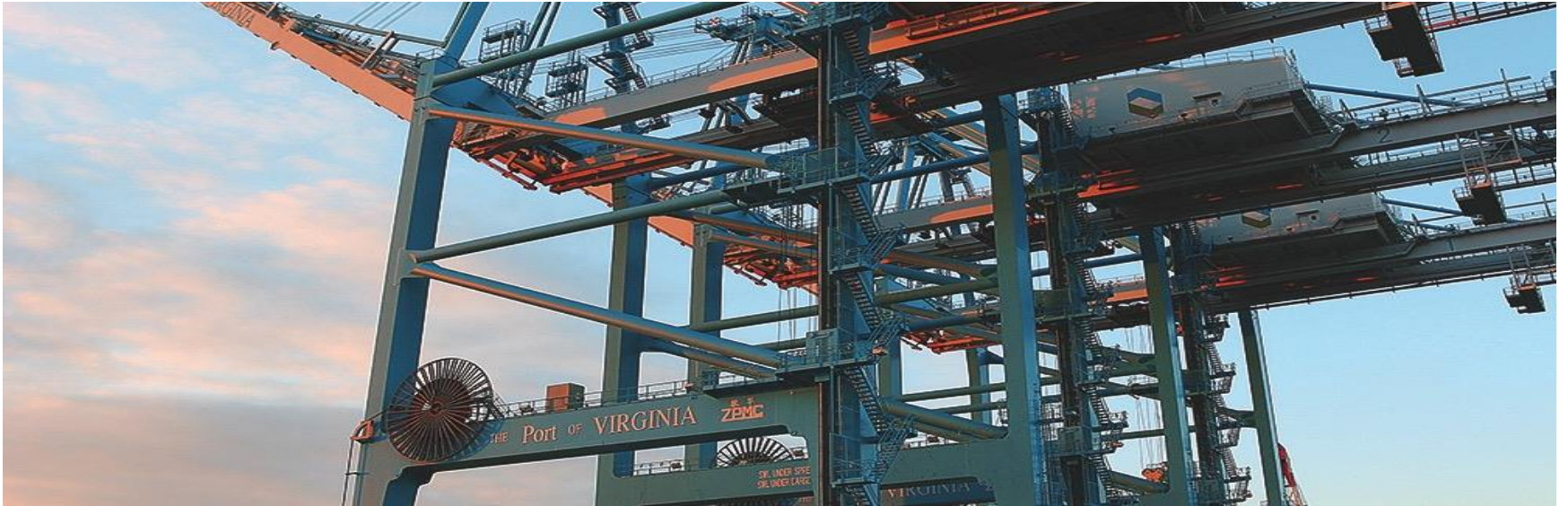


MARINE TERMINAL AUTOMATION – FINDING THE RIGHT FIT

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Main Benefits of Automation

- Improved operational safety
- Improved operational productivity
- Better use of land resources (densification)
- Improved intermodal exchanges (gate & rail)
- Reduced environmental impact (greener operation)
- Improved profit (lower costs + higher capacity)

Productivity Improvements - Vessel

- Historically, densification implied loss of productivity due to increased shifting
- Automation allows for off-hours stack grooming at significantly reduced cost
- Inventory accuracy allows for the use of auto stow algorithms
- Elimination of vessel yard planning allows for all cranes to operate simultaneously
- Decoupled operations with optimized drive distances provide for highly efficient horizontal transport
- Near random access to all containers facilitates cycling – cycling is GOOD!!
- STS OCR allows containers to be identified very fast – with extreme accuracy

Productivity Improvements – Gate & Rail

- Historically, there has been too much focus on vessel productivity 😊
- That implies not enough on the other key success factors for marine terminal operation
- Truck Management Systems (TMS) are the future – and the future is NOW!!
- Automation and TMS are kindred spirits. They support each other
- Traditional terminals tend to concentrate load + discharge containers in designated yard locations
- Concentration implies congestion. Congestion equals reduced effectiveness
- Regulating demand, and optimizing container positioning based on advanced planning equals SIGNIFICANTLY improved operations

Investment Payback Calculations

- Civil works infrastructure costs (40-50%) for automated terminals are approximately 2x a conventional terminal
- Equipment costs (40-50%) for automated terminals are 3x the cost of a conventional terminal
- IT costs (5-10%) for automated terminals are about 5x the cost of a conventional terminal
- Automated terminals typically cost \$300M-\$1.5B, depending on the scope.
 - Land reclamation/creation are typical of the high-end prices
 - Land conversion projects are typical of the low end
 - Fully automated terminals have higher upfront costs than semiautomated terminals
- Capacity increment is from 60% utilization to approximately 80% (possibly higher – Europe cases)
- Cost benefits vary widely and are very difficult to estimate
- IF you can use the capacity and can get the production running smoothly (fully automated takes longer than semi) – **approximately 10 years payback.**

Automation and Densification

- Densification benchmarks
 - Grounded – 1 high (least dense – very fast intermodal times – very slow vessel ops)
 - TOP Picks – 3-5 high – BUT very inefficient shifting operations. Good for vessel load/discharge in well-planned yard
 - RTG – 3-4 high – shifting is costly. Vessel operations least effective
 - RMG – 4-5 high – shifting CAN be free. Not very good at handling area-focused delivery (equipment fixed – not scalable)
- Footprint of terminal has an impact. The layout must support stacks 35- to 50-TEU long perpendicular to the berth – in close proximity.

Automating Terminals in the USA

- Formula for success very difficult to create
 - Greenfield site (only a couple of cases – Baltimore and Georgia/SC sites)
 - Brownfield site possible but MUCH harder.
 - Proximity to an operating sister terminal (now things get tough)
 - Some baseline book of business (line operators very conservative)
 - On-dock rail is critical – and very hard to develop
 - Trained local labor staff – engaged in a win-win relationship!!!!!!
- Good examples
 - APMTVA, LBCT, TRAPAC, GCT
- There are bad examples 😊 (but no names to be mentioned)

Degrees of Automation

- Fully automated (automated horizontal transport)
 - Higher upfront cost
 - Longer development time
 - Lower productivity (Auto-Strad possible exception)
 - Lowest operating cost
 - Very hard to do as part of a “conversion” project
- Semi-automated
 - Lower upfront investment cost
 - Faster productivity ramp-up
 - Highest productivity (so far)
 - Higher operating cost
 - More inconsistent in large call size scenarios

Ramp-Up Times

- Automated takes longer than semi-automated
 - Automated bugs are severe
- Training of the team takes a long time
 - More problematic in semi-automated cases
- Dedicated labor is more critical
 - Casual labor cannot just sit down and work
- The software is still VERY buggy
- Operational variability causes problems
 - Vessel size + Lack of pro forma reliability = **HUGE CHALLENGES**

The Question

What is the most important thing to manage on any automation project?

..... Answer

EXPECTATIONS!!

Thank You