Worklists:

Worklist files are text files which can contain any reasonable number (1000) of commonly used object positions. The TCSGUI software will only display the first 100 objects in a file. Please note that loading a worklist larger than 1000 objects will cause TCSMON to only list the first 1000 entries. The list will truncate at that point. TCS will notify the observer of this and will suggest breaking the list into smaller ones.

Creating a worklist:

The worklist file name should end with a ".wrk" suffix. The format is as follows:

Reference-number Object-name RA Dec Epoch RA-proper-motion Dec-proper-motion

Fields must be space-delimited. The fields are defined as follows:

Reference number - Must be present and can be any numeric, but is not used by the TCS software.

Object-name- MUST BY PRECEDED AND FOLLOWED BY DOUBLE QUOTES. An example is "KAP1 CET".

RA- hh mm ss.ss -or- hh mm.mm -or- hh.hh
(The last field MUST contain a '.', unless it is seconds. The last field may have as many numbers after the decimal as needed.)

Dec- dd mm ss.ss -or- dd mm.mm -or- dd.dd
(The last field MUST contain a '.', unless it is seconds. The last field may have as many numbers after the decimal as needed.)

Epoch- yyyy.yy (Year and decimal fraction – see note below)

RA-proper-motion- annual proper motion in time seconds XXXX
Dec-proper-motion - annual proper motion in arc seconds XXXX

An important note about Epoch and Equinox:

"Equator" and "Equinox" are most often used synonymously, and refer to the celestial coordinate system under use. However, Earth precesses with a period of ~25800 years. As a result, the observed stellar coordinates will be a function of time. To avoid confusion, we thus give stellar coordinates at a standard equator and equinox. The current standard is J2000, where "J" means that we are using a Julian epoch and 2000.0 means January 1, 2000 at 12:00 TT (terrestrial time). The previous standard (which you might rarely see) was B1950, where "B" meant a Besselian epoch. To go from J2000 to observed coordinates, one must apply the precession corrections, which fortunately the 2.7 m TCS does for us. Note that this has all referred to corrections of the stellar position for the precession of Earth. It has nothing to do with any motion of the star.

The "epoch" is quite another beast, and should never be confused or conflated with "equinox". "Epoch" refers to the reference date for application of “stellar proper motions”. Thus, one needs to compute the elapsed time since the coordinate epoch, multiply by the given proper motions (paying appropriate attention to units -- in particular whether the RA proper motion is in arcsec/year or seconds to RA/year) and add to the catalog coordinates. Note that this refers only to the motion of the star.

Now we get to the 2.7 m TCS. It has a fatal design flaw that assumed that equinox=epoch, and it mistakenly calls that date "epoch". Thus, the astute 2.7 m observer ensures that all stellar coordinate worklists are given with the same date for equinox and epoch. If you pull your coordinates from SIMBAD, you are fine, as that is the default there.

However, Gaia astrometry is far more precise than anything before, thus forcing them away from the conventional standards. They have adopted ICRS coordinates rather J2000.0. But note that their web page (https://www.cosmos.esa.int/web/gaia/faqs) states:

> "To within ~25 mas, mean J2000.0 equatorial coordinates are the same as ICRS coordinates such that, for "ordinary" applications, they can in practice be considered to be the same. For high-accuracy applications, the appropriate frame conversion shall be used."

Gaia then gives their “epoch” as J2015.5. (Don't let this 'J" confuse you -- it means Julian date and does not refer to equinox!). So, to use Gaia coordinates on the 2.7 m, you need to know that they are (effectively) equator/equinox 2000.0 (for precession) and 2015.5 for application of proper motion. But TCS can't deal with this. So, it is best to use stellar coordinates from Simbad (http://simbad.u-strasbg.fr/simbad/ or http://simbad.harvard.edu/simbad/).

There is then the additional complication that TCS wants the rather archaic units of (seconds of RA)/year for the RA proper motions (and (arcsec/year) for DEC proper motion). So, if your Gaia proper motion is "rapm" (milliarcsec/year), then you have to compute: rapm/(1000*15*cos(declination)).

Worklist Example:

```
  1 "HR   72   " 00 18 41.8 -08 03 10 2000.0  0.028  -0.139
  2 "Gl  15  A " 00 18 22.9  44 01 23 2000.0  0.268  0.41
  3 "HR  173   " 00 40 32.9 -23 48 16 2000.0  0.047 -0.333
   ...     ...    ...   ...       ...  ...   ...   ...
145 "ALPHA SCO " 16 26 20.2 -26 19 22  1950.0  0.001-0.02
146 "ALPHA HER " 17 12 21.9  14 26 45  1950.0  0.001 0.03
147 "DELTA SGE " 19 47 23.2  18 32 03  2000.0  0.001 0.01
```

Loading a worklist into TCS

To load a worklist you must have the worklist file located on atlas's home disk (preferably in your default login directory). Most observers are creating a subdirectory in their home directory called worklists and putting all of their worklists in that location. All worklists should have the ".wrk" suffix in their name.

On the TCSGUI, select "File -> Open / Transfer Work list" which will popup a new window that will allow you to select your worklist file. Select the worklist file. After selecting your file and clicking on OK, the entire file is loaded into TCS.

Look under "Next -> Work List" and you should see your file listed if it loaded properly.

Note: If there are a bunch of worklists listed under "Next->Work List" you can clear them out by selecting "File-> Clear Lists ". This does not remove the files from disk, just unloads them from TCS memory.

Selecting an object in a worklist

To select an object from a loaded worklist, choose Next-> Work List -> your_work_list. This will bring up a window in which you can select your object from the entire list. Double clicking on the object or selecting the object and clicking on OK or Apply will load the object into the Next buffer. After loading it into the Next buffer, you can move to it as you would any other object.

Ephemerides:

The ephemeris files can either contain a single object as they have historically, or they can have many, each beginning with a header of the form.

..object name [magnitude [spectral class]]

The literal "..object" tells the program that this is a new object. "Object" is not case-sensitive. The object 'name' should not be longer than 16 characters. Magnitude is a real number, and is *optional*. Spectral type is a character string (no spaces) up to 20 characters, and is also *optional*.

A file having a single object may also have a header, but it is optional.

The filename should be no longer than 16 characters (excluding path). The last of those 16 characters should be '.eph', as this is used in the TCSGUI File->Load/Transfer Ephemeris file name filter.

The ephemeris records are of the format:

Date RA Dec Epoch Parallax [*unused fields for documentation only*] where the field are defined as follows:

Date

yyyy mm dd hh mm ss
-or-
yyyy mm dd.dd (fractional days with any reasonable decimal places)
-or-
mjd

RA
hh mm ss.ss
-or-
hh mm.mm
-or-
hh.hh
(The last field MUST contain a '.', unless it is seconds. The last field may have as many numbers after the decimal as needed.)

Dec
dd mm ss.ss
-or-

dd mm.mm
-or-

dd.dd
(The last field MUST contain a '.', unless it is seconds. The last field may have as many numbers after the decimal as needed.)

Epoch

yyyy.yy (Year and decimal fraction)

Horizontal Parallax
mm ss.ss (Arcminutes Arcseconds)

The ephemeris records are interpolated using a 3-point method.

The ephemeris entries' time tags must be evenly spaced in time, but can be of any reasonable spacing, as long as there are no more than 1000 entries per day. Obviously the entries must be in ascending time order. Fields must be space-delimited.

Examples:

1) This has fractional days, fractional seconds in coordinates, and an object header.

```
..object Ceres
1999 1  1.00000 21  4 58.8 -22 31  9 2000.00 0.00
1999 1  2.00000 21  6 34.5 -22 26 20 2000.0 0 0.00
1999 1  3.00000 21  8  9.9 -22 21 30 2000.00 0.00
1999 1  4.00000 21  9 45.0 -22 16 38 2000.0 0 0.00
1999 1  5.00000 21 11 19.9 -22 11 46 2000.0 0 0.00
1999 1  6.00000 21 12 54.4 -22  6 54 2000.0 0 0.00
```

```
1999 1  7.00000 21 14 28.6 -22  2  0 2000.00 0.00
1999 1  8.00000 21 16  2.6 -21 57  7 2000.00 0.00
1999 1  9.00000 21 17 36.1 -21 52 12 2000.0 0 0.00
1999 1 10.00000 21 19  9.4 -21 47 17 2000.0 0 0.00
```

2) This has hours, minutes, seconds, fractional minutes in coordinates, and no header.

```
1999 4  3 0 0 0 5 47.428 -16 32.11 2000.0 0.00
1999 4  4 0 0 0 5 44.321 -16 21.53 2000.0 0.00
1999 4  5 0 0 0 5 41.278 -16 10.49 2000.0 0.00
1999 4  6 0 0 0 5 38.302 -15 59.02 2000.0 0.00
1999 4  7 0 0 0 5 35.391 -15 47.14 2000.0 0.00
1999 4  8 0 0 0 5 32.548 -15 34.86 2000.0 0.00
1999 4  9 0 0 0 5 29.772 -15 22.20 2000.0 0.00
1999 4 10 0 0 0 5 27.063 -15  9.19 2000.0 0.00
```