

SCIENCE AND TECHNOLOGY FOR
ARMY HOMELAND
SECURITY

REPORT 1



NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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REPORT 1

Committee on Army Science and Technology for Homeland Defense
Board on Army Science and Technology
Division on Engineering and Physical Sciences

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

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Preface

This study is being conducted by the Committee on Army Science and Technology for Homeland Defense of the Board on Army Science and Technology, in the Division on Engineering and Physical Sciences of the National Academies. Sponsored by the Deputy Assistant Secretary of the Army for Research and Technology, the committee will produce a series of reports encompassing possible science and technology in support of the Army's role in homeland security (HLS). The statement of task for this first report is as follows:

The National Research Council will:

Review relevant literature and activities, such as the National Academies' emerging Science and Technology Program plan and Research Strategy for Combating Terrorism and their work with the interagency Technical Support Working Group (TSWG), reports from the Gilmore Commission and Hart-Rudman Commission, the DoD Counter-Terrorism Technology Task Force (DCT3F) plan, DOD Information Assurance policies and existing military operation and contingency plans to develop an Army context for the enhanced campaign against terrorism.

Determine areas of emphasis for Army S&T in support of counterterrorism (CT) and anti-terrorism (AT). Operational areas the NRC should examine include indications and warning, denial and survivability, recovery and consequence management, and attribution and retaliation.

In the first year, produce a report within nine months from contract award containing findings and recommendations that provide insights for high-payoff technologies.

BACKGROUND OF THE STUDY

The terrorist attacks of September 11, 2001, have forced the nation to consider how to prepare for the defense of the homeland. Terrorism is no longer an item on the evening news, taking place in some distant locale. Terrorism has become a domestic issue. As part of this recognition, the Army requested that the Board on Army Science and Technology (BAST) create a committee to meet over a 3-year period to consider how science and technology might better enable the Army to accomplish its mission in the homeland. It is anticipated that the committee will produce several reports during this period.

COMMITTEE PROCESS

This first report is a broad survey of relevant technologies, written in a relatively short period of time. Because of the scope of the review, the lack of a well-defined operational framework,¹ and the time-sensitive nature of the Army's interest, the committee has determined not to study specific products but rather to consider areas of technologies one level above individual products, processes, or services. In any case it should be noted that it is not the intent of this study to recommend budget actions; the technology assessments are intended to assist the Army in formulating its future technology plans.

The committee began its work by reviewing the literature listed below but found that very little has been said about the Army's role in HLS and the technology needs in support thereof.

- The National Strategy for Homeland Security,
- The Federal Response Plan,
- The National Academies' report *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism*,
- The interagency Technical Support Working Group (TSWG) outputs,
- Reports from the Gilmore Commission and the Hart-Rudman Commission,
- The Department of Defense (DoD) Counter-Terrorism Technology Task Force (DCT3F) plan,
- DoD information assurance policies, and
- Existing military operation and contingency plans.

There are other reports, such as the annual report of the Department of Energy's Chemical/Biological National Security Program (CBNP), that the committee did not review for lack of time but that might provide additional information to the reader.

¹Operational framework refers to a plan that the Army would use to conduct whatever operation may be necessary in response to a terrorist attack.

In addition to the literature search, the committee requested a series of briefings from the Army to better understand the Army’s view of the homeland mission. It also heard from representatives of the National Guard Bureau to understand the role of the Army National Guard. A thorough legal briefing on the limitations of the Posse Comitatus Act facilitated this understanding. Lastly, the committee heard from scientists with expertise in a wide range of technologies in an effort to preview emerging types of equipment.

Even as this report was being prepared, doctrine and policy were being developed. The Department of Homeland Security and the Department of Defense’s Northern Command, which are to have the major responsibilities and authorities for homeland security at the national level, are still in the early stages of formation and organization. The actual role that will be played by the Army in homeland security must certainly depend in large measure on the operational assignments Army units will be given in the framework of, or in support of, these overarching organizations. This remains in a state of flux. While, as is indicated in the report, it is anticipated that much of the doctrine will be drawn from existing protocols, the lack of specific doctrine made the study of specific equipment requirements difficult. Therefore the committee assumes certain functional requirements, which are described in Chapter 1.

REPORT ORGANIZATION

The DOD’s Defense Counter-Terrorism Technology Task Force (DCT3F), in calling for and reviewing technical proposals in the wake of September 11, used the following taxonomy:

- Indications and warning,
- Denial and survivability,
- Recovery and consequence management, and
- Attribution and retaliation.

The study sponsor chose to make this taxonomy the basis for the committee’s tasking document,² so the report is organized around these operational areas.

²In other documents, the Pentagon has used a different taxonomy but to the same end. For example, the Joint Warfighting Science and Technology Plan uses the following groupings of operational capabilities and subcapabilities:

<i>Prevention</i>	<i>Protection</i>	<i>Response</i>
Denial	Infrastructure	Attribution
Indications and warnings	Personnel	Consequence management
Deterrence	Facilities	Crisis management
Preemptive strike	Retaliation	

These four areas describe events in a time continuum beginning when intelligence indicates an event may take place and ending when blame can be attributed and appropriate retaliation executed. In Chapters 2 through 5 the committee has divided the four operational areas first into functional capabilities and then into technologies. Because the same technologies may be necessary in more than one of the operational areas, conclusions and recommendations concerning these technologies may appear in more than one chapter. Chapter 6 captures the overarching observations of the committee and Chapter 7 lists the findings, conclusions, and recommendations.

COMMITTEE COMPOSITION

The membership of this committee was intended to contain a broad representation of scientific and technological skill sets that have application to the Army's role in homeland security. These skill sets range from information technologies such as communications, computer sciences, and sensor technologies to materials and civil engineering, with special emphasis on structural hardening and resistance to nuclear and conventional explosive forces. Biosecurity expertise was considered important, as was a thorough understanding of the Army's capabilities. A security clearance was considered essential, as many of the topics that would be of interest to the committee are classified.

The committee worked very hard at its task and is grateful to all those who contributed to the report. Although the report limits itself to a fairly high-indenture level of exploration, the committee is satisfied that it will provide significant assistance to the Army as it moves on to future missions.

John W. Lyons, *Chair*
Committee on Army Science and
Technology for Homeland Defense

Acknowledgment of Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

Thomas N. Burnette, Jr., LTG U.S. Army (retired),
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Harvey W. Schadler, NAE, GE Corporate Research and Development, and
Andrew Sessler, NAS, Lawrence Berkeley National Laboratory Center.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recom-

mendations nor did they see the final draft of the report before its release. The review of this report was overseen by Alexander H. Flax, NAE. Appointed by the NRC's Report Review Committee, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

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Acronyms

2-D	two-dimensional
3-D	three-dimensional
A and R	attribution and retaliation
AMC	Army Materiel Command
ARNG	Army National Guard
ATD	Advanced Technology Demonstration
BCT	brigade combat team
C&C	computer and communications
C2	command and control
C4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CBR	chemical, biological, and radiological
CBRN	chemical, biological, radiological, and nuclear
CBRNE	chemical, biological, radiological, nuclear, and high explosive
CM	consequence management
CM and R	consequence management and recovery
CST	civil support team
D and S	denial and survivability
D2PC	Dispersion and Diffusion Puff Calculator
DARPA	Defense Advanced Research Projects Agency