

Release Announcement and Installation Notes
SPICE-Enhanced Cosmographia Mission Visualization Software
Version 4.0

February 2019

Dear Colleagues,

The Navigation and Ancillary Information Facility (NAIF) at JPL is pleased to announce the availability of Version 4.0 of the SPICE-Enhanced Cosmographia mission visualization tool. It may be used to create animations of the observation geometry pertaining to solar system flight projects that make use of data in SPICE formats: planet, satellite, comet and asteroid orbits; spacecraft trajectory; spacecraft orientation; instrument field-of-view "cones" and instrument footprints. SPICE-Enhanced Cosmographia has many user controls, allowing one to manage what is seen and from what vantage point. (In the text that follows we often shorten the name "SPICE-Enhanced Cosmographia" to simply "Cosmographia.")

Cosmographia is a precision technical tool primarily designed for scientists and engineers involved with mission planning, SPICE data characterization, and science data analysis. It may be useful for some outreach efforts, but there are other visualization tools probably better suited for that purpose.

SPICE-Enhanced Cosmographia is free to all persons, including commercial entities, subject to the license and disclaimer provisions articulated below and provided with the distribution packages. The same rules that apply for getting help from NAIF regarding SPICE apply to Cosmographia. See "Getting Help from NAIF" here: <http://naif.jpl.nasa.gov/naif/rules.html>.

A summary of the changes/additions made since the last release is provided near the end of this announcement.

Compatibility note: we have tried to make these instances of Cosmographia robust, but we are not able to test it on every imaginable configuration of OSX, Linux and Windows and their allied 3rd party libraries; there is a chance the Cosmographia package we produced will not work on your computer. If you have carefully followed the installation instructions and are still having problems, we might be able to help, but there is no guarantee.

Cosmographia is a downloadable tool, not a web application; you must download and install the appropriate binary on your computer. The download site is given below. Executable binaries have been prepared for OSX, Windows and Linux. These executables work on modern versions of the named operating systems, and perhaps on some older versions as well.

The Cosmographia installers include generic SPICE ephemerides for the planets, their satellites, and a few asteroids. The installers also provide several complete examples of catalog files for a number of recent flight projects. To use any of these examples you'll need to download the corresponding SPICE archive from the NAIF server and install the archive on your machine as described in the aareadme.txt provided by the installer.

Additional SPICE kernels may be obtained from the NAIF server here: <http://naif.jpl.nasa.gov/naif/data.html>. This web page provides access to SPICE archives from past and on-going missions, operational SPICE kernels from flying missions, and generic SPICE

kernels not tied to a single mission. Archived SPICE data are generally complete only up to three-to-twelve months behind real time, consistent with mission archiving schedules. Operational SPICE collections are generally complete to the current date. The NAIF server has SPICE data for a few foreign missions, but in general one must obtain SPICE data from the space agency in charge of any given mission.

Of course you may use your own, locally prepared SPICE data in Cosmographia. To run Cosmographia using your own SPICE data you will need to have the appropriate SPICE kernels (data files) on your computer, and you'll need to construct—or be given—a set of catalog files used to tell Cosmographia which SPICE files to use and how to use them. NAIF has prepared a User's Guide for constructing these types of catalog files, and we also provide some templates to use as starting points.

Cosmographia is one of a number of visualization tools developed within the worldwide planetary science community, each having unique characteristics that make it suitable to meet particular requirements. Many of these tools use SPICE to some degree, and some are available to interested parties. Names of, and contacts for, some of these tools may be found here: http://naif.jpl.nasa.gov/naif/SPICE_aware_Tools_List.pdf.

NAIF has elected to focus its own development efforts on Cosmographia for a number of reasons, including its full use of SPICE kernel types, its multi-platform availability, and our ability to freely distribute it. Those interested in space mission geometry visualization capabilities can make their own determinations about which of these tool(s), if any, to use.

Access to the Cosmographia installers is available from this web page: <http://naif.jpl.nasa.gov/naif/cosmographia.html>.

As of now NAIF is only able to provide binaries. Perhaps in the future we'll be able to offer the source code.

An on-line Cosmographia User's Guide is found here: <http://cosmoguide.org>. In addition to traditional textual instructions this User's Guide contains video tutorials on many topics. At the time of this V 4.0 announcement the available UG was prepared for the previous release of Cosmographia, V 3, but other than not describing a few new features, it is suitable for V 4.0. It will be updated to reflect the new features ASAP.

This Release 4.0 of the SPICE-Enhanced Cosmographia was focused primarily on upgrading its infrastructure to modern versions of the several support libraries. But some user-focused additions were also made.

Those using Cosmographia on OSX or Linux platforms may see some of its scripting-based functionality by running one or both of two scripts included in the Cosmographia distribution to demonstrate and test the scripting capabilities. (Sorry, scripting is still not available for Windows versions.) To do this:

- Start up Cosmographia
- Using the "File" drop-down menu select "Run script..."
- Select "cosmoguide_example.py" (a shorter, demonstration script) or "cosmoscripting_runall.py" (a longer, test script) from the "data/scripting" subdirectory within the program directory tree
- Watch the action comments appearing briefly at the top-center of the screen that describe the next action to be taken by the script

Also available is a stand-alone Java-based tool, [jsongen](#), useful in preparing or editing the various catalog files needed to run Cosmographia. Both a GUI and a command-line version are included, but users are recommended to stick with the GUI version. This tool was built as a summer project by a high-school student. The time available was not sufficient to make it as robust as we'd like, but it does work. Alternatively, you could carefully use any text editor to prepare or revise a catalog file.

We have not yet been able to re-establish video recording for the Linux and Windows versions of Cosmographia. (We hope to eventually add this feature.) In the meantime Linux and Windows users will need to use a 3rd party video capture tool.

NAIF plans to continue development of SPICE-Enhanced Cosmographia, but this will likely come at a slow pace. In doing further development we will attempt to maintain backwards compatibility as much as possible, but cannot guarantee achieving this. Potential users of this software should carefully consider these circumstances before embarking on use of the tool. Should you have any questions in this regard, contact the NAIF Manager: Charles.Acton (at) jpl.nasa.gov. Also read the disclaimer below.

If you believe you've found a bug, or if you have a suggestion for improved functionality, please contact the NAIF manager as noted above.

Cosmographia Help

Help with using the SPICE-Enhanced Cosmographia tool is provided via the [Cosmographia User's Guide](#) and several on-screen menus. The User's Guide discusses not only running the Cosmographia application, but also how to construct JavaScript Object Notation (JSON) format "catalog files" used to define new objects and provide the needed data. It also discusses the optional Python-based scripting interface to the program (not available for Windows).

NAIF has quite limited resources for providing personal help—we ask that you make every effort to use the above mentioned resources. If you need help beyond what is provided in these documents you may contact one of the [NAIF Team members](#).

Installation Notes

The Cosmographia installer will guide you through the simple installation. If you are a first-time user, that's all that is needed. Cosmographia 4.0 will be installed in a newly created folder on your machine. If you check the box to install the extras, the program directory will also include examples of catalog files for a number of recent flight projects, catalog templates, and the original catalog creation User's Guide in PDF format.

----- **What's New and Changed in Version 4.0** -----

Here we note the more significant changes since the previous release on 21 December 2015. We do not discuss bug fixes and some usability and appearance improvements.

GUI

Distance, angle, and sensor panels were made movable.

Distance and angle display formats were improved.

Options for standard window sizes were added to Menu/Window.

Video resolution set was updated in Toolbar/Settings/Interface.

Earth month map selector was removed from Toolbar/Settings/Graphics.

Near Earth Asteroid (NEA) and Potentially Hazardous Asteroid (PHA) add-ons were added in
Toolbar/Settings/Add-ons.

Label and message text size was increased on Mac Retina displays.

Complete dimming of stars was enabled in Toolbar/Settings/Graphics.

Catalogs

Annotation catalog features were extended to allow positioning and color selection.

Opacity attribute was added for trajectory plots.

Python scripting

Video recording functions were added (OSX only).

Window size functions were added.

Fade/unfade functions were added.

Internals

SPICE was upgraded to N0066.

Qt was upgrade to Qt5.

PyQt was upgraded to PyQt5.

Time handling was upgraded to load leapseconds from SPICE.

Vector scale resetting to zero was fixed.

Known Deficiencies

Python scripting is not available for the Windows version.

Internal video recording is not available on the Linux and Windows versions.

Asteroid add-ons have flickering appearance on some Mac display configurations

----- Credits -----

The SPICE-Enhanced version of Cosmographia is an enhancement of the open source Cosmographia application developed by Chris Laurel of Fifth Star Labs LLC. NAIF is pleased that Chris has agreed to allow NAIF to release the enhanced version of his program.

For rendering, Cosmographia uses the VESTA library from Astos Solutions. NAIF thanks Astos Solutions for permission to use the VESTA library in the SPICE-extended version of Cosmographia.

The catalog creation User's Guide and templates for preparing catalog files used to connect SPICE data to Cosmographia were prepared by summer students Michelle Park and Farhan Alam, with updates by Boris Semenov and Charles Acton. Farhan Alam also built the custom catalog editor tool, jsongen.

Summer student Nicholas Edington developed the prototype scripting interface which was subsequently enhanced by Eric Ferguson.

Summer student Michelle Park drafted the on-line Cosmographia User's Guide, which was subsequently tweaked by Boris Semenov to discuss additional capabilities.

Eric Ferguson, Drew Hall, and Eric Castello, supported by the NAIF Team, developed the SPICE extensions to Cosmographia.

The SPICE format generic planet, satellite and asteroid ephemerides are produced by JPL's Solar System Dynamics Group.

SPICE format planet, satellite and asteroid size, shape and orientation data are taken from the "Report of the IAU Working Group on Cartographic Coordinates and Rotational Elements: 2009."

NAIF Team members Nathaniel Bachman, Boris Semenov and Edward Wright, and their predecessors, under leadership of the NAIF manager Charles Acton developed the SPICE system components used extensively within this version of Cosmographia.

SPICE development occurs under the auspices of the Planetary Data System program of NASA's Planetary Science Division, for which William Knopf is the NASA Program Executive at NASA HQ, and Maria Banks is the PDS Project Manager at GSFC.

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