

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

February 2004

Advanced Energetic Materials—Summary

BOARD ON MANUFACTURING AND ENGINEERING DESIGN

Background

Advanced energetic materials—explosive fill and propellants—are a critical technology for national security. While several new promising concepts have emerged in recent years, the Department of Defense is concerned about prioritization of resources and the ability to maintain and improve the knowledge base leading to the continued development of new energetic materials applications. To help address its concerns, the DOD's Office of the Undersecretary for Science and Technology and Defense Threat Reduction Agency asked the National Research Council (NRC) to investigate and assess the scope and health of U.S. energetic materials research and development efforts. To carry out this study, the NRC formed the ad hoc Committee on Advanced Energetic Materials and Manufacturing Technologies.

Findings and Recommendations

The committee's major findings are as follows:

- Although all modern defense systems and weaponry rely on energetic materials as an explosive fill or a propellant from guns, rifles, missiles, and rockets, the U.S. effort in research and development of energetic materials is small, fragmented, and suboptimal, leaving this critical national technology area at risk.
- The suboptimal U.S. effort is characterized by severe resource limitations across the entire spectrum of energetic materials research and development, but particularly in the funding for scale-up and advanced development studies of potential new materials and in the training of replacements for the aging workforce.
- The current focus in the Department of Defense is on limited theater actions, with an emphasis on deployment of precision strike smart weapons that are smaller, cheaper, and at the same time more lethal against all target classes—demands that advanced energetic materials can address.
- Current funding sources for the military services for advanced energetic materials research are most often narrowly focused on near-term individual service. The resulting competition for scarce resources inhibits cooperative research and development efforts across the government aimed at more global national requirements.

In addition to the specific technical recommendations presented at the end of each chapter in the report, the committee offers the following two major recommendations:

1. The committee recommends that the Department of Defense redirect attention and resources to focus on strategies for reducing transition barriers to scale-up.

This effort should be closely coupled to the ongoing efforts of the services to improve target lethality and weapons effects. Such an approach would ensure an extensive technology effort from the energetic materials community and would help provide for an adequate supply of well-trained scientists and engineers to meet the nation's future defense requirements.

2. The committee recommends that the Department of Defense consider centralizing its management of energetic materials research and development in order to achieve a longer-term, cross-service perspective.

One possible approach to such a restructuring might include establishing an Energetic Materials Technology Office in the Office of the Secretary of Defense (OSD). A clear benefit of this approach would be a robust and productive national effort in energetic materials technology.

The Advanced Energetics Initiative, recently launched by the Office of the Secretary of Defense, could be the cornerstone of this national effort. Any approach to implementing an Energetic Materials Technology Office, however, would require establishing broad oversight and coordination responsibility as well as authority over all the energetic materials programs of the Department of Defense and a charter to develop cooperative engagement with and coordination of industrial and academic programs of the National Laboratories focused on energetic materials.

The overarching issue remains one of priority. Energetic materials are a key component of the nation's defense strategies. A coordinated and sustained effort in research, technology transition, and production technologies is needed to maintain the contribution of these materials to U.S. national defense.

For Further Information

Copies of the complete report, *Advanced Energetic Materials*, can be obtained from the National Academy Press, 2101 Constitution Avenue, N.W., Washington, DC 20418, 202-334-3313, <<http://books.nap.edu/catalog/10918.html>>.

Support for this project was provided by the Defense Threat Reduction Agency, U.S. Department of Defense. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the sponsors. More information about the Board on Manufacturing and Engineering Design can be found at <<http://www7.nationalacademies.org/bmaed/>>.

COMMITTEE ON ADVANCED ENERGETIC MATERIALS AND MANUFACTURING TECHNOLOGIES

RONALD L. ATKINS, *Chair*, Lawrence Livermore National Laboratory (retired); **DAVID E. BENDER**, Aerojet; **THOMAS B. BRILL**, University of Delaware; **PHILIP M. HOWE**, Los Alamos National Laboratory; **MALCOLM F. NICOL**, University of Nevada at Las Vegas; **JIMMIE C. OXLEY**, University of Rhode Island; **ANITA M. RENLUND**, Sandia National Laboratories; **ALBERT A. SCIARRETTA**, CNS Technologies; **JEAN'NE M. SHREEVE**, University of Idaho; **ROBERT B. WARDLE**, ATK Thiokol Propulsion.

Liaison to the Board on Manufacturing and Engineering Design

ROBERT J. EAGAN, Sandia National Laboratories.

Staff

TONI MARECHAUX, Board Director; **CUNG VU**, Study Director (until December 2000); **SHARON YEUNG DRESSEN**, Study Director (until November 2002); **EMILY ANN MEYER**, Research Associate; **TERI THOROWGOOD**, Research Associate; **JUDY ESTEP**, Senior Project Assistant (until April 2002).