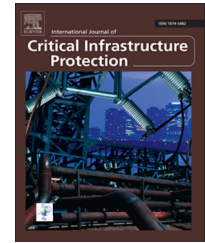Available online at www.sciencedirect.com

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Whither cyberpower?

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ABSTRACT

Since World War II, control over land, sea, air and space has been essential to projecting national power. During the past two decades, the domain of cyberspace has emerged; it is the new frontier for wielding the four instruments of power – diplomacy, information, military and economics. The pervasiveness of cyberspace supports near instantaneous action in all the domains of human power – land, sea, air, space and cyberspace. Could cyberspace be the one domain to rule them all?

This paper draws on recognized theories of power in the physical world to create a lens for projecting and analyzing the future of cyberpower and cyber powers, helping clarify the nature of cyberspace and the entities that interact in cyberspace. The paper considers nation-states as well as non-state actors, and examines how they might operate, evolve and wield power in cyberspace. Also, it discusses power scenarios that may emerge in the cyberspace of the future.

1. Introduction

Mankind has always sought power. The first powers were land based. As technology advanced, great maritime powers developed. In his seminal 1890 book, *The Influence of Sea Power upon History*, Mahan [38] described the sea as a social and political domain that could be exploited to extend a nation's power around the world. Mahan's ideas influenced President Theodore Roosevelt to project America's influence, for example, by constructing the Panama Canal and dispatching the Great White Fleet on a circumnavigation of the world [33].

Advances in technology brought on the next domain of power – air. Douhet's 1921 book, *The Command of the Air* [11], is the equivalent of Mahan's classic book. However, while Mahan published his work long after sea power had been established, Douhet published his book at the dawn of air travel. Douhet predicted that the air domain would become a critical battlefield with the ability to carry war to all places,

and whoever controlled the air would also control the surface. Also, he implied that air power would be necessary to win any future wars because of its aptitude for destruction [12]. Douhet was proved to be correct – air superiority during World War II was vital to victory.

As technology advanced, space became the next domain of power. The two superpowers, America and the Soviet Union, were locked in an intense race to space. The Soviet Union won with Sputnik, but America persisted with advanced technology – moon landings, space shuttles, highly accurate MIRV'd missiles and Reagan's Strategic Defense Initiative.

For the past 60 years, control over land, sea, air and space has been essential to projecting national power. Now, cyberspace has come into existence; it is the new frontier for the instruments of power – diplomacy, information, military and economics. The pervasiveness of cyberspace supports near instantaneous action in all the domains of human power – land, sea, air, space and cyberspace.

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This paper attempts to clarify the nature of cyberpower and the essential requirements of a cyber power [60]. It considers nation-states as well as non-state actors, and examines how they might operate, evolve and wield power in cyberspace. Also, it discusses power scenarios that may emerge in the cyberspace of the future.

2. National power

Scholars define national power in myriad ways. Organski [51] views power as the ability of a state to influence the behavior of other states. Nye [49] describes power as the ability of an entity to influence another entity to achieve desired outcomes, even to make the entity do something it would not otherwise do.

Keohane and Nye [35] distinguish between hard power and soft power. Hard power is the ability of an entity to use threats or rewards to get other entities to do what they otherwise would not do. Soft power is the ability of an entity to achieve goals through attraction rather than coercion.

Power also requires resources. Nolte [48] sees national power as control over resources, principally military resources. Other resources include wealth, time, political capital [28], geographical size, population and economic strength (GDP) [37]. However, Wight et al. [72] give credit to "less tangible elements like administrative and financial efficiency, education and technological skill, and above all moral cohesion."

Regardless of how "power" is defined, its overarching themes are resources and influence. Resources and influence crystallize into four elements – diplomatic power, informational power, military power and economic power – that have come to be known as the DIME model of national power. The DIME model was created during the Carter and Reagan administrations. Carter's 1977 Presidential Directive/NSC-18 [45] identified the superior technology, economic system, political system and military of the United States as the components that gave it an edge over the Soviet Union. Reagan's 1982 National Security Decision Directive Number 32 [46] stated that national security required the development and integration of a set of strategies covering the diplomatic, informational, economic/political and military components of national power.

2.1. Diplomatic power

States communicate and interact with each other using diplomacy. Diplomacy seeks to foster acceptable relations and mutual understanding between states [17]. Negotiation and compromise are key components [72]. Diplomacy is generally viewed as a political action, but it may also carry the threat of physical force [17].

Diplomacy may also rely on political and governmental power. While diplomacy often focuses on a country's relations with other nations, political and governmental power are more concerned with what happens within a nation. Nevertheless, a strong government and contented citizens almost always enhance the diplomatic power of a state and its influence over other nations.

2.2. Informational power

According to Groh et al. [26], the information dimension involves the "use of information content and technology as strategic instruments to shape fundamental political, economic, military and cultural forces on a long-term basis to affect the global behavior of governments, supra-governmental organizations, and societies to support national security." Informational power is wielded in a complex environment comprising the physical, informational and cognitive dimensions. The goal is to engage, inform, educate, persuade and influence perceptions and attitudes of target audiences to ultimately change behavior [42].

President Reagan's National Security Decision Directive 130 [47] called information an integral and vital part of U.S. national security policy and strategy. The directive noted that informational power includes the need to communicate with people of differing ideologies and cultures, and listed international radio and television broadcasting, publications and utilizing new technologies to achieve effective communication with the world. Now, also explicitly included in the informational dimension are the Internet, mobile communications, social networks and other technologies that have become ubiquitous.

Murphy et al. [42] emphasize the role that the informational dimension plays in strategic communication as a proactive and continuous process that supports the national security strategy by identifying and responding to threats and opportunities with information-related activities that include actions as well as words. Informational power influences a nation itself – as well as other nations – by helping define and project the nation's culture. This includes not just language, traditions, religion, art and music, but also political, economic and military aspects.

2.3. Military power

Several scholars [22,48,54] believe that the most important component of national power is military power. Troxell [69] notes that military operations range from military engagement, security cooperation and deterrence activities to crisis response and limited contingency operations and, if necessary, major operations and campaigns.

The ability to physically defeat an adversary is the purest form of military power. However, military power is much more than winning wars. Troxell [69] lists five other components of military power: coercion, deterrence, compellence, reassurance and dissuasion.

A nation's military may use coercion by threatening the use of force to prevent an opposing nation from taking an action. This may occur in one of the two ways. Deterrence may be used to convince the adversary that the risks of an action outweigh the potential benefits; or the military may use compellence to change the behavior of the adversary nation. Reassurance extends security guarantees to friendly nations and allies. Dissuasion is the ultimate purpose of both defense and deterrence – persuading other nations not to take actions that are harmful to themselves. Dissuasion also includes efforts to influence other nations not to build up military forces that could pose a threat [69].