

Wing Tank Flammability Testing

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Wing Tank Flammability Testing

Outline

- Background
- Test Articles and Methods
 - Scale Fuel Tank in Altitude Chamber
 - Wing Tank Piece in Wind Tunnel
- Preliminary Result

Wing Tank Flammability Testing

Background

- Recent FAA rulemaking and regulation has focused on improving the safety of the fleet through more thorough systems analysis and ignition source reduction
 - FAA intends to make a rule requiring flammability control of some or all CWTs with an emphasis on inerting system technologies
- The model being used by the FAA for fleet flammability reduction was developed with CWTs in mind
 - Model uses bulk fuel temperature to determine flammability which may not be as good an indicator of flammability for wings
 - Different secondary parameters (day temperature, fuel height, sun intensity, etc.) effect each tank differently
 - Flight test data caused us to look at our assumptions about wing tank flammability and more advanced model did not replicate data well

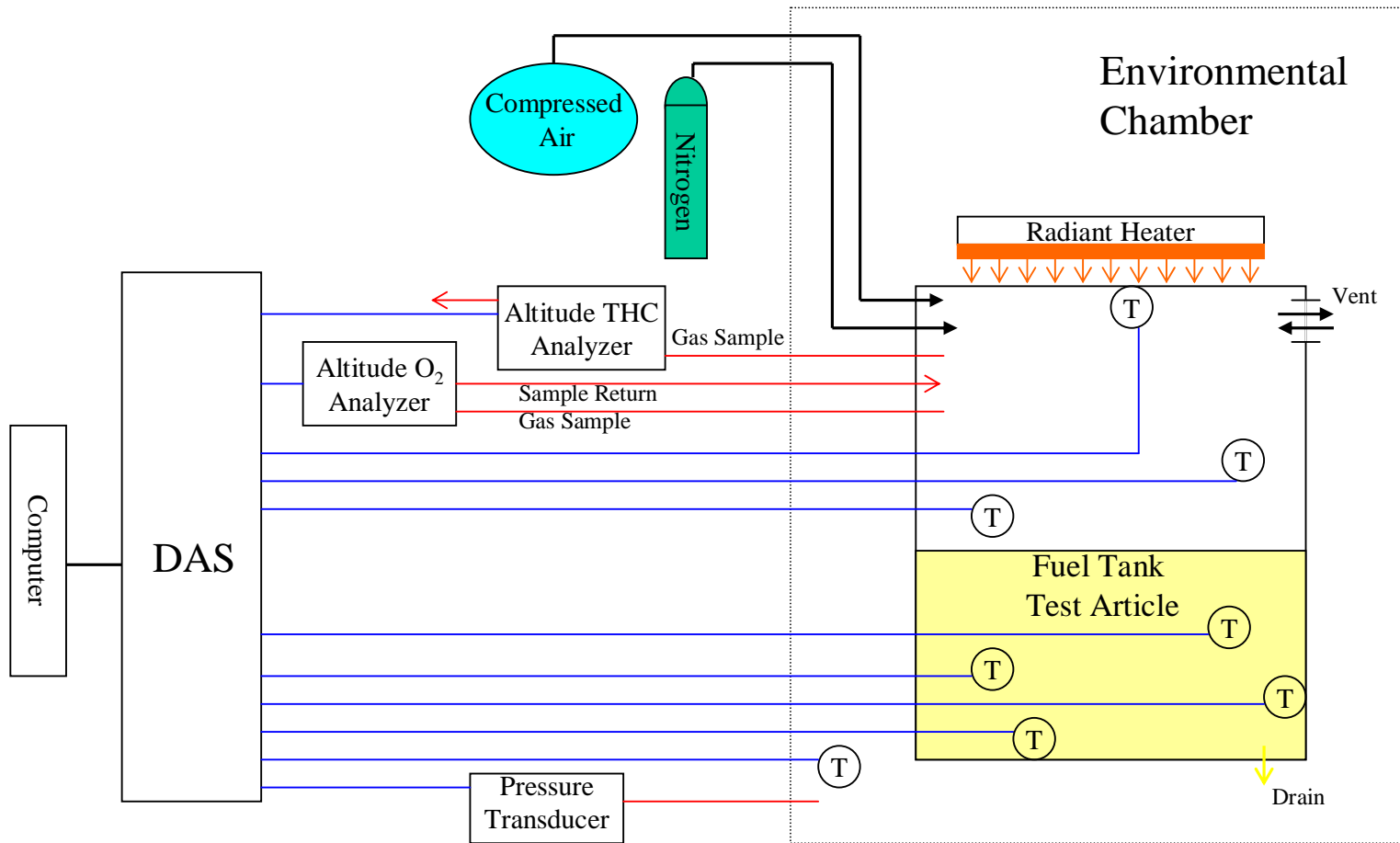
Wing Tank Flammability Testing

Test Article – Scale Tank in Altitude Chamber

- Used existing 128 gal aluminum fuel tank in altitude chamber for testing
 - Has extensive array of thermocouples that were repositioned for this testing as well as gas sample ports for THC analysis
 - Has fill port and vent port, as well as inerting and ventilation capability
- Used altitude chamber to control the ambient temperature of the fuel and tank
 - Fill the tank to the desired fuel load (40, 60, or 80% full) and allow temperature of tank, fuel, and chamber to equilibrate
 - Used a radiant heater to heat the top of the tank, which in turn heats the ullage and fuel

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Block Diagram of Wing Tank Flammability Test Article



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Test Article – Wing Piece in Wind Tunnel

- Goal of experiment is to examine the cooling effects on wing tank temperatures and fuel vapor concentrations associated with air flow over the wing tank due to aircraft taxi/take-off
- Effects will be quantified for use in future modeling work



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Test Article – Wing Piece in Wind Tunnel

- Outboard section of 727 wing containing the surge tank has been mounted in the low-speed section (max air speed of approximately 150 mph) of the FAA's wind tunnel facility
- Surge tank is instrumented with 12 thermocouples and a hydrocarbon gas sampling probe
- Wing section mounted such that it can be rotated to represent appropriate angle of attack
- Radiant heaters will be used to heat top of wing prior to startup of wind tunnel



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Test Article – Wing Piece in Wind Tunnel

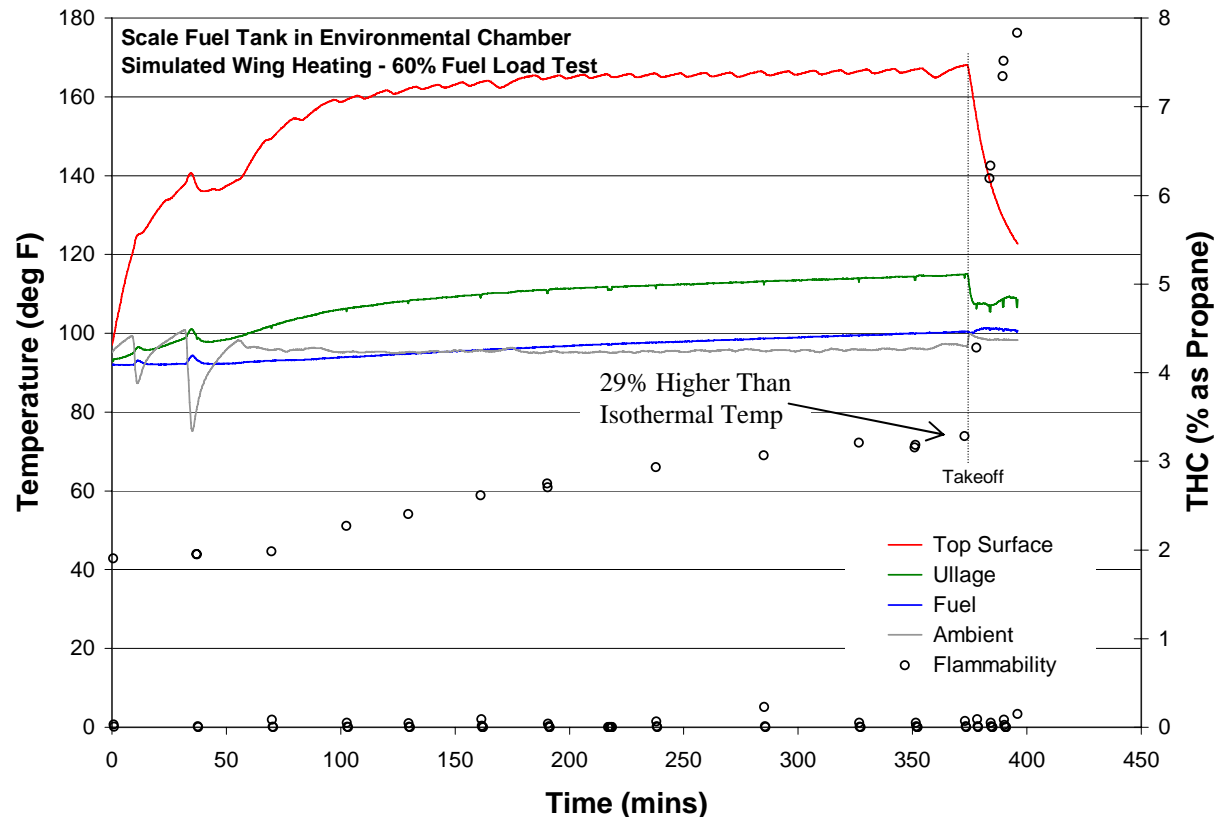


AJP-6320 Fire

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Results - Preliminary

- Preliminary testing shows large increases in flammability with top heating but takes time to generate vapor (F.P. 115)
 - Top fuel temp 3-5 deg higher than bulk avg.
- Altitude effects very significant on the flammability in this configuration
 - This was not observed in flight test



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Work Status

- Completed initial block of tests using scale aluminum fuel tank in our altitude chamber
 - Examined the effects of fuel height and tank top temperature
 - Compared top heating data with isothermal data
- Plan to do additional tests to make direct comparisons to bottom heat and examine top cooling effects with altitude
- Wind tunnel tests are scheduled to begin next week