Lehrstuhl Flug-Triebwerksdesign

Brandenburgische Technische Universität Cottbus

Research/ Study Project: Maintenance evaluation of novel aircraft HEX

Build a first-pass maintenance concept for novel aircraft heat exchangers (HEX) that quantifies degradation pathways, detectability, inspection/cleaning intervals, and through-life cost—using standards-informed theory, moderated analytical models, and light MATLAB simulations.

Scope of Work

1. **Standards & Operational Envelope Mapping**

- Map applicable envelopes and guidance (e.g., RCM/MSG-3 logic, DO-160 sections, MIL-STD-810 sand/dust/temperature, engine-related FAA/EASA references).
- Translate to HEX-relevant boundary conditions and degradation stressors (fouling/blockage, icing, erosion/corrosion, thermal cycling).

2. **Failure Logic & Maintainability Models (paper study + simple MATLAB)**

- Construct **FMECA** for the selected HEX designs (e.g., TPMS/POCS vs. legacy fins).
- Define health indicators (HI): UA shortfall, pressure-drop excess at reference flow, efficiency drift rate.
- Build lightweight parametric kernels for degraders (e.g., fouling factor growth vs. time/PSD; Darcy–Forchheimer pressure rise; fin-efficiency loss with wall thinning).
- Produce screening curves: inspection/cleaning interval vs. energy cost/risk (RCM trade).

3. **Maintenance Concept & Cost–Risk Trade**

- Propose initial maintenance tasks (on-condition triggers, inspection method, cleaning method & expected restoration, replacement criteria).
- Recommend initial intervals by use-case (route/PSD band, climate, duty factor) with sensitivity bands.
- Outline data needed later for calibration (bench/fleet), including minimal sensor set.

Deliverables

- **Initial Maintenance Evaluation Report** (RCM logic, FMECA, tasks, intervals, assumptions).
- **Maintenance Task Cards (draft)**: inspection scope, access/NDT, cleaning method, acceptance criteria.
- **MATLAB mini-toolkit**: functions to estimate UA/Δp drift under configurable stressors; plots of interval vs. cost/risk; simple uncertainty bands.
- **Gap list** for future validation (what bench/fleet data to collect; which assumptions most influence intervals).

Required Profile

- Strong working knowledge of **airworthiness & maintainability frameworks** (RCM/MSG-3), environmental test envelopes (DO-160, MIL-STD-810), and aircraft engine/airframe integration constraints.
- Heat-exchanger fundamentals: UA analysis, fin efficiency, porous media pressure-drop (Darcy–Forchheimer).
- **MATLAB** for analytical modeling, parameter sweeps, plotting, and basic uncertainty analysis.
- Familiarity with AM-specific failure modes (roughness, porosity, erosion, cleanability/access) is advantageous.

➢ **Are you interested or do you know someone who likes this?**
Please send the below documents to Mr. Akilan Mathi mathiaki@b-tu.de or akilanmathi.btu@gmail.com:

- CV
- A short description (max. 600 words) explaining (1) your skill set relevant to the job (2) and a technical problem (ideally related to above description but not mandatory) you have worked in the past.