



NATIONAL DEFENSE RESEARCH INSTITUTE

THE ARTS
CHILD POLICY
CIVIL JUSTICE
EDUCATION
ENERGY AND ENVIRONMENT
HEALTH AND HEALTH CARE
INTERNATIONAL AFFAIRS
NATIONAL SECURITY
POPULATION AND AGING
PUBLIC SAFETY
SCIENCE AND TECHNOLOGY
SUBSTANCE ABUSE
TERRORISM AND
HOMELAND SECURITY
TRANSPORTATION AND
INFRASTRUCTURE
WORKFORCE AND WORKPLACE

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

[Jump down to document](#) ▼

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world.

Support RAND

[Purchase this document](#)

[Browse Books & Publications](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore [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 PDFs to a non-RAND Web site is prohibited. RAND PDFs 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](#).

This product is part of the RAND Corporation monograph series. RAND monographs present major research findings that address the challenges facing the public and private sectors. All RAND monographs undergo rigorous peer review to ensure high standards for research quality and objectivity.

EVALUATING NOVEL THREATS TO THE HOMELAND

UNMANNED AERIAL VEHICLES
AND CRUISE MISSILES

Brian A. Jackson, David R. Frelinger
Michael J. Lostumbo, Robert W. Button

Prepared for the Defense Threat Reduction Agency

Approved for public release; distribution unlimited



RAND

NATIONAL DEFENSE RESEARCH INSTITUTE

The research described in this report was prepared for the Defense Threat Reduction Agency. The research was conducted in 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 Department of the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community under Contract W74V8H-06-C-0002.

Library of Congress Cataloging-in-Publication Data is available for this publication.

ISBN 978-0-8330-4169-2

The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors.

RAND® is a registered trademark.

Cover Design by Stephen Bloodsworth

© Copyright 2008 RAND Corporation

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2008 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

How to invest homeland security resources wisely in the United States can appear to be an intractable problem because the large, open American society seems to be vulnerable to so many threats in every corner of the country. This monograph is intended to present a defense-planning approach to bound the problem and thereby aid policy and resource decisions about one type of potential threat to the homeland: cruise missiles and unmanned aerial vehicles (UAVs). The methodology used can be applied to other modes of attack, and the insights gained from this approach extend to other threats as well. Indeed, although the focus of the research is on a specific class of weapons, it does not look at that class in isolation; rather, it considers the weapons as one of many options open to a potential attacker and seeks to identify investment strategies that are effective against multiple threats and weapons.

Cruise missiles and UAVs are the chosen focus of this monograph because they represent important tools in the arsenal of the U.S. military. The U.S. military has demonstrated their utility in modern combat in many recent conflicts. Therefore, it should not be surprising that cruise missiles and UAVs are increasingly entering the inventories of militaries around the world, and even those of some terrorist organizations. Cruise missiles are at times dubbed “the poor man’s air force”: In some circumstances, they can achieve similar effects to that of fixed-winged aircraft for a fraction of the cost. And, although perhaps not as illustrious as ballistic missiles, cruise missiles carry a certain status for countries and militaries as a milestone in weapon prowess

and technical advancement. But how much of a threat do these capabilities represent?

The difficulty in answering this question stems from intelligence and law-enforcement organizations' limited ability to monitor terrorist organizations and uncover new attack modes before they have been used in an attack. For instance, in July 2006, Hezbollah apparently surprised both Israeli and U.S. intelligence organizations when it attacked an Israeli naval vessel with a C-802 anti-ship cruise missile. That limited ability means that, in planning defenses, a traditional intelligence threat assessment cannot focus only on known or likely attack modes. Instead, defense planners must consider plausible attack modes, including weapons that could be transferred from a national military to a terrorist organization, particularly those that can be operated by a small number of people and do not require large infrastructure or support investments.

Assessing how such weapons could be used in attacks in the United States is also difficult, because there is also an almost infinite number of targets within the homeland that are vulnerable from the air and therefore represent possible sites for attack. For such a challenge as thinking about how to respond to the potential use of these weapons or the design of defensive approaches, an unbounded problem becomes intractable: The resource requirements of protecting everything quickly become staggering. This challenge is further complicated because such weapons represent only one from a variety of attack options an adversary could choose to use. Before the country invests in a wide array of cruise-missile or other air-defense assets for the nation, the problem needs to be bounded so that scarce resources can be focused productively.

Examining the Threat from UAVs and Cruise Missiles via a "Red Analysis of Alternatives"

In essence, to assess the threat of cruise missiles and UAVs to the homeland, we cannot consider them in isolation; instead, we must consider the problem from the attacker's point of view, in which these systems

are only one of many ways to stage an attack. We call this approach a “red analysis of alternatives” because it will consider cruise missiles and UAVs as one option among many attack possibilities from the point of view of a potential adversary. As a result, we designed our analysis to explicitly compare these systems against other ways in which adversaries could choose to stage offensive operations and to explicitly test whether (and in what specific operational situations) UAVs and cruise missiles provided significant advantages over those alternatives.

The advantages provided by UAVs and cruise missiles over other attack modes are not in the destructive power that they can carry; they are in the way they carry that power and the distance from which they allow an adversary to control its delivery. The value of this advantage to an adversary and, as a result, the likely attractiveness of these systems will therefore be driven by the benefits of aerial attack in solving specific operational problems.

UAVs and cruise missiles are most likely to be attractive in situations in which their aerial, long-standoff capability solves key operational problems an attacker faces in planning and mounting an operation. These systems appear most advantageous because they could make it easier for an adversary to do five main things:

1. attack over perimeter defenses
2. attack over national borders
3. carry out multiple simultaneous attacks
4. conduct an attack campaign (a series of attacks over time)
5. attack area targets with unconventional weapons.

Looking specifically at how adversaries can perform these specific tasks enables analysis of UAVs and cruise missiles in the context of where their advantages are likely to be most important. Through such an analysis, it is possible to identify the key characteristics of the systems that distinguish them from other means of attack and highlight the specific factors that might lead adversaries to acquire and use them.

After analyzing cruise missiles and UAVs in their most favorable light from the attacker’s perspective, we conclude that they do

not appear to have major advantages over other ways of carrying out operations against similar targets, although they cannot be dismissed outright as a potential threat. Where they did appear preferable, the choice for these systems was driven by the actions of the defense or in-place security measures—i.e., were alternative attack modes foreclosed by defenses or did concerns about a potentially compromised plan push the attacking group farther away from its desired targets? The price of these advantages was, however, greater complexity, technological uncertainty, and higher cost and risks associated with these platforms. Consequently, rather than being an attack mode likely to be widely embraced by such actors, UAVs and cruise missiles appear to represent a “niche threat”—potentially making some contribution to the overall asymmetric and terrorist threat. Cruise missiles and UAVs do provide some advantages to an attacker, but in most cases there are simpler alternatives that provide similar, or even superior, capabilities.

Considering Defensive Approaches

In considering appropriate defensive responses to these systems, the homeland-security planner must weigh the scale of investments that are appropriate given the nature of the threat they pose. In view of the availability of alternative attack modes and the uncertainties associated with the success of cruise missiles and UAVs to adversaries, broad-based and expensive efforts focused only on this specific threat appear unrealistic. Given resource constraints, defense planning must therefore also include a broad examination of all the defensive options that are available to craft a prudent and realistic response.

Efforts to defend against this threat could be directed in a wide variety of ways, ranging from counterproliferation efforts to limit technology acquisition, to counterterrorism targeting groups’ procuring the devices, to recovery plans for addressing the consequences of attacks if they do occur. From a comparison of the options and qualitative examination of their costs, we conclude that a prudent defensive strategy appropriate to the magnitude of the cruise-missile and UAV threat would focus primarily on counterterrorism and law enforcement to

prevent attacks and on measures to mitigate the results of such attacks and quickly recover after they occur. Such an investment will increase security not only against cruise-missile and UAV attacks but against a wide variety of potential terrorist attacks.

Some modest defensive investments specific to cruise missiles and UAVs are called for. The Defense Department and the Intelligence Community should gather information to help law enforcement identify potential supply chains and conduct forensics analysis of these systems. Collection of relevant technology and information to support the development of better forensics approaches—e.g., acquisition and study of foreign UAV and cruise-missile systems in ongoing efforts to gather and exploit technical intelligence—has an important role in building the foundations needed for post-attack study and for determining any unique signatures of specific countries' systems. The key to gaining the full benefits of such activity is the ability to share relevant information with law-enforcement organizations.

In addition, diplomatic efforts to strengthen international arms control regimes, particularly those focused on long-range and large-payload air vehicles, could make it more difficult for adversaries to obtain the most destructive of these systems.

In our examination of defensive options, we assessed the potential for deploying active defenses to shoot down cruise missiles and UAVs; nevertheless, we do not recommend broadly investing in such defenses for use in the homeland. Relative to the threat posed by UAVs and cruise missiles, active defense systems are too costly to operate, can defend only very small areas, and have limitations even within these small, defended areas. It is our conclusion that investments in defenses at the point of attack will take away resources from other more-productive defense investments focused on preventing a much wider range of attacks before they occur.