Monitoring sediment with underwater drones

Sediment, diffuse pollution and SDB
session 8

Ir. Jasper Schmeits,
Innovatiomanager
Tauw Group

19 September 2019
RemTech Expo
FerraraFiere
`Who is Jasper Schmeits? @Tauw Group
First experience

Experience on using innovative techniques within remediation of polluted sediments:

• Remediation of river “Vecht”:
  • Pollutants:
    • Zinc, lead, arsenic, mercury and PAH
  • Creating Digital Terrain model
    • Top: multibeam echosounder
    • Bottom: subbotom profiler
  • Use of XRF to determine the boundary and for validating end-result

Based on this experience curious about:
Added value of getting sensors into the water
Applications of aquatic drones

- Maintenance of offshore systems (Oil&Gas; subsea telecommunication cables)
- Inspection/assessment of underwater infrastructure
- Support and assistance during drilling/dredging/construction operations
- Cleaning and debris removal
- Access locations such as nuclear power plants
- Archeology (ship wrecks)
- Object location and recovery for with tragedies and disasters
- **Environmental: benthic, geophysical and sedimentation surveys (visual, acoustic, water quality)**
Aquatic drones - variations

Unmanned Underwater Vehicles (UUV)

Unmanned Surface Vehicle (USV)

Aerial Drones (Interacting with aquatic environments)

Seabed Working Vehicles

Remotely Operated Vehicles (ROV)

Tethered

Observation Class (Mini/Micro)

Inspection/Work Class

Medium/Heavy Work Class

Hybrid AUV/ROV (semi-autonomous)

Autonomous Underwater Vehicle (AUV)

Lightweight (portable)

Large Diameter Gliders

Towed (ROV)

Biomimetic (both ROV and AUV)
Technological development

- **2014**
  - Basic RC submarines

- **2015-2016**
  - Open source drone kits

- **2017**
  - New features and robustness

- **2017-2019**
  - Combination with automated surface vehicles

- **2017-2019**
  - Underwater communications and positioning

- **New sensors, sonars, water sampler, …**

**Future: 2017-2019**

**New applications! NOW!**
First advantage:
- Camera under water
Examples:
- Underwater inspections
Examples:
- Underwater inspections
Second advantage:
- Equip system with sensors

Attached Equipment:
(1) In-situ TROLL 9500 Sensors:
- Nitrate and Ammonium ISE
- Rugged Dissolved Oxygen
(2) CTD Diver:
- Temperature
- Pressure
- Conductivity
(3) Diving light
(4) HD Video Camera (GoPro 3+)
(5) Algae sensor (chlorophyll and blue/green algae)
- More options!
Examples:
- Pollution source

Discharges of Household / Industries
• Measurements inside culvert (up to 20m)
Examples:
- Spatial distribution

Mapping of spatial distribution of parameters
- Electric conductivity, Temperature, DO, etc.
- Specific parameters like:
  - Chlorophyl and Cyanobacteria sensor
    (blue-green algae)
  - Multi parameter sensor
    (COD/BOD, NO3/NO2, HS-, oil-components, Suspended dust, etc.)
Examples:
- Geophysical search

Combination with sonar scan:
  - Scan of quay walls
    - Identification of inconsistencies or discontinuities that may indicate problems.
  - Depth measurements
  - Side-scan imaging
  - Fish-finder:
    - Useful to easily detect debris material on sub-surface
Tirth advantage:
- Connecting data to other data collection systems

• Connecting water quality to sediment in lake:
  • Output gamma spectrometer (Medusa)
    • Insight in sediment variation and spatial distribution
  • Quality results of XRF
    • Insight in quality of Heavy Metals in samples
• Connecting to Satellite data
  • Low resolution data for larger area
New developments

Currently testing/implementing:
- Water sampler
- New tests using 3D multibeam sonar
- Connecting to Virtual Reality
- Underwater GPS
  - Real-time info:
    - distance of drone to bottom
- Real-time data readings
- Sensoring of plastics
1. Visibility under water

2. Putting sensors on system:
   • Macro-parameters
   • Specific pollutants
   • Sonar systems

3. Connecting data to other data collection equipment
   • Gamma spectrometer
   • XRF
   • Satellite data

4. More developments are possible
   • Use of new technologies simultaneously to collect better data
   • Possibility to add other equipment allow several other future applications
Grazie per l'attenzione!