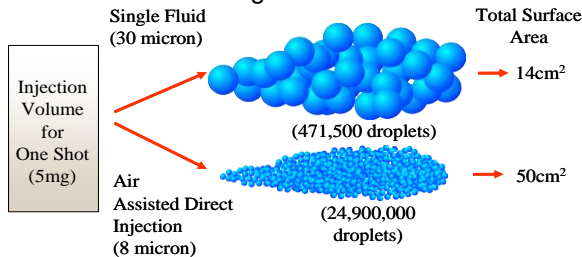


FlexDI™ – Spark Ignited Heavy Fuels

FlexDI™ is production-proven direct fuel injection technology able to offer an advanced Spark Ignition solution for heavy fuel engines including JP5, JP8 and JetA1. FlexDI™ is also able to be used for spark ignited Diesel applications.

FlexDI™ offers:

- Unique solution applicable to both 2 & 4 strokes
- Spark ignited Kerosene and Diesel; for UAVs JP5, JP8, JetA, JetA1 (theatre-proven) and gasoline operation with no change to engine calibration
- High specific power; greater than 70KW/L
- Low fuel consumption; 30%+ reduction during cruise conditions
- Cold start capability; demonstrated to -30°C
- Proven environmental capabilities: -30 to +49°C, up to 20,000ft DA, 0-100% relative humidity
- Noise compliance to MIL-STD-1474D
- Automatic altitude compensation
- Electronic oil metering



What Orbital brings to the UAV market

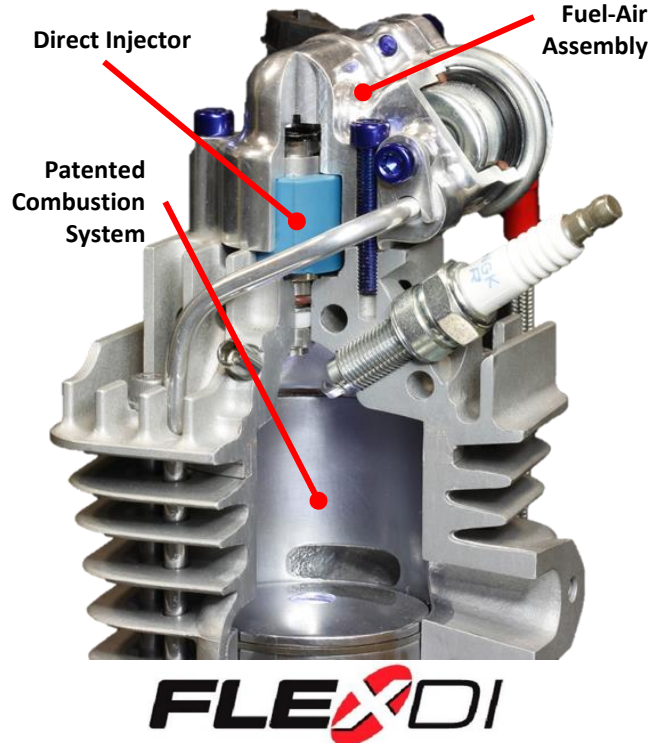
More than 30 years of proven experience dedicated to engine design and prototype manufacture, EMS calibration and optimisation, testing for performance, emissions and fuel consumption.

- Engine calibration dynamometers
- Propeller stand facilities
- Altitude simulation facilities; up to 20,000ft capability depending on engine capacity



Orbital's Propeller Stand Facility

Key Components – SUAS Heavy Fuel Engine

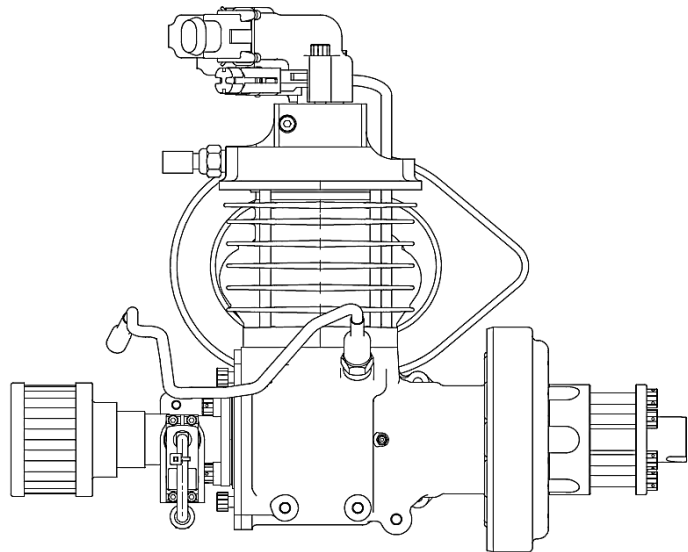


FLEXDI MILITARY TRACK RECORD

- 2002-2003
 - Initial R&D development
- 2003-2004
 - Barrus (50Hp diesel-kero-gasoline)
 - Publication of technical capability papers
- 2005-2008
 - Mercury JP Optimax released
<http://www.mercurygovsales.com/technology/optimaxjp.php>
 - Polaris 4S MV800 (JP8/Gasoline)
- 2009-2012
 - Various UAS customers (undisclosed)
 - Internal R&D funded engine design
 - AAI/Textron: Orbital HF on Aerosonde (2012)
- 2013+
 - Gen2 Orbital HF SUAS engine development and production supply



HFDI.75 (4.5hp) Heavy Fuel Engine



ENGINE SPECIFICATIONS

Engine Configuration	Single Cylinder	Low weight design
Engine Capacity	75cc	Low vibration signature
Power	~4.5hp @ 6,000rpm	Sea level standard ISA on JP5 fuel
Electrical Power	300-400W	Can be customised to suit application
Fuel Consumption	325 g/kWh	Typical of cruise conditions
Fuel Compatibility	JP5, JP8, Jet A, Jet A1, Gasoline	
Propeller Coupling	Direct coupled	
Engine system weight	4.4 kg	Includes inlet and exhaust system, EMS and ignition system.
Power Supply for EMS	13.8 VDC	Automotive standard 12V DC supply
Lubrication Oil		Specialty HFE 2-stroke oil

OPERATING ENVIRONMENT

Max. Operating Altitude	20,000ft	Density Altitude
Operating Temperature	-25 to 50°C	
Storage Temperature	-40 to 65°C	
Humidity	RH 95% @ 35°C	
Exhaust	Lightweight	Low noise signature exhaust system
Launch Acceleration	~20g for 30ms	
TBO	~300hrs	
Communications	CAN bus	Speed control mode available through Orbital FlexECU CAN bus

ORBITAL APPLICATION SERVICES

Orbital's extensive experience in engine design, UAVE systems integration, prototype manufacture, EMS calibration and optimisation enables customers to easily access support for custom applications of the HFDI75 engine.

A wide range of support is available, including:

- Alternative intake system design
- Alternative muffler design
- Engine mounting systems
- Engine cooling system design
- Oil supply system (oil tank etc.)
- Fuel delivery systems design (fuel tank, fuel pump, filter assembly etc.), including custom design of lightweight, integrated fuel/oil delivery modules
- Power supply system integration
- Alternative propeller hub designs
- Component packaging/systems integration into the UAV airframe
- On-site specialist engineer support for flight testing



3 to 250+hp
Heavy Fuel Engines

State of the Art Unmanned Aerial Vehicle Engines

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