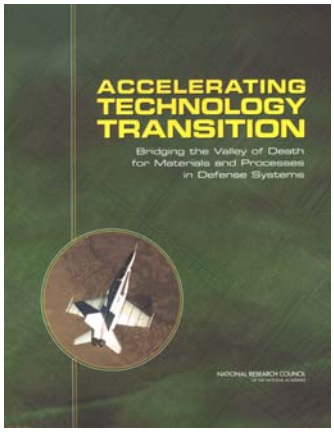
THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

August 2004

Accelerating Technology Transition: Bridging the Valley of Death for Materials and Processes in Defense Systems—*Summary*

NATIONAL MATERIALS ADVISORY BOARD
BOARD ON MANUFACTURING AND ENGINEERING DESIGN

Introduction



Accelerating the transition of new technologies into systems and products will be crucial to the Department of Defenses development of a lighter, more flexible fighting force. Current long transition times—ten years or more is now typical—are attributed to the complexity of the process. To help meet these challenges,the Department of Defense asked the National Research Council to examine lessons learned from rapid technology applications by integrated design and manufacturing groups. Based on presentations and discussions at an NRC-sponsored workshop to explore these successful cases, three key areas emerged. They are: creating a culture for innovation and rapid technology transition; methodologies and approaches; and enabling tools and databases.

Findings and Recommendations

Creating a Culture for Innovation and Rapid Technology Transition Acceleration of technology transition must begin at the inception of the new material or technology. It requires communication throughout the process between the creators and end-users of the technology. Component prototypes must be made available as soon as possible, and champions who can remove barriers and generate support are essential.

Effective technology transition is an iterative process of development, implementation, and acceptance that requires a culture that fosters innovation, rapid development, and accelerated transition. Within the military, creating such a culture requires actions such as introducing flexibility, implementing shorter and more iterative design and manufacturing processes, decentralizing decision making, simplifying procurement and acquisition, updating standards and testing procedures, making greater use of off-the-shelf technology, and valuing innovation over short-term efficiency.

Other conditions must also be met. In particular the establishment of enterprises similar to “Skunkworks”, team determination to make the technology succeed, open and free

communication, and a champion who is willing to take personnel risks are common characteristics of successful technology transitions.

Recommendation: The DOD should endeavor to create a culture that fosters innovation, rapid development, and accelerated deployment of new technologies.

Methodologies and Approaches Most of the best practices identified in the study as effective in accelerating technology development and product introduction worked by changing the risk-reward relationship. Currently in the military, this relationship is the biggest barrier to insertion of new technology into military systems. Three best practices were identified as particularly effective:

Best Practice 1: Developing a Viral Process for Technology Development This practice, which entails quick, iterative development cycles and prototyping, requires effective modeling of materials and processes. Predictive models can reduce the time needed to accommodate the complexities and risk that appears as development proceeds. Economic considerations must be part of these models, because optimization of both economic and technical performance is vital for successful insertion of new materials.

Best Practice 2: Increased Reliance on Functional Requirements rather than Specifications A critical barrier to rapid adoption of new technology, particularly for DOD, is the failure to provide vendors with information about functional requirements of the desired systems. For new technology development, providing specifications only can reduce the ability of different vendors to implement rapidly the knowledge and technologies they have developed for non-military systems.

Best Practice 3: Developing a Mechanism for Creating Successful Teams Many examples of successful, committed, multidisciplinary teams exist in a variety of industries. There is a particular challenge in creating such teams in DOD because the military is likely to take on the roles of the venture capitalist, technology developer, and customer; all of which may have conflicting. For that reason, creation and management of such teams within DOD must be supported from the highest levels.

Recommendation: DOD should adopt these best practices to enable the accelerated transition of new materials and technologies from concept to implementation.

Enabling Tools and Databases A key factor in accelerating technology and materials transition will be the application of computation-based methods. Early successes in computational materials engineering suggest a path to enhance national capabilities in this context. Recently, a new level of capability has been demonstrated in the development and application of more predictive mechanistic numerical models including accelerated process optimization at the component level; efficient accurate forecasting of property variation; and active linking of materials models in higher-order system design processes. Several challenges exist, however, for the advancement of these capabilities including dissemination of information about these models and the rapid transformation of academic computational materials science capabilities into useful engineering tools.

Recommendation: The Office of Science and Technology Policy should lead a multi-agency initiative in Computational Materials Engineering to address three broad areas: methods and tools, databases, and dissemination and infrastructure.

For Further Information

Copies of *Accelerating Technology Transition: Bridging the Valley of Death for Materials and Processes in Defense Systems* can be obtained from the National Academy Press, 2101 Constitution Avenue, N.W., Washington, DC 20418, 201-334-3313, < http://books.nap.edu/>.

Support for this project was provided by the 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 National Materials Advisory Board can be found at <http://www7.nationalacademies.org/nmab>.

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