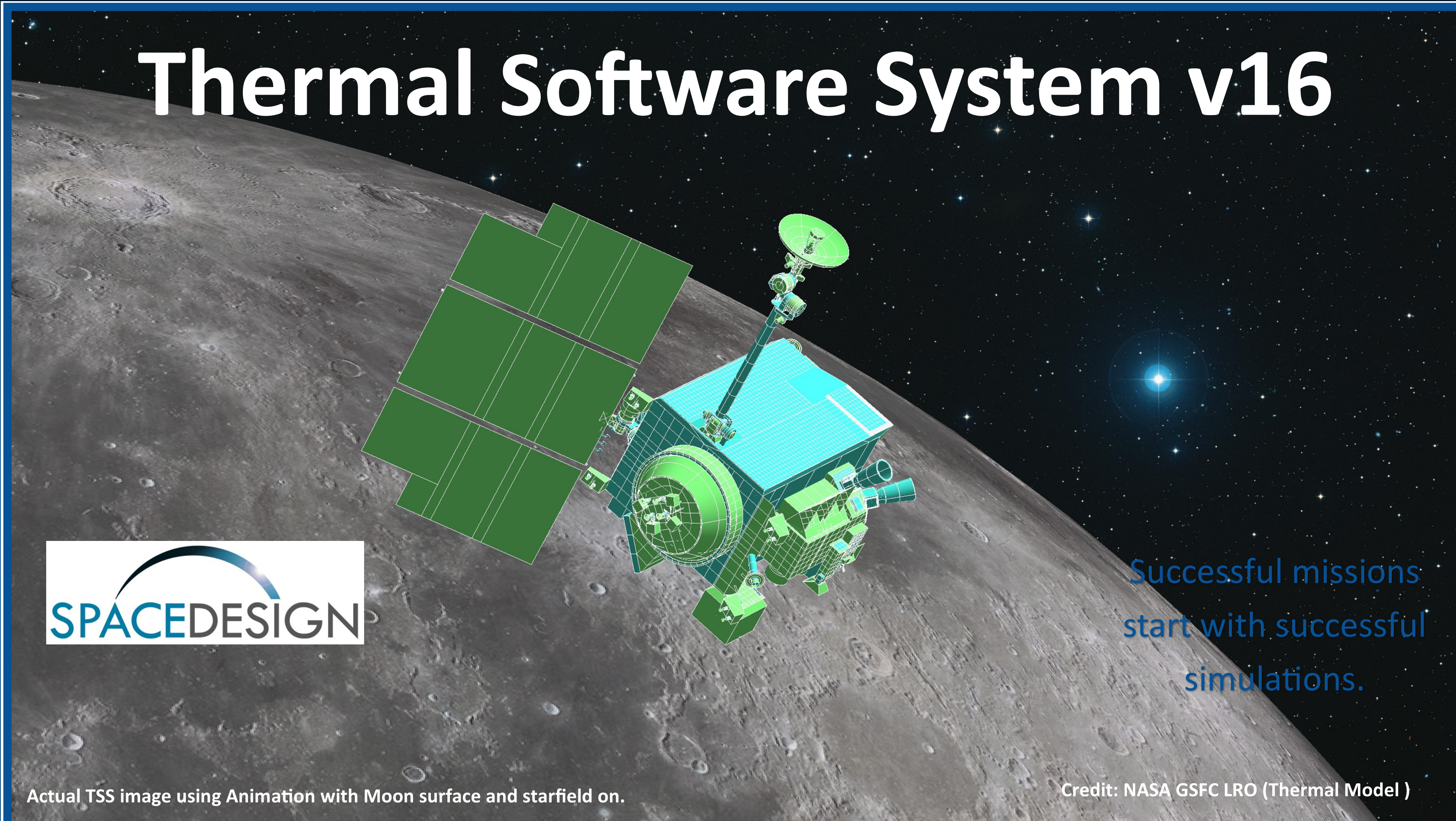


Actual TSS image using Animation with Moon surface and starfield on.

Credit: NASA GSFC LRO (Thermal Model)

Executive

Organizes model files, common launch point for all applications, encapsulates the license manager and provides TSS file system interface.

Transfer

Transfers CAD data from STEP and IGES standards to Geometry, dual view allows for user control to move only important thermal surfaces.

Geometry

High quality computational geometry engine, allows users to easily setup and analyze thermal models. Simple intuitive user interface with built-in help.

Radk

Calculates radiation conductors and view factors with Monte Carlo ray tracing with Oct-cells. Easy output to Sinda/Fluint format. Analyzes CAD model directly.

Orbit

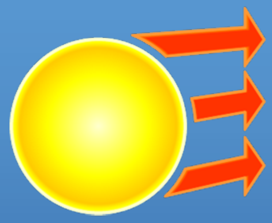
Creates orbits for spacecraft in orbit around any planet and the Sun. Orbits can also be based on trajectory or planetary surface.

Animation

Automatically points assemblies and components at important targets such as towards the Sun, Star or Planet. Easy to use intuitive kinematics.

Heatsource

Creates heatsources to model thermal vacuum tests with infrared and/or solar sources. Allows the user to model almost any radiation source.



Heatrate

High speed ray tracing makes finding orbital heating fast and easy. Output results are automatically formatted for Spacedesign Sinda/Fluint.

Mesh

Creates finite volume meshes from computational surface geometry to be used in solid radiation to conduction modeling.

Concap

Finite volume analysis to determine conductors both inside surfaces and between objects. Simple and intuitive method for making connections.

FECC

Finite element analysis with computational surface geometry to produce second order analysis for spacecraft and any detailed thermal analysis.

Sinda/Fluint	Finite Difference solver with built in logic and sub-routines to do the heavy lifting when you need real time critical solutions for thermal problems.
XYPlot	Plotting made easy to get data into presentations fast and with a focus on displaying thermal results.
Image	Creates photo realistic images using Monte Carlo ray tracing from various light sources to capture specular (mirrored) reflections and shadowing.

SPACEDESIGN

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Why should my company buy Thermal Software System v16?

- Faster Graphics – Multi-threaded OpenGL only found in TSS
- Faster Sinda/Fluint – SF 7.0A adds faster analysis capability
- More Accurate Radiant Exchange – Boundary representation models are not faceted

These advantages set you apart for your customers to build a better spacecraft that was not previously possible before v16 TSS. TSS v16 is a must have in our industry.

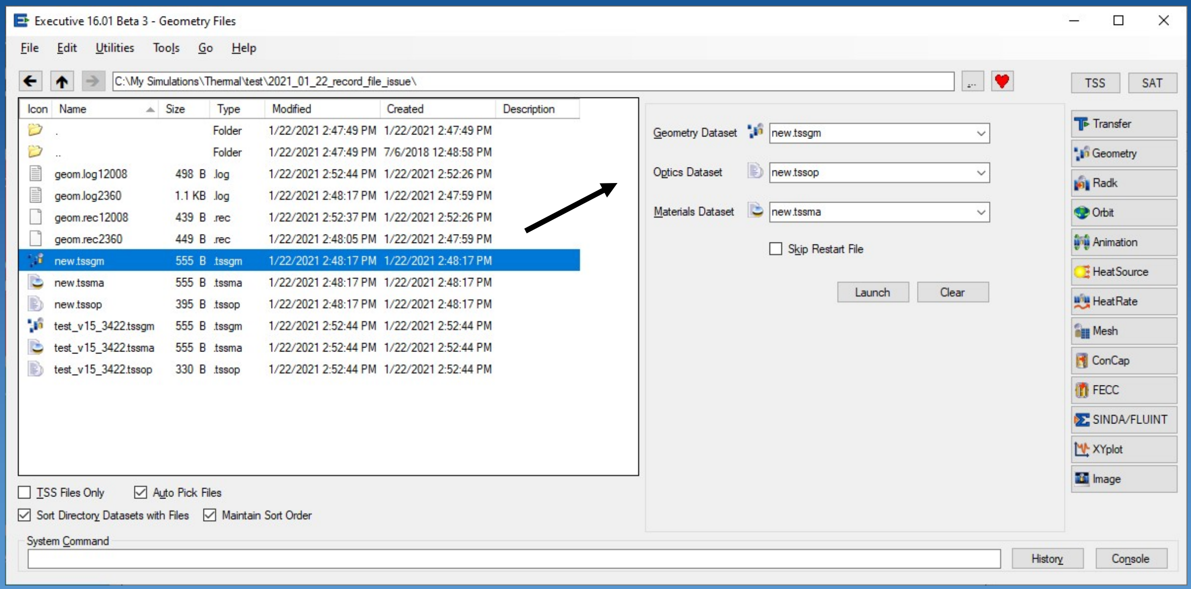
What is Thermal Software System (TSS) v16?

Thermal Software System, often referred to as TSS, is a software bundle of graphical user interface programs utilizing OpenGL and Microsoft .NET libraries, and is a front end to high powered command line analysis software. Thermal engineers use this intuitive tool to model their spacecraft's geometry and orbital mechanics to determine radiation conductors, orbital heating rates, conduction conductors, capacitance values, fluid loops, and temperatures.

The tool provides synthesis with easy adjustment of previously mentioned values to change the model results to obtain thermal control. The tool not only allows thermal engineers to perform highly accurate thermal analysis but includes the capabilities to achieve thermal control by adding thermal control devices.

The starting point for all TSS applications is the Executive application (shown below). The right-hand side lists the applications and provides a common sense flow for thermal design.

Double click new.tssgm, opens Geometry form to launch Geometry application with the geometry file (.tssgm), optics file (.tssop), and materials file (.tssma). Similar behavior launches the other applications.



What is new in TSS v16?

- Boundary Representation in Radiation Exchange

  Radiant exchange can take a long time to perform analysis. Determining radiation conductors and orbital heating can consume hours and days of analysis time. TSS v16 has a unique capability to allow users to load CAD models directly and use boundary representation. Older software packages use only computed surface geometry (CSG) that requires the end user to facet their geometry. Although this method can still be used in TSS, modern thermal engineers know to load CAD models directly. Older software requires users to laboriously reduce the model by augmenting the CAD model. A simple change can require thermal engineers to repeat the entire CAD model augmentation again, slowing spacecraft development and costing your customer more money. By using the boundary representation directly, time and money are saved.

- Millimeter Units thoughout TSS

  CAD packages typically use millimeters as units. Moving data into TSS is easier when unit conversions can be avoided. Moving data into TSS has been simplified by adding millimeters throughout the program.

What is new in TSS v16 (cont.)?

- Spacedesign Sinda/Fluint 7.0A

  Faster anaylsis can be achieved by using a modified Dufort-Frankel method. Internal testing shows finite difference models run 30 to 60% faster than Forward-Back. Our software can do Finite-Volume analysis (nodes at the centroid) or Finite-Element analysis (nodes at the vertices) and then use our finite-difference solver Sinda/Fluint 7.0A to determine the temperatures throughout the conduction/capacitance network. A simple and intuitive user interface called SindaWin provides organization for your important simulations. Sinda/Fluint 7.0A can have an unlimited number of conductors and 1 million nodes.

- Polygon Conduction

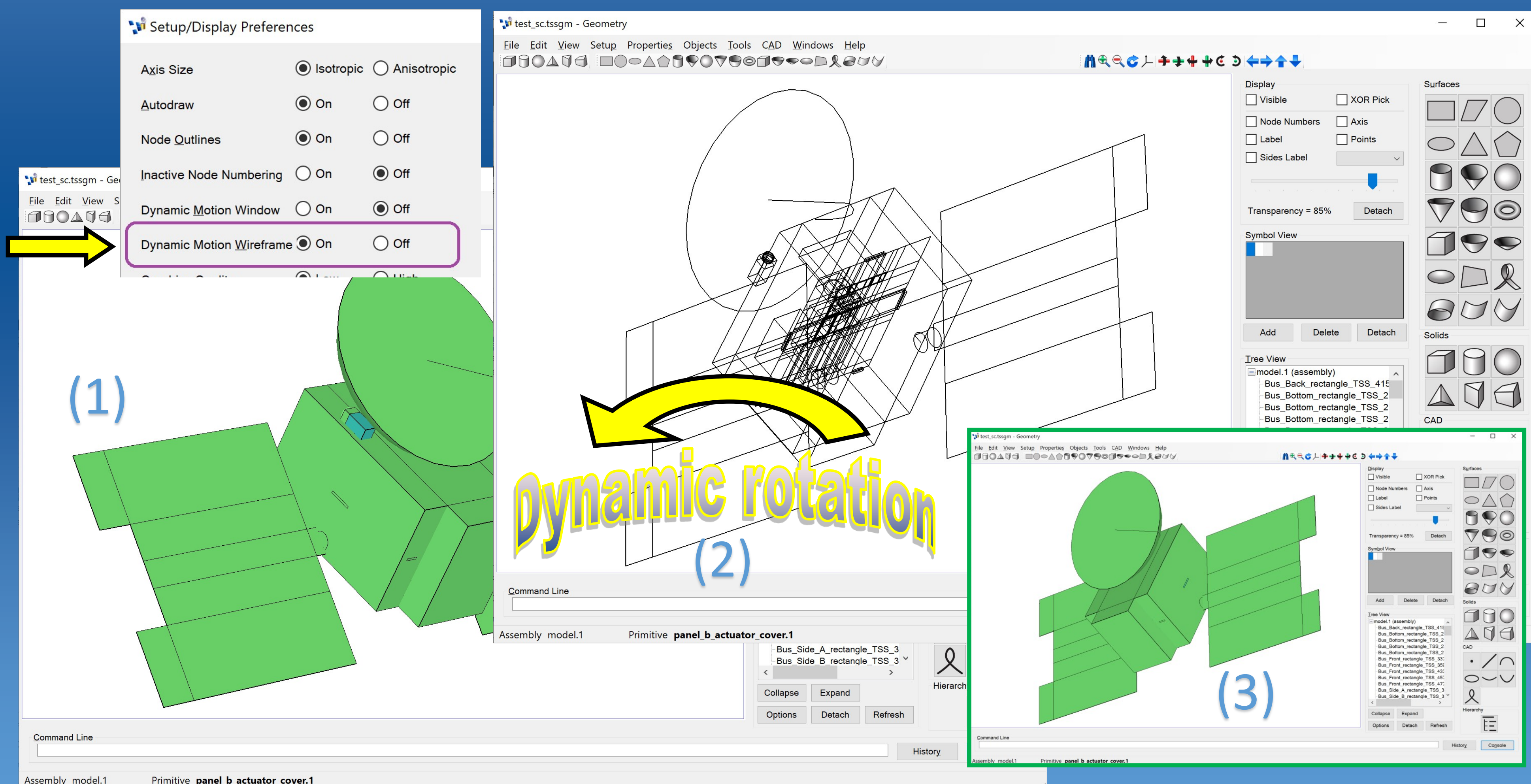
  Polygons offer an easy way to build point based models quickly. These surfaces have long been in TSS as radiation surfaces, now these can be used in defining your capacitance/ conduction network.

- Faster Graphics using Multi-threaded OpenGL and Dynamic Motion Wireframe

  Graphics systems that use multi-threaded OpenGL allow for faster model loading when producing a graphical representation and faster drawing when rendering. Solid rendered graphics performance is faster than previous versions of TSS.

- Faster Graphics using Multi-threaded OpenGL and Dynamic Motion Wireframe (cont.)

Another enhancement to improve graphics speed is wireframe dynamic rotation, translation, and zoom. (1) Alt-Pick with the right mouse button in the graphics area (picks without object selection) and (2) then move the mouse, the graphics area turns to wireframe while dynamically displaying the model. When you see the view you want, (3) release the mouse and then the view returns to full solid rendered graphics. Process shown in images 1, 2, and 3, below.



What else is new in TSS v16?

32-character submodel names

Allows users to create larger 32-character submodel names, previous versions allowed only 8-characters. With 32-characters, submodel names can be more descriptive and meaningful.

E* multilayer insulation†

Multilayer insulation can be modeled using an effective emissivity, e* (pronounced e-star). TSS now facilitates users applying multilayer insulation and provides a 'calculator' to determine the e* for various blanket configurations.

Windows Fonts

Select any Windows font to improve visibility of your work in the graphics window when displaying temperatures, heating rates, or any data mapping.

Increase line length for note lines

V16 allows note comments to span 1023 characters per line, with no limit to the number of lines. Previously the comments were limited to 80 characters per line.

Roll Angle for Graphical View

Previous view settings had no assignment of up direction other than the default up setting. A Roll Angle allows the definition of a unique view when added to the "look from" vector.

†Initial capability appeared in Revision C of v15.01.

Notes:

Thermal Software System v16

Transfer

Transfers CAD data from STEP and IGES standards to Geometry, dual view allows for user control to move only important thermal surfaces.