



IN-house production of MI cable



## References

### ➤ ELECTRICAL PROPULSION:

- HELIOS, Spot, Smart 1, Alphasat, Alphabus

### ➤ GREEN PROPELLANT THRUSTER

- Prisma HPGP, google skyboxe

### ➤ HEAT PIPE SYSTEM

- ARABSAT, Hotbird, Skynet

### ➤ HEATING APPLICATIONS:

- Cassini Probe, Venus satellite, Curiosity Rover

### ➤ HYDRAZINE PROPULSION:

- Pleiades, Spirale, ELISA, SSOT
- Alsat, Astroterra, Sentinel-2, Galileo, MUSIS, Myriade

### ➤ THERMOCOUPLE APPLICATIONS:

- ATV module
- Material Space Laboratory on ISS
- Vulcain Engine



### ➤ OUR COMPANY

With nearly 60 years of experience in heating solutions and temperature measurement, THERMOCOAX has acquired a great deal of skill and expertise. THERMOCOAX products are widely used and endorsed in many industries where the highest quality and utmost reliability are essential. All our mineral insulated cables are manufactured in-house with our proprietary and unique procedures.



sales@thermocoax-space.com  
www.thermocoax-space.com

### ➤ YOUR CONTACT

➤ **FRANCE :**  
THERMOCOAX SAS  
40 Bd Henri Sellier  
F 92156 SURESNES Cedex  
Tel.: +33 1 41 38 80 50  
Fax: +33 1 41 38 80 70  
info@thermocoax.com

➤ **GERMANY**  
THERMOCOAX ISOPAD GmbH  
Englerstrasse 11  
D-69 126 HEIDELBERG  
Tel.: +49 6221 3043-0  
Fax: +49 6221 3043-956  
Isopad.info@thermocoax.com

➤ **USA**  
THERMOCOAX Inc.  
6825 Shiloh Road East,  
Ste B-3  
ALPHARETTA, GA 30005  
Tel.: +1 800 298 3345  
Fax: +1 678 947 4450  
info@thermocoax.us

➤ **UK**  
THERMOCOAX UK Ltd.  
Vienna House, International Square  
Birmingham International Park  
Soliuhull, B37 7GN  
Tel.: +44 (0)121 767 1822  
info-uk@thermocoax.com

➤ **CHINA**  
Tel.: 13701325459  
info-china@thermocoax.com



Data subject to alteration without notice - May 2015  
Head Office: Planquignon - F01420 THIS D 0146 - 0E L'ORME France - THERMOCOAX SAS au capital de 441 046 € - RCS ALENÇON B 323 459 925 - N° TVA / VAT N°: CEFR 32 459 925  
E241-4



### ➤ Space Research Industries



## Our capabilities

**Our mission is to develop complete thermal solutions, through advance innovation : from conception to prototype development, all the way through to production.**

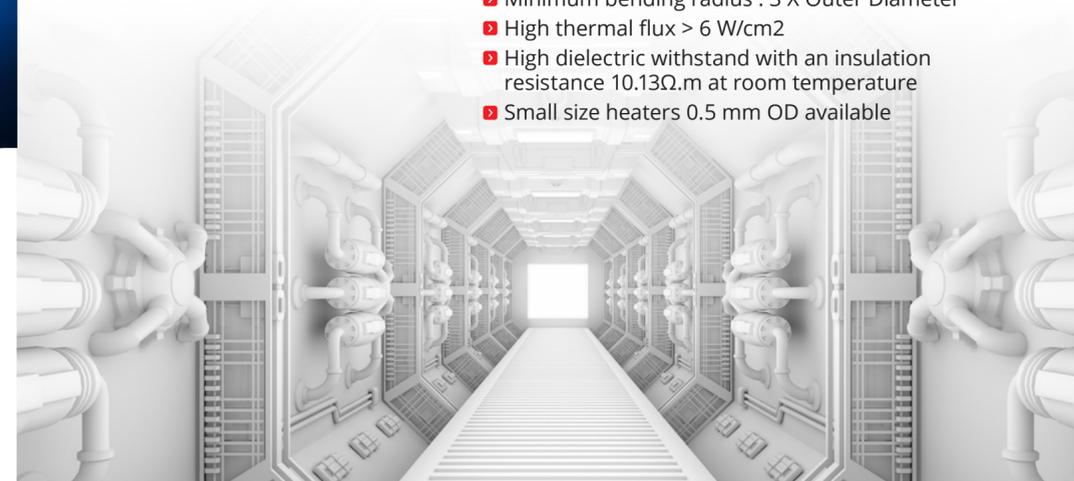
Our custom thermal systems provide cleaner, cost effective and safer solutions :

- 3D Design / thermal modeling
- From cryogenic temperatures up to 1000°C
- Suitable for atmosphere to UHV environment
- Thermal modeling / simulation
- Experience in common and special alloys (tungsten, aluminum, titanium...)
- Product support & engineering
- Prototypes
- Production manufacturing
- From small up to large size devices
- Research & testing services



The industry's most trusted Mineral Insulated Cable

- True cold end heater (no connector on the cold/hot junction)
- Minimum bending radius : 3 X Outer Diameter
- High thermal flux > 6 W/cm2
- High dielectric withstand with an insulation resistance 10.13Ω.m at room temperature
- Small size heaters 0.5 mm OD available



## Catalyst Bed Heater FOR CHEMICAL THRUSTERS

Heating system to pre-heat the reactor (thruster) to enable the propellant decomposition

Hydrazine or Green Propellant (ADN)  
THERMOCOAX offers 2 designs



### Coiled Heater Design

- ▶ Heating cable willed around catalyst
- ▶ 6 and 10 W
- ▶ Other power adjustable
- ▶ 2 heating loops for redundancy
- ▶ Withstanding 1 000°C

### Cartridge Design

- ▶ 3 and 3.5 W under 28 V
- ▶ 2 heating loops for redundancy
- ▶ Weight : 35 gr
- ▶ Withstanding 1 000°C

DESIGN FOR A 15 YEAR SPACE MISSION



- ▶ Thrust power from 0.1 up to 250 Newton
- ▶ Heat power: 3, 3.2, 6 and 10 W
- ▶ Voltage 28 V
- ▶ Maxi voltage 37 V
- ▶ Dielectric and insulation resistance under 500 V
- ▶ TML < 1%
- ▶ CVCM < 0.1%
- ▶ ESA Certified

## Electrical Thruster

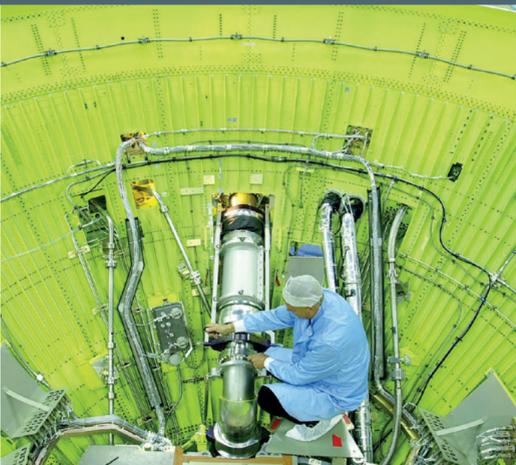
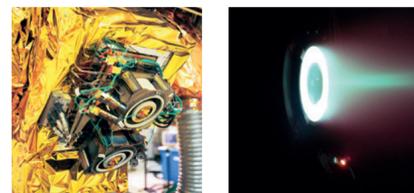
### Hall Effect engine

THERMOCOAX magnetic coils accelerate the ions (i.e. Xenon) and drive the engine's thrust.

THERMOCOAX offers the cable or the complete assembly coil ready to be used.

This technology is space qualified and has proven its efficiency and excellent behavior during the space missions.

The Mineral Insulated Cable is the solution for a good behavior in vacuum and high temperature exposition.



INCREASE RATIO PERFORMANCE / COST

### Experience on 92 and 200 mN thrust

- ▶ Inner magnetic coil
- ▶ 4 outer magnetic coils
- ▶ 600°C max
- ▶ Cable Ø 1.9 mm
- ▶ Copper conductor: Ø 1.31mm

- ▶ Partial Discharge Tests : 500 VAC, 1 min, 1 MHz
- ▶ Maxi voltage : 350 V
- ▶ Discharge current : up to 5 Amp
- ▶ Dielectric and insulation resistance under 500 V
- ▶ TML < 1%
- ▶ CVCM < 0.1%
- ▶ ESA Certified

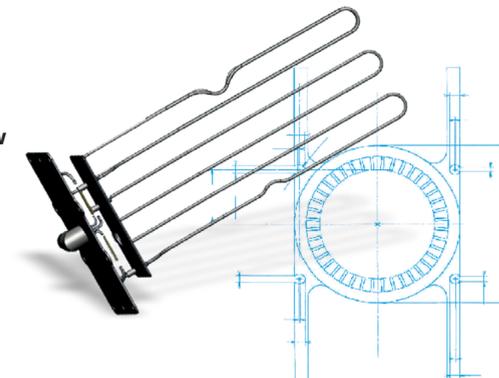


## Heat pipe

For the thermal control of the satellite. Sun exposition gets very hot and shadow gets very cold.

THERMOCOAX heating system is designed for thermal active control and heat cold satellite areas.

- ▶ The cables batches are qualified LAT space standard
- ▶ Light weight and easy integration
- ▶ Standard design
- ▶ Heating power up to 150 W under 100 V
- ▶ Power density 6 W/cm<sup>2</sup>
- ▶ Other heating power and voltage available
- ▶ Cable Ø down to 1 mm
- ▶ Partial Discharge : 200 and 500 VAC
- ▶ Dielectric and insulation resistance under 500 V
- ▶ TML < 1%
- ▶ CVCM < 0.1%



SECURE DATA DURING ANALYSIS



## Heating system FOR MULTISPECTRAL CAMERA

- ▶ Redundancy loops
- ▶ Temperature operation +10 up to +50°C
- ▶ Temperature Survival range : -30 up to +60°C
- ▶ Operating voltage 25 to 50 VDC
- ▶ From 10 to 100 W dissipate
- ▶ Cylinder internal parts black anodized
- ▶ Homogeneity ±2°C

## Temperature

THERMOCOAX manufactures its own thermocouple cables. We guarantee high product quality and traceability for our customer

- ▶ From cryogenic temperatures up to 2300°C
- ▶ THERMOCOAX proposes the whole range of thermocouples: T, E, J, K, N, S, R, B, D and C type.
- ▶ Our in-house manufacturing workshops allows THERMOCOAX to adapt the cable construction, i.e. the use of special insulator which meet the particular requirements for high temperature
- ▶ From 0.25 up to 5 mm OD
- ▶ Special junction on extension cable dedicated to space environment
- ▶ Solution for harsh environment as graphite....

THERMOCOAX has its own calibration laboratory and is in conformity with NIST standards.



- ▶ Vibrations Resistant
- ▶ Shock resistance
- ▶ Hermetically sealed
- ▶ Design for 10 years
- ▶ Space Mission

- ▶ Insulation 10<sup>12</sup> Ω\* meter at room temperature
- ▶ Calibration in accordance with NIST
- ▶ TML < 1%
- ▶ CVCM < 0.1%

EXPAND END USER APPLICATION BASE

Concept, design and computerizing model techniques (CMT) to simulate the prototype working performances

Inhouse testing and calibration using COFRAC certified laboratory

R&D department for static and dynamic thermal modeling

