

## **Instrumentation for Engine Start Cycle Characterization at Cold Weather High Altitude Condition**

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**Abstract :** A cold soaked gas turbine engine have known starting problems in high altitude and low temperature conditions. The high altitude results in lower ambient temperature, pressure, and density. Soaking at low temperature leads to higher oil viscosity, increasing the engine starter system torque requirement. Also, low temperature soaks results in a cold compressor rotor and casing. Since the thermal mass of rotor is higher than casing, casing expands faster, thereby, increasing the blade-casing tip clearance. The low pressure flow over the compressor blade coupled with the secondary flow through the compressor tip clearance during start result in stall inception. The present study discusses engine instrumentation required for capturing the stall inception event. The engine fan exit and combustion chamber were instrumented with dynamic pressure probes to capture the pressure characteristic and clamp-on current meter on primary igniter cable to capture ignition event during start cycle. The experiment was carried out at 10500 Ft. pressure altitude and -15°C ambient temperature. The high pressure compressor stall events were recorded during the starts.

**Keywords :** compressor inlet, dynamic pressure probe, engine start cycle, flight test instrumentation

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