

**The Partnership Process  
for  
Electronic Warfare Acquisition**

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**Abstract**

The Partnership Process is an acquisition reform initiative that has emerged from the electronic warfare (EW) community. This initiative combines many recent military acquisition reform efforts into a holistic and detailed process for developing and fielding needed weapon systems. The new process also draws on lessons learned from world-class companies to reengineer EW acquisition. These companies are customer-driven, consequently the Air Force acquisition community must respond to the voice of its customer, the warfighter, by using military worth as the procurement criterion. Top companies maintain open dialogue with their suppliers, so the Partnership Process emphasizes new ways of fostering communication with industry. The best organizations achieve their results through continuous optimization, so we adopt methods to converge on best solutions.

The new acquisition process can be summarized by six activities (see table) that consistently put superior solutions into the hands of our warfighter's as quickly and inexpensively as possible.

<b>Activity</b>	<b>Innovative Theme</b>
<i>Quantify mission deficiencies</i>	Base deficiency analysis on warfighter strategy-to-task.
<i>Establish requirements</i>	Frame the requirement in terms of airspace bought back.
<i>Convey requirements</i>	Structure RFPs to ask for military worth, not specifications.
<i>Select the source</i>	Incentivize the contractor to reach beyond thresholds.
<i>Develop the solution</i>	Continuously optimize trades to converge to a solution.
<i>Evaluate the result</i>	Link test and evaluation directly to warfighter needs.

The results summarized in this paper were achieved over the past year and a half through a series of intensive integrated process team (IPT) meetings that included broad representation from military organizations and US contractors. While the insights gained are couched in terms of EW, the principles are broadly applicable to other mission areas.

## WARNING

*This is not easy or light material! For the moment put aside everything you have ever learned about defense acquisition. **Boldface procedures are:***

**1. Approach this paper with a fresh outlook; prepare to change your perspective.**

**2. Careful reading and jotting notes in the margins are recommended best practices.**

### Introduction

Two years ago the future for electronic warfare appeared rather bleak. The mood was perhaps best captured by the August 1995 issue of the *Journal of Electronic Defense*. On the cover of this issue was a graveyard with several tombstones one of which displayed the inscription “R.I.P, Here Lies EW.” This issue lamented the cancellation of several EW programs and voiced a concern that DoD leadership was no longer inclined to invest in EW systems.

At about the same time, senior military decision makers engaged in a thorough self-critique in an attempt to ascertain why the area of EW was fairing so poorly. This examination produced some stark observations. Specifically, these leaders found that:

- We couldn't convey the worth of EW systems.
- We didn't establish and maintain the critical linkages from requirements, through system development, to test.
- We put functional loyalties above trust and teamwork.
- We denied that problems existed or blamed others for our difficulties.

- We didn't ask how to develop systems *better, faster, and cheaper*.

Consequently, we spent too much time and money on EW programs that ended up being canceled before they were finished or were completed only to find out that no one could demonstrate how well they satisfied a genuine warfighter need. The conclusion was that we had to change our ways of doing business or face obsolescence.

The mandate to seek and make the necessary change came in a June 1995 memo signed by Mrs Darleen Druyun, then acting Assistant Secretary of the Air Force (Acquisition), and Lt Gen (Ret) Howard Leaf, Director of Air Force Test and Evaluation. Their letter challenged the EW community to realize a vision of “a single team which closes the gaps between our organizations using a disciplined process to quantify the requirement, make informed cost/performance trades, and demonstrate military worth of the resulting system.” This challenge was later endorsed by Air Force Deputy Chief of Staff for Plans and Operations, Lt Gen Ralph Eberhart.

To meet this challenge military members of the EW community formed a team with industry through the Association of Old Crows (AOC). This team consisted of representatives from each of the principal stovepipes within the acquisition community. These included: warfighter, program management, industry, and testers (both developmental and operational). Military members came primarily from Air Force staff and field agencies, but included OSD offices as well. We believe that every major EW company -- from major weapon system houses to small technical consulting firms -- participated in our efforts to at least some degree. Meetings were typically held once a month over a nine

month period and lasted two to three days each. Extensive work was conducted off-line. Contact was maintained through electronic mail correspondence, comprehensive meeting minutes, a World Wide Web site, and numerous summary documents.

One of the first tasks undertaken by the reform team was to create a mission statement:

*Transform the electronic warfare acquisition process to consistently put superior solutions in the hands of America's warfighters as quickly and inexpensively as possible.*

This mission statement served to guide all subsequent efforts. It provided focus and was an invaluable touchstone to keep our efforts on track when working through the details of process reengineering.

To accomplish our mission, we subdivided into four integrated process teams (IPT) each with its own objective. A *Process* IPT was tasked to identify and map the most efficient path through the DoDD 5000 process. Its guiding principle was to minimize acquisition cycle time. A *Military Worth* IPT tackled the challenge of finding a method to provide, quantify, and prove the military worth of EW systems. A *Best Solutions* IPT examined ways to balance the competing variables of effectiveness, cost, and schedule in the pursuit of "best value" for the warfighter. Facilitating information crossflow was a *Core* group which was analogous to an overarching IPT. This Core IPT retained final decision authority to provide guidance and arbitrate conflicts and ensured that results from the other three IPTs were integrated into a comprehensible whole.

We cannot overemphasize the importance of our early efforts to define our mission and

objectives and to embrace a true implementation of the IPT approach. Our mission statement was focused, but broadly worded. This kept participants on track while encouraging them to question existing practices and to propose breakthrough changes. Our IPTs possessed strong leaders *and* empowered members. These factors enabled the IPTs to avoid the pitfalls of alternative teaming arrangements such as are found in the committee.

### Key Insights

The results of the Partnership's deliberations can best be summarized as consisting of a military worth method and a process that provides the context for its implementation. Before delving into these facets of the Partnership, we must first review four key insights which we found to be necessary precursors for the method and process to be executable. The four key insights are:

- conceptualizing military worth,
- communicating in terms of an acquisition trade space,
- recognizing and leveraging core competencies, and
- facilitating a partnership approach

### *Military Worth*

Essential to an understanding of the Partnership Process is an appreciation for the concept of military worth. Military worth is *the quantifiable effect of a system or its components on a military objective*. It is a function of three principle factors:

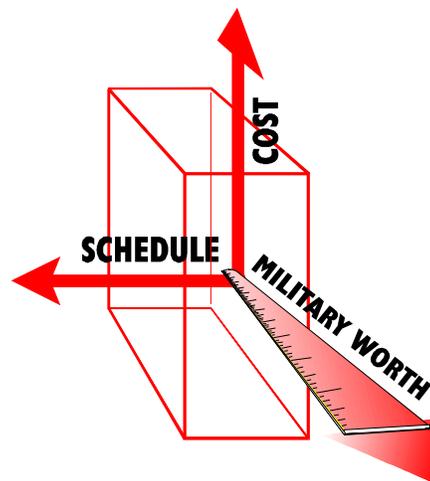
- operational objectives achieved
- resources expended
- time required

Note that our definition of military worth is stated in non-EW terms and does not make any reference to survivability. For the EW community this change of mindset represents a real breakthrough in its thinking on this subject. Note also, that the key words in our definition are “quantifiable” and “military objective.” Deficiencies must be quantified in terms of military objectives that cannot be accomplished. Without such a quantification, it is not possible to link proposed solutions with military deficiencies. This problem has been particularly acute in the electronic warfare arena where we have traditionally promoted EW systems as a form of insurance against loss of platforms and crews. This has led to a mentality where minimizing such losses, or reducing attrition, has become the primary measure of effectiveness for EW solutions. The problem with this perspective is that it ignores a key tenet of the warfighter’s operational art, that being he *manages* attrition to a very low level.

To identify the operational objectives that must be achieved in an air campaign, we need go no further than the Air Tasking Order (ATO). Mission deficiencies should be articulated in terms of ATO objectives that cannot be accomplished and requirements should be stated so that they can be directly linked to how such shortfalls can be alleviated. While we can currently express the military worth that derives from the accomplishment of mission objectives, a much more difficult challenge is to fully capture the effects of the other two variables, resources expended and time required to execute the campaign. This problem can be made manageable, however, if we constrain ourselves to a fixed attrition rate and restrict our analyses to a few key, but representative days of a campaign.

### Trade Space

When we define military worth as a single measure, we can formulate a trade space for the three competing acquisition variables of effectiveness, cost, and schedule. In today’s acquisition environment, performance is no longer paramount and cost is much more a driver than it has been in the past. Thus, the program manager and his customer, the warfighter, must make difficult compromises as they converge on a solution to a mission deficiency.



**Figure 1.** Military worth enables one to formulate a trade space for competing acquisition variables.

Treating cost more as a constraint -- as called for by the policy of Cost As an Independent Variable (CAIV) -- is not possible without a knowledge of the function which correlates a given level of military worth to a given level of resource investment. Without a single performance measure to capture military worth, the concept of the trade space becomes intractable.

We believe that our approach to military worth enables us to define the performance axis of the trade space. This in turn allows us to apply CAIV to the requirements and development processes. When one factors

in the dimension of time (as defined by the required asset available [RAA] date and/or how fast various acquisition strategies and technologies can deliver) one has in effect bounded the trade space that must be negotiated during the development process.

### *Core Competencies and Partnering*

The concept of core competencies is a useful one to describe what each functional stovepipe contributes to the process of defense acquisition. In this context, the warfighter's core competency is quantifying mission deficiencies and establishing requirements. Program management exercises its core competency when it correctly translates the warfighter's requirements into a workable contractual arrangement with industry. This core competency further extends to using insight rather than oversight to guide the development program to a successful conclusion as measured by the military worth afforded in the resulting solution. Industry's core competency is finding, proposing, developing, and producing innovative solutions to warfighter problems. The test community's core competency is testing and evaluating the military worth of solutions developed by industry and providing insight to facilitate informed decision making.

Each stovepipe contributes in a unique and synergistic way to the acquisition process and each field of expertise must be applied appropriately or the process does not produce optimal results. This can happen when core competencies are misapplied or misappropriated. A classic example of such misappropriation is when the government dictates system specifications depriving industry of the freedom to innovate.

Adopting the perspective of core competencies allows us to realize that only a team ap-

proach enables the stovepipes to work together to a common purpose. The medium for communicating this common purpose is the military worth that all agree can be delivered to the warfighter while meeting the other constraints of cost and schedule. Embracing this common language has enormous implications for the nuts and bolts of conducting a development effort. It all begins at the front end when the warfighter first articulates that he has a deficiency in his current or projected ability to fulfill national military objectives. Even then it is necessary for the warfighter to share his evolving insight with his acquisition partners to include industry. As leadership for the evolving effort to address the deficiency transitions from warfighter to program manager and is communicated formally to industry in a request for proposal (RFP), it is essential that the warfighter's true need be kept at the forefront by constant linkage of system performance with military objectives. When the process moves to development and finally test and evaluation (T&E), the linkage should remain strong. Only if such linkage is maintained can decision makers ascertain whether the warfighter gets a solution worth the precious national resources being invested in it.

Ensuring that solutions are linked to the military worth they afford the warfighter entails the following:

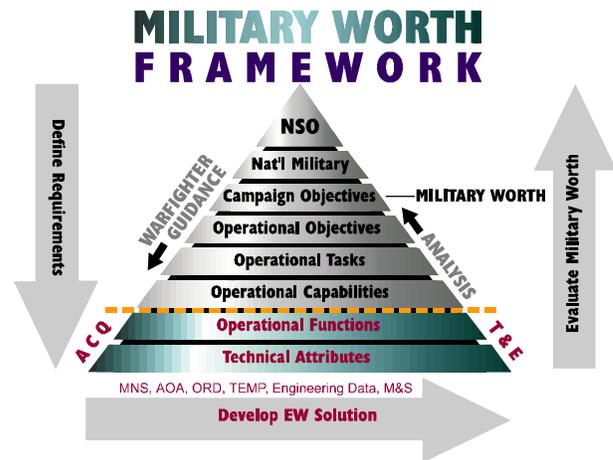
- standardization in scenarios and threat descriptions used to derive the deficiencies and requirements,
- commonality in modeling and simulation (M&S) tools employed, and
- agreement on concepts of operations (CONOPS) that represent how troops and materiel are used in campaign operations.

Standardization and commonality result from applying discipline to the acquisition process and from constant efforts to ensure that information is communicated to all stakeholder communities in a timely manner. The importance of this discipline cannot be overstated.

## The Military Worth Method

Our method for expressing the military worth of EW systems is adapted from pioneering work performed by the Air Force Studies and Analyses Agency (AFSAA). AFSAA developed a methodology that builds on the classic strategy-to-task (STT) framework which links high level national security objectives to lower level tasks and capabilities. The Partnership expanded this framework to include two additional levels, operational functions and technical attributes, which ensures that links exist all the way down to attributes decided at the engineering level. This extended framework permits trades during the development process to be understood within the context of their effects on the operational and campaign objectives that have military worth for the warfighter.

Figure 2 illustrates the military worth framework. One way to describe the progress of an acquisition effort is to imagine warfighter guidance defining requirements down the left side of the pyramid to the level of operational tasks. From there, military worth is linked to engineering considerations that are guided by the program office which is responsible for developing the solution. Finally, when a test item is available, test and evaluation methods are used to move back up the right side of the pyramid, ensuring that lower-level attributes satisfy higher-level objectives.



**Figure 2.** The military worth method links campaign-level measures to technical attributes.

Before moving on to outline how the military worth method is applied, we must first describe some of the building blocks that make it possible. These include warfighter plans, the geometric perspective, the probability of kill ( $P_k$ ) grid, and a parameter known as reduction in low-kill offset (RiO).

### Warfighter Plans

The front end of the military worth framework requires us to capture warfighter guidance. We accomplish this task by basing all analyses on a firm foundation of warfighter-developed plans. This foundation consists of the following inputs:

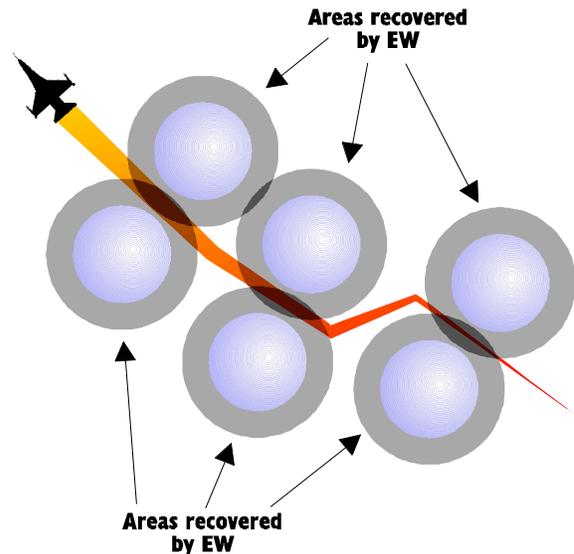
- approved scenarios and threat descriptions from the Defense Intelligence Agency (DIA)
- Operations Plans from theater CINCs
- ATOs for specific days of a campaign from Joint Forces Air Component Command (JFACC) staffs
- mission profiles created by operational crews using approved mission-planning tools

These inputs form the basis for subsequent work to identify mission deficiencies and establish requirements for proposed solutions. Notice that all of this work is essentially a data generation exercise that must be completed before any analysis can begin. Only with this data in hand it is then possible to run campaign-, mission-, and engagement-level models to discern which missions can be accomplished and those which cannot. The latter in its aggregate sum constitutes our quantified deficiency.

As an example consider a campaign in Southwest Asia (SWA) in 2010. In this case, the DIA scenario involves an aggressor force offering many different targets to include armor and troop concentrations, weapons of mass destruction (WMD) and their delivery vehicles, military industrial complexes, and the like being employed by a rogue state to invade an ally. The CINC's OPlan calls for halting the invasion force, commencing a counteroffensive, and destroying the warmaking potential of the enemy. Many of the targets in the scenario are heavily defended by modern surface-to-air missile (SAM) systems that pose an unacceptable risk to warfighter strike platforms attempting to negate these targets as specified in the JFACC's ATO. Mission planners do their best to lay out profiles to attack the target set using the force structure available to them in the projected time frame of 2010. In so doing they may find that they can avoid a certain measure of the threat SAMs simply by tactical considerations. The remaining threats which cannot be avoided and which result in a projected higher-than-acceptable attrition rate constitute the basis for a quantified mission deficiency. This quantified deficiency may be expressed as a percentage of the target set that cannot be held at risk by the warfighter's strike assets.

### The Geometric Perspective

As illustrated in Figure 3, mission profiles are generated to attack targets taking into account threat laydowns and capabilities. Some missions cannot be accomplished because they penetrate a threat's lethal envelope. To the extent that EW systems can enable platforms to operate in these environments, they provide military worth to the warfighter. The requirement, then, for EW systems is to *buy back airspace* so that mission objectives can be accomplished. Thus, for a strike asset, EW systems provide military worth by enabling the platform to hold more targets at risk (TAR).

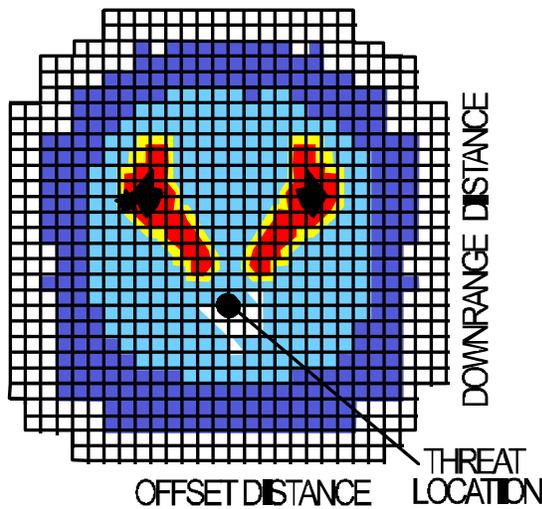


**Figure 3.** The geometric perspective helps us understand how EW buys back airspace.

This perspective of “airspace bought back” is a geometric or spatial one. It derives directly from a consideration of how the warfighter intends to use the resources available to him to accomplish his missions. It also has tremendous implications for how we evaluate systems that are offered as solutions to the identified deficiencies. This geometric perspective is at the very heart of our military worth method.

### The Probability of Kill ( $P_k$ ) Grid

We have identified the geometric perspective as the means to establish the basis for expressing the military worth of EW systems. The analytical construct which enables this perspective to be carried into the modeling simulation (M&S) domain is the probability of kill ( $P_k$ ) grid. Figure 4 provides an example of one. The  $P_k$  grid is a representation of a threat system's lethal envelope. It provides the spatial correlation for the odds of a platform being killed by a threat at specified offset and downrange distances out to the threat's maximum kinematic range.  $P_k$  grids are developed by applying engagement level (i.e., one-on-one) models for a specific set of assets and conditions. Asset characteristics include threat system capabilities, platform signature, and EW suite performance. Engagement conditions of import include altitude and airspeed. Multiple  $P_k$  grids are necessary to characterize all three dimensions of a threat's lethal envelope.



**Figure 4.** The spatial variation of probability of kill within a threat's kinematic envelope is communicated by the different shades within a  $P_k$  grid.

An important consideration in the use of  $P_k$  grids is to note that the value at each grid point is the result of an *outcome*-based calculation. In other words, a  $P_k$  value is simply an assessment of the odds of the aircraft being killed no matter what contributes to or causes those odds to be achieved. Thus,  $P_k$  grids can represent the effect of any type of EW system no matter what technique is employed be it signature reduction, jamming, or deployment of a decoy.

### Reduction in Low-Kill Offset (RiO)

Reduction in Low-Kill Offset (RiO) describes the effect an EW system has on the lethal envelope of a threat. In its simplest manifestation, if the threat's lethal envelope is pictured as a circle, then RiO is a decrease in radius of that circle to the extent the EW system is capable of reducing the threat's effective lethal range. Naturally, the effect of EW is more sophisticated than that, but the concept of RiO remains valid as a means for conveying shrinkage in the threat's envelope or lethality within that envelope. An important companion value that accompanies the specification of RiO is the threshold for a given probability of survival ( $P_s$ ). Essentially, this is the value at which the probability of kill is almost zero. It is not zero because anytime you are within the kinematic range of a threat, there is some (even if very low) possibility that it could achieve a hit despite successful function of the EW system. Setting a threshold value for  $P_s$  is necessary because it has mathematical significance at the aggregate level for the overall acceptable attrition rate set by the warfighter. RiO based on a specified  $P_s$  can be used analytically to determine the extent a threat must be reduced to allow successful mission completion or empirically as a means to characterize the effects of an EW system.

## The Holistic Process

With the essential elements of the military worth method now defined, we can move on to the process-oriented aspects of our Partnership approach. From our team deliberations we were able to identify six key activities that constitute the core functions which must be performed in all acquisition efforts. The six key activities are:

- Quantify mission deficiencies
- Establish requirements
- Convey requirements
- Select the source
- Develop the solution
- Evaluate the result

In the parlance of the DoDD 5000 acquisition process, the first two activities -- quantify mission deficiencies and establish requirements -- are conducted prior to a Milestone I decision. These activities are subsequently repeated only as necessary whenever

- significant new information becomes available about the threat
- revisions are made to national strategic objectives or defense guidance
- significant deviations in the requirements trade space are discovered

Any one of these changes would merit a revisit to the baseline established for the quantified mission deficiency or to the acceptable confines of the acquisition trade space as articulated in the ORD.

The remaining four activities are repeated throughout the various phases of the acquisition process. These phases include: Concept Exploration; Program Definition and Risk Reduction (PDRR); Engineering and Manufacturing Development (EMD); and

Production, Fielding/Deployment and Operational Support. We can see, for example, that we *select a source* at the beginning of each acquisition phase when the government contracts with industry to execute the activities associated with that phase.

### *Quantify Mission Deficiencies*

Quantifying mission deficiencies is the first functional activity and the one that sets the stage for subsequent efforts by initiating use of the military worth method. As described earlier, this activity phase necessitates application of the strategy-to-task framework to establish the linkages from national strategic objectives to operational tasks and capabilities. It begins with an examination of the Defense Planning Guidance (DPG) and a study of potential theaters of conflict. We gather information about threat systems, enemy CONOPS, and our projected force structure, then conduct analyses to determine which mission objectives cannot be accomplished after all non-materiel solutions have been considered. The output of this activity includes Mission Area Plans (MAP) and Mission Needs Statements (MNS). Quantification of mission deficiencies in this fashion ensures process integrity. Any solution that can potentially address our shortfalls, whether it be an EW or a non-EW system, remains a contender at this stage.

Quantifying mission deficiencies is necessarily led by the warfighter. Additionally, in consonance with the Partnership philosophy, it is also a time when team relationships are first forged. When the approval for a MNS appears imminent, an Integrated Concept Team (ICT) is formed to guide the emerging program through early acquisition efforts. Members of the ICT come from each of the functional stovepipes including support contractors. Firms that intend to bid on de-

velopment and production contracts participate through such forums as warfighter-hosted Industry Days. They are also given access to ICT members involved in operations planning and in the conduct of deficiency analyses. Industry participation is critical as communication of the military's evolving understanding of its deficiency will have a tremendous impact on the innovative solutions that contractors are beginning to formulate at this point in time.

Communication with industry is also enhanced through sharing analytical tools and common data bases. Standardized models and simulations, scenarios, and threat descriptions greatly enhance the prospects that industry's eventual solutions will meet warfighter needs. With a common analytical baseline, both government and industry can make accurate "apples-to-apples" comparisons among various proposed solutions.

After the MNS has been followed by an ORD and the program has achieved Milestone I approval, the ICT becomes an Integrated Product Team (IPT). Leadership will also transition at that point from warfighter to program manager. However, the teaming arrangements forged under the ICT help ensure that the warfighter retains significant influence throughout the rest of the process.

### *Establish Requirements*

Establishing requirements is a pivotal government function that will have tremendous impact on all downstream activities. This activity phase includes concept exploration studies that investigate the full range of possible solutions and their probable life-cycle costs. Concept exploration helps us to understand what is technically feasible and what potential solutions are likely to cost.

During this activity phase it is also important to conduct what we call the "vertical AoA." In a vertical AoA we "rack and stack" potential solutions in terms of their projected military worth. The insight we gain from such an exercise can have a profound influence on the acquisition strategy we choose. We may find that we can develop modest solutions quickly at relatively low cost. We can compare the advantages of these lower-cost solutions to more robust ones that require more time and money to develop. We can then decide to pursue a short-term approach, a long-term one, or a phased strategy that addresses both immediate and future needs. Whatever approach is taken, it is important to recognize the common thread: a military worth yardstick that allows us comparisons within a very diverse solution set.

Analysis of mission deficiencies and potential solutions is likely to uncover "knees in the curve" that represent significant changes in the potential costs that will be incurred and/or capabilities that can be developed and fielded. Such natural "break points" serve to highlight where one might select thresholds and objectives. In any case the output of all these analyses is a bounded solution trade space that is communicated in the ORD. The ORD conveys the boundaries of this trade space so that government and industry can avoid the restrictions of point requirements and remain free to explore the widest possible range of alternative solutions.

An example of how requirements might be stated in an ORD is seen in Figure 5. This exhibit is in line with our earlier example regarding the shortfalls in a platform's ability to strike the full target set posited for a SWA 2010 scenario. The table indicates the relationship between RiO and TAR starting with the current capability via the column marked 0% RiO. No reduction in the

threats' lethal envelopes only allows 20% of the targets to be held at risk. The last column marked 100% RiO tells us that complete reductions in the lethal envelopes of the three threats listed will allow the platform to attack the full target set. Between these two extremes are differing levels of RiO which allow us to put varying numbers

of targets at risk. While we are interested in the amount of RiO a proposed solution will achieve, our primary concern is how many targets the proposed solution will allow us to put at risk. In other words, our requirement is stated in terms that can be directly linked to accomplishment of mission objectives.

Threat	Reduction in Low-Kill Offset (RiO) Versus Targets at Risk (TAR)											← RiO
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
SA-X	20	20	30	35	<b>45</b>	<b>55</b>	<b>70</b>	85	95	100	100	← TAR (%)
SA-Y	30	35	35	40	<b>50</b>	<b>60</b>	<b>75</b>	95	100	100	100	
AAA-A	<b>60</b>	<b>60</b>	<b>65</b>	<b>65</b>	<b>70</b>	<b>80</b>	<b>90</b>	100	100	100	100	

**Figure 5.** The reduction in lethal offset (RiO) versus targets at risk (TAR) trade space table is the means for communicating EW requirements for a strike asset. (Example thresholds and objectives are shown as bolded lines.)

### Convey Requirements

During the third functional activity phase, the government conveys threshold and objective requirements to industry through a request for proposal (RFP). A key element of the RFP process is active interchange between the government and industry to ensure that all potential solutions are fairly considered. Ultimately, when the final RFP is issued, it should contain:

- a description of the government's acquisition strategy
- the ORD or a suitable substitute, such as the System Requirements Document (SRD)
- a Statement of Objectives (SOO) (rather than a Statement of Work)
- a copy of the modeling and simulation (M&S) toolset and the accom-

panying database(s) if not already provided to the contractor

- a description of the proposal evaluation criteria

Some of these elements, such as providing a Statement of Objectives, are already becoming standard practice in the government due to on-going reform initiatives. However, providing more specific proposal evaluation criteria to industry is still meeting with resistance among those in the government's acquisition workforce. The Joint Strike Fighter (JSF) and Joint Direct Attack Munition (JDAM) program offices have had success at providing more specific evaluation criteria in their solicitations to industry.

The activity of conveying requirements to industry presents an opportunity unique to the development of subsystems like those for EW. Major subsystems such as communication and navigation avionics, engines,

life-support systems, etc., are similar to EW suites in that they can be integrated onto several platforms. If adopted throughout the Air Force, such systems offer significant life-cycle cost savings and reductions in logistics footprints. The time for such commodity (or common) solutions to be raised as a possibility for industry to consider is when the government conveys its requirements. It is important at this stage for the government to indicate interest in such approaches insofar as industry is not predisposed to offer commodity solutions given the government's predilection in the past to favor custom designs. In the current environment of severe cost constraints and emphasis on jointness, commodity approaches offer great promise to achieve savings via elimination of duplicative development programs, reduction in the requirements for test and evaluation, increased economies of scale in production, and significantly reduced operations and maintenance (O&M) costs.

Subsystems also present unique opportunities for cost savings in the area of system integration. The costs for development and production of subsystem components (such as the black boxes that make up an EW suite) are frequently relatively small compared to the costs associated with integrating these components on a platform. In the past our practice has been to default to the aircraft prime to procure and integrate new subsystems for the platform they originally built. In the process we have paid a premium price because the government has acted as though it had no other alternative when in reality there have existed a number of firms capable of performing the integration function. It would behoove the government to introduce more competition for the integration of new subsystems on our platforms. In so doing, all industry bidders will be highly motivated

to offer the government cost-competitive solutions.

### *Select the Source*

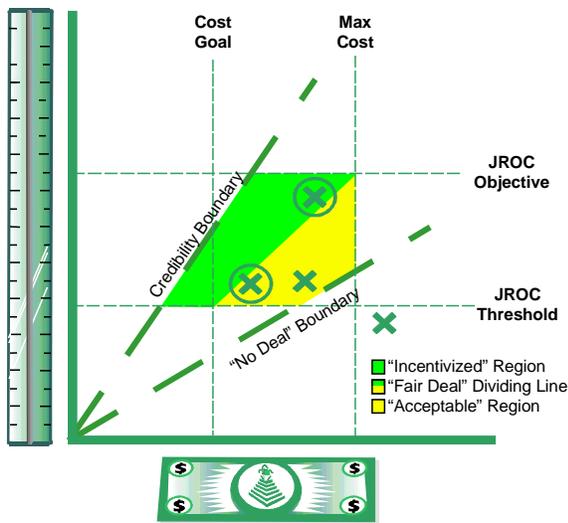
Once proposals are received, the next activity phase commences which involves selection of the source(s). A key innovation for this activity is using digital simulation models (DSM) in the source selection process. Using DSMs provides a means to analyze how well proposed solutions provide military worth to the warfighter.

The DSM essentially describes the performance of a proposed system and may give insight into engineering level functions as well. Contractor DSMs must be compatible with the standard M&S toolset that the government has defined. For electronic protection systems, the primary means for communicating system performance is the  $P_k$  grid. These grids are employed in models to evaluate a system's contribution to attaining mission objectives. Thus, they permit the government to verify that proposed solutions help meet campaign-level requirements. Once this verification is done, the government's evaluation then focuses on the more important challenge -- assessing the technical credibility of each proposed solution.

Another key innovation in this activity phase is the use of a disciplined framework for choosing the contractor(s) who offers the best value solution. Figure 6 captures our thoughts on this framework. We no longer simply choose the lowest-cost bidder at or just above threshold performance levels. Instead, we reward proposals that approach objective levels of capability at costs that represent a better overall investment.

Since we defined our trade space earlier in the process, we have a fair idea of the ac-

ceptable range for system performance, cost, and time to develop. If a proposal comes in at high cost and low performance, it will most likely fall outside the “no deal” boundary or competitive range. On the other hand, if a proposal comes in at low-cost and high-performance straining its credibility, evaluators will probably rate its risk as too high. Proposals that fall in on or around the middle of the trade space -- near our “fair deal” dividing line -- are generally the most credible (i.e., have acceptable levels of risk) and offer the most potential for best value.



**Figure 6.** Having a military worth measure allows us to evaluate proposals for best value.

While the figure only shows the cost and military worth dimensions of the requirements trade space, the concept can be extended to include other factors such as suitability and schedule. Using this approach to make a best value assessment -- rather than choosing the lowest-cost, technically acceptable bid -- requires a more sophisticated view than has typically been employed in the past. However, it results in a better overall solution to the warfighter’s needs.

*Develop the Solution*

After establishing a contractual relationship, the job of the government/contractor team is to manage risk and make informed decisions as it converges on the optimal solution. During this period, each side must be careful to stick to its core competencies. In the case of the government, this means using insight, and not oversight to manage the process. For industry, this means taking the lead in developing a solution, without asking the government to specify what it should build.

During this activity phase, many factors can affect the available trade space. Elements such as changes in the threat, funding perturbations, and technological developments can, in effect, redefine the trade space. As we negotiate these changes, we ultimately produce an item we can test and evaluate.

As we develop the solution, we are moving across the bottom of the military worth pyramid. At the same time, we navigate up and down the pyramid to establish and verify the military worth of our solution. By constantly checking the impacts of our technical decisions, we ensure that the solution we ultimately develop will satisfy warfighter needs. In this vein, the standardized toolset provided by the government is especially useful to help us perform “continuous Analyses of Alternatives (AoA).” Such assessments are made possible by quick-turn analysis tools which can calculate the effect that changes in technical performance parameters have on a solution’s military value. Although quick-turn analysis does not provide the in-depth, detailed results of physics-based M&S, we generally gain enough insight to make informed decisions that can not wait for the extensive time it takes to conduct high-fidelity model runs.

*Evaluate the Result*

When evaluating the result of our development activities, we use a test item to see how well the solution measures up to our expectations. Thus, the purpose of T&E is to support decisions about the future of an acquisition. The data to support such decisions is used to update the Single Acquisition Management Plan (SAMP), the ORD, and the DSM of the solution. Update of the DSM is a critical part of the “model-test-model” philosophy inherent in DoD’s Electronic Warfare (EW) Test and Evaluation Process.

Testing is the final validation of a system’s military worth. Adopting a Partnership approach means T&E personnel become our partners from the earliest stages of an acquisition effort. This involvement educates them about mission needs and solution characteristics so that they can understand the deficiency and how the solution responds to it. Furthermore, early involvement allows testers to anticipate unique testing needs and ensure that they have been addressed by the time the test item is ready for evaluation.

The standard measure in use today to assess the effectiveness of EW is a parameter known as Reduction in Lethality (RiL). This parameter is incompatible with the Partnership’s military worth method because it severs the link to higher-level measures that have meaning to the warfighter. It is calculated simply as an average of the numbers of hits against a platform with its EW system off then on within the kinematic envelope of a threat. Because it cannot tell you *where* airspace is bought back, it can not provide insight into mission objectives accomplished. The Partnership’s military worth method overcomes this shortcoming by using the RiO measure discussed earlier.

The traditional test perspective has also been one of testing for compliance to point requirements. This view often promoted a simple pass/fail mentality. As a result, we’ve rejected good EW systems because they failed a specific point requirement during operational testing. However, when we make military worth a part of the verification process, we go beyond such a mentality. Using our military worth methodology allows us to evaluate the results within the context of a requirements trade space. If we find that the capability is different from what we originally projected, we can see what effect this difference has on the system’s ability to meet the warfighter’s need. Thus, we consider the system’s potential within a *spectrum* of capability, not a point requirement. When this information is considered in light of the latest data on anticipated cost and schedule, we can make an informed decision about whether or how it is still worthwhile to continue with the program.

Our new process doesn’t change the *way* systems are tested. What changes is how we use and interpret data when assessing a system’s contribution to mission success. Adopting a geometric perspective and using RiO means we incorporate knowledge of *where* hits occur in the airspace about a threat. Thus, the shortcomings of RiL are avoided. Using RiO allows us to link test results back to mission objectives. The military worth methodology makes this possible.

### **Applying the Partnership Beyond EW**

While we have developed a military worth methodology and an improved process focused on application to EW systems, we believe that the fundamental principles apply to all military acquisition efforts. That this assertion is a reasonable one should not be

surprising since many facets of the methodology are adopted from other programs (like JSF) that have been at the forefront of implementing innovative acquisition reforms. Systems that have traditionally had a difficult time linking their performance to mission objectives should benefit in particular. Mission areas that are currently considering applying our process include command and control (C<sup>2</sup>), navigation warfare, and combat identification friend or foe. In some cases, the concept of the P<sub>k</sub> grid may have direct application enabling a straightforward adoption of our military worth methodology. In others, a new analytical construct will have to be created to provide the linkage from operational capabilities to technical attributes. This aspect must be assessed on a case by case basis, but should not dissuade acquisition professionals from endeavoring to embrace Partnership tenets.

## Conclusions

We believe adopting the Partnership Process produces a win-win outcome for all.

The Partnership enables the government to fully understand warfighter needs and to express requirements constrained by cost and schedule. The government wins because it adheres to its core competency to define the trade space and make informed decisions within that context.

Program managers now have the means to gain a complete picture of warfighter requirements. As a result, programs are more likely to remain responsive to warfighter needs and avoid program cancellation. Program managers win by having a disciplined process and the tools they need to make insightful trades between the variables of cost

and schedule and the anticipated military worth of the proposed solution.

Industry wins because it gets the chance to deliver responsive solutions that satisfy customer requirements. It decides how to converge on best-value solutions within a bounded trade space. All parties can communicate in a common language, to define and understand the common goal. Additionally, because we can show the analytical basis for program decisions, industry will more likely participate in stable programs that are well defined and defended.

The Partnership adds value to the T&E process by replacing pass/fail test requirements with an acceptable range of system performance. Consequently, testers can provide greater understanding of the system's contributions to military worth. Test directors win by having the tools that help them make quantitative assessments of a system's operational effectiveness.

And finally, the most important winner in the Partnership Process is the warfighter. The warfighter becomes the focal point for all acquisition activities. Warfighter needs drive our process forward, ensuring we develop solutions *better, faster, and cheaper*.

## For More Information . . .

Find us on the World Wide Web at:  
[http://www.safaq.hq.af.mil/acq\\_ref/aqpe](http://www.safaq.hq.af.mil/acq_ref/aqpe)

## Dedication

This paper is dedicated to the memory of Jeff Steinwedel -- IPT leader, industry partner, family man, and colleague. His thoughts and ideas greatly influenced the

development of the Partnership and to a large extent are responsible for the success it has achieved. We will sorely miss his intellect, his vision, and his friendship.