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ECR Discharge Ion Engines and Their Space Experiences HITOSHI KUNINAKA, ISAS/JAXA, TATSUYA NAKAI, University of Tokyo, KAZUTAKA NISHIYAMA, ISAS/JAXA — Ion engine μ10 has a long life and high reliability because of electrodeless ECR plasma generation in both the ion generator and the neutralizer using 4GHz microwave. Measurements on the electron energy distribution in the ion generator revealed the discharge mechanism to heat gradually a part of the thermal electron along magnetic track. The high-energy electrons generate ions in collision process and return to the thermal electrons. The recycling process of electrons results in the effective plasma generation in comparison with the DC discharge ion generator, in which the high-energy electrons are expendable. Four μ10, each generating a thrust of 8 mN, specific impulse of 3,200 seconds, and consuming 350 W of electric power, propel the "HAYABUSA" asteroid explorer launched on May 2003. After vacuum exposure and several runs of baking to reduce residual gas, the ion engine system established continuous acceleration. In 2005, HAYABUSA, using solar electric propulsion, managed to successfully cover the distance between 0.86 AU and 1.7 AU in the solar system, as well as rendezvous with, land on, and lift off from the asteroid. During the 3-year flight, the ion engine system generated a delta-V of 1,400 m/s while consuming 22 kg of xenon propellant and operating for 25,900 hours.

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