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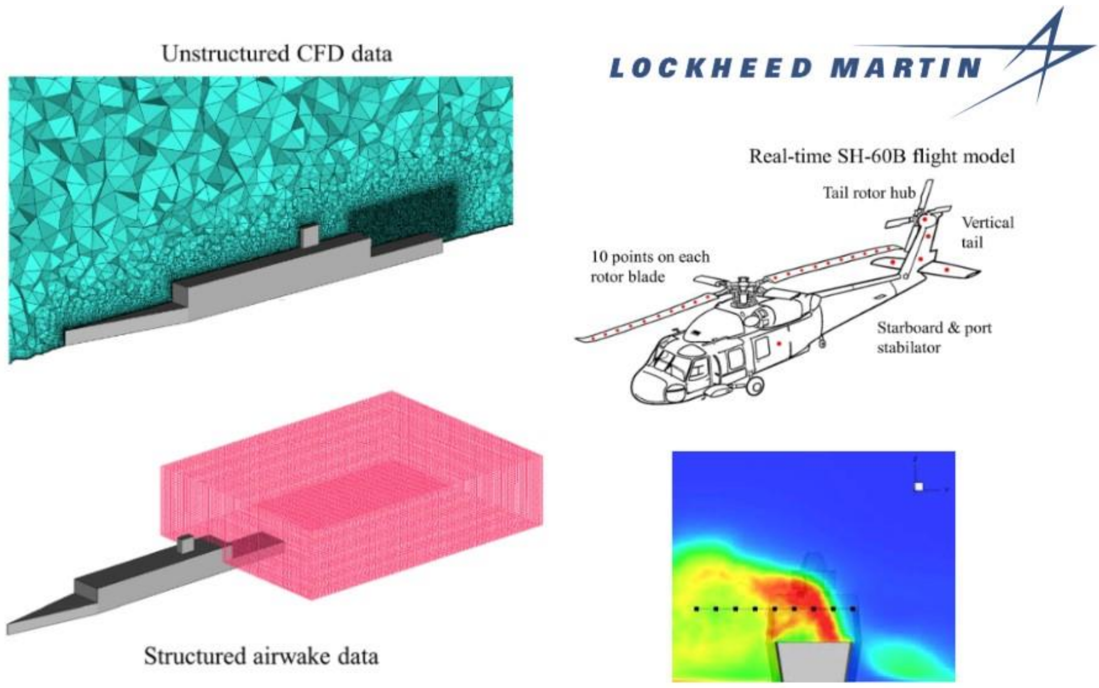
Canada’s CSC Project: Heli-Ops Landing Data Logic Board Project Summary

Problem:

Team did not know if/if not we could land a helicopter within the following variables:

- Various headwind angle scenarios (pre-defined).
- Turbine engine throttle power.
- Arrangement of active turbine engine outtakes.



Constraints:

Only the following variables were known:

- Turbine Engine Uptake Mass Flow at 100% throttle.
- Turbine exhaust temperatures at 100% throttle.
- Turbine Engines that must be turned on at 7 different headwinds.
- Uptake mass flow rate when each of 3 Turbines are on at once.

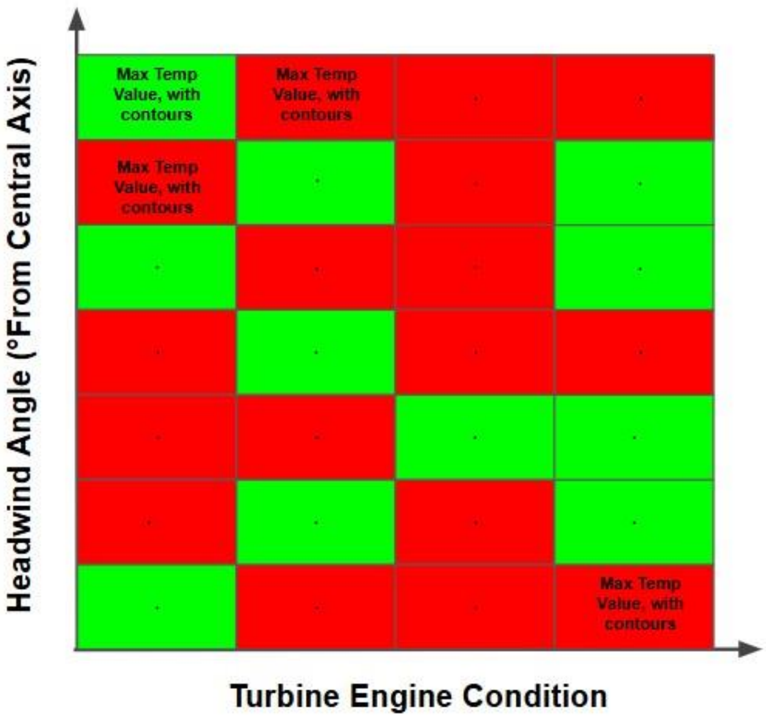
My Solution:

- Applied thermodynamic fundamentals to calculate exhaust mass flow rate(s) for different scenarios of Turbine engine on/off conditions.

$$\dot{m}_{\text{exhaust}} = \rho_{\text{exhaust}} \; A_{\text{exhaust}} \; v_{\text{exhaust}}$$

$$\dot{m}_{\text{exhaust}} = \underbrace{\frac{p_e}{R_{\text{gas}}\, T_{\text{exhaust}}}}_{\rho_e} \times A_{\text{exhaust}} \times \underbrace{\sqrt{2\, c_p \left(T_{\text{exhaust}} - T_{\text{ambient}}\right)}}_{v_e}$$

- Developed 7 aerodynamic headwind angle simulations for 4 different uptake conditions, different RANS simulations on full-throttle to deliver 28 contours - covering all possible conditions.
- Used these contours to present max temperature over the flight deck for different scenarios. X (4 values) was Engine throttle condition and Y (7 values) was headwind angle.



- Provided Vendors with concise logic board of different wind and engine conditions

- Vendors could use this data table to validate (with their simulations and flight conditions) if or if not, the helicopter could land.