



NATIONAL DEFENSE RESEARCH INSTITUTE

CHILDREN AND FAMILIES
EDUCATION AND THE ARTS
ENERGY AND ENVIRONMENT
HEALTH AND HEALTH CARE
INFRASTRUCTURE AND
TRANSPORTATION
INTERNATIONAL AFFAIRS
LAW AND BUSINESS
NATIONAL SECURITY
POPULATION AND AGING
PUBLIC SAFETY
SCIENCE AND TECHNOLOGY
TERRORISM AND
HOMELAND SECURITY

The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis.

This electronic document was made available from www.rand.org as a public service of the RAND Corporation.

Skip all front matter: [Jump to Page 1](#) ▼

Support RAND

[Purchase this document](#)

[Browse Reports & Bookstore](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore the [RAND National Defense Research Institute](#)

View [document details](#)

Limited Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law as indicated in a notice appearing later in this work. This electronic representation of RAND intellectual property is provided for non-commercial use only. Unauthorized posting of RAND electronic documents to a non-RAND website is prohibited. RAND electronic documents are protected under copyright law. Permission is required from RAND to reproduce, or reuse in another form, any of our research documents for commercial use. For information on reprint and linking permissions, please see [RAND Permissions](#).

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2012		2. REPORT TYPE		3. DATES COVERED 00-00-2012 to 00-00-2012	
4. TITLE AND SUBTITLE Lessons from RAND's Work on Planning Under Uncertainty for National Security			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) RAND Corporation, 1776 Main Street, P.O. Box 2138, Santa Monica, CA, 90407			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT RAND's progress in dealing with uncertainty analysis for national security has benefited from a confluence of developments in four domains, as indicated in Figure S.1. Most familiar perhaps is technology: modern computers and software allow analysis that would have been inconceivable in the early days of systems and policy analysis, such as examining a vast possibility space when considering options for the way ahead. Technology, however, is only an enabler. Developments in understanding strategic planning and decisionmaking, and in analytic theory and methods, have also been fundamental. These, in turn, have been influenced by insights from the theory of complex adaptive systems, which recognizes that behaviors of such systems can be inherently difficult or impossible to predict with confidence. Nonetheless, the behaviors can often be analyzed, anticipated, nudged, and occasionally even controlled.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 8	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

This product is part of the RAND Corporation technical report series. Reports may include research findings on a specific topic that is limited in scope; present discussions of the methodology employed in research; provide literature reviews, survey instruments, modeling exercises, guidelines for practitioners and research professionals, and supporting documentation; or deliver preliminary findings. All RAND reports undergo rigorous peer review to ensure that they meet high standards for research quality and objectivity.

TECHNICAL REPORT

Lessons from RAND's Work on Planning Under Uncertainty for National Security

Paul K. Davis

Prepared for the Office of the Secretary of Defense

Approved for public release; distribution unlimited



NATIONAL DEFENSE RESEARCH INSTITUTE

The research for this paper was conducted within the RAND National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community.

Library of Congress Cataloging-in-Publication Data

Davis, Paul K., 1943-

Lessons from RAND's work on planning under uncertainty for national security / Paul K. Davis.

p. cm.

Includes bibliographical references.

ISBN 978-0-8330-7661-8 (pbk. : alk. paper)

1. National security—United States—Planning. 2. Interagency coordination—United States. 3. Strategic planning—United States 4. System analysis. I. Title..

UA23.D2877 2012

355'.033573—dc23

2012028666

The RAND Corporation is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

RAND® is a registered trademark.

© Copyright 2012 RAND Corporation

Permission is given to duplicate this document for personal use only, as long as it is unaltered and complete. Copies may not be duplicated for commercial purposes. Unauthorized posting of RAND documents to a non-RAND website is prohibited. RAND documents are protected under copyright law. For information on reprint and linking permissions, please visit the RAND permissions page (<http://www.rand.org/publications/permissions.html>).

Published 2012 by the RAND Corporation

1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665

RAND URL: <http://www.rand.org>

To order RAND documents or to obtain additional information, contact

Distribution Services: Telephone: (310) 451-7002;

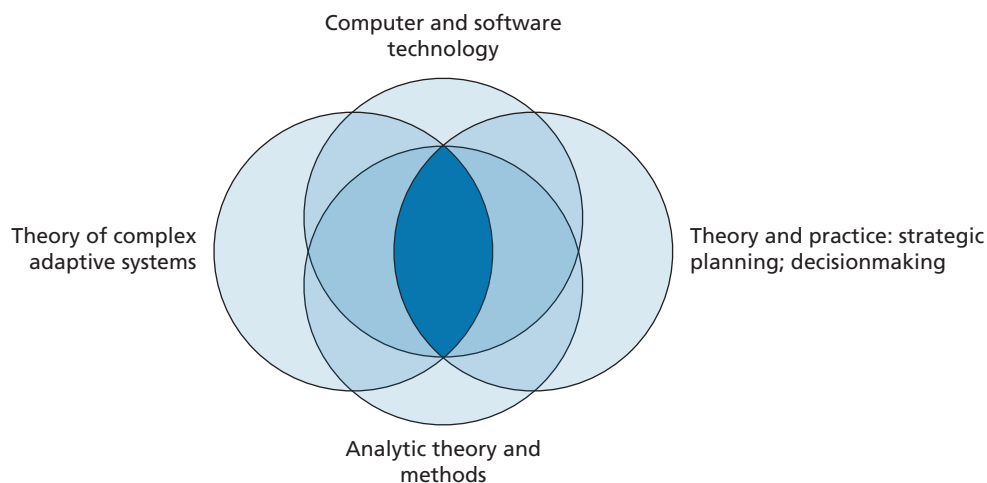
Fax: (310) 451-6915; Email: order@rand.org

Summary

RAND's progress in dealing with uncertainty analysis for national security has benefited from a confluence of developments in four domains, as indicated in Figure S.1. Most familiar perhaps is technology: modern computers and software allow analysis that would have been inconceivable in the early days of systems and policy analysis, such as examining a vast possibility space when considering options for the way ahead. Technology, however, is only an enabler. Developments in understanding strategic planning and decisionmaking, and in analytic theory and methods, have also been fundamental. These, in turn, have been influenced by insights from the theory of complex adaptive systems, which recognizes that behaviors of such systems can be inherently difficult or impossible to predict with confidence. Nonetheless, the behaviors can often be analyzed, anticipated, nudged, and occasionally even controlled.

Much of the paper focuses on “deep” uncertainties, that is, important uncertainties that cannot be adequately addressed by normal versions of sensitivity analysis or probabilistic analysis. RAND's work has emphasized the following: facing up to deep uncertainty in many dimensions; performing exploratory analysis of the possibility space (also called scenario space); identifying regions of that space that pose special risks or opportunities; finding options

Figure S.1
Confluence of Influences



RAND TR1249-S.1

to improve capabilities; and using portfolio analysis to conceive and compare strategic options for dealing with the diversity of challenges in an economically acceptable manner.

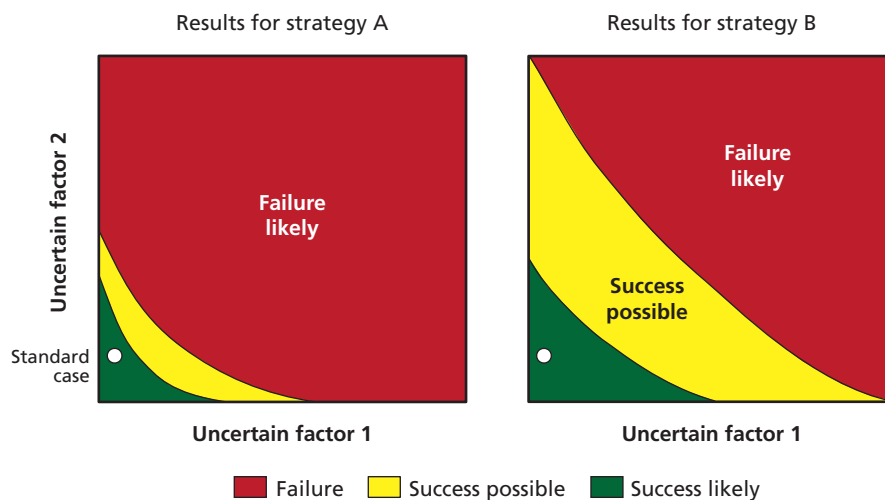
A cross-cutting theme (the “FARness principle”) is that strategies should provide: future flexibility for taking on different missions or objectives, adaptiveness to deal with unanticipated circumstances, and robustness to shocks such as unanticipated adverse events. RAND authors often use “planning for adaptiveness” or “robust decisionmaking” (with a different meaning of “robust”) to cover all elements of FARness.

To illustrate this core philosophy with a simple example, Figure S.2 assumes two primary uncertainties, which creates a two-dimensional possibility space. How well a strategy will perform depends on the situation that actually arises, which could be anywhere in the space. Both strategies A and B are likely to succeed in a standard case (the point in the lower left, which is in the green area indicating likely success), but strategy B (right pane) is more likely to be successful or at least to make success possible (depending on other factors) in a much larger portion of the space (green and yellow regions) than is strategy A. That is, strategy B is more robust to uncertainty.

Ultimately, different problems call for different approaches to uncertainty. This is illustrated in the main text for applications to strategic planning, acquisition management, logistics, personnel management (manpower research), crisis decisionmaking, and organization and management. Looking across the research discussed, several themes stand out:

- Uncertainty analysis requires both creative, divergent work to understand the range of possibilities, as well as more convergent work to assist decisionmakers in conceiving and choosing among strategies. In both phases, there is need for both human-intensive work (e.g., brainstorming, gaming, and judgment) and more analytical methods, including computational discovery.

Figure S.2
Comparing Strategies A and B Across a Range of Conditions 1 and 2



- Also, there is need for both theory-driven and data-driven approaches. Indeed, competition between such approaches can help stimulate progress.
- Experimentation and iteration are often crucial for uncertainty reduction and discovery.
- In practice, strategy will often be revisited and modified over time, despite the common assumption of once-and-for-all decisionmaking. Where possible, planning should anticipate the need for particular adaptations and identify signals that should trigger them.
- Because major surprises will nonetheless occur, planning should also provide general capabilities and organizational agility that allows for immediate adaptations to unanticipated developments. That is, part of good planning is ensuring the agility to “cope.”
- Policymakers should demand analysis that aids them in finding strategies that lead to flexibility, adaptiveness, and robustness (in short, “robust strategies” or what some call “agile” capabilities). This would be quite different from settling for best-estimate analysis and a list of assumptions.

To elaborate on the last item, a common concept of good analytic practice for dealing with uncertainty when reporting to a policymaker is to show key assumptions, watch for the policymaker to acknowledge the assumptions, and then present results. Unfortunately, even if policymakers know the assumptions and believe them to be reasonable, the approach is inadequate. The appropriate standard for analysts should also include the following:

- Being sure that omitting considerations because of uncertainty does not critically affect study conclusions.
- Being sure that conclusions identify reasonable ways to hedge against consequences of uncertainty, to include preparing for adaptation.
- Sensitizing policymakers to the importance of such hedging, which is more valuable than final increments of fine-tuned optimizing for the baseline case.

The somewhat radical vision of RAND authors here is for policymakers to agree with this and then require their organizations to follow a corresponding analytic doctrine.