Preface

Over the past decade or so, societies around the world have relied increasingly on satellites for vital communication services, environmental monitoring, navigation, weather prediction, and scientific research. This largely beneficial trend is expected to intensify: more countries are developing satellite technology and using the services derived from it.

The same technologies have made possible the development of military capabilities in space that go far beyond those employed during the Cold War for intelligence gathering early warning. Some in the United States see space as a critical enabler for bringing decisive military force to bear anywhere on Earth with little or no warning. This rapid strike capability is a central element of the post-9/11 national security strategy, which seeks not only to deter or defeat any potential aggressor but also to prevent the acquisition of threatening capabilities by hostile states or terrorist groups. Protecting and enhancing U.S. military capability in space is emerging as an important focus of military planning. Recent official documents have proposed, for example, various anti-satellite and space-based weapons to protect and augment U.S. capabilities in space.

These new missions are controversial in the view of close U.S. allies and are likely to be contested by others if pursued. Serious public discussion of military space plans has not yet occurred in the United States, though important questions of policy, planning and budgeting loom: What missions are best carried out from space? What are the likely costs and available alternatives to various space weapons proposals? How susceptible are satellites to interference? How easily can they be disabled or destroyed? What measures can be taken to reduce their vulnerability?

The answers to these questions depend on physical laws and technical facts that are not widely understood outside of a rather narrow slice of the science and engineering community. The paper that follows makes accessible to a general audience the necessary facts upon which an informed evaluation of space policy choices can take place. The authors, physicists David Wright, Laura Grego, and Lisbeth Gronlund, describe the mechanics of satellite orbits and explain why certain operations are suited to particular orbits. They discuss the requirements for launching satellites into space and maneuvering them once in space. They consider the consequences of the space environment for basing certain military missions there. Finally, they describe the elements of a satellite system and assess the vulnerability of these components to various types of interference or destruction. They also include an analysis of technical measures for reducing satellite vulnerability.

The paper makes no attempt to provide policy recommendations. Although the authors' views on space weapons and missile defense are well known to those who follow these issues, they are not asserted here. Instead, the intent is to provide a neutral reference. Those engaged in the policy process, no matter what their views, should find this work useful.

This paper is part of the American Academy's "Reconsidering the Rules of Space" project. The study examines the implications of U.S. policy in space from a variety of perspectives, and considers the international rules and principles needed for protecting a long-term balance of commercial, military, and scientific activities in space. The project is producing a series of papers, intended to help inform public discussion of legitimate uses of space, and induce a further examination of U.S. official plans and policies in space. Forthcoming papers will consider the interaction of military, scientific, and commercial activities in space; Chinese and Russian perspectives on U.S. space plans; and the possible elements of a more comprehensive space security system.

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