AxSTREAM SYSTEM SIMULATION

Aircraft Anti-Icing Equipment Modeling

Case Study Summary

Goals:

Estimate the heating requirement to prevent ice formation on airplane wings operating at steady-state conditions and cruising altitude. Evaluate the heat transfer processes, HTCs, and wall temperature distribution. Determine the transient evolution of the AIS operation for a given airplane mission control map.

Requirements:

AIS-enabled valve opening if the outside temperature is below -5°C

Parameters:

Temperature and pressure depend on cruising altitude.
Air pressure -65 psi
Bleed air temperature - 200 ºC.

Constraints:

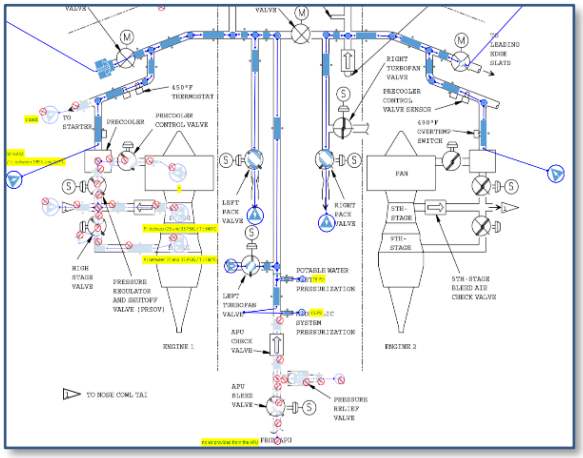
Hot bleed air is provided by a gas turbine engine with a pressure ratio of 32.7

Results of the Study:

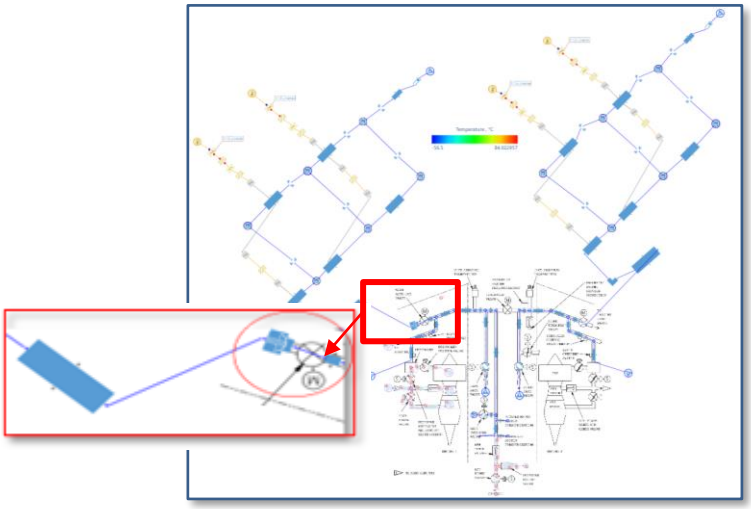
Any desired operating regime may be modelled according to the mission control map by coupling a pneumatic system to the AIS . Within AxSTREAM System Simulation, the full anti-icing system with the corresponding pneumatic equipment (as well as other subsystems) were modelled to simulate the combined system operation.

Aircraft Anti-Icing & Pneumatic System

The airplane uses hot bleed air from a pneumatic system to melt the ice on the wings' leading edges. Airplane wings are composed of five stages where the three outermost stages may require an AIS (Anti-Icing System).



AIS-enabled valve opening is performed if the outside temperature is below -5°C. Temperature and pressure depend on altitude. At 37,000+ ft, the outside temperature reaches -50°C. The outside temperature is -5°C when the altitude is 3079m, which is reached 213s after take-off for the considered mission.



Since the aircraft mission profile was known, engine and AIS operations were simulated for the entire flight. It was determined that valve lift provides an adequate amount of heat to the wings during steady-state flight conditions.