

BIPROPELLANT ROCKET ENGINES

Enabling In-space Operations
and Exploration

| ENGINE | THRUST | SPECIFIC IMPULSE | TOTAL IMPULSE | TOTAL PULSES | MINIMUM PULSE BIT | MASS |
|------------------------|-------------|---|---------------------------------|--------------|-------------------|--|
| AJ10-220 | 59.2-65.4 N | 285 sec (lbf/lbm) (Steady firing) 268 sec (lbf/lbm) (Pulse Mode) | 680,000 N-s | 65,000+ | 4.0 N-sec | 1.95 kg |
| R-1E | 111 N | 280 sec (lbf/lbm) | 11,120,000 N-sec | 30,000 | 0.89 N-sec | 2 kg |
| R-4D-11 | 378-511 N | 164:1 = 311 sec (lbf/lbm) 300:1 = 315.5 sec (lbf/lbm) | 20,016,000 N-sec | 31,950 | 15.6 N-sec | 164:1 = 3.76 kg 300:1 = 4.31 kg |
| R-4D-15 | 378-511 N | 320.6 sec (60 sec run) 322.2 sec (1200+ sec run) | 13,019,945 N-sec | 391 | 35.6 N-sec | 300:1 = 5.2 kg 375:1 = 5.44 kg |
| R-4D-15 (Dual Mode) | 329-556 N | 320.6 sec (60 sec run) 322.2 sec (1200+ sec run) | 9.55 X 10 ⁶ N-sec | 672 | 35.6 N-sec | 300:1 = 5.2 kg 375:1 = 5.44 kg |
| R-42 | 890 N | 305 sec (lbf/lbm) | 24,271,000 N-sec | - | 44.48 N-sec | 4.53 kg |
| R-6F | 22 N | 305 sec (lbf/lbm) | >89,700 N-sec | >19,881 | 0.53 N-sec | 0.965 kg |
| R-42DM | 890 N | 27 sec (lbf/lbm) | >20,000,000 N-sec | >60 | 44.48 N-sec | 7.3 kg |
| R-40B | 4,000 N | 293 sec (lbf/lbm) | 92,073,600 N-sec | 50,000 | 111 N-sec | 10.5 kg |
| AR-40 | 6,000 N | 316 sec (lbf/lbm) | 1,440 MN-sec | - | - | 118 kg |
| ISE - 5 | 20-24 N | 280-300 sec | - | 10,000 | - | 0.4 kg |
| ISE - 100 | 400-490 N | 322 sec | - | 10,000 | - | 2 kg |

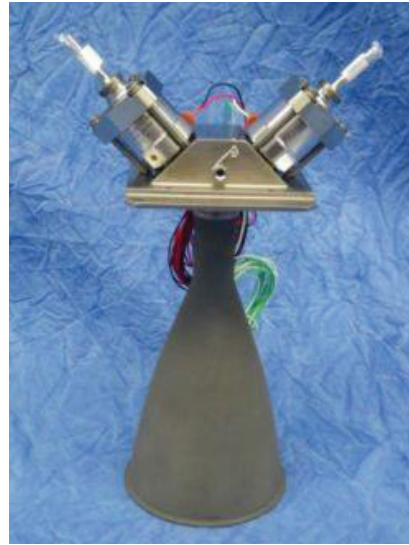


KEY FEATURES

Bipropellant engines are used on various spacecraft for a wide variety of missions including geosynchronous-orbiting satellites, International Space Station servicing vehicles, and interplanetary exploration to assist with orbit insertion, Delta-V, and reaction control.

Beginning with the Apollo missions to the Moon, Aerojet Rocketdyne has delivered more than 2,500 bipropellant rocket engines for in-space propulsion use. Aerojet Rocketdyne has bipropellant in-space rocket engines ranging in thrust level from 2.5-lbf thrust to 6,000-lbf thrust.

Bipropellant engines produce thrust when two propellant valves open and liquid fuel (typically monomethyl hydrazine, or hydrazine) and liquid oxidizer (nitrogen tetroxide) hypergolically ignite in the chamber. The resulting hot gas exits the nozzle, creating thrust.



R-4D ENGINE FAMILY

Aerojet Rocketdyne's R-4D engines — a family of 100-pound thrust bipropellant thrusters — were originally developed for the Apollo program and were key to the rescue of the Apollo 13 crew. Since then, the R-4D has evolved into the world's highest reliability apogee- insertion engine available today. R-4D engines have flown over 300 apogee-insertion missions, with a 100 percent success rate.

ISE ENGINE FAMILY

Aerojet Rocketdyne's ISE engines — a low cost and low mass bi-propellant family of 5 pound and 100 pound thrusters using high performance Mon-25 oxidizer provides system level benefits due to low freezing temperatures and higher densities. ISE engines are ideal for deep space missions and landing applications.



Bipropellant Rocket Engines

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