# FARO SCANNING AND 3D MODELING OF THE THERESA E. CONNOR

## INTRODUCTION

This sailing season marks the 60th season for the launching of the Theresa E. Connor schooner. The Theresa E. Connor is the last of the saltbankers that are operating out of the port of Lunenburg, Nova Scotia. The old schooner represents the way of life for many generations of fisherman along the Atlantic coast.

The Theresa E. Connor stands for a unique symbol of our fishing heritage and is the flagship of the Fisheries Museum of the Atlantic. This schooner is a legitimate reminder of the age of schooner fishing that lasted for close to one hundred years here in Atlantic Canada. Launched in Lunenburg in 1938 on December 14 at the Smith and Rhuland Shipyard (which is the same shipyard the Bluenose was built). The Theresa E. Connor spent the remainder of 1963 fishing cod traps within the Labrador fishery. Then from 1963 to 1965, the Theresa E. Connor was fishing for the Zwicker and Company in a reduced capacity. Then in 1965, the Lunenburg Marine Museum Society purchased the Theresa E. Connor and opened the vessel up to the public in the year 1967.

This project came around by the people who run the Fisheries Museum of the Atlantic. They asked if it would be possible to scan the schooner and get enough information to do something with it. For this project, there was one major goal that was agreed upon by everyone involved in the project. That goal was to scan the Theresa E. Connor to get enough information to bring back to the office. That information would be used to measure how much the keel has hogged over the years.

The study area was the Theresa E. Connor itself, but the old schooner was located in dry dock on the edge of town. As you can see by the index maps below, Figures 1 & 2, dry dock was not only located just outside of town, but it was also surrounded by fence that you needed someone who worked there to let you in and out.

When it comes to the data sets that were used for this project, they were the .fls files that came over from the Faro Scanner itself. The .fls files were then brought into SCENE, where all the unwanted data was then cleaned up. Once the desired product was produced, the files were then exported as .las files. The .las files were then brought into Global Mapper to be exported as a 3D PDF. The why that these files were created and processed can be found under the Methodology section.

Figure 1: Study Area Overview

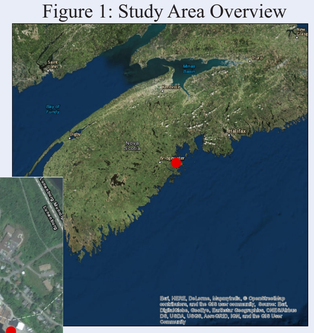
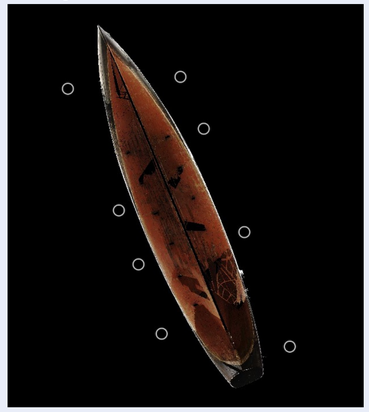


Figure 2: Study Area

Figure 3: Locations of Faro Scanner



## DISCUSSION

Overall, this was a great project to work on; everyone who was involved in the project was committed to getting the job done, but also getting the job done in a timely manner and the first time around.

The thing that came up upon arriving back at the office and once getting into the software is how little that was known about this software and how it works. Therefore, on top of figuring out how the Faro scanner works we had to figure out how this SCENE software works. The processing for this project took longer than first expected, everyone thought that it would maybe take way less than it actually did. This is due to a couple of reasons we had to learn a couple new software packages and our time was limited to how deep we could get into the software.

The processing for this project was not as hard as first thought, once you have done the process ten times it becomes easy. After the processing was completed and all the cleaning was completed, we tried to take the total station points that were collected and apply them to the scans through a transformation, but for some reason, unknown to everyone who worked on the project, the information just would not work with the scans or they would not do what they were supposed to. Therefore, this part of the project needs to be looked at closer and it would have been better if the points were taken at the same time the scans were taking place. The recommendation was made of using an RTK (Real Time Kinematic) GPS instead of the total station. The information from the RTK seems to work better with the SCENE software than any other information.

The references for the software that was used to process the data for this project was very limited, this is something that should be looked into for future projects.

### REFERENCES


.FLS file type was used to start the entire project; came straight from the Faro Scanner

.LAS file type was exported from SCENE and brought into Global Mapper and used to export as a 3D PDF

Coordinate System: UTM WGS84 (CSRS) Zone 20

May5th was the one and only day that that data was collected

This data was collected by Jim Noble, Alasdair Sneddon, John MacDonald, Mitch MacInnis, Ruairidh MacKenzie, and Katie Chute

The background information on the Theresa E. connor came mostly from The Fisheries Museum of the Atlantic website (https://fisheriesmuseum.novascotia.ca/educational-resources/newsletter/theresa-e-connor ) and other information came from Lisa Zygowski (Resident Boat Builder).



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Instructor(s): Jim Norton and Rob Hodder

Client: Fisheries Museum of the Atlantic


## METHODOLOGY

This section will walk the reader through the process from the scanning of the Theresa E. Connor, the processing of cleaning the data that was collected by the Faro Scanner, and then finally exporting the files out into a format that can be brought into another software and exported out from that second software package as a 3D PDF.

The first thing that was done upon arriving on site was planning how many scans it was going to take to scan the keel of the Theresa E. Connor. The second thing that was talked about was where the Faro Scanner was going to be placed; along with the spheres, (the spheres were used as targets and reference points to tie the images together). As you can see in Figure 3, this is where the locations of the Faro Scanner were located throughout the site. Then the spheres were located around where the scanner, there had to be at least two spheres in the same locations for at least two scans or else the images and scans would not come together properly.

The next thing once all the scanning was completed and we were back at the office was to start the process of bringing in the files into the SCENE software and cleaning the data began. The first thing that was done was create a new project through the SCENE software; this is done by going File - New - Project. With doing this a window will pop up asking, you to choose the folder of which you are working within and to name the project that you are working on. The second thing was to bring the files into SCENE, this is done by going to windows explorer and selecting the folders of the scans, you are going to use, then drag and drop them into the workspace located on the left hand side of the software. The third thing was to set a reference scan, the purpose of setting a reference scan is that if you do not have enough targets then you can use the reference scan as a basepoint / starting location to locate the other images. By using that reference scan, this is done by right clicking on the scan of your choosing, going to the properties and then to the scan tab and checking off the “Reference Scan” box.

The next process is the preprocessing section, this process is done by right clicking the scan cluster, then selecting Operations - Preprocessing - Preprocess Scans. Once this process has run through a window will pop up, within this window you need to make sure that the following check boxes are checked off; Filter Dark Scan Points, Filter Stray Scan Points, Apply Pictures, Detect Articial References (with only the Spheres check boxes checked), Detect Natural References, and Create Scan Point Cloud(s), then you can click Okay and another process will run. Once this process is completed the scans might not show up, that is when you go to the toolbar located at the top of the software and go View - View - 3D View, this will show you the scans as a 3D point cloud. Do not worry if the scans come in at different angles the next step is going to fix that.

The following process, after the preprocessing process has been completed, is to place the scans. This process is done by right clicking on the scan cluster again, and then go to Operations - Registration - Place Scans. There is two parts to this process the first part is the Top View Based process, this process is done by selecting it from the drop down menu located at the top right of the window that pops up. Then click Okay, once that process has ran another window will pop up showing you the results of the Top View Based process, click okay and the process will be applied to the scans. The second step to this process is the Cloud-to-Cloud process; this is done through the same Place Scans window you just need to select it from the drop down menu located in the top right hand corner of the window. Again, once that process is complete another window will pop up and you click Okay to apply them to the scans you are working with. Once these processes are completed, your scans should come together nicely and they should look like one large scan, but are still individual scans.

Figures 4 & 5 show what the scans look like after the running the above Preprocessing process and the above Place Scans process.

The final process is to start cleaning the data of all the unwanted information. This is done by using three tools that are found in the main toolbar located at the top of the software as seen in Figure 6. Then when you are satisfied with the final product, it should look something like Figure 7.

Then to export your final product so it can be used in another software, you need to right click on the scan cluster and go to Import/Export, then Export Scan Points. This is where you can select the format of the files you are exporting and this is where you can choose where you wish the files to go as they are being exported. For this project the files type chosen was PTS files (*.pts).

For this project the exported *.pts files were brought into Global Mapper and then exported as a 3D PDF for viewing purposes and also to measure the hog in the keel of the old schooner.

Figure 6: Tools to use for Cleaning the data

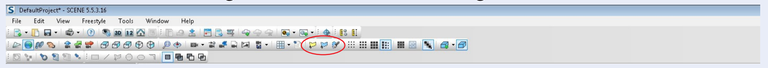



Figure 7: Final Product

## RESULTS

When it comes to the final product, once the cleaning of the data has been completed the Theresa E. Connor looks good. There is only one thing that we could not get to work and that was when we tried to connect the total station point to a scan location it would not work, for some reason. Therefore, in the end the boat could not be georeferenced.

Now to answer the question about the Theresa E. Connor keel, can it be measured from a 3D Model to determine the hog in the keel? The answer is yes it can be measured from a 3D model, but just how accurate that measurement will be in question. The only way one could tell if the measurement from the 3D model is correct unless you measure it in real life just to make sure that you are getting the correct number.

Overall, this project was a complete success, we were able to answer the question that the Museum had and we were able to produce a product that was to everyone's liking.

There was some troubles, but every project has its troubles that is how you learn. Learning new software was another learning experience and we only had a short amount of time to figure things out in order to get the project completed and back to our client.

In the end, everything came together, well except the total station data, and the project was a complete success.

Figure 4: After Preprocessing and Place Scans

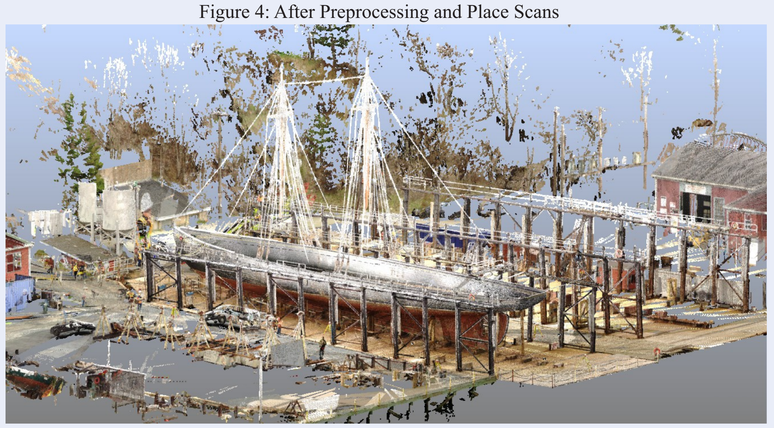
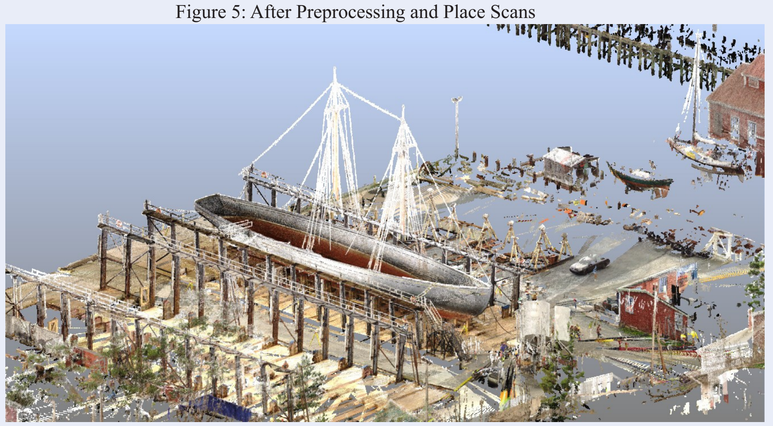


Figure 5: After Preprocessing and Place Scans



## CONCLUSION AND RECOMMENDATIONS

In conclusion, to this project there are a few recommendations that were suggested. The first thing would to be use RTK (Real Time Kinematic) to collect the points/locations instead of the Total Station. The second thing that was recommend was to collect the points at the same time that the scans were being collected. So for example, locate where the Faro Scanner would be setup and then take that location/point with the RTK, then set up the Faro to scan and at the same time take to locations of where the spheres are located. Repeat this process for all ten scans and sphere locations that are going to be used to complete this project.

Another thing that was recommend for this project was maybe instead of scanning 360 degrees try doing only 180 degrees and focus in on the boat. The reason that this recommendation came up is, there was just so much unwanted data that it took long to clean up the data then original thought. Also by cutting down the degrees, that the scanner is collecting then it would cut the processing time in half and there would be less cleaning of unwanted data to be done. Then the third thing that was recommended was the references for the software that was used to process the data for this project was very limited, this is something that should be looked into for future projects.

In completing this project there is one conclusion that came to mind and that was yes the Faro scanner works, but it is always going to be a good idea to double check the measurement of the hog by measuring it for yourself. That way by measuring it yourself then you can compare the measurement you collect to what was collect by the Faro scanner. The reason that is being said is that the points found within the point cloud are not tightly coupled and when you go in to take your measurement there may be no points there to reference your measurement. This will need to be looked at closer in future projects to see if this problem can be fixed either through the Faro scanner itself or through the software.