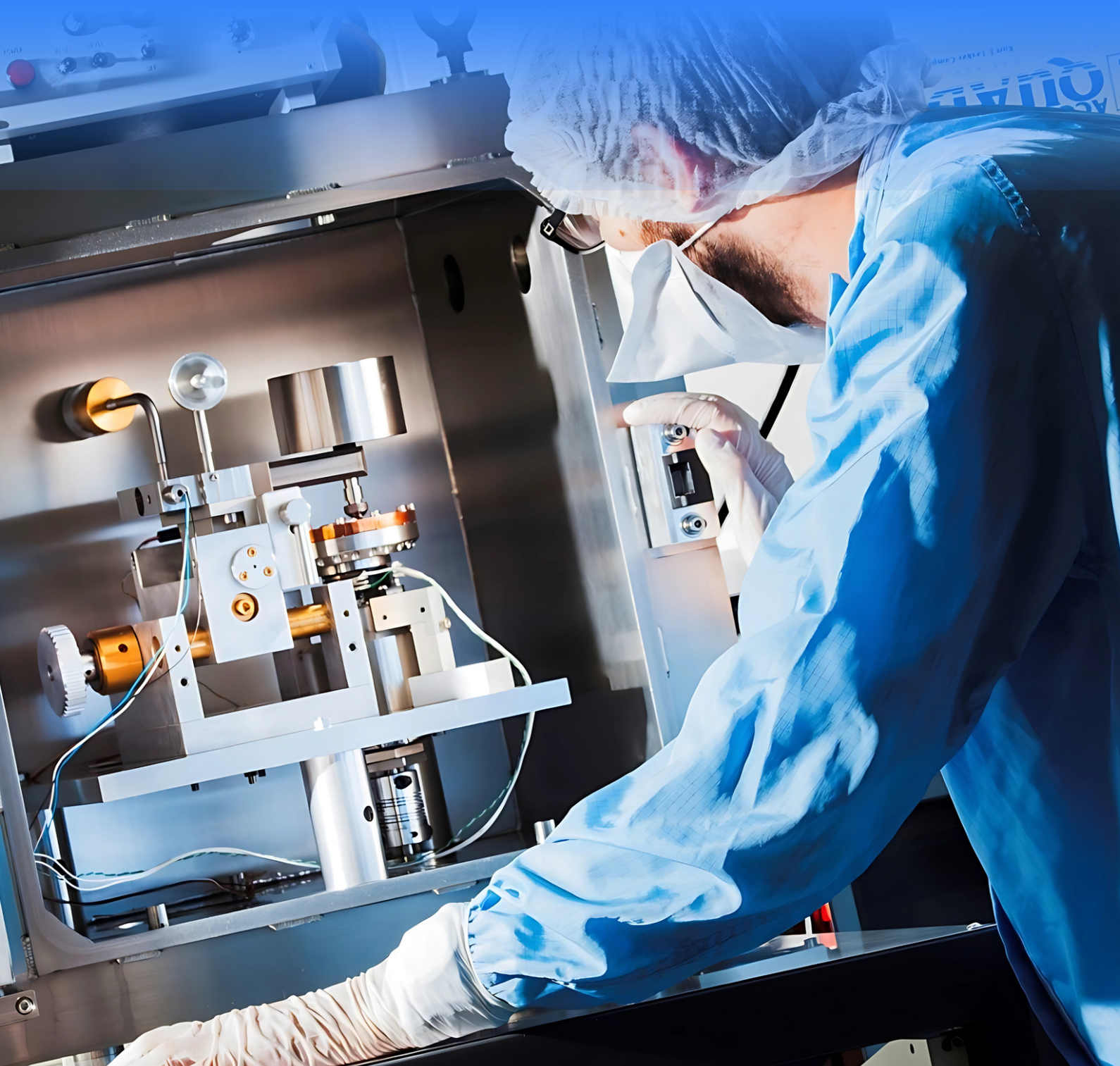




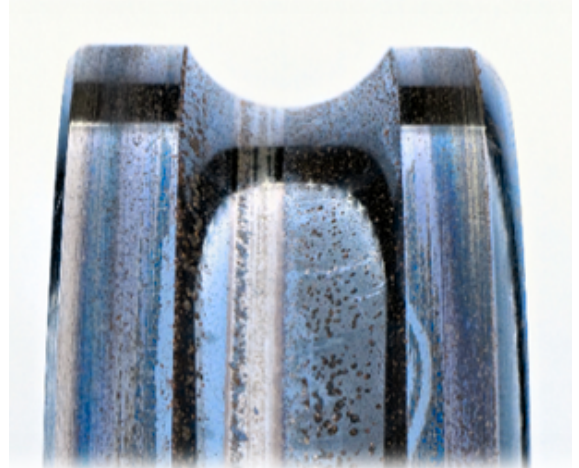
Keeping Space Moving

Your Partner in Space Tribology



R&D and Consultancy Services

The application of ‘good tribology’ contributes significantly to the efficiency, reliability and performance of spacecraft mechanisms. As ESA's external centre of excellence, ESTL (the European Space Tribology Laboratory) offers independent, specialist support in this field for the benefit of the space mechanisms community. Key aspects of ESTL's remit include development and sharing of technical expertise and advice on the performance of solid and fluid lubricants as well as the polymeric and metallic materials used in tribological components such as bearings, gears and screws.



Tribology Applications Programme (TAP)

ESA-Funded Annual Programme

- 10–12 R&D projects per year benefiting the European space community.
- Covers development, evaluation, and validation of tribological advancements.

Recent Projects Include:

- New solid lubricants (e.g., improved PVD MoS₂, lead alternatives).
- Fluid/solid lubricant behaviour using the Vacuum Mini-Traction Machine (VMTM).
- Hybrid lubrication (synergistic fluid/solid behaviour)
- Impact of surface treatments and cage processing parameters on lubrication
- Mapping and quantification of solid and fluid degradation
- PFAS free lubricants and creep barriers
- Component testing (bearings and gears).

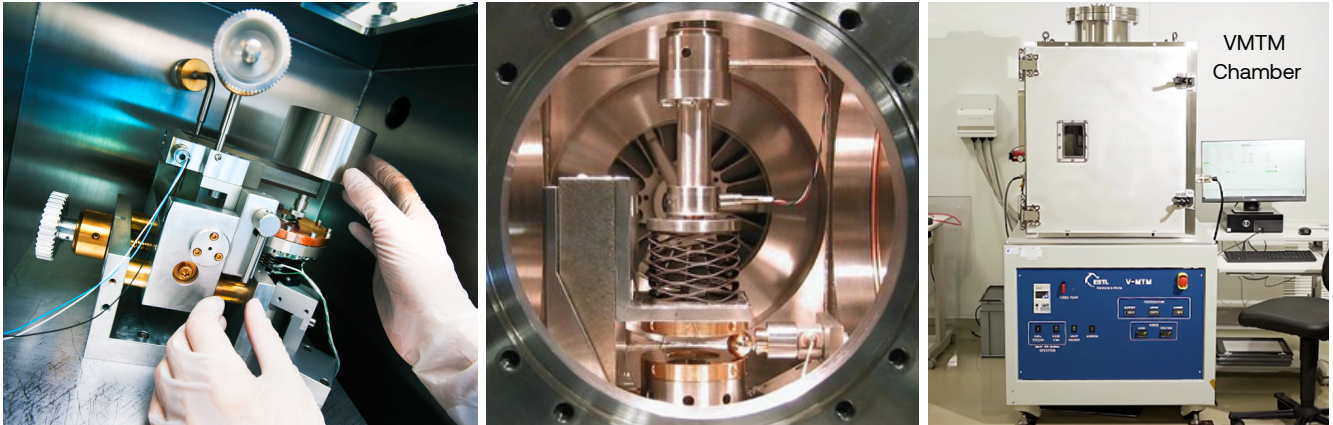
Outputs are openly shared with entities within the ESA member and Cooperating States via our website and summarised at key events (FPDs, ESMATS etc.).

Specialised Facilities

To support these activities, ESTL maintains a comprehensive set of specialised vacuum test facilities available for space tribology research and development including:

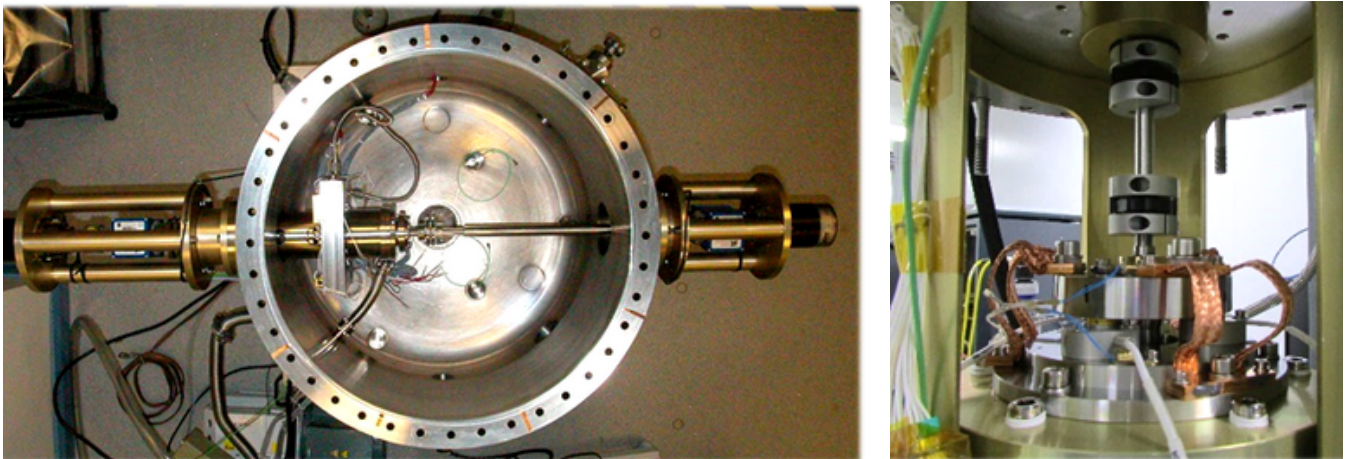
Vacuum Test Systems

- Pin-on-Disc Tribometers – Friction & wear testing (-100°C to +200°C).
- Spiral Orbit Tribometer (SOT) – Lubricant life & friction in rolling contact (-50°C to +120°C).
- Vacuum Mini-Traction Machine (VMTM) – Visualise lubricant behaviour in bearing-like conditions (-100°C to +120°C).



Component Testing, Inspection and Analytical Tools:

- Gear test rigs (including harmonic/planetary gearboxes).
- Advanced Bearing Test Rig (ABTR) – Film thickness & preload analysis.
- Microscopy (SEM, EDS, Optical), Profilometry, RGA, μ -Hardness, CMM, FTIR, RADIANT high mass ion mobility spectrometry



Commercial R&D & Development Contracts

- Confidential, client-specific R&D for global clients.
- **ESA/ARTES-funded developments in:**
 - Ionic fluid lubricants
 - Lead replacement
 - Surface functionalisation
 - Piezo motors
 - In-orbit re-lubrication micro-pumps

Consultancy & Training

Free ESA-Funded Support:

- **Minor Consultancy** – Up to 1 day free support for entities in ESA Member & Cooperating States.
- **Major Consultancy** – ESA-approved studies offering deeper technical support (limited annual funding).

Tailored Services:

- Commercial consultancy for bearing system design, bearing and lubricant selection and analysis, post-test inspection and more.
- Customised training (delivered at events like ESMATS & AMS or on request).

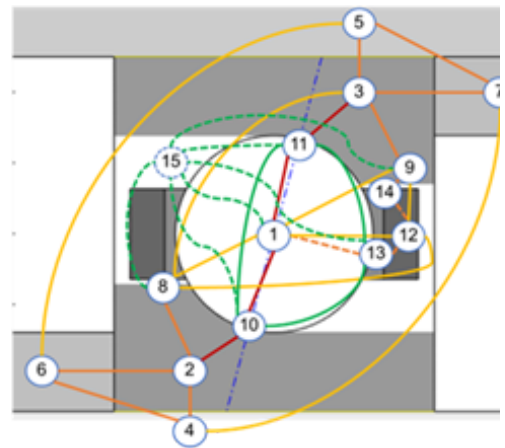
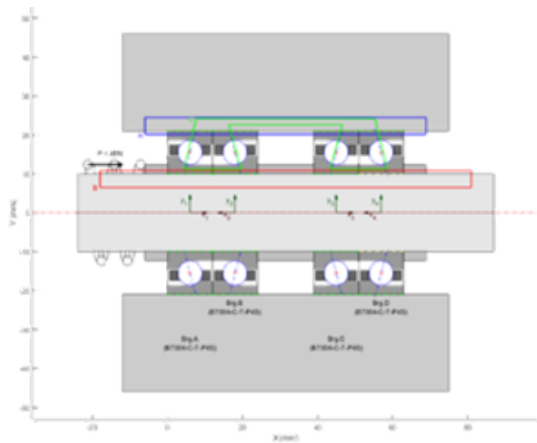


Training courses are customised to meet client needs

Online Resources & Tools

Register via ESTL Website Members for Access:

- Technical Reports Database – 50+ years of R&D outputs (TAPs).
- DOLLS – Liquid lubricant properties.
- DEBRA – Bearing performance data.
- CABARET – state-of-the-art ball bearing analysis software tailored for space applications



CABARET ball bearing analysis software

- Space Tribology Handbook
- Guidelines Documents - Handling and Preloading Bearings; Qualification of New Fluid Lubricant



Register here for ESTL Members' Area.....





*Want a digital version of this
brochure?
Scan QR code.*



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ESR Technology also provides partnership mechanism and sub-assembly design, development and recurrent build through its **ESR Space Team**. Details here...

