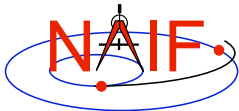# SPICE "Plate Model"

Overview of Current Status and Plans
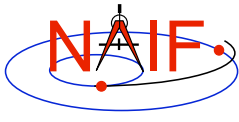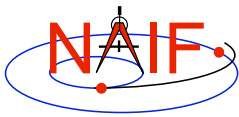
March 2006

- **Plate Model Kernel for Irregularly Shaped Objects**
- **Subsystem Components**
- **Work in Progress**
- **Partial list of Interface Routines**
  - **GETFOV**
  - **PLTANG**
  - **PLSANG**
  - **PLBORE**
  - **PLINVU**
  - **PLINVU_2**
  - **PNTOCC**
  - **RAYOCC**

- **Graphics from Plate Models**
  - **Itokowa**
  - **Golveka**
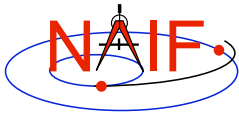 - **Kleopatra**
  - **Phobos**

- **The plate subsystem models an irregularly shaped body using tessellation of the surface with triangular "plates."**
- **The tightly integrated Toolkit software:**
  - produces a plate model from a variety of shape data sources
  - with a plate model in hand, allows a user to determine:
    » **the location of an instrument's boresight vector intersection with the body represented by the plate model**
    » **plates within an instrument's field of view**
    » **the illumination conditions of any plate:**
      - phase
      - incidence
      - emission
      - albedo, if this data was provided when creating the plate kernel

- **The MKPLAT application processes three shape data formats into plate kernels:**
  - **Plate-vertex table**
    » **Contains the body-fixed coordinates of each plate model vertex and a list that associates particular vertices with each plate.**
  - **Gaskell shape model**
    » **Contains the body-fixed coordinates of each vertex. The order of the vertex data implicitly defines the plate-vertex mapping.**
  - **Vertex-facet table**
    » **Similar to the plate-vertex table. PDS uses this format.**
- **Plate kernels are built upon the SPICE "database kernel."**
  - **This will change during final implementation.**
- **The IDL/CSPICE interface (Icy) can read the kernel data, then create a 3D interactive graphic of the body.**

Use Plate Model Kernel and PCK Together

Kernel Production   Kernel Use

Input:

Lists of plate model vertices and associated plates, and optionally, albedo data for each plate

→ MKPLAT Program →

Plate Model Kernel

Your application program

platelib library
(Only in FORTRAN)

Plate model-specific routines for determining viewing geometry

Input:

Some source of rotation information (pole RA/DEC and "prime meridian" location)

Text editor
(Entries usually made by NAIF)

or

A program that produces a binary PCK
(Usually done by NAIF)

Text PCK

Binary PCK

Planetary Constants Kernel (PCK) containing rotation data for the body

spicelib or cspice

Standard SPICE routines for obtaining rotation state

Plate-Kernel

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- **The current SPICE plate system is a prototype for future capabilities.**
  - **Used with success on NASA's NEAR mission, but had shortcomings.**
  - **The current version (3.0.0) is much improved compared to the version available prior to June 2004, but NAIF expects software errors and/or deficiencies still exist; the code and subsystem documentation are not yet to NAIF standards, and persistent performance issues remain.**
  - **Caution: This subsystem is still very much a work in progress and is subject to change at any time.**

- **Further development requires knowledge of mission requirements. Should NAIF add additional programmatic interfaces (see listing on next page)? Icy-based visualization tools? C language implementation? Other?**
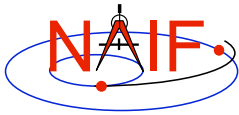
Plate-Kernel

6
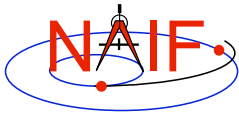
Here are listed the brief abstracts for some of the current interface routines for a plate model file. "Will these meet user requirements?", is one of the questions of interest to NAIF staff.
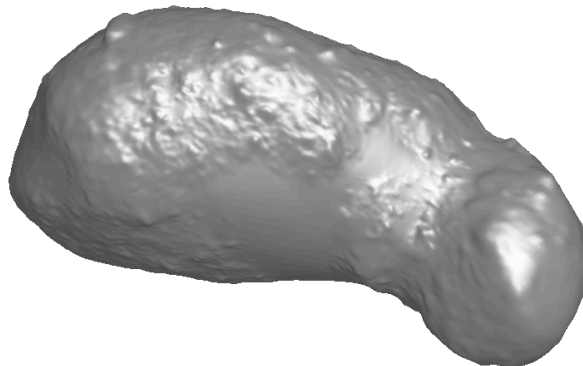
- **GETFOV: Given an instrument ID, return the field of view (FOV) boresight vector, vectors to the FOV corners, and vectors parallel to the sides of the FOV. Vectors are expressed in the instrument's reference frame.**

- **PLTANG: Return the angle between a plate's normal vector and the vector to a target body (emission and incidence).**

- **PLSANG: Return the angle between the vector to the sun and the vector to an observer, both vectors measured from the center of a given plate. (phase).**

- **PLBORE: Return the plate ID and coordinates where a ray from an observer intersects the plate model.**

- **PLINVU: Return a list of plates in an instrument's field of view, given instrument ID and time.**

- **PLINVU_2: Return a list of plates in an instrument's field of view, given instrument ID, time and a boresight rotation matrix.**

- **PNTOCC: For a given plate, field of view, observer and solar direction from the plate model, determine if the plate faces away from the observer, and if not what fraction is in the field of view, is visible and is in shadow.**

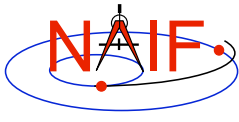- **RAYOCC: Determine if a ray intersects a given plate.**

Model data provide by Bob Gaskell
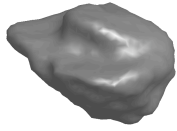
Golveka, (radar shape model),
http://www.psi.edu/pds/archive/rshape.html
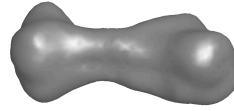
Kloepatra, (radar shape model),
http://www.psi.edu/pds/archive/rshape.html
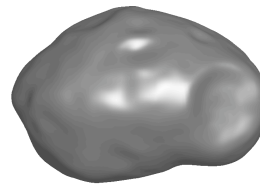
Phobos, (data provide by Bob Gaskell)