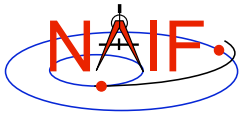


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Navigation and Ancillary Information Facility

# SPICE System Development Plans

March 2006

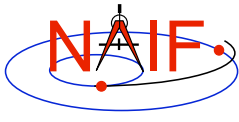


## Agenda

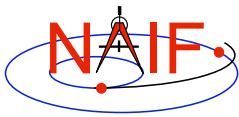
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Navigation and Ancillary Information Facility

- **Work in progress (more or less)**
- **Other ideas**



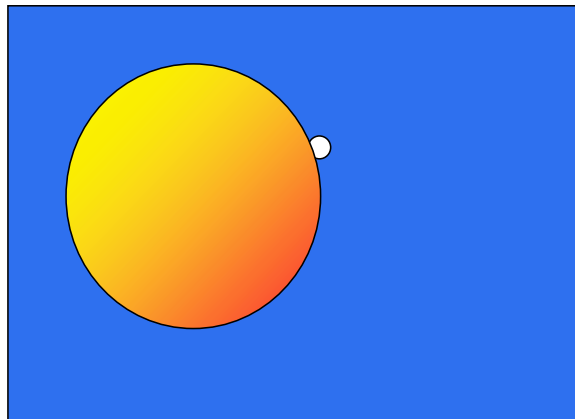
## Work in Progress

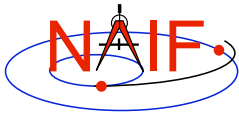


## Event Finding

- **Add routines that will search for geometrically defined events such as**
  - Transit
  - Occultation
  - Eclipse
  - Rise or set
  - Closest approach
  - Max. elongation
  - etc.

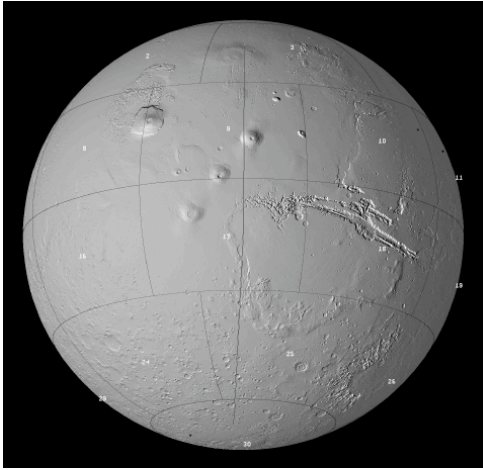
What should we add to this list?





## Terrain Kernel

Navigation and Ancillary Information Facility



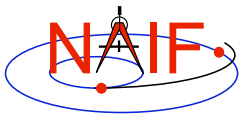
**Mars Global Terrain**  
Based on Illuminated MOLA data\*

\*Courtesy of T. Duxbury/MGS MOLA Team

- A “terrain kernel” would hold global terrain data sets, such as produced by the MGS MOLA instrument
- Related SPICE Toolkit software would provide easy access to such data
  - Close coupling with SPICE will afford easily-made geometry computations related to instrument field-of-view, lighting angles, altitude, etc.

Plans for Further Development

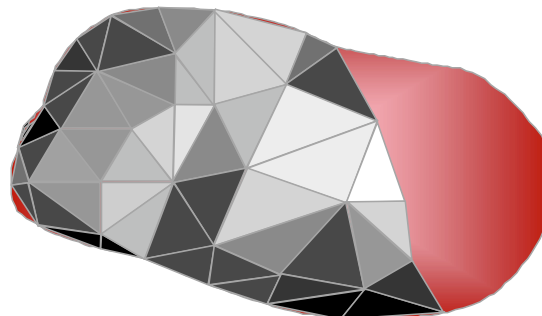
5



## Plate Model Kernel for Irregularly Shaped Objects

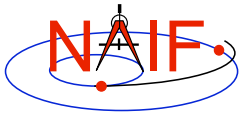
Navigation and Ancillary Information Facility

- Model an irregular body using tessellation of the surface with triangular “plates”
- Provide tightly integrated Toolkit software that:
  - will produce a plate model from shape data
  - given such a plate model, will allow you to determine:
    - » which plates are in view?
    - » what are the illumination conditions of any plate?
      - phase
      - incidence
      - emission



Plans for Further Development

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## Run-time SPK and CK Kernels

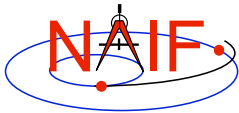
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Navigation and Ancillary Information Facility

- **Develop means to provide immediate (run-time) access to a collection of orbit data or orientation data that have not yet been placed into an SPK or CK file, respectively**
  - The data would appear as if they came from such a file
  - Such data can be written to a real SPK or CK file for later use

Plans for Further Development

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## New Interfaces

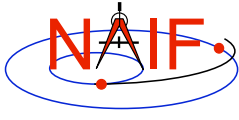
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Navigation and Ancillary Information Facility

- **Provide a Matlab link to CSPICE, similar to that recently released for Interactive Data Language (IDL)**
- **Provide a Java Native Interface (JNI) link to CSPICE**

Plans for Further Development

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## “Sky” Catalog Kernel

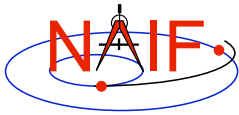
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Navigation and Ancillary Information Facility

- **Generic catalog for objects with “static” positions**
  - Think of “star catalog” as a model
- **Can support a wide range of objects/spectral bands, using a single interface**
  - Point Sources (Radio, Infra Red, Visible, Ultra Violet, X-Ray)
  - Galaxy, quasar, pulsar, nebula
- **Portable kernel files**
- **Compact data representations**
- **Data are indexed, providing high speed access**
  - Indexes on position, magnitude, etc.

Plans for Further Development

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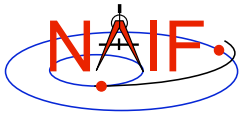
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Navigation and Ancillary Information Facility

## Other Ideas

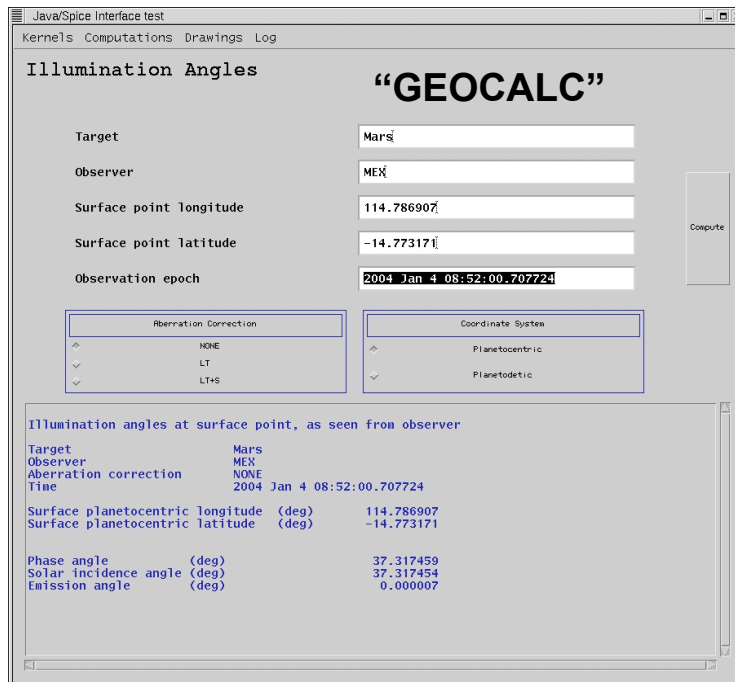
Plans for Further Development

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## Geometry Engine

Navigation and Ancillary Information Facility

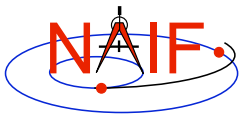


Local GUI application  
or  
web-based tool

In this example, compute the illumination angles on Mars at LON 114.7 and LAT -14.7 as seen from Mars Express on 2004 JAN 4 08:52:00. The user can pick either a planetocentric or planetodetic reference frame.

Plans for Further Development

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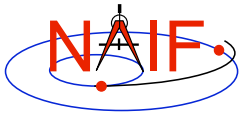
## SPICE Interpreter

Navigation and Ancillary Information Facility

- **Implement a small, interpreted, high-level language interface to the full set of SPICE functionality**
  - Would include mathematical computations typically used in association with SPICE
- **This tool would provide flexible access to all SPICE computations**
- **Useful as a stand-alone tool with a command-line interface**
- **Useful as a geometry engine that is integrated into a larger information system**

Plans for Further Development

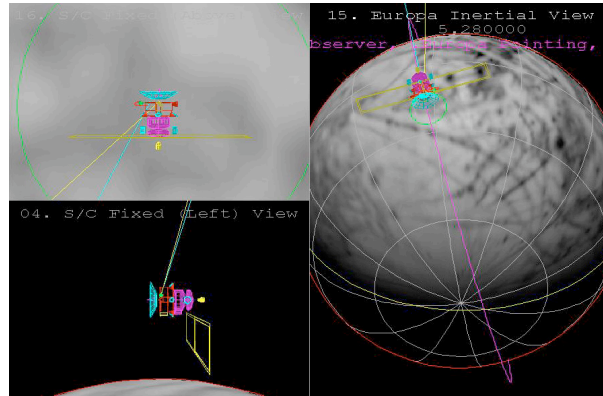
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## Better Integration with Popular Visualization Programs

Navigation and Ancillary Information Facility

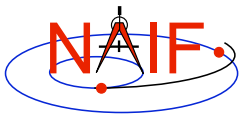
- A number of space geometry visualization tools provide some sort of interface with SPICE
- NAIF should strive to make these interfaces more complete and more easily used



- Examples above are from the Satellite Orbit Analysis Program (SOAP), implemented by The Aerospace Corporation.
- Satellite Toolkit from Analytical Graphics Inc. is another visualization package with some SPICE connections.

Plans for Further Development

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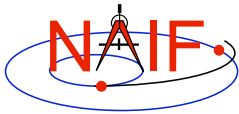
## Other Possibilities - 1

Navigation and Ancillary Information Facility

- **Additional interfaces to SPICE:**
  - Python, Perl, MS Excel
- **Add additional target models: rings, gravity, atmosphere, magnetosphere, ...**
- **Develop a more flexible and extensible instrument modeling mechanism**

Plans for Further Development

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## Other Possibilities - 2

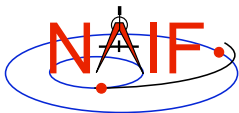
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Navigation and Ancillary Information Facility

- **Provide tools for easier specification and visualization of reference frames**
- **Provide a “predict spk” tool that makes it easy to construct an SPK file from simple rules**
- **Provide a better interface with the extensive comet/asteroid ephemeris database implemented by JPL’s Solar System Dynamics Group**
- **Provide extended precision calculations for time and other quantities used by Radio Science investigations**

Plans for Further Development

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## Other Possibilities - 3

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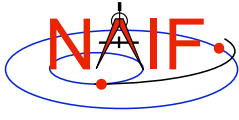
Navigation and Ancillary Information Facility

- **Add more high-level computations, such as instrument footprint coverage**
- **Add hyperlinks to all SPICE documentation**
- **Provide a C-Kernel merge utility, analogous to the existing SPKMERGE program**

Plans for Further Development

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# Your Suggestions?

Navigation and Ancillary Information Facility

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- **What do you propose?**