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ASSOCIATES

Bulk Materials Handling 2009

Improving Port Effectiveness

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What is an effective port?

- Enables economic development
- Handles the maximum product possible
- Achieves high productivity
- Does not delay ships
- Provides storage requirement
- Adds value to buyers
  - Storage
  - Breakdown
  - Blending
- Makes a good return on investment?

Terminals Types

- Dedicated terminals
  - CAPEX high
  - Few benefits of scale
- Floating transshipment
  - Low efficiency
  - Limited capacity
  - No benefits of scale
- Common user terminals
  - Scale benefits
  - Spreads costs over throughput

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The Anatomy of a Terminal

The Export Process

- Mine to Terminal
  - Road
  - Rail
  - Conveyor
  - Barge
- Unload
  - to stockpile (stacker)
  - to ship
- Consolidate packets
- Blend
- Load ship

Ask yourself a key question

- What can I impact?
  - Mining and preparation of the coal
  - Dispatch of coal from mine to terminals
  - Transport of coal to terminal
  - Unloading and stacking coal in terminal
  - Packet assembly and washing blending
  - Ship arrival and preparation
  - Reclaim and load out

Your can only truly improve what you control.

If you do not control the supply chain you need to limit your view to just the terminal

Just the terminal?

- Have enough storage!
  - Remove the supply chain risk
  - Look at how to improve storage utilization
    - Shared stock piles
    - Auto level on bedding coal
    - Excellence in coal quality monitoring
  - Store more on less
- Ensure you have reliable equipment
  - Reliability Centered Maintenance
    - Business focus
    - Eliminate failures

So improving performance?

- Where are the problems?
  - Apply Pareto analysis
  - 80/20 rule
- Why are delays occurring?
  - Packets not ready in terminal
    - Coal not at the mine
  - Train not available
    - Wagons
    - Engines
    - Paths
  - Coal not in specification…

Barge or Rail or…

Wagon Tipplers

Vibrators

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Stockpiles

Re-claimer head

Bulk Handling Equipment

- The Equipment
  - Stackers
  - Re-claimers
  - Conveyors
  - Loaders
  - Mobile Equipment
- Maintenance
  - Reliability Centered Maintenance
- Operational Performance
  - Automation and Training

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Reliability Cent'd Maintenance

- 1960's: RCM development by airlines
- 1970's: RCM used by military
- 1978: first use of the term "Reliability Centered Maintenance" in book showing strong correlation between age and failure rate did not exist
- 1990's: The start of transfers of the RCM methodology to other sectors

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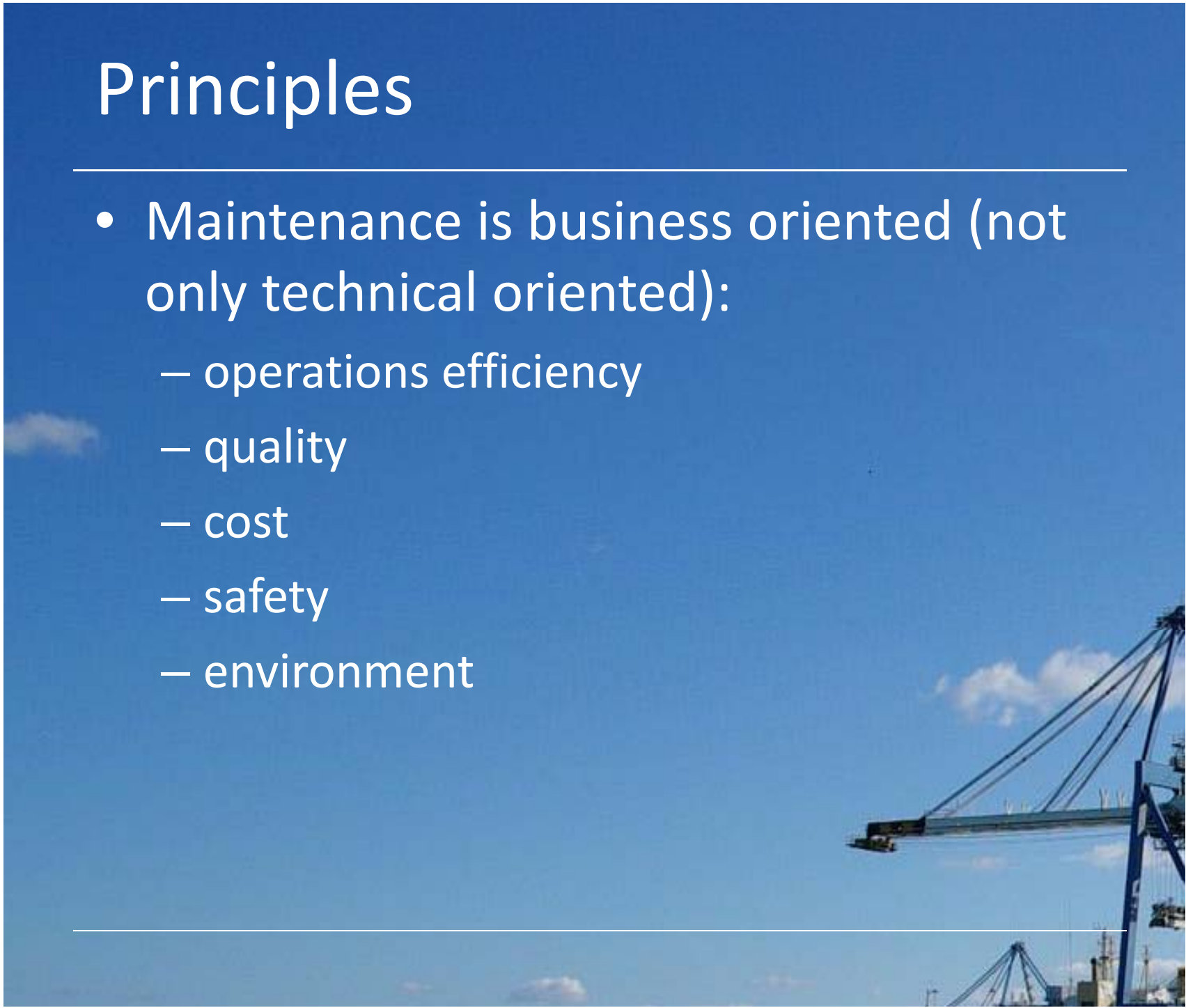
Principles

- Maintenance is business oriented (not only technical oriented):
  - operations efficiency
  - quality
  - cost
  - safety
  - environment

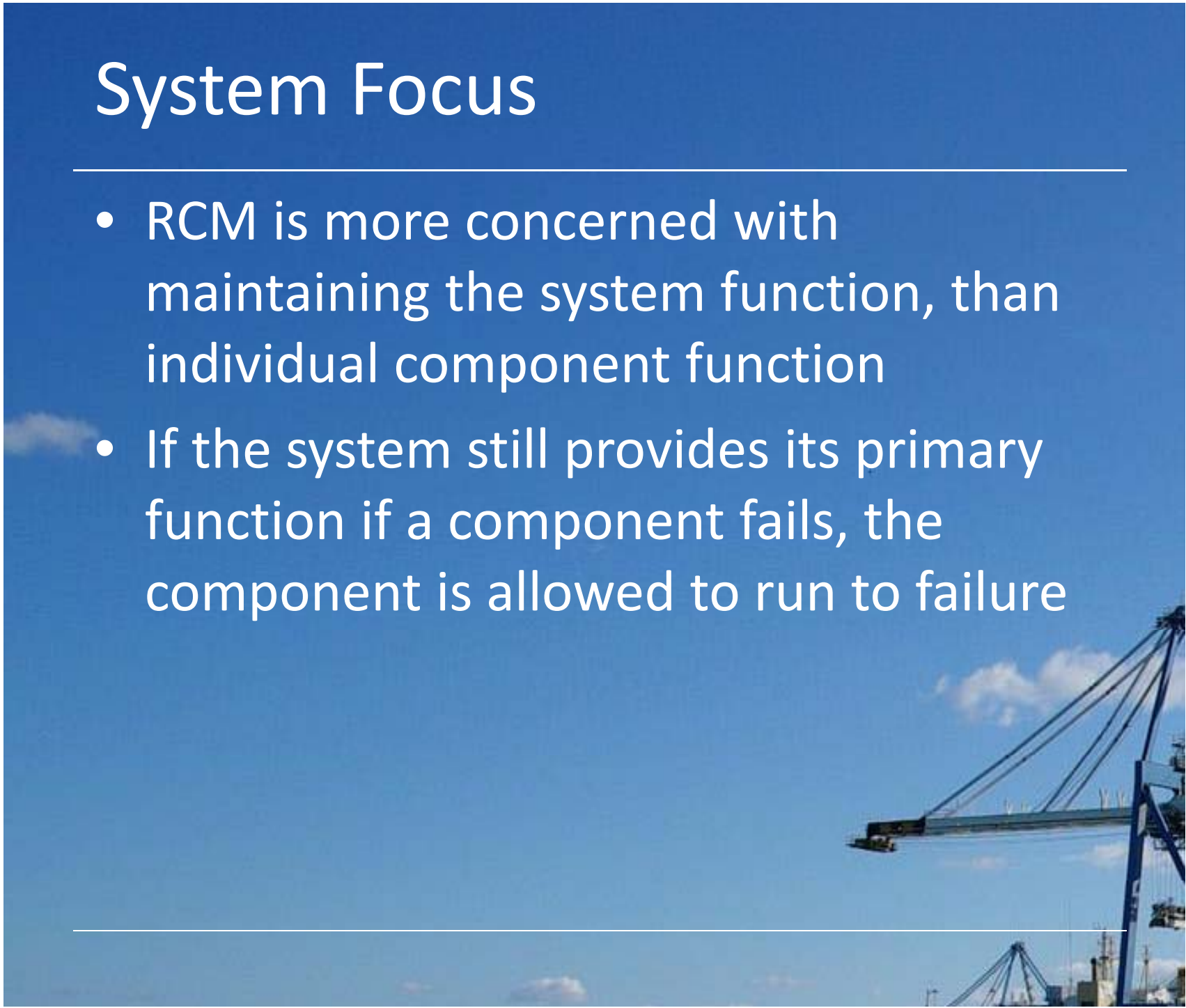


Functional Orientation

- RCM focuses on preserving the functions of equipment, not on preserving the equipment itself
- Equipment function: what users wants
  - primary functions: speed, output, product quality
  - secondary functions: safety, comfort, environmental integrity

System Focus

- RCM is more concerned with maintaining the system function, than individual component function
- If the system still provides its primary function if a component fails, the component is allowed to run to failure



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Performance Improvement

- Reliability Centered Maintenance is a methodology that can be used to improve general system performance

Eliminate Failures

- Failure:
  - the inability of equipment, system or plant to fulfill its intended functions
- Failure mode:
  - what is wrong
  - what we need to prevent or physically fix
- Failure cause:
  - why it went wrong
- Failure effect:
  - the consequence of the failure

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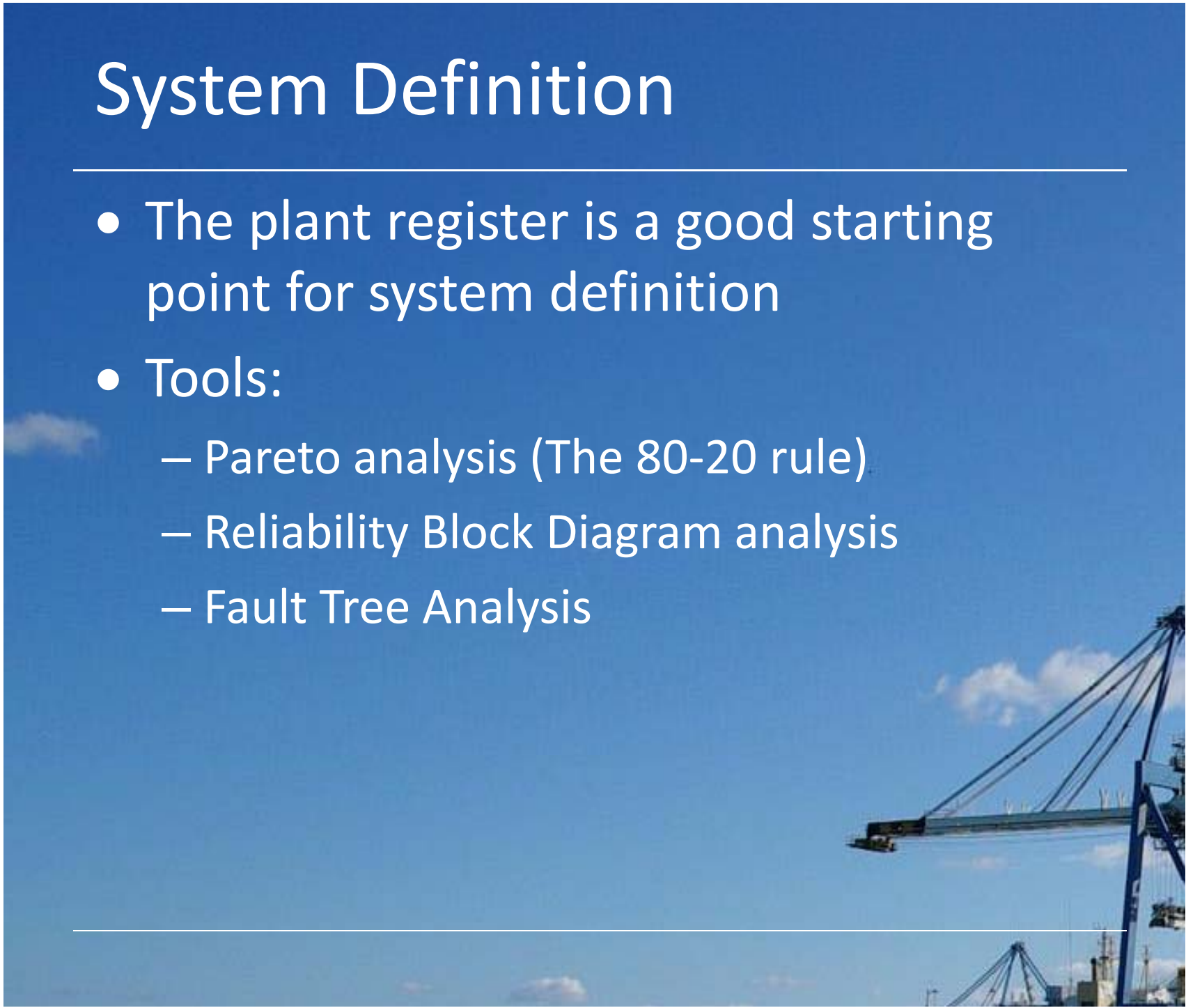
The Analysis Process

- Preparation
- System selection and definition
- System function definition
- Functional failures definition
- Failure modes analysis
- Failure consequences assessment
- Selection of maintenance actions
- Data collection and documentation

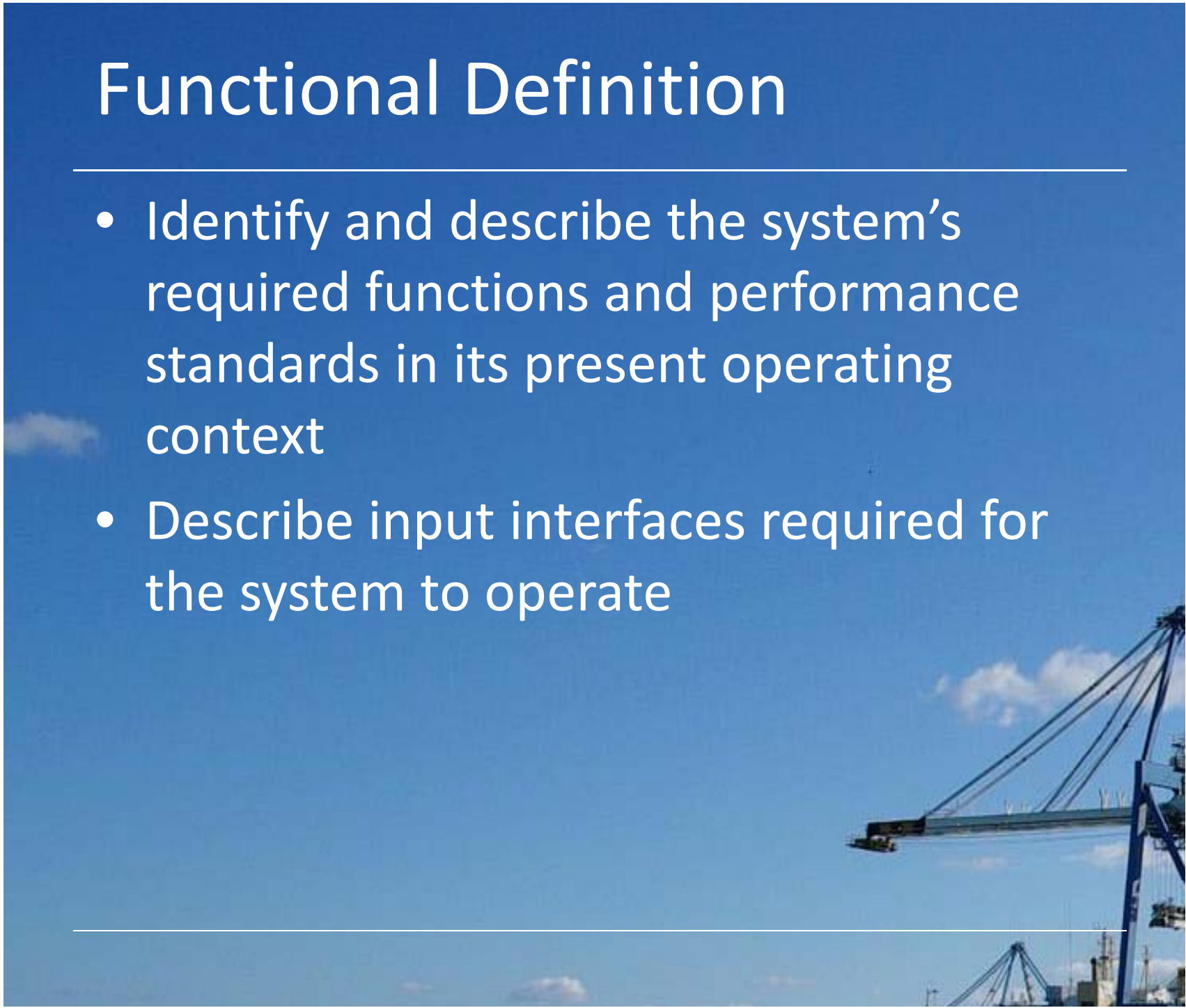
System Definition

- The plant register is a good starting point for system definition
- Tools:
  - Pareto analysis (The 80-20 rule)
  - Reliability Block Diagram analysis
  - Fault Tree Analysis



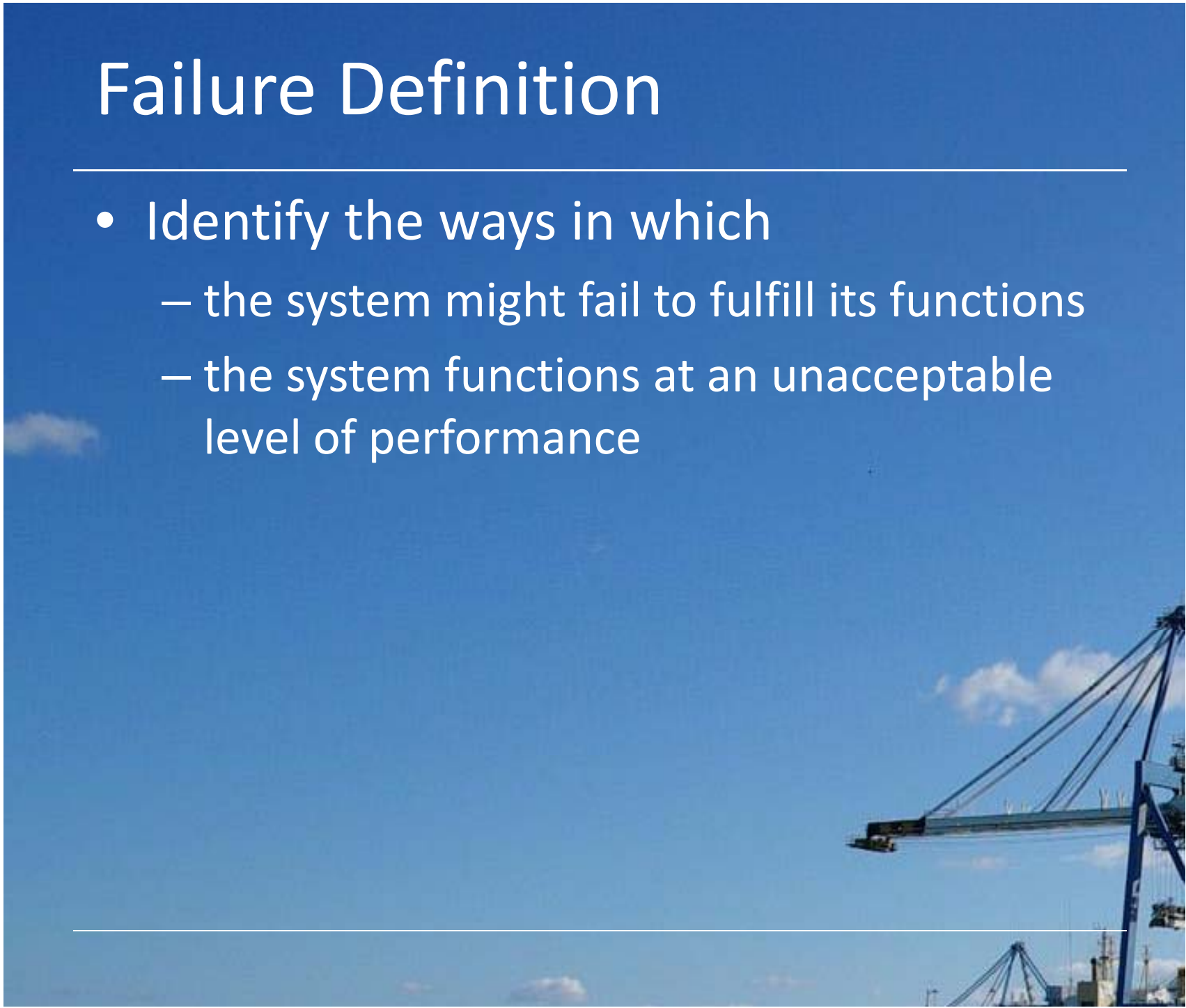
Functional Definition

- Identify and describe the system's required functions and performance standards in its present operating context
- Describe input interfaces required for the system to operate



Failure Definition

- Identify the ways in which
  - the system might fail to fulfill its functions
  - the system functions at an unacceptable level of performance



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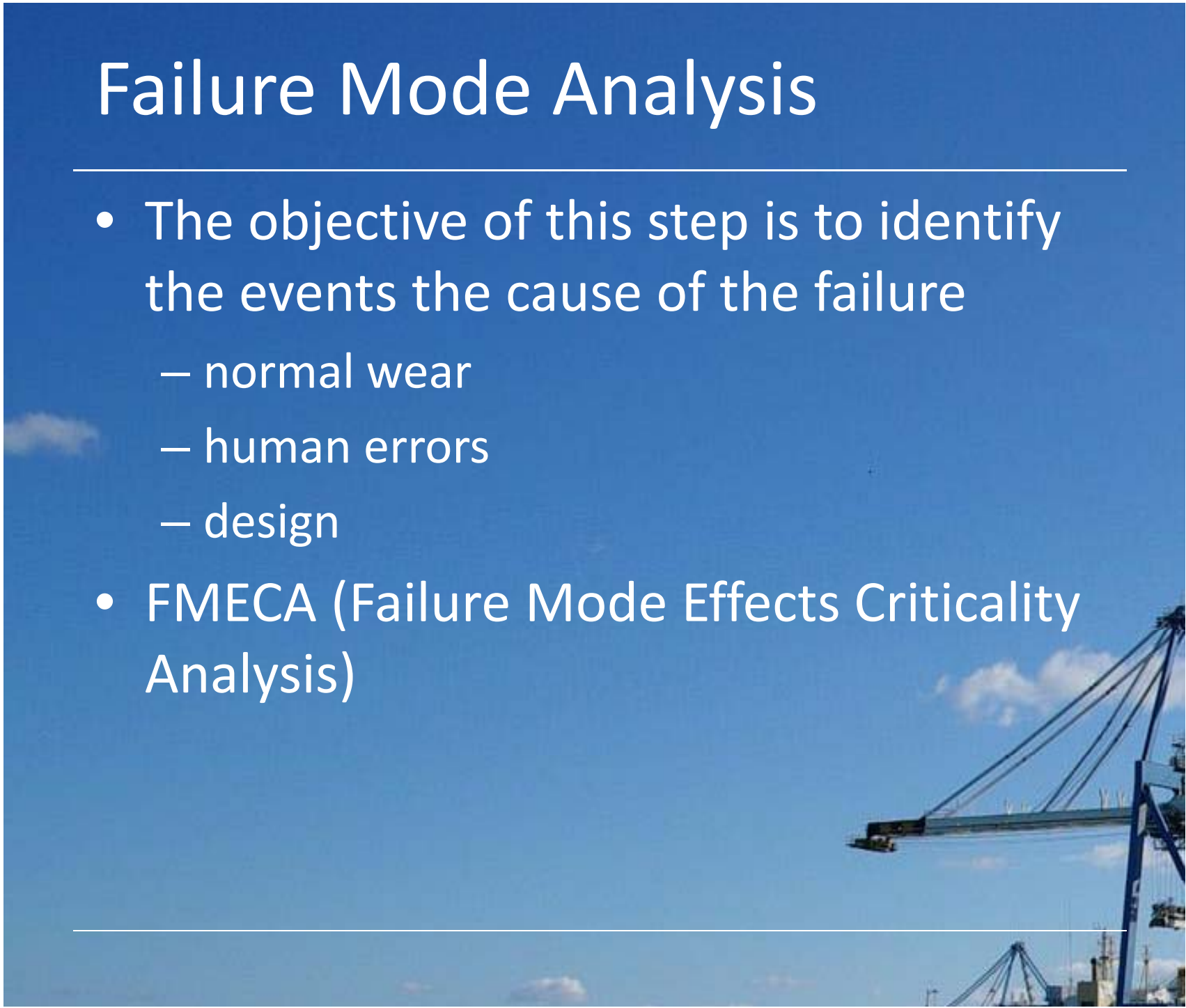
Failure Mode Analysis

- The objective of this step is to identify the events the cause of the failure
  - normal wear
  - human errors
  - design
- FMECA (Failure Mode Effects Criticality Analysis)



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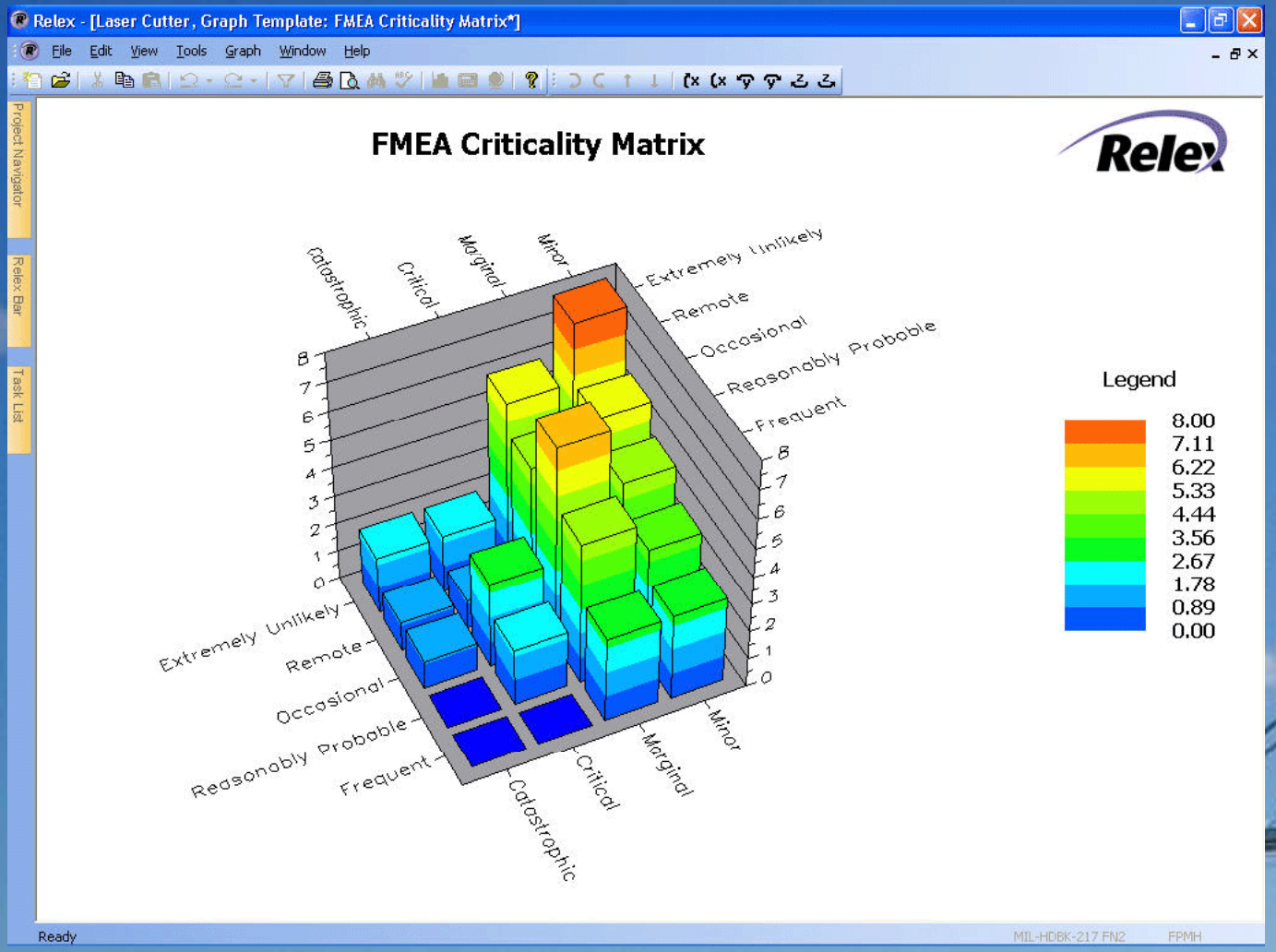
FMEA/FMECA



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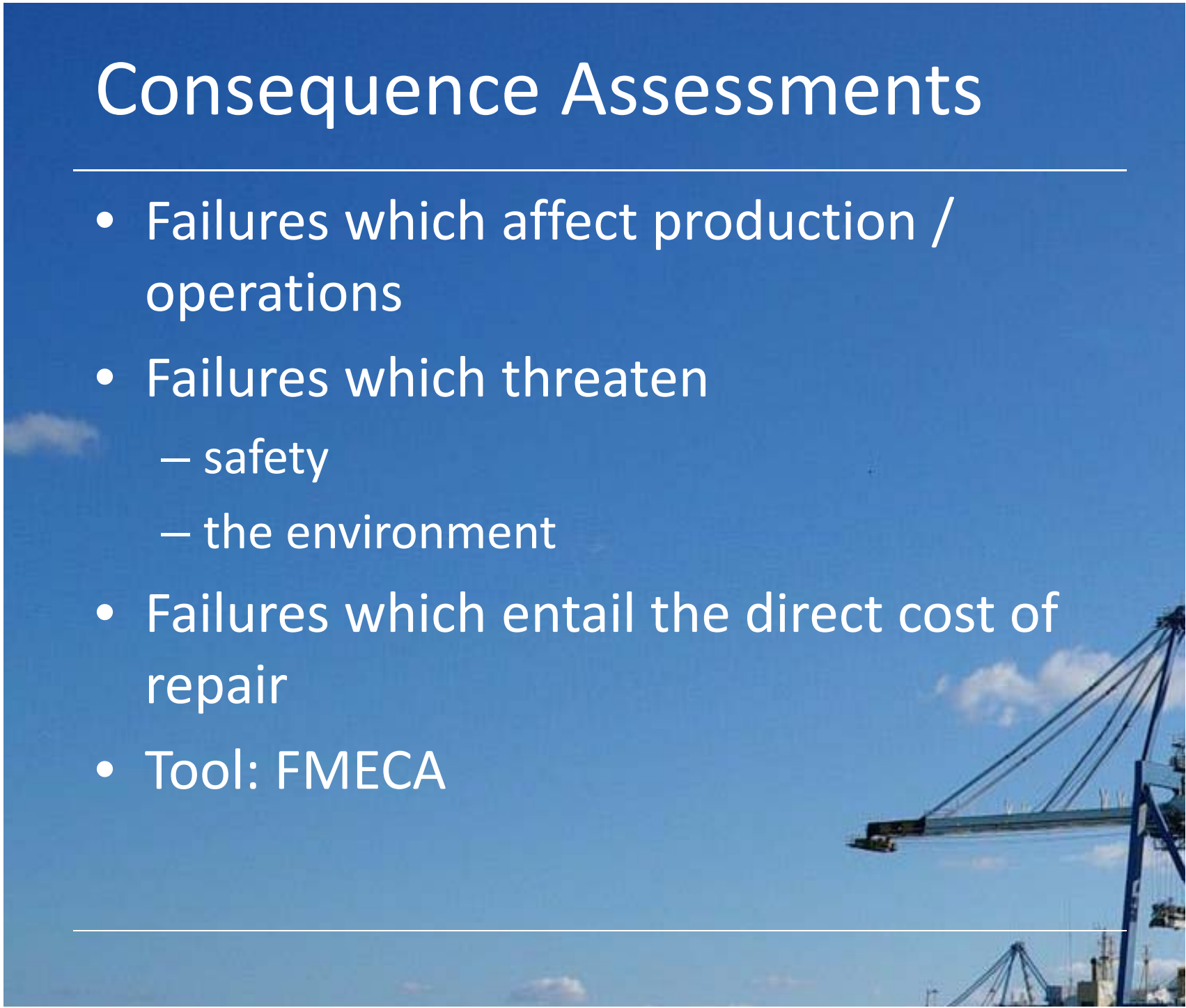
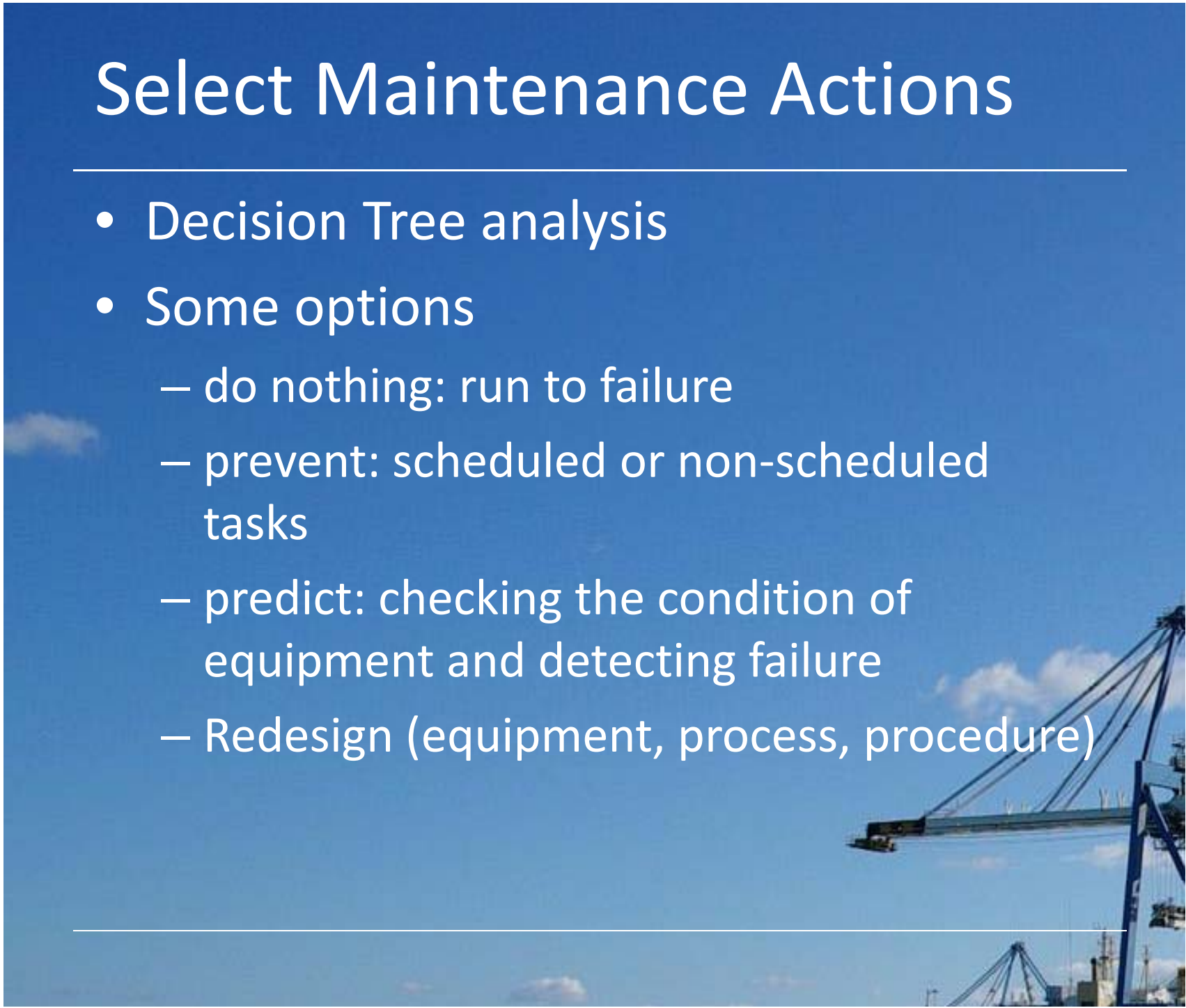
Consequence Assessments

- Failures which affect production / operations
- Failures which threaten
  - safety
  - the environment
- Failures which entail the direct cost of repair
- Tool: FMECA



Select Maintenance Actions

- Decision Tree analysis
- Some options
  - do nothing: run to failure
  - prevent: scheduled or non-scheduled tasks
  - predict: checking the condition of equipment and detecting failure
  - Redesign (equipment, process, procedure)

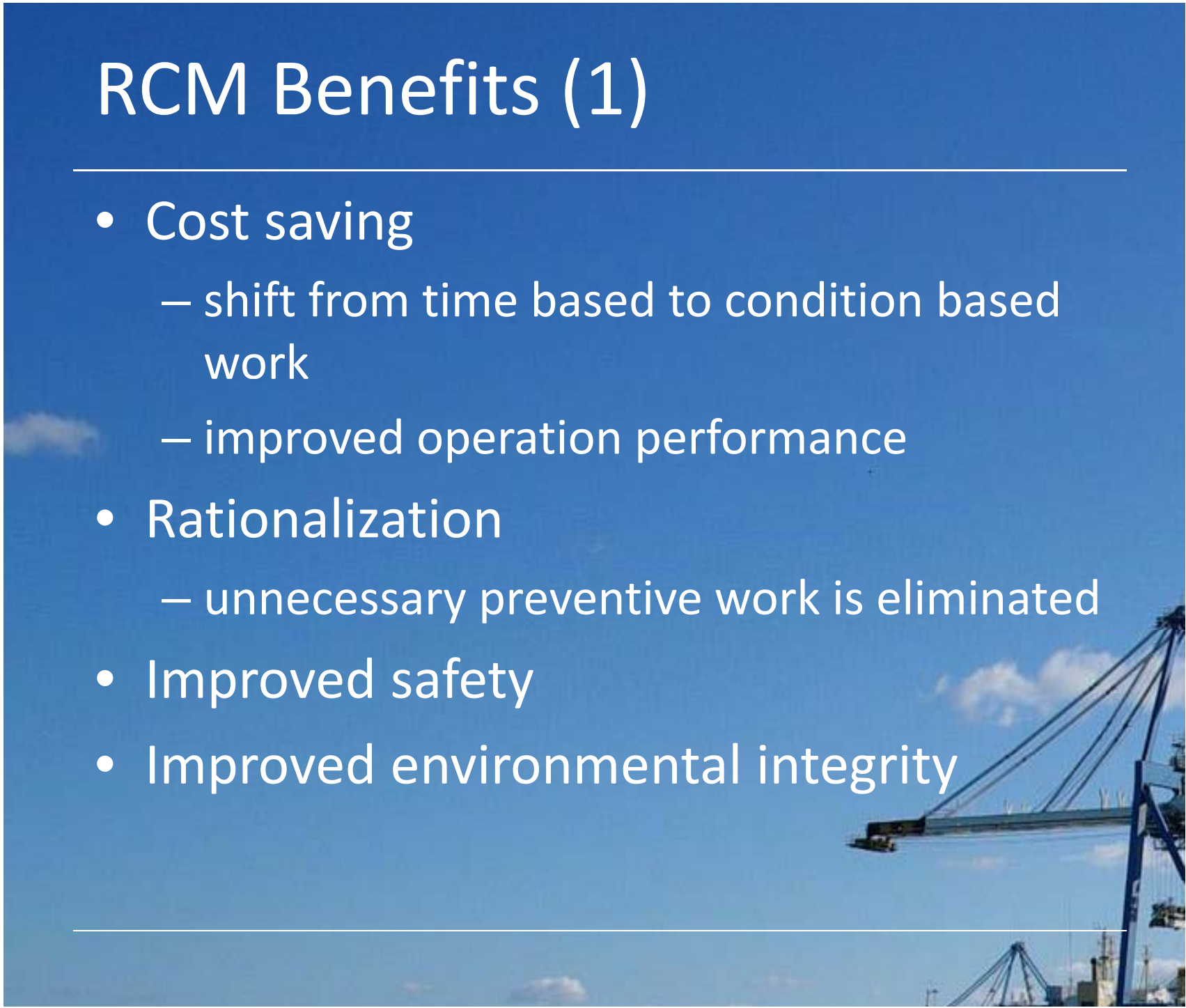


The Use of Simulation

- Can give an idea of the answers to questions and test alternative strategies, “What if?”
- Must represent terminal or systems as it is being studied…in the depth it is being studied…
  - Validate against know events
- Understand the inputs and assumptions carefully
  - Garbage in garbage out

RCM Benefits (1)

- Cost saving
  - shift from time based to condition based work
  - improved operation performance
- Rationalization
  - unnecessary preventive work is eliminated
- Improved safety
- Improved environmental integrity

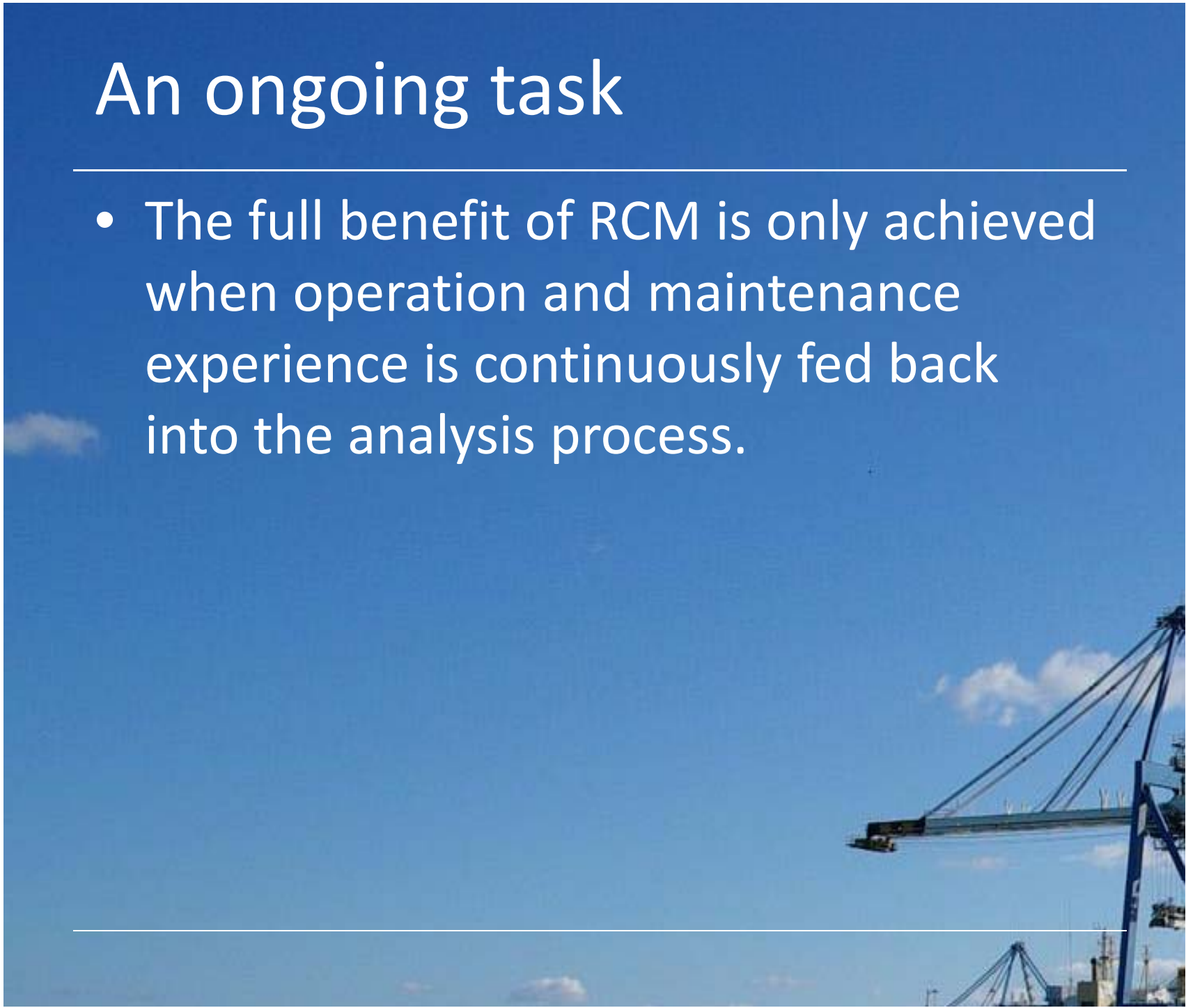


RCM Benefits (2)

- A precise and comprehensive maintenance database
  - during the analysis, information is gathered in a coherent form
- Education
  - improved overall level of skill and technical knowledge
- Improved teamwork
- Greater motivation of individuals

An ongoing task

- The full benefit of RCM is only achieved when operation and maintenance experience is continuously fed back into the analysis process.



Marine Facilities

Marine Operations

- The players and their roles
  - Harbour Master
  - Port Captain
  - Ships Master
  - Pilot
  - Mooring Master/Gang

Improving Marine Operations

- Take a holistic view on safety
  - Harbour Master
  - Terminal Manager
- Dynamic Under Keel Clearance
  - Measurements
  - Forecasts
  - Integrated analysis
- Why do ships queue?
  - The cost of competition
  - Who pays the penalty

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Take a Holistic View of Safety

- Regulation

"75% of the propeller must be in the water when the ship comes alongside"

- Reason

"to ensure that the ship can maneuver and exit the terminal safely"

- The impact
- The cost…
- What options?

Under Keel Clearance

- Under Keel Clearance
  - from lowest part of hull to sea bed
- International Guidelines – PIANC
  - 10% of draft, say 1.8 to 2.0 m
- Important Factors
  - Swell/Sea state
  - Tidal cycle
  - Channel layout
  - Speed of ship (squat)
  - Nature of seabed

Economics and UKC

- 0.5m additional draft
  - 12,000 t
  - US$ 2m to 20m in sales
  - 5 to 20% lower freight rate
  - 50 ship terminals it all adds up…
- Risk
  - Grounding
  - Closure of terminal
  - Environmental disaster
  - Insurance?

Managing UKC

- The basics
  - Surveying, data collection
  - Tidal height predictions
  - Can mean surprises: swell, surge, weather
- Real time systems
  - Safe and reliable
  - No assistance in load management
- Dynamic UKC
  - Peak performance
  - Must be well validated

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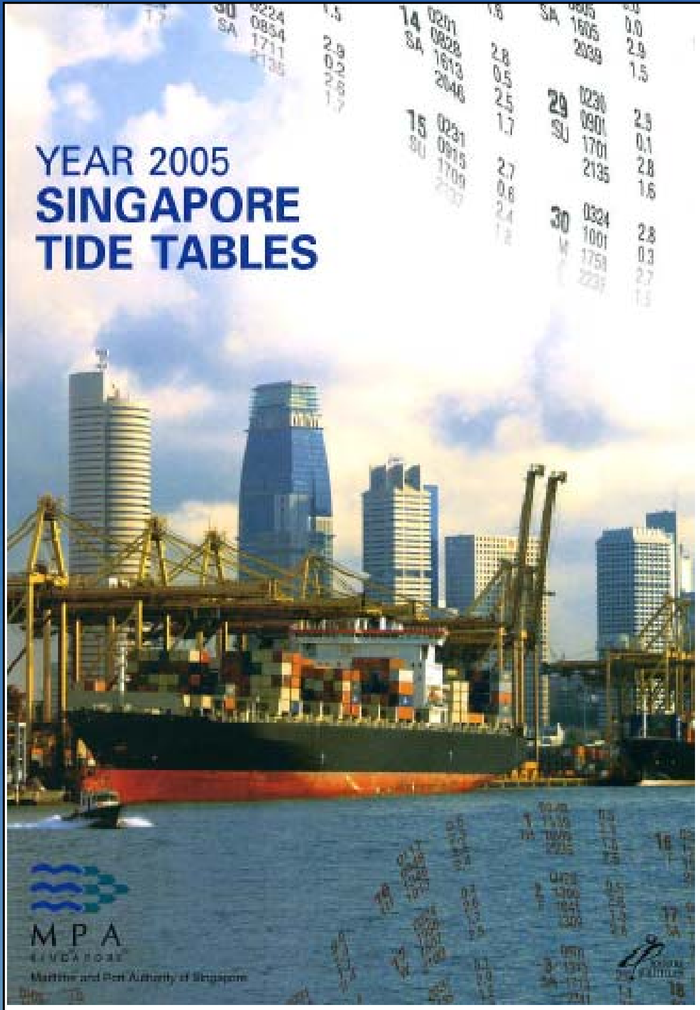
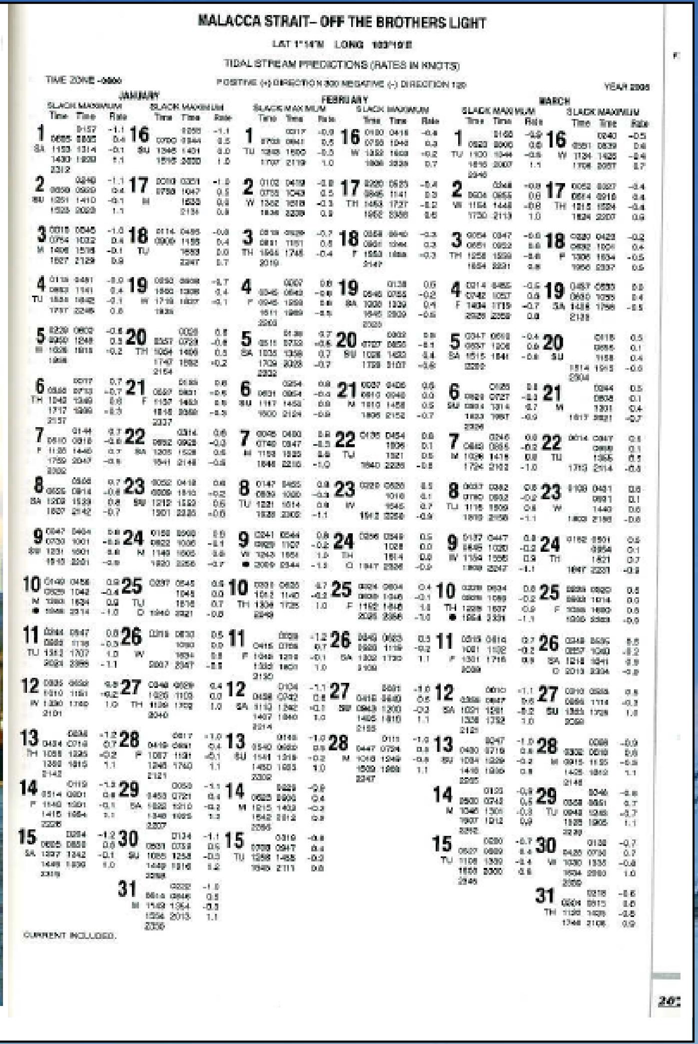
The Basics





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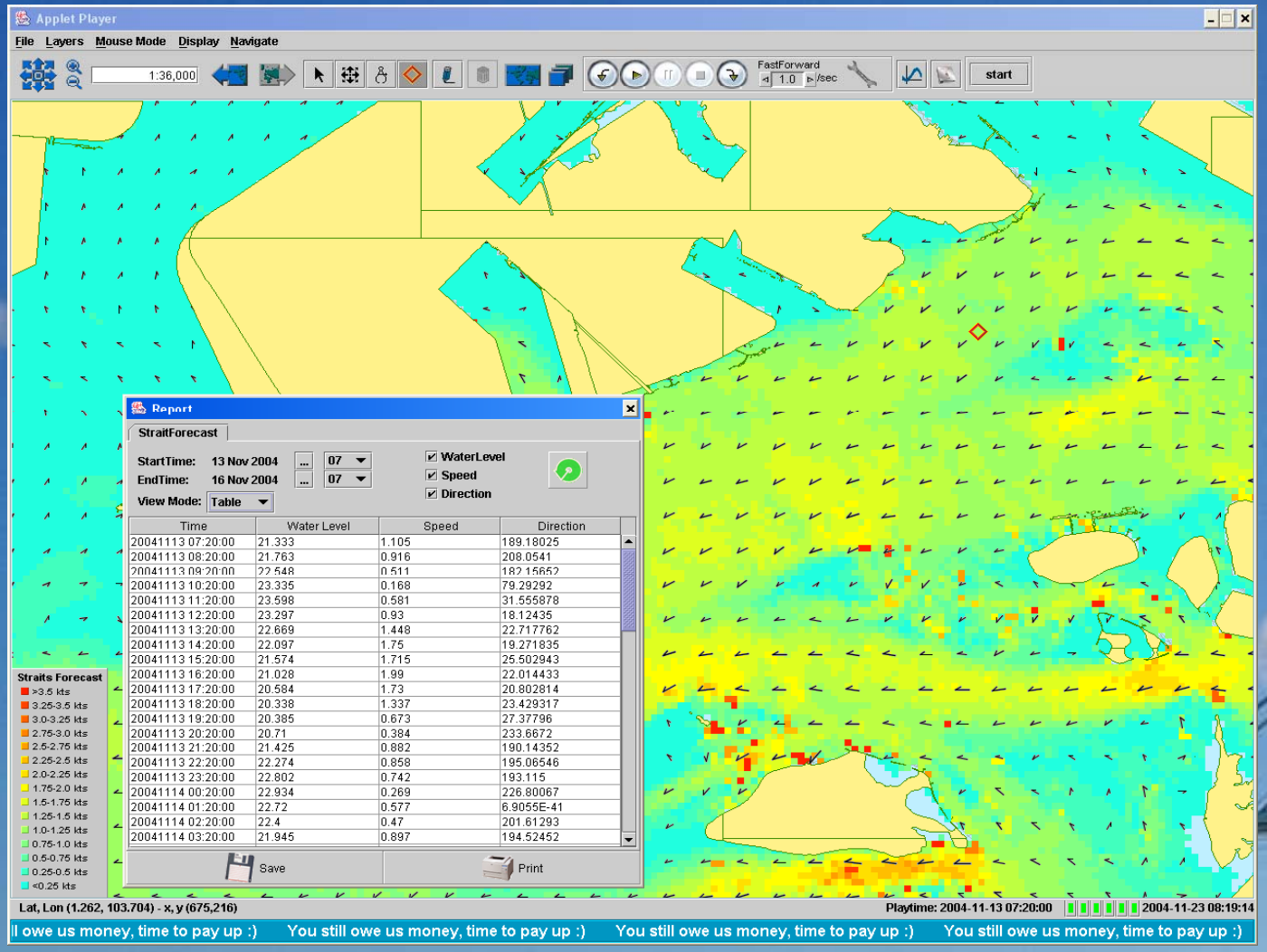
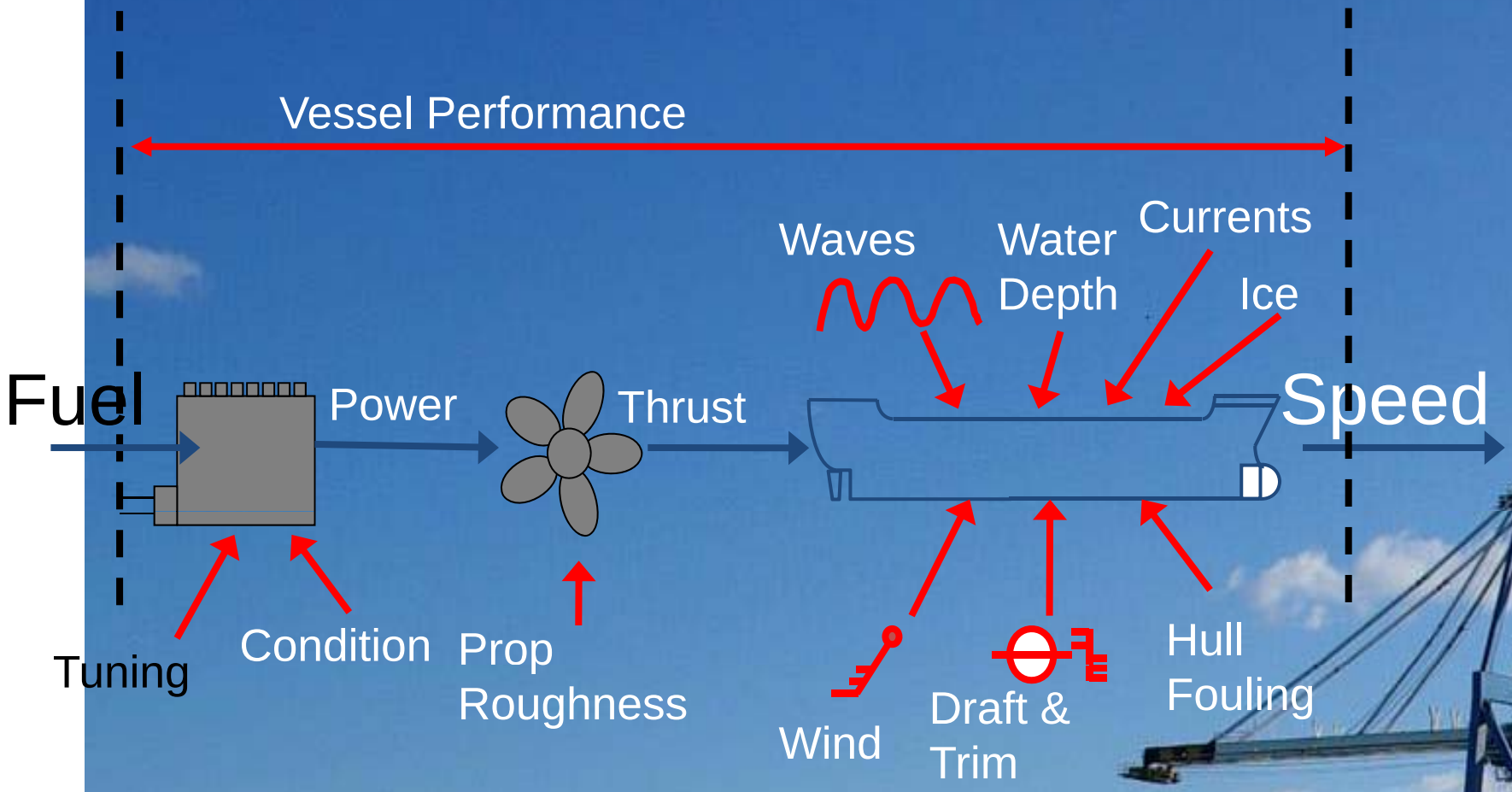
Digital Tidal Atlas



And what about the ship...



A very expensive queue

- 78 ships at Hay Point (55 DBCT, 22 BHP)
  - Estimated annual cost: US$ 1 billion
  - Demurrage bill: US$ 0.1 billion
  - Cost to terminal: US$ 0
- 50 ships at Newcastle
  - Estimated annual cost: US$ 0.75 billion
  - Demurrage bill: US$ 0.1 billion
  - Cost to terminal: US$ 0
- 0 ships at Port Hedland…

Where is the problem

- Berths not operating close to capacity
  - The “rules” are against this happening
  - Inefficient services, blending!
  - Stockpile space is limited, sub-optimal?
- Mines have stockpiles of coal
  - They compete for sales
  - Mines sell coal and promise delivery
  - Coal 150km to 300km from terminal
- The rail system…

Simple solutions

- Mandate CIF
  - FOB places most risk with ship owner
  - Buyers risk on delivery time
  - CIF moves risk to the mines
- Queue Management
  - Independent arbiter
- More terminal capacity
- Rail upgrades
  - Who pays?
  - The impact of flexibility

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Thank you for your attention