



CH2MHILL®



The Future of Container Terminal Automation

May 16, 2013

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CH2M HILL Today



- Headquarters in Englewood, Colorado
- 367 Port & Maritime staff
 - Over 30,000 employees worldwide
- US \$6.4 billion in revenue (2011)
- 100 percent owned by our employees
- Broadly diversified across multiple business sectors
 - Transportation, Water, Environmental, Design-Build, Program Management, Construction Management
- Performing work from over 254 area offices in 164 countries and on all 7 continents

CH2MHILL®

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Halcrow

Focus on the Port & Maritime Industry

- Designed port and intermodal facilities for more than 100 ports throughout the world
- Acquisition of Halcrow, an internationally recognized engineering firm, in November 2011 resulted in combined strength of 367 professionals in the industry
- Engineering News-Record (ENR) ranked CH2M HILL the #2 largest designer of port & maritime facilities nationwide (July 2012)



Serving a Broad Range of Markets Worldwide



- Container
- Cruise
- Dry and Liquid Bulk
- General Cargo
- Ferries
- Oil and Gas
- Urban Waterfront
- U.S. Coast Guard
- U.S. Navy

***The Future of Container
Terminal Automation***

Containerized Shipping

- Containerization of Cargo began in the 1950's, became popular in the 1960's
- 60% of Dry Cargo and 90% of non-bulk cargo is shipped in containers
- Changed Global commerce dramatically in a 50 Years
- Container Handling Technologies continue to evolve
- Container Handling Methodologies continue to improve terminal and shipping efficiencies



Drivers in the Industry

- Container Ships are Getting Bigger
- Increased Efficiency is Required to handle more containers during same ship call durations
- Flexibility up and down the logistics chain is extremely important
- Changing Security Requirements (i.e. CBP ACE)



Evolution of the Container Ship



- Panamax Ships Capacity up to 4000 TEU's
- Post Panamax Ships Capacity of 8000 TEU's
- New Panamax Ships Capacity of 12,500 TEU's
- New Post Panamax Ships Capacity of 15,000 TEU's
- "Malacca Max" 18,000 TEU's +++

Automated Terminals

How do you handle the increased throughput associated with larger and larger ships without significantly increasing call duration and decreasing the shipper's and customer's flexibility, while maintaining vigilance in security?



**One Answer -
Use Automation**

Automated Terminals

- Automated container terminals are defined as those that use container handling equipment that require no human interaction. Automated terminals automate at least one component of the terminal system.
- There are more than a dozen semi or fully automated terminals in use throughout the world at this time.
- As of 2012, there is one Automated terminal in the US located in Portsmouth, VA and two Automated terminals planned in POLA.

Automated Terminal Systems

- Ship to Shore Cranes
 - Usually only partially automated with Operator Assistance such as Anti- Sway compensation
 - Efficiency affected by Human Performance (i.e. Fatigue, Boredom)
 - Cranes Connected to Terminal Operating System to coordinate with other automated systems
 - Cranes Utilize Maintenance Tracking Systems (i.e. Spreader Lift Counters)



Automated Terminal Systems (cont'd)

- Shuttle Carriers (AGV's)
 - Carry Cargo From STS to Stacks or to other facilities (ICTF)
 - Automated Guided Vehicles (AGV) utilizing wireless dispatch and a variety of guidance systems (inertial, gyroscopic, GPS, transponders in pavement)
 - Dispatched by TOS
 - Enhanced efficiency by placing container in Container Stack Buffer and returning to the STS crane loading area (Auto Straddle Carrier)
 - Some semi automated terminals use manually driven trucks and straddle carriers



Automated Terminal Systems (cont'd)

- Automated Stacking Cranes (ASC's)
 - Stack Containers the AGV's bring to the buffer
 - Rail Mounted Gantry Cranes – tight tolerances allow for taller stacks
 - Rubber Tire Gantry Cranes – cost effective for lower densities
 - Two Cranes work a stack in tandem
 - Automated Cranes will reorder stacks overnight to allow for efficient loading of OTR's (Street Trucks)
 - Cranes can be nested
 - ICTF Cranes
 - Connected to the TOS



Automated Terminal Systems (cont'd)

- Automated Gate Facilities
 - Cargo moves efficiently in and out of port
 - Security and CBP needs are integrated with each vehicular movement
 - RPM operations are integrated



Automated Terminal Systems (cont'd)

- Terminal Operating System
 - Receives Data from STS
 - Dispatches and monitors AGV's
 - Controls ASC's by developing routes for containers based on shippers, OTR's and customer's systems
 - Develops program for Stack Combing
 - Connected to billing, vessel management, and other external systems
 - Proprietary and Single Vendor Solutions

Terminal Operating Systems

Terminal Operating Systems

- Use Heuristic Algorithms to develop optimal routes for containers based on yard layouts, handling equipment, shippers and customers requirements, and interaction with OTR's or Rail facilities.
- Use Rules based system dependent upon condition of the individual components in the systems purview.
- Dispatches both automated and manual components of the container handling systems.
- Maintains record of container location in the facility.
- Disparate systems are connected with EDI interfaces.

Implementation

Keys to effective implementation of an automated system from an IT perspective

- Interface early and often with terminal operator to determine their operational arrangement and requirements (i.e. Mobile Control).
- Interface with terminal engineering team to locate required infrastructure (conduits for fiber, poles for cameras, facilities for wireless, pavement transponders etc...)
- Plan for the future by including the additional expandable facilities that fit the projects budgets.
- Develop and maintain a change management plan for the inevitable changes that will occur.
- Determine integration requirements with existing systems early in the process.
- Actively Participate in RFP formulation for these projects.

Future Technology

What about the Future?

- Intelligent Containers
- Fully Automated STS cranes
- Mag-Lev replaces AGV
- TOS using Quantum Computing

- Cargotech Port 2060 (port2060.cargotech.com)
 - Unmanned Aerial Spreaders
 - Large Lashed Container Blocks
 - Ubiquitous Computing

All of these technologies will require advanced computing power and a high level of systems integration.

Thank You

Thank you for your time and attention!