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Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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RECENT DEVELOPMENT OF FLIGHT DEMONSTRATORS FOR REUSABLE SUBORBITAL TECHNOLOGIES AND IT'S APPLICATION

Abstract

The recent market trend for space transportation has paved way for many organizations to design, develop and launch reusable launch vehicles. Falcon 9 of Space X, New Sheppard of Blue origin etc. are the products of this trend. This has motivated many academic organizations to start developing reusable launch vehicles. Winged rocket of Kyushu Institute of Technology is an unique example. Since 2005, Kyushu Institute of Technology has been designing and developing sub-scale rockets to validate the necessary technologies for suborbital winged rocket (launch vehicle). One such version is WIRES13 (WInged Reusable sounding) rocket developed together in collaboration with University of Southern California (USC). This vehicle is propelled by two LOX Kerosene engines developed by USC. The objective of this vehicle is to validate the technologies such as high power propulsion system, recovery system reaction control system and long range communication system required for a suborbital vehicle. This vehicle will be launched in December 2018 from Mojave, United States . WIRES13 has a body length of 4.6 meters and launch mass is 1000 kg. The semi-monocoque structure is made of carbon fiber reinforced plastic and the double fault tolerant avionics uses the ARINC 429 protocol for communication. The recovery system consists of two stage parachute and 3 airbags. The engines are made of inconel and are operated by Pressure fed regenerative cooling system. Helium gas is utilized as pressurant for propulsion system. After the powered flight, the remaining helium is used to validate the reaction control system. In parallel to WIRES13 development, WIRES15 is also under development in collaboration with JAXA and other organizations in Japan. WIRES15 will be launched in December 2019 in Mojave, United States. WIREs15 has the similar structure of WIRES13 but it is equipped with a wing to validate the guidance and control technology after the re-entry phase. Most of the subsystems are similar to that of WIRES13. The design and development of both these vehicles and the importance of this study are discussed.