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Author: Dr. Marco MOLINA
Leonardo Spa, Italy, marco.molina@leonardocompany.com

Mr. Giuseppe Pilato
Manpower c/o Leonardo, Italy, giuseppe.pilato.ext@leonardocompany.com
Mrs. Meganne Christian
Consiglio Nazionale delle Ricerche (CNR), Italy, christian@bo.imm.cnr.it
Mr. Vittorio Morandi
Consiglio Nazionale delle Ricerche (CNR), Italy, morandi@bo.imm.cnr.it
Mr. Vincenzo Palermo
Consiglio Nazionale delle Ricerche (CNR), Italy, vincenzo.palermo@isof.cnr.it
Mr. Patrick Queeckers
Université Libre de Bruxelles, Belgium, pqueeck@ulb.ac.be
Mr. Yarjan Abdul Samad
University of Cambridge, United Kingdom, yy418@cam.ac.uk
Mr. Fabio Iermano
Université Libre de Bruxelles, Belgium, Fabio.Iermano@ulb.ac.be
Mrs. Lucia Lombardi
University of Cambridge, United Kingdom, ll455@cam.ac.uk
Mr. Cristophe Minetti
Université Libre de Bruxelles, Belgium, cminetti@ulb.ac.be
Mr. Andrea Ferrari
University of Cambridge, United Kingdom, acf26@hermes.cam.ac.uk
Mr. Carlo Iorio
Université Libre de Bruxelles, Belgium, ciorio@ulb.ac.be
Mr. Constantine Papakonstantinou
Université Libre de Bruxelles, Belgium, constantine.athanasios@gmail.com
Mr. Andrea Ferrara
Université Libre de Bruxelles, Belgium, andreaferrara90@gmail.com

# GRAPHENE LOOP HEAT PIPES IN SPACE

**Abstract**

Under the Graphene Flagship of European Commission, a graphene enhanced capillary pump has been developed for a Loop Heat Pipe. The Loop Heat Pipes (LHP) are passive devices for thermal control of equipment and payloads in Space. capable to transfer heat from the heat sources to the satellite radiators, LHPs use the own waste heat of the devices to be cooled as the driving energy for pumping a fluid through a loop. The core of a LHP is a capillary pump, a phase separator that allows pressure being generated by capillarity across a porous structure, in two phase conditions for the operating fluid. Traditionally, LHPs capillary pumps are sintered metal wicks. Various properties of graphene have been considered for enhancing the LHP performance, acting at capillary pump level: the small scale of its porosity, its wettability and its thermal conductivity.

Major issues in using conventional LHPs, i.e. with metallic wicks, in operational space missions are related to their non-deterministic start-up behaviour and the necessity to ensure operations without interruption for the entire mission duration.

Superior start-up capabilities have been measured on an acetone experimental LHP with a Graphene Oxide deposition on its sintered Nickel wick, operated in a vacuum chamber on ground.

Furthermore in 2017, for the first time ever, a Graphene LHP capillary pump has been tested during an ESA zero-g parabolic flight campaign, to eliminate the gravity effects: the measurements confirmed the superiority of a Graphene LHP with respect to a conventional one.

The last step (2019-2020) of the Graphene Loop Heat Pipe roadmap is a demonstration on-orbit to confirm, in the long-term, the performances measured on ground and during the zero-g parabolic flight.

The paper presents the results obtained in zero-g and the future developments toward the space qualification of a Graphene Loop Heat Pipe.