

A Survey for Cartography in Military Geography

Kittichai Phukan, Wichai Pawgasame
Data Communication Division
Defence Technology Institute
Pakkret, Nonthaburi, Thailand
kittichai.p@dti.or.th

Abstract—Geospatial Information is an important asset in military operations. Valuable geospatial data can provide decision makers with prominent mission planning as well as command and control. Modern geospatial information is distributed in digital format allowing interactive map to be delivered to the audience. In modern warfare, many entities are involved in the battlefield. These large number of entities could confuse the audience. The environment could greatly effect military operations. Such effects must be understandable to the military personnels, who read the map. Hence, the problem of representing geospatial information is very crucial in military operations. The challenge is how to represent geospatial information in the format that meets the cognitive capability of the military personnels. An effective cartography must be employed in order to convey geospatial information that meets the reader's capability. This article explores researches in cartography in the aspect of cognitive capability of the military personnels, which could be a guideline for producing tactical maps.

Index Terms—Cartography, Military Geography, Cognitive Map

I. INTRODUCTION

Military Geography is the use of geospatial data by the military in order to gain advantages over the operations [1]. The military operations involve space, time and what exists within that space and time; by definition, this is confined to geospatial information. Military strategists utilize military geography in order to plan and assign actions for achieving the goal of securing assets in the military. The essential of military geography have evolved from a critical analysis in a battlefield to a response of asymmetrical threats (i.e., threats by insurgency) [1]. In the early war, the scale of battlefields was small such that a military general could see the entire battlefield from a vantage point [2]. Hence, geospatial information was obtained through the eyes of a military general without using topographical map. As the innovation of guns and long-range weapon were emerged, a military general could not see an entire battlefield and had to rely on a topographical maps in order to obtain spatial information. Since the first World War, the battlefield has grown to the global scale and military geography must rely on the accurate map coordinate. The modern military geography requires more sophisticated geospatial information rather than accurate map coordinates. Different geospatial information is required for different military operations such as peacekeeping, disaster relief, counter-insurgency, or combat operations. Geospatial Information should be able provide diverse information according to different military operations. Consequently, the

representation of the information should be different based on the military operation. A careful study of the representation is needed to provide geospatial information that meet the cognitive capability of the military personnels.

Uncontrollable factors such as weather and terrain can have more impacts on a battle than any other controllable factors (i.e. weapons, equipment, or supplies) [3]. Weather changes from time to time, while terrain may change dramatically from the time of map survey and printing [4]. Such dynamic environment requires the decent and timely update of geospatial information. Geographic Information System (GIS) can provide the military operations with timely geospatial information. However, the process of terrain data collection and map production must be studied carefully before GIS being deployed into the military operations.

The process of terrain data collection, the representation of terrain and spatial data on the map, and the production of map are known as Cartography [5]. Cartography require the mixed knowledge of science, art and technology in order to produce desired geospatial information that are meaningful to the audience. In this article, the audience is the military personnels who are familiar with the military mapping and symbology system. This article study Cartography in the military aspect, in which produced geospatial information would meet the cognitive aspects of the military personnels. In term of technology, the data collection and representation technologies are studied. This article distinguishes terrain data from spatial data such that terrain data is the data that visually represents the earth surface, while spatial data is the data that is associated with the map by its coordinate. This article does not provide the study of how spatial data is collected but would rather provide the study of spatial data representation on the map. However, the study of terrain data collection is included in this article.

This article is organized as follows. Section II presents the characteristics of military geography. Section III explains the concepts, elements, and technologies of cartography, which are necessary for the production of geospatial information. Section IV considers the cognitive capability of human in geospatial information interpretation. Section V gives the examples of cartography techniques and their application to the military geospatial information. The terms geospatial and geographic information may have the same meaning and are used interchangeably in many literatures. However, the term geospatial information will be used throughout this article.