

Examples of Tools Using and/or Producing SPICE Kernels\*  
(Tools not included in the SPICE Toolkit)

Tool Name	Acronym	Brief Abstract	Type	Developer	References	Usage Restrictions*	Contact
<b>Spacecraft Trajectory Design</b>							
Copernicus		Spacecraft trajectory design	Program	NASA/JSC	<a href="http://www.nasa.gov/centers/johnson/copernicus/index.html">http://www.nasa.gov/centers/johnson/copernicus/index.html</a>		Gerald Condon <gerald.j.condon@nasa.gov>
General Mission Analysis Tool	GMAT	Spacecraft trajectory design	Program	NASA/GSFC	<a href="http://gmats.gsfc.nasa.gov/">http://gmats.gsfc.nasa.gov/</a>		gmats@gsfc.nasa.gov
Optimal Trajectories by Implicit Simulation	OTIS	Spacecraft trajectory and vehicle design	Program	NASA/GRC	<a href="http://otis.grc.nasa.gov/index.html">http://otis.grc.nasa.gov/index.html</a>	Domestic use	robert.falck@nasa.gov
Mission Analysis and Simulation Tool in Fortran	MASTIF	6-DOF Simulation	Program	NASA/GRC		Restricted use	waldy.k.sjauw@nasa.gov
Spacecraft N-Body Analysis Program	SNAP	3-DOF trajectory propagator	Program	NASA/GRC		Restricted use	michael.c.martin@nasa.gov
Fast Spiral Trajectory Optimization Program	FASTOP	Low thrust spiral trajectory design	Program	NASA/GRC		Under Development	robert.falck@nasa.gov
Hybrid Trajectory Optimization Program	HYTOP	Low-thrust orbit transfer optimization	Program	Aerospace Corp.	none	Restricted use	David Garza <david.garza@aero.org>
Indirect Trajectory Optimization Program	ITOP	Low-thrust orbit transfer optimization	Program	Aerospace Corp.	none	Restricted use	David Garza <david.garza@aero.org>
Trajectory Optimization Program	TOP	Launch, reentry, and space vehicle trajectory optimization	Program	Aerospace Corp.	none	Restricted use	Gregory Fruth <gregory.fruth@aero.org>
<b>Natural Body Ephemeris Access</b>							
CALCEPH	CALCEPH	Access SPICE planetary ephemeris (SPK), binary PCK and allied frames, plus other ephemeris formats	Library	CNRS/IMCCE	<a href="http://www.imcce.fr/inpop/calceph/">http://www.imcce.fr/inpop/calceph/</a>	See reference website	inpop@imcce.fr
Ephemerides of Planets and Moon	EPH	Access SPICE planetary ephemeris (SPK), binary PCK and allied frames, plus other ephemeris formats	Library	Institute of Applied Astronomy (IAA)		Under development Not distributed	Dmitry Pavlov <dpavlov@ipa.nw.ru>
<b>Spacecraft Operations</b>							
Activity Plan Generator	APGEN	Enables mission and science planners to perform resource-driven planning that spans the range of high-level mission scenarios to detailed science activity plans	Program	NASA/JPL	<a href="http://www.researchgate.net/publication/3816487_JIT_planning_an_approach_to_autonomous_scheduling_for_spaceships">http://www.researchgate.net/publication/3816487_JIT_planning_an_approach_to_autonomous_scheduling_for_spaceships</a>		Pierre Madauge <pierre.f.madauge@jpl.nasa.gov>
Automated Scheduling and Planning Environment	ASPEN	A modular, reconfigurable application framework which is capable of supporting a wide variety of planning and scheduling applications	Program set	NASA/AMMOS	<a href="http://aspn.jpl.nasa.gov/">http://aspn.jpl.nasa.gov/</a>	Domestic licensing	Steve Chien <steve.chien@jpl.nasa.gov>
Science interface for robots	Maestro	A science-operations interface for robotic spacecraft and systems	Program	NASA/JPL	<a href="http://www-robotics.jpl.nasa.gov/facilities/facility.cfm?Facility=9">http://www-robotics.jpl.nasa.gov/facilities/facility.cfm?Facility=9</a>		Jeff Norris <jeffrey.s.norris@jpl.nasa.gov>
Sequence and Command Generation	SEQGEN	Expand science and engineering activities into their resultant spacecraft commands, model changes in spacecraft state based on commands in order to produce event predictions; model sequences expanded onboard the spacecraft and those expanded on the ground; indicate conflicts in the modeling of commands and violations of flight rules.	Program	NASA/AMMOS	<a href="http://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=1&amp;ved=0CF1QJAHQAQ&amp;url=http://34%2Farc.aiaa.org%2Fdoi%2F10.2514%2F6.2008-3481&amp;ei=8nYUlvast6-igLq0VCoDQ&amp;usq=AFQjCNH9nqCR1A0IHhYLp8Kgc7cndw">http://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=1&amp;ved=0CF1QJAHQAQ&amp;url=http://34%2Farc.aiaa.org%2Fdoi%2F10.2514%2F6.2008-3481&amp;ei=8nYUlvast6-igLq0VCoDQ&amp;usq=AFQjCNH9nqCR1A0IHhYLp8Kgc7cndw</a>		Benjamin Smith <benjamin.d.smith@jpl.nasa.gov>
Multi-mission Payload Programming System	MMPPS	Optimally schedules payload operations on all Indian Remote Sensing (IRS) satellites	Program	Indian Space Research Organization (ISRO)		Not distributed	Daniel Deva Arul
Saturn Particle Impact Risk Estimator	SPIRE	Dust hazard analysis tool	Program	NASA/JPL		Not distributed	David Seal <seal@jpl.nasa.gov>
Mars Science Laboratory Interface	MSLICE	Software ensures that mission scientists can work closely with both rover and instrument engineers to create a plan that will maximize scientific data and be safe for the rover to perform	Web-based tool	NASA/JPL and NASA/Ames	<a href="http://www.nasa.gov/centers/ames/research/msl_operations.html">http://www.nasa.gov/centers/ames/research/msl_operations.html</a>	Commercial licensing	<a href="http://www.techbriefs.com/component/content/article/5707">http://www.techbriefs.com/component/content/article/5707</a>
Spacecraft Attitude Visualization	TBALL	Spacecraft Attitude Visualization	Program	NASA/JPL	none	Not distributed	Steve Collins <steven.m.collins@jpl.nasa.gov>
Spacecraft Attitude Simulation	Slawtooth	Spacecraft Attitude Simulation	Program	NASA/JPL	none	Not distributed	Tony Vanelli <vanelli@jpl.nasa.gov>
Multi-mission Power Analysis Tool	MMPAT	Spacecraft power analysis system	Program	NASA/JPL	<a href="http://www.embeddedtechmag.com/component/content/article/9446">http://www.embeddedtechmag.com/component/content/article/9446</a>		Eric Wood <eric.g.wood@jpl.nasa.gov>
Telecom Forecaster & Predictor	TFP	Spacecraft telecommunications prediction and analysis	Program set	NASA/JPL	<a href="http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=878247&amp;userType=inst">http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=878247&amp;userType=inst</a>		Kar-Ming Cheung <kar-ming.cheung@jpl.nasa.gov>
Telecom Orbital Analysis and Simulation Tool	TOAST	Telecom analysis and simulation	Program	NASA/JPL		Not distributed	
Orbital Trajectory Inference Engine	OTIE	Automated generation of spacecraft trajectory and/or visibility files	Program	NASA/JPL		Not distributed	
DSN Service Preparation Subsystem	SPS	Deep Space Network scheduling and operational matrix predicts generation	Program set	NASA/JPL	<a href="http://spoweb.ftops.jpl.nasa.gov/portalsppos/ps/Main.do">http://spoweb.ftops.jpl.nasa.gov/portalsppos/ps/Main.do</a>		Mark Johnston <mark.d.johnston@jpl.nasa.gov>
DSN Delta-DOR Service	DOR	Plan and correlate Delta Differential One-way Range measurements used in spacecraft navigation	Program set	NASA/JPL	<a href="http://ipnpr.jpl.nasa.gov/progress_report/42-193/193D.pdf">http://ipnpr.jpl.nasa.gov/progress_report/42-193/193D.pdf</a>	Not distributed	James Border <james.s.border@jpl.nasa.gov>
Global Ionospheric Model Calibration Software	GIMCAL	Spacecraft line-of-sight ionosphere calibration	Program set	NASA/JPL			Thomas Runge <Thomas.Runge@jpl.nasa.gov>
<b>Science Observation Planning</b>							
C-kernel Viewer	CKVIEW	Instrument Pointing Profile Visualizer	Program	DLR/IPE	none	Limited to certain flight teams	Thomas Roatsch <thomas.roatsch@dlr.de>
Mars Express HRSC Science Opportunity Analyzer	MEXSOA	Planning for MEX HRSC observations	Program	DLR/IPE	none	Not distributed	
Java Mission Planning and Analysis for Remote Sensing	Asteroid	Science observation planning and data analysis	Program set	Mars Space Flight Facility, Arizona State University	<a href="http://mars.asu.edu/">http://mars.asu.edu/</a>		Saadat Anwar <saadat@mars.asu.edu>
SciBox	SciBox	A scientific planning software package for images and spectral observations		Applied Physics Lab	<a href="http://www.spacedaily.com/reports/Software_Enables_Efficient_Planning_of_MESSENGER_Observations_999.html">http://www.spacedaily.com/reports/Software_Enables_Efficient_Planning_of_MESSENGER_Observations_999.html</a>		Teck Choo <teck.choo@jhuapl.edu>
Science Opportunity Analyzer	SOA	Science observation design tool	Program	NASA/JPL	<a href="http://descanso.jpl.nasa.gov/RCGSO/Paper/A0063Paper.pdf">http://descanso.jpl.nasa.gov/RCGSO/Paper/A0063Paper.pdf</a>		Barbara Streiffert <barbara.a.streiffert@jpl.nasa.gov>
Dave's Event Program	DEP	Mission event calculator	Program			Not distributed	David Seal <seal@jpl.nasa.gov>
Solar System Science Operations Laboratory	SOLAB	Software for computation, visualization and analysis of scientific observation opportunities, focusing on the geometrical requirements	Program	ESA/ESAC	<a href="http://www.academia.edu/2500875/The_Solar_System_Science_Operations_Laboratory_A_science_opportunity_analysis_tool_for_MarsrcPolo-R">http://www.academia.edu/2500875/The_Solar_System_Science_Operations_Laboratory_A_science_opportunity_analysis_tool_for_MarsrcPolo-R</a>	Under development	Marc Costa <marc.costa@sciops.esa.int>
Rosetta Science Planning and Scheduling Subsystem	RSGS	Integrated suite of tools focused on science observation planning	Program set	ESA/ESAC	none	Not distributed	
Committee on Earth Observation Satellites Visualization Environment	COVE	Acquisition planning, coverage assessment, coincidence scene observation, and archive data search tool for earth observing satellites from around the world	Web-based tool	Analytical Mechanics/CEOS SEO/NASA/LaRC	<a href="http://www.ceos-cove.org">http://www.ceos-cove.org</a>		Brian Killough <brian.d.killough@nasa.gov>
<b>Science Data Analysis</b>							
Analysts' Notebook		Notebook combines sequence information, engineering and science data, and documentation into standard web-accessible pages to provide mission "replay".	Web-based tool	NASA/PDS/Geosciences Node (Wash. U.)	<a href="http://an.rsl.wustl.edu/">http://an.rsl.wustl.edu/</a>	Not distributed	Tom Stein <stein@wunder.wustl.edu>
Orbital Data Explorer	ODE	Data search, display and download Suite of tools for the orthorectification and cartographic and scientific analysis of images from over 50 NASA and international instruments.	Web-based tool	NASA/PDS/Geosciences Node (Washington U.)	<a href="http://ode.rsl.wustl.edu/mars/">http://ode.rsl.wustl.edu/mars/</a>		odewebmaster@wunder.wustl.edu
Integrated Software for Imagers and Spectrometers	ISIS	Database of SPICE-corrected positional information about planetary image data computed using a uniform coordinate system and projection onto a common planetary surface shape.	Program set	USGS/Astrogeology Science Center	<a href="http://isis.astrogeology.usgs.gov/">http://isis.astrogeology.usgs.gov/</a>		Stuart Sides <ssides@usgs.gov>
Unified Planetary Coordinate	UPC	SPICE-corrected UPC-derived image locations and search capabilities using a navigable map, user-selectable image constraints (e.g., incidence angle, solar longitude, pixel resolution and phase angle), and facilitates bulk downloads and/or image processing using POW	Database	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/ps2009/pdf/2002.pdf">http://www.lpi.usra.edu/meetings/ps2009/pdf/2002.pdf</a>		Lisa Gaddis <lgaddis@usgs.gov>
Planetary Image Locator Tool	PILOT	Creates science-ready map projected images from raw Planetary Data System images.	Web-based tool	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/ps2013/pdf/2246.pdf">http://www.lpi.usra.edu/meetings/ps2013/pdf/2246.pdf</a>		Mark Bailen <mbailen@usgs.gov>
Map Projection on the Web	POW	3D visualization of position and orientation of spacecrafts, planetary ephemerides, as well as scientific data representation. (Emphasis on space physics.)	Web-based tool	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/ps2013/pdf/2068.pdf">http://www.lpi.usra.edu/meetings/ps2013/pdf/2068.pdf</a>		Trent Hare <thare@usgs.gov>
3D View		Visualisation and analysis of space physics data, from observational or model origins	Java applet	Centre de Données de Physique des Plasmas (CDPP)	<a href="http://3dview.cesr.fr/">http://3dview.cesr.fr/</a>		vincent.genot@irap.omp.eu
Automated Multi-Dataset Analysis	AMDA	Tool to generate a diagram showing the appearance of a planetary system at a specified time. Bodies and rings are rendered with terminators and shadows as appropriate.	Web-based tool	Centre de Données de Physique des Plasmas (CDPP)	<a href="http://cdpp.eu/AMDA">http://cdpp.eu/AMDA</a>	Registration required	vincent.genot@irap.omp.eu
Planet Viewers		Generate a diagram showing the apparent east-west motion of one or moons relative to the disk of a planet	Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed	Mark Showalter <mshowalter@seti.org>
Moon Trackers			Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed	Mark Showalter <mshowalter@seti.org>

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Tool Name	Acronym	Brief Abstract	Type	Developer	References	Usage Restrictions*	Contact
Ephemeris Generators		Generate a table listing useful information about the viewing geometry for a planet and/or any of its moons as a function of time	Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed	Mark Showalter <mshowalter@seti.org>
WWW Information Processing Environment	WIPE	A network-centric geospatial data processing, management and analysis server		Applied Coherent Technology Corp.	<a href="http://www.actgate.com/home/wipe.htm">http://www.actgate.com/home/wipe.htm</a>	Commercial product	Erick Malaret <malaret@actgate.com>
Small Bodies Image Browser		Graphically search through a large number of images quickly (currently just DAWN/Vesta)	Web-based tool	NASA/PDS/Small Bodies Node	<a href="http://sblb.psi.edu/">http://sblb.psi.edu/</a>		Eric Palmer <epalmer@psi.edu>
<b>Geometry Visualization</b>							
NAIF-extended Cosmographia	Cosmographia	Space simulation software	Program	NAIF-enhanced version of Chris Laurel's original	<a href="http://naif.jpl.nasa.gov/naif/cosmographia.html">http://naif.jpl.nasa.gov/naif/cosmographia.html</a>	Binaries provided by NAIF. Open source code eventually provided by Chris Laurel (see below).	Charles Acton <charles.h.acton@jpl.nasa.gov>
Cosmographia	Cosmographia	Space simulation software	Program	Open Source	<a href="https://github.com/clarel/cosmographia">https://github.com/clarel/cosmographia</a> <a href="https://code.google.com/p/cosmographia/">https://code.google.com/p/cosmographia/</a>		Chris Laurel <clarel@gmail.com>
SpaceTraveller™	SpaceTraveller™	Space simulation software	Program (32,64-bit)	BINARY SPACE	<a href="http://www.binary-space.com/products.html">http://www.binary-space.com/products.html</a>	Windows® 7 or higher; USD 22	Adrian Wenz <adrian.wenz@binary-space.com>
Celestia	Celestia	Space simulation software	Program	Open Source	<a href="http://www.shatters.net/celestia/">http://www.shatters.net/celestia/</a>		Chris Laurel <clarel@gmail.com>
Eyes on the Solar System		Space simulation software	Web-based tool	NASA/JPL	<a href="http://eyes.nasa.gov/">http://eyes.nasa.gov/</a>		Kevin Hussey <kevin.j.hussey@jpl.nasa.gov>
Rosetta Visualization Subsystem	ROVIZ	Rosetta orbit visualization (and more)	Program set	ESA/ESAC	<a href="http://comsim.esac.esa.int/rossim/bgrieger/DR/slides.pdf">http://comsim.esac.esa.int/rossim/bgrieger/DR/slides.pdf</a>	Under development	Bjoern Grieger <bgrieger@sciops.esa.int>
Solar System Visualization Project		Space simulation software	Program	NASA/JPL		Not distributed	Eric De Jong <eric.m.dejong@jpl.nasa.gov>
Solar System Simulator		Space simulation software	Web-based tool	NASA/JPL	<a href="http://space.jpl.nasa.gov/">http://space.jpl.nasa.gov/</a>		David Seal <seal@jpl.nasa.gov>
Dave's Interactive Geometry & Information Tool	DIGIT	Space simulation software	Program	NASA/JPL		Not distributed	David Seal <seal@jpl.nasa.gov>
Field of View Visualizer	FLOW	Instrument FOV visualizer	Program	JAXA	<a href="http://darts.jaxa.jp/planet/tools/flow/">http://darts.jaxa.jp/planet/tools/flow/</a>		Yukio Yamamoto <yukio@planeta.sci.isas.jaxa.jp>
Luna-Glob Orbit Visualization	LGOV	Spacecraft orbit visualization	Program	Russian Academy of Sciences/Space Research Institute	<a href="http://193.232.10.221/lgov/">http://193.232.10.221/lgov/</a>		aabbakumov@romance.iki.rssi.ru
Fast 3D Scenario Maker		Creates the necessary files and the kernel for Celestia to quickly get 3d animation for presentations	Program	Dauria Aerospace		Under development	Alexander Yanin <yani@dauria.ru>
<b>Multi- or Special Function</b>							
General time conversion tool	Chronos	Offers a wide assortment of time conversions	Web-based tool	NASA/JPL (NAIF)	<a href="http://naif.jpl.nasa.gov/cgi-bin/chronos.pl?setup=chronos">http://naif.jpl.nasa.gov/cgi-bin/chronos.pl?setup=chronos</a>		Charles Acton <charles.h.acton@jpl.nasa.gov>
Ephemeris generator for natural bodies	Horizons	Ephemeris generation and allied geometry computations	Internet-based tool	NASA/JPL	<a href="http://ssd.jpl.nasa.gov/horizons">http://ssd.jpl.nasa.gov/horizons</a>		Jon Giorgini <Jon.D.Giorgini@jpl.nasa.gov>
WebGeocalc	WebGeocalc	GUI interface to many SPICE computations	Web-based tool	NASA/JPL (NAIF) and NASA/AMES	<a href="http://wgc.jpl.nasa.gov:8080/webgeocalc">http://wgc.jpl.nasa.gov:8080/webgeocalc</a>	Under development	Charles Acton <charles.h.acton@jpl.nasa.gov>
Satellite Orbit Analysis Program	SOAP	Trajectory design and analysis		Aerospace Corp.	<a href="http://eeexplore.ieee.org/stamp/stamp.jsp?arnumber=00468892">http://eeexplore.ieee.org/stamp/stamp.jsp?arnumber=00468892</a>	Restricted use	Jon Giorgini <Jon.D.Giorgini@jpl.nasa.gov>
System Tool Kit (formerly Satellite Tool Kit)	STK	Large suite of mission design and analysis tools Over two thousand functions are provided for attitude and orbit dynamics, simulation, analysis and design.	Program set	Analytical Graphics Inc. Princeton Satellite Systems, Inc.	<a href="https://www.agi.com/products/by-product-type/applications/stk/Default.aspx">https://www.agi.com/products/by-product-type/applications/stk/Default.aspx</a>	Commercial product	Vince Coppola <vcoppola@agi.com>
Spacecraft Control Toolbox		This simulation package for VisualCommander enables you to simulate spacecraft control systems including sensors and actuators, attitude and orbit dynamics, and provides a library for control and estimation software.	C++ library	Princeton Satellite Systems, Inc.	<a href="http://www.psatellite.com/sct/index.php">http://www.psatellite.com/sct/index.php</a>	Commercial product	info@psatellite.com
Spacecraft Package for DSIM					<a href="http://www.psatellite.com/ControlSystems/spacecraftpkg.php">http://www.psatellite.com/ControlSystems/spacecraftpkg.php</a>	Commercial product	info@psatellite.com
Free Flyer	Free Flyer	Mission planning and analysis	Program	A. I. Solutions	<a href="http://www.ai-solutions.com/ProductsServices/FreeFlyer/Overview.aspx">http://www.ai-solutions.com/ProductsServices/FreeFlyer/Overview.aspx</a>	Commercial product	<a href="http://www.ai-solutions.com/ContactUs.aspx">http://www.ai-solutions.com/ContactUs.aspx</a>
Geometry Library for PSA Archives	GEOLIB	Generates a variety of observation geometry parameters recommended for inclusion in ESA/PSA science instrument archives	Library	ESA/ESAC	<a href="ftp://jso001.esac.esa.int/pub/software/GEOLIB/">ftp://jso001.esac.esa.int/pub/software/GEOLIB/</a>		Jose Luis Vazquez-Garcia <jlvazquez@sciops.esa.int>
Lunar Mapping and Modeling Portal	LMMP	Lunar mission tools	Web-based tool	NASA, U.S. Army, U.S.G.S.	<a href="http://pub.lmmp.nasa.gov">http://pub.lmmp.nasa.gov</a>		Shan Malhotra <shantanu.malhotra@jpl.nasa.gov>
Flight Algorithm Simulation for Human Exploration	Flache	Orion GN&C Flight algorithm simulator	Program	NASA/JSC, NASA/GRC		Not distributed	erin.eldridge@jacobs.com, zoran.milenkovic-1@nasa.gov
HWCNTRL	HWCNTRL	Control a spacecraft ground system	Program	DeWitt & Associates LLC w/ NASA/Wallops	<a href="http://www.dewitt-assoc.com/spacecraft.html">http://www.dewitt-assoc.com/spacecraft.html</a>	Restricted use	Henry DeWitt <hdewitt@dewitt-assoc.com>
<b>Radio Science Tools</b>							
events		calculates DSN view periods and spacecraft occultation times	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
Imbrkr		calculates bending angles for radio science occultation observations	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
postllr		creates Doppler files for radio science observations	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
bistat		calculates Doppler files for radio science bistatic scattering experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
predicts		calculates Doppler frequency predictions for radio science experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
LGA2		Calculates spacecraft low-gain antenna pointing angles for planning radio science experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
px6point		Calculates pointing angles for Advanced Water Vapor Radiometer	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
resid		Calculates Residual Frequency based on Reconstructed Ephemeris for Radio Science experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
atmosphere_mars		Calculates atmospheric profiles based on Radio Science data	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
atmosphere_venus		Calculates atmospheric profiles based on Radio Science data	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
point		Calculates DSN elevation and azimuth angles for planning of Radio Science experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
SEPAngleCL		Calculates Sun-Earth-Probe angle for planning of Radio Science Solar Conjunction Experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
occult		Generates a variety of observation geometry parameters for planning or analysis of Radio Science experiments	Program	NASA/JPL	none	Restricted use	Asmar, Sami <sami.w.asmar@jpl.nasa.gov>
STEER Coefficient Maker	SCM	Calculates tuning adjustment required to move a radio science open loop receiver signal to the center of its frequency window. Requires customized SPK reader for maximum precision.	Program	Stanford U.	none	Not Distributed	Dick Simpson <rsimpson@stanford.edu>
Radio Science Geometry Calculation	BSRGEOM	Calculates geometry for radio science observation(s). Can be used for planning or analysis.	Program set	Stanford U.	none	Not Distributed	Dick Simpson <rsimpson@stanford.edu>
Radio Science Simulator	RSS	Orbit simulator about planetary bodies	software package	UniBw Munich	none	not distributed	Tom Andert <tom.andert@unibw-muenchen.de>
Frequency Predictor		Prediction of received carrier frequency of interplanetary spacecraft: Level-2: calibrated received carrier frequency, frequency residuals & differential Doppler -> public archive product! Level-3: occultation plane, bending angle, refractivity of planetary atmospheres	software package	UniBw Munich	none	not distributed	Tom Andert <tom.andert@unibw-muenchen.de>
Radio Science Data Analysis		MEX, VEX occultation predictor; Rosetta BSR and gravity investigation planner; geometry calculator: solar zenith angle, surface coordinates of occultation point; spacecraft antenna mispointing; radio signal defocussing loss etc....	software package	RIU-PF, Cologne University	none	Not distributed	Martin Pätzold <martin.paetzold@uni-koeln.de>
Misc. for daily routine use			software	RIU-PF, Cologne University	none	Not distributed	Martin Pätzold <martin.paetzold@uni-koeln.de>
<b>A few of the many other instrument tools</b>							
assorted tools		planning, commanding and data processing	Program set	MARSIS Ops Center, ASI/INAF	none	Not distributed	
assorted tools		planning, commanding and data processing	Program set	SHARAD Ops Center, ASI/INAF	none	Not distributed	Fabrizio Bernardini <fabrizio.bernardini@iaps.inaf.it>
assorted tools		planning, commanding and data processing	Program set	Co-Sharps SHARAD Processing System, SWRI	none	Not distributed	Fabrizio Bernardini <fabrizio@boulder.swri.edu>

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\*NAIF has not tested and does not endorse any of the tools in this listing other than those marked as developed by NAIF.

## Examples of Tools

(Tools not)

Tool Name	Acronym	Brief Abstract
<b><i>Spacecraft Trajectory Design</i></b>		
Copernicus		Spacecraft trajectory design
General Mission Analysis Tool	GMAT	Spacecraft trajectory design
Optimal Trajectories by Implicit Simulation	OTIS	Spacecraft trajectory and vehicle design
Mission Analysis and Simulation Tool in Fortran	MASTIF	6-DOF Simulation
Spacecraft N-Body Analysis Program	SNAP	3-DOF trajectory propagator
Fast Spiral Trajectory Optimization Program	FastSTOP	Low thrust spiral trajectory design
Hybrid Trajectory Optimization Program	HYTOP	Low-thrust orbit transfer optimization
Indirect Trajectory Optimization Program	ITOP	Low-thrust orbit transfer optimization
Trajectory Optimization Program	TOP	Launch, reentry, and space vehicle trajectory optimization
<b><i>Natural Body Ephemeris Access</i></b>		
CALCEPH	CALCEPH	Access SPICE planetary ephemeris (SPK), binary PCK and allied frames, plus other ephemeris formats
Ephemerides of Planets and Moon	EPM	Access SPICE planetary ephemeris (SPK), binary PCK and allied frames, plus other ephemeris formats
<b><i>Spacecraft Operations</i></b>		
Activity Plan Generator	APGEN	Enables mission and science planners to perform resource-driven planning that spans the range of high-level mission scenarios to detailed science activity plans
Automated Scheduling and Planning Environment	ASPEN	A modular, reconfigurable application framework which is capable of supporting a wide variety of planning and scheduling applications
Science interface for robots	Maestro	A science-operations interface for robotic spacecraft and systems
Sequence and Command Generation	SEQGEN	Expand a series of science and engineering activities into their resultant spacecraft commands; model changes in spacecraft state based on commands in order to produce event predictions; model sequences expanded onboard the spacecraft and those expanded on the ground, and indicate conflicts in the modeling of commands and violations of flight rules.
Multi-mission Payload Programming System	MMPPS	Optimally schedules payload operations on all Indian Remote Sensing (IRS) satellites
Saturn Particle Impact Risk Estimator	SPIRE	Dust hazard analysis tool

Tool Name	Acronym	Brief Abstract
Mars Science Laboratory Interface	MSLICE	Software ensures that mission scientists can work closely with both rover and instrument engineers to create a plan that will maximize scientific data and be safe for the rover to perform
Spacecraft Attitude Visualization	TBALL	Spacecraft Attitude Visualization
Spacecraft Attitude Simulation	Sleewtooth	Spacecraft Attitude Simulation
Multi-mission Power Analysis Tool	MMPAT	Spacecraft power analysis system
Telecom Forecaster & Predictor	TFP	Spacecraft telecommunications prediction and analysis
Telecom Orbital Analysis and Simulation Tool	TOAST	Telecom analysis and simulation
Orbital Trajectory Inference Engine	OTIE	Automated generation of spacecraft trajectory and/or visibility files
DSN Service Preparation Subsystem	SPS	Deep Space Network scheduling and operational metric predicts generation
DSN Delta-DOR Service	DOR	Plan and correlate Delta Differential One-way Range measurements used in spacecraft navigation
Global Ionospheric Model Calibration Software	GIMCAL	Spacecraft line-of-sight ionosphere calibration
DARTS Shell	DARTS/Dshell	Spacecraft dynamics simulator
<b><i>Science Observation Planning</i></b>		
C-kernel Viewer	CKVIEW	Instrument Pointing Profile Visualizer
Mars Express HRSC Science Opportunity Analyzer	MEXSOA	Planning for MEX HRSC observations
Java Mission Planning and Analysis for Remote Sensing	JMARS, MTT, J-Moon, J-Vesta, J-Asteroid	Science observation planning and data analysis
SciBox	SciBox	A scientific planning software package for images and spectral observations
Science Opportunity Analyzer	SOA	Science observation design tool
Dave's Event Program	DEP	Mission event calculator
Solar System Science Operations Laboratory	SOLAB	Software for computation, visualization and analysis of scientific observation opportunities, focusing on the geometrical requirements
Rosetta Science Planning and Scheduling Subsystem	RSGS	Integrated suite of tools focused on science observation planning
Committee on Earth Observation Satellites Visualization Environment	COVE	Acquisition planning, coverage assessment, coincidence scene observation, and archive data search tool for earth observing satellites from around the world

Tool Name	Acronym	Brief Abstract
<b><i>Science Data Analysis</i></b>		
Analysts' Notebook		Notebook combines sequence information, engineering and science data, and documentation into standard web-accessible pages to provide mission "replay".
Orbital Data Explorer	ODE	Data search, display and download
Integrated Software for Imagers and Spectrometers	ISIS	Suite of tools for the orthorectification and cartographic and scientific analysis of images from over 50 NASA and international instruments.
Unified Planetary Coordinate	UPC	Database of SPICE-corrected positional information about planetary image data computed using a uniform coordinate system and projection onto a common planetary surface shape.
Planetary Image Locator Tool	PILOT	SPICE-corrected UPC-derived image locations and search capabilities using a navigable map, user selectable image constraints (e.g., incidence angle, solar longitude, pixel resolution and phase angle), and facilitates bulk downloads and/or image processing using POW
Map Projection on the Web	POW	Creates science-ready map projected images from raw Planetary Data System images.
3D View		3D visualization of position and orientation of spacecrafts, planetary ephemerides, as well as scientific data representation. (Emphasis on space physics.)
Automated Multi-Dataset Analysis	AMDA	Visualisation and analysis of space physics data, from observational or model origins
Planet Viewers		Tool to generate a diagram showing the appearance of a planetary system at a specified time. Bodies and rings are rendered with terminators and shadows as appropriate.
Moon Trackers		Generate a diagram showing the apparent east-west motion of one or moons relative to the disk of a planet
Ephemeris Generators		Generate a table listing useful information about the viewing geometry for a planet and/or any of its moons as a function of time
WWW Information Processing Environment	WIPE	A network-centric geospatial data processing, management and analysis server
Small Bodies Image Browser		Graphically search through a large number of images quickly (currently just DAWN/Vesta)
STEER Coefficient Maker	SCM	Calculates tuning adjustment required to move a radio science open loop receiver signal to the center of its frequency window. Requires customized SPK reader for maximum precision.
Radio Science Geometry Calculation	BSRGEOM	Calculates geometry for radio science observation(s). Can be used for planning or analysis.
Radio Science Simulator	RSS	Orbit simulator about planetary bodies

Tool Name	Acronym	Brief Abstract
Frequency Predictor		Prediction of received carrier frequency of interplanetary spacecraft
Radio Science Data Analysis		Level-2: calibrated received carrier frequency, frequency residuals & differential Doppler -- public archive product! Level-3: occultation plane, bending angle, refractivity of planetary atmospheres
Misc. for daily routine use		MEX, VEX occultation predictor; Rosetta BSR and gravity investigation planner; geometry calculator: solar zenith angle, surface coordinates of occultation point; spacecraft antenna mispointing; radio signal defocussing loss etc....
<b><i>Geometry Visualization</i></b>		
Celestia	Celestia	Space simulation software
Eyes on the Solar System		Space simulation software
Rosetta Visualization Subsystem	ROVIZ	Rosetta orbit visualization (and more)
Solar System Visualization Project		Space simulation software
Solar System Simulator		Space simulation software
Dave's Interactive Geometry & Information Tool	DIGIT	Space simulation software
Field of View Visualizer	FLOW	Instrument FOV visualizer
Luna-Glob Orbit Visualization	LGOV	Spacecraft orbit visualization
Fast 3D Scenario Maker		Creates the necessary files and the kernel for Celestia to quickly get 3d animation for presentations

Tool Name	Acronym	Brief Abstract
<b><i>Multi- or Special Function</i></b>		
Ephemeris generator for natural bodies	Horizons	Ephemeris generation and allied geometry computations
WebGeocalc	WebGeocalc	GUI interface to many SPICE computations
Satellite Orbit Analysis Program	SOAP	Trajectory design and analysis
System Tool Kit (formerly Satellite Tool Kit)	STK	Large suite of mission design and analysis tools
Spacecraft Control Toolbox		Over two thousand functions are provided for attitude and orbit dynamics, simulation, analysis and design.
Spacecraft Package for DSim		This simulation package for VisualCommander enables you to simulate spacecraft control systems including sensors and actuators, attitude and orbit dynamics, and provides a library for control and estimation software.
Free Flyer	Free Flyer	Mission planning and analysis
Geometry Library for PSA Archives	GEOLIB	Generates a variety of observation geometry parameters recommended for inclusion in ESA/PSA science instrument archives
Lunar Mapping and Modeling Portal	LMMP	Lunar mission tools
Flight Algorithm Simulation for Human Exploration	Flashe	Orion GN&C Flight algorithm simulator
HWCNTRL	HWCNTRL	Control a spacecraft ground system
<b><i>Radio Science Tools</i></b>		
events		calculates DSN view periods and spacecraft occultation times
lmbtrk		calculates bending angles for radio science occultation observations
postlb		creates Doppler files for radio science observations
bistat		calculates Doppler files for radio science bistatic scattering experiments
predicts		calculates Doppler frequency predictions for radio science experiments
LGA2		Calculates spacecraft low-gain antenna pointing angles for planning radio science experiments
px6point		Calculates pointing angles for Advanced Water Vapor Radiometer

Tool Name	Acronym	Brief Abstract
resid		Calculates Residual Frequency based on Reconstructed Ephemeris for Radio Science experiments
atmosphere_mars		Calculates atmospheric profiles based on Radio Science data
atmosphere_venus		Calculates atmospheric profiles based on Radio Science data
point		Calculates DSN elevation and azimuth angles for planning of Radio Science experiments
SEPangleCL		Calculates Sun-Earth-Probe angle for planning of Radio Science Solar Conjunction Experiments
occult		Generates a variety of observation geometry parameters for planning or analysis of Radio Science experiments
STEER Coefficient Maker	SCM	Calculates tuning adjustment required to move a radio science open loop receiver signal to the center of its frequency window. Requires customized SPK reader for maximum precision.
Radio Science Geometry Calculation	BSRGEOM	Calculates geometry for radio science observation(s). Can be used for planning or analysis.
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Tool Name	Acronym	Brief Abstract
<i>A few of the many other instrument tools</i>		
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## Using and/or Producing SPICE Kernels<sup>+</sup>

t included in the SPICE Toolkit)

Type	Developer	References	Restrictions*
Program	NASA/JSC	<a href="http://www.nasa.gov/centers/johnson/copernicus/index.html">http://www.nasa.gov/centers/johnson/copernicus/index.html</a>	
Program	NASA/GSFC	<a href="http://gmat.gsfc.nasa.gov/">http://gmat.gsfc.nasa.gov/</a>	
Program	NASA/GRC	<a href="http://otis.grc.nasa.gov/index.html">http://otis.grc.nasa.gov/index.html</a>	Domestic use
Program	NASA/GRC		Restricted use
Program	NASA/GRC		Restricted use
Program	NASA/GRC		Under Development
Program	Aerospace Corp.	none	Restricted use
Program	Aerospace Corp.	none	Restricted use
Program	Aerospace Corp.	none	Restricted use
Library	CNRS/IMCCE	<a href="http://www.imcce.fr/inpop/calceph/">http://www.imcce.fr/inpop/calceph/</a>	See reference website
Library	Institute of Applied Astronomy (IAA)		Under development Not distributed
Program	NASA/JPL	<a href="http://www.researchgate.net/publication/3816487_JIT_planning_an_approach_to_autonomous_scheduling_for_spacemissions">http://www.researchgate.net/publication/3816487_JIT_planning_an_approach_to_autonomous_scheduling_for_spacemissions</a>	
Program set	NASA/AMMOS	<a href="http://aspen.jpl.nasa.gov/">http://aspen.jpl.nasa.gov/</a>	Domestic licensing
Program	NASA/JPL	<a href="http://www-robotics.jpl.nasa.gov/facilities/facility.cfm?Facility=9">http://www-robotics.jpl.nasa.gov/facilities/facility.cfm?Facility=9</a>	
Program	NASA/AMMOS	<a href="http://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=18&amp;ved=0CFIQFjAHOAo&amp;url=http%3A%2F%2Farc.aiaa.org%2Fdoi%2Fpdfplus%2F10.2514%2F6.2008-3481&amp;ei=BnYBUvasl6S-igLg0YCoDQ&amp;usg=AFQjCNH9nqqCR1A0NIhYiLpBK Cgc7cmdvw">http://www.google.com/url?sa=t&amp;rct=j&amp;q=&amp;esrc=s&amp;source=web&amp;cd=18&amp;ved=0CFIQFjAHOAo&amp;url=http%3A%2F%2Farc.aiaa.org%2Fdoi%2Fpdfplus%2F10.2514%2F6.2008-3481&amp;ei=BnYBUvasl6S-igLg0YCoDQ&amp;usg=AFQjCNH9nqqCR1A0NIhYiLpBK Cgc7cmdvw</a>	
Program	Indian Space Research Organization (ISRO)		Not distributed
Program	NASA/JPL		Not distributed

Type	Developer	References	Restrictions*
Web-based tool	NASA/JPL and NASA/Ames	<a href="http://www.nasa.gov/centers/ames/research/msl_operations.html">http://www.nasa.gov/centers/ames/research/msl_operations.html</a>	Commercial licensing
Program	NASA/JPL	none	Not distributed
Program	NASA/JPL	none	Not distributed
Program	NASA/JPL	<a href="http://www.embeddedtechmag.com/component/content/article/9446">http://www.embeddedtechmag.com/component/content/article/9446</a>	
Program set	NASA/JPL	<a href="http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=878247&amp;userType=inst">http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&amp;arnumber=878247&amp;userType=inst</a>	
Program	NASA/JPL		Not distributed
Program	NASA/JPL		Not distributed
Program set	NASA/JPL	<a href="http://spsweb.fltops.jpl.nasa.gov/portalappsops/Main.do">http://spsweb.fltops.jpl.nasa.gov/portalappsops/Main.do</a>	
Program set	NASA/JPL	<a href="http://ipnpr.jpl.nasa.gov/progress_report/42-193/193D.pdf">http://ipnpr.jpl.nasa.gov/progress_report/42-193/193D.pdf</a>	Not distributed
Program set	NASA/JPL		
Program set	NASA/JPL	<a href="http://dshell.jpl.nasa.gov/">http://dshell.jpl.nasa.gov/</a>	Discuss with management
Program	DLR/IPE	none	Limited to certain flight teams
Program	DLR/IPE	none	Not distributed
Program set	Mars Space Flight Facility, Arizona State University	<a href="http://jmars.asu.edu/">http://jmars.asu.edu/</a>	
	Applied Physics Lab	<a href="http://www.spacedaily.com/reports/Software_Enables_Efficient_Planning_of_MESSENGER_Observations_999.html">http://www.spacedaily.com/reports/Software_Enables_Efficient_Planning_of_MESSENGER_Observations_999.html</a>	
Program	NASA/JPL	<a href="http://descanso.jpl.nasa.gov/RCSGSO/Paper/A0063Paper.pdf">http://descanso.jpl.nasa.gov/RCSGSO/Paper/A0063Paper.pdf</a>	
Program			Not distributed
Program	ESA/ESAC	<a href="http://www.academia.edu/2500875/The_Solar_System_Science_Operations_Laboratory_A_science_opportunity_analysis_tool_for_MarcoPolo-R">http://www.academia.edu/2500875/The_Solar_System_Science_Operations_Laboratory_A_science_opportunity_analysis_tool_for_MarcoPolo-R</a>	Under development
Program set	ESA/ESAC	none	Under development Not distributed
Web-based tool	Analytical Mechanics/CEOS SEO/NASA/LaRC	<a href="http://www.ceos-cove.org">http://www.ceos-cove.org</a>	

Type	Developer	References	Restrictions*
Web-based tool	NASA/PDS/Geosciences Node (Wash. U.)	<a href="http://an.rsl.wustl.edu/">http://an.rsl.wustl.edu/</a>	Not distributed
Web-based tool	NASA/PDS/Geosciences Node (Washington U.)	<a href="http://ode.rsl.wustl.edu/mars/">http://ode.rsl.wustl.edu/mars/</a>	
Program set	USGS/Astrogeology Science Center	<a href="http://isis.astrogeology.usgs.gov/">http://isis.astrogeology.usgs.gov/</a>	
Database	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/lpsc2009/pdf/2002.pdf">http://www.lpi.usra.edu/meetings/lpsc2009/pdf/2002.pdf</a>	
Web-based tool	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2246.pdf">http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2246.pdf</a>	
Web-based tool	USGS/Astrogeology Science Center	<a href="http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2068.pdf">http://www.lpi.usra.edu/meetings/lpsc2013/pdf/2068.pdf</a>	
Java applet	Centre de Données de Physique des Plasmas (CDPP)	<a href="http://3dview.cesr.fr/">http://3dview.cesr.fr/</a>	
Web-based tool	Centre de Données de Physique des Plasmas (CDPP)	<a href="http://cdpp.eu/AMDA">http://cdpp.eu/AMDA</a>	Registration required
Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed
Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed
Web-based tool	NASA/PDS/Rings Node (SETI Institute)	<a href="http://pds-rings.seti.org/tools/">http://pds-rings.seti.org/tools/</a>	Not distributed
	Applied Coherent Technology Corp.	<a href="http://www.actgate.com/home/wipe.htm">http://www.actgate.com/home/wipe.htm</a>	Commercial product
Web-based tool	NASA/PDS/Small Bodies Node	<a href="http://sbib.psi.edu/">http://sbib.psi.edu/</a>	
Program	Stanford U.	none	Not Distributed
Program set	Stanford U.	none	Not Distributed
software package	UniBw Munich	none	not distributed

Type	Developer	References	Restrictions*
software package	UniBw Munich	none	not distributed
software package	RIU-PF, Cologne University	none	Not distributed
software	RIU-PF, Cologne University	none	Not distributed
Program	Open Source	<a href="http://www.shatters.net/celestia/">http://www.shatters.net/celestia/</a>	
Web-based tool	NASA/JPL	<a href="http://eyes.nasa.gov/">http://eyes.nasa.gov/</a>	
Program set	ESA/ESAC	<a href="http://comsim.esac.esa.int/rossim/bgrieger/CDR/slides.pdf">http://comsim.esac.esa.int/rossim/bgrieger/CDR/slides.pdf</a>	Under development Not distributed
	NASA/JPL		
Web-based tool	NASA/JPL	<a href="http://space.jpl.nasa.gov/">http://space.jpl.nasa.gov/</a>	
Program	NASA/JPL		Not distributed
Program	JAXA	<a href="http://darts.jaxa.jp/planet/tools/flow/">http://darts.jaxa.jp/planet/tools/flow/</a>	
Program	Russian Academy of Sciences/Space Research Institute	<a href="http://193.232.10.221/lgov/">http://193.232.10.221/lgov/</a>	
Program	Dauria Aerospace		Under development



Type	Developer	References	Restrictions*
Program	NASA/JPL	none	Restricted use
Program	NASA/JPL	none	Restricted use
Program	NASA/JPL	none	Restricted use
Program	NASA/JPL	none	Restricted use
Program	NASA/JPL	none	Restricted use
Program	NASA/JPL	none	Restricted use
Program	Stanford U.	none	Not Distributed
Program set	Stanford U.	none	Not Distributed
software package	UniBw Munich	none	not distributed
software package	UniBw Munich	none	not distributed
software package	RIU-PF, Cologne University	none	Not distributed
software	RIU-PF, Cologne University	none	Not distributed

Type	Developer	References	Restrictions*
Program set	MARSIS Ops Center, ASI/INAF	none	Not distributed
Program set	SHARAD Ops Center, ASI/INAF	none	Not distributed
Program set	Co-Sharps SHARAD Processing System, SWRI	none	Not distributed

apply for some U.S. tools.

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