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A study on the development of the OMS/MP based on the Fundamentals of Systems Engineering

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Abstract

The Systems Engineering method is increasingly recognized as a central in the Acquisition of Weapon Systems in South Korea. Because of these trends, issues concerned with improving weapon system design are increasingly raised. This paper presents a development of Operational Mode Summary/Mission Profile (OMS/MP) in terms of Weapon Systems Acquisition for application to Systems Engineering method. For a systematic approach, a precise concept of OMS/MP is derived by analyzing the concept of conventional OMS/MP. This paper reviews the results of a series of previously reported examples aiming to develop the OMS/MP of a weapon system. Based on this, the limitations of the conventional OSM/MP applications are investigated. And these limitations can be resolved by the Fundamentals of Systems Engineering. Finally, the OMS/MP framework based on the Fundamentals of Systems Engineering has been proposed and is successfully implemented for the Harbor Underwater Surveillance System.

Keywords: OMS/MP; ORD; Systems Engineering; Weapon system; Naval ship design; Weapon system acquisition; RAM; ILS; Shipbuilding; Harbor Underwater Surveillance System

1. Introduction

The objective of this paper is to develop an Operational Mode Summary/Mission Profile (OMS/MP) in terms of weapon system acquisition using the Fundamentals of Systems Engineering approach. According to the DAPA regulation in South Korea, Systems Engineering approach must be applied in order to acquire effective weapon systems. In general, the weapon systems acquisition process is divided into four phases: Precedent Study Phase, Exploratory Development Phase, System Development Phase, and Operations and Support phase. OMS/MP is a basic document which describes the acquisition process of weapon systems. It provides foundation information from logisticians, testers and evaluators, capability developers and analyst. OMS/MP used to be the appendix of Operational Requirements Document (ORD) and is the document which is written right after naval ships or weapon systems' Precedent Study phase in the early phase of the weapon system acquisition. In addition, the OMS/MP describes how to operate weapon systems during wartime and peacetime. The contents covered by OMS/MP are as shown below (DAPA, 2017) (Table 1).

However, it is difficult to say there has been sufficient research about the development of OMS/MP during the acquisition of warships and weapon systems. Even though OSM/MP has been compiled during the acquisition of most of the recent warships and weapon systems, they are unavailable due to confidentially restrictions. There are barely a few examples of foreign naval applications and these along with some portions of opened OMS/MP that are primarily process oriented are available Unfortunately these few example do not provide a coherent and systematic approach for developing OMS/MP.

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Table 1
Definition of OMS and MP.

Definition	Contents
OMS (Operational Mode Summary): Description that a variety of expected behavior will be used for the system to carry out the operational mission	- Documentation of the use of the system, which serves as a reference for basic input value or test and evaluation of the system design - It is necessary to include all the major mission (primary missions), which are listed in the Mission Profile - Must include the percentage of various mission frequency or system used in each mission - Percentage of system during the life cycle of the system which is the details of the exposure time for each of the environmental conditions
MP (Mission Profile): Temporally narrative of operational incident and the environment in which the system until the end from the start of the specific mission are facing	- Identification of task, event, period, operating conditions and environment in which the system is encountered at the stage of the mission - Include the typical mission scenario - It is required to identify the need to complete mission, Task or operation Event to successfully complete the mission. - Descriptions of the specific capacity (time, times, miles, cycle, etc.) of the essential functions of each mission - It must be consistent with the doctrine and tactics

Thus, this paper suggests the idea of applications for Fundamentals of Systems Engineering. This can be achieved by deriving implications of the domestic and overseas examples related to writing the OMS/MP. Based on this, Fundamentals of Systems Engineering are introduced to suggest the development tools of systematical OMS/MP.

2. Previous works

The requirements of OMS/MP writings are recently standardized but it is rare that they are opened due to the security constraint associated with acquiring weapon systems. Therefore, four cases of OMS/MP developed by domestic and overseas are investigated in this paper. Three cases are domestic and the other case is overseas.

2.1. Domestic case

For the domestic case, a submarine which is an Integrated Weapon System and one of the most complicated weapon systems (Jang et al., 2011), the army's combat vehicle mounted with weapon systems (Yoo et al., 2013) and a SONAR system of submarine (Song et al., 2015), are the main cases of OMS/MP applications.

2.1.1. Submarine OMS/MP

OMS/MP applications of submarine consist of three phases; Mission Area Analysis, Composition of combat scenarios, quantification of OMS/MP during wartime and peacetime. Descriptions are given below (Jang et al., 2011).

As seen in Fig. 1, the first phase is Mission Area Analysis. This phase investigates the external battle environment considering future global situations, and science & technology which are related to submarine operations. Furthermore, the future navy's operational concepts for a submarine are determined and derived. Finally, the submarine's required capability is suggested.

The second phase is to compose combat scenarios. Based on the Mission Area Analysis results, several combat scenarios are written by considering specific operations related to the submarine. And then, the Switch ON List has been composed. It indicates the ON or OFF state of the required equipment to operate for the finalized combat scenario.

The third phase is quantification during wartime and peacetime. By selecting the mission-area related to the worst case, quantifications are determined. The Template of OMS/MP is shown as a table below (Table 2 and 3) (Jang et al., 2011).

2.1.2. SONAR System's OMS/MP

In order to apply OMS/MP on the submarine's SONAR System, OMS/MP setting results of the submarine at which the SONAR System is mounted, are referred. Per the results of investigations for submarine's operation condition and Mission Area Analysis, sonar system's OMS/MP has been applied based on the composed wartime combat scenarios and peacetime operation scenarios. Procedures for the applications are as follows (Song et al., 2015) (Fig. 2).

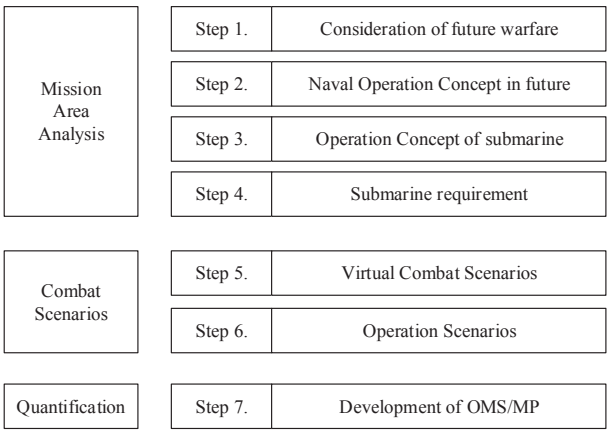

Fig. 1. Process of submarine's OMS/MP.

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