

Charting shallow waters using laser bathymetry vs multibeam

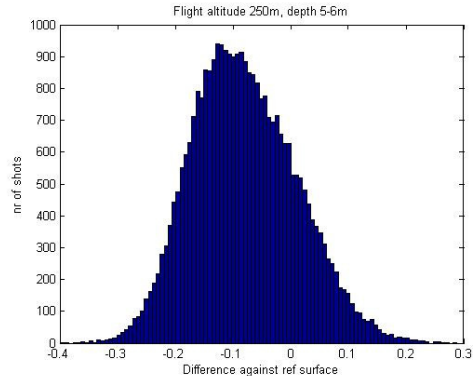
By Airborne Hydrography AB

Interest is now turning towards near coastline surveying and shallow waters and a new group of users are cities and regional planners, marine biologists and government agencies protecting wildlife. Historically merchant shipping has never had any or little use of charting data below the 10 m line while leisure boating has not attracted enough interest to motivate extreme accuracy surveys in shallow waters. Around the globe, the least surveyed waters are the shallow areas. However, this is the most important region for all marine life due to the penetration of sunlight and its impact on green vegetation.

Surveying the coastline is multidisciplinary since it involves both land (topographic data) and water (hydrographic data). The objective is cost-efficient and accurate data acquisition using state-of-the-art technology. The Hawk Eye II™ system is an airborne laser bathymetry and topography system developed to fulfil the surveying needs in the coastal zone. The system simultaneously collects accurate geodic referenced digital elevation data both above and below surface.

Multibeam vs LiDAR accuracy

Airborne Hydrography AB, Swedish manufacturer of HawkEye, has performed a qualitative comparison between multibeam data and laser bathymetry data. The multibeam data was recorded during [august 2009] using a [Koningsberg Simrad XX] system. The airborne laser bathymetry system HawkEye II, was used during the same time period, in order to secure that environment effects and weather conditions were equal. The study showed that data generated by the HawkEye system are



equivalent to the multibeam data. The typical difference between the laser and multibeam data is less than 10 cm, which for all practical purposes is insignificant.

In other comparisons, the price/performance ratio favours using LiDAR systems since areal coverage under shallow water conditions is 10-fold. Typically, a multibeam system will measure less than 0.5 km² per hour whereas the LiDAR system will measure 8-12 km² per hour. That said multibeam surveying in shallow waters can be a slow process.

Submersed vegetation surveying

In addition to traditional depth charting, the HawkEye system is the only surveying system adopted for shallow water environment surveys. Using airborne laser scanning for classification of vegetation, such as eelgrass beds (*Zostera marina*) have successfully been done in southern Sweden and have shown results, reaching >80% overall accuracy (Tulldahl

et al. 2007, 2008a). Eelgrass will not grow below < 2.5 m mean low water making studies of eelgrass and other submersed vegetation surveying difficult using the multibeam technology.

Cost-efficient large area surveying

Historically, multibeam sensors, hyperspectral cameras and aerial photographs have been successfully used. The limit being that these technologies are not adopted for mapping the marine environment on a large scale. The HawkEye LiDAR system will penetrate a similar depth range as the depth of interest, ie the euphotic zone. This is the depth within which sufficient sunlight penetrates the watercolumn and where photosynthesis occur. The shallow water area, protruding out from land to the approx 30 m depth curve is presently the region given priority for conservation (Naturvårdsverket 2007).

The typical use LiDAR data, apart from the above mentioned, are:

- Environmental surveying – Shore erosion, marine life habitat protection
- Natural catastrophes mitigation – Mitigation of effects of tsunamis, hurricanes
- Tourism – natural harbours for leisure boating, sand beaches, diving areas
- Urban expansion along the coastline
- Inland water area expansion – housing, leisure areas, wildlife

Conclusion

LiDAR bathymetry is a cost-efficient method which houses a promising future in shallow water surveys. The advantages, that is high data collection rate and high sensitivity, makes it an ideal choice for coastline surveys and awareness is being created.