



## ▶ APPLICATION NOTE

### Power Electronics Cooling Systems for Electric and Hybrid Planes

*FCI Aerospace ANCS001A*



The future of electrified flight relies on the delicate balance of power density vs. weight. While this exciting technology is constantly evolving and improving, effective temperature control of power electronics will always pose a challenge.

Heat generated from high power density motors, batteries, sophisticated avionics, and controls present thermal management problems for rapid electric aircraft adoption. Efficient cooling system designs are paramount to electric flight and urban air mobility's success.

#### **Problem**

- ▶ New design of a hybrid electric aircraft requiring direct liquid mass flow and temperature measurement of the enhanced power electronics coolant system.
- ▶ The system consisted of a liquid loop installed inside a pressurized fuselage and utilized an externally mounted ram channel to dump the excess heat generated from the electric propulsion unit and DC/DC converters to ambient air.
- ▶ The liquid flow and temperature sensors needed to transmit continuous signals to the propulsion system control unit to regulate the coolant pump output levels during both flight and ground check operations.

#### **Flow Conditions**

- ▶ **Pipe Diameter:** 1.5" O.D.
- ▶ **Flow Range:** 50 lpm to 250 lpm
- ▶ **Media:** Ethylene glycol coolant
- ▶ **Operating Temperature:** -40°C to 70°C

#### **Solution:** *AS-FT Dual Function Flow and Temperature Transmitter*

- ▶ Multiple AS-FT sensors uniquely calibrated to customer specifications were placed at key measuring points in the cooling system.
- ▶ The AS-FT is dual-function, providing both mass flow rate and temperature from the same device.
- ▶ Dual 0-5VDC outputs provided continuous flow rate and temperature measurements to the pump control system.
- ▶ Fully flight qualified, COTS, Line Replaceable Unit (LRU) were easily integrated into the design and installed with minimal effort.



#### **Benefits**

- ▶ Lightest weight and least installed space solution – no need for two discrete sensors, tap points, and cabling.
- ▶ Low cost – combined 2-in-1 COTS sensor means fewer components on BOM to manage, qualify, and install.
- ▶ No moving parts – thermal dispersion technology offers ultra-reliable continuous operation with no routine maintenance.
- ▶ Certifications include: MIL-STD-810, MIL-STD-461 and RTCA / DO-160.