Contribution ID: **76** Type: **Poster**

A helium gas-cooled test bench for hyper- and superconducting aviation cables

Wednesday 29 October 2025 14:08 (1 minute)

We present the design of a modular test bench to investigate the electrical and thermal performance of aviation-relevant power cables and terminations under a wide range of steady-state or dynamic loading conditions. A promising route towards sustainable aviation combines LH2, fuel cells and compact electric motors linked by a low-weight cryogenic distribution network that may consist of high-purity aluminum (hyper-conducting) or of superconducting cables. To validate the design of such cables and auxiliary technology under operational conditions and to test their resilience to various failure scenarios, a dedicated forced-flow GHe test bench is built, allowing for tests between 50 K to 100 K at He pressure levels up to 10 bar and flow rates up to 50 g/s. The closed loop GHe flow is driven by a cryofan and re-cooled with a single-stage cryocooler. Its pressure and temperature are measured at multiple locations and compared to model predictions of the cable-, heat exchangers- and joints behavior. Cable current and voltage are monitored to evaluate its electrical stability and AC losses, while inductive voltage loops are used to analyze the cable current distribution.

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Session Classification: Poster session