A DECISION SUPPORT PROCEDURE FOR BEST VALUE SOURCE SELECTIONS

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Here we discuss the use of decision analytic procedures in Best Value source selections. Such source selections specifically require that choosing an offeror other than the one with the lowest assessed cost must be justified by showing that the added value of that offeror's proposal is worth the associated extra cost to the government. Such a demonstration implies cost–benefit tradeoffs with an associated issue of benefit quantification during the source selection. This article is written for two audiences. One is acquisition practitioners who are implementing an acquisition program that will employ a Best Value source selection. We aim to familiarize this audience with relevant decision analytic tradeoff procedures and with important methodological problems. This article will familiarize the second audience, decision analysis practitioners, with an important problem for which their tools are highly relevant. We will describe the Best Value process, provide an illustrative procedural template, and discuss methods for required cost–benefit tradeoffs. The report also addresses legal issues in Best Value source selections. Finally, the report presents lessons learned based on the authors' experience in Best Value acquisitions.

Source selection is the formal process by which the government makes procurement decisions for acquisitions. At different stages of an acquisition, sources (contractors) are chosen to develop concepts, to conduct studies, to develop systems, to produce a system, or to provide services. Decision issues are not separated by the artificial barriers created by the sequenced programmatic approach, but instead transcend those boundaries. Decision support procedures and tools should help link each decision to the ultimate benefits and costs associated with the eventual decision outcomes.

THE PROCESS

In the Best Value approach to source selection, the Source Selection Evaluation Board (SSEB) makes its report to the Source Selection Advisory Council (SSAC), designating evaluation results for those offeror proposals in the competitive range. The SSAC, unlike the SSEB, can actually compare the offeror proposals against each other. The award is then made to the "most advantageous alternative to the government." The Best Value comparison process is triggered if that proposal with the lowest total cost is not also considered to offer the greatest benefit to the government (Federal Contracts Report, 1993; Sochon, 1994; USGSA, 1992). It must be noted that the so-called Best Value approach does not implement anything that was not already permissible under the Federal Acquisition Regulation (FAR, 1993). However the strong precedent for competition and choosing the lowest bidders, and the fear of the tremendous costs and associated damage caused by the program delays that occur with protests, require clarification of this procedure. The Best Value variation of source selection generally proceeds as follows:

- The SSAC members (or a special Best Value team assisting the SSAC) compare the offeror proposals (not the proposal scores) based on the information provided them in the report and briefings by the SSEB.

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- Discriminators (i.e., relative advantages that one proposal has over another) among the proposals are established through this comparative process. Discriminators will relate to one or more of the evaluation factors used in the SSEB evaluation process and must be traceable to those factor evaluations.

- Impact areas of the discriminators are defined—that is, the benefit areas affected by the discriminators. A discriminator might be some aspect of the offeror's technical approach to an important system capability. The associated impact area would be some aspect of conditional expected performance. (Note that benefits are assigned to impact areas, not to the discriminator differences.) The benefit assessment is thus a prediction, and assessment procedures must consider the uncertainty involved.

- Discriminator impact areas are often characterized in Best Value methodology descriptions as either "quantified" or "nonquantified." The term "quantify" is ambiguous. Procedurally, in source selections, it usually means to assign dollar values to levels of the variable to be quantified. To engineers it seems to mean to assess on an interval or ratio scale. For example, a quantified discriminator impact area might be "expected payload." A non-quantified (sometimes called "qualified") discriminator impact area might be "expected program management efficiency." Such distinctions are not very useful from a measurement theoretic

point of view, but can have strong implications as used in the currently defined acquisition process. Furthermore, as indicated, these benefit impacts are uncertain, and the uncertainty must be characterized (even if it can't be directly quantified).

- The benefits associated with the impact of each discriminator are described using as much clarity of definition and precision of assessment as is feasible. As indicated, benefits are assessed for predicted impacts, and the expectation and uncertainty should be assessed.

- The benefits associated with quantified discriminators are traded off against the total cost to the government (not simply contract price). These total cost estimates should be adjusted for cost risk (also characterized as cost realism). As indicated, the described tradeoff translates benefits to dollars. Less stringent tradeoff requirements allow for systematic judgmental assessments of the worth of the benefits relative to each other and relative to cost. The tradeoff process depends on the implementation method chosen. At this point, a single, well-defined requirement for the scalar aspects of the tradeoff process has not been defined. Several alternatives are discussed in the next section.

- Nonquantified benefits associated with discriminators are also used. Although these benefits are used only as tie-breakers by some agencies, they can be traded off against other benefits or costs, which is the procedure recommended here.

- The resulting implications are examined by the SSAC and a decision is recommended to the Source Selection Authority (SSA).

VARIATIONS OF THE APPROACH

Several methods for trading off cost and benefits in Best Value decisions have been described. Four are reported here, but for the reasons explained below, only methods 2 and 3 are recommended.

1. Dollar cost to obtain increased benefit. In this method an estimate is established of the cost to provide from the lower cost, lower rated technical proposal a benefit of comparable magnitude to that associated with the higher rated technical proposal. How could the lower cost proposal be best upgraded to achieve the key benefits (as indicated by discriminator impact areas) of the higher rated technical proposal, and what would be the cost to do so? This adjustment should be in terms of the most probable total cost to the government and should adjust for cost realism and for discounted cash flow. The decision would then be made in terms of the adjusted cost figures. The idea seems simple. If the cost to provide the added benefit is less than the actual cost difference, then the added benefit of the higher rated technical proposal is not worth its added cost. Thus the lower bid provides the greatest value in a cost–benefit sense. This procedure does not suggest "technical leveling" (i.e., to actually transmit the ideas to the lower bidder). It is simply a cost estimating methodology designed to answer the Best Value question.

A potentially serious problem with this procedure is that the technical approaches of the offerors may be so different that the cost to change the lower cost, lower rated technical proposal to provide the technical benefit of the higher cost, higher rated proposal is prohibitively large, or cannot be reasonably calculated, indicating choice of the higher rated proposal. Yet, the government may assess that the perceived value of the benefit associated with this technical superiority is minimal, less than the cost difference and it clearly would not pay this difference. This indicates that the lower bidder should be chosen. It also shows that this tradeoff method can produce different results from the following two methods. The cost to provide a benefit is not necessarily a valid indication of the value of the benefit to the decision maker as reflected by "willingness to pay" (see Discriminator Benefit Tradeoff method). This method consequently is not usually a desirable approach from a decision analytic point of view; we do not recommend it here.

2. Direct discriminator impacts benefits quantification. The direct discriminator impacts benefits quantification involves directly assessing the value to the government of the effects associated with discriminator advantages of each offeror. For each discriminator, the impact area is identified and an attempt is made to directly quantify the benefit of the impact using a model, an established methodology, a surrogate index, or some other measure that characterizes the benefit of the impact. An example would be increased productivity of a workforce attributable to increased user friendliness of computer

workstations. A discriminator can be unique to a particular offeror, or several offerors' proposals may have potential impacts with respect to a discriminator. All important discriminators are quantified where possible.

An important consideration related to this and the procedure described is that generally in offeror comparisons, each offeror has one or more advantages over other offerors. Thus the lowest bidder may also have several benefit advantages over the higher bidder even though the preponderance of benefits clearly lies with the higher bidder. Once discriminator impacts have been quantified for all offerors, costs are appropriately adjusted for each offer to yield adjusted net values. (See "A Procedural Example" for more information on the procedure and terminology.) A practical issue is that some discriminators cannot be quantified,[1] and some discriminators can only be partially quantified. When this occurs, the nonquantified discriminator impacts can be traded off against quantified ones using the third procedure discussed here, or they can be used as the breakers.

3. Discriminator benefit tradeoff. In this method the SSAC determines the relative value of the increased benefits associated with the technically superior proposal in direct tradeoffs, in which described benefits are directly compared pairwise using ordinal preference or ranking type assessments. "Willingness to pay" is often used as a preference assessment method. All attribute differences or advantage impacts among alternatives become "benefits" for tradeoff in this approach. If there

are more than two offerors in the Best Value comparison, as is usually the case, benefits are traded off for each pair of offerors. A rank ordering of the benefits can be established using this process which can also provide consistency checks. A version of the process is described in the example approach presented in the next section. Tools such as Multi-Attribute Utility Theory (MAUT) or the Analytic Hierarchy Process (AHP) can be used in establishing such an ordering. These tools, if employed using appropriate axiomatic tests, can provide interval level utility assessments. The results of the discriminator benefit tradeoff method are likely to differ from those of the first method described. At the same time, the ordering of options derived from this approach should agree fairly well with those of the second method, and should provide a valid representation of the decision maker's values.

4. Point scoring. In this method, price points and technical points are assigned in a manner established in the Source Selection Evaluation Plan (SSEP) and described in the Request For Proposals (RFP). This procedure when used by the SSEB can be somewhat restrictive and is usually avoided in source selections for this reason. Assigning points to discriminator advantages proportionally to the weights of evaluation criteria on which the advantage is based may not validly quantify the value of the resultant benefits associated with discriminator impact areas, thus misrepresenting discriminator benefit. These relative benefits must

still be established and justified as a meaningful difference to establish Best Value, for as indicated, discriminators need not be the actual evaluation criteria of the SSEP. If points are assigned that actually represent the value of the discriminator impact to the government, this accomplishes the same result as the tradeoff approach of methods 2 or 3 above (which must still be used to assure consistency), and the approach is simply a variation of one of those. Attempting to assure that the resultant benefit assignments do not violate implications of the point distribution rules set forth in the SSEP and partially explained in the RFP is very difficult, especially if a discriminator relates to more than one evaluation criterion. The ordering of the impact benefits thus derived can thus potentially be different from what might be expected from the ordering of the importance of weights assigned in the RFP. It's a good idea to examine the implications of such cases as a check on the analysis, but that should be the extent of the procedure.

A Procedural Example: The Best Value Assessment Plan For System X Source Selection

Here we give an example of the general approach to Best Value for the hypothetical System X source selection. The approach is based on accepted practice, the legal and procedural rulings with respect to Best Value procurements, and certain assumptions about quantification. This approach is to be implemented when

the SSEB evaluation has been completed and the issue of Best Value must be addressed by the SSAC. Because the crucial question is overall value to the government, certain steps related to cost realism and risk are included. This is a specific example, and variations dependent on procurement conditions are quite appropriate (see Faris and Lovelace, 1994, for further discussion). It also tries not to do violence to current practice while still inserting accepted, valid assessment techniques into the process. The treatment of uncertainty assessments and cost–benefit tradeoffs is necessarily abbreviated and other variations using benefit and cost ranges are acceptable.

Recommended Steps

Step 1. A Best Value working group (BVWG) is formed. This is done after SSEB reports are finished. This BVWG should be small, but the group in aggregate should represent complete knowledge of proposal cost, management, and technical content (as well as any special evaluation areas, e.g., software capability evaluation [SCE]). The BVWG should serve in an advisory role to the SSAC. BVWG members should be familiar with the evaluations done by the SSEB and the summary report preparations, and they need access to all relevant information. Initially the BVWG can be formed mostly of those familiar with the SSEB evaluations in order to efficiently define discriminators. Then a subset of SSAC members may join to enhance the identification of impact areas and associated benefits.

Step 2. The BVWG reviews the cost realism information. The BVWG should review cost realism work done and pre-

pare the relevant information in a tabular format. If the required information is not available, the BVWG should prepare the information from data provided by the SSEB.

This cost information should include all adjustments to price and cost to reflect an accurate assessment of the true total cost to the government of the offeror's proposal (sometimes denoted as the "government's most probable cost," or GMPC). Adjustments made to the offeror's cost can be to correct arithmetic errors, adjust inappropriate labor mixes, or to reflect technical or management-related risks that will affect the effort or schedule required to deliver the capability as proposed. (See Carroll, 1994, for further discussion.)

Where schedule adjustments are made, they are also quantified as part of a cost realism assessment. Both schedule and cost risk are determined by the major uncertain events in the program life cycle, some due to the nature of the offeror's proposal and some external to the proposal. Costs are conditional on schedule, and uncertainty assessments must accommodate such dependencies. One must therefore carefully integrate cost and schedule realism assessments.

Another consideration involves the use of the total acquisition cost of the program to the government as a second cost metric, in addition to the life-cycle cost, for comparing different offeror proposals. When schedule corrections are made, any impact on the government effort (including support personnel) required to manage the program can also be accounted for and included in an adjusted total cost number. This assessment can be difficult for some contracts involving large support structures, and if a simplified approach is

chosen for that reason, it must be even-handed with respect to the evaluations of all offers.

Risks external to the offeror's proposal but part of the system life cycle and thus the total cost to the government are often included as quantified (or qualified) risks. Such a risk could be due to some event (e.g., a technology requirement upon which the system employment is dependent) that causes uncertainty unique to the offeror's approach to the program, and for which a specific program cost assessment cannot be reasonably made. This partitioning of risks can be a matter of

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preference. The impact of all risks that can be quantified can be included in this cost realism adjustment, both program internal and program external risks. The desire is that the resulting number be a realistic estimate of the most probable life-cycle cost to the government of choosing the offeror in question to provide the desired capability or system. A caution is that risk inclusion should be accomplished evenhandedly so that all important risks are included for all offerors during the same period.

All adjustments to proposed cost or price should be recapped in tabular format and supported by descriptive methodology detailing the logic and providing an audit trail (Table 1). A separate but related table should account for uncertainty in the adjustments made by indicating the uncertainty ranges associated with the as-

**Table 1.
Cost Realism Table**

Cost Realism Assessment ($M)	Offeror X1	Offeror X2	Offeror X3	Offeror X4
1. Proposed cost (for proposed effort)	$54.5	$59.3	$65.0	$50.2
2. Arithmetic cost adjustment (for errors, omissions, etc.)	0.5	0.2	0.0	(0.2)
3. Cost adjustment of offeror effort. This adjustment results from an independent assessment of technical/management effort required to deliver the system as proposed by the offeror.	1.2	0.7	1.5	3.0
4. Cost adjustments due to technical and/or management risks. These will impact the delivery schedule or effort required to deliver the proposed system as scheduled; they can be due to overly optimistic schedule assumptions, complex technical interdependencies not accounted for in the proposed effort, and the like.	6.0	2.5	1.0	8.0
Total – cost realism assessment	**$62.2**	**$62.7**	**$67.5**	**$61.0**

sessments. An appropriate confidence interval (e.g., 80 percent) should be consistently used for discussions of uncertainty. The choice of an 80 percent confidence interval instead of, say, a 95 percent range, itself reflects a tradeoff. The important point is that cost adjustments are uncertain assessments, and the magnitude of the uncertainty should be indicated to decision makers.

Step 3. The BVWG works with the SSAC to establish discriminators. The BVWG reviews the technical, management, and cost evaluations. In doing so, the BVWG reviews offeror strengths and weaknesses with respect to the evaluation factors as summarized by the SSEB evaluation final reports. The BVWG conducts a comparative evaluation of these offeror strengths and weaknesses to identify comparative advantages and weaknesses associated with each offeror's proposal. These advantages and weaknesses identify discriminators among offeror proposals.

Each discriminator is traced to the evaluation factor(s) from which it is derived and these discriminator/evaluation factor links are listed. The impact area of each discriminator is also listed. This is the potential programmatic or operational benefit (or risk) associated with the discriminator. For each discriminator identified for each offeror, the impact(s) are described in sufficient detail to support the resultant benefits assessment, and provide summary rationale for the benefit. Ben-

efits could include reduced system down time or enhanced interoperability with other Department of Defense (DoD) systems. Technical or management risks that are related to events beyond the control of the offeror and that thus were not previously accounted for in cost realism adjustments can also be included here as discriminators. As indicated earlier, when discriminator impacts and issues of quantification are addressed, it is beneficial to involve some SSAC members. The appropriate member depends on several factors relating to efficiency and validity of the process. Using the benefit description developed, one makes a determination concerning which discriminator impacts can be quantified (e.g., as a potential cost avoidance in development, as a cost savings in program management and thus program costs, as a cost savings in operations and support, as an operational benefit that can be partially quantified, as a quality, capability enhancement). Nonquantifiable benefits and risks developed in the above description are listed with supporting rationale. These can be recapped in tabular format (Table 2).

Step 4. A benefits summary table is prepared. This table relates the offeror benefit checks in the above table to a benefits reference summary, which should describe in detail the rationale for the benefit claimed for the offeror. This latter description should be systematic and should include referenced precedents, studies, similar systems, and any other relevant information used to assess the benefit associated with the discriminator. If the ben-

Table 2.
Discriminator Impacts Table

Discriminator	Impact area of discriminator	Evaluation factor from which discriminator is derived (can be more than one).	Quantitative? Indicate if benefit can be, or has been quantified.	Qualitative? Indicate if benefit cannot be quantified and is supported only by descriptive rationale.	Offerors			
					X 1	X 2	X 3	X 4
1. Key personnel	P, M, C	Management		X	+	+		
2. Early delivery	P, C	Technical/ overall	X		+	+		
3. Past performance	P, M	Related experience		X	–	+	–	+
4. Training	P	Management	X		+	+	+	

*P = productivity, M = mission effectiveness, C = cost. No entry means no impact, + indicates a positive impact for the offeror, and – indicates a negative impact or risk for the offeror.

efit will be quantified, this should also be indicated. The benefits summary table contains a very brief summary of the conclusions to be drawn.

Step 5. The BVWG quantifies the benefits listed as quantifiable in the discriminator impacts table (Table 2). These benefits are quantified and inserted into the appropriate cells for appropriate offerors in the quantified benefits table below. The methods for quantification can include analyses specific to the impact area, use of a particular cost or related model identified early in the source selection process, or use of some logically developed algorithm. Generally, these benefits will be positive, reflected as deltas above the offeror scoring lowest overall on the evaluation criterion (or criteria) linked to that discriminator. The benefits summary table or a similar report indicated in Step 4, explaining the basis of each and every predicted benefit, is prepared and referenced. The explanation includes the logic for the quantification method chosen, referenced precedents, studies, information sources, etc. A description of the procedure should be provided sufficient to facilitate a clear understanding of how quantification of the benefit was accomplished.

At this time, the BVWG also quantifies those technology and business risks, identified in the discriminator impact table, that can be quantified. As indicated, these may be due to potential events outside the offeror's control that can occur at any point in the system life cycle, or they can be risks that have not yet been considered in the evaluation process. This means that the risks are based on information that has not already been accounted for in the cost realism adjustment made (Table 1) described in Step 2. Where possible, and if appropriate, the potential impact of the identified risk is quantified as a cost impact on the program. These most probable quantified technical or management risks are also inserted into the appropriate cells in Table 3. Generally such risks will have a negative value— that is, they are "negative benefits" or "disbenefits" which will thus increase the overall total cost to the government.

The impact of particular technical or business risks are uncertain, and the BVWG can assess the range of potential cost impacts from the minimum to a maximum figure for each individual risk. As indicated, the most probable value is inserted in the table as a point estimate; however, an appropriate cumulative probable

Table 3.
Quantified Benefits Table ($M)

Discriminator impact (Quantified benefits from Table 2)	Offeror X1	Offeror X2	Offeror X3	Offeror X4
Early delivery	$1.5	$2.5	–	–
Training	$2.0	$2.0	$3.0	–
Summed quantified benefits	$3.5	$4.5	$3.0	$0.0
Cell entries $ benefits [($) if negative]				

impact, such as 80 percent (probability is 0.80 that the cost impact will be that amount or less) can also be assessed as a more conservative or risk-averse estimate. Both the most likely and 80 percent cumulative probable estimates can be used in later summaries. It should be indicated which is being used, and use should be consistent.

Step 6. A net value summary table is prepared. The "net value" is a number used for comparative purposes only and will not correspond to a true price or life cycle cost (see Table 4). It provides for systematic benefit and cost comparisons that take account of not only the realistic predicted cost to the government of the system but also of the benefits associated with the offerors' respective proposed systems. Positive quantified benefits are subtracted from an offeror's projected cost in this table. Risks that are potential expected losses are added to cost.

That offeror with the lowest net value represents the Best Value at this point in the analysis. The quantified benefits have been considered in the analysis and the net value is the result. The nonquantified ben-

efits must still be considered, and these may or may not change that offeror considered the Best Value.

Step 7. A nonquantified benefits evaluation and summary is prepared. This is done for those benefits and risks listed as nonquantifiable in the discriminator impacts table. The nonquantifiable, or qualitative, discriminator impacts can then be detailed in another table in the same order for each offeror. See Table 5 for an example. The rank order can be a consensus rank order developed by the SSAC of the relative importances of the nonquantified discriminators based on the descriptions of likely impacts. Since quantification of impact benefits has not been accomplished, precise weights cannot be assessed. However, for each discriminator, the SSAC can establish a rank order of offeror proposals in terms of likely impacts with respect to that discriminator. These rank orders are indicated in the table.

Comparison to quantified benefits. One method for further precision in assessing the relative benefits of the nonquantified benefits is a comparison of each of these

Table 4.
Net Value Summary Table ($M)

	Offeror X1	Offeror X2	Offeror X3	Offeror X4
Original bid price	$54.5	$59.3	$65.0	$50.2
Cost realism adjustment to price	+7.7	+3.4	+2.5	+10.8
Most probable cost to the government	62.2	62.7	67.5	61.0
Sum of quantified benefits and risks	− 3.5	− 4.5	− 3.0	− 0.0
"Net value" of offer	$58.7	$58.2	$64.5	$61.0

**Table 5.
Nonquantified Benefits Table**

Discriminator	Discriminator Impact Area	Offeror X1 Benefit Explanation	Offeror X2 Benefit Explanation	Offeror X3 Benefit Explanation	Offeror X4 Benefit Explanation
Key personnel (KP)	Productivity mission effectiveness cost	Strong selection for program manager and software development manager Denote as B(KP), X1	Strong key personnel selections for all positions, particularly software development manager and planning manager. Denote as B(KP), X2		
Past performance (PP)	Productivity mission effectiveness	Extensive relevant experience with like projects; this is offset by significant cost or schedule overruns Denote as B(PP), X1	Relevant experience with like projects and this agency Denote as B(PP), X2	Relevant experience with like projects and this agency, but history of significant cost or schedule overruns Denote as B(PP), X3	Relevant experience with like projects and this agency Denote as B(PP), X4
Position of offeror rank ordered benefits		Rank 3	Rank 1	Rank 4	Rank 2

nonquantified benefits to those that have been quantified, thus bracketing non-quantified benefit values between the values of those that are quantified. Which is worth more to the government, the nonquantified benefit or the quantified benefit? For a particular offeror benefit, a pair of quantified benefits is found such that the nonquantified benefit is worth more than one benefit and less than the other. These benefits can be any from the list of quantified benefits (if there is a sufficiently large set). Assign the nonquantified benefit a dollar value between the quantified values. If desired, these could be integrated with the quantified benefits in the net value table, or they can be inserted in the nonquantified benefits table (Table 5).

Direct comparison of nonquantified benefits. Nonquantified benefits can also be directly compared to each other using

an iterative, stepwise process. There are numerous procedures for such comparative evaluations involving the ordinal properties of the benefits. For example, in comparing the benefits of Offerors 1 and 2, first the relative magnitudes of the nonquantified benefit items of each offeror are rank-ordered relative to each other without comparing to those of the other offeror. Then the smallest benefit item (or largest) of one offeror is compared to the smallest (or largest) benefit item of the other. A decision is made as to which item is worth more to the government and why. The reasons for the decision are recorded. Then, for the offeror whose smallest benefit item is the lesser of the two, his smallest two benefit items are compared to the smallest of the other offeror. These two must either be worth more or less than the smallest item of the other offeror. If less, the third smallest item is added. If larger, the other offeror's second smallest benefit item is added to his first and the process is continued. Eventually, the benefits of each offeror will be ordered relative to those of the other offeror and there will be an advantage for one of the two. This is done for each pair of offerors (if necessary). Actually there will be many shortcuts in this seemingly tedious procedure, and it will not require as much time as initially anticipated.

A comparison of the nonquantified benefits listed Table 5 indicates that:

B(PP), X2 equals approximately B(PP), X4

B(PP), X4 is significantly greater than B(PP), X1

B(PP), X1 is slightly greater than B(PP), X3

B(KP), X2 is greater than B(KP), X1.

These inequalities imply that:

B(PP), X2 + B(KP), X2 > B(PP), X1 + B(KP), X1.

Similarly, further direct comparisons of these nonquantified benefits indicate that

B(PP), X4 > B(PP), X1 + B(KP), X1
B(PP), X1 + B(KP), X1 > B(PP), X3.

By aggregating the inequalities, it can be deduced that the order of the nonquantified benefits of the offerors is X2 – X4 – X1 – X3 as indicated in the bottom row of Table 5. Because Bidder X2 has the best overall net value prior to the nonquantified benefits comparison, and given the dominance by X2 in the nonquantified benefits, X2 remains the best overall net value.

Step 8. Quantified and nonquantified benefits are traded off. After the nonquantified benefits are compared, one of two situations will exist. The offeror with the lowest quantified net value may also have the greatest nonquantified benefits ranking. If so, the process is finished and that offeror is recommended. If the offeror with the greatest total nonquantified benefits ranking does not have the lowest net value, nonquantified benefits must be traded against quantified benefits using the process described in Step 7.

The comparison can be accomplished in several ways. One way is to again pro-

ceed pairwise. The offerors are ordered in terms of the net value results. The process starts with the lowest net value offeror. The net value difference between this and the second offeror is a benefit advantage over the second offeror. This net value advantage, in dollars, is compared to the nonquantified benefits directly. The net value difference may be more beneficial than the total of all of the nonquantified benefits of the second offeror or it may be possible to bracket it somewhere in the order. This pairwise comparison is accomplished iteratively and the results are integrated, interpreted, and summarized. The nature of the procedure should be fairly obvious; we won't discuss further variations. The point is that this comparative procedure provides a linked evaluation with the paired comparison ordering and reasons as supporting rationale for the results.

We can draw two conclusions. One is that this benefit comparison procedure is systematic, and although it depends only on ordinal preferences, it can be strongly supported by the benefits rationale prepared in the benefits summary table. The

second is that the procedure is guaranteed to produce a recommendation. Though the procedure may seem very tedious, it can be made quite efficient. The important point is that ordinal ranking procedures that do not assume inordinate levels of precision can be used to produce the systematic evaluation desirable in Best Value procurements. The criticism that such assessments cannot be defended, and therefore should not be employed, does not make sense. If such judgments cannot be made, how can the decision made using some other less systematic approach be defended?

Step 9. An overall best value summary table is prepared. Finally, depending on the actual process used to compare nonquantified benefits, the BVWG must judge whether the results of this benefits comparison should change the offeror order in the net value table (see Table 6). A summary final rank order table is prepared indicating the nature of the final order with the systematic explanation of the benefits and costs audit trials that resulted in the ordering. This table contains the original

Table 6.
Best Value Summary Table ($M)

	Offeror X1	Offeror X2	Offeror X3	Offeror X4
Original bid price	$54.5	$59.3	$65.0	$50.2
"Cost realism" cost	$62.2	$62.7	$64.5	$61.0
Net value adjusted for quantified benefits	$58.7	$58.2	$64.5	$61.0
Nonquantified benefits comparison results	Third highest aggregated nonquantified benefits	Highest aggregated nonquantified benefits	Fourth Highest (lowest) aggregated nonquantified benefits	Second Highest aggregated nonquantified benefits
Summary	Rank 2 or 3	Best Net Value	Least Value	Rank 2 or 3

proposed price, the adjusted "cost realism" cost, the net value including quantified discriminator impact, and the nonquantified benefits from the nonquantified benefits table. The iterative stepwise process described above to reach the final decision can be explained proceeding through the related comparisons using this summary, with final remarks in the comments area. For the example here, the results of the comparative process are clear with respect to the best and worst overall net values. Because X2 is the best overall net value, it is not necessary to resolve the uncertainty about the ranks of X1, and X4. (The quantified overall cost (net value) for X4 is $2.3M higher than that for X1, but X4 nonquantified benefits are higher than those for X1. The question concerns the quantified value of these benefits. Do they compensate for the $2.3M? If this question needed resolution, the process described earlier would be used.)

LEGAL PRECEDENTS; PROTESTS OF BEST VALUE DECISIONS

Protests involving Best Value source selections have involved issues of improprieties, unfairness, improper procedures, failure to follow advertised procedures, and others. Several protests of Best Value procurements have involved the contention that the government didn't tell the offerors what it was going to do in sufficient detail to allow them to clearly state their case in the most advantageous way, or that the government did not do what it said it would do. The following are discussions of several relevant protests including non-DoD examples. (See GAO

Review, April, 1994; GSBCA No. 12813-P-R {LEXIS 255}, 1994; Koch,1994; O'Keefe, 1978; and Sochon, 1994, for examples and discussion, and Widnall *v.* B3H Corp, 1996).) These protests demonstrate that the problem of an appropriate procedure for the crucial benefit to cost tradeoffs, the resolution of which should include practicing decision analysts, is in danger of being determined by legal precedents with respect to protests.

IMPORTANT BEST VALUE CASES

Cost realism adjustments. The Treasury Multi-User Acquisition Contract (TMAC) (Koch, D., 1994) decisions established several precedents for Best Value procurements. One was that adjustments for cost realism and the projection of most probable life cycle cost to the government were acceptable practices. Also, there is no requirement in the law for technical factors to be proportional to cost factors. Technical factors can have a cost of their own expressed in terms of dollars irrespective of cost of acquisition and ownership considerations. TMAC also established that if no offeror protests the lack of information in the solicitation on the evaluation procedures prior to proposal submission, then there is no basis for a later protest based on this lack of information.

Quantification. In Grumman Data Systems Corporation *v.* Department of the Air Force (1992, Grumman), the Air Force used quantifiable and nonquantifiable discriminators. (See Federal Contract Report, 1994.) The quantifiable discriminators were translated to dollars. The importance of the nonquantifiable discriminators was stressed but not translated to dollars. This ruling upheld this version of tradeoffs but does not eliminate others. This tradeoff

process was also upheld in Computer Science Corporation (CSC) *v.* Department of the Army in the Army Reserve Component Automation Systems (RCAS) procurement (see Koch, D.1994, and GSBCA No. 11635-P, 1992 B.P.D. § 100). This Grumman protest also established the reasonableness of the cost technical tradeoff (CTTO) analysis by stating, "There is no formulaic methodology for conducting a Best Value determination; what matters is that the award is consistent with the terms of the solicitation and that any price premium is justified by the specific technical enhancements." (See Federal Contract Report, 1994.) Thus there is no necessary, defined formula for linking technical scores and cost. This link must be assessed. Because there is not one prescribed formula, other criteria such as "reasonable approach" and "even-handedness" are appropriate for evaluating the linkage approach.

"There is no formulaic methodology for conducting a Best Value determination; what matters is that the award is consistent with the terms of the solicitation and that any price premium is justified by the specific technical enhancements."

In Lockheed Missiles and Space Company *v.* Department of the Treasury, TMAC II (GSBCA Nos. 11776-P, 11777-P, 1992, B.P.D. § 155), the government failed to properly conduct present value and most probable cost adjustments on the estimated dollar value of the increased technical benefits in the Best Value assessment, but had done so on the original cost comparison. Lockheed recomputed the adjusted most probable costs based on the formulas used in the source selection, and the results favored a reversal of the decision. Nonetheless, the protest was denied. The General Services Board of Contract Appeals (GSBCA) determined that there were other values (e.g., nonquantified discriminator benefits) that the Treasury Department did not include in their analysis, and that these compensated for the error in benefits assessment. Note that this essentially means that GSBCA was itself assessing the value of benefits and also determining that nonquantified benefits do trade off against quantified benefits! The TMAC II ruling also upheld the use of the price–risk analysis discussed earlier.

Clarity with respect to benefit tradeoff procedures. The protest by System Resources Inc. (GSBCA No. 12536-P, 1993, B.P.D. § 253) was upheld, indicating that simply stating in the RFP that a Best Value approach will be used is not enough guidance. It must also be indicated that a benefit–cost tradeoff will occur. In this case, credit was given to an offeror's proposal for projected capability in excess of a threshold standard listed in the RFP, and offerors were not told that any such credit would be given. The RFP can be silent on exactly how this trade benefit–cost tradeoff will be done, but this silence may increase the probability of a protest. In this case, the lack of instructions was misleading, for the standard was stated in threshold form with no indication that capability above that threshold would be traded against capabilities in other areas (i.e., explanation of the SSEB conditional decision rule for trading off capability above this threshold).

Benefits traceable to evaluation factors. In the USAF Desktop IV case in May 1993, it was stated that the evaluator cannot assign benefit to services or capabilities (including using them as discriminators in Best Value) not specified somewhere in the RFP (O'Keefe, 1993). The services must be requested or identified in some useful language in the RFP. Note that the same ruling established that services that are inherent but unstated can be used and assigned a value (Federal Acquisition Report, 1993). The Desktop IV ruling also established that the National Defense Authorization Act of 1991 gives defense agencies the authority to make Best Value awards without discussions with offerors—again no change from established practice (O'Keefe, 1993).

Burden of proof for compliance with solicitation terms. In a recent and important decision, the GSBCA upheld a protest by the B3H Corporation against the U.S. Air Force (GSBCA No. 12813-P-R, 1994 GSBCA LEXIS 255) on the basis that the Air Force made the award contrary to the terms of the solicitation, indicating that the record does not "with any degree of certainty" support the conclusion that the added values of the awardees' proposals were worth the higher prices associated with those respective proposals. The protest was by a small business that protested only the small business award of a multiple-award procurement, contending that the protester had the lowest cost of the small business proposals, and that the Air Force selection process was inconsistent with the terms of the solicitation. It was claimed that the Air Force did not show that the proposals of the two small business offerors awarded contracts were worth the extra 15 percent and 5 percent costs respectively associated with them. Thus the B3H Corp. maintained that its proposal represented the best value to the government. The decision of the GSBCA supported this contention, indicating, among other things, the following: "What is lacking as a whole is a reasoned basis leading to the conclusion that the benefits of the awardees' proposals are in fact worth the apparent extra costs."

The single dissenting judge (one of three) to the GSBCA decision summarized his view of the implication of the GSBCA decision to uphold the protest. "There is also the matter that the majority seems to think that the Air Force, when challenged, is required to prove that its procurement is perfect. In every legal system of which I am aware, quasi or otherwise, he who alleges an impropriety must produce evidence sufficient to prove it.

"In every legal system of which I am aware, quasi or otherwise, he who alleges an impropriety must produce evidence sufficient to prove it."

This majority, for whatever reason, has reversed that fundamental rule. In this procurement, the protester said it didn't think the two better qualified offerors were worth the additional money, but it offered no evidence at all to prove it, thus committing the same sin that the majority says that the government committed, and which the majority used as a reason to grant the protest."

In Widnall *v.* B3H Corp. (1996), the B3H decision was overturned by the U.S. Circuit Court of Appeals, which stated that if the GSBCA board task is to assure that an agency's procurement decision is

grounded in reason, and if such is the case, then the board defers to the agency decision, even if the board might have chosen a different offeror (i.e., there is not necessarily a need to be right, only to be reasonable). The court further noted that discriminators can be quantified or non-quantified "for

"The question seems to regard what constitutes sufficient rigor with respect to establishing the relative worth of any benefits claimed for an offeror who is not the lowest bidder."

the board does not require that each difference in a proposal be assigned an exact dollar value representing its worth to the government." (Widnall *v.* B3H, 1996, part III). The agency is required to present a reasoned analysis showing that the government expects to receive benefits commensurate with the extra costs it will have to pay. This case also goes on to describe other decisions entrusted to the agency and thus the SSA including, for example, which nonquantified discriminator to emphasize. Thus, this decision removes the apparent need for the agency to prove that its analysis is "correct" beyond some reasonable doubt.

IMPLICATIONS OF BEST VALUE PROTEST FINDINGS

There are several implications of these findings, and unfortunately they are not unambiguous. One is that there has not been agreement on what constitutes sufficient demonstration of Best Value. It is very obvious that no one is asking for a "perfect" analysis, as was clearly demonstrated in the TMAC II decision. However, as demonstrated clearly by B3H, some

systematic demonstration of the benefit to cost tradeoffs beyond a mere statement of opinion by the SSA is required. Even the dissenting judge in the B3H protest would probably not argue with this. The question seems to regard what constitutes sufficient rigor with respect to establishing the relative worth of any benefits claimed for an offeror who is not the lowest bidder. Systematic dollar value quantification of impact area benefits using rigorous quantification procedures and measures based on historical precedent will likely provide sufficient proof. However, it is generally not clear what parts of benefit can be translated to dollars. The B3H decision demonstrated that the SSA's detailed claims regarding increased savings to accrue may not be sufficient (at least to some judges). But Widnall *v.* B3H demonstrates that a "reasoned analysis" is sufficient. Would a sufficient justification be a systematic, linked tradeoff process such as that used in the Multi-Attribute Utility Theory (MAUT) technique with a judgmental assessment of the benefit-to-cost link supported by logic and rationale? This is more systematic than extensive testimony by the SSA in B3H, but it is less rigorous than detailed cost modeling of the increased benefits using precedent-based measures. This question is not clearly answered by these cases, but this is certainly a reasoned analysis that satisfies the criteria of Widnall *v.* B3H.

Another finding that is apparent from these cases is that the government should be very clear in its guidance to offerors, specifying in advance the procedures it intends to follow and even its conditional decision rules where feasible. The government should specify not only that a Best Value procurement will take place, but that

cost and technical factors will be traded off. An example in support of this prescript is the U.S. Marine Corps Mobile Protected Weapon System (MPWS) procurement. In that concept design procurement the government provided the offerors the actual evaluation structure, in that case a MAUT model, including the attributes (called factors or criteria) and intra-attribute utility functions, attribute weights and rationale for all. The evaluation was quite successful (see Buede & Bresnick, 1992).

The government should obviously follow the procedures specified in the SSEP and explained to offerors in the solicitation and should avoid any procedures not so specified. But the government cannot specify all possible contingencies. Further, it cannot specify the exact details that will determine a decision outcome. It can clearly define the evaluation factors and subfactors (if any) and specify how the evaluations will be conducted with respect to these. The specific Best Value methodological approach to be used can be clearly laid out in the solicitation. In current practice, however, there is not apparent agreement on a single recommended approach. An urgent job for decision analysts is, at a minimum, to lay out guidelines for several conditional approaches along with the conditions under which each approach should be employed. Unless this is done, the solution may well be determined by legal experts having only a partial understanding of the measurement concepts and resultant implications of their decisions.

The thing that is unclear from the legal discussion is the specific nature of the benefit-to-cost tradeoff. The B3H case demonstrates that a mere verbal description of benefits by the SSA is probably not sufficient justification for decisions.

Other protest outcomes (e.g., Widnall *v.* B3H) seem to demonstrate that an attempt at a systematic approach to characterize benefits and offeror differences with respect to discriminator impacts should suffice. The use of MAUT tools to aid the SSAC in this systematic tradeoff process should be valuable. Such a MAUT approach would be hardest to defend if it relied only on judgmental assessments. These judgmental assessments should be systematically linked by the MAUT process and supported by rationale, and thus they would be better than SSA opinions about the group of discriminators (the apparent problem in B3H).

If the benefit tradeoffs were further supported by a linkage to cost realism estimates through a systematic analysis or algorithm, the MAUT analysis would be very strong and should provide the "reasoned analysis" required by the GSBCA. The MAUT analysis will generally not take as much time as a detailed costing of discriminator impact areas using rigorous costing algorithms. The SSAC and BVWG generally do not plan to spend several weeks or months doing the Best Value analysis. This would imply that costing, if done, would involve simplified approximations to more formal approaches. Otherwise, MAUT provides a reasoned analysis that can be accomplished in a shorter time.

One answer to the desirable nature of the benefit-to-cost tradeoff process is, "It

> **"An urgent job for decision analysts is, at a minimum, to lay out guidelines for several conditional approaches along with the conditions under which each approach should be employed."**

depends." That is, sometimes tradeoffs can be quantified; sometimes they cannot. Measurement always involves abstraction of the real world situation to a mathematical model, and the models appropriate for different conditions are different. The lack of a universal answer may be dissatisfying to some, but it should comfort the practitioners who have always shied away from quantification because they feared rigid application of inappropriate models. It should also satisfy the practitioners who wish to plan ahead, for it implies that the entire acquisition must be systematically implemented, with linked modeling and measurement procedures defined early and consistently implemented. This can help prepare for later quantification of benefits.

A general summary of this guidance is that when the source selection is done, the source selection team must be able to convincingly show that the analysis and decision-making process were sound and fair. An SSA opinion that "the added cost is worth it" will probably not suffice (and did not initially in the referenced B3H case). All costs and benefits must be systematically characterized as quantified or not, and the decision process must have a systematic, understandable, and consistent logic thread. Unquantified benefits can be traded against cost differences, but the trades must be rigorous, understandable, and the result of a "reasoned analysis," a logically consistent decision process. While there may be some residual uncertainty about the absolute precision of assessments used in evaluations, the procedures were applied to all offerors in an evenhanded manner.

Decision support tools help to provide the necessary consistency and audit trail.

The use of these tools provides for public scrutiny of the evaluation process and avoids an inherent weakness in the argument of the dissenting judge in the B3H protest case. That judge seemed to claim that the SSAC shouldn't be second guessed because the board is most knowledgeable on all the issues and thus best qualified to make the tradeoff assessments.

However, while the SSAC members may be quite knowledgeable, this doesn't guarantee the sanctity or even the correctness of their procedures. An "analysis based in reason is still required." (See O'Connor, Faris, and Lovelace [1996] for further discussion of such analyses and tools to support them.)

RECOMMENDATIONS BASED ON BEST VALUE APPLICATIONS

The authors have collectively applied the principles, procedures, and tools discussed in this article to more than 100 acquisitions, many of which have involved Best Value source selections. This section provides recommendations resulting from that Best Value work.

TIME:
UNDERESTIMATION AND
RESULTANT RUSH TO JUDGMENT

All of the historic problems of planning time pertain to acquisitions. More often than not, the evaluation team develops an evaluation schedule (and program schedule) based on overly optimistic estimates of the time needed to accomplish the activities involved in executing the source selection plan. The reasons are many and are well known to practitioners. For example, the time required for the Source

Selection Evaluation Board to accomplish its evaluation is very often longer than planned. The time required for discussions with offerors including clarification requests, deficiency ratings, oral discussions, and revision of offers is also very often longer than anticipated. Yet, because acquisitions are usually highly visible to the government and public, and delays in awards can be costly to all, the planned award announcement date is maintained until it is obviously impossible to attain. Usually, rather than slip that date, the time allowed for activities at the end of the cycle are squeezed. In Best Value source selections, this squeezed time is the time for the Best Value working group to accomplish Best Value deliberations and discriminator quantification. This problem is often further exacerbated by insufficient time allotment to these activities (especially discriminator quantification) in the original schedule. This insufficiency in the original scheduling can be caused by a lack of understanding of both what is involved in Best Value source selections and of the time required to implement a valid cost–benefit tradeoff process and associated discriminator impact benefit quantifications.

The validity and precision of the cost–benefit tradeoff process and associated discriminator impact benefit quantification are directly affected by the time allotted to them. Procedures to assure validity, precision, and thus "correctness" take time. The recommendation here is obvious. Sufficient time should be allotted to the Best Value deliberations in the original source selection schedule, and that time should not be shortened unless it becomes clear that it is not required, (e.g., a Best Value situation does not eventuate

after SSEB evaluation). As a general rule, at least one month should be allotted to discriminator impact benefit quantification.

The authors have often faced the argument that there is no need for benefit quantification, especially if it is going to be done poorly, and that traditional source selection procedures will suffice. The benefits of the Best Value approach will not be argued here, save to note that it was originally developed to address an apparent inadequacy in the traditional process. The issue that the traditional process should be implemented because practitioners do not plan and implement well is not really a viable one. If the intent to use a Best Value process has been stated to the offerors, then it should be implemented as well as can be done.

> *"Sufficient time should be allotted to the Best Value deliberations in the original source selection schedule, and that time should not be shortened unless it becomes clear that it is not required."*

CLARITY OF INTENT TO USE A BEST VALUE PROCESS

Another important issue is that it should be clear both to offerors and the acquisition team that a Best Value process will be used. Vague wording such as "the government will choose the offeror providing the best overall value to the government" are considered by some practitioners to adequately signal a Best Value acquisition to the offerors. For the offerors, a less ambiguous statement is one that indicates that the government will implement a Best Value process that will involve

a cost–benefit tradeoff process. For the government, the SSAC members should understand the Best Value process that will be used and should plan accordingly for it.

BEST VALUE WORKING GROUP COMPOSITION AND PROCEDURE

A BVWG chairperson should be appointed as early in the evaluation process as feasible. This provides time for that person to organize for such issues as BVWG composition, schedule, and procedures as well as to begin to attack technical issues such as procedures and tools for cost–benefit tradeoffs and discriminator impact benefit quantification. The BVWG should include a sufficient number of SSAC personnel to assure valid benefit assessments and also SSAC buy-in into the analysis results. At the same time, the BVWG should not be so large that meetings are too large and progress difficult. All BVWG members should expect to be workers that will participate totally in the Best Value cost–benefit tradeoff process. The larger this group, the more important it is that the meeting leader (BVWG chairperson or a facilitator) possess both good meeting facilitation and analysis skills.

"A set of discriminators must be established that validly characterizes the benefit advantages of each of the proposals over others."

The BVWG should also include evaluation personnel most familiar with the content and evaluation of the offerors' proposals. This familiarity includes knowledge of the basis for assessed costs and assessed technical and management benefits associated with the respective proposals. Such personnel include Source Selection Evaluation Board (SSEB) members such as the technical, management, past performance, and cost panel chairpersons. These personnel can serve as BVWG advisors.

DISCRIMINATORS: HOW MANY?

The number of discriminators needed is often pondered. The answer depends on the particular source selection and will evolve from the proposal evaluation process and results. A set of discriminators must be established that validly characterizes the benefit advantages of each of the proposals over others. The discriminators must not necessarily span all of the benefits, but rather must characterize the benefits that discriminate in a discernible way among proposals. Thus benefits common to all need not be reexamined at this point.

All discriminators must be traceable back to one or more evaluation factors. This doesn't mean that they correspond to a specific set of evaluation score differences, but they must be inherent in the intent of the evaluation or must be derivable as implications of the evaluation. (No new evaluation factors representing services or capabilities not requested in the solicitation should be introduced at this point. This is an important and often difficult issue that can be misunderstood.) Discriminator impact areas must be identifiable and clearly stated, for it is these to which benefit is attached. If this linkage cannot be established, the discriminator should be reexamined. These are issues relating to cost–benefit analysis procedure, and they will not be discussed in detail here. The principles and procedures employed in decision analysis, especially

those of Multi-Attribute Utility Analysis (usually denoted as MAUA, MAUT, or MAU), are particularly relevant here.

TREATMENT OF RISK

The risks associated with offeror proposals are treated to a degree in the cost-realism adjustments described in the first report in this three-article series. The most probable cost to the government (MPC) thus incorporates some of the proposal risk implications. However, as indicated in the first report in this series, certain discriminators will also involve risks. Avoidance of risks associated with one offeror can be a benefit or advantage associated with choosing another offeror's approach. Thus analytic procedures for quantifying risks associated with offeror proposals are very relevant. These will not be discussed here, but it is quite important that BVWG members understand and can employ these procedures or can get assistance in doing so.

One should also note that the term "risk" has multiple meanings and can be a source of confusion. For example, some government agencies have SSEB (or an equivalent body) members evaluate offeror proposals by assigning each factor a rating and a risk.

Still others assign factor ratings at one level and risks at the next higher level where the several factor ratings are aggregated into a single rating. Usually the factor ratings are pegged to an evaluation scale or standard. The risks, if defined, are usually briefly described. These do not represent the kind of risks often discussed in economic or decision analyses. Yet they do represent the consensus of an evaluation panel regarding a conditional evaluation of an aspect of an offeror's proposal. Recall that it is not these risks that would be directly quantified, but rather the judged impacts of the risks. Clearly the impact must be carefully characterized, and the approach to such characterization must be consistent throughout the analysis. The BVWG should carefully plan for this difficult process. The goal is not for a perfect analysis, but it is to achieve a consistent, "reasoned" analysis.

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ENDNOTE

1. In one version of this approach, benefits are characterized as "quantifiable" and "nonquantifiable", and the described tradeoff process is accomplished for the "quantifiable" benefits. The "nonquantifiable" or "qualified" benefits can only be used as tie-breakers. However, the distinction between "quantified" and "nonquantified" benefits in any of the Best Value implementations is not clearly defined. In fact, whether a benefit can be quantified may be a function of the degree of planning for such tradeoffs done early in the acquisition process. The term "quantification" can lead to confusion between the ability to quantify and the nature of the scale or "uniqueness" of the measurements obtained from the quantification procedure (Krantz, et. al., 1971).