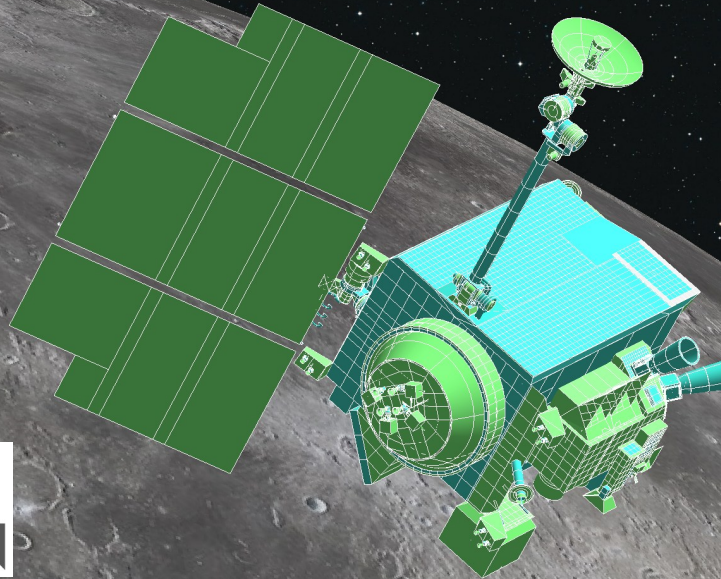# Thermal Software System v17

Successful missions

still start with

successful

simulations.

SPACEDESIGN

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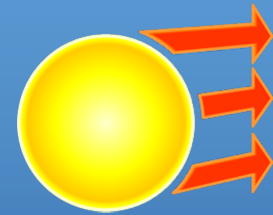
Animation
Automatically points assemblies and components at important targets such as towards the Sun, Star or Planet. Easy to use intuitive kinematics.

|	
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.
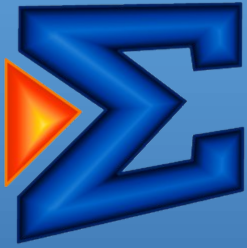
Sinda/Fluint — Finite Difference solver with built in logic and sub-routines to do the heavy lifting when you need real time critical solutions for thermal problems.

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

Sales Contact

E-mail :

sales@spacedesign.com

Telephone :

(713) 522-0230

Why should my company buy Thermal Software System v17?

- Faster Graphics—Multi-threaded OpenGL only found in TSS

- Faster Solutions—Sinda/Fluint 7.0B with Multiple Generalized Value correspondence

- Easier Connections—Concap face connections make conduction easier

These advantages set you apart for your competitors to build a better spacecraft that was not previously possible before v17 TSS. TSS v17 is a must have in our industry.


Credit: NASA/ESA/CSA/NGC

What is Thermal Software System (TSS) v17?

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.
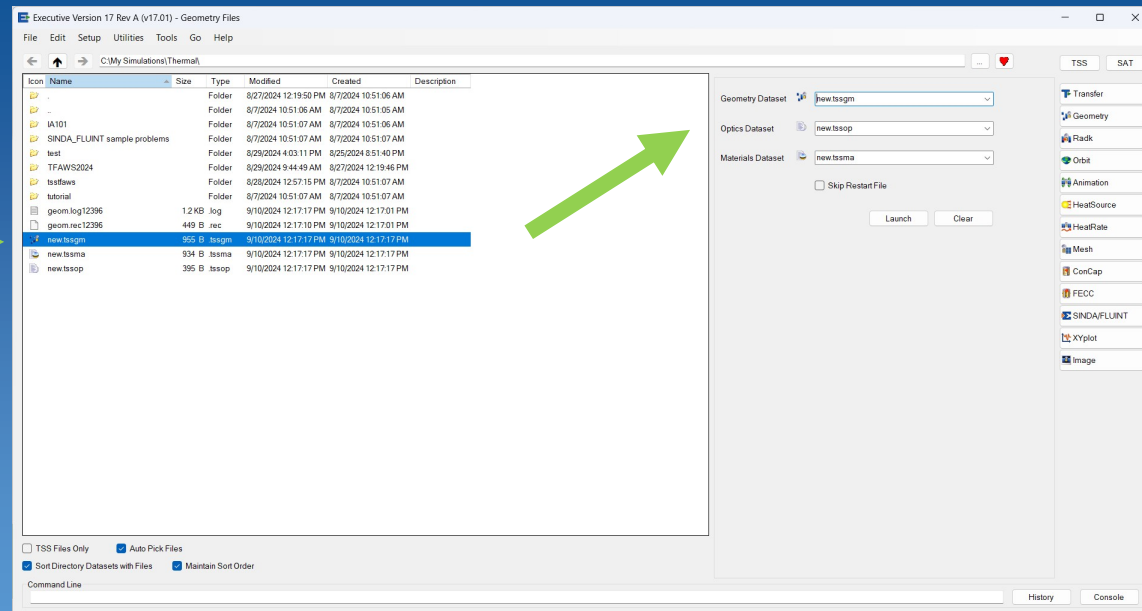
What is new in TSS v17?

Latest Build environment for a successful future

Developed with Visual Studio 2022 (C, C++, .NET) and Intel oneAPI 2024 (Intel Fortran Compiler, 2023 Standard) Thermal Software System can be easily maintained to meet the most demanding computational needs. v17 supports Windows Server 2022/2025, Windows 11/10, and CentOS 7/8.

Consistent Units throughout, starting in Geometry

Units are very important in thermal analysis, you've got to have the Stefan-Boltzmann constant right, absolute zero set properly, and all the data going into the model must match. To coordinate the analysis process, default units are now based on Geometry defaults for a model (Concap and Heatrate used to be different). Although, they can be set differently in any part of the analysis process if the user wants. This doesn't remove the ability to set individual units for properties, surfaces, or heat sources.

Face Connections in Concap

The new version has a simple way to connect dissimilar meshes by Solid Face Connection. This simple method allows thousands of conduction kA/l values to be generated in seconds. The speed and simplicity of Solid Face Connect make generating model faster than ever.

What is new in TSS v17 (cont.)?

Export Comma Separated Value (CSV) data from XYPlot

XYPlot allows easy and convienent graphing for temperature vs. time results. These results can now be easily exported to spreadsheet programs for plotting. The ability to write this data leverages results by communicating it to other applications.

Spacedesign Sinda/Fluint 7.0B

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 7.0B 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 7.0B can have an unlimited number of conductors and 1 million nodes.

Orthogonal Meshing extended with internal and external merge

The Mesh application now has output merge for internal and external solids to maintain an orthogonal X-direction, Y-direction, Z-direction mesh for thermal analysis. Thermal Engineers typically want to develop models with directionality given known or expected

Orthogonal Meshing extended with internal and external merge (continued)

thermal pathways. The internal merge allows the user to specify how to combine the internal nodes, this capability, along with solid face connections in Concap provide a simple and easy method to develop solid shape models.
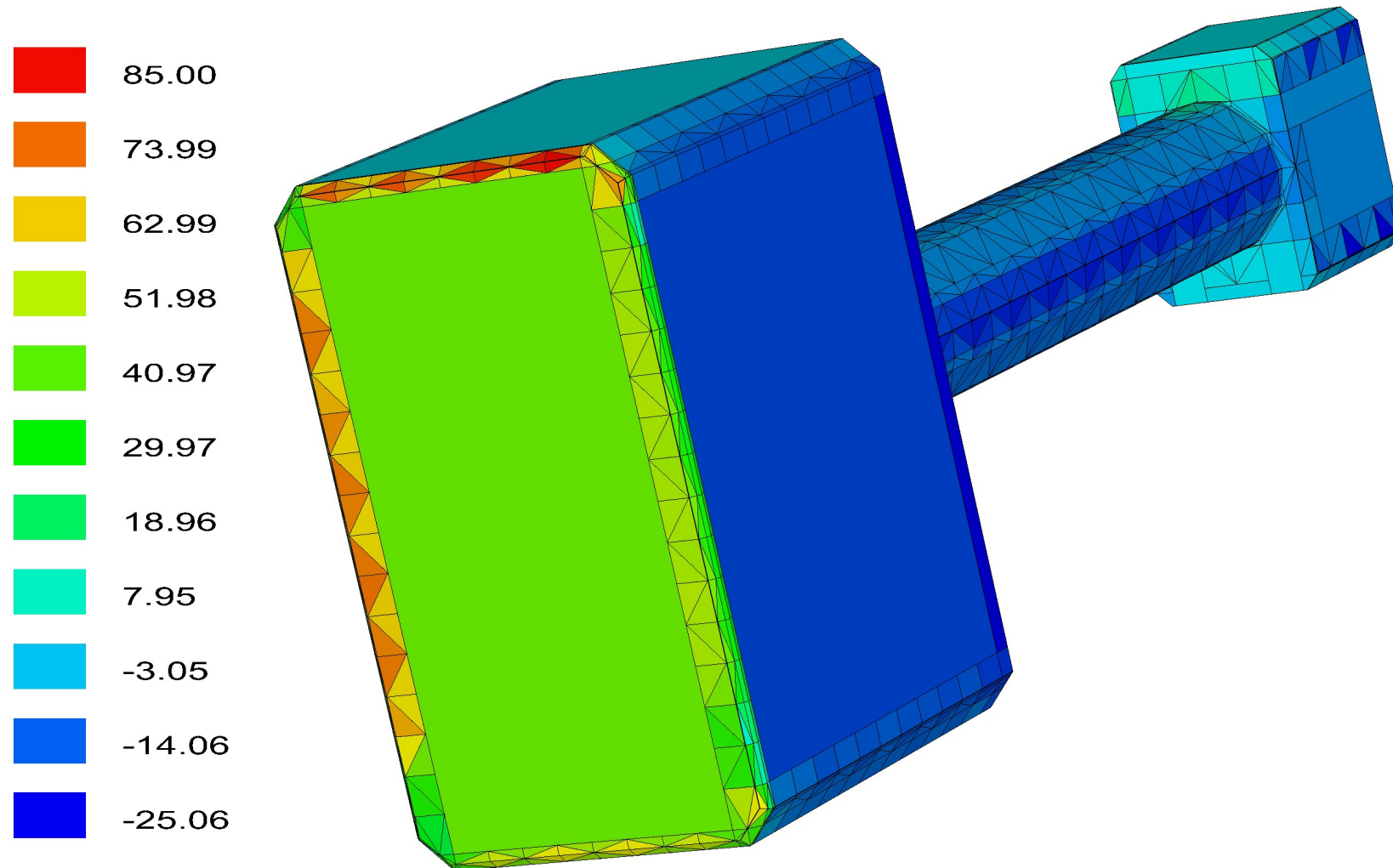
What else is new in TSS v17?

Pyramid solids

Can be used to connect a three sided tetrahedron to a four sided non-orthogonal brick.

Umbra/Penumbra Heating

Solar heating can be calculated in the partial shading entering and exiting the Solar Shadow along with the precise entrance and exit times.

Transfer improvements

Holes, curved edges, and edges with notches can now be converted from a CAD model to a thermal model for the user. There are also many, many more improvements in Transfer.

SindaWin 'STOP' button to halt execution

Every once in a while, you look at your Sinda/Fluint input deck and think it perfect and hit Run | Analysis. Then you realize you forgot to change the output time, or a conductor value.

Polynomial Curve Properties

Users can input properties as a curve instead of a linear interpolation tables. A polynomical curve provides a continuous precision across a range of temperatures.

Notes:

_____

_____

_____

_____

_____

_____

_____

_____

_____
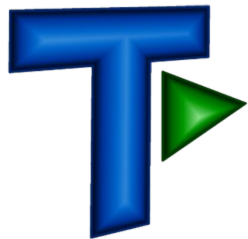
_____

_____

_____

_____

Thermal Software System v17

More Thermal Control?

Yes, please!!!

Credit: NASA/Ball Aerospace/SpaceX

Transfer

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