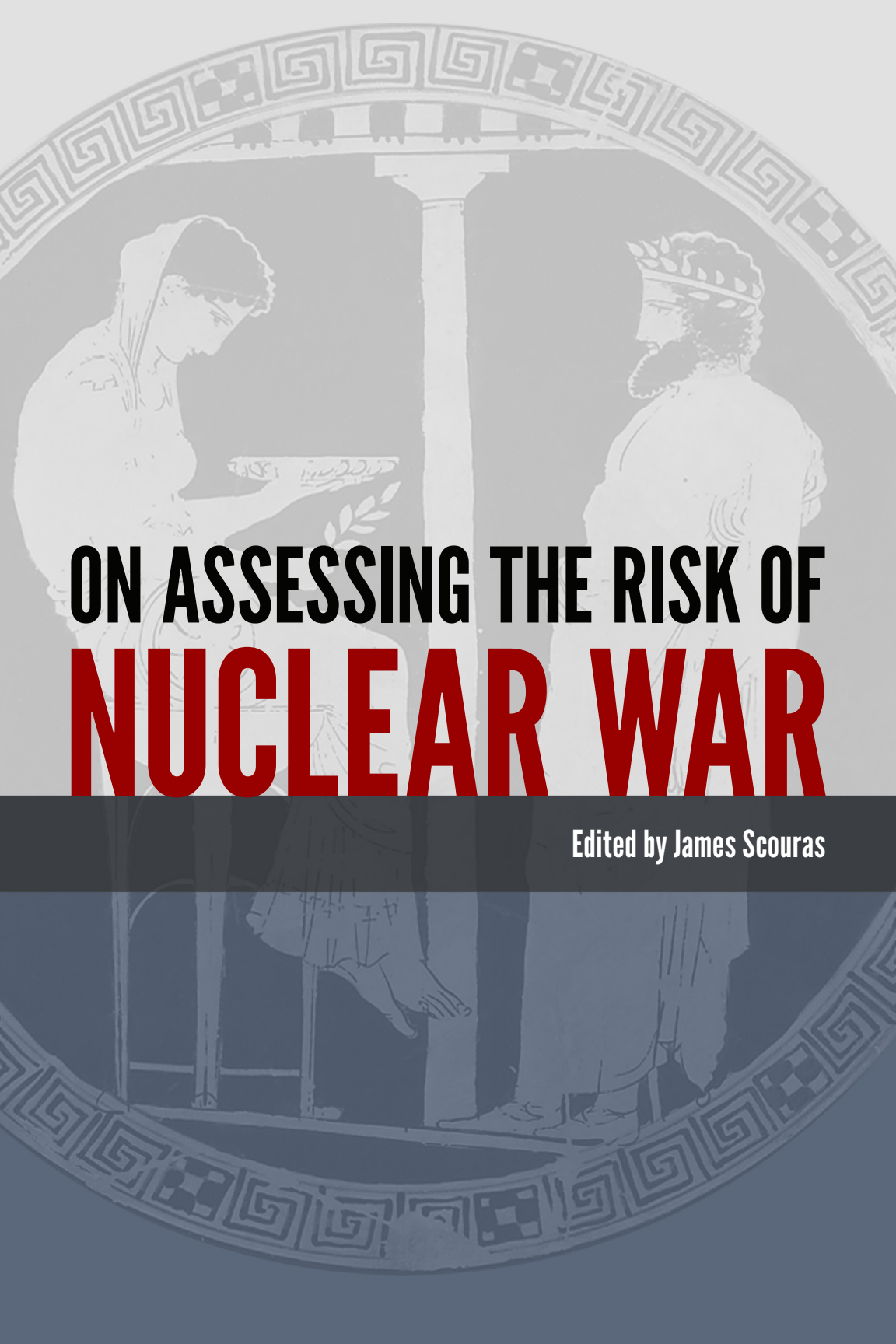

ON ASSESSING THE RISK OF NUCLEAR WAR

Edited by James Scouras

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To Kathy, the love of my life, without whose faithful support
this work would never have been completed.

The price we pay for maintaining nuclear weapons
is the gamble that the highly improbable
will not lead to the unthinkable.

—Eben Harrell, "The Nuclear Risk: How Long Will Our Luck Hold?"

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Preface

General perception of the risk of nuclear war has a strong influence on the broad directions of national policy. For example, arguments for both national missile defenses and deep reductions in nuclear forces depend in no small part on judgments that deterrence is unreliable. However, such judgments are usually based on intuition, rather than on a synthesis of insights from the most appropriate analytic methods that can be brought to bear. This book attempts to establish a methodological basis for more rigorously addressing the question, What is the risk of nuclear war? Its goals are to clarify the extent to which this is a researchable question and to explore promising analytic approaches.

This work had its intellectual origins in a series of conversations, beginning in June 2008, with Dr. Martin Hellman, professor emeritus of electrical engineering at Stanford University. At the start of these discussions, I was chief scientist of the Defense Threat Reduction Agency's Advanced Systems and Concepts Office. Dr. Hellman had been thinking, writing, and advocating for some time on the issue of assessing the risk of deterrence failure.[1] In particular, he had authored "Risk Analysis of Nuclear Deterrence," in which he discusses the criticality of estimating nuclear risk and the lack of existing analyses that attempt to do so. In this article he proposes "as a first step toward reducing the risk of a failure of nuclear deterrence . . . that several prestigious scientific and engineering bodies undertake serious studies to estimate its failure rate."[2] Dr. Hellman's proposal ultimately led to a congressionally mandated study, "Risk Analysis Methods for Nuclear War and Nuclear Terrorism," currently being undertaken by a National Academies of Sciences, Engineering, and Medicine committee of which I am a member.[3]

Many interesting insights came out of my conversations with Dr. Hellman. Among them was the notion that perhaps neither the scientific and engineering communities nor the national security and risk analysis communities are fully prepared to tackle this daunting challenge. Thus, the idea emerged that the first step toward a more comprehensive study should be a preliminary examination of the *feasibility* of assessing the risk of deterrence failure, focusing on the utility and limitations of some of the more promising approaches that could be used.

After I left the Defense Threat Reduction Agency to join the Johns Hopkins University Applied Physics Laboratory, the opportunity arose to pursue this idea. The Laboratory allocates a portion of its funding to a program of innovative research with the potential for significant impact on critical national challenges. This study, initially funded under that program, focuses on four diverse but complementary approaches to assessing the likelihood of deterrence failure: historical case study, elicited expert knowledge, probabilistic risk assessment, and complex systems theory. It also assesses the state of knowledge on both the physical and intangible consequences of nuclear weapons use. Finally, it examines the challenge of integrating knowledge obtained from these diverse disciplines and disparate approaches.

In addition to myself, the study participants are Andrew Bennett, Jane M. Booker, Dallas Boyd, Michael J. Frankel, Martin E. Hellman, Edward T. Toton, and George W. Ullrich. I am a senior scholar at the Johns Hopkins University Applied Physics Laboratory. Dr. Bennett is a professor of government and international affairs at Georgetown University. Dr. Booker, currently a consultant, was formerly group leader of the Statistics Group at Los Alamos National Laboratory. Mr. Boyd is an analyst whose work focuses on nuclear weapons policy and nuclear counterterrorism. Dr. Frankel, one of the nation's leading experts on effects of nuclear weapons, is a technology and national security consultant. Dr. Hellman is professor emeritus of electrical engineering at Stanford University and an eminent thought leader on nuclear risk. Dr. Toton, president of Toton Inc., is a theoretical physicist with a history of research in global catastrophic risk and quantification of uncertainty. Dr. Ullrich, formerly deputy director of the Defense Nuclear Agency, is senior vice president for strategy development at Applied Research Associates.

This book is the primary documentation of the Johns Hopkins University Applied Physics Laboratory study. It should be of interest to policy-makers, analysts, and citizens concerned with nuclear risk and the fragility of nuclear deterrence. The authors hope it will inspire others to tackle this critical issue.

Notes

1. See the Defusing the Nuclear Threat website, http://www.nuclearrisk.org, developed and maintained by Dr. Hellman, for a compendium of this work.
2. Martin E. Hellman, "Risk Analysis of Nuclear Deterrence," *The Bent of Tau Beta Pi* 99, no. 2 (2008): 14–22, https://ee.stanford.edu/~hellman/publications/74.pdf.
3. National Academies of Sciences, Engineering, and Medicine, "Risk Analysis Methods for Nuclear War and Nuclear Terrorism," https://www.nationalacademies.org/our-work/risk-analysis-methods-for-nuclear-war-and-nuclear-terrorism. While I am a member of the study committee, the views expressed in the chapters that follow are those of the authors and do not necessarily reflect those of the National Academies study committee.

Editor's Acknowledgments

I am grateful for the contributions of the authors, as well as numerous other colleagues, in advancing this book. In particular, I think Martin Hellman for providing the original inspiration for the topic; numerous nuanced discussions involving the intricate relationships among nuclear strategy, risk, and analysis; and detailed reviews of all chapters in their formative stages; Gregory Melcher, for providing the original funding under which this work was begun at the Johns Hopkins University Applied Physics Laboratory and for his continued support throughout the project; Andrew Bennett, for reviewing and significantly improving the first and final chapters; Jane Booker for alerting me to the importance of including a chapter on knowledge integration; and numerous reviewers who are individually acknowledged in the various chapters.