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DEVELOPMENT STATUS AND FLIGHT DEMONSTRATION PLAN OF EXPERIMENTAL WINGED
ROCKET WIRES#015 AT TOKYO UNIVERSITY OF SCIENCE

Abstract

The Space Systems Laboratory at Tokyo University of Science and the Tokyo University of Science's start-up SPACE WALKER Inc. have been developing a scaled winged experimental rocket called WIRES015 (WInged REUsable Sounding rocket)[1] in cooperation with JAXA (Japan Aerospace Exploration Agency) and DLR (Deutsches Zentrum fuer Luft- und Raumfahrt: the German Aerospace Center). It has the dimensions of 4.6m and initial mass of 1,000kg to conduct the comprehensive flight demonstration of the technologies for realizing suborbital spaceplane[2] such as LOX/LNG (Liquid OXYgen/Liquefied Natural Gas) engine, autonomous NGC (Navigation, Guidance and Control) system and fully composite LOX and LNG propellant tanks. The LOX/LNG engine employs full expander cycle system with a common pump to feed the LOX and LNG to the combustor, which achieves high Isp (specific impulse) performance. The features of NGC are the guidance by DynDGA (Dynamic Distributed Genetic Algorithm) and the attitude control law by DI (Dynamic Inversion) theory that guarantees stability onboard. One of the most important demonstration technologies is the world's first composite liquid oxygen tank using LOX compatible pCFRPC (pitch Carbon Fiber Reinforced Poly Carbonate), which is currently being a joint research and development with DLR. WIRES015 is currently in the process of fabrication. The helicopter sling test for validating the NGC and parachute recovery system will be conducted by the end of 2022, and CFT (Captive Firing Test) and the hardware-in-the-simulation test are planned by the end of 2023. The first flight test will be conducted in the first quarter of 2024 followed by the three additional flight tests. [1] Yonemoto, K., et. al., "Development Status of Experimental Winged Rocket WIRES015 and its Flight Demonstration Plan at Esrange of Sweden in Cooperation with University, Agency, Industries and International Partners", GLEX-2021,6,1,7,x62871. [2] Yonemoto, K., et. al., "Preliminary Design of Suborbital Spaceplane with LNG Engines by a Japanese University Start-up with the Partnership of Industries: Part 2," IAC-20,D2,4,9,x59725.