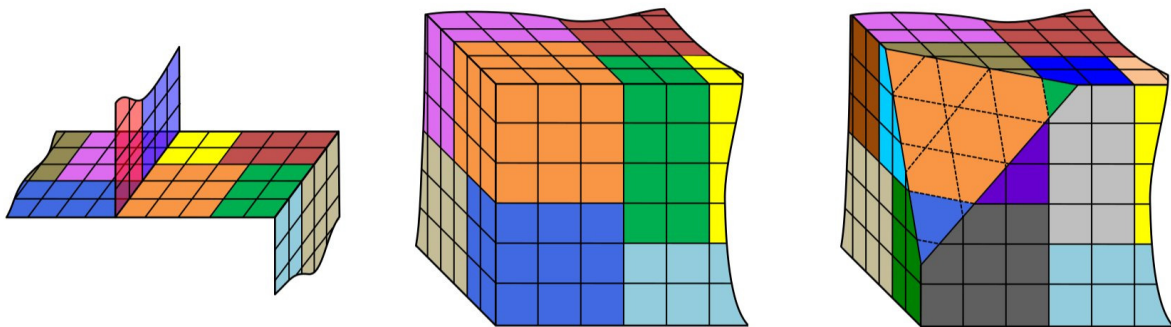


Proceedings of the
**30th European
Space Thermal Analysis
Workshop**

ESA/ESTEC, Noordwijk, The Netherlands

5–6 October 2016



courtesy: University of Liège

Abstract

This document contains the presentations of the 30th European Space Thermal Analysis Workshop held at ESA/ESTEC, Noordwijk, The Netherlands on 5–6 October 2016. The final schedule for the Workshop can be found after the table of contents. The list of participants appears as the final appendix. The other appendices consist of copies of the viewgraphs used in each presentation and any related documents.

Proceedings of previous workshops can be found at http://www.esa.int/TEC/Thermal_control under ‘Workshops’.

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⇒ Please note that text like [this](#) are clickable hyperlinks in the document.

⇒ This document contains video material. By (double) clicking on picture of a video the movie file is copied to disk and then played with an external viewer. This has been tested with Adobe Reader 9 in Windows and Linux using vlc as external viewer. Other pdf readers may not work automatically. As a last resort the user can manually extract the movie attachment from the file and play it separately.

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W List of Participants**299**

Programme Day 1

- 9:00 Registration
- 9:45 **Opening address**
Wolfgang Supper (ESA/ESTEC, The Netherlands)
- 9:50 **Welcome and introduction**
Harrie Rooijackers (ESA/ESTEC, The Netherlands)
- 10:00 **GENETIK+ — Near-real time thermal model correlation using genetic algorithm**
Guillaume Mas (CNES, France)
- 10:25 **World Space Observatory-Ultraviolet — Thermal Analysis of Spacecraft Electronics**
Samuel Tustain (RAL Space, United Kingdom)
- 10:50 **Thermal mapping on Bepicolombo's Mercury Planetary Orbiter (MPO) using SINASIV**
Claudia Terhes & Simon Appel (ESA/ESTEC, The Netherlands)
- 11:15 Coffee break in the Foyer
- 11:45 **Correlation of MLI Performance Measurement with a Custom MATLAB Tool**
Lars Tiedemann & Peter Lindenmaier (HPS GmbH, Germany)
João Pedro Loureiro (HPS Lda., Portugal)
- 12:10 **Solar Orbiter STM Thermal Testing and Correlation**
Scott Morgan (Airbus Defence and Space, United Kingdom)
- 12:35 **Automated thermal model correlation**
Martin Trinoga (Airbus Safran Launchers, Germany)
- 13:00 Lunch in the ESTEC Restaurant
- 14:00 **The challenges of modelling helium gas conduction and helium seal interfaces in ESATAN-TMS r7**
Nicole Melzack (RAL Space, United Kingdom)
- 14:25 **Improved integrated way of post-processing thermal result data**
Henri Brouquet (ITP Engines UK Ltd, United Kingdom)
- 14:50 **Thermal modelling of thruster nozzles and plumes for planetary landers**
Hannah Rana & Andrea Passaro (ESA/ESTEC, The Netherlands)
- 15:15 **Thermal experiments on LISA Pathfinder's Inertial Sensors**
Ferran Gibert (University of Trento, Italy)
- 15:45 Coffee break in the Foyer

- 16:15 **Quasi-autonomous spacecraft thermal model reduction**
 Germán Fernández Rico (Max Planck Institute for Solar System Research, Germany)
 Isabel Pérez Grande & Ignacio Torralbo (Universidad Politécnica de Madrid, Spain)
- 16:40 **Space Thermal Analysis through Reduced Finite Element Modelling**
 Lionel Jacques
 (Space Structures and Systems Laboratory, University of Liège & Centre Spatial de Liège, Belgium)
 Luc Masset & Gaetan Kerschen (Space Structures and Systems Laboratory, University of Liège, Belgium)
- 17:05 **VEGA Launch Vehicle — Improved Fluidic Thermal Prediction Model**
 P. Perugini & David Moroni & Matteo Tirelli (Avio S.p.A., Italy)
- 17:30 Social Gathering in the Foyer
- 19:30 Dinner in *Blu Beach*

Programme Day 2

- 9:00 **SYSTEMA — THERMICA**
 Timothée Soriano & Antoine Caugant (Airbus Defense and Space SAS, France)
- 9:45 **Gas conduction and convection modelling techniques for the ExoMars Rover**
 Joshua Katzenberg (Airbus Defence and Space, United Kingdom)
- 10:10 **Modelling of complex satellite manoeuvres with ESATAN-TMS**
 Nicolas Bures (ITP Engines UK Ltd, United Kingdom)
- 10:35 **pyTCDDT (TCDDT 2.0) — A flexible and scriptable toolbox for thermal analyses.**
 Marco Giardino & Andrea Tosetto (Blue Engineering, Italy)
 James Etchells & Harrie Rooijackers (ESA/ESTEC, The Netherlands)
- 11:00 Coffee break in the Foyer
- 11:30 **A comprehensive integration methodology based on cosimulation — Integration of thermal management in early phases of an electronic / electrical design**
 Benoit Triquigneaux & M.Bareille & Julien Pouzin & Laurent Labracherie & J.Vidal
 (ALTRAN Technologies, France)
- 11:55 **THERM3D / e-Therm GMM (conductive) and TMM generation of thermo-mechanical antenna support designed for ALM**
 Patrick Connil & Jean Paul Dudon & Thierry Basset & Patrick Hugonnot (TAS, France)
 François Brunetti (DOREA, France)
- 12:20 **Development towards 3D thermography**
 Gianluca Casarosa (ESA/ESTEC, The Netherlands)
- 12:45 **Data exchange for thermal analysis — a status update**
 James Etchells & Duncan Gibson & Harrie Rooijackers & Matthew Vaughan (ESA/ESTEC, The Netherlands)
- 13:00 Closure
- 13:00 Lunch in the ESTEC Restaurant

Opening address

Good Morning Ladies and Gentlemen
Dear Colleagues and Friends

On behalf of the European Space Agency, I have the pleasure to welcome all of you to this 30th edition of the Space Thermal Analysis Workshop here at ESTEC and I would like to express a warm welcome to all participants coming from various ESA Member States and a number of other countries.

30th anniversary ! That is quite an achievement and also a sort of record.

It started out as the ESATAN workshop in 1985 with 38 attendants and was promoted and organized by my now retired colleague Charles Stroom with the aim

- to introduce the ESATAN space thermal analysis tool to the European thermal community as a replacement for SINDA
- and to create a forum to exchange information and experience between users and developers

The second workshop was held in 1987 and called "ESATAN Users Meeting". After the third one in 1989, the workshop has been taking place every year since that time.

I unfortunately did not attend the first two workshops in 1985 and 1987 - as I only joined the Agency in December of 1987. But then I had the pleasure to attend many of the 28 workshops over the years.

Looking back at the development of space thermal analysis there has been quite some changes and a lot of progress.

From tools like CBTS, VWHEAT (with VUFACT, RADCON, ROHCAT), VUVU, MATRAD, Manip, Polytan, ESABASE, ESARAD to today's ESATAN-TMS, EcoSim, Thermica/Thermisol, TMG and others with powerful pre- and post-processing tools and advanced GUI's make the life of the thermal engineer easier.

However, a word of warning from an old thermal engineer - any software tool is only as good as the engineer sitting on the other side of the terminal. Experience and thermal engineering knowledge is still very much needed prior to switching on the computer and using any of these tools. And the experience and knowledge is even more needed when looking at the results!

Over the years, the scope of the workshop has significantly evolved, as ESA's approach to the thermal tools also evolved.

The workshop objectives today are:

- to promote the exchange of views and experiences amongst the users of European thermal analysis tools and related methodologies
- to provide a forum for contact between end users and software developers
- to present new features of thermal tools and solicit feedback for development
- to present innovative methodologies, standardisation activities.

Let me also say a few words on statistics:

Over the last 30+ years we have had - including this year's - close to 600 presentations and almost 2000 registered external participants, some of them attending many workshops over the years. I want to sincerely thank all participants and authors, past and present.

This year again more than 100 participants have registered, which confirms the interest and important role of Thermal Software & Analysis Methods to the space community. For us, this is a clear sign of appreciation and a confirmation of the usefulness of this workshop and it also clearly demonstrates the continued need for such events to exchange information and to strengthen further cooperation on the subject as well as to provide recommendations for future developments.

I also want to take the occasion to thank all my colleagues - Harrie, Duncan and also the Conference Bureau - who have worked hard to prepare and organise these workshops.

I hope you will find this event both enjoyable and rewarding and I want to wish you all a very fruitful and interesting workshop.

Let me now hand over to my colleague Harrie Rooijackers, the organiser of the workshop, who will provide you with some details on the logistics.

Wolfgang Supper
Head of Thermal Division