**Extending NASA's SPICE Ancillary Information System to Meet Future Mission Needs.** C. Acton, N. Bachman, L. Elson, B. Semenov, F. Turner, E. Wright; Caltech/Jet Propulsion Laboratory

NASA's SPICE system is used as the mechanism for capturing, archiving and disseminating a variety of ancillary information needed by scientists involved in observation planning, science data analysis, and correlation of data across instruments and missions. Key components of SPICE ancillary data are spacecraft trajectory, target body ephemeris, target size/shape/orientation, spacecraft orientation, reference frame specifications, instrument mounting and field-of-view geometry, and commands and events associated with the conduct of a mission.

SPICE is the de facto ancillary data standard for essentially all NASA planetary missions, used during all mission phases--conception through data archival in NASA's Planetary Data System. Some SPICE components are used in support of sun-earth connection, astrophysics, earth science and space technology demonstration missions. SPICE was ready for use on the ill-fated Russian Mars 96 mission, and it is now being deployed on ESA's Mars Express mission. It may also be used on Rosetta to support U.S. investigators, and could be used in support of some upcoming Japanese deep space missions. (The use of SPICE by foreign partners is not restricted by U.S. export regulations.)

SPICE has been applied to landers and rovers as well as to orbiters and fly-by vehicles. While originally focused on science needs, SPICE has found a multitude of applications in mission design and visualization, spacecraft operations, and even operation of core functions of NASA's Deep Space Network.

The SPICE specification encompasses both data files and allied software. SPICE data files contain low level data from which numerous quantities of interest can be derived–items such as latitude and longitude, range, smear velocity, lighting angles (phase, incidence, emission), visibility windows, and similar quantities. SPICE kernel files can be easily ported to all popular platforms. Most SPICE files are generated by flight projects, although generic SPICE ephemerides for planets, satellites and some comets and asteroids are also available.

The SPICE system encompasses a large suite of software–the SPICE Toolkit–consisting primarily of module (subroutine) libraries. These library modules are used to read SPICE files and to compute the derived quantities of most interest to scientists and engineers. Some modules are also used in mission operations to write SPICE files. The customer integrates appropriate SPICELIB subroutines into an application program designed to accomplish whatever is needed.

The overall SPICE concept and architecture reflect the thinking of a local computing paradigm. While still relevant, extension of this architecture is needed to more fully utilize network-based information system concepts, and to better handle the quick turnaround times needed in mission planning functions. This paper summarizes the current SPICE architecture and outlines ideas for how this system can/should be extended to meet future space mission requirements.

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