

# Fundamental Research of Detonation Engine and Its Space Flight Experiment Using Sounding Rocket

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## Abstract

The detonation engine generates detonation and compression waves at extremely high frequencies (1–100 kHz) to drastically increase reaction speed, leading to radical reduction of rocket engine weights and high performance by easy generation of thrust. The research group of Nagoya University, Keio University, JAXA/ISAS, and Muroran Institute of technology has successfully demonstrated a detonation engine in space flight. The Detonation Engine System (DES) developed in this study was loaded onto the mission section of the sounding rocket S-520-31 and launched from the JAXA Uchinoura Space Center at 5:30 a.m. on July 27, 2021. After the separation of the first stage rocket, the rotating detonation engine and pulse detonation engine were successfully operated in space, and photo images, pressure, temperature, vibration, position, and attitude data were acquired by telemetry and RATS (Reentry and Recovery Module with Deployable Aeroshell Technology for Sounding Rocket Experiment). The fuel is methane and the oxidizer is oxygen. The success of this space flight demonstration will bring the detonation engine much closer to practical use as a kick motor for deep space exploration, and as a first and second stage engine for rockets.

