INSTITUTE FOR DEFENSE ANALYSES

Improving the Quality and Use of Analysts and Analytics in the Department of Defense

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Executive Summary

On August 22, 2019, the Principal Deputy Director of Cost Assessment and Program Evaluation (CAPE) engaged the Institute for Defense Analyses (IDA) to assess the current state of analytics to support senior decision makers in the Department of Defense (DOD), identify best practices and areas of deficiency, and make concrete recommendations for actions that could be taken to raise the standard of analytic excellence throughout the Department.

IDA assessed three key aspects of DOD analysis: (1) the development and quality of DOD analysts, (2) the characteristics and quality of DOD analysis, and (3) the manner in which analysis requirements are developed and analysis is used in the Department. To this end, IDA pursued three basic lines of effort:

- First, the IDA team conducted roughly 25 interviews of analysts, leaders of analytic organizations, and leaders who use analysis, including both current and former DOD officials.
- Second, the team assessed 41 examples of recent analysis that were collected by CAPE and by IDA from a variety of DOD analytic organizations.
- Finally, IDA analyzed personnel data from the Defense Manpower Data Center (DMDC) and other sources to assess analysts, analyst training, and analyst career tracks.

Chapter 1 of this report provides a brief introduction. Chapter 2 provides background on principles of analysis and the use of analysis at DOD. Chapter 3 explains each of the major lines of effort pursued in this review. Section 3.A discusses IDA's interviews of analysts, leaders of analytic organizations, and leaders who use analysis. Section 3.B discusses IDA's review of sample analyses collected by CAPE and by IDA from a variety of DOD analytic organizations. Section 3.C discusses IDA's review of personnel data from the Defense Manpower Data Center (DMDC) and other sources. Chapter 4 discusses IDA's nine findings regarding areas of potential improvement, along with a set of recommendations for addressing each finding. Appendix A includes the full text of IDA's findings and recommendations.

IDA's findings and recommendations are summarized as follows:

Finding 1: Leaders who value analysis and engage with analysts are more likely to get good analysis. Too many leaders rely on their own instincts rather than looking to analysis to inform decisions.

Recommendation 1: Examples of impactful analysis should be taught in leadership schools and courses. Analyst career paths should be designed to bring analysts into greater contact with future leaders (and vice versa).

Finding 2: Effective analysis addresses the issues that matter the most, including important issues that do not require immediate decision. Addressing the issue of the day should not be allowed to crowd out longer-term analysis having substantial impact.

Recommendation 2: CAPE should work to establish an analytic agenda for the Department and set aside analytic resources for in-depth analyses that help shape the debate on major issues of substantial importance to the Department.

Finding 3: Good analysis flows from good questions. Framing the question well is foundational. The key is communication and iteration between leaders and analysts.

Recommendation 3: CAPE should make a clear channel of communication with senior leaders one of the basic principles for good analysis in the Department.

Finding 4: A strong analytic team needs members with a high degree of technical proficiency, relevant operational experience, and the ability to synthesize to take apart and frame an issue, understand the significance of key assumptions, and identify potential flaws or gaps in tools and data.

Recommendation 4**:** To ensure the Department's ability to form strong analytic teams, CAPE should establish itself as the functional career advocate to foster training and career development for military and civilian analysts in the Department. Each of the military departments should designate its own functional career advocate for the same purposes.

Finding 5: Good analysis includes the selection of tools that match the issues to be addressed and the recognition that no model can offer perfect insights. Good analysts need to be aware of the full range of tools available and their appropriate use.

Recommendation 5: CAPE should invest in state-of-the-art analytic tools, advocate for the fielding of information technology (IT) systems and networks that enable access to widely available analytic tools, work to improve wargaming processes, and initiate the development of common scenarios and concepts of operation (CONOPS) to serve as a baseline for cross-service and joint analysis.

Finding 6: An analysis is only as good as the data on which it is based. Analysis that is built on small and/or imperfect datasets or that applies sophisticated techniques that are not warranted by the data is not likely to provide useful insights.

Recommendation 6: CAPE should actively encourage the systematic collection and curation of key DOD data and make the preservation of analytic products and supporting data one of the basic principles for good analysis in the Department.

Finding 7: Good analysts should "be fearless." They should have the courage to tell the leadership the results of the analysis and defend those results. Good analysts should always listen to and learn from multiple sources of competing information and seek to provide objective, accurate information without becoming advocates.

Recommendation 7: CAPE should make independence and objectivity one of the basic principles for good analysis. CAPE should routinely use and should encourage analytic organizations across the Department to routinely use independent review to ensure that their analytic products live up to this standard.

Finding 8: Analysis is only effective if it can be clearly communicated to the decision makers who will use it. Effective analytic products should be succinct and cogently answer the questions asked on the basis of clear evidence without emotional appeals.

Recommendation 8**:** To ensure that issues are fully thought through, deficiencies or gaps are identified and addressed and that the basis for findings and recommendations is preserved and available to future decision makers, DOD analysts should prepare written summaries for different levels of leadership. Where possible, working analysts should attend senior leader meetings to better understand leadership perspectives and help avoid misunderstandings about the analysis.

Finding 9: The single most important thing that CAPE can do to promote good analysis in the Department is to conduct excellent analysis itself and use this analysis to continually challenge the military services and Defense components to produce the same.

Recommendation 9: CAPE should retain a sufficient pool of analytic resources (in-house and extramural) to carry out superior analysis on a sustained basis.

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1. Introduction

On August 22, 2019, the Principal Deputy Director of Cost Assessment and Program Evaluation (CAPE) engaged the Institute for Defense Analyses (IDA) to assess the current state of analytics to support senior decision makers in the Department of Defense (DOD), identify best practices and areas of deficiency, and make concrete recommendations for actions that could be taken to raise the standard of analytic excellence throughout the Department. Because some form of analysis is or could be used to support virtually every major decision that the DOD makes, maintaining a high quality of analysis is critical to the successful accomplishment of the missions and objectives of the Department.

In accordance with the tasking, IDA examined three key aspects of DOD analysis. First, IDA sought to assess the development and quality of analysts by examining the characteristics of good analysts and the recruitment, training, and career paths that can be expected to foster such characteristics. Second, IDA sought to assess the quality of analysis and the manner in which it is produced by examining the characteristics of good analysis and the practices and principles that contribute to such analysis. Finally, IDA sought to assess the manner in which analysis requirements are developed and prioritized and to identify best practices for ensuring that analysis makes a positive contribution to the decision-making processes of the Department.

After reviewing the relevant literature, IDA undertook three basic lines of effort to make these assessments. First, the IDA team conducted roughly 25 interviews of analysts, leaders of analytic organizations, and leaders who use analysis, including current and former DOD officials. Second, the team assessed 41 examples of recent analysis that were collected by CAPE and by IDA from a variety of DOD analytic organizations. Finally, IDA analyzed personnel data from the Defense Manpower Data Center (DMDC) and other sources to assess analysts, analyst training, and analyst career tracks.

This paper recommends a series of steps that the Director of Cost Assessment and Program Evaluation (DCAPE) could take to improve the Department's analytic performance in each of nine areas. These recommendations use four levers available to the Director to influence the development of analysts, the quality of analysis, and the prioritization and use of analysis in the Department: (1) take direct action to shape the development and work of the CAPE staff, (2) review the products of other analytic organizations in the Department and issue guidance for future work, (3) advocate and work with the Secretary and Deputy Secretary of Defense to direct action by other DOD components, and (4) assert a role as functional career advocate for DOD analysts and work with analytic

leaders in the military departments to foster the development of needed skills and capabilities throughout the Department.

Chapter 2 of this report provides background on principles of analysis and the use of analysis at DOD. Chapter 3 explains each of the major lines of effort pursued in this review. Section 3.A discusses IDA's interviews of analysts, leaders of analytic organizations, and leaders who use analysis. Section 3.B discusses IDA's review of sample analyses collected by CAPE and by IDA from a variety of DOD analytic organizations. Section 3.C discusses IDA's review of personnel data from the Defense Manpower Data Center (DMDC) and other sources. Finally, Chapter 4 discusses the findings and recommendations arising out of IDA's assessment.

There is no set formula for producing quality analysts, no set of recommendations that can ensure the quality of an analytic product, and no guarantee that senior leaders will heed the recommendations of even the best analysis. In general, however, informed decision making is unlikely without quality analysis, and quality analysis is unlikely to be produced without a good analytic team. The recommendations in this paper, if implemented, should advance efforts to produce quality analysis and contribute to sound decision-making processes, thereby supporting the successful accomplishment of the Department's national security missions and objectives.

2. Background

Analysis is the process of examining relevant information to inform conclusions and support decision making. There are as many types of analysis as there are types of decisions in the Department. For example, DOD Instruction (DODI) 7041.03 states that "[t]he purpose of economic analysis is to give the decision maker insight into economic factors bearing on accomplishing … objectives."[1] Similarly, Quade and Boucher define systems analysis as "a systematic approach to helping a decisionmaker choose a course of action by investigating his full problem, searching out objectives and alternatives, and comparing them in the light of their consequences, using an appropriate framework – in so far as possible analytic – to bring expert judgment and intuition to bear on the problem."[2]

In the seminal work, *How Much is Enough*, Enthoven and Smith argue that quality analysis is a foundation of strong leadership, enabling a senior decision maker to challenge, question, propose, and resolve disputes instead of "merely serving as a referee or a helpless bystander."[3] There are many theories on how good analysis is best produced. For example, a 2005 book on policy analysis outlines an eight-step analytic process: (1) define the problem, (2) assemble some evidence, (3) construct the alternatives, (4) select the criteria, (5) project the outcomes, (6) confront the tradeoffs, (7) decide, and (8) tell the story.[4] A 2017 book on decision analysis also offers eight steps, but they are almost completely different: (1) problem statement, (2) issue raising, (3) situation analysis, (4) stakeholder analysis, (5) objectives hierarchy, (6) decision hierarchy, (7) modeling, and (8) estimate the value of information.[5]

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1 Department of Defense, "Economic Analysis for Decision-Making," DODI 7041.03 (Washington, DC: DCAPE, September 9, 2015, Incorporating Change 1, October 2, 2017), 7, https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/704103p.pdf?ver=2019-08-12-152105-700.

2 E. S. Quade, "Introduction," in *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), eds., E. S. Quade and W. I. Boucher (Santa Monica, CA: RAND Corporation, June 1968), 2, https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.

3 Alain C. Enthoven and K. Wayne Smith, *How Much Is Enough? Shaping the Defense Program, 1961–1969*, CB-403 (Santa Monica, CA: RAND Corporation, 1971), 80, https://www.rand.org/pubs/commercial_books/CB403.html.

4 Eugene Bardach, *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*, 2nd ed. (Washington, DC: CQ Press, 2005).

5 David Charlesworth, *Decision Analysis for Managers: A Guide for Making Better Personal and Business Decisions*, 2nd ed. (New York, NY: Business Expert Press, 2017).

Perhaps the best lesson to draw from these varied prescriptions is that there is no single formula for producing good analysis. While it may be helpful for an analyst to consider the various processes suggested in guidebooks and instruction manuals, the most important step an analyst can take is to think for himself or herself. In this spirit, Quade and Boucher offer eleven "principles of good analysis," with an emphasis on the need for flexibility and judgment:

1. Efficient use of expert judgment is the essence of analysis.
2. Choice of the right objectives is essential.
3. Sensitivity testing is important.
4. The design of alternatives is as important as their analysis.
5. Interdisciplinary teams are usually necessary.
6. The analysis of questions of R&D [research and development] should not emphasize optimization.
7. For broad questions, comparisons for a single contingency are not enough.
8. Partial answers to relevant questions are more useful than full answers to empty questions.
9. Estimates of cost are essential to a choice among alternatives.
10. The decision maker by his actions can compensate to an extent for partial analysis.
11. A good new idea is worth a thousand evaluations.[6]

Analysis is conducted at all levels and in all parts of the defense enterprise. In fact, analysis is or could be used to support the full range of the Department's operations and activities, including planning, programming and budget decisions, military planning and operations decisions, acquisition decisions, manpower and personnel policy decisions, logistics decisions, real property management decisions, and energy and environmental policy decisions. An Army instruction manual on operations research and systems analysis explains:

> When asked the question, who does analysis? General Maxwell Thurman replied, "EVERYONE." Whether determining what resources to use for a refueling mission, how to deploy units, or determining which combat systems to purchase in the future, soldiers to leaders are involved in the analysis process. Among some of the more common applications are:

[6] Quade and Boucher, *Systems Analysis and Policy Planning*, 422.

1) The application of statistical theory and sampling theory in systems development and testing.

2) The application of inventory theory and forecasting techniques in determining demand and establishing procurement levels, procurement quantities and lead times for major and secondary items.

3) Network analysis and transportation models for evaluating supply routes in operations plans and for project time and cost analysis.

4) Simulation and game theory in testing operational plans.

5) Cost Benefit Analysis in evaluation of competing systems.[7]

DCAPE serves as the principal official within the Office of the Secretary of Defense (OSD) with responsibility for program evaluation and analysis. CAPE's mission is to provide the Department with timely, insightful, and unbiased analysis for resource allocation, the execution of approved strategies and policies, and the assessment of alternative plans, programs and policies. Pursuant to Department of Defense Directive (DODD) 5105.84,[8] the Director leads the development of improved analytical skills and competencies within the cost assessment and program evaluation workforce of the Department to include improved tools, data, and methods to promote performance, economy, and efficiency in analyzing national security planning and the allocation of defense resources.

CAPE sits at the top of a distributed analytic enterprise in the Department. Key analytic organizations include the Center for Army Analysis, the OPNAV Assessment Division (N81), the Air Force Chief Analytics Officer (A9), the Office of Acquisition, Analytics and Policy in the Office of the Under Secretary for Acquisition Support, the Office of People Analytics in the Office of the Under Secretary for Personnel and Readiness, and the Analytics Center of Excellence in the Defense Logistics Agency. Additional

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[7] ORSA Committee, *Operations Research/Systems Analysis (ORSA): Fundamental Principles, Techniques, and Applications* (Fort Lee, VA: Army Logistics University, October 2011), 3–4, https://www.fa49.army.mil/pdfs/ORSA_Book.pdf. The Military Operations Research Society (MORS) lists 21 Communities of Practice (COPs) in the analytic arena: affordability analysis, campaign analysis, cost analysis, cyber, data science and artificial intelligence, deterrence analysis, developing command and control, experimentation, human behavior and performance, intelligence, surveillance & reconnaissance (ISR), irregular warfare, logistics, manpower and personnel, military assessments, modeling & simulation, multi-domain operations, national security risk analysis, red-teaming, social sciences, undersea warfare, and wargaming (see "Communities of Practice," MORS, accessed August 2020, https://www.mors.org/Communities/Communities-of-Practice).

[8] Department of Defense, "Director of Cost Assessment and Program Evaluation," DODD 5105.84 (Washington, DC: Office of the Chief Management Officer of the Department of Defense, May 11, 2012, as amended August 14, 2020), https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/510584e.pdf.

analysts are embedded in defense agencies, military commands, and other entities throughout the Department.[9] Military and civilian organizations receive additional analytic support from outside entities including Federally Funded Research and Development Centers (FFRDCs) and University Affiliated Research Centers (UARCs).

Over the years, DOD has benefited from sound and relevant analysis that is provided in a timely manner to support the decision-making process. Unfortunately, not all of the analysis provided by the Department's many analytic organizations lives up to these standards.[10] This revelation is hardly surprising: DOD consists of hundreds of diverse components that need analytic support to address complex and diverse decisions on a daily basis. No set of analytic principles or organizational constructs could possibly guarantee quality across such a range of requirements. Even so, better analysis is likely to result in more informed and defensible decisions, so the task of identifying best practices and areas of deficiency and making concrete recommendations for improvements is well worth performing.

[9] As discussed subsequently, IDA could not identify personnel data associated unambiguously with all of these organizations. IDA's assessment is based on a smaller subset of such organizations for which unambiguous associations were possible.

[10] For example, a 2019 Government Accountability Office (GAO) review concluded that the Department's Support for Strategic Analysis (SSA) approach failed to provide senior leaders appropriate support for the evaluation of the force structure necessary to implement the National Defense Strategy. In particular, GAO found that the SSA approach suffered from cumbersome, out-of-date, and inflexible analytic products, from analysis that failed to vary the services' programmed force structures or test key assumptions, and from an absence of a body or process of joint analytic capabilities to test force structure (see United States Government Accountability Office, *Defense Strategy: Revised Analytic Approach Needed to Support Force Structure Decision-Making*, GAO-19-385 (Washington, DC: GAO, March 2019), https://www.gao.gov/products/GAO-19-385).

3. Analytic Approach

IDA examined the lifecycle of DOD analysis by assessing the development and quality of analysts, the production and quality of analysis, and prioritization and use of analysis by decision makers in the Department. To this end, IDA pursued three basic lines of effort:

- First, the IDA team conducted roughly 25 interviews of analysts, leaders of analytic organizations, and leaders who use analysis, including current and former DOD officials.
- Second, the team assessed 41 examples of recent analysis that were collected by CAPE and by IDA from a variety of DOD analytic organizations.
- Finally, the team analyzed personnel data from the DMDC and other sources to assess analysts, analyst training, and analyst career tracks.

The balance of this chapter discusses each of these three lines of effort.

A. Interviews of Current and Former DOD Leaders and Analysts

Over a period of eight weeks, from October 9 to November 26, 2019, the IDA team interviewed 25 current and former DOD leaders and analysts on the quality of analysis, the quality of analysts, and the use of analysis by the Department. The interviews fell into three general categories: (1) interviews of analysts; (2) interviews of leaders of analytic organizations; and (3) interviews of leaders who use analysis. The interviewees included individuals who served as Under Secretaries and Assistant Secretaries of Defense, retired service chiefs and vice chiefs of staff, former combatant commanders, current and former leaders of CAPE, Program Analysis and Evaluation (PA&E), and leading analytic organizations in the military services, and military and civilian analysts.

The interviews did not follow a rigid format. Rather, each interview was shaped by the unique roles, views, and interests of the interviewee. In general, however, the interviews sought to explore a common set of questions.

- First, with regard to the quality of DOD analysts: (1) What makes a good analyst? (2) What is the overall quality of analysts in the Department? (3) How well does the Department do at attracting and retaining analysts?

- Second, with regard to the quality of DOD analysis: (1) What are the hallmarks of good analysis? (2) Does DOD analysis meet those standards? (3) What factors (internal and external) limit the ability of DOD analytic organizations to provide quality analysis?
- Finally, with regard to the appropriate use of analysis: (1) How is analysis actually used at DOD? (2) How are requirements for analysis developed and communicated? (3) To what extent to DOD leaders rely on analysis in the decision-making process?

1. Quality of Analysts

Most interviewees had a positive view of the technical capabilities of DOD analysts, expressing the view that DOD either has the technical capabilities that it needs or knows how to access them when needed. Interviewees also had a generally positive view of education and training opportunities available to analysts before and after they join the Department. Interviewees noted that the best analysis requires a command of analytic tools, domain expertise, and the ability to synthesize (i.e., to take apart and frame an issue, understand the significance of key assumptions, and identify potential flaws or gaps in tools and data). These capabilities do not need to be resident in a single analyst, as long as they are available to the analytic team.

Several interviewees expressed a concern that constrained career paths for analysts could undermine the Department's ability to maintain needed expertise over time. Others asserted that there has been a steady loss of technical expertise in the military and civilian workforce in recent decades as the Department has relied increasingly on contractors to do the work that government staff used to do. Contractors play an important role in helping the government access talent that it may not be able to afford directly, but a core of government expertise is needed to maintain strategic thinking and understand and interpret the analytic work produced by outside entities.

With regard to military analysts in the field of operations research, IDA learned that military rotation cycles can make it difficult for officers to build up needed expertise and that an analyst assignment is seen by some as a career-killer. For example,

- The Navy and Marine Corps do not have any career tracks for operational research. Operators are rotated through analytic positions, but many officers view analytical duty as a distraction or impediment to promotion. The Naval Postgraduate School has a 2-year training course for operational research, but, upon completing the course, graduates are sent for a sea-tour.
- The Air Force accesses operational research officers at commissioning and sends them directly into Masters' programs. Career analysts stay in the analyst

field and may also get PhDs, but the Air Force has only a handful of O-6 operational research analysts and no General Officers.

- The Army has a well-developed operational research career field starting around the 7th year of service, but the perception is that "these people aren't promoted." The Army's "single track" career ladder for analysts provides an opportunity for promotion to O-6 but has made analysts less likely to work with future senior leaders and vice versa.

With regard to civilian analysts, IDA was told that the Department is generally unable to compete with private sector salaries, although the DOD mission remains a major draw. IDA was also told that career tracks for civilian analysts suffer from "benign neglect," in that civilians are hired based on their qualification to do work on the first day and that there is insufficient focus on succession planning within the civil service. In the Air Force, for example, budget cuts have limited civilian positions in higher grades, which has created gaps in career ladders and questions about where future leaders will come from.

A number of interviewees told IDA that analysts come through a pipeline that affords little contact and communication with current and future military leaders. Many senior leaders come through a pipeline that offers them insufficient opportunity to use and value the work of analytic organizations. As a result, the analytic community often does not know how to talk to senior leaders. It is difficult for analysts to bridge the gap. One interviewee explained that "analysts can't fight past the palace gates" if leaders don't want them to.

2. Quality of Analysis

Most interviewees also expressed a generally positive view of the quality of DOD analysis. However, several interviewees expressed concern that the Department's quick response, "PowerPoint culture" may be undermining critical thought in parts of the analytic community. Others observed that the rote application of a fixed approach or a standard set of tools to a wide variety of problems is not likely to provide useful information. We were told that some reports include extensive tables and figures but provide little analysis or synthesis of the results.

Some interviewees stated that they had seen cases in which alternatives were skewed to favor a particular preferred option, cases in which highly questionable assumptions were hidden in footnotes, and cases where an executive summary or formal findings were not supported by the analysis. Interviewees also told us that organizational structure and reporting relationships can be helpful maintaining the independence and objectivity of an analytic organization. For example, we were told the following:

- Analytic organizations that are headed by analysts and/or that report directly to senior leaders who understand and value the use of analysis are more likely to maintain independence and objectivity.

- Analytic organizations that are headed by military officers may find it difficult to maintain independence and objectivity because leaders rotate through and are likely to be attuned to the biases of higher ranking officers who will play a role in their promotion.
- Analytic organizations that report directly to system commands may also find it difficult to maintain objectivity because of the inherent conflict between owning a program and needing to analyze it.
- A fee-for-service model can also be problematic because the billpayer may expect to call the shots. Some interviewees expressed the view that this problem can even extend to FFRDCs that are viewed as being "captured" through an enduring relationship with the sponsoring military service.

Our interviews also brought out an ongoing controversy about the value of sophisticated "campaign models" for assessing military options:

- Some interviewees insisted that the right way to focus on joint and longer term issues is to use campaign analysis and that CAPE should resume its leadership in the area by building comprehensive models that can be used for cross-service analysis.
- Others argued that there is no good way to model warfare analytically and that efforts to use Department-wide campaign analysis have been undermined by the lengthy process required to establish a common set of assumptions and parameters. In this view, least-common-denominator negotiations and the gaming of the results by the services have resulted in models that were less than useful and likely out of date by the time they were released for use.
- There was agreement, however, that analysts need to know enough about their models and reality to understand limitations on the results, make appropriate adjustments, and express needed caveats. Use of the wrong model or unwarranted assumptions can lead to unsupported results. Unexpected results may reveal important insights or just that something is wrong with the model. Analysts need to understand their own tools well enough to be able to know the difference.

One area of consensus was that DOD analysis is undermined by problems in the availability of quality data. Our interviewees generally agreed that the Department does not systematically collect, store, and curate data to make these data available and useful for use in analysis and decision making. Resource constraints and cultural resistance to data sharing have resulted in an environment in which key data can be deeply flawed and closely held. Our interviewees pointed out the following:

- There is virtually no funding for the curation of data in the Department. Curation for unknown future research is not normally a funded part of any project.
- Recent efforts to improve the quality of DOD data have focused on the production of an audited financial statement rather than the availability of useful data for analysis and decision support.
- Data access problems are exacerbated by classification issues, which can delay the delivery of program data and slow the production of needed analysis by months.
- Increased privatization has led to contractors owning some key data (including operational, performance, and system data), which can limit its availability to analysts.
- Pentagon systems do not yet have the capability to handle sophisticated analytic tools, and key meeting rooms for Pentagon leadership do not have the capacity to share complex data.
- When tools require data that cannot be obtained, analysts may be left to rely upon subjective opinions and informed guesses.

One interviewee characterized the Department's data problems by saying that DOD is more inclined to be in "the data destruction business, rather than the data analysis business." He explained that when a particular set of data no longer falls within the scope of a current problem, it becomes "orphaned" (i.e., the people who originally worked with or developed the data may have moved on and likely were given no guidance for archiving the data in a way to make it accessible). Everyone assumes that data will be available to be mined at a later date, but, without deliberate curation, data often get lost. The result is "perishable analysis" (i.e., data sets are assembled for specific analyses but are not systematically tracked, maintained, or curated). As a result, it is frequently impossible to recreate or build upon analysis without rebuilding data sets from the ground up.

3. Use of Analysis

A number of interviewees expressed the view that the Department produces less analysis and relies less on analysis than it used to. In this view, current and recent DOD leaders have become more likely to rely on their "gut" for major decisions and less likely to turn to analysis for decisions that really matter to them. Some senior military and civilian leaders tend to rely upon their own instincts, rather than looking to analysis to shape decisions.

A retired four-star told IDA that military leaders often act on the belief that "when it comes to warfighting, knowledge about how to fight takes precedence over analysis." A

retired two-star explained that the prevalence of instinct and intuition over analysis in senior leader decision making may be sensible when "you have a broad knowledge base built on personal experience and you are making quick decisions based on what that experience has told you." This type of decision making can prove problematic, however, when senior leaders begin to believe that any decision—even one that is not related to any relevant "experience base" or data—can be made based on gut instinct.

Other interviewees asserted that senior leaders tend to be reactive, which leads to time frames that are antithetical to good analysis. Typically, staff will be asked to respond to a question a month or less before the analysis is needed. Experienced bureaucrats tend to focus on "keeping the boss happy" and that leads to analysts being consumed with what happens next week and not being able to dedicate time to preempting issues that could be important in the future.

A number of interviewees expressed a concern that DOD analysis focuses heavily on platforms rather than on the broader issue of capabilities, which makes this analysis less useful in guiding the strategic posture of the Department. According to these interviewees, there is no natural advocate for longer term analysis that takes a broader perspective:

- The military services work in stovepipes, with individual warfighting communities often more focused on "program protection" and looking unfavorably on analysis that is inconsistent with the story they wish to tell.
- Combatant commanders have had some ability to look at cross-cutting warfighting issues in the past but, with reductions in resources, have limited planning and analytic capability.
- The Joint Staff lacks analytic depth, and staff level work tends to be "lowest common denominator negotiations" because military staff rotates through and does not want to burn bridges with home services.
- The Joint Capabilities Integration and Development System (JCIDS) was intended to ensure analysis of integrated capabilities but has instead focused narrowly on material solutions and specific platforms, "checking the homework" of the services.

Finally, the IDA team was told that CAPE is not as effective as it could be in filling this gap and providing strategic analysis. Several interviewees told IDA that CAPE is largely an "event-driven" organization that provides fast-turn analysis for the hot issue of the moment rather than addressing strategic and joint issues: "CAPE's idea of long term is one week." CAPE gets too many issue papers (300 papers are too many to be addressed with analytical rigor), and too much of the focus is on taking an issue and boiling it down to a single PowerPoint slide, which is unlikely to reflect any nuance. Perhaps as a result, CAPE staff tend to focus on finding gaps in service analyses but are not likely to fill in

those gaps themselves. As a result, interviewees told IDA that CAPE does not generate as many new ideas or as much innovative analysis as it could or should.

B. Reviews of Analyses

In late 2019 and early 2020, IDA worked with CAPE to collect a diverse set of more than 41 analyses conducted by CAPE on a wide range of subjects, by analytic organizations in the Army, Navy, Air Force, and Marine Corps, and on behalf of these organizations by IDA, RAND, CNA, and MITRE. Table 1 provides a list of the analyses considered in the IDA review.

Table 1. List of Analyses Considered in the IDA Review

Study	Type	Organization
C-17	AoA (COEA)	IDA
Sexual Orientation (1)	Study (SECDEF)	RAND
Sexual Orientation (2)	Study (SECDEF)	RAND
DAWMS	Study (NDAA)	IDA
AC-130 Weapons	AoA	IDA
Mark VI	AoA	IDA
Next Gen Gunship	AoA	RAND
Invisible Wounds	Study (Non-profit org)	RAND
GCV	AoA	Army
OASuW	AoA	Navy
T-AO(X)	AoA	CNA
JWARN	AoA	Army
SBEM	AoA	Air Force
C-130 AMP	Study (NDAA)	IDA
DCGS (Navy-2)	AoA	RAND
SSC(X)—Navy Report	Study (SECDEF)	Navy
A2/AD	Study (NDAA)	IDA
Future Navy – Navy	Study (NDAA)	Navy
Future Navy – CSBA	Study (NDAA)	CSBA
Transgender Policies	Study (USD(P&R))	RAND
Close Combat	SPR – CAPE	CAPE
Taiwan Munitions	Study	IDA
Carrier Strike Group	SPR – CAPE	CAPE

Study	Type	Organization
Future Air Force – AF	Study (NDAA)	Air Force
Future Air Force – CSBA	Study (NDAA)	CSBA
Airlift Fleet Mix	Study (NDAA)	IDA
Aircraft Sustainment	Study	CAPE/IDA
Next Gen Chem Detector	AoA	Army
Navy TASW	Study	Navy
Navy LCC & AS	Study	Navy
Navy DI fit-fill	Study	Navy
MITRE Navy	Study (NDAA)	MITRE
MITRE AF	Study (NDAA)	MITRE
USMC KC-130J	Force Size Study	USMC
USMC Marksmanship	Study (CBA)	USMC
USMC MCCES	Study	USMC
USMC MCRD	Study	USMC
JCREW	AoA	IDA
Wideband comms	AoA	OSD/A&S & USAF
AEA	AoA	USAF
F-15 EPAWSS	AoA	USAF

Note: The abbreviations used in this table are defined in Appendix D of this paper.

Each of these analyses was reviewed and assessed by a senior three-person IDA team, each of which had a background in performing, leading, and reviewing major analyses. The IDA team asked a series of questions about each analysis reviewed:

1. Is the analytical problem well-posed?
2. Are the alternatives robust and unbiased?
3. Are the assumptions and constraints appropriate?
4. Are the methodologies appropriate?
5. Are the results and recommendations clearly stated?
6. Are the results and recommendations supported by the analysis?
7. What was the impact of the analysis?[11]

[11] Leading studies on analysis and decision quality support these questions as indicators of quality analysis. For example:

- *Problem well-posed*: Bardach, *A Practical Guide for Policy Analysis*; Charlesworth, *Decision Analysis for Managers*; Carl Spetzler, Hannah Winter, and Jennifer Meyer, "The Requirements for Decision Quality," in *Decision Quality* (Hoboken, NJ: John Wiley & Sons, Inc., 2016), 11–20.

The set of case studies reviewed was not large enough or diverse enough to be able to be projected to the full range of analyses conducted by the Department. Moreover, although the IDA team has deep expertise, its judgments about the analyses are inherently subjective. Nonetheless, the results of the review provide a useful indication of the relative strengths and weaknesses of DOD analysis.

Table 2 tabulates the answers to each of the seven IDA questions.

Table 2. Answers to the Seven IDA Questions

1. Is the analytical problem well posed?

Yes	No	Mixed	Ind	N/A
29	6	6	0	0

Overall (excluding #7 and N/A)
Yes = 142 of 242; 59%

2. Is the set of solutions to the problem considered in the analysis reasonably comprehensive and unbiased?

Yes	No	Mixed	Ind	N/A
21	15	3	0	2

AoA
Yes = 69 of 96; 72% *

3. Are the assumptions and constraints used appropriate?

Yes	No	Mixed	Ind	N/A
21	7	9	3	1

Not an AoA
Yes = 73 of 146; 50% *

4. Are the analytical methodologies used appropriate?

Yes	No	Mixed	Ind	N/A
21	13	4	3	0

5. Are the results and recommendations clearly stated?

Yes	No	Mixed	Ind	N/A
32	3	6	0	0

6. Are the results and recommendations supported by the analysis?

Yes	No	Mixed	Ind	N/A
18	18	4	0	1

*AoA v Not AoA Difference in Yes v Not Yes significant; Fisher Exact Test p= .0008
Note: Difference also significant if #2 is excluded for Not AoA (p=.0082)

7. Did the analysis have impact?

Yes	No	Mixed	Ind	N/A
9	9	1	22	0

Mixed = Yes and No
Ind = Indeterminate
N/A = Not Applicable

- *Comprehensive and unbiased alternatives:* Bardach, *A Practical Guide for Policy Analysis*; Spetzler, Winter, and Meyer, "The Requirements for Decision Quality"; E. S. Quade, "Principles and Procedures of Systems Analysis," in *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), ed. E. S. Quade and W. I. Boucher (Santa Monica, CA: RAND Corporation, June 1968), 30–53, https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.
- *Appropriate assumptions and constraints*: Anirudh Dhebar, "Managing the Quality of Quantitative Analysis," *MIT Sloan Management Review* 34, no. 2 (Winter 1993): 69–75; E. S. Quade, "Pitfalls and Limitations," in *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), ed. E. S. Quade and W. I. Boucher (Santa Monica, CA: RAND Corporation, June 1968), 345–363, https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.
- *Appropriate methodologies:* Charlesworth, *Decision Analysis for Managers*; Dhebar, "Managing the Quality of Quantitative Analysis."
- *Results clearly stated and supported:* Bardach, *A Practical Guide for Policy Analysis*; Dhebar, "Managing the Quality of Quantitative Analysis."

Table 3 shows correlations between the answers to the seven questions.

Table 3. Correlations Between the Answers to the Seven Questions

	AoA	*FFRDC*	*Q1*	*Q2*	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Total*
AoA	1									
FFRDC	-0.04157	1								
Q1	0.404722	0.060305	1							
Q2	0.3595	-0.07895	0.490302	1						
Q3	-0.01952	0.31981	0.122937	0.026253	1					
Q4	0.280571	0.124105	0.23018	0.026253	0.511905	1				
Q5	0.061872	0.256511	-0.08213	-0.09799	0.307654	0.189768	1			
Q6	0.299799	0.262022	0.353033	0.360581	0.56836	0.470036	-0.00579	1		
Q7	0.058926	0.097993	0.211636	0.216161	-0.07188	0.046004	0.138889	0.243267	1	
Total	0.363572	0.257329	0.584684	0.506289	0.647006	0.649093	0.327656	0.794626	0.403269	1

Note: Areas of statistically significant correlation are highlighted in green.
Note: For n = 41, critical Spearman value is .311 at .05 significance.

The IDA team determined that most analytical problems in the selected analyses were well-posed (29 of the 41 analyses reviewed) and that the results and recommendations were generally clearly stated (positive results for 32 of the 41 analyses reviewed). On other issues, the results were less favorable. For example, the IDA team determined that

- A reasonable set of alternatives was pursued in only half of the analyses (21 out of the 41 analyses reviewed).
- Unreasonable assumptions and constraints were not uncommon (seven cases with unreaonable assumptions and constraints and nine mixed results).
- Inappropriate analytical methodologies were used in numerous analyses (13 cases with inappropriate methodologies and 4 mixed results).
- Results and recommendations were supported by the analysis in only about half of the analyses (18 positive results, 18 negative results, and 4 mixed results).

The IDA team assessed the overall independence of the analyses reviewed by using three questions as a surrogate for indepedendence: the questions on the use of reasonable alternatives, appropriate assumptions and constraints, and supported results and recommendations. Overall, just over half of the answers to these questions (60 out of 119) were positive, which indicates a strong basis for concern about the independence of the analyses. IDA then separated the results into studies conducted by the services and studies conducted by FFRDCs. Just under half (25 out of 52) of the answers for services' analyses were positive for independence while just over 60 percent (34 out of 55) answers for FFRDCs' analyses were positive. IDA determined that the difference in levels of independence was not great enough to be statistically significant, even if the analyses considered were able to be projected to a larger universe.

The IDA team was unable to reach a definitive conclusion on the impact of the analyses because this issue requires an assessment of facts that cannot be determined from the analysis and supporting materials alone. The IDA team assessed that nine of the analyses considered had an impact on decision making, while nine did not. The team was unable to reach a positive or negative conclusion for the remaining analyses. IDA then requested that CAPE experts make an independent judgment on the impact of the analyses. The CAPE experts reached an almost identical determination.

Having positive answers to the first five questions as judged by IDA's team of analysts does not translate to an analysis with effect (i.e., an analysis appreciated by and used by decision makers). Senior DOD leaders, many of whom have not participated in analytical efforts during their careers, could have different perspectives than the analysts have regarding what constitutes useful analytical input to their decision making. Also, whatever their views in that regard, it is clear that in DOD, as in the rest of the U.S. government, senior leaders consider many factors other than analytical results when making decisions.

The IDA team assessed that conducting objective, unbiased Analyses of Alternatives (AoAs) remains a challenge for the Department. The team saw cases in which an AoA appeared to be constrained to endorse the extant service position rather than objectively assessing a reasonable range of realistic alternatives.[12] Some AoAs eliminated feasible alternatives that did not satisfy 100% of extant requirements,[13] while others recommended a solution despite the fact that it did not satisfy all approved requirements, which created at least the appearance that the analysis was distorted in an effort to advance a preferred alternative.[14] Other analyses suffered from the same problems; however, overall, AoAs registered positive answers to 72 percent of IDA’s questions, while non-AoAs registered positive answers only 50 percent of the time—and even some constrained or biased AoAs have arguably been useful to the Department.[15]

[12] For example, the Ground Combat Vehicle (GCV) AoA focused on small, squad-size tactical engagements and recommended only a full-squad solution.

[13] For example, the Next Gen Gunship AoA eliminated the least costly AC-130 variant due to insufficient survivability, but the Air Force ultimately decided to pursue an AC-130 variant.

[14] For example, the Space-based Environmental Monitoring (SBEM) AoA recommended eliminating requirements, including ground water content sensing, that had previously been approved (the National Polar-orbiting Operational Environmental Satellite System (NPOESS)), which enabled the Air Force to accept and pursue a small satellite microwave imager (only).

[15] For example, the GCV AoA, while constraining its alternatives and scenarios, did nonetheless inform the Army that the service’s desire to procure a full-squad solution was unaffordable, and the Army cancelled the program.

The IDA team, during its review, made a number of other, more subjective observations based on the analyses reviewed and the experience of the team. For example,

- Leadership and/or sponsor support can make the difference between an objective study and a biased study.
- Study scoping matters. An overly broad scope can lead to an analysis that produces nothing useful.
- Adequate tradespace should be allowed, and assumptions and constraints should not be permitted to dictate the answer to a question.
- Alternatives should be comprehensive, but proliferating them can be problematic because of the resulting complexity.
- AoAs should inform requirements rather than being dictated by them. This observation means that AoAs should be started and completed as early as possible in a program and that CAPE should provide guidance for AoA content as early as possible (i.e., before advocates have the opportunity to obtain leadership commitments to a particular approach absent rigorous analysis).
- Access to sound data matters. Data that are withheld or cannot be found can lead to informed guesses rather than objective analysis and undermine an analysis.
- Analytic tools matter, and understanding the limitations of tools is important to the robustness of results and conclusions.
- In some cases, the direction of an analysis may be shaped by the available models rather than by the problem itself.
- Time should be taken in the beginning of an analysis to conceptualize, adapt, or create models to fit the problem rather than the other way around.
- Large group analyses (including joint analyses) can be problematic, particularly when these analyses dilute conclusions by trying to accommodate all competing stakeholder interests.

C. Personnel Data

For a period of almost a year beginning in August 2019, IDA worked to collect and analyze data on analysts and the staffing of analytic organizations in DOD. This effort was made more difficult by the fact that the Department does not have a civilian career field for analysts, while the military specialty of operations research/systems analyst includes only some of the military's many analysts. While many analysts can be readily identified

because they work in a handful of well-known analytic organizations, others are scattered in non-analytic agencies and commands throughout the Department.[16]

IDA took a systematic approach to the identification of analysts and analytic organizations in the Department. Because of limitations on time and issues with the accessibility of data, IDA eventually had to limit this phase of its work to civilian analysts. IDA sought to information in three areas:

- First, IDA identified potential job codes associated with analysts. IDA consulted with subject matter experts (SMEs), obtained a preliminary list of job codes from DMDC, and applied web-scraping tools to extract civilian job postings (on USAjobs.gov) that referenced analysis or analytic capabilities.
- Second, IDA accessed and merged DOD personnel data from numerous sources to identify individual civilian employees associated with the potential analyst job codes. IDA created, found, and decoded data dictionaries, mapped out unit and organizational relationships, identified useful data fields, and filtered data on the individuals based on job codes and education. This data product provides significant value since it enables other personnel data to be associated with organizations, thereby enabling within and cross-organizational analysis without relying on surveys.
- Finally, IDA identified the organizations for which the potential analysts work as potential analytic organizations. IDA then cross-checked this list by generating a list of known analytic organizations (based on a literature survey and consultation with SMEs in each military service). IDA consulted DOD personnel data to identify all individuals working for organizations that were confirmed to be analytic organizations.

Having defined a universe of analysts and analytic organizations and having collected relevant personnel data on the relevant individuals in this universe, IDA sought to assess three major issues:

- What is the relationship to organizational leadership? IDA sought to determine where analytic organizations sit relative to the leadership that they serve. For example, does the number of layers or nodes between analysts and leadership vary by service or by type of organization?

[16] See "Where Are the Civilian Analysts in DOD?," an informal IDA deliverable, for an overview of analysts by tier and service and for a case study on how the data products were used to address Congressional questions that CAPE received. In addition to the briefing, IDA provided the underlying data products in the form of excel spreadsheets and interactive web graphics of the hierarchy of organizations and the distribution of analysts.

- What are the characteristics of DOD analysts? What is the experience/tenure level of analysts? What is the education level? How are DOD analysts (e.g., education, roles, and so forth) distributed across DOD organizations?
- In examining the population of analysts IDA identified three segments of analysts (see Figure 1).

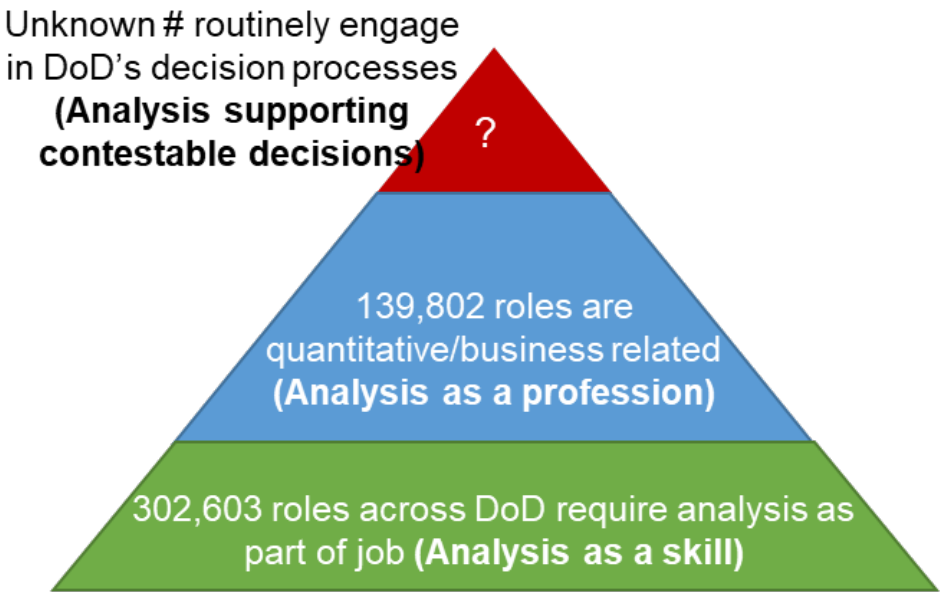

Figure 1. Analyst Pyramid

The base layer consist of all jobs that may require analysis as part of the job function. We consider these roles "analysis as a skill." The middle tier consists of jobs that are more technically or quantitatively focused. We consider this layer as "analysis as a profession." Finally, the tip of the pyramid consists of jobs that directly support DOD's major decision-making business processes ("analysis supporting contestable decisions"). Without a formal mapping of business processes to organizations, IDA could not identify this population. As a proxy, IDA examined a few headquarters-level analytic organizations that support contestable decisions within OSD, the services, and the Joint Staff. Each segment represents a subset of the previous tiers.

The total population of analysts whose job is "analysis as a skill" consists of 302,603 across the DOD or about 40% of civilian jobs. These jobs include all those that may require analysis as part of the job requirement. This population was broadly dispersed throughout the DOD across many different job functions including contracting, administration, information technology, and logistics management. What these data primarily highlight is that analysis is required for many jobs within the DOD. Forty-four percent of this population has an advanced degree (i.e., a Masters' degree or higher).

The second tier, analysts whose job is "analysis as a profession," is comprised of technical or quantitatively focused analytical roles. This population represents ~140,000 people of which 30% across the DOD are associated directly with material commands. Within the Air Force and Navy, the concentration is even higher, with greater than 50% of these analysts working at a material command. The top three organizations for the Army were the Army Corps of Engineers, the Futures Command, and the Contracting Command. Forty-four percent of this tier also has an advanced degree.

The final tier consists of analysts that support DOD's contestable decision-making processes (e.g., budget, acquisition and so forth).[17] Instead of formally modeling these processes, IDA examined four specific known analytic organizations that comprise a subset of all the organizations that support contestable decision making for which data could be identified: A9, CAPE, the Center for Army Analysis (CAA), and J8.[18] Table 4 summarizes numbers of analysts (including military and civilian analysts), most common job series for analysts, and numbers of analysts with advanced degrees for the identified organizations.

Table 4. IDA's Examination of Four Specific Known Analytic Organizations

	A9	CAPE	CAA	J8
Number of analysts	57	109	88	35
Most common job series	Operations Research	Operations Research	Operations Research	Misc. Administration and Program
Percent with Advanced Degrees	77%	82%	64%	90%

A higher proportion of these analysts have advanced degrees compared to the general DOD analytical population. CAPE is the largest of these organizations, but it also has the acquisition cost-estimating mission, which is generally housed in other analytic organizations (e.g., the Air Force Cost Analysis Agency) within the services. Finally, these organizations are relatively small and mostly use the operations research job code. J8 was the exception, where the most common job code was Misc. Admin and Program. Another interesting facet is that J8 is the smallest number of civilian analysts even though it, like CAPE, is supposed to provide cross-cutting assessments.

[17] If this area is of further interest, then organizations would need to be mapped to the DOD's decision-making processes to understand the organization-to-organization information flow and to see which organizations support multiple processes vs. those that specialize.

[18] N8 was not examined because while IDA found the UIC, we could not find individuals associated with that UIC. In addition, in our examination of other Navy documents to cross-check the UIC, we were unable to find N8 within them (i.e., because the billets are held at another level or because the UIC changed).

A9, CAPE, and J8 are one link away from their respective senior leaders. Based on the unit structure, CAA is four links from leadership. However, the apparent distance of the organization from leadership is driven by the way the Army uses Unit Identification Codes (UICs). In practice, CAA is two links from the Army Chief of Staff and three from the Secretary of the Army. This extra link, as compared to OSD, the Air Force, and the Navy, is driven by the fact that CAA is housed within G8.

Across and within each of the tiers, IDA did not see much difference in the tenure of analysts. Most of the analysts across DOD have 10–20 years of experience. Given the limitations in the data, whether these observations apply to all the organizations supporting contestable decision making is unknown.

4. Discussion

On the basis of the review described in this paper, IDA reached nine findings regarding areas of potential improvement for analysts, analysis, and the use of analysis in DOD. IDA also proposed a set of recommended actions that could be taken to address each of the findings. These recommendations use four levers that IDA assessed and are available to CAPE to drive the Department's analytic enterprise: (1) direct action in areas over which CAPE has authority, including CAPE personnel and analyses conducted by CAPE personnel, (2) CAPE review of analysis conducted by the components and guidance to the components on the conduct of analysis, (3) CAPE advocacy and recommendations to the Secretary and Deputy Secretary of Defense for direction to DOD leadership and changes to leadership education and training programs, and (4) use of CAPE convening authority to network with the military services and defense components to drive change through coordinated efforts.

1. Leadership Focus

Finding 1: *IDA found that leaders who value analysis and engage with analysts are more likely to get good analysis. Too many senior military and civilian leaders tend to rely upon their own instincts rather than looking to analysis to shape decisions.*

This finding was based primarily on interviews with senior leaders and senior analysts. These leaders and analysts told the IDA team that

- Leaders who take time to engage with analysts, help frame questions, and explain problems to be addressed are more likely to obtain useful results. Leaders who do not value analysis and are not engaged with analysts are less likely to get good analysis or to rely upon the results.
- To get the most out of analysis, leaders need to know enough to question analyses and understand the uses and limitations of analysis. Exposing developing leaders to the role and use of analysis before they get to the senior leader level may be helpful.
- Leaders have to not only recognize good analysis, but also recognize when they are not getting the right information or analysis. They need to know enough to question analyses and push people on the technical, operational, and cost aspects of an analysis.

- The analytic community often does not know how to talk to senior leaders. It is hard for analysts to bridge the gap: "Analysts can't fight past the palace gates" if leaders do not want them to.
- Some senior military and civilian leaders tend to rely upon their own instincts rather than looking to analysis to shape decisions. One retired four-star told us that military leaders often act on the belief that "when it comes to warfighting, knowledge about how to fight takes precedence over analysis."
- Many analysts come through a pipeline that affords little contact and communication with current and future military leaders. Many senior leaders come through a pipeline that offers them insufficient opportunity to use and value the work of analytic organizations.
- Senior leaders tend to be reactive, leading to time frames that are antithetical to good analysis. Typically, staff will be asked to respond to a question a month or less before the analysis is needed.
- Experienced bureaucrats often focus on "keeping the boss happy," which leads to analysts being consumed with what happens next week and not being able to dedicate time to preempting issues that could be important in the future.

Recommendation 1: *To improve the use of analysis in the Department, CAPE should work toward the following objectives:*

- *Teach examples of impactful analysis (and negative examples from lack of analysis) in leadership schools and courses, making an understanding of the potential uses and benefits of analysis an element of preparation for General Officers and civilian leaders (including political appointees and Senior Executive Service (SES));*
- *Design analyst career paths to close the analyst-leader gap by bringing analysts into greater contact with future leaders (and vice versa) throughout their careers; and*
- *Design some military analyst positions to attract future senior leaders on rotational assignments, providing them direct exposure to analysis and what it can do.*

2. Timely Analysis of the Right Issues

Finding 2: *Effective analysis addresses the issues that matter the most to senior decision makers and to the future of the Department, including important issues, even if they are not urgent. Addressing the issue of the day should not be allowed to crowd out analysis with a longer term impact. Good analysis takes time, so analytic leaders may need to begin work on some issues before a question is asked.*

This finding is also based primarily on interviews of senior leaders and analysts. A number of interviewees told IDA that much of the Department's analysis focuses heavily on specific weapons platforms rather than on the broader issue of delivery of capabilities. According to these interviewees,

- The military services work in stovepipes, with individual warfighting communities often more focused on "program protection" and looking unfavorably on analysis that is inconsistent with the story they wish to tell.
- Combatant commanders have had some ability to look at cross-cutting warfighting issues in the past but, with reductions in resources, have limited planning and analytic capability.
- The Joint Staff lacks analytic depth and staff level work tends to be "lowest common denominator negotiations" because military staff rotates through and does not want to burn bridges with home services.
- JCIDS was intended to ensure the analysis of integrated capabilities but has instead focused narrowly on material solutions and specific platforms (i.e., "checking the homework" of the services).

A number of interviewees told IDA that CAPE is not as effective as it perhaps should be in filling this gap and providing strategic analysis. These interviewees indicated that

- Strategic Portfolio Reviews (SPRs) were established, in part, as a mechanism for addressing issues at a more strategic level, but efforts to use SPRs in this manner have been undermined by the limited time frame available to conduct the reviews.
- CAPE is largely an "event-driven" organization that provides fast-turn analysis for the hot issue of the moment rather than addressing strategic and joint issues. "CAPE's idea of long term is one week," one interviewee told IDA.
- CAPE staff tend to focus on finding gaps in service analyses but are not likely to fill in those gaps themselves. CAPE can vet ideas but does not generally generate new ideas or innovative analysis.
- CAPE gets too many issues (300 issue papers are too many to be addressed with analytical rigor), and too much of the focus is on taking an issue and boiling it down to a single PowerPoint slide, which is unlikely to reflect any nuance.

A common thread running through the interviews is a logical conclusion from this assessment: there is no natural advocate in the Department for longer term analysis that takes a broader perspective.

Recommendation 2: *To ensure that major issues facing the Department benefit from the best possible analysis, CAPE should*

- *Reassert a role in establishing an analytic agenda for the entire Department by identifying major topics that should be addressed and gaps in the Department's effort to address those issues;*
- *Set aside some analytic resources (either organic or external) to focus on a small number of in-depth analyses designed to shape the debate and generate tangible recommendations for major issues, such as the defense of the Baltic States or the logistics of a conflict in the Pacific;*
- *Endeavor to use these in-depth analyses to demonstrate the value of longer duration, quality analysis to senior leaders, thereby shifting the leadership paradigm and building a demand for more such analysis, seeking to engage senior leaders in the prioritization of the topics for in-depth studies, and ensuring that those leaders are briefed on the results; and*
- *Refocus some of the effort currently devoted to issue papers to anticipate key issues before they are raised and bring its portfolio expertise to bear on a handful of significant issues at the front-end of the programming process, when it is still early enough to influence the service Program Objective Memorandums (POMs).*

3. Framing the Question

Finding 3: *Good analysis flows from good questions. Framing the question correctly is foundational. The key is communication and iteration between leaders and analysts.*

Senior leaders and analysts told the IDA team that senior leaders do not always know exactly what question they want addressed, how to ask the question, or what types of questions are and are not readily susceptible to analysis. As a result, questions may be poorly posed, may not accurately reflect senior leaders' intent, or may not be susceptible to effective analysis.

Interviewees told IDA that it is important that the question reflect the understanding of the analyst and the decision maker and that an effective question should be framed in a way that (1) makes the analysis relevant to decision making, (2) allows for creativity in answers, and (3) is unbiased and does not contain the answer. The key to such a question is communication (and often iteration) between analysts and the decision maker. Leaders should help define the problems with which they want help, and analysts need to communicate what is and is not susceptible to analysis.

With regard to AoAs and related documents, interviewees indicated that requirements tradespace should be flexible and not be frozen in a way that rigidly constrains analytic

outcomes. Good decisions flow from an appreciation of how much those decisions would change (or not) if requirements were varied within reasonable bounds. Interviewees indicated that analysis can go wrong if

- A problem is insufficiently focused, as in the case of some recent SPRs that asked vague questions and left unclear what decisions were to be made and what analysis was needed to support decisions. Some of these SPRs were cancelled before producing output, while others changed in scope multiple times during cycle, which made it difficult to produce useful results.
- The analyst does not fully understand the leader's expression of his/her concerns, as in a case where analysts interact with action officers who are several layers below the decision maker (and who may be afraid to go to the decision maker for clarification). In such a case, miscommunication is likely, and, even if high-quality analysis is produced, it may not penetrate through to leadership and influence decisions.

IDA's review of select analytic products confirmed that the structuring of a question for analysis continues to be a problem area. IDA assessed that

- Most, but not all, problems were well-posed. The IDA team judged that the problems were well-posed for 20 out of 28 analyses reviewed, with analytic problems not well-posed or having mixed results for the remaining 8 analyses.
- A reasonable set of alternatives was pursued in more than half of the analytic products reviewed. The IDA team found that 16 analyses pursued a reasonably comprehensive and unbiased set of alternatives. Eleven failed to pursue such alternatives or had mixed results, and, in one case, the question was not applicable.
- Unreasonable assumptions and constraints were not uncommon. The IDA team found that 10 analyses used appropriate assumptions or constraints, 5 failed to do so, and 10 analyses had mixed results.

Recommendation 3: *To improve the likelihood that questions will be well framed for analysis, CAPE should include a clear channel of communication with senior leaders as one of the basic principles for good analysis in the Department. In particular, leaders of DOD analytic organizations should be encouraged to*

- *Gain an understanding of leadership priorities and perspectives, including by attending senior leader meetings where possible;*
- *Engage in an iterative process with senior leaders to shape issues for analysis and develop a common understanding between leaders and analysts of what questions will be addressed; and*

- *Regularly inform senior leaders of progress and problems with ongoing analysis (or framing of issues) to shape expectations and reduce the risk that analysis will go off track.*

4. The Right Mix of Expertise

Finding 4: *A high degree of technical proficiency (most frequently found in civilian analysts) and relevant operational experience (most frequently found in military analysts) are needed for a good analytic team. In addition, a strong team needs creative individuals with the ability to synthesize—to take apart and frame an issue, understand the significance of key assumptions, and identify potential flaws or gaps in tools and data.*

Interviewees told the IDA team that technical proficiency and operational knowledge are baseline requirements for good analysis, but all relevant skills do not need to be present in the same individual. A good team will include analysts with technical skills and seasoned veterans with experience and operational knowledge. Operational experience does not have to be current but should provide a sense of what soldiers do when they are in the field and how they are impacted by different types of interventions.

Other skills are also critical. Interviewees told IDA that an ideal analytic team would include not only technical experts and individuals with domain knowledge, but also "synthesizers" with broader perspective—systems thinkers who are willing to "work outside of their comfort zones" and have "fine-tuned BS detectors." The mix of talent on an analytic team should include the skills of communication, synthesis, knowledge of how the Department works, and technical skills (including knowledge of analytic techniques and technical knowledge of systems reviewed).

Although most interviewees had a positive view of the technical capabilities of DOD analysts and the availability of education and training opportunities in the field, several interviewees expressed a concern that constrained career paths for analysts could undermine the Department's ability to maintain needed expertise over time. Some interviewees stated there has been a steady loss of technical expertise in the military and civilian workforce in recent decades as the Department has relied increasingly on contractors to do work government staff used to do. Contractors play an important role in helping government access talent that it may not be able to afford directly, but some core of government expertise is needed to maintain strategic thinking and understand and interpret analytic work produced by outside entities.

With regard to military analysts, some interviewees expressed the view that military rotation cycles make it difficult for officers to build up needed expertise and that in at least some services, an analyst assignment is seen as a career killer. With regard to civilian analysts, several interviewees expressed concern about the Department's ability to compete with private sector salaries, although the DOD mission remains a major draw. Others stated

that career tracks for civilian analysts suffer from "benign neglect"—civilians are hired for qualification to do work on the first day, and there is insufficient focus on succession planning within the civil service. In the Air Force, for example, budget cuts have limited civilian positions in higher grades, creating gaps in career ladders and questions about where future leaders will come from.

One way in which the Department could provide increased attention to the analytic community would be by supporting workshops and symposia that provide an opportunity for analysts to share tradecraft and advance their understanding of analytic tools and methods. IDA understands that CAPE has stopped providing formal support to the Military Operations Research Society (MORS), a professional association that provides development opportunities, including courses, workshops, and symposia, for DOD analysts. While the scope of this project did not enable IDA to develop an independent assessment of the value of MORS activities, CAPE may want to reconsider this decision.

Recommendation 4: *CAPE should exercise its statutory responsibility for the development of improved analytical skills and competencies within the analytic workforce of the Department by establishing itself as the functional career advocate for military and civilian analysts throughout the Department and ensuring that each of the military departments designates its own functional career advocate for military and civilian analysts.*

In the role of the OSD-level functional career advocate for DOD analysts, CAPE should regularly convene meetings with functional career advocates in the military departments to coordinate their efforts to:

- *Foster a core of senior (i.e., SES) analysts who can play a key role in identifying and developing analytic talent in the military departments;*
- *Develop career tracks and training and education opportunities for civilian analysts (including exposure to data-driven enterprises in the private sector, where appropriate);*
- *Design career tracks for military analysts to provide appropriate opportunities to develop operational experience and build relationships with future senior leaders;*
- *Provide on-the-job training of new analysts by exposing them to operational issues and apprenticing them to experienced senior analysts who serve as mentors;*
- *Support workshops and symposia that provide an opportunity for analysts to share tradecraft and advance their understanding of analytic tools and methods; and*

- *Ensure that the Department makes effective use of existing direct hiring authority (and requests new authority if existing authority is inadequate) to expedite the hiring of qualified civilian analysts.*

CAPE should leverage outside expertise and tools of universities, FFRDCs, and contractors but must retain a substantial core of government expertise to provide strategic and tactical direction and to oversee, understand, and critically review and interpret analytic work produced by outside entities.

5. Applying the Right Tools

Finding 5: *Good analysis includes the selection of tools that match the issues to be addressed and the recognition that no model can offer perfect insights. Good analysts need to be aware of the full range of tools available and of their appropriate use.*

IDA's review of analytic products found that the use of inappropriate and/or unclear methodologies is not uncommon. The IDA team found that 14 analyses used appropriate analytical methodologies, while 12 applied inappropriate methodologies or a mix of appropriate and inappropriate methodologies. The team assessed that selected models developed by CAPE and used in some of the analyses generated cogent results and were key to dealing with stakeholder critiques. However, the rote application of a fixed approach or a standard set of tools to a wide variety of problems is not likely to provide useful information. Some reports include extensive tables and figures but provide little synthesis of the results and what they mean. In some cases, reliance on existing analytical models has inappropriately restricted the approach taken to a specific problem.

Fifty years ago, Quade and Boucher wrote that "we have not yet learned enough to supply a sequence of steps or rules that, if followed mechanically – by the numbers, so to speak – would automatically guarantee solutions that will stand the tests of time. In the main, this is so because military systems analysis is to some extent still an art – or at least a craft – rather than a form of engineering or an exact science."[19] IDA interviewees made a similar point, noting that analysts need to know enough about their models and reality to understand limitations on the results, make appropriate adjustments, and express needed caveats.

IDA's interviews also highlighted an ongoing controversy about the value of wargaming and sophisticated "campaign models" for assessing military options:

- Some interviewees saw wargaming as a declining art that does not make use of new capabilities now available in the private sector. In this view, most current wargames are simpler than they should be, rely too much upon deterministic assumptions, and, as a result, produce few insights.

[19] Quade, "Principles and Procedures of Systems Analysis," 30.

- Some interviewees insisted that the right way to focus on joint and longer term issues is to use campaign analysis and that CAPE should resume its leadership in the area by building comprehensive models that can be used for cross-service analysis.
- Others argued that there is no good way to model warfare analytically and that efforts to use Department-wide campaign analysis have been undermined by the lengthy process required to establish a common set of assumptions and parameters, which has resulted in least-common-denominator negotiations, the gaming of the results by the services, and models that were out of date by the time they were released for use.
- There was agreement, however, that analysts need to know enough about their models and about reality to understand limitations on the results, make appropriate adjustments, and express needed caveats. Use of the wrong model or unwarranted assumptions can lead to unsupported results. Unexpected results may reveal important insights or just that something is wrong with the model. Analysts need to understand their own tools well enough to be able to know the difference.

The risk of not understanding tools and results may be a particular problem when non-analytic organizations contract out for analysis and leaders accept the results "from a black box" without the expertise to explore limitations in the tools, understand the significance of key assumptions, and identify potential gaps or weakness in the data.

Recommendation 5:

- *CAPE should routinely review major pieces of analysis produced by the military services and defense components to ensure that appropriate models and tools are used and that limitations or caveats are appropriately noted.*
- *CAPE should develop or invest in state-of-the-art analytic tools that can be made available for use by analysts throughout the Department and develop a baseline understanding of the assumptions and limitations built into those tools.*
- *CAPE should advocate for the fielding of information technology (IT) systems and networks that enable the Department's analysts to access modern analytic tools.*
- *CAPE should work with the Joint Staff and the service analytic organizations to improve the sophistication and analytic rigor of the Department's wargaming processes by leveraging available technology and the expertise of gaming companies.*
- *CAPE should work with OSD/Policy and the Joint Staff to build common scenarios and concepts of operations (CONOPS) to serve as a baseline for cross-*

service and joint analysis and ensure that analysis is not skewed by the selection of particular scenarios to bolster desired results.

6. Accessing the Right Data

Finding 6: *An analysis is only as good as the data on which it is based. Analysis that is built on small and/or imperfect datasets or that applies sophisticated techniques that are not warranted by the data is not likely to provide useful insights.*

DODD 5105.84 requires defense components to ensure that DCAPE "has timely access to any records and data in the DoD (including the records and data of each Military Department, Defense Agency, and DoD Field Activity, including classified and proprietary information) that the DCAPE considers necessary to review in order to carry out any duties in this Directive, except where limited by law."[20] Even with this authority, IDA learned, CAPE often faces delays and has to fight for access to data. Other analytic offices, which lack CAPE's statutory and regulatory authority, face an even more difficult task in trying to access relevant data.

Interviewees told IDA that the Department does not systematically collect, store, and curate data to make these data available and useful for use in analysis and decision making. Resource constraints and cultural resistance to data sharing have resulted in an environment in which key data are both deeply flawed and closely held. Individuals and offices within the Department sometimes create one-off data collection systems and "hoard" data to protect their decision space from outside interference. In other cases, the people who originally worked with or developed a data set may move on, leaving the data "orphaned." Everyone assumes that data will be available to be mined at a later date, but, without deliberate curation, data often get lost.

Interviewees told IDA that the Department's data systems result in perishable analysis: data sets are assembled for specific analyses but are not systematically tracked, maintained, or curated. As a result, it is frequently impossible to recreate or build upon analysis without rebuilding data sets from the ground up. IDA was told that

- There is virtually no funding for the curation of data in the Department. Curation for unknown future research is not normally a funded part of any project.
- Recent efforts to improve the quality of DOD data have focused on the production of an audited financial statement rather than the availability of useful data for analysis and decision support.

[20] Department of Defense, "Director of Cost Assessment and Program Evaluation," DODD 5105.84, 8.

- Data access problems are exacerbated by classification issues, which can delay the delivery of program data and slow the production of needed analysis by months.
- Increased privatization has led to contractors owning some key data (including operational data, performance data, and system data), which can limit its availability to analysts.
- Pentagon systems do not yet have the capability to handle sophisticated analytic tools, and key meeting rooms for Pentagon leadership do not have the capacity to share complex data.

For these reasons, there are cases in which data needed to support sound analysis are withheld or cannot be found. When tools require data that cannot be obtained, analysts may be left to rely upon subjective opinions and informed guesses.

In the last few years, Congress and the Department have established new positions for Chief Data Officers (CDOs), with responsibility for managing DOD data assets, including the standardization of data format, the sharing of data assets, and the development of common, usable, Defense-wide data sets. While establishing these new positions CDOs is an important first step toward addressing the Department's data problems, the data needs of a Department with more than 3 million personnel and an annual budget in excess of $700 billion are unlikely to be addressed by a single official or a small group of officials with limited resources.

Recommendation 6:

- *CAPE should play a proactive role in encouraging the systematic collection and curation of key sources of data in the Department (including cost data and testing data) and in ensuring that the data are routinely available to support analytic needs.*
- *CAPE should include the preservation of analytic products and supporting data as one of the basic principles for good analysis in the Department. In particular, DOD analytic organizations should preserve key analyses and supporting data sets (in partnership with academic institutions and FFRDCs where appropriate) to ensure that these analyses are appropriately repeatable and can be tracked, built upon, and adjusted to reflect changed circumstances, without having to be rebuilt from the ground up.*

7. Independence and Objectivity

Finding 7: *Good analysts should "be fearless." They should have the courage to tell the leadership the results of the analysis and defend those results. At the same time, it is important that analysts not be seen as advocates. They should provide objective information but should also be prepared to listen and learn from multiple sources of competing information.*

The IDA review of analytic products found reason for concern about the independence and objectivity of DOD analytic products:

- Taking questions about the use of reasonable alternatives, appropriate assumptions and restraints, and adequately supported results and recommendations as indicia of independence and objectivity, the IDA team found that 59 percent of the FFRDC analyses reviewed but only 38 percent of the military Service analyses reviewed showed indicia of independence and objectivity.
- Product-by-product reviews found that some AoAs had been constrained to endorse the extant service position rather than objectively assess the range of realistic alternatives. While some AoAs eliminated alternatives that failed to satisfy all extant requirements, others considered and/or recommended solutions that did not satisfy all approved requirements.
- The IDA team noted that even constrained or biased AoAs have arguably been useful in identifying costs and selecting alternatives.

These findings were reinforced by interviewees, who told IDA that analysis will be trusted and will have an impact on decision makers only if it is seen as objective. If analysis is not seen as objective, leaders are more likely to revert to "gut decisions" because they are more likely to trust their own instincts than those of their analysts. Interviewees stated that skewed analysis is most likely to occur when the leadership wants a "prized thing" and seeks a specific answer from the analysis and when analysts do not feel empowered to operate independently from this expectation. Some interviewees stated that they had seen cases in which alternatives were skewed to favor a particular preferred option, cases in which highly questionable assumptions are hidden in footnotes, and cases where an executive summary or bottom line up front (BLUF) is not supported by the analysis at all.

Organizational structure and reporting relationships are seen by some as a key factor for maintaining the independence and objectivity of an analytic organization. According to interviewees,

- Analytic organizations that are headed by analysts and/or report directly to senior leaders who understand and value the use of analysis are more likely to maintain independence and objectivity.

- Analytic organizations that are headed by military officers may find it difficult to maintain independence and objectivity because leaders rotate through and are likely to be attuned to the biases of higher ranking officers who will play a role in their promotion.
- Analytic organizations that report directly to system commands may find it especially difficult to maintain objectivity because of the inherent conflict between owning a program and needing to analyze it.
- A fee-for-service model can also be problematic because the billpayer may expect to call the shots. Some of our interviewees expressed the view that this problem even extends to military services who seek analysis from their "own captured" FFRDCs.
- Joint analyses with large oversight groups can result in analysis dilution by the pressure to accommodate too many stakeholder interests. Analytical courage may be needed not only to stand behind results at the end of the process, but also to stand up during the process for reasonable assumptions and the analytical flexibility to "test" via excursions the consequences of alternative data or operational concept assumptions.

Recommendation 7: *CAPE should include the independence and objectivity of analysts and analytic organizations as one of the basic principles for good analysis in the Department. In particular, the principles should call for*

- *DOD analysts and analytic organizations to avoid questionable assumptions, biased results, and programmatic recommendations that risk turning analysts into advocates and*
- *The routine use of independent review (including appropriate use of in-process review) to ensure that DOD analytic products live up to these standards.*

To safeguard the independence and objectivity of analysis in the Department, CAPE should further exercise its role as the principal advisor to the Secretary of Defense on matters of program evaluation and analysis by

- *Reviewing major pieces of analysis produced by the Military Services and defense components to identify questionable assumptions or biased results;*
- *Pulling together a team of seasoned analysts under CAPE leadership to periodically assess major DOD analytic organizations for the independence, objectivity, and quality of both the workforce and the work performed; and*
- *Where appropriate, direct that AoAs for major platforms and similar analytic products be performed by independent, third-party organizations.*

8. Clearly Communicating the Results

Finding 8: *Analysis is only effective if it can be clearly communicated to the decision makers who will use it. Effective analytic products should be succinct, answer the question on the basis of clear evidence exactly, without emotional appeals, and be communicated to the decision maker in a manner that is directly relevant to the decision being made.*

IDA's review of analytic products found that the results and recommendations presented were usually—but not always—clearly stated (with positive results for 32 of the 41 analyses reviewed). On the other hand, results and recommendations were actually supported by the analysis for only half of the products reviewed (18 positive results, 18 negative results, and 4 mixed results).

IDA interviewees reported that a poor presentation or report can destroy months of work. If an analyst cannot describe the question and the analysis outcomes to technical people, operators, acquisition and other decision makers, and policy people, the analysis is not likely to impact policy decisions. Interviewees provided numerous observations about problematic presentations. For example,

- Tables and graphs that support conclusions in a way that the decision maker can understand are helpful; however, tables should present useful information and not be populated with pictures or numbers that do not advance the discussion.
- The presentation of too many alternatives may needlessly confuse decision makers and undermine the impact of the analysis. For example, while a reasonably large number of alternatives should be considered in an AoA, some AoAs address multiple alternatives that turn out to be minor variations on a smaller set. Comprehensiveness should be sought without runaway proliferation that clouds the final findings and recommendations.
- The movement away from written reports and increasing reliance on "PowerPoint analysis" has weakened the quality of analysis. Good analysis should be written down and reviewed. This process reveals flaws and gaps in the analysis that can be identified and corrected.

Recommendation 8: *CAPE should take steps to improve the communication of its analytic findings by*

- *Routinely preparing summaries of varying lengths that are appropriate for different levels of leadership to ensure that results can be pitched to decision-makers without distorting results;*
- *Preparing written summaries of analyses (which can be attached to the final version of slides presented to leadership) to ensure that issues are fully thought through, deficiencies or gaps are identified and addressed, and the basis for*

findings and recommendations is preserved and available to future decision-makers; and

- *Where possible, bringing the analysts who are performing the work to senior leader meetings so that they can better understand leadership goals and perspectives and, where appropriate, clarify what the analysis does and does not show.*

9. Leading by Example

Finding 9: *The single most important thing that CAPE can do to promote good analysis in the Department is to conduct excellent analysis itself and use this analysis to continually challenge the military services and Defense components to produce the same.*

After consideration of information collected about the state of analysis and the use and quality of analysts in the Department, the IDA team assessed that DOD leaders are most likely to demand quality analysis when they see that such analysis leads to positive results (in the form of more efficient and effective programs and operations and/or enhanced support for the Department's decisions) as a result of data-driven decision making. While examples of successful analyses may be provided in leadership courses, such training is unlikely to have as much of an impact as hands-on experience. For this reason, the team concluded, the best way to create a demand for quality analysis is to provide examples of such analysis and show what they can do in practice.

Recommendation 9: *CAPE should ensure that it retains a sufficient pool of analytic resources (in-house and extramural) necessary to carry out superior analysis on a sustained basis, including defending the CAPE budget and seeking targeted increases where appropriate. Particularly in times of restrictions on headquarters billets, maintaining the needed capability is likely to require investment in long-term partnerships with highly qualified outside entities that can provide on-call high-quality and objective analytic support. However, CAPE must maintain sufficient in-house capacity to be a capable partner and educated consumer of such outside support.*

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Appendix A.
Findings and Recommendations

This appendix provides the full text of Institute for Defense Analyses' (IDA) findings and recommendations.

Finding 1: IDA found that leaders who value analysis and engage with analysts are more likely to get good analysis. Too many senior military and civilian leaders tend to rely upon their own instincts rather than looking to analysis to shape decisions.

Recommendation 1: To improve the use of analysis in the Department, CAPE should work toward the following objectives:

- Teach examples of impactful analysis (and negative examples from lack of analysis) in leadership schools and courses, making an understanding of the potential uses and benefits of analysis an element of preparation for General Officers and civilian leaders (including political appointees and Senior Executive Service (SES));
- Design analyst career paths to close the analyst-leader gap by bringing analysts into greater contact with future leaders (and vice versa) throughout their careers; and
- Design some military analyst positions to attract future senior leaders on rotational assignments, providing them direct exposure to analysis and what it can do.

Finding 2: Effective analysis addresses the issues that matter the most to senior decision makers and to the future of the Department, including important issues, even if they are not urgent. Addressing the issue of the day should not be allowed to crowd out analysis with a longer term impact. Good analysis takes time, so analytic leaders may need to begin work on some issues before a question is asked.

Recommendation 2: To ensure that major issues facing the Department benefit from the best possible analysis, CAPE should

- Reassert a role in establishing an analytic agenda for the entire Department by identifying major topics that should be addressed and gaps in the Department's effort to address those issues;

- Set aside some analytic resources (either organic or external) to focus on a small number of in-depth analyses designed to shape the debate and generate tangible recommendations for major issues, such as the defense of the Baltic States or the logistics of a conflict in the Pacific;
- Endeavor to use these in-depth analyses to demonstrate the value of longer duration, quality analysis to senior leaders, thereby shifting the leadership paradigm and building a demand for more such analysis, seeking to engage senior leaders in the prioritization of the topics for in-depth studies, and ensuring that those leaders are briefed on the results; and
- Refocus some of the effort currently devoted to issue papers to anticipate key issues before they are raised and bring its portfolio expertise to bear on a handful of significant issues at the front-end of the programming process, when it is still early enough to influence the service Program Objective Memorandums (POMs).

Finding 3: Good analysis flows from good questions. Framing the question correctly is foundational. The key is communication and iteration between leaders and analysts.

Recommendation 3: To improve the likelihood that questions will be well framed for analysis, CAPE should include a clear channel of communication with senior leaders as one of the basic principles for good analysis in the Department. In particular, leaders of DOD analytic organizations should be encouraged to

- Gain an understanding of leadership priorities and perspectives, including by attending senior leader meetings where possible;
- Engage in an iterative process with senior leaders to shape issues for analysis and develop a common understanding between leaders and analysts of what questions will be addressed; and
- Regularly inform senior leaders of progress and problems with ongoing analysis (or framing of issues) to shape expectations and reduce the risk that analysis will go off track.

Finding 4: A high degree of technical proficiency (most frequently found in civilian analysts) and relevant operational experience (most frequently found in military analysts) are needed for a good analytic team. In addition, a strong team needs creative individuals with the ability to synthesize—to take apart and frame an issue, understand the significance of key assumptions, and identify potential flaws or gaps in tools and data.

Recommendation 4: CAPE should exercise its statutory responsibility for the development of improved analytical skills and competencies within the analytic workforce of the Department by establishing itself as the functional career advocate for military and civilian analysts throughout the Department and ensuring that each of the military

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CAPE should leverage outside expertise and tools of universities, FFRDCs, and contractors but must retain a substantial core of government expertise to provide strategic and tactical direction and to oversee, understand, and critically review and interpret analytic work produced by outside entities.

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Finding 6: An analysis is only as good as the data on which it is based. Analysis that is built on small and/or imperfect datasets or that applies sophisticated techniques that are not warranted by the data is not likely to provide useful insights.

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- CAPE should include the preservation of analytic products and supporting data as one of the basic principles for good analysis in the Department. In particular, DOD analytic organizations should preserve key analyses and supporting data sets (in partnership with academic institutions and FFRDCs where appropriate) to ensure that these analyses are appropriately repeatable and can be tracked, built upon, and adjusted to reflect changed circumstances, without having to be rebuilt from the ground up.

Finding 7: Good analysts should "be fearless." They should have the courage to tell the leadership the results of the analysis and defend those results. At the same time, it is important that analysts not be seen as advocates. They should provide objective information but should also be prepared to listen and learn from multiple sources of competing information.

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Recommendation 8: CAPE should take steps to improve the communication of its analytic findings by

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- Where possible, bringing the analysts who are performing the work to senior leader meetings so that they can better understand leadership goals and perspectives and, where appropriate, clarify what the analysis does and does not show.

Finding 9: The single most important thing that CAPE can do to promote good analysis in the Department is to conduct excellent analysis itself and use this analysis to continually challenge the military services and Defense components to produce the same.

Recommendation 9: CAPE should ensure that it retains a sufficient pool of analytic resources (in-house and extramural) necessary to carry out superior analysis on a sustained basis, including defending the CAPE budget and seeking targeted increases where

appropriate. Particularly in times of restrictions on headquarters billets, maintaining the needed capability is likely to require investment in long-term partnerships with highly qualified outside entities that can provide on-call high-quality and objective analytic support. However, CAPE must maintain sufficient in-house capacity to be a capable partner and educated consumer of such outside support.

Appendix B.
Illustrations

Figure

Tables

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Appendix C.
References

Bardach, Eugene. *A Practical Guide for Policy Analysis: The Eightfold Path to More Effective Problem Solving*, 2nd ed. Washington, DC: CQ Press, 2005.

Charlesworth, David. *Decision Analysis for Managers: A Guide for Making Better Personal and Business Decisions*.2nd ed. New York, NY: Business Expert Press. 2017.

Department of Defense. "Director of Cost Assessment and Program Evaluation." DODD 5105.84. Washington, DC: Office of the Chief Management Officer of the Department of Defense, May 11, 2012, as amended August 14, 2020. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/510584e.pdf.

Department of Defense. "Economic Analysis for Decision-Making." DODI 7041.03. Washington, DC: DCAPE, September 9, 2015, Incorporating Change 1, October 2, 2017. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/704103p.pdf?ver=2019-08-12-152105-700.

Dhebar, Anirudh. "Managing the Quality of Quantitative Analysis." *MIT Sloan Management Review* 34, no. 2 (Winter 1993): 69–75.

Enthoven, Alain C., and K. Wayne Smith. *How Much Is Enough? Shaping the Defense Program, 1961–1969*. CB-403. Santa Monica, CA: RAND Corporation, 1971. https://www.rand.org/pubs/commercial_books/CB403.html.

MORS. "Communities of Practice." Accessed August 2020. https://www.mors.org/Communities/Communities-of-Practice

ORSA Committee. *Operations Research/Systems Analysis (ORSA): Fundamental Principles, Techniques, and Applications*. Fort Lee, VA: Army Logistics University, October 2011. https://www.fa49.army.mil/pdfs/ORSA_Book.pdf.

Quade, E. S. "Introduction." In *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), edited by E. S. Quade and W. I. Boucher,1–19. Santa Monica, CA: RAND Corporation, June 1968. https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.

Quade, E. S. "Pitfalls and Limitations." In *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), edited by E. S. Quade and W. I. Boucher, 345–363. Santa Monica, CA: RAND Corporation, June 1968. https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.

Quade, E. S. “Principles and Procedures of Systems Analysis.” In *Systems Analysis and Policy Planning: Applications in Defense*, R-439-PR (Abridged), edited by E. S. Quade and W. I. Boucher, 30–53. Santa Monica, CA: RAND Corporation, June 1968. https://apps.dtic.mil/dtic/tr/fulltext/u2/671764.pdf.

Spetzler, Carl, Hannah Winter, and Jennifer Meyer. “The Requirements for Decision Quality.” In *Decision Quality*, 11–20. Hoboken, NJ: John Wiley & Sons, Inc., 2016.

United States Government Accountability Office. *Defense Strategy: Revised Analytic Approach Needed to Support Force Structure Decision-Making*. GAO-19-385. Washington, DC: GAO, March 2019. https://www.gao.gov/products/GAO-19-385.

Appendix D.
Abbreviations

A2/AD	anti access and area denial
A9	U.S. Air Force Studies, Analysis and Assessments
AEA	airborne electronic attack
AMP	Avionics Modernization Program
AoA	Analysis of Alternatives
AS	Submarine Tender
BLUF	bottom line up front
CAA	Center for Army Analysis
CAPE	Cost Assessment and Program Evaluation
CDO	Chief Data Officer
CNA	Center for Naval Analyses
CONOPS	concepts of operation
COP	Community of Practice
CSBA	Center for Strategic and Budgetary Assessments
DAWMS	Deep Attack Weapons Mix Study
DCAPE	Director of Cost Assessment and Program Evaluation
DCGS	Distributed Common Ground System
DI	Distributed Inventory
DMDC	Defense Manpower Data Center
DOD	Department of Defense
DODD	DOD Instruction
EPAWSS	Eagle Passive/Active Warning and Survivability System
FFRDC	Federally Funded Research and Development Center
G8	U.S. Army Resource Management
GAO	Government Accountability Office
GCV	Ground Combat Vehicle
IDA	Institute for Defense Analyses
ISR	intelligence, surveillance and reconnaissance
IT	information technology
J8	Joint Staff Force Structure, Resources, and Assessment Directorate
JCIDS	Joint Capabilities Integration and Development System
JCREW	Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare
JWARN	Joint Warning and Reporting Network
LCC	amphibious command ship
MCCES	Marine Corps Communication-Electronics School

MCRD	Marine Corps Recruit Depot
MORS	Military Operations Research Society
N8	U.S. Navy Warfare Requirements, Resources and Force Structure Directorate
NDAA	National Defense Authorization Act
NPOESS	National Polar-orbiting Operational Environmental Satellite System
OASuW	Offensive Anti-Surface Warfare
OPNAV	Office of the Chief of Naval Operations
ORSA	Operations Research/Systems Analysis
OSD	Office of the Secretary of Defense
PA&E	Program Analysis and Evaluation
POM	Program Objective Memorandum
R&D	research and development
SBEM	Space Based Environmental Monitoring
SECDEF	Secretary of Defense
SES	Senior Executive Service
SME	subject matter expert
SPR	Strategic Portfolio Review
SSA	Support for Strategic Analysis
SSC	small surface combatant
T-AO(X)	Navy's new Fleet Replenishment Oiler
TASW	Theater Anti-Submarine Warfare
UARC	University Affiliated Research Center
UIC	Unit Identification Code
USD(P&R)	Under Secretary of Defense (Personnel and Readiness)