

15th SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Operations (3)

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DEVELOPMENT OF AUTOMATIC SATELLITE OPERATION SYSTEM
- USING REIMEI GROUND STATION AS A TEST BENCH -

Abstract

We are in progress to develop a system for automatic or unmanned operation of satellite in order to reduce human load of its steady operation phase. The REIMEI ground station is used as a test bench for verification of proposed method. REIMEI was developed by ISAS/JAXA, launched on Aug. 24th 2005, and has been working on the orbit for more than five years at present of March 2011. The radio wave regulation in Japan requires a qualified operator to be at the operation room. With this automatic operation system, however, he (she) just watches the console in case of some emergency. In conventional operation system, operators manage sending command, receiving telemetry, antenna driving, satellite health check, emergency action, and recording log etc. by mouse/keyboard operations. In our new automatic operation system, a scheduler software as a substitutive operator manages all the operations through a unified procedure. The scheduler reads a schedule file of the operation sequences, which is a part of satellite operation procedure. Then the scheduler manages sending command, receiving telemetry, and driving antenna in accordance with an operation time line which is prepared before the operation pass. The scheduler performs diagnostics of satellite anomaly based upon the received telemetry data and status of the ground station. In case that some anomaly of the satellite is detected, the scheduler initiates an emergency schedule that was prepared depending on the emergency level. If the emergency is serious, the scheduler calls up or mails to an appropriate staff for the emergency. We have a prototype model of REIMEI's onboard computer(OBC) to verify operation plans before sending them at OBC hardware level. We also use this equipment to verify automatic operation plans. After verification, this automatic operation system is implemented on REIMEI ground station and used in steady operation. The automatic operation system is nearly completed for downlink operations of the data recorder that account for 75% of REIMEI steady operation. The system automatically performs downlink signal lock-on, uplink acquisition, satellite health check, data downlink, LOS(loss of signal) procedure, and lock-off during visible time. This approach is very effective to reduce psychological and physical load of operators. We have a plan to expand the automatic operation to all kinds of satellite operations such as sending stored-commands operations, and low-elevation pass operations etc. Also, we have a plan to develop emergency operation system by mobile gear, for example, iPad or Android smart phone.