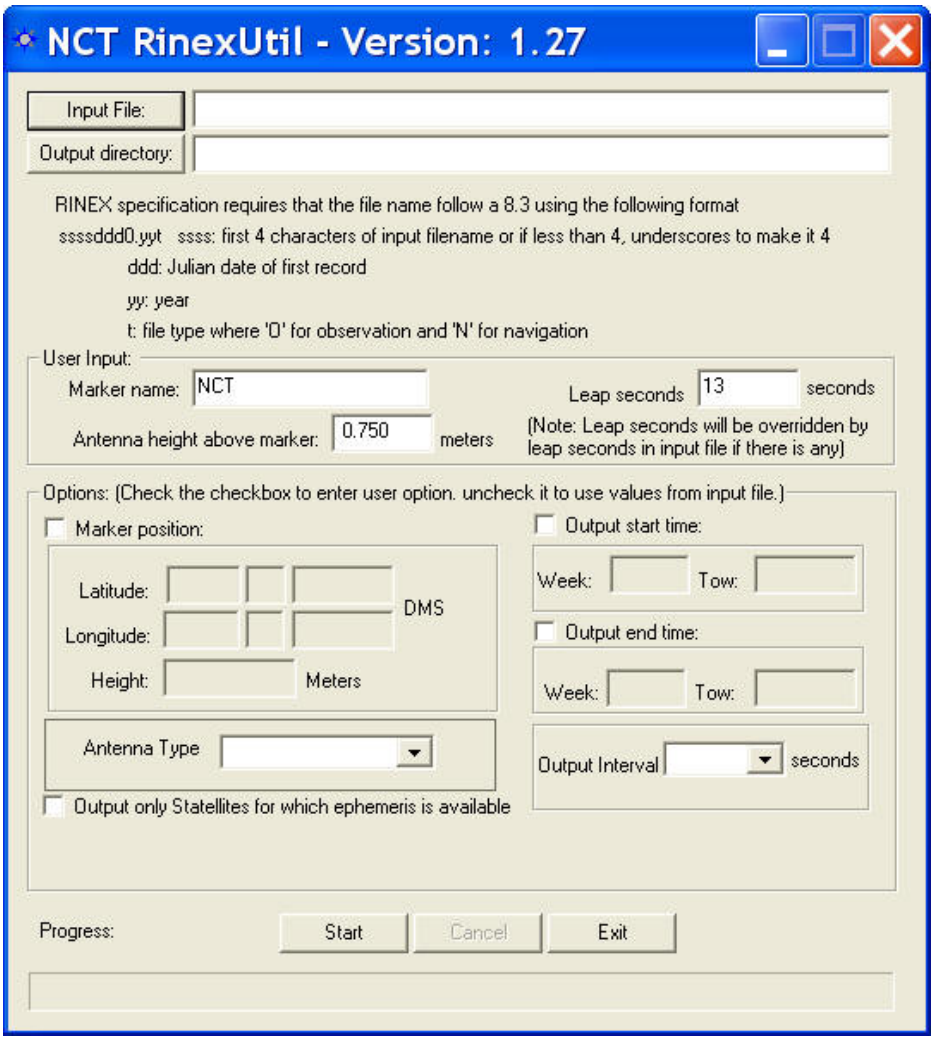
RINEX Utility

User Guide

find your way



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RINEX Utility User Guide
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Revision History

Rev C (Feb 2009)	Format change. Updated graphics. Described new feature, the Antenna Type drop-down list. Added MEAS1B, PVT1B, and ALM1B to the list of NCT messages that the RINEX Utility converts to the RINEX V2.1 format. Deleted the 'Known Issues' section – these 2 issues fixed in this software release (v1.27): The error message, "No Valid Observation Available", no longer appears during the conversion process. When the user manually enters a Marker Position into RINEX, the resulting OBS file's XYZ Positions are now correct.
Rev B (Dec 2006)	Updated graphics; updated 'Known Issues'; Format change
Rev A (Jun 2006)	Initial release

Use of this Document

This User Guide is intended to be used by someone familiar with the concepts of GPS and satellite surveying equipment.

Note indicates additional information to make better use of the product.

This symbol means Reader Be Careful. Indicates a caution, care, and/or safety situation. The user might do something that could result in equipment damage or loss of data.

This symbol means Danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical and RF circuitry and be familiar with standard practices for preventing accidents.

Revisions to this User Guide can be obtained in a digital format from *http://www.navcomtech.com/Support/DownloadCenter.cfm?category=manuals*

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Overview of the RINEX Utility

The RINEX Utility converts NCT (NavCom Technology) binary raw data (0xB0, 0xB1, 0x44, MEAS1B, PVT1B, and ALM1B messages) to RINEX v2.1 format. Converting NCT raw data to RINEX provides a means to post-process the raw data when third party software packages do not support the NCT Binary format, but do possess the ability to import RINEX Standard measurement data.

Most post-processing programs require a minimum of 60 minutes of data to process and almanac and ephemeris data at the beginning of the file.

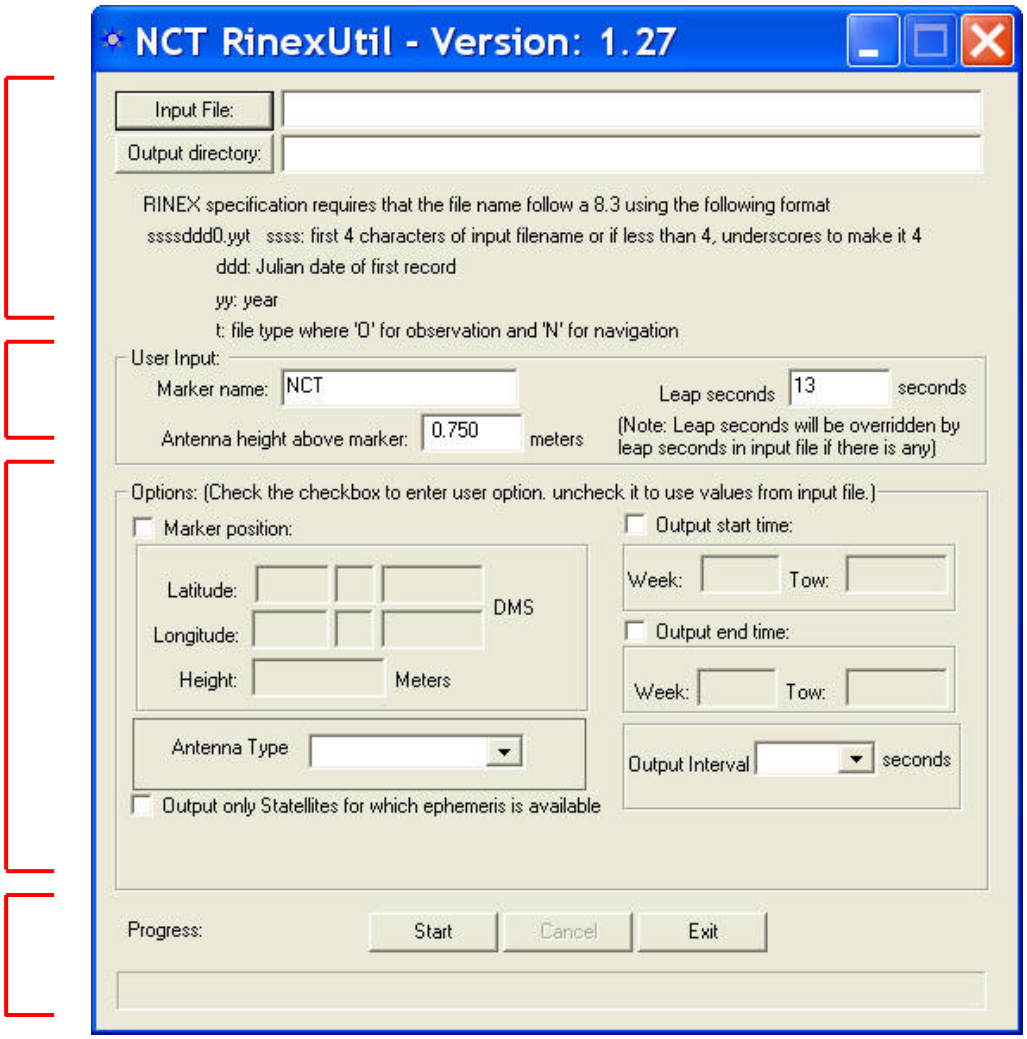

Figure 1: NavCom RINEX Utility

The NCT RINEX Utility GUI is divided into four major areas:

- ✓ File I/O
- ✓ User Input
- ✓ Options
- ✓ Execution and Progress

File I/O

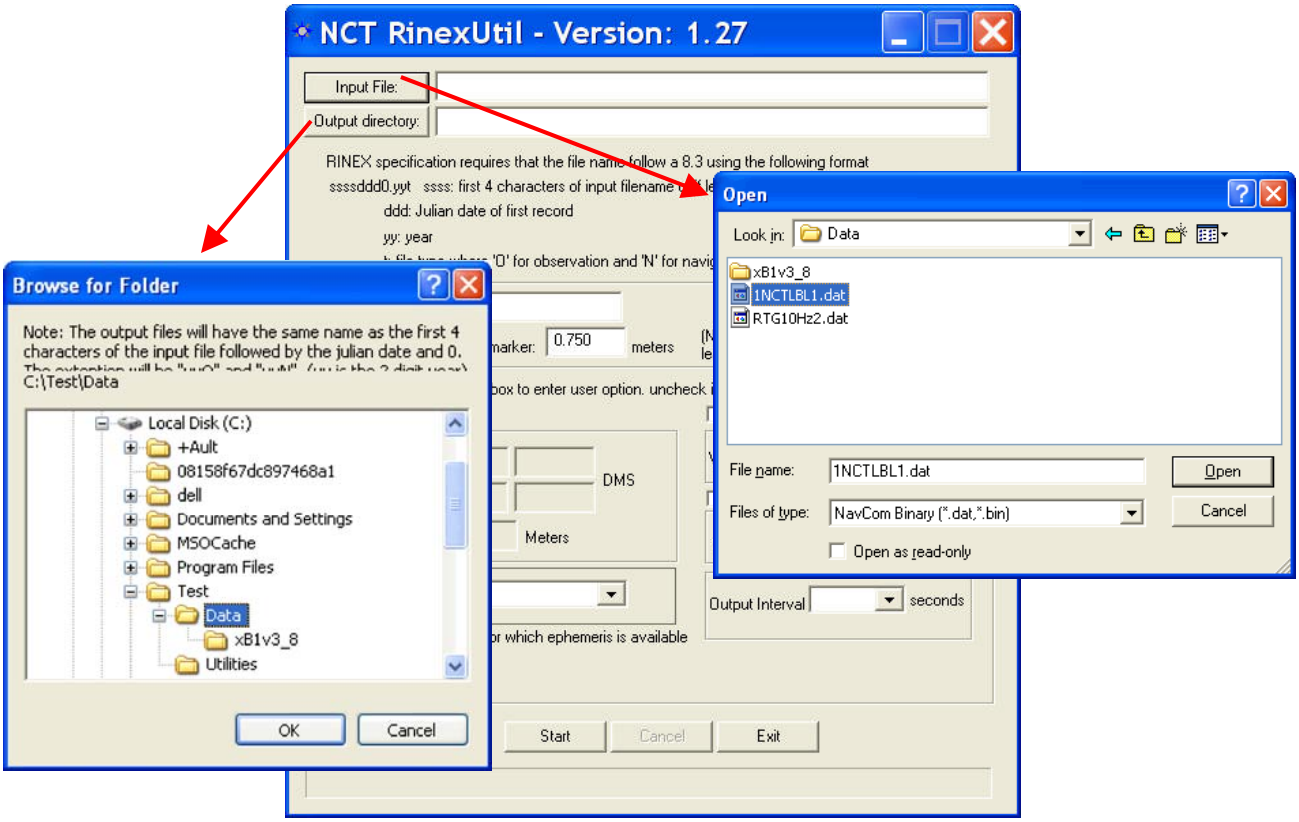

Figure 2: Input File and Output Directory

Refer to Figure 2 for the steps below:

- ✓ Click the *Input File* button to navigate to and select the NCT binary raw data file (**.dat*) to be converted to the RINEX v2.1 format.
- ✓ Click the *Output Directory* button to select the folder to save the converted files. The RINEX Utility converts the NCT data file into two RINEX files, one with GPS navigation data and the other with observation data (refer to the section below, *RINEX File Naming Conventions*).

The conversion options available in the *User Input* and *Options* areas of the RINEX Utility window are not always necessary to complete the conversion. However, selecting the appropriate *Antenna Type* is always recommended to obtain the best results (see Figure 6).

If the user enters conversion options, the headers of the RINEX files display the user specific information. If the user does not enter options, the headers display the default information shown in Table 1.

Table 1: RINEX Utility Defaults

Leap Seconds	0 or Last Entered
Marker Name	None or Last Entered
Antenna Height	0.0 or Last Entered
Marker Position	Disabled
Output Times (Start and End)	Disabled
Sat Ephemeris when Available	Disabled

- ✓ These conversion options are available:
  - *User Input: Marker Name, Leap Seconds,* and *Antenna Height Above Marker*
  - *Options: Marker Position, Output Start / End Times, Antenna Type, Output Interval,* and *Ephemeris Output*

Refer to the sections below, *User Input* and *Options*, for details.

- ✓ If no conversion options are desired, click the *Start* button to generate the RINEX files.

RINEX File Naming Conventions

RINEX requires the file naming convention to follow a specific format. The easiest way to relate files is to use the same naming convention for all related files in a given directory and to use separate directories for files recorded on the same date. The file naming convention is:

- ✓ File names are limited to 8 characters followed by a 3 character extension (MS-DOS compatible; ssssddd0.yyt)
- ✓ ssss = a unique file identifier. All four characters must be used. If less than 4 characters are used, enter "_" (underscore) to fill the space. Any alpha-numeric character is acceptable (A-Z and 0 -9).

If the name of the data file is longer than four characters, it is truncated when the RINEX files are generated. For example, "cnav8b.DAT" becomes "cnav".

- ✓ ddd = the Julian date of the year; i.e. March 23, 2007 = Julian date 082
- ✓ 0 = required fill character
- ✓ yy = last two digits of the calendar year
- ✓ t = file type; the output files will be tagged as either O for observation or N for navigation, for example, "cnav0820.07N" and "cnav0820.07O".

User Input

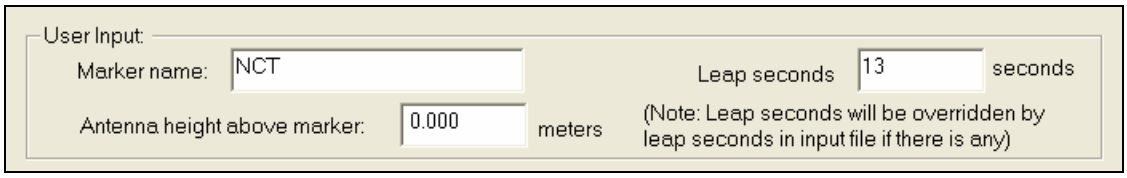

Figure 3: User Input Area

Completing the *User Input* fields is optional. Entries in these fields are included in the headers of the RINEX navigation or observation files.

Figure 3 shows the *User Input* area of the RINEX Utility.

- ✓ *Marker name:* Allows up to 60 characters to identify the site where the data was collected.
- ✓ *Leap seconds:* Allows the user to insert the current GPS Leap Second value, if known. If left blank no leap second value will be reported in the RINEX ephemeris (navigation) file header, or the RINEX Utility will use the leap second time reported in the raw data file (if one exists). If the raw data file has a larger leap second value reported than the user entered value, the raw data file value will be used instead.
- ✓ *Antenna height above marker:* Allows the user to insert antenna base height above the survey point. This adjustment can often be made in the Post Processing Software package as well.

Options

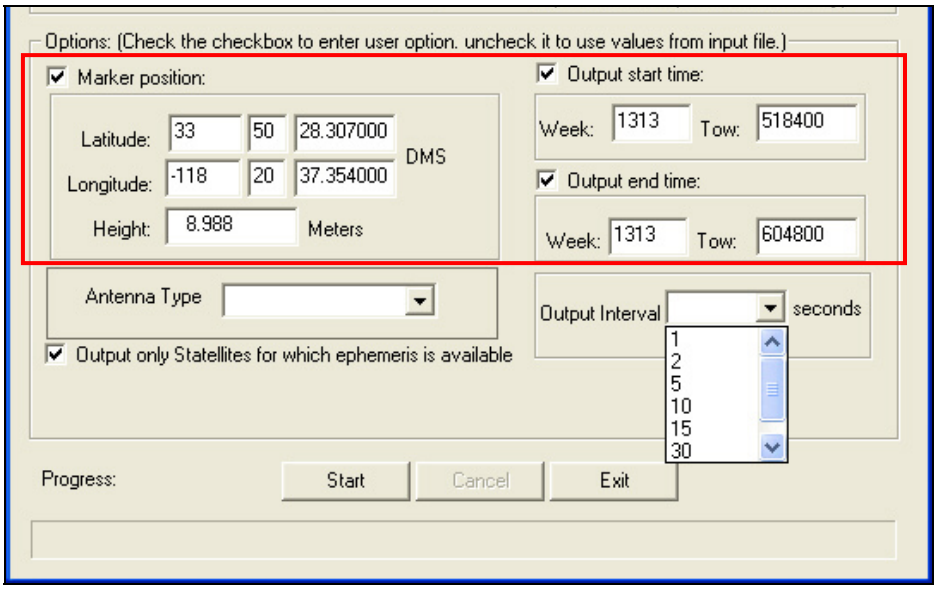

Figure 4: Options Area

Completing the *Options* fields is optional. To modify an option, the box above and/or to the left must be checked (✓).

Figure 4 shows the *Options* area of the RINEX Utility.

- ✓ *Marker Position:* Allows the user to input the Latitude, Longitude, and Height of the surveyed position in Degrees Minutes and Seconds. These coordinates are converted to Cartesian ECEF format and inserted into the "Approximate Position XYZ" area of the RINEX observation file. If left disabled, the RINEX Utility will average the position based on the range measurements received from the total number of epochs in the data collection period.

  RINEX Utility conforms to RINEX Standard 2.10, which states that the Cartesian ECEF position in the observation file header is WGS84. This means that the height entered in the RINEX Utility must be WGS84. The RINEX Utility makes no attempt to convert other datum heights to WGS84. Using height data from a datum other than WGS84 will result in errors in the Z-axis.

- ✓ *Output start time / Output end time*: If enabled, the *Output Start* and *Output End* times allow the user to parse a large raw data file into a smaller snap shot of the overall data collection period. Caveats are that the GPS Week Number, and the GPS Time Of Week (TOW in seconds) be entered. Refer to the sections below, *GPS Week Number* and *GPS Time*, for details on these values.

  If the *Output Start* and *Output End* times are disabled, the RINEX Utility will process the entire data collection period.

GPS Week Number

The GPS Week Number count began at midnight on the evening of 05 January 1980 / morning of 06 January 1980. Since that time, the count has been incremented by 1 each week, and broadcast as part of the GPS message. The GPS Week Number field in the data stream is modulo 1024. This meant that at the completion of week 1023, the GPS Week Number rolled over to 0 on midnight GPS Time of the evening of 21 August 1999 / morning of 22 August 1999.

The NCT-2000D and NCT-2100D use an adjusted 16-bit integer (U16) in the data to avoid this confusion. They can handle up to week 65535.

For example, in Figure 4 the GPS Week Number for the *Output Start* / *End* times is 1313. To determine the week/date, subtract 1024 from 1313, which is 290. Then add 290 weeks to 21 August 1999. The result is Sunday 6 March 2005.

GPS Time

The GPS time (seconds into the week) always starts on Sunday morning at 00:00 GMT. Each 24 hour period contains 86,400 seconds. A full week contains 604,800 seconds. Please see the table below for a breakdown of hourly / daily increments.

Table 2: GPS Time

GMT	Sun	Mon	Tue	Wed	Thu	Fri	Sat
0:00:00	0	86400	172800	259200	345600	432000	518400
1:00:00	3600	90000	176400	262800	349200	435600	522000
2:00:00	7200	93600	180000	266400	352800	439200	525600
3:00:00	10800	97200	183600	270000	356400	442800	529200
4:00:00	14400	100800	187200	273600	360000	446400	532800
5:00:00	18000	104400	190800	277200	363600	450000	536400
6:00:00	21600	108000	194400	280800	367200	453600	540000
7:00:00	25200	111600	198000	284400	370800	457200	543600
8:00:00	28800	115200	201600	288000	374400	460800	547200
9:00:00	32400	118800	205200	291600	378000	464400	550800
10:00:00	36000	122400	208800	295200	381600	468000	554400
11:00:00	39600	126000	212400	298800	385200	471600	558000
12:00:00	43200	129600	216000	302400	388800	475200	561600
13:00:00	46800	133200	219600	306000	392400	478800	565200
14:00:00	50400	136800	223200	309600	396000	482400	568800
15:00:00	54000	140400	226800	313200	399600	486000	572400
16:00:00	57600	144000	230400	316800	403200	489600	576000
17:00:00	61200	147600	234000	320400	406800	493200	579600
18:00:00	64800	151200	237600	324000	410400	496800	583200
19:00:00	68400	154800	241200	327600	414000	500400	586800
20:00:00	72000	158400	244800	331200	417600	504000	590400
21:00:00	75600	162000	248400	334800	421200	507600	594000
22:00:00	79200	165600	252000	338400	424800	511200	597600
23:00:00	82800	169200	255600	342000	428400	514800	601200
23:59:59	86399	172799	259199	345599	431999	518399	604799

Example: 518400 = Sat 0:00:00 GMT

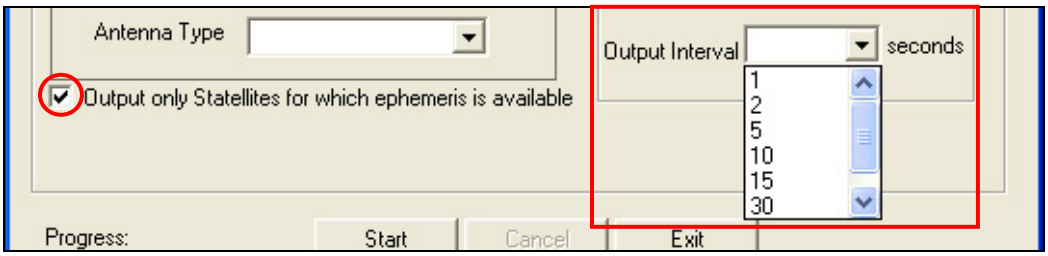

Figure 5: Output Interval and Ephemeris Output

- ✓ *Ephemeris Output:* If enabled, outputs the ephemeris (navigation) file, but only with ephemeris data for those satellites that have been tracked over the data collection period. If disabled the ephemeris file will contain data on all satellites.
- ✓ *Output Interval*: Select the output interval in seconds to decimally parse the data, if desired.

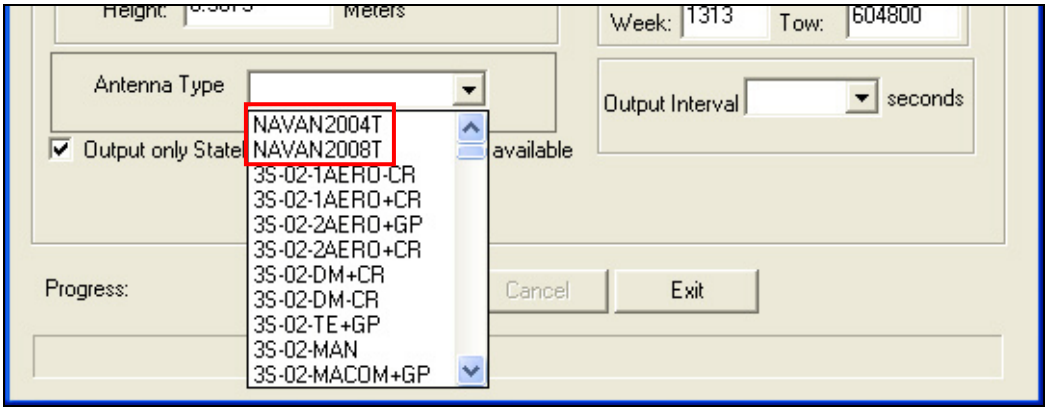

Figure 6: Antenna Type

- ✓ *Antenna Type:* Select the antenna type used to collect the data. Figure 6 identifies the NavCom antennae available in the drop-down list:

- *NAVAN2004T:* The standard integrated antenna (PN: 82-001002-3002). It tracks all GPS, WAAS/EGNOS/MSAS/GAGAN and StarFire™ signals. Our compact GPS antenna has excellent tracking performance and a stable phase center for GPS L1 and L2. This antenna is listed in the NOAA GPS Antenna Calibration tables, as NAVAN2004T.

- *NAVAN2008T:* The airborne integrated antenna (PN: 82-001002-3001). It tracks all GPS, WAAS/EGNOS/MSAS/GAGAN and StarFire™ signals. Our compact GPS antenna has excellent tracking performance and a stable phase center for GPS L1 and L2. This antenna is listed in the NOAA GPS Antenna Calibration tables, as NAVAN2008T. It is included with the VueStar system, and is an option for many (but not all) NavCom GPS receivers.

Execution and Progress

The *Start* button engages the conversion process, which can be stopped at any time by clicking the *Cancel* button. The *Exit* button closes the utility at any time, including during program execution, thereby canceling the process.

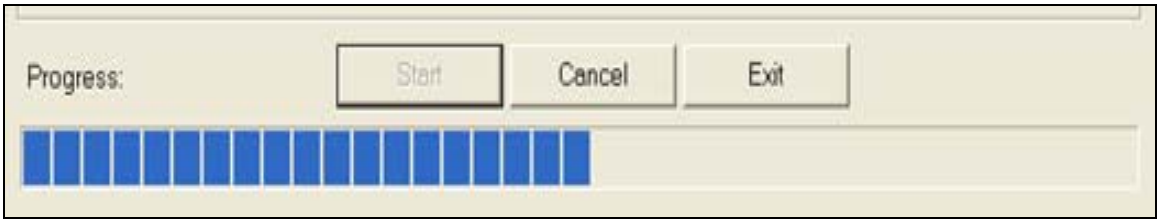

Figure 7: Progress of RINEX Conversion

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