

Trouble in Paradise: The Challenges of Mobile Lidar Surveying on a Remote Pacific Island



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A new take on remote sensing

- American Samoa was hit hard by a tsunami in 2009.
- The National Oceanic and Atmospheric Administration (NOAA) needed current, accurate topographic data to assess the island's vulnerability to future storms and tsunamis.



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- NOAA contracted Sanborn Map to carry out a survey of the island.
- One deliverable was position data with an accuracy of 18 cm or better.



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- The island is so remote that logistics and budget limitations ruled out using an aircraft-mounted lidar to survey.
- Mobile lidar mapping became a very attractive alternative.



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- If the survey team was hoping for respite in a tropical paradise, they were in for a surprise.
- From Denver, it took 15 hours to fly to American Samoa, then another 2 hours to get to the survey site.



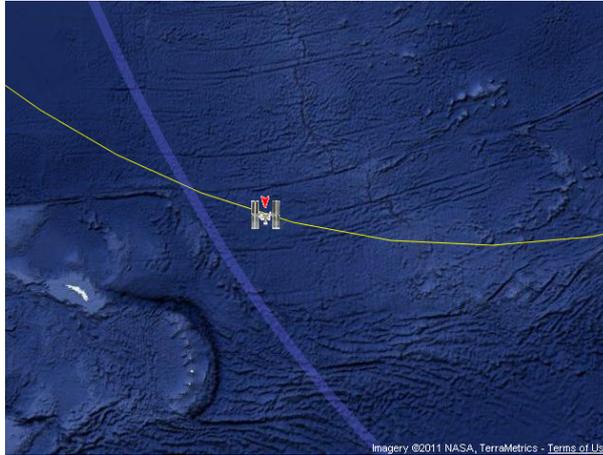
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- The island's amenities were so basic there was no building to store the Lynx survey vehicle.
- To protect the equipment from torrential rain, they wrapped the entire system in tarp every night.



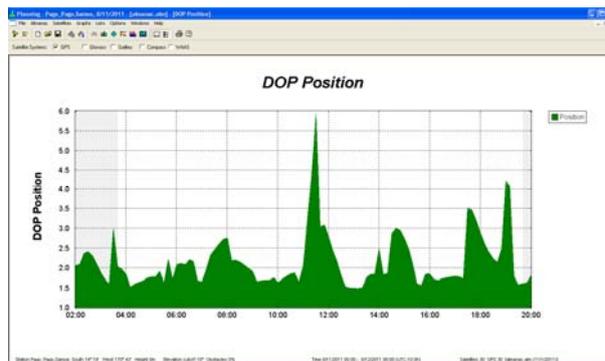
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- Because the island is so remote, GPS satellites do not track this area with the density and frequency of more populous areas.
- So when planning, the survey team had to pay very close attention to PDOP values.



Google Earth image, © NASA, TerraMetrics

- The optimal DOP survey window was between 6 a.m. and 12 p.m.
- Smaller, later windows were not risked due to traffic, travel time, and the local residents' practice of stopping work during the evening prayer time.



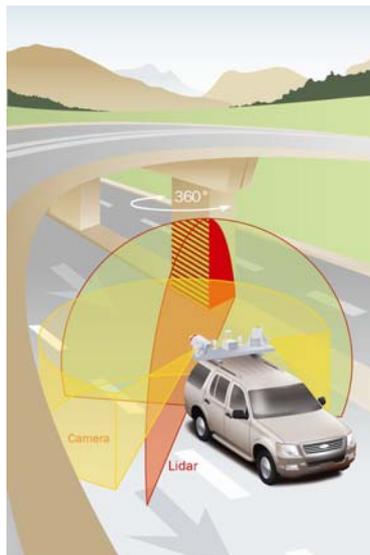
- Apart from logistics and expense, low-altitude flight over the island is out of the question.
- The mountains' near-vertical faces create laser "shadowing"— areas "invisible" to an overhead laser because they do not present a sufficient planar surface.



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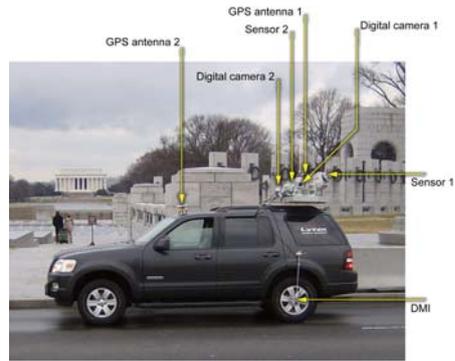
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- Laser shadowing is not a problem with the Lynx Mobile Mapper. Using two sensors, each optimizes the line-of-sight least accessible to the other.
- In post-processing, range, angle and intensity data are combined from both sensors to produce a much more complete and accurate 3D model.



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- A mobile solution that incorporates Lidar, cameras and position/navigation
- Designed from the ground up for mobile applications
- Continues as the most advanced mobile mapping solution – V100, V200 and now the M1



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- Field of view: **360°**
- Measurement Speed: **Up to 500kHz per sensor, programmable**
- Scanner speed: **80 – 200 Hz programmable**
- Simultaneous multiple return collection: **4 returns**
- Eye safety: **Class 1**



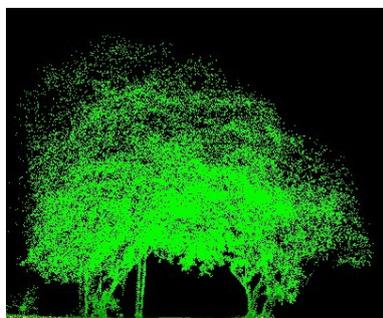
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- Foliage could be so thick some roadways were “tunnels” through which the survey vehicle could not pass.
- Here crew members walked into the jungle with RTK rods and collected shots out of the Lynx’s range.



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- To avoid gaps in the data a Total Station was used to collect control and interpolation points from areas inaccessible to the survey vehicle and surveyors on foot.



- Lidar point cloud indicates the density of the island's vegetation.

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Check weather & GPS



Check Lynx equipment



Check survey vehicle



Check DMI



- The survey team concentrated on the main and secondary roads of the coastal villages.
- Survey start times were determined by viable PDOP windows and weather conditions.



Google Earth, Image © 2011 GeoEye © 2011 Europa Technologies

The low-lying village of Tafuna with its airport landing strip show the island's vulnerability to rising water levels.



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Prep Team – Set up base stations, lay down reflective targets



Mobile Survey Team – Drive survey vehicle, operate Lynx Mobile Mapper



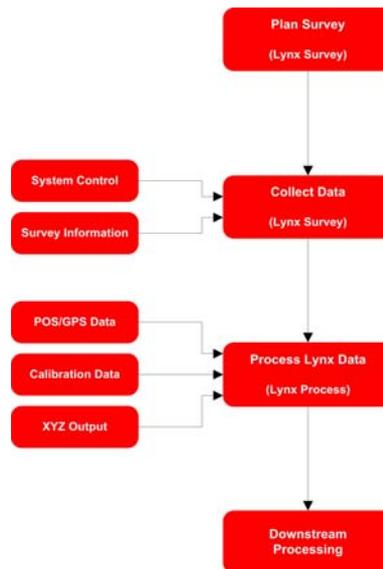
Data Processing Team – Download, prepare, process and output data

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- After a day's scan the team returned to the base to download the data.
- Processing continued all the way through the DASHMap workflow (next slide).

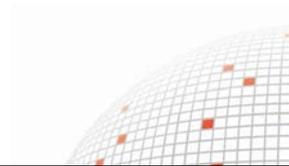
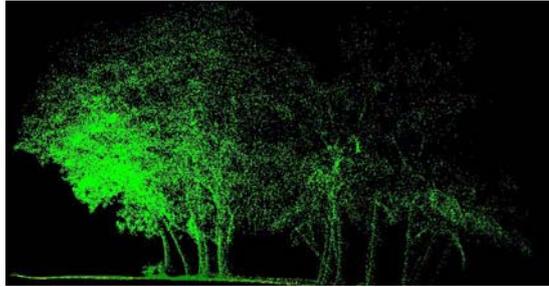


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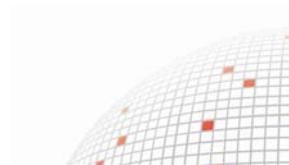
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- Data was checked systematically to ensure a good solution and complete coverage.
- Data was checked in LAS format to see if “ghosting” or other anomalies seen in similar surveys were present.
- If no anomalies were found, calibration was then performed.



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- While processing and checking data, other crew members collected control and interpolation points to fill in the areas that the Lynx could not penetrate.



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- Before leaving, Sanborn's geomatics specialist set up a control network so data could be checked against it before shipping all equipment and personnel back to the U.S. mainland.



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- When airborne lidar surveying is not feasible, mobile lidar can provide a viable alternative.
- The Lynx Mobile Mapper collected data with an RMSE from 1 to 6 cm accuracy, which far exceeded the contractor's requirements of 18 cm.
- The survey was completed at a cost well under that of a comparable airborne survey.
- The client, NOAA, now has up-to-date, accurate spatial data that will be invaluable in future planning.
- Now that American Samoa has the data essential to effective planning, it is in a better position to help minimize or avert the extensive property loss and damage that it experienced in 2009.

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Questions?

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