From data to decision-making under conditions of uncertainty

RISK Summer School 2025

August 26th to 28th, 2025

Université Grenoble Alpes

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FRANCE 2030

GRENOBLE INP UGA

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Risk Institute
Université Grenoble Alpes

DECODE Project

Decode stands for : DEvelop COmptences DEvoted to the management of uncertainty with creativity and drama tools

BRITISH COUNCIL

Swansea University
Prifysgol Abertawe

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Decision-making with data (partly digitized) in the context of ship digitalization. Challenges and issues

Capt. Octavian POSTOLACHE (Ecole Nationale Supérieure Maritime)

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Decision-making with data (partly digitized) in the context of ship digitalization. Challenges and issues

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ÉCOLE NATIONALE SUPÉRIEURE MARITIME

Digitalization in shipping

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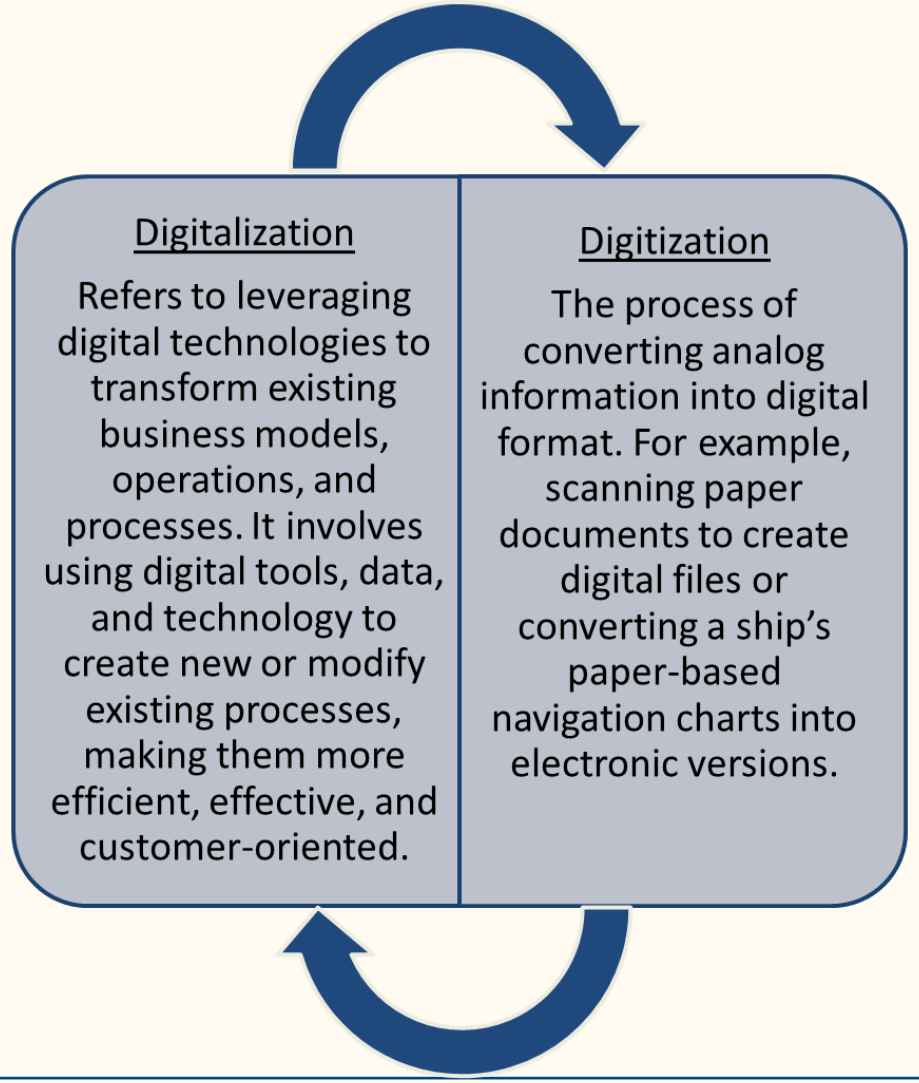
Digitalization in shipping



Digitalization

Refers to leveraging digital technologies to transform existing business models, operations, and processes. It involves using digital tools, data, and technology to create new or modify existing processes, making them more efficient, effective, and customer-oriented.

Digitization

The process of converting analog information into digital format. For example, scanning paper documents to create digital files or converting a ship's paper-based navigation charts into electronic versions.

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- Digitalisation in the maritime industry also refers to integrating and applying digital technologies, such as software systems, sensors, automation, and data analytics, to improve the efficiency, safety, and sustainability of maritime operations.
- This process involves transitioning from traditional manual methods to digital solutions that enable better decision-making, streamlined processes, and enhanced connectivity between various stakeholders in the shipping ecosystem.

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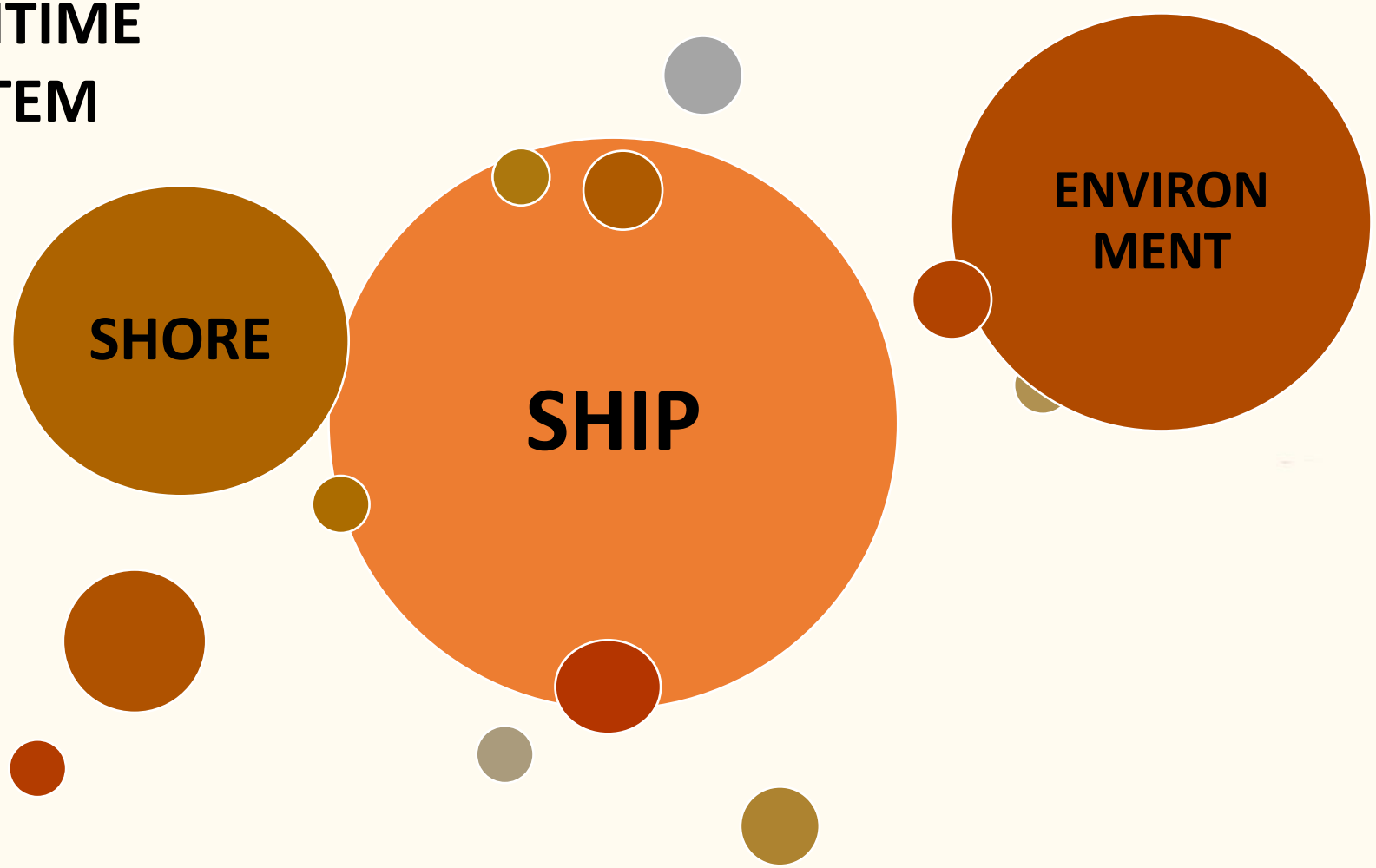
THE MARITIME ECOSYSTEM



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Operational Efficiency
Digitalisation reduces the time and effort required for various shipboard and shore-based operations, leading to optimized resource use and lower operational costs.

Safety Enhancement
With advanced monitoring systems and predictive analytics, digital tools can identify potential hazards, prevent accidents, and ensure compliance with safety regulations.

Environmental Impact
Digital technologies help monitor and control emissions, optimize fuel consumption, and ensure compliance with environmental regulations like MARPOL, contributing to the global effort to reduce the maritime industry's carbon footprint.

Regulatory Compliance
Digital tools simplify the process of maintaining and proving compliance with various international regulations, such as those set by the International Maritime Organization (IMO).

Global Connectivity
Digitalisation enables seamless communication and data exchange between vessels, ports, and shore-based operations, fostering collaboration and improving the overall efficiency of maritime logistics.

Source: Lloyds Maritime Institute https://www.lloydmaritime.com/

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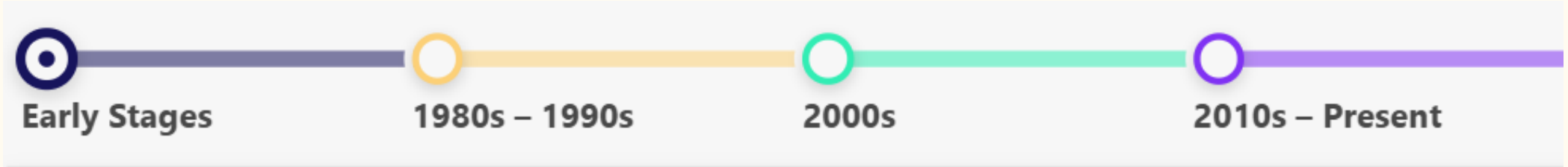

Early Stages

- **Manual and Analog Systems:** Traditionally, maritime operations relied heavily on manual processes and analog instruments. Navigation, communication, and cargo handling were largely dependent on the crew's skill and experience, with limited automation.
- **Introduction of Computers:** The late 20th century saw the introduction of computers and basic software systems in shipping, primarily for administrative tasks, such as managing cargo manifests and crew records.

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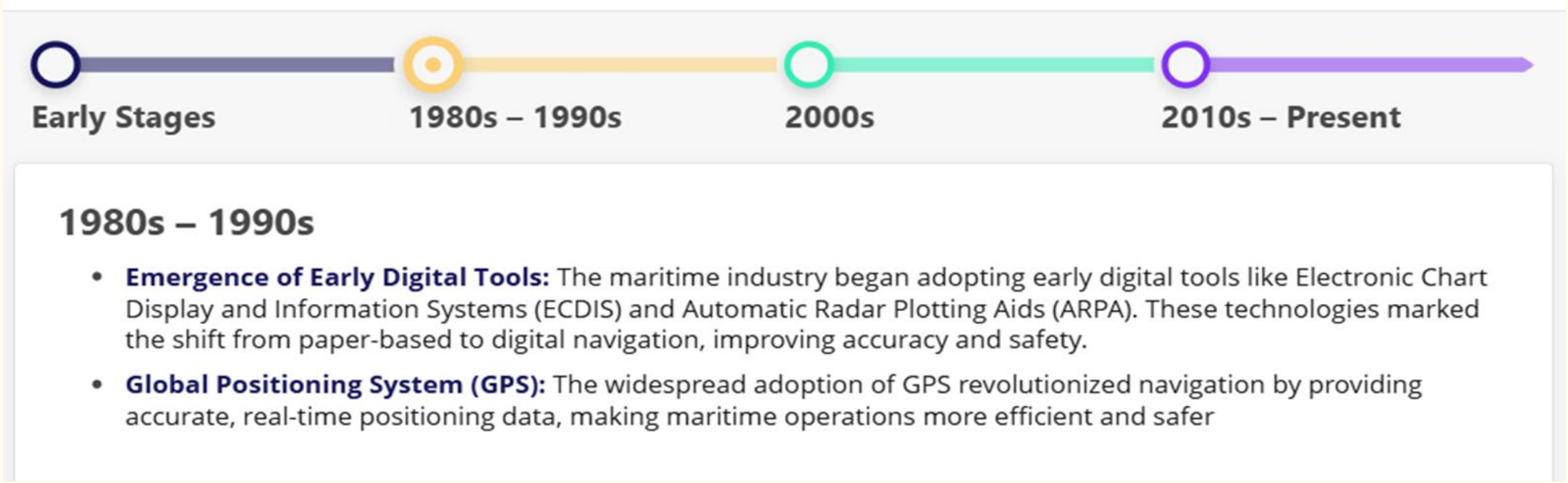

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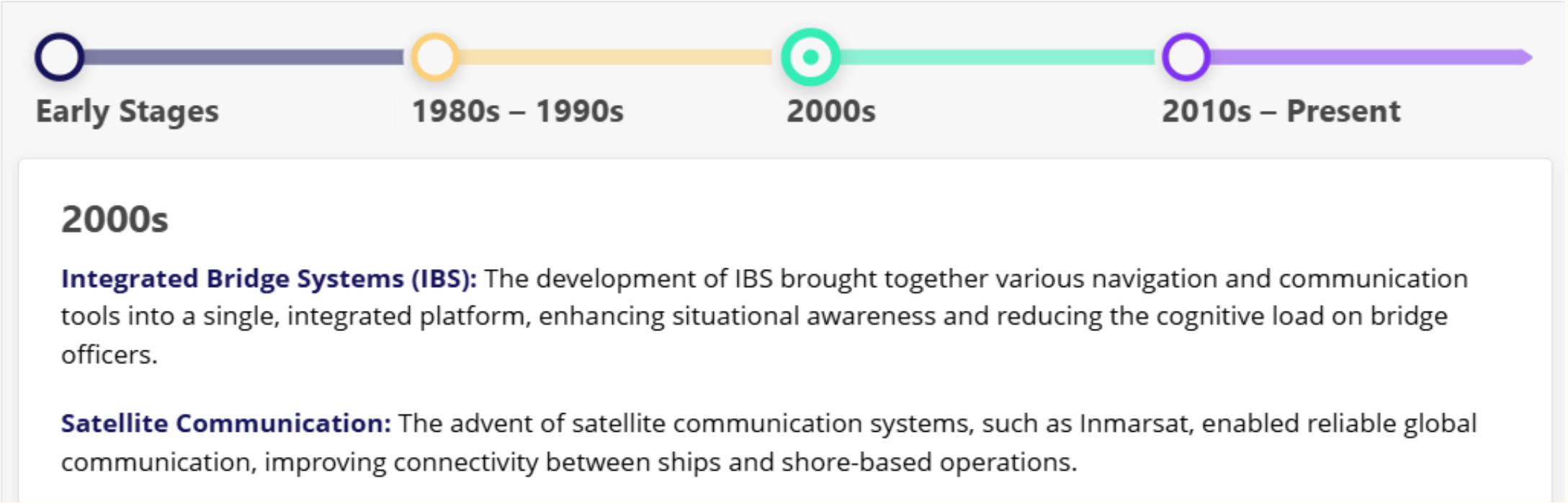

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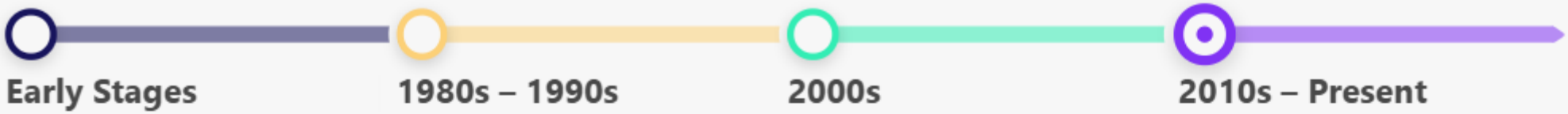
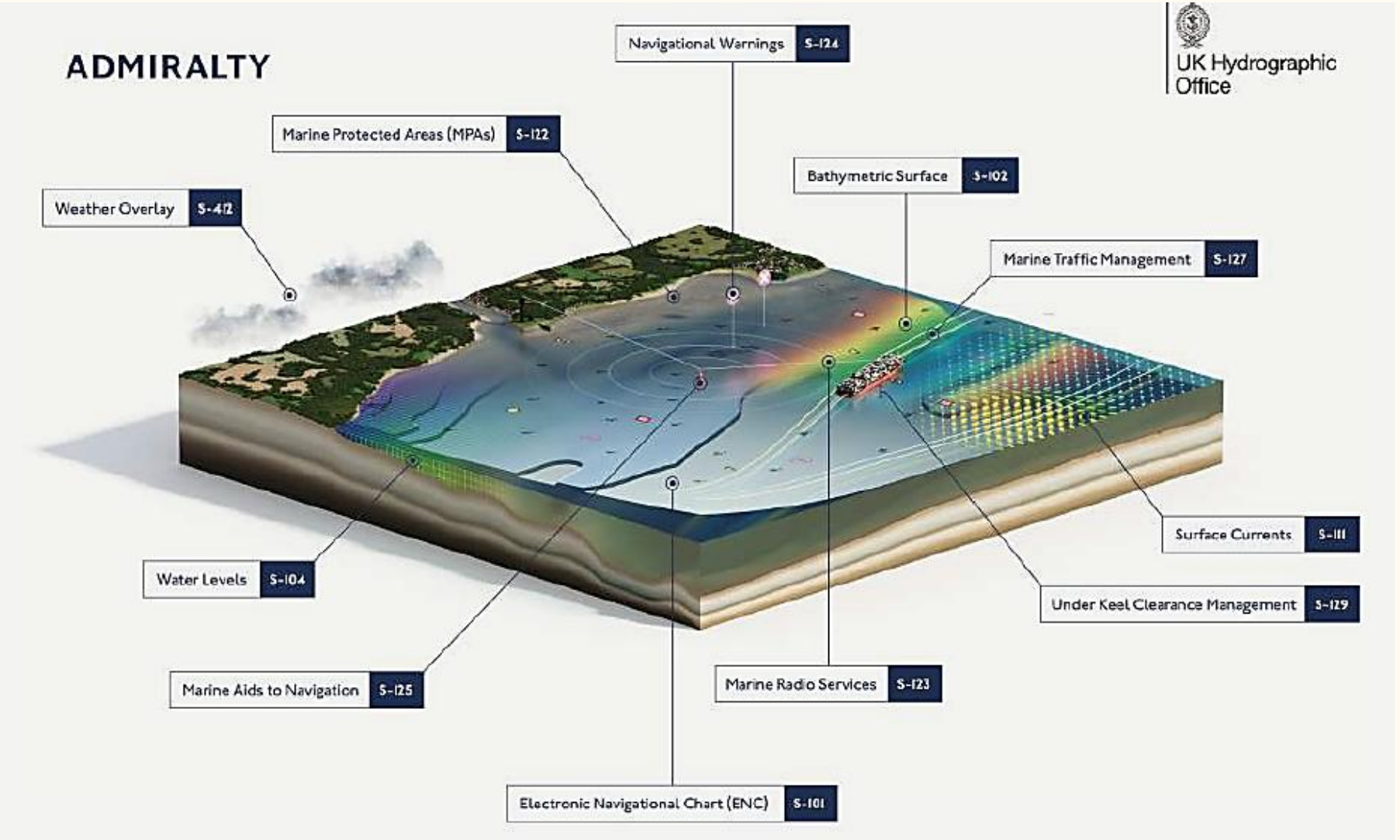


2010s – Present

- **Internet of Things (IoT):** IoT has enabled real-time monitoring of ship systems, cargo conditions, and environmental parameters through connected sensors, leading to more informed decision-making and predictive maintenance.
- **Big Data and Analytics:** The rise of big data analytics allows the maritime industry to process vast amounts of data generated by ships, helping to optimize operations, predict maintenance needs, and enhance safety and compliance.
- **Artificial Intelligence (AI) and Automation:** AI-powered systems are increasingly being used for route optimization, cargo management, and even autonomous navigation, pushing the boundaries of what digital technologies can achieve in shipping.
- **Blockchain and Smart Contracts:** Blockchain technology is being explored for its potential to streamline maritime logistics by providing transparent, secure, and tamper-proof transaction records, especially in cargo tracking and documentation.

Source: Lloyds Maritime Institute https://www.lloydmaritime.com/

Ship navigation – digital environment



Ship navigation – digital twin

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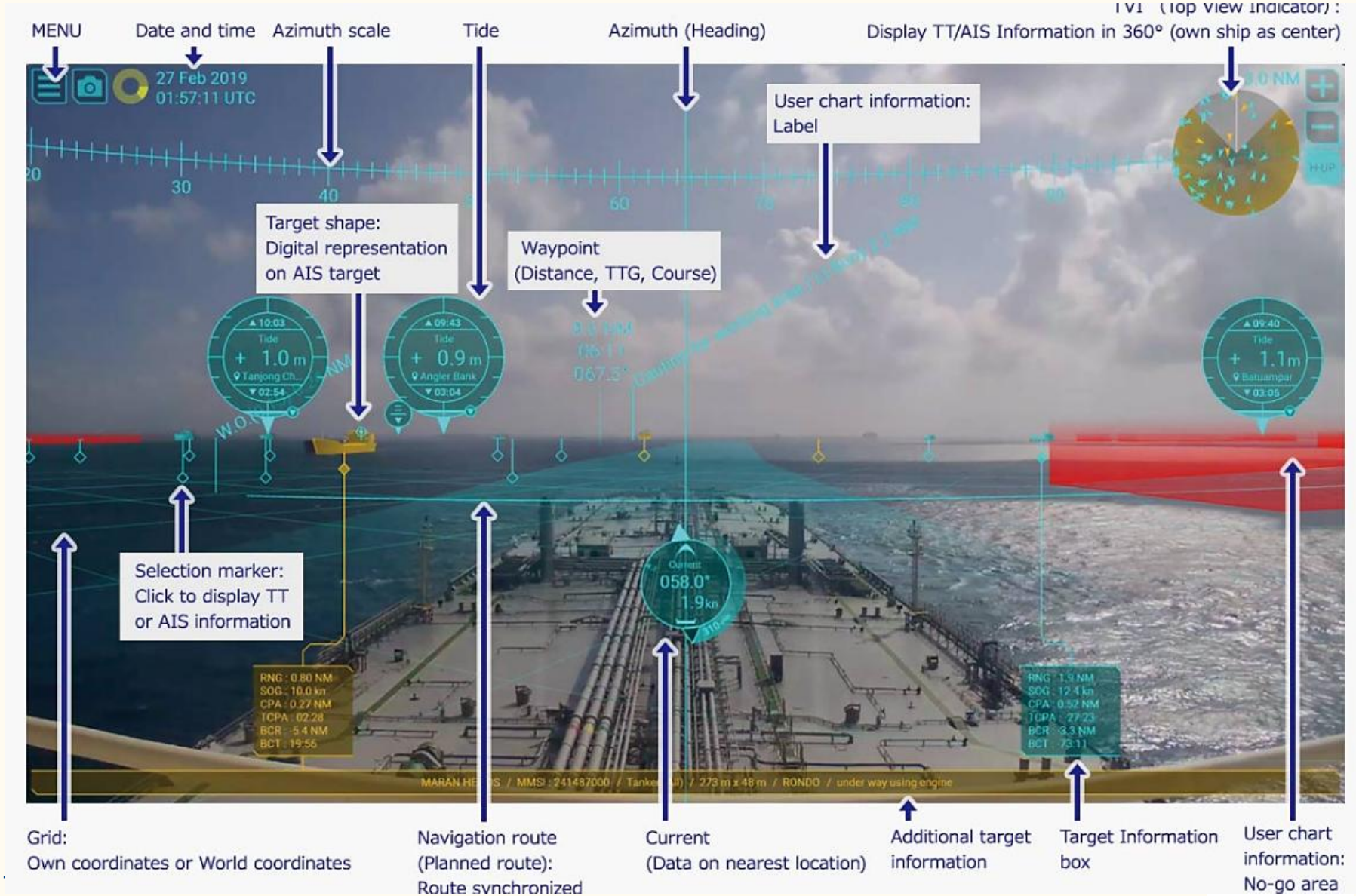
Ship navigation technology



Voyage optimization

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Voyage Optimization

Voyage optimization involves using advanced algorithms and real-time data to plot the most efficient route for a vessel. This data can include factors like weather, sea currents, port congestion, and fuel efficiency parameters, enabling ships to reduce their fuel consumption, minimize delays, and avoid adverse weather conditions.

What it replaces

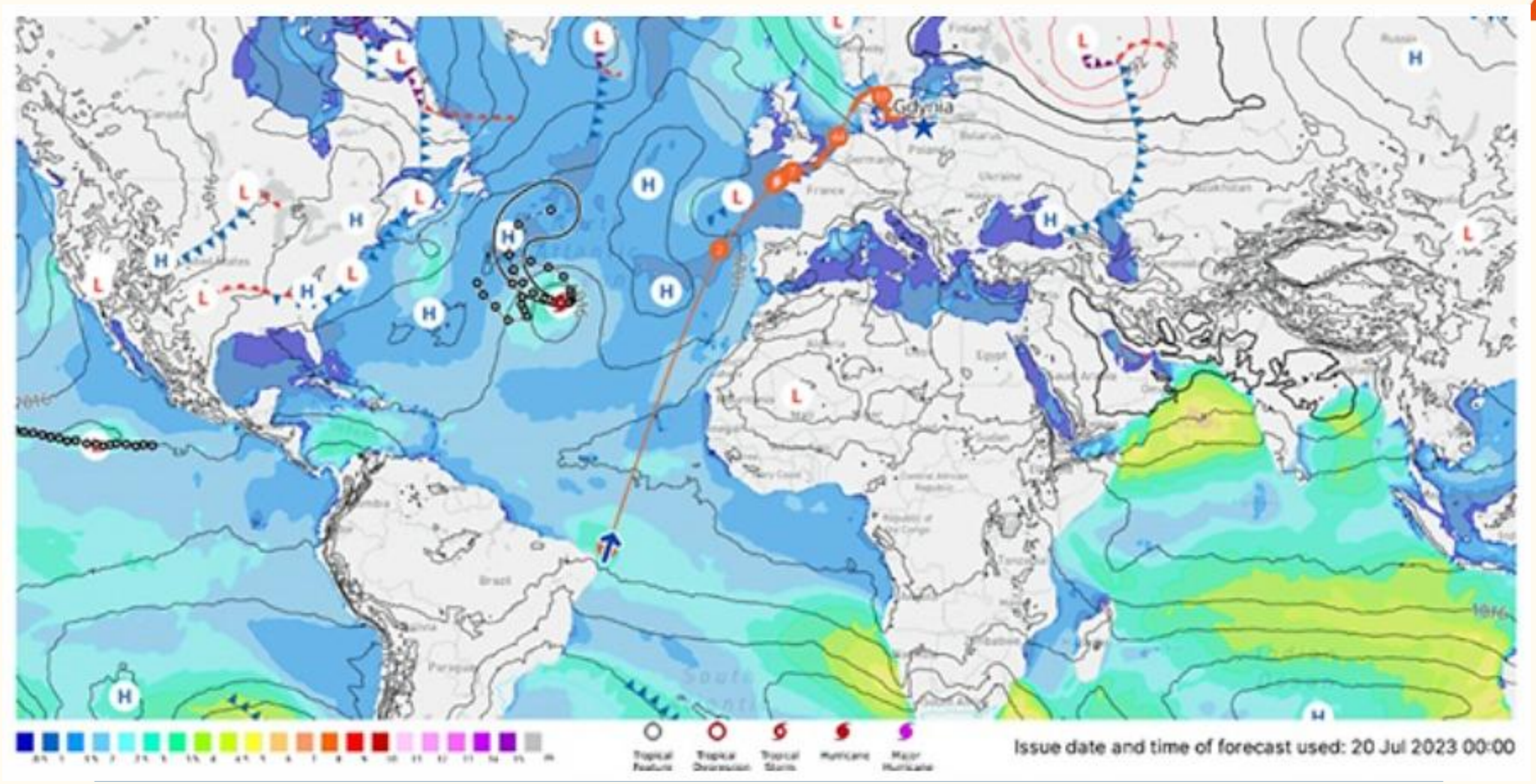
Traditional route planning, which relied heavily on manual calculations and static data, is now replaced by dynamic and automated systems that provide continuous, real-time optimization. The old method was time-consuming, less accurate, and often resulted in higher fuel consumption due to inefficiencies in planning.

Benefits

- Fuel Savings: By choosing the most fuel-efficient route, voyage optimization can significantly reduce fuel consumption, which is a major cost in maritime operations.
- Lower Emissions: Cutting down fuel use translates to reduced greenhouse gas emissions, helping shipping companies meet strict IMO regulations.
- Improved ETA Accuracy: With real-time monitoring, ships can stick closer to their estimated time of arrival (ETA), improving the reliability of operations and customer satisfaction.
- Cost Efficiency: Optimized voyages reduce wear and tear on engines, saving on maintenance costs in the long run.

Source: Lloyds Maritime Institute https://www.lloydmaritime.com/

Voyage optimization



Interfacing the digital environment with the digital ship and simulating optimal routes

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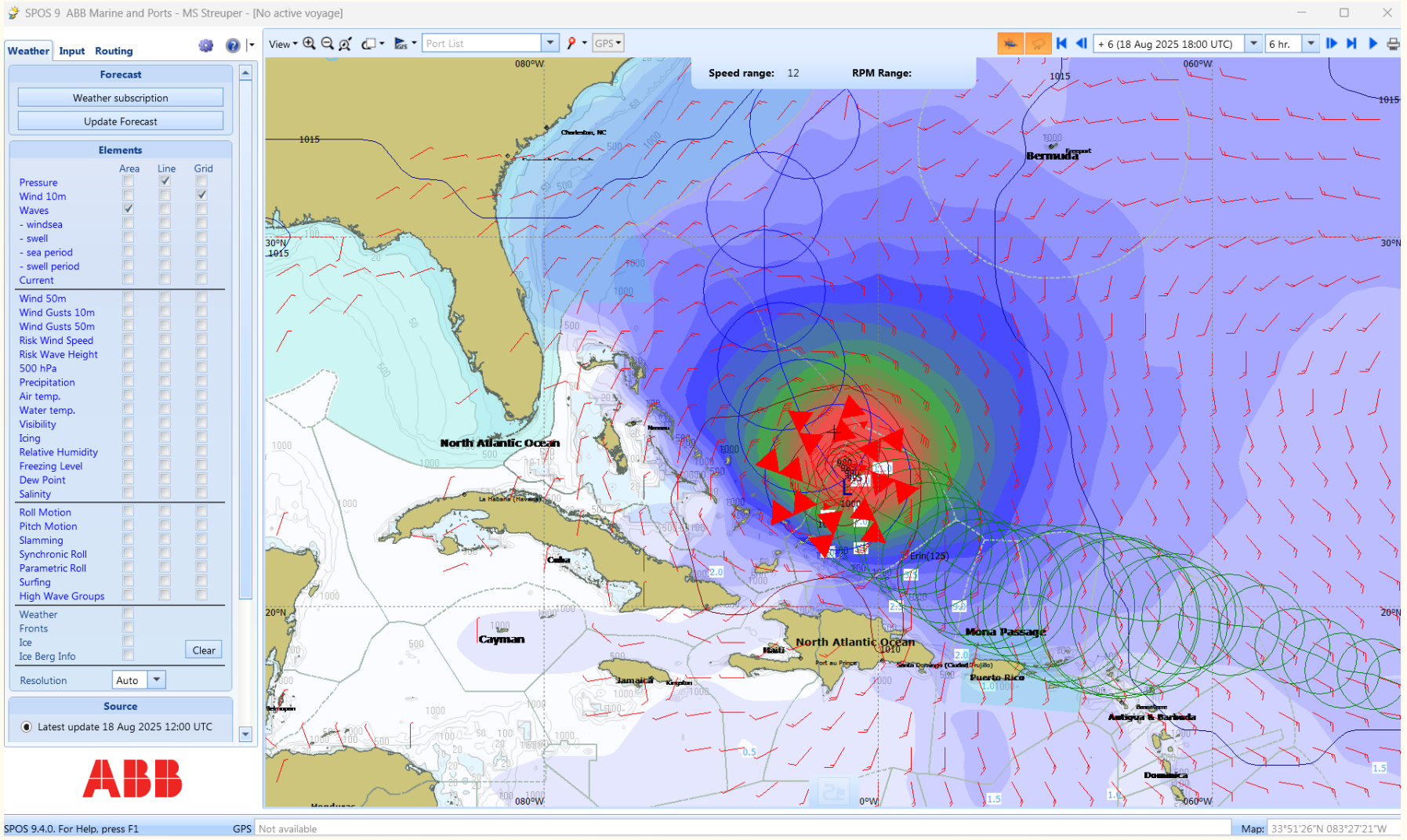

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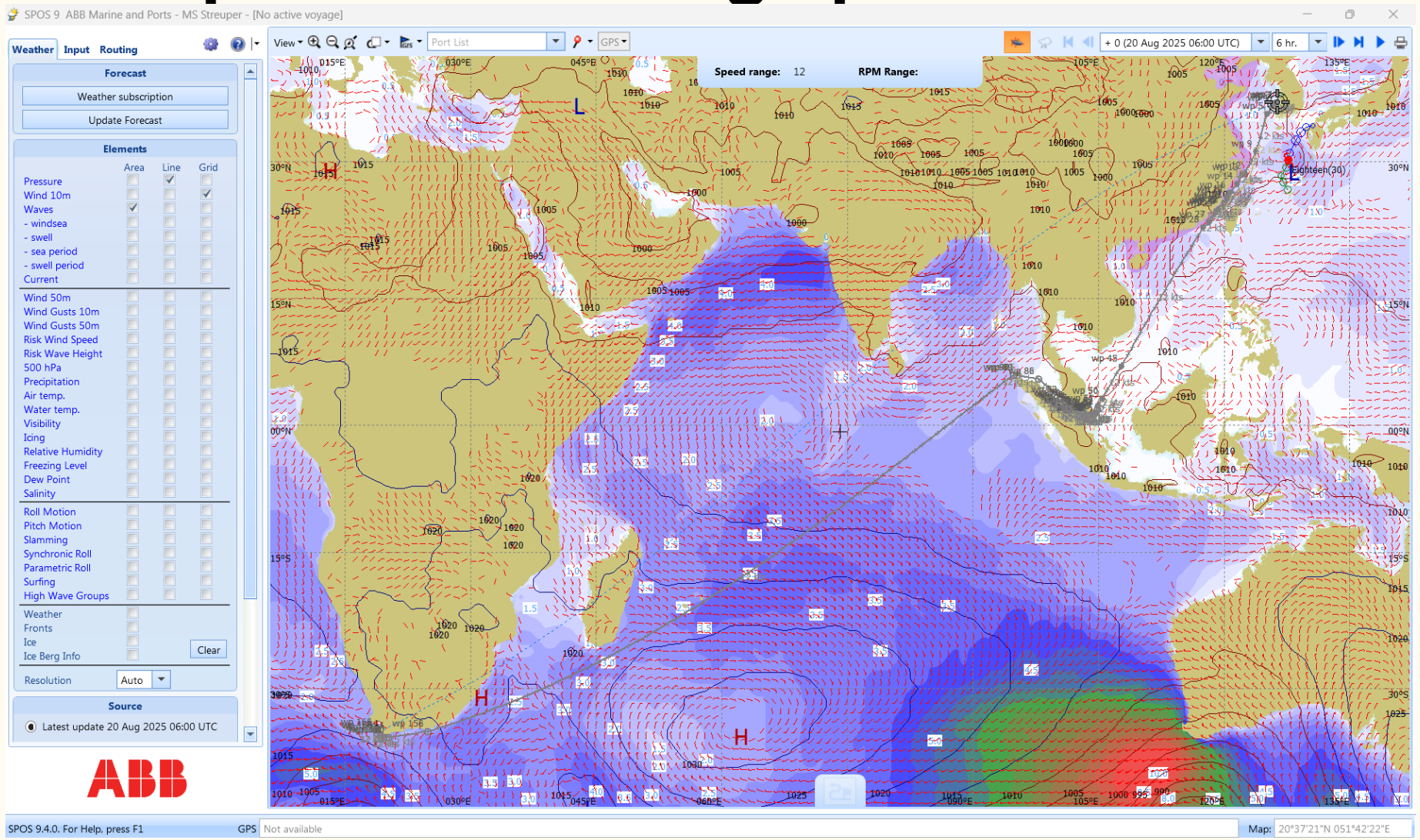

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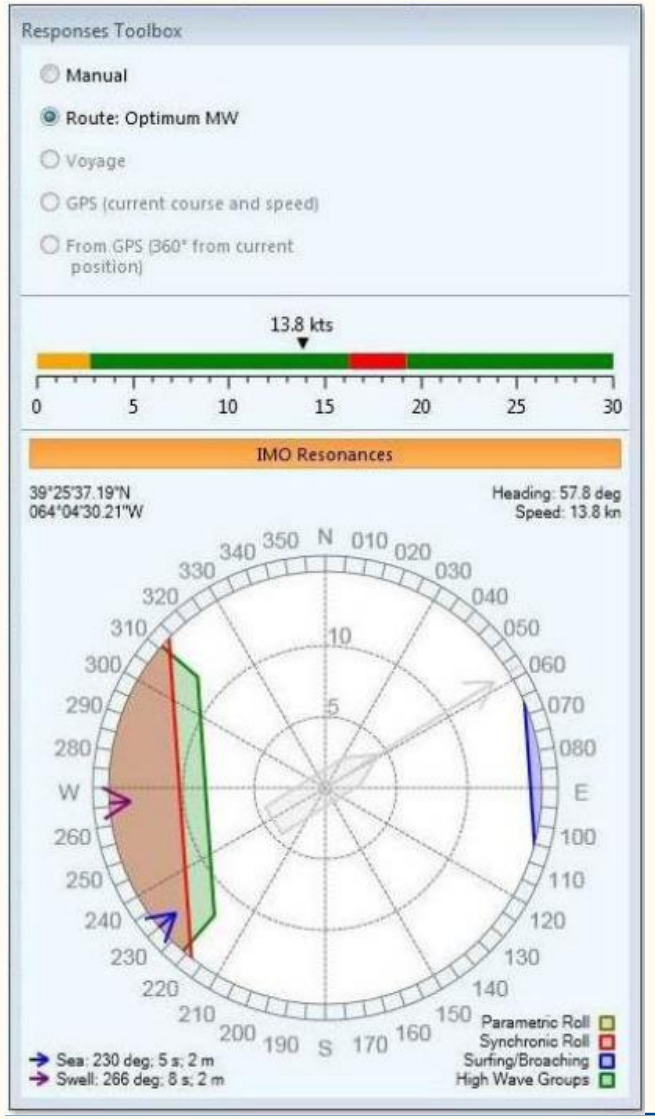
Preventing the parametric rolling



SPOS = Ship Performance Optimization System
ABB Ability™ OCTOPUS - Marine Advisory System
SPOS seakeeping module

The “true reality” – YouTube min. 7

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The “true reality” – errors are very expensive

A TEAM DECISION – IF YOU HAVE TIME!

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1. **Understand where we sail**
   - Clarify the objective.
   - Identify the expected outcome.
   - Ask questions if anything is unclear.
2. **Plan the Approach**
   - Break the task into smaller, manageable steps.
   - Set priorities and deadlines.
   - Allocate resources (time, tools, people).
3. **Gather Information and Resources**
   - Collect necessary data, tools, or materials.
   - Review relevant guidelines or instructions.
4. **Execute the Task**
   - Follow the plan step-by-step.
   - Stay focused and adapt if needed.
   - Document progress if required.
5. **Monitor and Adjust**
   - Check for errors or inefficiencies.
   - Make corrections or improvements.
   - Communicate updates if working in a team.
6. **Review and Finalize**
   - Ensure the task meets the original goal.
   - Perform quality checks.
   - Prepare for delivery or presentation.
7. **Deliver or Report**
   - Submit the completed task.
   - Share results with stakeholders.
   - Provide documentation or feedback.
8. **Reflect and Learn**
   - Evaluate what went well and what could improve.
   - Apply lessons to future tasks.

A PERSONAL DECISION – THERE IS NO TIME!

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Stress Tolerance
- High stress can cloud judgment or lead to impulsive choices.
- People with better stress management tend to stay focused and rational.

Experience and Expertise
- Past experiences help you recognize patterns and make faster, more informed decisions.
- Familiarity with similar situations reduces hesitation.

Cognitive Style
- Analytical thinkers may struggle with speed, while intuitive thinkers may thrive under pressure.
- Some people prefer data; others rely on gut feeling.

Confidence Level
- Self-assured individuals are more decisive.
- Low confidence can lead to second-guessing or decision paralysis.

A T T I T U D E

Risk Tolerance
- Risk-averse people may delay or avoid decisions.
- Risk-takers may act quickly but overlook consequences.

Emotional State
- Anxiety, anger, or excitement can distort perception and priorities.
- Calmness supports clearer thinking.

Values and Priorities
- Personal ethics, goals, or responsibilities shape what you consider a “good” decision.
- Urgency may force trade-offs between values and practicality.

Time Perception
- Some people feel more pressure than others under the same time constraints.
- This affects how quickly and confidently they act.

Decision-making and “THE REAL” REALITY

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Digital reality

Built by a computing machine with signals from:

- Data capture and input (Sensors and IoT, sometimes manual input)
- Modelling and simulation (3D modelling, physics engines and AI and machine learning)
- Rendering and Visualization (Graphics engines, lighting, textures, and shading and display devices: VR headsets, AR glasses, screens.
- Interaction Layer (enables users to interact with the digital world)
- Networking and Cloud Infrastructure
- Integration with Physical Systems (digital twins, continuous data flow.

Weaknesses?

- A lot of!

“The real” reality

In navigation, the most accurate representation of the environment is considered to be the one built by the human senses:

- Sight
- Hearing
- Touching
- Smelling
- Taste (not so often used in navigation)
- Proprioception

Can be altered by:

- Alcohol or drugs
- Placebo effect
- Previous experiences
- Cognitive biases
- Cultural background
- Emotional state
- Physical condition
- Media and information exposure, etc.

Decision-making and the new ideas

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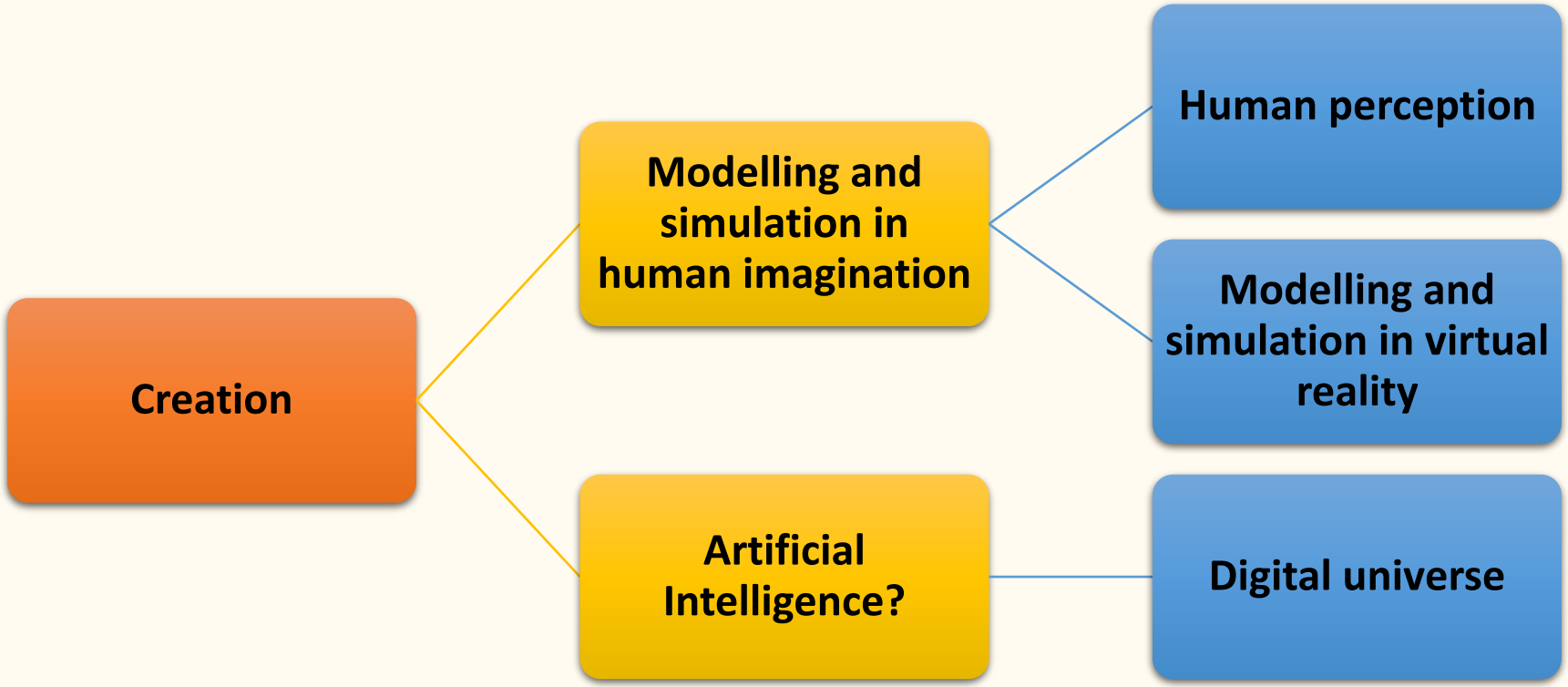

How to improve my decision-making?

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Choose, learn and practice one decision-making theory that suits your way of thinking

Create your attitude:
- Using cognitive and behavioural engineering)
- Using personal development techniques

Seek for help and work in team

Reduce habits that are slowing you down

DEVELOP YOUR COMMON SENSE

Know yourself and your way of thinking:
- use Introspection
- Keep a diary
- Know your inner values

Keep permanent contact with the "true" reality

Strengthen your useful abilities

Create you own intuition by acquiring experience

How to improve the decision-making?

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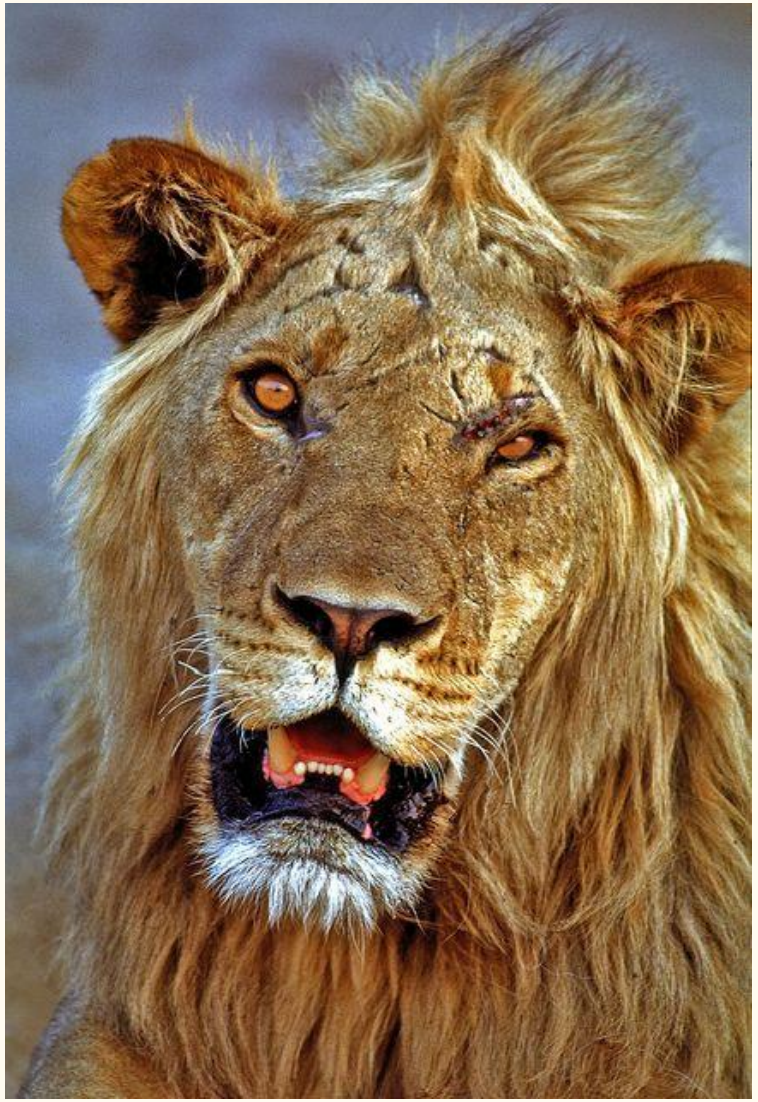
I wish you to make only small mistakes that you can easily fix and that you can learn from them. This way you will gain experience, and you will not make big and catastrophic errors.

THANK YOU FOR ATTENTION!



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