Computerized Micro Jet Engine Test Facility

Flexible test bed for experiments

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www.jet-engine-lab.technion.ac.il
Why micro-jets?

- Basic physics similar to full scale engines
- Education
  - UAVs
  - Fun
• Measurements of engine performance

• Integrated control of operation and data acquisition

• Easy expandability with additional equipment
System Components
• Representative of the whole category of micro-jets
• Used in scale models, as well as in some less conventional applications

• Diameter: 130mm
• Length: 267mm
• Max. Thrust: 230N

AMT Olympus engine
• Single spool
• Radial compressor
• Axial turbine
• Pressure ratio: 4:1
• Max. RPM: 108,000

• Compressed air start-up
• Propane gas pre-heating
• Evaporators
Measurement points

AMT Olympus engine
AMT Olympus engine
• Graphical programming language
• Evolved specifically for measurement and control
• Rapid software development
• GUI inherent in program
Program Front Panel

LabVIEW control software
Measurement of exhaust jet flow parameters

Experiment
Experiment: probe setup
Jet profile, 100mm downstream
Jet profile, 100mm downstream

- **CO2 (%)**
  - Y(mm) vs. CO2 (%)

- **CO (%)**
  - Y(mm) vs. CO (%)

- **O2 (%)**
  - Y(mm) vs. O2 (%)

**Test section**
- Engine Exhaust
- 80K RPM

**Jet direction**
- Upward

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Jet temperature along axis, various RPM

- 40K RPM
- 60K RPM
- 80K RPM

Test section
Jet direction
Engine Exhaust
Jet pressure along axis, various RPM
Comparison of theory and test result

Jet temperature along axis

Free jet theory and comparison to test
Comparison of theory and test result

Jet temperature – 500mm downstream

Free jet theory and comparison to test
Thermal imaging of jet

Intensity of IR radiation level

Temperature

High

Low

T(°C)

x(mm)
cRIO – reconfigurable input/output system
Includes a real time capable controller, with interchangeable I/O modules:
- analog and digital input and output
- thermocouple input
- step motor controller etc.

2nd generation test stand electronics box:
- Integrating power supplies, connection routing,
- data acquisition device (cRIO)
Inlet Obstruction testing

A custom made inlet with attachable flow disruption rings. Examination of flow inside the inlet is made via pitot tube. Aim of project is to examine effect of inlet obstructions on the engine operation parameters.

Exhaust options

The Olympus engine allows for different exhaust options, such as noise reduction devices (above) or a reheat section.
• A test bench was built with the capability to study the characteristics of various micro-turbine engines

• The system built is highly modular and flexible

• Useful experiments have already been performed

• Much is yet to be done, and we’ll be glad to cooperate on this matter
Questions?