GLOBAL CONTEXT OF MARITIME AUTOMATION AND AUTONOMY

ACHIEVING CRITICAL MASS
SPOTLIGHT ON THE U.S. VESSEL AUTOMATION INDUSTRY

CAPTAIN JÖRGEN STRANDBERG WÄRTSILÄ
Easter morning 1900: 5th Ave, New York City. Spot the automobile.

Source: US National Archives.

Easter morning 1913: 5th Ave, New York City. Spot the horse.

Source: George Grantham Bain Collection.
What has happened in shipping in the last 20 years?

Nothing!

Ships have become larger, and with that also the demand on ports and fairways

We have the same principal eco system!

We are a low value member of the transportation and logistics

We have the same accident rate!

According to the latest EMSA report, the accident rate is fairly static
While accounting knows about every dollar and cents across the company...

Nobody knows the true operational sweets spots or asset health across the fleet

A daily noon report based on manual input is accepted for performance comparison

Any knowledge is kept in the head of the SI and CE

Preventing best practice to be shared across fleet
LACK OF BUSINESS DEVELOPMENT

- Overall poor service moves freight to rail, road and air
- Shipmanagement has been commoditized
- Competition is only with other shipping companies
- Financial control instead of technology
- Economy of scale is seen as the only viable opportunity
- Shortsighted cost savings targeting crew and maintenance
- Market does not rewards quality due to oversupply of ships
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UNMANNED CARGO SHIP?

- EMISSION
- AUTONOMOUS NAVIGATION
- POWER CONTROL SYSTEM
- REMOTE OPERATIONAL CENTER
- SYSTEM INTEGRATOR
- SERVICE / LOGISTICS
Historically – Human needed at every level

**COMMAND AND CONTROL**
Captain

**NAVIGATION dept**
- Plan a voyage from A to B with safe refuge points along planned path
- Optimize voyage for weather and other factors
- Verify safety of planned voyage
- Execute voyage
- Update voyage as optimizations data changes
- Monitor health of navigation and anticollision systems and sensors

**ENGINE dept**
- Store energy quantity for planned trip
- Manage operations of propulsion plant in service
- Monitor health of plant and consumption of energy
- Store or produce life support commodities (potable water, heating, cooling, grey and back water)
- Monitor and manage life saving equipment

**DECK dept**
- Monitor and manage all mooring and anchoring arrangements, all shell doors and hatches, all tanks and voids
- Monitor and manage medical services, life saving equipment
- Monitor ships health and integrity of commercial payload. Manage payload activities as necessary

**HOTEL dept**
- Store food and other provisions for the intended trip
- Produce meals and drinks for the wellbeing of the occupants
- Provide adequate facilities for rest and recreation
Historically — Human needed at every level

The human is:
- The sensor – eyes and ears
- The integrator
- The decision maker
- The automation
- The back-up

It is not strange then, that human error is the top reason for accidents…
Remote Operation

Autonomous ship

Full hybrid ship

Full Auto route A-B

Auto docking

Part hybrid ship

Smart Digital

NOW

Now

Medium term

Far
Remote Operation

Autonomous ship

Full hybrid ship

NOW

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End - 2018
Future – where do we have to have humans?

COMMAND AND CONTROL
Captain

REMOTE/AUTON.

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REMOTE/AUTON.

FULL HYBRID SHIP

SHORE WORKERS

NO CUSTOMERS!
Soooo....?
For small ships, the crew cost is a large portion of overall opex.
Batteries only make sense for short trips, hybrid when load varies frequently
UNMANNED CARGO SHIP?

Sooooo....?
Remote Operation

Autonomous ship

Non-ICE range extender
Minimal moving parts
No seawater cooling

All weather small objects detection
Day & night visual identification
Graceful failure modes
Lizard brain autonomy

NOW

Full hybrid ship

Auto docking

Full Auto route A-B

Part hybrid ship

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Autonomous ship
Larger ships benefits more from smart technologies

Primary area of interest for autonomy
SMALL SHIPS – TYPE AND AGE

Small ships by Type

- General cargo ship
- Container
- Bulk
- Gas
- Passenger
- Service ships
- Specialized Cargo ships
- RoRo
- Oil / Chemical
- Other Tanker
- Offshore
- Tugs

Small ship age distribution

- 0-4 years old
- 5-14 years old
- 15-24 years old
- +25 years old
BENEFITS OF DIGITALIZATION

- **Fuel**
  - SFOC, trim, hull fouling,
  - Waste heat, operational patterns
  - Fleet patterns and best practice

- **Asset management**
  - Equipment reliability, maintenance scope, crew size

- **Newbuild & conversion**

**SAVINGS**

- OpEx
- LCC
- CapEx

**LEVEL AND DEPTH OF DIGITALIZATION**

- **large**
- **medium**
- **small**

- **deep**
- **small**

29 July 2019
SMART SHIPPING | JÖRGEN STRANDBERG
Conclusion

Autonomous ships will create new business opportunities in areas with
• High labour costs
• 3D – dirty – dangerous - demeaning
• Small – short
• Point to point

At the same time, conventional shipping will benefit from the new technologies such as
• Remote control, autonomous navigation and collision avoidance
• Digitalization and optimization
Smart Marine

In essence

SMART MARINE VISION

ASSET MANAGEMENT
Connect as many installations as possible, leverage data to optimize the asset performance throughout the asset life cycle, and convert this to value added services

PERFECT THE CORE
Superior and vast product portfolio and lifecycle customer services

VOYAGE MANAGEMENT
Develop the Intelligent Vessel of the future, connect it to the Smart Ports, optimize the voyage from berth to berth to address the waste of the marine supply chain

DATA
Current Location:
69° 10' 11.4816'' N
24° 56' 18.1644'' E

Eastern Gulf of Finland:
Strong breeze 11 m/s
True 5.9 m/s
Drift: 0.3 kn

Distance to shore
28.6 m

78°
20°/min
30.9 m

1.95 kn
2.03 kn
1.87 kn

10% STARBOARD THRUSTER
10% PORT THRUSTER
Auto Docking

Provides for autonomous dock-to-dock operation, optimized energy consumption and minimized danger of collisions.

• Uses mature DP controller to follow dedicated Harbor and Transit tracks:
  • Full 3 axis control (surge, sway, yaw) at low speed (docking and un-docking)
  • 2 axis control (surge and yaw) at high speed (transit)

• Captain responsible for collision detection and avoidance.

• Functions can also be used standalone – such as for autonomous docking or un-docking only.

• Full dock-to-dock operation tested Nov 2019 using the Norwegian ferry Folgefonna.
  • Video available: [https://m.youtube.com/watch?feature=youtu.be&v=8uedSwkeaUg](https://m.youtube.com/watch?feature=youtu.be&v=8uedSwkeaUg)
“Flashy corporate video”

Folgefonn autodocking
The Folgefonn ferry in Norway has been converted to fully electric, with the old diesel engines as back-up.

She has also been converted to induction charging.

She is also equipped with an autodocking feature, which takes her from berth to berth.
Nearfield Sensors

- Availability of new near field sensor suit provided by Wärtsilä Guidance Marine
- Integration of nearfield sensors based on different technologies into NACOS Platinum
  - 24GHz Radar
  - Lidar
  - IR Cameras

Smart Quay – application for smart docking

- Camera based distance measurement (absolute)
- Integration into NACOS Platinum using AR technology
Auto Docking

• New and simpler HMI design

• Product can be scaled up:
  • Base system uses a single controller, operator workstation, and one sensor of each type.
  • Additional controllers, operator workstations, and/or sensors can be added if redundancy is required
“Flashy corporate video”
Intellitug

- harbour tug with autonomous navigation
- Singapore PSA & MPA cooperation
ADOPTION OF NEW TECHNOLOGIES IN CONTEXT

- **1769**: N.J. Cugnot - Steam Car
- **1885**: Karl Benz - Gasoline Car
- **1900**: Henry Ford - Ford Model T
- **1913**: Breathalyzer
