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INSPECTION IN LIFE CRITICAL COMPONENTS AND MAINTAINABILITY OF REUSABLE  
SOUNDING ROCKET ENGINE**Abstract**

Reusable Sounding Rocket (RSR) is proposed in JAXA/ISAS and being developed in cooperation with MHI. The objectives of the RSR are to provide frequent mission opportunities for atmospheric observation with low cost and with short turnaround time, and also to improve technology readiness levels for reusable space transportation system. This rocket will take off vertically, reach to the high altitude more than 100 km, land on the launch site vertically, be launched again within 24 hours and be operated over and over again. In order to achieve the 100 flights of reusability, the design efforts for longer life and easier inspection were made on life critical components, and also the appropriate maintenance based on the inspection will be planed. As the critical engine components to limit the engine lifetime, the combustion chamber and the frictional parts in turbopumps, such as bearings and shaft seals, were extracted from the catastrophic engine failure modes. In the design of the combustion chamber, the maximum wall temperature is limited to secure the 100 flights of reusability without changing itself. The igniter torch has inspection ports and the injector face plate is removable to change damaged injector

elements. Some non-destructive testing methods, such as X-ray CT scanning, will be applied to the combustion chamber to detect the incipient damage and deformation. As for the bearings of high speed LH2 turbopump, hybrid ceramic bearings, which consist of SUS440C inner and outer races and Si<sub>3</sub>N<sub>4</sub> balls, were employed for prolonging the lifetime. In order to realize on-site inspection without overhaul, the LH2 and LOX turbopumps have inspection ports for the bearings and the seals, and the structure is designed to disassemble and assemble easily. A series of the RSR engine firing tests is planned in 2014, and the inspection on life critical components and the trial of engine maintenance will be carried out through the engine firing tests. This paper presents the current status of firing tests, the results of inspection and the practice of maintenance in the RSR engine.