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QUALIFICATION TEST RESULTS OF LE-9 ENGINE FOR H3 LAUNCH VEHICLE

Abstract

The H3 Launch Vehicle, Japanese next mainstay launch vehicle, has been developed since 2015 and its first test flight is scheduled for Japanese fiscal year 2020. The key concepts of H3 are reliability, affordability, and high performance to become more competitive in the international launch market than Japanese current mainstay launch vehicles, H-IIA and H-IIB. The booster engine of H3, called LE-9, is based on Japanese technological heritages: the design and evaluation method of high pressure and high temperature component of LE-7A, H-IIA/B's booster engine, and the simple and reliable engine cycle of LE-5B, their upper stage engine. Some key features of LE-9 engine were demonstrated through the LE-X technology demonstration program (2008 - 2014). JAXA is responsible for the LE-9 engine development, which Mitsubishi Heavy Industries, Ltd. (MHI) and IHI Corporation (IHI) are joining as contractors. MHI is in charge of engine system and combustor, and IHI is in charge of turbopumps development. In Bread Board Model (BBM) phase, failure modes and risks were identified and mitigated by high-fidelity analysis, elementary tests, and full-scale components tests. In Engineering Model (EM) phase, Four EM engines were produced for firing tests to validate start sequence, engine performance, durability, and others in a wide range of operations. Through EM hot firing test campaigns, the engines operated in a very stable state in a wide range of operations. The engine characteristics were mostly within expectation. In the latter part of EM phase, additively manufactured components, e.g. injector, pipes and valve casing, were tested, and its feasibilities were confirmed. In addition, three engines of them were supplied to stage firing tests. In the stage firing tests interface condition and operability between engines and propellant supply system were verified. Qualification Model (QM) phase is starting now. In QM phase, three engines will be tested to verify and certify all the engine specifications. First QM test campaign will be conducted from Apr to Jul 2020. In the congress test results of first QM campaign will be reported, and engine characteristics obtained in the campaign will be discussed.