ERPS – ENHANCED RADAR POSITIONING SYSTEM

Welcome from IALA

Working Arrangements

Working Programme for the Week;
Expectations for the Workshop

What do We Intend to Accomplish This Week?

- Education – teach the attendees what ERPS means
- Justification – the reasons why we are pursuing standardization for ERPS
- Identification –
    - Organizations that ought to participate
    - Standards that need to be written
- Planning – how standardization will progress

What Will be Our Outputs?

- Road Map – the way forward
- Draft Liaison Notes – to organizations identified, inviting them to put ERPS on their agendas
- Draft Standard Cover Sheets – short descriptions of the standards needed

What Happens Next?

IALA will take the outputs from this workshop into the ENG committee (ENG15):
- Liaison notes will be finalized and sent to intended organizations
- Draft standards will be put into proper form for the organizations

Driver – Why are we doing this?

IMO Strategy on Resilient PNT

"e-Navigation systems should be resilient and take into account issues of data validity, plausibility and integrity for the system to be robust, reliable and dependable. Requirements for redundancy, particularly in relation to position fixing systems, should be considered."

The e-Navigation Strategy Implementation Plan (MSC.1/Circ.1595) identified and captured the risk as one of the Risk Control Options (RCO 5) "Improved reliability and resilience of on-board PNT systems".

Regarding GNSS: To achieve resilience in PNT service provision, it is necessary to put in place a back-up or fall-back arrangements utilising alternative techniques that do not share the failure modes of GNSS. In the case of GNSS outage or malfunction, the alternative system can provide PNT services.

How ERPS Fits In

IALA Documents with Guidance:

- Recommendation R1017 Resilient Position, Navigation and Timing, Edition 1, 2018.
- Recommendation R0129 GNSS Vulnerability and Mitigation Measures, Edition 3.1, 2012.

R0129 defines: A backup system ensures continuation of the navigation application, but not necessarily with the full functionality of the primary system and may necessitate some change in procedures by the user.

ERPS is independent of GNSS and can be considers as a backup positioning system, adding resilience to navigation.
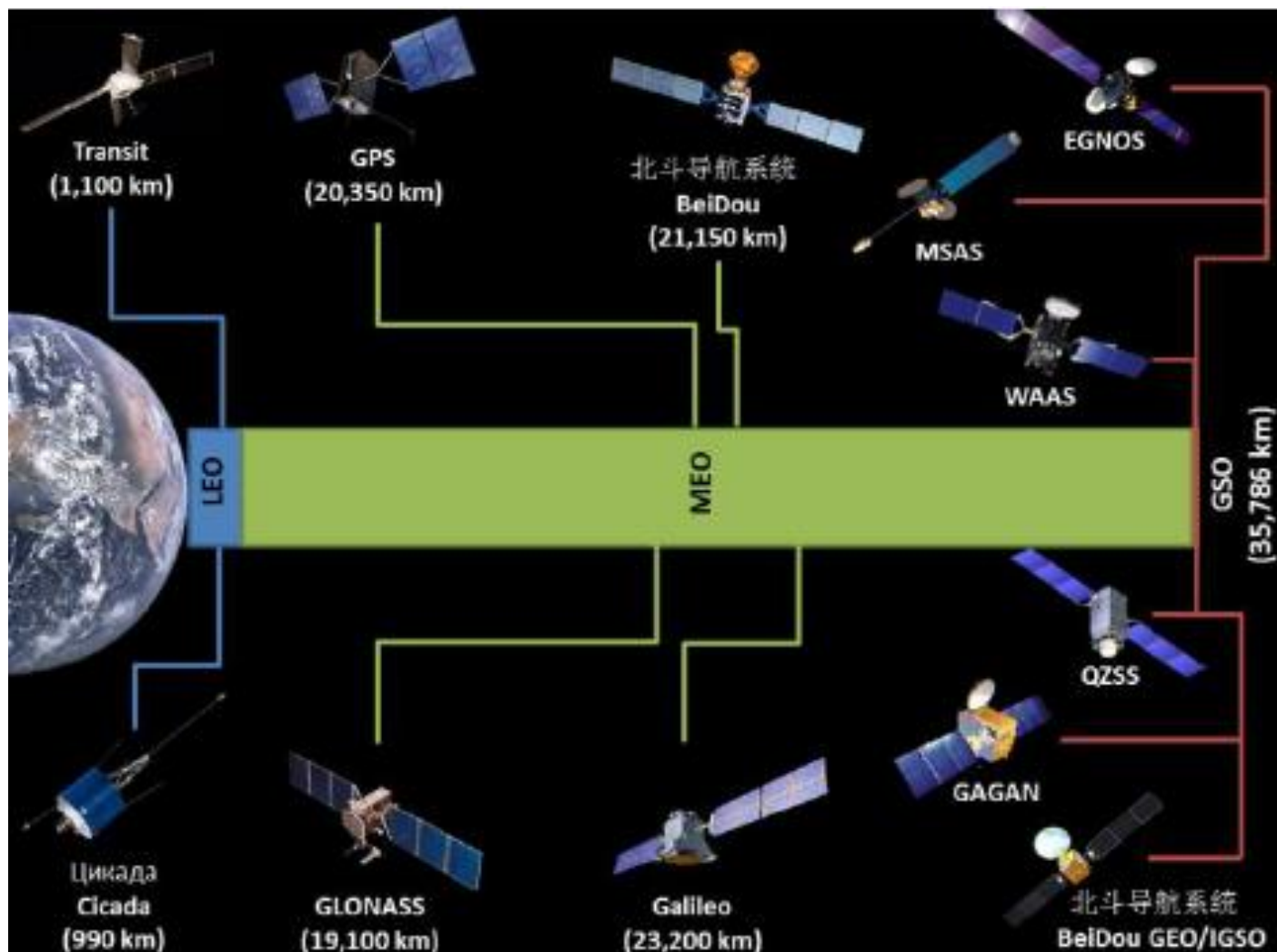
ERPS Concept
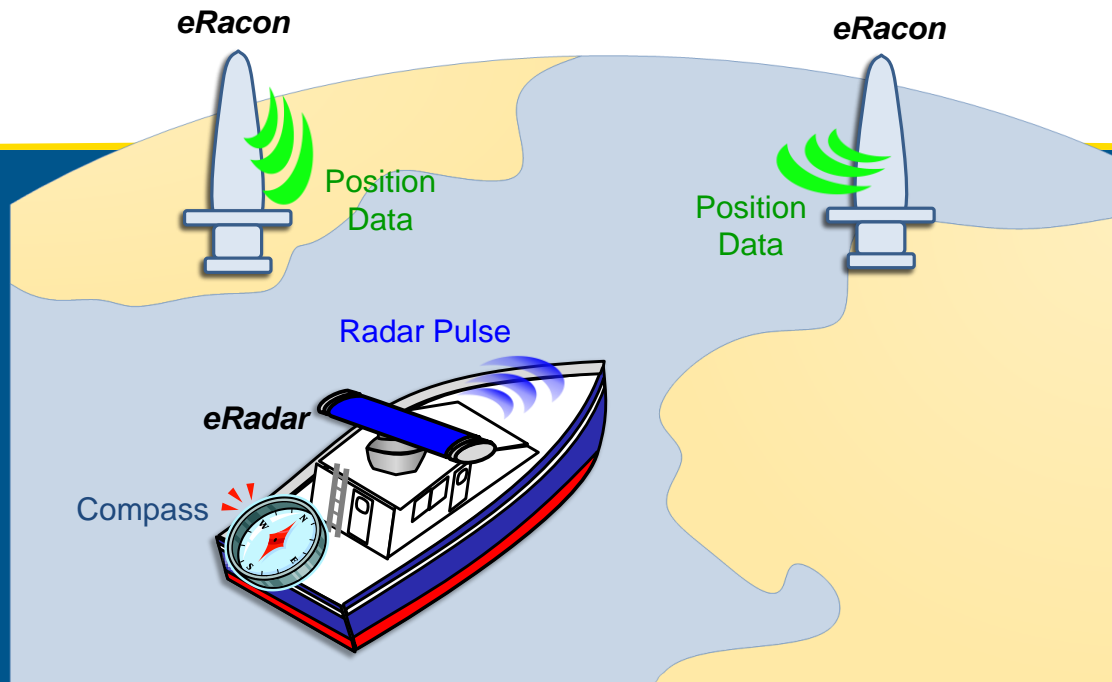
Summary

1. Context
2. Enhanced Radar Positioning system (ERPS)
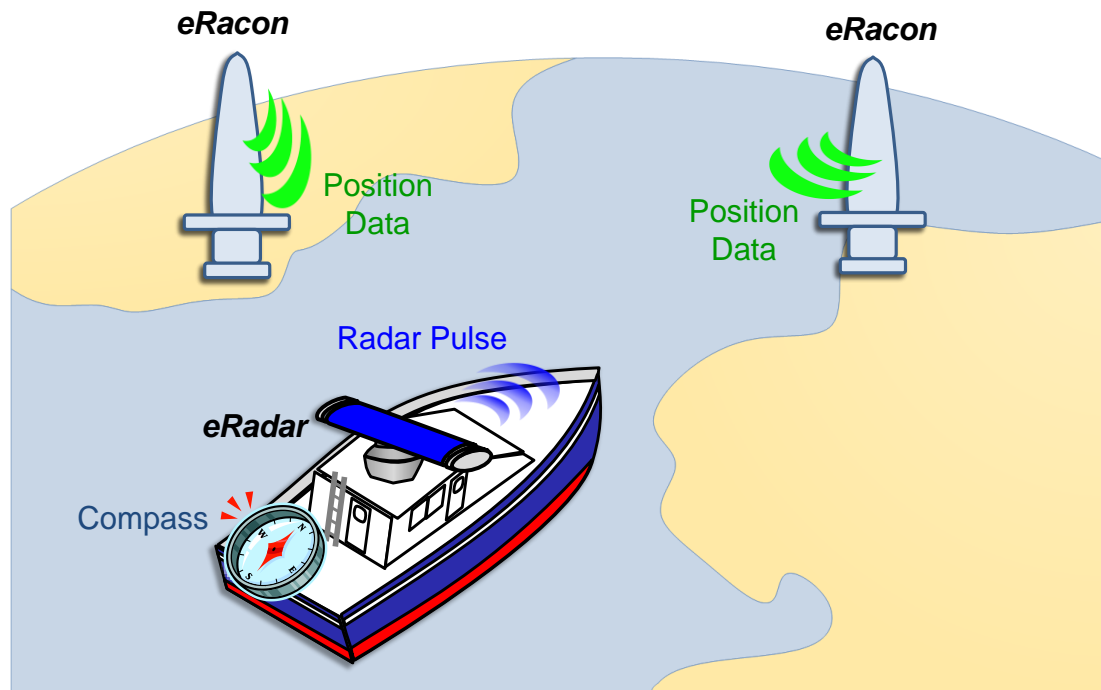3. How ERPS works?

Context

Enhanced Radar Positioning system

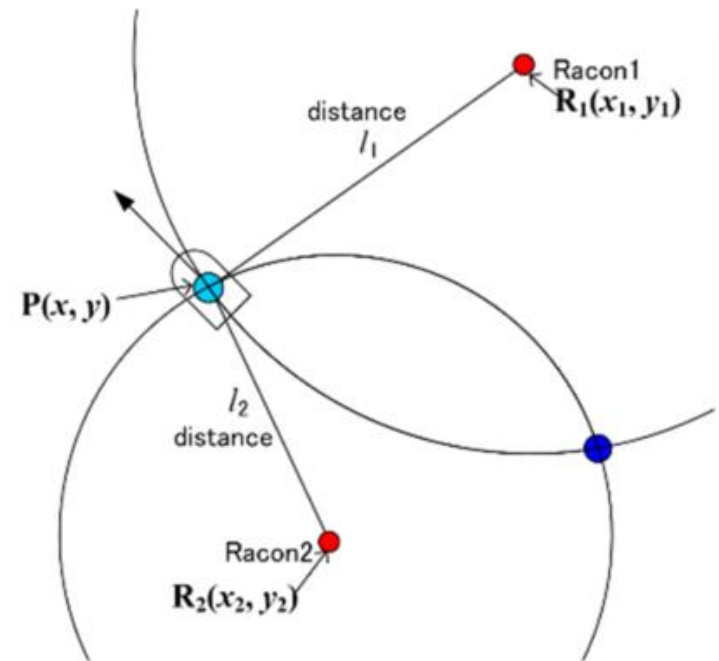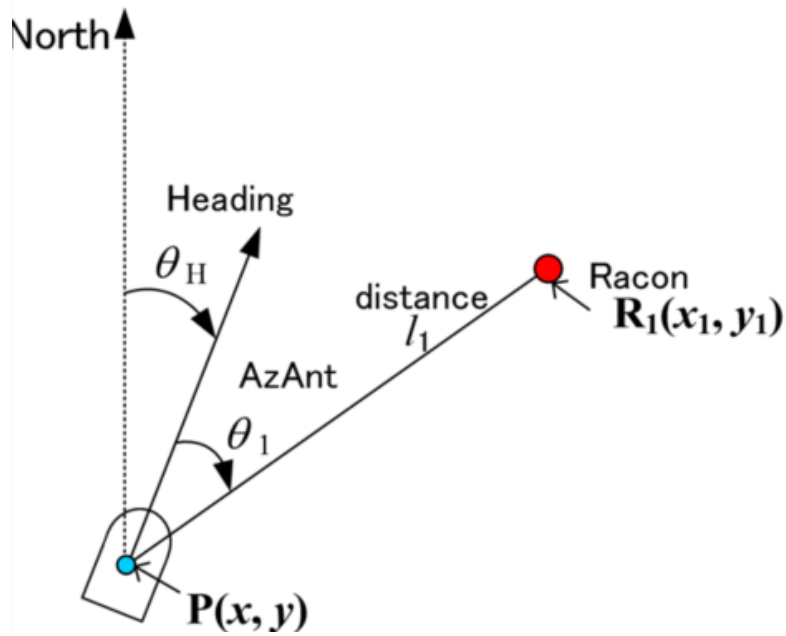Racon O

e-Racon A

Enhanced Radar Positioning system

How ERPS works?

$$\begin{cases} x = x_1 - l_1\cos(\pi/2 - \theta_H - \theta_1) \\ y = y_1 - l_1\sin(\pi/2 - \theta_H - \theta_1) \end{cases}$$

$$\begin{cases} (x - x_1)^2 + (y - y_1)^2 = l_1 \\ (x - x_2)^2 + (y - y_2)^2 = l_2 \end{cases}$$

North

Heading

θ_H

AzAnt

θ_1

distance
l_1

Racon
$\mathbf{R_1}(x_1, y_1)$

$\mathbf{P}(x, y)$

distance
l_1

Racon1
$\mathbf{R_1}(x_1, y_1)$

$P(x, y)$

l_2
distance

Racon2
$\mathbf{R_2}(x_2, y_2)$

ERPS Trials

Four ERPS trials were conducted with eRadar provided by Furuno and eRacons provided by Tideland:

- Denmark 2011
- UK 2013
- Singapore 2015
- Singapore 2017

Trials were overall successful, proving the concept. These results are from Singapore 2017 (compare to IMO Resolution A.1046 Harbour Entrance requirements of 10 meters accuracy and 99.8% availability):

	One eRacon		Two eRacons or Best Two of Three		Best Available	
Trial Phase	Horizontal Error (meters)	Availability (%)	Horizontal Error (meters)	Availability (%)	Horizontal Error (meters)	Availability (%)
Static	37.5	86.7	11.9	61.9	16.5	86
Dynamic	30.3	87.4	26.2	64	25.3	87.9
Berthing	38.6	87.3	2.5	62.7	12	93.7

ERPS Trial Conclusions:

- Generally good performance
- Radars in busy harbours are poorly serviced by racons in general:
  - Blocking of signal by other vessels
  - Racon busy transmitting
  - Racon Side Lobe Suppression (SLS) issues including too many radars at same frequency
- eRacon modulation can be visible on radar display
- Geometry is important (HDOP); careful site planning is essential
- Expected additional cost per unit for racons and radars is low
- ERPS is a candidate backup system to GNSS

Many thanks for the generous assistance of Danish Maritime Authority (DMA), General Lighthouse Authorities of the United Kingdom and Ireland (GLA), Maritime and Port Authority of Singapore (MPA), Furuno Electric and Tideland Signal
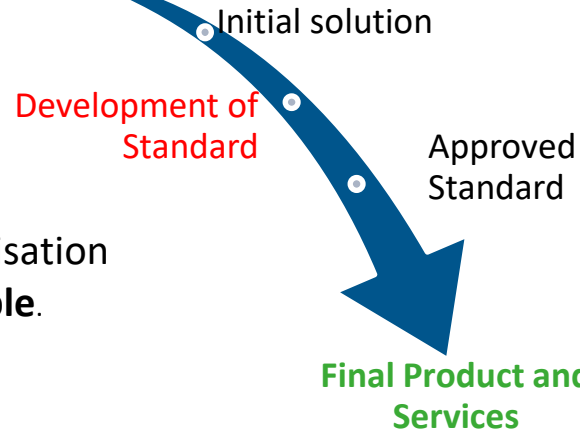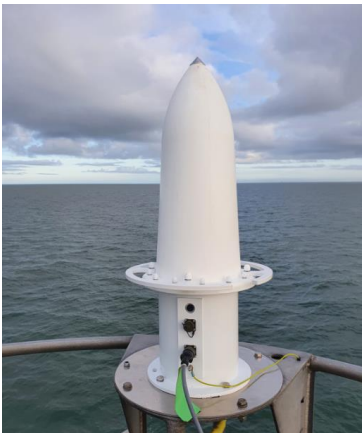
Need for Standardization

Standard. Where are we? Why do we need it?

Identification
of a Problem

Initial solution

Development of
Standard

Approved
Standard

Final Product and
Services

ERPS is a system that requires standardisation
for it to become **useful** and **interoperable**.

IALA (eRacon Manufacturers)

eRadar Manufacturers

Standard. What are we looking for?

*__Standard__: Document, **established by consensus** and approved by a recognized body, that provides, **for common and repeated use**, rules, guidelines or characteristics for activities or their results, **aimed at the achievement of the optimum degree of order** in a given context. (ISO IEC).*

*Standards should be based on the consolidated results of **science, technology and experience,** and aimed at the promotion of **optimum community benefits.** (CEN CENELC)*

COMPATIBILITY	PERFORMANCE	TEST
• Coherent Systems • Interoperability	• Safe products • Reduced Risk	• Demonstration of product properties • Reliability

Standards. Science, technology and experience.

We need to **identify** the <u>key stakeholders</u> to form **technical committees** and **working groups**.

- IALA Industrial Members and other interested Committees

- International Maritime Organization (IMO)

- The International Hydrographic Organization (IHO)

- International Electrotechnical Commission (IEC)

- Comité International Radio-Maritime (CIRM)

- International Telecommunication Union (ITU)

- European Telecommunications Standards Institute (ETSI)

- Radio Technical Commission For Maritime Services (RTCM)

- National Marine Electronics Association (NMEA)

- Federal Communications Commission (FCC)

Standard. Working group management.

Working group definition:
- Balance of interests represented
- Active, interested, expert participants
- Definition of the role the participants

Working group management:
- Identification of stakeholders
- Establishment of working group
- Establishment of working procedure
- Definition of the WG governance
- Definition of the timeframes
- Documentation management
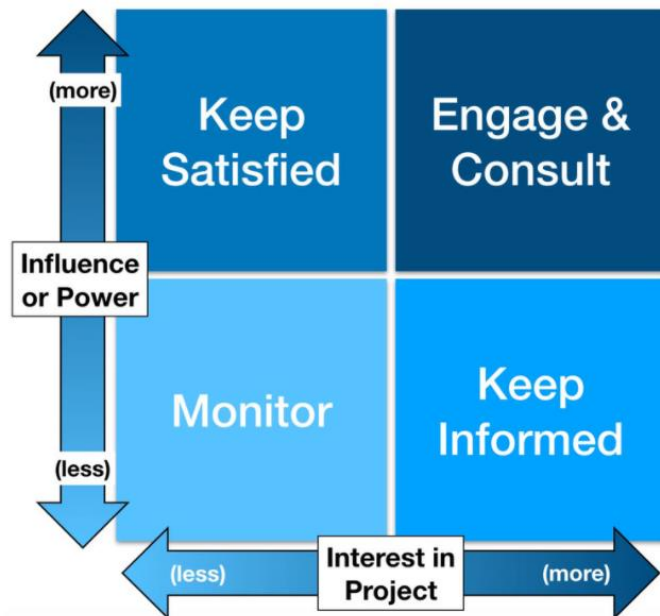
Example Stakeholders Management (PMI)
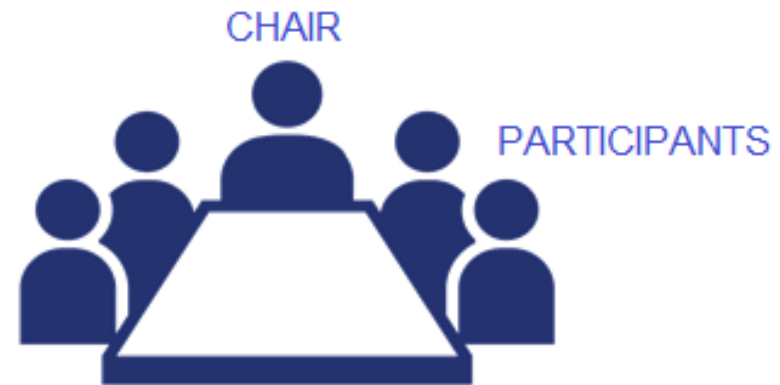
Experts working group

Standards. Value added.

MANUFACTURERS	• Innovative product • Improve the management and design • Reduction R&D and/or production costs • Maintenance of high level of competitiveness while reducing the amount of risk
USERS	• Established quality and safety level of the services and products • Informed to the characteristic of the products making easier the comparison between the different offers • Consistent user interfaces • System reliability and durability • Interoperability & compatibility with other systems • More transparency in the market
SOCIETY	• Reduced technical barriers to trade • Increased quality and safety • Help to the economical development • Trust in products, services and practices • Products and services in accordance with other regulations

Breakout Groups

List

Section
Title

Section
Title

References

Closing

QUESTIONS ?

Point of contact