

En'Urga Inc.

An Overview of Spray Testing Capability

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Innovation in Quality Control

En'Urga provides spray characterization services for all types of injectors and nozzles using real world fluids. Details of our capabilities are highlighted in the following pages



Innovation in Quality Control

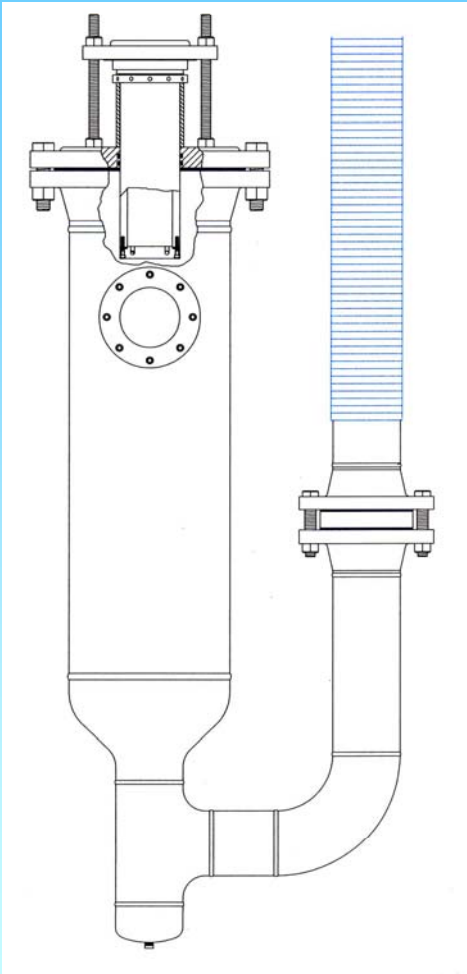
Spray Injection Capability

- *Steady state and pulsed injectors for pressures up to 3,000 PSI – typically using pressure vessels and accumulators*
- *Transient pressure up to 8,000 PSI – hand pump used to test diesel injectors*
- *Fuel flow rate up to 500 kg/hr and air up to 100 kg/hr*
- *Real world or synthetic fuels – gasoline, diesel, JP-8, kerosene, heptane, furnace oil, Mil C-3024*
- *Different liquids – water, polymers, solids containing fluids, pharmaceuticals, etc.*
- *Effervescent atomizers*

Diagnosics Capability

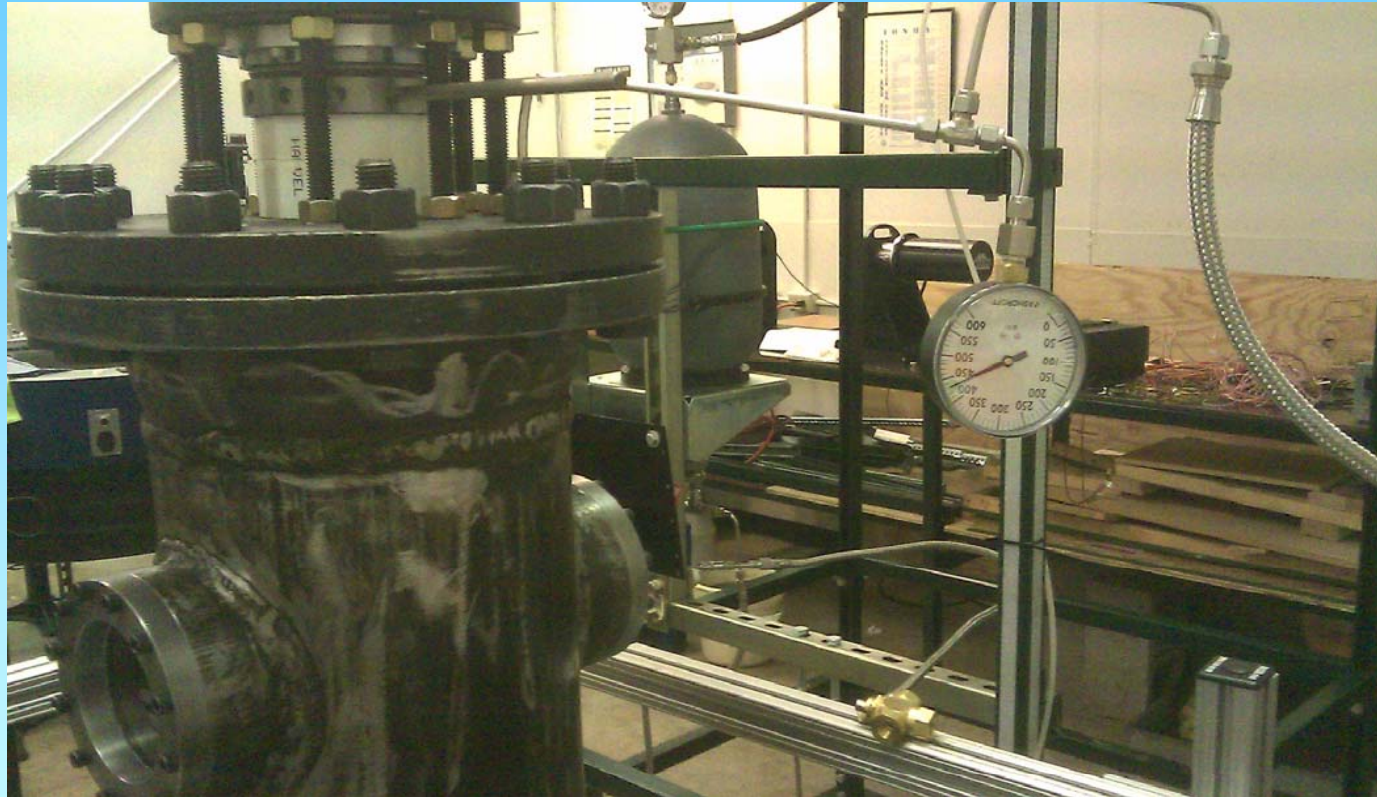
- *Spray patternation (SETScan optical patternator, En'Urga Inc.)*
- *Drop sizing – laser diffraction (Malvern)*
- *Drop sizing & velocity – PDA (Dantec)*
- *High speed spray imaging – 10,000 Hz (Quantum Tech.)*
- *Infrared spectrometry – 1,320 Hz (Spectraline Inc.)*
- *Visible spectrometry – 20 KHz (Spectraline Inc.)*
- *Mass flow measurements –gravimetric*
- *X-Ray tomography (dense sprays, windowless combustors, particulate filters, pharmaceutical powders, etc.)*
- *Correlation velocimetry (SCIvel – En'Urga Inc.)*

Spray Environment Capability



- *Pressure rating –24 in Hg to 100 PSI*
- *10 inch nominal ID*
- *4 inch fused silica window on 2 sides*
- *Can be switched to sapphire for infrared diagnostics*
- *34 inch high vessel to reduce spray bounce back*
- *Fully indexable injector mount*
- *Fitted with AP400 patternator*
- *Temperature controlled injection to 90°C*

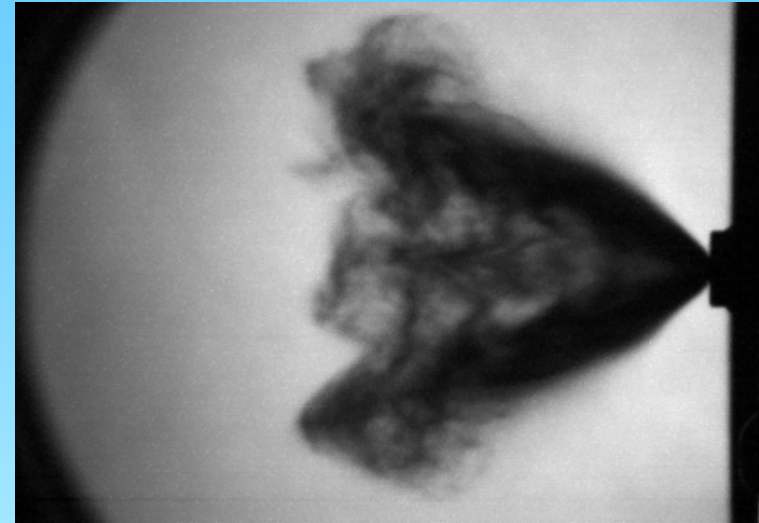
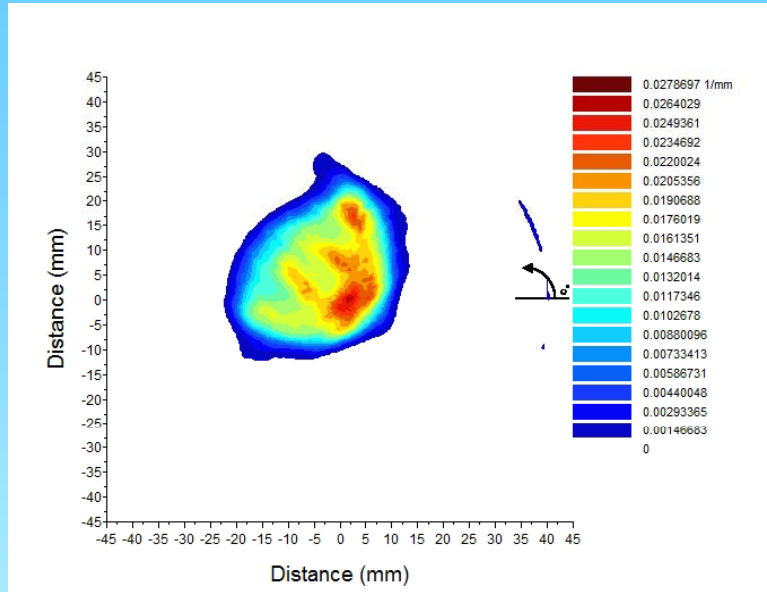
Pressure Vessel Test



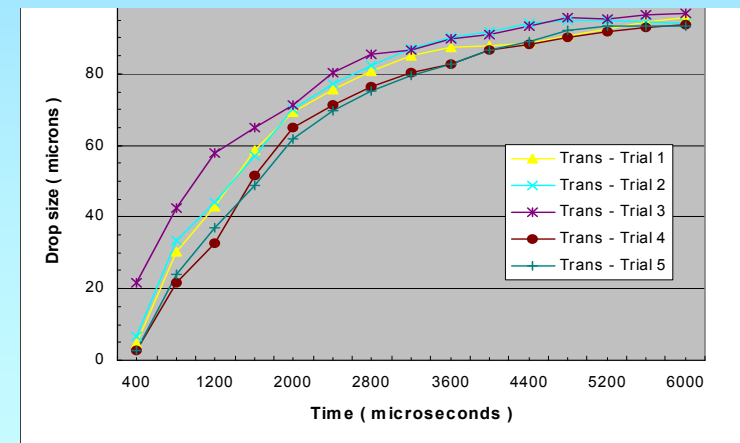
Resources

- *Fully equipped combustion, optical diagnostics, and electronics laboratory*
- *Design software for mechanical, optical, and electronic components*
- *Access to the extensive laboratory facilities at Purdue University*
- *Fully developed supply chain for out sourcing*
- *Highly skilled technical staff*

Sample Results



Injection pressure 10 MPa gage
Chamber pressure 40 Kpa absolute
Fuel temperature 90 °C



Quality Audit of Injectors

- *SETscan patternator based quality audit of injectors*
- *1000's of nozzle per day*
- *Currently used for 100% testing in the Aerospace and Automotive industry*
- *Complete turn key solution with spray stand and equipment*
- *Contract quality audit for statistical quality assurance*
- *Highly repeatable and accurate results*
- *Address production processes as soon as it occurs*

Partial list of customers

Boeing	Rolls Royce	Bosch
General Electric	Siemens	Hitachi
Exxon-Mobil	Proctor & Gamble	Continental
Abbott	Cummins	G.W. Lisk
Tenneco	Caterpillar	ITW
Eaton	General Motors	Natural Fog
United Technology	Ricardo	Nordson
Boston Scientific	Vertex Pharma	Toyota
Donaldson	Faurecia Emissions	Woodward
Danfoss	Pfizer	United Technology
FEV	Biogen	Spectrum Brands
Delphi	AVL	Agilent
S.C. Johnson & Son	Columbia Chemicals	Westinghouse