

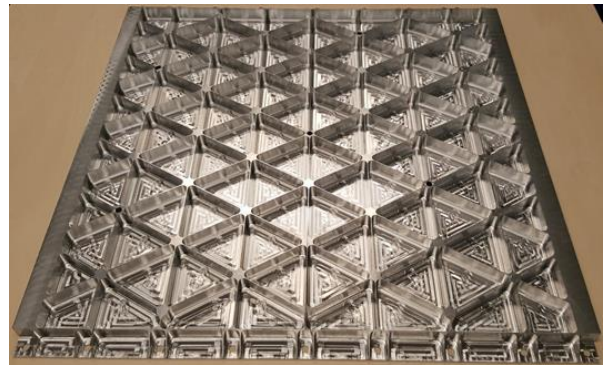
# Thermal Radiators

Spacecraft Thermal Radiators, are the crucial elements in the Thermal Control System, that reject waste heat to deep space, keeping a spacecraft cool enough to operate efficiently. They range from simple aluminium plates, to more complex aluminium panels, up to honeycomb panels, sometimes with thermal enhancements integrated inside them.

Azimut Space designs, optimizes, builds and verifies this critical component for its customers, starting from specification or as 'build-to-print', in many different sizes, quantities and price levels.

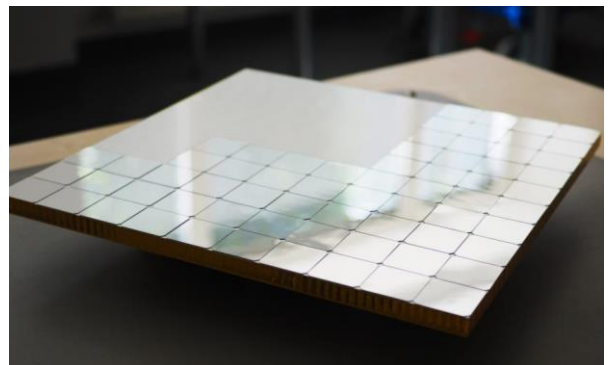
Different substrates are available for the radiators:

- Simple panels
- Machined panels
- Al-Sandwich panels
- Al-Sandwich panels with embedded heat pipes



A vast range of coatings are available, with ever higher performances (and prices):

- Painted (white or black)
- Polymeric foils
- Second Surface Mirror (SSM) Foils
- Optical Solar Reflectors (OSR)



Heat is brought to the radiator in different ways:

- Direct mounting (on the back)
- Heat pipes (Al-NH<sub>3</sub>, Cu-H<sub>2</sub>O)
- Thermal straps
- Mechanical pumped loops (MPL)

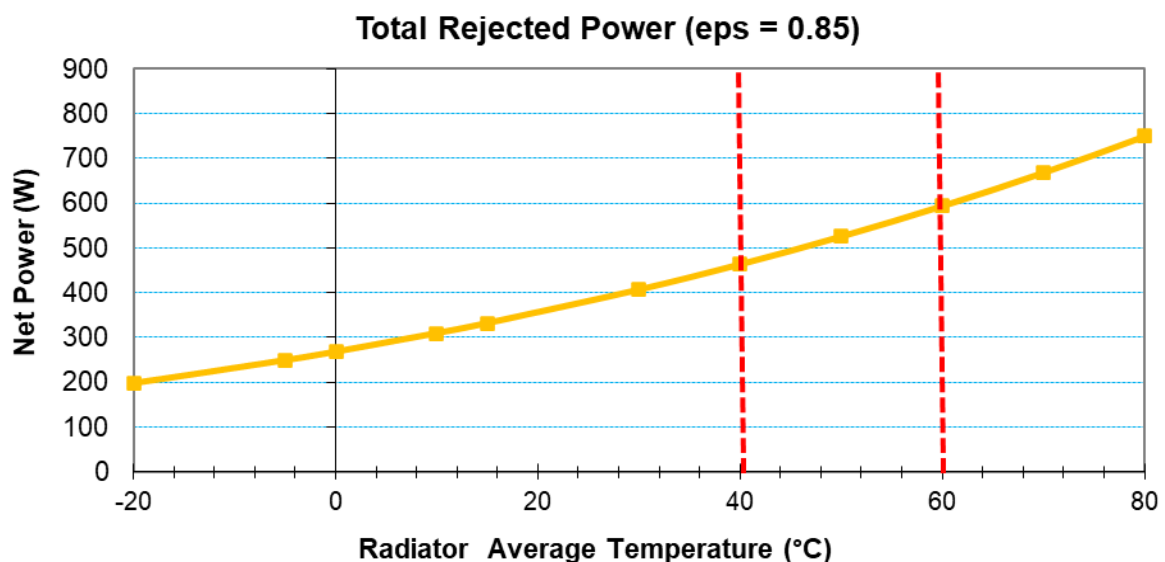
Further accessories are available, such as sensors, heaters, MLI, screens, mounting brackets.



Azimut Space provides full Design Support, in all domains, such as Thermal (ESATAN), mechanical (Solidworks) and FEM (SW). Radiators are delivered fully qualified, according to the Customer preferred standards (ECSS, NASA or simpler, tailored, standards). Options for large quantities are available.

## Specifications

<b>Dimensions</b>	(min) (max)	~0.1 x 0.1m <sup>2</sup> ~2.0 x 3.0 m <sup>2</sup>
<b>Materials</b>		Aluminium, diverse alloys (solid) Aluminium or Composites (facesheets) Aluminium (Honeycomb) Specialty foams (cores for heat pipes) Aluminium – NH3 (high performance) Copper – H2O (low cost) Embedded and surface-mounted
<b>Heat pipes</b>		
<b>Coatings</b>		Paints Special foils SSM foils OSR
<b>Temperature ranges</b>		-70°C to +80°C (typical) 0°C to 100°C (with Cu-H2O Heat pipes) -200°C to 0°C (cryogenic)
<b>Dissipation capabilities</b>		Depending on operating temperature (see below)
<b>Design elements</b>		Inserts Structural/thermal doublers Electrical grounding and bonding provisions



## CUSTOMERS AND PARTNERS

ESA, DLR, OHB, Thales Alenia Space, AIRBUS D&S,  
Beyond Gravity, Ariane Group, Luxspace, Sonaca, NASA

## SOFTWARE

ESATAN-TMS, Thermal Desktop, Solidworks, Solid Edge  
Hyperworks, LabView

## TEST FACILITIES

Thermal vacuum chamber, Thermal cycling chamber  
(cryogenic), vibration test facilities (external)

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