Indeed, no mechanisms presently exist for stimulating a coordinated attack on the questions and problems that are most significant in insuring continued organizational self-renewal in the Air Force.

There is significant need here for assignment of integrator role responsibility to facilitate joint discussion and decision-making on questions such as "How can organizational structures be redesigned to make optimal use of advanced information processing and communication technologies?" These efforts must be supported by research aimed at improving the technologies available for dealing with organizational design questions and adapting them to specific Air Force needs.

Maintaining a capacity for renewal requires the continual availability to Air Force managers of data relating to the health of the organizations which they are managing. An information system which provides for continual gathering and reporting of data on the motivation, utilization, and retention of Air Force personnel can

provide quite powerful indicators of organizational health and assist in the identification of trouble spots. Such information is of critical importance to organizational designers. Researchers at the University of Michigan are making progress in the design and development of such systems.[11]

preparing the "new managers"

The problems of preparing men to manage dynamic, change-oriented organizations are much more difficult than training men for more conventional roles. On 9 July 1969 Under Secretary of the Air Force John McLucas addressed a memorandum to the Assistant Secretaries of the Air Force which contained the following statement:

> I am concerned with the degree to which the Air Force is now prepared to ensure that the right kind of people will be available to meet the requirements of the new management techniques. We must carefully examine our assignment and training procedures to identify those with the skills and aptitudes necessary for increased managerial responsibilities, to train them for the demanding positions and then to retain and develop them for even heavier responsibilities.

The "new management techniques" combine skills in the use of sophisticated information and decision-making technologies with advanced skills in group dynamics and interpersonal relations. According to *Business Week* the new management is "bringing a new breed of manager into the executive suite and giving the old managers a new outlook. In company after company, it's also shattering the old organization charts."[12]

The new management is geared to change and requires men who have the skills, values, and self-confidence that are required to manage change and to seek continual self-renewal. These skills and values must be built into the organization through intensive and carefully planned development programs. Such development programs can be of two types—those which focus on developing individuals and those which focus on developing work groups or teams. For the development of individuals, the Air Force has one of the world's strongest "in-company" educational systems in the Air Force Academy and Air University. Working groups from the various schools now meet regularly to insure that current programs are geared to providing self-renewing leaders skilled in the new management techniques.

However, as important as individual leadership may be, experience indicates that organizational change and improvement require the training and development of teams as well as individuals. An individual committed to the new management will only become frustrated and create conflict if he is assigned to a group comprised of individuals still operating with the skills and assumptions of traditional management. Thus industry is increasingly turning to the use of organizational development programs to supplement more conventional management development efforts. This approach involves training work groups as teams. Rather than dealing with abstract problems in a classroom, the trainer or consultant works with the group to develop its skills through working on the problems which the team daily faces in carrying out its mission. Special emphasis is placed on developing skills in goal setting and communication and on resolving interpersonal and interdepartmental conflicts which inevitably result from complexity and change and which may interfere with effective performance.

The new techniques have been pioneered by several space-age companies. Their success is attested to by the rapidly spreading use of team or organizational development techniques throughout industry. The Air Force might well benefit from the creation of an internal organizational development capability as an important part of its long-range self-renewal effort.[13]

PREPARING for change and assisting in the search for organizational self-renewal are key responsibilities of every member of the Air Force. New concepts of organizational design, new techniques for organizational analysis, and new methods for the development of leadership skills provide potentials that were not previously available. It is becoming clear that conflict between needs for personal self-realization and needs for organizational performance and flexibility is unnecessary. The well-designed organi-

zation can be self-renewing and productive and at the same time provide a satisfying work environment in which its members can grow and make full use of their individual abilities. Developing such an organization is no simple task—it requires substantial and continued commitment on the part of Air Force leadership.

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Notes

1. This list is adapted from Howard M. Carlisle, "Are Functional Organizations Becoming Obsolete?" *Management Review*, January 1969, pp. 2–9.

2. For further elaboration of this concept relating inputs to environmental demands, see David Easton's "A Systems Analysis of Political Life," in Walter Buckley, ed., *Modern Systems Research for the Behavioral Scientist* (Chicago: Aldine, 1968), pp. 428–36.

3. Lt. Col. Robert H. Drumm has examined these changes in "Managing the Managers of Tomorrow," *Personnel*, November-December 1969, pp. 55–60, and in "Armed Forces Managers in a New Era," *Military Review*, November 1969, pp. 72–79.

4. Letter to Lieutenant General John W. Carpenter III, 31 January 1969.

5. In addition to the other references cited in this article, the reader who desires a more detailed treatment of organizational design concepts may wish to consult the following: Jay Lorsch and Paul R. Lawrence, eds., *Studies in Organization Design* (Homewood, Illinois: Irwin, 1970); Paul R. Lawrence and Jay W. Lorsch, *Developing Organizations* (Reading, Massachusetts: Addison-Wesley, 1969); and James D. Thompson, *Organizations in Action* (New York: McGraw-Hill, 1967).

6. Paul R. Lawrence and Jay W. Lorsch, *Organization and Environment: Managing Differentiation and Integration* (Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1967).

7. Jay W. Forrester, *Industrial Dynamics* (Cambridge: Massachusetts Institute of Technology Press, 1961); and Leonard Sayles, *Managerial Behavior: Administration in Complex Organizations* (New York: McGraw-Hill, 1964).

8. The alternative methods for achieving integration in an organization have been treated in much greater detail by Jay Galbraith in "Program Management," working paper, Sloan School of Management, M.I.T., Cambridge, Massachusetts, December 1968.

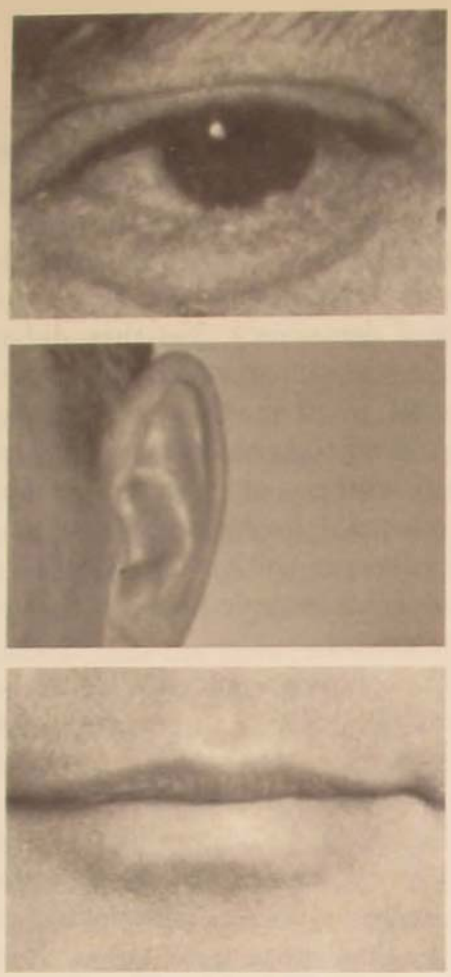
9. Paul R. Lawrence and Jay W. Lorsch, "New Management Job: The Integrator," *Harvard Business Review*, 45, November-December 1967, pp. 142–51.

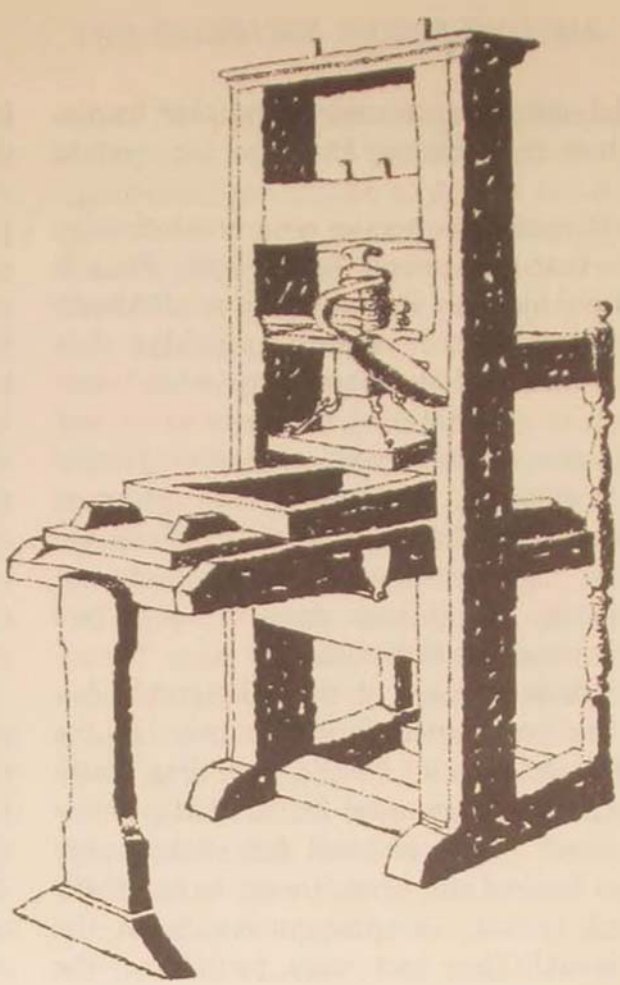
10. John B. Miner, "Innovations in Management Education for Intermediate Students—Continuing Education Programs," paper presented to the Eastern Academy of Management, Washington, D.C., 29 March 1969.

11. Rensis Likert and David G. Bowers, "Organizational Theory and Human Resource Accounting," *American Psychologist*, vol. 24, June 1969, pp. 585–92.

12. "The 'New Management' Finally Takes Over," 23 August 1969, pp. 58–62.

13. The following sources provide more details on organizational development programs and how they are implemented: Sheldon A. Davis, "An Organic Problem Solving Method of Organizational Change," *The Journal of Applied Behavioral Science*, vol. 3, 1967, pp. 3–21; Richard Beckhard, "The Confrontation Meeting," *Harvard Business Review*, 45, March-April 1967, pp. 149–55; Richard Beckhard, *Organization Development: Strategies and Models* (Reading, Massachusetts: Addison-Wesley, 1969); and Edgar H. Schein, *Process Consultation: Its Role in Organization Development* (Reading, Massachusetts: Addison-Wesley, 1969).





THE PRESS AND PUBLIC OPINION

HARRY M. ZUBKOFF

THE military services have a legitimate interest in how the press reports their affairs. The objective of all news reports is to provide the public with a solid base on which to form its opinions. Every government agency must, therefore, do what it can to insure that the reports of its activities are complete and in focus, not fragmentary or distorted. But, contrary to some opinion, we in the military information field do not "control" the press or "manage" the news. Our efforts to convey the facts to the people must be conducted within the framework of our governmental structure. So we have

a special obligation to understand that framework, how it functions, and how we operate within it.

Our democracy operates on a revolutionary theory—that the people know best. That is what the American Revolution was all about. We believe that the majority, provided they are well informed, will come up with better solutions to our national problems than any single leader or small group of leaders, even if they are geniuses. We believe that informed discussion and debate on national policies are the basic ingredients of our strength as an open society. Experience over the past two centuries bears out these beliefs.

The whole context of the relationship between the government and the press in the United States was set by the Founding Fathers. Those wise men, who feared that government power might be used for wicked purposes, so framed the Constitution as to enable the press to keep a constant watch on the government. They not only prohibited the government from censoring or regulating the press—that's what the British government did, and after all they had only recently gained their independence from the British—but they even assumed that the press would censor the government. "No government ought to be without censors," Jefferson wrote to President Washington, "and where the press is free, no one ever will." Jefferson believed that the survival of this new nation depended upon information that would, in his phrase, "penetrate the whole mass of the people." In fact, he thought information more important than the governmental structure itself: "The basis of the government being the opinion of the people, the very first object should be to keep that right: and were it left to me to decide whether we should have a government without newspapers or newspapers without a government, I should not hesitate a moment to prefer the latter." He also said, "When the press is free and every man able to read, all is safe." He was referring to the role of the press in informing the people on what the government is doing. Accordingly, our free press watches and criticizes the government and informs the people.

It is clear from all this that the founders considered informing the people to be a function of democracy. Yet they did not think it wise to set up an official information system. Instead, in effect, the press—privately owned, beyond official control—was incorporated into the machinery of government, but in a way that insured its freedom from any particular administration. This situation has made for a continuing struggle between the press and the government.

The press has not always pleased men in public life, despite their recognition of its vital role. Nearly all American presidents have arrived in office praising the press and departed condemning it. Editors like to quote Thomas Jefferson's remark that he would not hesitate to choose "newspapers without a government" rather than the reverse, but in the end even he changed his mind. Angry with the treatment he got from the press while he was President, he said: "The man who never looks into a newspaper is better informed than he who reads them, inasmuch as he who knows nothing is nearer the truth than he whose mind is filled with falsehoods and errors." That quotation is not often cited by editors.

Probably every President since Jefferson has had similar complaints. Woodrow Wilson started his first press conference by saying: "I feel that a large part of the success of public affairs depends on the newspapermen. . . ." But before long he was saying: "I am so accustomed to having everything reported erroneously that I have almost come to the point of believing nothing that I see in the newspapers."

President Truman once wrote to a reporter: "I wish you'd do a little soul searching and see if at *great* intervals, the President may be right." And according to Theodore Sorensen, President Kennedy never challenged the accu-

racy of Oscar Wilde's observation: "In America, the President reigns for four years, but Journalism governs forever."

Yet, no matter how angry they may get with the press, all who hold public office come to understand the importance of the press in making government work. The press, in fact, is a vital participant in our governmental process. It is the "fourth branch of government," a term Douglass Cater used for the title of his book on this subject. The "other" three branches would be quite different in their operation and probably not as effective if it were not for the press.

So government and the press, like it or not, live together in a sort of miserable marriage. It reminds one of the story of the disciple who asked Socrates whether it was better to marry or not to marry. "Whichever you do," replied Socrates, "you will regret it." Sometimes, as in marriage, the press and the government hate each other; and sometimes they get along reasonably well together. But the conflicts between them can never be wholly resolved unless one or the other abandons its responsibilities—in which event all of us would suffer, for a free society cannot survive without this peculiar partnership.

It is important to understand the origins of this relationship. Not only our government but our very form of democracy is dependent on the continuance of a free press. Not only our people but the very nature of our society is dependent on it. And the press affects our society in some very tangible as well as intangible ways. It affects public opinion, both directly and indirectly, and thus plays a major role in shaping—and changing—our society. In fact, the press has been a dominant force in much of the social legislation which affects our lives.

The press of a hundred years ago, for example, was responsible for crystallizing public opinion about the abolition of slavery and brought about a favorable climate for the amendments to the Constitution which grew out of the philosophical concept that all men are created equal. If the newspapers had not conditioned the public to accept this point of view over a long period of time, Abraham Lincoln might never have pursued it and the Civil War might not have taken place when it did. Another of the great changes in our society has been the rise of the labor unions, which came about because for more than fifty years the press presented the cause of labor favorably and thus created a climate of public opinion that made it possible for legislators to pass the great labor laws.

The press today is infinitely more widespread than it was 100 years ago or 50 or even 20 years ago, for, while newspapers have expanded their circulations, the chief difference lies in the enormous audience which television now reaches. If the press was influential before television, its impact has been multiplied many times over by the advent of television. Today many people, including those who are not well educated and even illiterate, have seen on television more of the world around them than had the most sophisticated travelers of fifty years ago. They have watched the democratic election process in action, from convention to campaign to the counting of votes; they have watched historic international debates and confrontations at the United Nations, visited other nations and other continents with the President, seen the savagery of guerrilla warfare in Africa and in Vietnam, and witnessed the brutality and destructiveness of riots in our own cities and on our campuses.

The audiences of today are measured in millions and tens of millions, for both the written and the broadcast media. Unquestionably this kind of circulation must impact heavily on public opinion, and this influence is felt in many ways, though there is no way to measure it precisely. It is so pervasive that, whether people are interested in public affairs or not, they are affected. This became clear when the Bureau of Applied Social Research

of Columbia University investigated the political preferences of people in one county in Ohio. So many people admitted that their votes were often swayed by others that those influential names which kept cropping up were labeled "opinion leaders."

This study constituted a sharp breakthrough in social research. Studies of personal influence began to cluster about the theory of opinion leadership, and the opinion leaders in each field proved to be readers of newspapers and magazines and listeners to broadcast news, or else the writers and broadcasters themselves. In fact, attention to the press is a condition of opinion leadership. The opinion leaders are thus simply extending the power of the press to influence public opinion.

But while the press has helped bring about changes in our society by influencing public opinion, the press itself is affected by the changes it has helped bring about as well as by the normal changes of a growing society. Some very significant changes have taken place in our society in this century, including our increasing interest in public affairs. People are concerned about their total environment today. For example, where once the disposal of waste was a private matter, or at least a local matter, it is now a matter of national concern. Where once the wage contract between the employer and the employee was a local arrangement, now the whole country is concerned. The pay of garbage collectors in New York City or of teachers in Washington, D.C., affects Oklahoma City and Los Angeles as well.

As a result, the press has been swamped with an interest in news. Wherever the citizen and the public interest meet—in crime, in zoning, in consumer regulations, in labor matters, in national defense, wherever the government and the people meet—these events must be reported if the people are to have the kind of information they need in order to govern themselves properly.

The fact is that we Americans, in terms of the amount of information available to us, are the best informed about public affairs of any people in the world. Through the various media of the press, each man's realization that he is involved in all other men's lives, one of history's great change-making ideas, has been vastly expanded. As never before and nowhere else, the press has done the job first enunciated by James Madison, the father of our Constitution: "A people who mean to be their own governors, must arm themselves with the power knowledge gives."

The trouble is that we are becoming less able to understand the meaning of current events because the information itself is outpacing our capacity to comprehend. It has very little to do with the performance of the news media or with any efforts by the government or the press to suppress or manage the news. It is simply that everything is becoming more complicated, more scientific, more technological; and most of us do not have the necessary education or training to comprehend fully the things that are happening.

Information, of course, is simply another word for knowledge, and the increase in the sheer bulk of knowledge is another revolutionary change of our time. The increase in knowledge during the past thirty years equals the amount gained in all the years of human history up to then. Some specialized areas have far outstripped others; in the field of physics, for example, the quantity of knowledge is doubling every ten years. But though the total amount of knowledge has multiplied many times, that part of it which is common knowledge—which ordinary individuals know—has increased much more slowly.

As areas of new knowledge have grown, they have become more and more specialized, and the specialists in the fields have come to use language that is less and less comprehensible to the layman. Today every public question—national defense, environmental pollution, educational policy—involves highly specialized knowledge. The role of the press is to

translate such knowledge into language the rest of us can understand, but there is considerable doubt on the part of many knowledgeable critics that the press is doing this job as well as it could, and certainly not as well as it should. As a result, there is a growing credibility gap separating the press and people. There is a disturbing skepticism among readers as to whether what they read in their newspapers is either true or relevant.

An old story illustrates this skepticism most aptly. A fellow asked a friend what he should do about a very critical article in the newspaper. Should he demand a public apology or file a suit for damages? His friend listened to the complaint and then said: "What should you do? Do nothing. Remember, half the people who read that paper never saw that article. Half of those who did read the article did not understand it. Half of those who did understand it did not believe it. And half of those who believed it are not worth bothering about."

The question is, Whose fault is it? The press is limited not so much by its own capacity to present news as it is by the reader's capacity to absorb news. That's the critical factor. Surveys have shown that people rarely spend more than 30 minutes a day—and usually less than that—reading their newspapers, and they spend another 15 to 30 minutes listening to radio or television news. This modest investment in time drastically limits the amount of news one can absorb and gives the press an excuse for limiting the amount of news it will publish.

As a result, of the thousands of things that happen on any given day, reporters and editors make only a very small selection to transmit to the public. By being extremely selective in choosing what to publish, the press has both simplified and complicated American life. It has simplified life by making it easy to concentrate on a few issues; it has complicated life by making it difficult for all pertinent views to be heard. Consequently, if individuals or groups have problems to bring before the public, they either have to hire publicity agents and advertise or else create some kind of disturbance so that the press will give them free publicity. Sometimes they do both: hire publicity agents to organize demonstrations.

Politicians particularly are sensitive to what the reporters select for publication, for this is what gets a reaction back home where the votes are. What makes news in our society thus influences public opinion and, in turn, impacts on governmental policy decisions.

THE critics contend not that the press is getting worse but that it is not getting better fast enough. McGeorge Bundy, president of the Ford Foundation, suggested in a talk to the American Society of Newspaper Editors that many specialists, particularly in the universities and in government, could tell more of the important relevant truths of our times than the reporters. He added:

> The professions of scholarship and of journalism are threatened with a requirement of merger. A cynic might say that the scholars should learn to write and the journalists should learn to think.

Magazine publishers learned years ago that sophisticated readers want and will take time to read sophisticated, interpretive writing in which a skilled reporter examines a complex situation—student demonstrations, the population explosion, the antiballistic missile—studies the background, interviews the experts, and comes up with the essential truth of the situation. Then he writes his story in a way that gets the reader involved and conveys the facts. This is a tough, highly skilled, creative kind of writing. It takes time and it costs money, but magazines have built multimillion circulations on it, and some of the best newspapers are following suit. But the problem of how to relate the news meaningfully—how to

provide perspective without ignoring the line between fact and opinion—has still not been resolved satisfactorily by most newspapers, and particularly not by television.

The critics further contend that the press is not covering ideas and causes very well, either. It emphasizes the conflict in the streets, but it does not relate that conflict to the underlying reasons. James Reston, one of the best-known journalists of our times, wrote this not long ago:

> I believe we in the news business are going to have to twist ourselves around and see these wider perspectives of the news, the causes as well as the effects, what is going to happen in addition to what governments do. It is not governments that are transforming the world today, but the fertility of people, the creativity of scientists, the techniques of engineers and economists and the discoveries of physicians. Almost all governments in the world today are merely rushing around trying to keep up with the consequences of what is happening outside their own official offices.

Reston points up the failure of the press to give us enough interpretation of the news or perspective on it—and in these days of complex affairs, a simple presentation of facts without explaining the meaning of those facts often has little significance. When newsmen fail to add up the meaning of change, people lack confidence that they know what is going on. And the tragedy is that many of those who are so sure that they know really do not. The loudest shouters, both on the left and the right, tend to ignore the actual changes taking place and base their views on a simple, more static society that simply does not exist any more. The noisiest debates are almost meaningless because their informational backgrounds are fragmentary and out of date.

Even a powerful nation like ours can become pervaded by a sense of its own ignorance and helplessness if it feels that it does not have an adequate view of where it is going. In fact, lack of confidence in the quality of news could be fatal in our kind of society. If society does not know about poverty, for example, it cannot deal with it; if the consumer does not know enough about what he is buying, he cannot protect himself; if the public is unaware of the threats to our country, it cannot provide for an adequate defense system. The way to insure our future is to be sure that information, the essential ingredient of democracy, is adequate.

Our elected officials risk a disastrous confrontation with the voters if they embark on an important policy without first making certain that a large body of Americans is informed about it and has had an opportunity to discuss it. Whatever the government seeks to do—whether it seeks to negotiate an arms control or disarmament treaty, or a treaty to prevent the proliferation of nuclear weapons, or an agreement to limit the production of ballistic missiles—there must be broad-ranging public discussion about the objective and the means of attaining it. The discussion takes place primarily in two places, the Congress and the press. The people participate only vicariously, in a sense, but their concurrence is absolutely imperative to the success of any long-range policy.

This is the beauty of the American system, that the people, through their majority view, are the final arbiters of our destiny, the final decision-makers in our governmental process. The important thing to remember is that the discussions, both in the Congress and in the press, take place over a period of time and that it is impossible for all the facts and all the arguments to emerge in one day—or from one source. Walter Lippmann once said, "The theory of a free press is that the truth will *emerge* from free reporting and free discussion, not that it will be presented perfectly and instantly in any one account."

The ultimate burden, therefore, falls upon the individual citizen. If he wishes to be well informed, he must read *widely* in the press and listen *widely* to the broadcasts. No one

example of either can serve him adequately. Moreover, he must add up what he reads and hears over a period of time and apply his own thinking processes to what he absorbs.

By way of illustration, consider the professor whose hobby was woodworking. He had his basement converted to a carpentry shop and bought a combination power tool that could be rigged as a lathe or a band saw or a drill press or anything else he could conceivably want to use. When he got it home, he took it out of the crate and sat down to read the instructions on how to assemble it. After spending a whole day trying to put it together properly, he finally gave up and called in the neighborhood handyman. This handyman was just an unschooled old fellow who did odd jobs. He came in, looked at all the parts strewn around the basement floor, and, without even glancing at the instructions, went right to work. In a half hour he had the thing completely assembled, without a single nut or bolt left over.

The professor marveled at him. "How on earth did you do that so fast," he asked, "and without even looking at the instructions?"

"Well, you see," said the handyman, "I never learned how to read, and when you don't know how to read, you have to learn how to think."

The moral, the real point, is that when you *do* know how to read, you have to think twice as hard—that's something we should all practice.

Office of the Secretary of the Air Force

In My Opinion

ON BEHALF OF PERSPECTIVE

COLONEL ROBERT F. HEMPHILL, USAF (RET)

MEMBERS of the gray-haired legion of the retired occasionally find time for rumination of the type that too often is an intrusive luxury for the busy commander or staff officer. Briefing deadlines, suspense dates, and visiting firemen are natural foes of quiet contemplation.

Depending upon circumstances, the retiree may discover himself to be a resident defense expert, gratuitously assumed by his neighbors to be broadly informed in the ways of arms and a source of reliable opinion on anything related to a military service. He must chuckle, reminiscent and misty-eyed, at World War II Spam jokes and nod sagely at topical growls about the military-industrial combine.

The retiree speaks from a unique platform, being peculiarly of and yet not fully within the service. He can encourage objective evaluation of the defense establishment, which increasingly is being called to account, during this season of disenchantment with a war which fits no earlier pattern and of nagging worry over perils at the doorstep. It is desirable that he be able to interpret lucidly and logically the defense function as he sees it, particularly its meaning in terms of people, the essential common denominator. What did it mean to him? Why did he elect to spend a substantial number of his productive, mature years in uniform? How does he feel about it now? What about the services today?

This calls for perspective, and the retiree needs to get his philosophical house in order if he is to make prologue of his past.

Like the career doctor, architect, salesman, or farmer, the career serviceman pursues his vocation for a number of reasons. Usually he likes it and gets satisfaction from performing responsibly and well. He sees it, perhaps unsurely at first, as a means of honoring the citizen's fundamental obligation to his nation and of doing something useful with his life. This, his visceral reaction tells him, is the way it ought to be. Not inconsequentially, the career pays him less than he would prefer but enough for him to provide

the necessities for himself and his family.

The individual on his way to becoming a military man does not always proceed via the nearest direct route from the schoolroom to the orderly room, clear-eyed and unafraid, sure of his goal. Indeed, some wander—others are shunted—into military life. Those who came along in the late 1930s and early 1940s found vocational preferences pre-empted by a nation preparing for the possibility of war, and they were not unfailingly pleased with their fortunes. But when the bombs exploded that Sunday morning in Hawaii, there was motivation enough for all. It was war! We had been attacked, and we would, by God, clean a few ploughs—which we did.

The World War II veteran who chose to remain in uniform did so because he found in service life a precious, ineffable purpose which outweighed and tempered the dislocations, discomforts, and dangers. There was a sense of continuing accomplishment, a strong feeling of kinship between the individual and his nation, a kind of proprietary, interdependent reliance that is produced by few other human endeavors.

It did not occur to him to question that intuitive sense of belonging and mattering. It was enough, even as the more tangible rewards of military life reinforced the quiet conviction that the career decision already taken had been the right one. He would have been slow to repudiate Stephen Decatur's "our country, right or wrong" rhetoric.

Threaded throughout the seasoning years of service was the pride of being a part of the nation's defenses. Beyond serious question, defense continued to be necessary because the nation was eminently worth protecting and preserving. It was still young in years and bright with promise, and its acknowledged imperfections were correctable. The hope persisted that the nation, functioning through its lawful governmental processes and applying its diplomatic skills complemented by sure and potent strength of arms, might be able to bring about just and enduring conditions of peace, at least in regions of immediate concern.

Such sanguinity did not go untested. There were wars and their rumors, police actions, and shows of force and flag which kept the private military household, if not the entire defense establishment, in tension. There were few truly peaceful periods during which the professional—even if his service had urged it—was free to tug at his mental moorings and wonder just who he was and where he was heading, or, for that matter, whether either he or his service was in constructive motion. If he wasn't the regular crew chief assigned to a specific defense task, he was off somewhere learning how to become one.

At service schools, where he polished his military know-how and marveled at the integrity with which immutable operational principles prove their immutability, the subject usually was wars and how to win them. That made sense. Why else would a nation keep a uniformed defense force trained in the application of violence? Who wants to come in second in a war?

Similarly, his study at civilian institutions pursued academic goals related to the defense mission, which also made good management sense.

But where, in all this, was the military professional supposed to learn to identify and to deal with the tides of change now reshaping the society which produced both him and the defense establishment? For that matter, were armed forces philosophers, whose concepts influence the evolution of the services, any more prescient than their fellows on the campuses, in industry, and elsewhere in government when it came to forecasting disruptive shifts within the nation's social structure? Whether they should have foreseen trouble both in the jungles of Southeast Asia and "right here in River City" is important now only as it sharpens their future perception.

The serviceman and the military machine he was forever tinkering with and testing were tucked away behind the chain link fence, and he was told to keep ready. There didn't seem to be time or need for anything else.

This seems now to have been shortsighted because defense and those who constitute it cannot exist apart from the nation served, whatever its current complexes. Only at the peril of alienation do military men forget this relationship, and in times of divisive stress, as at present, the erosion of traditional public support of the armed forces emphasizes its vulnerability.[1]

The American military man of today may wonder whether the defense establishment of which he is a part has become so engrossed in

the problem of fighting a strange and distant war that it has failed to apprehend the substantial changes in the community environment at home.

Unless he suffers it by choice or default, the man in uniform is not shut off from the sound and sight of events in that community, no matter where he may be. Service life may, if he lets it or if he is ineptly led, soften and dull his awareness, detaching him from the real world outside the perimeter fence and persuading him that he need not concern himself with mundane problems because his is a higher calling—even though he came from and ultimately will return to that world outside the fence.

He does not live in remote comfort within a steel cocoon, endlessly whetting his saber and updating his war plans, and yet undeniably he is committed, as his nonmilitary peers are not, to calculated, rehearsed response to incursive threats and actions. He is a man "set under authority," as was Luke's Roman centurion,[2] a human resource at the ready who can be momentarily and terminally employed in the national interest without moratorium, strike, or haggling over the scope of his employment. He does not blindly assume this role with its inherent limitation of his personal freedom but accepts it because of its promise of a broader freedom.

It is becoming evident that the career military man, a product of his time and place, cannot ignore the forces of change at work in the society upon which he depends. His mission is defense of his country from all enemies, foreign and domestic. He is committed not to the preservation of the status quo but to the safeguarding of those lawful forms and structures within which reasoned and reasonable change can occur. He may—perhaps must—seek involvement in the changes which roil about him today because of a growing conviction that it has to be done, that somehow he must be "responsive . . . to legitimate demands for change."[3] For him, whatever the roots of his philosophy, it may no longer be enough to hold sympathetically aloof, pursuing military competence within his closely defined assignment in the belief that there only lies his duty.

The career man is concerned about his stance on the major social, political, and moral issues confronting his nation. He, too, is a citizen and has inherited the responsibilities as well as the blessings. Sitting before his TV in Georgia, Germany, or Japan, he sees men treading the moon, living with new hearts, besieging campuses, and polluting the atmosphere. He reads of the flouted decorum of previously inviolable institutions, of the hopelessness of ghetto dwellers trapped in the poverty cycle, and he stirs hopefully at news of Strategic Arms Limitation Talks and the nuclear nonproliferation treaty. He wonders what these kaleidoscopically dissolving and shifting scenes mean to him and to the defense function. He wants to react but checks his impulse until he can ascertain that reaction will not impair his performance of duty—that still comes first.

But he should not be misunderstood if he asks whether "duty" has not gained a new dimension. In the face of sobering domestic challenges, is there not something additional that he should be doing? His uniform may complicate his reaction, but it cannot muffle his inclination to stand up and be counted among those who are ready to help.

It would seem, then, that the career serviceman thus disposed should be pointed toward avenues to explore in his desire to assist in the reduction of the nation's distressing internal problems. He needs to be told his service's position on such issues as urban decay, the increase in crime, subsistence-level existence, discrimination, inflation, the drug culture and the young, and the pollution of resources. He can decide then where his expanded duty lies, realizing that by his own earlier career choice he is not quite a free agent.

In the optimum case his service will disclose more than positions and policies. It will offer operational programs in which he can, to the limit of his interest and to the extent consistent with his traditional mission responsibility, invest himself.[4] It will provide for him a new career dimension which recognizes afresh that the American serviceman lays it on the line, anywhere, in the defense of his nation.

Like other men, the career serviceman passes

this way but once, and he wants to believe that his passage matters. He, too, wants to catch a vision and help it come a little closer—in perspective.

Tokyo, Japan

Notes

1. Chaplain (Lieutenant Colonel) William G. Devanny, "The Ecumenical Movement and the Military," *Military Review*, March 1967, pp. 28–34.
2. Luke 7:8 (Revised Standard Version).
3. Lieutenant General John W. Carpenter III, USAF, remarks at USAF Chaplains conference, 15 October 1969, extracted in *Air Force Policy Letter for Commanders*, Office of the Secretary of the Air Force, Washington, D.C., 1 November 1969.
4. Dr. John L. McLucas, "Domestic Action—A New Challenge for the Air Force," *Air Force and Space Digest*, February 1970, pp. 54–57.

LIFE SEMINAR: THE FOUR-YEAR SERVICE COMMITMENT

CAPTAIN ROBERT M. DANA

> *So the first year went by, in magnificent exclusion and activity of learning. It was strenuous as a battle, her college life, yet remote as peace . . . This was only a little side-show to the factories of the town.*
>
> D. H. LAWRENCE, *The Rainbow*

LAWRENCE'S description of college life relates to my generation of junior officers, campus unrest notwithstanding. That little olympiad of formal education is now the common experience of every junior Air Force officer entering extended active duty. It is the singular follow-on experience that commissioned service holds for the young officer that I wish to address, now with the leverage of some perspective. That is, what happens when the formalized college experience (the "little side-show") that each new lieutenant brings to the service meets head-on with the objective, open-ended demands of men (speaking on the highest plane) involved in a serious business? What happens when the academic world's clear-cut theorem or classically constructed plot dissolves into a situation where the rules of conformity may not always match the game? Be the results good, bad, or indifferent, I submit that when campus life abuts service life, for the new officer the latter is largely an objectifying, broadening experience.

The nature of this first exposure and its influence on young officers in deciding whether to remain in the Air Force are the broad fabric of this discussion. Its title draws an academic comparison: in the classroom the seminar is a forum for discussion, ultimately to arrive at a consensus or to draw an analogy, perhaps to expand a concept; in many ways the daily exchange of Air Force life has worked to the same end for me. It has been a maturation process that has touched virtually every aspect of living. Many have contributed to the broad experiences of my Air Force "life seminar," and from them has come the impetus for this discussion.

the democratizing experience

Because the Air Force community presents so much more of a national and international cross section than any academic community, I feel that the service has given me a valuable democratizing exposure. The ventilating effect of this experience is simply not available or possible in those large sunny classrooms presided over by a single professor. Ethnically, regionally, socially, economically, and intellectually there is no comparison. My college classmates, for example, were mostly from families that could afford college. Personally, I find it as stimulating

and broadening to talk with and train a Puerto Rican airman (who could not afford college) as to converse with my college roommate or a published professor.

To state the obvious, there is a growing tendency in the academic community toward the liberal viewpoint. Antiwar sentiment, the leadership of some liberal politicians, and emerging social freedoms are all readily apparent and in vogue on the campus. In the service one encounters a broader range of people and comes to know their opinions and attitudes. I have found the tempering effect of opposing viewpoints in the Air Force community most healthy. Avoiding oversimplification, so often apparent in the artificial antitheses ("When all guns are outlawed, only outlaws will have guns" to cite an example), and the pat answers of fashionable viewpoints actually lends weight and dignity of understanding to the held opinion. Thus, one's viewpoints can be forged from a variety of experience that is not limited to ivory tower consensus.

In short, most college graduates welcome the opportunity to practice within everyday society what they have learned in school. Take a subject commonly (but incorrectly) considered to be esoteric and academic, namely poetry. The imagery of poetry is so firmly chained to the five senses that verse demands actual experience to give it resonance and its deepest meaning. The same is true of natural sciences, engineering, or whatever. No discipline can fully mature if confined to the study; it wants application. The military community provides a seedbed for this maturing. It provides a great service. It also wages war, man's most astounding negative phenomenon. Within that scenario there is surely life to be lived and experience to be gained.

I find, as well, that the uniform, with its openly worn rank and experience (i.e., service ribbons) is a great leveler. "Rank among second lieutenants is like . . ." (The indelicate quotation and its truth are generally familiar.) This common condition of junior officers was reinforced by the recent decision to discontinue the granting of regular commissions through ROTC and OTS and to require instead that they be won on active duty. There is one exception: the value of the intense and specialized education of the USAF Academy graduate quickly and invariably emerges. My own experience is that to be non-Academy, nonrated, and in a nonoperational assignment decidedly places one in a second-team status. Unfortunately, few enjoy carrying the water bucket, a fact apparent—hopefully—to most personnel officers.

the comparative experience

To draw comparisons of all kinds is part of the maturation process. The junior officer compares service life with his past, and the service compares him with his peers. When I came on active duty, I quickly found that arbitrarily, by virtue of putting on the uniform, I was to be measured in an adult world by adult standards. It is the same when one marries; he automatically becomes a part of adult society and is judged by its standards. In both cases, the meld of society's law and custom binds him forever to the serious task of living in the strong and objective light of all men's judgment, criticism, and opinion. To any sensitive person this realization is a splendid guideline for devoting quality effort to the enterprise of living. Accordingly, when one adopts a position in contrast to those of his fellows and then must live by it and show its worth —that is drama and adventure.

One other aspect of the comparative experience is compensation. It is invariably a point of reference for the junior officer. I feel that except for the junior second lieutenant Air Force compensation compares favorably with that in civilian life. Further, I feel that the security provided by the Air Force medical benefits is invaluable, especially since the cost of medical care is perhaps the most inflated of all the rising costs of living. I do take issue with unreservedly advertising the termination of the twenty-year career as "retirement." Except for the highest ranks, it would be difficult for an officer to live on the twenty-year retirement pay, after taxes. Moreover, should an officer terminate his service at any point prior to twenty years of active duty, no annuity is forthcoming from the government. This is in contrast to many civilian profit-sharing retirement plans, where one can receive all or part of his retirement contribution after only a few years of service. For this reason, primarily, I was sorry to see the Hubbell pay plan fail of enactment.

In any event, I think the real compensation one seeks in the Air Force is in his job—that ultimate reward of actually being paid to do something one enjoys. Then those twice-a-month paychecks, instead of being merely the necessary thing to live by, become but two slices of bread holding the thick beefsteak of career fulfillment.

the arable experience

It is, of course, the desire of men not merely to sustain themselves and endure their days in slow deterioration, ending with their six feet of earth. Rather, they seek to flourish and thrive.

Three growth experiences have been dominant for me during my service. I feel, first of all, that the prevailing tendency in the Air Force is toward generalism, rather than specialization. An officer is trained and expected to perform in many career contexts, which is one of the most demanding requirements of the service. The Squadron Officer School's "whole man" concept exemplifies this idea on a basic level. The opportunity for worldwide duty assignments, on either permanent change of station or temporary duty, at considerable expense to the government, enhances the diversified nature of an Air Force career. To the young officer this challenge is undoubtedly a blue chip in favor of staying in the service.

My second noteworthy growth experience has involved a method of approach to duties, specifically decision-making. For want of a better term, I call it the "modulated" approach to a task, and it seems to be applicable to virtually all situations where a decision must be made or an idea sold. I also feel that such an approach should be consciously cultivated by the junior officer.

I have found in dealing with senior officers that they tend to stand back from the hard-sell, "whiz kid" approach of junior officers pressing their ideas or programs, replete with polysyllabic jargon. Far more successful, I have found, is the dispassionate approach, using simple language, backed to the hilt with facts, and explaining where necessary the shoptalk of a job or project. Then, after carefully laying the foundation, is the time to make a decision or proposal. Thus, having prepared and presented the case and made the proposal, we junior officers concentrate on watching our seniors. Oh, how we watch! The discovery and practice of this modulated approach has been no small help to me in arriving at decisions and working with people.

My third growth experience is interrelated with the other two and closely identified with the Air Force. I am thinking of the familiar term "management," but as it applies to the junior officer. Not having been trained as a warrior, I have served instead an apprenticeship as a decision-maker (my synonym for manager). Those sound management principles demonstrated to me have been abiding and invaluable.

Without belaboring the topic, let me say that one of the most useful management methods is to relate duties and work flow to working documents. It is an elementary systems analysis technique, but one that works especially well for the novice. By learning the use of every document in the office, one quickly learns the instruments used by each employee, acquires a store of informed shoptalk ("Type me an 1149" instead of "Type me one of those . . . ah . . . forms you use"), and usually, to the pleasure of his subordinates, soon learns the nature of their duties. The Air Force, like a business, is firmly tied to the printed word of the working document. Moreover, the association of document with duty enables the manager to recollect them both. This has been a useful technique for me in almost any office-management situation.

Many outstanding junior officers I have known have scrutinized the Air Force in much the same way as I. Today's youth are informed, idealistic, and searching for what I have called the arable—the growth—experience, although they may not articulate their desires in so many words. They wish to know if they can produce a useful product in the "factories of the town," to hark back to the epigraph. If the junior officer finds he cannot grow and produce in the Air Force environment, for whatever reason, he will probably terminate his service commitment in a blue funk at the end of four years. I know, because I have been down that very path with such a decision awaiting me.

Extension Course Institute, AU

Books and Ideas

KHE SANH

WILLIAM H. GREENHALGH, JR.

ONE of the startling phenomena of the war in Vietnam is the tremendous impact of news coverage, particularly that of the TV news services, on the conduct of the war and the reactions of the American people. The news media exaggerated both the significance and the seriousness of the threat to the U.S. Marine Corps base at Khe Sanh. While it is true that Khe Sanh was a strategically important outpost, it is also true that the Marines were never besieged and never in any real danger of being overwhelmed. Despite rantings of the less responsible segment of the press and demands of politicians that the Marines be withdrawn before they could be annihilated in a second Dien Bien Phu, the defense of Khe Sanh was carefully considered and well planned to stop a major enemy drive into northern South Vietnam.

Many will ask why Khe Sanh was chosen for such a stand. The Marine base with its small but newly rebuilt airstrip was a few hundred meters from the tiny village of Khe Sanh, both astride the famous Route 9, mostly a dirt highway between Laos and the coastal plain. The terrain is rugged and heavily forested, with surrounding mountains that rise almost 3000 feet above the valley floor. Weather in the area during the first three months of the year is unbelievably bad, influenced by the northeast monsoon. Low clouds and persistent fog, rain that varies from a drizzle to a downpour, and winds that switch direction and change velocity without warning —all make air support in the region difficult at best during this period. The ground fighting also is hindered by the fog and rain and by the difficulty of movement. Despite or perhaps because of all this, the North Vietnamese chose to move against Khe Sanh early in 1968. As part of their winter-spring campaign, they chose to attack the westernmost of the string of strong points roughly paralleling the southern edge of the Demilitarized Zone separating the two Vietnams.

The concept upon which Marine Corps organization and tactical doctrine are based eschews passive defense of a fixed camp, yet there were not sufficient forces available to carry out the mobile type of campaign for which the Marines are so renowned. The monsoon weather further restricted the use of air power in a mobile combat environment, since even the helicopter must have some ceiling and visibility in order to operate effectively with troops in the field. Enemy demolition of bridges and monsoon

washouts had closed Route 9 east of Khe Sanh, forcing the garrison to rely on air support until the engineers could reopen the road. Under different political or military conditions, these factors might well have induced the commander to withdraw from the Khe Sanh area to a position where his lines of communication were secure and he could have greater flexibility of operation.

Withdrawal, on the other hand, also presented the commander with problems. Ground withdrawal was difficult because of the closed road, and extraction by air would have been extremely hazardous. As the garrison became smaller, its vulnerability to the surrounding enemy forces would have increased, with the possibility of being overwhelmed by sheer weight of numbers. With Khe Sanh in the hands of the enemy, the route would have been open for unrestricted infiltration of large numbers of enemy troops into the northern provinces of South Vietnam, where they could have tied down considerably larger friendly forces at a crucial time and might well have had a decisive effect upon the later Tet offensive. Psychologically, the enemy would have been able to exploit a withdrawal as a "victory" in his propaganda campaign against American involvement and the existing government of South Vietnam. The apparent determination of the North Vietnamese to take Khe Sanh meant that our defense of it would probably tie down large numbers of enemy troops in a concentration susceptible to air attack. With the assurance that air power could support the garrison at Khe Sanh, it was decided to reinforce and defend that Marine base. The stage was set for another Marine Corps epic battle.

The decision, once made, was subjected to a withering barrage of criticism from a variety of sources, a barrage that grew in volume as the news services expanded their coverage of Khe Sanh. Reporters and TV photographers commuted between Saigon and Khe Sanh, and each sensational new film tended to give the impression that the beleaguered Marines had been irrevocably committed to another Dien Bien Phu. Important political voices demanded the withdrawal of the Marine garrison in the face of the numerically superior enemy forces surrounding them. Advocates and opponents of air power debated publicly whether Khe Sanh could be supplied and defended by air power alone. Public opinion became aroused, and controversy raged over whether the Khe Sanh base should be defended or abandoned. The fate of the Marines was variously assayed, the predominant opinion of the press apparently being that they would be doomed if they were not immediately withdrawn from this modern Dien Bien Phu.

Nothing could have been further from the truth. The confident and competent Marines, never confined to their base, conducted regular patrols at considerable distances from the perimeter. Further, air power had come of age since Dien Bien Phu. The stage was set, and the Marines were ready.

The Battle for Khe Sanh tells the story of the Marine stand in great detail that will delight the military historian.† The author, a Marine aviator with an M.A. in history from Texas Christian University, served in the area during that operation and is thus intimately familiar with the terrain so important to his narrative.

The narrative begins with the arrival of the Marines, the first U.S. ground combat units committed in South Vietnam, and develops the subsequent events in a manner that is useful in understanding the Khe Sanh situation. Of particular interest is the detailed account of the Hill Battles in the Khe Sanh area in April 1967, during which the Marines drove a reinforced regiment of North Vietnamese troops from several key hills nearby.

The real story of Khe Sanh, however, begins in December 1967, when it became obvious that something big was developing. Large numbers of North Vietnamese regular troops were moving into the Khe Sanh area and staying, and large supply caches were being assembled. The confrontation intensified in January 1968 as enemy strength increased, and the Marine garrison was reinforced. The battle was joined, yet there was no single large assault, no all-out at-

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Moyers S. Shore II, *The Battle for Khe Sanh* (Washington: Historical Branch, G-3 Division, U.S. Marine Corps, 1969, $1.75), 203 pp.

tack on the base, nothing that could really be called a battle. As for the ground fighting, Khe Sanh was primarily a series of short, sharp probing fights, during which the defenders of the base and its outlying hilltop strong points took a heavy toll of the enemy, and the enemy continued to bombard the camp by mortar, rocket, and artillery.

Without air power, Khe Sanh probably would never have happened, and without effective air power, Khe Sanh could not have survived. Although the author discusses air power at Khe Sanh, his sources are unfortunately almost totally Marine Corps records. Although this is a Marine Corps story, the inclusion of a fuller treatment of the contribution of air power would not have detracted from the magnificent stand by the ground Marines or the outstanding work of the Marine air. The failure of the author to use the readily available Air Force and Army sources is inexplicable.

Certainly Marine air was outstanding—each element did an exceptional job—but even the casual reader will be struck by the obvious inference that other air support was merely incidental.[1] Great emphasis is justifiably placed upon the Marine helicopters that supplied and supported the isolated hilltop outposts, purely a Marine operation. Faced with growing helicopter losses in this task, the Marines developed the "Super Gaggle," in which coordinated action by large numbers of tactical fighter aircraft, cargo helicopters, and helicopter gunships replaced single-helicopter tactics. The success of the new method, proved by decreased helicopter losses, demonstrated the adaptability of the Marine airmen. Their willingness to learn from the successes of others was attested to by their development of the Mini-Arc Light and the Micro-Arc Light, wherein artillery and tactical aircraft were coordinated for instantaneous and concentrated application of firepower on a small target area, like the B-52 missions (Arc Light) but on a smaller scale. Despite their unaccustomed defense of a fixed position, the Marines retained their tactical flexibility and their ability to adapt to unusual situations.

A new application of a proved weapon system that became highly effective at Khe Sanh was the use of the B-52 in close support. Originally restricted to drops at some distance from friendly lines, the B-52 crews felt that they could deliver their bomb loads with great accuracy much closer to the lines. The enemy, aware of the restrictive bombline, had moved his forces close to friendly lines for protection from air attack. The B-52 proposal appeared worth a try. After a single B-52 had demonstrated its accuracy of delivery under control of a ground radar station, the bombline was moved to less than one-third the former distance from the Marine perimeter. The first few B-52 strikes close to the line proved devastating to the massed enemy forces. The Marine defenders were particularly enthusiastic, and subsequent B-52 strikes were used largely in this role.

Tactical air contributed more firepower and greater flexibility to the Khe Sanh battle than any other single source of support, yet its effectiveness and value were denigrated through misunderstanding and serious coordination problems. Operation NIAGARA, the Air Force portion of the Khe Sanh operation, called for Airborne Battlefield Command and Control Center (ABCCC) direction of all aircraft other than Marine tactical aircraft in direct support of the Khe Sanh perimeter. The Marines, with their own control agency at Khe Sanh, scheduled all their air resources to close support, thus precluding any overall coordination of the total air effort. Because of difficulties arising from the presence of two control agencies, Marine and Air Force, an informal agreement between the ABCCC and the Marine control agency attempted to delineate control areas on a temporary basis. Throughout the engagement, Marine interpretation of plans and operations orders did not agree with Air Force interpretation, leading inevitably to increasing confusion and inefficient application of available resources.

The author somewhat incorrectly states that Marine Corps support within the Khe Sanh tactical area of responsibility resulted from negotiations between the Commanding General, III Marine Amphibious Force, and the U.S. Seventh Air Force. General William W. Momyer, Commander of the Seventh Air Force, was also Deputy Commander for Air, U.S. Military As-

sistance Command, Vietnam, and in that capacity he was responsible for coordinating all air effort in the Khe Sanh area. The author further indicates that General Momyer was given responsibility for the overall NIAGARA effort during the 22 January–13 February period, whereas in reality Seventh Air Force had that responsibility continuously. The Marine commander at Khe Sanh had control of the area out to the range of his 155mm artillery, but even within this zone the ABCCC was supposed to have a degree of traffic control. The absence of centralized control of air operations from the very start created a situation wherein two separate organizations were carrying out air operations independently in a very small block of airspace that was also being used by numbers of B-52s and Navy aircraft.

Eventually, General Momyer was given full responsibility and authority for management of all Marine and USAF tactical aircraft in South Vietnam, which greatly reduced coordination problems and clarified the manner in which air power was to be applied. Had a single manager for all air been clearly defined at the very start of the operation, all the misunderstandings could have been avoided. Despite these problems and the wasted effort, tactical aircraft of all the participating services gave the Marine garrison at Khe Sanh a concentration of air support that probably exceeded any previous similar effort.

The obvious purpose of Captain Shore's book is to relate the story of the Marine Corps ground forces at Khe Sanh, and it does this exceptionally well. Although it is difficult to prepare a comprehensive history so soon after the event, particularly if its impact on subsequent developments is to be evaluated, the author has done a well-researched and thorough job. He presents a fine record of the activities of the Marine helicopter units, but his treatment of the other aspects of air power in the battle is of lesser value. Nevertheless, the book is well worth reading if its limitations are clearly understood. Controversy over Khe Sanh will probably continue well into the future, and the Shore monograph will undoubtedly contribute to the controversy.

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Note

1. For an account of the role of air at Khe Sanh, see Burl W. McLaughlin, Major General, USAF, "Khe Sanh: Keeping an Outpost Alive," *Air University Review*, XX, 1 (November-December 1968), 57–77.

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