Setup

1. **Open CastTime via Start Menu > All Programs > Pydro64 > Contribs. On the Contribs GUI that opens, click File > CastTime. Regarding the PC utilized for CastTime, please consider:**
   - The MVP PC is preferred, as this will facilitate data transfer from the MVP to CastTime.
   - If CastTime is used on a separate PC, that PC must be able to receive UDP transmissions from the MVP PC, which may entail user privileges and firewall exceptions.
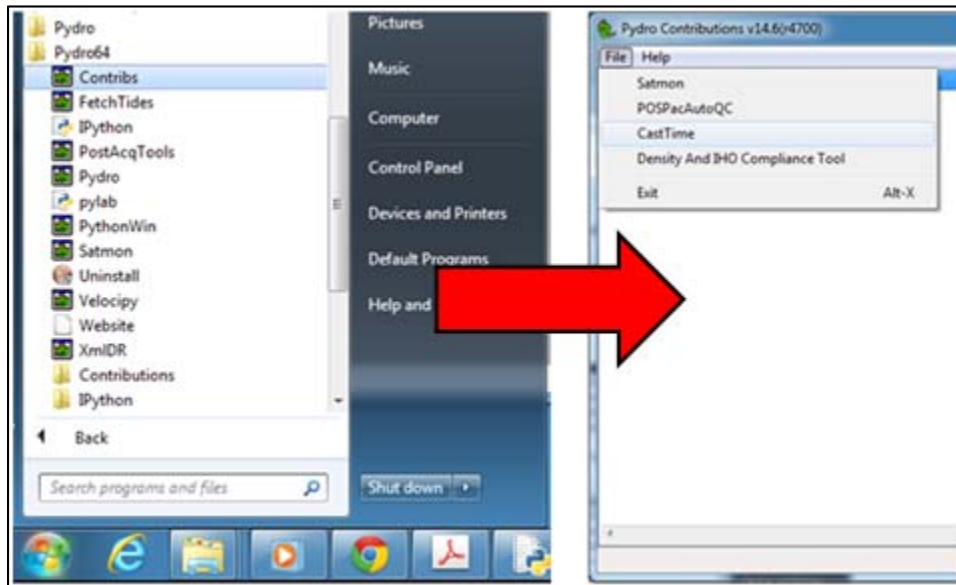

Figure 1. Accessing CastTime.

2. **Configure setup parameters in CastTime,** by clicking File > Setup.
   - Step 1: Specify UDP IP and UDP Port.
     o If CastTime resides on the MVP PC, the UDP IP should be '127.0.0.1'.
     o If CastTime resides on a separate PC, UPD IP should be the IP address of that PC.
     o The UDP Port must be the same as the Remote IP Address (4010) in the Multibeam Interface of the MVP Configuration settings.
   - Step 2: Specify Pass Thru IP and Pass Thru Port, if desired.
     o This optional parameter is used as needed to pass on the cast data to other recipients (SVP Editor, for example).
   - Step 3: Specify the datagram transfer protocol.
     o For MVP Controller v2.35, the protocol must be 'Undefined'.
     o For MVP Controller v2.43 and higher, the protocol should be 'NAVOISS60'.
     o This protocol must be the same protocol as specified in the Multibeam Interface of the MVP Configuration settings.
   - Step 4: Specify the cast data format.

- o The format must be the same format specified in the Multibeam Interface of the MVP Configuration settings.
    - o The 's12', 'asvp', and 'calc' formats are currently supported.
- Step 5: Toggle plotting on and off by clicking Show.
    - o Recommend to leave plotting on for the sound speed profile and ray trace comparison.
- Step 6: Specify transducer draft.
    - o Enter the transducer draft as depth of multibeam below water line. Must be a positive number.
- Step 7: Specify multibeam swath width.
    - o This is a +/- value, in that a swath entry of 70 equates to a 140 degree swath width.
    - o An entry of 70 (regardless of actual swath width) is a conservative measure, ensuring an adequate buffer exists in CastTime, so a reaction occurs well prior to exceeding allowable tolerance levels.
    - o If the user feels CastTime is too conservative, the swath entry can be reduced.
- Step 8: Specify maximum allowable refraction error.
    - o NOAA maximum allowable error is 0.3m + 0.5% of the water depth.
    - o Select A and B as desired to designate depth-dependent tolerance level.
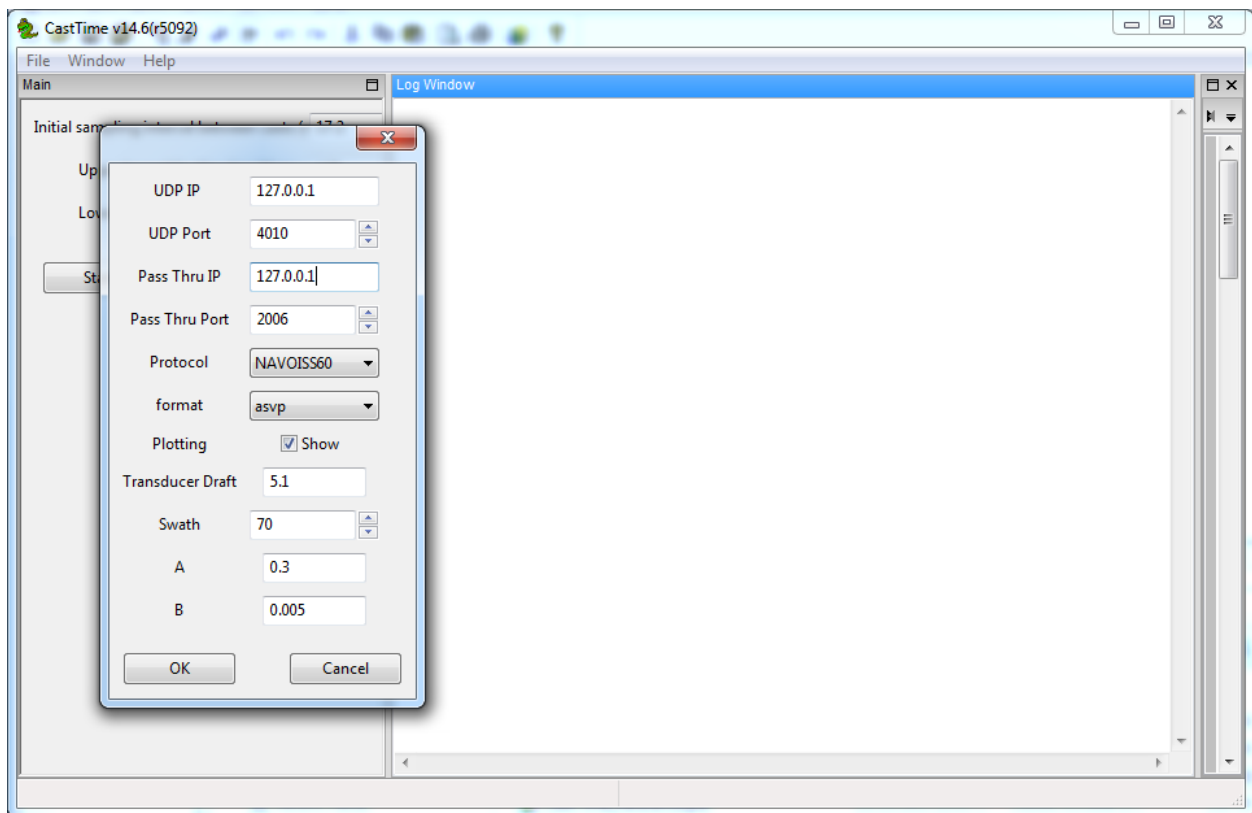

Figure 2. CastTime setup parameters for when CastTime resides on the same PC as the MVP Controller software.

3. **Open the Rolls-Royce MVP Controller Software**. CastTime does not impact anything on the Main Screen, and all parameters must be set as per standard MVP operation (Depth Off Bottom, etc.).

4. **Under Edit > System Configuration, set the MULTIBEAM Interface settings:**
   - Set the switch to UDP.
   - Click the Auto Send button to ensure cast data is sent automatically to CastTime.
   - If CastTime will reside on the MVP PC, both the Local and Remote IP Addresses should by 127.0.0.1.
   - If CastTime will reside on a separate PC, the Local IP Address must be that of the MVP PC, and the Remote IP Address must be that of the separate PC.
   - Set the Local UDP Port to 4001, and the Remote UDP Port to 4010. These can be changed if necessary, but the Local and Remote Ports must not be the same.
   - For MVP Controller versions 2.43 and higher, the UDP Protocol should be set to "NAVOISS60"; for version 2.35, the UDP Protocol must be "Undefined".
   - Set the Output File Format to either 's12', 'asvp', or 'calc'.
   - Ensure all the above settings correlate with the setup parameters in CastTime.

Figure 3. MVP Multibeam Interface parameters for when CastTime resides on the same PC as the MVP Controller software.

Operation

1. **Set the user parameters on the CastTime main screen.**
    - Specify an initial sampling interval. A conservative approach would be to set the initial sampling interval very small, and then gradually grow into a more relaxed sampling interval, such that the relaxed interval is effectively "earned".   Or, to maximize spatial extents, the initial interval could be set such that a cast is performed near the start and end of a survey line.
    - Specify algorithm upper and lower bounds. Sampling recommendations will never surpass these bounds. It should be set at the discretion of the chief surveyor—setting a large upper bound will minimize needless casts during unchanging (or "boring") oceanographic conditions; however, any sudden changes in the oceanography may not be detected in a timely manner if an excessively large upper bound is reached. Set the lower bound based on the fastest sampling intervals possible, based water depth and equipment limitations.
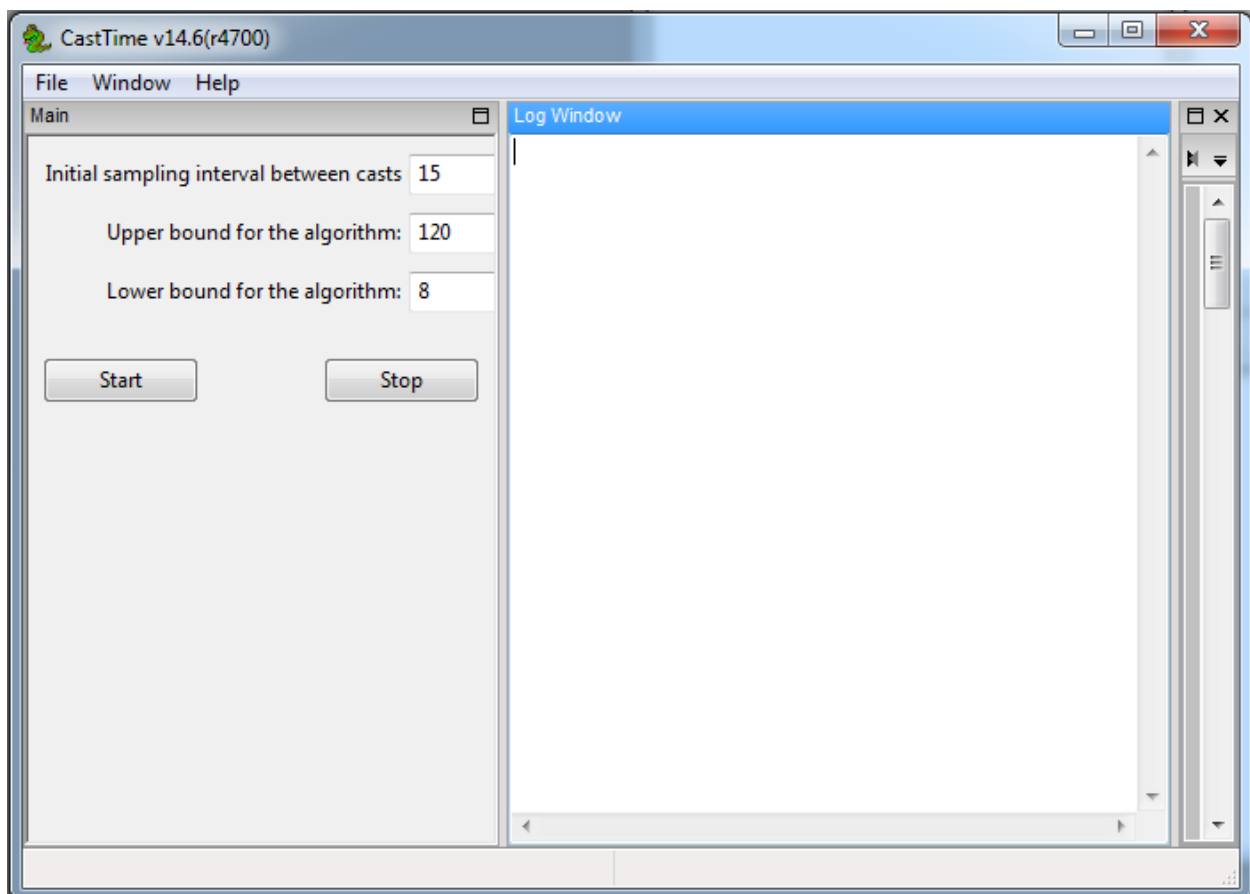

Figure 4. Upon starting CastTime, an initial sampling interval and algorithm upper and lower bounds must be set.

2. **Click Start,** and CastTime enters a monitoring mode and will receive any casts acquired by the MVP from this point forward. After the first cast is acquired, the time of next cast is based purely on the initial sampling interval recommendation; casts thereafter will be compared, and a sampling interval recommended.

3. **Monitor the Output Window.** Swath widths are given that fall within full, (2/3), or (1/3) of the maximum allowable error, bounds which correlate to the CastTime reaction criteria. Various examples are given below for a +/-70 degree swath width:

   - 70/70/70 would enact the "Relax" mode
   - 70/70/69 would enact the "Steady" mode
   - 70/69/68 would enact the "Panic" mode
   - 69/68/67 means that you may be exceeding the maximum allowable error in the outermost beam!
   - A time of next cast will be recommended and may be taken into consideration by the surveyor in deciding when to cast next.

Figure 5. CastTime waits for cast data, then performs the comparison. The maximum outer beam refraction error is listed alongside the user-specified maximum allowable error. The algorithm "mode" is set, and interval recommendation given. Note that if the actual time elapsed is greater than the previous interval (as it is here), the recommendation is based on the previous interval retained in memory.

4. A plot of the sound speed profiles (left) alongside their ray-traces (right) is provided.
   - The simulated seafloors in the ray-trace comparison answer the question: what might the seafloor look like *had the outdated profile still been used?*

- The vertical difference in the simulated seafloors is an estimation of depth sounding uncertainty due to refraction, and the highest magnitude of this difference (almost always the outermost beam) is the Outer Beam Refraction Error in the CastTime window.
- The beam footprints that lie within the bounds of allowable error are designated as usable swath per user specification.
- If desired, one can view, zoom, or pan around the plot, or save the plot.
- Change any of the setup or user parameters while this plot is displayed. Those parameters currently cannot be adjusted while CastTime is "listening" to the MVP.
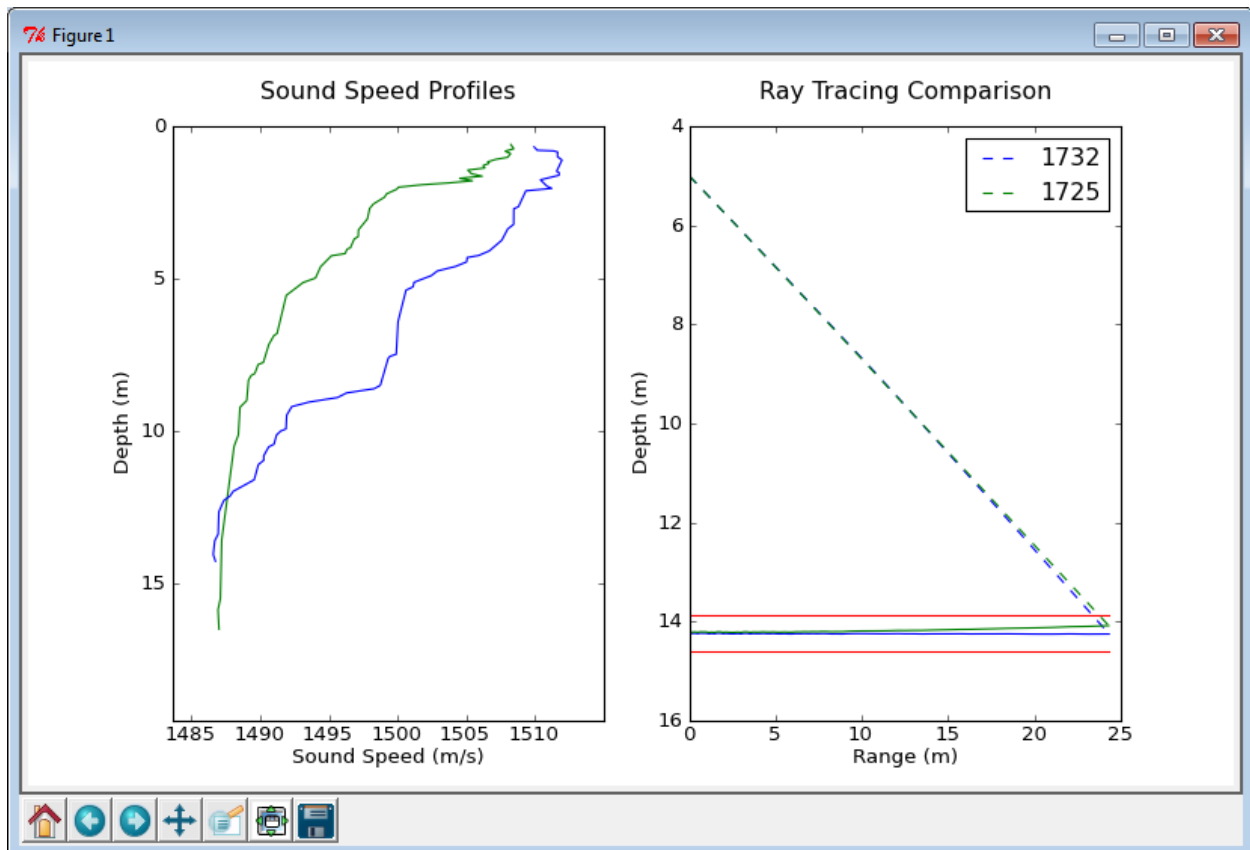- When finished, close the plot to resume CastTime MVP monitoring.

Figure 6. Sound speed profiles used in the comparison (left) and their ray-traces (right). Profile timestamps are given in the upper right hand corner. The user-specified bounds of allowable error due to refraction are also plotted (solid red lines).

5. **Sample by the recommended intervals if they are reasonable; or, sample any time you feel it is appropriate**. The manual adjustment may be necessary to 1) maximize spatial extents of the survey area, 2) there is suspicion of sudden changes in the oceanography, or 3) it happens to be a convenient time to sample. Using manual adjustments, a surveyor's intuition and best practices are not lost and are used in conjunction with CastTime in order to make the best decision.

6. **To change any of the setup or user parameters, first click Stop**. MVP monitoring mode will be suspended, and any desired changes can be made to the parameters. Note that, upon clicking Stop, the sampling interval in memory is cleared. If you desire to retain the current interval upon re-starting CastTime, enter it in as the Initial sampling interval (in the user parameters), as CastTime will again draw from this user input for the initial interval.

7. **If you wish to exit CastTime,** first suspend the MVP monitoring mode by clicking Stop. Then click File>Exit.

8. Any issues with using the program, **contact** matthew.wilson@noaa.gov