Proposals for Projects on SPICE.

Project 1.

Construct a family of made-up spacecraft in orbit around Jupiter's moon Europa. (Make up several versions of this spacecraft operating in several kinds of orbits—various values for inclination, period, eccentricity). Study the ground viewing conditions for these various orbits over the time it takes Saturn to orbit once around the sun. Characterize and contrast these conditions. What does this analysis tell you about selecting the "optimal" orbit for a Europa orbiter for a science mission? How might your results vary as you change focus between ground observations and atmospheric observations? How might your results vary as you change focus between daylight observations and night time observations? What can you say about selecting orbital parameters to find an "appropriate" compromise for a mission containing instruments that wish to observe under all of these conditions? Based on your conclusions, propose a mission to Europa. The mission will have a camera and a communications antenna. Create attitude and ephemeris kernels for one Jupiter orbit around the Sun. Identify time periods for data download and for science.

Project 2.

Obtain SPK(s) for one of the Mars orbiting spacecraft (MGS, Odyssey, MEX, MRO). Make up an IK and an FK for that spacecraft that will contain a nadir-looking framing camera with a 1 deg. by 1 deg. field-of-view. Determine how many orbits of Mars are needed for this camera to obtain 100% ground coverage of Mars. Think about how you define "100% coverage" and how this could affect the answer.

Project 3.

Make a plan to find MGS using Mars Express. Identify intervals of time where there is direct vision between the two spacecrafts, and calculate the orientation of Mars Express with respect to Mars so the

camera will point to the MGS predicted location.

Bibliography:

-*Spice Required Readings*.
-*Spice Tutorials*.

-*Spherical Astronomy*, Robin M. Green. Cambridge University Press
-*Spacecraft Systems Engineering* 3rd Edition, Fortescue, Stark, Swinerd, Wiley

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