Towards Clean Aviation: SuperThermo Electric Motors for Electric & Hybrid Aviation.

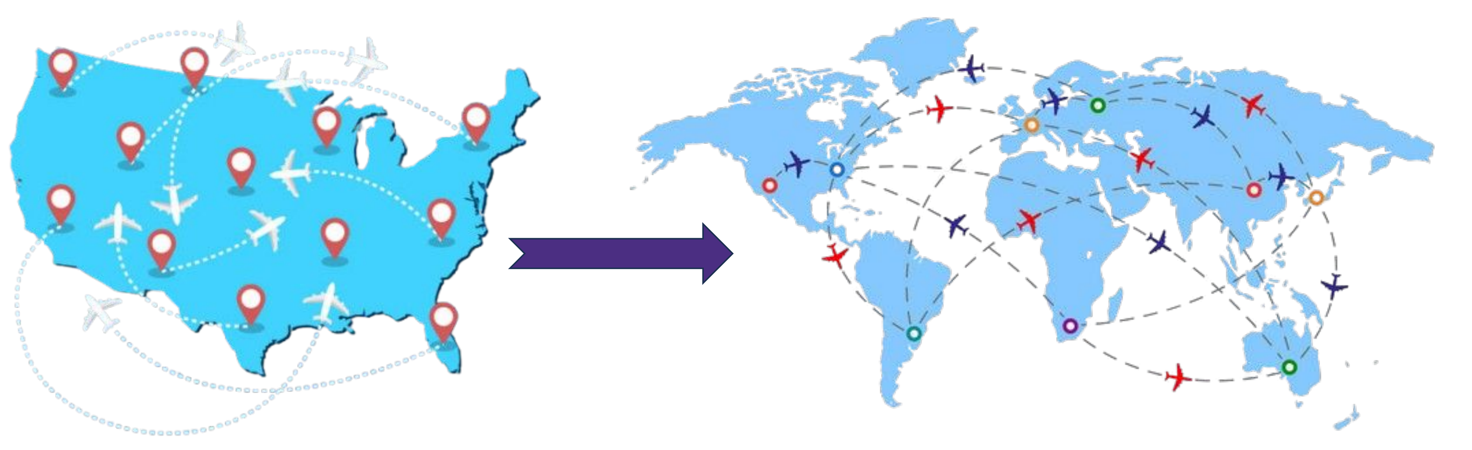
ADVISOR: SEP MAKHSOUS

AUTHORS: CHRISTINA SARIEDDINE, HONGRUI WU & JACKSON SHEPARD

AUTONOMY, ROBOTICS, & CONNECTIVITY

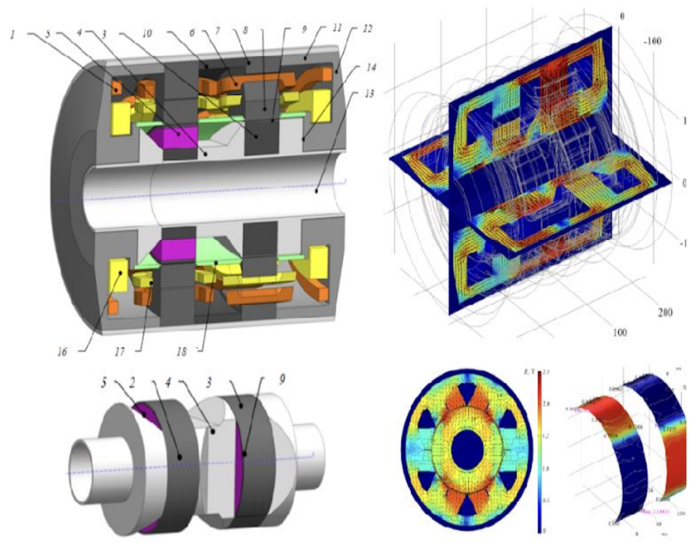
Motivation

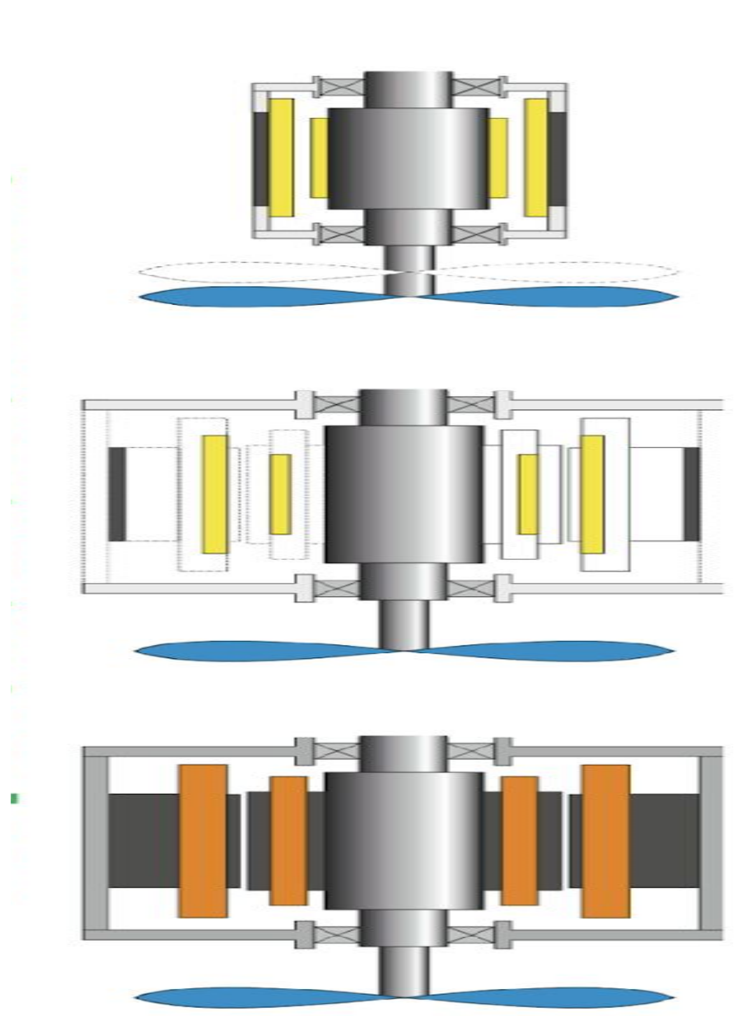
Flying is awesome, but CO2 emissions? Not so much! Electric aviation is here to transform the future of air travel, but there's a catch: keeping those motors cool is like staying chill during a marathon—essential for endurance and performance. Crack the cooling challenge, and we'll soar over oceans guilt-free, because the planet deserves a first-class ticket to sustainability!



State of the Art

The aviation industry is rapidly advancing toward electrification, yet existing electric motor technologies struggle with power density and thermal efficiency under high-demand conditions.





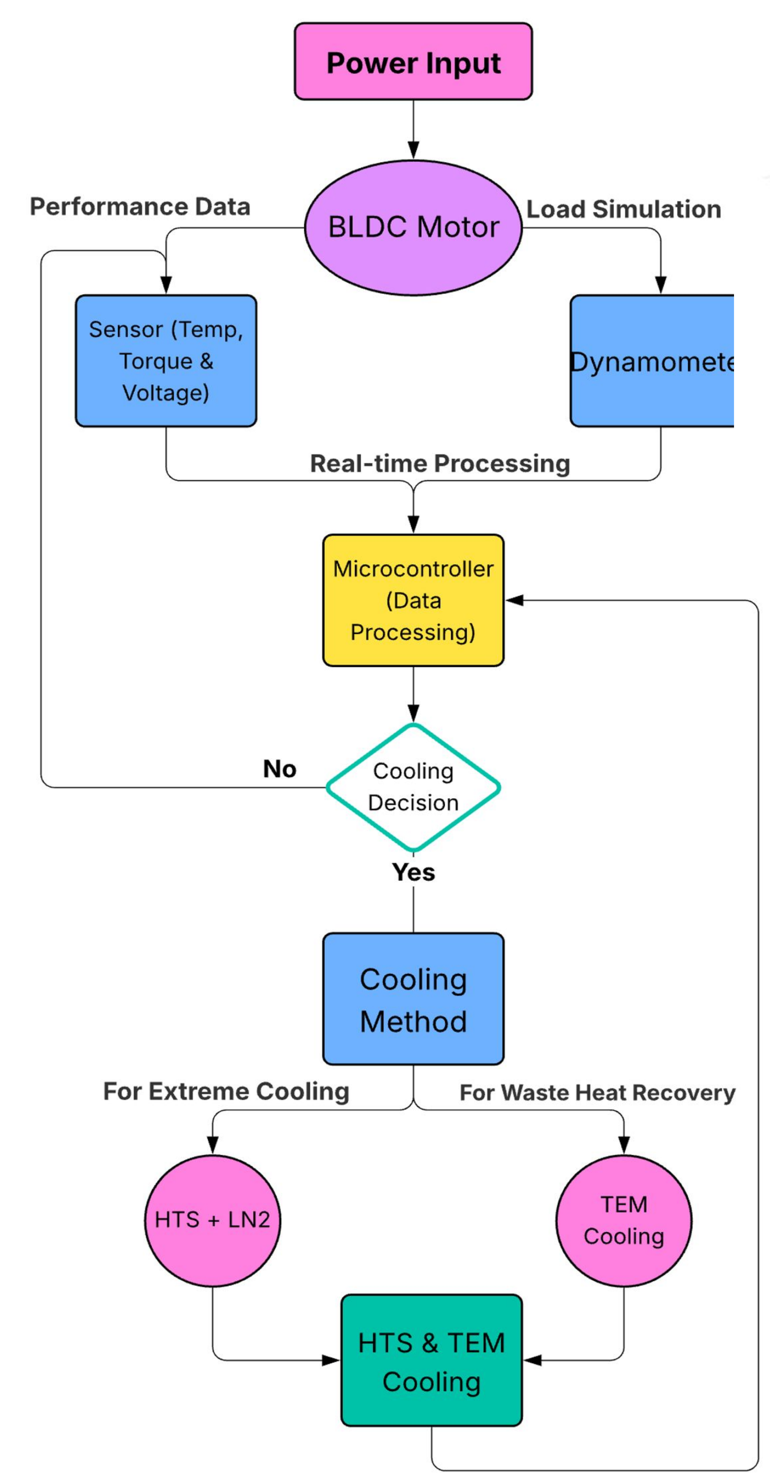
High-temperature superconductors (HTS) have shown promise in small-scale systems, demonstrating reliability and efficiency, but their application in large-scale aviation propulsion remains underexplored.

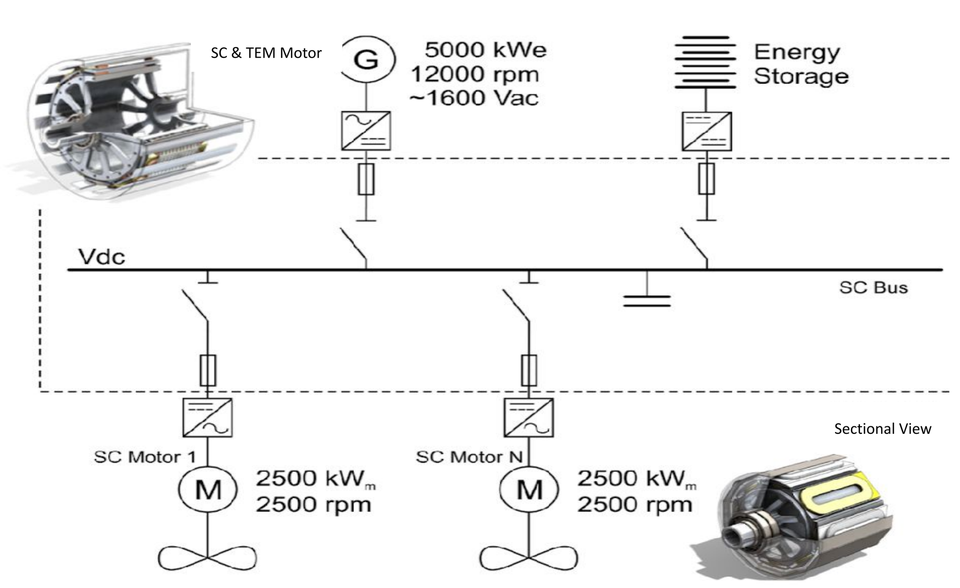
Thermoelectric modules (TEM) are used for cooling and heat recovery but remain unexplored in aviation propulsion.

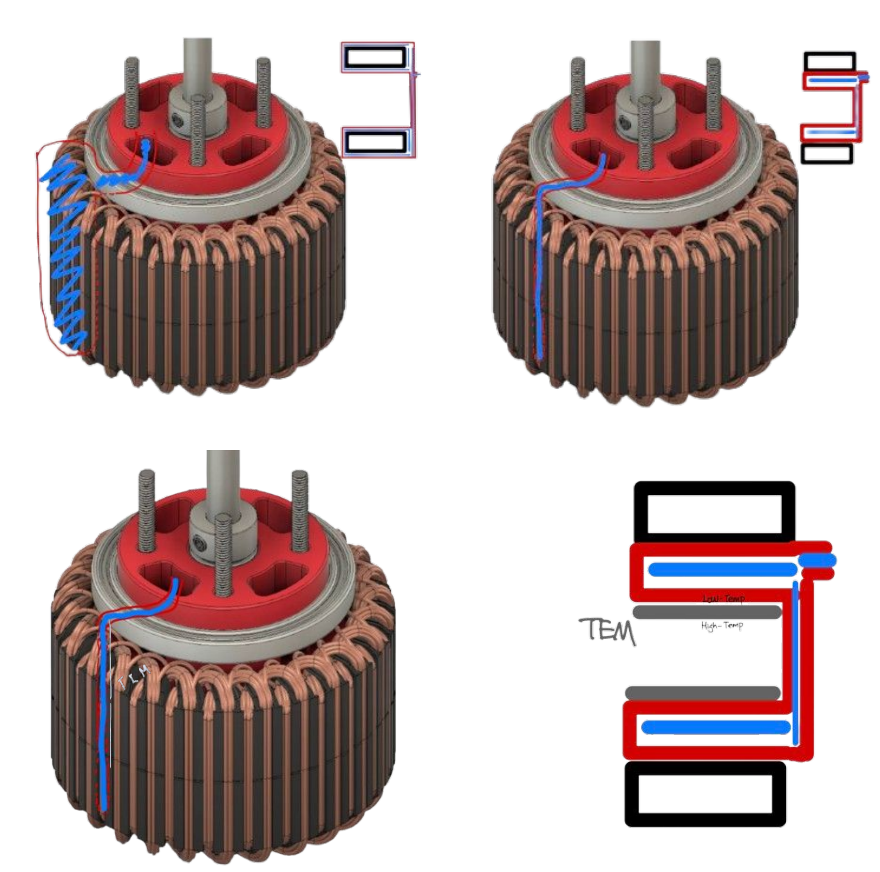
The integration of HTS and TEM for aviation propulsion remains unexplored and untested.

Approach

Our approach integrates high-temperature superconductors (HTS) and thermoelectric modules (TEM) to address the thermal and efficiency challenges in electric aviation. By embedding HTS into the stator windings for high power density and leveraging TEM for waste heat recovery, we pioneer a novel cooling architecture that has not been explored before.







Reference & Acknowledgement

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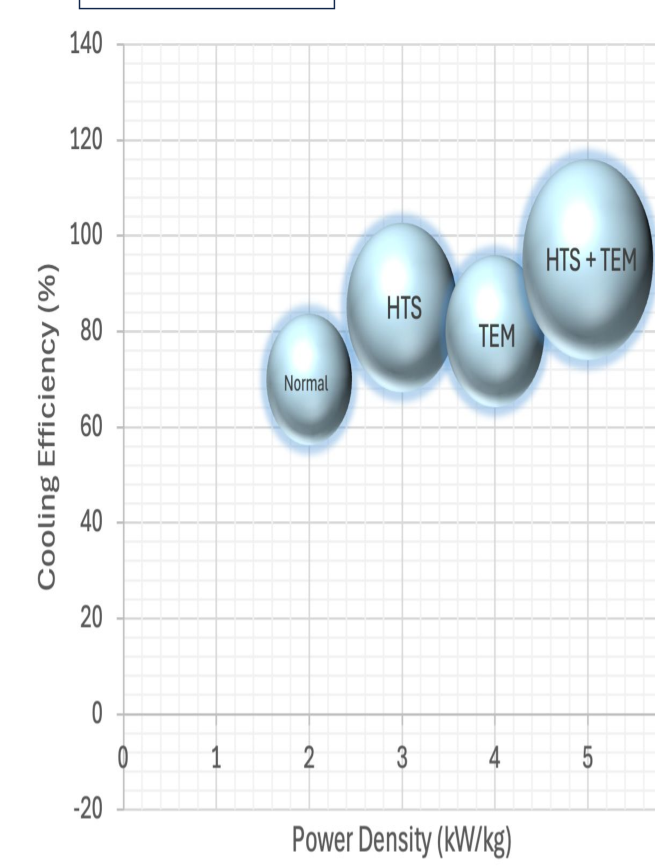
Experimental Setup

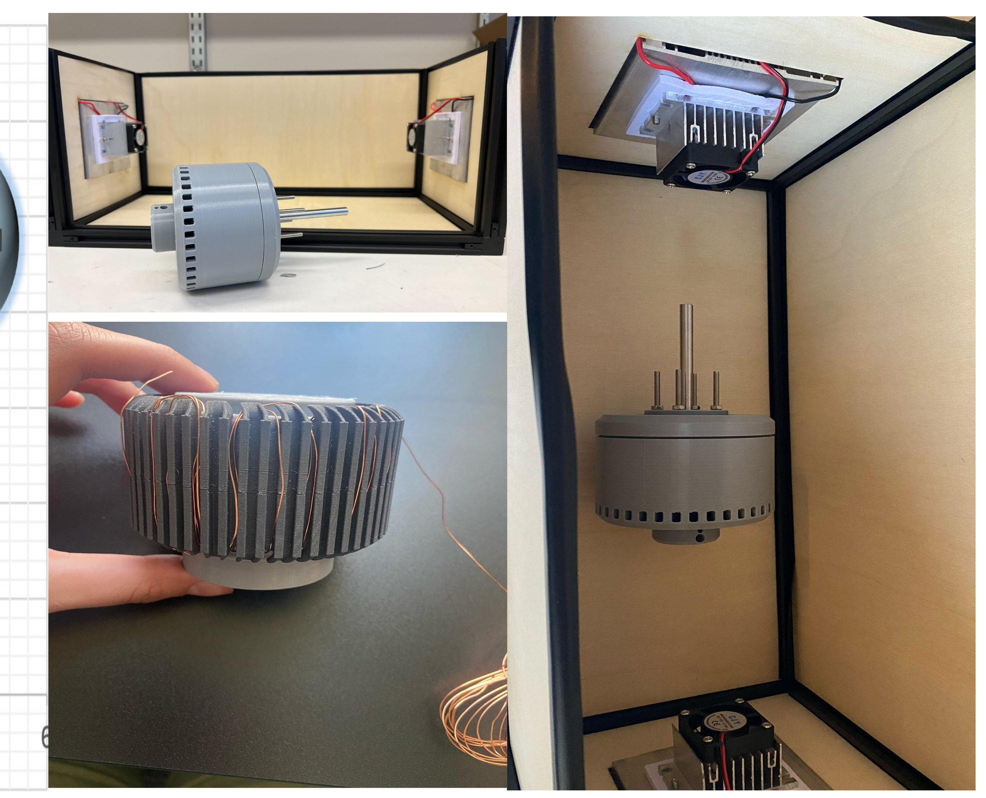
A custom-built BLDC motor with HTS-integrated stator windings is tested under realistic load profiles using a programmable dynamometer.

Cooling methods:

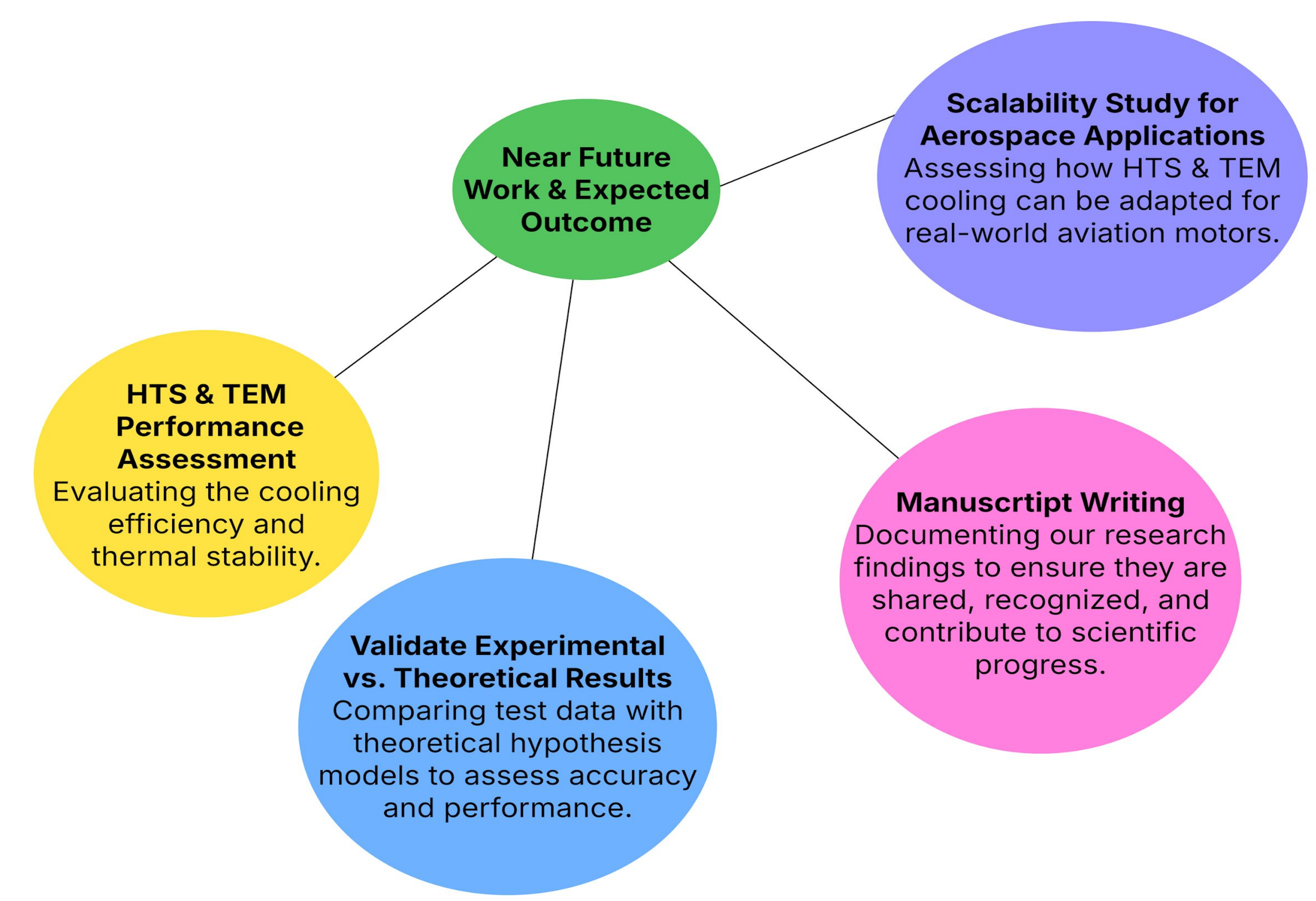
- HTS + LN_2
- TEM

→ Evaluated in a climate-controlled chamber (-55°C to 40°C)





Future Expectations



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