Release Announcement and Installation Notes
SPICE-Enhanced Cosmographia Mission Visualization Software
Version 4.2

December 2022

Dear Colleagues,

The Navigation and Ancillary Information Facility (NAIF) at JPL is pleased to announce the availability of Version 4.2 of the SPICE-Enhanced Cosmographia mission visualization tool.

A summary of the changes/additions made since the last release is available at
 https://naif.jpl.nasa.gov/pub/naif/cosmographia/packages/Cosmographia_42_whats.new

The Cosmographia installers are available from
 https://naif.jpl.nasa.gov/naif/cosmographia_components.html

An on-line Cosmographia User's Guide updated for Version 4.2 is found at
 http://cosmoguide.org.

The SPICE-Enhanced Cosmographia 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 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.

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.

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, Linux and Windows. These executables work on modern versions of the named operating systems, and perhaps on some older versions as well.

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.

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 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. The UG was originally created for Cosmographia Version 3.0 and had been later updated to cover all new features that were added in Versions 4.0, 4.1, and 4.2. The new features available in these later versions are indicated in the UG using the [4.0+], [4.1+], and [4.2+] labels.

This Release 4.2 of Cosmographia was focused on a single major change – upgrading the Python version used internally and in the program scripting interface from version 2 to 3. This upgrade made it possible to fix a long-standing deficiency – the lack of scripting support in the Windows version of the program.

In Cosmographia version 4.2, the Python 3-based scripting interface is available on all three supported environments – OSX, Linux and Windows.

Users may see some of the Cosmographia scripting-based functionality by running one or both of two scripts included in the Cosmographia distribution to demonstrate and test the scripting capabilities. 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 Cosmographia, but this will continue coming 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: Boris.Semenov (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 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.

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 4.2 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 flight projects, catalog templates, and the original catalog creation User's Guide in PDF format.

Known Deficiencies in Version 4.2
Internal video recording is not available on the Linux and Window versions.
The "Description" button on the Find panel does not work in Linux.

Appendix 1: Credits
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The version of Cosmographia provided by NAIF is an extension of the open-source Cosmographia application originally developed by Chris Laurel of Fifth Star Labs LLC in 2010-2011. NAIF is pleased that Chris has agreed to allow us to release the JPL-extended version of his program.

For rendering, Cosmographia uses the open-source VESTA library from Astos Solutions. NAIF thanks Astos Solutions for permission to use the VESTA library in the JPL-extended version of this program.

In 2014-2015 Eric Ferguson, Andrew Hall and Jonathan Castello have developed the initial set of JPL extensions to Cosmographia, with the Europa Clipper and Cassini projects, and NASA's Advanced Multi-Mission Operations System (AMMOS), providing the funding.

Since 2016, under contract with NAIF, Chris Laurel of Fifth Star Labs LLC continues development of JPL extensions to Cosmographia using funding provided by the Planetary Data System.

The initial User's Guide and templates for preparing JSON files used to connect SPICE data to Cosmographia were prepared by JPL 2014-2015 summer students Michelle Park and Farhan Alam, with updates by Eric Ferguson, Boris Semenov, and Charles Acton of the NAIF Group at JPL. This User's Guide website was prepared by JPL 2015 summer student Michelle Park, with updates by Boris Semenov and Charles Acton of the NAIF Group at JPL.

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 Charles Acton's management, developed the SPICE system components used extensively within this version of Cosmographia. Boris Semenov is the current NAIF manager.

Development of Cosmographia occurs under the auspices of the Planetary Data System program, managed by NASA's Planetary Science Division.

Appendix 2: License and Disclaimer

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