ESR Space
Insight into Motion

in collaboration with SpaceMech Limited

SpaceMech

Compact Thermal Shutter (CTS)

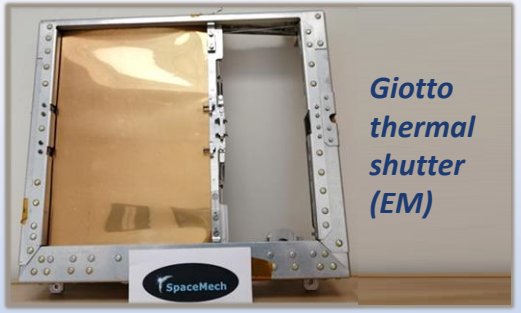
Thermal Shutter Demonstrator

- **Designed to stabilise cubesat payload orbital temperatures**
- **Slim Design Maximises payload volume**
- **Low-power DC motor provides simple drive interface, with end-stop/ position sensor options**
- **Readily scalable to larger cube-sats and small-sats**

Parameter	Details/Value
Applications	Thermal or optical shutter
Suitable platform	1U, 2U, 3U, 2x2U, 2x3U cubesat or custom size
Development Programme	UKSA GEI – by Spacemech Ltd
Radiator Area Efficiency (%)	75% (OSR or painted) with IR emissivity > 0.87 Solar absorptivity < 0.15 (OSR) < 0.20 (Paint)
Shield Film Properties (Tailorable)	Single sided VDA Kapton (baseline) IR emissivity < 0.10 Solar absorptivity < 0.15
Mass Efficiency	0.7 gm/cm^2
Volume fraction in 1U	0.14
Operating life cycles	>1,000,000 demonstrated at ambient
Power when actuated	< 1.0 W

Developed under a UKSA GEI project, the compact thermal control device is to enable Cube-sats and small spacecraft to actively regulate payload temperatures, using a design based on mechanism flown on Giotto and Rosetta spacecrafts (lower right). This combination of deep space heritage and updated technology has allowed for miniaturisation while achieving a high view factor to space in the open state.

Several design iterations were performed to reach an optimised design. Metallic and polymeric belt options were characterised for lifetime potential, en route to a highly reliable, radiation tolerant design. A fully-functional Demonstrator unit was manufactured and evaluated. This unit is shown incorporated into a dummy Cube-Sat (TRL 3 unit shown above). A qualification programme is currently being planned.



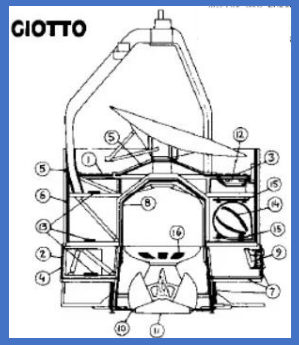
Giotto thermal shutter (EM)

Contact: andrew.gibson@esrtechnology.com **esrtechnology.com**

ESR Thermal Shutter Heritage / Evolution

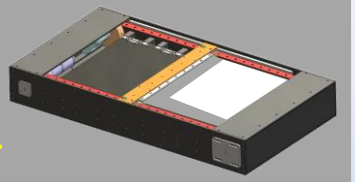
Heritage Mission | Development Activity | Potential Mission/Follow-on Activity

Giotto Thermal Shutters
Launched 1985
(BAe for Fokker/ESA)

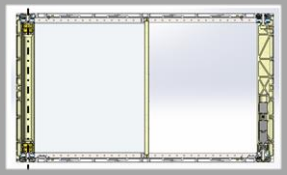


CFESat Boom (Belt-drive mechanism)
Launched 2007
(SSTL/ESR/Sula for NRL)

LDRLR Mock-Up
Completed Feb 2022
(ESR/ALM/ Spacemech for ESA)



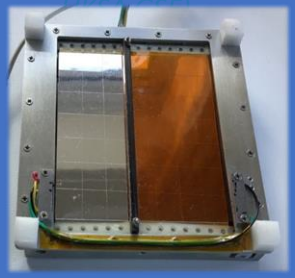
LDRLR Breadboard System
Ongoing - 2022-2023
(ESR/ALM/ Spacemech for ESA)



LDRLR Qualification for EL3 (TBC)
Mission planned 2030
(ESR/Spacemech For ESA)

Rosetta Thermal Shutters
Launched 2004

Compact Thermal Shutter (CTS)
Delivered 2019
(Spacemech for UKSA GEI-40)



Dust Mitigation Testbed
Completed Mar 2022
(ESR/Spacemech for UKSA GEI-40)

Retractable MLI Cover
Development (2024)
(proposal early 2024 TBC by ESR/Spacemech/ Almatech/RAL)

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