

Navigation and Ancillary Information Facility

SPICE Development Plans

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Higher Fidelity Shape Models

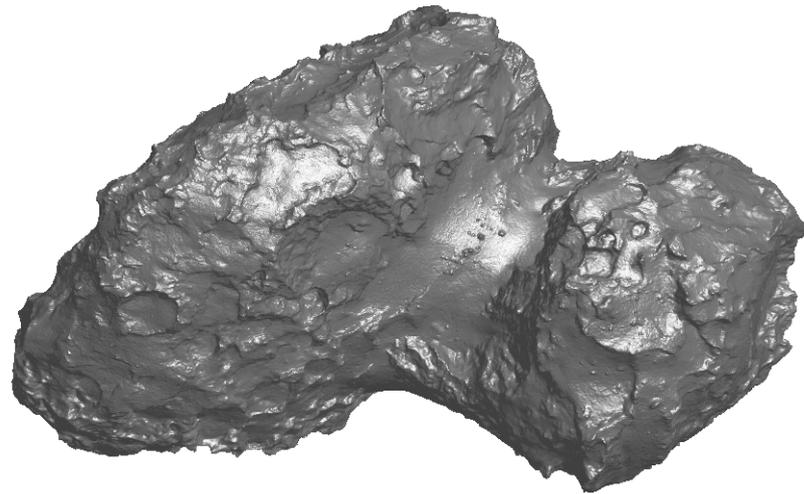
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- **Extension of the shape model subsystem**
 - **Called Digital Shape Kernel (DSK)**
 - **Add two new shape model capabilities...**
 - » **tessellated plate model, for small, irregularly shaped bodies**
 - » **digital elevation model, for large regularly shaped bodies for which we have terrain data**
 - **Status**
 - » **The plate model container will be released as part of the N66 Toolkit, now targeted for December 2016.**
 - » **Work on the digital elevation model container is still ongoing**
 - **Date for release of a “final” version has not yet been set**



Example of Tessellated Plate DSK

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67P/Churyumov-Gerasimenko

This is a rendering of shape data extracted from a 4 million plate DSK of comet C-G.



More WebGeocalc Development

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- **NAIF implemented a client-server GUI interface to a SPICE geometry engine, named WebGeocalc**
 - It's already seeing quite a lot of use around the globe
- **We are now adding more capability to it, and hope to continue further development. Examples:**
 - Programmatic interface (done but not yet released)
 - VOTable as an output format (draft version is under review)
 - More kinds of computations
 - Allow user to view text kernels
 - Many “small” improvements

and

 - Possibly consider means to allow a user to download to the WGC server her/his own kernel(s)
- **We recently helped ESAC set up WGC in support of upcoming ESA missions.**



More SPICE-enhanced Cosmographia Development

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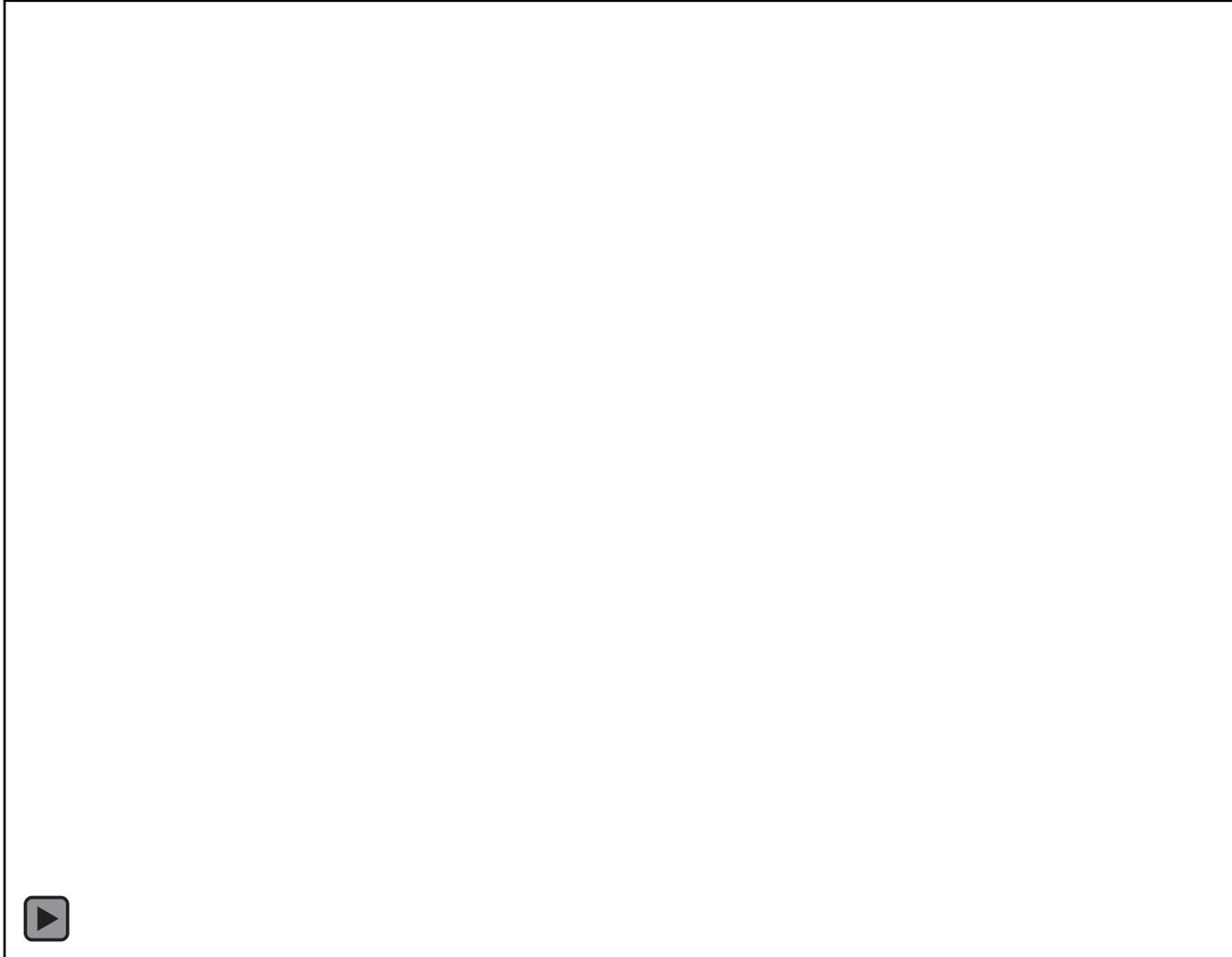
- **Many visualization programs use SPICE.**
- **NAIF has adopted the Cosmographia program and is now adding more SPICE and other functionality.**
 - **Display spacecraft trajectory and orientation, target body size/shape/orientation, instrument field-of-view frustums and footprints, orientations of various frames, directions to objects.**
 - **Provides substantial user control of all visualization aspects**
 - **Works on Mac, Linux and Windows**
- **This tool is aimed at working scientists and engineers, but can also be used for PR purposes.**
- **NAIF has already found it very useful in “explaining” complex viewing conditions and in illuminating problems in geometry data.**



Cosmographia Movie Clip

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Cassini camera viewing Saturn and satellites





More API Interfaces

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- **Java Native Interface (JNI Spice)**
 - An alpha-test release was made in February, 2010
 - Date for official addition to the Toolkit is TBD
- **Python**
 - Several SPICE users have implemented and are offering their own, partial Python interfaces to SPICE
 - » Check here for links to two of them
 - <http://naif.jpl.nasa.gov/naif/links.html>
 - We'll let these serve the Python community for now.
- **Thread-safe and object oriented Toolkit**
 - We imagine building a whole new Toolkit, likely in C++, while also maintaining existing Toolkits
 - Work is supposed to start very soon, with completion TBD.



Some Other Possibilities

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- **More high-level computations, such as instrument footprint coverage?**
- **More “geometry finder” computations?**
- **Complete the star catalog subsystem started long ago?**
- **Additional target models: rings, gravity, atmosphere, magnetosphere, ... ?**
- **Develop a more flexible and extensible instrument modeling mechanism?**



What do You Suggest?

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- **NAIF solicits suggestions from the user community.**
- **We're interested in programmatic ideas as well as technical ones. For example:**
 - **What amount of cooperation and interoperability with foreign partners is appropriate and achievable?**
 - **Should NAIF actively advocate for use of SPICE in the heliophysics or earth sciences disciplines, or simply let any such expansion be user driven as is now the case?**



Current Known Major SPICE Users

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<i>Data Restorations</i>	<i>Selected Past Users</i>	<i>Current/Pending Users</i>	<i>Possible Future Users</i>
Apollo 15, 16 [L]	Magellan [L]	Cassini Orbiter	NASA Discovery Program
Mariner 2 [L]	Clementine (NRL)	Mars Odyssey	NASA New Frontiers Program
Mariner 9 [L]	Mars 96 (RSA) [F]	Mars Exploration Rover	ExoMars 2018 (ESA, RSA)
Mariner 10 [L]	Mars Pathfinder	Mars Reconnaissance Orbiter	Luna-Glob (RSA)
Viking Orbiters [L]	NEAR	DAWN	ARM (HEOMD)
Viking Landers [L]	Deep Space 1	Mars Science Lab	Korean Pathfinder Lunar Orbiter
Pioneer 10/11/12 [L]	Galileo	Juno	
Haley armada [L]	Genesis	MAVEN	<i>Examples of Users not Requesting NAIF Help</i>
Phobos 2 [L] (RSA)	Deep Impact	SMAP (Earth Science)	Emirates Mars Mission (UAE via LASP)
Ulysses [L]	Huygens Probe (ESA) [L]	OSIRIS REX	Bevo-2 CubeSat (U.T. Austin, Texas A&M)
Voyagers [L]	Stardust/NExT	InSight	Proba-3 (ESA)
Lunar Orbiter [L]	Mars Global Surveyor	Mars 2020	Solar Probe Plus
Helios 1,2 [L]	Phoenix	Europa Clipper Mission Concept	EUMETSAT GEO satellites [L]
	EPOXI	NISAR (NASA and ISRO)	MOM (ISRO)
	GRAIL	Lunar Reconnaissance Orbiter	BepiColombo (ESA, JAXA)
	Messenger	New Horizons	JUICE (ESA)
	Phobos Sample Return (RSA) [F]	Mars Express (ESA)	Solar Orbiter (ESA)
	Venus Express (ESA)	Rosetta (ESA)	Van Allen Probes [L]
	Chandrayaan-1 (ISRO)	ExoMars 2016 (ESA, RSA)	STEREO [L]
	Hayabusa (JAXA)	Akatsuki (JAXA)	Spitzer Space Telescope [L]
[L] = limited use	Kaguya (JAXA)	Hayabusa-2 (JAXA)	Kepler [L]
[S] = special services	LADEE	Space Launch Systems (HEOMD)	Hubble Space Telescope [S][L]
[F] = mission failed	ISO [S] (ESA)	Planetary Data System	Radioastron (RSA) [L]
	CONTOUR [F]	Planetary Science Archive	IBEX [L]
	Space VLBI [L] (multinational)	JPL Solar System Dynamics	James Webb Space Telescope [S][L]
Last updated: 10/3/16	Smart-1 (ESA)	NASA Deep Space Network [S]	

- NAIF has or had project-supplied funding to support mission operations, consultation for flight team members, and SPICE data archive preparation. NAIF also has PDS funding to help scientists and students with using SPICE data that have been officially archived
- NAIF has or had NASA funding to support a foreign partner in SPICE deployment and archive review, and to consult with flight team
- NAIF has token funding to consult with kernel producers at APL. APL provides support to science teams.
- NAIF has or had modest PDS-supplied funding to consult on assembly of a SPICE archive.
- NAIF has PDS funding to help NASA funded scientists using SPICE data that have been officially archived at the NAIF Node of the