Outline

- ANCHOR project
  - General information
  - Concept and objectives
  - System elements
  - Tests and demos
- E-KnoT project
  - General information
  - Opportunities
ANCHOR – general information

The Captain Assistant system for Navigation and Routing during Operations in Harbor
ANCHOR – Idea

• PAS/ROHAN projects continuation

• BONUS call 2012: Innovation
ANCHOR – assumptions

- System for big ships
- Navigation system (not mooring)
- More extensive Harbor part
- Not only real time operations but also analysis

- partners from at least 3 countries (2 Baltic countries)
ANCHOR – Consortium

• Project coordinator: Astri Polska – Poland

• Project partners:
  – Akademia Marynarki Wojennej (AMW) – Poland
  – Automotive & Rail Innovation Center (ARIC) – Germany
  – RWTH Aachen University – Germany
  – University of Montpellier 2 - France
The aim of the project ANCHOR is to deliver the Captain Assistant system for Navigation and Routing during Operations in Harbor for large ships incoming to and outgoing from Harbor.

The main objective is to deliver a tools for increasing the safety and efficiency of ships movement inside the Harbor.

Main functionalities:

- Integration and implementation of innovative navigation solutions,
- Development of a software for the visualisation of the ship localisation,
- Elaboration of communication and data transfer system,
- Information about meteorology and hydrology from internet servers and network of sensors.
The system will consist of three main parts: Pilot Assist Sub-system (PAS), Harbor infrastructure (HI) and Communication sub-system (CS).
Work Package Breakdown Structure

- **WP 1: Project Management**
  - WP 2.1: Pilot Assist (PAS)
  - WP 2.2: Communication
  - WP 2.3: Harbour
  - WP 2.4: Tests Procedure Preparation

- **WP 2: Research and Technical Specification Elaboration**
  - WP 2.1: Pilot Terminal
  - WP 2.2: Communication
  - WP 2.3: Ship Module
  - WP 2.4: Software Integration

- **WP 3: Software**
  - WP 3.1: Pilot Terminal
  - WP 3.2: Server
  - WP 3.3: Ship Module
  - WP 3.4: Software Integration

- **WP 4: Hardware**
  - WP 4.1: Pilot Assist
  - WP 4.2: Communication
  - WP 4.3: Server
  - WP 4.4: Environment Sensors
  - WP 4.5: Hardware Integration

- **WP 5: Tests and Demos**
  - WP 5.1: Functional Pretests
  - WP 5.2: Functional Tests
  - WP 5.3: Demo in Rostock
  - WP 5.4: Demo in Gdansk

- **WP 6: Dissemination Activities**
Implementation Plan

2014

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<tr>
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<th>End</th>
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<td>Kick Off Meeting</td>
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Anchor Concept

The system will consist of three main parts: Pilot Assist Sub-system (PAS), Harbor infrastructure (HI) and Communication sub-system (CS).

1. **Pilot Assist (PAS)**
   - Ship Module
   - Internal Communication
   - Pilot Terminal

2. **Long range communication**

3. **Harbour**
   - Server
   - Internal Communication
   - Environment Measurements (NET)
Anchor elements

Pilot Assist (PAS)

- Ship Module
- Internal Communication
- Pilot Terminal
Anchor elements

PAS - Ship Module

- Control Unit – CPU
- Navigation Unit
- AIS
- Power Supply Unit
- User Interfaces
- Communication Unit
- Closure
In ANCHOR Ship Module are 5 electronics boards:

- **main board** (connected with Control Unit),
- **navigation board** (connected with Navigation Unit),
- **communication board** (connected with Communication Unit),
- **power supply board** (connected with Power Supply Unit),
- **universal board**.
Anchor elements

PAS - Ship Module

Main Board

- Microcontroller (ARM cortex M4)
- XTAL - Crystal oscillator
- Programming interface – JTAG
- CAN transceiver
- Ethernet chip and socket
- User interfaces logic (buttons, leds, LCD).
Anchor elements

PAS - Ship Module

Navigation Board
- GNSS chip (mounted on board) + active antenna connector
- External GNSS (Hemisphere) connector
- Inertial elements
- Compass (or compass connector)
- AIS connector (UART)
Anchor elements

PAS - Ship Module

Navigation Unit – Hemisphere H102

<table>
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<tr>
<th>Item</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Receiver type</td>
<td>L1, C/A code with carrier phase smoothing</td>
</tr>
<tr>
<td>Channels</td>
<td>Two 12-channel, parallel tracking</td>
</tr>
<tr>
<td></td>
<td>(Two 10-channel when tracking SBAS)</td>
</tr>
<tr>
<td>SBAS tracking</td>
<td>2-channel, parallel tracking</td>
</tr>
<tr>
<td>Update rate</td>
<td>Standard 10 Hz, optional 20 Hz (position and heading)</td>
</tr>
<tr>
<td>Horizontal accuracy</td>
<td>&lt; 1.0 m 95% confidence (DGPS)</td>
</tr>
<tr>
<td></td>
<td>&lt; 2.5 m 95% confidence (autonomous, no SA)</td>
</tr>
<tr>
<td>Heading accuracy</td>
<td>&lt; 0.75° rms</td>
</tr>
<tr>
<td></td>
<td>Normal operation: GPS</td>
</tr>
<tr>
<td></td>
<td>Coasting (no GPS): Gyro</td>
</tr>
<tr>
<td>Heave accuracy</td>
<td>&lt; 30 cm rms²</td>
</tr>
<tr>
<td></td>
<td>Normal operation: GPS</td>
</tr>
<tr>
<td></td>
<td>Coasting (no GPS): None</td>
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<tr>
<td>Pitch accuracy</td>
<td>&lt; 1.5° rms</td>
</tr>
<tr>
<td></td>
<td>Normal operation: GPS</td>
</tr>
<tr>
<td></td>
<td>Coasting (no GPS): Inertial sensor</td>
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<tr>
<td>Roll accuracy</td>
<td>&lt; 1.5° rms using accelerometer</td>
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<tr>
<td></td>
<td>Normal operation: Inertial sensor</td>
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<tr>
<td></td>
<td>Coasting (no GPS): Inertial sensor</td>
</tr>
<tr>
<td>Rate of turn</td>
<td>90°/s maximum</td>
</tr>
<tr>
<td>Cold start</td>
<td>&lt; 60 s typical (no almanac or RTC)</td>
</tr>
<tr>
<td>Warm start</td>
<td>&lt; 20 s typical (almanac and RTC)</td>
</tr>
<tr>
<td>Hot start</td>
<td>&lt; 1 s typical (almanac, RTC, and position)</td>
</tr>
<tr>
<td>Heading fix</td>
<td>&lt; 10 s typical (valid position)</td>
</tr>
<tr>
<td>Compass safe distance</td>
<td>30 cm² (when installed in an enclosure)</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>1,850 kph (996 kts)</td>
</tr>
<tr>
<td>Maximum altitude</td>
<td>18,288 m (60,000 ft)</td>
</tr>
</tbody>
</table>
Anchor elements

PAS - Ship Module
Hemisphere H102 – Test results

Position

- GNSS module with EGNOS
- Update rate 1 Hz
- Test duration – 20 minutes each
Anchor elements

PAS - Ship Module
Hemisphere H102 – Test results

- 2-antennas GNSS solution
- Test duration – 20 minutes

Note: The “true heading” here does not mean the reference one, it is a kind of Heading (refer to the true north).
Anchor elements

PAS - Ship Module

Communication Board

- GSM module with antenna connector
- Wi-Fi modem with antenna connector
- Radiomodem with antenna connector
- RS232 connector
- CAN connector
Anchor elements

PAS - Ship Module

Power Supply Board

- DC/DC converters
- Smart battery charger
- Power connector
Anchor elements

PAS - Ship Module

Universal Board
Anchor elements

PAS - Ship Module

Closure

• Protection against mechanical load.
• Protection against the water and salinity.
• Non – metallic material.
• With possibility of mounting to the ship.
• IP 66.
• No sink enclosure.
Anchor elements

PAS - Pilot Terminal

• Tablet/Laptop
• Visualization Software
Anchor elements

PAS - Internal Communication

- Wi-Fi
- Radiolink
- Ethernet (wire)

- **navigation data** (GNSS position, speed, heading, AIS information etc.),
- **data received from server** (information from sensors networks, alerts etc.),
- **configuration messages** (selected frame fields, frequency etc.).
Anchor elements

Harbor

- **Server**
  - Visualization
  - Analysis
  - Updating
  - Archive
  - GIS data access

- **Internal Communication**

- **Environment Measurements Network**
  - Weather conditions
  - Water conditions
Anchor elements

Long Range Communication

This sub-system assures the link between two main parts of the Anchor system: the PAS and the Harbor Infrastructure.

As a medium GSM connection will be implemented.
ANCHOR - Outcomes

- **Ship Module** for precise localization and orientation solution.

- **Pilot Terminal with software** for visualization and analysis of all needed data.

- **Guidance Module** for reliable, safe and energy and time efficient routing to the destination.
ANCHOR - Outcomes

- **Wireless Communication link** for reliable and fast data transmission between all the system elements.

- **Harbor Server** for analysing and graphical visualizing of all data, archiving.

- **Internet Platform** for GIS, GMES and local measurements data sharing and exchanging.

- **Environment Measurements Network** for accurate data on weather and water conditions.
Galileo Test Environments used by ANCHOR

- Test & verify the application of the European GNSS & Communications
- Based on Pseudolites – operational today
- railGATE is used for development, functional testing and validation, since positions (on a rail track) are repeatable and easily verified
- seaGATE is used for system demonstration

railGATE in Wegberg, Germany

seaGATE in Rostock, Germany

Aerial view by courtesy of tim-online.nrw.de
DEMO in Gdynia

• **Place:** Gdynia-Gdańsk harbor

• **Date:** June 2016

• **Aim:** to show to the beneficiaries and the audience all system functionalities
Future

• Technology improvements
  • New navigation unit, maybe with RTK option
  • e-LORAN receiver
  • Satellite communication module

• Functional improvements
  • Mooring/docking module
  • Collision avoiding system
Thank You for Your attention.
e-GNSS Knowledge Triangle

*e-KnoT*

Introduction to the project
Outline

• Introduction
• The project rationale
• A glance to the project activities
• The project consortium
Introduction
How did we come to this?

ERIG → G-TRAIN → GENIUS → e-Knot
The Gordian knot gave its name to a proverbial term for a problem solvable only by bold actions.

The Gordian knot cannot be undone: **education, research** and **industry** are strictly interconnected.

Gordias, the maker of the legendary Gordian Knot, was the father of the legendary King Midas.

The project aims at easing knowledge transfer and crossfertilisations.

We hope to “give birth” to scientists able to turn GNSS into gold.

It’s time to act! A clear investment on education and innovation creation is needed.
The knot that ties the triangle

The project addresses the different sides of the triangle, as well as some cross-layer actions.

The scope of the e-KNOT project is to strengthen the interaction between the areas of education-research-industry in Europe in order to consolidate a strong EGNSS knowledge triangle.

Build a solid network critical mass for the creation of a critical mass involving the relevant actors in the three areas with the final objective of supporting the European economy development.
The project rationale
The project organisation

WP100 Coordination and Management
- WP210 GNSS Msc
- WP220a Professional Training review and design
- WP220b Professional Training Implementation
- WP230 Specialising Master
- WP240 Support to Internships in companies
- WP250 Workshops promoting downstream apps

WP200 Education-Industry
- WP310a PhD Training review and design
- WP310b PhD Training Implementation
- WP320 GNSS Excellence weeks

WP300 Education-Research
- WP310a PhD Training review and design
- WP310b PhD Training Implementation
- WP320 GNSS Excellence weeks

WP400 Research-Industry
- WP410a Industry vouchers Design
- WP410b Industry Vouchers Implementation
- WP420a Technology Road Show - design
- WP420b Technology Road Show - Implementation
- WP430 Patenting process

WP500 Cross-layer actions
- WP510 International Outreach
- WP520 PhDs promotion
- WP530 Co-funded PhDs
- WP540 Business-research dialogue

WP600 Dissemination and awareness
- WP610 Promotion and awareness in new EU countries
- WP620 SUN dissemination
- WP630 Project results dissemination

WP630 Project results dissemination
• Provision of **scholarships** to students to do internships in a company

• **Professional Education Programme** providing specialized GNSS training developed by academia towards professionals

• Co-funded grants to attend the Specializing **Master in Navigation and Related Applications**

• Workshops in universities to promote the **development of GNSS downstream apps**
• Specialized **training for GNSS Ph.Ds**
  – content and training on research

• **GNSS excellence weeks** hosting the best scientific experts
  – exchange and networking
  – qualified advise
  – GNSS research promotion to public audiences
• **Consultancy Vouchers** for companies looking for scientific support

• **A Technology Roadshow** made of workshops for companies

• Events to support the **Patenting Process**
Cross-layer actions (WP500)

- **International outreach**
  - Benchmark the situation of the relationship between R-E-I
  - Interacting with other H2020 projects

- **Academia-Industry joint PhDs**
  - Promotion of industrial PhDs as a mean to grant innovation transfer to industry

- **“Business meets Research” events**
  - Effort to raise larger interest in the stakeholders about the need to support innovation to increase competitiveness
Dissemination (WP600)

• Special focus on European eastern countries

• SUN platform

• Dissemination of the results of the project
The project consortium
The project consortium

- The consortium managing the project grants excellent skills in GNSS education, GNSS research and links to the industrial world

- Several tasks will allow the involvement of other institutions in the activities
  - (e.g. teachers at the PhD Training)
Conclusions

• Along the 3 years of the project there will be several opportunities to be involved for
  – students
  – researchers
  – companies

• The primary goal is to bring R–E–I in E-GNSS together!

• GET TIED TO GNSS INNOVATION!
Website:  www.eknotproject.eu
Email:  info@eknotproject.eu
Social:  eknotgnssproject
        @eknotproject

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