

SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Architectures (4)

Author: Mr. Seung-Eun Yang

Korea Aerospace Research Institute (KARI), Korea, Republic of, seyang@kari.re.kr

Mr. Hyun-Kyu Shin

Korea Aerospace Research Institute (KARI), Korea, Republic of, hkshin@kari.re.kr

Dr. Sang-Kon Lee

Korea, Republic of, skon@kari.re.kr

SOFTWARE BASED CONTINGENCY OPERATION METHODS OF A LOW EARTH ORBIT  
SATELLITE

**Abstract**

Satellites are exposed to severe space environment including radiation, rapidly changing temperature, high vacuum, micrometeoroids, Electro Static Discharge (ESD) and etc. These may lead a fault or anomaly of the satellite. This paper describes software methods that resolve anomaly state of the satellite: flexible telemetry packing, event error log and critical parameter checking.

To check the status of satellite, telemetry is used which is normally processed at 1Hz rate. However, some data is changing faster and these may need to be checked at a ground station for abnormal condition. By adopting the proposed flexible telemetry packing method, faster periodic data acquisition is possible, which overcomes the system budget.

In the case of Low Earth Orbit (LEO) satellite, the contact time is limited because of its orbital characteristics. And the status checking by analyzing telemetry data costs considerable time. Therefore, fast handling for an abnormal case is not easy and it may cause failure especially for LEO satellite. The time consumption of status checking can be decreased by providing the information of what happens on the satellite. Based on this idea, we use the event logging mechanism which logs an event that occurs on the satellite. Each event is managed by its own level. The logged events are transmitted to the ground station and used to figure out the satellites state. For abnormal cases, error information is logged into a software error table which is operated independently of event log table.

The proposed methods above are effective when a fault occurs while contact is maintained. However, none contact period is longer than contact period for LEO satellite. Therefore, appropriate management should be made for fault cases during none contact time. To achieve this, critical parameter checking logic is devised. Every important parameter that should be checked is defined in the critical parameter table. The proposed logic checks parameters at the defined rate. If a certain item shows a problem, appropriate task sequences are executed. Task sequences for each case are defined in an additional table.

This paper introduces software methods to figure out the fault cases of a satellite. By applying the proposed methods, it is possible to manage fault cases which occur contact or none contact period of the LEO satellite.