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The Logistics Support Resource Strategy Map: A Design and Assessment Tool

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by

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Designing a resource strategy for logistics support includes choosing to use contracted, blended, or organic support, or a combination thereof, for acquisition products. Non-cost issues have received much less attention than cost in resource strategy design—even though policy requires the incorporation of many non-cost issues. This lack of attention is partially due to the large number of issues that can impact strategy design, the diversity of issue features and impacts, and the diversity of characteristics of programs, their environments, and potential strategies. Although many issues that should be included in logistic planning have been identified, little guidance is provided for how program management teams can incorporate them into logistics support resource strategy design. Tools that facilitate describing logistics requirements and the impacts of resource strategies on program success can potentially improve resource strategy design, assessment, and documentation for review. The structure and use of the Logistics Support Resource Strategy Map for helping program management teams consider a broad range of logistics support resource strategy design issues are described. An example application illustrates the Map's use. Implications for practice and potential future developments tool are discussed.

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Abstract[1]

Designing a resource strategy for logistics support includes choosing to use contracted, blended, or organic support, or a combination thereof, for acquisition products. Non-cost issues have received much less attention than cost in resource strategy design—even though policy requires the incorporation of many non-cost issues. This lack of attention is partially due to the large number of issues that can impact strategy design, the diversity of issue features and impacts, and the diversity of characteristics of programs, their environments, and potential strategies. Although many issues that should be included in logistic planning have been identified, little guidance is provided for how program management teams can incorporate them into logistics support resource strategy design. Tools that facilitate describing logistics requirements and the impacts of resource strategies on program success can potentially improve resource strategy design, assessment, and documentation for review. The structure and use of the Logistics Support Resource Strategy Map for helping program management teams consider a broad range of logistics support resource strategy design issues are described. An example application illustrates the Map's use. Implications for practice and potential future developments tool are discussed.

Keywords: Logistic support, resource strategy, strategy design and assessment

[1] The Logistic Support Resource Strategy Map and the example application described in this report are shown at Appendix B and C, and are digitally available from the first author at no cost.

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Introduction

"'[The] logistic process is at once the military element in the nation's economy and the economic element in its military operation.' […] Logistical conditions and capabilities largely determined what was strategically available and tactically feasible […] logistics is always the indispensible servant of victory, and 'like any indispensible servant, it is frequently the master'" (S. B. Duncan, as cited in Rose, 2006, p. 191)

The ability to provide effective and efficient logistics support for deployed military systems is a critical part of successful program management. At least two important questions must be addressed to meet this acquisition goal:

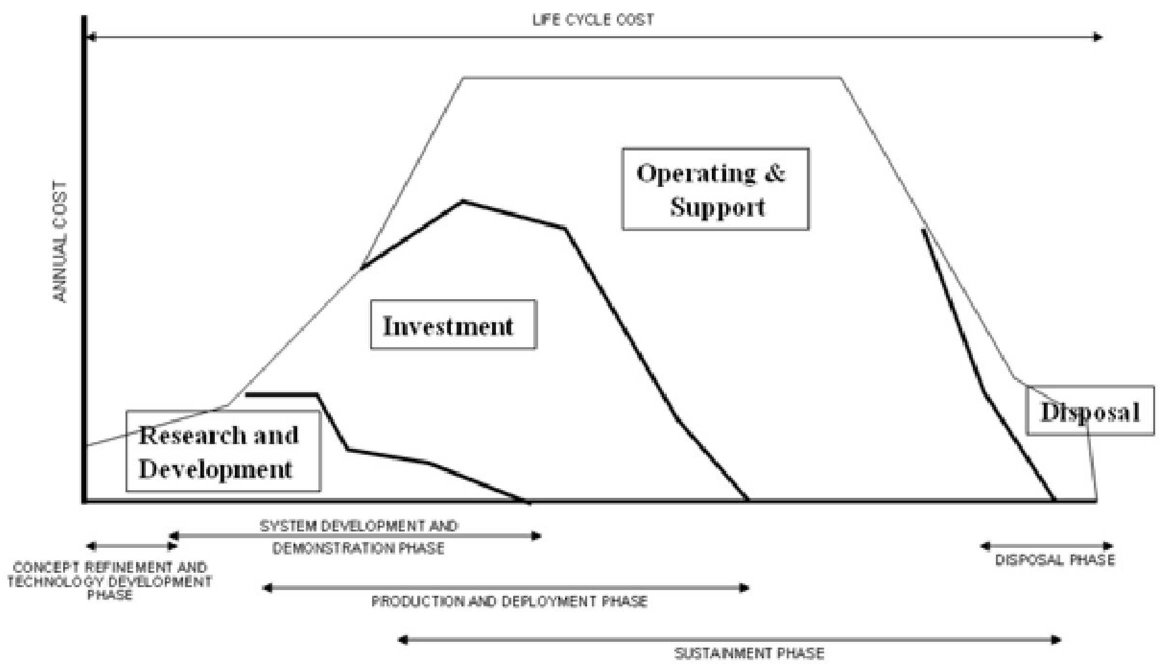
1) What types of resources will be used to provide what logistics support? i.e. What is the logistic support resource strategy?

2) Given the logistics support resource strategy selected, how can logistics operations be managed to maximize effectiveness and efficiency?

The Department of Defense has addressed logistics operations (the second question) at length. Logistics support operations can be assessed by both their effectiveness in meeting requirements and their efficiency of use of funds. Performance of logistics support operations in meeting requirements is measured with metrics such as the average response time and other metrics developed through Performance-based Logistics (PBL). These metrics are used to assess the effectiveness of logistics operations. Costs—including monies paid to contracted logistics support providers, government expenses incurred to contract and manage those providers, and funds for organic logistics support—are used with performance measures to assess the efficiency of the use of funds (Defense Acquisition University (DAU), 2005).

In contrast, logistics support resource strategy design (the first question) has received much less attention beyond the preference for the cheapest alternative. As used here, a logistics support resource strategy describes the sources (contracted, organic, or blended) of support provided to meet different logistics support requirements. However, a DoD program's logistics support resource strategy is important because it profoundly impacts total program performance. Figure 1 describes the relative costs in a product's lifecycle. As shown, operations and logistics costs are large when compared to Research and Development, Investment, and Disposal costs. Therefore, the effective and efficient design of a program's logistics support resource strategy is critical to overall program success.

Figure 1. Relative Costs during a Product Lifecycle
(DAU, 2004, November, p. 43)



Most naval logistics support is provided by two types of resources: commercial organizations that contract with the government to provide material, equipment and services (a.k.a., Contractor Logistics Support, CLS) and internal military resources that provide the same material, equipment, and services. These are referred to as "contracted" and "organic" forms of logistics support, respectively. Three logistics support resourcing strategies are commonly considered: 1) contracting for all logistics support, 2) providing all logistics support with organic resources, and 3) providing some support through contracts and the remainder of support from organic resources, referred to as a “blended” strategy.

The three strategies are very different from one another in their characteristics, challenges for the government, and risks. The decision to provide support entirely with contracted resources (CLS) is an outsourcing strategy that often requires significant government contracting effort; it also requires contract management expertise and experience on both the government and contractor sides of the agreement. Contracted logistics introduce challenges to the government that include reduced control of resources and increased sensitivity to the goals of private enterprises. In contrast, by providing all logistics support with organic resources, program managers apply a “make” (versus “buy”) approach to providing logistics. Organic logistics support (OLS) presents challenges of developing and retaining adequate expertise, building the infrastructure of diagnostics, spares, maintenance facilities, etc.; such support also can increase resource allocation risks . Different again is a blended strategy, which can be a disaggregation of meeting the same support requirements between contracted and organic resources, an interdependent allocation of different types of support among different resources, or a combination of the two. Blended logistics resource support strategies bring with them the challenges of comparison between contracted and organic performance and operational interface management. These differences make forecasting the impacts of specific logistics support resource strategies and logistics support performance and cost very difficult. This inability to forecast, in turn, makes logistics support resource strategy design difficult.

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Problem Description

The logistical features and characteristics of programs and their environments vary widely. Some impacts on resource strategy design (i.e., the use of CLS, blended, and OLS) can be described and assessed in monetary terms, such as differences in labor costs between contracted and organic personnel. Other aspects may have significant impacts but are intangible, such as reductions in commitment or morale of contracted suppliers due to many large rapid changes in government needs or the introduction of a more lucrative opportunity for using their resources. Many potentially important aspects lie between these two extremes.

Logistics support resource strategies also vary widely. This diversity is partially due to differing abilities of resources to fulfill different logistics requirements. For example, the contractor that develops a critical technology for a new weapons system may be the only organization capable of providing its logistics support. If logistics support is viewed as a single, monolithic set of requirements, then a resource strategy can be described by specifying the resources that fulfill sets of requirements. But different logistics support requirements can often be better met by different support resources. Therefore, total logistics support is often disaggregated into sets of requirements—each potentially with a different logistics support resource strategy or design.

The disaggregation of logistics support can be based on technical knowledge, workforce characteristics, and legal and ownership issues. Contractors may own specific product knowledge, software, facilities, or technical data that are required to provide logistics support, or may have access to necessary or preferred business relationships (e.g., supply chains of critical components). Legal (often proprietary) constraints or extraordinarily high prices for access may require some logistics support requirements to be clustered for supply by specific firms. Clustering based on this third criterion is typically contractor-specific. Therefore, good logistics support resource strategy design includes an analysis of how clustering support requirements for resourcing can impact the attractiveness of specific strategies.

Due to the uniqueness of programs, environments, and strategies, no one logistics support resource strategy is always best for all programs. Each strategy has a different set of features and characteristics that provide different advantages and disadvantages relative to other strategies. Those advantages and disadvantages generate benefits and costs. For example, the contracted logistics support organization may have developed a piece of equipment that is unique to the system being supported and, therefore, would have an intimate knowledge of its design and manufacturing. This provides special expertise in system maintenance and repair that are not available organically. That expertise may reduce repair times, costs, or both. Likewise, organic resources may be fully dedicated to the program and available with zero notice. This allows the organic resources to respond faster to unexpected increases in demands for logistics support, which could reduce response times experienced by warfighters. An example of this type of advantage of organic support is found in Coryell's (2004) case study of logistics support for the Army's Stryker program in which a change in logistics support resource strategy was driven by the flexibility provided by organic resources. Anecdotal evidence suggests that contracted, blended, and organic strategies each provide a broad and diverse spectrum of advantages and disadvantages. However, selecting the best logistics support resource strategy for a specific program is difficult because of the need to identify the important features and characteristics of the program, its environment, and potential strategies and to assess their impacts on logistics support resource strategy selection. ***Given this multitude of potential drivers of and influences on logistics support, how can acquisition program managers select the best logistics support resource strategy for a specific program?***

DoD Policies Regarding Logistics Support Resource Strategy

Basic DoD logistics policy, as described in the *Acquisition Logistics Guide* (Defense Systems Management College, 1997) suggests six comparison criteria when performing tradeoff studies among alternative system designs and logistics support strategies (pp. 8-10):

- Lifecycle cost comparisons,
- Diagnostic characteristics (e.g., Built-in-Test (BIT)),
- Energy characteristics,
- Battle damage repair characteristics,
- Transportability characteristics, and
- Facilities requirements.

As this list indicates, cost and measurable logistic performance metrics have predominated logistics support resource strategy selection policy. The *Guide* (pp. 8-11) also suggests nine supportability issues for use in logistics strategy design:

- Operations and maintenance personnel and staff-hour constraints,
- Personnel skill-level constraints,
- Lifecycle and Operations and Support (O&S) cost constraints,
- Target percentages of system failures correctable at each maintenance level,
- Mean down time in the operational environment,
- Turn-around time in the operational environment,
- Standardization and interoperability requirements,
- Built-in fault-isolation capability, and
- Transportability requirements (identification of conveyances on which the system and its components are transportable).

Only two of the nine (personnel skill-level constraints and operations and maintenance personnel and staff-hour constraints) reach beyond cost and logistic operations metrics. Acquisition procedures as specified in DoD 5000.2-R also emphasizes cost in assessing logistics strategies, saying “Life-cycle costs [...] shall play a key role in the overall [logistics support concept] selection process” (p.90).

While cost and logistic operations performance should and will remain a centerpiece of logistics support analysis, more recent DoD policy has shifted to increase the importance of other criteria in logistics support resource strategy design. The Acting USD (AT&L) has promulgated the Performance-based Logistics (PBL) approach (2004, January 23). Later that same year, the Under Secretary of Defense (AT&L) established the following high-level performance metrics for Performance-based Logistics (2004, August 16):

- Operational Availability,
- Operational Reliability,
- Cost per Unit Usage,
- Logistics Footprint, and
- Logistics Response Time.

Only one of these high-level performance metrics (Cost per Unit Usage) is cost based. The other four metrics address readiness (availability, reliability, and response time) and impacts of logistics (footprint). This clearly shows the importance of integrating non-cost logistics support issues into logistics support design, including resource strategy.

The Performance-based Logistics guidelines (DAU, 2005) also leave no doubt about the importance of non-cost factors in selecting a logistics support resource strategy. The Business Case Analysis requires:

> Consideration of performance and cost risk will explicitly consider contract versus organic risk management, financial accountability, and recovery actions. The risk assessment should address the probability and confidence

level of the following events: poor performance, cost growth, extended labor disputes, and changeover in PSI / PSP. (p. 3-30)

The guidelines explicitly describe the resource strategy addressed in the current work as an important logistics support design decision (Figure 2).

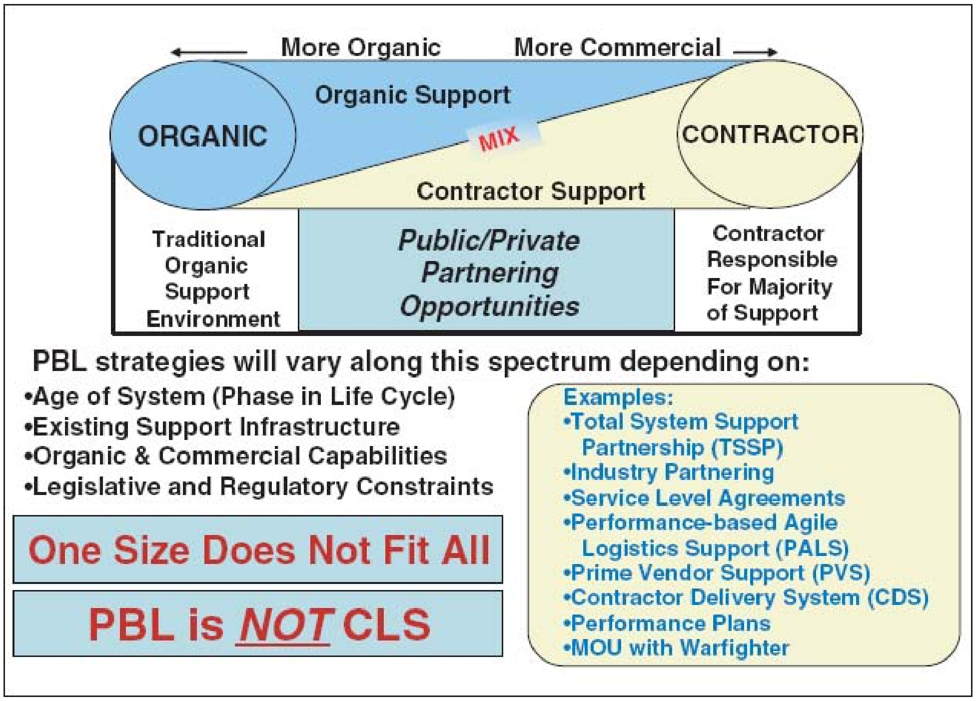

Figure 2. An Illustration of the Role of Logistics Resource Strategy in Performance-based Logistics
(DAU, 2005, p. 2-3)

Coryell's (2004) case study of logistic support in the Army's Stryker program demonstrates the role of non-cost factors in logistic support resource strategy design in implementing the PBL policy. A cost analysis was performed, suggesting the use of purely organic support (Figure 3). However, a different, non-cost issue drove the logistic support resource strategy design. Specifically, the design shifted from a primarily contracted strategy to a more blended strategy based on the differences in the flexibility of logistic support that could be provided by organic and contracted resources.

Cost Summary

(FY08-27)

FY06 Constant $s

	MANPOWER	SUPPLY SUPPORT	MAINTENANCE PLANNING
STATUS QUO ($4,172.5 M)	$935.8 M	$1,850.9 M	$1,385.8 M
ORGANIC ($3,784.7 M)	$531.3 M	$1,910.3 M	$1,343.1 M
COMBINED ($3,990.7 M)	$711.2 M	$1,909.9 M	$1,369.6 M

Cost of Recommendation = $3,810.8 M

10

Figure 3. Cost Analysis Results of Stryker Logistic Support Resource Strategies

(Coryell, 2004, p. 63, Figure 15)

Logistics Support Strategy Improvement Efforts

Several evaluations of DoD logistics support resource strategies have identified areas for improvement. The U.S. Government Accountability Office (GAO) found little data had been collected that could verify the cost effectiveness of logistics strategies (2002). The same report expressed concern over several aspects of logistics support, including:

- Ability to develop and maintain critical technical skills and knowledge,
- Deployment of contractors to the battlefield and how protecting and supporting these contractors may affect their troops' ability to accomplish their missions,
- Ability to shift funds in response to changing conditions, and
- Availability of affordable technical data to develop additional or new sources of repair and maintenance to ensure a competitive market.

Performance-based Logistics (PBL) is a major DoD effort to improve logistics support, including resource strategies. PBL explicitly addresses the resourcing issue.

The Business Case Analysis (BCA) portion of PBL is particularly relevant to the current work. The PBL guide (DAU, 2005) describes the BCA as "an expanded cost/benefit analysis created with the intent of determining a best-value solution for product support" (p. 3-27). The analysis includes much more than traditional economic factors such as cost, including:

- Performance measures,
- Capitalization/asset ownership,
- Size of footprint,
- Reliability growth,
- Lifecycle costs,
- Diminished manufacturing sources management,

- Obsolescence/Obsolescence mitigation plan,
- Technology insertion,
- Risk management,
- Minimum and maximum essential logistics capabilities (peacetime to full mobilization requirement),
- Existing infrastructure,
- Common consumables support,
- Reliability and maintainability forecasts at the major system,
- Supply chain responsiveness, and
- Surge capabilities.

Notice here the shift from a focus on cost (“expanded cost/benefit analysis”) to indentifying the broader “best-value solution.” The factors to be considered include many that are difficult or impossible to measure in monetary terms (surge capabilities) or even quantify (e.g., Technology insertion). The PBL BCA provides a useful enumeration of some of the non-cost factors that should be considered in logistics support resource strategy design. However, the guidelines provide little assistance about ***how*** to incorporate those factors into logistics support resource strategy design. The next section describes a tool for this purpose.

A Logistics Support Resource Strategy Map

As described, the features and characteristics of programs, their environments, and specific resource strategies vary widely, as do their impacts on logistics support. The qualitative nature of many important features and characteristics precludes the use of precise mathematical modeling for inclusion in logistics support resource strategy design. However, they can be structured in ways that facilitate objective assessment and inclusion in strategy design. Examples include the different types of flexibility that contracted, blended, and organic strategies provide programs. A useful tool for inclusive resource strategy design will identify and model both qualitative and quantitative features and characteristics and how they impact the attractiveness of different resourcing strategies. The incorporation of qualitative factors in strategy assessment can improve strategy selection by prompting decision-makers to use these factors in decision-making. It is important to note that ***the Logistics Support Resource Strategy Map does not replace critical thinking or analysis by the program management team, but can facilitate that thinking and analysis to improve logistics support resource strategy design.***

An Excel®-based Logistics Support Resource Strategy Map (Map) at Appendix B, has been developed to facilitate logistics support resource strategy design. The Map facilitates five aspects of designing a logistics support resources strategy for a specific set of requirements:

- Identifying and describing logistics support resource strategy criteria that are relevant for meeting specific logistics support requirements;
- Quantifying the relative importance of logistics support resource strategy criteria to meeting specific requirements or sets of requirements;
- Qualitative assessment of the degree to which the program and strategy (as they relate to the requirements) favor the use of organic resources, contracted resources, or a blend of organic and contracted resources;
- The quantification of the support for the use of contracted, blended, or organic resources to meet specific criteria and the aggregation of that support for sets

of criteria for specific requirements; this can facilitate the grouping of requirements for logistics support acquisition.

- The <u>aggregation</u> of priority-weighted support across criteria for comparison of different program strategies; and

- <u>Documentation</u> and support of logistics support resource strategy decisions for use in program reviews.

The sorting function in Excel® allows the reorganization of the criteria considered to facilitate team discussion and strategy assessment. For example, criteria can be sorted by those that apply to a particular logistics support requirement, by the type of criteria, or in descending order from those most supported by contracted resourcing to those least supported by contracted resourcing (Figure 4).

Logistic Support Resource Strategy Map

Importance of Criteria	Logistic Support Resource Strategy Criteria	Criteria Type	Logistic Support Requirement	Organic Logistic Support					Blended Logistic Support					Contracted Logistic Support	Reasoning behind assessment	Locations of supporting information	Level of Support for CLS (range: 0-10)	Priority-weighted level of Support for CLS (range: 0-10)	Cumulative level of Support for CLS (range: 0 - no. of criteria used)
				0	1	2	3	4	5	6	7	8	9	10					
				-----Assessment based on Specific Logistic Support Resource Strategy Criteria-----															
99	Lack of attractiveness to contractors of providing logisitic support	Business relations	all	Very High					--Balanced--					Very Low	Lack could be caused by low expected profit, high risk, little strategic value added to contractor, etc.		0	0.00	0.00
99	Legal and related vulnerability of CLS personnel	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty of measuring logistic support performance	Business relations	all	Very High					--Balanced--					Very Low			0	0.00	
99	Risks associated with a new CLS contractor	Business relations	all	Very High					--Balanced--					Very Low	"Very High" may suggest using a known contractor as well as OLS		0	0.00	
99	CLS unit cost to provide logistic support operations	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	CLS unit cost to supervise logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	CLS unit cost to manage logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	Cost of protecting non-military lostistic support personnel	Cost	all	Very High					--Balanced--					Very Low	May change over time. Consider specifying "when" assumed in assessment.		0	0.00	
99	Difficulty of CLS to transfer support to other profitable uses	cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Few potential CLS suppliers / potential for gouging / size of profits paid to CLS	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Dis-economies of scale (inverse of large economies of scale)	Cost	all	Very High					--Balanced--					Very Low	Suggested impact of assessment assumes CLS can better take advantage of economies of scale		0	0.00	
99	Cost of contracting (bidding, contract setup, contract enforcement)	Cost	all	Very High					--Balanced--					Very Low			0	0.00	

Figure 4. Partial Screenshot of ***Logistics Support Resource Strategy Map***

In addition, the Map facilitates the documentation of the strategy modeling. Each row in a Logistics Support Resource Strategy Map represents a specific criterion that may be used to assess a resource strategy to meet one or more support requirements. Each column of the Map describes a characteristic of the criteria, as follows:

- Importance of Criterion,
- Logistic Support Resource Strategy Criterion,
- Criterion Type,
- Logistic Support Requirement,
- Degree of Program & Strategy Support,
- Reasoning behind Assessment,
- Locations of Supporting Information,
- Degree of Support for Contracted Logistics Support,
- Priority-weighted Degree of Support for Contracted Logistic Support, and
- Cumulative Degree of Support for Contracted Logistics Support.

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Components of a Logistics Support Resource Strategy Map

Importance of Criterion (Column B in the spreadsheet)**:** This value is the quantified assessment of the relative importance of specific criteria in meeting the requirement named in Column E in the spreadsheet. Consistent with ranking criteria from the most to least important, smaller values indicate more important criteria. Duplicate use of the same importance value and fractional values are accommodated, but values less than one are to be avoided (see “Priority-weighted Degree of Support for CLS” below). All criteria are initially assessed to have essentially no importance (value = 99). This forces the program team to identify and select criteria to be used in assessment by assigning them a smaller importance value. Criteria that are not selected (i.e., value remains 99) are ignored in the quantitative assessments.

Logistics Support Resource Strategy Criterion (Column C in the spreadsheet): In this Map, 51 potential criteria are provided in 8 categories. These suggested criteria were developed based on a review of civilian and military logistics support literature. For example, Fine and Whitney (1996) group the reasons to make (organic support) or buy (contracted support) into issues of capacity and knowledge. They go on to discuss the roles of several factors in the make-buy (organic versus contracted) decision for product support—including the ability of a buyer to provide the support needed (more supports organic), relative costs, the quality of system performance, the criticality of the product to organizational success (more supports organic), the availability of qualified suppliers, product complexity, skill of suppliers, competitive advantages of suppliers, profit for suppliers. Parmigiani (2007) investigates the impact of product specificity (which would increase with product maturity) on firms’ tendency to outsource; her findings suggest increased maturity increases blended support over outsourcing and increases organic support over blended strategies. Military research also provided the basis for potential criteria. For example, Wild (2006) discusses the roles of direct (logistic operations) costs, indirect (logistic supervision and management) costs, transaction (contracting) costs, control (e.g., responsiveness), economies of scale (e.g., fleet size), internal capabilities, profits and competitive advantages (e.g., bargaining power), coordination of the value chain, and information and property rights in outsourcing by the DoD. Several of the criteria suggested by the literature were investigated by others in more depth to assess their applicability to DoD acquisition. For example, Coryell (2004) performs a case study of the shift from predominantly CLS to a more blended logistics support strategy in the Army's Stryker program. He concludes (p. 61) that the primary reason for the change was not cost, but the need for more flexibility in combat operations.

In the Logistic Support Resource Strategy Map all criteria are worded so that the more the criterion is met or is true, the stronger support is provided for an organic logistics support resource strategy. Criteria descriptions can be changed and customized to fit program needs; five spaces for new criteria are also provided. For example, one criterion that reflects logistics support costs is "CLS unit cost to provide logistics support operations." A very high value for this criterion (i.e. CLS costs are very high) supports the use of organic logistics support resources. The opposite is also true. The less the criterion is met (i.e., CLS costs are low), the more the criterion supports the use of contracted logistics support resources.

Criterion Type (Column D in the spreadsheet): Criteria are categorized as being one of eight types:

- Business relations,
- Cost,
- Funding,
- Information and technology,
- Labor resources,
- Logistics operations performance,
- Product characteristics,
- Program characteristics, and

- Program environments.

All criteria of a given type can be grouped to facilitate discussion and assessment by sorting.

Logistics Support Requirement (Column E in the spreadsheet): This cell for each criterion can be used to specify which logistics support requirements are being addressed with the strategy being assessed. This may be useful when a logistics support resource strategy is being assessed that has different requirements that may be addressed with different criteria. Requirement descriptions can be changed as needed to reflect program and strategy characteristics.

Degree of Program and Strategy Support (Columns F through P in the spreadsheet): The Map provides 11 possible degrees of program and strategy support for the use of organic support to meet requirements from “Very high,” which supports the use of organic resources, to “Very low,” which supports the use of contracted resources. All criteria are worded so that the more or better organic logistics support fills the criteria, the higher the assessment that is given (see “**Logistics Support Resource Strategy Criterion”** above). Therefore, an assessment of “Very High” indicates that using only organic resource strategy can meet the criterion very well; an assessment of “Very Low” indicates that using only contracted resource strategy can meet the criterion very well; and assessments between these extremes indicate the ability of various amounts of blended strategy to meet the criterion best. The degree of support that the strategy provides for filling the criteria with organic resources is indicated by inserting an “X” in the cell that represents the level of support.

Reasoning behind the Assessment (Column Q in the spreadsheet): Space is provided to document the basis for the assessed degree of support provided by the strategy to meet the criteria.

Locations of Supporting Information (Column R in the spreadsheet): Space is provided to document the location of information that supports the assessed degree of support provided by the strategy to meet the criteria with organic resources.

Degree of Support for CLS (Column S in the spreadsheet): The Map quantifies the assessed degree of support provided by the program and strategy to meet the criteria with organic, blended, or contracted resources into integer values from 0 to 10; these reflect the degree of support for contracted resources, with 0 reflecting little support for contracted resources (i.e., strong support for organic resources) and 10 representing strong support for contracted resources. The juxtaposition from increasing qualitative assessment supporting organic resources to increasing quantified support supporting contracted resources (i.e. "Very High" support for organic is assigned the lowest numerical value and vice versa) is purposeful and intended to assist the assessment team in adopting multiple perspectives for improved assessment and logistics support resource strategy planning.

Priority-weighted Degree of Support for CLS (Column T in the spreadsheet): The Map integrates the assessed importance of the criteria and degree of support into a priority-weighted degree of support for the use of contracted resources. Values range from 0 to 10 if the recommendations for assessing each criterion's importance described above are used,[2] with large values reflecting important criteria that strongly support the use of contracted resources and vice versa (less importance, less support for CLS, or both). These values are generated by dividing the degree of support (range = {0,10}) by the importance of the criteria (range = {1,98}). As an example, if a strategy of contracting all logistics support to a new contractor was being assessed, if the criterion "Risks associated with a new CLS contractor" were considered the most important criterion (Importance of Criteria = 1) and the risks were considered to be very low ("X" in "Very Low" cell, column P),

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[2] Assessments of criteria importance less than one generate Priority-weighted Degree of Support for CLS values that do not accurately reflect the relative positions of criteria due to division by very small values.

then the Priority-weighted Degree of Support for CLS would be 10 (= 10/1). In contrast, if the assessments for the same criterion for the same strategy were that the criterion was ranked third among criteria (Importance of Criterion = 3), and the risk was assessed to be between that for a balanced blended strategy and a contracted strategy (e.g., 8, “X” in column N) then the Priority-weighted Degree of Support for CLS would be 2.67 (=8/3). Note that the Priority-weighted Degree of Support for CLS directly (linearly) reflects the assessments of criteria importance and the strategies support of organic, blended, or contracted support. Values, or differences in values, are directly proportional to those assessments. For example, the change from a value of 10 to a value of 2.67 in the example above is the product of the reduction in the importance (8/10) and the support degree (1/3). *Users of the Map should not read more meaning or validity into these values than their underlying structure suggest.*

Cumulative Degree of Support for CLS (Column U in the spreadsheet)**.** The Map aggregates the Priority-weighted degrees of Support for CLS into a single quantitative value that represents the strategy’s overall support for CLS. This single value can be useful in comparing different logistics support resource strategies. This value is the sum of the Priority-weighted degrees of support for CLS for all criteria used for strategy assessment (importance < 99) divided by 10.[3] Possible values range from zero to the number of significant criteria. Note that, ceteris paribus (all else equal), a strategy that uses more criteria will have a larger Cumulative Degree of Support for CLS. Therefore, care must be taken in comparing strategies using the Cumulative Degree of Support for CLS to be sure that the strategy assessments use the same number of criteria.

Application Process for the Logistics Support Resource Strategy Map. The following steps can be used to describe and assess a set of logistics support requirements for resource strategy planning.

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[3] The sum is divided by ten solely to keep maximum value equal to the number of criteria used for assessment.

Phase I: Create Criterion/Requirements Sets for Assessment

1. **Develop a rich description of the logistics support resource strategy to be assessed.**

2. **Identify the logistics support requirements or sets of requirements to be supported by a single resource strategy**. Group requirements into sets that must be or are planned to be supported with the same logistics support resource strategy.

3. **Identify the rows that describe criteria to be used for assessment for each requirement set.** Use the criteria types and specific criteria suggested in the Map in columns C and D as a basis for discussing and indentifying criteria to be used to assess the resource strategy for each requirements set. Enter requirement set names or identifiers in the "Logistics Support Requirement(s)" column (E) of the rows of criteria to be used to assess each requirement set. Copy and insert entire rows of criteria needed for multiple requirement sets. Specify and add assessment criteria if required by altering criteria or entering additional criteria not listed into a row with a column C with the label "blank." To retain the Map's ability to consistently quantify the characterization of a program and strategy on the criteria, describe the criteria so that more of the criteria supports the use of Organic Logistics Support.

Phase II: Assess Criterion/Requirement Set Needs in Logistics Support Resources

4. **Assess and quantify the importance of each criterion.** Sort the rows of assessments ("Assessments" range) by Logistics Support Requirement (Column E) to gather the criteria being used to assess the resource strategy for different requirement sets. For each criterion/requirement set (i.e., each row), enter a number in the "Importance of Criterion" column (B) that reflects the relative importance of the criterion relative to the other criteria for that requirement set. Although almost all values are allowed,[4] it is suggested to restrict values to the range of 1 to 10—with 1 representing the most important criteria, and 10 representing the least important criteria. The Map can use multiple uses of the same importance value for different criteria and fractional importance values as well as unique integer values, but values less than one are to be avoided (see "Priority-weighted Degree of Support for CLS").

[4] The default value of 99 reflects criteria that are not used. Therefore, users must purposefully identify all criteria to be used by changing their importance value.

5. **<u>Qualitatively assess the support provided by different resource strategies.</u>** For each criterion/requirements set (i.e., each row), evaluate how well organic, blended, or contracted logistics support is expected to meet the criterion for the specified requirements set. State the assessment in terms of the ability of organic support to meet the criterion by answering the question, “Based on this criterion, how well do the program and proposed logistic support resource strategy support the use of organic logistics support?” with answers from “Very High” (which strongly supports the use of an organic strategy), “Balanced” (which suggests that there are both advantages and disadvantages to both organic and contracted support), or “Very Low,” (which strongly suggests that a contracted resource strategy can meet the criteria much better than an organic strategy). For example, if the contracted developer of a product to be supported owns critical product information, the assessment for the criterion “Availability/affordability of technical data to the DoD” would be “Low” or “Very Low,” supporting the use of contracted resources (the developer in this case). Assess each criterion in isolation, as if it were the only criterion impacting the logistics support resource strategy design.

6. **<u>Quantify support assessments.</u>** For each criterion/requirements set (i.e., each row), quantify assessments by entering the letter "X" in the appropriate box in Columns F through P. Assessments to the left (closer to “Very High”) indicate that an organic strategy outperforms a blended or contracted resource strategy for the specified criterion and requirements set. Use the letter “X” and only a single assessment for each criterion/requirement set if numerical estimates of support are desired. Upper and lower case “X”s are equivalent. Typing over existing text does not cause problems.

7. **<u>Document assessments.</u>** For each criterion/requirements set (i.e., each row), add notes in the “Reasoning behind assessment” cell that explain the basis for the assessment. Likewise, enter references to data, reports, etc., in the “Locations of supporting information” cell as pointers to support for the assessment.

Phase III: Review, Discuss, and Revise Assessments from Different Perspectives

8. **<u>Review the most important criteria</u>.** Sort criterion/requirement sets by “Importance of Criterion” in ascending order (select "Assessments" range, then Data/Sort/Column B, Smallest to Largest, no headers) to view the criteria assessed to be most important in logistics support resource strategy design. Review, discuss, and revise as required to reflect criteria importance. For example, criteria reflecting legal

constraints that must be met should be assigned a small value (e.g., one).

9. **<u>Review criteria that suggest support for Organic or Contracted Logistics Support</u>*.*** Sort criterion/requirement sets by "Degree of Support for CLS (0-10 scale)" in ascending order (select "Assessments" range, then Data/Sort/Column S, Smallest to Largest, no headers) to view the criterion/requirement sets that are most strongly supported by organic logistics support.[5] Review, discuss, and revise as required. Sort criterion/requirement sets by "Degree of Support for CLS (0-10 scale)" in descending order (select "Assessments" range, then Data/Sort/Column S, Largest to Smallest, no headers) to view the criterion/requirement sets that are most strongly supported by contracted logistics support. Review, discuss, and revise as required.

10. **<u>Review drivers of a contracted resource strategy</u>.** Sort criterion/requirement sets by "Priority-weighted degree of Support for CLS " in ascending order (select "Assessments" range, then Data/Sort/Column T, Smallest to Largest, no headers) to view the criterion/requirement sets that are both important and that strongly support a contracted resource strategy.

The Logistics Support Resource Strategy Map is designed primarily for qualitative assessment and the identification of shared and differing impacts of a resource strategy on logistics support. Assessments are based on the perceptions and judgments of program team members about the program, logistics support resource strategy issues and their impacts. Those impacts can suggest information to develop that will improve resource strategy design, groupings of support requirements for effective and efficient acquisition, possible or beneficial evolutionary paths of support that indicate changes in government management needs, or alternative logistic support resource strategies. However, the Map also uses those assessments to calculate degrees of support for Contracted Logistics Support (and, by inference, lack of support for OLS) that can support strategy design choices.

[5] Hiding rows with values of zero may facilitate viewing and review.

Example Application of the Logistics Support Resource Strategy Map

The use of the Logistics Support Resource Strategy Map will be illustrated with an application to the Predator A Unmanned Aerial Vehicle. See the attached tool as applied to the Predator A case and the following description of the application of the procedure above.

Phase I: Create Criterion/Requirements Sets for Assessment

Drew et al. (2005) provide a rich description of the Predator A program as it relates to logistics support (Step 1 in the Process for the Logistics Support Resource Strategy Map above). A brief summary is included in Appendix A. As described by Drew et al. (2005, p. 74),

> The Predator system consists of three elements—the air vehicle, the Ground Control Station (GCS), and the ground-based mission command and control station (CS). The GCS, which helps land and takeoff the air vehicle, is where the mission pilot is housed. The ground-based mission command and control station oversees the mission plan and its implementation, makes command decisions when needed, collects and disseminates the mission data, and interacts with higher Air Force echelons.

For simplicity and economy, the Logistics Support Resource Strategy Map was applied to the vehicle portion of the Predator system. Note that this choice by the authors implies two potentially important decisions in logistics support resource strategy design: 1) a disaggregation of the logistics support of the system into at least two parts, vehicle support and other support,[6] and 2) the provision of all vehicle support with a single resource strategy (all organic, blended, or all contracted). These choices effectively perform Step 2 in the Process for the Logistics Support Resource Strategy Map above. Therefore, the description of the Logistics

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[6] This choice at this point in the logistic support resource strategy design does not preclude adopting the same resource strategy for combinations of the vehicle, GCS, and CS.

Requirements for the example as being for “all,” refers only to the Predator A vehicle.

Figure 5. Predator A
(Drew et al., 2005)

Predator A Vehicle Logistics Support Resource Drivers

The Predator A program has a rich history. The portions that most strongly impacted the logistics support resourcing strategy for the vehicle are described here as the basis for illustrating the use of the Logistics Support Resource Strategy Map. See Appendix A of this study and Drew et al. (2005) for a more detailed description and analysis. The acquisition history of Predator A strongly influenced its logistics support resource strategy. Predator A was developed to fill a specific operational need for continuous Intelligence, Surveillance, and Reconnaissance ISR that was not being met. The program had strong support from multiple services, was in a rapid acquisition process (primarily bypassing the advanced development phase), and used accelerated production schedules to get units to the warfighters faster. The accelerated acquisition probably succeeded in delivering the product faster and reduced some oversight compared with traditional acquisition processes. However, it also imprinted the program with characteristics that impacted logistics support. Deployment occurred very quickly after successful testing. At that time, the developer was the only stakeholder knowledgeable enough about the vehicle to provide logistics support. No organic personnel existed with the requisite knowledge and skill sets to provide logistics support. In addition, the developer had paid for most of the development and, therefore, had a large influence on the amounts and types of information gathered about the vehicle and owned most of the available data on vehicle performance.

Program characteristics also impacted logistics in the Predator A case. Concept of Operations (CONOPS) requirements and mission needs were dynamic during and after first deployment. The developer was generally successful in responding to these changes. But in doing so, the developer became the sole holder of critical product knowledge. In addition, a $5 million-per-vehicle cost limitation required extensive vehicle knowledge to make the retrofits and improvements for the increased capabilities common in high-technology, fast-development products. These could only be performed by the developer.

DoD organizational issues also impacted Predator A logistics support resource strategy design. No Air Force specialty code exists that covers most of the Predator A's needs, limiting the availability of organic logistics support personnel. Training was conducted at Indian Springs Air Force Station in Nevada at a remote location considered unattractive by some military personnel. Training took two years, leaving only one year of productive work in a traditional three-year rotation.

Based on the available information on the program and its logistics, and using Step 3 above, the researchers considered 12 of the suggested possible criteria important in resource strategy design.

- Quantity of OLS logistics support operations labor pool relative to CLS,
- Quality of OLS logistics support operations labor pool relative to CLS,
- OLS ability to provide required skills relative to CLS,
- OLS availability of cross-trained personnel,
- Availability/affordability of reliability and/or maintainability data to the DoD,

- Minimum fleet size & replacement rate required to maintain continuous logistics support,
- Vulnerability of CLS personnel to battlefield threats,
- CLS unit cost to provide logistics support operations,
- OLS speed of deployment relative to CLS,
- Risk of labor disputes,
- Product immaturity (inverse of product maturity), and
- Classification of program and its logistics support as a core competence or mission of the DoD.

However, two important characteristics of the program that impacted logistics were not captured in the 12 criteria. The first was the impact of the $5 million-per-vehicle cap on required knowledge for retrofits and improvements. The second was the flexibility of the developer (but not organic resources) to react quickly to changing CONOPs and missions. Therefore, (in accordance with Step 3 above) two additional criteria were added:

- Ability of OLS vs. CLS to do upgrades within $5 million total-unit-cost cap, and
- Ability of OLS vs. CLS to react quickly to changing CONOPs and missions.

Phase II: Assess Criterion/Requirement Set Needs in Logistics Support Resources

The researchers assessed the importance of each of the resulting 14 criteria for designing the logistics support based on their understanding of the program (Step 4). For simplicity, we decided to use ordinal (integer) values to reflect the relative importance of criteria. Three criteria were considered most important and assigned the value one:

- Quantity of OLS logistics support operations labor pool relative to CLS,
- Quality of OLS logistics support operations labor pool relative to CLS, and

- Product immaturity (inverse of product maturity).

The first two criteria reflect the differences in the knowledge and specialized skills between the developer and the currently available organic logistics support work forces. Drew et al. (2005, p. 46) describe this difference as "The contractor work force comprises mostly skilled mechanics with exceptional knowledge of the air vehicle. By contrast, the Air Force does not hire highly skilled mechanics; it "raises" them," which is typical of organic support resources. The third criterion reflects the dynamic nature of the product and its requirements. The supporting information about the assessments of these criteria is captured in the "Reasoning behind assessment" cell for each criterion. Interestingly, this criterion and the two that were added are different criteria types—with product immaturity describing a product characteristic and reaction times measuring labor resources. This difference can facilitate identifying different logistics-support and risk-mitigation strategies.

Three of the criteria were assessed to be important but not as important as those above; they are assigned a value of two, followed by supporting notes from their "Reasoning behind assessment" cells:

- Ability of OLS vs. CLS to react quickly to changing CONOPs and missions—NEW CRITERIA ADDED
- OLS ability to provide required skills relative to CLS—No trained OLS staff
- Program and its logistics support are classified as a core competency or mission of the DoD—Fills critical ISR need. Expanded to strike capability. Strong command support for the program.

Two of the criteria were assessed to be next in importance and assigned a value of three, followed by supporting notes from their "Reasoning behind assessment" cells:

- Ability of OLS vs. CLS to do upgrades within $5 million total-unit-cost cap—Cap hinders retrofits (even to improve capabilities). Requires intimate vehicle knowledge to constrain retrofit cost.

- Availability/affordability of reliability and/or maintainability data to the DoD—Developer paid for most of development. Not developed/available.

Similarly, the remaining criteria were assessed the following importance values, followed by supporting notes:

- Minimum fleet size & replacement rate required to maintain continuous logistics support—4. Current fleet of 100 supports CLS. Fleet expected to grow 12+ vehicles/yr.
- Vulnerability of CLS personnel to battlefield threats—5. Forward sites require logistics support for takeoff, etc.
- OLS speed of deployment relative to CLS—5. None.
- CLS unit cost to provide logistics support operations—6. Slight advantage to CLS, see Drew et al. study).
- Risk of labor disputes—7. No indication of a risk but could become one.
- OLS availability of cross-trained personnel—8. None.

Each of the 14 criterion were then assessed for the ability of organic support to fulfill the criteria (Step 5) from “Very High” (value=0) to “Very Low” (value=10). Those assessments were then quantified with the selection of a degree in the spreadsheet (Step 6). These assessments were facilitated by the deep reflection of logistics issues required to perform the previous five steps. The quantified assessments were:

- Quantity of OLS logistics support operations labor pool relative to CLS—10
- Quality of OLS logistics support operations labor pool relative to CLS—10
- OLS ability to provide required skills relative to CLS—10
- Ability of OLS vs. CLS to react quickly to changing CONOPs and missions—10
- OLS availability of cross-trained personnel—9

- Availability/affordability of reliability and/or maintainability data to the DoD—8
- Minimum fleet size & replacement rate required to maintain continuous logistics support—8
- Vulnerability of CLS personnel to battlefield threats—8
- Ability to OLS vs. CLS to do upgrades within $5 million total-unit-cost cap—8
- CLS unit cost to provide logistics support operations—6
- OLS speed of deployment relative to CLS—5
- Risk of labor disputes—5
- Product immaturity (inverse of product maturity)—1
- Program and its logistics support are classified as a core competence or mission of the DoD—1

The degree of support for each criterion was assessed in isolation, as if the other criteria did not influence the assessment. For example, high product immaturity alone suggests the use of organic support based partially on the reasoning that the many changes require a deep understanding of and sensitivity to requirements and users, which organic support is more likely to be able to provide. But this assessment might shift more toward support of contracted support if the difference in product knowledge of organic and contracted support resources is incorporated into the assessment of the product immaturity.

Phase III: Review, Discuss, and Revise Assessments from Different Perspectives

The researchers then reviewed the assessment using the Map. To review the criteria assessed to be most important (Step 7), we sorted the criteria in ascending order of "Importance of Criteria." Our review of these criteria indicated that the quantity and quality of logistics support labor available are very important in the assessment, which is consistent with the hard requirement for very knowledgeable and specialized vehicle support. This review provided an opportunity to test the fidelity of the program as described in the Map, improve that fidelity, and build confidence in the Map's usefulness.

We then reviewed the assessment based on the degree of support for the use of contracted logistics support (Step 8); we did this by sorting the criteria in descending order based on the "Degree of Support for CLS." This review revealed that two of the three most important criteria and one of the criteria rated with an importance of two were assessed with the maximum degree of support for the use of contracted resources. This suggests that contracted logistics support may be the best strategy for the Predator A vehicle.

Finally, we reviewed the description of the drivers of a contracted strategy (Step 9) by sorting the criteria in descending order based on the "Priority-weighed degree of Support for CLS." Comparing this review with the previous one revealed that the top four criteria do not change; this consistency suggests that relative influence of the criteria on a design does not alter the suggested design based solely on support for organic or contracted resources. The fifth criterion, if support for CLS is the basis (Vulnerability of CLS personnel to battlefield threats), moves four places lower when importance is included in the assessment, suggesting that although this criterion suggests the use of contracted resources, it should have significantly less influence than other criteria.

Tool Evaluation and Implications for Practice

The Map and its methodology for its use have several advantages as a tool for facilitating logistics support resource strategy design. These include:

- **Provide framework for assessment** by providing structure of criteria and assessment methodology;
- **Provide support for improved assessment criteria identification** due to the extensive list of possible criteria;
- **Provide support for improved assessment quality** due to increased specification of criteria, focusing of assessment on organic, blended, and contracted resources, and signaling (with differing assessments) where more in-depth investigation may be needed;
- **Provide flexibility for adaptation** to many different types of programs and products;
- **High ease of use** due to basis in the widely used Excel® spreadsheet application;
- **High ease of understanding** by users due to its transparency (no hidden or locked cells or complex equations); and
- **Provides documentation** of both assessments and reasoning behind those assessments which can be used to support logistics support resource strategy designs in program reviews.

The Map and the methodology for its use also have weaknesses, including:

- **Illusion of objectivity** based on its use of a computer format, although assessments remain based on the judgments of the program team;
- **Lack of internal checks and balances;** the Map and methodology have no way of identifying if criteria have been overlooked, ignored, or assessed incorrectly.

The use of the Map by program teams can significantly improve logistics support resource strategy design processes through the advantages identified above. The Map can also improve program reviews by providing structured and clear documentation of the evaluation process used to design logistics support resource strategies. This documentation will allow easier and faster review, improvement, and approval of DoD programs. Doing so may help program teams to better manage the major acquisition challenge of logistics support resource strategy design.

Conclusions

The current research extends previous research on the costs of logistics support resource strategies by modeling the impacts of programs, environments, and strategies on resourcing with organic, blended, or contracted resources. The structure of the Logistics Support Resource Strategy Map and methodology for its use are designed for ease of understanding and adaptation by users. The Map and methodology were initially tested by application to the vehicle portion of the Predator A unmanned aerial vehicle system. This test indicated that the Map and its methodology can significantly improve logistics support resource strategy design and can facilitate managing program reviews by documenting a program team's assessment of the relative importance of specific program, environment, and strategy features and characteristics as they relate to logistics support resource strategy design and by focusing team assessments on resource design. However, the test also revealed that the successful use of the Map and its methodology is dependent on the deep reflection and evaluation of program team members. Additional validation and verification of the Map is needed to increase the confidence for its use in practice. This can be done by applying the Map to other DoD programs and by improving the Map and its methodology based on those tests.

As discussed above, the Logistics Support Resource Strategy Map is founded on the assessments of the program team. Poor or inadequately supported observations and assessments will generate poor results (i.e., garbage in—garbage out). Sensitivity tests by subject-matter experts can be used to improve user understanding of the impacts of different importance and assessment values on results. The results of such analyses can improve the Map's usefulness.

The Logistics Support Resource Strategy Map may improve DoD acquisition by improving logistics support resource design. In combination with other acquisition tools and methods, the Map can significantly improve program performance and reduce costs. The continued development and use of this and other tools for managing the acquisition process will provide better materiel to warfighters faster for less cost.

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Appendix A. Predator A Program Description as It Relates to Logistics Support

(taken primarily from Drew et al., 2005)

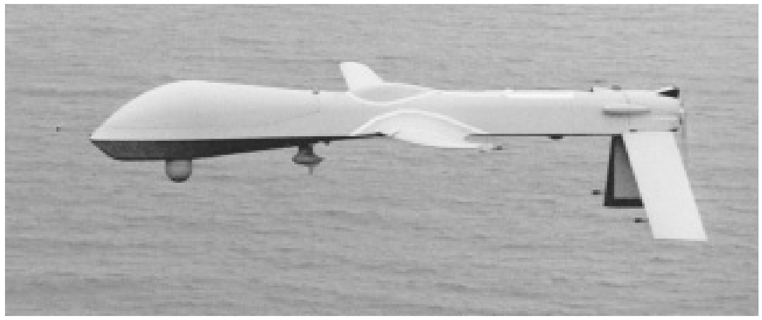
Predator Unmanned Aerial Vehicle is an offspring of an Advanced Concept Technology Demonstration (ACTD) program run by DARPA. Because survivability at these altitudes was thought to be questionable (the UAV was not to be stealthy), the unit cost of the vehicle had to be such that it could be viewed as expendable. The resulting unit cost cap was set at $5 million. Predator was first used in an operational context in Bosnia in July 1995, where it proved its operational utility. The resulting enthusiasm for rapidly fielding Predator led to a decision to forgo the normal acquisition approach and simply to make modifications to the vehicle as technology and money allowed. As a result, many of the normal activities associated with formal engineering development activity (now called SDD) did not occur. Among these were the lack of data, tools, and planning for long-term support of Predator. Moreover, the resulting financing did not allow the Air Force to redress some of these shortfalls, in part because the original cost cap of $5 million per plane was still in place.

The Predator System

The Predator system consists of three elements—the air vehicle, the Ground Control Station (GCS), and the ground-based mission command-and-control station (CS). The GCS, which helps the air vehicle land and take off, is where the mission pilot is housed. The ground-based mission command-and-control station oversees the mission plan and its implementation, makes command decisions when needed, collects and disseminates the mission data, and interacts with higher Air Force echelons.

The Air Vehicle

Predator A weighs about 2,250 lbs., has a wingspan of about 49 ft., and is powered by an internal-combustion engine adapted from a snowmobile motor. Predator A's relatively slow cruise speed hinders its ability to operate from a base that is more than 500 nmi from the desired target area. But its simple operation allows it to operate off very austere bases, enabling a reasonable number of basing options that are within flying range. The vehicle and all of its parts are designed to be easily transported in a C-130, which also can fly into and out of austere bases.



Predator A in Flight

The Ground Stations

Predator has both a forward-based GCS and a mission control station (CS). Originally, the GCS was housed in a large 40-ft trailer. However, it was determined that all that is needed at the remote forward location are the pilot stations. The trailer was abandoned, leaving a much smaller enclosure with just the pilot workstations. The ancillary equipment (for example, power generator) were also reduced in size, and the number of people located forward—the pilots and the personnel needed to support the vehicle and the GCS—became minimal. The GCS is designed to be readily deployable to austere sites that have little or no supporting infrastructure. Thus, it has been designed to be minimal in its capabilities and support needs, and is sufficiently small to permit deployment by small transport aircraft capable of landing at austere locations. The GCS plays a direct role in landings and takeoffs of the air vehicle and passes instructions to the vehicle while it is in flight. The GCS consists of two pilot stations, each with a joystick for piloting the vehicle, and a couple of displays that show the vehicle's status and flight-related data essential for successfully piloting the air vehicle. The GCS also has a direct LOS communication antenna and a larger antenna for communication to the vehicle via satellite relay. The LOS communications link is essential for piloting the vehicle when it is landing or taking off. Sending vehicle flight data to the GCS by means of a satellite relay would delay the pilot's reaction time—making it insufficient to make corrective maneuver instructions to save the vehicle under a number of realistic scenarios.

The BLOS communication link allows the GCS to fly the vehicle when it is performing its mission functions. The sensitivity of successfully flying the air vehicle to the time delay is much less if the vehicle is at altitude. The pilot has substantial time to detect the problem and make the corrective control instructions. The GCS also has a deployable differential GPS unit for providing precision landing data to Predator and the GCS. The mission CS is considerably larger. It consists of a large 40-foot trailer, a power generator, an air-conditioning unit, and a set of antennas (one being a 6-m antenna that receives the video data from the Predator). The CS needs external inputs to aid in situational awareness. These include information on target areas of interest from warfighting commanders as well as potentially dangerous areas where Predator might come under attack. When Predator is on station, targets of opportunity may arise, causing changes in Predator's mission plan. These may be handled exclusively by the CS or could involve consultation and coordination with the upper command echelons.

Deployment

Predator is routinely deployed from the United States to a forward location to perform its mission. Predator's main CONUS home base is Indian Springs Air Force Station, Nevada. The entire deployment package consists of the following: air vehicles; the GCS (and perhaps the CS); various ground-based antennas for communications to and from the air vehicle and between the GCS and CS; equipment for a differential GPS at the site; maintenance equipment (including spare parts); and personnel to operate the air vehicle, maintain it, and manage the base (for example, prepare food and provide security). For deployment, Predator's wings are removed, and the entire vehicle is put into a box for transporting to the desired location. Assembling or disassembling Predator's wings is simple, involving the removal of two connectors that hold the wings in place after they have been inserted into the fuselage. Because of the different missions Predator performs, and the potential for encountering icing conditions, each vehicle has multiple wings (for example, with and without weapon attachments, with and without de-icing capabilities). These wing kits give the mission planner the widest set of options for employing Predator's capabilities. The entire deployment package is airlifted to its planned forward operating location. The deployment package consists of two pallets that fit within a single C-130. The total size of the deployment might vary, with four air vehicle sets being the nominal for continuous operation (three to provide continuous coverage and a fourth as a spare in case of a vehicle loss). Planning calls for no more than 24 hours for deployment preparation and for 24 hours to achieve active status once reaching the deployment site. The deployment site is usually a remote site, away from any major air base, and is, at best, sparsely provisioned. Predator deployment means bringing essentially everything required for 30 days of operation. Moreover, Predator relies almost exclusively on continuing airlift support during the employment phase, as access to suitable ground transportation is not always possible.

At least in part because Predator is essentially hand-built, it has proven to be easily modified. For example, adding a Hellfire missile to its wings was quickly accomplished, along with suitable software for weapon employment. A laser designator was added to the mission ball, along with a laser tracker and the ability to track moving targets.

Survivability

The primary survivability measure available to Predator A is avoidance. This tactic requires good intelligence on the vehicle's location and flexible mission planning that provides safe routes to and from the target area of interest. Predator can also fly at altitudes where most IR SAM threats have poor performance and where ground-to-air artillery threats are minimal. Nevertheless, it is expected that modern SAMs will eventually be acquired by countries hostile to the United States (including those in the Third World). When this happens, Predator A will face higher attrition rates. This will negatively affect the number of the Predators needed to perform the mission.

Appendix B. Logistics Support Resource Strategy Map

The below illustrates contents of the authors' logistics support analysis tool, the Logistics Support Resource Strategy Map. This Excel®-based decision aid facilitates the strategy selection process and available from the authors directly.

Logistic Support Resource Strategy Map

Developed by David N. Ford and John Dillard
Naval Postgraduate School
September, 2008

Introduction

The Logistic Support Resource Strategy Map can facilitate program management teams in their design and assessment of logistic support resource strategies. Logistic support resource strategies are described by assessing how much the strategy causes different logistic support strategy criteria to support the use of an Organic Logistic Support (OLS), Contracted Logistic Support (CLS), or a blended approach that uses both organic and contracted support.

The Logistic Support Resource Strategy Map is designed primarily for qualitative assessment and the identification of shared and differing impacts of a resource strategy on logistic support. Those impacts can suggest information to develop, the grouping of support requirements for acquisition, evolution of support, or alternative strategies. However, the map also uses those assessments to calculate levels of support for Contracted Logistic Support (and by inference lack of support for OLS) that can support straqtegy design choices.

Criteria Types Provided

Business relations
Cost
Funding
Information and technology
Labor resources
Logistic operations performance
Product characteristics
Program characteristics
Program environment
You can add other criteria types.

Suggested Steps for Use:

A. Describe and Assess a Candidate Logistics Support Resource Strategy

1 **Review assessment criteria** (columns C and D). Enter any criteria not listed in a row with column C with "blank". Describe the criteria so that more of the criteria favors Organic Logistic Support.

2 **Identify the logistic support requirement or set of requirements being assessed** as a single unit.

3 For the selected logistic support requirement(s), **identify the rows that describe important criteria** (Column C) in assessing the resourcing of logistic support for that requirement(s). Enter the requirement in the "Logistic Support Requirement(s)" column (E) of that row.

4 In the "Importance of Criteria" column (B) **enter a number 1-10 that reflects the relative importance of the criteria**. 1=most important, 10=least important. Default=99= not important or not a factor. Ties and decimals are okay.

5 **Assess the criteria for the requirement.** Mark the assessment with an "X" in the appropriate box. Type over existing text. Case does not matter, but use "X" or "x" if you want numberical estimates of support for CLS.

6 Repeat steps 3-5 above for the other logistic support requirements being assessed.

B. Evaluate the Candidate Logistics Support Resource Strategy

- ***To see the most important criteria*** select the "Assessments" range in the name box and sort "Importance of Criteria" in acending order (Data/Sort/Column B, Smallest to Largest, no headers)
- ***To see the criteria that the assessment suggests is best supported by Contracted Logistic Support*** select the "Assessments" range in the name box and sort "Level of Support for CLS (0-10 scale)" (Col. S) in decending order (Data/Sort/Column S, Largest to Smallest, no headers)
- ***To sort by amount of support for Contracted Logistic Support*** (Col. S) select the range "Assessments" in the name box and sort ""in acending importance (Data/Sort/"Importance", Ascending,Headers)
- ***To sort by criteria type*** select the "Assessments" range in the name box and sort "Criteria Type" (Data/Sort/Criteria Type, , "A to Z" or "Z to A", no headers)

Notes:

These instructions assume a basic competence in using Microsoft Excel.

(Step 3) To find specific criteria more easily select the "Assessments" range in the name box and sort "Criteria Type" in "A to Z" order (Data/Sort/Criteria Type, A to Z, no headers) or search for keywords (Home/Find & Select/Find.../keyword, Find Next).

(Step 4) Differing importance assessments for a requirement may indicate the need to clarify the impacts of not meeting the requirement or a need to disaggregate the requirement. Add new rows as needed to separate support resourcing impacts.

(Step 5) Differing assessments for a requirement may indicate the need to disaggregate the requirement. Add new rows as needed to separate support resourcing impacts.

Logistic Support Resource Strategy Map

Importance of Criteria	Logistic Support Resource Strategy Criteria	Criteria Type	Logistic Support Requirement	Organic Logistic Support 0	1	2	3	4	Blended Logistic Support 5	6	7	8	9	Contracted Logistic Support 10	Reasoning behind assessment	Locations of supporting information	Level of Support for CLS (range: 0-10)	Priority-weighted level of Support for CLS (range: 0-10)	Cumulative level of Support for CLS (range: 0 - no. of criteria used)
				----Assessment based on Specific Logistic Support Resource Strategy Criteria----															
99	Lack of attractiveness to contractors of providing logisitic support	Business relations	all	Very High					--Balanced--					Very Low	Lack could be caused by low expected profit, high risk, little strategic value added to contractor, etc.		0	0.00	0.00
99	Legal and related vulnerability of CLS personnel	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty of measuring logistic support performance	Business relations	all	Very High					--Balanced--					Very Low			0	0.00	
99	Risks associated with a new CLS contractor	Business relations	all	Very High					--Balanced--					Very Low	"Very High" may suggest using a known contractor as well as OLS		0	0.00	
99	CLS unit cost to provide logistic support operations	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	CLS unit cost to supervise logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	CLS unit cost to manage logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	Cost of protecting non-military lostistic support personnel	Cost	all	Very High					--Balanced--					Very Low	May change over time. Consider specifying "when" assumed in assessment.		0	0.00	
99	Difficulty of CLS to transfer support to other profitable uses	cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Few potential CLS suppliers / potential for gouging / size of profits paid to CLS	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Dis-economies of scale (inverse of large economies of scale)	Cost	all	Very High					--Balanced--					Very Low	Suggested impact of assessment assumes CLS can better take advantage of economies of scale		0	0.00	
99	Cost of contracting (bidding, contract setup, contract enforcement)	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Min. (fleet size & replacement rate) required to maintain continuous logistic support / (fleet size & replacement rate)	Cost	all	Very High					--Balanced--					Very Low	OLS with fleet size below min. can result is slack resources that increase costs over logistic needs. Assumes CLS can reallocate slack resources.		0	0.00	
99	Cost of monitoring and managing CLS relative to same for OLS	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Potential need to to shift government funds in response to changing conditions	Funding	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS access to improved technologies, business practices, commercial transportation, etc. relative to CLS	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability/affordability of reliability and/or maintainability data to DoD	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability/affordability of technical data to DoD	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS speed of deployment relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS availability of cross-trained personnel	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quantity of OLS logistic support operations labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quality of OLS logistic support operations labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support operations labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quantity of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quality of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quantity of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quality of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Maximum allowed CLS deployment duration relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS ability to provide supply and support locations relative to CLS ability	Labor resources	all	Very High					--Balanced--					Very High			0	0.00	
99	Availability of logistic support operations resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low	Consider flexibility in compensation, max possible deployment duration,		0	0.00	

<-- Sum of priority-weighted levels of support for CLS. Useful for comparing different logistic support resource strategies

Importance of Criteria	Logistic Support Resource Strategy Criteria	Criteria Type	Logistic Support Requirement	Organic Logistic Support 0	1	2	3	4	Blended Logistic Support 5	6	7	8	9	Contracted Logistic Support 10	Reasoning behind assessment	Locations of supporting information	Level of Support for CLS (range: 0-10)	Priority-weighted level of Support for CLS (range: 0-10)	Cumulative level of Support for CLS (range: 0 - no. of criteria used)
				----Assessment based on Specific Logistic Support Resource Strategy Criteria----															
99	OLS flexibility in hiring/firing or reassignemnt relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS ability to provide required skills relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability of logistic support supervisory resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability of logistic support management resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Risk of labor disputes	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Sensativity of product information	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Product simplicity (inverse of product complexity)	Product characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Product immaturity (inverse of product maturity)	Product characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty of commoditizing product or support	Product characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty and size of integrating the logistic value chain	Program characteristic	all	Very High					--Balanced--					Very Low	Whether this supports OLS or CLS may depend on the different abilities of candidate OLS and CLS.		0	0.00	
99	Mean time between failures, repair cyle time, repair costs, other perf. metrics	Logistic ops performance	all	Very High					--Balanced--					Very Low	Disaggregate into separate performance metrics if assessements vary across metrics		0	0.00	
99	Vulnerability of CLS personnel to battlefield threats	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Need for flexibility in logistics support for surges & contingencies	Program characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Need for OLC to develop / maintain organic logistic knowledge and skills	Program characteristic	all	Very High					--Balanced--					Very Low	May support blended strategy with cross-training. Consider other OLS learning opportunities		0	0.00	
99	Importance of chain of command for logistic support success	Program environment	all	Very High					--Balanced--					Very Low	Some field commanders areuncomfortable with non-military personnel in or near battlefields		0	0.00	
99	Discomfort of military leaders with non-military / non-federal civilian personnel	Program environment	all	Very High					--Balanced--					Very Low	May be more of an issue if CLS will use local resouces		0	0.00	
99	Minimum OLS depot maintenance and repair (50/50 requirement)	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Reputation risk of program if CLS underperforms or otherwise misperforms	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Ability to meet logistic support needs in face of force structure reductions	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Program and its logistic support is a core compentency or mission of DoD	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Describe so that "Very High" supports OLS and "Very Low" support CLS.		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	

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Appendix C. Logistics Support Resource Strategy Map as it Might be Applied to the Predator A Program

The below illustrates application of the Logistics Support Resource Strategy Map using the notional example of an unmanned aerial vehicle program.

Logistic Support Resource Strategy Map: Predator Example

Importance of Criteria	Logistic Support Resource Strategy Criteria	Criteria Type	Logistic Support Requirement	Organic Logistic Support 0	1	2	3	4	Blended Logistic Support 5	6	7	8	9	Contracted Logistic Support 10	Reasoning behind assessment	Locations of supporting information	Level of Support for CLS (range: 0-10)	Priority-weighted level of Support for CLS (range: 0-10)	Cumulative level of Support for CLS (range: 0 - no. of criteria used)
				-----Assessment based on Specific Logistic Support Resource Strategy Criteria-----															
1	Quantity of OLS logistic support operations labor pool relative to CLS	Labor resources	Vehicle Maint & Repair	Very High					--Balanced--					x	No comprehensive specialty code. No trained OLS pool or career path. Changes with development of AF reserve guard or support	Rand p. 41	10	10.00	4.43
1	Quality of OLS logistic support operations labor pool relative to CLS	Labor resources	Vehicle Maint & Repair	Very High					--Balanced--					x	Only development firm knows the vehicle		10	10.00	
2	Ability of OLS vs. CLS to react quickly to change CONOPs and missions	Labor resources	Vehicle Maint & Repair	Very High					--Balanced--					x	NEW CRITERIA ADDED	Rand p . 46, 49	10	5.00	
2	OLS ability to provide required skills relative to CLS	Labor resources	Vehicle Maint & Repair	Very High					--Balanced--					x	No trained OLS staff		10	5.00	
8	OLS availability of cross-trained personnel	Labor resources	all	Very High					--Balanced--				X	Very Low			9	1.13	
3	Ability to OLS vs. CLS to do upgrades within $5mill total unit cost cap.	Cost	Vehicle retrofits & upgrades	Very High					--Balanced--			X		Very Low	Cap hinders retrofits (even to improve capabilities). Requires intimate vehicle knowledge to constrain retrofit cost.*	Rand p. 42	8	2.67	
3	Availability/affordability of reliability and/or maintainability data to DoD	Information and technology	Vehicle	Very High					--Balanced--			X		Very Low	Developer paid for most of development - not developed/available.	Rand p 19, 49	8	2.67	
4	Min. (fleet size & replacement rate) required to maintain continuous logistic support / (fleet size & replacement rate)	Cost	vehicles	Very High					--Balanced--			X		Very Low	Current fleet of 100 supports CLS. Fleet expected to grow 12+ vehicles/yr.	Rand p.73-4	8	2.00	
5	Vulnerability of CLS personnel to battlefield threats	Program characteristic	all	Very High					--Balanced--			X		Very Low	Forward sites require logistic support for takeoff etc.	Rand p. 46	8	1.60	
6	CLS unit cost to provide logistic support operations	Cost	all??????	Very High					--Balance	X				Very Low	Slight advantage to CLS.	Rand p. 44-6	6	1.00	
5	OLS speed of deployment relative to CLS	Labor resources	all	Very High					X					Very Low			5	1.00	
7	Risk of labor disputes	Labor resources	all	Very High					X					Very Low	No indication of a risk but could become one.		5	0.71	
1	Product immaturity (inverse of product maturity)	Product characteristic	all	Very High	X				--Balanced--					Very Low	ACTD extension. Prototype became production vehicle	Rand p. 20	1	1.00	
2	Program and its logistic support is a core compentency or mission of DoD	Program environment	all	Very High	X				--Balanced--					Very Low	Fills critical ISR need. Expanded to strike capability. Strong command support for the program.		1	0.50	
99	Risks associated with a new CLS contractor	Business relations	all	Very High					--Balanced--					Very Low	"Very High" may suggest using a known contractor as well as OLS		0	0.00	
99	Lack of attractiveness to contractors of providing logisitic support	Business relations	all	Very High					--Balanced--					Very Low	Lack could be caused by low expected profit, high risk, little strategic value added to contractor, etc.		0	0.00	
99	Difficulty of measuring logistic support performance	Business relations	all	Very High					--Balanced--					Very Low			0	0.00	
99	CLS unit cost to supervise logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	CLS unit cost to manage logistic support	Cost	all	Very High					--Balanced--					Very Low	Consider relative workforce sizes, deployment lengths, impacts of competition		0	0.00	
99	Cost of protecting non-military logistic support personnel	Cost	all	Very High					--Balanced--					Very Low	May change over time. Consider specifying "when" assumed in assessment.		0	0.00	
99	Difficulty of OLS to transfer support to other profitable uses	cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Few potential CLS suppliers / potential for gouging / size of profits paid to CLS	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Dis-economies of scale (inverse of large economies of scale)	Cost	all	Very High					--Balanced--					Very Low	Suggested impact of assessment assumes CLS can better take advantage of economies of scale		0	0.00	
99	Cost of contracting (bidding, contract setup, contract enforcement)	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Cost of monitoring and managing CLS relative to same for OLS	Cost	all	Very High					--Balanced--					Very Low			0	0.00	
99	Potential need to to shift government funds in response to changing conditions	Funding	all	Very High					--Balanced--					Very Low			0	0.00	
99	CLS access to improved technologies, business practices, commercial transportation, etc. relative to CLS	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability/affordability of technical data to DoD	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Sensativity of product information	Information and technology	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support operations labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	

Importance of Criteria	Logistic Support Resource Strategy Criteria	Criteria Type	Logistic Support Requirement	Organic Logistic Support 0	1	2	3	Blended Logistic Support 4	5	6	7	8	9	Contracted Logistic Support 10	Reasoning behind assessment	Locations of supporting information	Level of Support for CLS (range: 0-10)	Priority-weighted level of Support for CLS (range: 0-10)	Cumulative level of Support for CLS (range: 0 - no. of criteria used)
				----Assessment based on Specific Logistic Support Resource Strategy Criteria----															
99	Quantity of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quality of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support supervisory labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quantity of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Quality of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Flexibility of OLS logistic support management labor pool relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Maximum allowed CLS deployment duration relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	OLS ability to provide supply and support locations relative to CLS ability	Labor resources	all	Very High					--Balanced--					Very High			0	0.00	
99	Availability of logistic support operations resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low	Consider flexibility in compensation, max possible deployment duration,		0	0.00	
99	OLS flexibility in hiring/firing or reassignemnt relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability of logistic support supervisory resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Availability of logistic support management resources by OLS relative to CLS	Labor resources	all	Very High					--Balanced--					Very Low			0	0.00	
99	Mean time between failures, repair cyle time, repair costs, other perf. metrics	Logistic ops performance	all	Very High					--Balanced--					Very Low	Disaggregate into separate performance metrics if assessements vary across metrics		0	0.00	
99	Product simplicity (inverse of product complexity)	Product characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty of commoditizing product or support	Product characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Difficulty and size of integrating the logistic value chain	Program characteristic	all	Very High					--Balanced--					Very Low	Whether this supports OLS or CLS may depend on the different abilities of candidate OLS and CLS.		0	0.00	
99	Need for flexibility in logistics support for surges & contingencies	Program characteristic	all	Very High					--Balanced--					Very Low			0	0.00	
99	Need for OLC to develop / maintain organic logistic knowledge and skills	Program characteristic	all	Very High					--Balanced--					Very Low	May support blended strategy with cross-training. Consider other OLS learning opportunities		0	0.00	
99	Importance of chain of command for logistic support success	Program environment	all	Very High					--Balanced--					Very Low	Some field commanders areuncomfortable with non-military personnel in or near battlefields		0	0.00	
99	Discomfort of military leaders with non-military / non-federal civilian personnel	Program environment	all	Very High					--Balanced--					Very Low	May be more of an issue if CLS will use local resouces		0	0.00	
99	Minimum OLS depot maintenance and repair (50/50 requirement)	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Reputation risk of program if CLS underperforms or otherwise misperforms	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Ability to meet logistic support needs in face of force structure reductions	Program environment	all	Very High					--Balanced--					Very Low			0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Describe so that "Very High" supports OLS and "Very Low" support CLS.		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	
99	Other	specify	all	Very High					--Balanced--					Very Low	Be sure that "Very High" supports OLS and "Very Low" support CLS		0	0.00	

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- Managing Services Supply Chain
- MOSA Contracting Implications
- Portfolio Optimization via KVA + RO
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- Software Requirements for OA
- Spiral Development
- Strategy for Defense Acquisition Research
- The Software, Hardware Asset Reuse Enterprise (SHARE) repository

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- Joint Contingency Contracting
- Model for Optimizing Contingency Contracting Planning and Execution
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