# Study of spacecraft onboard software verification environment

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As performance of micro-processing units (MPUs) advances, onboard software (OBS) of spacecraft, such as for guidance, navigation and control, has been growing larger in scale and more complex. At the same time, improvement in spacecraft reliability as well as cost reduction and shortening of the development period are being demanded. It would therefore be very useful to prepare a verification environment for OBS that is commonly utilized for various spacecraft.

A few methods are used to verify OBS. Full-software simulation on general-purpose PCs is for logic tests. Processor-in-the-loop simulation (PILS) in which OBS is executed on an onboard processor is able to verify real-time operating systems (RTOSs), device drivers, as well as major logics of OBS. Using a software emulator instead of the processor is an effective way to check the behavior during hardware malfunctions and monitoring in detail. For all methods, a simulator with an interface is necessary to supply input data for OBS and to receive output data from it. The simulator consists of component models that depend on each spacecraft, and the framework that controls execution of the simulation and connection of the models.

The aim of our study is to design a framework and interface capable of absorbing the dependencies on OBSs, spacecrafts and methods for the verification environment. We have implemented a tentative interface commonly used for FSS and PILS. A framework and interface that maintain high compatibility between PILS and methods using software emulators are also being developed.