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

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SYSTEM DESIGN AND TECHNICAL DEMONSTRATIONS FOR REUSABLE SOUNDING ROCKET

Abstract

Recently, in spite of existence of many launch demands for scientific researches using sounding rockets, the opportunities of launches are actually restricted because of high-cost of rocket launches, long period of launch preparations, and so on. In order to make the access to space for researches by the sounding rocket much easier and make the opportunities of the rocket launches much frequent, a fully reusable sounding rocket is proposed in ISAS/JAXA. Vehicle systems and ground / flight operations are designed for observations of atmospheric phenomena, micro-gravity experiments and so on. The mission definition of the proposed reusable sounding rocket is summarized as follows: 1) To achieve 100km in altitude and returns/lands at the launch site, 2) The payload to be carried should be 100 km and returns with the vehicle, 3) Flight frequency is higher than 5 times in two-month launch season, and two seasons per, 4) The minimum flight interval for the turnaround capability is one day, and 5) Operational flight cost excluding development cost should be an order of magnitude less than the existing ISAS sounding rocket. System and subsystem designs such as aerodynamics, propulsion systems, structures, etc were conducted, respectively. A vertical take-off and vertical landing system is adopted because of 1) simple ground support equipments, 2) streamlined flight and ground operations, 3) compact system and light inert weight, and so on. In phase A of the development plan of the proposed reusable sounding rocket, demonstrations of the key and critical technologies to develop the reusable sounding rocket will be conducted for engineering verifications of subsystems before the manufacture of flight system. In phases after the phase A, the flight engine and flight model of reusable sounding rocket will be manufactured and tested. Ground firing tests, take-off and landing tests, low and high altitude flight tests will be repeatedly conducted. After these system verifications, the reusable system will be operated as a sounding rocket. The key technologies with respect to the returning flight are 1) aerodynamic design and flight demonstration for returning flight, 2) fuel/oxidizer management demonstration, and 3) landing gear development. Moreover, the key technologies with respect to the repeated operations are 4) reusable engine development and repeated engine operation development, 5) reusable insulation development for cryogenic tank, and 6) health management system construction. Present status of system design and technical demonstrations are introduced in this paper.