moffatt & nichol

The Challenges of Container Terminal Development

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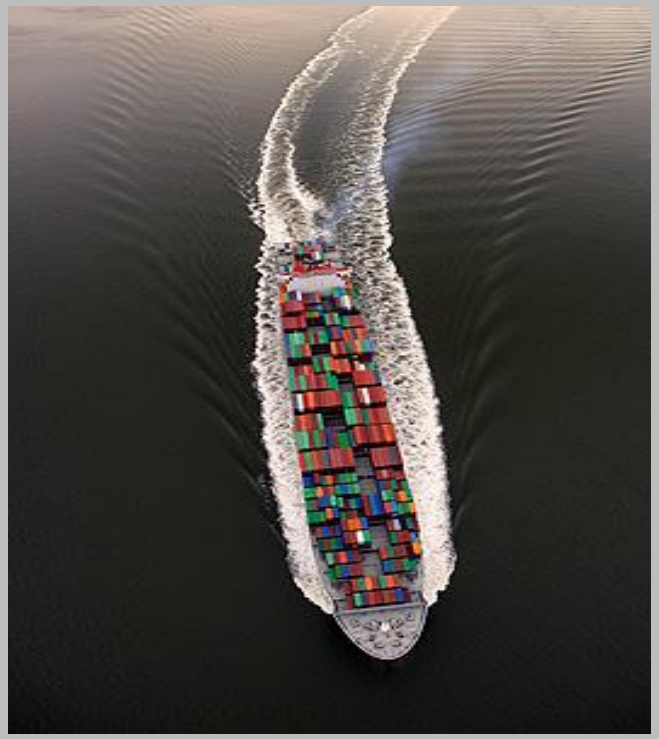
State of Containerization

- **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!

The Business Case for Automated Terminals

- **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

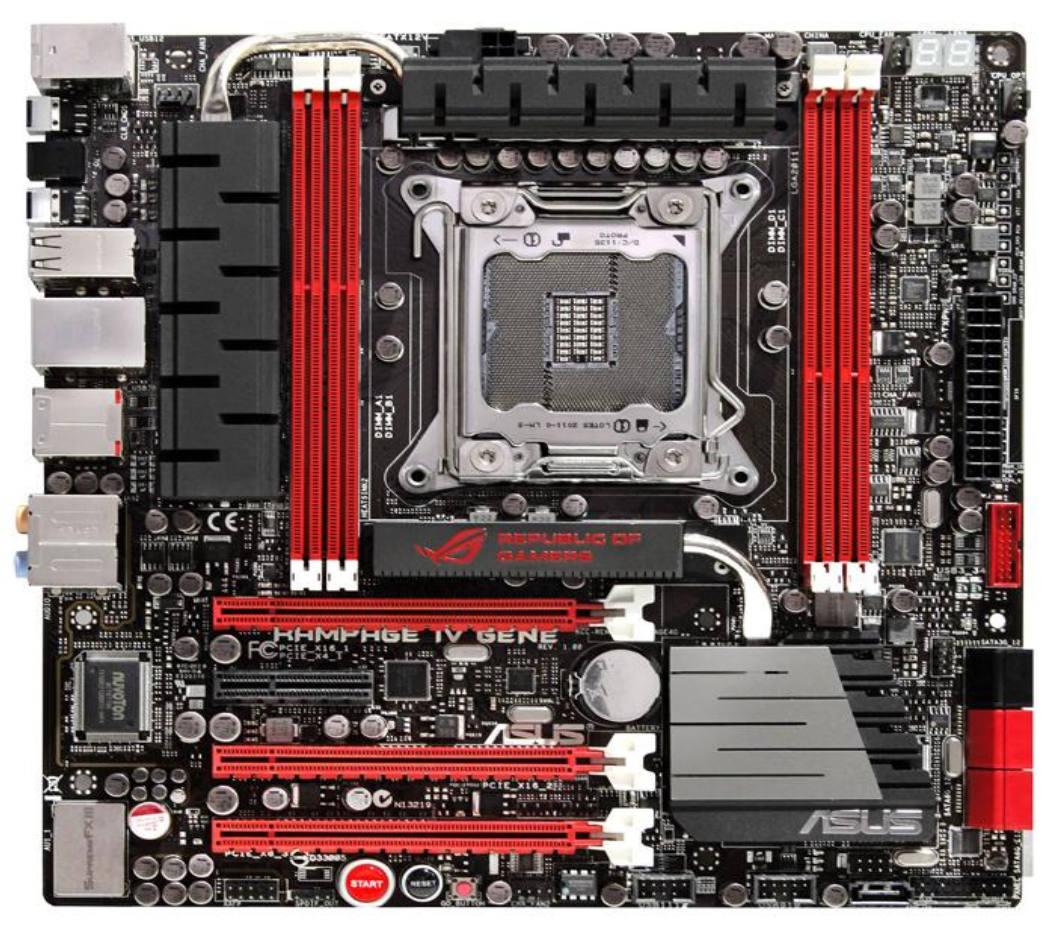
Horizontal Transport

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

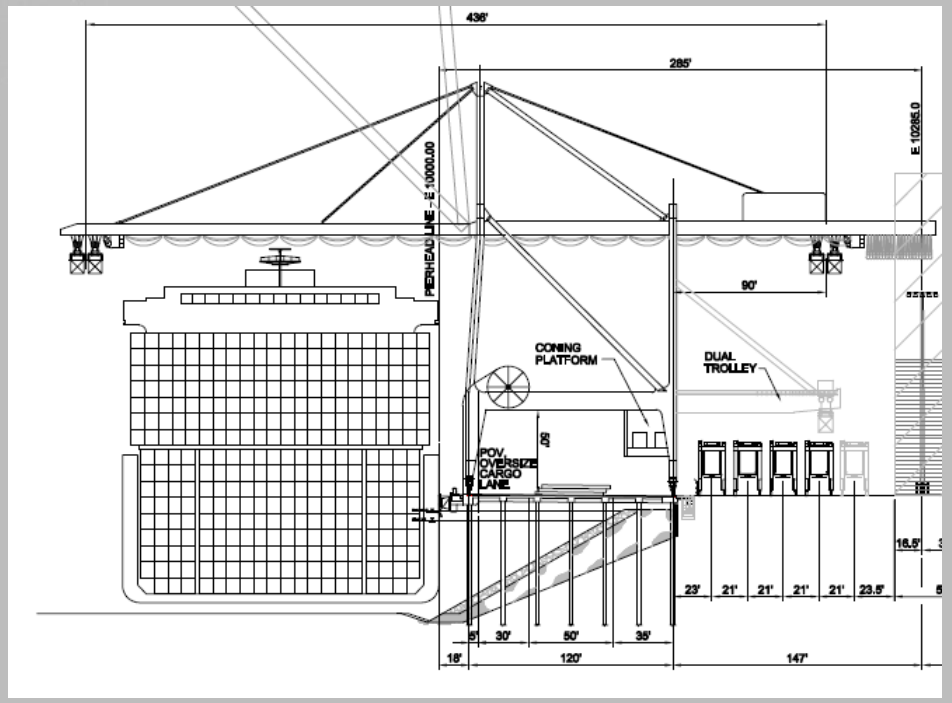
- **So, the planner is like a tailor**
- **He must try to fashion the terminal to fit the business case perfectly**
  - **CAPACITY**
    - Annual throughput
  - **PRODUCTIVITY**
    - Vessel
    - Gate
    - Rail
  - **COST**
    - Facilities
    - Equipment
    - Labor
    - Energy
- **One size does not fit all!**

Planning and Layout – Tailoring to Fit the BC

- **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

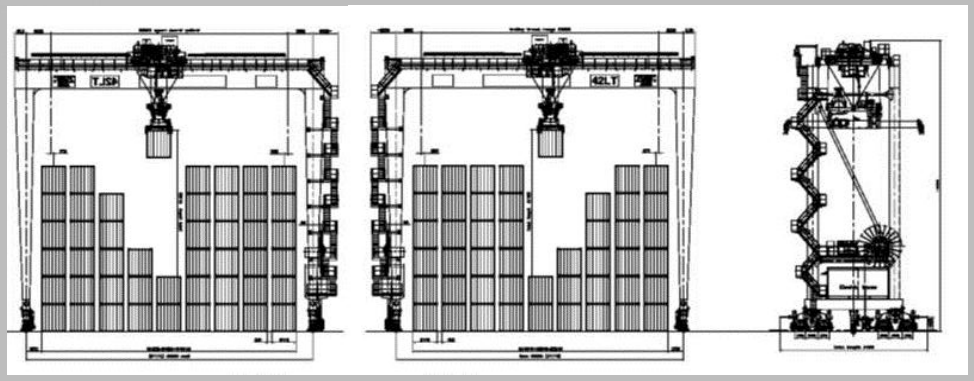


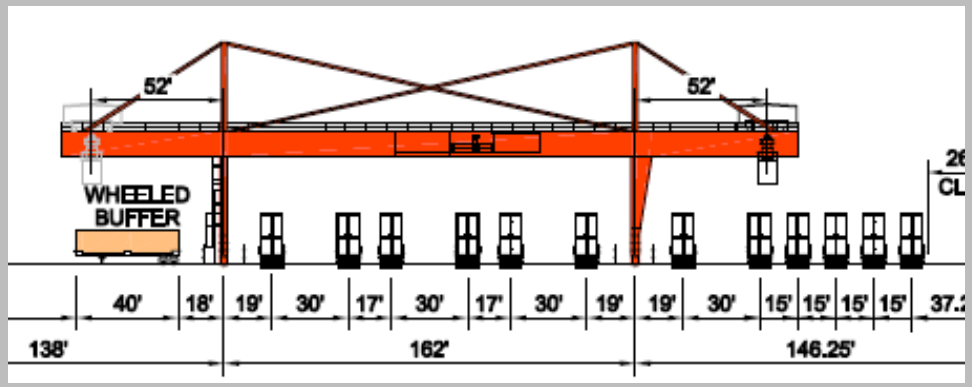
Planning and Layout – Tailoring to Fit the BC

Planning and Layout – Tailoring to Fit the BC

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






E21


HHLA
LK 10 G
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1000V

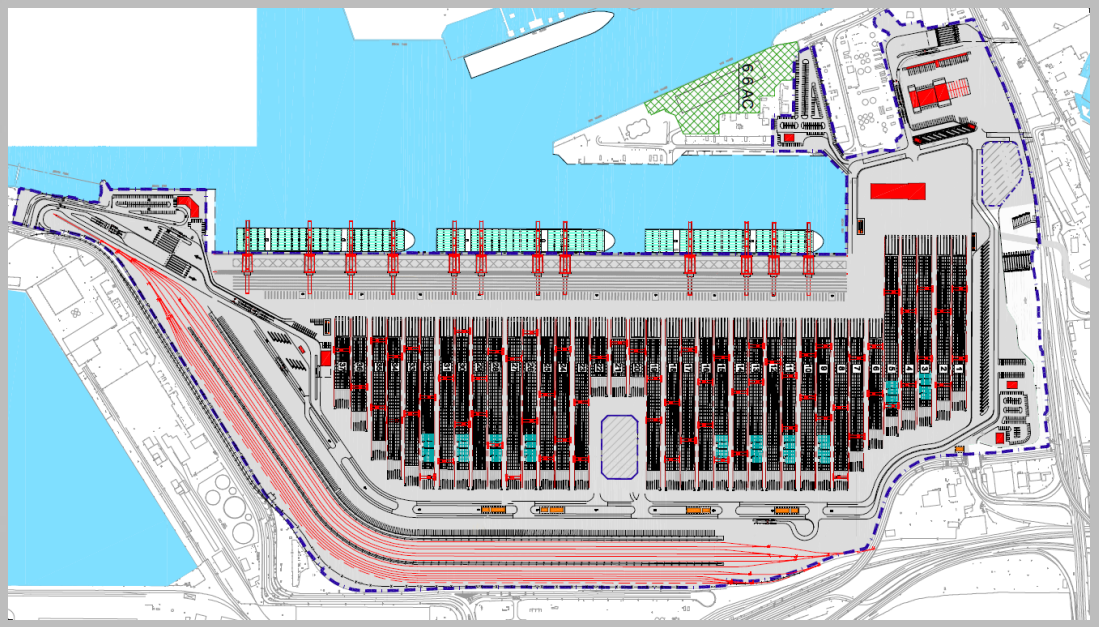
Simulation

- **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**

Whole Terminal Simulation Demo.mp4

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

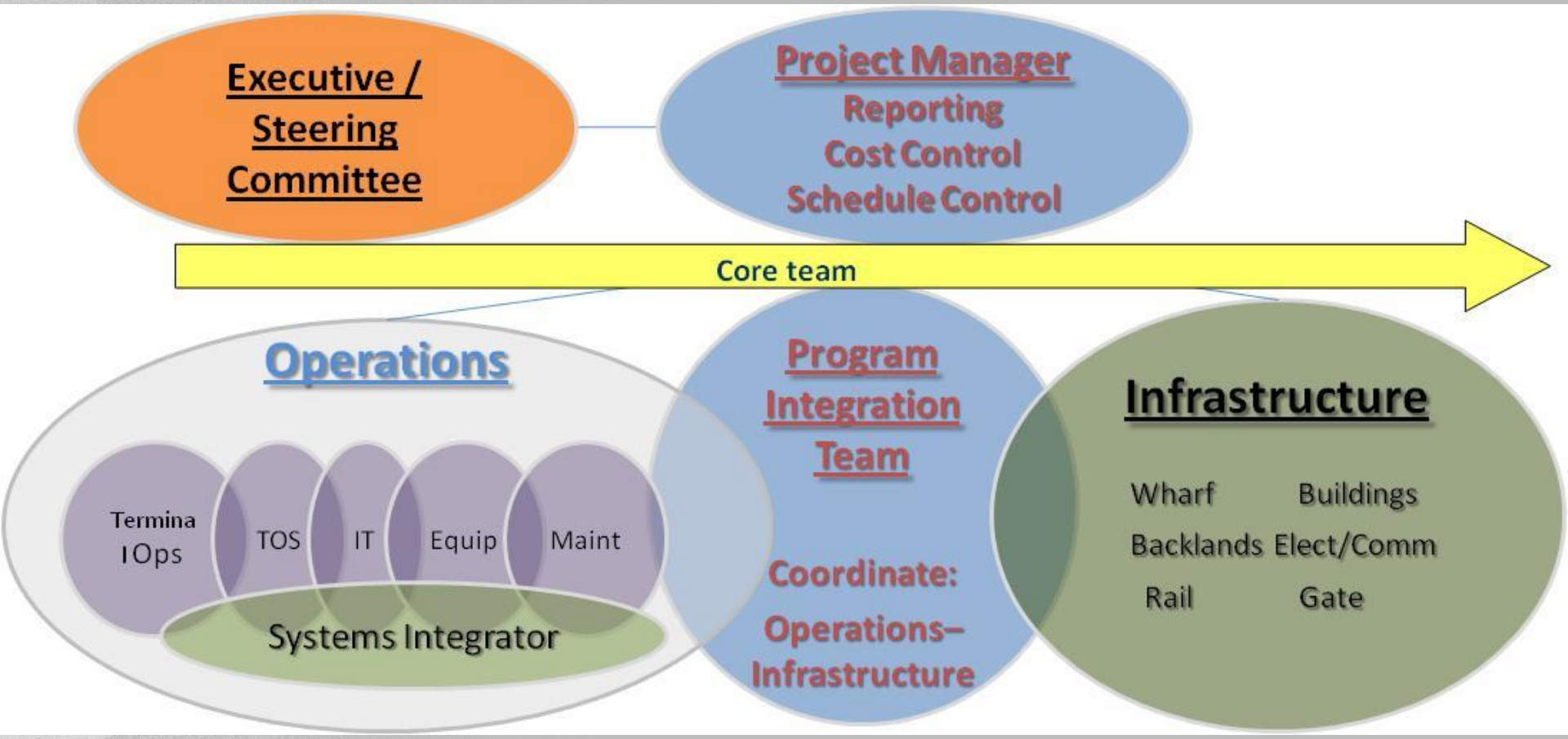
Development Philosophy

- 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

ASC Runway

Project

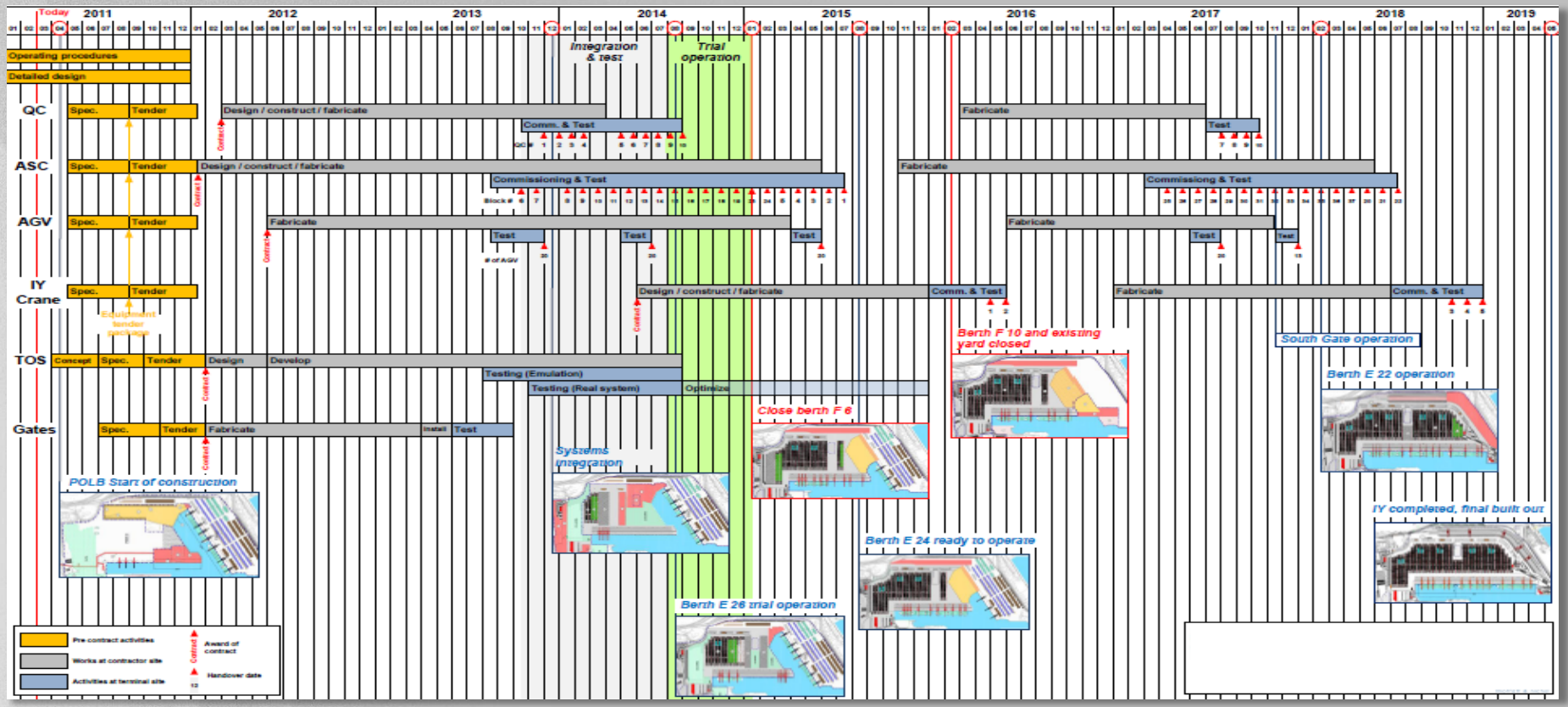
Project Organization



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



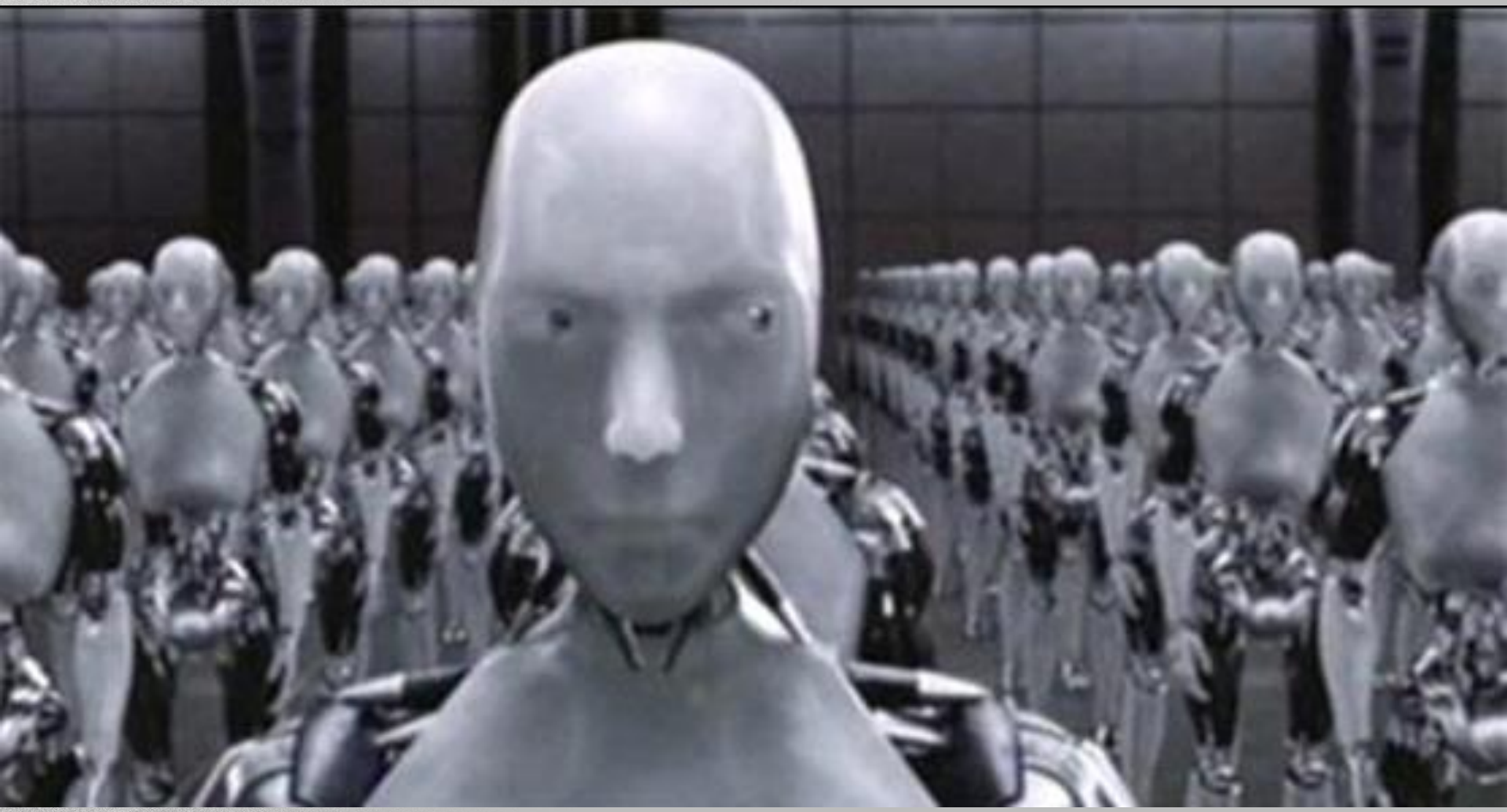
- Design
- Specification
- Procurement

- Construction
- Fabrication
- Delivery

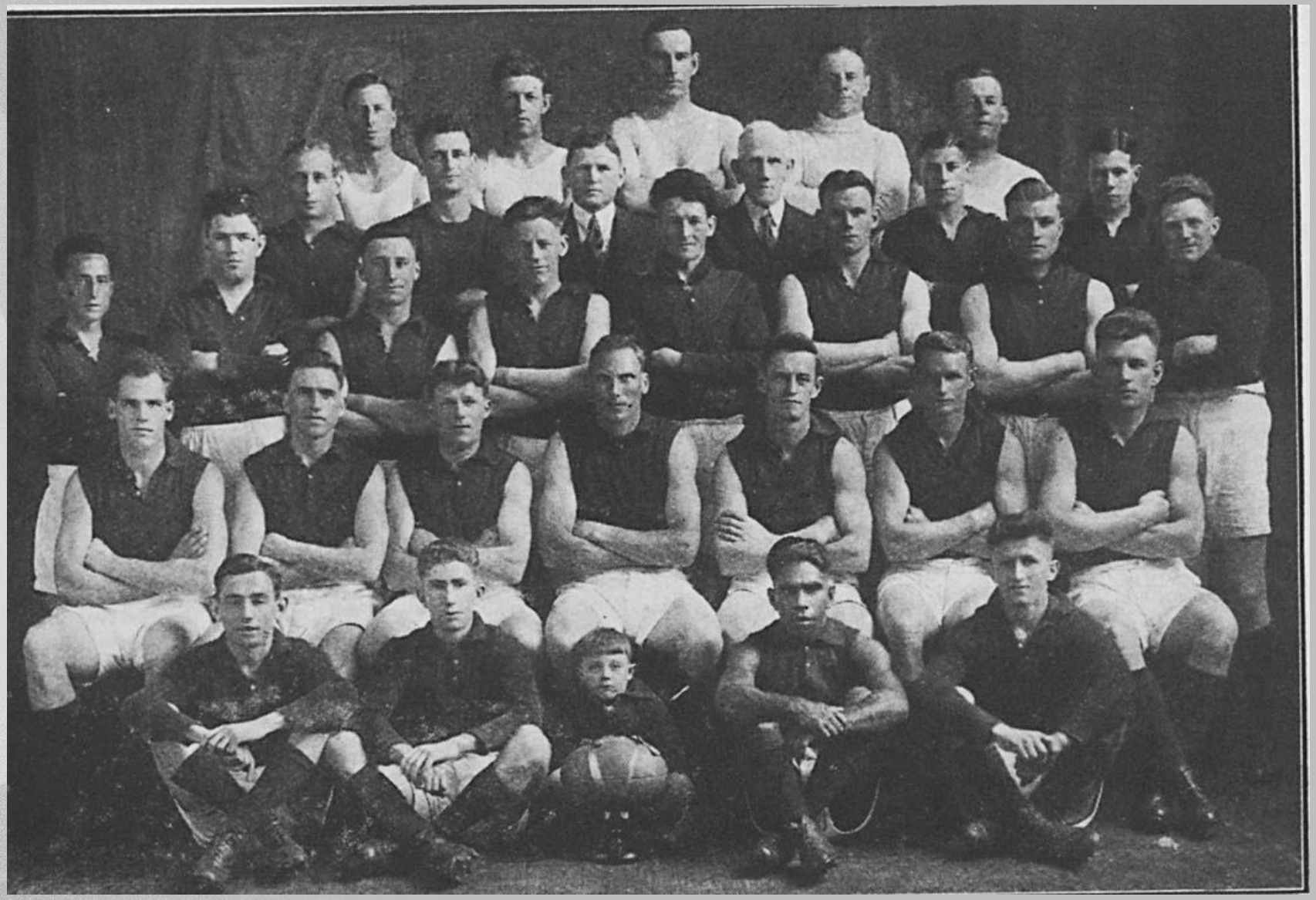
- Commissioning
- Testing
- Integration

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

Development Challenges

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

Interface Management

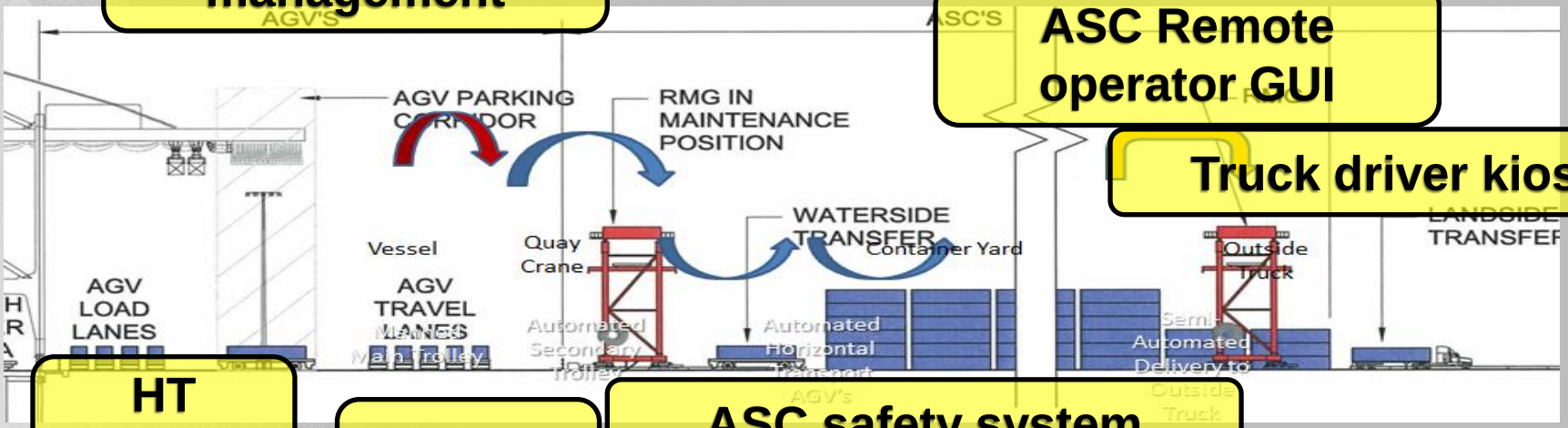
- It is all about interfaces – there are no standards
- Locations and dimensions
- Loads
- Power supply
- Data communication
- User interfaces

Interface Management

Function – Scope – Responsibility – Timing – Testing

- 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



TOS

Maintenance management

ASC Remote operator GUI

Truck driver kiosk

HT safety

X-ray

ASC safety system

Reefer monitoring

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

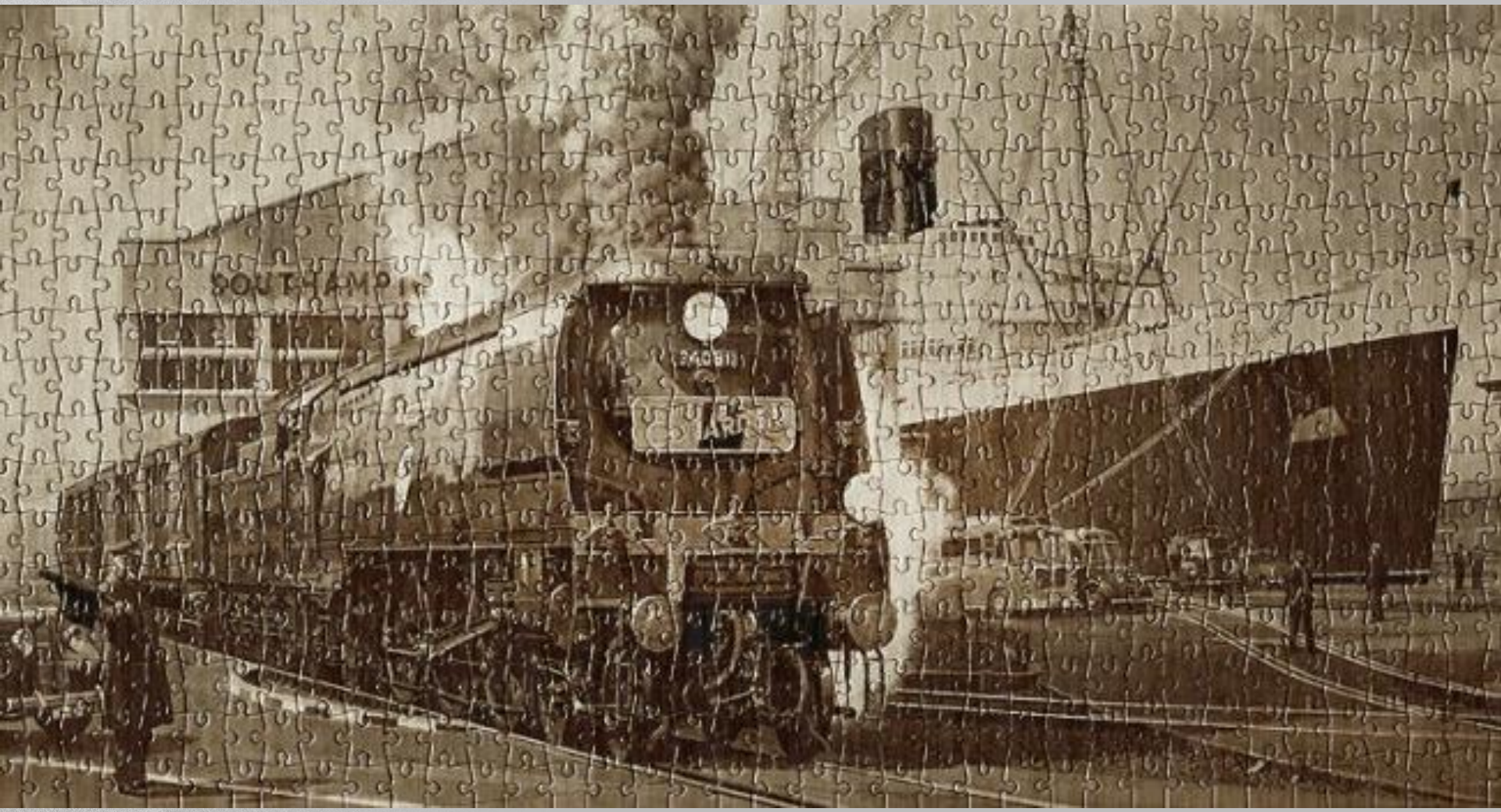
Contract Management

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

Testing – Training – Take Off

Four major types of testing:

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

Testing – Training – Take Off

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