

NOAA Ship THOMAS JEFFERSON

Procedure Document

Procedure: Velodyne LP-16 LiDAR Patch Test

PROCEDURE TEMPLATE

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20190620

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Approved:

TBD

1. Overview and Scope

Following the installation of a Velodyne LP-16 LiDAR puck, a patch test needs to be completed to determine pitch, roll, yaw, and timing offsets that need to be applied in Hypack for acquisition.

2. Procedure Inputs and Outputs


Inputs:

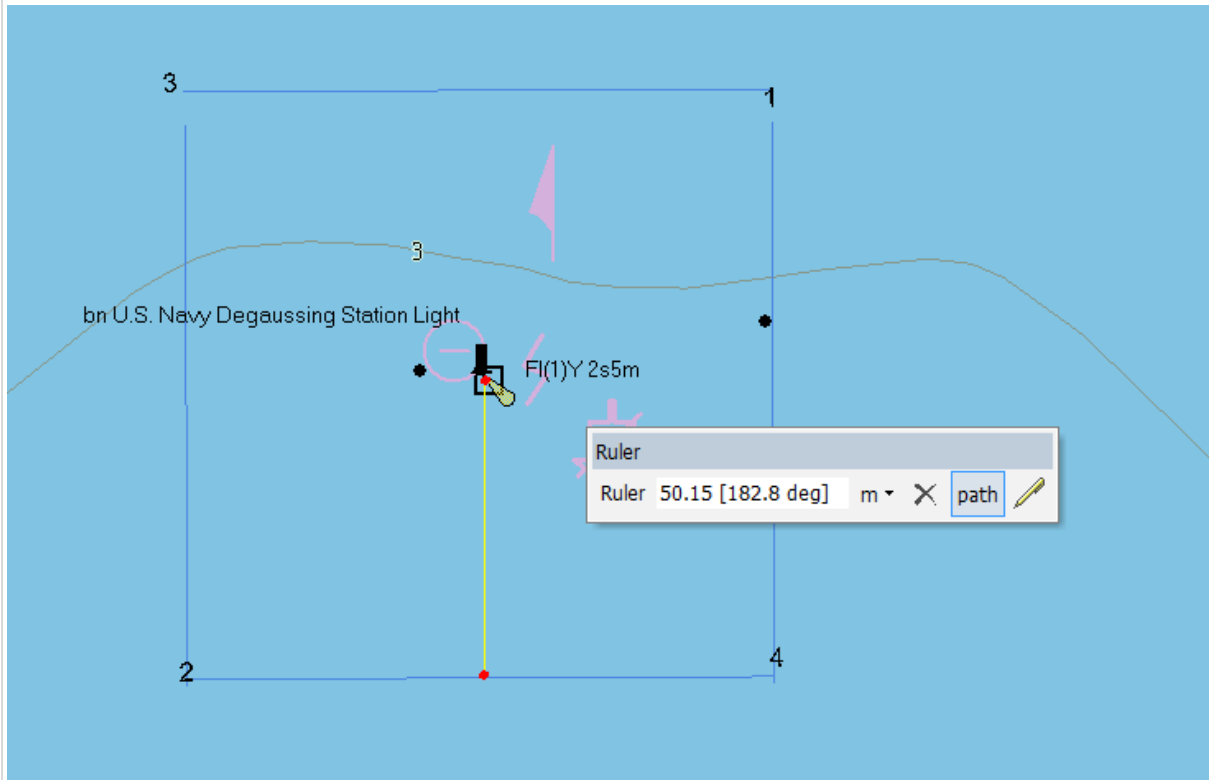
Four (4) lines of LiDAR data collected from Hypack.

Outputs:

Yaw, pitch, roll, and GPS Latency corrector values.

3. Procedure

Planning	
	Choose an object for patch testing
Locate an object which will allow for 4 lines of data to be collected on all sides in a square pattern. The object should be substantial with well defined edges. Rectangular or circular objects work best. Some examples are pictured below.	
 <p>***I would like to get a pic of the object the next we go by***</p>	
	Line Planning
Create a line plan consisting of 4 lines in a square pattern around the object. Lines should be placed 30-60 meters from the object. Lines will be run in a direction that places the object to starboard.	

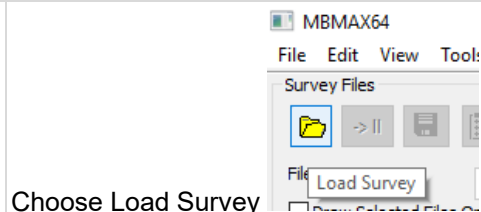


Acquisition

Follow the line plan placing the object to starboard. Log the 4 lines of data through Hypack while maintaining a speed of approximately 6 knots. It is helpful to have the Real Time Cloud open to monitor LiDAR function for adequate data density and quality.

Post-Acquisition Processing

Open HYSWEEP Editor (64 bit)



Choose Load Survey

Open the HSX .LOG file

Choose the 4 appropriate lines around the object. If you only have 4 lines in the survey, you can click Select All. Otherwise, highlight the appropriate lines and click Select.

In the Read Time Parameters window, select Elevation Mode and adjust the Matrix Cells to be 0.1x0.1 by clicking the Edit button.

Read Parameters

Survey Corrections Devices Processing

Survey

☐ Depth Mode ☒ Elevation Mode

17:53:19 06/10/2019

☐ Load Sidescan (if available)

Select Frequency

☒ 1 ☐ 2

☐ Load Multidetector (if available)

ERDDM_2019 | Elizabeth River, Norfolk, VA | 2904 |

Details Memory Test...

Matrix

Cells 0.10 x 0.10 | Cloud Sections 300 x 300 | Auto Size to Data | Rotate to Survey Line

Edit...

Check the Devices tab to confirm appropriate settings

Survey Corrections Devices Processing

Select All Files

Select Survey Files Before Making Changes

161_0002_1754.HSX
161_0003_1755.HSX
161_0005_1756.HSX
161_0006_1757.HSX

Navigation HYPACK | X=0.000 | Y=0.000 | Z=0.000 | Latency=0.000

MRU Applanix | X=0.000 | Y=0.000 | Z=0.000 | Pitch=0.00 | Roll=0.00

Alternate Device for Heave No

Heading Applanix | Yaw=0.00

Tide HYPACK

Sonar Head 1 Velodyne | X=0.987 | Y=-2.143 | Z=-3.377

Sonar Head 2

Edit

Check the heave settings in the Processing tab

Read Parameters

Survey Corrections Devices Processing

Select All Files

Select Survey Files Before Making Changes

161_0002_1754.HSX
161_0003_1755.HSX
161_0005_1756.HSX
161_0006_1757.HSX

Heave

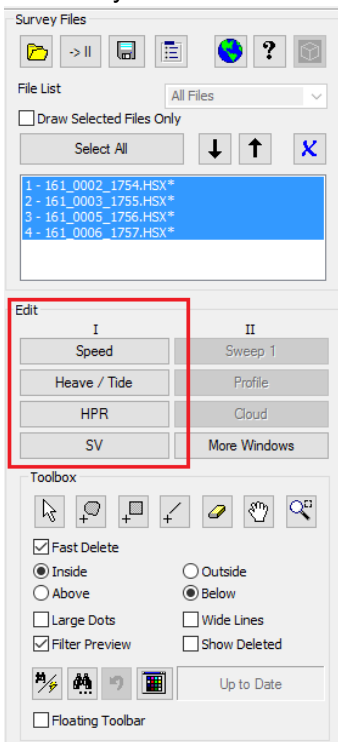
Use MRU Heave

Correct Induced Heave

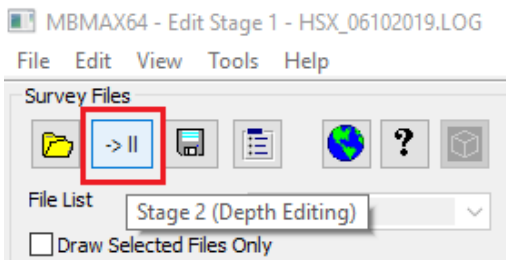
Heave...

Click OK when finished.

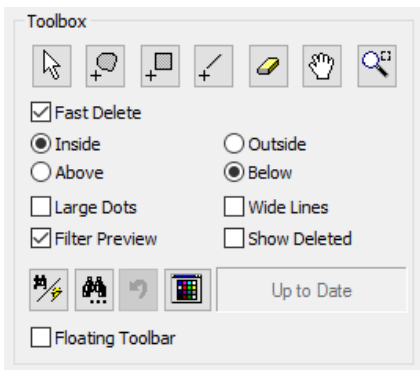
You now have an opportunity to view and edit ancillary data (vessel speed, heave/tide, heading, pitch, roll) if necessary.



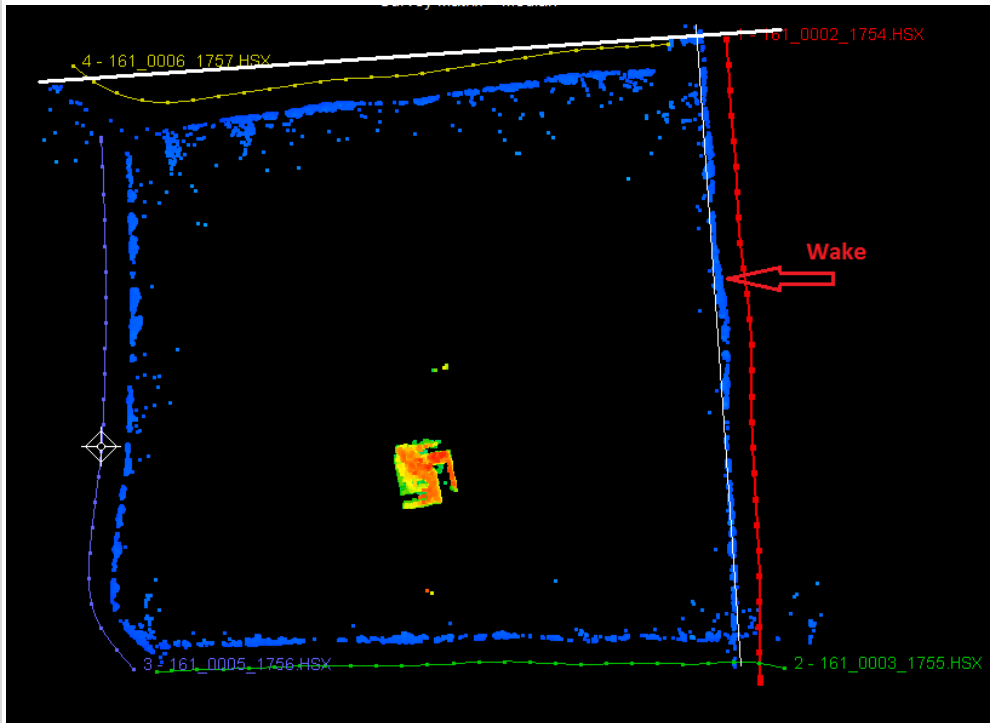
Once finished viewing/editing ancillary data, click the Stage 2 (depth editing) button.



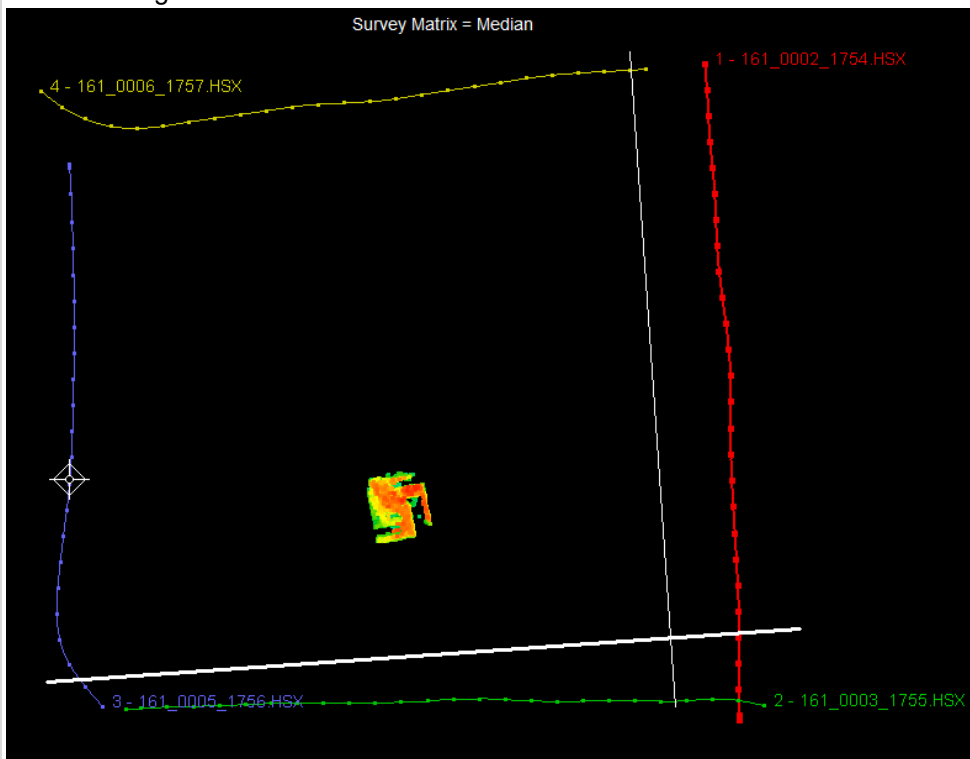
You will now see a matrix of the points collected by the LiDAR. You can clearly see the object as well as noise from the launch wake. Take some time to do some data cleaning to eliminate noise and other objects that are not of interest. There are lasso tools and fast delete options to help with this process.



Before cleaning:



After cleaning:



After you are finished cleaning, open a cloud window. Here you can control how you view your object- from the top (Map View), or from the side (Profile View). You will use both of these views while determining patch test values.

Edit

I

Speed

Heave / Tide

HPR

SV

II

Sweep 1

Profile

Cloud

More Windows

Cloud Window - Section = 1, Total = 1

X

⚡

🔄

📐

☀️

🔍

⬆️

✅

⬇️

🗺️

📊

Show

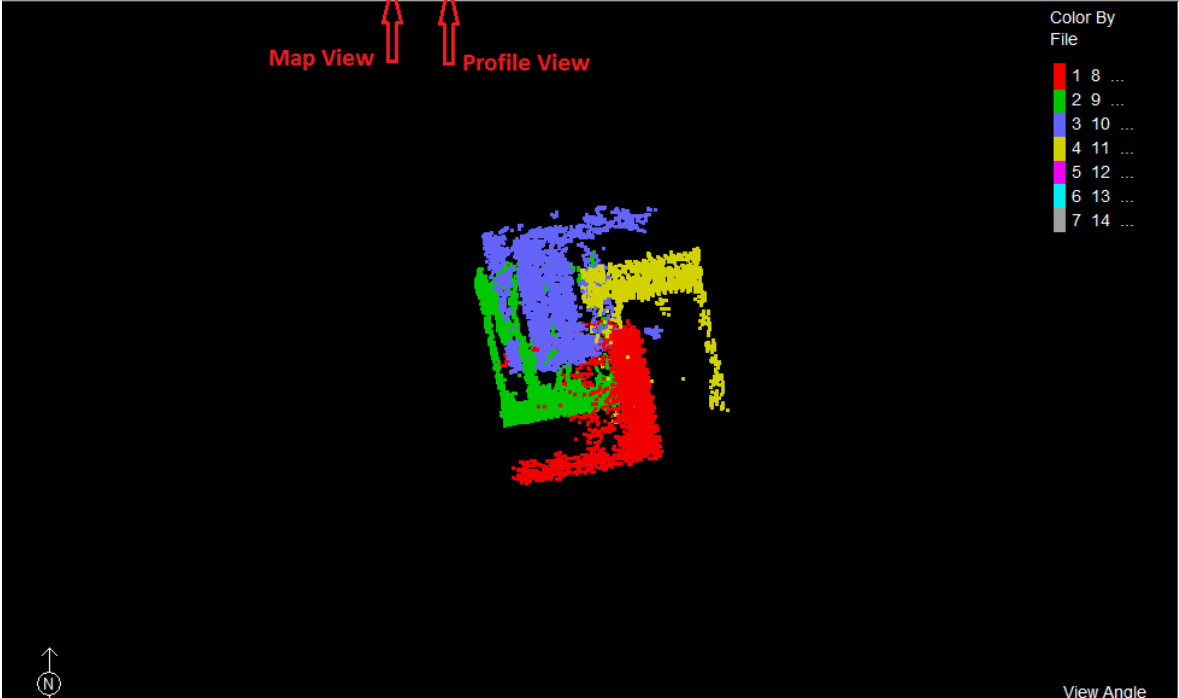
☒ Color Bar

☐ Checked Beams

☒ Grid Lines

Map View

Profile View



Color By

File

1 8 ...

2 9 ...

3 10 ...

4 11 ...

5 12 ...

6 13 ...

7 14 ...

From here we can clearly see that some adjustments need to be made to bring the 4 sides of the object in to a rectangular shape. To start the process, click File, Read Parameters and choose the Devices tab. This is where you have the ability to change Patch Test Offsets.

Read Parameters

Survey

Corrections

Devices

Processing

Select All Files

161_0002_1754.HSX

161_0003_1755.HSX

161_0005_1756.HSX

161_0006_1757.HSX

Select Survey Files Before Making Changes

Navigation

HYPACK | X=0.000 | Y=0.000 | Z=0.000 | Latency=0.000

MRU

Applanix | X=0.000 | Y=0.000 | Z=0.000 | Pitch=0.00 | Roll=0.00

Alternate Device for Heave

No

Heading

Applanix | Yaw=0.00

Tide

HYPACK

Sonar Head 1

Velodyne | X=0.987 | Y=-2.143 | Z=-3.377

Sonar Head 2

Edit

Patch Test

Yaw=0.00 | Pitch=0.00 | Roll=0.00 | GPS Latency=0.000

Edit

Offsets From MBMAX Boat File

Load

Save Current Offsets...

X

☐ Always Load Offsets From Boat File

OK

Cancel

Apply

Click the Edit button to open the Patch Test Offsets window. Here is where you will enter values to start the trial-and-error process to determine final values. Work with one value at a time so that you can see the results of the change in the Cloud Window.

Patch Test Offsets

Head 1

Yaw

2.0

Pitch

0.00

Roll

0.00

Head 2

Yaw

Pitch

Roll

GPS

Latency

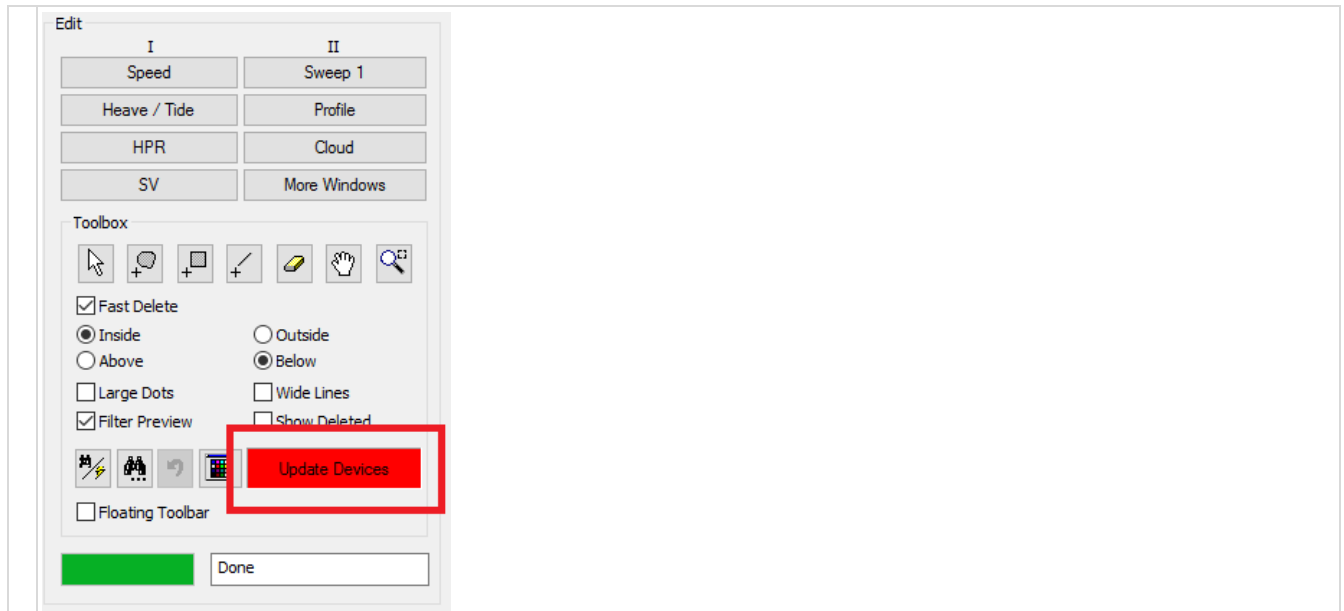
0.000

Patch Test History...

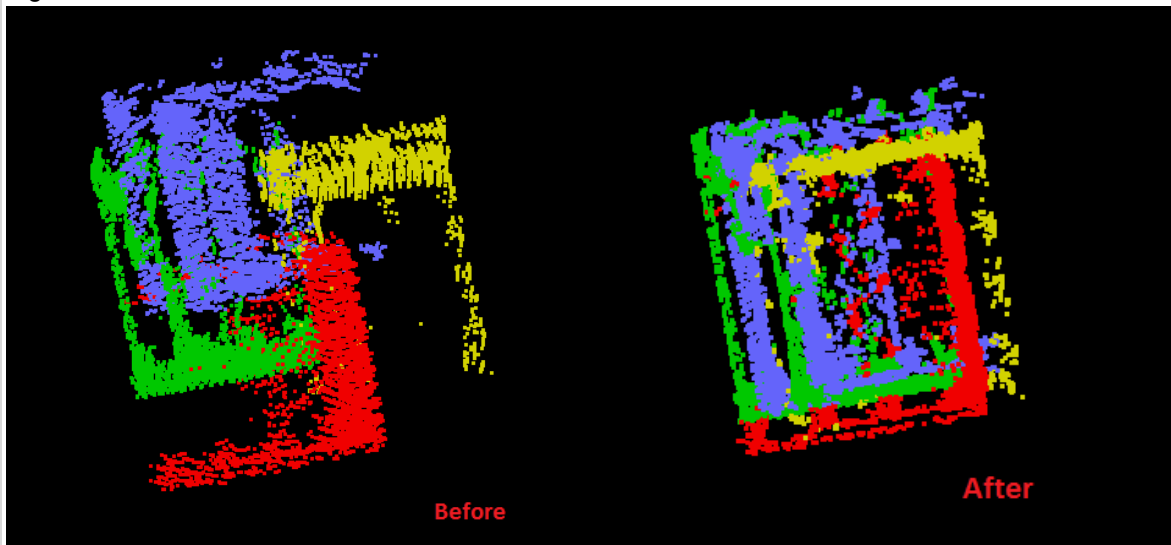
OK

Cancel

Click OK and OK again to close the Read Time Parameters. In order to see the changes in the Cloud Window, click the red Update Devices button.

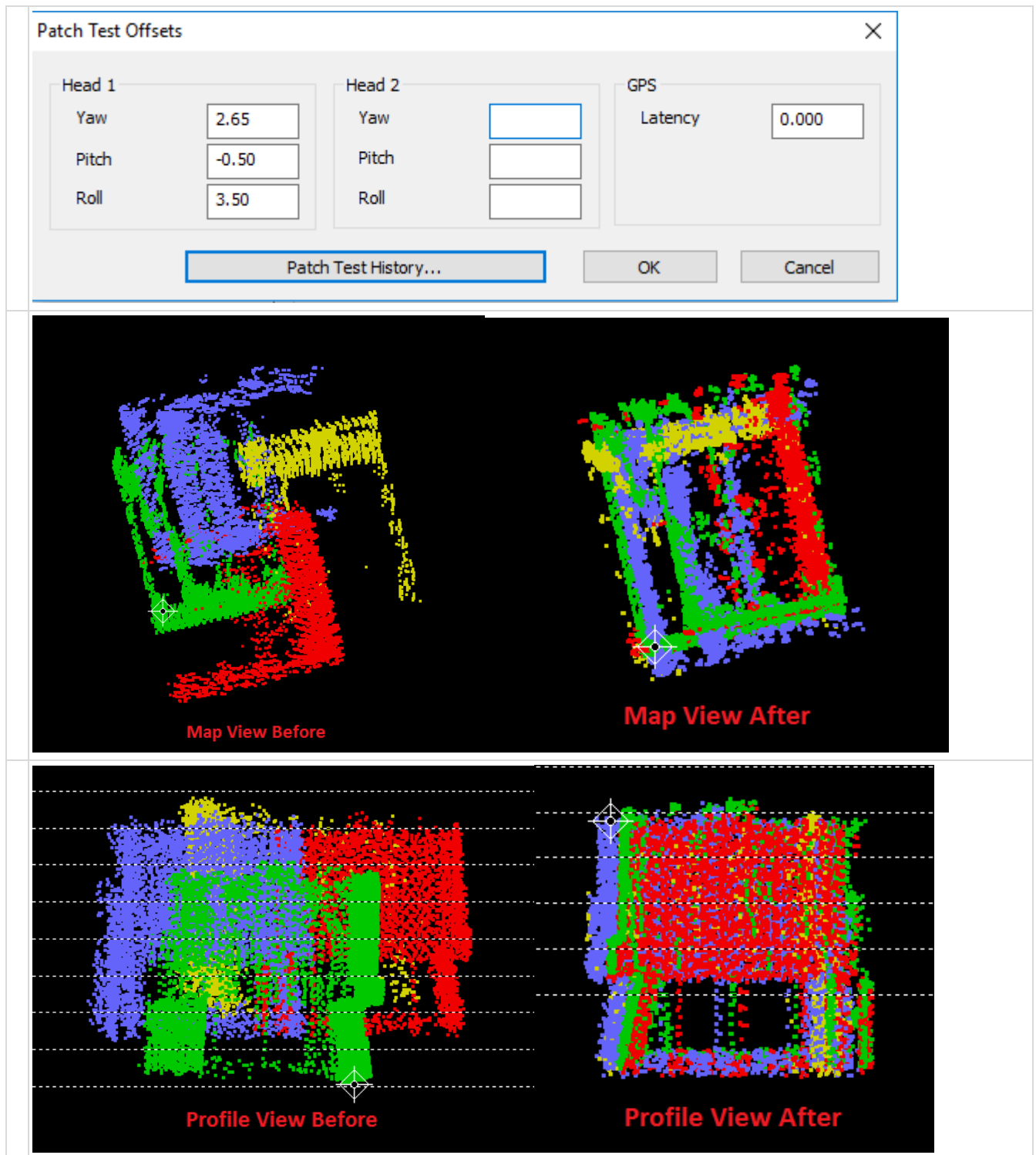


Note how the image changes in the Cloud Window. If you started with a positive number and the points move closer together, then you are heading in the right direction. If the points move farther apart, then try a negative number. Here we can see that an initial yaw value of 2 moved the sides of the rectangle closer together.



Return to the Patch Test Offsets window and try different values for Yaw until you are satisfied with the results. Remember that you can change your views and rotate the object in the Cloud Window to further inspect the results of the changes.

Once a final Yaw values has been determined, continue the process for Pitch and Roll while leaving the previously determined values in place. Final results for this object are shown below. These values are then entered in to Hypack Hardware Offsets tab for the VLP-16.



4. References

Burnett, Joe. "Performing a LIDAR/Laser Patch Test on Non-Aerial Vessels of Opportunity" September 2018 Hypack Publication.