

## **EIGHT YEARS OPERATION OF COMS FOR THE OCEAN MONITORING MISSION<sup>1</sup>**

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**KEY WORDS:** Communication Ocean Meteorological Satellite, Ocean Monitoring Mission Operation, geostationary satellite, Geostationary Ocean Color Imager

**ABSTRACT:** This paper discusses the characteristics and the status of the ocean mission operation of the Communication Ocean Meteorological Satellite (COMS). The COMS is currently on an extended operation service after the planned 7 years normal operation service since April 2011. The ocean mission is performed by the Geostationary Ocean Color Imager (GOCI) which is one of the payloads mounted on the COMS. The operation concept and satellite mission planning of the COMS are discussed for the ocean monitoring of the GOCI. And the results of 8 years operation of the COMS are looked into to provide the accomplishment status of the ocean observation mission during the COMS operation. The operational results show that the ocean mission of the COMS is in good condition even on the extended operation service following the planned 7 years normal operation service.

### **1. INTRODUCTION**

Communication Ocean Meteorological Satellite (COMS) is the geostationary satellite which performs the three missions of meteorological observation, ocean monitoring, and telecommunication service simultaneously (Cho, 2013a; Lee et al., 2010). The COMS was located at the orbital position of 128.2° East originally and has moved to the orbital position of 128.15° in August 2018 for the operation of the Geostationary Korea Multi-Purpose Satellite 2A (GEO-KOMPSAT 2A; GK2A), which is the follow-up satellite of the COMS for the meteorological mission and located at the orbital position of 128.25° after launch in December 2018. The COMS is currently on an extended operation service after the planned 7 years normal operation service since April 2011

The ocean mission of the COMS is performed by the Geostationary Ocean Color Imager (GOCI) which is one of the payloads mounted on the COMS (Faure et al., 2012). The GOCI watches the ocean surrounding the Korean peninsula to provide ocean images every day. The GOCI is operated to take the ocean images 8 times a day and 7 days a week. For the ocean mission operation, the satellite control ground station makes the daily mission planning of the ocean monitoring and sends daily mission commands to the COMS.

Since the launch of the COMS, the operational status of the COMS has been reported several times regarding the mission planning and the operation results of the Earth observation during the period of the in-orbit test and the normal operation of the COMS before the extension of the mission (Cho, 2013a; Cho, 2013b; Cho, 2015; Cho and Woo, 2017).

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<sup>1</sup> This paper presents a recent status of the COMS operation for the ocean mission in English at the Asian Conference on Remote Sensing ACRS 2019 as an update of the previous presentation which was presented in Korean at the KSRS fall conference 2017(Cho and Woo, 2017).

This paper gives the current status of the COMS operation for the ocean monitoring mission with the status about the extended operation after the planned 7 years normal operation service, so that the update of operational status for the COMS mission can be shared in public. First, the operation concept and satellite mission planning of the COMS are discussed for the ocean monitoring of the GOCI. And the results of 8 years operation of the COMS are looked into to provide the accomplishment status of the ocean observation mission during the COMS operation.

## **2. MISSION PLANNING FOR OCEAN MONITORING**

In the development process of the COMS, the COMS has been designed to be provide the normal operation service up to 7 years mission life. The planned 7 years normal operation of the COMS began in April 2011 and ended in March 2018. The extension of the mission operation of the COMS was approved in the relevant committee of Korea government so that the operation of the three missions of the COMS is extended 2 years more after the end of the 7 years normal operation. The COMS is currently on an extended operation service since April 2018, after the successful achievement of the planned 7 years normal operation. In the current extension of mission operation, the operation concept and characteristics of the COMS are maintained without any change as it was in the 7 years normal operation.

The ocean mission of the COMS is to monitor the ocean surrounding the Korean peninsula and the GOCI of the COMS is the instrument that carries out the mission. The GOCI observes the fixed ocean area of 2500km×2500km every time, which includes the East Sea, the East China Sea, and the Yellow Sea around the Korean peninsula. The GOCI has the 8 spectral bands in the visible region and the near-infrared region of the light spectrum to take 8 color images from a single observation. The time required for a single observation is about 30 minutes and the observation period is 1 hour, so that the GOCI can provide 8 images from 09:15 to 16:45 (Korean Standard Time) every day in the case of the observation of the maximum capability allowed in the current operation concept of the COMS.

For the satellite control including mission planning of the GOCI, the COMS is operated by the Satellite Operation Center (SOC) of the Korea Aerospace Research Institute (KARI). The Korea Ocean Satellite Center (KOSC) of Korea Institute of Ocean Science & Technology (KIOST) plays a role in the reception, processing, archive, distribution, and application of the GOCI image data as the principle user of the COMS ocean mission. The KARI SOC backs up the reception and processing the GOCI image data in case there is a trouble in the KOSC. The two ground stations of KARI SOC and KIOST KOSC also extend their ground system operation in accordance with the extended mission operation of the COMS so as to maintain the satellite mission operation as well as the pervious normal operation service.

In order to carry out the satellite mission successfully, the orbital position and the attitude of the satellite needs to be maintained stably within the required range. In order to keep the attitude of the COMS to the extent required, the COMS is operated to take the Wheel Off Loading (WOL) maneuver twice a day (Lee et al., 2011). For the sake of orbit maintenance, the COMS is operated to take the Station Keeping (SK) maneuvers (Lee et al., 2011). The SK maneuver is performed in two directions, East-West direction and the North-South direction. The COMS takes each direction SK maneuver once a week.

The mission plan of the COMS is generated normally on a daily basis. In a daily mission planning for the COMS operation, the KOSC, the principle user of the GOCI image data, sends

the user mission requests to the SOC in the KARI. The requests for the satellite orbit and attitude control are generated according to the satellite operation procedure in the KARI SOC.

In a daily mission plan, the meteorological mission, the ocean mission, and the satellite control can be requested to be done together in the same time. In some case, one mission can give an impact on other missions, that is, two or more missions can conflict one another. When a mission conflict occurs in the daily process of mission planning, it is resolved normally by applying the mission priority rule according to the specifications of COMS mission conflict management. As a result of the mission conflict resolution, lower priority mission can be revoked or rescheduled. After resolving the mission conflict, the final daily mission plan is converted to the satellite command script and then sent to the satellite through the antenna system of the ground system.

### **3. MISSION OPERATION RESULTS**

In the development process of the COMS, the GOCI is designed to observe the ocean every day and to take images 8 times a day. The principle user makes the formal request of 8 times observations every day for the ocean mission request, which means the demand for maximum use of the GOCI in the allowed operation concept of the COMS. In the real operation of the satellite mission, all the user requests cannot be carried out as they are, because some of the requested ocean missions can be cancelled out due to the mission conflict with other mission or be changed from the original request for better ocean mission operation in the mission planning process of the COMS.

The COMS has three mission which are independent one another, so that the COMS is designed to perform the three missions simultaneously. In the operation of COMS, the ocean mission does not conflict with the telecommunication mission. In the operation concept design of the COMS, there are some constraints on the ocean mission due to the simultaneous operation with the meteorological mission. Thanks to the pause time between two successive observations of the GOCI, the COMS operation concept can be designed so that the GOCI observation does not conflict with the WOL maneuver. In the case the ocean mission conflicts with the SK maneuver, the mission conflict resolution is needed in the mission planning process.

The results of the ocean mission operation of the COMS are investigated with review on the mission conflicts and the mission changes for the 8 years operation of the COMS which includes the 7 years planned operation and the 1 year extended operation. The status of the operated ocean missions of the satellite is analyzed through a comparison with the mission requests of the user. As an analysis result, the Figure 1 shows the operation results of both the user request and the mission planning in terms of the number of ocean images for the 8 years operation of the COMS. In the Figure 1, each year represents the duration from April of the year to March of the following year. The Figure 1 tells that the number of image requested by user is almost same as the number of images planned by the mission operator with minimized cancellation of the images due to mission conflict. It is found in the Figure 1 that the ocean mission of the COMS is in good condition even on the 1 year extended operation service after the planned 7 years normal operation service. As shown in the Figure 2, the investigation on the GOCI images received by the ground station of the KASI SOC shows that the ocean mission has been operated successfully and the image data has been secured reliably from the satellite except for the case in which some trouble of the ground station is found. So that the status of the ocean mission operation is summarized comprehensively based on the missions actually performed through the resolution for the mission conflicts and the mission changes for the 8 years operation of the COMS.

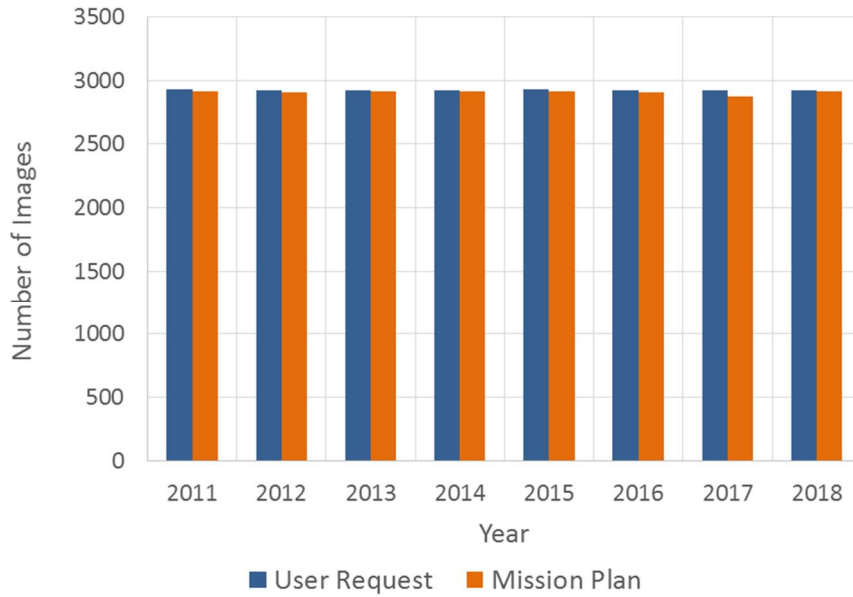


Figure 1. Number of ocean images for the 8 years operation of the COMS

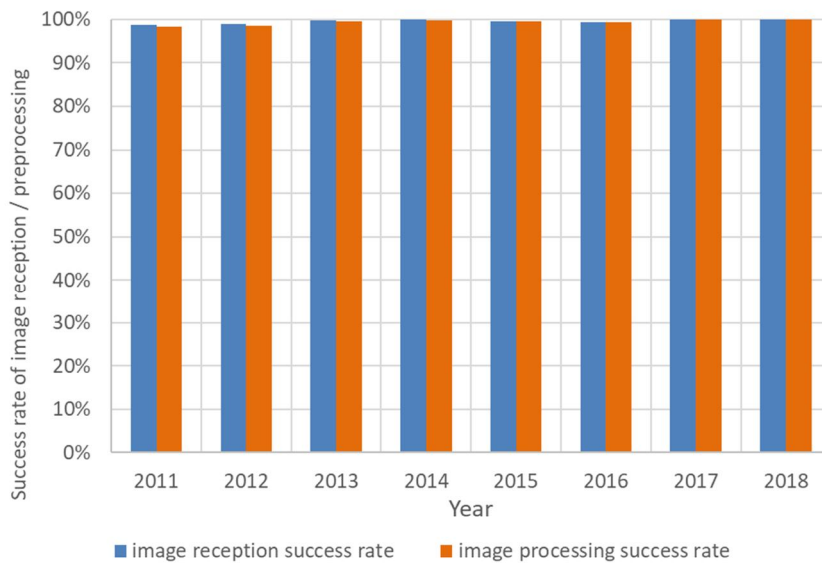


Figure 2. Ocean image reception and processing for the 8 years operation of the COMS

#### 4. CONCLUSIONS

The COMS is currently on an extended operation service since April 2018, after the successful achievement of the planned 7 years normal operation. This paper discusses the characteristics and the status of the COMS operation for the ocean mission including operation concept and satellite mission planning for the ocean monitoring, such as operation time of the GOCI, mission request from the principle user, mission conflict between the ocean mission and the other missions of the COMS, and change of the ocean mission. And the results of 8 years operation of the COMS are looked into to provide the accomplishment status of the ocean observation mission during the COMS operation. The operational results show that the ocean mission of the COMS is in good condition even on the extended operation service following the planned 7 years normal operation service.

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