The Challenges of Container Terminal Development

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State of Containerization

- Since its inception, the container shipping industry has done their best to increase the *efficiency* of goods movement
  - Larger, more efficient vessels
  - Double-stack trains
  - More efficient terminals
    - Faster quay cranes
    - Higher throughput density per unit area
    - Lower cost per move
  - Computers & software
    - Elimination of paper documentation
    - Terminal operating systems
  - The internet
  - Container handling automation
State of Containerization

- Changes taking place in our industry:
  - Globalization
  - Bigger ships
  - Growing (and shrinking) container volume
  - Rising cost of infrastructure development
  - Volatility in the investment climate
  - The environment, especially emissions (CO2)
  - New levels of security along with new threats
  - The world economy affecting the import/export balance
  - Volatility of fuel prices

*Never have so many things been changing at once!*
The Business Case for Automated Terminals

- From a business standpoint, why do container terminals exist?
  - To provide economic benefit to a region
    - Public ports
  - To ensure the competitiveness of a steamship line
    - Steamship line owned and operated terminals
  - To make money
    - Private terminal operators

- What do these all have in common?

_They must be competitive to survive!_
So, why an automated terminal?

Predictability and reliability in:
- Capacity
- Productivity
- Cost

Over the economic life
The Business Case

$E^3$

Economical
(meeting the business case)

Efficient
(delivering capacity, speed and reliability at lowest cost)

Environmentally Sustainable
(lowest energy consumption)
What were the technical challenges?
What was the Challenge?

Quay Crane
- To unload and load the vessel
  - Safe
  - Fast
  - Accurate
  - Reliable
  - Maintainable
  - Durable
What was the Challenge?

Safe
Accurate
Reliable
Maintainable
Durable

Horizontal Transport
What was the Challenge?

- Safe
- Fast
- Accurate
- Reliable
- Maintainable
- Durable

Automated Stacking Cranes
What was the Challenge?

Computer Hardware and IT Network
What was the Challenge?

TOS (Terminal Operating System)

- Core planning application of the terminal operations
- Multiple modules for planning and inventory management
  - Berth planning
  - STS allocation
  - Work queues
  - Inventory management
  - Reporting
  - Billing
What was the Challenge?

We have cleared the hurdles!
What challenges remain?
What is One of These Projects About?

The Four “P’s”

- **Planning** *(detail planning)*
- **Project** *(project implementation)*
- **People** *(skilled project team)*
- **Process** *(realization process)*
What Challenges Remain?

Planning
What Challenges Remain?

- When the investors make the decision to move from “planning” to building a “project”, there are plenty of challenges
- What is the “project”?  
  - To deliver an automated container handling system that can satisfy the goals of the business case over the required economic life
What Challenges Remain?

- The business case will have required performance parameters
  - Capacity
  - Productivity
  - Cost

- In addition to the business case parameters, the “project” will occur in an environment that contains a unique set of opportunities and constraints
  - Land area and shape
  - Environmental requirements
  - Labor
Planning and Layout – Tailoring to Fit the BC

- So, the planner is like a tailor
- He must try to fashion the terminal to fit the business case perfectly

- **CAPACITY**
  - Annual throughput

- **PRODUCTIVITY**
  - Vessel
  - Gate
  - Rail

- **COST**
  - Facilities
  - Equipment
  - Labor
  - Energy

- One size does not fit all!
The planning goal is a bunch of numbers:

- **Capacity:**
  - 4 million TEU’s per year
  - 35% rail

- **Productivity:**
  - Vessel: 150 gross / 200 net mph
  - Gate: 30 minute turn time
  - Rail: 24 hour turn time

- **Cost**
  - Infrastructure: $750M
  - Equipment: $400M
  - Labor: $75 / box
Planning and Layout – Tailoring to Fit the BC

- Layout begins with “where to put the rails”?
  - Quay cranes
    - Productivity
    - Hoist, trolley configurations
      - Single/dual trolley
      - Single/tandem hoist
    - Lashing platform
    - Hatches
    - OOG
    - Worker access
    - Horizontal transport system
Planning and Layout – Tailoring to Fit the BC
Planning and Layout – Tailoring to Fit the BC
“Where to put the rails”? 
- ASC’s 
  - How many ASC blocks?
  - How many cranes per block?
  - End-loaded / side-loaded
  - Width, height, length of blocks
  - Reefer / hazardous bays and access
  - Maintenance and emergency access
- IY 
  - Rail tracks
  - Wide span gantry cranes
Simulation

- To accurately confirm that the operational assumptions work on the desired layout and determine:
  - the number of yard cranes and transport equipment
  - the quay crane productivities
  - the road truck service levels
- To identify bottlenecks in an early stage of design
- Support specifying of equipment and Terminal Operating System
Planning and Layout – Tailoring to Fit the BC

- Once we know “where to put the rails”, we can locate everything else around them
  - Gate
    - Queuing and holding
  - Buildings
  - Maintenance
  - VACIS / RPM
  - OOG staging
  - Reefer services
Infrastructure Design

- Once we have planned a terminal that satisfies the business case and we get a “go” from the investors
  - Design basis that meets the operational requirements
  - Construction document
  - Construction of infrastructure
The infrastructure for an automated terminal is fixed for its economic life.

An automated container terminal will be designed to perform under high utilization.

It is critical to predict performance and operating cost for the life of the infrastructure.

Stacking area flat and drainable.

Power source redundancy, 100% fault free, reliable.
Project
Managing & Controlling to “Go-Live”

- **Schedule Control**
  - Continuous redefinition of must have and nice to have
  - Change impact analysis and adjust realization schedule

- **Cost Control**
  - Budget cost shall reflect the level of unreliability of some of the past costs
  - Take a holistic realization budget view
  - Change impact analysis and adjust realization budget
Complex Schedule Management

- Design
- Specification
- Procurement
- Construction
- Fabrication
- Delivery
- Commissioning
- Testing
- Integration
People
A Project is NOT Managed by Robots
Find the Right Team
Developing the Team

- Internal Project Management
  - Schedule control
  - Cost control
  - Reporting
  - People
    - Build a star team, not a team of stars

- Establish shared ownership for the (good and bad) results
- Develop team members to fullest potential
- Make the work interesting and engaging
- Develop a self-managing team
- Motivate and inspire team members
- Lead and facilitate constructive communication
Building a Team

Building a successful automated terminal is a **team effort**

- Executive
- Project Manager
- Planning
- Operations
- Maintenance

- Civil Infrastructure
- TOS
- IT / Integration
- Finance
- Scheduling

*The Composition and Skills of the Team Are Critical – Every Individual Is Critical*
The Right Program Manager

- A program manager who can lead a team of experts:
  - Infrastructure designers
  - Terminal operation
  - Maintenance
  - Finance
  - TOS implementation
  - IT systems
  - Equipment
Development Challenges

No Shift in Paradigm

- Not having a project executive with excellent leadership skills
  - Allow spirited discussion
  - Build consensus when it is appropriate
  - Make well informed decision

- Approaching development and operation the same as conventional terminal

- Not looking at issues in systemic way
  - Don’t solve one problem and create multiple other problems

- Not willing to change familiar approach

- Implementing what other terminals implemented without appropriate investigation
Process
It is all about interfaces – there are no standards
- Locations and dimensions
- Loads
- Power supply
- Data communication
- User interfaces
There are no simple solutions for a complex world

Keep interfaces lean and straightforward

Will be more complex where it has direct and measurable advantage to performance
Testing – Training – Take Off

- Maintenance management
- TOS
- ASC Remote operator GUI
- Truck driver kiosk
- HT safety
- ASC safety system
- X-ray
- Reefer monitoring
- Testing – Training – Take Off
Contract Management

- The project has to deal with many contracts and contractors
- They are at different locations
- Each contactor has its own methods
- More people are involved
- Usually our order is not the only order in their book
- Be clear with the terms, establish a project term base
- Use state-of-the-art communication and documentation tools
- Establish a reporting and escalation structure
- Find the balance between being rigid and flexible
- Always be cooperative
What you write is what you get
Contract Management

- Specification
- RFP
- Proposals
- Commercial contract
- Design drawings
- Structural calculations
- Function specifications
- Design reviews
- Interface specifications
- Technical correspondence
- Submittals
- Commercial correspondence
- Risk analysis
- UI definitions
- IT architecture
- Meeting notes
- Progress reports
- Inspection reports
- Test procedures
- Factory test reports
- Shipment & unloading procedures
- Maintenance manuals
- Operation manuals
- Acceptance test reports
Integration Management
Integration Management

- An automated terminal is a highly integrated system of components that must fit together perfectly.
- The only standard is the container.

THIS IS WHERE PROJECTS TYPICALLY SUCCEED OR FAIL
Testing – Training – Take Off

- Operations and maintenance take the lead!
- Operations has to run it
- Maintenance has to keep it running
Four major types of testing:

- Equipment testing
- IT testing
- Live Equipment Testing (LET)
- Operational testing
Operation Testing

- Last testing phase to prepare for “go-live”
- Test under real-live circumstances
- Operations in the lead, IT/EQ to support
- Three types of testing:
  - Flow testing (gate-yard, vessel-yard, rail-yard, etc.)
  - Volume testing
  - Mini-terminal testing
THANK YOU