Chapter 86
Application of Cyber Security in Emerging C4ISR Systems

Ashfaq Ahmad Malik
National University of Sciences & Technology, Pakistan

Adil Khan
National University of Sciences & Technology, Pakistan

Athar Mahboob
National University of Sciences & Technology, Pakistan

Junaid Zubairi
State University of New York at Fredonia, USA

ABSTRACT

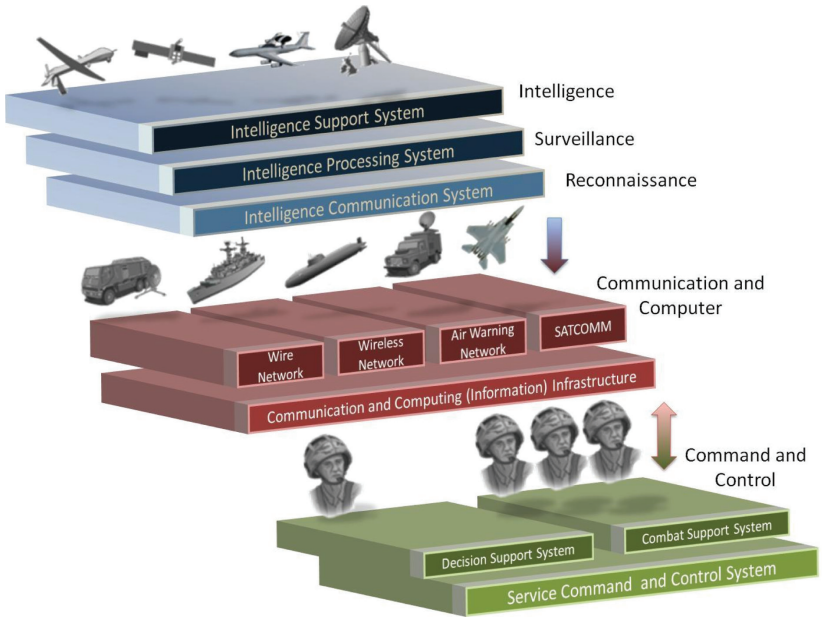
C4ISR stands for Command, Control, Communications, Computers, Intelligence, Surveillance & Reconnaissance. C4ISR systems are primarily used by organizations in the defense sector. However, they are also increasingly being used by civil sector organizations such as railways, airports, oil, and gas exploration departments. The C4ISR system is a system of systems and it can also be termed as network of networks and works on similar principles as the Internet. Hence it is vulnerable to similar attacks called cyber attacks and warrants appropriate security measures to save it from these attacks or to recover if the attack succeeds. All of the measures put in place to achieve this are called cyber security of C4ISR systems. This chapter gives an overview of C4ISR systems focusing on the perspective of cyber security warranting information assurance.

1. INTRODUCTION TO THE C4ISR SYSTEMS

C4ISR is the abbreviation of Command, Control, Communications, Computers, Intelligence, Surveillance & Reconnaissance (Figure 1). The C4ISR system is the central nervous system of military organizations. There is an increase in requirement and usage of these systems even by civil organizations such as railways, airports, oil and gas exploration departments, etc., hence C4I systems are a source of growing attraction for various people and organizations. The primary objective of a C4ISR system is to present the overall scenario and picture of the area of interest (such as a battlefield, operation area of ships/forces in sea/land/air or a disaster area, etc.). This allows a clear situational awareness for better decision making by the mission commanders to achieve their missions. A comprehensive and better situational

DOI: 10.4018/978-1-4666-4707-7.ch086

Figure 1. The concept of C4ISR (Stokes, 2010)



awareness of the battlefield helps the commander in making of effective and timely decisions which in turn helps in effective control of the situation through an advance planning and efficient utilization of the available resources. Figure1 shows the overall concept of C4ISR systems.

Historically, C4ISR systems have followed an evolutionary path in their development. The terminology of C4ISR is used by the military organizations, specially by US-DoD, to mean the use of organizational setup utilized by military forces for carrying out a mission. The first C of C4ISR stands for command which means authority over subordinates with responsibility. Second C stands for control which means exercising authority over subordinates. These are the aspects of leadership and are commonly known as C2. The facilities used by commanders and leaders in carrying out their assigned missions are largely dependent on communication and computers hence terms C3 and C4 are well known and accepted. The I of C4ISR represents Intelligence, i.e. the collecting of information which is required by leaders/commanders to carry out a mission. Hence the terms C3I and C4I started coming into use over a period of time. The information is gathered through intelligence, surveillance and reconnaissance which is the reason for the ISR part. The systematic observation of certain things is called surveillance whereas observations on specific occasions is defined as reconnaissance. Hence, the systems are now collectively termed as C4ISR systems (Anthony, 2002).

The overall purpose of a modern C4ISR System is to achieve a better Command & Control of a situation (i.e. in the battlefield, at sea, disaster management, etc.) through good and updated ISR functions and using the latest computer and communication technologies effectively. A very brief and comprehensive C2 model which has been basically derived from tactical level but also fits in higher more strategic levels is described as bottom up approach for design of C2 systems (Anthony, 2002) (Stanton, et. al., 2008):

It is proposed that the command and control activities are triggered by events such as the receipt of orders or information, which provide a mission