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Improving port and terminal service levels, while dealing with ever-increasing complexities

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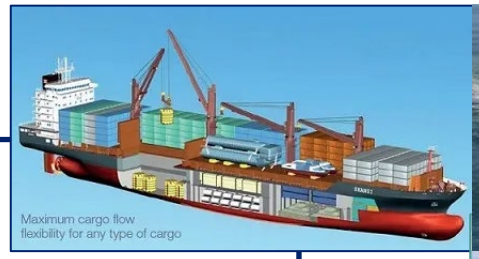
Today’s agenda

Improving port and terminal service levels

1. Cargo shipping in 2040
2. Ports in 2040
3. Port and terminal performance today
4. Crane selection
5. Improving dry bulk terminal operations

Global cargo shipping in 2040 …

- Stagnant or declining global cargo shipping volumes
- .. But higher regional / coastal volumes
- ***Bigger global fleet, but lower average vessel sizes and more variety***
- ***Changed hull designs and ship designs; smarter bow and stern designs***
- ***Ships: smaller, greener, smarter, more efficient, more flexible, faster (?)***
- ***More varied and smarter cargo handling equipment – at berth and on-board***
- Liquefied fuels and combustion engines still dominant for propulsion
- ***Changed propulsion and maneuvering systems***
- ***Dynamic positioning normal for most / all cargo vessels***
- Regionalization of vessel traffic control
- More remote control in physical piloting and tugging
- ***More use of power assistance solutions*** - wind, sails, solar, hydro generators, excess heat, air bubbles
- Sail support systems will be common in bulk shipping
- ***More restrictions on deep-sea shipping; growth of no-go zones***
- More caps on ship sizes, by cargo segment, by basin



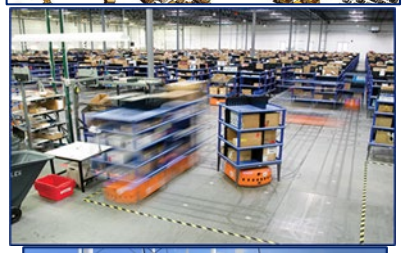
Lower harmful emissions?

- Overall
- Per ton-mile
- Per ship

Ports in 2040 – Ever growing physical complexities

- More advanced logistics on-site, warehousing, robotics etc.
- ***More varied, diverse technical equipment & systems***
- ***More robotics and automation, AGV's in various formats, mobile robots etc.***
- Digitalization, ICT trends
- On-site green power production
- Cold ironing, shore-ship power
- ***Wider range of fuel types, bunker facilities***
- ***More chemical processing plants in port***
- ***More ships, more types, more variety, smaller average sizes***
- ***More small craft for various non-cargo purposes***

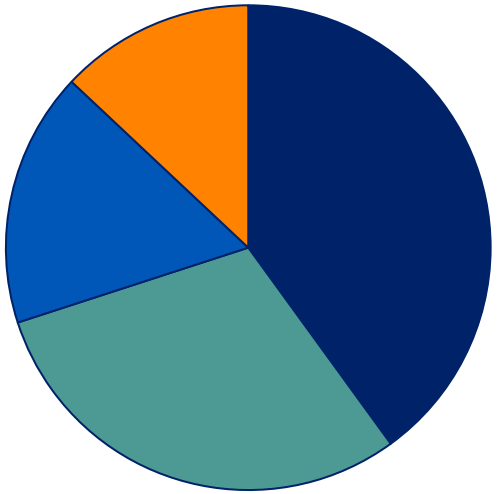
- ***More variety in terminal types & berthing facilities***
- ***Ropeless, automated mooring***
- ***More automation in piloting and tugging, more complex harbor control***
- Regionalized vessel traffic control
- Common caps on max ship sizes, by segment
- More emergency response facilities
- ***More ship waste reception facilities***
- ***More technical services provided to ships in port***
- Higher skill levels (requirements)
- ***Increasing range compliance requirements***



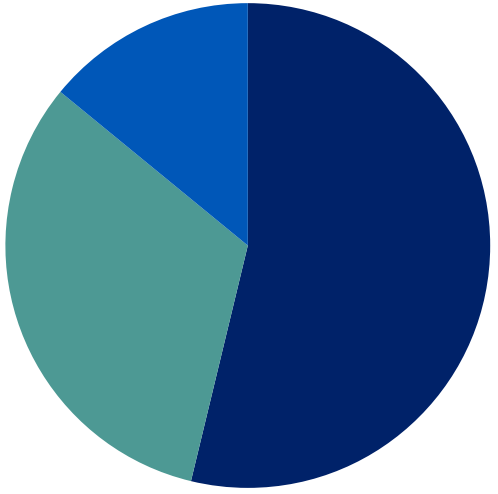
➔ ***How to continue to improve service levels while mastering growing complexities & obligations?***

Main maritime cargo segments today (~ 13 bn tons pa)

Trade (in tons) by ship type



Trade (in tons) by cargo segment



- Dry bulk ~ 40 %
- Liquid bulk ~ 30 %
- Container ~ 17 %
- Other ~ 13 %

- Stagnation of growth in coming 1-2 decades
- Slow shift towards upstream materials and inputs?

Terminal performance, KPI's *)

	Range	Best in class
▪ Idle time at berth	40 - 300 min	40 - 100 min
▪ Turnaround time per vessel	25 - 120 hrs	25 - 55 hrs
▪ Berth-on-Arrival (BOA)	80 - 98 %	92 - 98 %
▪ Berth waiting time (non-BOA)	15 - 48 hrs	12 - 18 hrs
▪ Average crane performance		
• Dry bulk	200 – 1250 tph	700 – 1250 tph
• General cargo	150 – 650 tph	350 – 650 tph
▪ Throughput per berth meter pa		
• Dry bulk	2,500 – 15,000 tpm	9,500 – 12,000 tpm
• General cargo	1,000 – 6,500 tpm	3,500 – 6,500 tpm
• Containers	500 – 3,300 TEUpm	2,300 – 3,300 TEUpm

*) Based on multiple global surveys

Pairing crane types with cargo & terminal types – balancing performance and flexibility

Level Luffing Crane

- Better visibility for operator; rail mounted, high mobility
- Better reach, both on vessel and yard and can work multiple hatches and holds without moving
- Short cycle time, provided operator is well trained and hopper are oversized
- Less dependent on location of hoppers etc.
- Lower costs

Gantry Crane

- Less flexible and slower compared to LLC
- Linear motion of the crane is not suitable for break bulk, general cargo
- Crane needs to be re-positioned much more frequently, which means time losses
- Higher costs, both capex and opex
- Crane is more suitable for container cargo

Continuous off-loader

- Continuous loaders and off-loaders are much costlier compared to other options
- Not multi-cargo, designed for one commodity
- Cannot provide lifs; additional cranes needed for hatches
- More prone to breakdowns, costlier to maintain
- Throughput rates are typically higher than other crane options

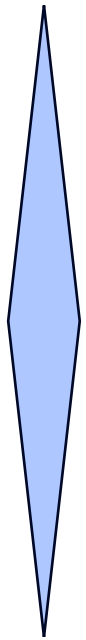
Mobile Harbor Crane

- Higher mobility due to independence from quay side rails
- Much longer cycle times than LLC; need for frequent repositioning
- Need for ground spreaders can lead to surface damage
- Ground spreaders limits space and flexibility for hoppers, conveyors, trucks
- More suitable for project cargo

Improving performance of dry bulk terminals

Primary performance variables

1. Berth/vessel scheduling practices
2. ***Project preparation/management SOPs***
3. ***Vessel and cargo clearance practices***
4. ***Quay side cranes, loaders/unloaders – capacities, productivity, maintenance etc.***
5. ***Skills of crane operators***
6. Auxiliary equipment, design, availability, management:
   - ***hoppers, sizing, mobility, positioning viz cranes***
   - conveyors,
   - trucks,
   - shovels,
   - slings/jigs for handling of hatches
7. ***"Balancing the line" between all the transportation parts***
8. Gang set-up, skills of gang supervisor
9. Formal SOPs for stevedoring operations



Other performance variables

- ***Vessel design – relative width of hatches***
- Vessel design - number of cargo holds
- ***Chief mate management skills***

- ***Labor practices and incentives for crane operators***
- ***Designed placement & mobility of cranes & hoppers***

- Rain, thunderstorms
- Wind
- Waves
- Tidal range
- Temperature, humidity

- Yard & terminal lay-out and traffic system
- Yard traffic management
- Yard & terminal marshalling practices

Introduction

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- 30+ years of international consulting experience
- 20+ years in port consulting, with main focus on port planning and port & terminal operations
- 100’s of port development consulting projects globally
- Worked for both strategy consulting AND port consulting engineering firms
- Also wide consulting experience in shipping and shipbuilding
- Degrees in Mechanical Engineering, Industrial Engineering and Industrial Management from Dutch Universities (Delft, Twente)
- Additional training in naval architecture and ship engineering