“Underwater positioning using Laser optical instrument for near-shore underwater archaeological applications”

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Need for this approach

- To eliminate or minimize using conventional tools.
- To eliminate problems of making control networks underwater, at places where two parts of a site are separated by more than 100 meters.
- To overcome problems like poor visibility.
- To obtain geographical positions of all targets of an artifact using Laser optical instrument.
- To get detailed geographical grid map showing artifact with related shoreline and other coastal features.
Objectives

- Introducing a technique of measuring angles and distances using Laser optical instrument (LaserTrak).
- Developing a software to process the Lasertrak field data quickly.
- Elimination of conventional tools, especially for large site measurements.
- True representation of all targets of any underwater artifact with geographical grid.
- To utilize final output into wide variety of software packages such as GIS, Hydropro, Hypack, Autocad, etc.
Software developed to meet this objective

- A program to obtain geographical positions of underwater artifact based on field measurements obtained using LaserTrak

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Basic inputs required for the software

- Identification number of every target of artifact
- Accurate geographical co-ordinates of “A” & “B”
- Horizontal angles from “A” to every target of artifact
- Vertical angles from “A” to every target
- Laser measured distance from “A” to every target
Method of obtaining geographical co-ordinates of ground control stations A, B, C, etc.

- Using Trimble DGPS (Differential Global Positioning System) over every ground control station under static mode.

- Minimum two ground control stations required.
Computations done by the developed software

• Computes azimuth of main baseline “AB” (Ground control stations)

• Converts all measured slant distances into horizontal distances.

• Computes final geographical positions of all corners of the artifact including related shoreline with important features (if surveyed).
A Wall-like underwater structure off Dwarka
Underwater positioning using LaserTrak

Figure shows the method of obtaining underwater positions for an artifact using laser optical instrument (LaserTrak) operated from a ground control station on the shore.

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Figure shows 3 archaeological sites off Somnath temple along Gujarat coast with shoreline and prominent land features included. Using Laser Trak, all these features can be surveyed from only one set up on the shore with great ease, thereby saving lot of time.
Part of a ship wreck at Poompuhar

Picture courtesy: NIO MARC

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A Ringstone off Somnath (Gujarat)

Picture courtesy: NIO MARC

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Conclusions

• Ideal for various near-shore shallow water archaeological explorations. Also the relevant shoreline with all important land features can be surveyed from the same setup and shown on the map with great ease.

• The method and software developed totally reduces the usage of underwater compass and measuring tape to bare minimum, especially for large sites, which had been a herculian task so far, under poor visibility conditions.

• As final map obtained is in geographical grid and all field measurements are from shore ground control stations, relocating any target of an artifact after few months or years of time, with LaserTrak, is quiet easier, faster and accurate.
Thank you