DLR magazine

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THE POWER OF SALT

Research for the Energiewende:
Test facility for new storage technologies is in operation

DRIVING TOWARDS AUTOMATION: Intelligent vehicles

'SOLO' SPACE ODYSSEY: Robots for planetary exploration

LIGHTER FOR THE SHORT HAUL: Fibre-metal laminates for aircraft manufacturing

SAFE AT SEA

Shipping is becoming digital. Cutting-edge navigation, communications and information technologies have long since entered the maritime transport system. Today, nautical information is provided by electronic systems, rather than a sextant and hand lead-line. But how reliable and resilient are they? Within its e-navigation strategy, the International Maritime Organisation (IMO) has identified the digitalisation of shipping to be a major challenge. This includes the implementation of system and data integrity into the maritime traffic system as well as increasing the resilience of navigation-relevant systems. Here, DLR scientists will bring their expertise in communications and navigation to the table.

DLR know-how for standardised navigation data

By Evelin Engler

Positioning. Navigation. Timing. In short – PNT. For several years now, an interdisciplinary expert team has dealt with the question of how ship-side provision of PNT data should be performed to meet the numerous accuracy and integrity requirements. Ship types and user needs are extremely diverse. The German Aerospace Center (DLR), together with the Federal Maritime and Hydrographic Agency (BSH), the Federal Waterways and Shipping Administration (WSV), and ship suppliers in coordination with the German Federal Ministry of Transport and Digital Infrastructure (BMVI), has developed a concept that is based on modularisation of the maritime PNT system architecture. It introduces a scaling of the system performance to specify minimum as well as demand-driven higher performance requirements. In June 2017, the Maritime Safety Committee (MSC) adopted the guidelines for ship-side positioning, navigation and time data processing.

The Guidelines establish a framework that classifies, structures and harmonises the ship-side provision of PNT data and associated integrity and status information using radionavigation receivers, PNT-relevant sensors and data sources as well as position reference systems. But why is it becoming increasingly important to standardise the software (guidelines) as well as the devices (performance standard)? In addition to economic aspects, the focus of IMO's standardisation activities is on the safety of shipping and the protection of maritime habitats. PNT data is essential for safe shipping because they are key to navigating a ship from one location to another, to avoid collisions and groundings, and to execute specific nautical tasks in an assisted, semi- or fully-automated way. Each application has its specific requirements on PNT data provision. For a small dinghy, for example, it is sufficient to know the current position. But the turning and docking of a large container ship requires accurately and reliably determining the location of the ship's hull in relation to the port basin. Position accuracies of a few tens of metres may be sufficient for ships in the middle of the ocean.

In April 1912 the Titanic collided with an iceberg south-east of Newfoundland and sank soon after in the North Atlantic. More than 1500 people lost their life. As a result, the first version of the 'International Convention for the Safety of Life at Sea (SOLAS)' came into being and specified minimum safety standards regarding the number of lifeboats, emergency equipment, along with safety procedures, including continuous radio watches. Since 1958 the International Maritime Organization (IMO), as a United Nations specialised agency, has been responsible for establishing the highest standards worldwide for safe, efficient and sustainable shipping.

Image: Raytheon-Anschütz

Modern shipping depends on reliable provision of PNT data. This is ensured by establishing quality standards for the data.

In straits, areas with high traffic densities and ports it is important to determine the location of each ship's hull with an accuracy of few metres in order to safely avoid collisions. The overall requirements for shipside PNT data provision have to be structured in a temporal, spatial and functional context, before suitable technological solutions may be identified, classified and ultimately standardised on the system or component level.

The special feature of the established guidelines is that they, for the first time, set out norms to manufacturers, yards, ship owners and ship suppliers, on how redundancy in the ship-side database might be used to achieve an evaluation of the integrity of PNT data in accordance with common global standards. This provides clarity regarding the quality and trustworthiness of currently available PNT data. Navigational staff on board of cruise liners, container ships and ferries as well as pilots in the ports of the world will be assisted as such to avoid misinterpretation of situation pictures and to make correct decisions in critical situations.

Research and standardisation are complementary development processes; together they shape the transition from today to tomorrow. Research has the task of addressing how systems can become more reliable or how to reduce the risks of accidents. The international standardisation bodies are responsible for deciding which of the solution alternatives deserves the 'best practice' predicate and ultimately will be standardised.

Evelin Engler is a researcher at the DLR Institute of Communications and Navigation and works with maritime standardisation bodies.

STRUCTURING OF PNT DATA OUTPUT

Grade I

- Latitude and longitude
- Speed and course over ground (SOG and COG)
- Time

Grade II

- + Heading and rate of turn
- + Speed and course through water (STW and CTW)

Grade III

- + Altitude
- + Depth

Grade IV

- + Heave, sway and surge
- + Yaw, pitch and roll

Which PNT data is needed – whether position and time or even the three-dimensional position of the ship – is now specified by the degree of PNT data provision.

About DLR

DLR, the German Aerospace Center, is Germany's national research centre for aeronautics and space. Its extensive research and development work in aeronautics, space, energy, transport, digitalisation and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for the nation's largest project management agency.

DLR has approximately 8000 employees at 20 locations in Germany: Cologne (Headquarters), Augsburg, Berlin, Bonn, Braunschweig, Bremen, Bremerhaven, Dresden, Göttingen, Hamburg, Jena, Jülich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Oldenburg, Stade, Stuttgart, Trauen and Weilheim. DLR also has offices in Brussels, Paris, Tokyo and Washington DC.

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DLR Department of Public Affairs and Communications
Linder Höhe, D 51147 Köln
Phone: +49 (0) 2203 601-2116
Email: kommunikation@dlr.de
Web DLR.de
Twitter @DLR_en

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