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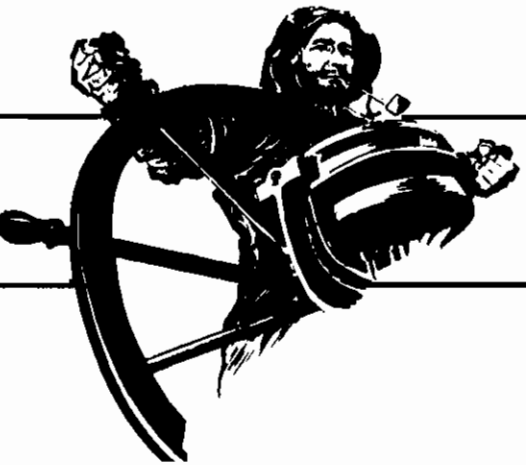

SET AND DRIFT

THE ROLE OF CONGRESS IN THE DEFENSE BUDGET PROCESS— A POSITIVE VIEW

by

Michael A. West*

Given the general cynicism about what transpires on Capitol Hill, it is somewhat audacious to attempt to present a positive interpretation of the role of Congress and, more specifically, that of the House Armed Services Committee in the Annual Defense Budget Process. But to try and accomplish this via an idealization of the role and function of that shadowy marplot, the committee staffer, seems downright presumptuous.

To simplify the task, this paper will be confined to the primary legislation handled by the committee, the annual DOD Appropriation Authorization Bill. This legislation directly authorizes appropriations for approximately one third of the defense budget, indirectly authorizes appropriations for another third through such devices as manpower ceilings and floors, and does not address the remaining third which is largely operations and maintenance funding. In short, this paper will focus primarily upon committee consideration of research and development and procurement of weapon systems--hardware.

Objectives. (It should be emphasized that these objectives are closely intertwined and can only be discretely considered for the purposes of this paper.)

The first objective is to locate and correct inconsistencies and shortcomings in the Defense budget submission so that the committee may fashion a more rational and cost-effective allocation of defense resources. At first glance, this undertaking might seem a bit presumptuous in light of all the "scrubs" the defense submission receives from the Services, Office of Secretary of Defense (OSD), and Office of Management and Budget (OMB) before it even gets to the Hill. How is it

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possible for politicians and their minions to improve on the efforts of Program Analysis and Evaluation (PA&E) and OMB to analyze programs and set necessary priorities? The short answer is to recognize that Congress has no monopoly on political machinations and that politics permeate the whole defense budgetary process from start to finish. Those who have worked intimately in any of the civilian secretariats know this well. Ambassador Komer, when testifying before the committee earlier this year, asserted that we are all political horsetraders and that this process is largely the same in both the executive and legislative arenas.

We are all too aware of examples where program A, program B, and program C are competing or overlap each other in the performance of some specific mission. The rational, logical thing to do would be to pick the best of these programs and terminate the other two in order to gain the maximum return on investment. Too often, however, there are careers, jobs, and various other special interests involved that militate against the bureaucracy making a decision of that sort and there are always comforting rationales that can be called upon to support a multiple approach to the same mission. This may result ultimately in the underfunding of each program involved, but it may be the price for achieving the necessary political consensus within the bureaucracy to develop an acceptable budgetary recommendation. And so it goes at each level of the budget formulation process with the result that inconsistencies and shortcomings do exist and rationality is not exalted. The product reaching Congress is more a reflection of the success of various competing factions within the executive branch packaged in the manner to best insure Presidential approval and it may be predicated on nothing more substantial than an arbitrarily imposed dollar ceiling.

The executive branch and DOD are not the sole repositories of knowledge, rationality, and consistency on defense matters and it follows, therefore, that congressional questioning and restructuring of the defense submission is fully as legitimate as what occurred across the river. It is, perhaps, even more rational as there are fewer active players in Congress, consensus building is less constrained by institutional inhibitions and there is greater flexibility and responsiveness. What is more, Congress can often make those difficult choices that the bureaucracy cannot seem to accomplish without jeopardizing the cohesion it requires to function.

A second objective is to translate the defense request into legislation that will, to the greatest extent possible, accomplish the first objective and yet conform to political realities on the Hill to secure congressional approval.

The Hill is totally success-oriented in measuring power and influence. The compromises and political factors involved in the formulation of the defense budget submission within the executive branch are not sufficient to ensure its acceptance by Congress. As in the case of the executive branch, the committee has to come up with a package that will command consensus. Although this effort is demanding, it is facilitated by the reliance in Congress upon the committee system and the pervasive norms of reciprocity and deference to expertise. Whatever else the committee and its staff accomplish, they must draw up legislation that will be approved. Defeats on the floor for whatever reason must be avoided like the plague. Such defeats will only encourage factions hostile to defense within Congress to expand the scope and raise the tempo of their activities. Continuing resolutions are in nobody's interest. Legislation is the vehicle and that vehicle has to be able to negotiate the terrain.

A third objective is to preserve and maintain the committee's jurisdiction,

role and influence in the defense budget process.

As is the case of every other institution involved in parceling out limited resources among contending claimants, Congress is the scene of a spirited zero-sum game among competing subordinate entities seeking to broaden jurisdictional boundaries and acquire control of a larger share of available resources. If discredited or weakened through floor defeats or the perception that it is out of step with political realities in Congress, the committee's ability to work in behalf of defense will be eroded. Again, as power and influence on the Hill are measured by legislative success, efforts to protect the committee's reputation of effectiveness are essential for all concerned.

A final objective is to be as responsive as possible to the concerns of Members of Congress on defense matters. Although no Congressman will consciously support a bad program, it is nonetheless true that he will support more vigorously good programs associated with his district. Reconciling diverse and frequently conflicting member interests within authorization legislation is a necessary prerequisite for a consensus on the floor. In addition, addressing member concerns has an important collateral benefit in that Congressmen are exposed to a wide range of information that often results in the discovery of certain shortcomings in the Defense Budget Request that escaped earlier consideration and warrant remedial action at this point in the process. In sum, the committee's objectives are to fashion the most rational and cost-effective defense authorization legislation that can secure congressional approval in such a manner that will be responsive to salient member concerns and preserve the committee's influence.

Advantages. The committee and its staff enjoy special advantages in fashioning rational, cost-effective defense authorization legislation.

First and foremost is institutional flexibility. Within broad guidelines furnished by House rules and certain other established procedures, the committee has considerable freedom in the manner in which it operates. Rules on the Hill are to discourage gross abuses and not to restrain initiative. The committee has a number of formal and informal methods it can employ and is not encumbered by NSARCS, DSARCS and stacks of regulations. Furthermore, it can be very responsive when it is in its interest to be.

This flexibility extends to the staff and within very elastic limits, staff work is basically a free-style exercise. Initiative is encouraged and, as long as the results are consistent with the objectives and basic Hill norms, job security is not likely to be a problem. Nelson will turn a blind eye to the details as long as his captains are capturing ships.

DOD is like a lumbering giant requiring total concentration to provide and preserve the level of coordination and cooperation to function and move toward its goals. In contrast, the committee and its staff represent a smaller, nimbler, and quicker player in the process. Opposing the giant through direct confrontation is a difficult proposition at best. Rather, the committee must use diversion, create confusion in his mind, take advantage of his incoordination, place impediments in his path to limit his options and be persistent. It is hoped that the giant, seeking the path of least resistance, will end up deciding to go in the direction desired by the committee. Better still, the giant should come to this conclusion believing that he did it on his own initiative as he will not be easily dissuaded from this course of action if he thinks it is his own.

It is true that if the giant resists all other forms of persuasion, the committee can subdue him with the

legislative language club. However, this should be a last resort. It is not the basis of a positive working relationship and it also implies the inadequacy of committee efforts to be effective through other, more subtle forms of persuasion. After all, the objective is not to belabor DOD unnecessarily, but to insure Congress' legitimate participation in the process and to provide a periodic corrective for DOD's institutional shortcomings.

There is also the committee's relative position in the defense budget process. The fact that it takes up the defense request after it has been put together in the executive branch offers a number of benefits. The committee has later, more exact figures and information on programs that are incorporated into its authorization bill. It is also in a better position to judge whether certain assumptions contained in the defense request are being borne out—inflation estimates, projections on the ability to negotiate contracts, the ability of contractors to perform, etc.

A third advantage has to do with perspective, both in a political and overall sense. Insofar as political considerations are concerned, the committee and its staff are particularly well qualified to look at the Defense request and see what modifications are in order to come up with legislation that will be enacted by Congress.

The committee and its staff also enjoy the advantage of perspective in an overall sense stemming from the fact that they are charged with oversight for a broad range of defense programs rarely matched in the Department of Defense. One staffer may be responsible for all Air Force, Navy, Marine, and Army aviation programs and must develop an understanding of how they relate to each other and how they can be integrated into the most cost-effective whole. This perspective allows the committee to make difficult decisions on competing and overlapping programs that would be impossible without this understanding or if approached solely through the evaluation of each separate program on its individual merits. Of equal importance, the committee and its staff do not have to evaluate programs against the backdrop of the internal bureaucratic political considerations that may have shaped executive branch decisions.

Another advantage has to do with the depth and diversity of the committee's knowledge. Service career patterns being what they are, it is becoming increasingly more commonplace for members and congressional staffers to possess greater institutional memories than the Service and DOD representatives they deal with. About the time their Service or DOD counterparts acquire a respectable mastery of the subject and its historical context, they are transferred to new billets and the learning process begins anew. Thus, this greater depth of knowledge strengthens the staffer's hand in dealing with the Services and DOD and in having his recommendations prevail in committee.

The committee and its staff also benefit from the diversity of expertise they can draw upon. There are official and unofficial channels with the Services, OSD, industry representatives, lobbyists, and a multitude of other interested parties. Institutionally, they can also draw upon the resources of the General Accounting Office, the Congressional Budget Office, and the Congressional Research Service of the Library of Congress.

Because information is the coin of the realm on the Hill, staffers are continually trying to expand and cultivate their contacts so that they will receive relevant information in a timely manner. Staffer effectiveness is directly proportional to the amount, quality, and timeliness of information he can acquire.

A final advantage is the natural alliance that exists between the

committee and the Services. In general, committee members and staffers have an abiding distrust of PA&E and OMB types. They view themselves as being genuinely concerned with the welfare of the "troops" and endeavor consistently to provide them with the wherewithal they require to accomplish their missions. Conversely, PA&E types are seen as "pointy headed systems analysts" who would not recognize reality if it bumped into them. Likewise, OMB is perceived as a den of "bean counters" subservient to the whims of their master who know the price of the defense systems they evaluate, but little about their military value.

Under the circumstances it is not difficult for the Services to receive a sympathetic hearing about the "shabby treatment" they have suffered in the executive branch budget cycle, primarily at the hands of PA&E and OMB. It should also come as no surprise that they avail themselves of the opportunity—officially and unofficially—to provide the committee and its staff with a valuable source of information. It would be difficult to overestimate the contribution to the committee's overall effectiveness that results from this natural and enduring alliance with the Services.

There is also a touch of irony in the fact that through its persistent and continuing efforts to centralize and expand its control, OSD has actually enhanced the committee's ability to function as a court of appeals for the Services.

In sum, the committee and its staff enjoy the advantages of institutional flexibility, political and overall perspective, depth and diversification of knowledge, and a powerful alliance with the Services.

Methods. First of all there are hearings that allow the committee to examine in detail controversial issues and programs, receive Service input, and force decisionmakers to rationalize and defend their actions. As importantly, hearings provide a record to justify and explain committee actions that differ from those contained in the President's submission.

In addition to their value in the committee's annual consideration of DOD authorization legislation, hearings can be employed to good effect in exercising periodic oversight. For example, if the committee becomes aware that something is amiss in the Department of Defense, it can ask the principals to come over and testify. They may not want to have this opportunity to explain how well everything is progressing. They undoubtedly recognize, as the committee does, that transcripts are read with meticulous care in the Pentagon and that hearings might disclose items that may elicit interest and response among contending bureaucratic entities in that arena. In this fashion hearings serve as an ideal instrument for liberating cats from an assortment of bureaucratic bags. In other cases, the mere scheduling of hearings and their tenor enables the committee to send subtle, but unmistakable signals to the Pentagon.

Notwithstanding their particular utility, hearings are constrained by a number of inherent limitations. First, they constitute a high profile approach that is inappropriate in cases where discretion is a paramount consideration. Furthermore, some issues cannot effectively be handled in this manner and some are too minor to justify formal hearings. Finally, their requirement for substantial staff preparation and member participation when both are in high demand militate against indiscriminate use. In sum, hearings are a conspicuous, time-consuming, labor-intensive method whose employment must be carefully measured against committee priorities.

A second method is the use of report language to explain the committee rationale for its actions, outline its

specific reservations and conditions that apply to various defense programs and activities and set forth future guidance. Frequently report language is used to facilitate congressional oversight by levying specific reporting requirements in DOD and the Services. Finally, it serves as the halfway measure between informal guidance and legislative language in the hope that a word to the wise will be sufficient.

As suggested, legislative language is employed to give greater force and authority to specific committee and congressional guidance and direction by incorporating them into law. Accordingly, it is the ultimate sanction of the Congress to ensure compliance with its wishes. Recognition of the force of legislative language and its inherent inflexibility by Congress is shown by the restraint governing its use. Nevertheless, it remains as the club behind the door to subdue benighted or unruly giants should other means prove inadequate.

Less formal than the first three methods is the use of letters and requests for information. This method is lower key and can easily be adjusted to suit the circumstances. It is especially useful for exploratory purposes by allowing the committee to ask those involved in various activities for information and clarification so that it might better "understand" these developments. It is also useful in providing committee interpretations of legislative and report language to assist DOD's compliance with the spirit and letter of that direction.

More widespread and useful are formal and informal contacts between members and staff and their DOD and Service counterparts. This is how most of the business is transacted and offers the most positive means for accomplishing our objectives in a manner that will be mutually satisfactory. Working on the basis of trust and candor, each side can exchange useful information, exert subtle influence and keep a finger on the pulse of each institution.

Although informal exchanges characterize the member's and staff's relations with all of their sources of information, it is especially important with respect to the official OSD and Service legislative liaison channels. The OSD and Service representatives serve as a major conduit of information between the two branches of government and it is essential for them to try to broaden this channel to the maximum extent possible. This requires initiative, trust, and discretion, but it can pay impressive dividends. It allows DOD or the Service involved to develop a better understanding of prevailing committee and congressional attitudes. It can help identify those actions that must be taken to gain required congressional approval. It also allows the committee to give informal advisory opinions and guidance to forestall future misunderstanding and conflict. Lastly, it permits the individuals involved in this relationship to exert subtle influence on both sides of the river in a positive fashion.

Attributes. The committee's success in its endeavors requires the existence of committee staffers possessing the proper attributes to contribute effectively to committee work.

Our ideal staffer, first of all, must have the intellectual capacity to perceive what the relevant issues are and what must be done within the Legislature to achieve the desired result. He must be capable of putting the pieces together and correlate information from diverse sources quickly enough to affect the result.

He should be intellectually honest with a commitment to achieving the committee's first objective within existing political constraints. This means not being simply a bean counter looking for cuts irrespective of their consequences or pandering to institutional prejudices to achieve sensational results if the

ultimate consequences are expected to be sterile or negative; it also means the ability to defer judgment and fight the predisposition to come to a conclusion before examining as much relevant information as time permits.

He should also possess the political savvy to know the political process and how to use it. He must understand the relationship between his committee and other committees in the House and Senate involved in the defense budget process and the art of the possible within that framework. He should be able to recognize the trade-offs and risks associated with a certain course of action. Finally, he must know what will put the committee in as favorable light as possible.

Our staffer should be able to relate effectively to his members. This means being aware of their interests and meeting their specific needs while attempting to reconcile those needs with committee objectives. He should also be able to work well with other members of the staff to ensure the greatest possible harmony and coordination of their collective efforts on the committee's behalf. Finally, he should know how to deal with his Service and OSD contacts—official and unofficial—to elicit the most useful information and exert influence through them.

He must be discreet as he cannot act as broker for useful information from a variety of sources if he is not careful and does not exercise good judgment. Even the most sympathetic Service sources will not want to deal if they feel they are pouring gasoline over career and institutional interests in the presence of a maladroit or a pyromaniac with a book of matches. The responsible management of information is probably the most demanding aspect of a staffer's job and is largely responsible for his effectiveness.

A staffer should have initiative and not be afraid to try something new to gain his objectives. He should be imaginative in approaching problems. His working environment is largely unstructured and offers tremendous opportunities for those able to recognize and seize them.

He should be skilled in the arts of subtlety as the most effective approach to the solution of problems on the Hill is often the most indirect. This entails accepting a degree of anonymity and lack of outward recognition that many would find unattractive.

Our staffer should be patient and persistent in his efforts. Although he might only be able to alter the course of events one degree, the longer he perseveres the greater the arc and extent of his success.

Finally, he must be perceived as being an important player in the defense authorization process to continue to be effective. The success orientation of the Hill is harsh and it is ultimately a produce or perish situation. Those who exercise power are players, those who do not are nonplayers and do not enter into the equation.

Conclusion. Although this idealization of the capability of the House Armed Services Committee and its staff to exert a positive influence in the legislative phase of the defense budget process is overdrawn in some respects, it should not be discounted. For whatever reasons, the Hill is well endowed with capable members and staffers who recognize the advantages they possess and can skillfully wield the tools at their disposal.

Three final precepts will be useful to anyone in any future dealings with the Hill and its denizens.

One, don't try to "blow" something by. If the member or staffer involved is competent he will have information as good or better than yours and he may know beforehand what you are up to. Your credibility will plummet and the areas you are responsible for will receive special scrutiny. Worse yet, you may

end up out of the loop as a nonplayer. Honesty and candor are still the best policy and may elicit in return a degree of understanding and cooperation that will be gratifying.

Two, don't try to make a pitch that is predicated on "Trust me on this" unless you feel certain you can stake your integrity on it—which in fact is what you are doing. Even if you are certain, chances for success are not good because of an ingrained wariness on the committee's part toward nice guys who couldn't deliver and left it holding the bag.

Three, don't end run the staff and go to a member unless you are sure you don't have to work with him anymore, or that the issue is so clear-cut and vital and the staffer so ignorant or malevolent that no other course is available. Staffers don't get mad, they get even, and time is usually on their side. Moreover, members who have a good working relationship with certain committee staffers may not be appreciative or responsive to such a ploy. Thus, whatever the prospects for individual success on your part, there is a good chance that it will become a pyrrhic victory for your Service.

WEATHER PROBLEMS AFFECTING USE OF PRECISION GUIDED MUNITIONS

by

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The introduction of Precision Guided Munitions (PGMs) during the Vietnam war sharply enhanced the accuracy, and thereby the potency, of airpower. The value of this new electronic warfare (EW) capability was dramatically highlighted by the example of the Thanh Hoa bridge—an important target in North Vietnam that survived an estimated 800 to 1,000 aerial attacks during 1965 to 1968, but was destroyed by the first flight of PGM-armed F-4 aircraft sent against it after bombing was resumed in 1972. Subsequent to the Vietnam war, developmental work has produced, or is producing, a number of variations of this new type of combat weapon. PGMs now employ active, semiactive and passive operating modes and exploit a wide range of electromagnetic (EM) frequencies. PGM development has focused EW attention on the high frequency portion of the EM spectrum (visual and infrared) where the greatest resolution, and thereby greatest accuracy, is attainable. Recent emphasis on electro-optic (E-O) capabilities (0.2 to 40 micrometers) reflects this optimization effort. Of significance, however, is the need to recognize and address the fact that such "optimization" applies only to PGM accuracy—not to potential employment limitations posed by environmental sensitivities. "Weather" sensitivity is, in fact, increased as E-O techniques are employed. Also, traditional types of weather forecasts are no longer sufficient to help PGM operators plan for and minimize weather effects—forecast maximum lock-on range and probabilities of cloud free line-of-sight are needed. These new capabilities are now being generated and employed by U.S. Air Force personnel and will be improved in the future.

PGM CHARACTERISTICS. General. A PGM is a missile, bomb or artillery

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shell equipped with a terminal guidance system to enhance the PGM's capability to hit a target. As used here, a PGM is an air-to-ground missile or bomb equipped with a terminal guidance unit designed to sense the difference in EM radiation emitted or reflected by a target and its background and to guide the weapon to the target. PGMs vary both in their intended operating mode (active, semiactive, passive) and the portion of the EM spectrum in which they are designed to function (ranging from visual to millimeter wavelengths). Their performances are affected not only by sensible weather elements (e.g., rain and clouds), but also by atmospheric aerosol distribution, the solar illumination and other considerations that affect the amounts of energy that are received by the sensor from the target and background. When the environment is unfavorable for use of one type of PGM, another type may often be employed successfully; however, even collectively, PGMs do not have a true "all weather" capability. The obvious advantage of PGMs over conventional weapons is accuracy, and one obvious disadvantage is their environmental sensitivity. Another disadvantage is their high cost. The TV Maverick, for example, costs approximately $21,700 each. An additional potential disadvantage is aircraft exposure time to enemy defenses. Such exposure time may be more significant than with conventional bombs and rockets owing to increased crew member time requirements for the preparation for launch of a PGM.

PGM Components. The two components of a PGM are the sensor and the tracker, the former being the most environmentally sensitive.

Sensor. The human eye and a TV camera are familiar examples of E-O sensors. These sensors "see" EM energy at visible wavelengths. Sensors used in PGMs can operate at visible wavelengths or at infrared and millimeter/microwave wavelengths. The energy received by the PGM sensor's detector is converted to electrical voltages that drive electronic logic circuits. The sensor discriminates between differences in the received energy levels from different points within its field of view (FOV). This ability to detect contrast between energy levels is basic to the PGM's operation. Two characteristics of PGM sensors are important with respect to environmental support. First, each sensor has a minimum energy contrast threshold. Below this threshold, energy differences are insufficient to activate the logic circuits. Second, sensors can work only in limited energy ranges. Too little energy cannot be detected, and too much energy will saturate, or perhaps damage, the sensor (for example, looking directly into the sun).

Tracker. While the sensor sees the energy within its FOV, the tracker activates the PGM's aerodynamic control surfaces to keep the pattern of energy differences within the sensor's FOV and guides the weapon to the target. Trackers have different levels of sophistication that improve the ability of a PGM to continue on course to target. The term "lock-on" is used to describe the activation of the tracker. There are two fundamental sensor-tracker systems: edge and centroid. The edge tracker locks on and guides the PGM toward the area of the most intense energy contrast within the sensor's FOV. The E-O Guided Bomb has an edge tracker. The centroid tracker locks on and guides the PGM toward the center (centroid) of the most intense radiation (maximum reflected or emitted energy) or least intense radiation (minimum reflected or emitted energy). This capability to select a centroid with a maximum or minimum radiative intensity is called dual polarity. The pilot selects this option from the cockpit by means of a

polarity switch. The TV Maverick (AGM-65A and AGM-65B) has a centroid tracker.

PGM Guidance Systems. A brief description of each of the three types of PGM guidance systems is provided below. It may be noted that both the active and semiactive systems rely on two-way propagation of energy—that is, from a source to a target and then back to a PGM sensor. Because the passive system, on the other hand, relies simply on one-way propagation (target to PGM sensor), this type of guidance system enjoys the potential advantage of a shorter overall path length subjected to the effects of environmental attenuation.

Active. An active guidance system responds to reflected energy. The PGM emits radiation in the direction of the target, the target reflects the energy back to the PGM, the PGM senses the reflected radiation, and the PGM "homes in" on the beam of reflected energy.

Semiactive. A semiactive guidance system functions in much the same manner as an active system. The difference is that the energy is radiated by an external source such as a radar or a laser designator on another aircraft or the ground (or perhaps on the attack aircraft itself).

Passive. Passive guidance systems "home in" on the naturally emitted or reflected energy contrast between a target and its background. The TV and Infrared Mavericks and the TV GBU-15 are passive PGMs.

PGM Inventory. Table I identifies specific PGMs according to their guidance systems and operating wavelengths. A brief description of some of the USAF and other DOD PGMs is provided below.

TABLE I—PRECISION GUIDED MUNITIONS, THEIR OPERATING WAVELENGTHS AND GUIDANCE SYSTEM TYPES

	Active	Semiactive	Passive
Visible			Modular Guided Glide Bomb (GBU-15) TV Maverick (AGM-65A, AGM-65B) Electro-Optical Guided Bomb (GBU-8) Bullpup* (AGM-12B, AGM-12C)
Infrared		Laser Guided Bomb (GBU-10, GBU-12, GBU-16) Laser Maverick (AGM-65C) Bulldog** (AGM-83A)	I^2R Maverick (AGM-65D) Modular Guided Glide Bomb (GBU-15)
Millimeterwave/ Microwave	Harpoon* (AGM-84A)		Anti-Radiation Missile (AGM-78) Shrike (AGM-45A) HARM*

*USN Weapon
**USMC Weapon

Laser Guided Bomb (GBU-10, GBU-12, GBU-16). The tactical Laser Guided Bomb (LGB), called *Paveway* during the Southeast Asia conflict, has a semiactive guidance system. The LGB is an unpowered bomb with a sensor-tracker forward and aerodynamic control section aft. A target is designated by a laser flown on an airplane or by a ground-located laser designator. The LGB is released from the aircraft after the tracker system locks on to the target. The LGB homes in on the centroid of the reflected energy from the target.

Electro-Optical Guided Bomb (GBU-8). The tactical Electro-Optical Guided Bomb (EOGB), also known as *Hobo* during the Southeast Asia conflict, is an unpowered 2,000 pound bomb (MK 84) with a passive TV sensor-edge tracker guidance system and aerodynamic control. The EOGB is released after the tracker system locks on to the contrast between a target and its background.

TV Maverick (AGM-65A, AGM-65B). The TV Maverick is a rocket-powered missile with a passive TV sensor-tracker system. The "A" model was initially produced in 1971 and the "B" model was delivered in late 1975. The "B" model optically magnifies the image of the scene. The missile can be launched from an A-7, A-10, F-4 and the Teledyne Ryan Remotely Piloted Vehicle (RPV, BGM-34) after the tracker locks on to the centroid of the reflected visible energy from the target.

Imaging Infrared (I^2R) Maverick (AGM-65D). The I^2R Maverick, currently under Air Force Systems Command development and testing, is a rocket-powered missile with a passive infrared sensor-tracker system. The tracker locks on to the thermal contrast between the target and its background.

Laser Guided Maverick (AGM-65C). The laser guided Maverick uses a semiactive sensor-tracker system designed for use in the close air support role. Employment of this missile is similar to the laser guided bomb. It is in advanced engineering development.

Modular Guided Glide Bomb (GBU-15). The GBU-15 is another version of the EOGB. This passive sensor-tracker system currently operates at visible wavelengths; later models will use a passive infrared or laser sensor. This weapon has two aerodynamic versions. With the cruciform wing configuration, low-altitude attack is achievable, and a high-altitude standoff attack capability is obtained with the planar (flip-out) wing configuration. Another unique feature of the GBU-15 is that the tracker does not have to be locked on to the target prior to release. The GBU-15 can be guided after launch by radar and data link with the launching aircraft to a position where the TV sensor-tracker system can be locked on to the target. The image seen by the GBU-15 is displayed continuously in the cockpit of the launching aircraft. (Use of the radar/data link mode of guiding the GBU-15 to the target vicinity would seemingly make this PGM particularly vulnerable to enemy ECM efforts.)

PGM SENSITIVITIES TO THE ENVIRONMENT. General. Environmental influences that may adversely affect PGM employment may be divided into three categories. First, severe weather effects on the delivery vehicle and/or the PGM itself—these may be termed "nonelectromagnetic sensitivities." Second, electromagnetic propagation sensitivities, involving atmospheric attenuation of the target/background signal prior to receipt by the target acquisition or PGM sensor. Third, environmental influences on inherent target/background contrast (i.e., before the signal is subjected to atmospheric attenuation).

Nonelectromagnetic Sensitivities. All PGMs may be adversely affected by icing, turbulence, lightning, ablation (erosion), and electrical charge buildup (triboelectrification). The degree of PGM system degradation caused by these influences is not known in detail. Severe or greater turbulence may be sufficient to "break lock." Icing can disturb aerodynamic flight, but it can also coat the sensor cover to such an extent that the sensor is no longer useful. The term ablation (or erosion) describes the deterioration, through pitting, of the sensor cover by passage through large aerosols, hail and the like. This deterioration and the icing over of the sensor cover are probably most significant to shorter (i.e., visible) wavelength systems. Lightning and electrical charge buildup have the potential for creating transient currents in the PGM's electronics that may affect system performance. (Forecasting of the weather effects described in this paragraph was being accomplished routinely by Air Weather Service personnel in support of USAF aviation well prior to the introduction of PGMs; therefore, while this is not part of the new weather support capability needed for PGMs, it is important that these forecast requirements be applied not only to planned aircraft operations, but also to planned PGM employment.)

Electromagnetic Propagation Sensitivities. All PGMs (and associated target acquisition systems) may be affected adversely by meteorological elements that degrade EM propagation conditions—the degree of the potential effect and specific meteorological conditions of importance are functions of the particular PGM's operating wavelength. Figure 1 illustrates the basic problem involved in trying to select a sensor that can "see through weather" with enough resolution to recognize a target. Table II provides a more specific breakdown for each type of PGM.

Visual Systems. TV sensors and the human eye cannot see through clouds (including dense fogs). Hence, a cloud free line-of-sight (CFLOS) between the target and the sensor is essential. Reduced visibility because of scattering and absorption by haze, fog and precipitation further limit the capabilities of visible systems. These systems require a clear line-of-sight (CLOS) to the target; i.e., a line-of-sight clear of clouds and within the maximum target acquisition range of the sensor, defined as the range at which the apparent contrast exceeds the required threshold. Furthermore, each visible system requires a minimum level of illumination.

Infrared Systems. In general, laser systems operating at various infrared

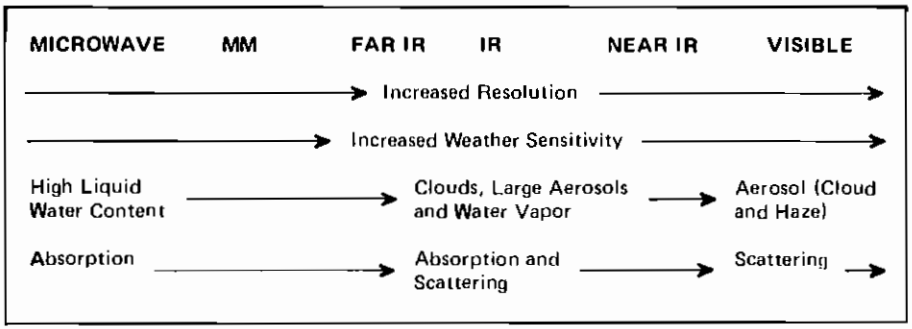

Fig. 1—Adverse Weather Elements and Sensor Resolution as a Function of Wavelength Categories

TABLE II—MAJOR ATMOSPHERIC AND SOLAR EFFECTS ON PRECISION GUIDED MUNITIONS AND TARGET ACQUISITION SYSTEMS

PGM/TA Systems	Environmental Limitations	Time of Employment	System Resolution
Eye/TV (Visible)	Clouds (includes fogs) Haze (includes all dry aerosols) Sun Angle	Day (avoid dawn and dusk)	High
Silicon Vidicon TV (Visible and Near IR)	Precipitation Light Levels	Day (and moonlight)	
Laser (Infrarad)	Clouds (except very thin) Haze (Near IR only) Absolute Humidity (Far and Far Far IR only)	Day or Night	Not Applicable
Infrared	Clouds (except very thin) Haze (Near IR only Absolute Humidity (Far and Far Far IR only)	Day or Night	Medium
Millimeterwave/ Microwave	Heavy clouds (high liquid water content) Precipitation	Day or Night	Low

wavelengths and passive infrared systems require a CFLOS to the target. However, a laser beam can sometimes penetrate thin cloudiness with enough energy to be detected, and passive infrared systems may detect very hot targets (e.g., a rocket exhaust) through thin clouds. As with visual systems, the transmission of energy at near infrared wavelengths will be degraded by haze, fog and precipitation. In addition, systems operating at longer infrared wavelengths are degraded by the absorption of infrared energy by atmospheric water vapor. These systems will generally require a CLOS to the target. They can operate during the daytime or at night.

Millimeterwave/Microwave Systems. Millimeterwave/microwave system performance may be degraded by two main atmospheric factors: heavy cloudiness (thick cloudiness that contains large droplet distributions of near-precipitation-sized particles) and precipitation. These systems can be employed during the day or night.

Target/Background Contrast Influences. Fundamental to the detection capability and hence the effectiveness of passive PGM sensors is sufficient apparent contrast between the target and background. Apparent contrast is a function both of propagation conditions between the target and the PGM sensor (sensitivities described in the preceding paragraph), and the inherent contrast between target and background (i.e., contrast observed before the reflected or emitted energy from the target/background is subjected to atmospheric attenuation en route to the sensor).

Visual Contrast. At visual and near IR wavelengths, reflected sunlight from target/background to the PGM sensor is the important physical process. Inherent contrast depends on the level of solar insulation and the respective reflectivities of the target and background. Meteorological conditions can affect inherent contrast by reducing brightness levels (e.g., cloud cover) and by changing the reflectivity of the background (e.g., snow cover); on the whole,

however, inherent contrast in the visual and near IR portion of the EM spectrum is largely independent of atmospheric conditions.

Thermal Contrast. At IR and millimeterwave/microwave wavelengths, emission of EM energy from the target/background to the PGM sensor is the important physical process. Inherent contrast, in this case, depends on the respective emitting temperature and emissivities of the target and background. While the importance of environmental effects on this "thermal contrast" is almost certainly significant (at least compared to the effect on visual contrast described in the preceding paragraph), it cannot be stated definitively owing to lack of a comprehensive data base and relative inexperience in using thermal contrast-dependent systems. The following examples, however, can illustrate the types of atmospheric influences that may cause thermal contrast problems of significance.

Effects of Sunrise/Sunset Crossover. As a result of the diurnal temperature cycle, the target may be warmer than its background during the day and colder at night. In this instance, two daily crossover points may occur (see Figure 2) at which times the thermal contrast may go to zero and a thermal contrast-dependent PGM could not distinguish the target.

Effects of Cloudy Days/Nights. Cloud cover inhibits normally strong thermal contrasts observed between targets and their backgrounds. This adverse effect is stimulated by the cloud cover inhibiting nighttime radiational cooling effect and the daytime differential heating effect. The result of the reduced target/background thermal contrast is, again, a decreased probability that a thermal contrast-dependent PGM will be able to distinguish its target.

Effect of Strong Winds and Precipitation. Wind will also act to reduce the thermal contrast by equalizing the physical temperature difference between target and background. The higher the wind speed, the smaller the temperature difference. Rainfall and snowfall will completely change the infrared scene. Standing water, the percolation of rainfall into the ground and the coverings of the target and background by snow alter the emissivities and radiative temperatures of the target and/or background. In each case reduced thermal contrast occurs and PGM reliability drops accordingly.

Effect of Weather-Induced Thermal Clutter. Because the infrared PGM sensor will lock on to the hottest (or coldest) area within its FOV, thermal clutter (i.e., other hot/cold spots in the vicinity of the target) may adversely affect results. Obvious examples of thermal clutter include burning objects

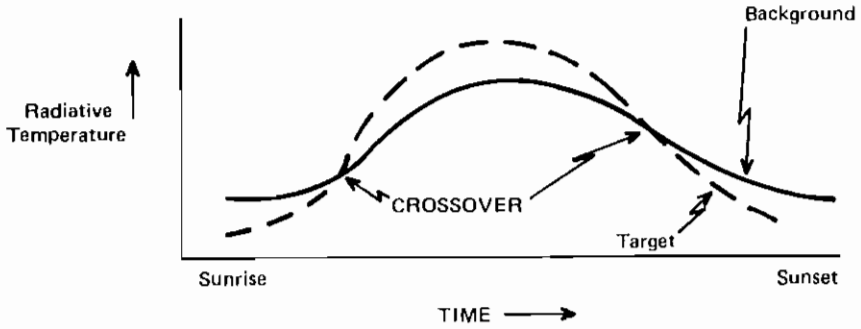

Fig. 2—Example of Radiative Temperature "Crossover"

and hot pavement surfaces. However, some less obvious instances of thermal clutter may occur because of weather-induced circumstances. For example, infrared imagery taken at Fort Polk, Louisiana in February 1977 showed that tanks operating in a wooded area had a lower radiative temperature than the surrounding trees. Subsequent analysis revealed that the radiative temperature of the trees was high because of below-normal precipitation during the preceding winter season and below-normal cooling by evapotranspiration from the leaf surfaces. This example is included simply to illustrate the complexity of possible influences on target-to-background thermal signatures.

ILLUSTRATION OF PGM WEATHER FORECAST SUPPORT: THE TV MAVERICK. Operational Considerations. The TV Maverick PGM is a locate, lock-on, launch and leave weapon usually fired from a shallow attack angle against small targets such as trucks, tanks, APCs and bunkers. Mission planning must address the following questions:

a. Will severe weather (icing, turbulence, thunderstorms, etc.) limit choice of operating areas and/or mission timing?

b. Will there be enough light in the target area? Because the TV system relies on reflected sunlight (as does the human eye), operations must normally be conducted between about 30 minutes after sunrise and 30 minutes before sunset, and then only if cloud conditions are such that sufficient sunlight is reaching the ground to satisfy the weapon's illumination-level baseline.

c. Will the slant range visibility be good enough to facilitate lock-on at an acceptable range? As long as inherent target-to-background contrast exceeds 0.20 (the Maverick's contrast threshold —this compares to 0.02 for the human eye), maximum lock-on range is a function of atmospheric propagation conditions (i.e., "visibility") between the target and the aircraft.

d. Once inside the maximum lock-on range, what is the probability that there will be a cloud free line-of-sight to the target such that lock-on can actually be achieved?

e. How do enemy defenses, in combination with visibility and cloud constraints, limit the size of the probable safe launch envelope? See the depiction in Figure 3.

Weather Decision-Assistance. As with all other types of aircraft operations, USAF operations personnel conducting TV Maverick training or combat missions receive tailored weather forecast briefings from locally assigned Air Weather Service personnel. As implied by the term "tailored," the value of the forecast data depends upon the degree to which they can be specifically geared to the type of operation to be conducted. In the case of the TV Maverick, the forecast data required are those that will help answer the questions highlighted above. Except for severe weather prediction (and of course excluding the question on enemy defenses), these represent new challenges for Air Weather Service personnel. In response to this new requirement, a capability is being used to provide best possible estimates of anticipated illumination levels, lock-on ranges and cloud free line-of-sight probabilities. The procedures that constitute this newly developed "manual" PGM-support forecast effort rely on a number of approximations rapidly obtainable using a series of nomograms. Examples of these manual approximation techniques are provided below:

a. For illumination level, if mostly cloudy conditions are expected, standard lumination tables (function of sun angle) are "adjusted" by applying a reduction factor based upon forecast cloud type. These reduction factors are interpolated from the values depicted in Table III.

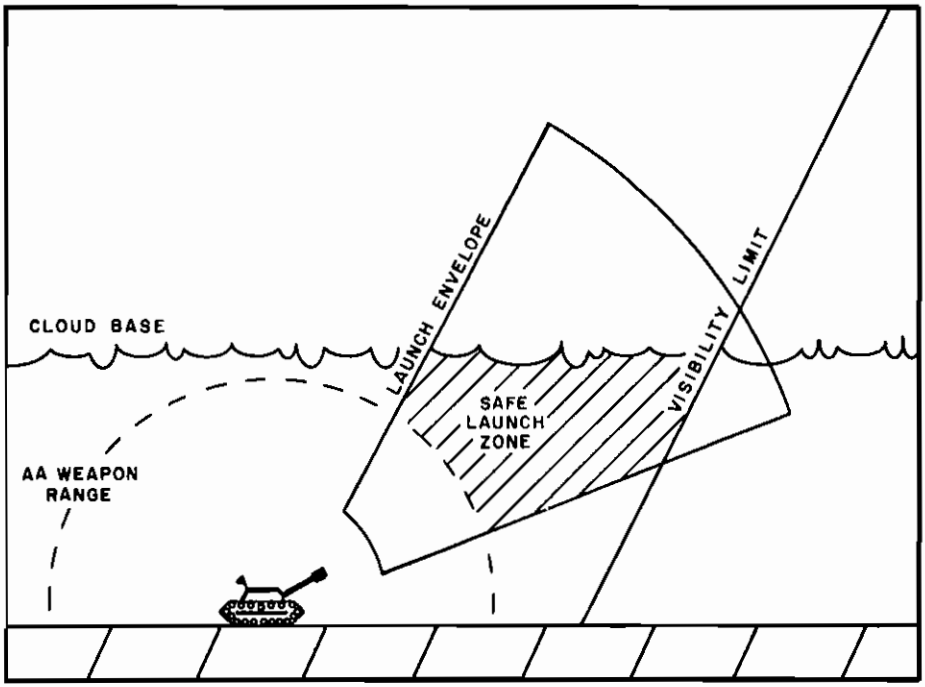

Fig. 3—Safe Launch Zone in a Visual Acquisition, Air-to-Ground Mode

TABLE III—RATIO OF ILLUMINATION WITH OVERCAST SKY TO ILLUMINATION WITH CLOUDLESS SKY AS A FUNCTION OF CLOUD TYPE

Cloud Type	Ci	Cs	Ac	As	Sc	St	Ns	Fog
Sun Near Zenith (SA=90°)	0.85	0.84	0.52	0.41	0.35	0.25	0.15	0.17
Sun Near Horizon (SA=0°)	0.80	0.65	0.45	0.41	0.29	0.24	0.25	0.19

Where Ci = cirrus, Cs = cirro-stratus
Ac = alto-cumulus, As = alto-stratus
Sc = strato-cumulus, St = Stratus
Ns = Nimbo-stratus

b. For visibility, horizontal visibility forecasts are simply "converted" to slant range visibility forecasts by applying a standard ratio and adjusting for aircraft altitude (i.e., sensor height) and aerosol depth (i.e., "inversion height"). Figure 4 depicts the diagram used to calculate the conversion factor. Using this derived slant range visibility forecast, it is then possible to determine expected maximum Target Acquisition Range (range the pilot's eye can see it) and Lock-On Range (range the TV Maverick can see it) by computing the inherent target/background contrast (again, from look-up tables) and entering Figures 5 and 6.

c. For cloud free line-of-sight probabilities, an empirically derived conversion table (Lund and Shanklin) is

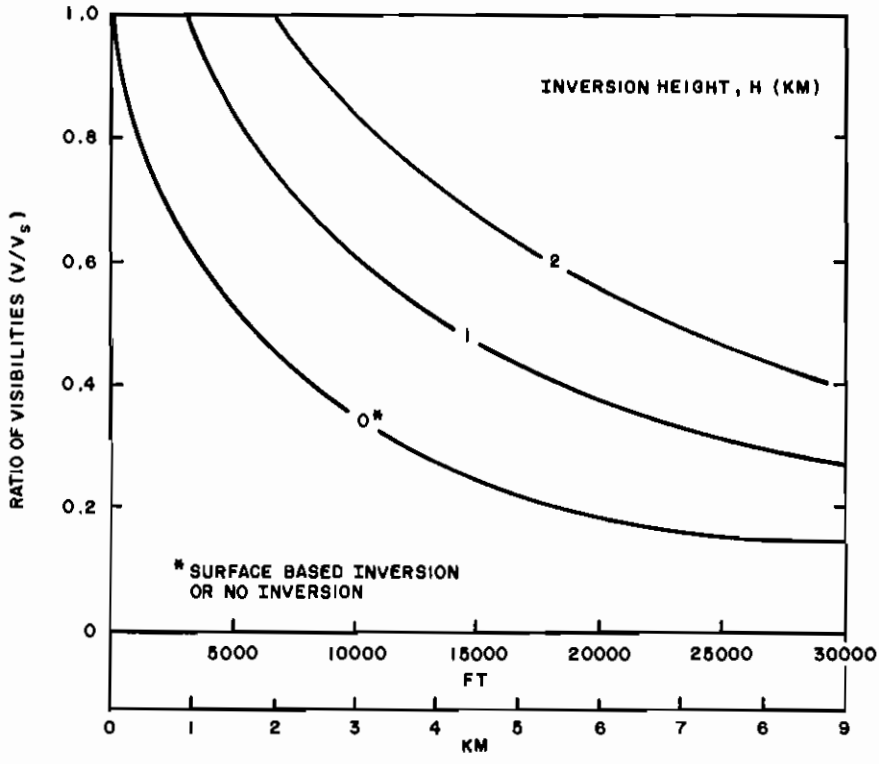

Fig. 4—Relationship Between Ground Visibility (V), Slant Range Visibility (V_S), Sensor Altitude and Inversion Height

similarly available, using forecast cloud cover (below the aircraft) and dive angle (see Table IV).

Projected Improvements in Forecasting Capability. Planned improvements in TV Maverick weather support capabilities include the development of an appropriate atmospheric transmission model and the computerization of the forecast production computations. Technique development of the transmission model is now in progress at AWS's Environmental Technical Applications Center at Scott AFB. Following the successful testing of that model and preparation of other required software, Air Force Global Weather Central at Offutt AFB will be tasked to start producing mission-tailored forecasts of illumination conditions, atmospheric transmission conditions and cloud free line of sight probabilities for scheduled TV Maverick missions. The local weather office supporting the TV Maverick aircraft will receive these forecasts and adapt them to their specific briefing requirements. Assuming that this centralized production program can be successfully implemented for the TV Maverick, this improved concept can then be readily adopted for support of other types of PGMs, both existing and forthcoming.

SUMMARY AND CONCLUSIONS. The information provided in the preceding pages leads readily to the conclusion that PGM development and operation must afford necessary attention to potential weather limitations. Known wavelength-dependent characteristics of atmospheric processes should be important considerations in the conceptual and design phase of PGM development. For example, the trade-off between

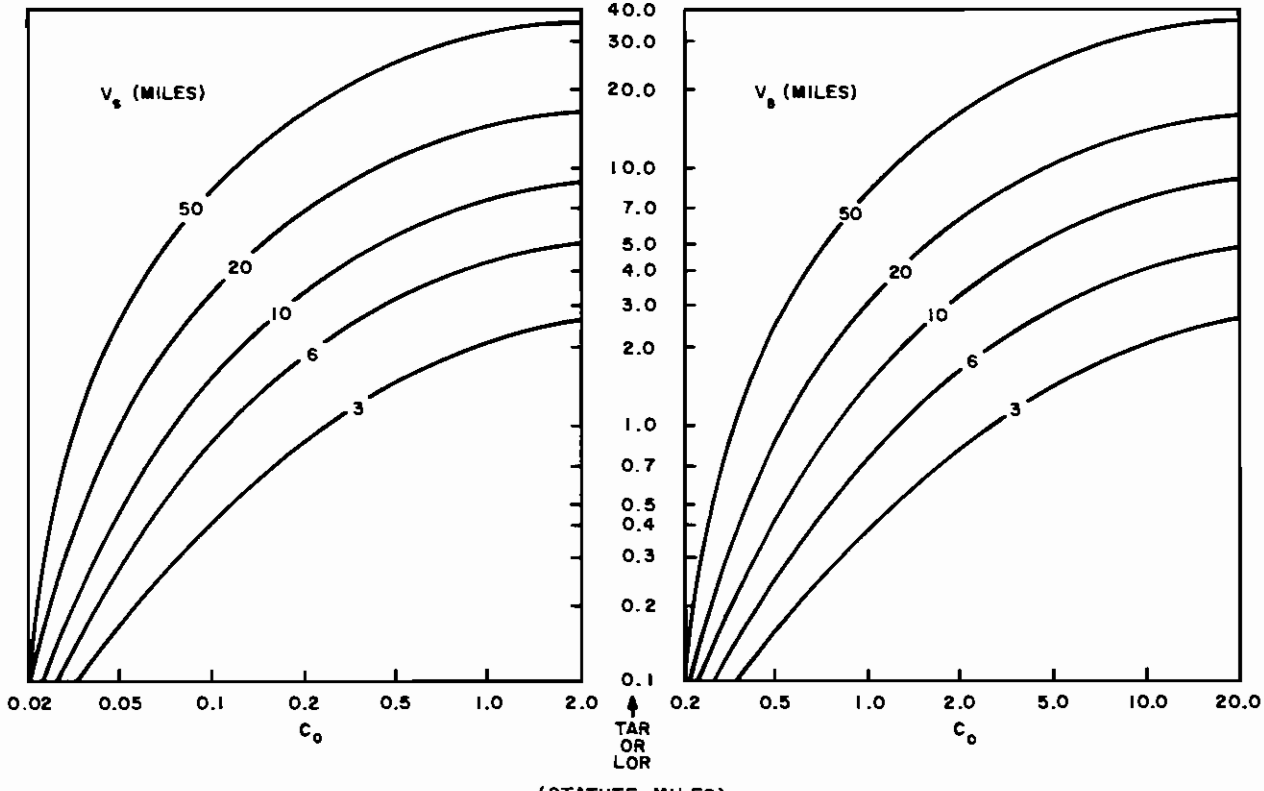

Fig. 5—Maximum Target Acquisition Range (TAR) or Lock-On Range (LOR) as a Function of Slant Range Visibility (V_S) and Inherent Contrast (C_O) Where Contrast Threshold is 0.02 (human eye)

Fig. 6—Maximum Target Acquisition Range (TAR) or Lock-On Range (LOR) as a Function of Slant Range Visibility (V_S) and Inherent Contrast (C_O) Where Contrast Threshold is 0.20 (TV Maverick)

TABLE IV—PROBABILITIES OF CLOUD FREE LINE-OF-SIGHT AS A FUNCTION OF LOOK (DIVE) ANGLE AND TOTAL SKY COVER BELOW SENSOR ALTITUDE

Look (dive) Angle (°)	Tenths of Sky Cover Below Sensor										
	0	1	2	3	4	5	6	7	8	9	10
90	1.00	.97	.92	.87	.81	.77	.70	.62	.48	.31	.08
80	.99	.97	.92	.87	.81	.77	.69	.61	.47	.31	.08
70	.99	.97	.91	.86	.80	.76	.68	.61	.47	.30	.08
60	.99	.96	.90	.85	.80	.75	.66	.60	.46	.29	.08
50	.99	.96	.90	.85	.78	.73	.64	.58	.45	.29	.08
40	.99	.95	.88	.83	.76	.71	.62	.55	.42	.27	.07
30	.98	.93	.86	.80	.73	.66	.57	.50	.38	.24	.06
20	.98	.90	.83	.75	.67	.59	.50	.42	.33	.21	.05
10	.97	.86	.76	.65	.55	.47	.39	.32	.24	.16	.03

weapon resolution and environmental sensitivity should be addressed as part of a conscious decision process. Similarly, climatological data should be consulted to determine the scope of potential worldwide utility before weapon production decisions (i.e., whether to produce and, if so, how many) are made. In the employment phase, weather forecast support should be optimized as a decision-assistance tool benefiting choice of PGM, cost-effective use, etc. This requires both a receptive interest by operations personnel and a dedicated, capable forecasting effort by weather support personnel. Air Weather Service emphasis has generated an awareness of the need for a dedicated PGM-support effort. Concurrently, an initial capability to provide the new types of forecasts required by PGMs has been developed and action is in progress toward substantially upgrading that capability in the near future. Weather problems affecting PGMs cannot be totally eliminated—they can, however, be reduced and their adverse effects minimized.

Because some institutional issues affecting the Naval War College are believed to be of interest to many of our readers, the following article was taken from a paper prepared by the authors for delivery at the May 1979 meeting of the Intermediate Military Education Coordination Conference.

NAVAL WAR COLLEGE ISSUES OF CURRENT INTEREST

by

Captain W.A. Platte, U.S. Navy and F.H. Hartmann*

Faculty. At the Naval War College, curricula are developed entirely by the resident faculty. Theoretical material is applied to national security issues. One-third of the faculty (23) is civilian; these professional educators develop much of the theoretical material. Two-thirds of the faculty (46) are military; these experienced officers bring practical understanding of defense issues, from unit command to highest level, into the classroom. This blend of civilian and military instructors has served the college well for 7 years and is being projected into the future.

The 1:2 civilian military ratio does not hold true across the three teaching departments of the college because each department has different requirements. Thus, the Strategy Department is operated half-civilian and half-military, the Management Department is about three-eighths civilian, and the Naval Operations Department is over 90 percent military. As departmental faculty requirements change, the college has considerable flexibility to adapt by changing the various faculty mixes.

Further flexibility is derived through civilian faculty hiring procedures. Recruitment of new civilian faculty is the responsibility of the departmental chairmen, within policy established by the president of the college. About one-third of the civilian faculty is hired on 1 or 2 year contracts. This means considerable turnover, and infusion of new ideas, each year. Another third of the civilian faculty is on 5 to 7 year contracts. They provide an ameliorating influence on the newcomers. The final third is employed on indefinite contracts, the equivalent to tenure at a civilian institution. They provide continuity and the institutional memory.

Without this influential civilian component, the college would be hard pressed to maintain quality programs. This is not to say that military instructors are not good; many are outstanding. The problem with military faculty is continuity. Turnover is rapid. The college has military instructors from all services, including the Coast Guard. Assignments generally are for 3 years, although any students co-opted for the faculty at the end of the year are allowed to remain only 2 years.

The college has tried to encourage the faculty to write and conduct research. The civilian faculty members have an enviable record in this regard. Some are prolific writers. The military faculty has been more inhibited, in part because of shortened tours mentioned previously. However, some good articles have been produced. A requirement for faculty writing has been established--any faculty member who has been at the college for more than 1 year is expected to write and have published at least one piece each year.

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*Captain Platte is Deputy to the President and Dean of Academics and Professor Hartmann is Special Academic Advisor to the President, Naval War College.

The faculty also has been encouraged to lecture at other schools, attend professional conferences, and consult for the Government if invited. All of these things are being done to the extent travel funds permit.

In sum, the faculty at a service college, as at any educational institution, is its great strength, a flower to be carefully cultivated. The civilian-military mix, differing terms of employment, and professional development of the faculty must be kept under constant review. It's not an easy game, but it's the only game in town if the service colleges are to fulfill their mission.

Grading. Evaluation of student work and grading student work need not be the same thing. Instructors can evaluate their students' progress without grading. But if a grading system is used, evaluation automatically is part of it.

The Naval War College has evaluated student work throughout its 95-year history. A formal grading system was instituted in 1972. This system has been modified several times—different scaling has been tried—but over the years since its perhaps traumatic inauguration it has become a routine, accepted feature of college life.

The key to its acceptability is that it is a relatively benign system, even though it need not be. Patterned after grading in most graduate schools, using an A,B,C,F, scale, the current system prescribes B as the expected grade for graduate students, A for work well above average, C for work requiring remedial measures, and F for failure. In grading, the instructor is telling the student how he or she is doing, thus accomplishing the main purpose of the system.

Because of the high caliber student body, experience has shown that very few officers receive final grades of C, about two-thirds receive B, and about one-third A.

The grading system is kept under close surveillance and is, itself, evaluated periodically.

Grades are believed to stimulate student effort, independent thought, and work in areas that they might think to be of lower future utility. The college can obtain more work and better thinking, and direct both to study areas the college believes important, by how it structures its courses and grades.

A major benefit is that grading assists in course accreditation by the American Council on Education. This benefit of course accrues another benefit: officer students greatly desire enrollment in ACE-accredited courses.

Electives. Electives offer a number of advantages by way of enriching and diversifying a curriculum, as well as providing opportunities for experimentation.

First, since the current core curriculum of the Naval War College is divided into three courses prepared by the separate departmental faculties, despite careful provisions for review and coordination there is always some danger that the materials are not fully cross-related, integrated, and coordinated in the student's mind. By allowing a student a free choice in an electives program, we can have a greater assurance that he or she will be able to correlate the materials as the elective is always concurrent with some portion of the core curriculum and induces comparisons of technique and content.

Second, an electives program provides a welcome opportunity for curriculum experimentation using small units. In this way, new concepts and approaches can be developed and tested before being adopted to core use but with such a possibility in mind.

Third, an electives program permits individuals with prime academic or professional credentials, whose first responsibility is administrative, to become involved in the teaching process

inasmuch as the time demands are more modest than a commitment to core teaching. In this way, currently, not only the President of the Naval War College but also his Deputy have been able to teach. Staff personnel otherwise somewhat isolated from contact with the student body are brought into a fruitful intellectual association, as in the case presently of our assistant curator of the Naval Historical Collection who is qualified in the Latin American area.

The present program traces its antecedents back to 1967. So far as the records show, this was the first such program at the college. At the time there were no electives programs at our sister institutions, but the idea quickly found favor and shortly became a relatively standard part of all command and staff-level curricula.

In 1978 the program was given a distinctly new shape. The electives were structured to require one-fifth of total student effort. A program was created of 10-week courses to be offered in one or more of the three trimesters that make up the academic year. The student, while allowed a free selection of electives, was required to select one elective for credit each trimester.

The specific thinking behind this new program was that we needed to offer the students greater opportunity individually to tailor their programs. Because the core curriculum of three courses is uniformly required (with a very few students excused from portions of it to do research), individual tailoring logically had to stem from the electives. Equally important was the need to tap more fully the rich teaching resources available in a dedicated faculty. Because faculty of diverse skills are recruited for primary duty in connection with teaching a core course, but have specialties that may then not be fully exploited, this approach also held promise of being very satisfactory to faculty who wanted to offer work in their specialties.

The program thus formulated was quickly executed as follows: An Electives Coordinator was appointed and faculty and qualified staff members were invited to offer course proposals. These were screened and coordinated by a Policy Committee composed of each of the academic department chairmen. The president personally interviewed each instructor whose proposal survived this quality screening.

In academic year 1978-1979 this resulted in the following course offerings:

Fall Trimester

Foundations of Moral Obligation
Sino-Soviet Relations
International Relations
The Soviet Union—Domestic Reality and Foreign Policy
International Law for the Naval Commander
Constitutional Law: Principles and Policies
Ocean Law & Policy
Nuclear Deterrence
Applications of Operations Research
International Economic Relationships
Logistics Management
Concepts and Issues in Defense Planning, Programming and Budgeting
Navy Financial Management
National Security Organization Process
The Soviet Navy and Soviet Naval Tactics

Advanced Electronic Warfare
Advanced Principles of Amphibious Warfare

Winter Trimester

Foundations of Moral Obligation
Sino-Soviet Relations
The Soviet Union: Domestic Reality and Foreign Policy
Individual Behavior
Applications of Operations Research
International Economic Relationships
Logistics Management
Issues in Defense Programming and Budgeting
National Security Organization Process
The Soviet Navy and Soviet Naval Tactics
Advanced Electronic Warfare
Advanced Principles of Amphibious Warfare
European Politics and the Alliance
Role of the Military in Latin America
International Relations
Law and Morality in the Use of Force
Strategic Research Elective: Future Naval Strategic Concepts
Tactical Research Elective: Future Naval Tactical Concepts
Directed Research Elective
U.S. Foreign Policy in the 20th Century
The U.S. and International Communism
Managerial Accounting
The Management of Time
Aggregate Force Planning Models
Case Development

Spring Trimester

International Relations
The Soviet Union: Domestic Reality & Foreign Policy
The Soviet Navy and Soviet Naval Tactics
Tactical Research Elective: Future Naval Tactical Concepts
Directed Research Elective
U.S. Foreign Policy in the 20th Century
Managerial Accounting
Case Development
Intelligence and Policy
Contemporary Middle Eastern Problems
French Revolutionary & Napoleonic Wars

In the fall, 95 percent of students were placed in their first choice elective.

In the winter, 85 percent of students were placed in their first choice elective.

Student evaluations in December 1978 show considerable enthusiasm. They indicate that students do see the program as an outlet for their own specialized interests. The evaluations also indicate that the program as a whole is taking up almost exactly the planned amount of student effort, but

with wide variations for individual courses.

Next year's Electives Program is being planned along similar lines, except that the program as a whole is being given equal weight with each of the Departments, i.e., one-fourth of the total student effort.

Student Research. Student research at the Naval War College has varied over the years from being a standard requirement for every student to a limited opportunity for a relatively few carefully chosen students. Today, although every student is engaged in writing a number of essays and papers in the core curriculum, the name "research" is used only for efforts requiring considerable work under fairly close faculty supervision, either in connection with electives or, more frequently, in connection with the program of our Center for Advanced Research (CAR).

CAR is a small establishment that focuses its attention on strategic and tactical concepts, but other social science topics may be suggested by students and approved. To work with CAR, a student makes an individual application to do research in lieu of the second or third trimesters of the core curriculum. These applications are reviewed by a faculty Advanced Research Council and acceptance of proposals is made by the president after review and on recommendation of the Council. The self-imposed limitation is 5 percent of the student body, a factor that makes selection competitive in nature.

The selection criteria employed by the Advanced Research Council are: professional and academic qualifications of student applicant, potential value of contemplated project, and reasonableness of research plan. Students selected as CAR Research Associates for a trimester are excused from the core curriculum for that period, but may attend lectures/seminars and may continue with one elective if desired and authorized. Research projects are normally conducted individually or in small groups, under supervision of one or more faculty advisors and CAR staff. Research travel and other research-related costs are supported by RDT&E allocations administered by CAR separately from other NWC accounts.

Project reports and research manuscripts that meet in-house publication standards are reproduced, bound, and circulated to selected distribution lists (war college libraries, certain DoD activities, and other appropriate activities/individuals).

Following is a brief summary of projects in which CNC&S student research associates currently are engaged:

Lamps OTHDCT&A: A Tactical Matrix

This study investigates the Light Airborne Multi-Purpose System (LAMPS) in its Harpoon Over-the-Horizon Detection, Classification, Targeting, and Assessment (OTHDCT&A) role, operating without dedicated CV support. Possible geographical situations and ASUW threats are outlined; LAMPS tactics are compiled into a tactical matrix of attack criteria and targeting and communications methods. The measures of effectiveness are increased warning time and probability of hit for seeker pattern over target. Finally, tactics are evaluated (assuming hostilities) using the Sea Control Tactical Analysis Game (SEATAG).

NALT

This study constructs a model for analysis of the Indian Ocean Naval Arms Limitation Talks (NALT) and follow-on NALT between the United States and the Soviet Union.

Soviet Naval Vulnerabilities

Traditional net assessment emphasizes our weak points and seeks ways to shore them up. This study will attempt to identify our competitor's weak points and then to determine strategies to exploit those weak points. Strategies will be developed for three contexts of world order: peacetime, crisis, and war.

NATO Command and Control Systems—Marine Corps

This study will examine the interface between land and maritime air C^3 operating in NATO with emphasis on the Interoperability among USMC, USN, and NATO Systems (MTDS, NADGE).

USN-USAF Interaction for Ocean Surface Surveillance

USAF long-range, land-based aircraft have a collateral mission of supporting various USN maritime functions (ASW, Reconnaissance, Interdiction, etc.). Historically, interactions between the Navy and Air Force have been inhibited by conflicting primary missions, legislation, and parochial rivalry. This study will examine one aspect of potential interaction—ocean surface surveillance—from the perspectives of feasibility and potential effectiveness.

Advanced ASW Tactics for Maritime Patrol Aircraft

This project examines several advanced acoustic and nonacoustic devices presently being deployed and suggests tactics for their employment. It also examines future roles and missions of P3C, P3X, and VPX aircraft in their use of these new systems and examines possibilities for the conduct of air ASW into the next century.

Military Professionalism and Ethics

This study addresses a problem addressed in various media and fora, i.e., an erosion of values within the military profession. An effort will be made to determine the nature of the problem, review studies conducted to date, and develop a theoretical base from which to seek solutions. The final result should produce course material for the NWC curriculum and provide guidance for the War College to serve as a forum to investigate and instill standards of military professionalism and ethics.

Reorganization of the Navy V/STOL Program to Provide a Sea Control Weapons System

This study will analyze the Navy V/STOL program as established in 1976 and its subsequent revisions in order to assess the present status and direction of the program. Further analysis will specifically include fleet aviation requirements outside the carrier-air umbrella. Practical recommendations for the alteration of the V/STOL program to meet those requirements will be made. It is envisioned that airframe and system requirements for a sea control weapons system will be identified.

Soviet Intermodal Transport

An examination of Soviet and East European progress in the development of high efficiency (principally container) transport. Areas examined will include transportation system capacity enhancement, interoperability (intra and international), and possible effects on strategic mobility.

Strategic Implications of PRC Military Modernization

Given PRC current capabilities and perceivable trends to modernize them, what are the strategic implications of modernization? This project will examine current capabilities (strategic and conventional) modern trends and alternatives; from the examination it will draw conclusions about Chinese strategic directions.

Contending Concepts in Tactical and Grandtactics/Operational Art

This study will examine Soviet doctrine, operational art and tactics; U.S. concepts for dealing with this threat; and arrive at conclusions regarding future land warfare.