19th International Heat Pipe Conference
13th International Heat Pipe Symposium

Space Challenge
Two-Phase Heat Transfer for CubeSats

CHALLENGE RULES

1. Introduction

Argotec is an Italian engineering company, providing products and professional engineering services primarily for Space and Defence markets. Argotec has its headquarters in Turin and an established in-country presence in Germany.
Argotec has professional capabilities in engineering for Space industry, and a long and recognised experience in Human Space Flight and Operations, with personnel supporting a wide range of Human Space Flight missions within the International Space Station (ISS) program. Argotec expertise encompasses different activity domains:

- the engineering activities, which include the design, development and testing of payloads for the International Space Station (ISS), small satellites and avionics for aerospace applications;
- the support to ISS operations, the training of astronauts and ISS flight controllers;
- the Research & Development of new technologies for application in the Space, Defence and industrial fields.

One of the main research streams is focused on the development of two-phase heat transfer technologies for Space and Ground applications. The design of passive thermal control systems is supported by numerical simulations, while their integration and testing is performed in Argotec facilities, which provide all the required equipment. Two-phase technologies are also applied to CubeSats. Argotec activities include the design and development of small satellites for Earth orbits or Deep Space missions, from the feasibility study to the on-obit operations and satellite decommissioning. Argotec is currently developing ArgoMoon, the only European satellite that will take part in NASA Exploration Mission 1. ArgoMoon will be one of the first CubeSats to be deployed from the Space Launch System secondary propulsion stage along its orbit towards the Moon and it will monitor the release of other CubeSats documenting with photographs their deployment. Moreover, it will demonstrate the operability of a CubeSat in a space environment beyond Low Earth Orbit.

2. Background

The current use of small satellites and CubeSats is allowing a cheaper access to Space. The availability of miniaturized components and electronics can help building low-cost, high-performance satellites. Nevertheless, the high-performance components used on board small satellites produce relatively high thermal loads that must be properly dissipated. Hence, the path towards the realization of small satellites embedding high-performance equipment can be extended if either novel heat transfer systems or new configurations of the currently available technologies are developed to fit into limited volumes. Due to the relatively high power that must be dissipated and to the limited available volume, the use of two-phase heat transfer systems is envisioned as an efficient solution.

3. The challenge

This Challenge seeks to foster the creation of new - or to advance existing – two phase heat transfer systems for application on board CubeSats or small satellites (maximum size 12U). Given the current technological trend pushing towards the miniaturization of satellites, the challenge is open to heat transfer systems that can be applied to either Earth or Deep Space

missions. Systems that can be mounted on deployable surfaces are also welcome. A minimum TRL of 3 is required, which means that an analytical and experimental proof-of-concept of the critical function must be already available. The challenge is open to proposals that can have a short-term industrial return. In this respect, the challenge can be seen as a means to fill the gap between low-TRL concepts and their concretization into high-TRL technologies. The submitted papers will be evaluated according to the following criteria:

1. Innovation
2. Quality and pertinence to the challenge objective
3. Impact on future missions
4. Technical and economic feasibility

4. Challenge rules

Participation in this challenge implies full acceptance of the terms set out in these rules.
For the participation to the Challenge, candidates are invited to submit an abstract (not mandatory) describing the proposed technology. The abstract shall be sent by e-mail to spacechallenge@argotec.it not later than December 15, 2017 at 17.00 hours (CET). The participant can send the same abstract that has been submitted to the conference IHPC-IHPS 2018, even if it is not mandatory.
A full paper shall be submitted by e-mail to spacechallenge@argotec.it not later than **May 04**, **2018** at 17.00 hours (CET).
All the submitted documentation must be entirely written in English and in PDF format, according to the IHPC-IHPS 2018 templates (Download the template here).
The challenge offers one incentive prize to encourage the development of innovative solutions for heat transfer problems that can be of interest to the whole Space community. The winner will be refunded for the registration fee (up to 400€) for the Conference participation.
During a Qualifying Round, participants will have the possibility to register and to submit their papers. At the end of the Qualifying Round, a board of jurors composed of Argotec personnel will evaluate each submitted paper and will select the winner. The jurors' decision is final and binding.
The winner shall be registered to the conference IHPC-IHPS 2018 in order to get the award. For the registration fee, terms and condition see http://www.heatpipepisa.it/registration.

5. Challenge award

One paper will be selected and the main author will be the winner of the Space Challenge. The winner will be notified one month before the conference and awarded in Pisa during the International Heat Pipe Conference.
Moreover, Argotec will offer to the winner the opportunity to be supported by the Argotec Team for the design, integration and testing of the proposed heat transfer technology. He/she will have also the possibility to integrate and test the technology at the Argotec laboratories, in Turin (Italy). The collaboration opportunity between Argotec and the Space Challenge winner will be agreed after the IHPC-IHPS 2018.

6. Schedule

Date	Event	Remarks
02-10-2017	Abstract submission opening	
15-12-2017	Abstract submission closure	Jurors board starts preliminary evaluation
04-05-2018	Full paper submission closure	Jurors board starts paper evaluation
31-05-2018	Final results announcement	
14-06-2018	Prize giving ceremony	

7. Eligibility

The Challenge is open to students from all over the World. Each participant is allowed to submit multiple papers.

8. Questions/Comments

Any questions or request for clarifications should be sent by email to: spacechallenge@argotec.it