통신해양기상위성 전기적 지상 성능시험 장치 하드웨어 설계

조영호 · 양군호
한국항공우주연구원 · 한국항공우주연구원

Electrical Ground Support Equipment(EGSE) Hardware Design for the Communication, Ocean & Metrological Satellite(COMS)

Cho, Young-Ho · Yang, Goon-Ho
Korea Aerospace Research Institute

Abstract - The COMS(Communication, Ocean & Meteorological Satellite) is the geostationary satellite which will be performing three main objectives such as meteorological service, ocean monitoring and Ka-band satellite communications. This paper reports on the hardware architecture of the system electrical ground support equipment(EGSE) for the COMS satellite. EGSE is used to check out satellite during the development prior to lunch. The EGSE represented in this paper consist of two parts. First, I will deal with the OCOE(Overall Check Out Equipment) system which controls and operates the all EGSE system. In second part, we will introduce the SCOE(Specific Check Out Equipment) systems which can test the specific subsystems of the COMS satellite.

Key Words : COMS, EGSE, OCOE, SCOE

1. Introduction

According to the space development plan of Korean government, COMS satellite development project is under cooperating between ASTRIUM and KARI. The COMS(Communication, Ocean & Meteorological Satellite) is the geostationary satellite which will be performing three main objectives such as meteorological service, ocean monitoring and Ka-band satellite communications. During development for its satellite, we must check out the functions and state of health for satellite. Therefore, the main task of EGSE is to check out satellite systems, at system or subsystem level, during integration and validation phases of their life-cycle. Through a combination of hardware and software elements, EGSE supports manual, semi-automatic and fully automated testing. Automation is achieved by offering users simple, yet powerful means to write their own test application programs(test sequence) in high-level. the philosophy of automation was driven primarily by the hardware configuration for COMS[1]-[3].

This paper represents EGSE H/W configurations which will be u sed for the COMS satellite testing. Additionally, the EGSE config uration had to be as flexible as possible regarding requirements o n reusability on different EGSE test levels and with different uni t test device combinations and subsystem check-out equipment(S COE) respectively.

2. H/W System design

Figure 1 shows the simplified interconnection diagram for COMS integration and test. The EGSE supplies telecommand and stimulus signals to COMS and receives telemetry and status signal from COMS. It has the function which discriminates between right and and wrong based on this signal flow. To achieve this functions, the EGSE are connected to each SCOE via ethernet and connected to spacecraft via hardline. Most of SCOE are controlled and monitored under OCOE[4]-[5].

2.1 OCOE SYSTEMS

The OCOE is a Test System used to pilot or test a Specimen. It is a data processing system, consisting on a set of dedicated software running on a particular hardware platform. An OCOE is the core element of EGSE. Its Software Architecture is based on
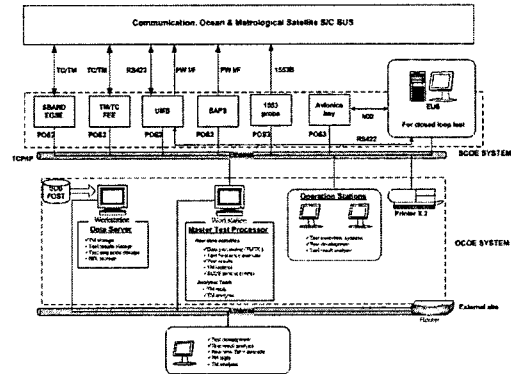

Figure 1. Simplified EGSE configuration

an Open Center kernel, customized for COMS project. This customization is performed by configuring the standard OC components and bricks, and by adding specific bricks and components to the basic OC System Frame.

The OCOE is composed of :

a central data server computer,

a set of Workstations (Man Machine Interface),

a set of standard peripherals (printers, tapes, ...),

a set of interface equipment to the satellite (FEE Front-End Equipment, ...)

an interconnecting Local Access Network.

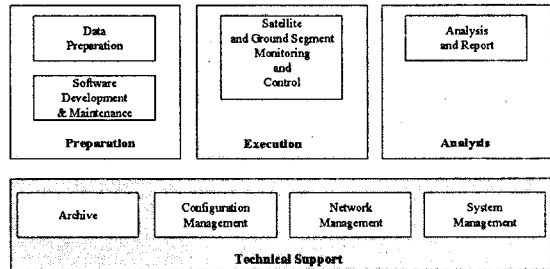OCOE have two dedicated computers to share the real time activity

Figure 2. the main functions of OC

The functions provided by Open Center, from an operational point of view, are management of satellite data from COMS corresponding to different integration steps of a satellite. this functions are available to prepare test sequnece program and synoptic performed on the integrated satellite. In realtime section, Open Center manages incoming data from a satellite and SCOE. Also it provides off line analysis of archived data for all the processed data

2.2 SCOE SYSTEMS

The SCOE is a test equipment specific to a given test facility. It contains one or several data processing units, and is used to test

or interface the specimen. A SCOE has its own software core, that can use Open Center. It provides autonomous operation, and may provide a dedicated man machine interface and specific peripherals (electrical units, printers, ...). A SCOE may be used and controlled through the OCOE (connected through the Local Access Network, as described in the OCOE).

UMB(Umbilical Bay) SCOE

The Umbilical Bay provides the following functions:
● Power supply to the S/C during integration, assembly and test (4 x 60 V /35 A DC power supplies)
● Acquisition and monitoring of up to 10 EPS parameters (main bus voltages, main bus currents, battery voltages, battery currents···)
● Protection of the S/C against overvoltages and overcurrents (shutdown signal distributed to other EGSE) according to a programmable safety matrix
● Relays commands generation (ex: battery isolation relays, S/C separation···)
● SW loading/dumping (RAM and PROM SW) through RS422 link
● TM/TC signal routing (PSK TM and NRZ/PSK TC)
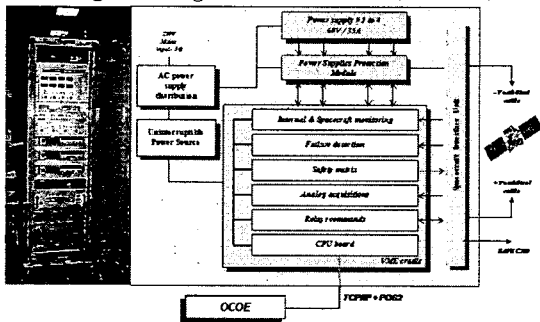
Figure 3. Real UMB H/W and electrical I/F block diagram

It is assisted by an internal uninterrupted power supply so as to achieve minimal functions of acquisitions, monitoring and display in case of main AC loss.
All the functions in terms of commands/acquisitions/status/alarms are accessible on both the rack and from the OCOE through a TCP/IP protocol (POS2).
The umbilical SCOE interfaces with the S/C using the +/-Y umbilical connectors. It interfaces with the SAPS to perform fast shutdown and to the TM/TC FEE to convey TM and TC.

TCR SCOE
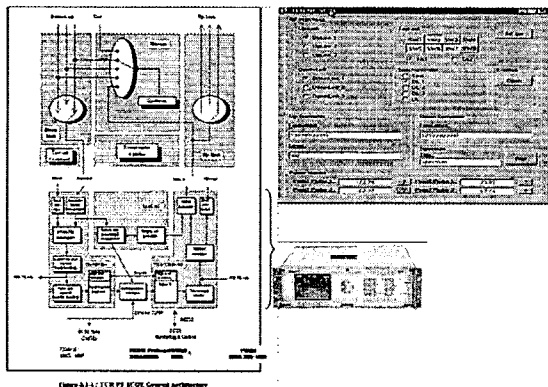
Figure 4. S-band EGSE H/W and electrical I/F diagram

The TCR SCOE(=S-band EGSE) includes RF measuring Equipments and associated Computer and one RF Coupling And Load Assembly . The system perform RF tests (spectrum , power measurements , AGC , Transit time , ···) , RF switching , Interface switching , Modulation /Demodulation .

The COMS TCR SCOE is used to :
● PM/FM   PSK/FSK modulate/demodulate the PCM TM/TC signals in interface with the FEE
● Perform the Transponders Test

FEE SCOE
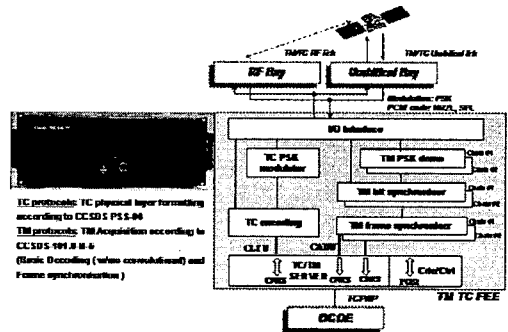
Figure 5. FEE SCOE H/W and Electrical I/F diagram

The Telecommand and Telemetry Front End equipments (TMFEE and TCFEE) provides the following functions:
● normal and dwell/AIT TM bit stream demodulation
● TC encoding and signal modulation.
● It provides interfaces switching (for Launch   and Clean Room)
● interfaces the S/C either through the umbilical SCOE (PSK TM, NRZ TC) or through the TCR SCOE (PSK TM, PSK TC)
● It has the capability to interface with a remote ground station to support the SCC validation.
● It provides emergency TC sending function
● It manages SCU TC flow constraint
● TM up to 2 Mbit/s   NRZ/biPhase data   PSK modulated or not
● TC up to 2 Mbit/s   NRZ   data PSK modulated or not

3. CONCLUSION

In this paper, we presented COMS EGSE H/W configuration and make mention of a few SCOE in details. The COMS EGSE design is based on the COMS satellite requirements. The technologies mentioned above have become reusability on different EGSE test levels and with different unit test device combinations.

ACKNOWLEDGEMENTS

REFERENCE

[1] Yonggil Jeong, Youngho Cho, Eunjung Choi, Juyong Jung, Chunsam Kim, "Design of Telemetry Acquistion and Monitoring System for the Transponder of Communication & Broadcasting Satellite(CBS) Payload System", JC-SAT2002, 2002.
[2] D. Nicklauben, F. P. Zappen, L. Gunther, " The ABRIXAS EGSE architecture and EGSE software development approach", Pro. of the DASIA97 Conference, 1997.
[3] Taebyeong Chae, Youngho Cho, Koonho Yang, "COMS Metrological Imager Interface(MI2U) Design", JC-SAT2006, 2006.
[4] "COMS satellite functional test requirements specification", COMS.SPI.00011.DP.T.ASTR, KARI/ASTRIUM, 2007.
[5] "COMS Health-Check tests requirements Specification", COMS.SPI.00012.DP.T.ASTR, KARI/ASTRIUM, 2007.