



FURUNO



Enhanced Radar Positioning Systems for Resilient Positioning

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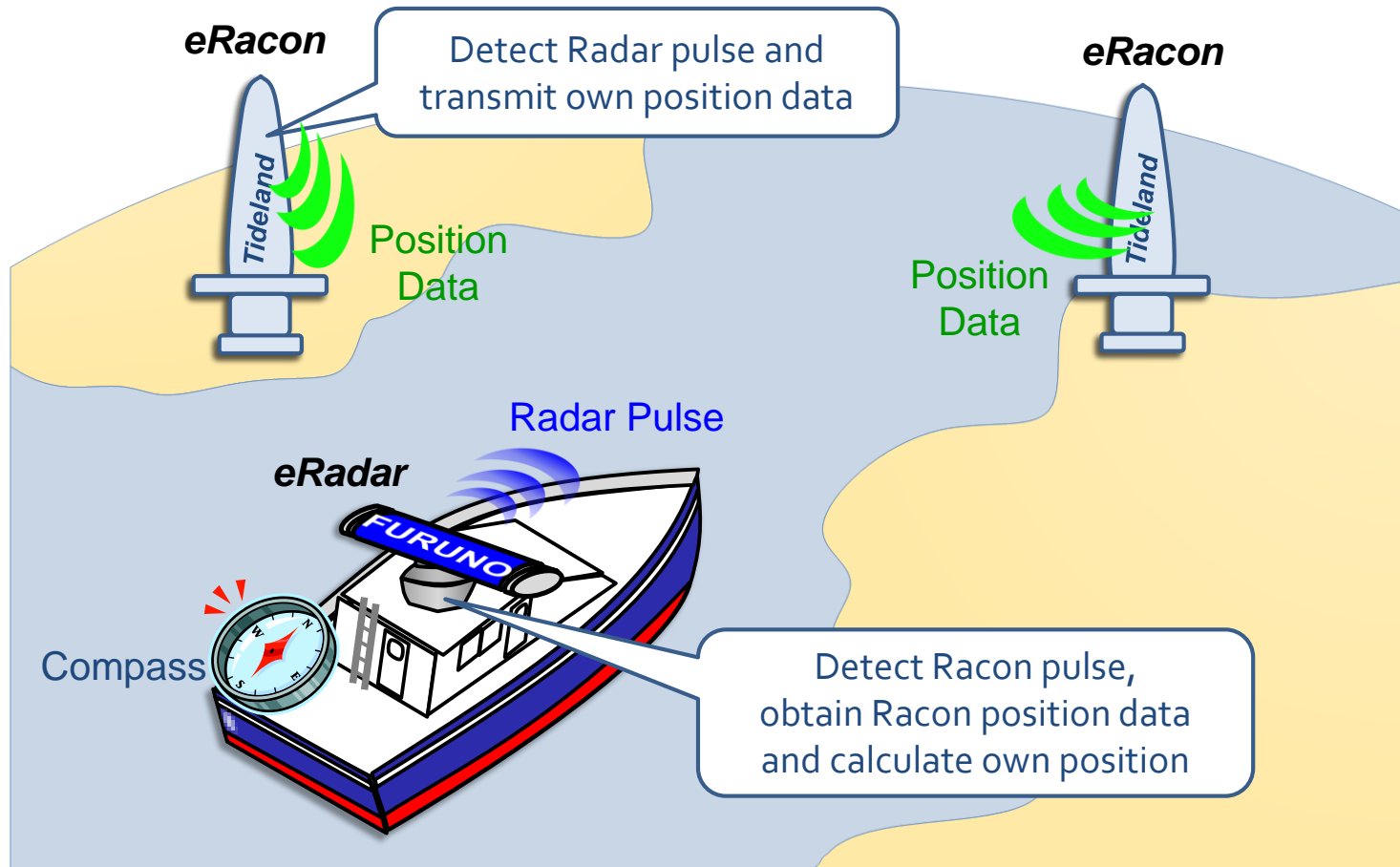
Need for Resilient Positioning

- Lack of an electronic precision navigation systems if GNSS ceases to function
- GNSS are based on similar technology and are susceptible to the same interference and jamming
- Establish accurate, reliable and real-time positioning systems independent of GNSS

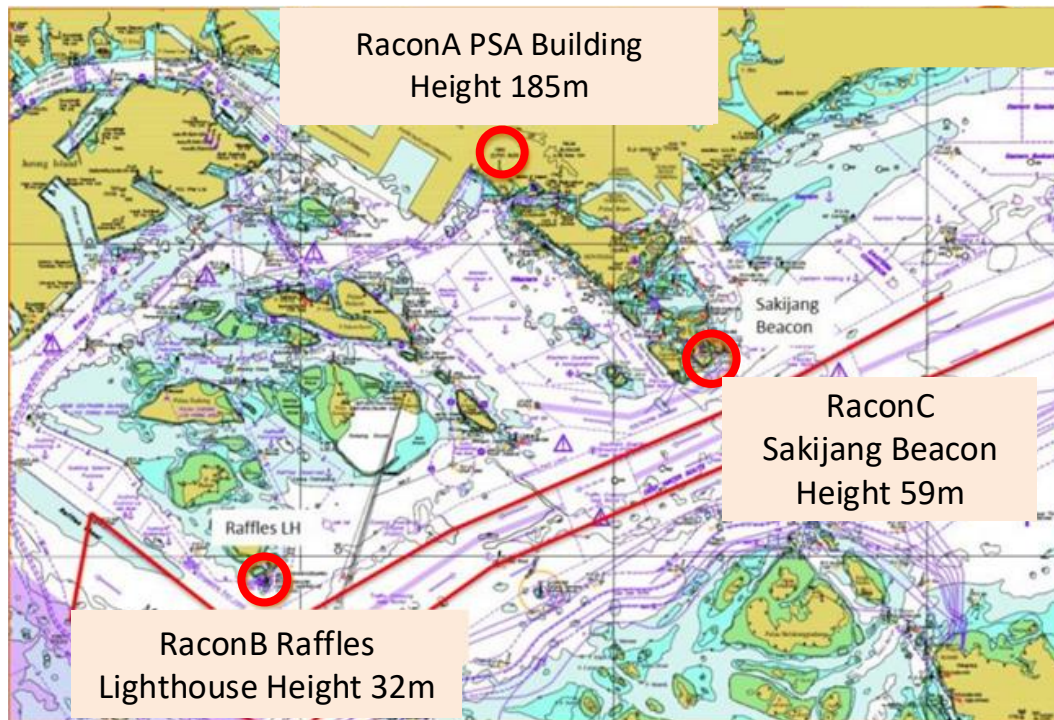
Our Solution – Enhanced Radar Positioning System (ERPS)

- Radar is an alternative system not susceptible to the same failures as GNSS
- ERPS provides absolute position fixing
- ERPS is independent from GNSS

ERPS Concept



Sea Trial – Singapore Strait Aug '17



	One eRacon		Two eRacons		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	86.0
Dynamic	30.3	87.4	26.2	64.0	25.3	87.9
Berthing	38.6	87.3	2.5	62.7	12.0	97.3

Moving Forward

- Five e-Racon units installed covering Singapore Strait and two additional being planned for sea trial at end 2018
- Presented at 10th Marine Electronic Highway Working Group to Littoral States (Indonesia, Malaysia & Singapore)
- SOMS - Critical and strategic waterway
- Vessels are encouraged to participate by fitting e-Radars

Standardization

- Standardization needed to go forward
- Technical details need to be defined
- Participation by radar and racon vendors needed
- Participation by international groups needed (CIRM, ITU, IALA, IMO)



The authors wish to thank the administrations who hosted the sea trials and all who prepared and participated in the execution of the trials.