FIG WORKING WEEK 2017

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Concept of autonomous UUV/USV operations for harbor surveys

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From digitalisation to augmented reality

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UUV / USV

	Unmanned Underwater Vehicle	Unmanned Surface Vehicle
Remotely Operated	ROV – Remotely Operated Vehicle  [OpenROV.com] [Geomar.tv] 	 [Evologics.de]  [Maritimerobotics.com]
Autonomous	AUV – Autonomous Underwater Vehicle  [Kongsberg.com] [Bluefinrobotics.com] 	 [ASVglobal.com]  [Rolls-Royce]

Hydrographic Harbor Surveys


[HHM, D. Hasenpusch]

Hydrographic Harbor Surveys

Tasks:
- Verification of target depth of waterways
- Surveys for dredging

Surveys Specifications:
- Daily surveyed area: around 120 – 250 ha
- Repetition rate: between weekly to 4 years
- Accuracy requirements:
  - Vertical: 10-15 cm
  - Horizontal: 5-10 cm

Challenges & Restrictions:
- Occupied berths
- Ship traffic
- Tidal influences
- Dredging

Advantages of Autonomous Harbor Surveys:
- Increase of time flexibility
- Reduction of personal
- Central control

UUV / USV for Harbor Surveys

Requirements for autonomous harbor surveys		Availability	
		UUV	USV
Survey data quality	High navigation accuracy (within a few centimeters)	✗	✓
	Accuracy of sounding data (THU < 0.1m, TVU <0.15m)	✗	✓
Survey platform	Same sensor payload as vessels	✓	✓
	Survey duration / battery capacity	✓	✓
	Speed of up to 4 m/s	✓	✓
	Operation at strong swell	✓	(✓)
Technical infrastructure	Data handling / data transfer	✓	✓
	Fast recharge of batteries	✓	✓
Autonomy	Autonomous decision-making (e.g. approach of power station)	(✓)	(✓)
	Collision avoidance	(✓)	(✓)
	Real-time quality monitoring => Taking action		
	• Standard deviation / density	✗	✗
	• Settings of echo sounder	✓	✓
	• Failure of sensors	✓	✓

- Advantages of UUV

- Diving (obstacle avoidance/ surveying underneath of ships)
- Less affected by waves / stable attitude

- Advantages of USV

- Visibility => Larger variety of techniques for collision avoidance possible
- Accuracy & reliability of navigation => Accuracy of sounding data

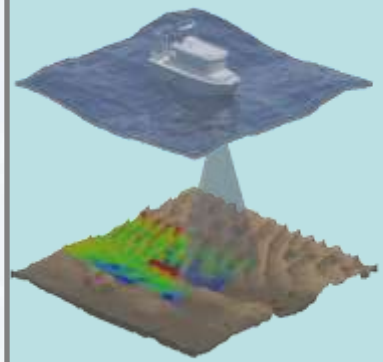
Autonomous Harbor Surveys

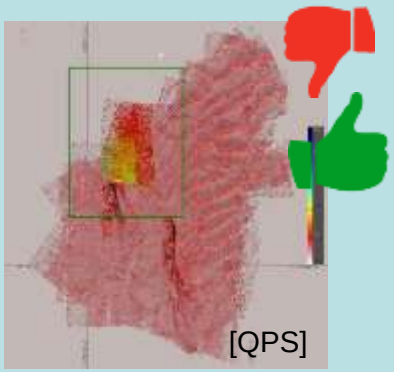
Legislation

Collision Avoidance

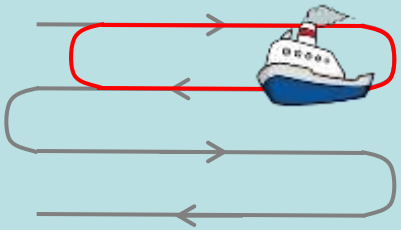
Online Quality Control ➔ Decision Tool

Data acquisition → Evaluation data quality → Selection of appropriate action → Interaction with wayplanning





Action A
Action B
Action C



Thank you for your attention