



**of the European Community for research, technological
development and demonstration activities (2007-2013)**

**Collaborative Project & Small or medium-scale focused research
project**

Space TRIPS

Project title: **Space Thermoacoustic Radio-Isotopic Power System**

Project number: **312639**

Project coordinator: **HEKYOM, Orsay, France**

HZDR participant: **Institute of Fluid Dynamics**

Starting date: **01.01.2013**

Duration (months): **36**

Summary

The project relates to an advanced thermal to electric conversion for radio-isotopic power systems (RPS). Indeed RPSs are a key for space exploration as the solar power is very low in deep space, notably in Jupiter orbit and beyond. These systems will be also useful for Mars exploration, where solar power is subject to nights and dust storms.

So Europe aims to get its independence for such missions, and ESA have initiated development of RPS. If thermoelectricity fits well with small RPS (e.g. 20We), for 100We range, high efficiency conversion is desirable. Indeed this leads to save between 2/3 up to 3/4 of the radioisotope mass. This is of real importance in term of cost and safety.

Stirling converters under development in USA have low reliability due to pistons (sensitive to launch vibrations and shocks, subject to wear). Thermo acoustic (TAc), coupled with magneto hydrodynamic (MHD) generator is innovating technology free of moving parts. Unfortunately, the Technological Readiness Level is low and the priority is given to Stirling in ESA's programme, even if ESA has supported the first studies of TAc-MHD systems. This project is complementary with ESA's approach.

So, the objective of this proposal is to raise the TRL of this technology from 2 to 3-4 and show that this option is viable for European RPSs. The approach is based on 3 axes:

- Theoretical modeling, which has been already developed but needs to be validated,
- Experimentation of a thermo acoustic engine coupled with a MHD generator,
- Design of the space RPS, equipped with this conversion system, to check if the technology is suitable for space mission.

The targets are:

- to validate the process efficiency (close to 20% or above),
- to justify the compatibility of the technology with space missions,

In Europe, there is a strong expertise in thermo acoustic and MHD. But these technologies have never been coupled. The consortium, coordinated by the start-up company HEKYOM, associates three research organizations: CNRS in France, IPUL in Latvia and HZDR in Germany. The space and nuclear industries are represented by THALES ALENIA Space-Italy and AREVA. THALES ALENIA Space represents also the end-user in term of space systems.