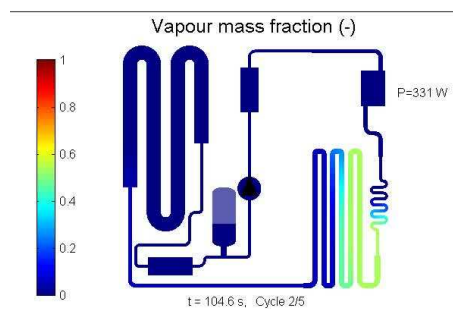
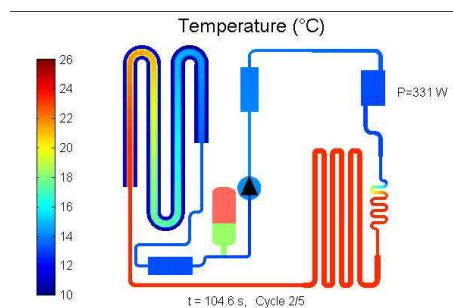


Proceedings of the  
**27<sup>th</sup> European  
Space Thermal Analysis  
Workshop**

ESA/ESTEC, Noordwijk, The Netherlands

3–4 December 2013



credits: National Aerospace Laboratory NLR

### **Abstract**

This document contains the presentations of the 27<sup>th</sup> European Space Thermal Analysis Workshop held at ESA/ESTEC, Noordwijk, The Netherlands on 3–4 December 2013. 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](http://www.esa.int/TEC/Thermal_control) under 'Workshops'.

Copyright © 2014 European Space Agency - ISSN 1022-6656

---

Please note that this document contains clickable hyperlinks which are shown as [blue text](#).

# Contents

<b>Title page</b>	<b>1</b>
<b>Abstract</b>	<b>2</b>
<b>Contents</b>	<b>3</b>
<b>Programme</b>	<b>6</b>

---

## Appendices

<b>A</b>	<b>Welcome and introduction</b>	<b>9</b>
<b>B</b>	<b>Thermal Concept Design Tool — Flux calculation results and the new tool presentation</b>	<b>17</b>
<b>C</b>	<b>Evaluation of Heat Transfer Parameters from CFD for Use in TMM in Case of Gas Convection in Vented Cavities</b>	<b>33</b>
<b>D</b>	<b>Introduction to Simulation Data Management</b>	<b>43</b>
<b>E</b>	<b>EVATHERM for Early Validation of Thermal Control</b>	<b>59</b>
<b>F</b>	<b>Thermo-electrical Detailed Analysis</b>	<b>73</b>
<b>G</b>	<b>Correlating thermal balance test results with a thermal mathematical model using evolutionary algorithms</b>	<b>89</b>
<b>H</b>	<b>Exchange of Thermal Models — Challenges and Solutions</b>	<b>109</b>
<b>I</b>	<b>The KT Thermal Mapping Tool — an semi-automated temperature transfer between structural and thermal models</b>	<b>119</b>
<b>J</b>	<b>Mapping nodal properties between dissimilar nodal representations of S/C structures using ESATAN-TMS</b>	<b>137</b>
<b>K</b>	<b>MASCOT — Thermal subsystem design</b>	<b>151</b>
<b>L</b>	<b>LHP MODULE SOFTWARE — Application at System Level</b>	<b>165</b>
<b>M</b>	<b>Time dependent behaviour of pumped two-phase cooling systems — Experiments and Simulations</b>	<b>177</b>
<b>N</b>	<b>Study on the utilization of the FHTS extension of ESATAN-TMS for the thermal modeling of a bi-propellant satellite propulsion system</b>	<b>193</b>
<b>O</b>	<b>Thermal Modeling of CubeSats and Small Satellites</b>	<b>205</b>
<b>P</b>	<b>E-THERM POLICY</b>	<b>221</b>
<b>Q</b>	<b>ESATAN Thermal Modelling Suite — Product Developments and Demonstration</b>	<b>235</b>
<b>R</b>	<b>SYSTEMA-THERMICA — Launcher Case Set-up and Thermal Analysis</b>	<b>261</b>
<b>S</b>	<b>First Application of Esatan-TMS r6 Solids for a Launcher Upper Stage Thermal Model</b>	<b>279</b>

<b>T</b>	<b>Enhancement of ray tracing method for radiative heat transfer with new Isocell quasi-Monte Carlo technique and application to EUI space instrument baffle</b>	<b>291</b>
<b>U</b>	<b>Calculation of Optimal Solar Array Steering Laws for Temperature Critical Missions</b>	<b>303</b>
<b>V</b>	<b>BepiColombo MTM STM Thermal Test</b>	<b>311</b>
<b>W</b>	<b>List of Participants</b>	<b>321</b>

---

## Programme Day 1

- 9:00 Registration
- 9:45 **Welcome and introduction**  
Harrie Rooijackers (ESA/ESTEC, The Netherlands)
- 10:00 **Thermal Concept Design Tool — Flux calculation results and the new tool presentation**  
Andrea Tosetto & Matteo Gorlani (Blue Engineering, Torino, Italy)  
Harrie Rooijackers (ESA/ESTEC, The Netherlands)
- 10:25 **Evaluation of Heat Transfer Parameters from CFD for Use in TMM in Case of Gas Convection in Vented Cavities**  
Christian Wendt (Astrium Space Transportation, Bremen, Germany)
- 10:50 **Introduction to Simulation Data Management**  
Peter Bartholomew (MDAO Technologies, United Kingdom)
- 11:15 Coffee break in the Foyer
- 11:45 **EVATHERM for Early Validation of Thermal Control**  
Fabrice Mena (Astrium SAS, France)
- 12:10 **Thermo-electrical Detailed Analysis**  
François Mercier & B. Samaniego & V. Gineste & L. Gajewski & A. du Jeu (Astrium SAS, Toulouse, France)
- 12:35 **Correlating thermal balance test results with a thermal mathematical model using evolutionary algorithms**  
Niek van Zijl & B. Zandbergen (Delft University of Technology, The Netherlands)  
Bruin Benthem (Dutch Space B.V., The Netherlands)
- 13:00 Lunch in the ESTEC Restaurant
- 14:00 **Exchange of Thermal Models — Challenges and Solutions**  
Stefan Kasper (Jena-Optronik GmbH, Germany)
- 14:25 **The KT Thermal Mapping Tool — an semi-automated temperature transfer between structural and thermal models**  
Anton Zhukov & Markus Czupalla & Alexander Kuisl & Gerhard Bleicher & Winfried Gambietz  
(Kayser-Threde GmbH, München, Germany)
- 14:50 **Mapping nodal properties between dissimilar nodal representations of S/C structures using ESATAN-TMS**  
Alexander Maas (Dutch Space, The Netherlands)
- 15:15 **MASCOT — Thermal subsystem design**  
Luca Celotti & Riccardo Nadalini & Małgorzata Sołyga (ActiveSpace Technologies GmbH, Germany)  
Volodymyr Baturkin (DLR Institut für Raumfahrssysteme, Germany)  
Sergey Khairnasov & Vladimir Kravets (National Technical University of Ukraine, Ukraine)
- 15:40 Coffee break in the Foyer

- 16:00 **LHP MODULE SOFTWARE — Application at System Level**  
Paul Atinsounon & David Valentini (Thales Alenia Space, France)
- 16:25 **Time dependent behaviour of pumped two-phase cooling systems — Experiments and Simulations**  
Henk Jan van Gerner (NLR, The Netherlands)
- 16:50 **Study on the utilization of the FHTS extension of ESATAN-TMS for the thermal modeling of a bi-propellant satellite propulsion system**  
Martin Schröder (OHB System AG, Germany)
- 17:15 **Thermal Modeling of CubeSats and Small Satellites**  
Anwar Ali & M. Rizwan Mughal & Haider Ali & Leonardo M. Reyneri  
(Department of Electronics and Telecommunications, Politecnico di Torino, Italy)
- 17:40 Social Gathering in the Foyer
- 19:30 Dinner in *La Toscana*

## Programme Day 2

9:00 **E-THERM POLICY**

Thierry Basset & Patrick Hugonnot (Thales Alenia Space, France)

9:25 **ESATAN Thermal Modelling Suite — Product Developments and Demonstration**

Chris Kirtley & Henri Brouquet (ITP Engines UK Ltd, United Kingdom)

movies/media6

10:10 **SYSTEMA-THERMICA — Launcher Case Set-up and Thermal Analysis**

Timothée Soriano & Rose Nerriere (Astrium SAS, Toulouse, France)

10:55 Coffee break in the Foyer

11:20 **First Application of Esatan-TMS r6 Solids for a Launcher Upper Stage Thermal Model**

Harold Rathjen (Atrium, Bremen, Germany)

11:45 **Enhancement of ray tracing method for radiative heat transfer with new Isocell quasi-Monte Carlo technique and application to EUI space instrument baffle**

Lionel Jacques (Centre Spatial de Liège, Belgium)

Luc Masset & Gaetan Kerschen (University of Liège, Space Structures and Systems Laboratory, Belgium)

12:10 **Calculation of Optimal Solar Array Steering Laws for Temperature Critical Missions**

Andreas Brandl (Astrium GmbH Ottobrunn, Germany)

Jan-Hendrik Webert (Universität der Bundeswehr München, Germany)

12:35 **BepiColombo MTM STM Thermal Test**

Scott Morgan (Astrium EADS, United Kingdom)

13:00 Closure

13:00 Lunch in the ESTEC Restaurant