The Efficiencies of Low Logistics, Man-portable AUVs for Shallow Water Survey Operations

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NCS Survey – Who are we?

- Formed in June 2005
- Experienced Management Team with 30+ years in Survey Operations
- Experienced Field Staff
- Graduate & Ex-forces Training Program

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NCS Survey – Who we are

High Quality Survey Services to Positioning & Construction markets worldwide

- Rig, Barge and Vessel Positioning
- Metrology & Well Setting
- Dredging & Backfill Control
- Pipe & Cable Lay Support
- Precision Subsea Positioning
- Wind Farm Installations
- Hydrographic Surveys
- Route Surveys
What is an AUV?

- AUV – Autonomous Underwater Vehicle
- Definition of autonomous: 
  \textit{not subject to control from outside; independent}
What is Gavia?

- Man-portable
- Fully modular
- User changeable modules that can be replaced in minutes, allowing rapid sensor reconfiguration and battery replacement

2.7m

Propulsion    Control & Comms    INS    DVL    GeoSwath    Batt.    Nose

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Gavia for offshore market

- DGPS with Veripos Ultra
- Kearfott T24 INS
- Teledyne RDI 1200 kHz DVL
- Camera
- Obstacle Avoidance Sonar
- Acoustic modem

- Marine Sonics 900/1800 kHz SSS
- GeoSwath 500 kHz MBES
- SeeByte AutoTracker
- Iridium satellite phone
- WiFi communications on surface

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Low logistics, man-portable

- Size: 2.7m and 82kg with full payload
- Endurance: 4-5 hours
- Speed: 3½-4 knots
- Depth: 0m to 1,000m

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Benefits of Gavia

Over engineering has taken time but benefits are:

• Modular design – easy to transport in small units
  – easy to change between modules
  – easy to integrate new payload sensors

• Extended depth rating – currently 1,000m but 2,000m a potential soon

• Smaller platform required for deployment

• Does not require dedicated support vessel
Offshore applications

- Pipeline inspection using AutoTracker
- Various types of bathymetric, SSS and camera surveys
- Pre-lay and post-lay build surveys for pipelines, umbilicals, trenches, etc
- Hydrographic surveys
- Post-hurricane inspections (NTL surveys in US GoM)
- Exploration work
- Environmental surveys
Payload – MBES (bathy & backscatter)
Payload - SSS
Payload – Seebyte Autotracker
BP Caspian Project – Pipeline Inspection

- BP Caspian Business Unit contract through Saipem
- 8 x pipelines – 12” through to 30” – some trenched but exposed
- 2 x Fibre Optic Cable – nice to have but observed by SSS
- All from Sangachal Terminal, near Baku
- Water depths – 0m to 10m
- GVI, SSS & MBES
Due to success extended to include harbour survey and 90km survey of offshore pipeline

Offshore pipeline down to 120m water depth, although mostly 30-40m.

Still to be completed but estimate 4 days work

Harbour survey – 100 line km in 5 days – including 1 day of weather
BP Caspian Project – Side Scan Sonar examples

Side Scan Image of Exposed Pipelines and Fibre Optic Cable
(Range 30m, Frequency 900kHz)

- Trenches approximately 6m wide
- 28” GAS exposed on trench wall
- 30” OIL exposed on trench wall
- 4” Fibre Optic Cable alongside pipeline
BP Caspian Project – Cost Efficiencies

- Put the AUV where you want
- Speed of data acquisition
- Day rate of spread w.r.t. traditional vessel based system
- Quality of data is significantly better than vessel based and towed systems – no interference from surface/vessel or cable ‘tugging’
## Cost Efficiencies: ROV v AUV inspection

<table>
<thead>
<tr>
<th>Scope</th>
<th>AUV Cost</th>
<th>Percentage of ROVSV cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 hour shift 1 vehicle</td>
<td>£583/km for AUV and £200 for vessel</td>
<td>39%</td>
</tr>
<tr>
<td>12 hour shift 2 vehicles</td>
<td>£416/km for AUV and £100 for vessel</td>
<td>26%</td>
</tr>
<tr>
<td>24 hour shift 2 vehicles</td>
<td>£208/km for AUV and £100 for vessel</td>
<td>15%</td>
</tr>
</tbody>
</table>

Assumes ROVSV at c.£48,000/day
Future Developments

- Additional payload sensors
  - alternative SSS & MBES
  - addition of sub-bottom profiler (SBP)
- Extended mission lengths with improved battery technology
- Improved visual capability to full video
- ROV skid for launch from ROV at depth
- Cathodic protection – proximity CP for pipeline integrity

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Conclusions

- Fast response anywhere in the world
- Small teams
- Lower cost equipment
- Minimal equipment required for L&R
  - simple davit
  - from beach
  - vessel of opportunity
- Better quality data, especially in shallow water and/or areas where a vessel cannot access