Exchanging Thermal Geometric Models

STEP-TAS Capabilities and Implementation Status

Aerospace Thermal Control
Technology Workshop

March 1, 2001

Georg Siebes

Outline

- STEP
- Zooming in on STEP-TAS
- STEP-TAS Detail
- The U.S. STEP-TAS Pilot
- What are the benefits

What is STEP

- STEP = STandard for the Exchange of Product model data
  = casual name for ISO 10303

"STEP is an international standard, which provides an unambiguous, computer-interpretable definition of the physical and functional characteristics of a product throughout its life cycle."

What is STEP-TAS

- STEP-TAS = Thermal Analysis for Space

APPLICATION PROTOCOL:
THERMAL ANALYSIS
FOR SPACE

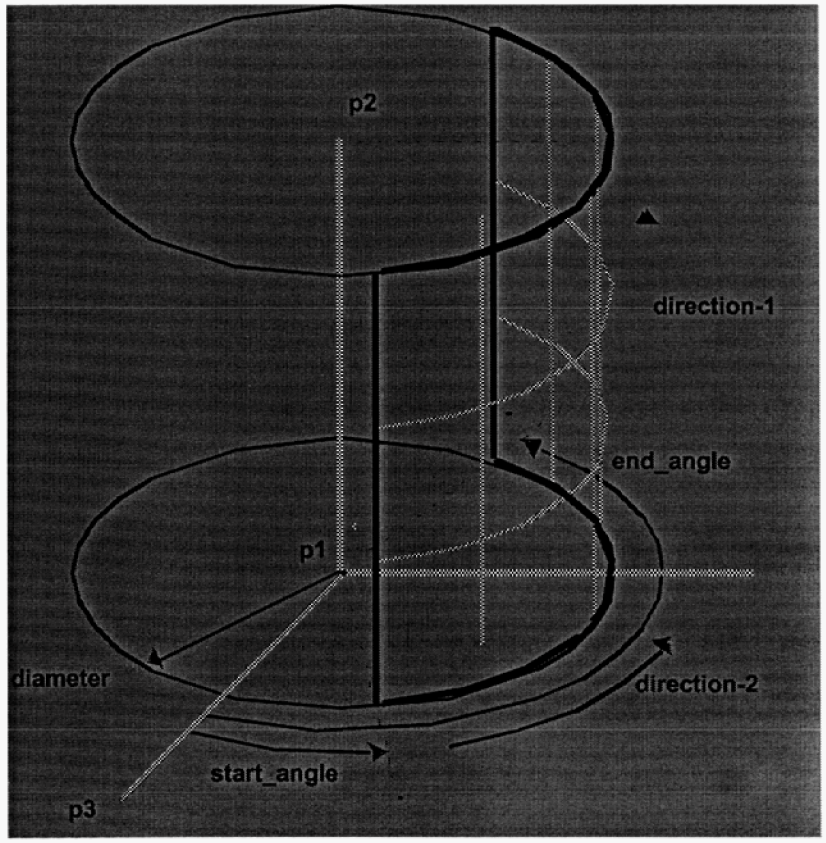
STEP-TAS-117-AP

Version 2.5 (24 December 1998)

Authors : Alain Calvaire (ESPRI CONCEPT)
Hans Peter de Koning (Fokker Space)
Pascal Husu (Association GOSET)

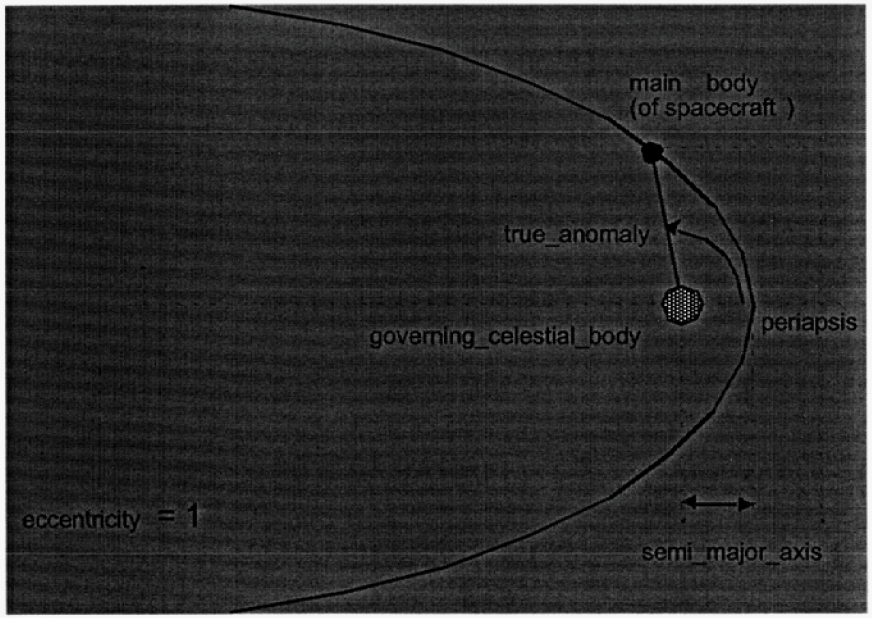
Application Protocol for space missions and models used in thermal analysis.

Details of STEP-TAS



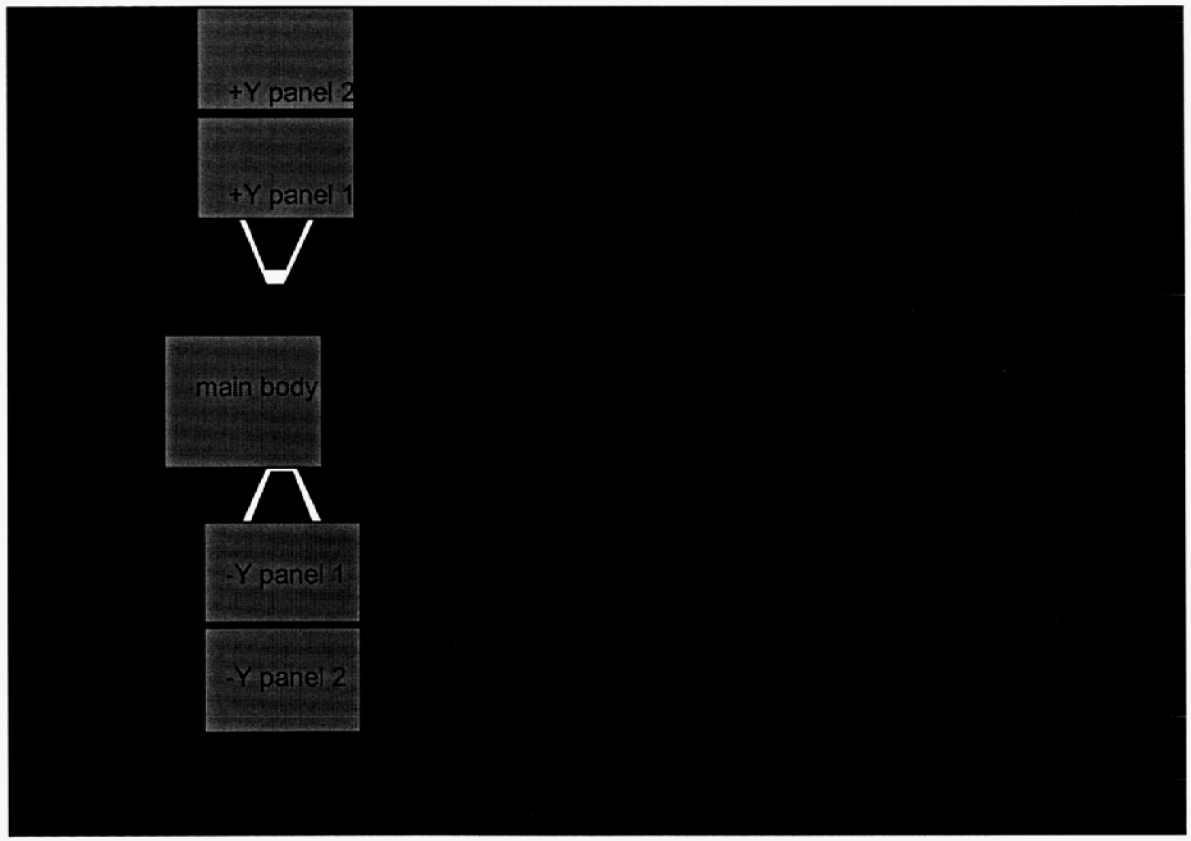
- Shapes
  - Primitives: triangle, rectangle, quadrilateral, disc, cylinder, cone, sphere, paraboloid
  - Compound shapes
  - Shapes conform to AP203 CC4 non-manifold surfaces
- Thermal-radiative model
  - associates thermal-radiative faces with surface shapes
  - thermal mesh
  - properties

Details of STEP-TAS



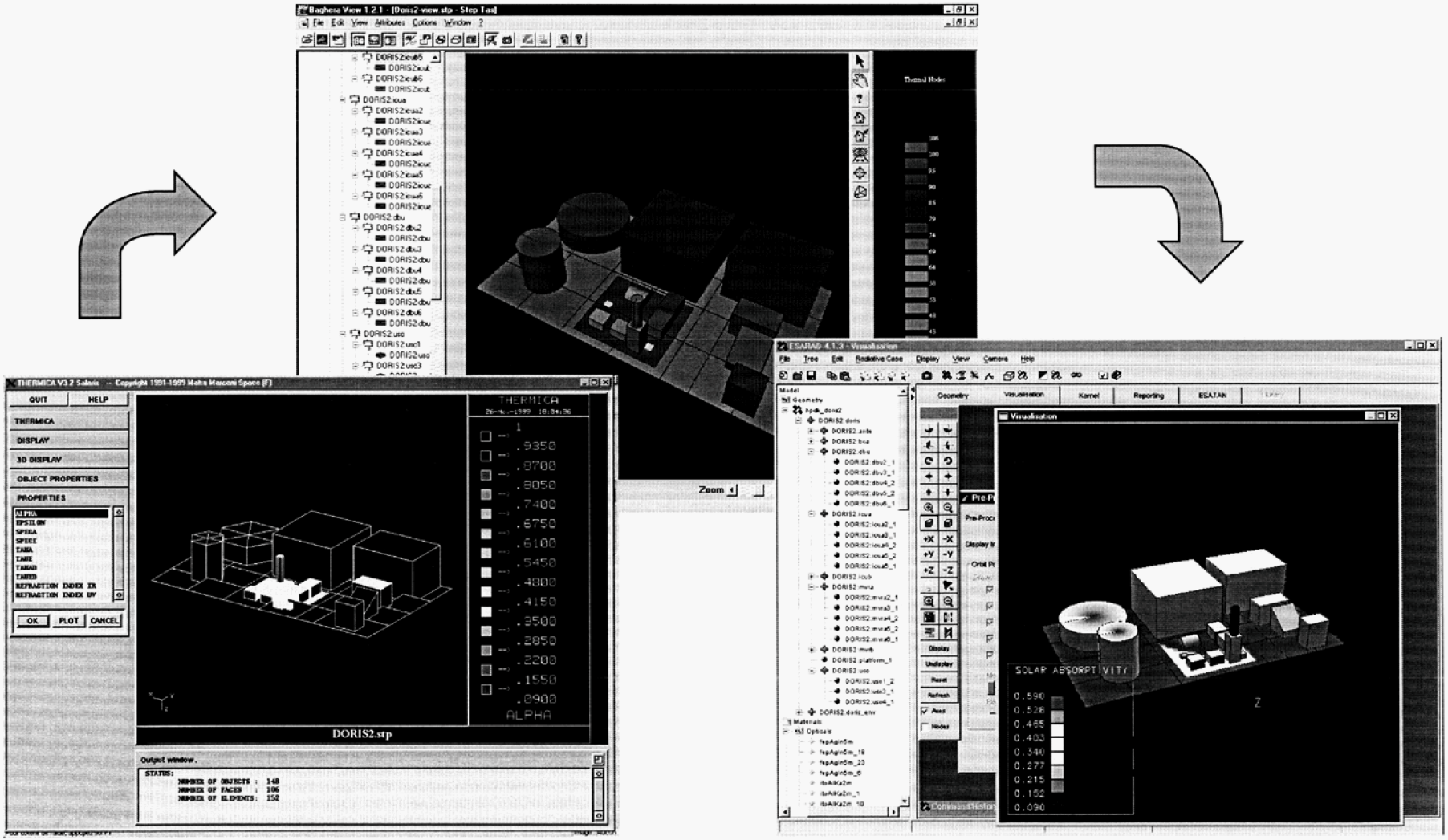
- Space mission aspects
  - orbit arc (Keplerian and discrete ephemeris)
  - space co-ordinate system, celestial bodies
  - orientation, general and named pointing, spinning, linear rotation rates
  - space thermal environment, including constant or lat/long dependent albedo / planetshine tables

Details of STEP-TAS

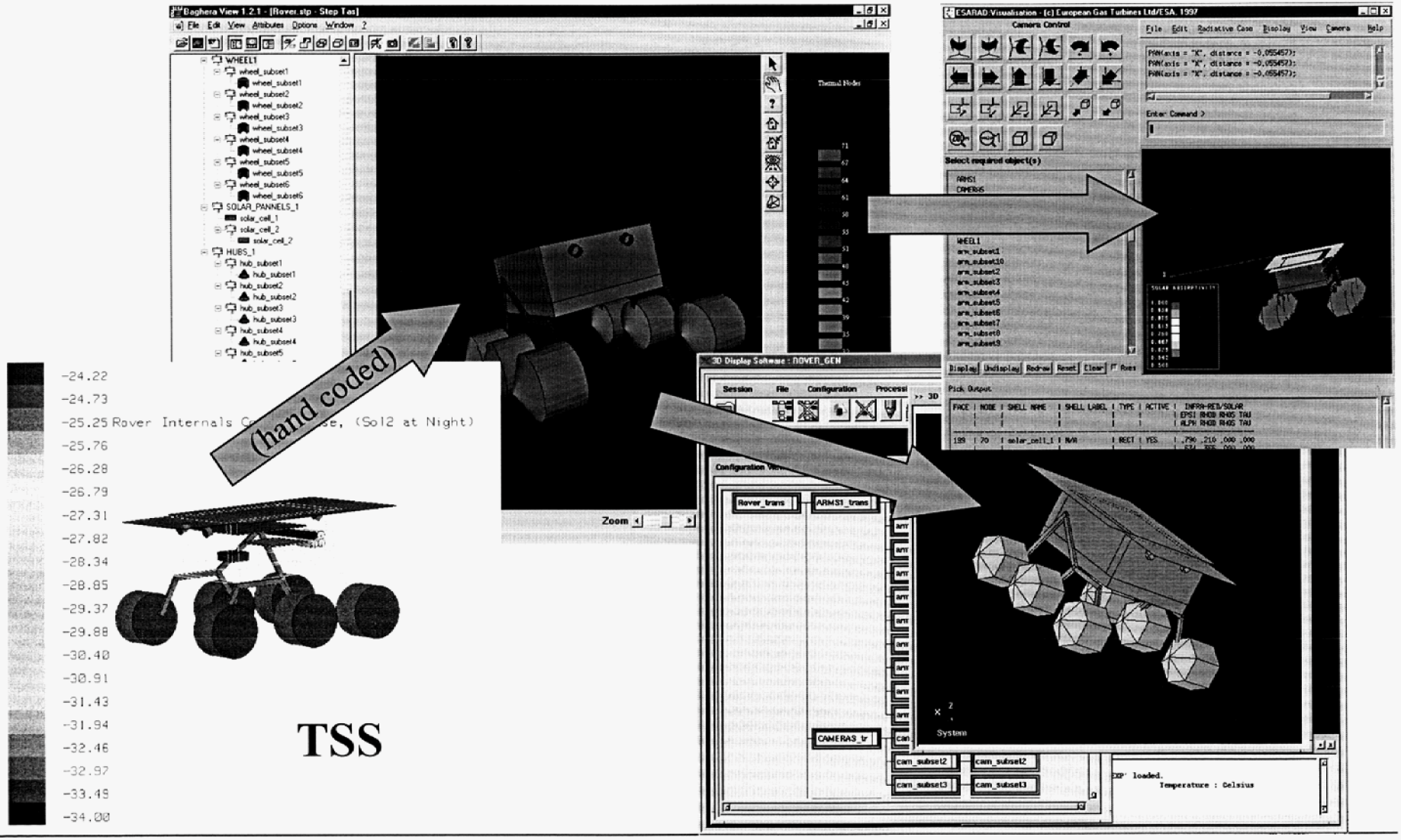


- Kinematic model conforms to STEP Part 105 for articulating rigid bodies (e.g. rotating solar arrays, gimballed antennas

Examples of STEP-TAS Exchanges



Examples of STEP-TAS Exchanges



The U.S. STEP-TAS Pilot - Participants

NASA

esa

JPL

esa ESTEC

CR C&R Technologies®

Network Analysis

SpaceDesign

cnes

SIMULOG

TAC TECHNOLOGIES

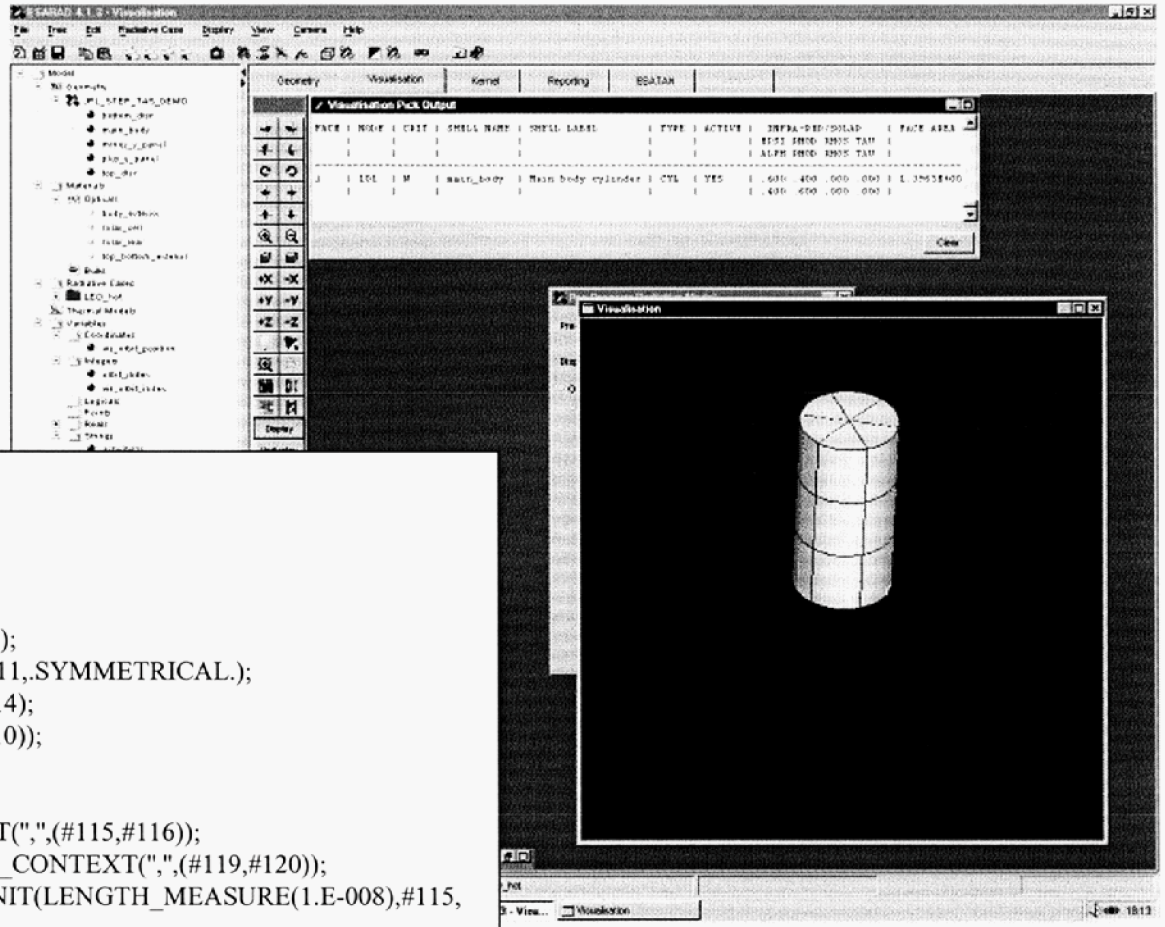
Home of the NEVADA Software Package

HARVARD THERMAL

Thermal Modeling Software

Thermal Consulting and Engineering Services

The U.S. STEP-TAS Pilot - Geometry

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ISO-10303-21;
HEADER;
...
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#110=TYPE_QUALIFIER('infra_red');
#111=ATR_PROPERTY_NAME('transmittance');
#112=ATR_PROPERTY_QUANTITATIVE(#111,.SYMMETRICAL.);
#113=ATR_PROPERTY_USAGE(#71,#112,#114);
#114=ATR_PROPERTY_MEANING((#109,#110));
#115=SI_UNIT(*,$,.METRE.);
#116=SI_UNIT(*,$,.DEGREE_CELSIUS.);
#117=GLOBAL_UNIT_ASSIGNED_CONTEXT(",",(#115,#116));
#118=GLOBAL_UNCERTAINTY_ASSIGNED_CONTEXT(",",(#119,#120));
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...
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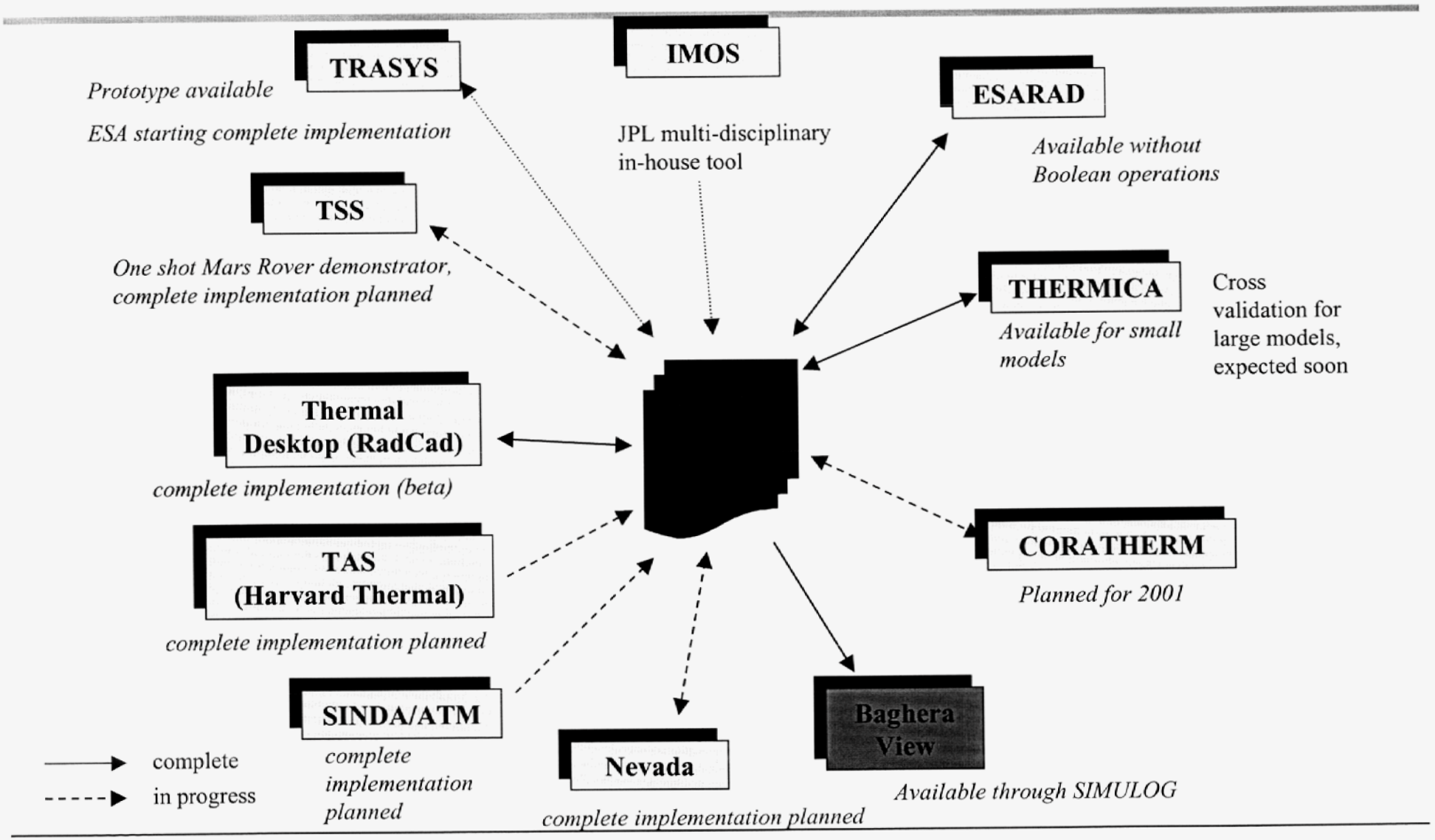
Live Demo at NASA TFAWS Conference

Current STEP-TAS Implementation Status

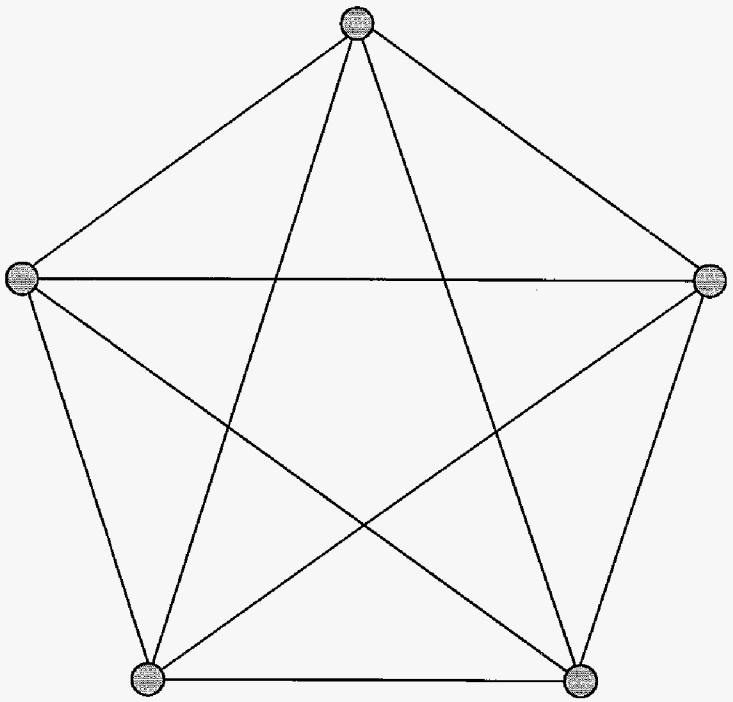


Benefit: Compliance with NASA Standard 2817

- The NASA CIO has officially approved and released NASA-STD-2817 (COMPUTER-AIDED ENGINEERING, DESIGN AND MANUFACTURING DATA INTERCHANGE), which includes the requirement for CAx systems used by NASA to have tools that support ISO 10303 (STEP).
- Preferred standards include APs 203, 209, 210, 225, and 227 for exchanging data among PDM, mechanical and electronic CAD/CAM, civil and facilities CAD, and CAE/analysis systems. STEP-TAS included in draft of next revision.
- Tools that enable data interchange, compliant with these standards, must be available to all CAE/CAD/CAM users at each NASA Center.

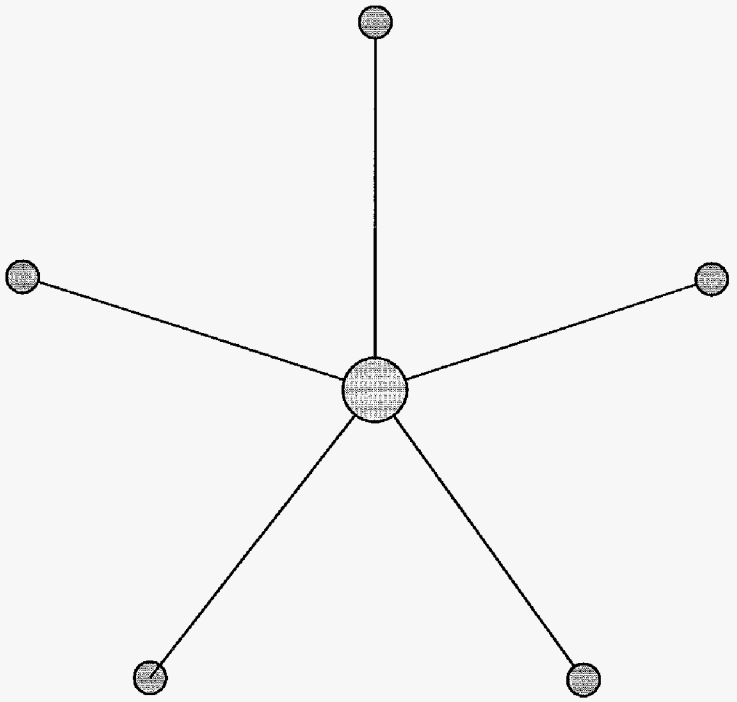
Benefit: Significant reduction in translators

$\sim N^2$



Point to Point Translators

$\sim N$



STEP

Benefits of STEP - TAS

- Thermal Radiation models can be freely exchanged globally
- Some thermal processes can be tailored to needs rather than being driven by tools
- Thermal models can be archived and retrieved independent of tool proprietary formats
- Will save time and money
- Engineers can spend more time engineering and less time translating data

Benefits

Demonstrate that ...

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Faster, Better, Cheaper

reduced cycle time

Art to Part

faster time to market

.

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... are not just words

Remember STEP is ...

S omething

T o

E mbrace

P ermanently