USER GUIDE FOR THE JPL PLANETARY AND LUNAR EPHEMERIS EXPORT PACKAGE

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I. Introduction

This User Guide is intended for the competent user who wishes to install the JPL ephemerides onto his computer. We hope that the ephemeris procedure described below will be as painless as possible. A number of people have written to say that they have had good success with it. Certainly, though, we shall continue to try to improve it and welcome any suggestions.

This guide contains the following sections:

We suggest that you initially read through the whole guide so that you will have an idea of the overall process.

It is assumed that you have read the README from this CD. For the installation of the ephemerides, there are two modes:

1) UNIX users who will use the binary files;
2) All other users; i.e., those who will convert the ascii files in binary.

The object is to have a binary file(s), written in the specific binary format of your computer. For UNIX users, the binary file(s) on the CD are already in that format. For the others, you must convert the ascii blocks into a binary file.

The blocks cover specific intervals of time. They may be used separately, or they may be merged together into a single large file.

II. ASCII to BINARY (for non-UNIX users)

To convert the ascii blocks into a binary ephemeris, you must first compile and run (one-time only) the program "ASC2EPH". This program accepts, via standard input, a header file followed by one or more of the ascii ephemeris blocks. Thus, the input is "header.XXX" and (a series of) "ascSYYYY.XXX". (The "S" stands for the "sign": "m" or "p" for "-" or "+"; i.e., "BC" or "AD". "YYYY" is the starting year of the block, and "XXX" is the ephemeris number.) The blocks must be in order with no gaps in the intervals of time-coverage. The binary output ephemeris is written onto a file called "JPLEPH".

An example for running ASC2EPH on a PC is the following:

```
C:\> copy header.200+ascp1980.200+ascp2000.200+ascp2020.200  infile.200

C:\> ASC2EPH < infile.200
```

In UNIX, one would use:

```
cat header.200 ascp1980.200 ascp2000.200 ascp2020.200 ascp2040 | ASC2EPH.e
```

Alternatively, you may make an individual binary file for each of the ascii blocks, by running "ASC2EPH" separately for each ascii block. These separate binary files may later be merged together by using "binmerge". This method has the advantage of requiring less storage during the creation process, since an ascii file requires about three times as much storage as the equivalent binary file.

III. Testing the Binary File

Once you have a binary ephemeris file, you may test it using the program, "TESTEPH". This program computes ephemeris positions and compares the results with equivalent values computed at JPL, contained in the file "TESTPO.XXX". So, compile "TESTEPH", assign the name "JPLEPH" to the binary ephemeris file that you are testing, and then run "TESTEPH", sending "TESTPO.XXX" to the executable via standard input.

The program "TESTEPH" will print out the list of ephemeris constants (retrieved by the subroutine "CONST") and will then use the subroutine "PLEPH" to read and interpolate the ephemeris for coordinates corresponding to the sample ones in "TESTPO.XXX". If any comparison yields a difference larger than 10**(-13) [in units of au or au/day], an error message will be printed out. Further, a line will be printed every 100 comparisons in any case, so that the progress can be monitored.

IV. Tailoring the Software

The software was written in standard Fortran-77. It should work on any machine with a standard compiler.

HOWEVER, there are two parts which are compiler dependent; both have to do with opening and reading a direct-access file. They are dealt with in the subroutine FSIZERi, i=1,3. (There are three versions of this subroutine.)

1) The parameter RECL in an OPEN statement is the number of units per record. For some compilers, it is given in bytes; in some, it is given in single precision words. Therefore, the parameter NRECL must be set by the user to 4, if RECL is given in bytes; to 1, if RECL is given in words. (If in doubt, use 4 for UNIX; 1 for VAX and PC)

2) Also for an OPEN statement, the program needs to know the exact value of RECL (number of single precision words times NRECL). Since this varies from one JPL ephemeris to another, RECL must be determined somehow and given to the OPEN statement. There are three methods, depending upon the compiler. We have included three versions of the subroutine FSIZER, one for each method.

```
**********************************************************************
*                                                                    *
*  Therefore, the user must choose which version of FSIZER to use by  *
```

```
*  un-commenting one of the CALL statements near line 846 in TESTEPH. *
*  The user must then set the value of NRECL within that version.     *
*                                                                     *
***********************************************************************
```

The following are the three choices of FSIZER:

1) Use the INQUIRE statement to find the length of the records automatically before opening the file. This works for VAX's; not in UNIX.

2) Open the file with a value of RECL which is just large enough to enable the reading of the pointers from the first record, use the information from the pointers to determine the exact value of RECL, close the file, and re-open it with the exact value. This seems to work for UNIX compilers. (For other compilers, this doesn't work since you can open a file only with the exact value of RECL.)

3) Hardwire the value of RECL. This number is NRECL*1652 for DE200, NRECL*2036 for DE405, and NRECL*1456 for DE406.

If in doubt, use #1 for a VAX, #2 for UNIX. The use of #3 is the least desirable, for the subroutine must be changed when a different ephemeris is used.

========== V. Final Product ==========

When "TESTEPH" has run successfully, you are done, because "TESTEPH" contains and uses the subroutines that are of primary interest to you.

1. PLEPH reads and interpolates the direct access ephemeris file, and

2. CONST extracts the constants used in making the ephemeris (planetary masses, length of the au, etc.)

These subroutines and three others of interest are described more fully in the README.

========== VI. Assistance ==========

If you are really stuck, direct your questions to


```
*********************************************************
* Dr E Myles Standish; JPL 301-150; Pasadena, CA  91109  *
* TEL: 818-354-3959                    FAX: 818-393-6388 *
* Internet:  ems@smyles.jpl.nasa.gov  [128.149.23.23]    *
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Please include your name, address, phone number, and e-mail address on all correspondence.

I shall try to answer your questions when I'm free from my normal obligations.

However, I'm not in business to supply ephemerides to the outside world; please realize that I cannot provide customized service to each individual user.