# *ESABASE2* Space Environment Simulation Framework

## Facts

*ESABASE2* provides its users with all means to perform reliable and highly efficient space environment analyses. Its up-to-date architecture and interfaces make it a valuable contribution for a more efficient spacecraft design.

*ESABASE2* stands for

- a state-of-the-art PC based tool,
- comprehensive data exchange capabilities,
- ergonomic geometry modelling and viewing capabilities,
- result visualisation and post processing capabilities.

## Efficiency through Ergonomics

### Ergonomic Workflow

ESABASE2 convinces its users by an ergonomic workflow concept. Dedicated editors support the user in the definition of design and mission parameters.

1. Project editor and outline
2. Geometry editor
3. Mission editor and visualisation
4. Application editor

Duplication of work is minimised by the possibility to combine once established geometries, mission specifications and application parameter settings.
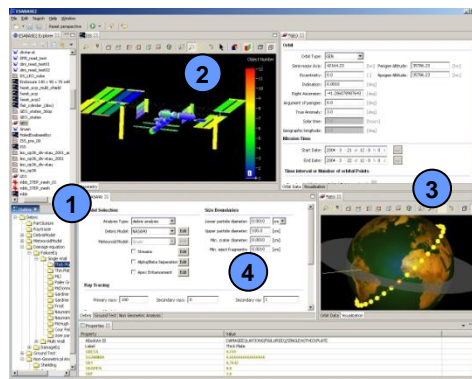


*ESABASE2 framework with different editors open*

### Interface to CAD Tools

The interface to external CAD tools like CATIA via STEP files (AP 203/214) allows the import of existing geometry models.

### Data Exchange

*ESABASE2* users can easily exchange single *ESABASE2* files (e. g. geometries) and/or all data belonging to one *ESABASE2* run.

The *ESABASE2* framework allows the conversion of geometry data between different formats such as STEP AP 203/214, GDML, STEP-SPE.

The input files of the former *ESABASE2* tool can be re-used.

# *ESABASE2*/Debris

## Risk Analysis

In order to appropriately consider the risk posed to a spacecraft by the space debris and meteoroid environment, fully three-dimensional analyses are required taking into account geometrical shadowing effects, the latest environment models, secondary ejecta and state-of-the-art damage and failure laws.

## Orbits and Trajectories

*ESABASE/Debris* allows the analysis of Earth-bound orbits, Lunar orbits and Lunar transfer orbits as well as L1/L2 orbits. In addition, a user defined arbitrary trajectory can be processed.

## Environment Models

*ESABASE2/Debris* provides the most complete access to debris and meteoroid models.
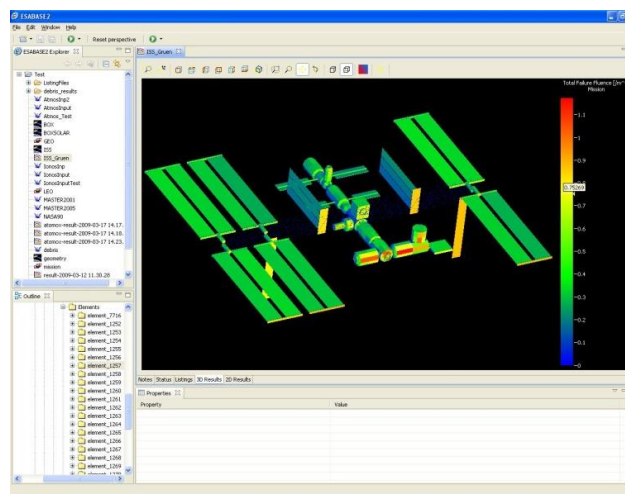
### Debris Models

- NASA 90
- ORDEM 2000
- ORDEM 3.0
- MASTER 2001
- MASTER 2005
- MASTER 2009

### Meteoroid Models

- Grün
- Divine-Straubach
- MEM
- LunarMEM
- Jenniskens (streams)



*Impact flux distribution on the ISS – displayed in the result editor*

## Damage Laws

The damage equations implemented in *ESABASE2* are freely configurable by means of their relevant parameters. Some common equations with predefined parameters are offered via the debris editor. In addition, user defined damage laws can be linked to *ESABASE2* via external freely programmable user subroutines.

# Other *ESABASE2* Analysis Modules

## Atmosphere/Ionosphere

The former *ESABASE/*Atomic Oxygen application is subdivided into two applications in its *ESABASE2* implementation.

Both applications provide 3 D numerical analysis capabilities for the assessment of fluxes and fluences of the constituents of the atmosphere or the ionosphere received by an orbiting spacecraft, and the resulting surface effects (e. g. material erosion). The following atmosphere, ionosphere and wind models can be accessed via the applications:

- NRLMSIS-E00
- MSIS86
- JB2006
- MET, DTM
- IRI2007
- IRI90
- HWM93
- HWM90

## Sunlight

The Sunlight application performs the calculation of the electromagnetic radiation incident onto the surfaces of a spacecraft during a mission. Amongst others, the application cases listed in the following can be performed:

- Illumination analysis
- Power profile analysis
- UV degradation investigation
- Stray light analysis
- Terrestrial test verification

## COMOVA Interface

ESA's contamination, outgassing and vent analysis tool COMOVA is integrated in *ESABASE2*. The use of COMOVA is facilitated through the geometry editing capabilities and the graphical user interface of *ESABASE2*. The latter provides both input editors as well as result display facilities.

## ESABASE2 Services

### Analysis Service

*ESABASE2* provides its users with a high amount of configuration possibilities and usable models. The proper application of them requires a sound technical and theoretical background, experience in the application of tools and especially the knowledge and ability to interpret and explain the results provided.

etamax space offers an analysis service, performing the assessment for you by its experienced staff. The risk assessment service includes:

- establishment of satellite geometrical model,
- establishment and justification of the mission vulnerability analysis approach,
- selection and justification of the environment models and failure equations,
- 3 D M/OD analyses by means of the *ESABASE2/Debris* software,
- discussion of the results vs. requirements and provision of design improvement recommendations.

### Training

etamax space offers a variety of *ESABASE2* trainings to make you familiar with all aspects of the tool. Each of the training modules is offered via three types of training (standard, on-site and consulting) to properly respond to your training needs.

For more information on the services please visit **www.esabase2.net/services/**

### How to obtain an *ESABASE2* Licence

- *ESABASE2* is distributed under an ESA Software Licence.
- Access will be granted to all interested parties from ESA member states.
- Other interested parties are invited to contact etamax space.
- The distribution of *ESABASE2* is bound to the establishment of a support contract between the licensee and etamax space (you can find the conditions at **http://www.esabase2.net/licencing**).
- Please register at **http://www.esabase2.net** or contact etamax space to obtain an *ESABASE2* license.

## *Fact Sheet*
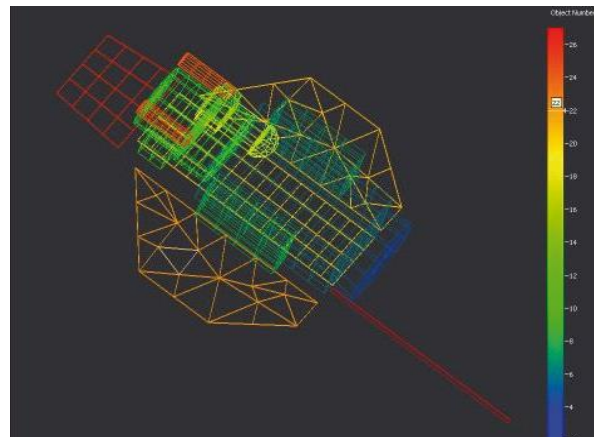
### Your Access to *ESABASE2*

Please feel free to contact us in case of further questions.

We are looking forward to providing you with more information on *ESABASE2*.
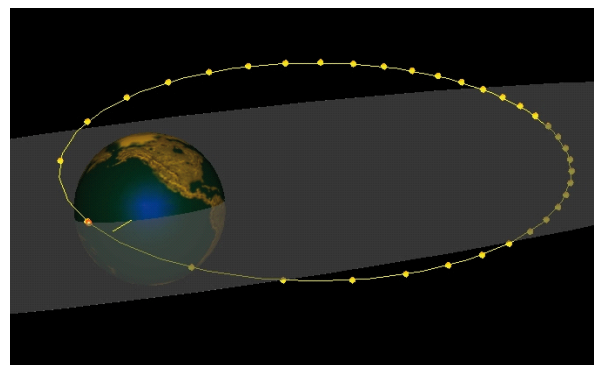
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