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A New Concept for Streamlining Up-Front Planning

Glenn A. Kent, David E. Thaler

Prepared for the United States Air Force

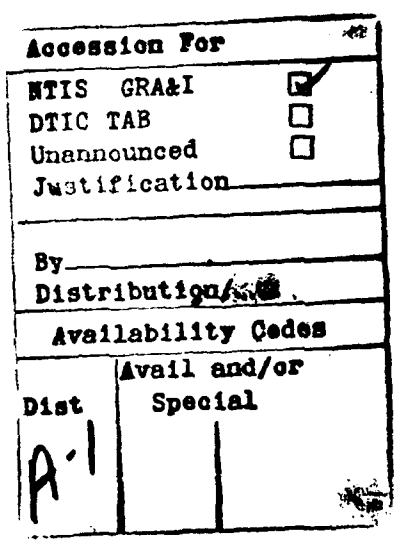
Project AIR FORCE

Approved for public release; distribution unlimited

Preface

The purpose of this report is to provide a framework for streamlining the process by which the Department of Defense (DoD) enhances the military capabilities of U.S. armed forces. The framework focuses on streamlining the part of the process often referred to as "up-front" planning—namely: Phase 0 between Milestone 0 and Milestone I. The framework is offered as a means of promoting timeliness, communication, and stability in this process.

This report was completed under the Acquisition Project of the Resource Management and System Acquisition Program of Project AIR FORCE. It should be of interest to individuals in the Office of the Secretary of Defense, the military departments, and Congress concerned with the structure and process by which the DoD modernizes U.S. military capabilities.



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Summary

Most observers of U.S. military affairs agree that the process within the Department of Defense (DoD) of enhancing U.S. military capability—or modernizing—involves an inordinate amount of time and energy. The length of time between formulating a concept to enhance military capability and realizing enhanced capability in U.S. operational forces averages 10 to 15 years. The enormous paper trail involves a great deal of "square-filling." Finally, the process suffers from various disruptive instabilities, in part because of a lack of communication and trust between disparate elements of DoD and among DoD, industry, and the Congress.

We propose a framework that will substantially streamline the process by which DoD modernizes military capability. The framework focuses on streamlining the part of the process often referred to as "up-front" planning. This planning is akin to Phase 0, which begins at Milestone 0 when an authority mandates that a particular military mission deserves increased emphasis and ends at Milestone I when a decision is made to develop and procure new systems that will equip force elements to enhance military capability.

The process of modernizing takes place in the presence of a hierarchy of objectives—from national security objectives that the President sets forth, to national military objectives that the Secretary of Defense (SecDef) and Chairman of the Joint Chiefs of Staff (CJCS) define, to campaign and operational objectives that combatant (and component) commanders formulate, and down to military tasks that force elements accomplish. Deficiencies in the ability to achieve key and relevant objectives, combined with opportunities to do better, drive the process for enhancing military capability (modernizing).

According to our framework, this process involves:

- defining operational requirements, identifying mission needs (missions in need of increased emphasis), and making "Mission Need Statements";
- identifying promising technologies and maturing new technology aggregates;
- defining, evaluating, and demonstrating new operational concepts for accomplishing military tasks;

- conducting programs for developing and acquiring new systems to implement selected operational concepts;
- organizing, equipping, training, and maintaining force elements to provide military capability; and
- deciding on the allocation of resources.

These activities, conducted more or less continuously, are interrelated and interactive. At the same time, they are indeed separable.

To correct the problems with the current process identified in the first paragraph, our framework emphasizes four items:

- **Concept development (Phase 0) is separable from science and technology (S&T) on the one hand and system development and acquisition on the other.**

Currently, concept development is often not defined as an explicit and separable activity but is subsumed under both S&T and system development and acquisition. The purpose of S&T efforts should be to forge a path from basic scientific research to mature technology aggregates—the output of this activity. The purpose of concept development is to define alternative operational concepts for accomplishing military tasks that take into account the operational deficiencies to be remedied as well as the available existing or emerging technologies. System development and acquisition efforts are dedicated to producing systems for the operational inventory to equip force elements to implement selected operational concepts and enhance military capability.

To first order, S&T activities are scientific and technical in nature, concept development activities are operational, and system development and acquisition activities are contractual and programmatic. Because of these substantive differences, the separability of these activities must be explicit. Moreover, *the interface at Milestone I is between* operational concepts *and programs to develop and acquire systems, not between* technologies *and such programs.*

- **We should make a clear and explicit distinction between entities that *conduct* these activities and those that *oversee* the activities.**

Current DoD directives do not explicitly distinguish between those who conduct the activities surrounding up-front planning and those who provide oversight.

Our framework makes clear that:

- The Advanced Research Projects Agency (ARPA) and the national, service, and industrial laboratories conduct S&T efforts
- The military departments conduct concept development according to their legal obligation "to fulfill (to the maximum extent practicable) the current and future operational requirements of the unified and specified combatant commands"
- The Service acquisition systems conduct system development and acquisition efforts.

If Phase 0 is recognized as an explicit, crucial, and separable activity, the Office of the Under Secretary of Defense for Acquisition (USD/A) must provide an appropriate entity or forum for its oversight. To this end, we recommend that three directors report to the USD/A: a director of S&T to oversee and allocate monies to S&T activities, a director of concept development to oversee and allocate monies to activities under Phase 0, and a director of logistics to oversee efforts to sustain forces during peacetime as well as during their deployment and employment. The USD/A would oversee system development and acquisition.

- **Concept demonstrations are different in nature and output from technology demonstrations on one hand and engineering/manufacturing demonstrations on the other.**

In current writings and often in practice distinctions between concept demonstrations and technology demonstrations, as well as between concept demonstrations and engineering/manufacturing demonstrations, are blurred.

Technology demonstrations are tests to show that a technology or technology aggregate can perform some stated function. Technology demonstrations are conducted in a technical environment. There need be no explicit definition of how the technology aggregates are to be used operationally.

Concept demonstrations are intended to demonstrate in an operational environment that systems (incorporating various technology aggregates), organizations, and tactics can be integrated according to a well-defined operational concept to accomplish some stated military task at some level of effectiveness. The purpose of the concept demonstration is to show proof-of-principle—a necessary condition for passing Milestone I. Notably, concept demonstrations are (or should be) conducted *in an atmosphere devoid of competition as to potential contractors who would build the systems for the operational inventory.*

Engineering/manufacturing demonstrations are conducted during Phase 1 of a system development and acquisition program (between Milestones I and II) to demonstrate that engineers have a system design that can be manufactured (and maintained) within stated criteria for performance, cost, and schedule. This demonstration may constitute a "fly-off" between potential contractors in competition to produce the system(s).

- **Concept Action Groups (CAGs) should serve as vehicles for purposeful interaction among disparate communities.**

The current process does not promote (or mandate) purposeful interaction among operators, scientists, development planners, intelligence personnel, cost analysts, and acquisition personnel.

We recommend that commanders of Service commands responsible for organizing, equipping, and training force elements, or higher authorities, convene CAGs as vehicles for the military departments to conduct concept development in a focused, interactive way. The CAG would be the engine for accomplishing the daunting task of matching mission needs to technology opportunities. CAGs would be run by senior operators from these Service commands. The output of the CAG in the first instance should be well-defined, end-to-end operational concepts to enhance military capability and formulas for demonstrating the proof-of-principle of these concepts.

Acknowledgments

The authors would like to thank RAND colleagues John Friel and David Kassing for reviewing the working draft that preceded this report.

Abbreviations and Acronyms

ACC	Air Combat Command
AFMC	Air Force Materiel Command
AFSPACECOM	Air Force Space Command
AMC	Air Mobility Command
ARPA	Advanced Research Projects Agency
ASD/SRR	Assistant Secretary of Defense for Strategy, Requirements, and Resources
CAG	Concept Action Group
CJCS	Chairman of the Joint Chiefs of Staff
DAB	Defense Acquisition Board
DDR&E	Director of Defense Research and Engineering
DoD	Department of Defense
FFRDC	federally funded research and development center
JROC	Joint Requirements Oversight Council
MajCom	Major Command
MNS	Mission Need Statements
OSD	Office of the Secretary of Defense
PPBS	Programming, Planning, and Budgeting System
S&T	science and technology
SecDef	Secretary of Defense
TAWC	The Air Warfare Center
TRADOC	Training and Doctrine Command
USD/A	Under Secretary of Defense for Acquisition
USD/P	Under Secretary of Defense for Policy

1. Introduction

The Secretary of Defense (SecDef) has two principal responsibilities:

1. To protect the interests of the United States by deterring those who threaten U.S. interests and by defeating those who aggress against those interests. This responsibility is discharged through the Chairman of the Joint Chiefs of Staff (CJCS) and the commanders of the unified and specified commands ("combatant" commanders).
2. To provide and enhance military capability to be employed by the combatant commanders. This responsibility is discharged through the military departments, which organize, equip, and train force elements.

Most observers agree that the process within the Department of Defense (DoD) of enhancing military capability involves an inordinately large amount of time and energy. The length of time between formulating a concept to enhance military capability and realizing enhanced capability in U.S. operational forces averages 10 to 15 years. The paper trail is enormous. Documents required of the multitude of organizational entities that help conceive new concepts and procure new items are proliferate and involve "square-filling," and generally are of little added value. Finally, the process suffers from various disruptive instabilities, in part because of a lack of communication and trust between disparate elements of DoD and among DoD, industry, and the Congress.

The goal of this report is to define a framework that will substantially streamline the process by which military capability is enhanced. In particular, the report focuses on streamlining the part of the process often referred to as "up-front" planning. In the vernacular of DoD Directive 5000.1, up-front planning is akin to Phase 0. Phase 0 begins at Milestone 0 when an authority mandates that a particular military mission deserves increased emphasis. This phase ends at Milestone I, when a decision is made to develop and procure new systems that will equip force elements to enhance military capability.

The remainder of this introduction is a description of the overall context in which defense planning is undertaken. With this as background, Section 2 then focuses on developing and defining the overall concept for streamlining Phase 0. Section 3 reviews how the proposed framework would save time and money and provides an example of how it would work. Section 4 offers concluding remarks. Key terms are defined in the Appendix.

Defense Planning in an Overall Context

In the final analysis, defense planning must link systems and force elements to the attainment of U.S. national military and security objectives. A framework for linking systems and force elements directly and coherently to national security objectives is described in a RAND report, entitled *A Framework for Enhancing Operational Capabilities*.[1] Before focusing on particular parts of the overall process, knowledge of this linkage is essential. Here, we describe this framework in general. The framework is portrayed in Figure 1; the Appendix defines the terms introduced in this figure.

A Hierarchy of Objectives

The part of the framework depicted on the left side of Figure 1 is a subordination, or hierarchy, of objectives—from national security and military objectives to attain or maintain, to campaign and operational objectives to achieve, and down to military tasks for force elements to accomplish. Despite the fact that "objectives" are center stage, this hierarchy of objectives is often referred to as "strategies-to-tasks."

The hierarchy begins with ensuring fundamental national goals—e.g., maintain the U.S. as a sovereign, democratic nation that provides for the general well-being of all citizens. In the presence of potential threats to these goals and opportunities to further the goals, the President sets forth national security objectives.

In light of these presidential statements, the SecDef, with the advice of the CJCS, defines the military means for attaining (or maintaining) the stated security objectives. These statements by the CJCS and the SecDef define overall national military objectives and strategies.

Combatant commanders detail how they intend to achieve the stated military objectives in their areas of responsibility. They do so with recognition of enemy and allied capabilities and the operational and natural environment unique to the region. These combatant commanders draw up campaign plans that define campaign and operational objectives and specify "concepts of employment" for achieving the operational objectives over time. Commanders then assign force elements to accomplish military tasks according to well-defined operational

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[1] Glenn A. Kent and William E. Simons, *A Framework for Enhancing Operational Capabilities*, RAND, R-4043-AF, 1991.

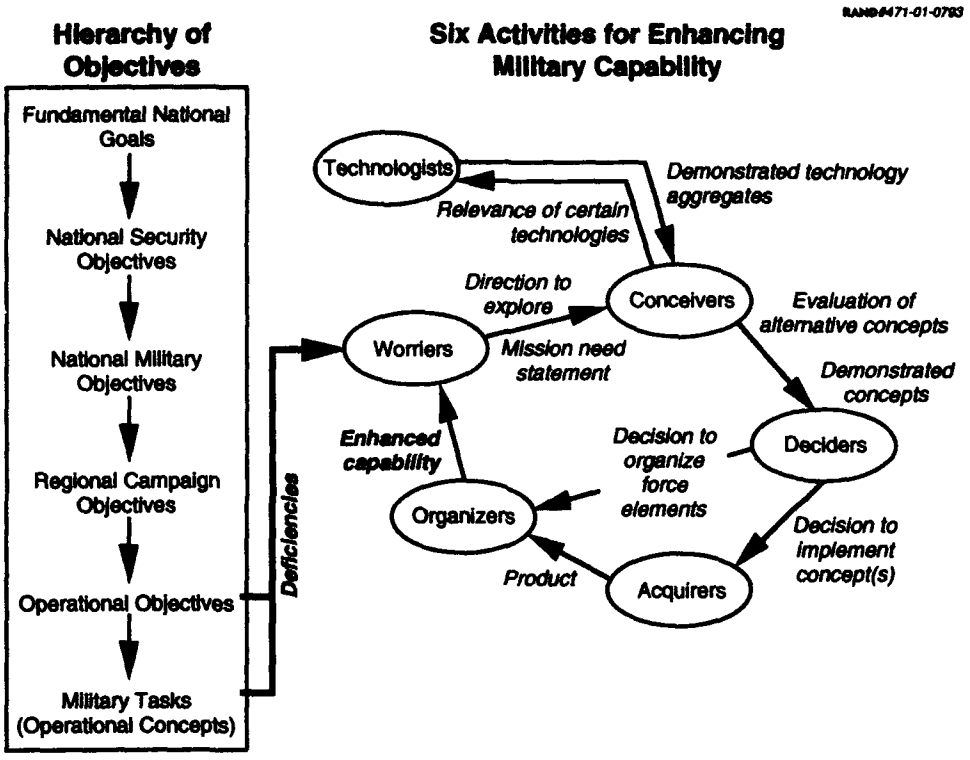

Figure 1—Relationship of the Hierarchy of Objectives to the Six Activities for Enhancing Military Capability

concepts for which the force elements have been organized, equipped, and trained. Accomplishing these tasks constitutes alternative, often complementary means of achieving operational objectives.

We have now arrived at the bottom of the hierarchy—the level of accomplishing military tasks according to defined operational concepts. This level is populated by the fundamental building blocks upon which military capabilities are based. We now address six activities that enliven the process of enhancing military capabilities.

Six Activities for Enhancing Military Capability

The DoD engages in six activities to enhance the capabilities of U.S. military forces:

1. Defining operational requirements, identifying mission needs, and making "Mission Need Statements"
2. Identifying promising technologies and maturing new technology aggregates

3. Defining, evaluating, and demonstrating new operational concepts for accomplishing military tasks
4. Conducting programs for developing and acquiring new systems to implement selected operational concepts
5. Organizing, equipping, training, and maintaining force elements to provide enhanced military capability
6. Deciding on the allocation of resources. (This activity overlies all other activities except the first.)

These activities, conducted more or less continuously, are interrelated and interactive. At the same time, they are indeed separable.

According to our framework, ***worriers, in the presence of operational requirements, identify mission needs and make Mission Need Statements.*** Operational requirements are defined in the context of requiring the operational capability to achieve campaign and operational objectives—now and in the future. Deficiencies in the ability to meet foreseen operational requirements cause worriers to identify missions in need of increased emphasis and to issue *Mission Need Statements (MNS)*. These statements, at Milestone 0, set in motion the process for enhancing military capabilities. At Milestone 0, worriers direct conceivers to take appropriate action.

Conceivers formulate, define, and evaluate new operational concepts. Conceivers also define and pursue proof-of-principle **concept demonstrations** ***of the more promising concepts.*** This activity constituting Phase 0 bears a strong operational orientation. The output of Phase 0 provides the basis for a Milestone I decision—a decision to develop and acquire the systems to implement the selected operational concept(s).

Technologists identify promising technologies; they also define and pursue **technology demonstrations.** The output of these demonstrations is mature technology aggregates. Often this activity is termed Science and Technology (S&T). Technology efforts produce enabling technology aggregates. These efforts must proceed apace somewhat independent of Mission Need Statements. Technologists are also an integral part of formulating and defining operational concepts. They advise conceivers about the state of the art with regard to existing and emerging enabling technologies. Informing conceivers of all relevant enabling technologies is central to concept formulation.

Deciders make the crucial choice about whether to allocate constrained resources to demonstrate new concepts and finally must decide whether to implement new concepts and organize and equip related force elements. The critical function of

deciding whether to allocate resources to major development and acquisition programs should occur in the context of the Programming, Planning, and Budgeting System (PPBS) in the Office of the SecDef (OSD). Deciders grant approval, through a Milestone I decision, to develop and produce systems required to implement new concepts. In making such decisions, the deciders account for the long-term budget implications of organizing, equipping, and training force elements according to the selected concept(s).

Acquirers conduct programs for developing and acquiring new systems to implement the selected concepts. Before deciders make a Milestone I decision to proceed, acquirers define the overall acquisition strategy and set forth criteria for passing program milestones. Once past Milestone I, they oversee the proper conduct of the program (on the basis of schedule, contract performance, and cost). The output is systems to equip the force elements organized by the military departments.

Organizers receive the new systems and equip, train, maintain, and sustain force elements to provide operational capability. Within the Air Force, four Major Commands (MajComs)—Air Combat Command (ACC), Air Mobility Command (AMC), Air Force Space Command (AFSPACECOM), and Air Force Materiel Command (AFMC)—are responsible for executing these functions. They also maintain roadmaps that chart the future status of force elements for which they are responsible. The equivalent organization in the Army is the Training and Doctrine Command (TRADOC).

2. Streamlining Up-Front Planning

The Introduction contained a brief overview of our framework for the overall process of providing and enhancing operational capability. We now turn to the focus of this report—the process surrounding "up-front" planning and, in particular, the activity we call "conceiving" or "concept development."

The following obstacles characterize the current process for up-front planning and inhibit streamlining efforts:

- Concept development is not defined as an explicit and separable activity; rather, in the OSD, it is subsumed under both S&T and system development and acquisition.
- The distinctions between concept demonstrations and technology demonstrations, as well as between concept demonstrations and engineering/manufacturing demonstrations, are blurred.
- The difference between those who conduct the activities surrounding up-front planning and those who provide oversight of these activities is not explicit.
- Documents mandated by the current process are often a hindrance to timely action.
- The current process does not promote (or mandate) purposeful interaction among operators, scientists, development planners, intelligence personnel, acquisition personnel, and others.

In this section, we focus on the conduct of three activities: (1) science and technology (S&T), (2) concept development, and (3) system development and acquisition. We then describe a forum for concept development called the "Concept Action Group." Finally, we propose a new structure in DoD for overseeing these and other activities.

Three Interrelated Activities

Figure 2 portrays the activities and interrelationships of S&T, concept development, and system development and acquisition.

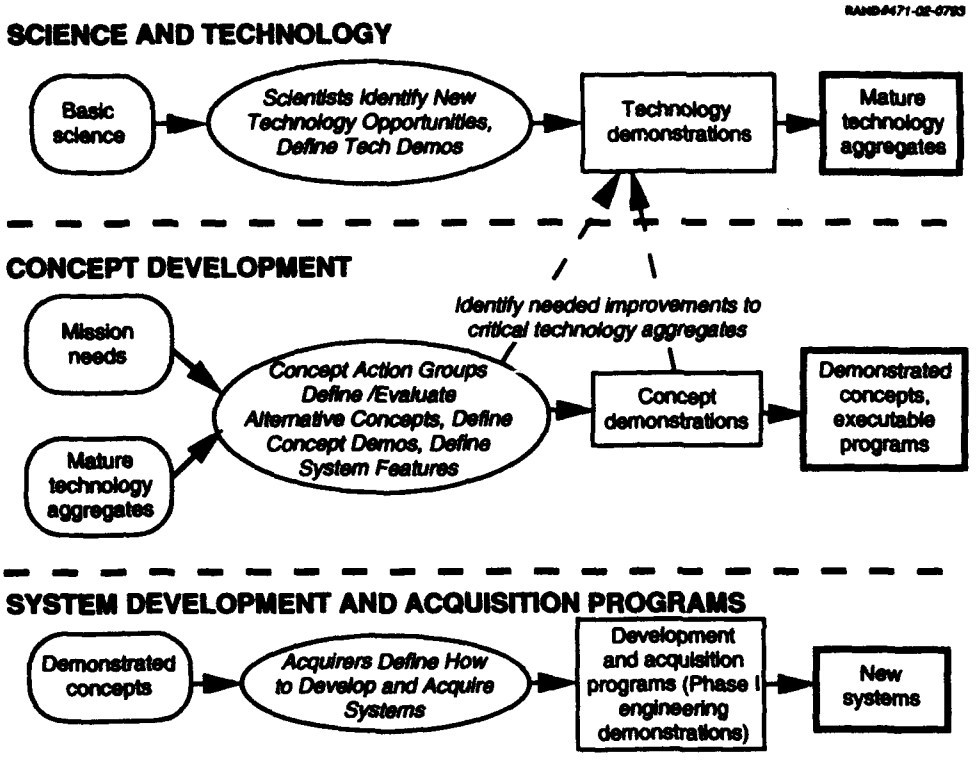

Figure 2—Three Interrelated Activities

S&T: Identifying Promising Technologies and Maturing Technology Aggregates

The purpose of S&T efforts should be to forge a path from basic scientific research to mature technology aggregates—the output of this activity. ARPA and the national, service, and industrial laboratories conduct these efforts.

S&T efforts should begin with basic research; results of basic research help identify opportunities for new technologies. The most promising new technologies are matured as technology aggregates. Finally, technologists define and direct technology demonstrations to establish proof-of-principle of these technology aggregates (i.e., to prove that technology aggregates can perform stated functions). These technology demonstrations generally should be conducted in a technical environment.

Under current practice, basic research, the catalyst for conceiving and identifying promising new technologies, is funded by budget category 6.1 monies. Maturing and demonstrating technologies constitute the mainstays of "exploratory development" and are funded by budget category 6.2 monies. In the context of

our framework, we renamed this category "technology maturation"—as distinct from exploratory development.

The output of S&T efforts—mature or maturing technology aggregates—then should become one input to concept development efforts. Technology aggregates enable operational concepts. Development planners—familiar with S&T activities and with what is technologically possible—are key players in the activity called concept development. They are aware of all relevant technological opportunities and make these known to others. Development planners are the critical link between S&T and concept development.

Our framework identifies a second important link between these two activities. Often conceivers will identify specific improvements in technology aggregates as prerequisites for implementing a stated operational concept or new system concept. Such *designated* technology demonstrations then are conducted in support of a new operational or system concept and are funded by budget category 6.3a monies.

Notably, *S&T efforts themselves should not be driven by the top-down approach suggested in the hierarchy of security and operational objectives* detailed in Figure 1. Certainly, technologists should be apprised of deficiencies in key military capabilities to help them identify and select the technologies to be matured. However, *to first order*, S&T efforts are driven by technical opportunity spawned by basic scientific research. On the other hand, concept development efforts are driven by deficiencies in the ability to accomplish critical military tasks. This difference in heritage is the key to understanding the important distinction between identifying and demonstrating new technologies and defining and demonstrating new operational concepts.

Concept Development: Defining, Evaluating, and Demonstrating New Concepts (Phase 0)

Concept development efforts should involve formulating, defining, evaluating, and testing alternative operational concepts;[1] defining and pursuing proof-of-principle concept demonstrations (critical experiments) for the most promising concepts; and defining the functional characteristics of new (and existing) systems needed to implement selected concepts. According to our framework, these efforts are funded by 6.3a monies.

[1]See Appendix. An operational concept is an end-to-end stream of activities that defines how force elements, systems, organizations, and tactics combine to accomplish a military task.

Concept development efforts should be conducted in the presence of two principal inputs: (1) a Mission Need Statement (MNS) and (2) relevant enabling technology aggregates (existing and emerging).

We must be clear that the purpose of a MNS is to energize and focus the efforts of conceivers on the most pressing problems. In our framework, the MNS is a statement by a proper authority that, according to the considered judgment of that authority, a particular mission (or mission area) deserves special emphasis at this time. We contend that a MNS should be simple, short, and pointed—with no annexes or attempts to define alternative solutions. The MNS has one critical purpose: to cause purposeful action by the conceivers.

According to our framework, the authorities that would issue a MNS generally are limited to: the CJCS aided by an appropriate council (the Joint Requirements Oversight Council [JROC]); the combatant commanders; the Under Secretary of Defense for Policy (USD/P) and, in particular, the Assistant Secretary of Defense for Strategy, Requirements, and Resources (ASD/SRR); the Under Secretary of Defense for Acquisition (USD/A, or whatever new name may be applied); Service Secretaries and Service Chiefs; and the commanders of the major commands within the Services.[2]

Who should be formally charged with conducting concept development? Since this activity is clearly operational, we contend that the military departments should conduct the activities of Phase 0. Indeed, public law charges the military departments "to fulfill (to the maximum extent practicable) the current and future operational requirements of the unified and specified combatant commands."[3] This charge logically includes formulating, defining, evaluating, testing, and demonstrating operational concepts to meet these operational requirements.

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[2]The law places the CJCS, as "spokesman for the commanders of the combatant commands," in a proactive role of obtaining, evaluating, and integrating their operational requirements and communicating them to other elements of DoD. See *Title 10, United States Code/Armed Forces*, Sec. 163, April 1991, p. 61.

This construction seems most logical for the issuance of Mission Need Statements. However, it appears more often than not to be in tension with current practice, where personnel in military departments develop Mission Need Statements *for particular systems (solutions)* and submit them to the JROC. The JROC "validates" the MNS and forwards it to the USD/A, who renders a Milestone 0 decision to commence concept development. Besides being illogical—concept development commences *after* the solution has already been named in the MNS—this practice places the CJCS in a *reactive* rather than *proactive* role. The practice seems far afield from the idea that the CJCS is uniquely responsible for evaluating and integrating information from combatant commanders and communicating these requirements to other elements of DoD.

[3]*Title 10*, Sec. 8013, p. 1388.

In particular, operators should be central to conducting concept development. Certainly, an activity with an explicitly operational orientation should be run by persons with operational mindsets.

Once operational concepts are defined and evaluated by the military departments, the most promising are tested for technical feasibility and operational viability. We call these *concept demonstrations*; they are not to be confused with *technology* demonstrations. Equipment to be tested is of the "brassboard" variety—we call them "functional prototypes." Their purpose is to replicate key functions defined in the operational concept. Still a part of Phase 0, these concept demonstrations should be conducted in an operational environment with 6.3a monies.

The output of concept development activities is demonstrated concepts that provide the basis for "executable" development and acquisition programs. At Milestone I, advocates seek approval to proceed to develop and acquire systems to implement the selected concept(s). Thus our framework explicitly holds that the interface at Milestone I is between *operational concepts* and programs to develop and acquire systems, not between *technologies* and such programs.

Development and Acquisition Programs: Producing New Systems

The acquirers take over when the proper authority in OSD grants approval, through a Milestone I decision, to allocate funds to implement a new concept and acquire the attendant systems. In the Air Force, the acquirers comprise the "Air Force Acquisition System." The purpose of their efforts is to develop and acquire the systems rapidly and efficiently to implement the selected concepts.

Acquirers must define the acquisition strategy setting forth criteria for passing program milestones and must ensure the proper conduct of the system development program (on the basis of schedule, contract performance, and cost). By definition and necessity, the operators in the military departments play an important role in these activities.

Currently the phase between a Milestone I decision—to initiate a system development program to implement a new concept—and a Milestone II decision—to pursue engineering and manufacturing development—is referred to as the "demonstration/validation" phase or Phase 1. We make it clear that the purpose of this phase is *not* to demonstrate that the concept is technically feasible and operationally viable. These matters are "demonstrated" and "validated" during Phase 0. Rather, the first order of business after Milestone I is to design and fabricate preproduction articles and then test these articles. In our framework, the purpose of Phase 1 is to demonstrate—through an

engineering/manufacturing demonstration—that the system can be engineered and produced according to the performance, schedule, and cost set forth in the acquisition strategy at Milestone I. Then, and again according to our framework, the next major milestone (Milestone II) is authority to proceed with low-rate production.

Concept Action Group: A Forum for Concept Development

We have provided an overall view of three key activities involved in enhancing military capabilities. Phase 0—concept development—is central to this overall process. We now propose an explicit forum for concept development. In particular, we propose convening "Concept Action Groups" (CAGs)[4] that would be run by senior officers from appropriate major commands. These groups would be the vehicles for causing interaction among the following:

- Senior people from the major commands responsible for organizing, equipping, and training force elements that provide operational capabilities
- Operators experienced in planning and executing military operations
- Development planners with expertise about the functions that can be performed by existing and emerging technology aggregates
- Conceivers and development planners proficient in formulating and defining concepts that match needs and opportunities
- Cost analysts skilled in estimating the costs of systems
- Where applicable, members of industry and outside analytic communities
- Intelligence personnel knowledgeable about potential enemy threats and possible countermeasures
- Acquirers skilled in defining executable programs and acquisition strategies for developing and acquiring systems.

The CAG would be the forum for causing purposeful interaction among disparate disciplines. It would serve as the engine for accomplishing the daunting task of matching mission needs to technology opportunities. The output of the CAG in the first instance should be well-defined, end-to-end operational concepts to enhance military capability; i.e., concepts that enable U.S. forces to accomplish military tasks and achieve operational objectives more effectively.

[4]This idea is introduced in Kent and Simons, pp. 19–23.

Alternative operational concepts for accomplishing stated military tasks may involve emerging technology aggregates and/or changes in tactics, organization, and training. In most instances, CAGs would focus on upgrading major basic systems (force elements) currently in the inventory. CAGs may also be convened to define replacements for aging major basic systems.

The first task for a CAG would be to develop a comprehensive and systematic description of potential concepts in the presence of a menu of alternative technology aggregates supplied by the development planner and the array of tactics made known by the operators. Once concepts are defined, the CAG must systematically evaluate alternative approaches and concepts. In the first instance, concepts would be evaluated (and tested) based on the expected increase in capability and on their operational viability. To this end, the CAG may establish criteria for improvements in capability which, if not met, would make a concept unworthy of further consideration—i.e., the improvement over current capability is not sufficient to warrant pursuing the concept. Concepts also would be evaluated based on robustness against enemy countermeasures, on cost and schedule, and on risks inherent in the development and acquisition programs for acquiring attendant systems.

Additionally, participants in CAGs should define the functional characteristics of system concepts and identify key trade-offs among their performance features. This activity is *not* the same as setting detailed specifications in the context of a system development and acquisition program—a task reserved for the acquirers. For example, participants may set the minimum stand-off effective range of an air-to-surface missile at 20 miles because of the range of terminal air defenses that the platform might encounter. Later, the acquirer may contract for a missile that is expected to have a range of more than 30 miles.

When their efforts are complete, the CAG would present the most promising concepts to the MajCom commander or other authority in the military department. The MajCom commander would decide on the concept(s) to be pursued and would initiate efforts for their demonstration.

If the expected cost of the proposed concept demonstration exceeds a certain threshold (to be set by the Services and OSD), funding would have to be negotiated with higher authority. If and when proof-of-principle is established, the military department would initiate action toward a Milestone I decision to implement the concept.

Concept Action Groups are by no means intended as exercises to be applied to less than significant matters. They should be convened at the behest of commanders of Service commands responsible for organizing, equipping, and

training force elements, or by higher authority. The small number of these "worriers" involved, combined with their thoughtfulness about which objectives (missions) deserve increased attention and focus, should guarantee that CAGs are special instruments for addressing critical issues. Moreover, the initial efforts of the CAGs (defining and evaluating alternative operational concepts) should be completed within a relatively short span of time—on the order of three to four months.

Oversight of the Three Interrelated Activities

We have now set the stage for recognizing Phase 0 as an explicit, crucial, and separable activity executed by the military departments. In turn, the Office of the USD/A would be responsible for providing an appropriate entity or forum for *oversight* of Phase 0. One means of oversight would be to mandate that three directors report to the USD/A—a Director of S&T, a Director of Concept Development, and a Director of Logistics. Figure 3 represents such an organization.

The division of responsibility would be clear:

- The Director of S&T would be responsible for overseeing (1) basic research (and thus deciding on the allocation of 6.1 monies), (2) the process for determining which new technologies generated by 6.1 efforts should be matured, and (3) the process for maturing these technologies into technology aggregates (the allocation of 6.2 monies).

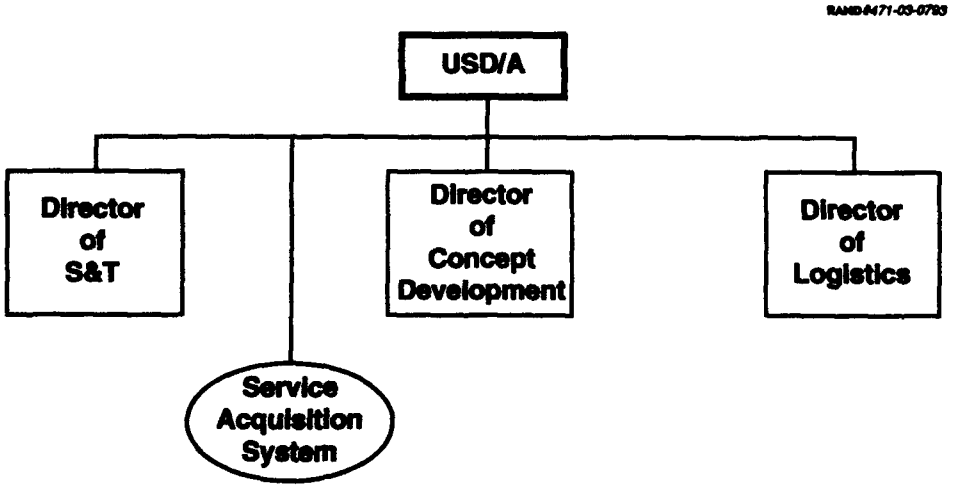

Figure 3—Proposed OSD Organizational Change

- The Director of Concept Development would be responsible for overseeing the activities of Phase 0 to ensure that (1) the appropriate MNSs are forthcoming; (2) the military departments respond appropriately to these directives; (3) a coherent, well-understood process exists for defining, evaluating, and selecting the concepts to be demonstrated; and (4) appropriate, timely concept demonstrations are undertaken by the military departments (and 6.3a monies are allocated accordingly). As is evident, our framework places concept development activities on an equal footing with S&T efforts.
- The "Acquisition System" would be responsible for implementing concepts after Milestone I under the oversight of the USD/A.

Although we do not explicitly treat the role of the Director of Logistics here, we recognize the importance of overseeing the "supply" part of the military departments' charter. In particular, we believe that the Office of the USD/A should explicitly oversee efforts to sustain forces during peacetime as well as during their deployment and employment.

3. Improvements Over Current Practice

Our Framework Versus the Current Concept for Up-Front Planning

Up-front planning (exploring, defining, evaluating, and then demonstrating new operational concepts in Phase 0) is critical to the process of enhancing operational capabilities. Despite this imperative, current DoD directives do not define this activity as separable or establish the venue for conducting it.

Concept development has been complicated by the recent initiative with regard to "technology thrusts" taken by the Bush Administration's Director of Defense Research and Engineering (DDR&E). Concept development, in effect, is being conducted under these so-called technology thrusts. For example, one technology thrust is named "Global Surveillance and Communications." Obviously, "Global Surveillance" does not name a technology thrust—it names a mission area. In practice, DDR&E has organized groups to explore (define) how new technologies can enhance capabilities in the stated mission area, indeed a concept development by another name. Such a construction implies that the principal venue for concept development is under S&T. We have already argued that an operationally oriented venue is far more appropriate (and more consistent with the law) for formulating, defining, and evaluating new operational concepts for accomplishing military tasks.[1]

A Minor Change in Organization

Having the military departments conduct concept development represents no fundamental change from current practice. However, we believe that with formal acceptance of the CAG concept, the interaction among disparate communities, especially operators and technologists, would be far more purposeful and the results far more timely. Currently, these communities have little focused interaction. Yet this is absolutely crucial—the technologists know

[1]Having personnel from the operational community participate in concept development groups organized and controlled by scientists is no substitute for conducting this activity in the correct venue—namely, the military departments, and specifically, in a forum organized by one of the major commands.

what is technically possible, and the operators know what is operationally viable and useful. The CAG concept would supplant the current, costly habits of operators defining "requirements" that the technologists and acquirers declare "infeasible" and, on the other hand, of technologists proposing applications of their favorite technology (read new systems) that the operators do not support.

In the case of the Army, CAGs would be convened and concept development conducted by TRADOC using the Battle Labs. In the Air Force, this activity would be conducted by ACC, AMC, AFSPACECOM, and AFMC regarding those force elements or logistic elements for which they are responsible.

Saving Time and Providing a Better Product

We argue that the framework described will save time and energy while producing a better product. By clearly defining the overall activity and its relationship to other activities and by establishing specifically who is to conduct these efforts and who is to maintain oversight, we encourage more purposeful action in a timely fashion.

First, a clear understanding of the purpose of a Mission Need Statement should greatly reduce the paperwork associated with these documents and encourage a much more proactive role for the proper authorities, especially the JROC (see footnote 3).

Second, creating a Director of Concept Development would help ensure that the appropriate military departments begin timely concept exploration.

Third, creating an explicit forum (the CAG) for exploring, defining, and evaluating new concepts for gaining stated capabilities should greatly reduce the time for attaining an initial product. An experiment recently conducted within the Air Force demonstrated that given a CAG to cause purposeful and intense interaction among participants, one can rather rapidly come to closure in exploring, defining, and evaluating alternative concepts and can be in a position to present these alternatives to higher authorities in less than four months. This concept presupposes that:

- The operators running the CAG have a clear mandate from the "four-star" level (or above) as to the deficiency they are to alleviate
- The technologists have a comprehensive grasp of the emerging and existing technologies available from all sources, including the commercial world
- The cost analysts can offer reasonable estimates of the cost of the systems to implement each concept

- The operators possess the wisdom to make insightful judgments as to which concepts are viable and effective in an operational sense.

The output of the CAG is a well-defined, thoroughly evaluated menu of alternative concepts. Within four months of convening a CAG, someone in authority would be in a position to make an informed selection as to those concepts deemed worthy of demonstrating. After all, at this juncture, one is not deciding to field systems in the operational inventory. Rather, one is merely deciding the concepts to demonstrate. Since in almost all cases the political and monetary exposures to the government are still small, one can afford to be risk-tolerant. Of course, authorities have the option of not selecting any concept for demonstration if none is deemed operationally viable—even if technically feasible.

If demonstrating a selected concept costs little, then finding the means to conduct the demonstration might be handled within the military department. In a number of cases, however, this may not be possible. Then one must appeal to the Director of Concept Development to provide, expeditiously, the 6.3a monies to fund the concept demonstration. Hopefully, one can avoid the current time-consuming practice—where the departments are exhorted to "make this a new line item in the submission of your next Program Objective Memorandum (POM)." In so doing, we save one to two years.[2]

Differentiating Among Demonstrations Saves Time and Money

Our emphasis on *concept* demonstration as distinct from the *engineering/ manufacturing* demonstration in Phase 1 after Milestone I is essential to saving precious time and money.

Concept demonstrations are intended to demonstrate one thing: that systems (incorporating various technology aggregates), organizations, and tactics can be integrated according to a well-defined operational concept to accomplish some stated military task at some level of effectiveness. The purpose of the concept demonstration is to show proof-of-principle—a necessary condition for passing Milestone I. The purpose is not to demonstrate whether engineers can design a system that can be produced and maintained at an affordable cost—an effort reserved for engineering/manufacturing demonstrations during Phase 1.

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[2] Of course, such a streamlined process would require the cooperation of the Congress. This arrangement would not be appropriate for concepts for basic equipment—new concepts for tanks, aircraft, submarines, etc. However, most initiatives will involve upgrading existing basic systems; in these cases, this streamlined concept of financing seems appropriate.

It follows, then, that concept demonstrations are not forums for selecting contractors for developing and producing new systems. Concept demonstrations should be conducted *in an atmosphere devoid of competition as to potential contractors who would build the systems for the operational inventory.* When appropriate, contractors with no conflict of interest would be empowered to provide assistance in these endeavors and serve as honest brokers—with the stipulation that they could not compete later for contracts to develop and produce the systems for the operational inventory. With concept demonstrations, therefore, there need be no long and involved process of developing and issuing requests for proposals (RFPs) as is required when selecting contractors to develop and produce hardware for the operational inventory. In fact, the preferred mode might be to rely on federally funded research and development centers (FFRDCs) and other nonprofit organizations to assist in demonstrations conducted by and at "test centers."

The acquirers must be deeply involved in concept development. After all, they develop and procure the systems to implement a selected concept. Thus, the acquirers should begin to define the acquisition strategy during concept demonstration. This concurrence should save several months.

With this method, the time between issuing an MNS at Milestone 0 and deciding whether to proceed at Milestone I should be considerably shorter than that incurred in current practice. For upgrades, the mean time between Milestone 0 and Milestone I should be no more than 18 to 24 months, including about 4 to 6 months to explore concepts and to decide which to demonstrate, 12 to 16 months to demonstrate, and 2 months to prepare for the Milestone I review.

The Overall Process

We now provide a perspective demonstrating the central role of the military departments in accomplishing their charter to organize, equip, and train. Figure 4 portrays such a perspective.

An Example of How to Apply Our Framework

Based on the experience in Desert Storm, the CJCS and the ASD/SRR jointly issue a MNS that states:

> It is increasingly likely that potential Third World adversaries of the United States will possess weapons of mass destruction. Possession of these weapons could cause grave concern about committing U.S. forces to halt aggression by rogue governments that threaten U.S. interests. The United States must strive to deter such actions by potential adversaries and be able

> to protect its deployed forces and its allies from enemy attacks with these weapons. Theater ballistic missiles are likely to be among the preferred means of delivery for such weapons.
>
> Accordingly, the mission of countering theater ballistic missiles armed with weapons of mass destruction deserves special and dedicated focus. Countering these missiles includes all operational phases—counterforce, boost-phase intercept, mid-course intercept, terminal intercept, and passive measures.
>
> We hereby direct that efforts be undertaken toward enhancing military capabilities to counter enemy theater ballistic missiles.

No additional statements of need are necessary. The DoD now undertakes implementing actions.

The Director of Concept Development, in the name of the USD/A, directs particular military departments to take the lead in defining and evaluating

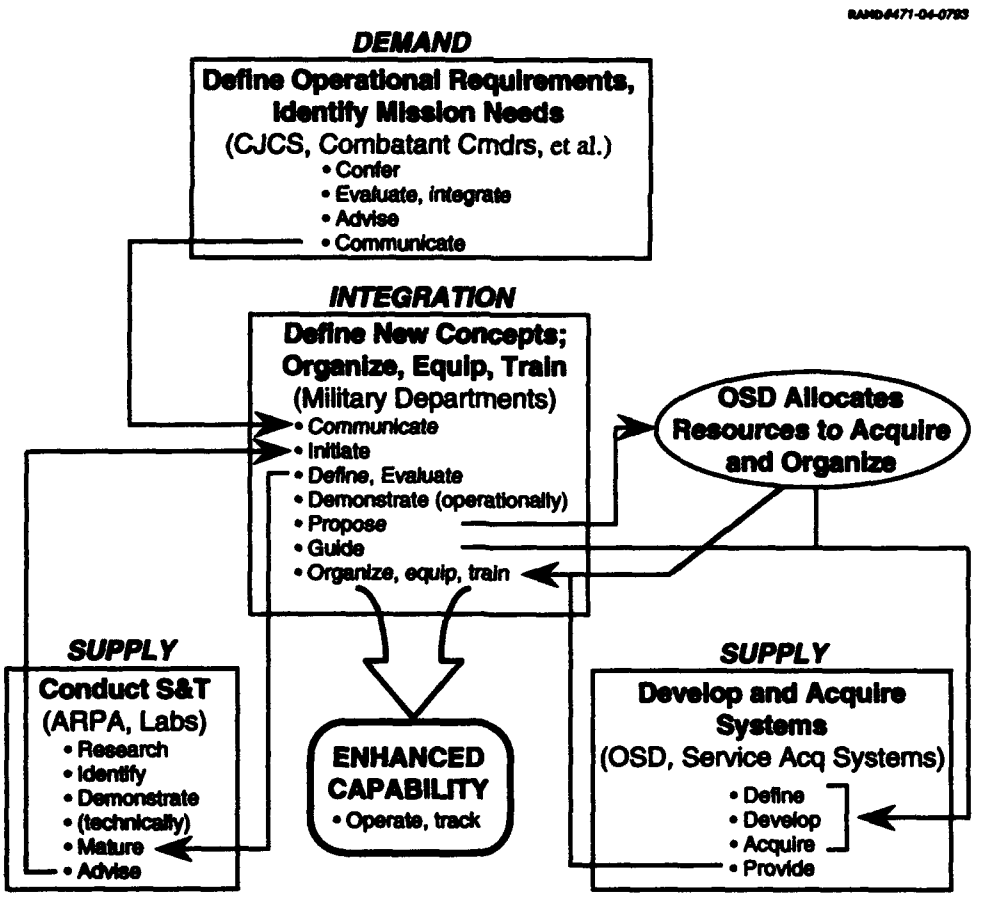

Figure 4—Summary of the Six Activities

concepts for countering the theater ballistic missile in each phase of its operations. These directions are in accord with the strengths of each Service. For example, the Air Force could be directed to focus on the tasks of destroying launchers in garrisons or dispersal areas (counterforce) and destroying ballistic missiles in their boost phase of flight. The Army and the Navy could be directed to formulate concepts for destroying enemy ballistic missiles in boost phase as well as in mid-course and terminal phases of flight. In addition, one of the Services could be tasked to define the overall architecture for battle management and engagement control. Milestone 0 has passed, and Phase 0 has begun.

Given such a statement, the Director of S&T tasks ARPA and the labs to prepare to participate in CAGs related to the MNS. They draw up menus of existing and emerging technology aggregates with potential applications in these areas.

Within the Air Force, the Secretary and the Chief designate the commander of Air Combat Command to take the lead in responding to the MNS. He designates a senior officer from the operations community to convene and run CAGs (there may be more than one) to define and evaluate new concepts for counterforce and boost-phase intercept. This officer invites all appropriate personnel to participate in the CAGs, including relevant technologists as well as personnel from AFSPACECOM, other Services, other agencies, and industry. The leader of each CAG is to brief the commander of ACC on the most promising concepts in three months.

Participants formulate, define, and evaluate alternative concepts. The CAG working on boost-phase intercept defines several concepts. Included are two concepts, one based on an air-launched hypervelocity missile and the other on a high-energy laser aboard a large aircraft. After an in-depth assessment of all the concepts, these two are adjudged worthy of presenting to the higher authorities. Members of the CAG also define the proof-of-principle concept demonstrations to be undertaken for demonstrating these concepts. Given that the demonstrations are estimated to exceed the threshold cost established by the OSD and the Services, the commander—with approval from the Secretary and the Chief—appeals to the Director of Concept Development to provide 6.3a funds. In the name of USD/A, the Director makes these funds available. Four months have passed and we are about to begin concept demonstration.[3]

[3] It may be decided that none of the concepts—even the most promising—be implemented. For example, demonstrations of some concepts might be shelved awaiting additional technology maturation. Alternatively, the decision to let the technology mature further might occur as a result of concept demonstrations. This latter course is carried through the example being described in the text.

With the CAG having defined the key functional characteristics of relevant system concepts and having formulated test parameters, engineers (from the government and/or industry) fabricate functional prototypes—using off-the-shelf equipment when possible—that reliably replicate the functional characteristics of each system concept. An Air Force test center—The Air Warfare Center (TAWC)—is designated to conduct the concept demonstrations and serves as the honest broker.

After eight months of conducting demonstrations, the operational concept involving the high-energy laser is deemed operationally nonviable. Alternatively, the concept involving the hypervelocity missile is deemed operationally viable and technically feasible—with the caveat that some additional technology maturation is required. These results are presented to the commander of ACC who—after being convinced that the risks inherent in maturing the technology in a timely fashion are not high and that the program would be executable—decides to recommend to the Chief and Secretary that the concept be implemented. The Chief and Secretary then decide to present the operational concept involving the hypervelocity missile to the Defense Acquisition Board (DAB) for Milestone I approval.[4]

The USD/A convenes a series of meetings of the DAB—with attendees including the Vice CJCS, the ASD/SRR, Service Acquisition Executives, and others—to review demonstrated operational concepts for countering theater ballistic missiles armed with weapons of mass destruction. Each military department presents analyses and results of demonstrations in areas where it is designated as the conceiver. Decisions on which concepts to implement are made at these meetings.

With respect to the concept involving the air-launched hypervelocity missile, the DAB agrees that enabling technologies require additional maturing (these technology efforts and demonstrations are to be funded with 6.3a monies), and decides that a second DAB review will occur in eight months. After eight months of dedicated technology efforts, the maturation is sufficient for experts to declare the concept technically and operationally viable, and acquirers attest that the program for system development and acquisition is indeed executable. In due time, the DAB is convened and the USD/A issues a Milestone I approval.

Even on this most complex matter, only 20 months have elapsed between Milestone 0 and the point where a Milestone I approval is granted to proceed.

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[4] The example is just that—an example. Our intention is not to render judgment on which concept is in reality viable or preferred.

4. Concluding Remarks

The framework proposed in this report is offered as a means of promoting timeliness, communication, and stability in the DoD process for enhancing U.S. military capabilities. The framework is based on the explicit delineation of six separable yet interrelated activities performed by worriers, conceivers, technologists, deciders, acquirers, and organizers. In particular, it raises the critical activity of concept development (the conceivers' Phase 0) to a level equal to that of the other activities.

To summarize, the Mission Need Statement should be recast as a short, pointed document issued proactively by the CJCS and a small list of other worriers. It should identify deficiencies in the ability to achieve objectives and direct conceivers to explore alternative operational concepts for remedying these deficiencies. It must not flag solutions. Its sole purpose is to pass Milestone 0—to energize the military departments to focus their efforts on critical issues and begin Phase 0 concept development.

Second, it is imperative to distinguish those who conduct these activities from those who oversee the activities. Because of the operational nature of concept development, *the military departments are the appropriate venue for conducting Phase 0—for defining, evaluating, and demonstrating alternative operational concepts for accomplishing military tasks.* Oversight should be maintained by a dedicated entity in the Office of the USD/A—a Director of Concept Development. This entity must be separate from and equal to entities that oversee S&T and system development and acquisition activities.

Concept Action Groups should be convened at the behest of commanders of Service commands responsible for organizing, equipping, and training force elements, or by higher authority, as special instruments for focused concept development in the presence of an MNS. CAGs should be run by senior officers from the operations community. All relevant communities should participate, including operators, development planners, technologists, intelligence personnel, cost analysts, acquirers, and other analysts. Their task is to match mission needs with technological opportunities in the form of alternative operational concepts. Then demonstrated concepts are presented for a Milestone I decision to procure systems to implement selected concepts. Hence concepts, *not technologies,* interface with system development and acquisition programs at Milestone I.

Finally, *concept* demonstrations must be differentiated from *technology* and *engineering/manufacturing* demonstrations. Concept demonstrations are meant to show proof-of-principle of operational concepts, a prerequisite for passing Milestone I. Technology demonstrations verify the viability of a scientific principle or technique for performing some discrete function or the viability of a combination of technologies (technology aggregate) for performing some higher function. To first order, demonstrated technology aggregates serve as inputs to concept development (Phase 0). The engineering/manufacturing demonstrations are used during Phase 1 of a system development and acquisition program to show that engineers indeed can design and manufacture a system within stated criteria for performance, cost, and schedule. Engineering/manufacturing demonstrations provide a forum for competition among potential contractors; this clearly distinguishes such demonstrations from concept demonstrations, which must be devoid of competition.

Appendix

Definitions of Key Terms

This appendix provides definitions of key terms used throughout the body of this document. The terms are grouped by activity.

Conducting Science and Technology

Technology: A scientific principle or technique for performing some discrete function. Examples are techniques for splitting atoms, producing microchips, forging nondistorting mirrors, developing composite materials, forming coherent laser beams, splitting beams of light to measure rotation, using the vibrations of an atom to keep time, and so on.

Technology aggregate: A combination of technologies that operate together to perform some higher function. Ring laser gyros that measure rotation by splitting a beam of light and atomic clocks that keep time according to the natural vibration frequencies of a cesium atom are examples.

Technology demonstration: A test to demonstrate that a technology or technology aggregate can perform some stated function. Technology demonstrations are conducted in a technical environment. No explicit definition is needed of how the technology aggregates are to be used (see *operational concept* below).

Exploring and Demonstrating New Concepts

Military task: Force elements operating according to some operational concept accomplish military tasks. Accomplishing tasks in combination with other tasks according to a specified "concept of employment" achieves a theater commander's operational objectives as defined in his overall campaign plan. Examples of alternative yet complementary tasks for achieving the operational objective of countering enemy tactical ballistic missiles (TBMs) include destroying transporter/erector/launchers (TELs) in the field, destroying TBMs in flight, and providing warning for passive defense.

Operational concept: An end-to-end stream of activities that defines how force elements, systems, organizations, and tactics combine to accomplish a military task. For instance, an operational concept for destroying TELs in the field could involve (1) Defense Support Program (DSP) satellites detecting a launch; (2) ground stations processing data to determine the launch point; (3) these ground stations passing information to JSTARS; (4) JSTARS identifying targets using its on-board synthetic aperture radar (SAR), determining the coordinates of targets using an on-board SAR/Global Positioning System (GPS) targeting system and relaying these coordinates to F-15Es on combat air patrol; (5) F-15Es flying to the target area and searching for and identifying TELs with their own on-board sensors; (6) F-15Es firing weapons to destroy the TEL; and (7) F-15Es or other systems reporting battle results.

System concept: A concept of a new system, especially that of a basic item of equipment such as a new fighter. The concept of a system defines its operational and functional characteristics based on the functions the system is to perform. A system concept integrates a number of technology aggregates or components. Generally, the concept of a system is defined in the context of operational concepts to accomplish stated military tasks.

Concept demonstration: A test conducted in an operational environment to demonstrate that systems can accomplish a military task at specified levels of operational effectiveness according to the defined operational concept. Importantly, this test clearly distinguishes *concept* demonstrations from *technology* demonstrations, defined above.

Stating Operational Requirements, Identifying Mission Needs

Operational requirement: An authoritative statement by combatant commanders and/or the CJCS that defines the campaign and operational objectives to be achieved and the military tasks to be accomplished to enable the commander to attain the military objectives set forth for his area of responsibility.[1]

Mission need: An operational objective or mission in need of increased emphasis. A mission need reflects an operational requirement to achieve a particular operational objective.

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[1] Our use of "operational requirements" is fully consistent with public law. See *Title 10, United States Code/Armed Forces*, Sec. 163, April 1991, p. 61.

Mission Need Statement (MNS): A statement by the CJCS, the combatant commanders, the Service chiefs, or the commanders of the "major commands" that a mission is in need of increased emphasis. A military department may also issue a MNS for basic items of equipment—i.e., when the time is right to start planning a new fighter, bomber, or transport, and resources are sought for defining the concept of this new basic item. The three conditions for issuing a MNS are (1) the mission is deemed important, (2) a deficiency exists in the current capability to accomplish it, and (3) opportunities exist to do significantly better.

Developing and Acquiring Systems

System development and acquisition program: A process, beginning at Milestone I, by which systems attendant to some new operational concept (or system concept) are developed and produced. The process involves milestones that chart a system's progress on its path to being acquired.

Executable program: A program with low risk with regard to the system being developed and acquired successfully according to stated performance, cost, and schedule. That is, the system(s) defined in the concept (in the form of functional characteristics and performance features) can be developed and acquired with the performance necessary to support the concept, at an affordable cost, and in a timely manner.

Engineering/manufacturing demonstration: Efforts conducted during Phase 1 of a system development and acquisition program to demonstrate that engineers have a design of a system that can indeed be manufactured (and maintained) within stated criteria for performance, cost, and schedule. This demonstration may constitute a "fly-off" between potential contractors in competition to produce the system(s). This factor distinguishes *engineering/ manufacturing* demonstrations from *concept* demonstrations. In concept demonstrations, the goal is to establish the proof-of-principle of a concept, and no flight hardware need be involved. Whether the system can be designed and manufactured within some envelope of cost, schedule, and performance is yet to be determined.