Facilities Engineering Seminar

Panel III: Terminal Technology – Not Just for Containers anymore

Technology in Container Handling – but more to come!

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Vancouver, BC 6th November 2013

Agenda

Introduction

History & State-of-the-Art in Container Handling Technology

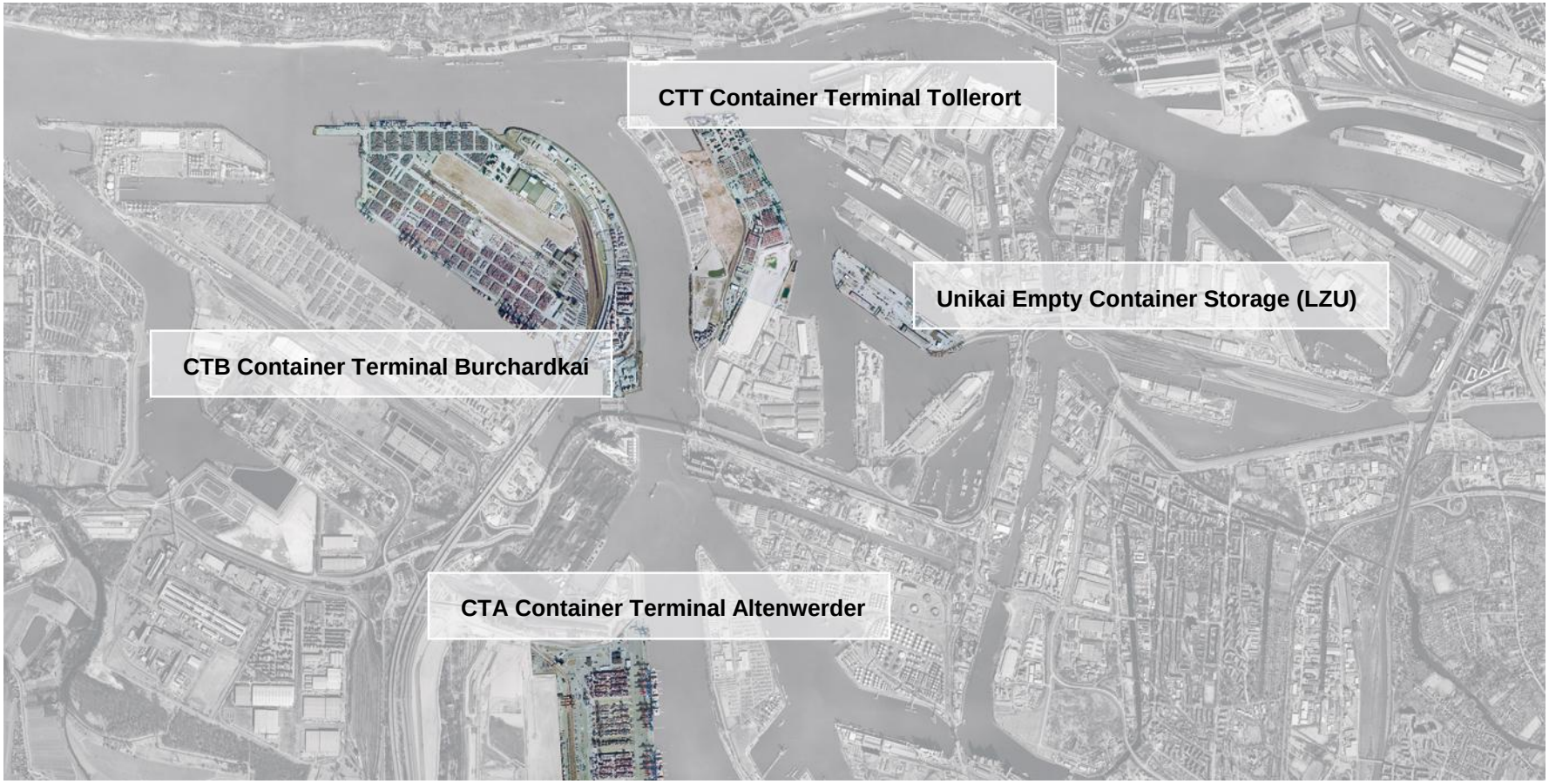
Scope of Technology Application – Big Bang vs. incremental Path

Outlook

HPC Hamburg Port Consulting GmbH

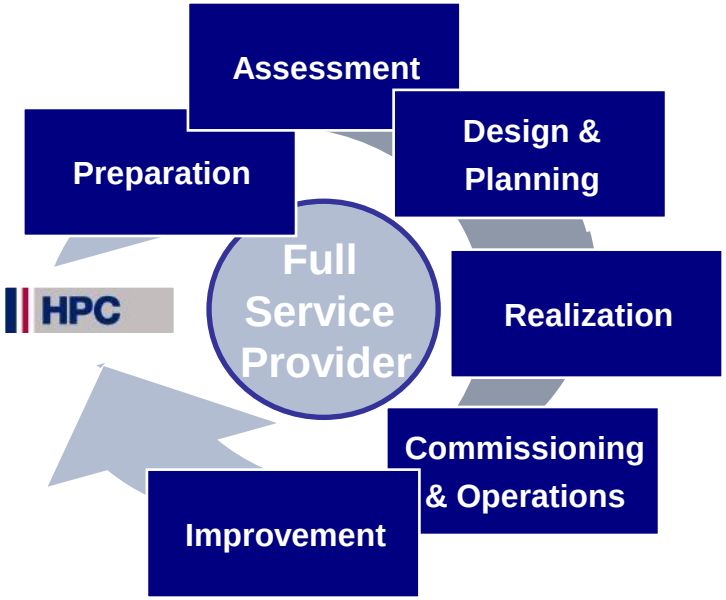
- Founded in 1976 as subsidiary of HHLA Hamburger Hafen und Logistik AG
- Around 100 experts (incl. subsidiaries, w/o HPC Ukraina), annual turnover in 2012: approx. € 15.0 million
- Reputation as one of the world's leading consultants in the port sector
- Since 1976 port and transport-related projects in more than 100 countries, both in the private and public sector
- Approx. 1100 projects world-wide with extensive experience in container terminal planning
- Subsidiaries for port training & management (HPTI) and transport solutions (Uniconsult), HPC Ukraina as terminal operator in Odessa (Ukraine)

HHLA Container Terminals in Hamburg



HPC Services

Container Terminal Automation Planning



Conceptual planning 1
- System selection
- System calibration

Concept validation 2
- Static assessments
- Dynamic simulations

Equipment definition 3
- Specification
- Tender Support
- Construction supervision

IT + TOS selection 4
- Business Process Definition (BPM)
- Specification
- Tender support

Integration / Commissioning 5
- IT + equipment integration support
- Commissioning support
- Operations Optimization

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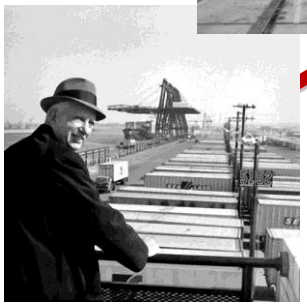
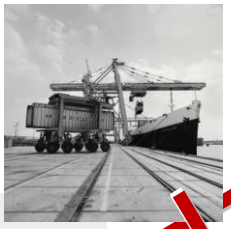
History of Technology Development

In Container Terminal Handling



50s/60s: Malcom McLean's idea and the twist-lock system



60s: typical container handling equipment

80s: Terminal Operating Systems

1993: ECT Rotterdam – first automated container terminal

90s: DGPS Tracking

2001: HHLA Container Terminal Altenwerder

2005 : Patrick AutoStrad Terminal, Brisbane

2014 : APMT Maasvlakte II

State-of-the-Art in Quayside Equipment

- **Ship-to-Shore Container Cranes**

Single Trolley

Double Trolley

- **Spreader**

Single (Twin)

Tandem 40‘

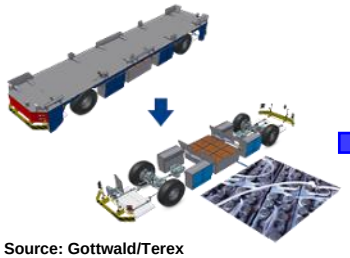
- **Automated Twistlock Handling**

→ **Quaside Technology has Potential to be improved**

State-of-the-Art in Horizontal Transport

- End of the 1980s Introduction at ECT Delta Terminal Rotterdam
- 2005 Adoption of Diesel-Electric Drives
- 2007 Lift-AGV Concept (Decoupling)
- Since 2009 Battery AGV Test-Trial at CT Altenwerder Hamburg

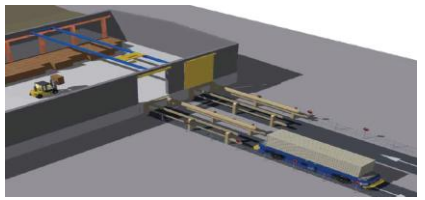
- **Battery-Driven AGV**
  - Diesel-Electric AGV8-12 hours of operation
  - Automated rapid battery changing & charging station



Source: Gottwald/Terex

- **Lift AGV**

Source: Gottwald/Terex



- **Terminal Tractor**

Source: Cargotec

- **Cassette AGV**

- **Shuttle Carrier**

→ **To achieve higher Degree of Efficiency & Low Fuel Consumption in the Terminal**

State-of-the-Art in Storage Yard Equipment

- **ASC – Automated Stacking Crane**

→ High Performance, electrically Drives

- **Hybrid RTG with Ultracapacitor**

→ Store & Re-use braking Energy

- **E-RTG**
  - **Cable Reel System**

  - **Conductor Bar System**

→ Electrification avoids On-Site Pollution

→ **Terminal "Electrification" requires Public Grid Capabilities !**

CTA Hamburg – the last Milestone (2001)

- STS with double trolley and twin spreaders (manned main trolley and automated secondary trolley)
- Manual twist-lock handling
- Automated horizontal transport by means of regular AGVs (battery-driven AGVs were developed and tested to become industry-proven)
- Automated stacking yard system with Double-ASCs
- Remote-controlled truck handover
- Manual horizontal transport to rail ramp
- Manual/semi-automated rail crane operation
- Proprietary TOS

→ **CTA had set the state for more than a decade of terminal development**

APMT Maasvlakte II – the next Step (2014)

- STS with double 40/ twin 20 spreaders (remote-controlled main trolley and automated secondary trolley)
- Twist-lock handling?
- Automated horizontal transport by means of battery-driven Lift-AGVs
- Automated stacking yard system with Twin-ASCs
- Truck handover?
- Automated horizontal transport to rail ramp
- Manual/semi-automated rail crane operation
- TOS yet to be developed

→ APMT Maasvlakte II is expected to set the new state by end of 2014

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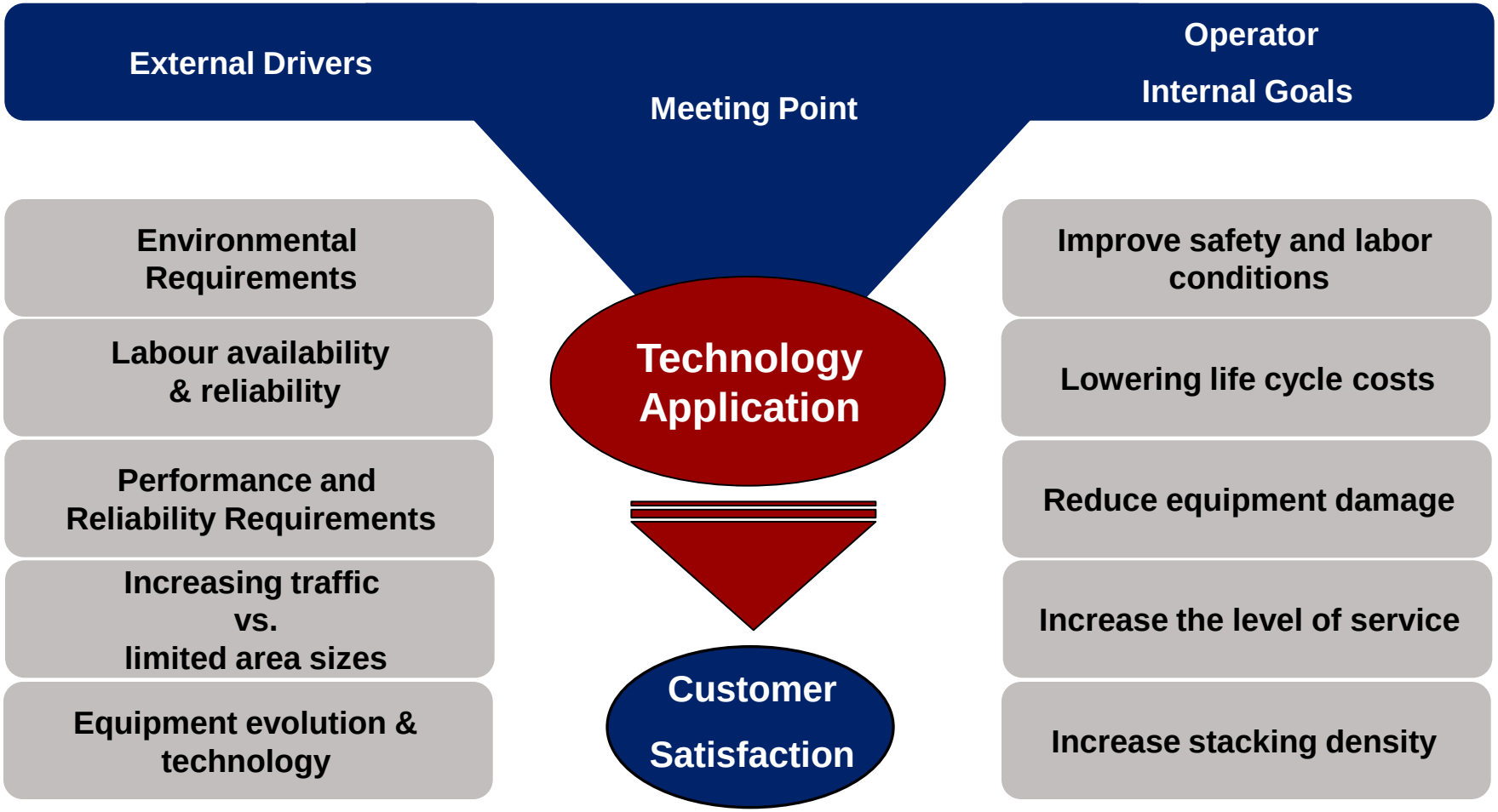
Technology Application Criteria



Technology changes Paradigms

Automated Terminal Planning Process

- Civil Structures
- Terminal Equipment
- **Layout and Operations Validation**
- Operating Layout
- Operations

From manual handling and decision making

From freely adaptable

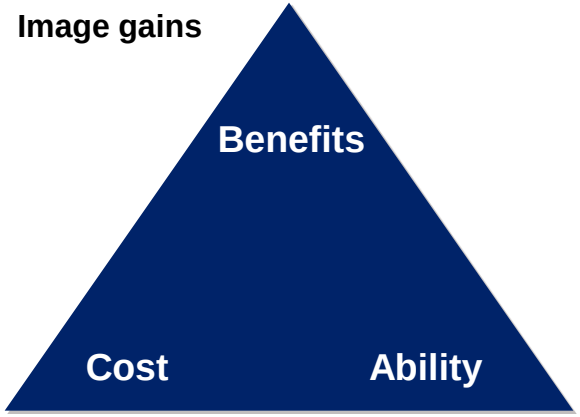
To robotics and automated decisions

To fixed configurations

→ **Automated Terminals are long term running Machines with inherent Processes!**

Trade-offs in Technology Application

- **Productivity and operating cost gains**
- **Quality improvement**
- **Process stabilisation and reliability**
- **Electrification and emission reduction**
- **Safety improvement**
- **Image gains**

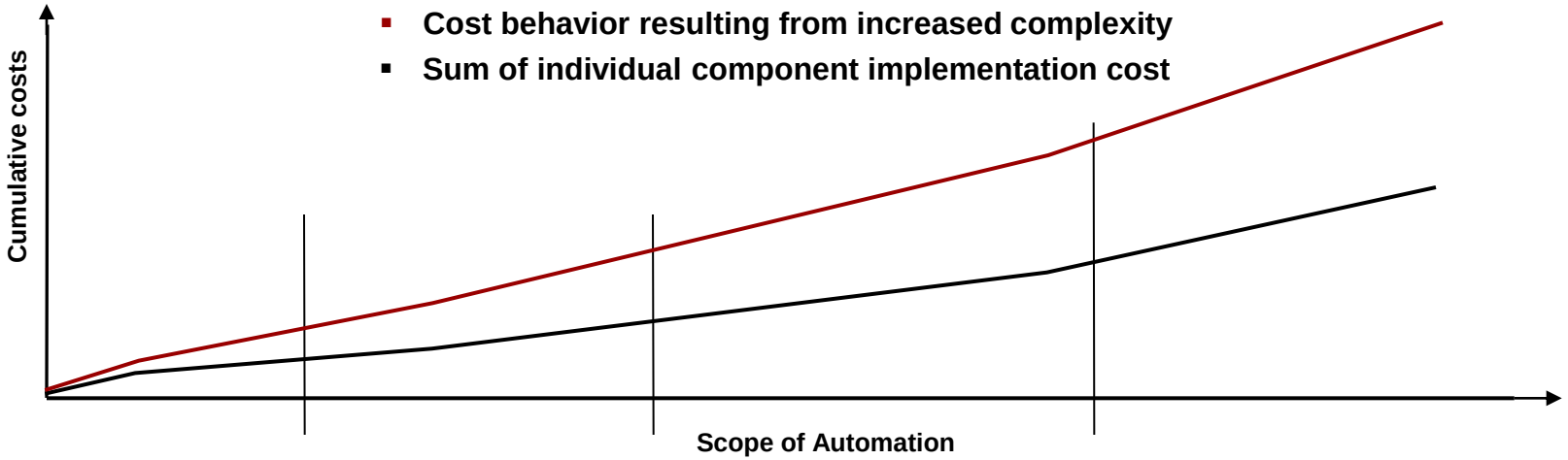


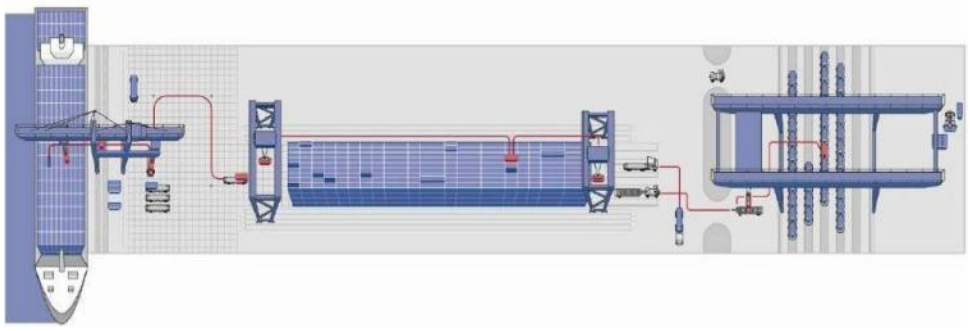
- **Investment cost**
- **Training cost**
- **M&R cost**
- **Cost of operations breakdown**
- **Opportunity cost for reduced flexibility**

- **TOS capabilities**
- **Ability to integrate**
- **Complexity management**
- **Usability**
- **Safety and regulatory frameworks**

→ System Decisions Trade-Offs determine long term Capacity, Performance and Cost

Complexity of Technology Implementation





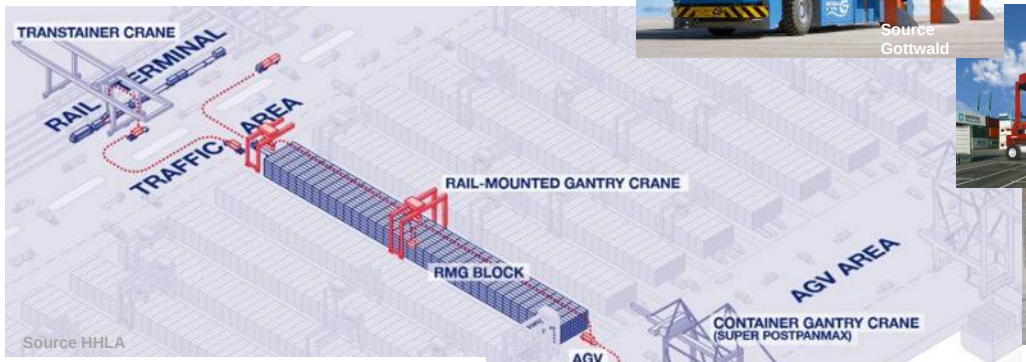
→ **Complexity is THE automation cost driver**
→ **Bing Bang solution require very professional management!**

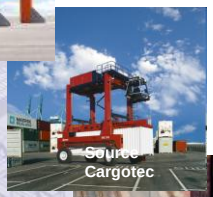
General Approach

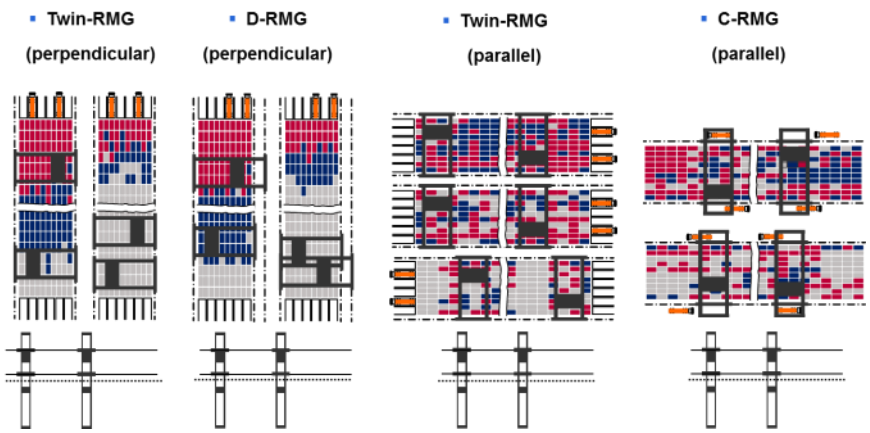
Aspects to be considered

connection to rail terminal also automated?

remote controlled or automated truck handover?







semi-automated main trolley?

back reach handling vs. portal served?

single vs. twin 20?
single vs. double 40?

single trolley vs. double trolley?

→All System Component Capacities must be balanced

→All System Decisions determine a long term, difficult-to-change Investment

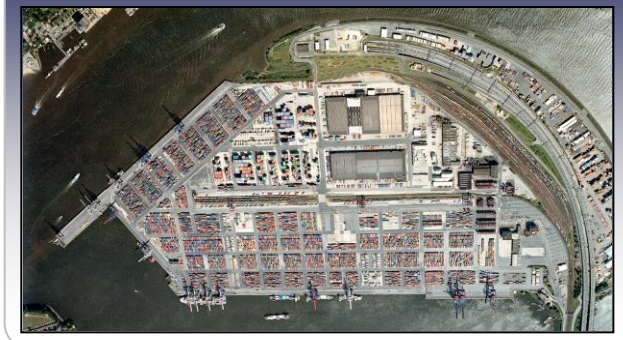
Big Bang vs. Incremental Approach

Greenfield Project

- Political framework conditions and set timelines
- Commercial performance expectations
- Cost structures of competing players
- Volume and complexity challenges

→ **Application of State-of-the-Art Technology is Survival Decision**

Conversion Project



- Scope of technology application and resulting process changes
- Adequate sequencing of conversion steps
- Proper phasing of conversion of capacities
- Acceptance within existing labour organisation

→ **Application of State-of-the-Art Technology incrementally or evolutionally**

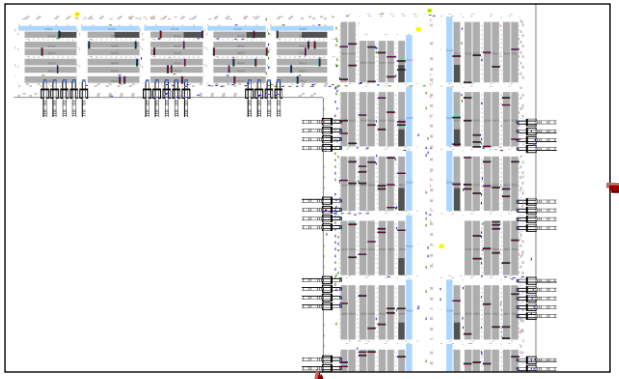
→ **Initial Situation determines Degree of Freedom in Design**

Required Resources

Consultants
Designers

Data Input & Planning
Design

Feedback

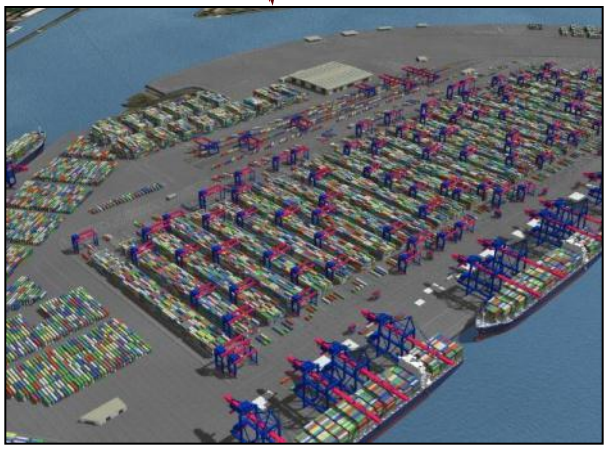


Simulate

Emulate

Feedback

Feedback



Decision Makers

Consultants &
Operators

Decisions

Analyse & Evaluate

→ **Technology Application requires experienced Professionals**

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Off-the-Shelf “Integrated Solutions” ?

Off-the-Shelf/ Integrated

- **Reduced complexity**
- **Faster implementation**
- **Responsibility/liability can be passed over to suppliers**
- **Integration MAY BE less costly and faster**

vs.

Taylor Made/ Customer-driven

- **If done right, terminal remains adaptable to market changes**
- **Due to higher involvement of operator, resources for continuous optimization are available inhouse**
- **Options remain with terminal operator to create a competitive advantage**

→ **Every Terminal is a unique Terminal and requires a specific Solution!**
→ **Integrated Offers are not necessarily creating synergies at the customer but for sure at the supplier site**

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