

## WebGeocalc Version 1.1.0 Release Announcement

### January 2015

Dear Colleagues,

NAIF is pleased to broadly announce the availability of a new interface to SPICE – WebGeocalc (WGC) Version 1.1.0. Some of you already know about WGC, either through prior "alpha-test" announcements or having come across a link to it on the NAIF website; in this case sorry for sending you old news.

WebGeocalc provides a Graphical User Interface to a SPICE-based "geometry engine" located at JPL. That geometry engine has access to all of the SPICE kernels resident on the NAIF server. These are organized in three categories.

**archived** kernels from NASA's planetary missions (and three ESA missions)

**mission operations** kernels from JPL-managed planetary missions (and three ESA missions)

**generic** kernels, such as planetary ephemerides, that are not tied to a specific mission

A few kernels from a few historic and some miscellaneous other missions are also available.

WGC allows users to make an assortment of typical SPICE observation geometry calculations, organized in three categories.

**Geometry Calculator:** traditional computation of numeric parameter values at one or a number of times, or over a time range

**Geometric Event Finder:** calculations showing, within a time range (a confinement window), when a particular geometric condition is "true" or when a particular geometric parameter is within a given range or at a MAX or MIN

**Time Calculator:** means for converting between time systems and time formats

NAIF believes WGC can serve the planetary science community in a variety of ways. Some examples are listed below.

Help a SPICE user check his or her own SPICE-based application program under development

Help a scientist or engineer quickly make a one-time space geometry computation

Help a science data peer reviewer do spot checks of geometry parameters contained in a data set being submitted to an archive center such as NASA's Planetary Data System

Allow persons unable to write a SPICE-based program to nevertheless make some kinds of space geometry calculations

To use WGC you need a computer with a reasonably modern web browser. WGC makes using SPICE *easier in some cases*, but not always trivial; one needs to know at least a bit

about SPICE to use WGC successfully. You'll also need to have some familiarity with some concepts of observation geometry.

If you would like to learn more about WGC, including information about its features and limitations, common user errors, and possibilities for further development, read "WebGeocalc Features, Limitations and Common User Problems – A Brief Summary" below. Should you decide to try using WGC it's important that you read the "About the Data" and "Rules of Use" links found at the top-right of all WGC pages.

Feel free to pass this announcement on to your colleagues. And let us know what you think about this tool—good, bad or otherwise.

Regards from,  
The NASA/JPL NAIF Team  
and  
Our WGC development partner at NASA/AMES, Mark Rose

## **Useful Links**

The URL for WebGeocalc is:

<http://wgc.jpl.nasa.gov:8080/webgeocalc>

A tutorial about WGC is available from this location:

<http://naif.jpl.nasa.gov/naif/webgeocalc.html>

Examples of using WebGeocalc are found here:

Easy: [http://naif.jpl.nasa.gov/naif/wgc\\_easy\\_usage\\_example.pdf](http://naif.jpl.nasa.gov/naif/wgc_easy_usage_example.pdf)

Challenging: [http://naif.jpl.nasa.gov/naif/wgc\\_challenging\\_usage\\_example.pdf](http://naif.jpl.nasa.gov/naif/wgc_challenging_usage_example.pdf)

## **WebGeocalc Features, Limitations and Most Common User Errors A Brief Summary**

### **Key features**

- For traditional kinds of computations (parameter value at time T) WGC can compute an answer for a single time (an epoch), a series of times, or over a range of times using a specified time step size.
- For traditional kinds of computations, output values may be plotted against time or against each other.

- For geometry finder kinds of computations, time intervals meeting the user specified search criteria are available in both numeric form and as intervals represented graphically along a time line.
- For all types of WGC computations, both numeric and graphical outputs may be saved for use in other documents.
- For all numeric results, individual values may be dragged to a "Saved Values" pane and then dragged back to a subsequent input panel, thus facilitating the "chaining" of computations.
- All detectable user errors will result in an error message being displayed. (Some are more understandable than others.)
- On-line help is available for all inputs, and, where appropriate, a graphic depicting the kind of calculation that will be made can be displayed; just click on any blue button containing a question mark.

### **Key limitations**

- WGC functionality is limited: it can make only the kinds of SPICE-related calculations built into the underlying geometry engine, which are a subset of the calculations possible if you build your own SPICE-based application. The calculation menu on the WGC home page lists all of the available calculations. (With some ingenuity, a WGC user can make some calculations that are not obvious at first glance.)
- As has been famously said, "The Achilles heel of SPICE is kernel management;" meaning that it can be difficult to know which of many SPICE kernels to use for a given job. WGC goes a long way to help solve this problem for **archived** and **generic** data sets, but not for **mission operations** data sets; read on for details.

WGC can work with predictive data as well as historical—sometimes called definitive—data. But this points to the primary circumstance of kernel management complication. **Archived** and **generic** SPICE data sets are the easiest to use, in part because these data sets are accompanied by meta-kernels used to organize and easily load all SPICE data needed. However, NAIF does not have meta-kernels for the **mission operations** data collections that support the daily workings of on-going missions. It is within the mission operations collections that any predictive data might be found. Selecting and loading kernels from these mission operations collections is possible using the "manual" kernel selection mechanism, but this can be somewhat of a challenge for those not quite familiar with the particular project's mission operations kernels.

- Only those SPICE kernels maintained on the NAIF server can be used in the NAIF instance of WebGeocalc. (Whether or not we'll eventually be able to allow a user to upload her/his own kernel for immediate use within WGC is unknown at this point.)
- One at a time: While one WGC computation is executing, any other computation requests received at the server will be placed in a queue, then run automatically as soon as the request

has reached the top of the queue. (If contention becomes a problem we may be able to run multiple instances of WGC.)

- To avoid unintended capturing of the geometry engine, the wall clock execution time and the number of computations or the number of steps in a geometry search, are limited. A failure message will be displayed if any of these limits has been exceeded.

### **Common User Errors**

During the user testing phase leading up to this release it seemed the most often occurring user errors are these.

1) Using unrecognizable time strings or numbers. SPICE is quite capable in terms of properly interpreting times (epochs), but it can't handle every conceivable form. WGC offers some online HELP text to describe what is acceptable. For UTC times the following excerpt from the primary SPICE time string processing module, str2et, may be helpful:  
[http://naif.jpl.nasa.gov/pub/naif/toolkit\\_docs/C/cspice/str2et\\_c.html#Examples](http://naif.jpl.nasa.gov/pub/naif/toolkit_docs/C/cspice/str2et_c.html#Examples)

2) Often a user seems unaware of the "tool tip" information showing the extent—begin time to end time—for the available SPICE data sets. Consequently, she or he asks to do a calculation outside of the time span of the SPICE data loaded into WGC. You may see the applicable start and end times for any data set by letting your cursor hover over the data set name appearing in the "Kernel selection" drop-down menu, or, after a kernel set has already been selected, hovering your cursor over the data set name appearing under the "Kernels Selected" panel on the right side of your browser's window.

Take note that for the mission archive data sets there are NO "predict data" for future times. In fact, archive data sets generally end three to six months before "today," and in some cases they end much earlier than that.

3) Geometric Event Finder calculations require the user select a step size to be used in the search. Doing so may not be straightforward, depending on the kind of search and the details of the geometry involved. Picking a step size that is too long may result in WGC failure to find some events. Picking a very small step size may take very long to execute, or, more likely, exceed a WGC limit on the number of steps allowed in a search.

Using a "cascading" (two-step) search process can help, but even in this approach, selection of appropriate step size requires some effort. An available WGC usage example tutorial named "wgc\_challenging\_usage\_example" helps explain this, as does the SPICE "geometry\_finder" tutorial.

### **Reliability**

The WGC geometry engine has been built using an "alpha-test" version of a Java Native Interface SPICE Toolkit. While the JNI Toolkits have not yet been officially tested to NAIF's usual standards, they have been in use, successfully, by quite a few customers and by NAIF for quite some time.

WGC uses more than just the JNI SPICE Toolkit; Google Web Toolkit, some other libraries, and various calculations internal to the WGC server are also used. NAIF is not aware of any bugs, but such could be possible. Additionally, some kinds of unexpected GUI behavior might be found. If you suspect you've found an error, please notify someone at NAIF.

### **Looking Ahead**

There are many improvements one could imagine making to WGC. One of these is adding a programmatic interface to the underlying geometry engine, using something like RESTful technology. NAIF has the resources in hand to do this in FY15.

Many other improvements are possible, for example: more kinds of SPICE computations, more usability features, access to certain SPICE kernel management utilities, the addition of graphics and perhaps even animations, and the ability to upload and then use your own kernels. NAIF has a list of possible improvements based on our own ideas and suggestions received from early WGC testers. If/when we'll be able to address any of these remains to be seen. In any case, should you have suggestions to improve WGC, use the "Feedback" button within the tool.

As we (slowly) add new capabilities and fix problems, we will deploy updated versions of WGC, likely with announcements of such being limited to the "spice\_announce" Mailman system. When a change is made the WGC version number seen at the top-left of your browser's WGC panel will be incremented.

NAIF is hopeful of being able to offer the WGC server-side geometry engine to interested flight projects and science centers, thus enabling them to feed their own collections of SPICE kernels into the engine. (Linux and Mac users only, for now.) If you are interested in exploring this possibility, send an email to the NAIF manager or use the "Feedback" button inside the WGC tool.