

Ensuring America's Space Security

Report of the FAS Panel on
Weapons in Space



September 2004

Acknowledgements

This report is the product of more than a year-long study conducted by the FAS's Panel on Weapons in Space. The Panel greatly appreciates the efforts of those who presented informative briefings to it; this report would not have been possible without their contributions. The presenters and four meetings at which they spoke are listed in Appendix 2.

Others deserve our thanks as well. George Lewis provided thorough, thoughtful comments on the first draft. Josh Kellar at FAS helped to research small satellites. Kellar provided valuable assistance in organizing the four Panel meetings, writing parts of the report and final editing. Professor Ted Postol at M.I.T. initiated some of the analysis on satellite vulnerability. Heidi La Bash of the Security Studies Program at M.I.T. helped with editing the report. Finally the Panel thanks Subrata Ghoshroy for his untiring dedication as Executive Director throughout this entire project. His hard work, initiating this study, assembling the Panel, identifying and organizing the presenters, and writing and editing the report, are fully appreciated. Ghoshroy wants to extend special thanks to Professor John Holdren at the John F. Kennedy School of Government, where he spent his sabbatical from the General Accounting Office.

The Panel thanks the Federation of American Scientists for sponsoring the study, particularly Henry Kelly, President and Michael Levi, Director of the Strategic Security Project. The Panel also thanks the John D. and Catherine T. MacArthur Foundation and the Ploughshares Fund for providing the resources that made the study possible.

Leonard Weiss, Chairman

October 2004

TABLE OF CONTENTS

Foreword	vi
Executive Summary	1
Section 1: Background: The Debate over Weaponizing Space	7
Section 2: Historic Growth of Space Activities	11
a. Services Provided by Space Assets	11
b. Military Use of Commercial Space Assets	12
Section 3: U.S. Space Systems: Vulnerabilities and Threats	14
Introduction	14
Threats with Possible Space Weapons Response	15
a. Small Satellites	15
b. Ground-based Anti-satellite Weapons	20
c. High-altitude Nuclear Explosion	23
Threats That Cannot be Addressed by Space Weapons	29
a. Jamming of Satellite Links Including GPS Signals	29
b. Control of High-Resolution Imagery	29
c. Orbital Debris	30
Loss of GPS Constellation	35
Section 4: Protecting U.S. Space Systems	36
The Case for Weaponization	36
a. The Rumsfeld Space Commission Report	36
b. Space Weapons-Related Programs	38
c. Selected Arguments for Weaponization	39
Alternatives to Weaponization	41
a. Mitigating Vulnerabilities	41

b. Has Deterrence Changed?	41
c. International Rules of the Road for Space	43
d. Improve Space Surveillance.....	43
Endnotes	45
Glossary of Acronyms and Terms	48
APPENDICES.....	62
General	
Appendix 1	Biographies of Panel Members and Staff
Appendix 2	Panel Meetings and Presenters
Technical	
Appendix - A	Issues in Space - Daniel Hastings
Appendix - B	Anti-Satellite Weapons - Geoffrey Forden
Appendix - C	Satellite Threat due to High-altitude Nuclear Detonation - Dennis Papadopoulos
Appendix - D	Sensitivity of GPS Coverage - Geoffrey Forden
Appendix - E	Orbital Debris Analysis - John Remo
Appendix - F	Capabilities of Potential Adversaries
1. China - Hui Zhang	
2. Russia - Pavel Podvig	
3. North Korea - David Wright	
Appendix - G	Commentary on the APS Report on Boost-Phase Missile Defense - John Remo

The FAS Panel on Weapons in Space

Leonard Weiss, Chair

Phillip E. Coyle III

Charles A. Fowler

Robert A. Frosch

Ivan Kaminow

C.Kumar N. Patel

John L. Remo

Ian Roxborough

Lawrence Scheinman

Ray Williamson

Jill Wittels

Staff

Subrata Ghoshroy - Executive Director and Editor

Josh Kellar - Research Assistant

Heidi La Bash- Assistant Editor

Foreword

The urgent national debate about placing weapons in space has been stirred by three recent developments. First was the release of the January 11, 2001 Report of the Commission to Assess United States National Security Space Management and Organization, chaired by then Secretary of Defense-designate, Donald Rumsfeld; the Rumsfeld Commission warned of a potential "Space Pearl Harbor" and inferred that placing weapons in space could be a response. Second, in 2002 the United States withdrew from the Anti-Ballistic Missile Treaty, thereby removing one of the key legal barriers to deploying weapons in space. Finally, increased use of space assets has contributed significantly to the overwhelming advantage enjoyed by the U. S. military, making those assets an increasingly attractive target to potential competitors and causing some to argue that placing weapons in space can deter such threats.

In response, in December 2002 the Federation of American Scientists assembled a panel of distinguished scientists and engineers, including academics and former high-level government officials, to assess the security benefits of space weaponization. Recognizing that the rate of technological and political change makes long-term prediction difficult, the Panel limited its analysis to whether the United States should weaponize space in the next five to ten years. In particular, the Panel examined in detail the question of how best to protect the space assets of the United States in this period, considering space-based and non space-based counters to the most likely threats.

The Panel's charter was to consider carefully the arguments of proponents and opponents of weaponizing space, to make original technical analysis of some critical issues, and to provide the public and policymakers with a detailed summary of its findings, conclusions, and recommendations. As part of its investigation the Panel heard testimony at four meetings from current and former military officials, independent researchers, academics, and representatives of non-governmental organizations involved with space and military policy. Testimony was taken from Randy Correll, Richard DalBello, Richard Garwin, Laura Grego, Daniel Hastings, Peter Hayes, Theresa Hitchens, Michael Krepon, Jeffrey Lewis, Dennis Papadopoulos, Pavel Podvig, Ted Postol, Robert Preston, John Remo, David Wright, and Qiu Yong. A list of the panels and presenters follows the main report.

This report therefore represents over a year of investigation and analysis. It broadly represents the views of the Panel. While not every member agrees with

every conclusion, the members are unanimous that, at this juncture, it is unwise and unnecessary to deploy weapons in space. It recommends the issue be revisited in five years to update this assessment.

Terms

The Panel took the term "weaponization" to mean the placement of weapons in orbit that could attack targets in space or on the ground. A Glossary of terms and abbreviations follows the main report.

