# TransHyBeriAN

## Characterization of Wall Temperature Effect during Transition of Hypersonic flow over a Cone By Experiments And Numerical Simulations

### BRINGING OUR ASTRONAUTS SAFELY HOME

Returning home to Earth is one of the most dangerous stages of any space mission, and in the past inadequate thermal protection has led to disasters. The TransHyBeriAN project will study how Thermal Protection Systems (TPS) in spacecraft can be made more effective and safe.

Descending towards Earth at speeds faster than five times the speed of sound, for astronauts the difference between life and death is equal to the strength of the Thermal Protection System (TPS) in their re-entry vehicle. At such speeds, the distribution of heat towards the protection shield can be very volatile; sometimes a flux will increase heat sharply three fold or more. In the past, disasters have happened, when spacecraft have burned up in the atmosphere during this difficult re-entry stage. Therefore there is a need to design stronger and safer TPS for future European space missions.

The TransHyBeriAN project will examine new ways to enhance the level of protection that TPS offer in spacecraft, which will help design future re-entry vehicles that are adequately protected against the extreme heat levels they might experience in the atmosphere.

Bringing together Russian and European researchers in a joint effort to undertake detailed and careful research into the physics involved in hypersonic transition, TransHyBeriAN project findings might prove pivotal for the design and development of the next generation of re-usable re-entry vehicles. Indeed, such designs require that spacecraft can withstand extreme heat numerous times.

Pursuing its research, the project will make use of six hypersonic facilities, and several numerical codes and databases in the EU and Russia. In this respect, TransHyBeriAN is set to bring together both valuable human and world class technical resources from Russia and the EU.

PATRICK **RAMBAUD**
IS PROJECT COORDINATOR

The plane © Kovalenko Inna - Fotolia.com

**TransHyberiAN will explore new ways to enhance the Thermal Protection System in re-entry vehicles.**

### QUESTIONS & ANSWERS

**What do you want to achieve with this project?**

We are expecting to highlight the mechanism of hypersonic transition and specially the role played by a local wall temperature variation on the most unstable mode of instability. Ultimately, delaying the amplification of this mode will allow us to keep a laminar boundary layer.

**Why is this project important for Europe?**

The guaranty for a human crew to access Space with the certitude of its secure return to Earth is crucial to confirm the leading European expertise in the technological Space challenge. The design of a safe vehicle requires mastering its boundary layer transition in hypersonic.

**How does your work benefit European citizens?**

European citizens will benefit of this knowledge with the development of a new generation of a hypersonic civil airplane. The current EU project LAPCAT expects to connect Paris to Sidney in less than four hours. To this aim the understanding of hypersonic transition will be imperative.

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### LIST OF PARTNERS

- Von Karman Institute for Fluid dynamics, Belgium
- Federal State Unitary Enterprise Central Research Institute for Machine Building, Russia
- Deutsches Zentrum für Luft-und-Raumfahrt e.V., Germany
- Khristianovich Institute of Theoretical and Applied Mechanics, Russia
- Federal State Unitary Enterprise Aerohydrodynamic Institute, Russia

### COORDINATOR

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### PROJECT INFORMATION

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(TransHyBeriAN)
Duration: 24 months
EU Contribution: € 499.999
Estimated total cost: € 651.373

SPACE EXPLORATION

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