Challenges, Potentials and Perspectives of Information Management in Ship Management

Tanker Operator Conference, Hamburg, 17.09.2013

Ole John, Fraunhofer CML

SHIP&INFORMATION MANAGEMENT

Fraunhofer CML

Agenda

1. Introduction
2. Challenges
3. Potentials and Perspectives

Fraunhofer CML

Agenda

1 Introduction

2 Challenges

3 Potentials and Perspectives

Fraunhofer CML

Fraunhofer-Gesellschaft

- Largest organization for applied research in Europe
- Contract research for direct benefit of business and in the interest of the society
  - 2/3 of research revenue is derived from contracts with industry and from publicly financed research
  - 1/3 is contributed by German federal and state governments in the form of institutional funding
- 80+ research institutions
- 22 000 employees
- 1,9 billion Euro (2012) research budget

Fraunhofer
CML

Fraunhofer Center for Maritime Logistics and Services

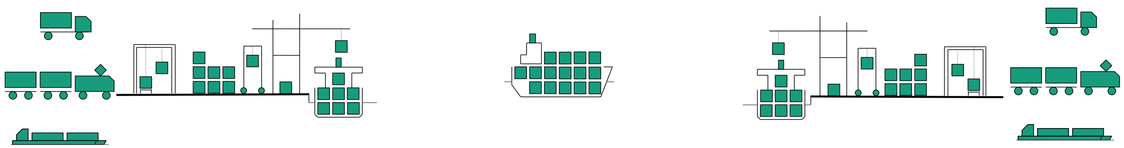
Logistics innovations within the maritime industry

Challenges

Productivity	Ecology	Safety & Security

Field of research

Maritime logistics chain				
Hinterland	Port & Terminal	Vessel	Port & Terminal	Hinterland



← Pre carriage → ← carriage → ← On carriage →

Material flow	Information flow	Services	Systems and Technologies

Research topics

Processes

Process design and control
- Coordination
- Synchronization
- Information Techn.

Planning

System planning and optimization
- Tools
- Integration
- Participation

Forecasts

Forecasting and market research
- Technologies
- Markets
- Strategies

Fraunhofer CML

Decision making requires information

"Shipping is complex business. Scheduling, network operations, intermodal transit, equipment availability, customs, ancient maritime laws, labyrinthine documentation, hurricanes, earthquakes, piracy, war, fluctuating oil prices, insurance premiums, canal tolls…"

Eivind Kolding, Maersk Line CEO

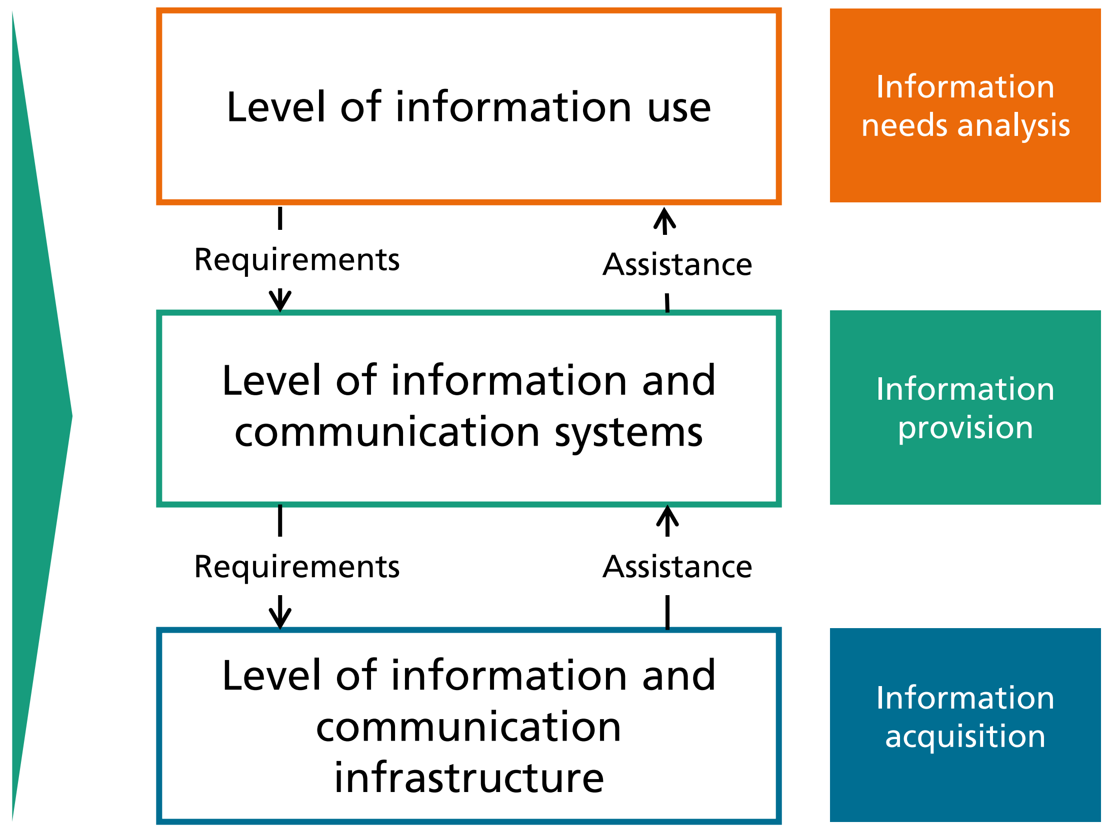
Maersk's Need for Change Manifesto, June 2011

Fraunhofer CML

The underlying challenge of decision making is the acquisition of information

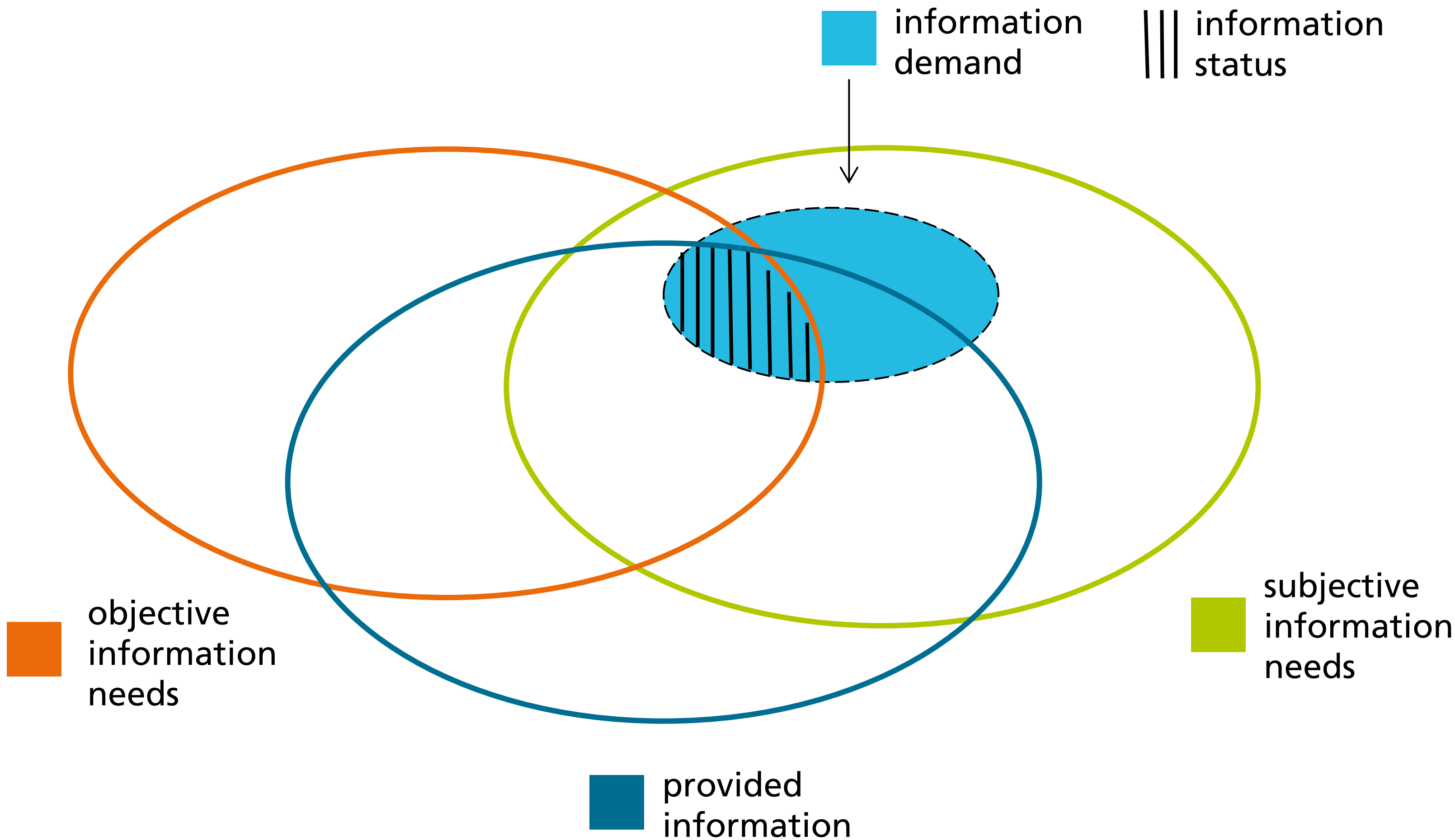
Information management

"Information management is the economic *planning*, *purchasing*, *converting*, *distribution* and *allocation* of information as resource for *preparation* and *support* of decisions as well as the design of the necessary *framework requirements* (Voß 2011)."



Fraunhofer CML

The alignment of information needs and provided information is already challenging for one sub-area in ship management



Agenda

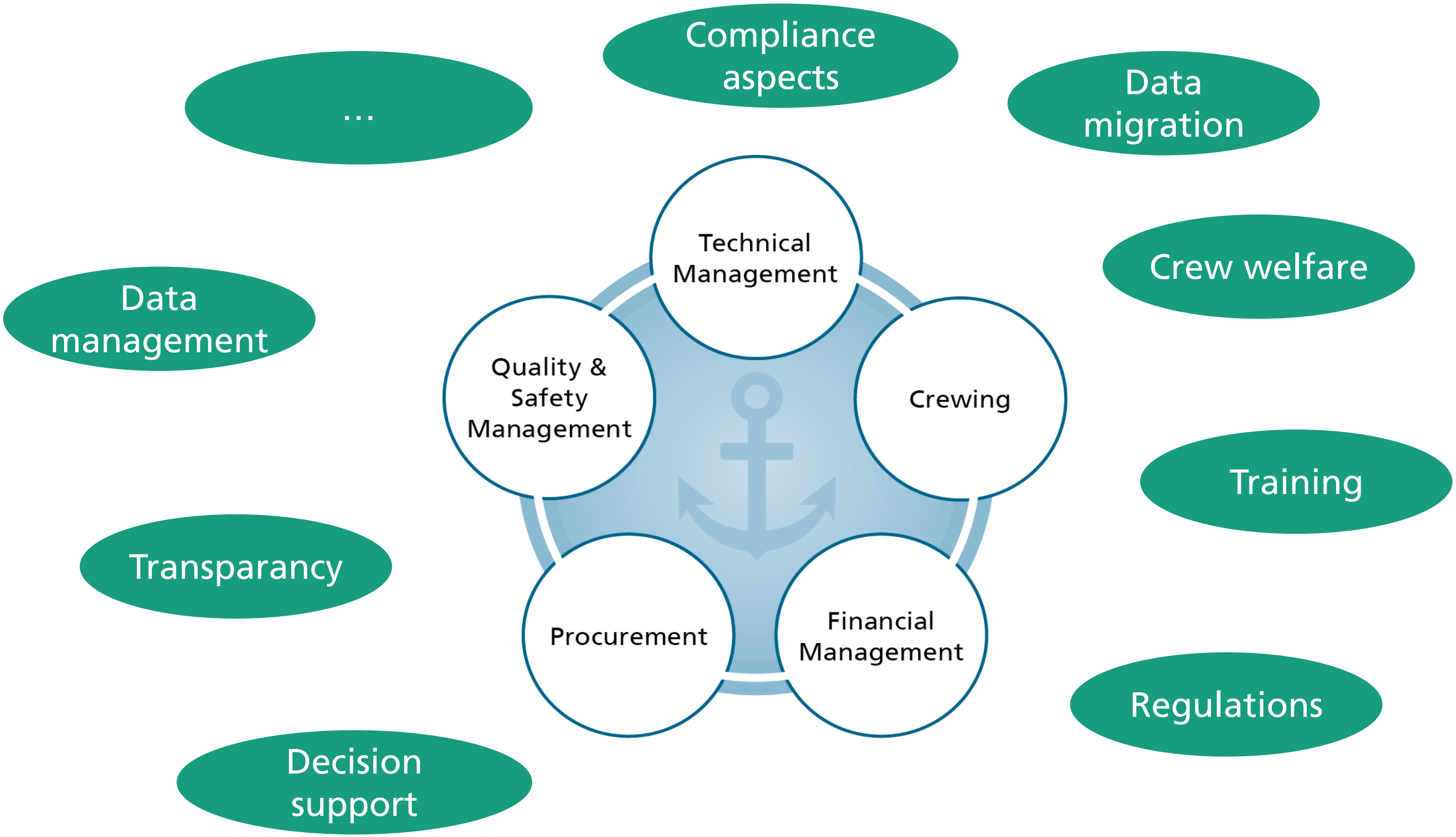
1 Einführung

2 Challenges

3 Potentials and Perspectives

Fraunhofer CML

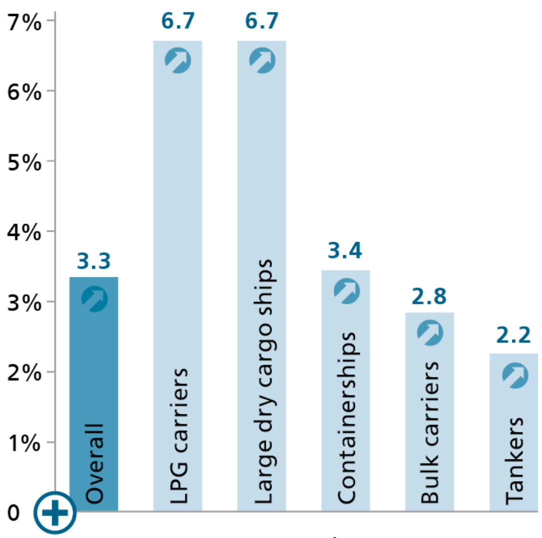
Challenge 1: Diversity of Tasks



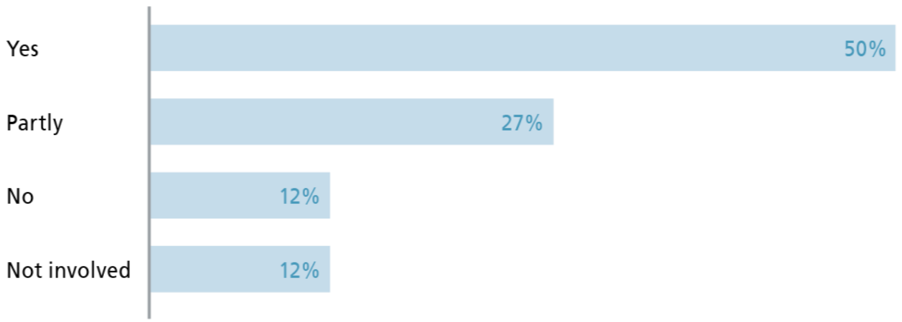
Challenge 2: Market challenges

Market pressure increases the willingness to embrace change

Increase of total shipping operating costs (%)



Are you actively changing your organizational processes or approaches to master the current market?



Drewry, Ship Operating Costs 2010-2011

Study Best Practice Ship Management 2013

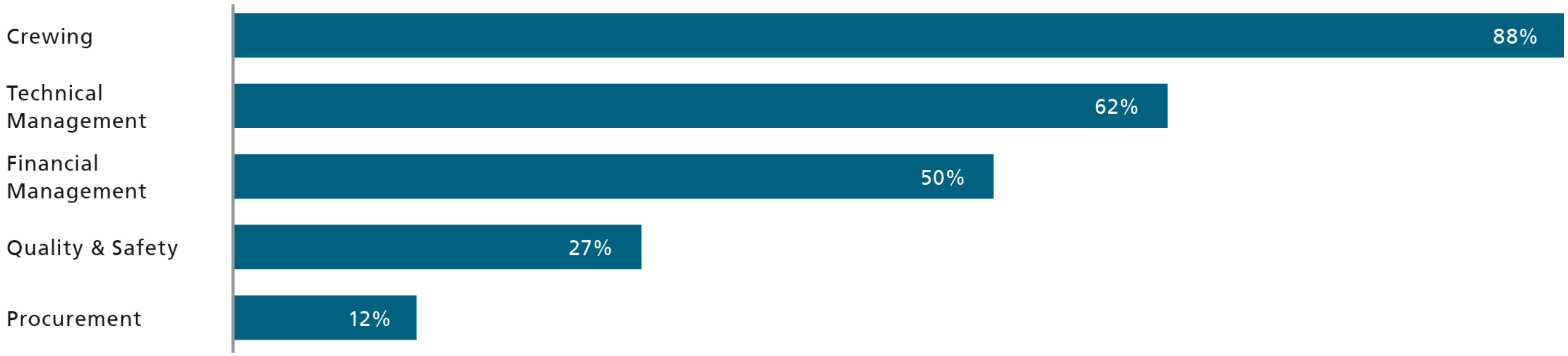
Fraunhofer CML

Study – Best Practice Ship Management 2013 (BSPM 2013)

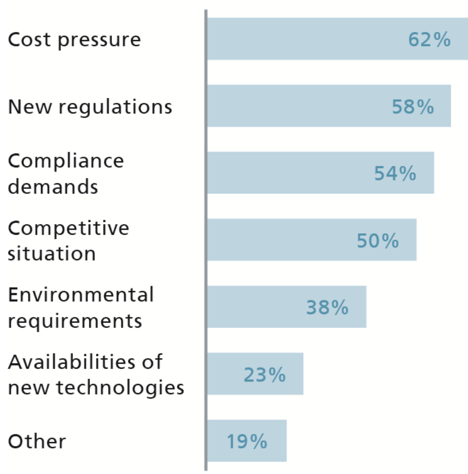
- Objectives:
  - Gather best practices in the different areas of ship management: (1) Crewing, (2) Technical Management, (3) Financial Management, (4) Quality & Safety Management, (5) Procurement.
- Tasks:
  - Analysis of status quo by interviewing decision makers on a global scale
  - Interviews have been backed up by the expertise of GL and CML
- Outcome:
  - Best practice ideas and best practice examples of ship managers worldwide.

BPSM 2013 – Main Challenges and Reasons

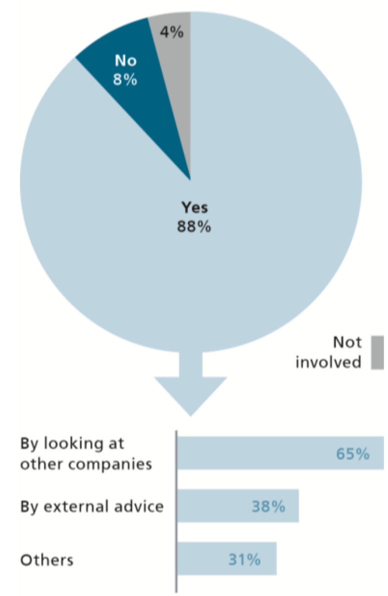
Main Challenges



Reasons

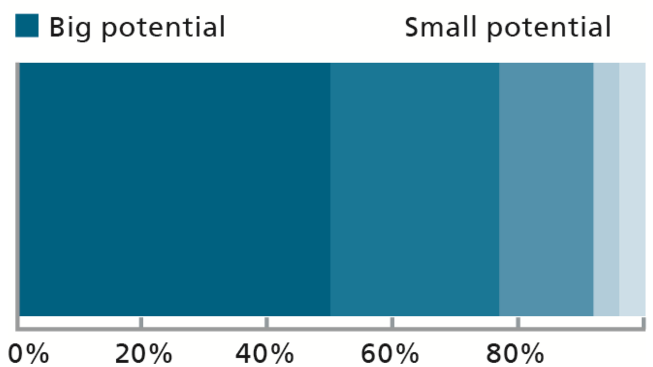


Examples

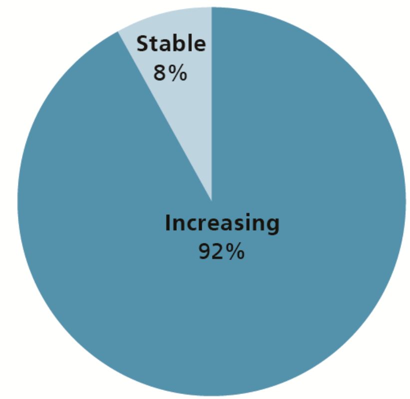


BPSM 2013 - Expectations regarding the role of ICT in implementing best practice

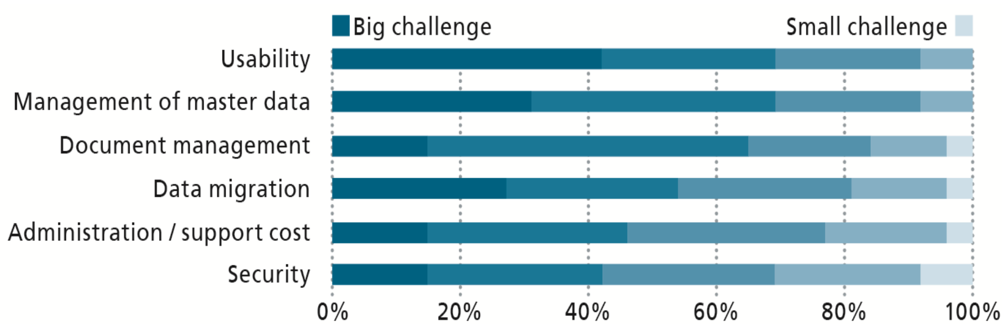
Role of ICT today



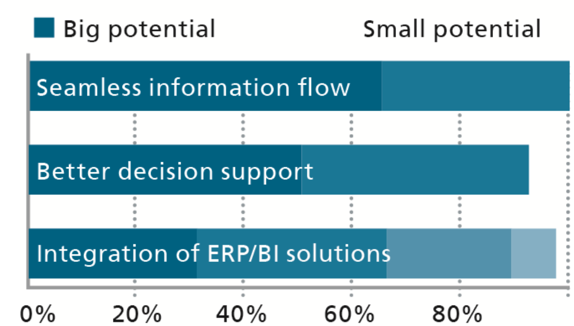
Role of ICT in future



Main Challenges



Main Opportunities

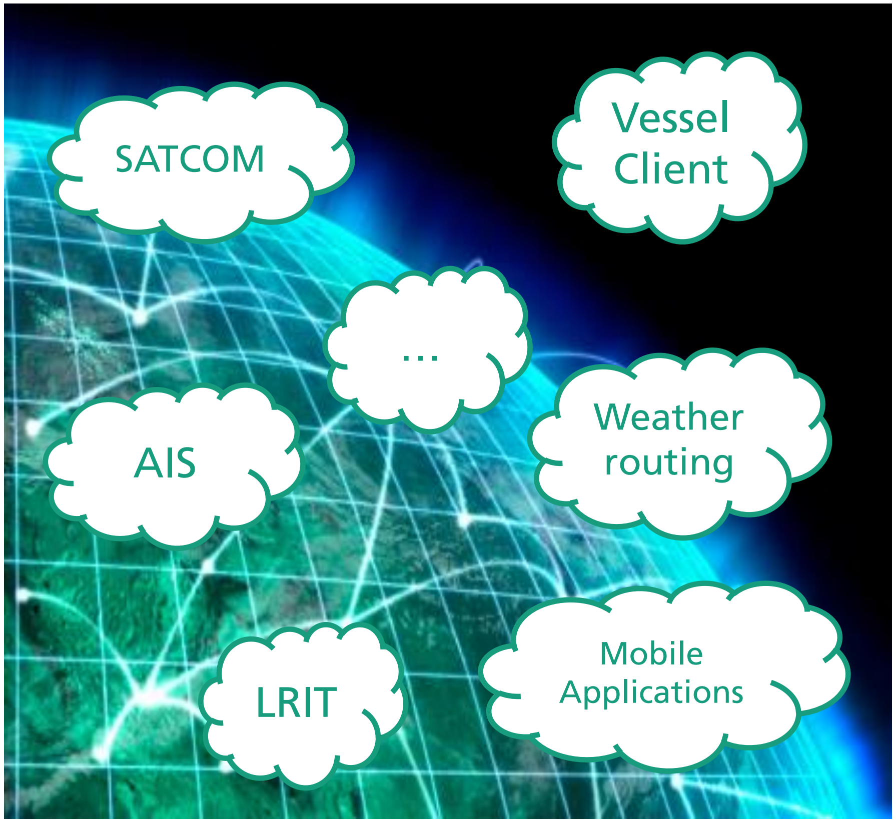


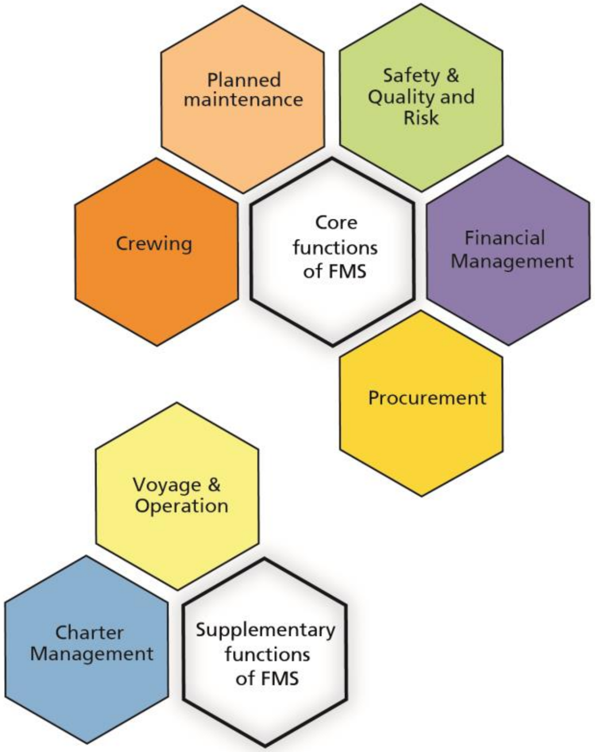
Fraunhofer CML

Challenge 3: Variety of systems

Rapidly growing number of media and types of information systems

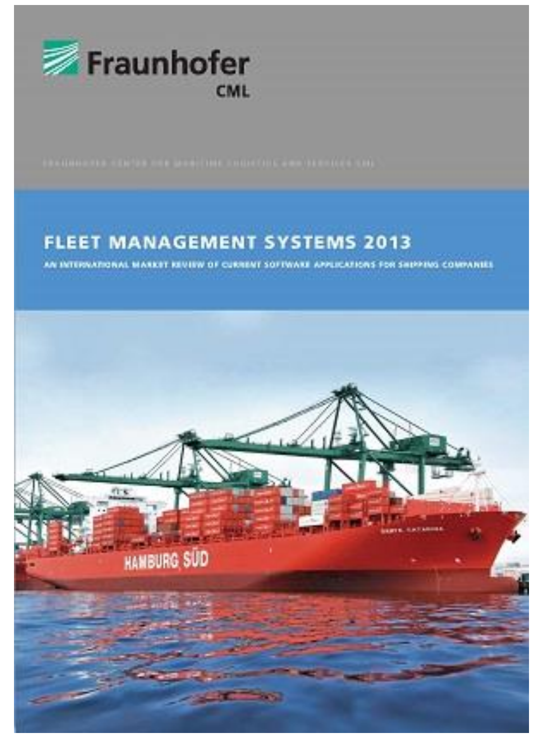
Core Modules of Fleet Management Systems





Study - Fleet management systems 2013

- Objectives:
  - Provide an overview about fleet management systems and their functions
- Tasks:
  - Enhance transparency and collect information about producers, systems and their functions
  - Identification of software systems and modules
- Outcome:
  - Extensive product overview
  - Market trends



ISBN 978-3-8396-0533-2

Agenda

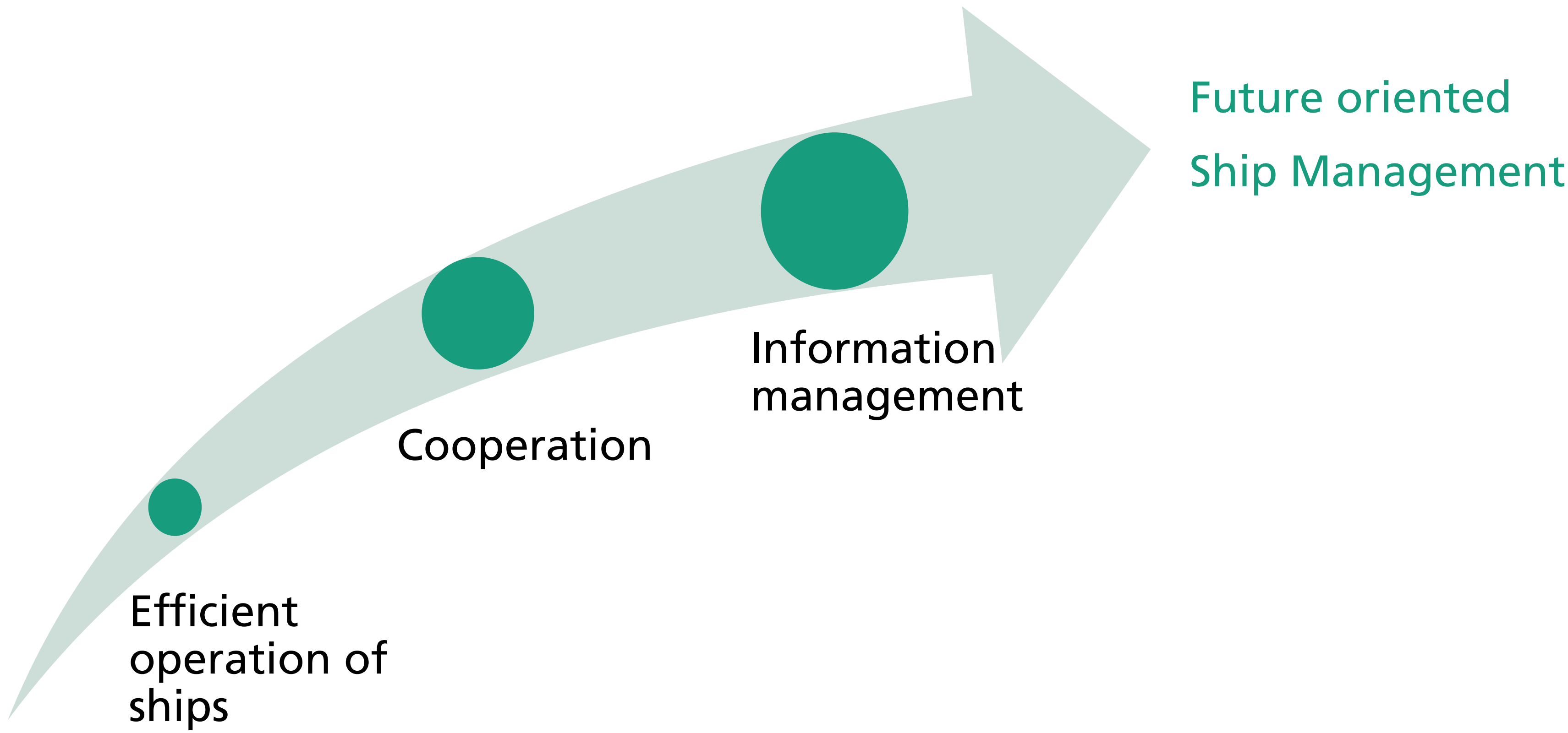
1 Introduction

2 Challenges

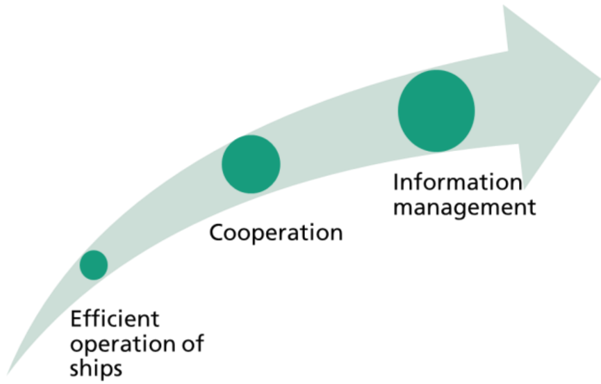
3 **Potentials and Perspectives**

Fraunhofer CML

Potentials and Perspectives



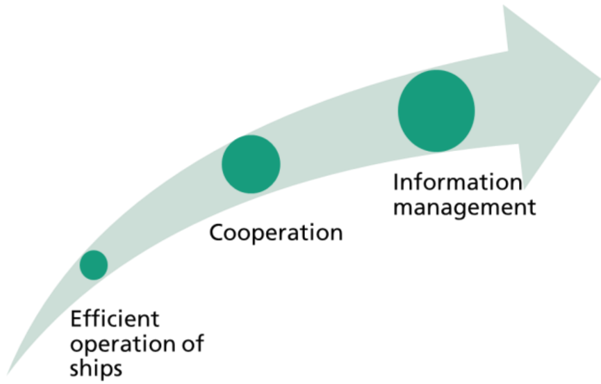
Potential 1: Efficient operation of ships

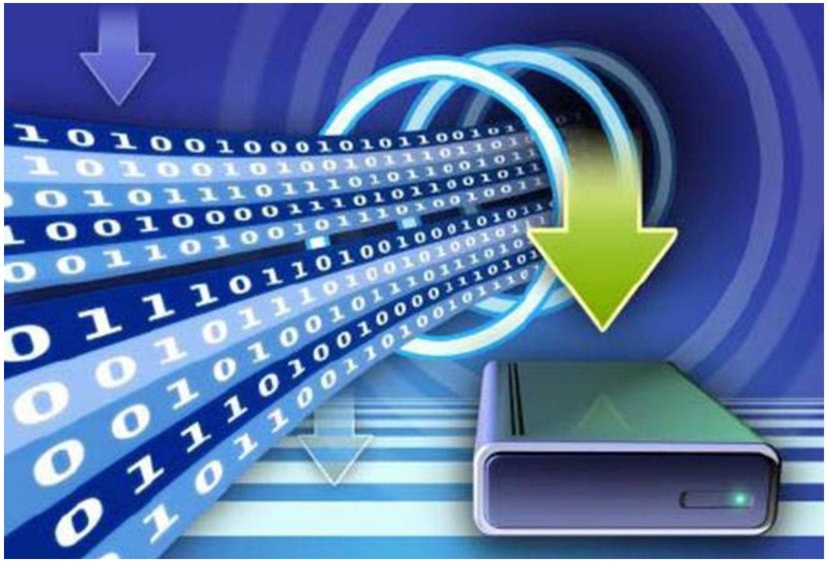


- Procedural:
  Condition Based Monitoring (CBM)
  Lifecycle Management (LCM)
- Operativ:
  Slow Steaming
  Weather Routing
- Technical:
  Ship Design

Fraunhofer CML

Potential 2: Cooperation

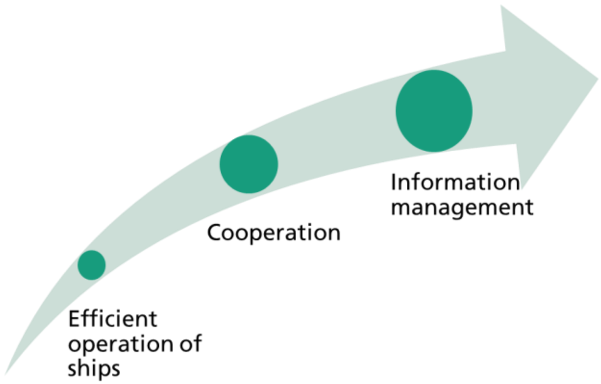




- E-Commerce (E-Marketplace)
- Standards (Data Formats)
- Single Window

Fraunhofer CML

Potential 3: Information management



- Use of various information systems
- Control of global information tide
- Using of relevant information for decision support

Decision support through relevant Information

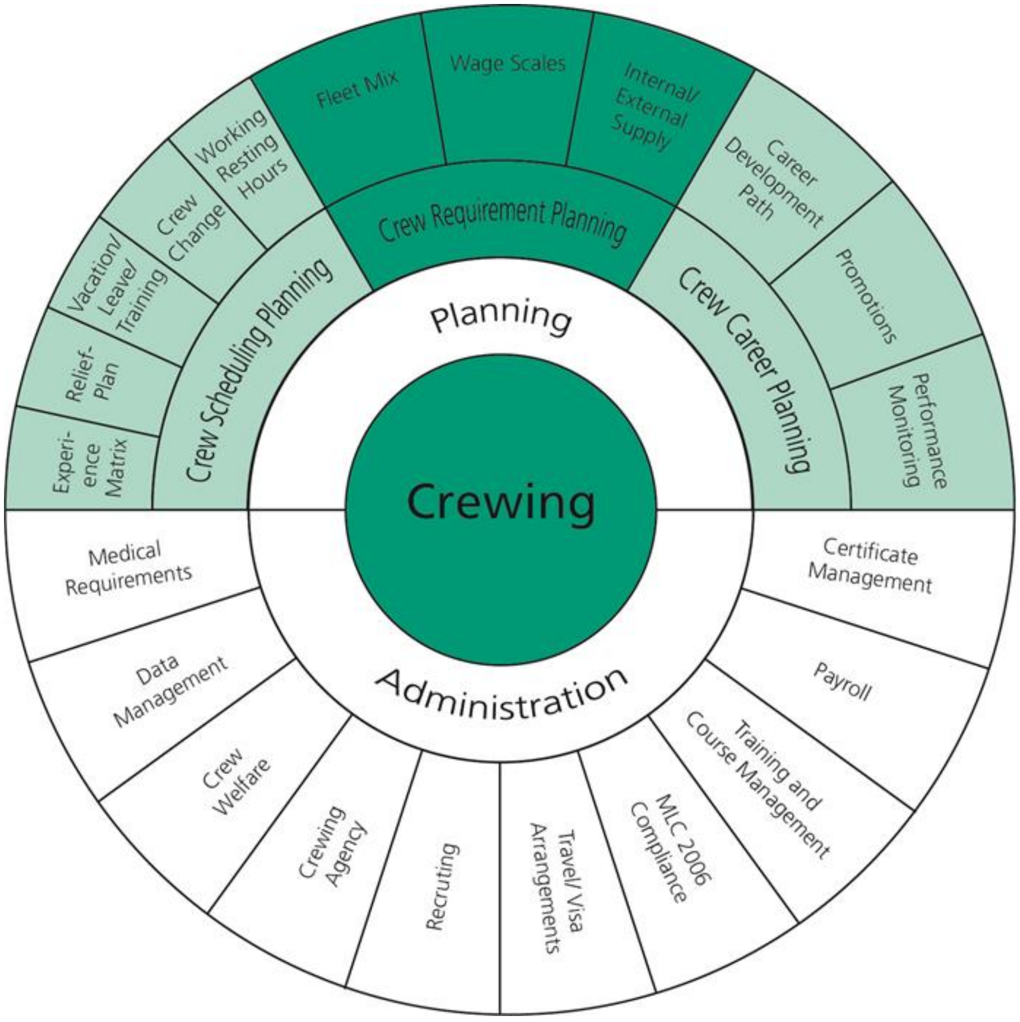
1. **Reactive Preparation**

- Target-oriented records
- Meaningful analyses of past data

2. **Active support**

- Supply of planning functions and
- Prediction modells

Decision support: (1) crew requirement planning



Fraunhofer CML

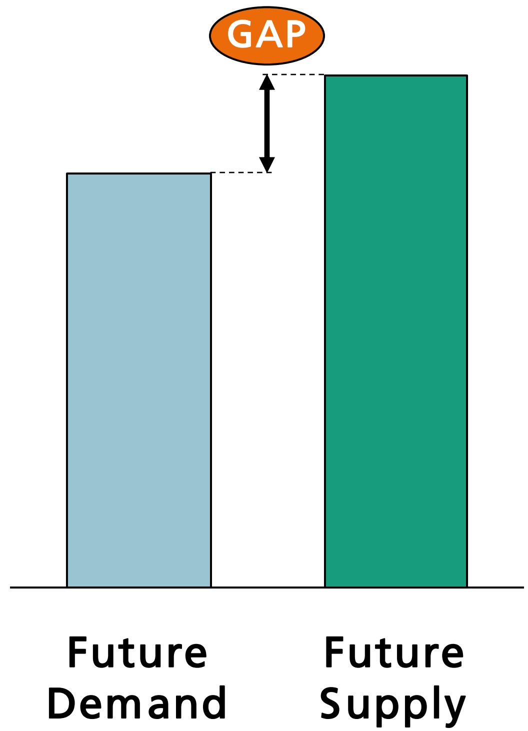
Major goal of crew requirement planning is to align crew demand generated by the (future) fleet with crew supply

DEMAND

How many seafarers needed to fulfill safe operations 24h / 365d?

<u>depends on</u>

- number of ships
- ship classes / ship types
- safe manning certificates
- leave time allowances
- sick leave
- process / planning inefficiencies
- …



(e.g. measured in FTE for a full year in two years from today)

SUPPLY

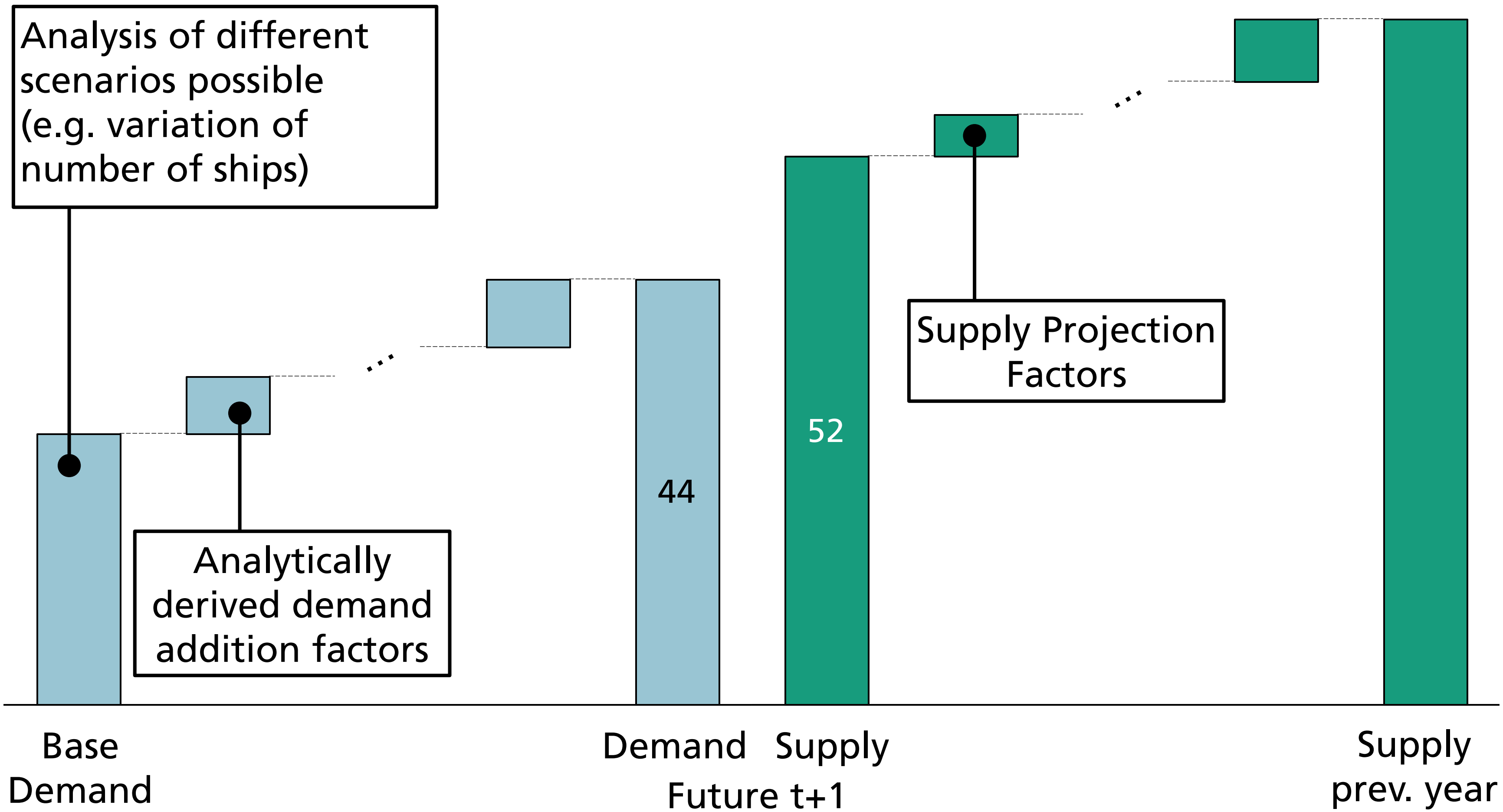
How many seafarers will be available on the company roster?

<u>depends on</u>

- current seafarer base
- promotions
- fluctuations
- …

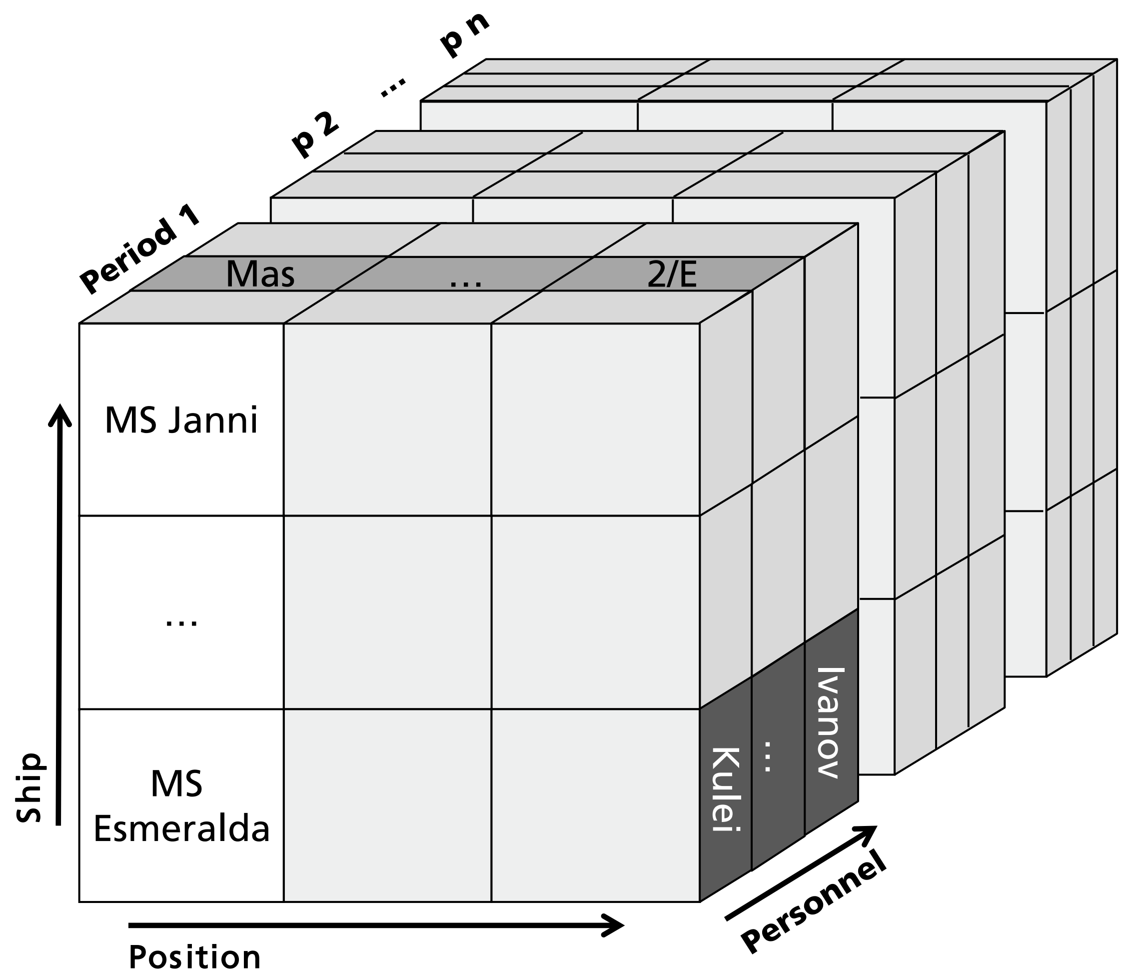
CMLs analytical approach based on demand analysis and supply projection

EXAMPLE: Master, Eastern-European Tariff, Tanker, Class XY



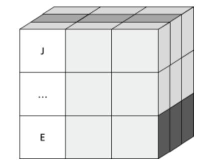
Fraunhofer CML

Crew Requirement Planning Cube used to allow analysis and planning on any granularity level

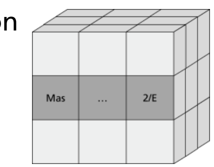


Hierarchic Aggregationlevels

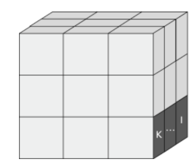
Dimension Ship
- Ship
- Ship Class
- Ship Typ
- Ship Management Pool



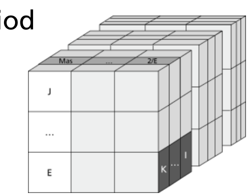
Dimension Position
- Position



Dimension Person
- Nationality/ Wage Scale
- Permanent/ Non permanent contract
- Rank
- Ship Class



Dimension Period
- Days
- Months
- Quarter
- Year



John; Gailus 2013: Model for a specific decision support system for crew requirement planning in ship management

Fraunhofer CML

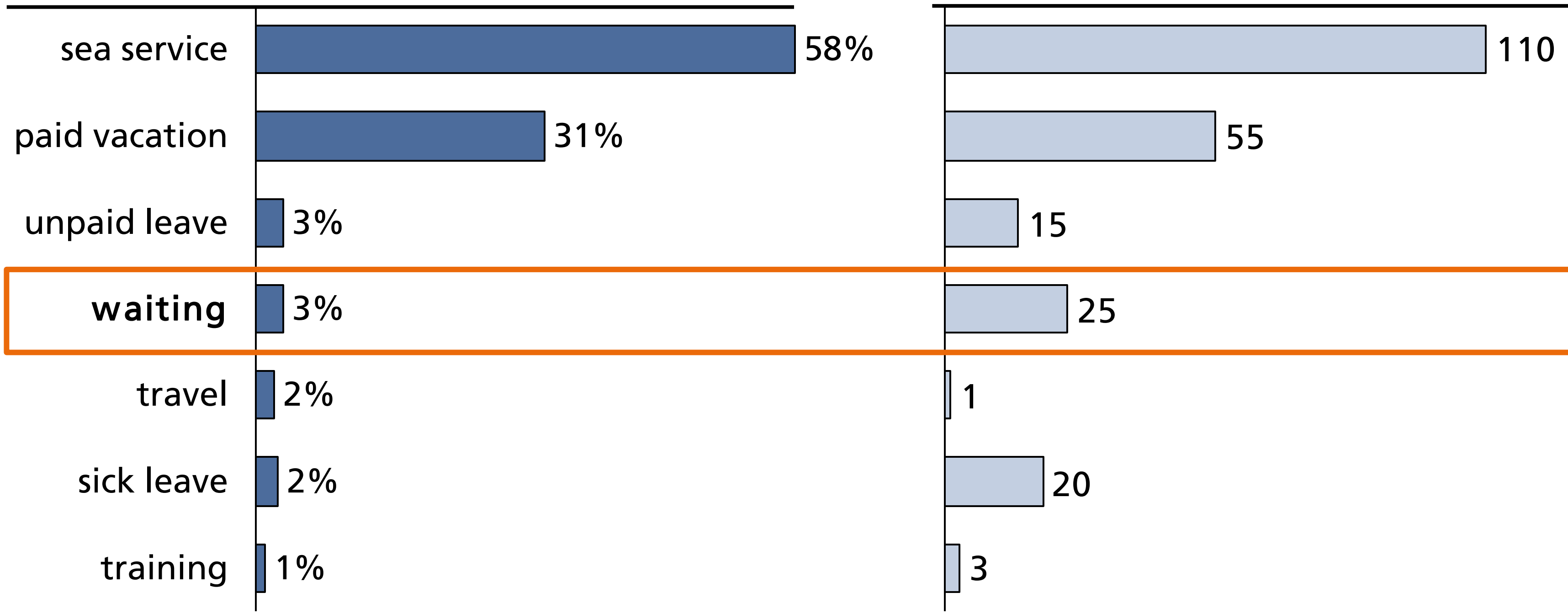
Analytical approach can diclose efficiency potentials already in the analysis phase

DISGUISED EXAMPLE

Activity Analysis of existing seafarers

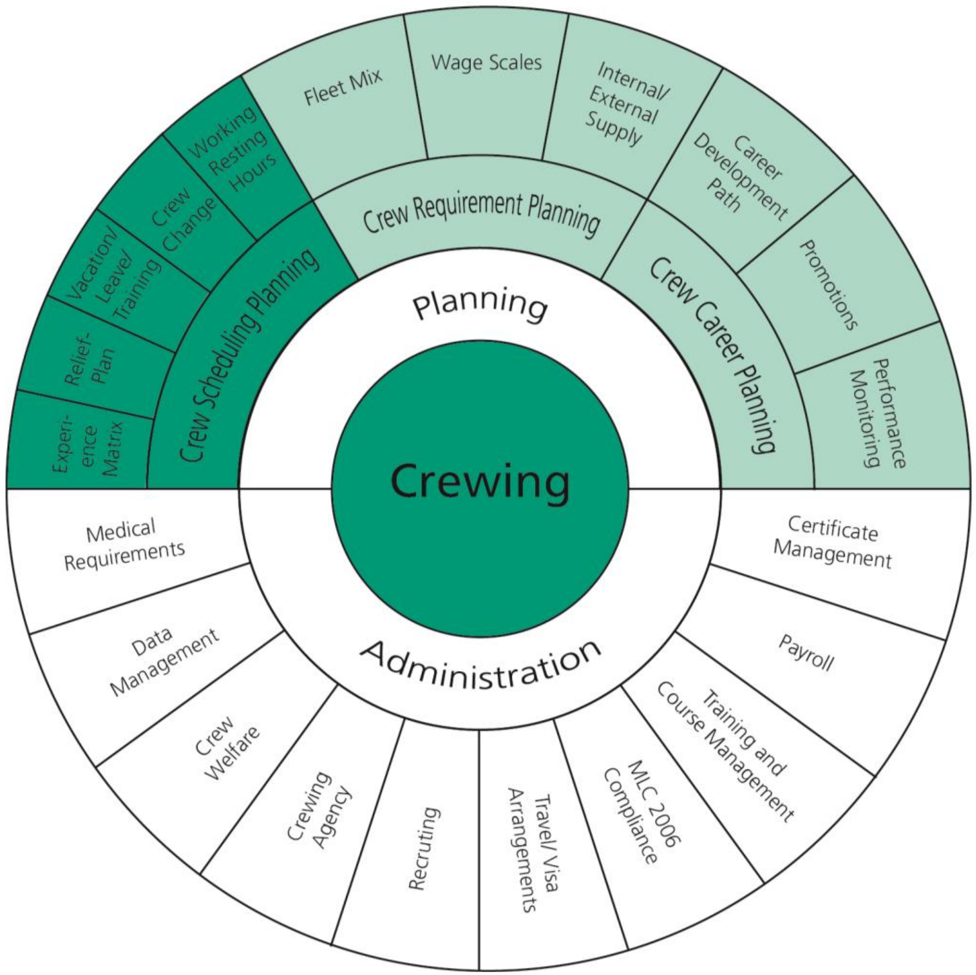
Share of time spent with activity [%]

average duration per activity [days]



- Process inefficiencies could be dicovered through data analysis
- Decomposing activities allows for benchmarking (int./ext.) to quantify potential

Decision support: (2) crew scheduling planning



Fraunhofer CML

Project EIS – Excellence Initiative Ship Management

- Goal: Development of an industry solution for ship management
- Funding: EFRE (EU, Hamburg)
- Period: 2/2012 – 8/2014 (30 Monate)

GL
Portal Systems
akquinet
humance
Fraunhofer CML
SITA
orange
evidanza Business Information Solutions
MARDYNAMICS

Reference Client

COLUMBIA SHIPMANAGEMENT (Deutschland) GmbH

Associated partner

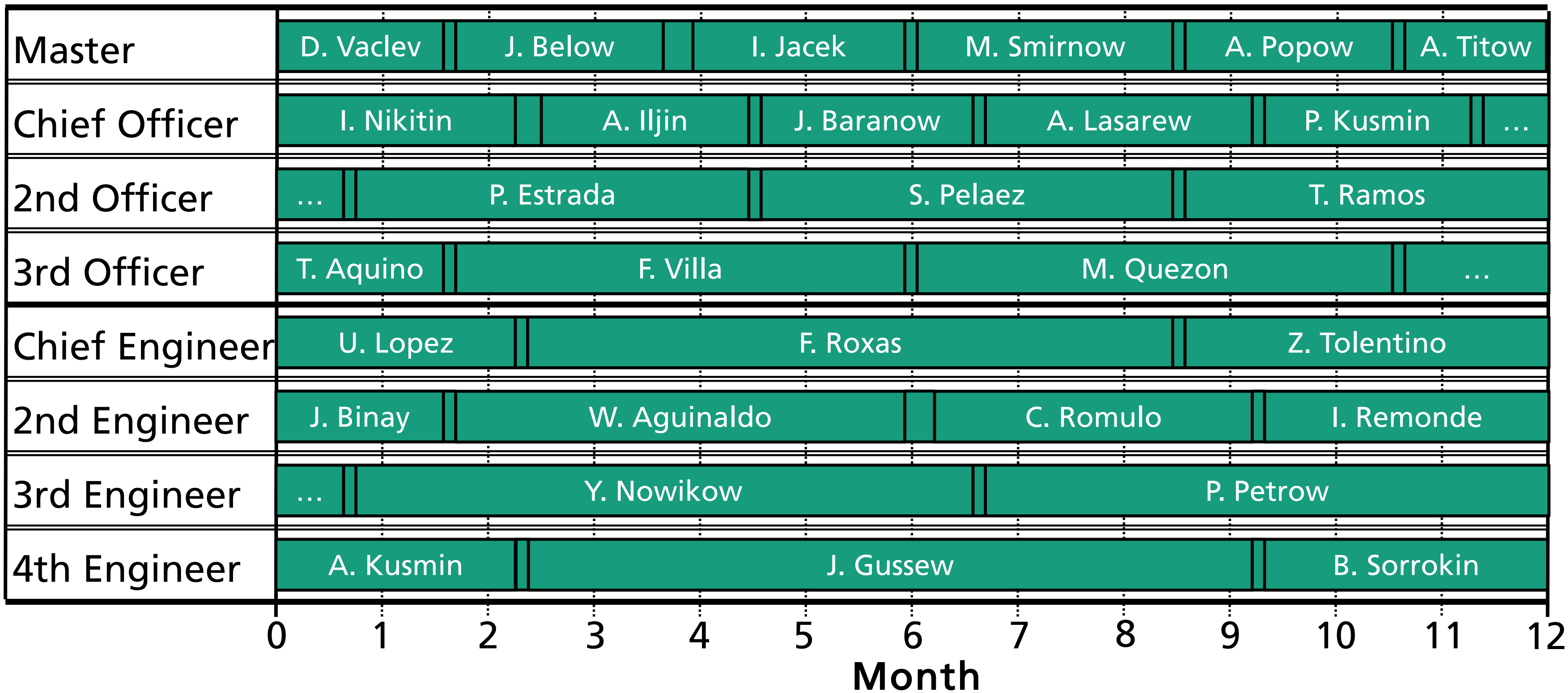
Logistik-Initiative Hamburg
maritimes cluster norddeutschland
VDR
AIDA
The Ahrenkiel Group
HARTMANN REEDEREI SETTING THE RIGHT COURSE
F. LAEISZ

Fraunhofer CML

Output of crew scheduling in ship management

→ For every position on every ship: Assignment of seafarers for a specific time period

Example: Cap Roberta



Challenges of crew scheduling in ship management

- **Various requirements**
- **Large problem sizes**

  → Large ship managers have hundreds of ships and thousands of seafarers
- **Long term planning**

  → It is done mostly for short term
- **Less reliability of seafarers**
- **Feasibility check to manage new ships**

  → It is done mostly through a rough estimation

Fraunhofer CML

Sequential approach

1 Construct the contract periods on the ships
(*contract period construction problem*)

↓ Input for

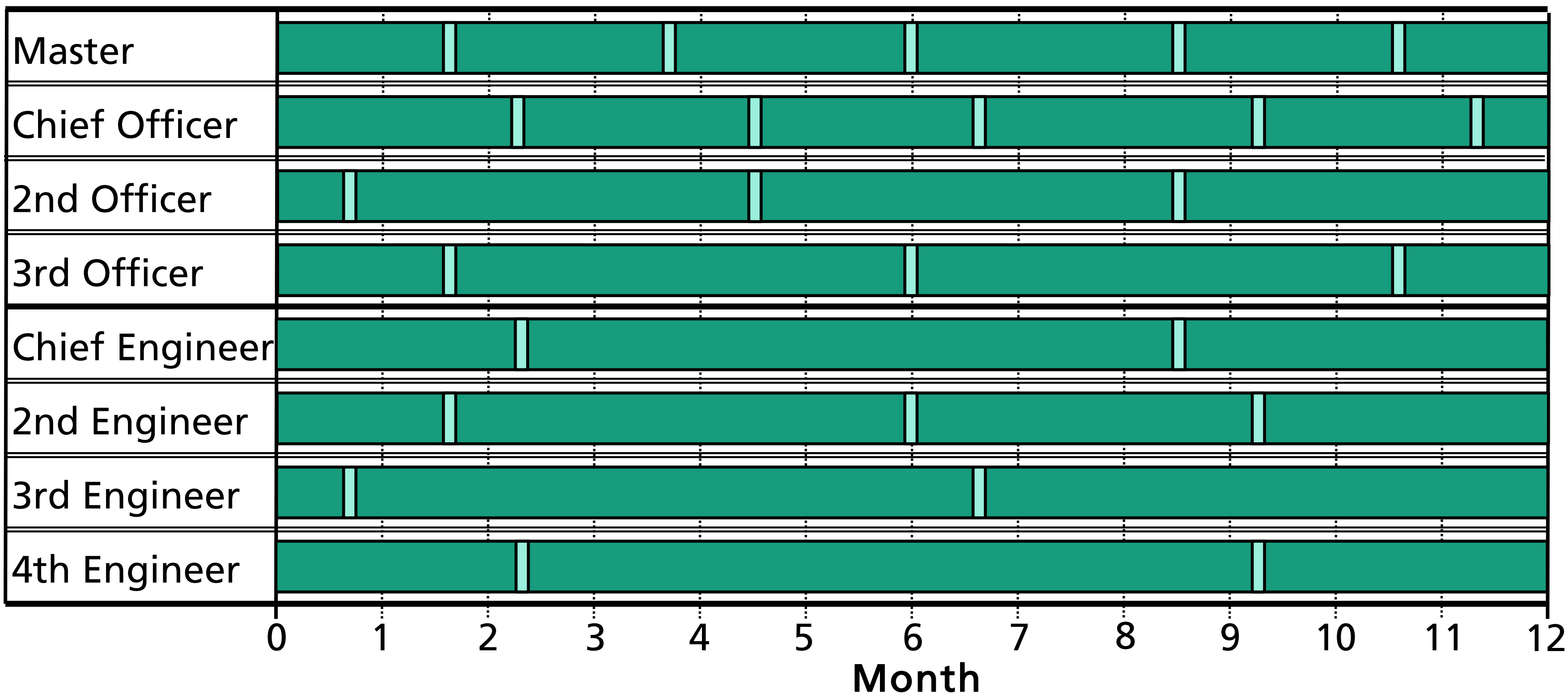
2 Assignment of the seafarers to the constructed contract periods
(*crew assignment problem*)

Fraunhofer CML

Sequential Approach – Contract Period Construction

1 *contract period construction*

2 *crew assignment*

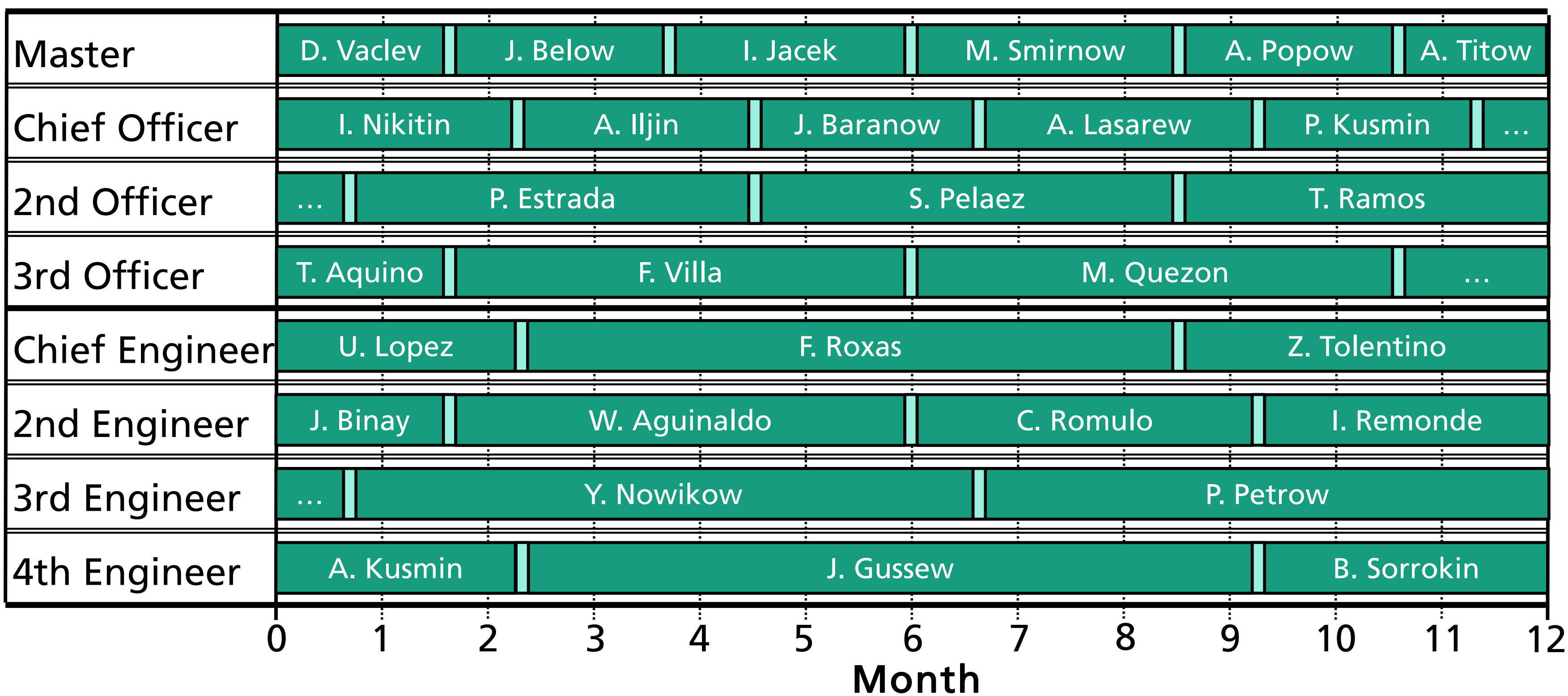


Fraunhofer CML

Sequential Approach – Crew assignment

1 *contract period construction*

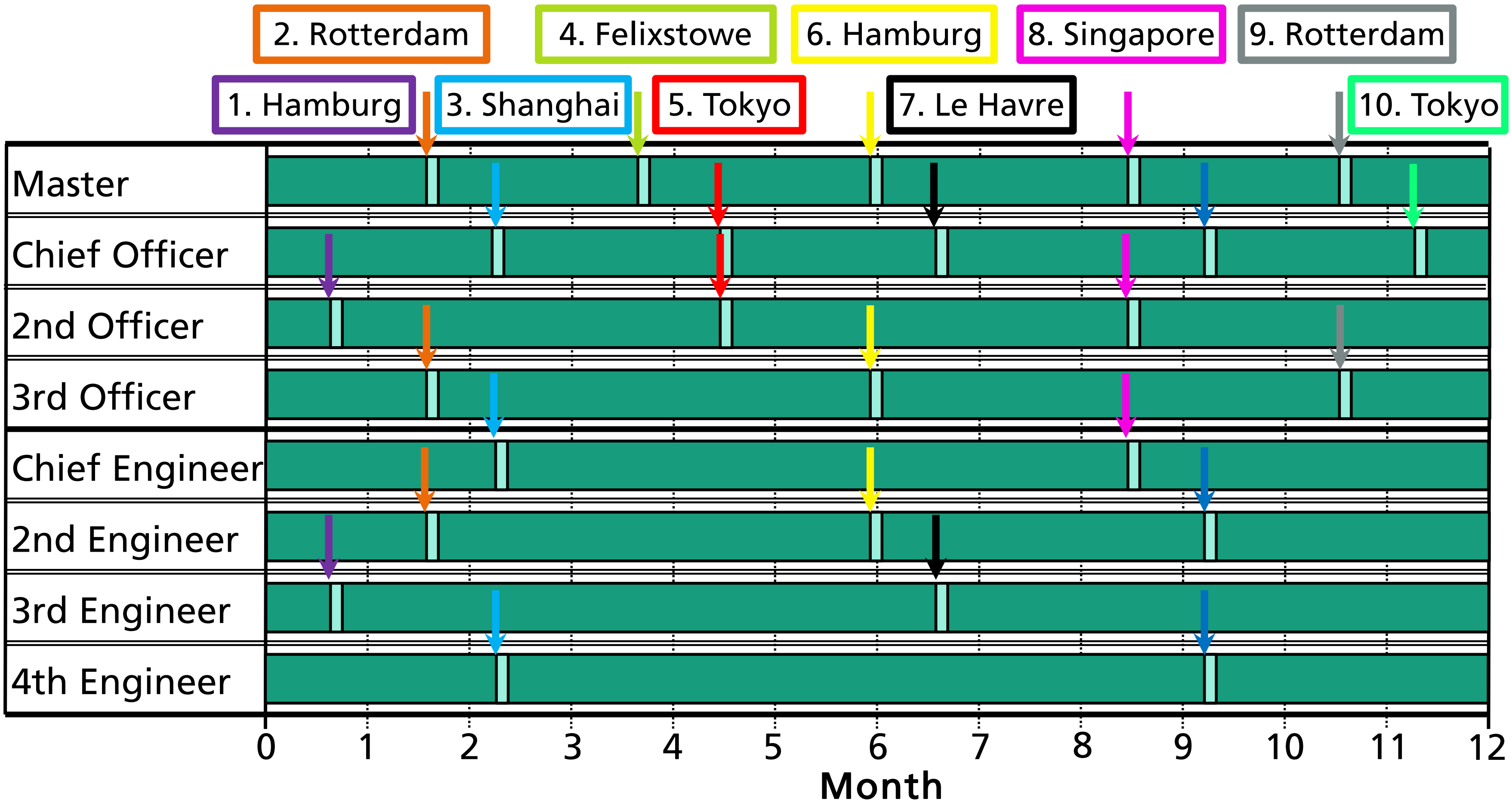
2 *crew assignment*



Fraunhofer CML

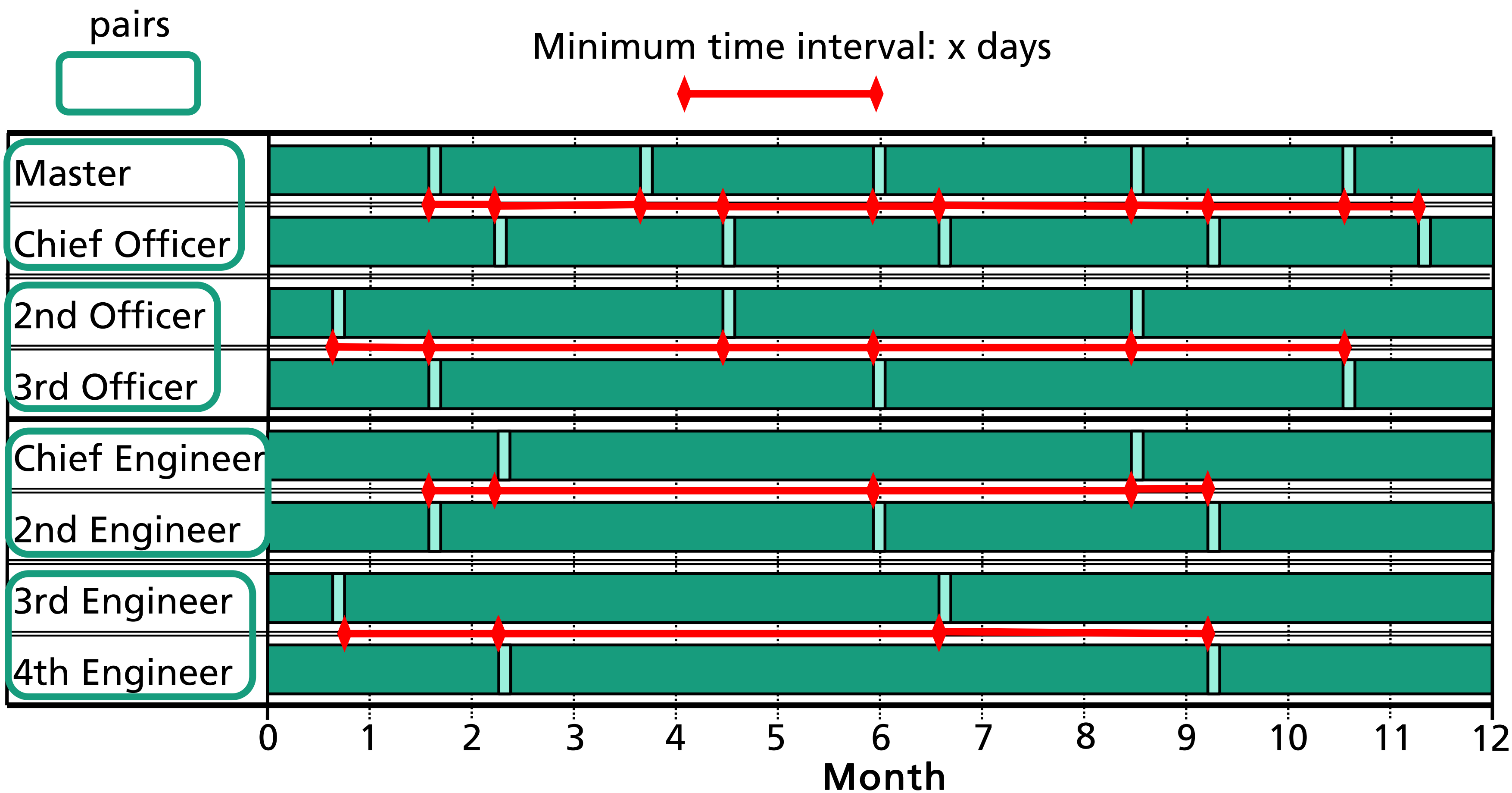
Contract Period Construction Problem - Constraints

Constraint 1: A Crew Change can only be conducted in a port



Contract Period Construction Problem - Constraints

Constraint 2: Minimum time interval between some crew changes

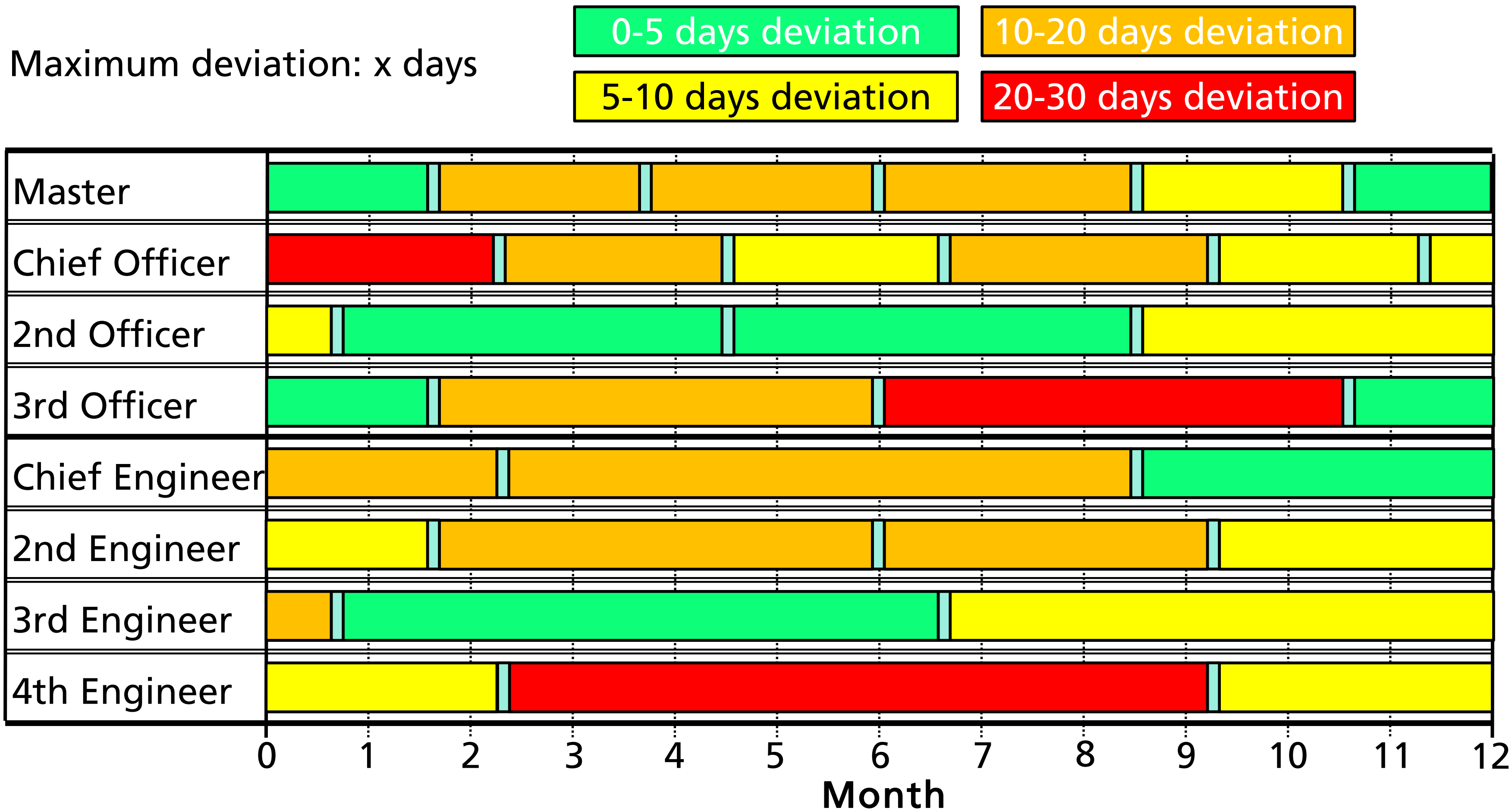


Fraunhofer CML

Contract Period Construction Problem - Constraints

Constraint 3: Maximum deviation from a fixed contract duration

Maximum deviation: x days



Contract Period Construction Problem

Further possible constraints:

- The number of position changes in the same port has to be less than a maximum value.
- The number of crew changes for one ship has to be less than a maximum value.

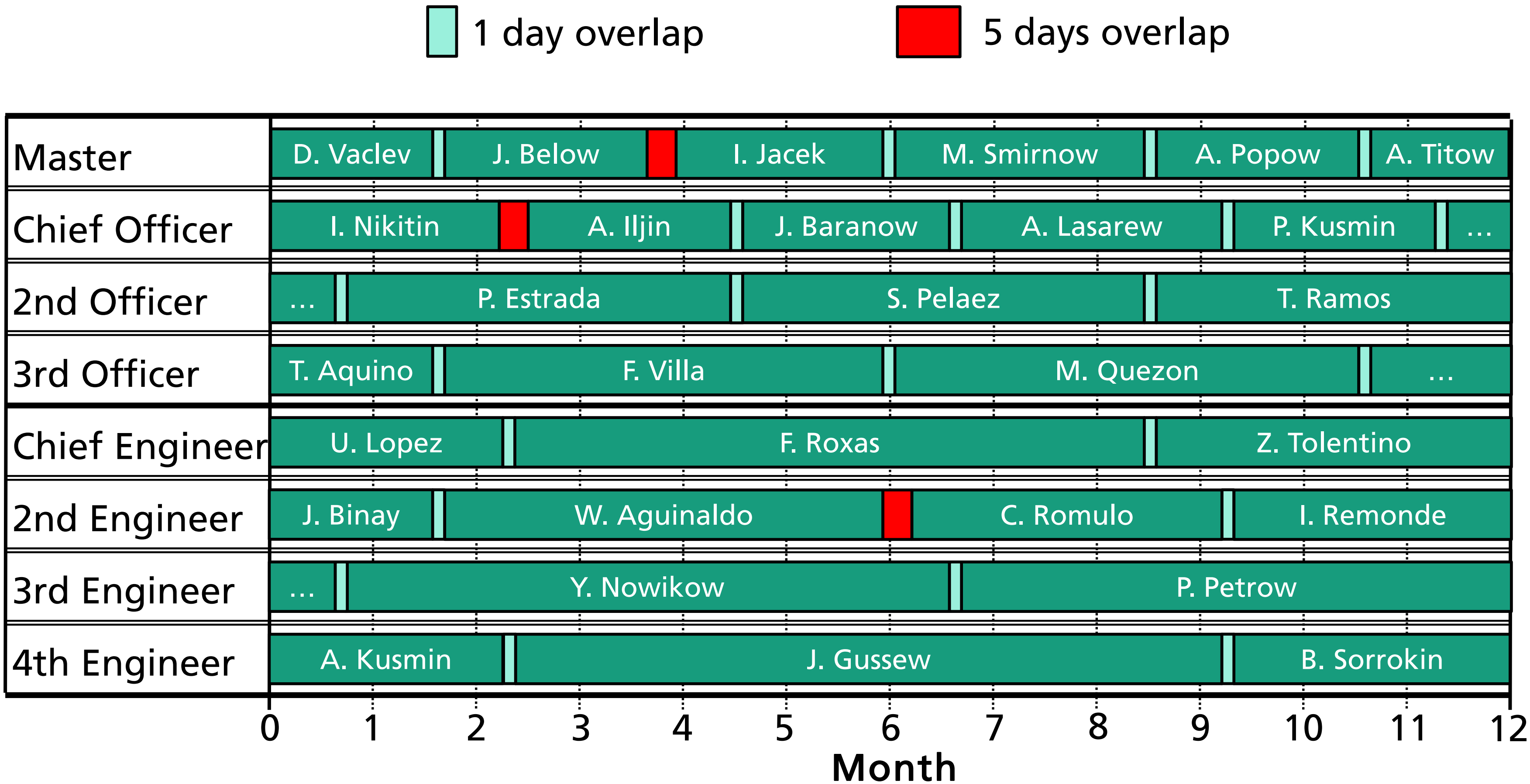
Possible objective values:

- Minimize the number of crew changes (crew change fix costs)
- Minimize the deviation from the fixed contract durations

Fraunhofer
CML

Crew assignment - Constraints

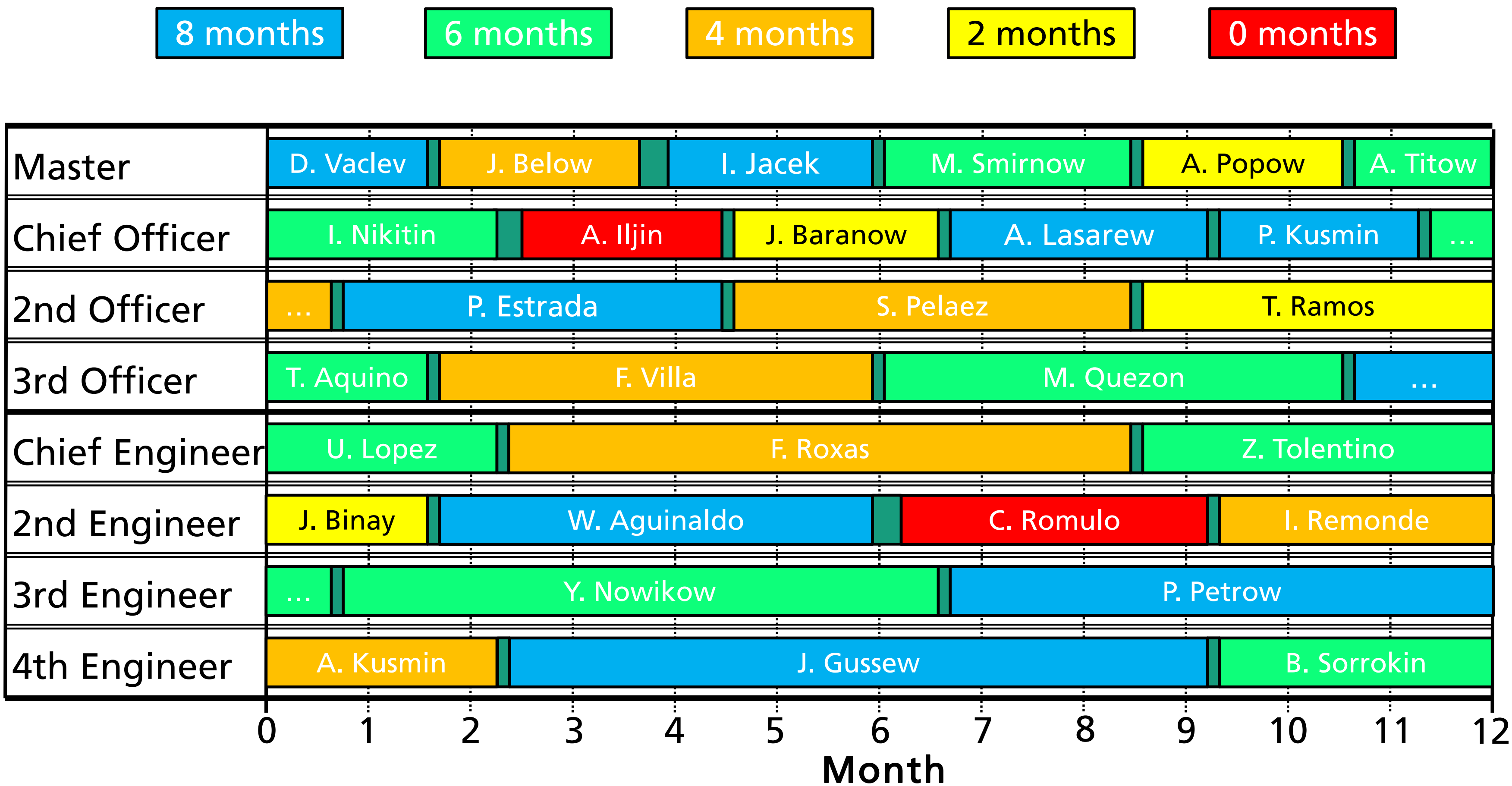
Constraint 1: Extended overlap for new seafarers in rank or in the company



Fraunhofer CML

Crew assignment - Constraints

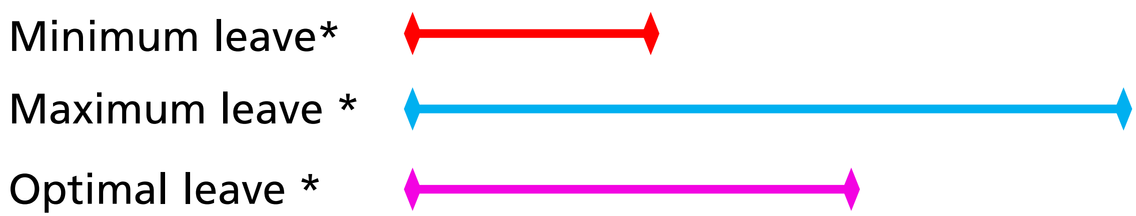
Constraint 2: Minimum experience times for specific rank combinations

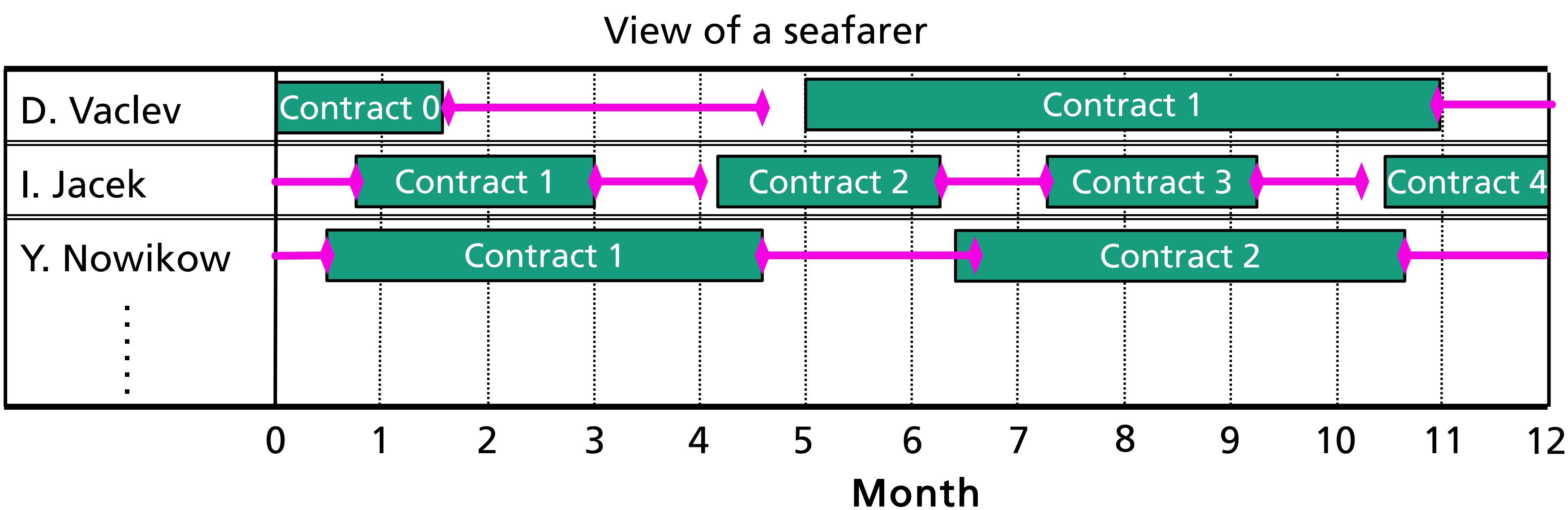


Fraunhofer
CML

Crew assignment - Constraints

Constraint 3: Consideration of minimum and maximum leave times





* depends on the contract duration

Fraunhofer CML

Crew Assignment Problem

Further possible constraints:

- Every seafarer could be assigned only to a specific ship type (container, bulker …)
- Earliest contract start dates of the seafarer have to be considered
- Preferred assignment of permanently employed seafarers

Possible objective values:

- Minimize the deviation of seafarer experience times among the ships
- Minimize the deviation of real leave times from optimal leave times

Benefits of mathematical optimization for crew scheduling

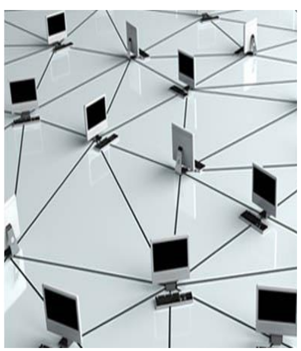
- Optimized crew scheduling for the whole fleet of ships
- Possibility to create a reliable long term plan (e.g. one year)
- Increase the reliability of the seafarers through a reliable crew schedule and vice versa
- Possibility to conduct strategic capacity planning

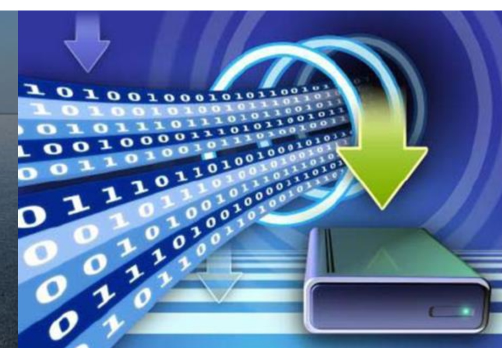
Fraunhofer
CML

Perspectives

"The future is already here - it's just not very evenly distributed."

William Gibson, 1993

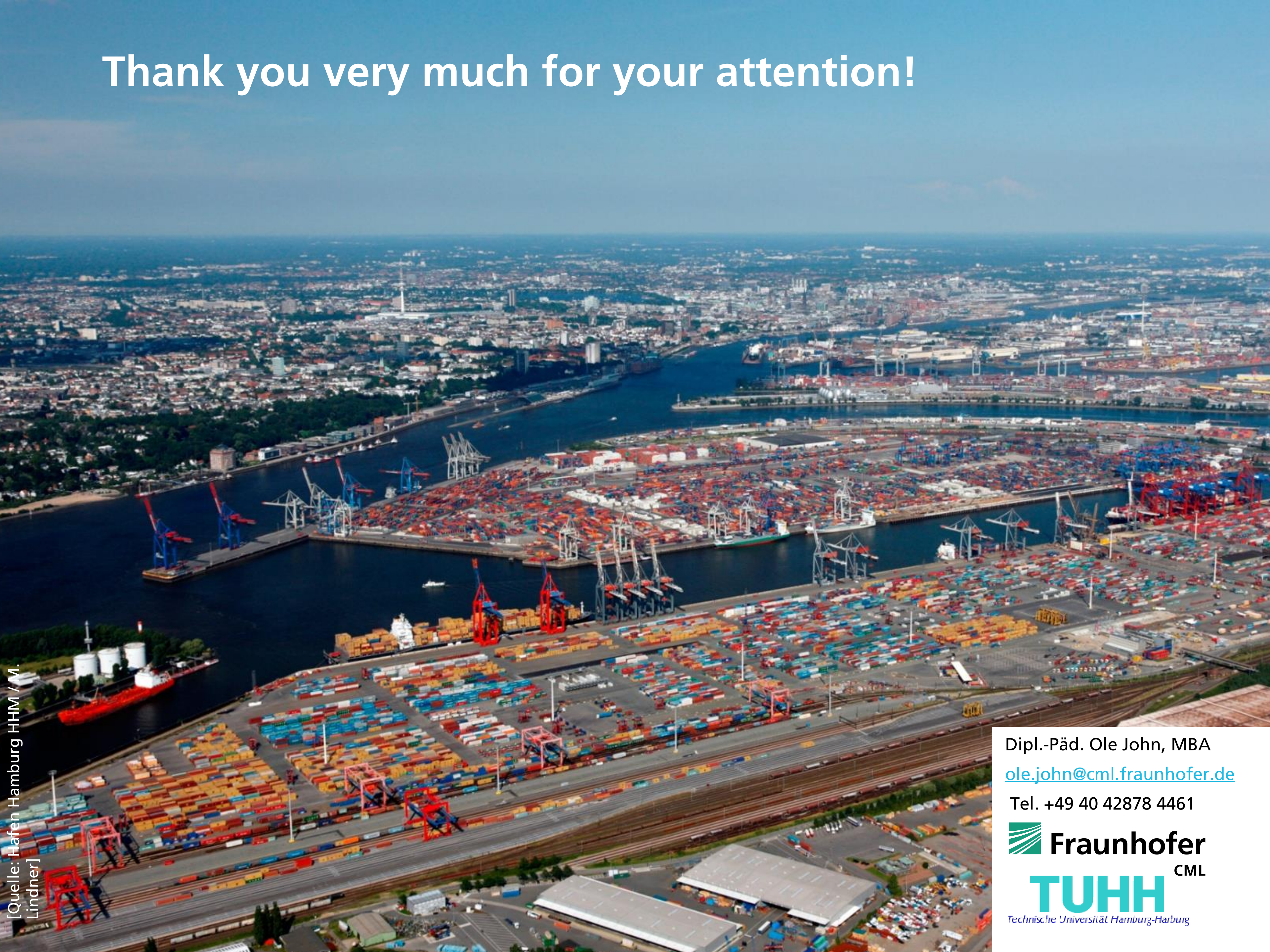




http://en.wikipedia.org/wiki/William_Gibson http://www.shippingscenarios.wartsila.com/

Fraunhofer CML

Thank you very much for your attention!



[Quelle: Hafen Hamburg HHM / M. Lindner]

Dipl.-Päd. Ole John, MBA

ole.john@cml.fraunhofer.de

Tel. +49 40 42878 4461

Fraunhofer CML

TUHH Technische Universität Hamburg-Harburg