Appendix J

SYSTEMA V4 - New framework for THERMICA

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SYSTEMA V4

New framework of THERMICA

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21st European Workshop on Thermal and ECLS Software
30 October 2007

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Agenda

- SYSTEMA overview
- SYSTEMA framework presentation
  - Geometry
  - Trajectory
  - Kinematics
  - Mission
  - Processing
- On-going evolutions
- SYSTEMA V4 demonstration

ASTRIUM Satellites

SYSTEMA Overview

- Description
  - SYSTEMA permits satellite system analyses with detailed applications intended for specialists (AOCS, thermal, power …)
  - SYSTEMA embeds applications requiring: a 3D surface model of the spacecraft, the spacecraft orientation in space, space environment models.
- History
  - System analysis software development with ESA and CNES for more than15 years
  - SYSTEMA development company funding for more than 10 years
  - Software distribution (THERMICA, DOSRAD …) for 10 years
  - Experience on observation and scientific spacecraft (HELIOS, SOHO, Mars-Express…) and telecommunication spacecraft (NILESAT, ASTRA, Intelsat, Inmost...)

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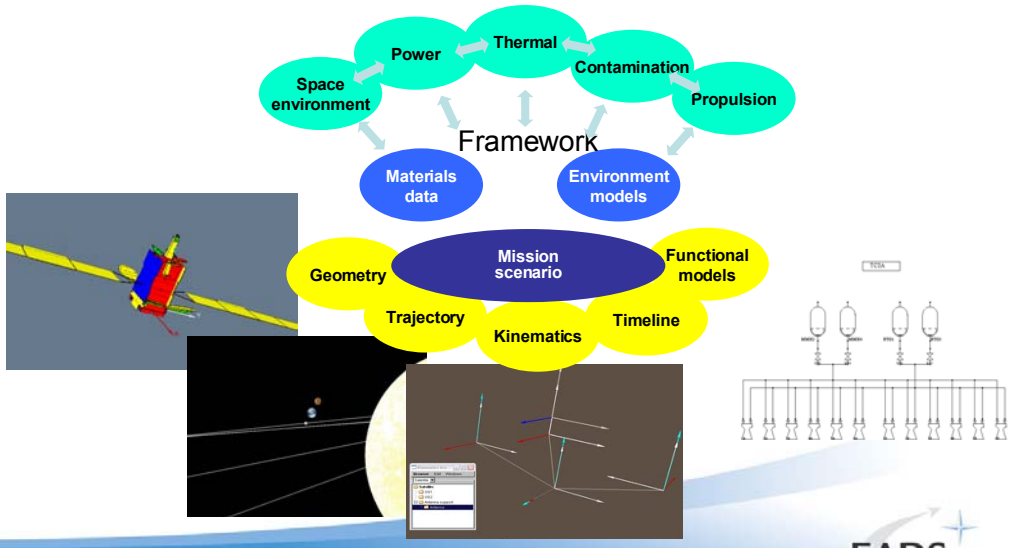
SYSTEMA: an interdisciplinary tool suite



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Current status of SYSTEMA

- SYSTEMA V3
  - Developed 10 years ago
  - Integrated framework
  - Embeds a large set of applications
  - Some applications (THERMICA) of SYSTEMA are sold
- SYSTEMA V4
  - Development initiated 3 years ago
  - New software technology + increased capabilities
  - Integrated framework
  - Application integration as a plug-in
  - SYSTEMA 4.2.2 released in 07/07
  - THERMICA 4.2.2 released in 07/07
  - DOSRAD 4.3 development planed by end of 2007

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SYSTEMA: The key features

- Clear separation between framework and applications
  - Easy to develop new applications for specific use
  - Easy to maintain and make evolutions
- Software standards based
  - Helps exchanges between tools (XML for all input/output files, HDF5 for large computation results)
- Modularity
- Rich platform support
  - PC, Linux, SUN, HP
- Modern and intuitive ergonomics

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SYSTEMA framework

- SYSTEMA framework embeds in a generic environment a large suite of engineering applications
- It provides a set of basic functionalities required to make an analysis:
  - CAD import / model generation / meshing / properties / results display
  - Trajectory definition (Keplerian or general)
  - Kinematics description (pointing laws or general)
  - Mission scenario description / results display / animation
  - Processing: defining the computation case and the run parameters
- Applications are plug-in package described by XML files
- SYSTEMA framework is also a powerful stand-alone application to perform mission and kinematics analysis.

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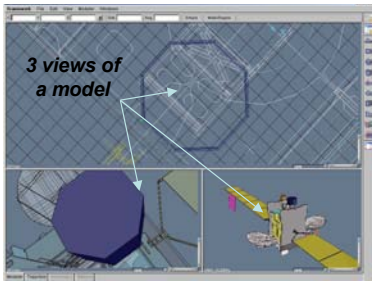
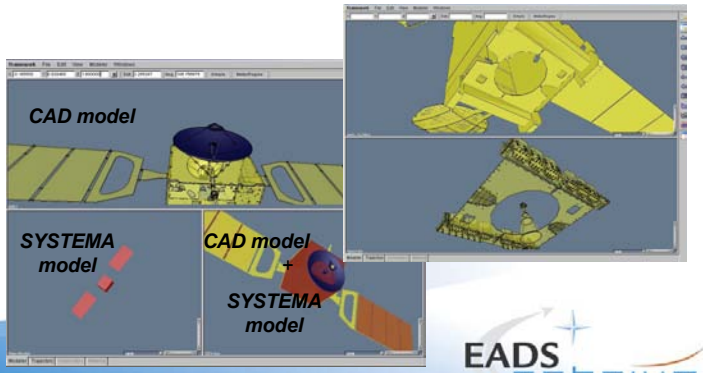
SYSTEMA Modeler

- Interfaced with several standard formats
  - STEP (CAD), unv, Nastran, IGES
- Easy model creation
  - Hierarchical description
  - Interactive shapes creation
- Easy 3D manipulation
  - Standard mouse zoom, pan, rotate
- Multi-viewers / multi-models management
  - Simultaneous points of view over a model
  - Several models can be loaded





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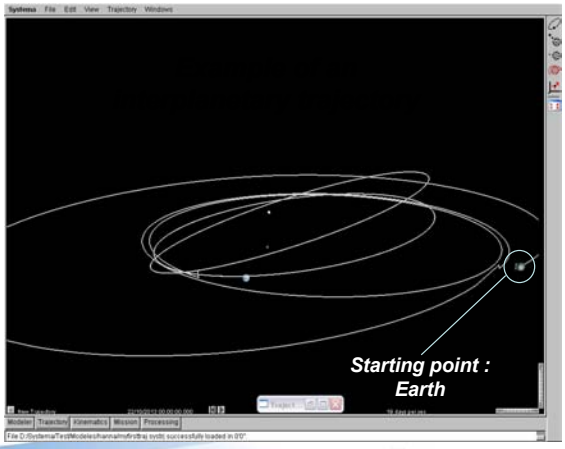
SYSTEMA Trajectory

- Management of every planets of the solar system, Sun and moon with the real ephemerid
- Complex trajectories as a structured assembly of orbital arcs
- Arc defined either as a Keplerian arc or as a general trajectory (position, velocity)
- Functionalities in each viewport: zoom, pan, rotate, fit
- Selection of arcs in the browser or in the 3D viewer
- Animation of the spacecraft trajectory including the planets



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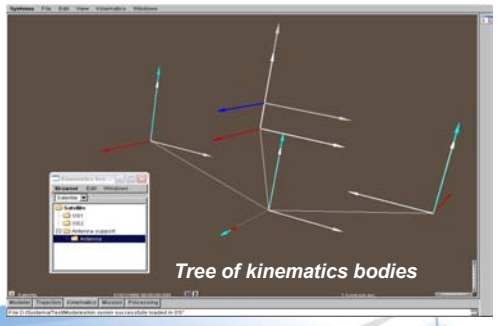
SYSTEMA Kinematics

- General definition of kinematics without the support of a geometry
- Tree of rigid moving bodies linked by degrees of freedom (and constraints)
- Compatibility with kinematics tools
- Definition of pointing laws of each moving bodies
- Definition of general kinematics laws



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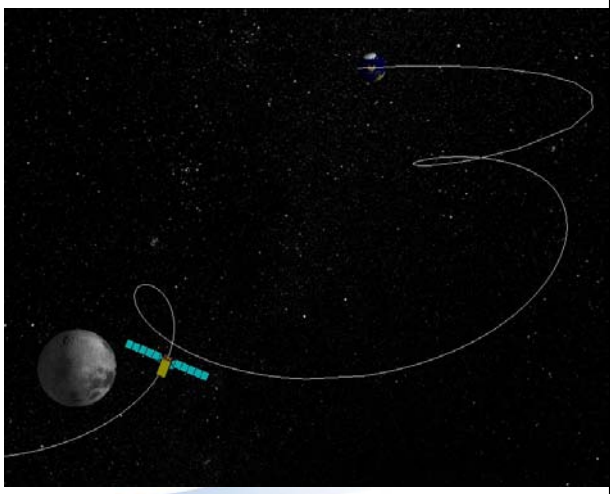
SYSTEMA Mission scenario

- The SYSTEMA mission scenario concept allows the user to define the whole system and the connection between the different aspects:
  - Geometrical model
  - Trajectories
  - Sequences of kinematics and pointing
- Management of a timeline, of events (eclipse…)
- Animation of the whole system
- In the future management of spacecraft modes (platform / payload usage…)



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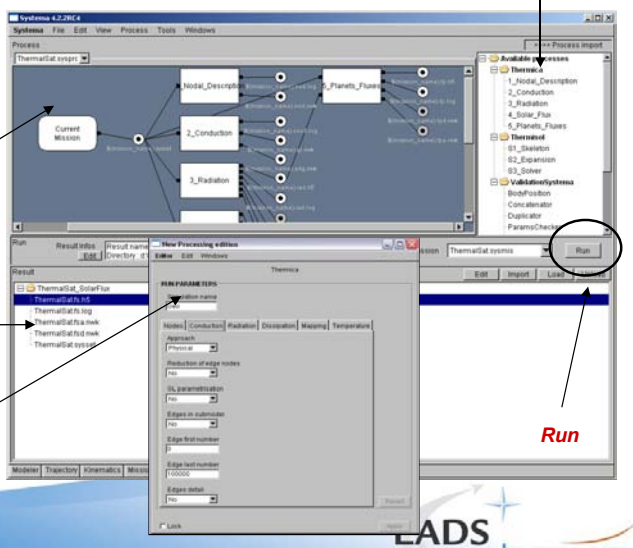
SYSTEMA Processing

- Interactive processing
  - Sets the applications and their properties, their input/output files…
  - A processing schematics created
  - Any mission can be chosen from this module
  - Results management



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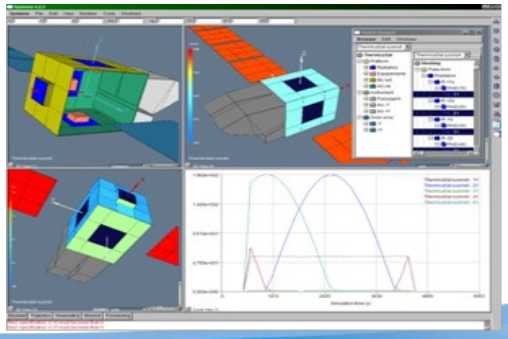
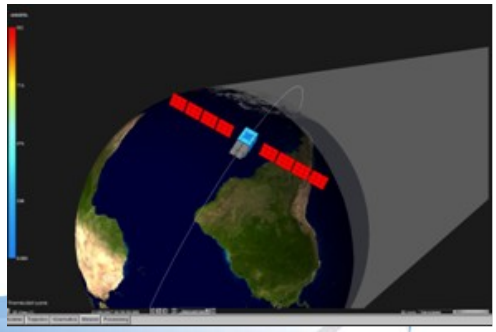
SYSTEMA Processing Results

- Analysis results can be displayed:
  - Text file
  - 2D table
  - 3D on animated model





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On-going evolutions

- New Graphical User Interface under QT → more user interaction (12/07)
- Sophisticated camera scenario support and video recording (12/07)
  - Creation of a working/demonstration movie
- More complex shapes support (boolean cuts) (12/07)

- Integration of DOSRAD application in V4 environment
- Enhancement of mission scenario definition
  - Mission sequence
  - Improved timeline management
- And more…

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http://www.systema.astrium.eads.net/
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