



Aircraft Engine Valves Thermal Management with Advanced Loop Heat Pipe

Project overview



EVAL in brief

- **Call**: H2020-CS2-CFP10-2019-01
- **Topic**: LPA-01-87 topic “Loop Heat Pipe development for severe environment”
- **Project type**: Innovation Action
- **Duration**: 01/06/2020 – 30/11/2022
- **Budget**: 454 750.00 Euro
- **Topic Manager**: Liebherr Aerospace Toulouse SAS

EVAL team

STCU: R&D projects facilitation,
administration & management



KhAI: Fundamental & applied research
in the field of complex thermal
engineering systems



Allatherm: Start-up company with a
key specialization in two-phase heat
transfer technology and devices



EVAL aim and concept

Develop and manufacture a LHP-based demonstrator for thermal management of aircraft engine bleed system valves exposed to very harsh environment

EVAL challenges:

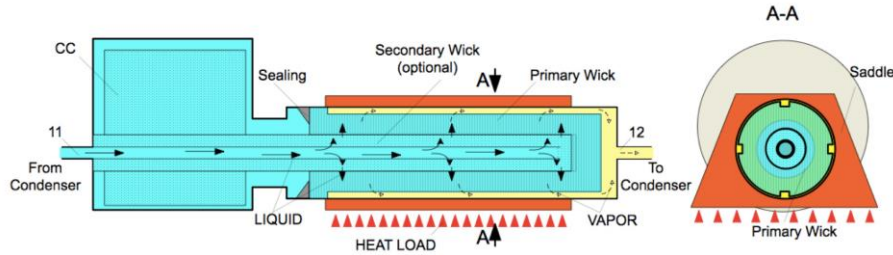
- **Temperature conditions of the bleed system valves** => too hot for the state-of-the-art LHPs
- **Engine secondary duct to be used as a heat sink** => heat transfer realization without negative effect on air flow, manufacturability and assembly
- **Complex and compact geometry of the UHBR engine** => components layout and integration challenges

EVAL approach:

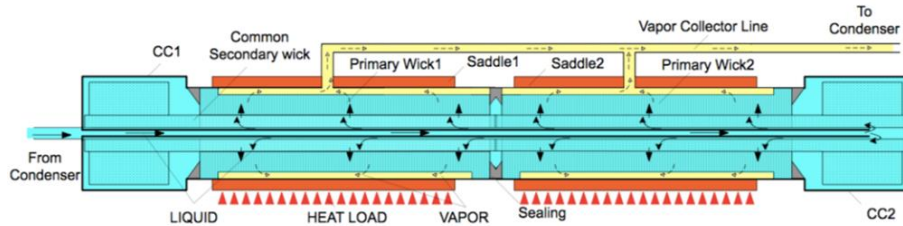
- ✓ Experiment on working fluids to fund the best option
- ✓ ALTOM patented technology of evaporator-reservoir modular unit
- ✓ Allatherm's proprietary technology of the LHP charging on-site

ALTOM LHP vs Classical LHP

Typical evaporator with attached reservoir

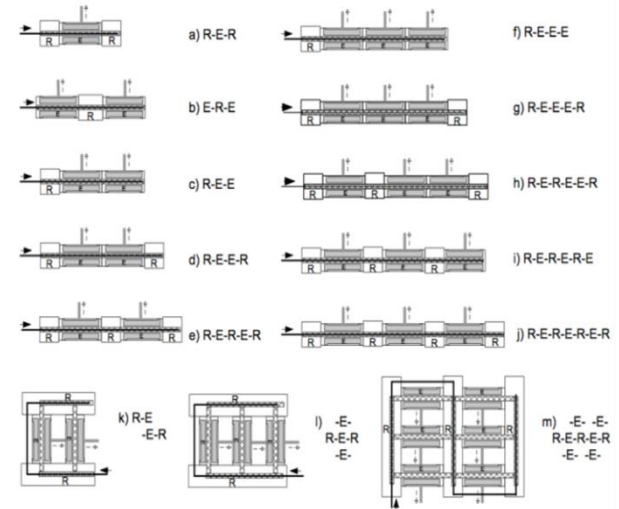


ALTOM evaporator-reservoir modular unit



Possible linear, parallel and mixed configuration of ALTOM modules

Linear,
Parallel,
Mixed



Courtesy of Allatherm SIA

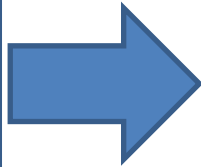
EVAL system vs active two-phase cooling system

- ✓ **Minimal weight** => no heavy components like pump
- ✓ **Compact and flexible design** => ALTOM multiple evaporator-reservoir-condenser design can be easily adapted to UHBR environment
- ✓ **High reliability** => confirmed by many applications
- ✓ **Zero power off-take** => 100% passive system

EVAL outputs

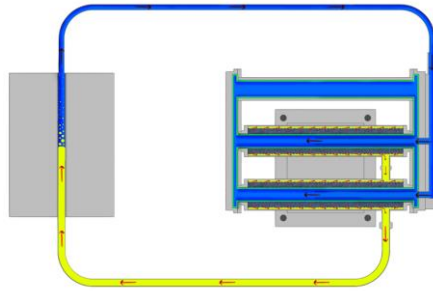
Output #1:

Knowledge advancement as for LHP operation in harsh environment:
1) thermal managed object $\approx 200\text{ }^{\circ}\text{C}$
2) heat sink $\approx 100\text{ }^{\circ}\text{C}$

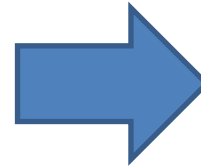


Output #2:

Demonstrator of LHP-based passive cooling device for UHBR engine bleed air system valves

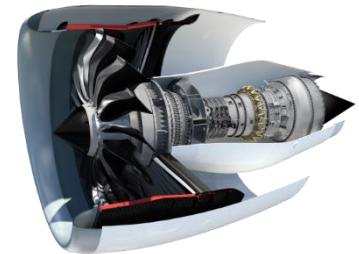


LHP with ALTOM dual evaporator



EVAL effect:

- 1) Accurate & precise regulation of the air flow in UHBR engine
- 2) Reliable & efficient long-term engine operation



Courtesy of Safran Aircraft Engines

EVAL expected impact

- 1. Contribution to creating resource efficient aviation that respects environment***
 - ✓ EVAL is “enabler” technology to run fuel-efficient and environmentally-friendly UHBR engine
- 2. Contribution to building industrial leadership of European aviation industry***
 - ✓ EU domestic innovative thermal management system will increase competitiveness of EU Tier 2/Tier 1, OEMs and Aircraft Operators
- 3. Contribution to ensuring safe and seamless mobility***
 - ✓ UHBR fuel efficiency will help to reduce flight ticket prices and freight charges for EU passengers and businesses



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