MPCORB Update Program

Version 2022-04-22

Objective

The objective of MPCUPDATE is to replace NEA orbits in MPCORB, that are normally quoted at a Standard Epoch, with orbits at the Current Epoch.

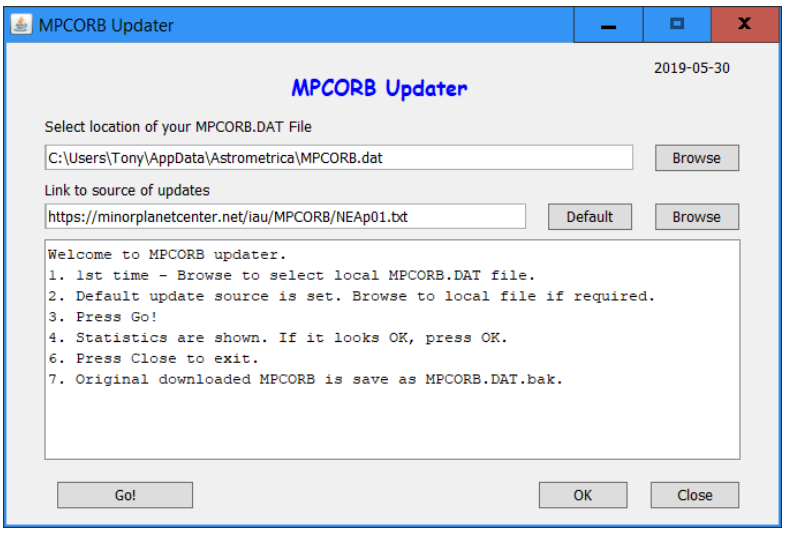
- So that Astrometrica can place known-object boxes at the correct position in recently acquired images.
- So that planetarium software (when using MPCORB) will show the correct coordinates for perturbed objects.

Additionally, the update ensures that recent discoveries are added to MPCORB and that objects that have been promoted from section 3 to section 2 (perturbed) or from section 2 to section 1 (numbered) are accounted for.

During the development of this program it was discovered that various out-of-sequence and duplicate object problems exist within MPCORB. A side effect of this program is that objects are correctly sorted, and duplicate NEAs removed.

Usage

The program is supplied as a Java "jar" file. Place this in any convenient directory and optionally put a shortcut on the desktop. Double click the program (or shortcut) and the window will open as shown below. A current Java run-time (JRE) is needed.



The first time you use this program you will need to use the Browse button next to the MPCORB.DAT file name and select your local copy of MPCORB.DAT.

The link to the source of updates defaults to the current NEATom at the MPC. You can use the Browse button to select a local file or to change the source to another internet address available by

http. In either case, the source file must be in similar format to an MPCOrb file. The Default button can be used to reset to the normal MPC source.

Press Go! To start the update.

The first time the program encounters a newly downloaded MPCORB.DAT, it makes a backup copy called MPCORB.DAT.bak. If anything goes wrong, you can always rename this back to MPCORB.DAT.

The originally downloaded copy of MPCORB.DAT is replaced by a sorted copy in which the sort sequences in sections 2 and 3 are corrected.

The program downloads the updates (or reads the local file) and, where a match of number or designation is found, the MPCORB record is replaced by the update.

If there is an update but no matching MPCORB record in section 1 or 2 then the record is added. If a matching MPCORB record is found in the wrong section it is deleted. Typical situations are:

- An object has been numbered. It is added to section 1 and deleted from section 2.
- An object now has a perturbed orbit. It is added to section 2 and deleted from section 3.
- A new object has been found. It is added to section 2.

Deletion of section 2 objects that have been numbered is done by compressing the designation of the object in its section 1 record and comparing that to designations in section 2. This may not be 100% effective as some numbered objects have multiple prior designations.

Various messages are shown including a list of objects added and deleted. If everything looks reasonable then press OK. This will commit the changes to MPCORB.DAT. Press Close to exit the program.

In 2022 some object data has been found to be corrupt in the NEA orbits file. If blank data is found in the first orbital element of an object, it is ignored and a message is shown.

Additional details

MPCORB

The MPCORB file is in three sections. The sections are separated by a zero-length lines (not blanc). The record format is described at:
https://www.minorplanetcenter.net/iau/info/MPOrbitFormat.html

The file is produced by a LINUX system and therefore does not have CRLF line endings. During the update process the file will acquire CRLF line ends when run on a Windows system.

Most objects in the file have epochs at a standard epoch. Standard epochs change at 200-day intervals. It appears that the standard epoch does not change for all objects at the same time so that some objects will be at the next standard epoch while others are at the previous one.

Some objects, especially in section 3, have individual epochs. This can include recent discoveries where the epoch is around the date of discovery or the date of a Daily Update MPEC. Objects

discovered long ago, and have been “lost”, may still reside in section 3 with an epoch associated with their discovery date.

The file has a header region explaining its purpose. A line starting with “Sorted” is added by this program after the file has been sorted into “correct” sequence.

Section 1 contains numbered objects in number sequence.

- The first 5 characters of each record contains the object’s number with leading zeroes if necessary. The first character can be A-Z or a – z for objects with compressed numbers over 100000. The two characters after the number are blank.
- The sequence is by compressed number and is case sensitive.

Section 2 contains perturbed objects in designation sequence.

- The designations have taken various formats over the years and any of those formats may be present. Designations are always 7 characters and are shown in the first 7 columns of each record.
- The objects generally appear in designation sequence, but the sort is not case-sensitive and other unexplained out-of-sequence problems exist.
- Objects in this section have non-blank indicators of perturbers in columns 143-149.

Section 3 contains unperturbed objects in designation sequence.

- The format is as for section 2 except that there are no perturbers marked in columns 143-149.
- The same out-of-sequence problems exist as for section 2.

It is not unknown for objects to be duplicated in different sections, in particular

- An object recently numbered can appear in sections 1 and 2.
- An object recently promoted from section 3 to section 2 can appear in both sections.

The output MPCORB produced by this program has duplicates removed and the sort sequence within each section corrected.

> Note: *The strange sequence of MPCORB has been flagged to the MPC who have acknowledged that it is not intentional and will be “looked at”.*

NEATom

The input file NEATom.dat or NEAp01.txt contains orbital elements for NEAs with an epoch of “tomorrow” – i.e. 00:00 UTC on the day after “now”. This is usually close to an observation planned for “tonight”.

NEATom.dat is not divided into sections. Records are of the same format as MPCORB but are sequenced according to the first 7 characters, case sensitive, regardless of whether the object is

numbered or not. As a consequence, objects with compressed numbers beginning with letters I, J or K are intermixed with unnumbered objects with designations starting with I, J or K.

- All records in NEATom are perturbed, so any NEA found in section 3 must be promoted to section 2.
- NEATom may contain records for objects that have been discovered since the last MPCORB update.
- NEATom may contain records for objects that have been numbered since the last update.