

## Training Opportunity for Portuguese Trainees

Reference	Specialist Area	Duty Station
PT-2012-TEC-MT	Thermal Engineering	ESTEC

### Overview of the Division missions:

The Thermal Division TEC-MT is the centre of competence of the Agency in all areas related to thermal design, engineering and verification. It provides support to projects, preparatory programs and technology programs. Within this frame, the Thermal Control Section TEC-MTT is in charge of all thermal and environmental control aspects, and the Thermal Analysis & Verification Section TEC-MTV is the focal point for analytical methods and systems, software tools and experimental/test services executed in the MSL (Mechanical Systems Laboratory).

### Overview of the field of activity proposed:

#### **Thermal Engineering:**

#### **(TEC-MTT)**

- Thermal Design & Modelling: Perform thermal modelling including steady state/transient analyses of instrument and satellites following familiarisation with project requirements and Agency's tools (ESARAD, ESATAN).
- Cryogenics: Investigate and assess cryogenic technologies (active and passive coolers) for applications in future ESA spacecraft (in the field of e.g. Science, Earth Observation); explore the application of cryogenic technologies for zero boil-off storage of e.g. cryogenic propellants.
- Heat Transfer & Heat Rejection: Investigate and assess heat transport technologies (capillary and mechanically pumped two-phase loops, single-phase loops, heat pipes) for thermal control (e.g. deployable radiators, laser head thermal control, high dissipative units) of future ESA spacecraft (in the field of e.g. Science, Earth Observation, Telecom).
- Thermal Protection: Investigate and assess thermal protection technologies (both – re-usable and ablative) for ongoing and future missions (e.g. planetary exploration and sample return missions) and re-usable launchers. Perform thermal modelling and analysis on component and system level.
- Generic thermal control technologies: Investigate and support the assessment of innovative and advanced technologies for the Thermal Control Subsystem e.g. tuneable infrared emittance coatings with electrochromic-based solutions, phase-change materials, miniaturised heat switch, heat pumps, etc.

#### **Thermal Analysis & Verification:**

#### **(TEC-MTV)**

- Analysis methods: Identify, assess and prototype advanced algorithms to improve thermal analyses capabilities, e.g. adaptation of tools for parallel computing, hybrid local finite element/global lumped parameter analysis models; parameter variation/sensitivity analysis/design optimisation/accuracy estimation in combination with stochastic methods; hybrid surface and solid thermal analysis models to better interface with CAD and to more realistically model 3D heat flow.
- Analysis tools in support to testing activities: real time model correlation, spatial and temporal extrapolation of measured temperatures, error localization in models to support the correlation, effect of convection during test at ambient pressure. Contribute to development and validation of: ESATAN/FHTS (thermal/thermo-hydraulic analysis package); ESARAD (thermal radiative analysis tool); EcosimPro (object oriented continuous systems simulation package).
- Verification: Correlation of models using flight data. Critical assessment of spacecraft thermal/mechanical testing, build and exploit a database of models/test results. Study the lessons learned from testing activities to improve test preparation and performance.

9. Mechanical Systems Laboratory: Participation in the daily testing activities of the laboratory to get familiar with the organization and execution of tests and the evaluation of test data. Investigate innovative test methods and instrumentation (e.g. optical measurements, force limiting). Participate to the development and acceptance of new test facilities (thermal cycling, CME & CTE tests, vibration tests).

**Required Education:**

Applicants should have just completed, or be in their final year of a University course at Masters level in a technical or scientific discipline.

Candidates must be fluent in English or French, the official languages of the Agency.

Candidates should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team.

Specific knowledge is very different, depending on the field of activity selected:

- 1. to 5. Physics, thermal / mechanical engineering university degree or equivalent, with basic knowledge of thermodynamics, radiative and conductive heat transfer, cryogenics, fluid/thermal simulations, computer systems.
- 6. & 7. Thermal/mechanical engineering with basic knowledge of thermal analysis, numerical methods and software engineering.
- 8. & 9. Experimental physics or aeronautical/mechanical engineering.