

SPICE Newsletter

April 2016

Looking For a New Team Member

NAIF is looking to hire a new, permanent staff member to join the existing four-person team. If you know of someone who might be interested in this possibility, please point him/her to this job description: <http://naif.jpl.nasa.gov/naif/newhire.pdf>.

Next SPICE Toolkit Release (Version N66) Delayed

NAIF is focusing on the first official release of part of the "new" Digital Shape Kernel (DSK)–that portion using a tessellated plate model for small, irregularly shaped bodies–as the driver for the next (version N66) Toolkit release. Our hopes of releasing the N66 Toolkit in April did not pan out. We are trying very hard to get this released sometime in June or July... stay tuned.

Digital Shape Kernel (DSK) Subsystem

As mentioned above we continue pressing forward on completing implementation of the tessellated plate model portion of the Digital Shape Kernel. We're also doing some work on the digital elevation model component, but this portion is further behind; it will be released in a future Toolkit (maybe N67).

The source shape data for any DSK come from outside of NAIF–the SPICE DSK sub-system simply provides a standard way of packaging shape data and then computing a variety of observation geometry based on those shapes, similar to the way SPICE works with the more traditional tri-axial shape models.

You can learn more about the Digital Shape Kernel by reading the "Shape model preview" tutorial available from the NAIF website: <http://naif.jpl.nasa.gov/naif/tutorials.html>. The file name is "37_shape_model_preview."

JNI Spice

With all development effort focused on DSK, there's been essentially no new work on the JNI Toolkits. The February 2010 alpha-test JNI Toolkits remain available for interested users.

Python SPICE

Some work was done long ago on a NAIF instance of Python wrappers for CSPICE, but there has been no advancement since then. Some SPICE users have made their own, partial versions of a Python-CSPICE interface that they are willing to freely share. Two of these are:

Andrew Annex: <https://github.com/AndrewAnnex/SpiceyPy>

Mark Showalter/Robert French: <https://github.com/SETI/pds-tools>

NAIF is now seriously contemplating just pointing to the two external Python Toolkit product lines mentioned above, both of which appear to be quite substantial works, and then focusing our own efforts on the "New Toolkit Architecture" mentioned below, once the DSK subsystem is complete.

New Toolkit Architecture

NAIF conducted a small study focused on if and how we could/should provide a "modern" Toolkit, and in so doing, migrate away from the Fortran 77 Toolkit as our baseline. Such a "modern" toolkit would most likely be based on a language not currently supported by NAIF, such as C++, and would likely provide some measure of thread safety and perhaps object

oriented architecture. A variety of other changes (improvements) would hopefully also be embraced. We realize we first need to learn a good deal more about C++ or any other possible target language, as well as about thread safety and object-oriented design. We have funds specifically allocated to this task starting in FY17.

In making such a fundamental change we acknowledge we must maintain support for the current suite of Toolkits.

WebGeocalc Tool (WGC)

The WebGeocalc tool (<http://naif.jpl.nasa.gov/naif/webgeocalc.html>), providing a GUI interface to a SPICE geometry engine based on a client-server architecture, is getting use from around the globe. We recently added a programmatic interface to the tool, although this has not yet been made available. We plan to add a bit more capability—a few more kinds of computations and assorted other improvements—after which we will announce a new release.

One of the enhancements we plan that was suggested by a customer (Baptiste Cecconi) is the ability to output numeric results in the form of a VOTable, a standard format for exchange of data used in the Virtual Observatory community. Thank you Baptiste for this great idea.

Cosmographia Visualization Tool

Since its last announced release we've been able to make a few enhancements to the Cosmographia mission visualization tool. Unfortunately the tool's developer has a new assignment, so we're on hold until we can find a new person to help. (We're working on it.)

Cosmographia and allied products are available here:

<http://naif.jpl.nasa.gov/naif/cosmographia.html>. Give it a try if you're interested in mission visualization.

Cosmographia was used by the Cassini project in producing several outreach videos, one of which may be found at the bottom of this webpage:

<http://saturn.jpl.nasa.gov/mission/flybys/titan20160404/>

Switching to PDS4 Standards

NAIF is in the process of implementing archive procedures and tools consistent with the new Planetary Data System (PDS) archive standards known as PDS4. This change will have little effect on SPICE consumers: there are no changes to kernel formats or Toolkit software. ("SPICE is SPICE is SPICE is ...") There are modest changes to the meta-content and organization of a SPICE archive.

SPICE-Aware Tools

With co-operation from many of our customers we assembled a "SPICE-Aware Tools List."

Perhaps you'll find some useful entries in this list. Look for it here:

<http://naif.jpl.nasa.gov/naif/links.html>. If you'd like to have your tool added to this list, send an email to [charles.acton \(at\) jpl.nasa.gov](mailto:charles.acton@jpl.nasa.gov).

New Dynamic Frames Kernels

For many years NAIF has had on its work list the goal of producing a generic, dynamic reference frames kernel. See the SPICE dynamic frames tutorial for an explanation of dynamic frames. <http://naif.jpl.nasa.gov/naif/tutorials.html>. The file name is "24_dynamic_frames."

(Note: many people use the term "coordinate system" where SPICE uses "reference frame.") Dynamic frames—certain reference frames for which the principal axes are based on

directions computed from ephemeris or body orientation—can be used to better understand the physical phenomena pertaining to the solar system and spacecraft used to explore it.

A draft of such a dynamic frames kernel was produced by an ESA colleague during the Mars Express primary mission time frame. NAIF has now produced a draft of an official generic dynamic frames kernel set. We are now comparing this with a number of other dynamic frames used in the (mostly fields and particles) science community; we hope to release this new dynamic frames kernel in the near future.

SPICE Live Training

The NAIF Team conducted a SPICE beginner's class near Pasadena in April 2016, with 60 students in attendance. The modest amount of feedback NAIF received at the end of the class (http://naif.jpl.nasa.gov/naif/WS2016_student_feedback.pdf) suggested the class was well received—at least by those who provided feedback. But the students did also provide a variety of suggestions for improving both the class and SPICE.

The next domestic beginner's class is not likely to be scheduled for another 18 months or so.

ESA's ExoMars TGO mission asked NAIF to plan on giving a SPICE beginner's class at the ESAC facility near Madrid in September 2016. The announcement for it is found here:

<http://www.cosmos.esa.int/web/spice/training-class-september-2016>

That class is open to folks outside of the ExoMars project, presumably including people from outside of Europe, although the number of attendees will be limited to fit the classroom.

No other foreign training classes involving NAIF are currently contemplated.

A Russian colleague is conducting some SPICE training at educational institutions in Moscow.

NAIF believes that an advanced training class could be helpful to some SPICE users, but finding the time to prepare the needed tutorials and programming lessons is a challenge. One day we'll get to it, especially if enough SPICE users push us in this direction.

SPICE Self Training

NAIF believes the live classes taught by NAIF team members have been quite useful because of the interactive nature. But given the infrequent occurrence of the classes as well as students' challenges to attend one of these, a self-training alternative was needed. To support self-training NAIF has published a typical class agenda and the shortened tutorials and lessons used in the live classes. The difference between the shortened tutorials and the standard ones available from the NAIF website is that many of the class tutorials have been reduced in scope and depth to just highlight the key points covered during a class. The lessons provided in the self-training packages are the same as those used in the live classes, these being a subset of those available from the NAIF website. Anyone interested in working through the self-training materials can find the needed information on the "Self-training" link on the NAIF website:

http://naif.jpl.nasa.gov/naif/self_training.html.

NAIF Website Updates

NAIF continues to make updates to its website in hopes of better serving the planetary science community. We also post announcements there, some of which are not sent to the "spice_announce" Mailman distribution list. If you are a frequent user of SPICE you might make a point of checking the announcements page,

<http://naif.jpl.nasa.gov/naif/announcements.html>, every now and then.

Flight Projects Using SPICE

For those curious about where SPICE is being used, here is a summary of what we know. (We have reason to believe the use of SPICE is more extensive than this.)

All current NASA planetary projects are using SPICE; we guess this will be true for Europa and Mars2020 as well.

Selection of the next NASA Discovery Program proposal(s) that will move to implementation will come along next year. It seems quite possible it or they will elect to use SPICE, but this is TBD.

A number of NASA projects from other science disciplines are also using SPICE (e.g. Solar Probe Plus and Soil Moisture Active and Passive).

To our surprise we heard that some students installed the Toolkit on-board several cubesats. Unfortunately some problems not related to SPICE terminated these missions prematurely.

ESA's Mars Express, Venus Express, and Rosetta missions continue to offer SPICE versions of ancillary data as an alternative to the official ancillary data files. Production of the SPICE archives for these missions lags behind production of the science data archives. More information is available here: <http://www.cosmos.esa.int/web/spice>.

ESA has stated it will use SPICE on ExoMars TGO, BepiColombo, JUICE and Solar Orbiter.

We recently learned that the European EUMETSAT organization is using a bit of SPICE in an instrument calibration tool (uses lunar observations), and that they've been asked to share this tool with other worldwide meteorological agencies. It's nice to see this sort of broader use of SPICE.

JAXA's Akatsuki mission to Venus and Hayabusa-2 mission to asteroid 1999 JU₃ intend to use SPICE for science support. A bit more information is available here: <http://darts.isas.jaxa.jp/planet/spice/index.html.en>.

ISRO made some use of SPICE on its Chandrayan-1 mission, but these data are apparently not yet openly published. NAIF has heard that ISRO's Mars Orbiter Mission (MOM) is using SPICE, and will release these data to ISSDC registered users after a validation and peer review period. It is looking as though there could be some use of SPICE on the joint NASA/ISRO NISAR earth observation mission (TBC).

We can speculate that future Russian planetary missions (ExoMars 2018, Venera-D, Luna-Glob) might consider once again trying SPICE, but there's been no specific conversation about this, and NAIF is precluded from having any bilateral discussions about this. The Russian SPICE website is here: http://spice.ikiweb.ru/index_en.html.

NAIF is precluded from having bilateral involvement with the Chinese Space Agency, so we are unaware if there is any use of SPICE on their solar system or other missions.

Please advise if you find any errors or omissions in the summary above.

A table summarizing much of the SPICE use by flight projects is available:
http://naif.jpl.nasa.gov/naif/SPICE_Users.pdf.

SPICE and the INTERNATIONAL PLANETARY DATA ALLIANCE (IPDA)

The use of SPICE is recommended—but not required—by the International Planetary Data Alliance. If you have ideas about what might be done to help make SPICE fit well into this international initiative, please let us know.

Getting Information on SPICE

If you have a question best answered by NAIF staff, please see our **Getting Help** webpage:
<http://naif.jpl.nasa.gov/naif/gettinghelp.html>

If you have a question likely answerable ONLY by a SPICE user—not a NAIF staffer—then use the "**spice_discussion**" Mailman system:

https://naif.jpl.nasa.gov/mailman/listinfo/spice_discussion.

Inputs to "spice_discussion" are now moderated.

The "**spice_announce**" Mailman system is reserved for use by NAIF staff to make announcements that seem fairly important and of broad interest. We try to limit the use of this notification system so as to not spam your mailbox.

NAIF's "**Announcements**" **web page** is used more often than is "spice_announce" for assorted announcements. <http://naif.jpl.nasa.gov/naif/announcements.html>

NAIF's NASA Performance Review Results

In January NAIF participated in a NASA-mandated Performance Review. We are pleased that the peer review panel gave NAIF the highest possible rating. This should mean that the NAIF/SPICE entity will continue to support NASA and NASA's partners for the foreseeable future.

Your Feedback

NAIF is always interested to hear your suggestions for improving SPICE capabilities and NAIF operations. Contact anyone at NAIF or communicate with any of the Planetary Data System management team listed below.

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