

# MSC Thermica

## An integrated thermal design environment

### Overview

MSC Thermica is a comprehensive spacecraft thermal design system developed for MSC Software by Astrium that transparently incorporates MSC Sinda into a powerful graphical environment. It can also be used for terrestrial applications, such as solar heating of buildings/automobiles, thermal design of lamp housings, and high temperature furnace design. Thermica was designed by spacecraft thermal engineers, and has been used worldwide for many years on numerous spacecraft, such as SPOT5 and Mars Express. The Thermica graphical editor allows construction of the thermal model with geometric shapes that are directly used by the radiation solver (cylinders, disks, etc.). Thermica also integrates with Patran to allow Patran generated models to be used by Thermica.

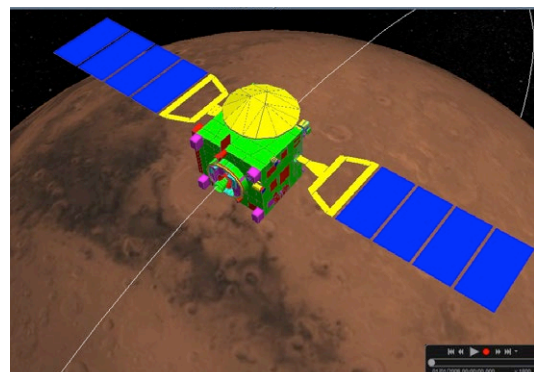
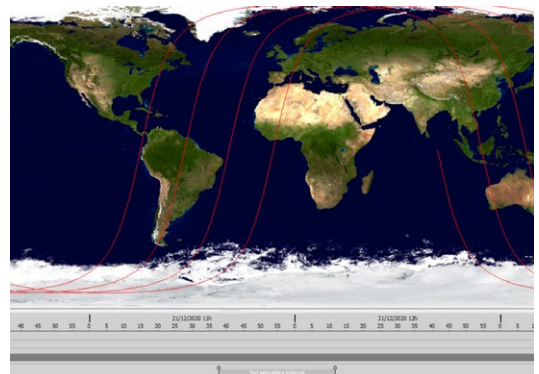
### Thermica thermal modeling

Thermica produces fully documented Sinda thermal models. Sinda from MSC Software, renowned for its speed and accuracy in the world of thermal analysis, is the thermal solver integrated into Thermica. Integrating Sinda simplifies generating the thermal models. Orbital heating, thermal radiation and temperature results are automatically generated and postprocessed. Results can be viewed as plots or overlaid on 3-D models which can be animated.

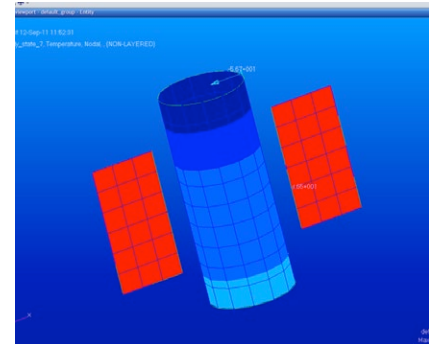
The Thermica model builder uses geometric shapes to build the models. CAD models and assemblies from CAD systems can be used in model creation.

### Key features

- Thermica runs native on windows computers without exceed
- Interactive model building with interfaces to CAD files from CATIA and other CAD systems
- Interfaces with NASTRAN files
- Meshing is separate from geometry allowing the model to be easily run with multiple meshes
- Graphical setup of orbits with import of trajectories from STK or other software
- Full mission planning for the earth, moon and all planets including trajectories to these planets
- Complex motion of doors, solar panels or instruments can be defined and verified graphically
- Arbitrary motion such as unfolding of solar panels can be modeled and visualized
- Complex models of sun with rays coming from different zones at different angles when spacecraft is close to the sun



- Angular dependent material properties
- Latitude, longitude, and time dependent planetary flux and albedo can be defined
- Built in IR models of all the planets and the moon with the IR a function of latitude and longitude
- 3D animations of orbits and interplanetary missions with textured mapped planets and moving bodies on the spacecraft
- Results such as absorbed solar flux or temperatures can be visualized on 3D animations.
- Creates complete Sinda thermal model with internal powers, heaters, thermostats, etc.
- Comprehensive interface to Patran, including transfer of true geometric shapes



## Advanced mission planning

Mission planning features allow multiple kinematic motions to be defined. These represent the various phases of the mission such as a battery charging phase or Earth observation phase. Then in the mission module, these phases can be easily set up in a timeline sequence to create realistic missions, sometime repeating a phase such as battery charging multiple times during the mission.. Finally 3D animations of the mission even with temperature, heat fluxes or other results overlaid on the model for interactive viewing or high definition movies of these animations created for presentations at up to 1080P 16 by 9 wide screen resolution.

A complete orbit generator and orbit plotting function is supplied. Nominal pointing, attitude laws (yaw, pitch, roll as a function of time), and any kinematic motion of mobile parts are easily defined by means of a menu-driven graphical interface. Orbits with multiple arcs to incorporate orbit maneuvers can be defined. Inner planetary trajectories terminating in orbits around the destination planet can be set up or defined using STK data. STK orbits and orientation s can be used by THERMICA.

## System requirements

- Windows 7 or XP either 32 or 64 bit
- 4 GB RAM minimum and 500 MB disk space
- MSC Sinda 2008 or later

## Proven software

Thermica has been used in a wide range of successful space programs.

- Telecom 2
- Hispasat
- Hotbird 2-3-4
- Astra
- Nilesat
- Intelsat KTV
- Spot 1-2-3-4-5
- ERS 1-2
- Helios 1
- Soho
- Silex
- Gomos
- International space station
- Mars express

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