# PH DENIX LIDAR SYSTEMS

1

## LiDAR Mapping Systems Post Processing - Applying a Geoid in TerraSolid

Revision Date: May 14, 2019

**Phoenix LiDAR Systems** 10131 National Blvd.

Los Angeles, CA 90034

www.phoenixlidar.com +1.323.577.3366 support@phoenixlidar.com

## Legal Notices

All the features, functionality, and other product specifications are subject to change without prior notice or obligation. Information contained herein is subject to change without notice.

Please read carefully and visit our website, <u>www.phoenixlidar.com</u> for further information and support.

**NOTE:** This brief provides a description of the workflow for applying a geoid file to a dataset in the United States. Your location and the product(s) you purchased may not support certain functions dedicated to specific models, upgrades or software.

## Disclaimer

Information in this document is provided in connection with Phoenix LiDAR Systems products. No license, expressed or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document. Except as provided in the terms and conditions of sale for such products, Phoenix LiDAR Systems assumes no liability whatsoever, disclaims any express or implied warranty, relating to sale and/or use of products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right.

Phoenix LiDAR Systems products are not intended for use in medical, life saving, life sustaining, critical control or safety systems, or in nuclear facility applications. In no event shall Phoenix LiDAR Systems liability exceed the price paid for the product from direct, indirect, special, incidental, or consequential damages resulting from the use of the product, its accompanying software, or its documentation. Phoenix LiDAR Systems makes no warranty or representation, expressed, implied, or statutory, with respect to its products or the contents or use of this documentation and all accompanying software, and specifically disclaims its quality, performance, merchantability, or fitness for any particular purpose. Phoenix LiDAR Systems reserves the right to revise or update its products, software, or documentation without obligation to notify any individual or entity. Backup collected data periodically to avoid any potential data loss. Phoenix LiDAR Systems disclaims any responsibility of all sorts of data loss or recovery.

# Applying a Geoid in TerraSolid

The Phoenix LiDAR Systems' Post Processing workflow creates LAS/LAZ in Ellipsoidal height, but if data is required to have orthometric height values, a geoid can be applied in the final stages of post processing in TerraSolid.

### 1 Prepare Data for use in TerraScan

#### 1.1 Download Continental United States Geoid model from Phoenix LiDAR Systems

Download the Continental US Geoid 12B LAZ file that has been optimized for use in TerraScan on our website at:

Client Links > Downloads > Geoids

This Geoid file is only applicable for the continental United States. Projects in other areas will require custom Geoid file with proper latitude, longitude, and dz values. Please contact <u>Support@phoenixlidar.com</u> if you need a geoid model for TerraSolid.

#### 1.2 Coordinate ranges, Projection systems, and Bounding delineation

Use TerraScan to read all the points in the project. If the project contains too many points to load all at once, read a representative tile (a center tile). In the dialog that pops up first, note the Easting and Northing origin of the data in its local projection system.

📕 Read points			×
Format: LA	Z 1.2	•	
Filename: 220 Points: 54	538_pre_geoid.laz 796 877		
3776899 <u>W</u>	584: Do not apply		
↓ 410684	D <u>e</u> fine		
<u>iransform:</u> No Fit <u>v</u> iew: 1	ne 🔻		
Only every	th point		
Only class 2	- Ground	-	>>
Inside fence only	/		

Coordinate origin of a LAZ file (in its local projection system)

Go to the TerraScan toolbar and locate the main toolbar and open "Scan Define Coordinate Setup". Ensure the resolution is at least 1000 (mm scale resolution) and that the Easting and Northing Origin will contain the coordinate origin of the data.

An other south	Units and I	esoluti	on
viaster unit:			
Resolution:	1000	per m	ı
	Origin		
Easting:	400000.000	)	
Northing:	3700000.00	00	
Elevation:	0.000		
	Coordinate	e range	
Eastings:	-1747484		+2547484
Northings:	+1552516		+ 5847484
Elevations:	-2147484		+2147484
OK	1	ſ	Cancel

TerraScan's Define Coordinate Setup

Use the 'place shape' or 'draw fence' tool to create a bounding box around the project area. The geoid file is very sparse, so this delineation needs to be **at least 5x larger than your project area**. This will ensure that TerraScan will have enough points to apply a valid model to the project needing a geoid adjustment.



Bounding box for loading the Geoid file

#### 1.3 Preparing Geoid Model

Highlight the bounding box created earlier and use TerraScan to 'read points'. All geoid files distributed by Phoenix LiDAR Systems are in WGS84, and need be transformed/projected to match your LiDAR data's datum/projection. You will likely apply the same transformation/projection used while importing your trajectory.

Load the Geoid LAZ and in the 'read points' dialog, apply the proper projection to match the LiDAR dataset, and select 'Inside fence only'.

Format:	LAZ 1.2		-	
Filename: Points:	continer 8 574 24	ntalus_geoid12b. 1	laz	
4 ↑	<u>W</u> GS84:	Do not apply		
	News	D <u>e</u> fine		
Fil view:	None 1	•		
Only every	10	th point		
			10 10	

Reading in the geoid file "Inside fence only". The geoid is in WGS84 lat lon coordinates

Format:	LAZ 1.2		-
Filename: Points:	continen 8 574 241	talus_geoid12b.	laz
1716314 ↑	<u>w</u> GS84:	UTM 11N NAD8	3
-8299	19	D <u>e</u> fine	
Transform:	None	•	
Fit <u>v</u> iew:	1		
	10	th point	
Only every	and a state of the		

Select the proper projection to match the lidar data

An alert will sometimes pop up saying that the first point is outside of the coordinate range, but click ok and disregard, as loading inside the fence alleviates this problem.

M Ale	rt	×
?	First point is outside the coordinate range. Change master units of the design file or apply a transformation to points.	
	<u>O</u> K Cancel	

Click OK when alert dialog pops up

With the Geoid points loaded, use TerraScan to 'Save points as' and save the geoid points as an ENZ file and ensure the extension is .xyz.

0 Cl	ass 0		^
	fault		_
3 10	ound wyvegetation		
4 M	edium vegetation		
5 Hi	gh vegetation		~
<u>S</u> elect all		Deselect <u>all</u>	
Points:	All points	-	
Line	All flightlines	•	
<u>F</u> ormat:	ENZ	•	
Delimeter:	Space	•	
Xyz decimals:	0.123	-	
Transform:	None	•	
	Inside fence	only	
	Inside fence	only	

Save points as ENZ (when naming the file, ensure .xyz is the extension)

### 2 Apply the Geoid in TerraScan

#### 2.1 Applying the Geoid Model

Once the Geoid file has been loaded and saved for the general region of the project, the dataset is ready for the application of the Geoid. If the dataset is in a 'Project', use the "Define Project" dialog to use 'Tools->Adjust to Geoid', otherwise load all the LiDAR points in TerraScan and use the main TerraScan dialog: 'Tools->Adjust to Geoid'. Select the Geoid.xyz file from the previous step. TerraScan will apply the dz values to the points by overwriting them, so if a backup is desired, make a copy prior to the 'Adjust to Geoid' step.

	Toolboxes	
	Show statistics	
22532_pre_geoid.laz - 13 471 910 points	<u>M</u> acro <u>A</u> ddon ►	
ile <u>O</u> utput <u>P</u> oint <u>V</u> iew <u>C</u> lassify <u>G</u> roup <u>T</u> ools	Draw <u>b</u> ounding box	
1 D C II 240001 000117	Draw into profile	
1 Default 1 249921.980117	Draw into sections	
1 Default 1 249921.900172	Draw polygons	
1 Default 1 249921.980227		
1 Default 1 249921.980279	S <u>m</u> oothen points	
1 Default 1 249921.980283	<u>T</u> hin points	
Cham In action	Adjust to geoid	
Show location	Convert geoid model	
	Transform loaded points	
	Transform known points	
🔀 Adjust to geoid 🛛 🗙	Output control report	
Dz model: Points from file 🔻	Assign color to points	
	Compute distance	
Inside fence only	Compute normal vectors	
	Extract color from images	
OK Cancel	Extract echo properties	
	Fit to reference	
	and the second se	
	Compare with reference	
	Compare with reference Sort	

Applying a geoid to a loaded dataset

This content is subject to change. Download the latest version from <u>www.phoenixlidar.com</u>

If you have any questions about this document, please contact Phoenix LiDAR Systems by sending a message to <a href="mailto:support@phoenixlidar.com">support@phoenixlidar.com</a>.

Copyright © 2018 Phoenix LiDAR Systems All Rights Reserved.