Summary of Thermal Utility Programs
Available at Goddard Space Flight Center

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Thermal Utility Programs

- **Geometry Input**
  - Geo_Info: *output various TSS surface properties (area, nodes, etc)*
  - Ren_Optics: *output TSS optics properties and make updates to both optics and geometry files*
  - TSS_Conv: *conversion between selected ASCII based geometry formats*

- **Geometry Output**
  - Radk_FUNC: *collection of Radk and HeatRate post processing functions*

- **Thermal Model Input**
  - TMM_Conv: *conversion between selected ASCII based thermal model formats*

- **Thermal Model Output**
  - Backload: *calculate backloads for selected nodes from temperature and radk output*
  - ThermPlot: *general post-processing program for thermal output*
  - Generate_T-XYZ: *find closest FEM node to geometry centroid and maps temperature for STOP analyses*
Disclaimer

• All programs developed to address specific need
  – Not developed to be robust and error free (i.e. not developed to be commercial software)
  – Have been developed and used successfully for years

• Tools may be provided as is
  – No support, expressed or implied, is included
  – Identified bugs will be corrected, but may not be considered high priority
  – No documentation exists (ThermPlot excepted)
Geo_Info
output various TSS surface properties (area, nodes, etc)

- Area Unit Conversion
- Sub-entity output
  - Nodal sub areas, activity, properties
Ren_Optics

output TSS optics properties and make updates to both optics and geometry files

- Rename specific properties
- Add prefix (to avoid duplicates)
- Check for, or remove, unused

- Make property tables
  - Optics (TSS, Desktop)
  - Materials (Desktop)

TFAWS 2008
Goddard Space Flight Center
Code 545 – Thermal Engineering Branch
TSS_Conv
conversion between selected ASCII based geometry formats

- Available conversions
  - TSS to ESARAD
  - TSS to Thermica
  - Esarad to TSS
  - Thermica to TSS
  - Esarad to Thermica
  - TSS to NEVADA
  - TMG to TSS

- Unit conversion

- Special cases
  - Solids to primitives
  - Torus breakdown
  - Polygons to triangles
  - Shorten entity names

Note: presented at 2002 TFAWS as “Use of TSS as a Neutral Format for Geometry Model Conversions: An Alternative to STEP-TAS”
Radk_Func

collection of Radk and HeatRate post processing functions

- Collection of utilities to post process RADK output
  - Renumber
  - Comment
  - Delete
  - Scale
  - Sum

- Can act on
  - All conductors
  - Conductors connected to
  - Conductor between

- Multiple sequential actions may be defined

- Some support for heatloads but not as mature
TMM_Conv
conversion between selected ASCII based thermal model formats

- Thermal Model Conversion
  - TAK2000 to SINDA
  - SINDA to ESATAN
  - ESATAN to SINDA

- Unit conversion
  - C, T, GL, GR, Q

- Renumbering
  - Nodes
  - Lin, Rad Conds
  - Arrays

- Variables
  - Convert names (shorten)
  - Replace with values
  - Replace with values and evaluate
Backloads

calculate backloads for selected nodes from temperature and radk output

- Backloads present a method for representing complex thermal environment for a surface/node as a simple heat load
- Requires Radk and Temperature Output
- May include env fluxes
  - Recommend separate IR & UV
- Numerous formats supported
- Output SS, TR or both
- Define conduction interfaces
- Include or exclude effects of other nodes in BL range (self view)
- Component file for validation

Note: application of backload usage presented at 2004 TFAWS as “Use of the Interface-Backload Method for Solving LISA and other Large, Divided Thermal Problems"
ThermPlot

general post-processing program for thermal output

- Generalized Post Processing Program
  - Data
  - Tables
  - Plots
  - Groups
  - HeatMaps

- Documentation Included
- No further updates planned

Note: presented at 2001 TFAWS as “Use of ThermPlot Software for Quick Evaluation of Thermal Model Results”
Generate_TXYZ
find closest FEM node to geometry centroid and maps temperature for STOP analyses

- Finds closest FEM node to TMM node for STOP mapping
- GMM
  - Revolves subdivided into segments to locate “centroid” near to surface
  - Options for double sided surfaces
  - Additional (non-geometric) centroids may be added
- TMM
  - Timestep selection
  - Dereference GMM node to TMM node (MLI mapping)
- FEM
  - Units and Coordinate System offsets
  - TMM node to FEM node override
- Output
  - Sorting
  - Multiple associations (>1 GMM nodes map to 1 FEM node)
Summary

• The described tools have not been developed to commercial levels
  – But they do expand the capabilities of existing tools

• Some of the features may be outdated, or have been reproduced or improved with later releases of various thermal codes
  – However, some of the capabilities remain unique (particularly the model conversion capabilities)

• The utilities are available to interested parties, but the source code remains under GSFC control