FRAMTIDA SAMVERKANSPLATTFORM FÖR AUTOMATISERAD OCH DIGITALISERAD SJÖFART

Robert Rylander

Mikael Hägg

Februari 2018

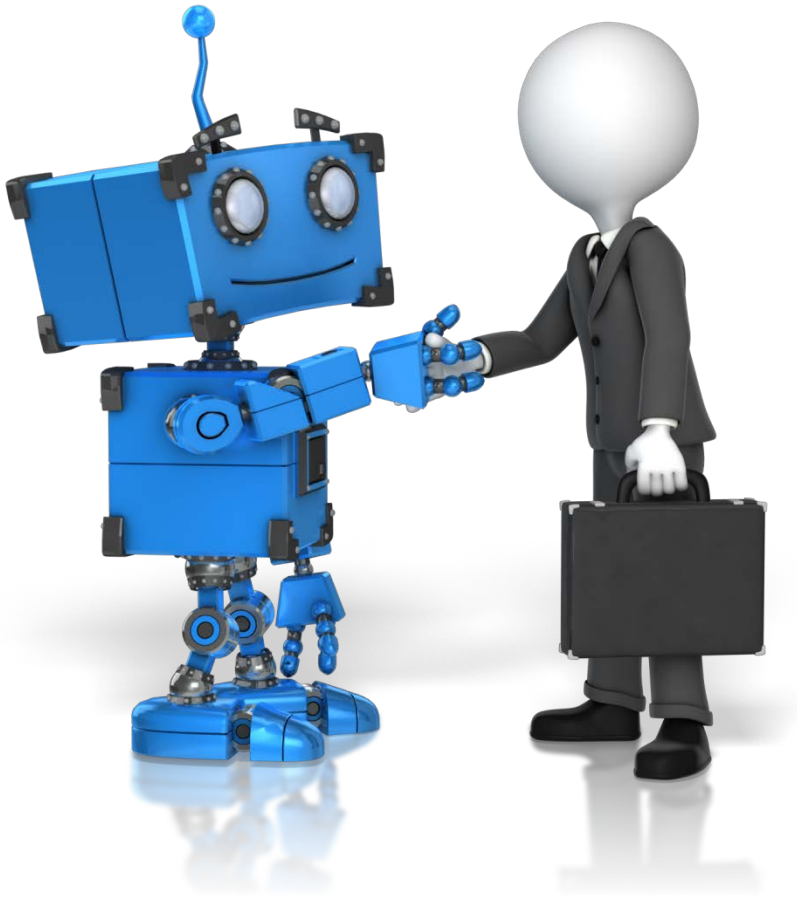
Research Institutes of Sweden

RISE ICT

RISE Viktoria / Lighthouse

Tema

- Igår
  - Bakgrund
  - Olikheter -> Likheter
- I morgon
  - Skall vi? Varför?
- Framtiden
  - Möjligheter



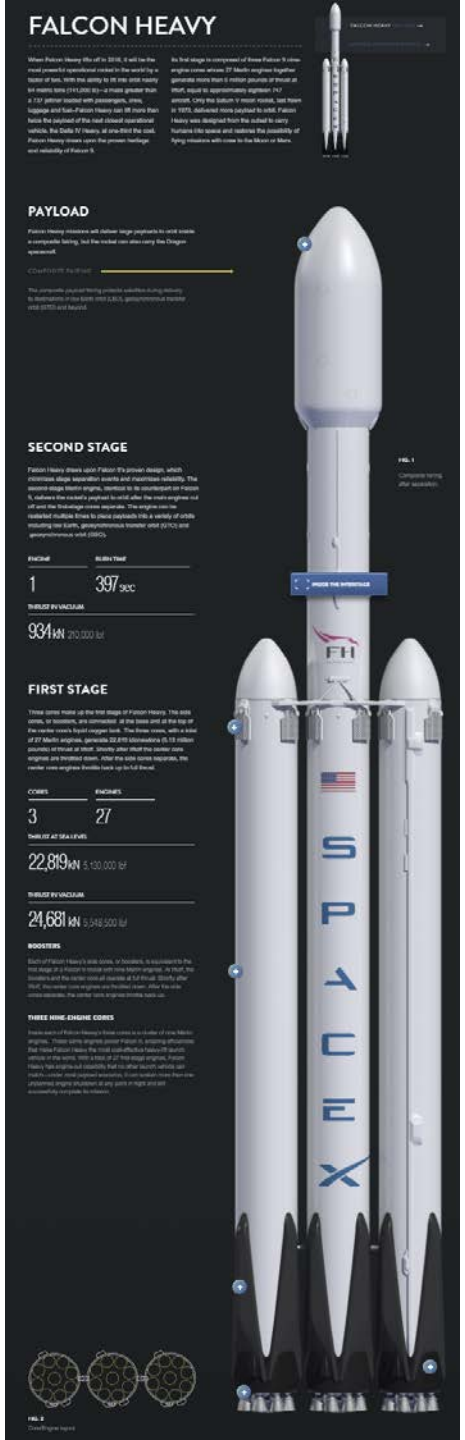
Brownstoner

News Listings Services Forum Resources

Walkabout: Safe Driving in Brooklyn's Schools

Brooklyn High School of Automotive Trades. 50 Bedford Ave. Photo: Brooklyn Public Library

History | Crown Heights | by Suzanne Spellen (aka Montrose Morris) | May 7, 2013 • 10:32am



RISE

DefenseNew

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Finland Targets Aut 2025

September 23, 2016 by Mike Schuler

Finland's autonomous maritime ecosystem initiative operations, enabling effective co-operation between i Rolls-Royce.

The Finnish government is taking the lead to ply the world's oceans in the not-so-dist

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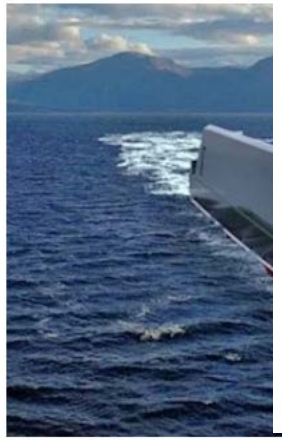
First Unman Offshore Ves

November 1, 2016 by Mike Schul



An artist illustration of the unmanned and automated offshore vessel Hrönn. Image: Ko

The UK's Automated Ships Ltd and Norway's Kongsberg Maritime ha they claim will be the world's first unmanned and fully-automated vessel for offshore operations.

中 国 船 级 社

智 能 船 舶 规 范

2015

2016 年 3 月 1 日生效

地址 Add: 北京市东直门南大街 9 号船检大厦
CCS Mansion, 9 Dongzhimen Nan Da Jie
电话 Tel: 0086-010-58112288
传真 Fax: 0086-010-58112811
邮码 Postcode: 100007
电子邮箱 : ccs@ccs.org.cn

INSIGHTS MULTIMEDIA

nsterdam's canals, monitoring the environment, providing ssembling bridges and other urban infrastructures

The Danish Maritime Authority is preparing for a future that includes autonomous ships by launching a pre-study on the matter.

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KONGSBERG

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Clean Technica

Exclusives & Originals Transp

Dutch Company I Autonomous Elec Europe

Facebook Twitter Goog

January 13th, 2018 by **Steve Hanley**

Cars and light trucks are sexy, but when it comes to from the transportation sector, vehicles that haul trailers, urban delivery vans, and ships have long efficient and reliable, but have a nasty habit of spe atmosphere every year. Dutch company Port Liner autonomous electric barge for the European market

Credit: Alexander Whiteman/ The Loadstar

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Kongsberg, Robert Allan Unveil Unmanned Fire Boat Design

February 5, 2018 by gCaptain

An illustration of the RALamander 2000. Photo: Kongsberg/Robert Allan

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Containership MOL Prestige Adrift Off British Columbia After Fire; Two Crew Medevaced

The Maritime Executive

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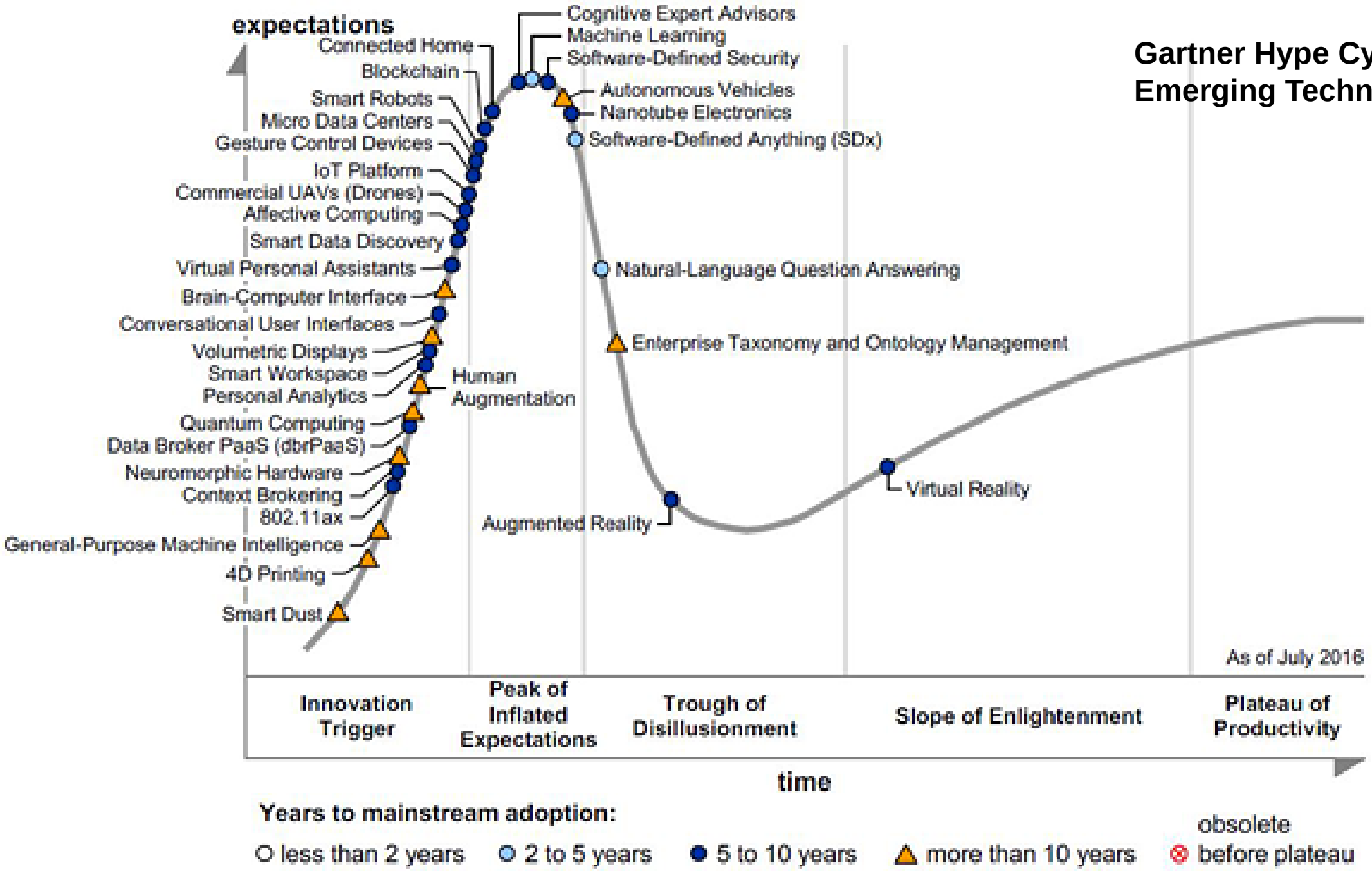
Courtesy gov.cn

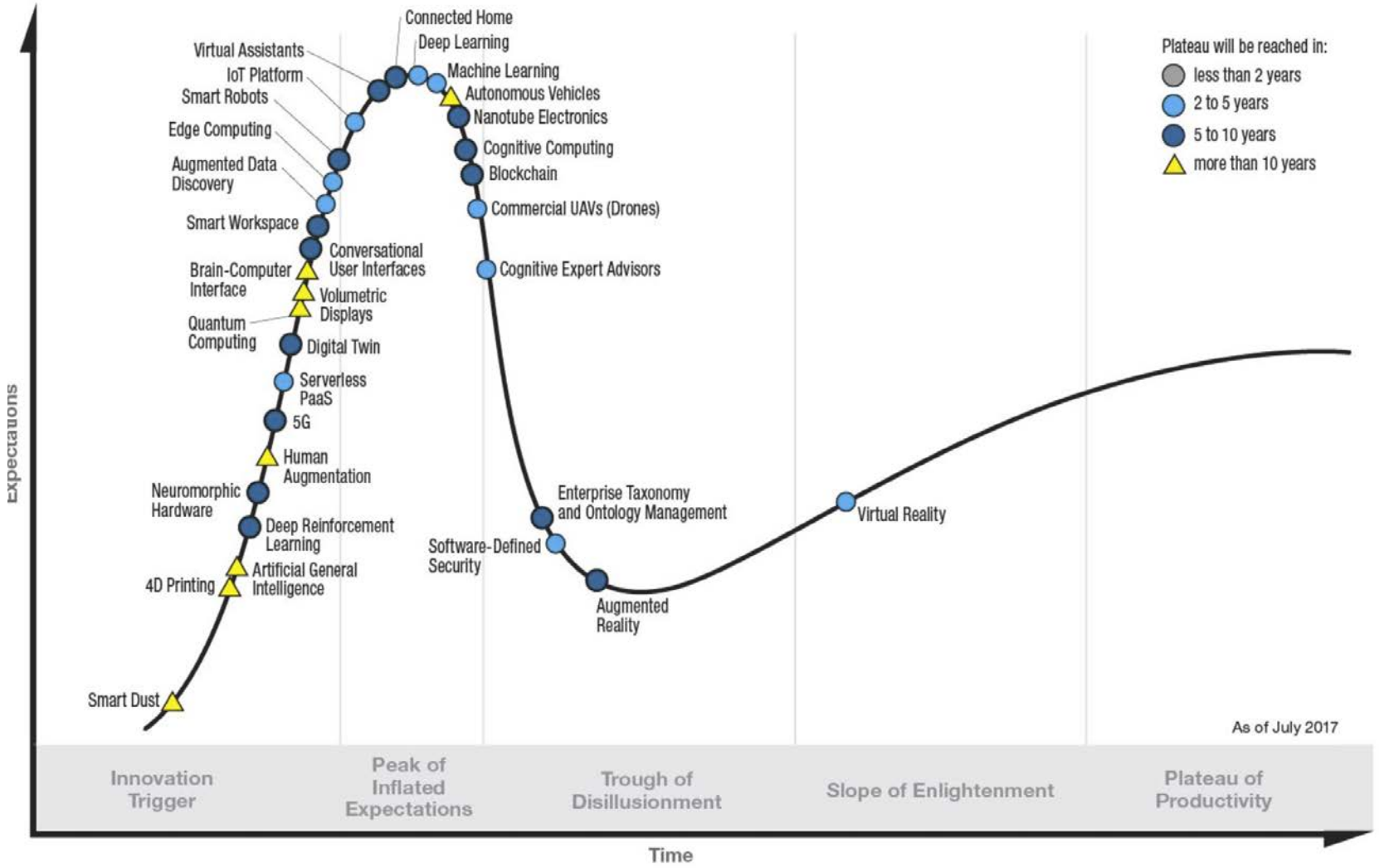
BY MAREX 2017-12-08 14:01:50

Gartner Hype Cycle 2016
Emerging Technology



Source: Gartner (July 2016)

Gartner Hype Cycle for Emerging Technologies, 2017



gartner.com/SmarterWithGartner

Source: Gartner (July 2017)

Gartner

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- I morgon
  - Skall vi? Varför?

CHALMERS
UNIVERSITY OF TECHNOLOGY

NORTHERN LEAD

Digitization:

Make analogue information digital

Digitalization:

Increased use of digital technology

Both are important! (and interesting)

Per Olof Arnäs , PhD Chalmers Univ. of Tech.
Service Management and Logistics

RI. SE

DAGENS NYHETER.

En utskrift från Dagens Nyheter, 2018-02-06 14:54
Artikelns ursprungsadress: https://www.dn.se/sthlm/nya-karolinska-stangs-under-ett-dygn-it-systemets-hardvara-ska-bytas-ut/

STHLM

Nya Karolinska stängs under ett dygn – it-systemets hårdvara ska bytas ut

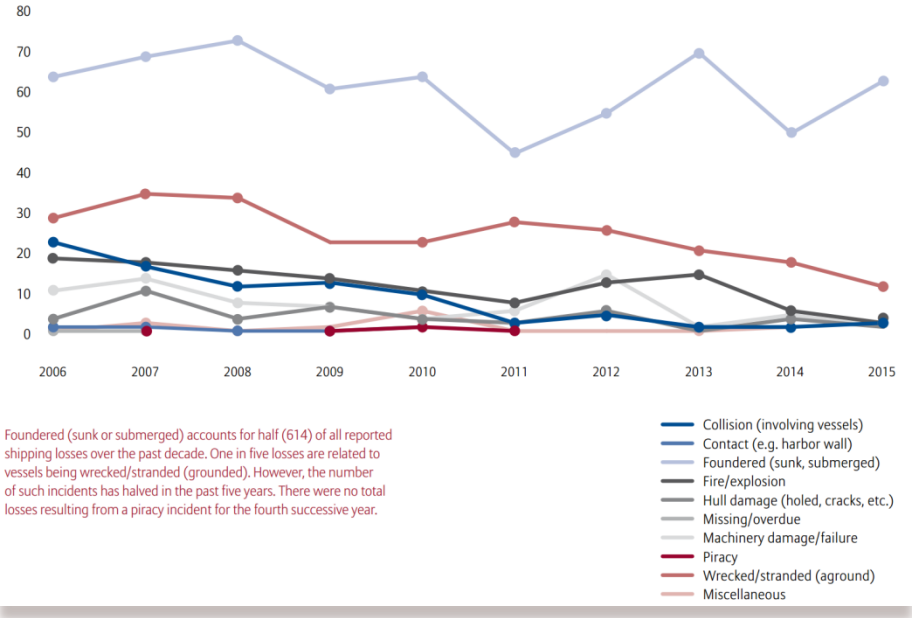
Uppdaterad 14:49 Publicerad 14:25

Foto: Foto: Marc Femenia

Om två veckor kommer Nya Karolinska att stängas för intag under ett dygn, för en uppdatering av det krånglande it-systemet. Under 24 timmar kommer ambulanser att omdirigeras och all planerad vård ställs in. Landstingstyrelsens arbetsutskott informerades i dag. Landstinget har hittills beslutat om fyra miljoner kronor i konsultstöd för att lösa it-problemen.

Use case: Navigation

Causes of Total Losses 2006-2015



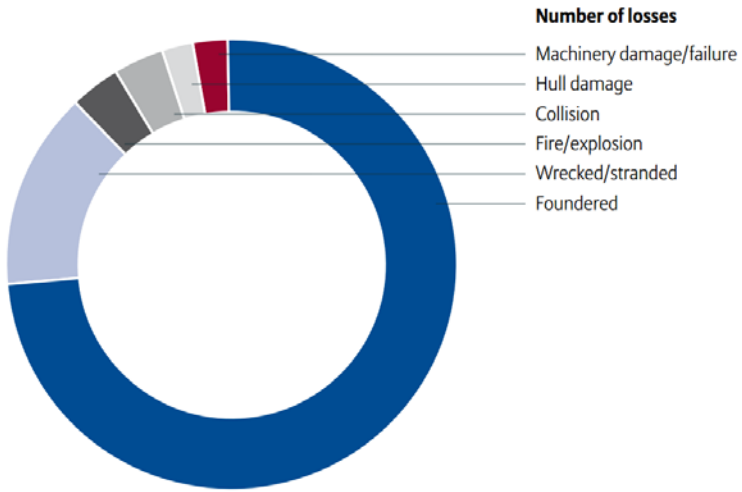
Foundered (sunk or submerged) accounts for half (614) of all reported shipping losses over the past decade. One in five losses are related to vessels being wrecked/stranded (grounded). However, the number of such incidents has halved in the past five years. There were no total losses resulting from a piracy incident for the fourth successive year.

Causes of Total Losses

January 1, 2015 - December 31, 2015

For every year over the past decade foundered has been the most common cause of loss for large ships. In 2015 it was the cause of almost 75% of total losses, often driven by bad weather, its highest proportion of all losses over the past decade. Such incidents were up 25% year-on-year. There were significant reductions in the number of wreckings/strandings and fires/explosions year-on-year.

Foundered	63
Wrecked/stranded	12
Collision	3
Fire/explosion	3
Hull damage	2
Machinery damage/failure	2
Total	**85**



Source: Lloyd's List Intelligence Casualty Statistics.
Data Analysis & Graphic: Allianz Global Corporate & Specialty

All Casualties including Total Losses - Top 10 regions: **2006 to 2015**

British Isles, N. Sea, Eng. Channel, Bay of Biscay	4,314
East Mediterranean & Black Sea	4,055
S. China, Indochina, Indonesia and Philippines	2,083
Japan, Korea and North China	1,779
Baltic	1,653
Great Lakes	1,323
Iceland and Northern Norway	967
West Mediterranean	887
North American West Coast	832
Gulf of Mexico	810
Others	6,731
Total Casualties by Region	**25,434**

Source: Lloyd's List Intelligence Casualty Statistics.
Data Analysis & Graphic: Allianz Global Corporate & Specialty

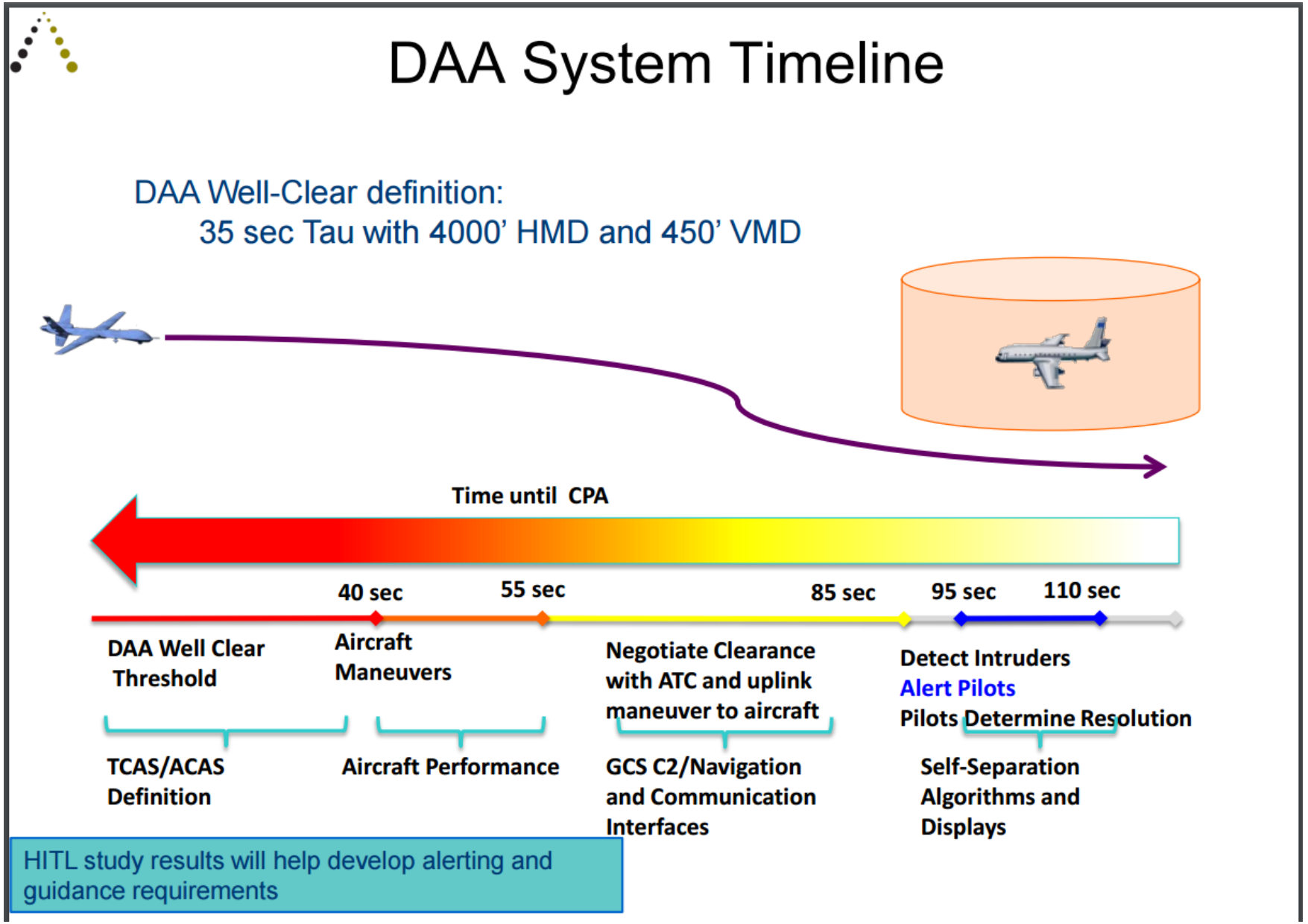
All Casualties including Total Losses - Top 10 regions: **2006 to 2015**

2006-2015: The British Isles, N.Sea, Eng. Channel, Bay of Biscay region has been the location of the most shipping casualties over the past decade with 17% of all incidents. Together, with the East Mediterranean and Black Sea region it accounts for a third of all incidents. Machinery damage (7,820) is the top cause of casualty, accounting for 31% of incidents. Collision ranks second (3,961) with wrecked/stranded (3,930) third.

Allianz Safety and Shipping Review2015

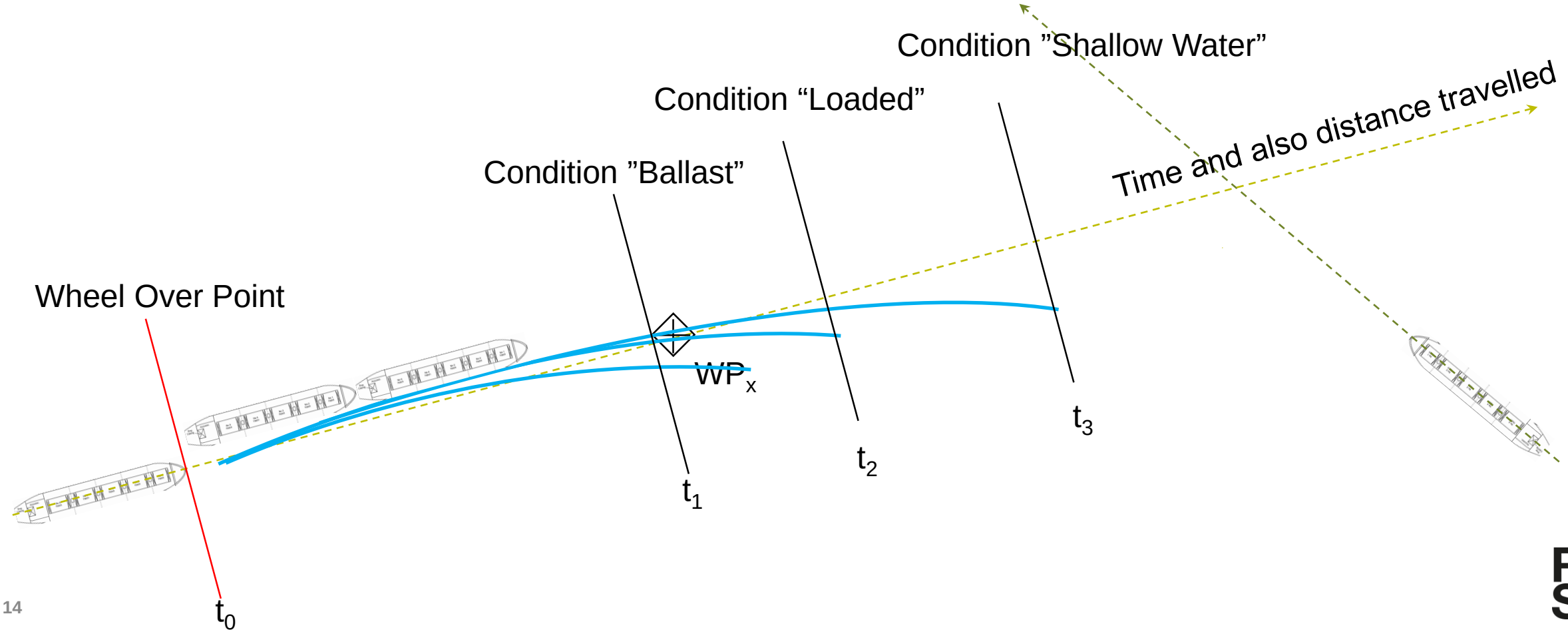
Challenges

Visual Detect And Avoid



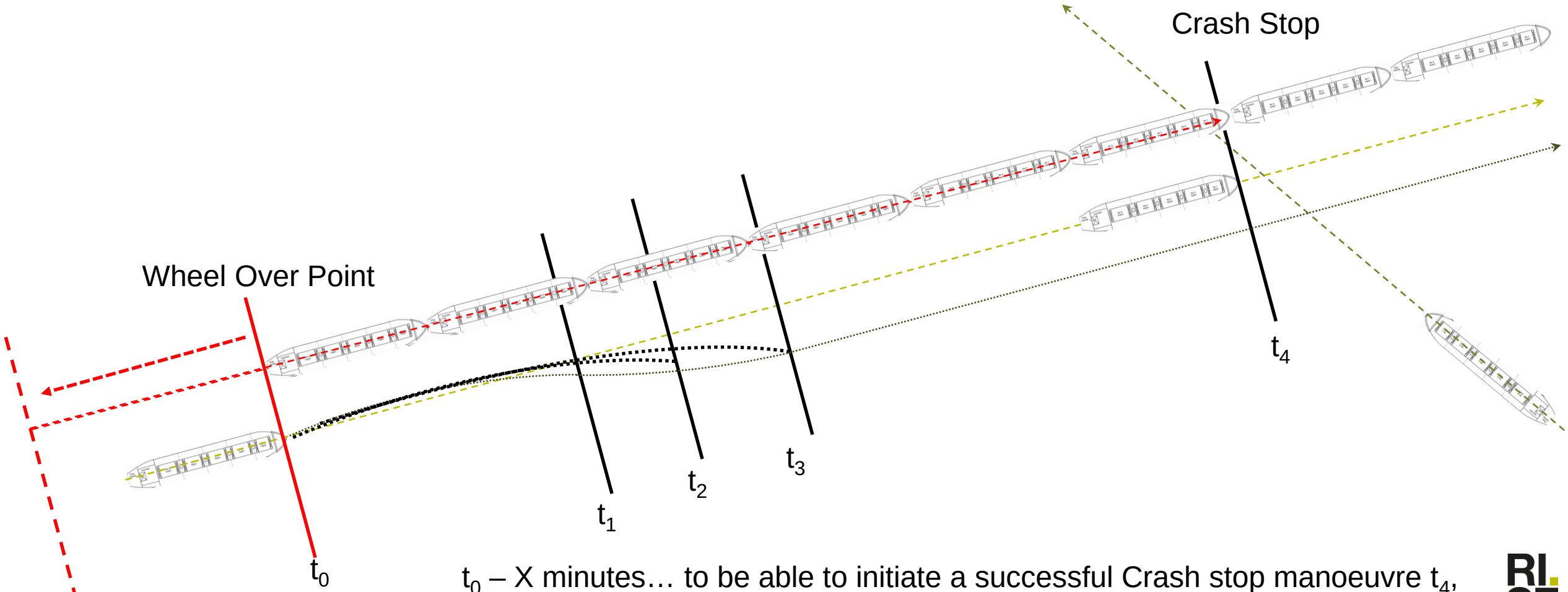
Course alteration to SB

Give way vessel or planned turn, service speed =17 kts
“Handy size” 15000 DWT bulk carrier (LOA ~150m) needs ~1,8 boat lengths (~270m) to start a turn.



A Crash Stop as alternative to give way

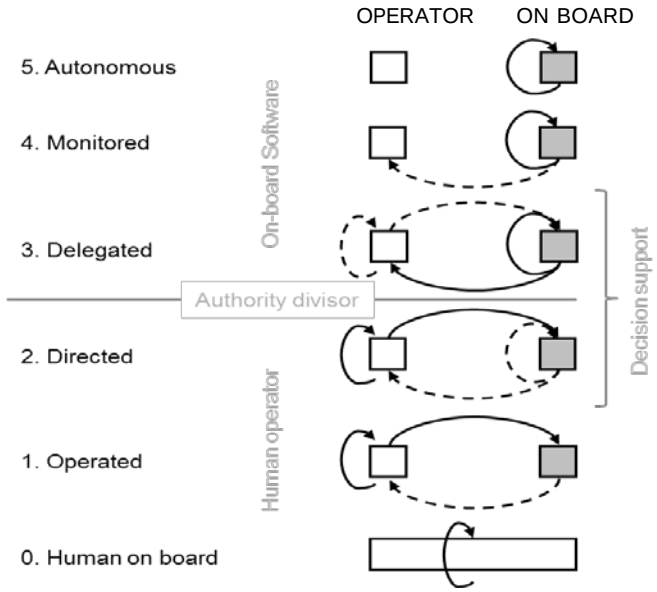
"Handy size" Bulk carrier (LOA ~150m) at service speed 17kts, needs ~8 boat lengths (~1200m) to crash stop.



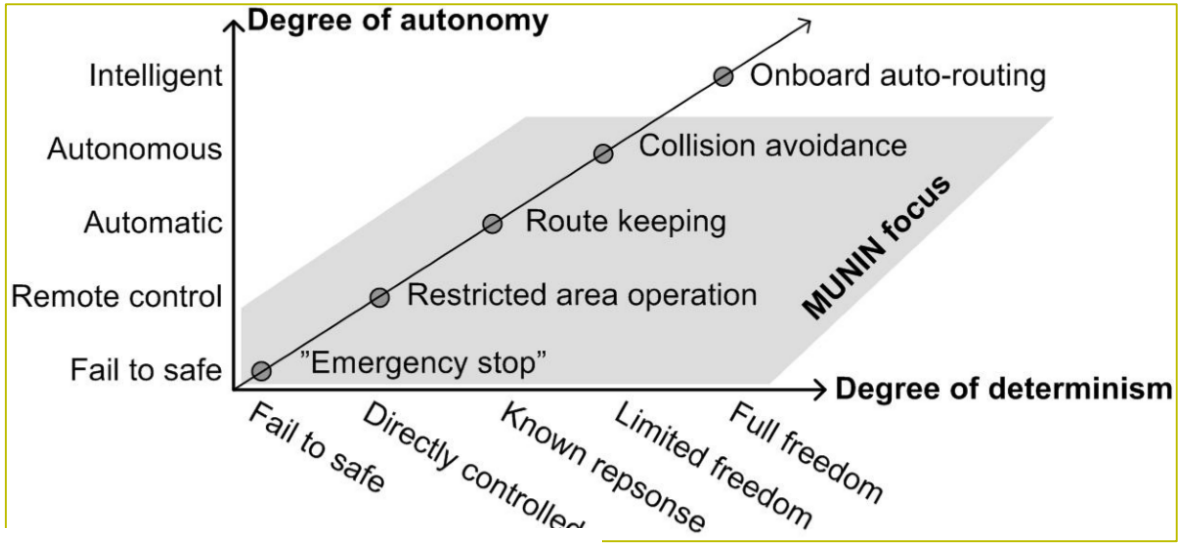
t_0 – X minutes… to be able to initiate a successful Crash stop manoeuvre t_4, the action had to be performed "in history"

Methods of control

SARUMS



MUNIN



AAWA

Level	Description
10	The computer does everything autonomously, ignores human
9	The computer informes human only if it (the computer) decides so
8	The computer informes human only if asked
7	The computer executes automatically, when neccssary informing human
6	The computer allows human a restricted time to veto before automatic execution
5	The computer executes the suggested action if human approves
4	Computer suggests single alternative
3	Computer narrows aleternatives down to a few
2	The computer offers a complete set of decision alternatives
1	The computer offers no assistance, human in charge of all decisions and actions

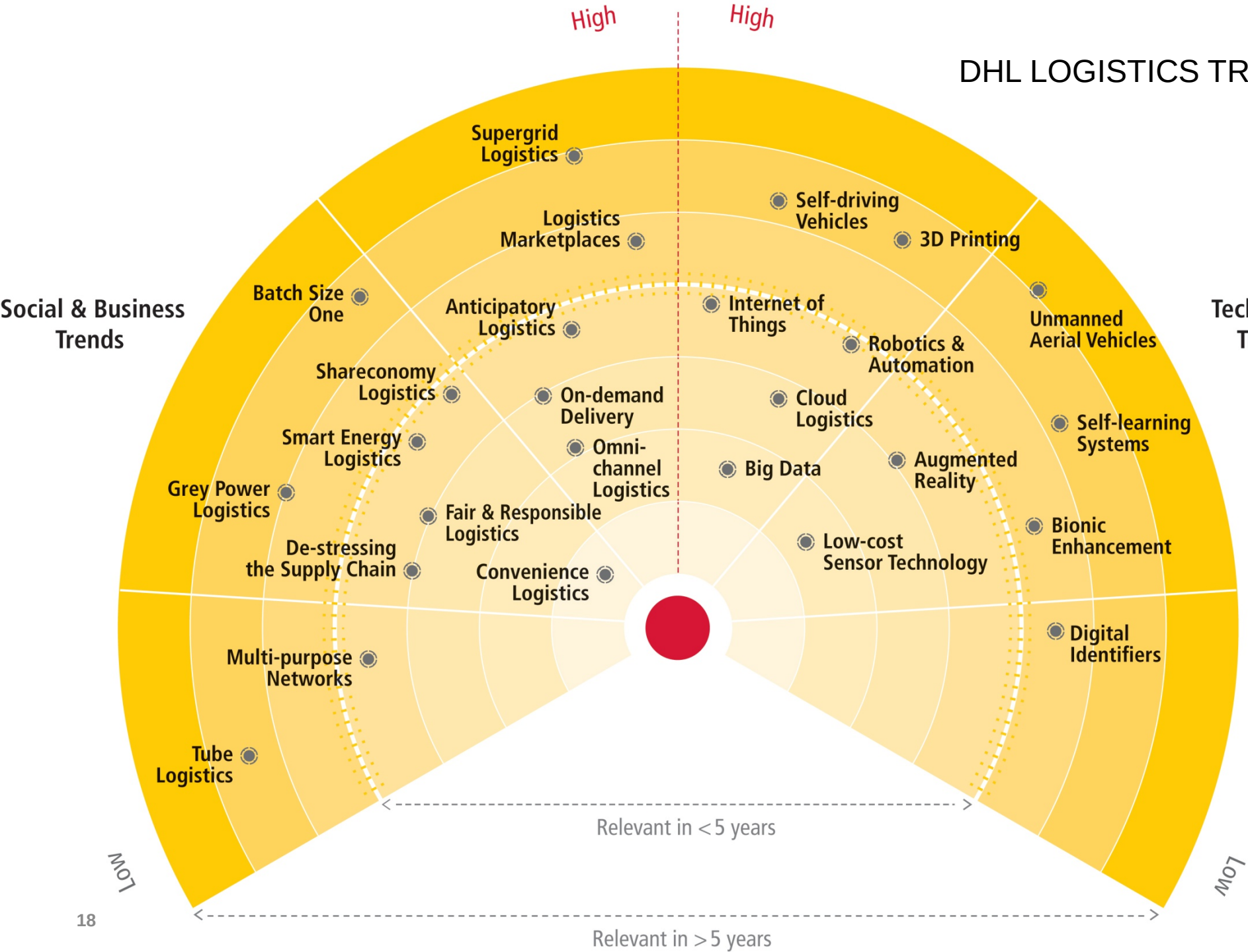
Table 1 – Sheridan levels of autonomy

USE CASE: CARGO

Figure 30: Overview of self-driving vehicle applications in logistics

SELF-DRIVING VEHICLES IN LOGISTICS A DHL
perspective on implications and use cases for the logistics industry 2014

DHL LOGISTICS TREND RADAR 2016



USE CASE: Sustainability

- Economic
- Environmental
- Social

Use case: Economics

+ 10 cm draft → + 20 kUSD profit

(per port call)

assuming typical Aframax tanker, 3 USD profit per barrel

FAMOS
FINALISING SURVEYS FOR THE BALTIC MOTORWAYS OF THE SEA

Co-financed by the European Union
Connecting Europe Facility

RI. SE

Use case: Environmental

? Will we have less collisions?

? Will we have more vessels or less vessels?

? Will they speed up? OR down? or keep the same...

? What type of energy for propulsion

! Automation of processes on vessel it self , will give some benefits. BUT the big impact will be when vessels are integrated with the whole logistic/transportation chain.

Use case: Social(technical)

- Fewer personnel on-board?

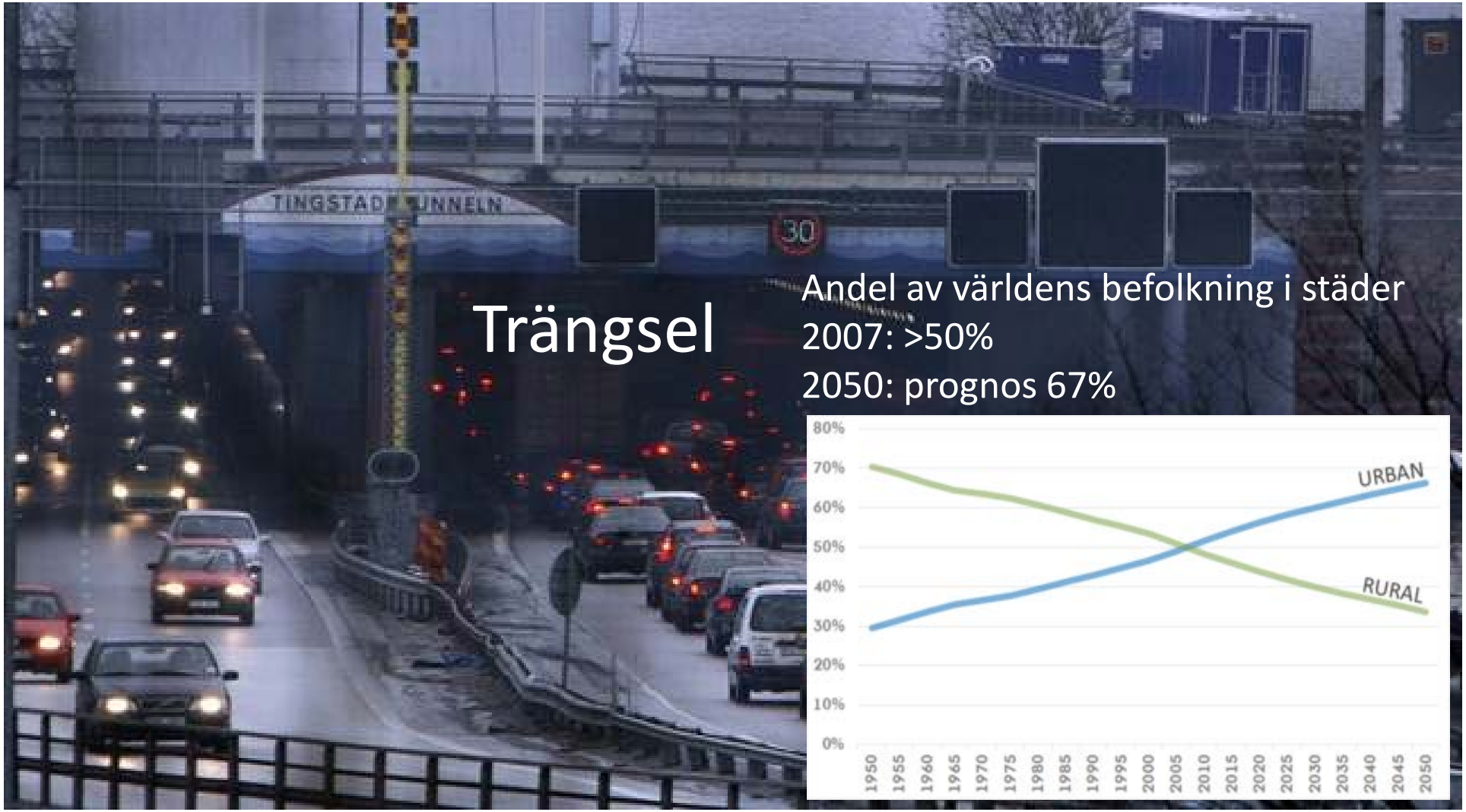
?

- More people in
  Shore based Control Centre?
- Accessible to people excluded today
- Families, fewer people will be away from home
- …

- **Framtiden**
  - **Möjligheter**

Urban WaterTruck

A sustainable transportation concept for urban waterways



Urban WaterTruck

VINNOVA

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KTH

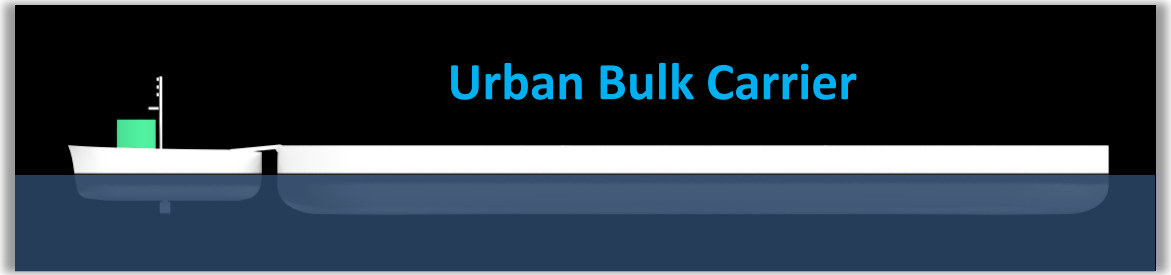
Per Gyllenspetz

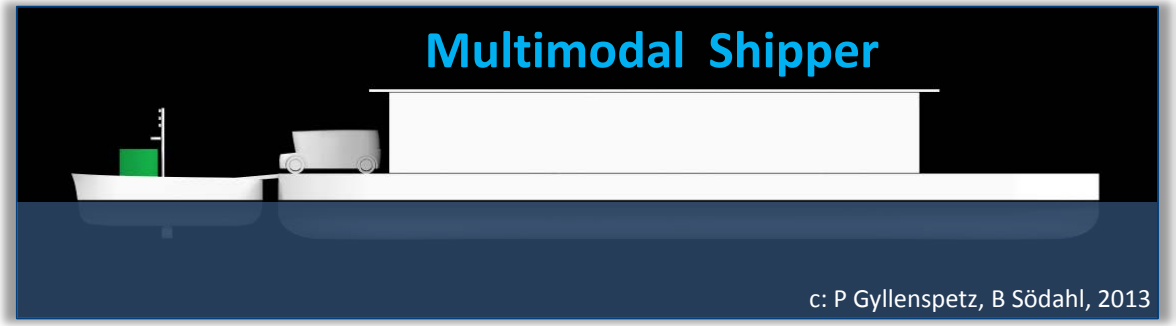
Sødahl
Maritime innovation & development

Urban WaterTruck

A sustainable transportation concept for urban waterways

Konceptidé

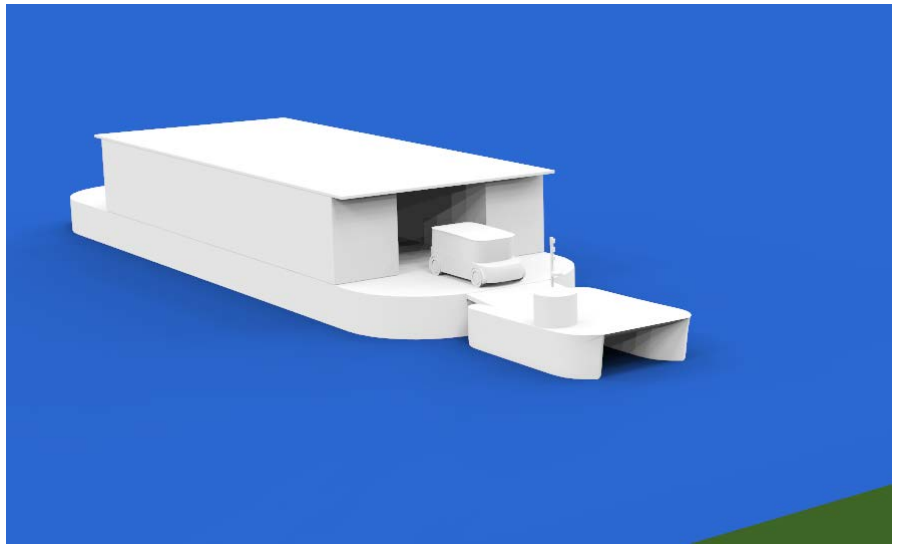


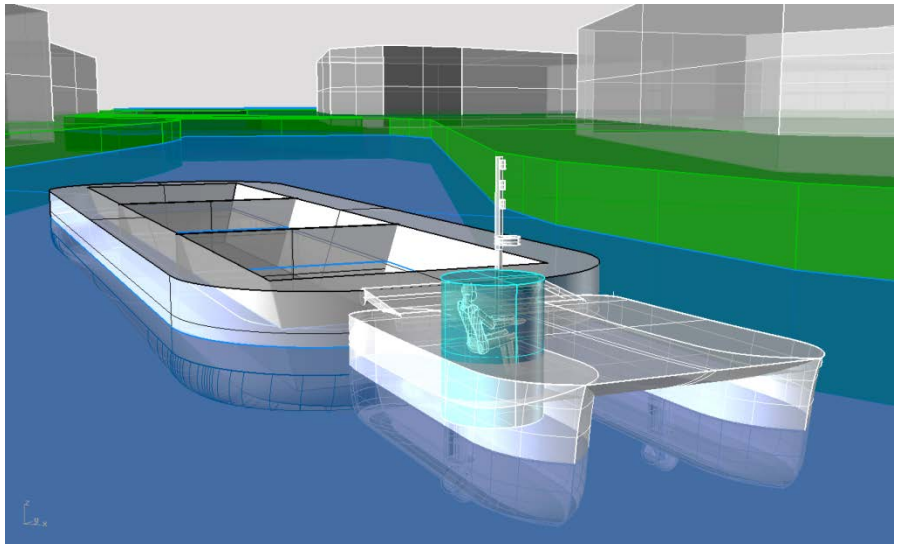


Urban WaterTruck

A sustainable transportation concept for urban waterways

Preliminära konceptskisser





- Standardiserad dragfarkost + olika typer av lastbärare – t ex godsdistribution, schaktmassor
- Modulariserade lösningar och teknologier från fordonsindustrin, bl a el/hybrid drivlina
- Automatisk förtöjning, kanske autonom styrning

Urban WaterTruck UWT

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KTH VETENSKAP OCH KONST

Per Gyllenspetz

Sødahl Maritime innovation & development

Waterway365

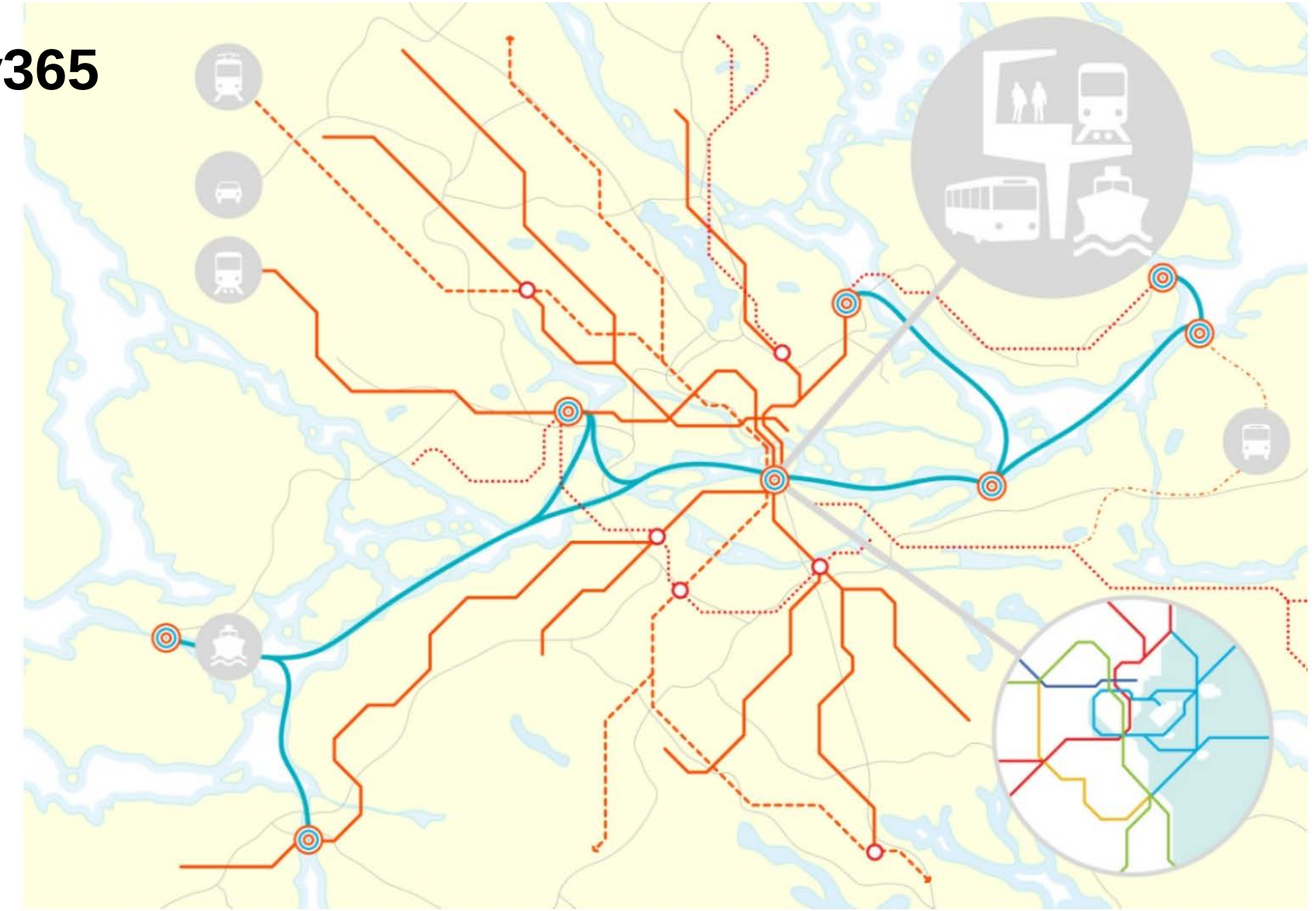


Figure 7. The blue routes exemplify suburban shuttle routs for distances <10 nautical mile (18.5 km).

WATERWAY 365 System Analysis of Challenges in Increased Urban Mobility by Utilization of the Water Ways

Waterway365

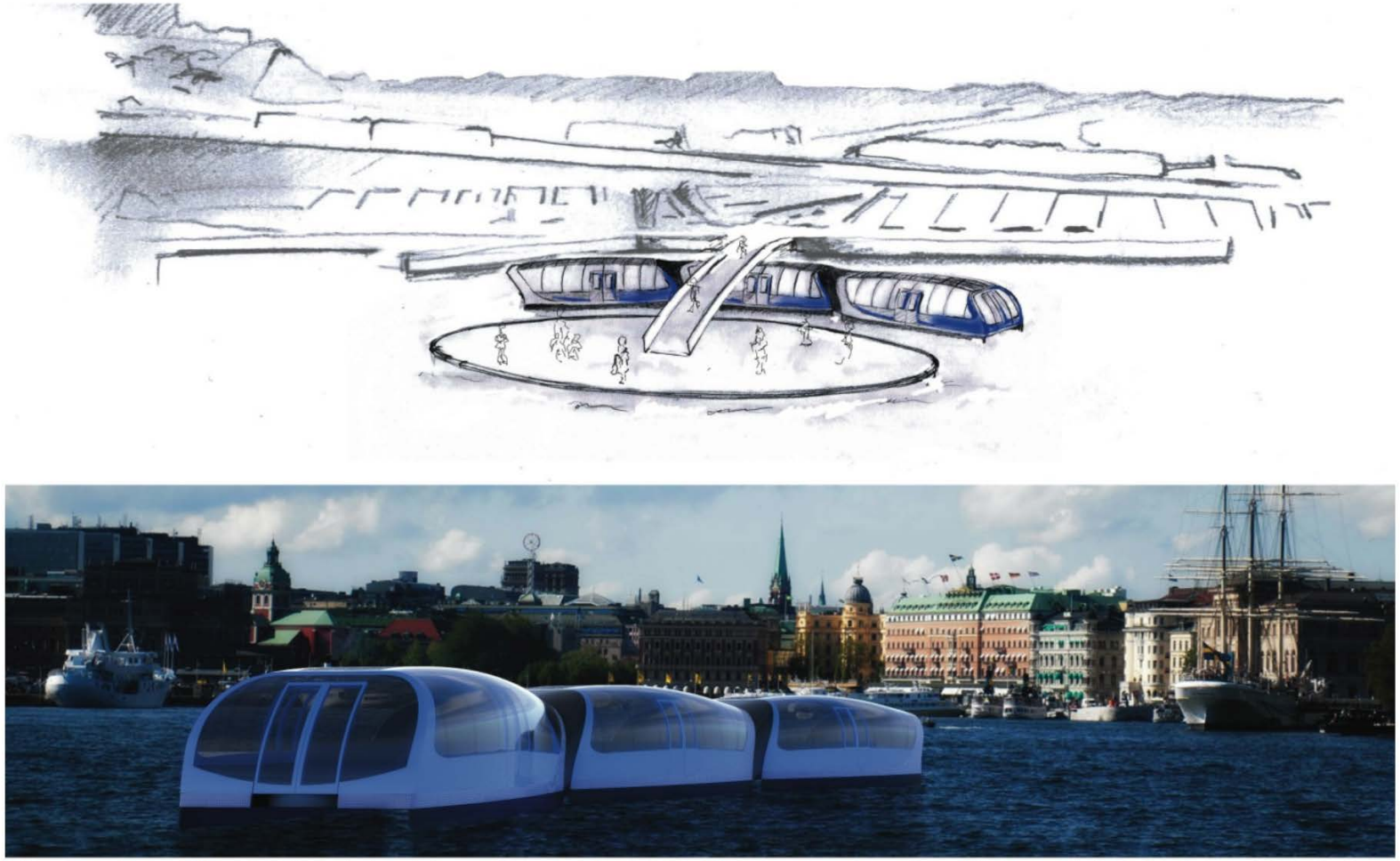


Figure 4. Example of a futuristic vision of a waterborne public transport system (Sjöbanan) for the inner city waterways developed by students at KTH and Konstfack in a collaborative student project in the course Marine Innovation given at KTH Centre for Naval Architecture.

WATERWAY 365 System Analysis of Challenges in Increased Urban Mobility by Utilization of the Water Ways

Waterway365

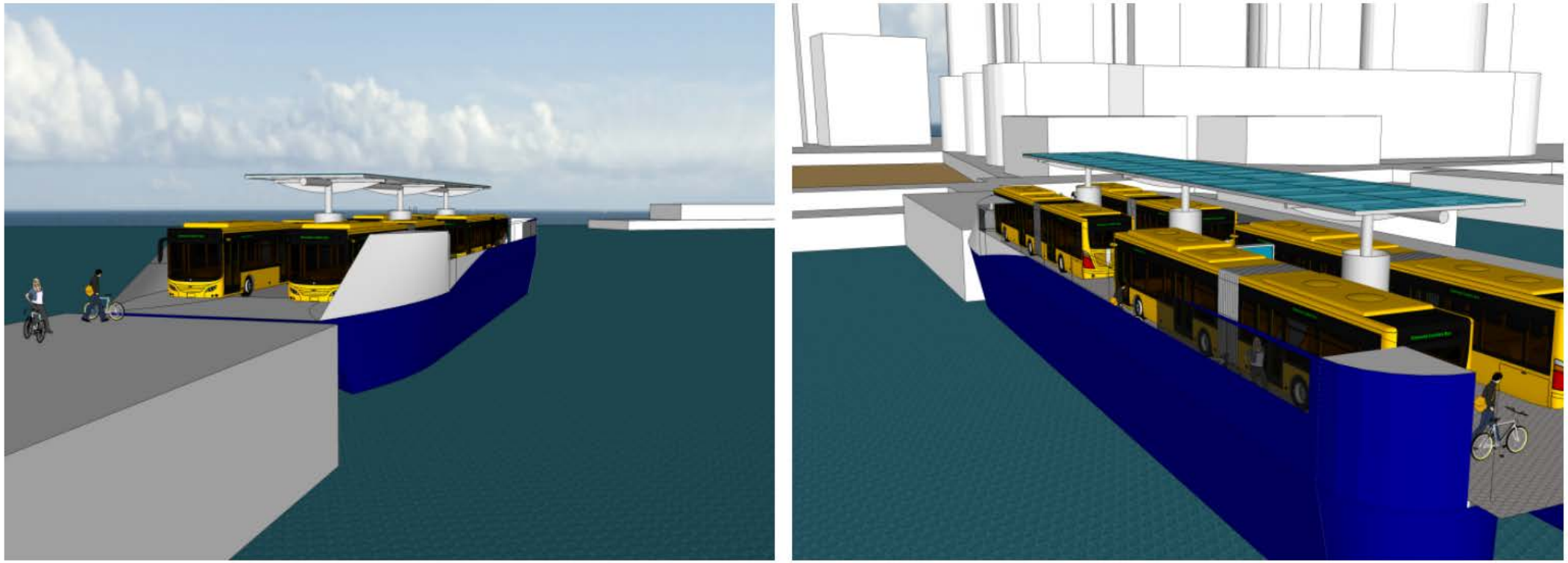
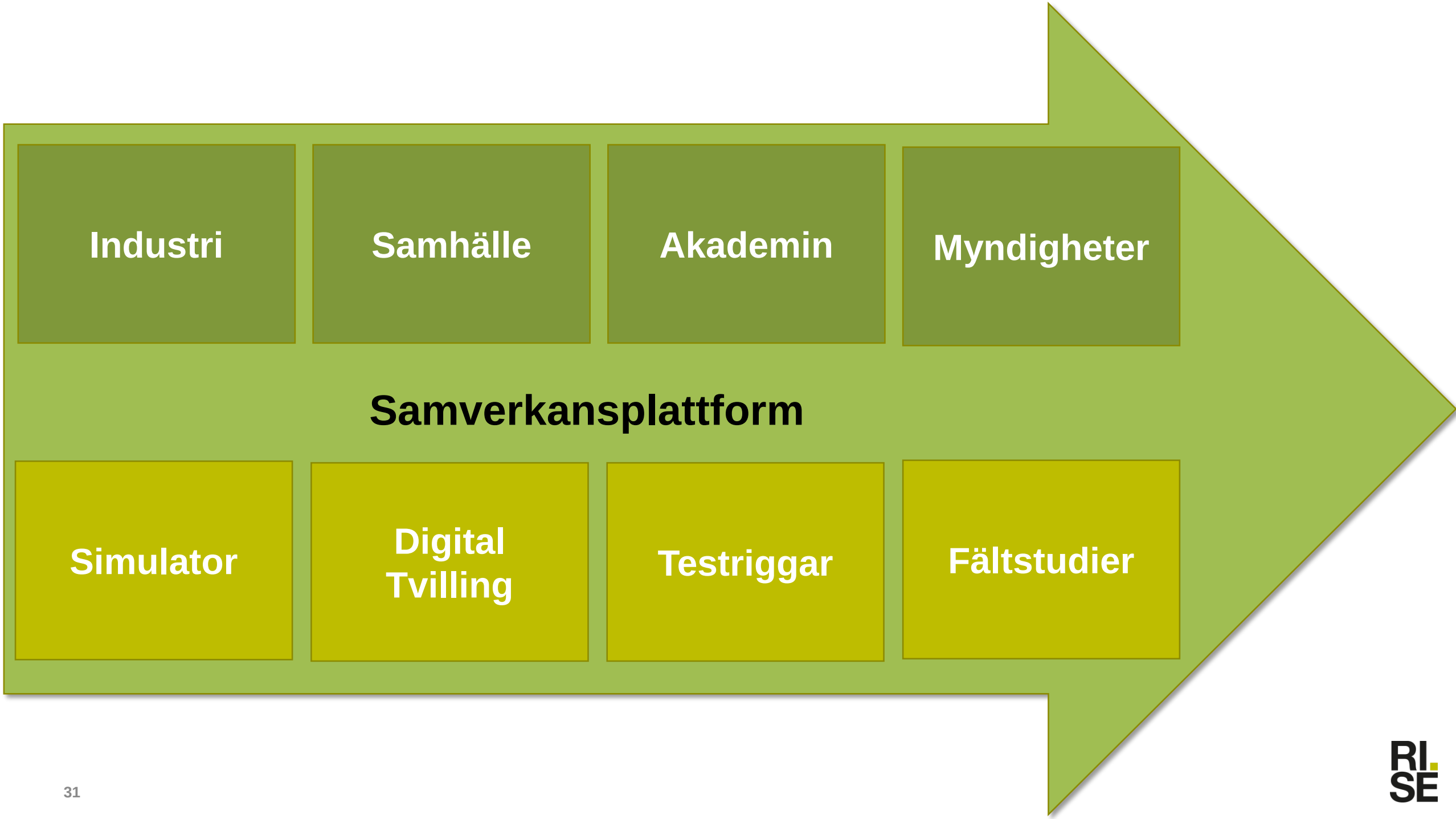


Figure 8. Bus-ferry concept.

Samverkansplattform för automatiserad och digitaliserad sjöfart


Industri
Samhälle
Akademin
Myndigheter
Samverkansplattform
Simulator
Digital Tvilling
Testriggar
Fältstudier

Industrin

- Högteknologisk
- Automatisering
- IoT 4-5G
- Material
- Serieproduktion
- Miljövänlig
- Nya arbetstillfällen
- Nya marknader för produkter
- Ny sjöfart
- …

Samhället

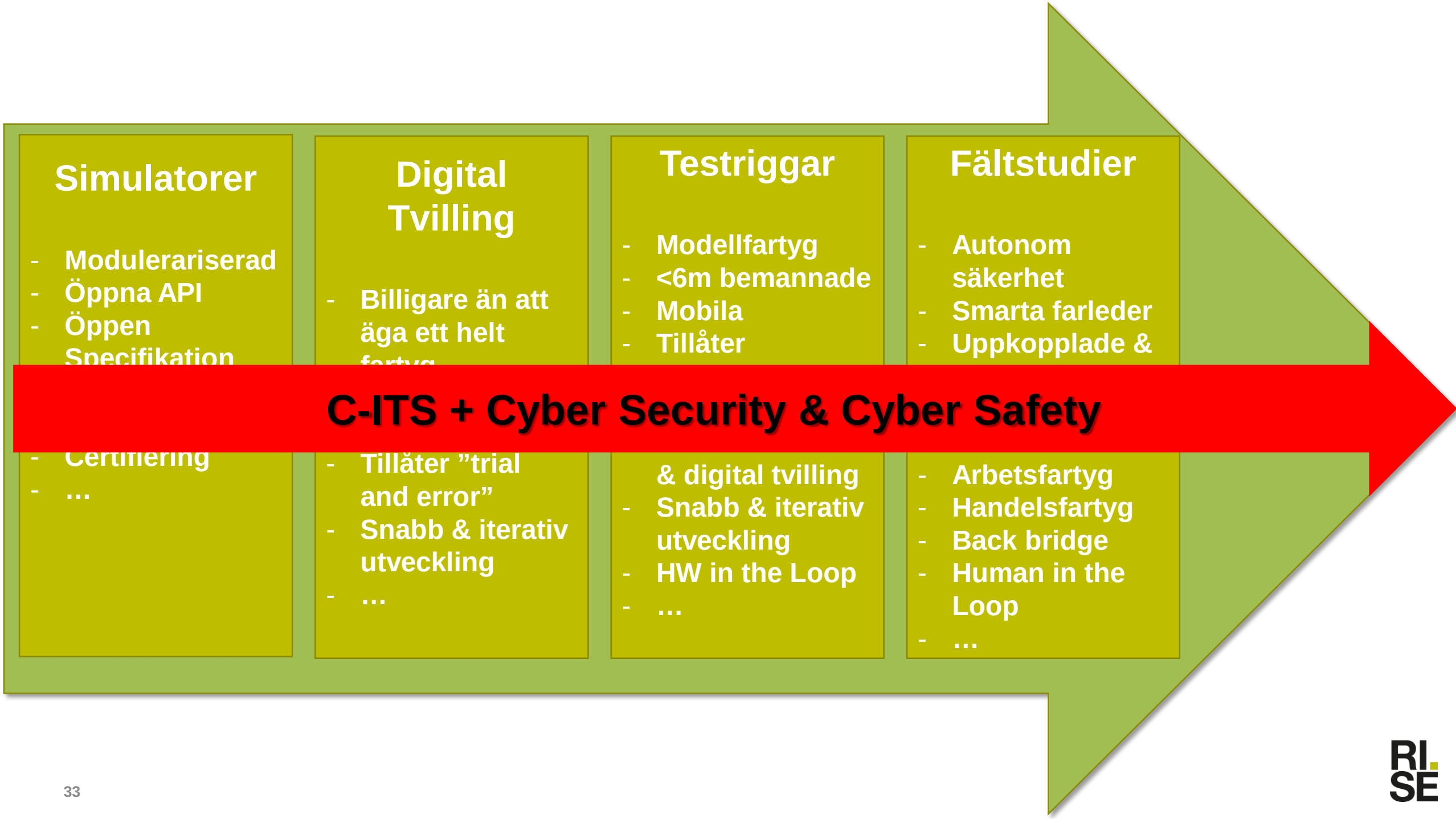
- Enormt omställnings-behov
- Ökande transportflöden
- Ökande logistikflöden
- Ineffektiva lösningar (väg)
- …

Akademin

- Organisationerna
- Individen
- Människa Maskin Interaktion
- Teknologier
- Cirkulär sjöfart
- Utbildningar
- Kompetens-försörjning
- …

Myndigheter

- Lagar & regelverk
- Tillsyn
- Validering & Certifiering
- Tillgänglighet
- Säkerhet
- Policy lab
- …


Simulatorer
- Modulerariserad
- Öppna API
- Öppen Specifikation
- Certifiering
- …
Digital Tvilling
- Billigare än att äga ett helt fartyg
- Tillåter ”trial and error”
- Snabb & iterativ utveckling
- …
Testriggar
- Modellfartyg
- <6m bemannade
- Mobila
- Tillåter & digital tvilling
- Snabb & iterativ utveckling
- HW in the Loop
- …
Fältstudier
- Autonom säkerhet
- Smarta farleder
- Uppkopplade &
- Arbetsfartyg
- Handelsfartyg
- Back bridge
- Human in the Loop
- …
C-ITS + Cyber Security & Cyber Safety

17.11.2017

Novia UAS launches Master of Engineering - Autonomous Maritime Operationsin Turku, Finland

Novia University of Applied Sciences in Turku, Finland has launched a first-of-its-kind education, Master of Engineering - Autonomous Maritime Operations >. Application period is 15 November – 15 December 2017.

The aim of the degree programme is to educate engineers and seafarers to meet the requirements for the fourth industrial revolution in maritime technology. The programme has a special focus on the digitalization of maritime operations and will start in February 2018. The degree title is Master of Engineering, Autonomous Maritime Operations. The programme comprises 60 ECTS and the study language is English.

The studies are optimized for flexible learning and studying, parallel with fulltime employment ashore or at sea. The major part of the studies and instruction are conducted using a learning platform.

The following topics are covered in the programme:

- Introduction to studies and introduction to Marine operations
- Autonomous vessels - automation
- Artificial Intelligence, Machine Learning, Human-Machine Interaction
- Remote Operations
- Cyber Security and Connectivity
- Classification, Qualification and Safety Perspectives

The new education is a result of the shipping industry's training needs

Per-Olof Karlsson, Head of Aboa Mare Maritime Academy and Training Center, says that he has received numerous contacts from the shipping industry seeking for an education corresponding to the requirements of the digitalization in the shipping industry. In addition, the Finnish Maritime Authorities have expressed the importance of an education within this new field. Aboa Mare has now met the shipping industry's training needs by launching this new education for both engineers and seafarers.

Cyber penetration tests conducted on ECDIS in transit

Tuesday, 06 February 2018 | Communications & Cyber Security

Cyber security testing was carried out on board the Zim Genova while at sea

Cyber security company Naval Dome reports that it has completed pilot testing of a cyber defence system for Lloyd's Register (LR) aboard XT Shipping's 4,300 TEU container ship Zim Genova. The vessel was operational during the tests, which were supervised by the classification society and ECDIS provider Totem Plus.

‘PlayStation generation’ needs maritime training to prevent catastrophes, say DP experts

Tue 06 Feb 2018 by Jamey Bergman

Print story Email us

Michael Cowlam (pictured) said 99% of collisions are with vessels attending offshore installations

Technical directors from separate consultancy firms serving the offshore industry have cited a lack of training as posing a significant danger to crew safety on offshore installations and vessels.

Speaking at the **European Dynamic Positioning Conference** in London, representatives from London

Recent whitepapers

The Formation & Testing of Sludge in Bunker Fuels
By Veritas Petroleum Services

Methanol and Marine Lubricants in a Lower Sulphur, Lower Emissions Future
By Chevron Marine Lubricants

Harnessing Digitalization to Ease Reporting & Improve Efficiency
By Eniram

Related articles

http://www.marinemec.com/news/view,playstation-generation-needs-maritime-training-to-prevent-catastrophes-say-dp-experts_50712.htm

- ***Framtiden***
  - ***Vinnova UDI?***

Vinnova UDI 1-2-3?

- **Lighthouse förstudie**
- **STM**
- …

Steg 1

Steg 2

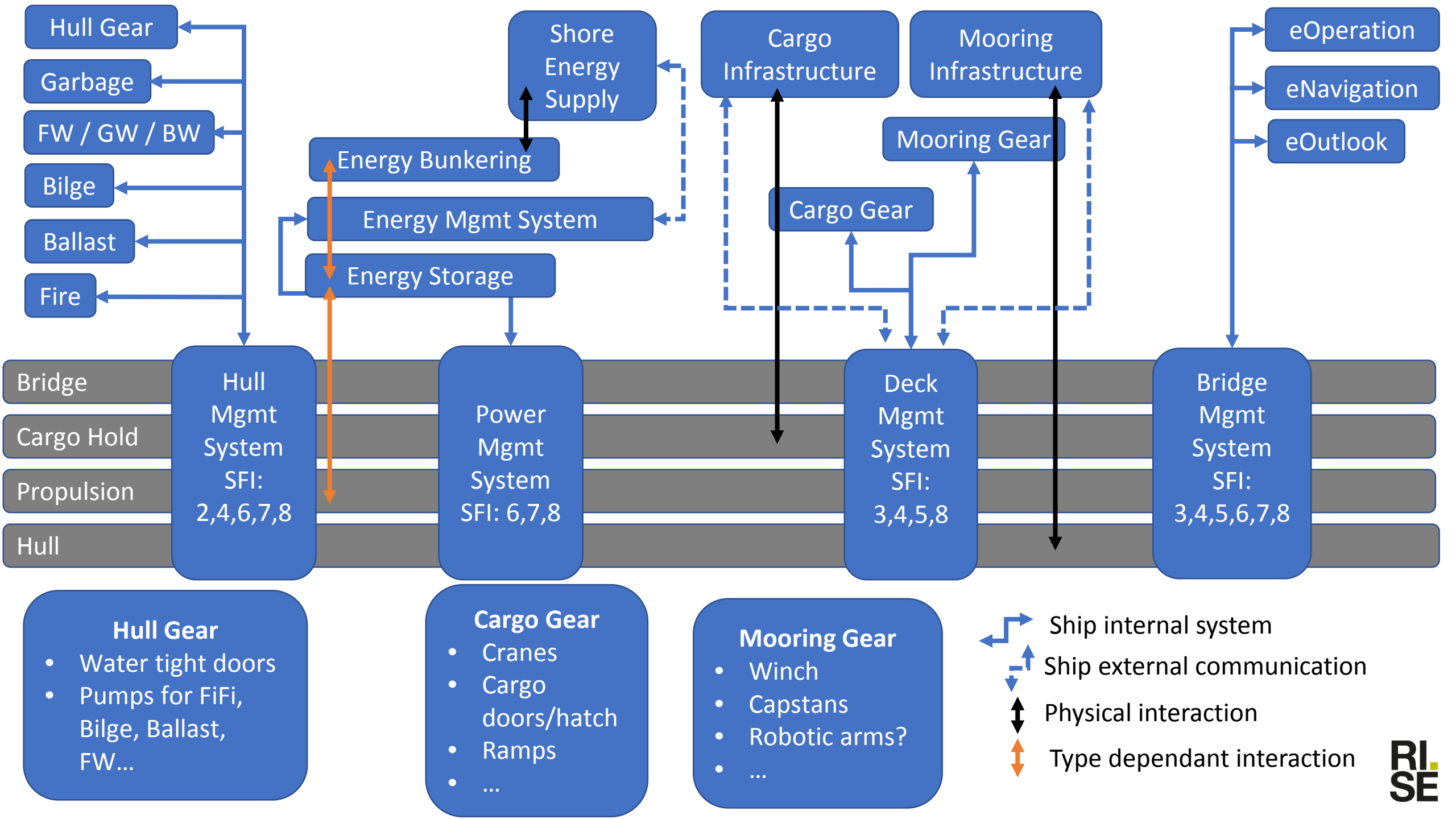
Steg 3

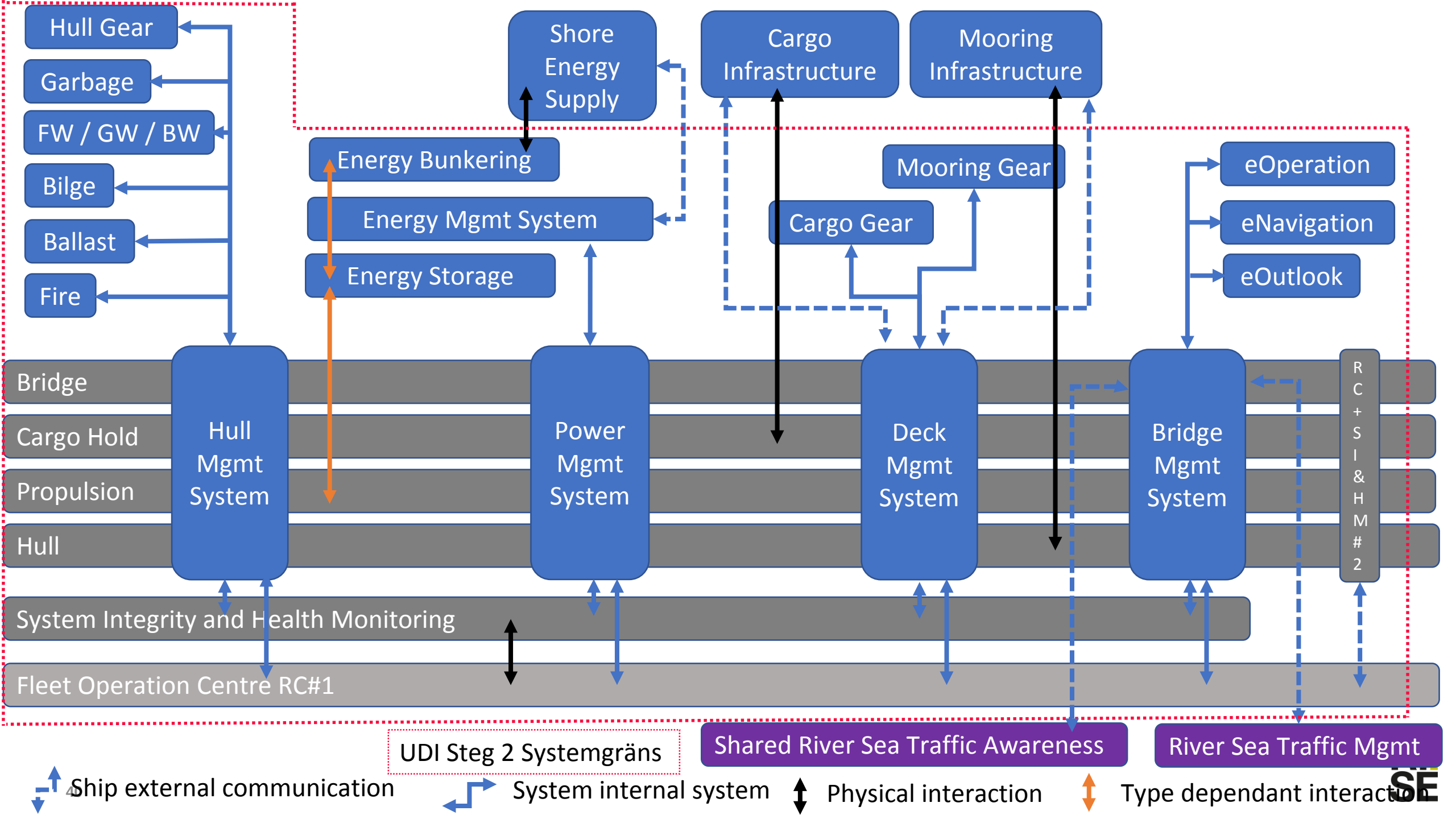
Digitaliseringens effekt på den framtida automatiserade och hållbara sjöfarten

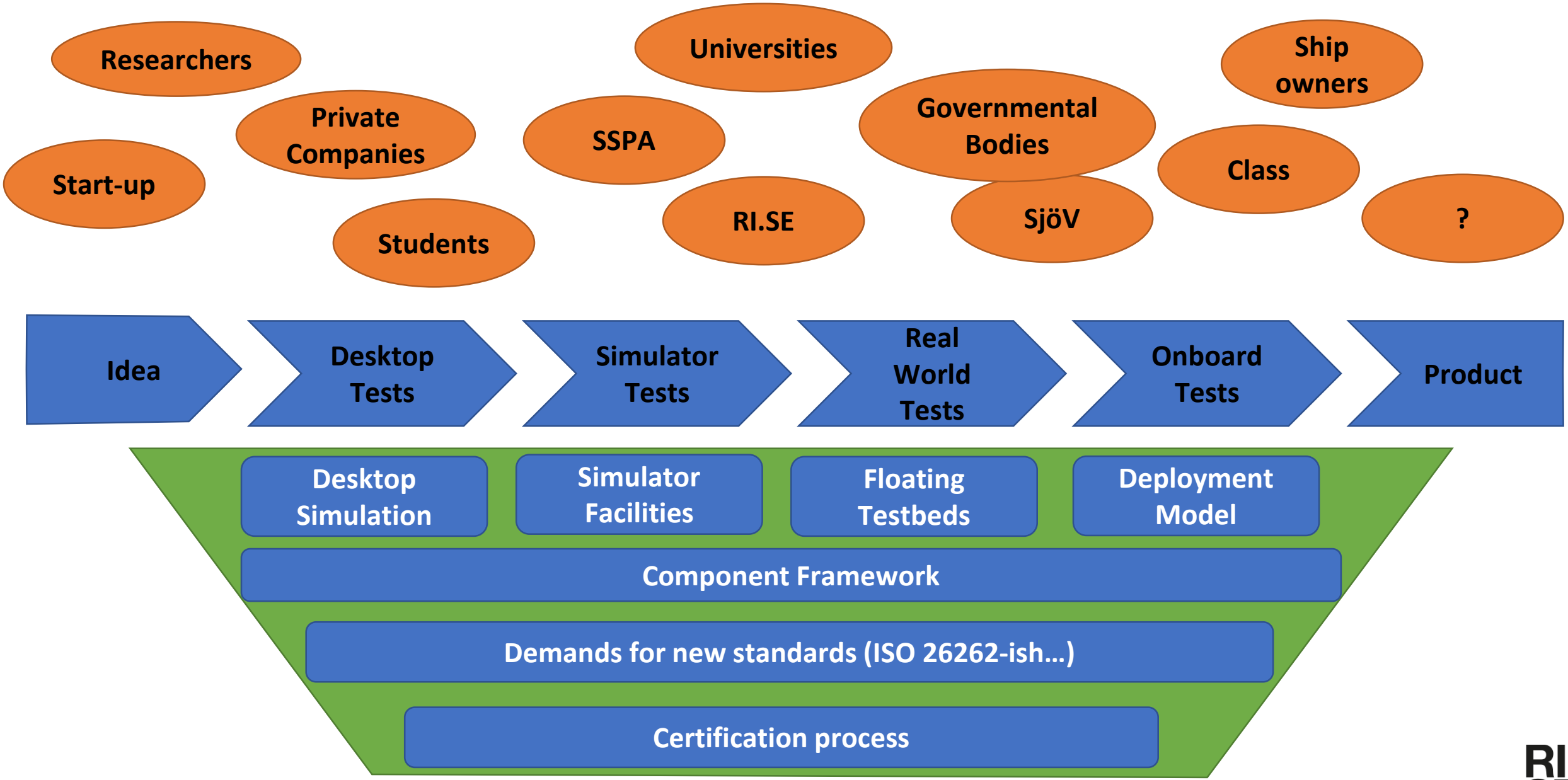
?

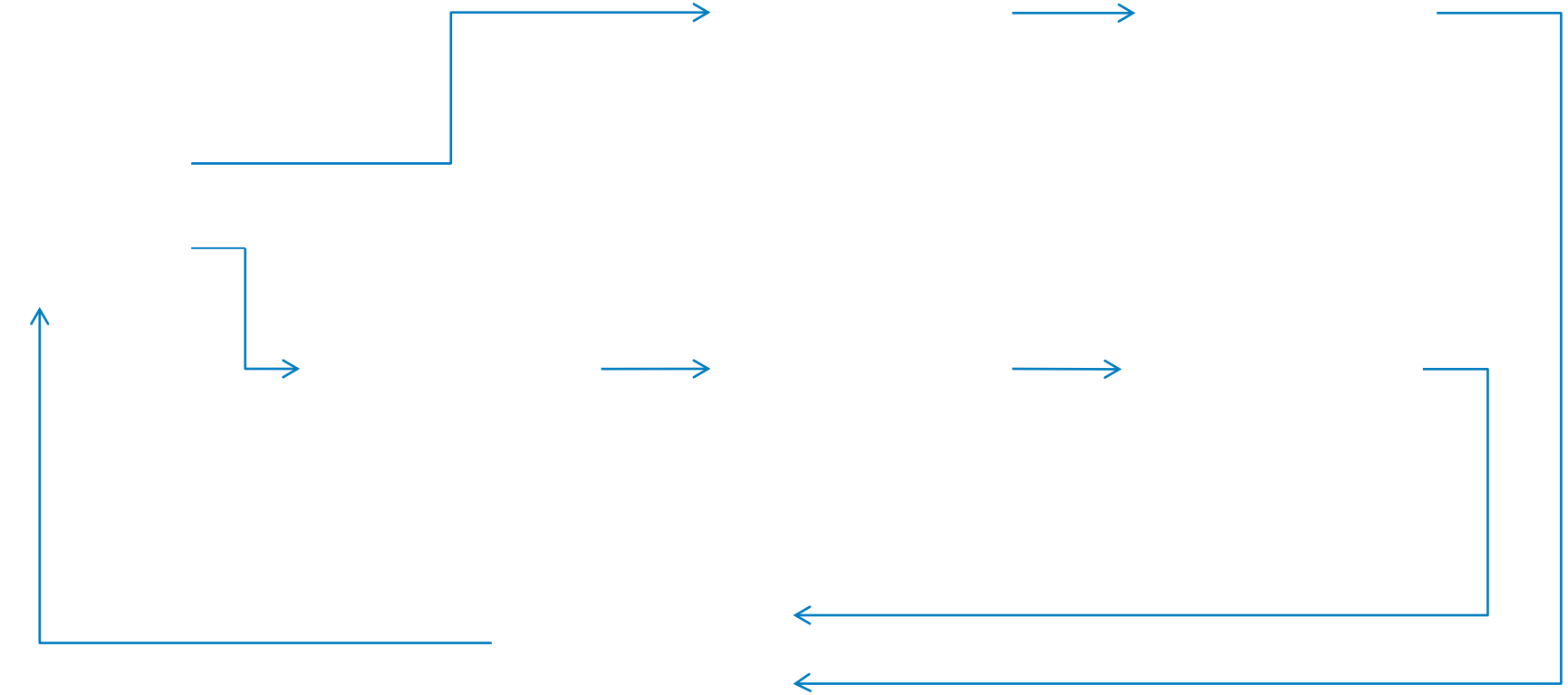
- UWT 1, DenCity, Waterway365
- MADS - Maritime Demoplats Sverige
- Praktiska försök i autonom säkerhet
- e-Sea Power
- Samverkansplattform Autonoma farkoster
- RESKILL

UWT2


Hull Gear
Garbage
FW / GW / BW
Bilge
Ballast
Fire
Shore Energy Supply
Energy Bunkering
Energy Mgmt System
Energy Storage
Cargo Infrastructure
Mooring Infrastructure
Mooring Gear
Cargo Gear
eOperation
eNavigation
eOutlook
Bridge
Cargo Hold
Propulsion
Hull
Hull Mgmt System SFI: 2,4,6,7,8
Power Mgmt System SFI: 6,7,8
Deck Mgmt System SFI: 3,4,5,8
Bridge Mgmt System SFI: 3,4,5,6,7,8
Hull Gear
Water tight doors
Pumps for FiFi, Bilge, Ballast, FW…
Cargo Gear
Cranes
Cargo doors/hatch
Ramps
…
Mooring Gear
Winch
Capstans
Robotic arms?
…
Ship internal system
Ship external communication
Physical interaction
Type dependant interaction
RI. SE


Hull Gear
Garbage
FW / GW / BW
Bilge
Ballast
Fire
Shore Energy Supply
Energy Bunkering
Energy Mgmt System
Energy Storage
Cargo Infrastructure
Mooring Infrastructure
Mooring Gear
Cargo Gear
eOperation
eNavigation
eOutlook
Bridge
Cargo Hold
Propulsion
Hull
Hull Mgmt System
Power Mgmt System
Deck Mgmt System
Bridge Mgmt System
RC+SI&HM#2
System Integrity and Health Monitoring
Fleet Operation Centre RC#1
Shared River Sea Traffic Awareness
River Sea Traffic Mgmt
UDI Steg 2 Systemgräns
Ship external communication
System internal system
Physical interaction
Type dependant interaction

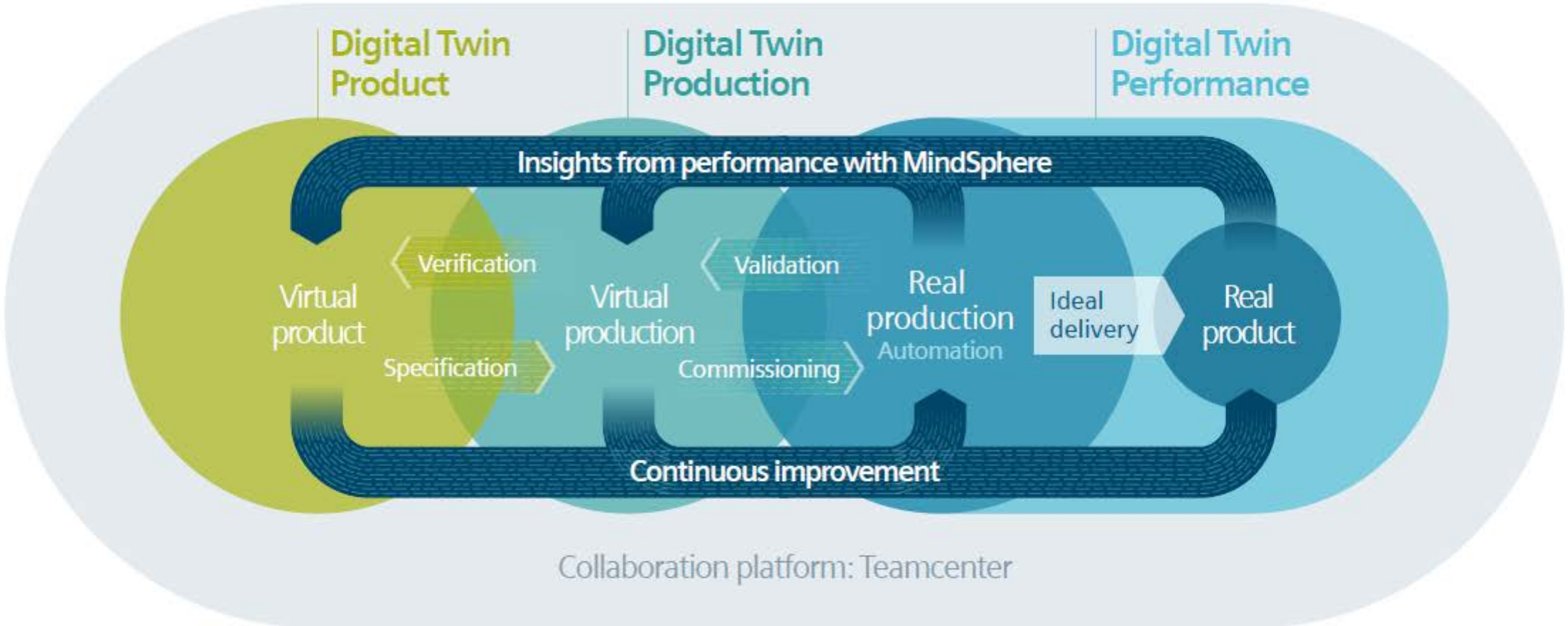

Researchers
Universities
Ship owners
Private Companies
SSPA
Governmental Bodies
Start-up
Class
RI.SE
SjöV
?
Students
Idea
Desktop Tests
Simulator Tests
Real World Tests
Onboard Tests
Product
Desktop Simulation
Simulator Facilities
Floating Testbeds
Deployment Model
Component Framework
Demands for new standards (ISO 26262-ish…)
Certification process



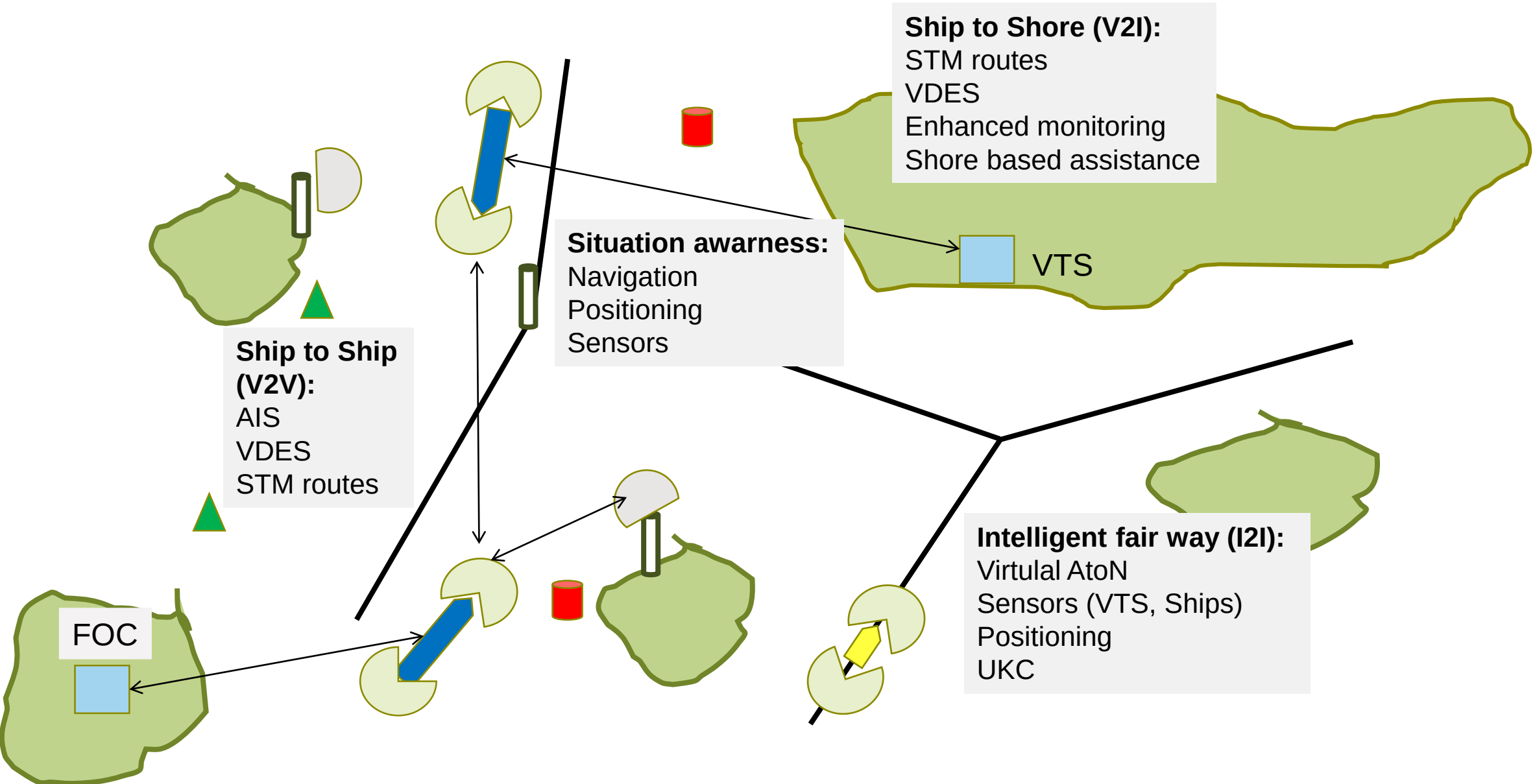
Rudder
Fix-Prop
CP-Prop
Autopilot
Combinator
Diesel Engine
Hull
Wave
Steer. Engine

Continuous improvement with the Digital Twin

SIEMENS
Ingenuity for life



”Operating picture”



Strategisk initiativ:

Vi ser :

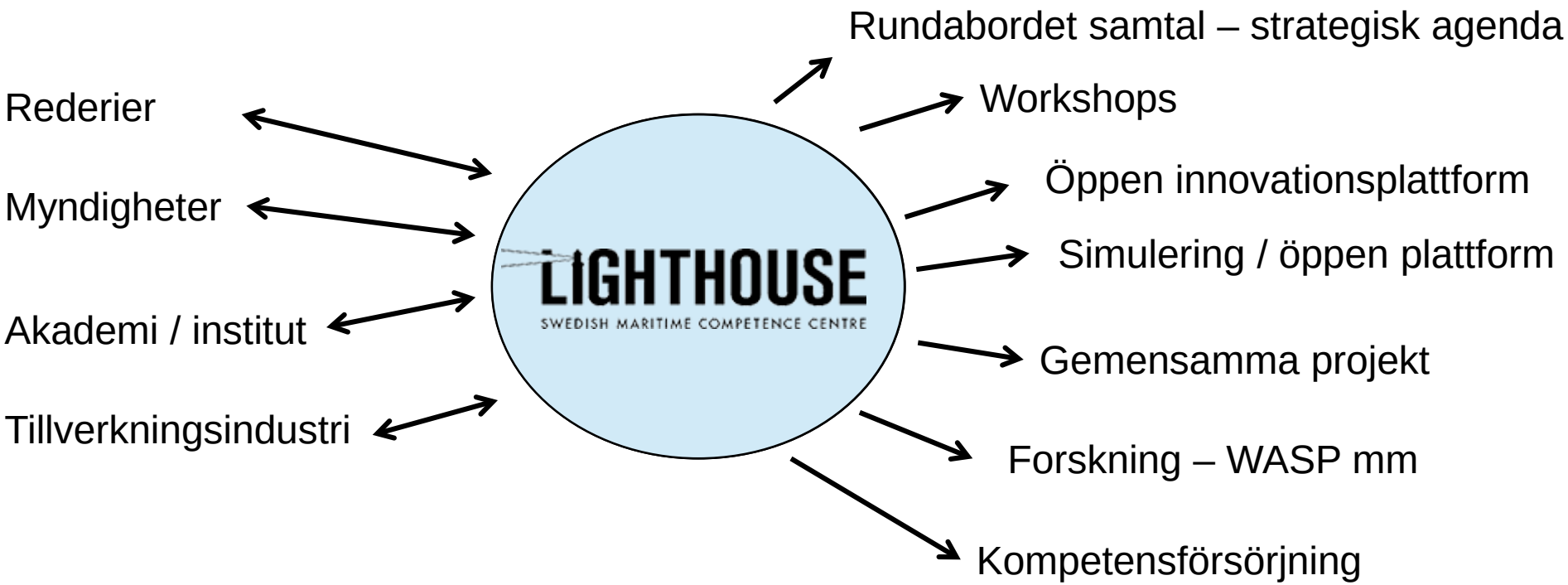
- Möjligheter för svenskt näringsliv att ta nya positioner inom den maritima domänen
- Möjligheter för svensk rederinäring att utvecklas och utveckla sitt signum som säker och miljöriktigt verksamhet
- Starka synergier med utvecklingen inom fordonsindustrin
- Trippel helix borgar för snabb och målinriktad utveckling

Syftet är etablerande av ett långsiktigt initiativ som bygger på svenska styrkor som:

- Stark och innovativ industri
- Rederier med hög säkerhetskultur och tradition
- Erfarenheter och synergier från utvecklingen inom fordonsindustrin av automatiserade och autonoma fordon
- Sea Traffic Management (STM) projektet
- Brett nätverk med ledande internationella aktörer

Strategisk initiativ:

En arena som erbjuder en **öppen miljö** för innovation och kompetensförsörjning inom fartygs ICT & automation som bidrar till att säkra svensk konkurrenskraft inom hållbar och säker sjöfart



Autonom säkerhet: Mål

Vision:

”Öka navigationssäkerheten genom att utnyttja digitaliseringens och automatiseringens möjligheter”

Mål:

- Sverige (industri, forskning, myndigheter) är ***ledande*** inom autonom säkerhet
- Konkret koncept för ***autonom säkerhet*** inom oceanfart, kustfart, skärgård och urbansjöfart som ***ger färre kollisioner och färre grundstötningar*** genom att utnyttja digitalisering och automation

Autonom säkerhet

Förutsättningar:

- Tar tillvara tjänster och infrastruktur som utvecklas i STM
- Vara en del i IMOs e-navigation
- Bygger på sensorer och kontrollfunktioner utvecklade i andra domäner (flyg, fordon)
- Praktiska demonstrationsprojekt
- Svenska farleder/hamnar
- Svenska befäl
- Svenska (ägda) fartyg
- Svensk industri

Road map

Nivå	Fartyg	Land	Gap
Autonomitet	Helt autonomt	FOC – remote monitor Smart VTS	Säkerhetskritiska system
Remote control	Remote controlled	FOC – remote control Smart VTS	Remote Control
Autonom Säkerhet	Ökat beslutstöd	Smart VTS FOC	C-ITS Nya sensorer Anti-collision/grounding
Idag	Track control Engine control	VTS FOC	

Road map

Nivå	Fartyg	Land	Gap
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Autonom Säkerhet	Ökat beslutstöd	Smart VTS FOC	C-ITS Nya sensorer Anti-collision/grounding
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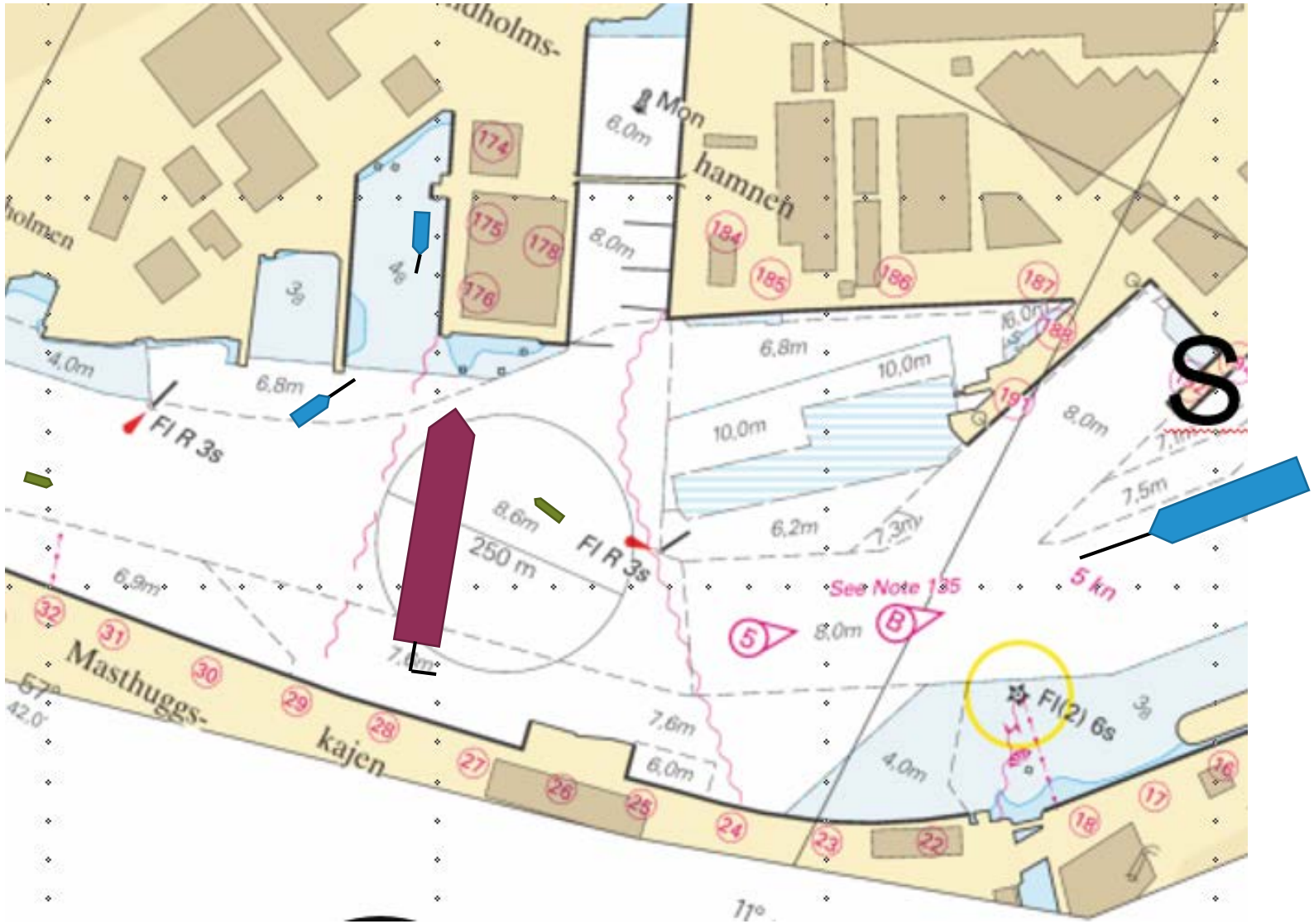
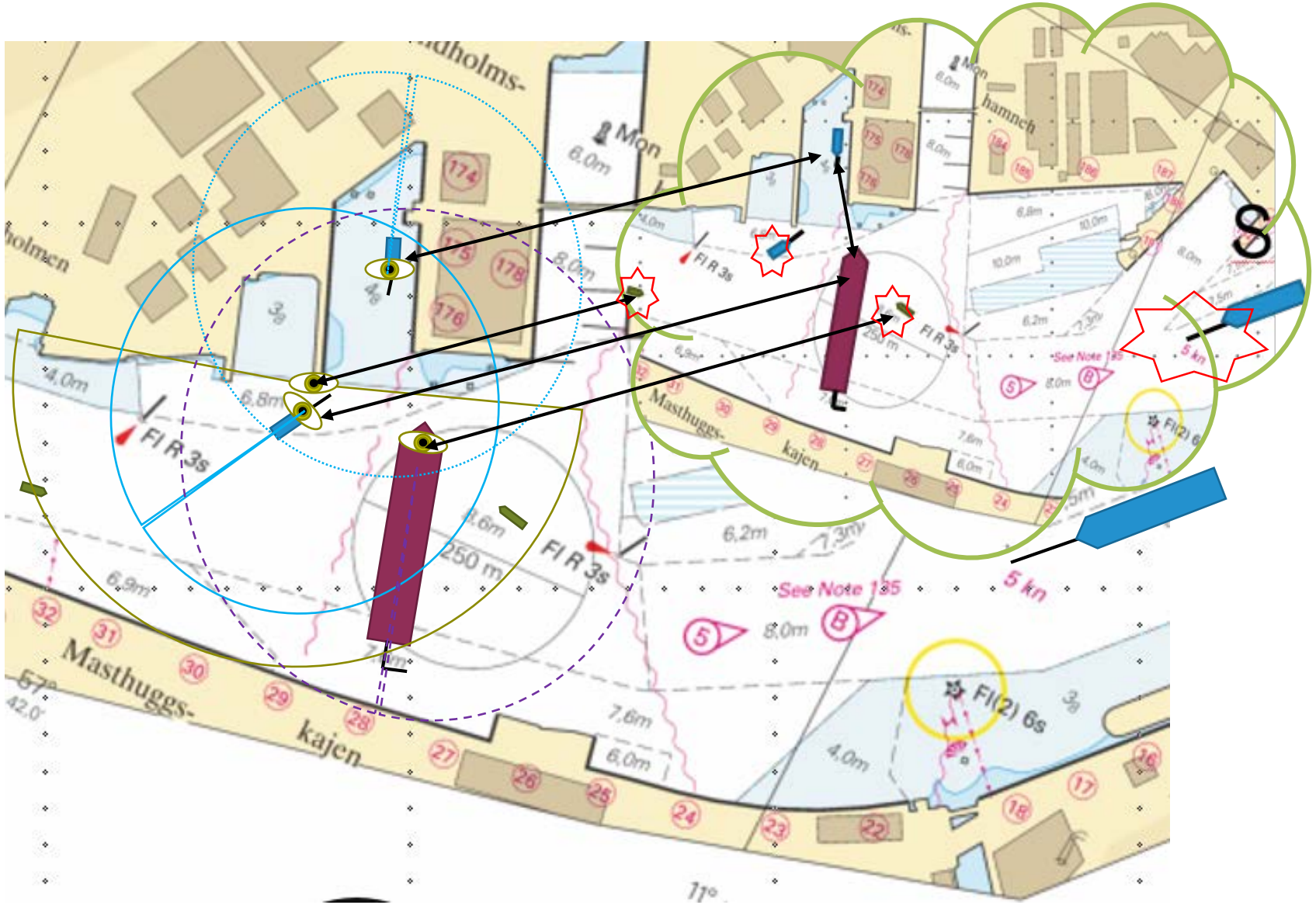
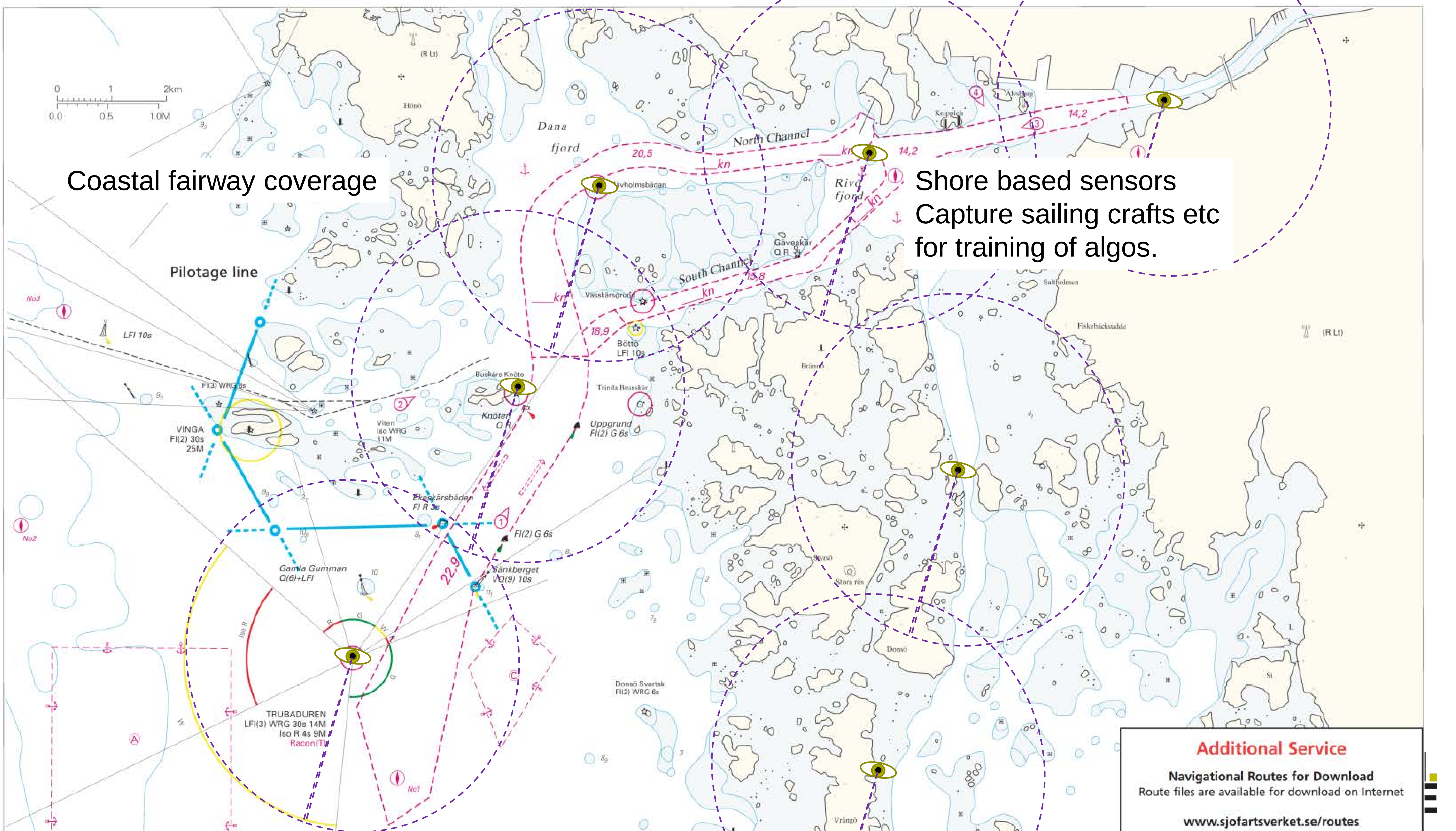
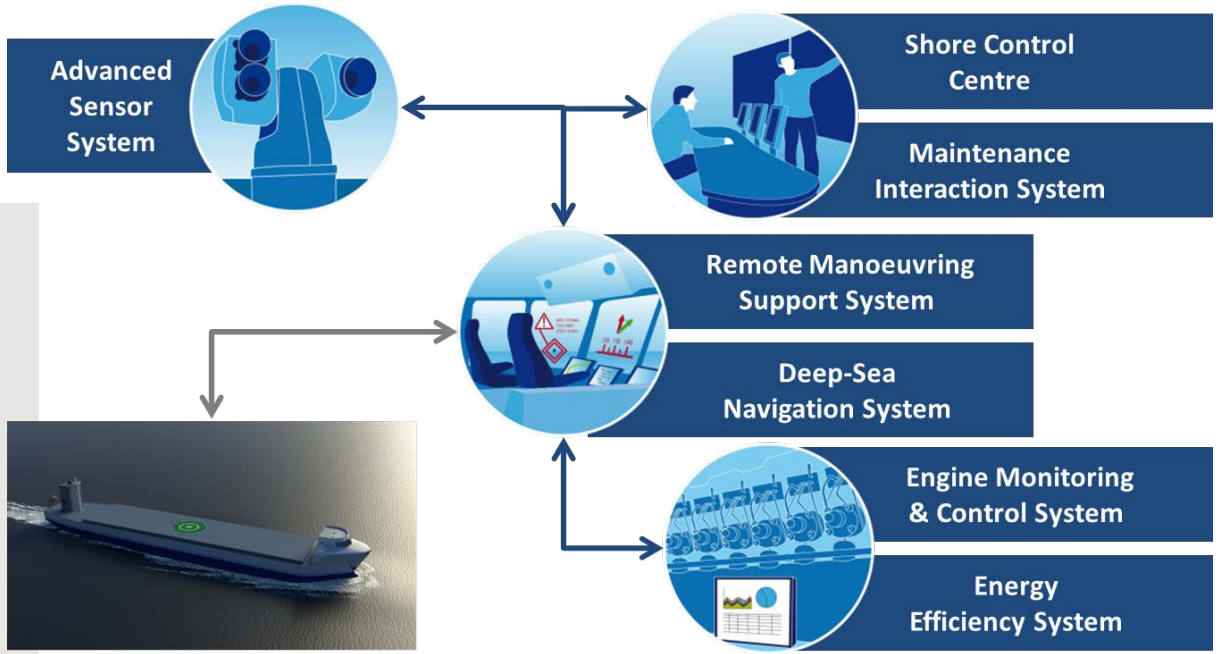

Mon
hamnen
6.0m
8.0m
174
175
178
176
184
185
186
187
188
191
4.0m
6.8m
Fl R 3s
6.8m
10.0m
10.0m
8.0m
7.5m
6.2m
7.3m
8.6m
250 m
Fl R 3s
See Note 185
5 kn
5
8.0m
B
6.9m
32
31
30
29
28
27
26
25
24
23
22
Masthuggs-
kajen
7.6m
6.0m
Fl(2) 6s
4.0m
17
18
16
57°
42.0'
11°


Mon
6.0m
Fl R 3s
Masthuggs-
kajen
See Note 135
5 kn
Fl(2) 6s
6.2m
7.6m
4.0m
6.9m
8.0m
250 m


Coastal fairway coverage
Shore based sensors
Capture sailing crafts etc
for training of algos.
Pilotage line
Dana fjord
North Channel
South Channel
Rivö fjord
VINGA
Fl(2) 30s
25M
TRUBADUREN
LFl(3) WRG 30s 14M
Iso R 4s 9M
Racon(T)
Gamla Gumman
Q(6)+LFl
Sänkberget
VQ(9) 10s
Ekeskärsbåden
Fl R 3s
Uppgrund
Fl(2) G 6s
Bötto
LFl 10s
Buskärs Knöte
Vasskärsgrund
Gäveskär
Q R
LFl 10s
Donsö Svartsk
Fl(2) WRG 6s
Viten
Iso WRG
11M
0
1
2km
0.0
0.5
1.0M
Additional Service
Navigational Routes for Download
Route files are available for download on Internet
www.sjofartsverket.se/routes

Systemelement

- **Beslutstöd:**
  - Anti-collision/grounding
  - Navigation
  - Sensorer ombord och iland
- **Intelligenta farleden:**
  - Virtuella AtoN
  - Sensorer
  - UKC management
  - Robust positionering
- **Smart VTS:**
  - Beslutstöd
  - Virtuell teknik – placerar operatören virtuellt ombord på fartyget
  - STM tjänster



Utbildning:

- Navigatör
- VTS operatör
- Shore center operatör

Kommunikation:

- C-ITS

Testrigg: Mål

- Industrin skall få tillgång till en **neutral plattform** där de kan testa en ”delmängd” **utan att behöva äga ett helt ekosystem**
- Akademin skall få tillgång till en **öppen plattform** som kan användas av studenter, forskare för att ta idéer/koncept från papper till verklighet och utveckla utbildningarna för att matcha framtida behov.
- Industrin får ett ”show room” för **rekrytering/kompetensförsörjning**
- Samhället kan se vilka **möjligheter** som finns och kan agera utifrån detta när det gäller **samhällsplanering, policys och regelverk**

Testrigg: Strategi

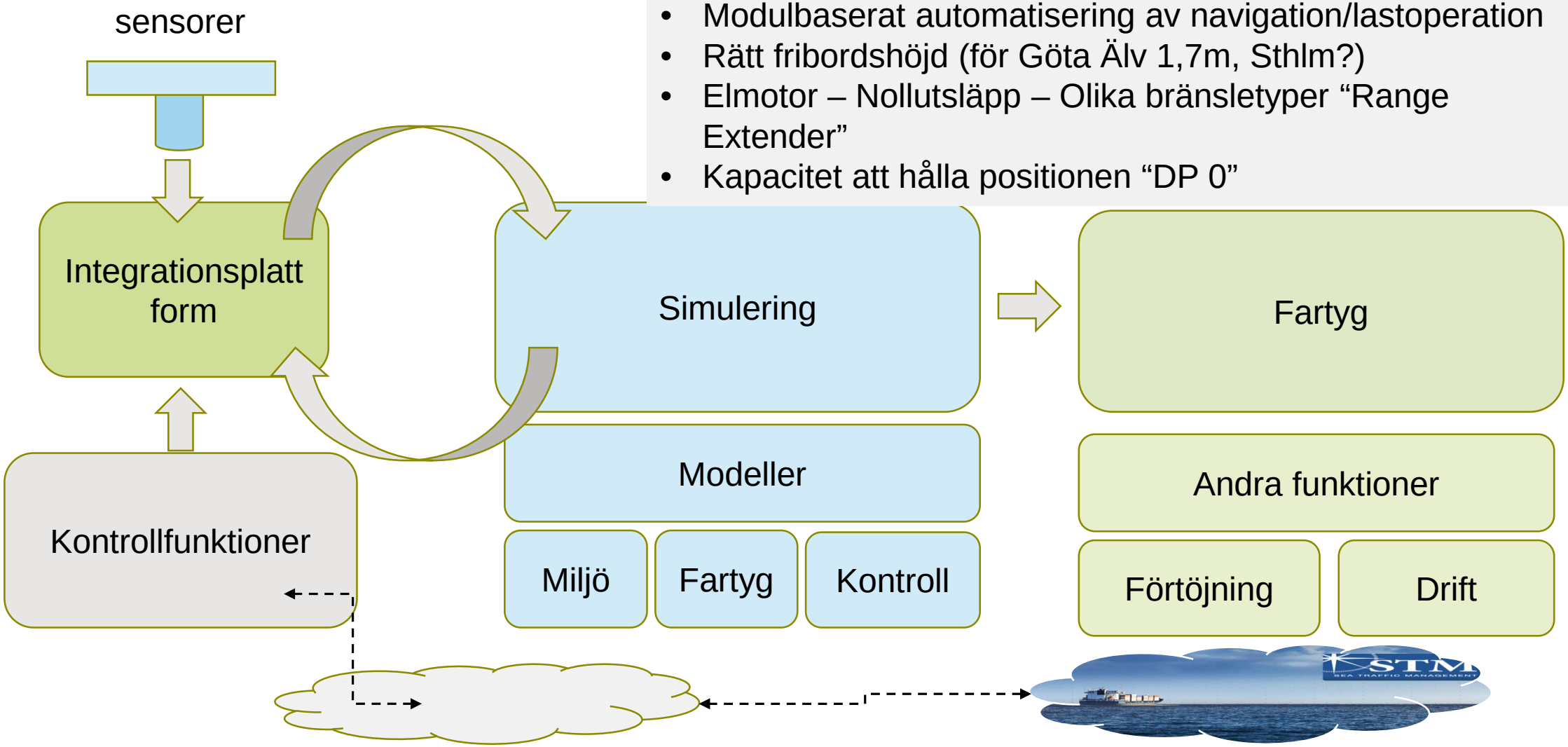
”Hur äter man en elefant? jo man skär den i små bitar…”

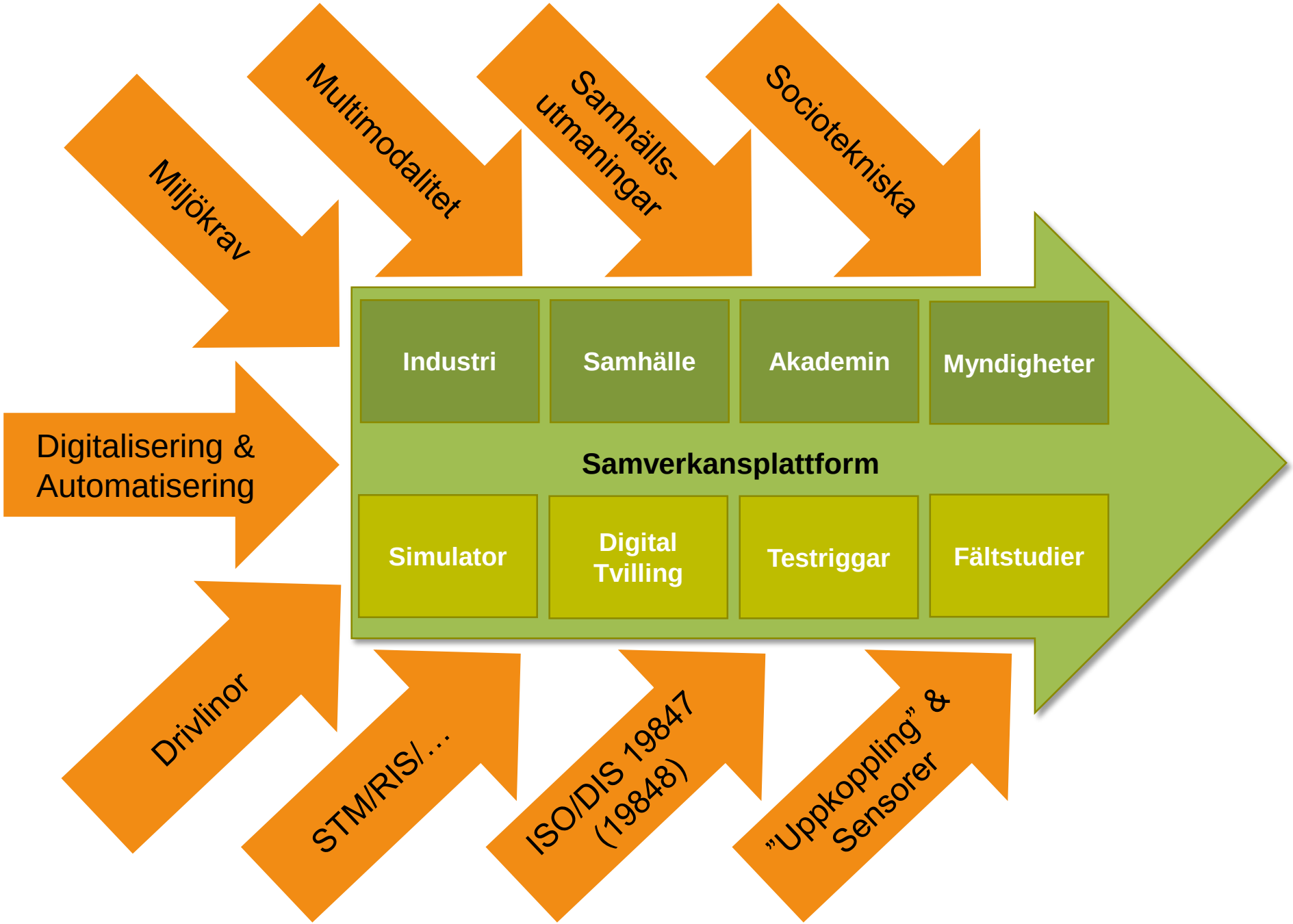
- En samverkansplattform i form av ett flytande testlabb gör att **industrins behov** kan börja att **delas upp i mindre delmoment** och framtida lösningar kan testas **i mindre och snabbare loopar** - om man har tillgång till en öppen testrigg.
- Fördelar med det ramverk som skall omfatta denna testrigg är att mycket utveckling som idag är knutet till mjukvara kan ske ”hemma på kammaren” och sedan testas i en digital tvilling för att sedan ta klivet ombord. Och vidare till validering, certifiering och produktifiering!

Testrigg: Uppbyggnad

Målbild första testrigg:

- LOA 6m bredd 4m
- Minimalistisk manuell – fail to safe
- Modulbaserat automatisering av navigation/lastoperation
- Rätt fribordshöjd (för Göta Älv 1,7m, Sthlm?)
- Elmotor – Nollutsläpp – Olika bränsletyper “Range Extender”
- Kapacitet att hålla positionen “DP 0”




Miljökrav
Multimodalitet
Samhälls-utmaningar
Sociotekniska
Digitalisering & Automatisering
Industri
Samhälle
Akademin
Myndigheter
Samverkansplattform
Simulator
Digital Tvilling
Testriggar
Fältstudier
Drivlinor
STM/RIS/…
ISO/DIS 19847 (19848)
”Uppkoppling” & Sensorer

ISO/DIS 19847
(19848)

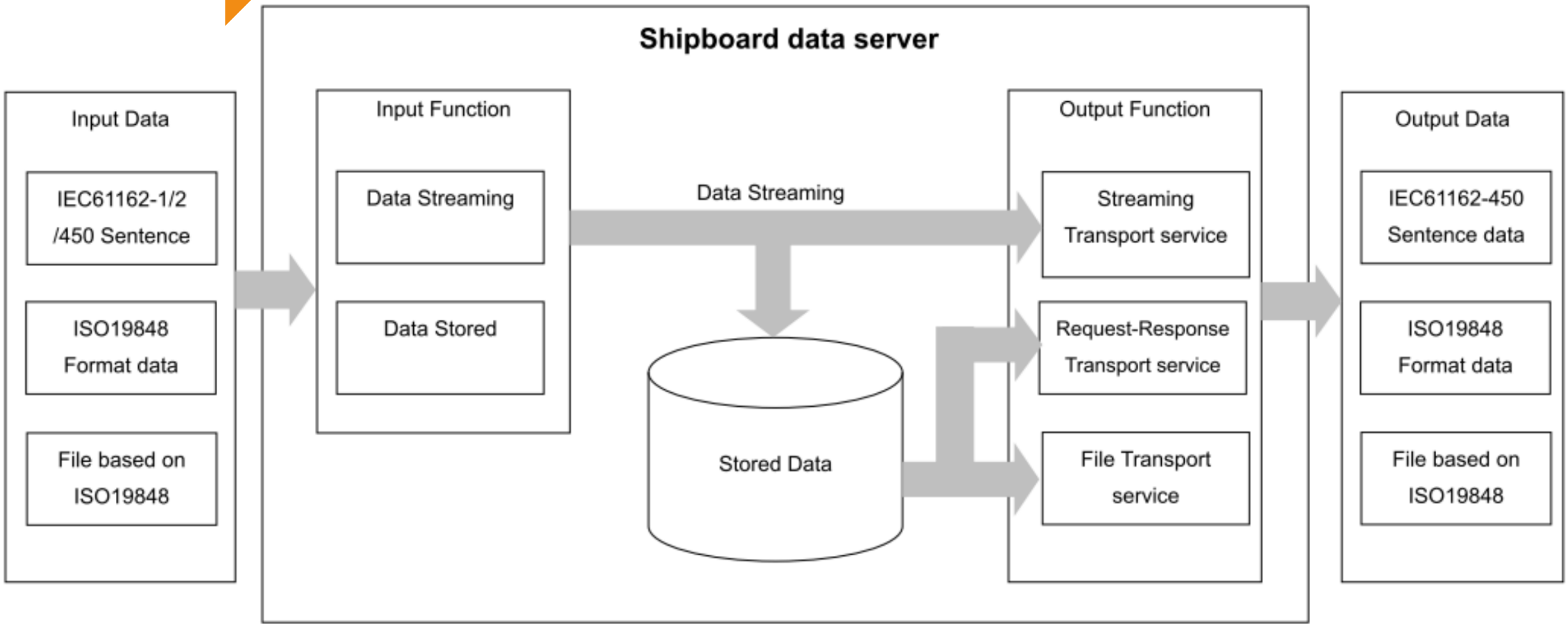


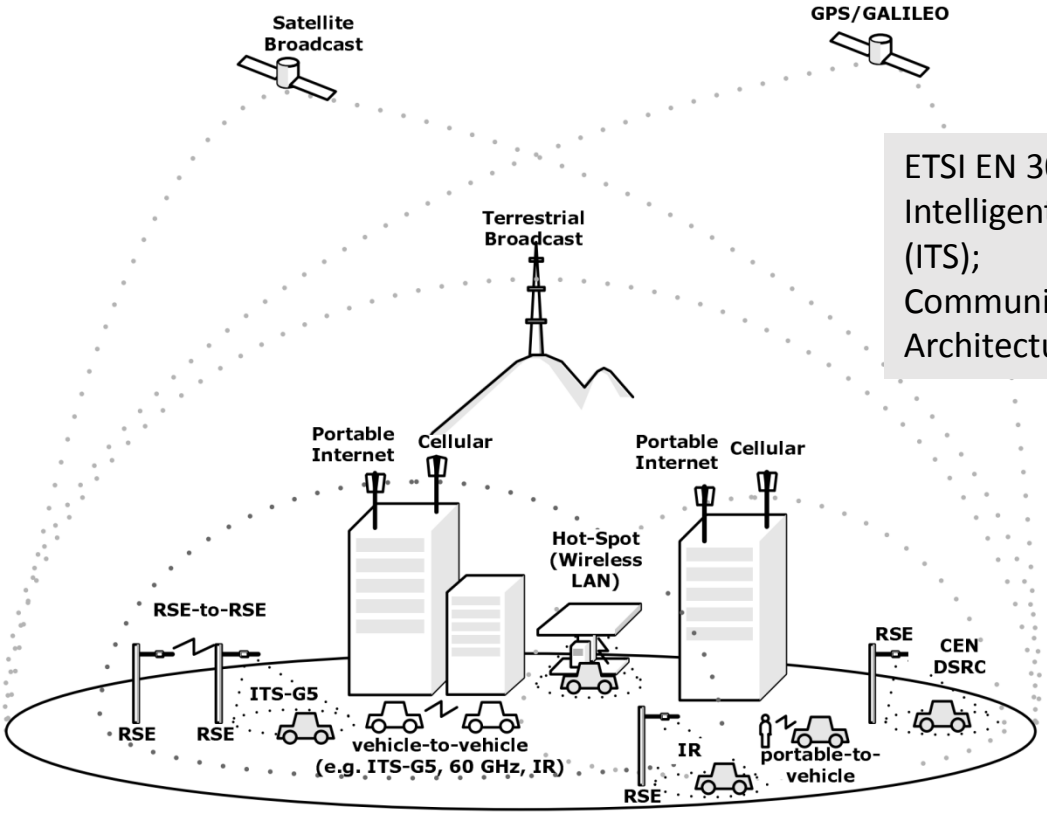
Figure 4 — Data input and output concept model

”Uppkoppling” & Sensorer

C-ITS för sjöfarten

C-ITS typically involves communication between;

- Vessels-to-vessel (V2V)
- Between vessel and infrastructure (V2I)
- Infrastructure-to-infrastructure (I2I)
- Personal ITS (P2X)



ETSI EN 302 665
Intelligent Transport Systems (ITS);
Communications Architecture

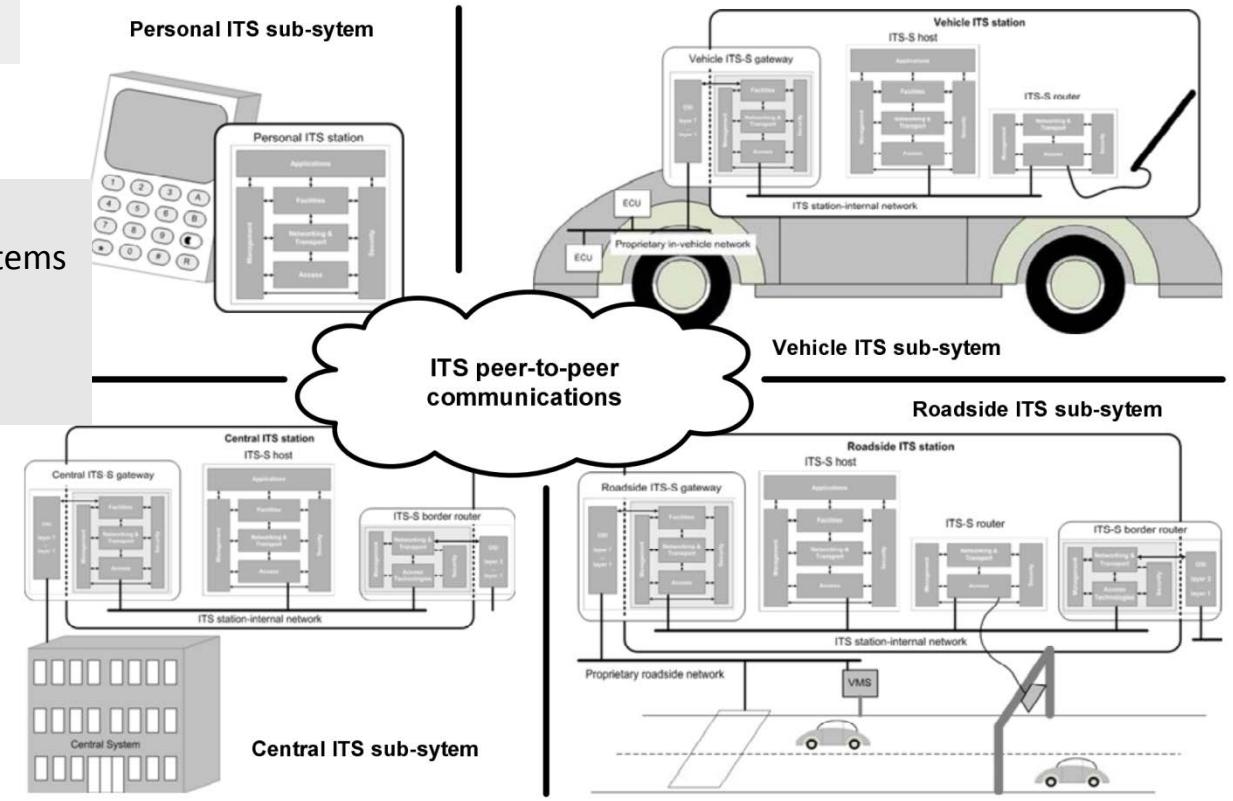
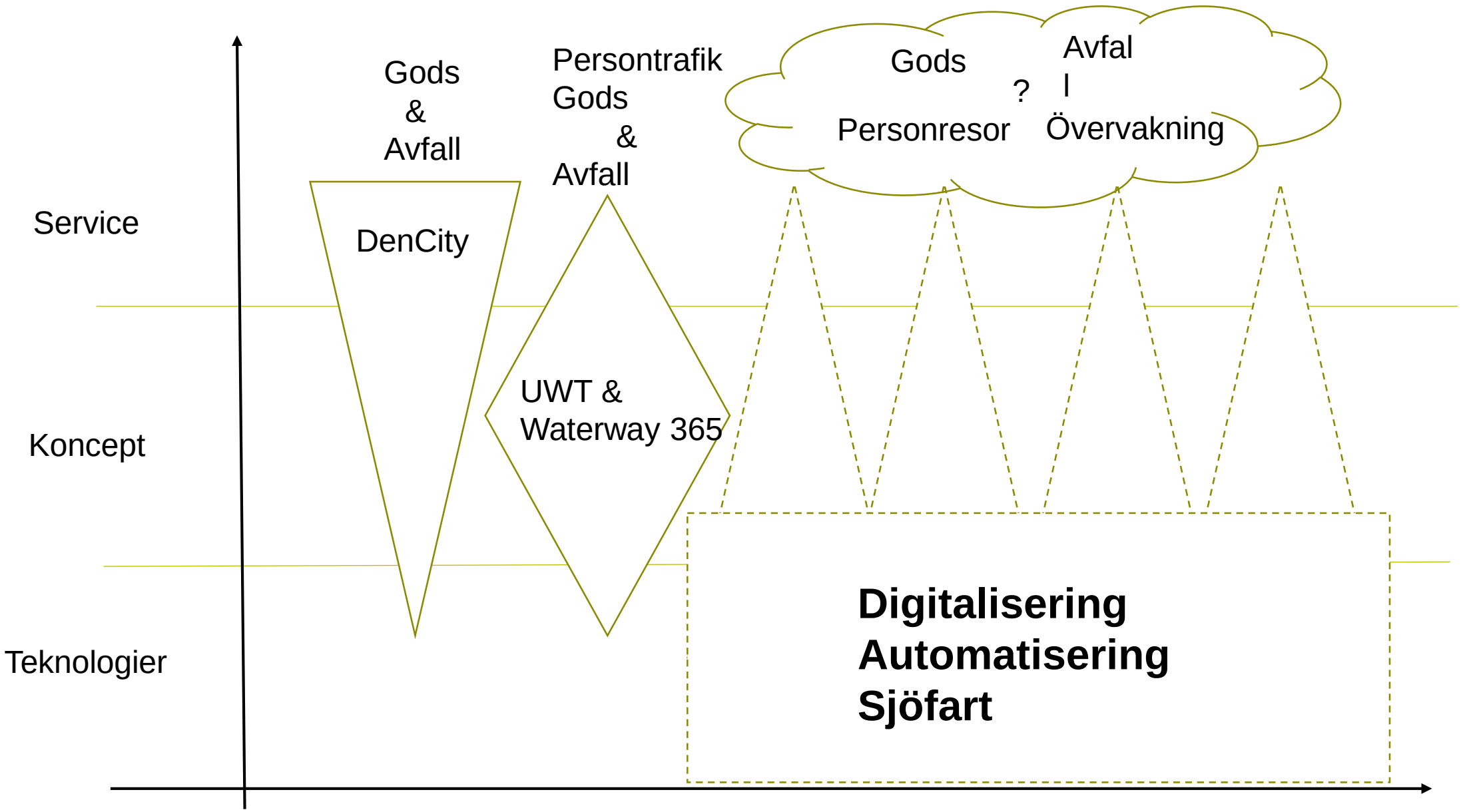


Figure 4: Illustration of ITS sub-systems


Gods
&
Avfall
Persontrafik
Gods
&
Avfall
Gods
?
Avfal
l
Personresor
Övervakning
Service
DenCity
Koncept
UWT &
Waterway 365
Teknologier
Digitalisering
Automatisering
Sjöfart

Vinnova UDI 1-2-3?

Steg 1

Steg 2

Steg 3

Digitaliseringens effekt på den framtida automatiserade och hållbara sjöfarten

!

?

Samverkan
Integrering med simulatorer
Digital tvilling (FMI?)
Små testriggar
C-ITS
Fältstudier

Use case
Mätfarkoster
Autonom säkerhet
Nollutsläpps Urban Sjöfart

Produktifiering
HW
SW
System
Fartyg
Services

?

robert.rylander@ri.se