

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Technologies for Future Space Transportation Systems (5)

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TECHNOLOGY DEMONSTRATIONS AND SYSTEM DESIGN FOR REUSABLE ROCKET FLIGHT
EXPERIMENTS

Abstract

In order to study a system architecture for reusable launch vehicle, we have proposed a reusable sounding rocket in ISAS/JAXA which makes the access to space for scientific researches much easier and make the opportunities of the rocket launches much frequent. Reusable sounding rocket is different from the present expendable rockets in 1) repeated operations, 2) returning flight / re-ignition of engine / vertical landing, that is, 3) fault tolerant / health management. Technology maturation studies as phase-A of reusable sounding rocket development have been conducted from 2010 to 2016 as follows, 1) proto-model engine development and repeated operation demonstration, 2) fuel/oxidizer management demonstration through planned flight, in-flight restart and turnaround ground operation, 3) detailed aerodynamic design and returning flight studies, 4) health monitoring subsystem demonstration, and 5) comprehensive preliminary system design and front loading studies for “flyable vehicle” including repeated flight operation architecture. As these technical demonstrations for reusable sounding rocket development have successfully completed, a study system level verifications by a flight demonstrator are in progress from 2016 as the next step. In this plan, a reusable rocket test vehicle will be establish for repeated flight demonstrations. Objectives of the demonstration are 1) system architecture study for repeated flight operation such as quick turnaround operation and fault tolerant design method, 2) life controlled and frequently repeated use of cryogenic propulsion system and its flight demonstrations, 3) study for the advanced returning flight method of vertical landers and its flight demonstrations, and 4) demonstration of advanced technology for future RLVs such as more composite on board, in flight fuel management, GH2/GOX auxiliary propulsion, health management, long-life high performance engine. These system level studies by a reusable flight demonstrator will be conducted for next three years. In this paper, ISAS/JAXA activities for development reusable launch vehicle, that is, technical demonstrations for reusable sounding rocket and a plan and present status of flight demonstrations by reusable rocket demonstrator, are summarised and reported.