American Samoa Mobile LiDAR Mapping Program Report

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

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SANBORN

EXECUTIVE SUMMARY

Sanborn Map Company was contracted by the National Oceanic and Atmospheric Administration (NOAA) Costal Services Center (the Center), to 3-dimensionally scan Seven (7) Villages using the Lynx Optech Mobile Mapping System.

A network of ground control points have been design and implemented into the project process to establish Quality Control checkpoints for LiDAR and collect data in areas inaccessible to the Mapper.

A local network was established in each village scanned. This was then processed and adjusted using Trimble Geomatics Office (TGO). Final horizontal coordinates are provided on UTM Zone 2 Coordinate System and Datum using EGM 09 Global Geoid. Furthermore, orthometric elevations were estimated for all points in the network using sophisticated modeling techniques.

The Laser and Camera Data was post processed using the final adjusted base station coordinates to apply accurate position data to the output point cloud.

The data sets were processed using GeoCue data and project management suite of tools in conjunction with TerraSolid's to create the Level II calibrated datasets and the final required Level III datasets.

Sanborn contracted 7 villages

	Village	Collection and Level II Processing	Level III Processing
1	Amanave	X	X
2	Fagaalu	X	X
3	Fagotogo	X	X
4	Leone	X	X
5	Pago Pago	X	X
6	Poloa	X	X
7	Vatia	X	X

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1.0 INTRODUCTION

This document contains the technical write-up of the LiDAR campaign, including standard specifications, system calibration techniques, field procedures, and the accuracy of the LiDAR data. Detailed survey report is attached as Appendix A.

1.1 Contact Information

Questions regarding the technical aspects of this report should be addressed to:

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1.2 Purpose of the LiDAR Acquisition

Sanborn Map company was contracted to produce level 2 and level 3 processed LiDAR collected via Mobile Mapping Ground Based methods coupled with and supported by Conventional Survey methods

The project area for was 7 pre-determined villages that were selected by NOAA to be scanned in the contract. The villages scanned were: Fagaalu, Fagotogo, Pago Pago, Vatia, Leone, Amanave and Poloa.

1.3 Project Location

1.4 Post Processing

The LAS data was extracted and processed through DASHMap, and then handled in Geocue and Terrasolid software. The boresight was performed on a building in Nuuli. The boresight was successful in tying together the building, and the correction file with adjustments to heading, roll, and pitch were applied to the entire data collection.

The final adjusted survey points were utilized to create final adjusted positioning for the laser ouput files using Applanix POS PAC 5.3 MMS for incorporating into the output of the updated SBET's.

2.0 LiDAR CALIBRATION

2.1 Introduction

LiDAR calibrations are performed to determine and therefore eliminate systematic biases that occur within the hardware of the Optech Lynx mobile mapping system. Once the biases are determined they can be modeled out. The systematic biases are corrected for include heading, roll, and pitch.

The following procedures are intended to prevent operational errors in the field and office

work, and are designed to detect inconsistencies. The emphasis is not only on the quality control (QC) aspects, but also on the documentation, i.e., on the quality assurance (QA).

2.2 Calibration Procedures

Sanborn performs calibration proceedures using TerraSolid products that are applied-inlcuding TerraScan and TerraMatch. Utilizing these two tools, Sanborn is able to correct each intiviual raw data strip to precisely match any overlapping swaths. In return, the RMSE of the enitre project is substantually lower, resulting in a more accurate dataset. TerraMatch samples the data perpenicular to the drive pattern to assess and correct for roll errors, pitch errors, and heading errors.

Once the population of the data base is complete, a filter is applied to each tile. The filter classifies bare earth and building rooftops per pass in order for TerraMatch to recognize the individual strips and their features, allowing the software to find corrections for roll, pitch, and heading throughout the project. Once the adjustments are calculated, the settings are applied to the final delivery tiles.

3.0 MOBILE LIDAR SYSTEM REPORT

3.1 Introduction

This section addresses LiDAR system, drive reporting and data acquisition methodology used during the collection of the America Samoa campaign. Although Sanborn conducts all LiDAR with the same rigorous and strict procedures and processes, all LiDAR collections are unique.

3.2 Field Work Procedures

The Lynx Mobile Mapper was installed on a Toyota RAV4. A survey and installation calibration was performed prior to collection of the village site.

Pre-collect checks such as cleaning the sensor head glass are performed. A five minute INS initialization is conducted, with the equipment running, prior to collection, to establish fine-alignment of the INS. GPS ambiguities are resolved by collecting in the proper PDOP window and limiting obstructions. The mobile mapping team coordinated daily with DOC and the survey team for establishment of base stations and collection.

A minimum of two GPS base stations were set for each America Samoa village, which is within the project area or within the required baseline specifications of the project.

An initial survey approach and daily collection was planned using detailed map base data supplied by NOAA. This included planning for PDOP and satellite visibility, route planning for data integrity, and identifying areas that may potentially require additional data collection missions due to terrain, vegetation or building obscurations.

At the completion of the days mission, the data was transferred to the workstation and data quality and coverage checks were performed.

3.3 Final LiDAR Processing

LiDAR filtering was accomplished using TerraSolid, TerraScan LiDAR processing and modeling software. The filtering process reclassifies all the data into classes with in the LAS formatted file based scheme set using the LAS format 1.2 specifications or by the client. Once the data is classified, the entire data set is reviewed and manually edited for anomalies that are outside the required guidelines of the product specification or contract guidelines, whichever apply.

The coordinate and datum transformations are then applied to the data set to reflect the required deliverable projection, coordinate and datum systems as provided in the contract.

The client required deliverables are then generated. At this time, a final QC process is undertaken to validate all deliverables for the project. Prior to release of data for delivery, Sanborn's quality control/quality assurance department reviews the data and then releases it for delivery.

4.0 GEODETIC AUTHENTICATION

4.1 Final LiDAR Verification

The LiDAR data was evaluated using a collection of 49 painted target control point. For America Samoa, the standard deviation is 0.062 meters and the root mean squared is 0.064 meters. The LiDAR data was compared to each of these benchmarks yielding a better result than was required for the project. Table 1 indicates the results for America Samoa and each point including the overall results as it compares to the LiDAR data set.

Table 1: LiDAR Accuracy Assessment based on the Checkpoint Survey (Meters)

Name	Vegetation Class	Easting	Northing	Known Z	Laser Z	Dz
1101	Bare Earth	535288.251	8425120.346	2.584	2.590	+0.006
1102	Bare Earth	535199.840	8425032.699	1.766	1.780	+0.014
1104	Bare Earth	535016.137	8424794.815	1.833	1.810	-0.023
1105	Bare Earth	535082.987	8424931.843	1.668	1.648	-0.020
1106	Bare Earth	535001.944	8424601.126	2.269	2.280	+0.011
1107	Bare Earth	535025.352	8424542.535	2.341	2.348	+0.007
1109	Bare Earth	535333.381	8424432.097	1.605	1.633	+0.028
1110	Bare Earth	535480.494	8424457.753	2.597	2.580	-0.017
1002	Bare Earth	517930.008	8417394.873	5.259	5.233	-0.026
1004	Bare Earth	517916.294	8417286.724	6.337	6.312	-0.025
1014	Bare Earth	517884.947	8417226.289	5.088	4.950	-0.138
1015	Bare Earth	517861.023	8417168.097	4.525	4.421	-0.104
1019	Bare Earth	517821.721	8417081.602	4.655	4.651	-0.004
1020	Bare Earth	517795.080	8417056.065	4.637	4.525	-0.112
1021	Bare Earth	517801.996	8417011.026	9.474	9.382	-0.092

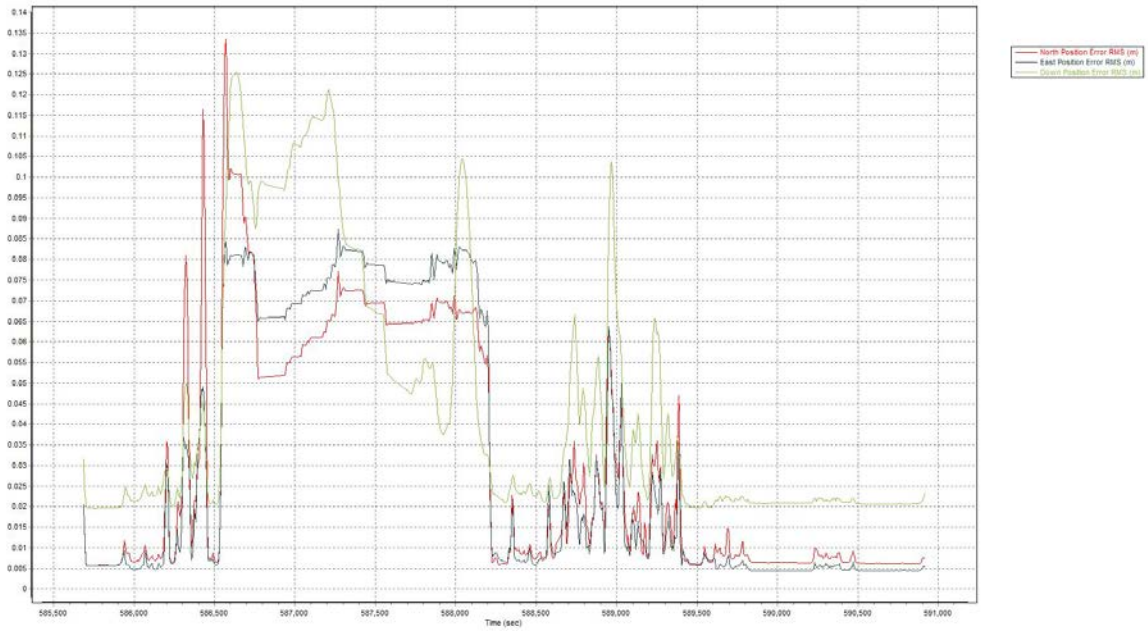
1038	Bare Earth	517930.004	8417394.875	5.283	5.233	-0.050
1045	Bare Earth	518012.756	8417465.695	11.833	11.810	-0.023
1046	Bare Earth	518046.292	8417366.076	25.630	25.627	-0.003
1274	Bare Earth	531997.324	8422081.864	2.122	2.146	+0.024
1275	Bare Earth	532405.106	8422315.053	1.921	1.974	+0.053
1276	Bare Earth	532918.238	8422287.265	2.235	2.254	+0.019
3241	Bare Earth	523323.757	8414953.395	2.276	2.279	+0.003
3242	Bare Earth	523466.259	8415203.222	2.447	2.400	-0.047
3243	Bare Earth	523454.782	8414630.994	18.661	18.756	+0.095
3244	Bare Earth	522969.876	8414878.683	2.639	2.647	+0.008
3245	Bare Earth	522867.664	8415078.113	2.484	2.506	+0.022
3246	Bare Earth	522936.194	8415124.381	2.956	2.954	-0.002
3247	Bare Earth	523557.012	8415586.489	5.325	5.252	-0.073
3248	Bare Earth	523495.917	8416012.303	19.743	19.737	-0.006
3128	Bare Earth	532888.302	8421859.332	2.367	2.414	+0.047
3129	Bare Earth	533242.553	8421627.135	2.781	2.643	-0.138
3130	Bare Earth	533521.517	8421465.487	1.851	1.856	+0.005
3131	Bare Earth	533710.241	8421570.893	1.847	1.889	+0.042
3132	Bare Earth	533899.085	8421579.544	2.709	2.766	+0.057
3096	Bare Earth	534327.812	8419929.760	2.065	2.051	-0.014
3097	Bare Earth	534568.338	8419790.080	2.587	2.643	+0.056
3099	Bare Earth	534372.898	8419822.316	2.322	2.233	-0.089
3100	Bare Earth	534146.648	8420016.934	1.818	1.849	+0.031
3101	Bare Earth	534365.295	8420263.819	3.914	3.924	+0.010
3103	Bare Earth	533998.817	8420023.344	3.492	3.515	+0.023
3003	Bare Earth	518433.526	8416087.436	5.196	5.186	-0.010
1087	Bare Earth	518032.311	8416390.069	4.884	4.651	-0.233
1088	Bare Earth	517875.543	8416370.872	6.232	6.212	-0.020
1098	Bare Earth	518238.977	8416293.285	3.885	3.787	-0.098

Average dz	-0.018
Minimum dz	-0.233
Maximum dz	+0.095
Average Magnitude	0.044
Root Mean Square	0.064
Std deviation	0.062

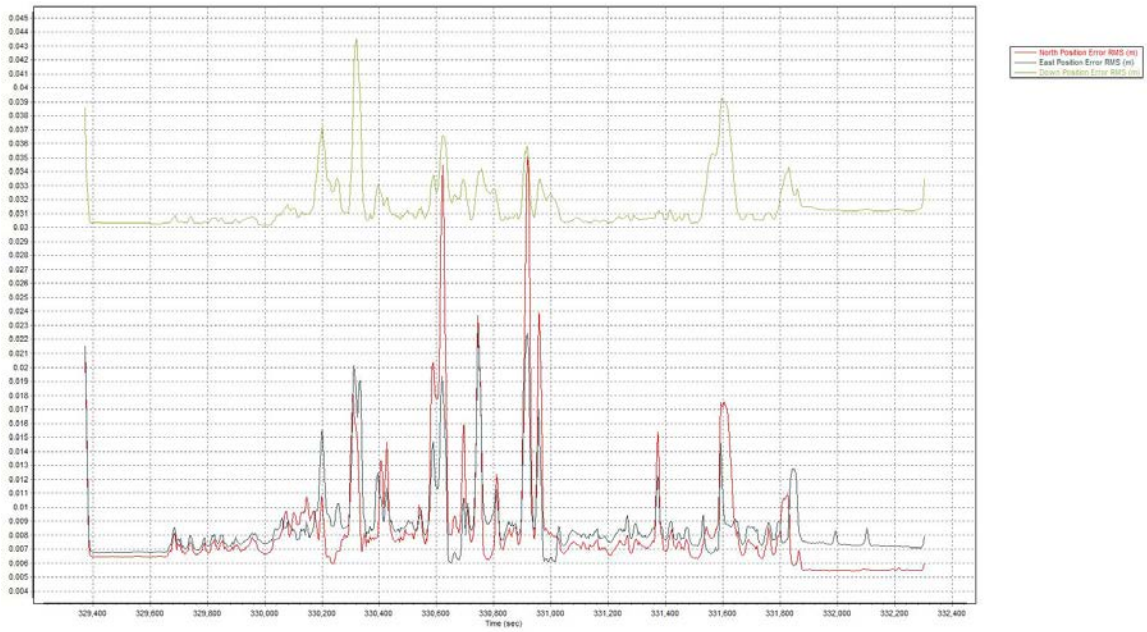
5.0 COORDINATES AND DATUM

Horizontal: UTM Zone 2 South
Vertical: NAVD88 (most current) ASVD02
Geoid: Geoid09
Units: Meters
HARN: CORS ASPA (aj5871)
Accuracy Tolerance: <18cm.

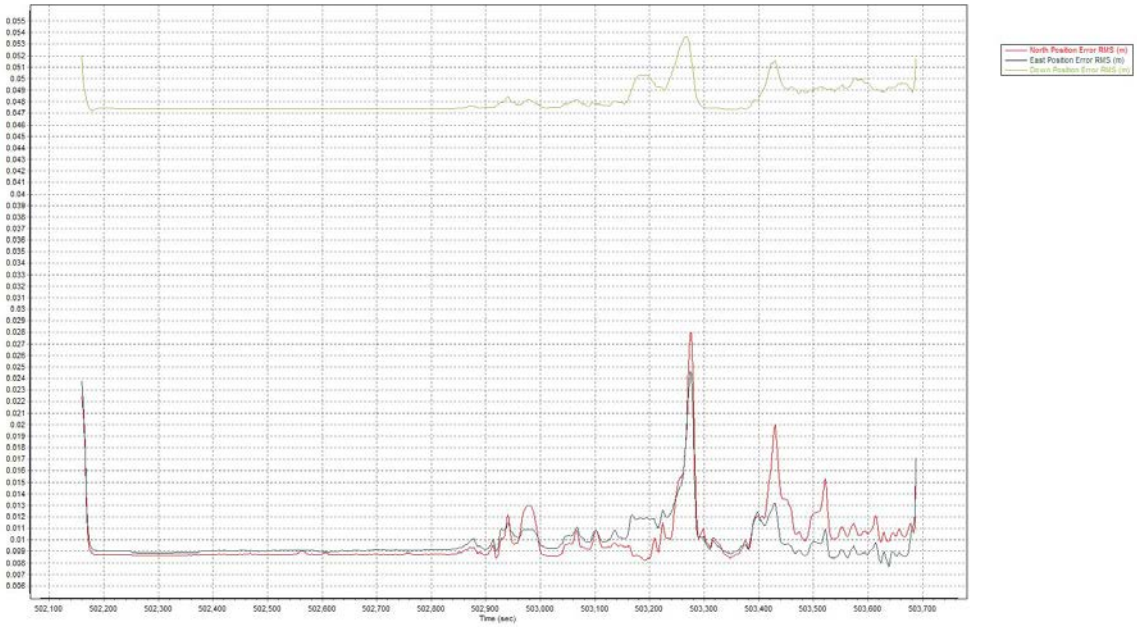
6.0 SBET INITIAL SOLUTION (FIELD CHECK)



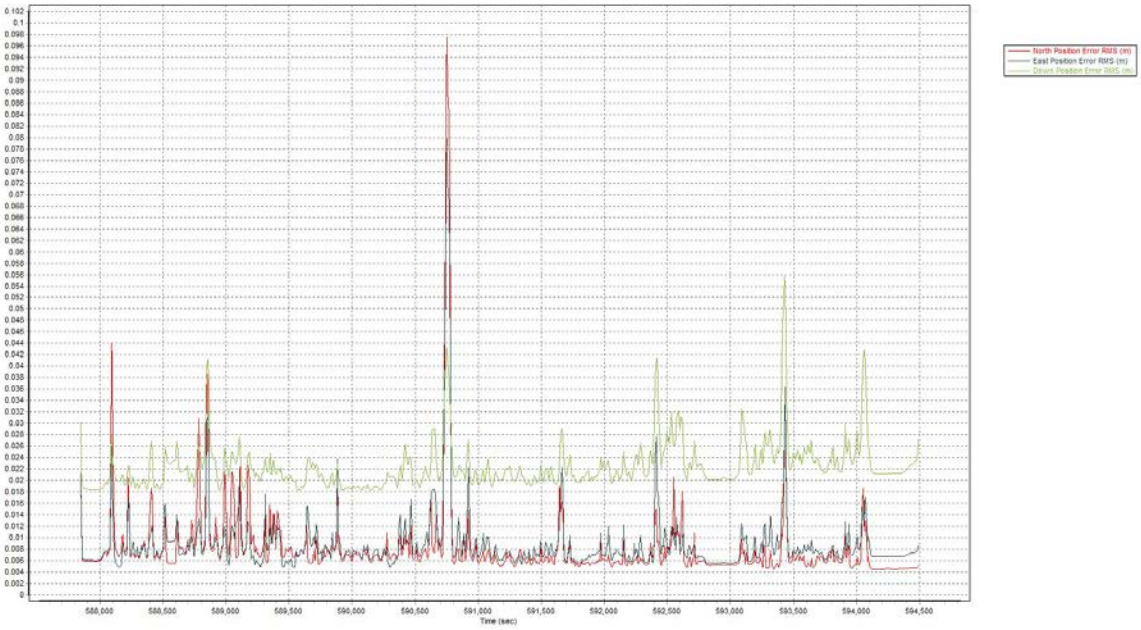
Amanave



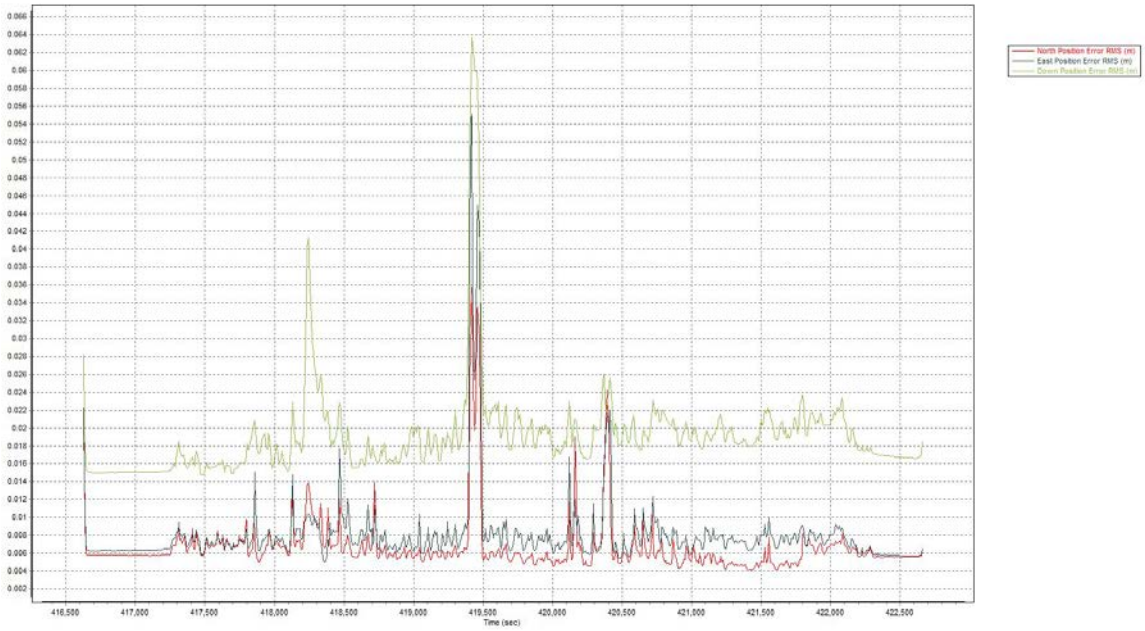
Fagaalu



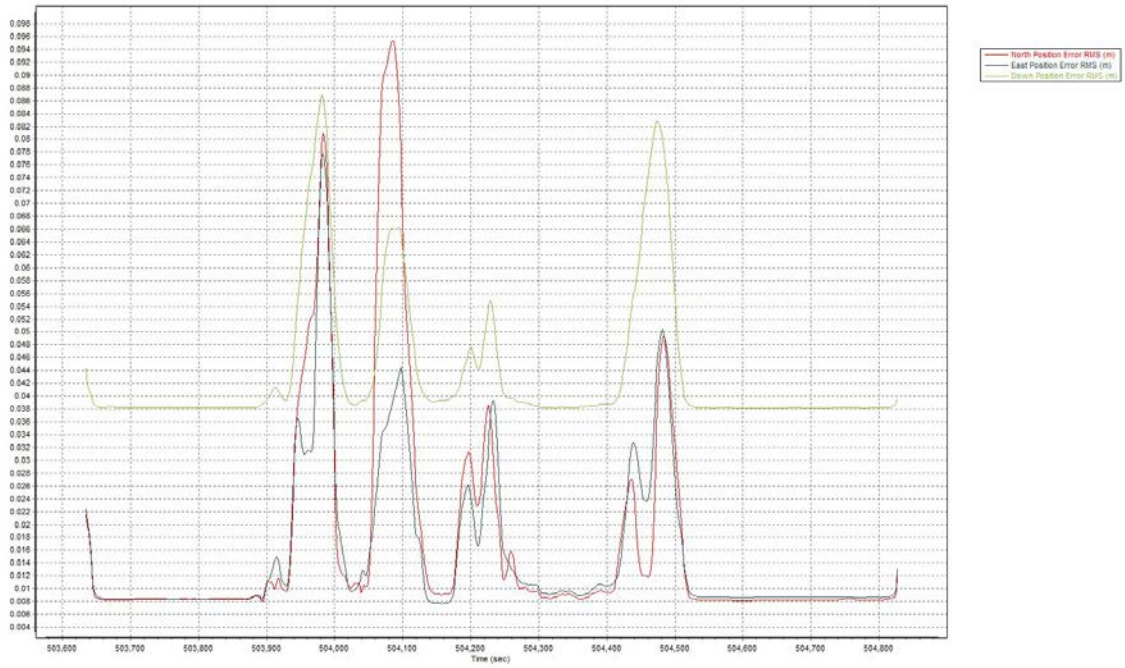
Fagatogo



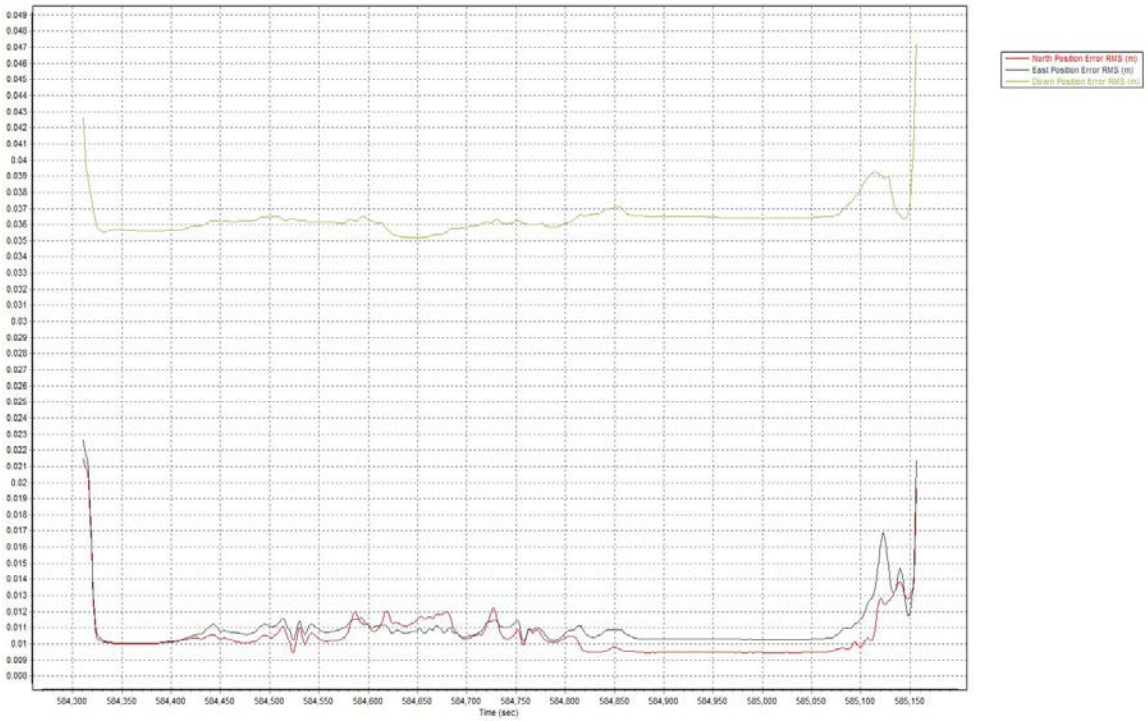
Leone



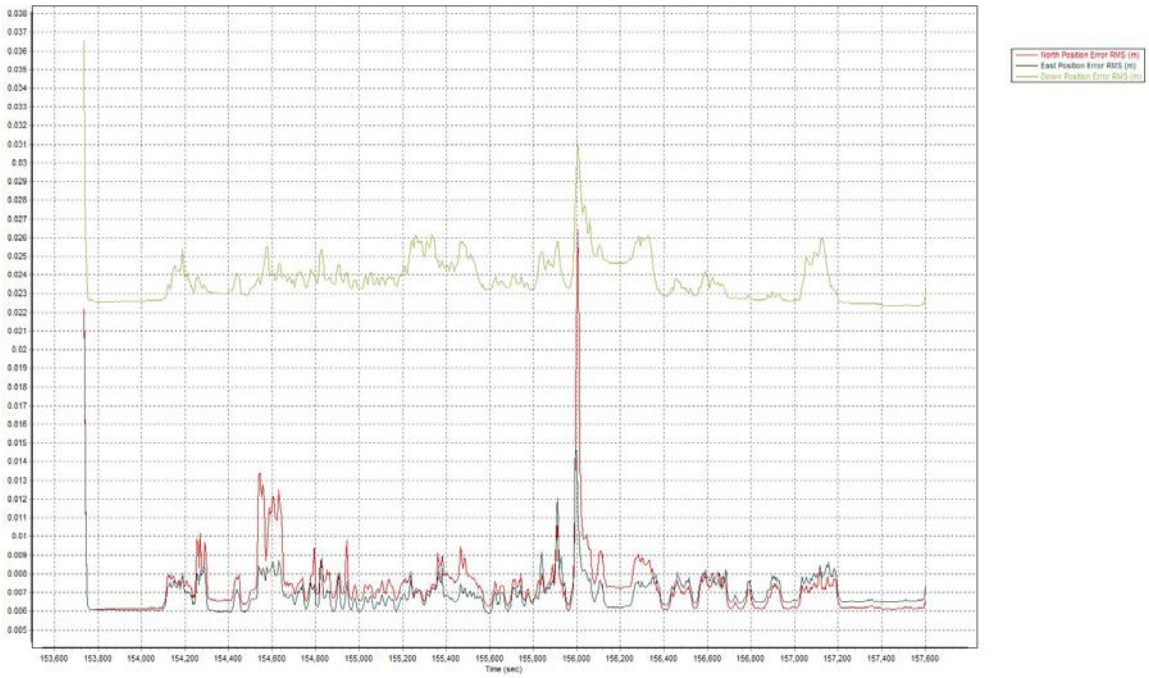
Pago Pago



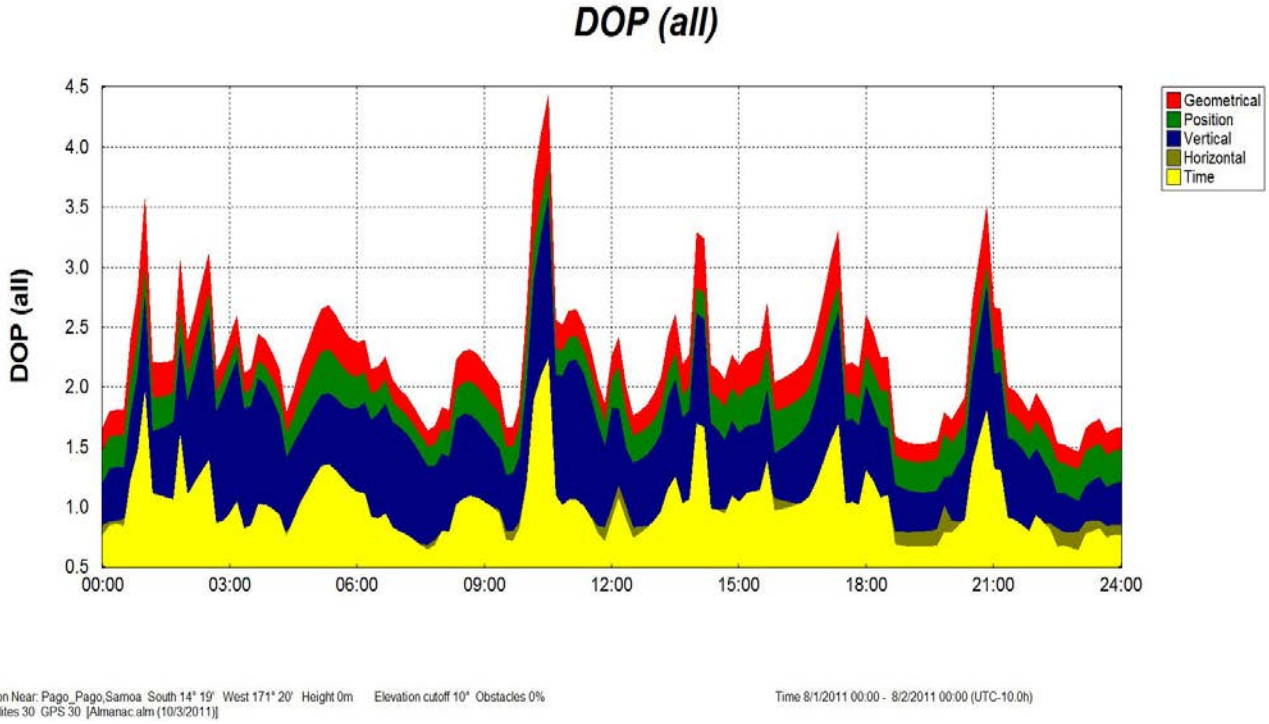
Poloa 1



Poloa 2



Vatia

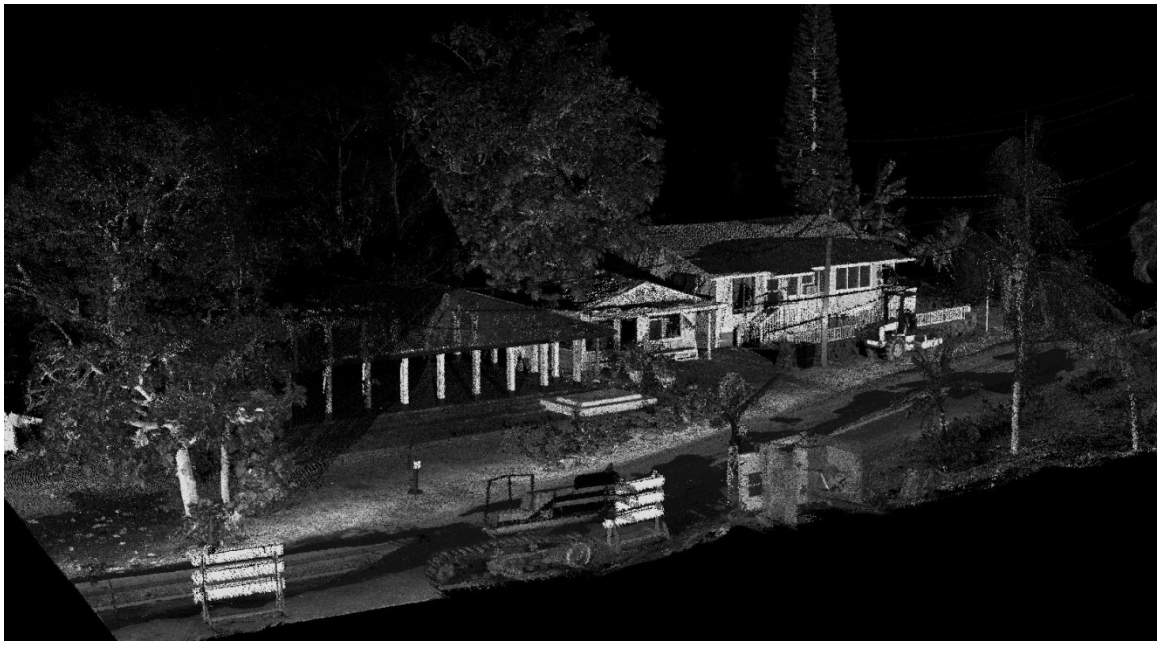


PDOP solution

Amanave 1

Amanave 2

Fagaalu 1



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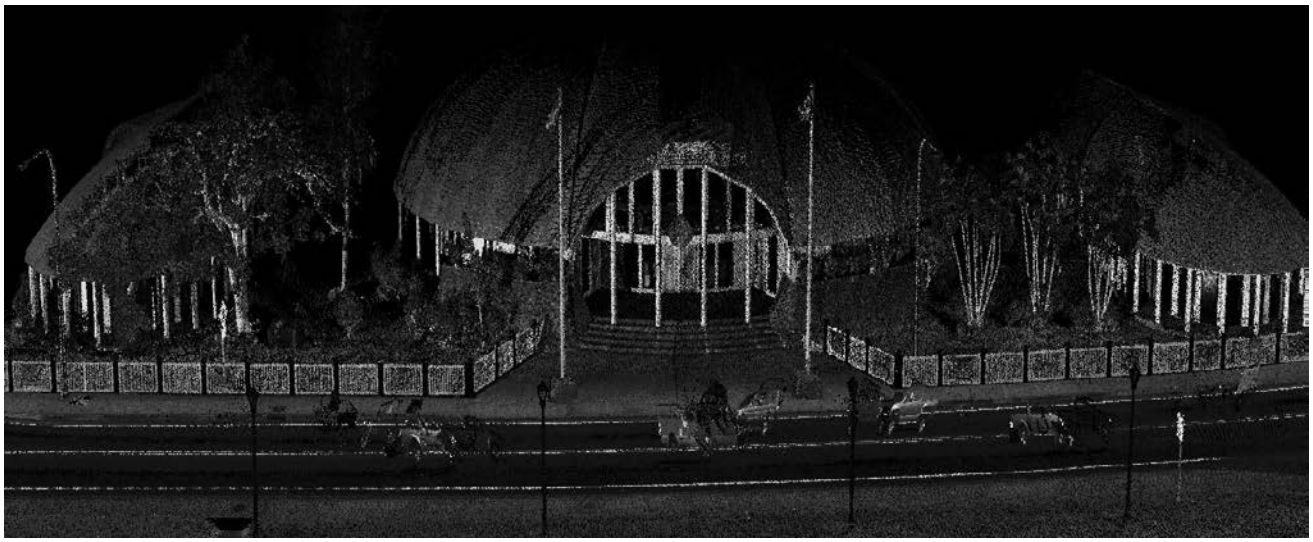
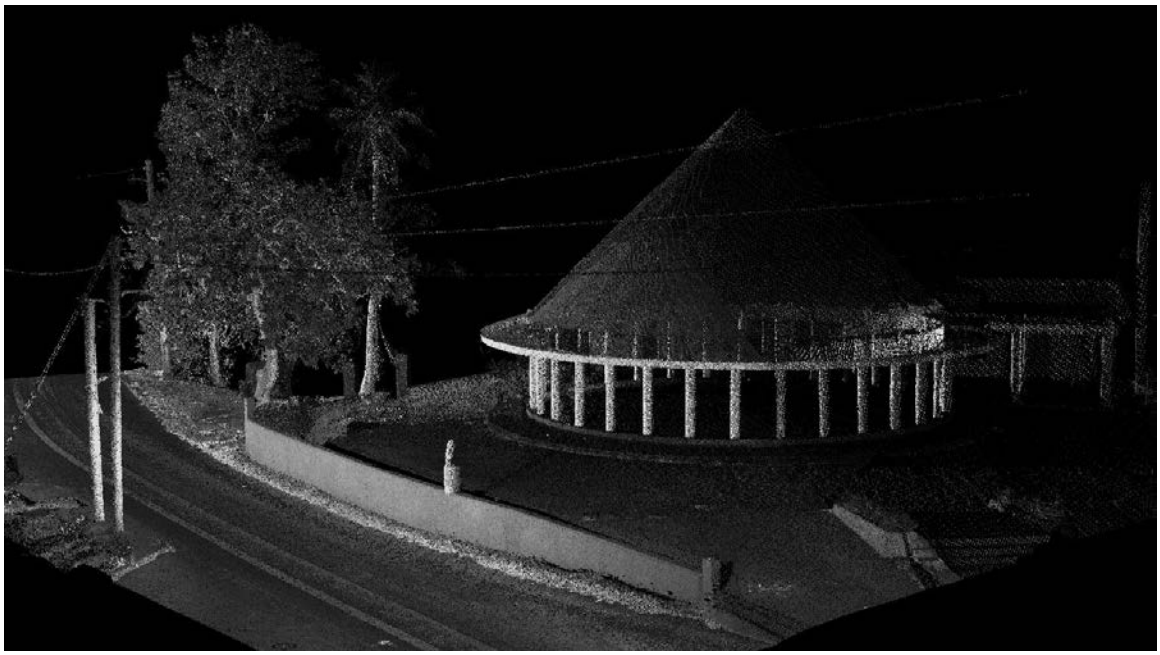


Fagatogo 1

Fagatogo 2

Leone 1



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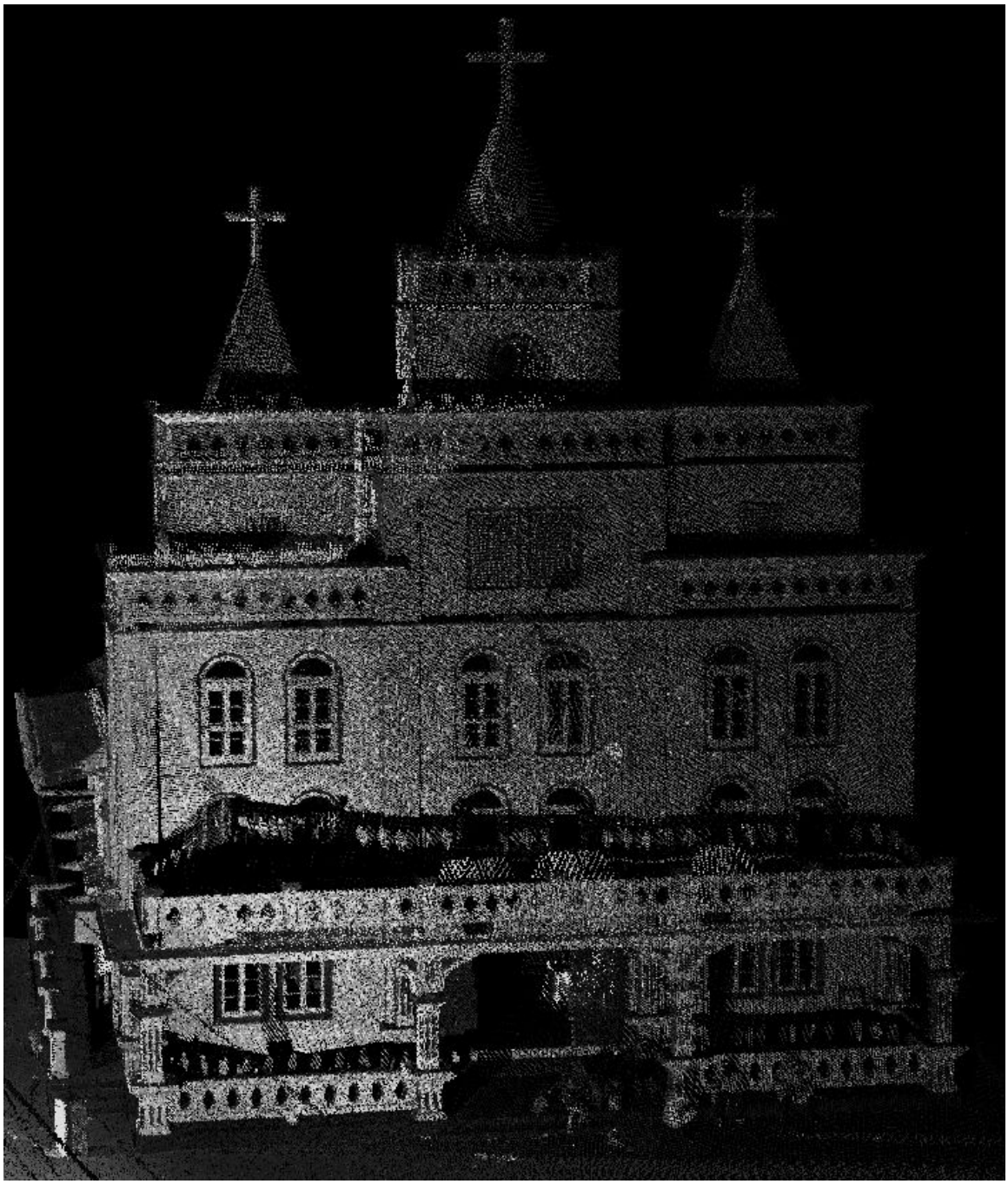


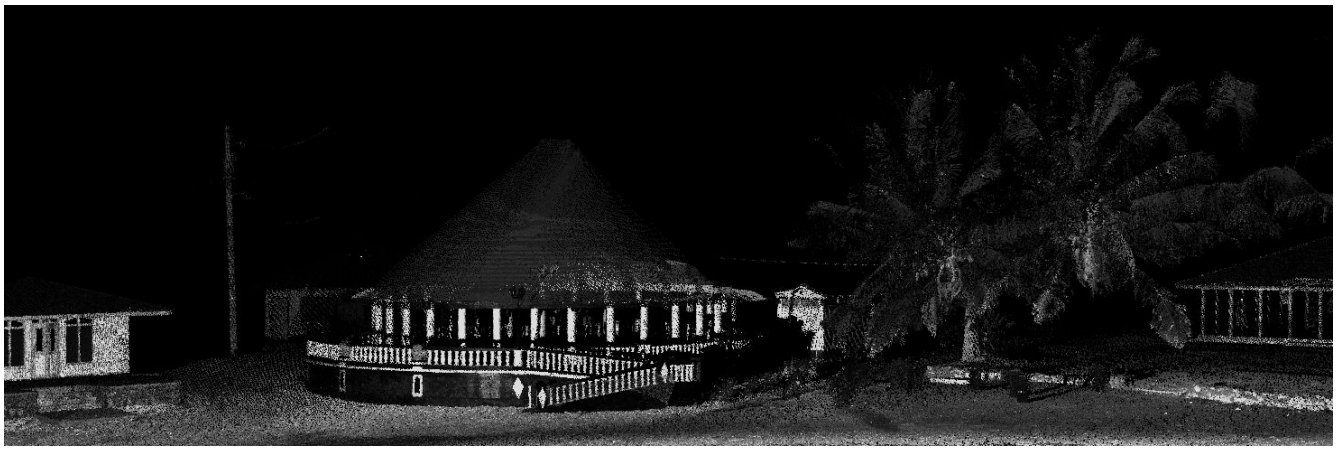
Leone 3

Pago Pago 1

Pago Pago 2

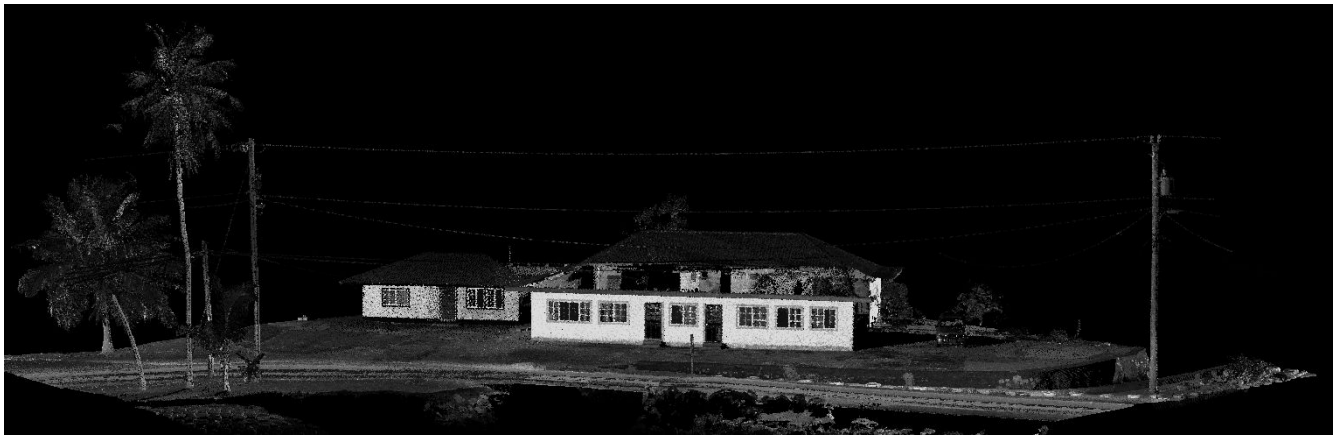
Poloa 1

Poloa 2



Vatia 1

Vatia 2



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