Chapter 11
Cyber Security in Tactical Network Infrastructure for Command and Control

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ABSTRACT

Emerging information and communications technology has had significant importance for military operations during the last decades. Development within such technology areas as sensors, computers, and wireless communications has allowed for faster and more efficient collection, transmission, storage, processing, analysis, and distribution of data. This has led to new and improved military capabilities within command and control, intelligence, targeting, and logistics. However, the increased complexity and interdependencies of networked systems, the continuously growing amounts of data, changing non-technical requirements, and evolving adversary threats makes upholding cyber security in command and control systems a challenging task. Although some best-practice approaches have been developed, finding good solutions for protecting critical infrastructure and important information assets is still an open research question requiring an interdisciplinary approach. This chapter describes recent developments within emerging network technology for command and control, and suggests focus areas where further research is needed in order to attain sufficient operational effect from the employed systems. While a gradual and evolutionary progress of military cyber security has been seen, a long-term commitment is required within such areas as procurement, standardization, training, doctrinal, and legal development, in order to achieve military utility of command and control systems.

INTRODUCTION

During the last couple of decades we have witnessed a rapid development within information and communications technology, something that has affected and reshaped our society in many ways. The advent of the Internet during the 1990s and its subsequent proliferation through mobile technology during the 2000s, including high-capacity mobile terminals and high-speed wireless communications, has resulted in a pervasive network where content is increasingly be-

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ing generated by end-users at the network edge. The ongoing miniaturization of components, and the integration of computational elements and physical entities, has given rise to cyber-physical systems, supporting and facilitating a multitude of human processes. The ability to mine large data sets, to fuse information from heterogeneous sources, and to perform real-time positioning of individual network nodes, has paved the way for a variety of new network-based services. Whereas most of these do indeed make our lives easier and facilitate our every-day tasks, some may be more questionable in terms of privacy.

The development of information and communications technology has also had a significant influence on military organizations. During the last few years, the concept of "cyber" has become extremely popular throughout many sectors, not least within the military domain. Armed forces of many countries have scrambled to update their doctrines and strategies on the topic (Ventre, 2012), and assertions have been made that the "cyber threat" is one of our time's most potent and alarming dangers (Bumiller & Shanker, 2012). A relevant question to ask is if this development thus constitutes a technical revolution, something that will profoundly change the way wars are fought and crises are responded to. Will cyberspace be the battlefield of tomorrow, leaving nations without an effective cyber defense vulnerable to attacks? Or has the fear of cyber warfare been blown out of proportion, perhaps at the expense of more relevant conventional military capabilities? Although the answer to these questions may vary depending on who you ask, we can say with certainty that the idea of information technology having a revolutionary effect on how wars are fought is not new.

The conduct and outcome of the first Iraq War in the early 1990s served as an eye-opener for many of those who had previously had little reason to stay updated on the latest development in military use of advanced technology. This was the first major conflict in which the Global Positioning System (GPS) came to active use, allowing for guided munitions to strike against targets with what appeared as surgical precision. This stood in stark contrast to the razing of entire cities and mass bombings as witnessed during World War II and the Vietnam War. The broadcasting of aerial video sequences showing specific government buildings, military installations and critical infrastructure in crosshairs being struck seconds later, in combination with reports of surprisingly low casualty figures, contributed to the sense that warfare had taken a revolutionary leap. This change was captured by the concept of "revolution in military affairs" (RMA), which predicted that military operations would forever be transformed by the ability to exploit technical advances in innovative ways to achieve victory, opening "a whole new era of warfare." (Boot, 2006) While not everyone was convinced of this at the time, it was difficult to analyze the first Iraq War without recognizing that the application of information and communications technology in support of a superior command and control capability had contributed to the successful outcome for the allied forces. There also seemed to be a near-universal agreement that a significant change in contemporary war-fighting was likely underway.

The concept of what constitutes "a revolution", military or otherwise, often differs depending on the circumstances in which it is being used, but commonly involves dramatic events that imminently attract attention. However, the term is more commonly used than defined, and one could quite easily compile a long list of events in recent history which would qualify as being social, political, technological or scientific revolutions. The difference between revolutionary and evolutionary changes can also be discussed. Whereas both concepts contain measures of wide-ranging (scope) and significant (magnitude) transformations, the main difference lies in how rapidly (speed) the change occurs (Shimko, 2010). However, when it comes to RMA, it has been suggested that the issue of speed should perhaps not be overly dwelled upon