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600-KN REUSABLE LOX/METHANE ROCKET ENGINE RESEARCH AND DEVELOPMENT

Abstract

Abstract: LOX/methane engine is an optimum choice of low-cost access-to-space because of relatively low cost, ambient storability, as well as lifetime and related potential of reusability. A 600-kN LOX/methane reusable engine has been developed by the Academy of Aerospace Launch Propulsion Technology (AALPT), China, as a low cost and high reliability booster for Chinese future Reusable Launch Vehicles. The 600-kN LOX/methane engine development program is under responsibility of Beijing Aerospace Propulsion Institute (BAPI), a division of the Academy of Aerospace Launch Propulsion Technology (AALPT). The requirements for low cost, high reliability and moderate performance had led to the choice of a gas generator cycle for the LOX/methane engine. The engine has a thrust rating of 70 ton in sea-level at an oxidizer-to-fuel mixture ration (O/F) of 2.88. A number of experiments at subscale level or sub-systems were conducted to study and evaluate methane/LOX gas-liquid and liquid-liquid injection combustion performance, combustion instability and methane cooling characteristics, thermo-mechanical behavior, and etc. Significant research and practical progress of the engine on performance, reliability, and reusability was demonstrated in developmental engine testing. The first prototype engine tests were demonstrated in 4 tests and 67 seconds with a short nozzle began in Jan 2011. These tests helped to verify compatibility of each component, and confirm the start-up, shut-down sequence and ignite characteristic. Four years later on Sep 2015, another engine been successfully developed and demonstrated over 2103 seconds and 13 mission cycles. The engine thrust levels of 101The advantage characteristic of LOX/methane engine is analyzed. The development status of 600-kN LOX/methane engine is introduced in this paper, and the developing tendency and researching emphasis of the LOX/methane engine were discussed. Key words: Reusable Launch Vehicles; LOX/methane rocket engine; reusability.