From Thruster to Field; an Architecting Example

by *Gerrit Muller*   University of South-Eastern Norway-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

Architecting is an activity that each organizational entity has to apply recursively. This presentation briefly introduces architecting, and then steps through various levels of architecting in an offshore example. The purpose is to show the change of perspective when going from level to level.

October 4, 2020
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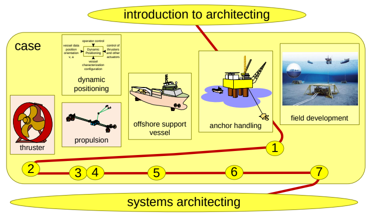
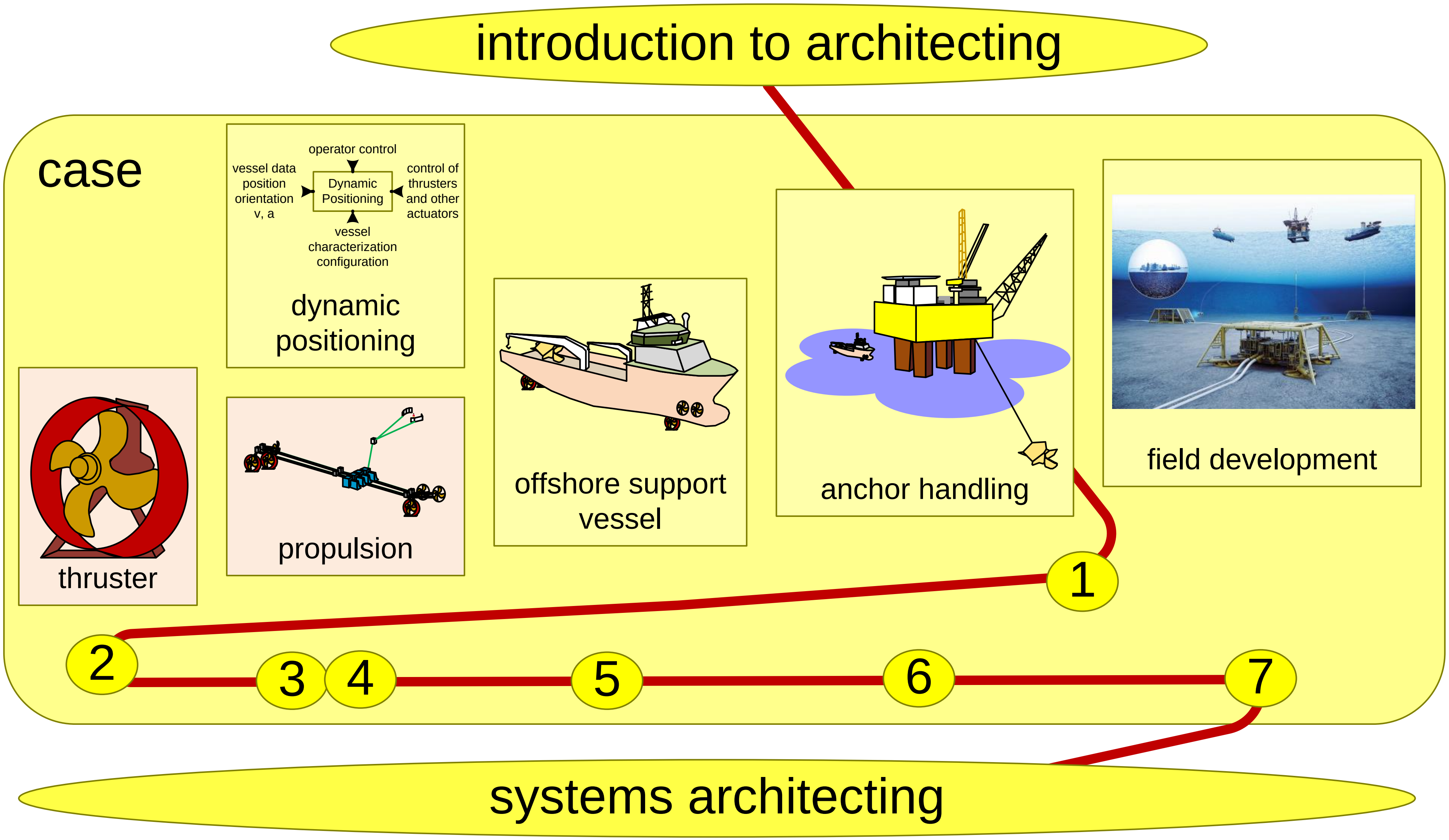
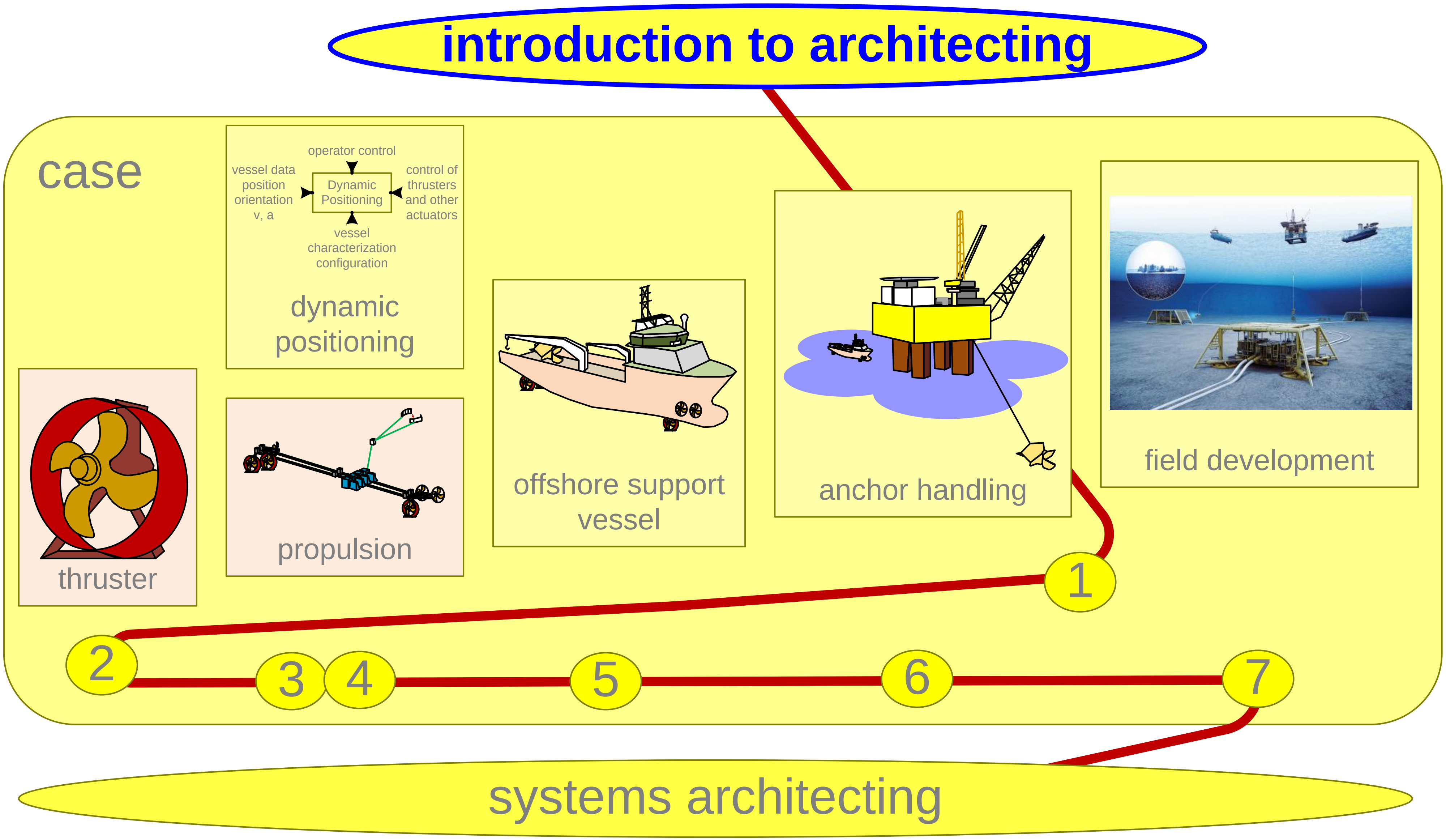


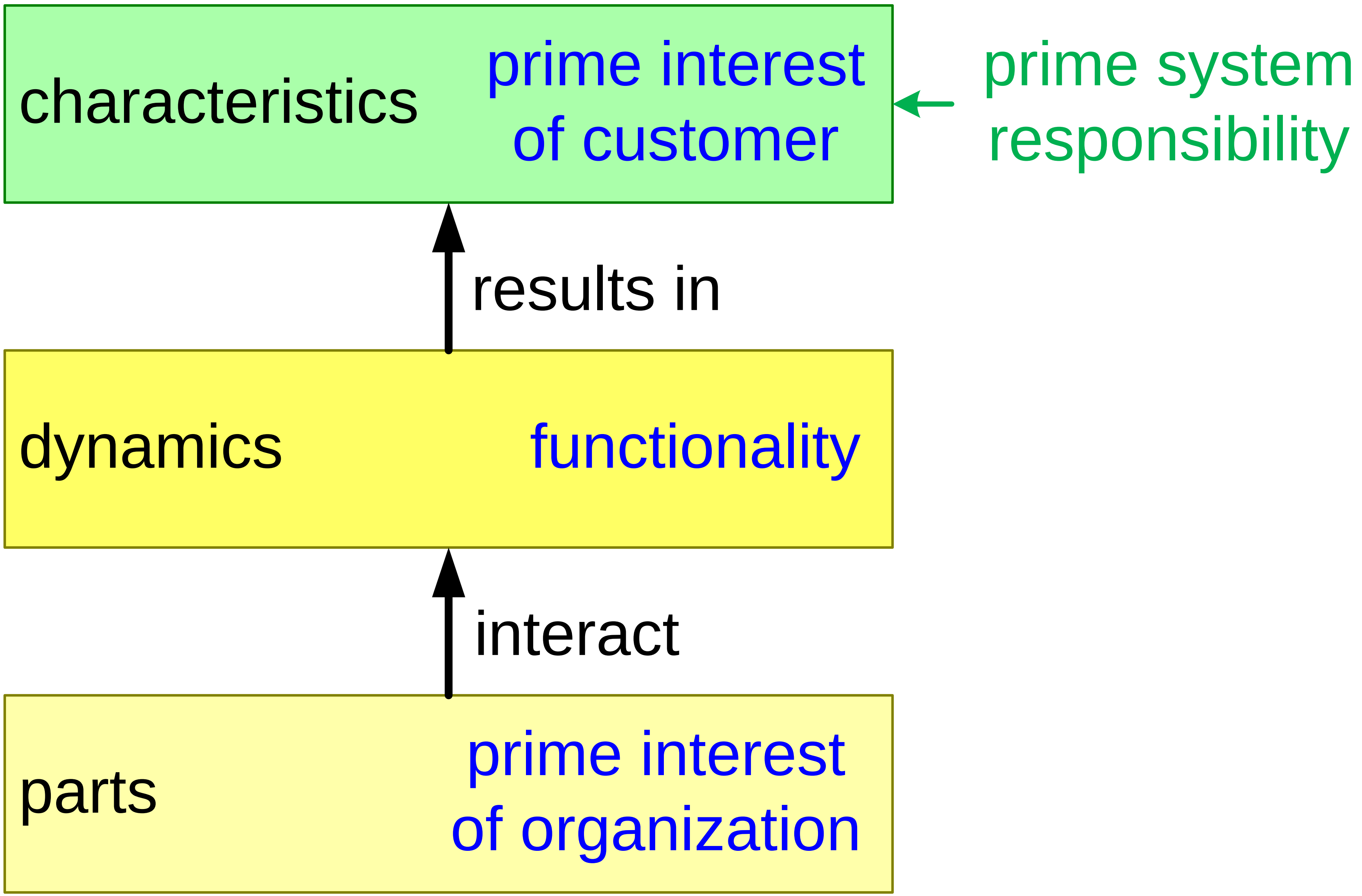
Figure of Contents™



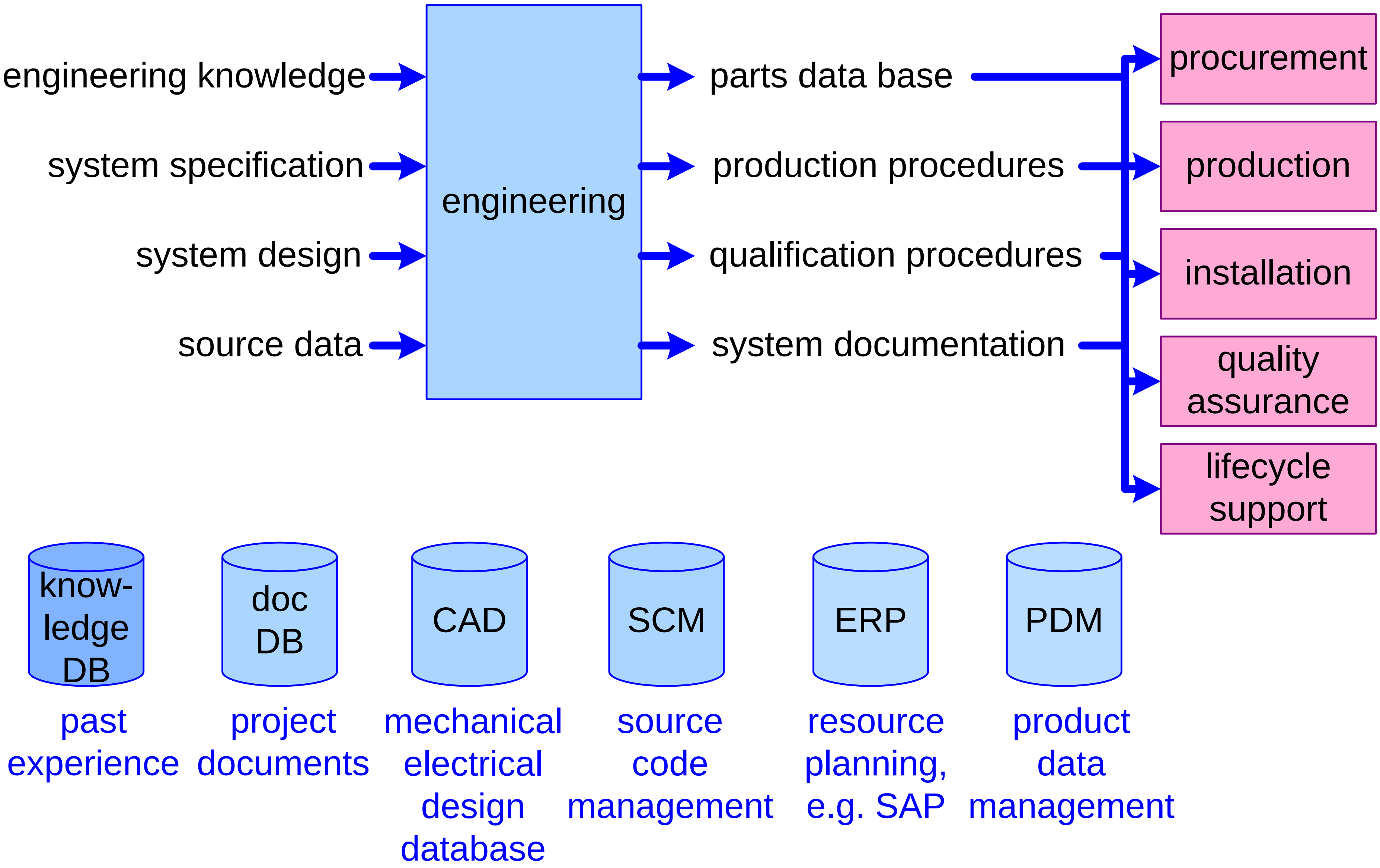
Introduction to Architecting



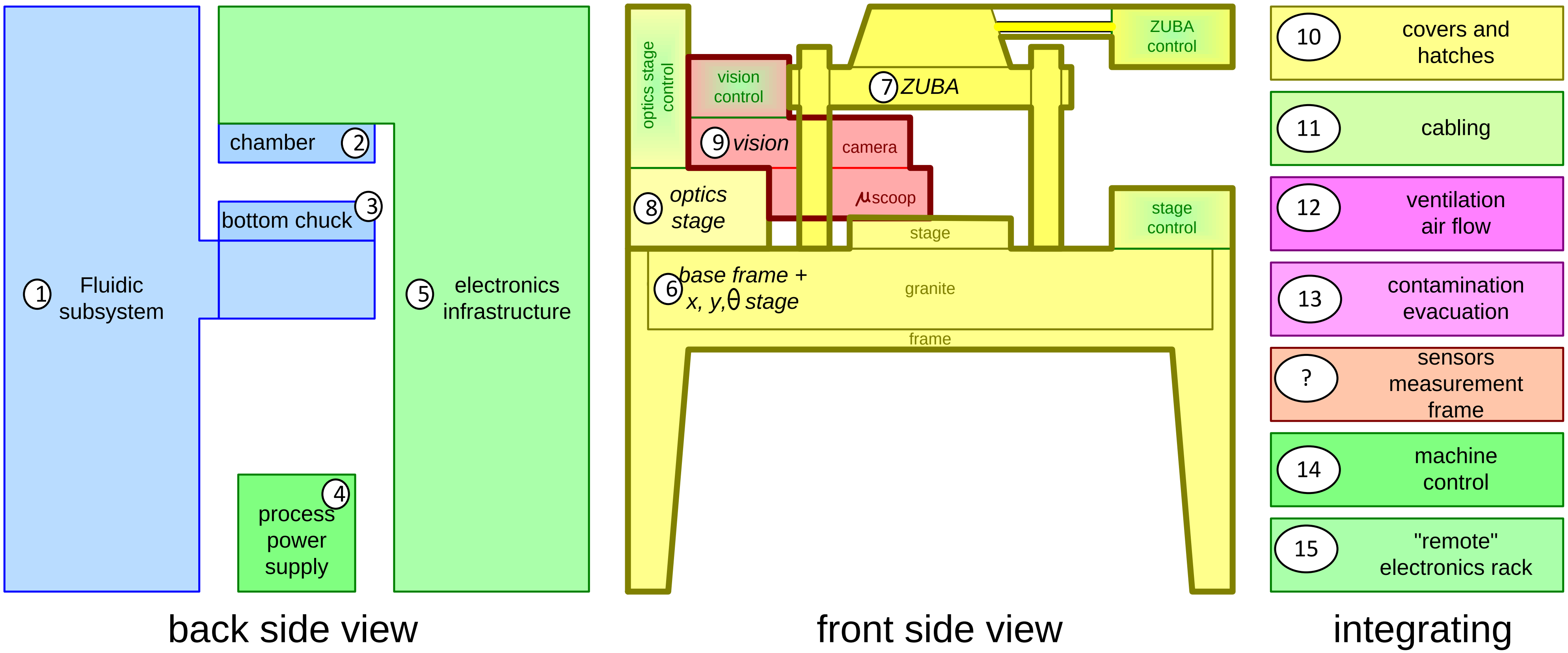
Parts, Dynamics, Characteristics



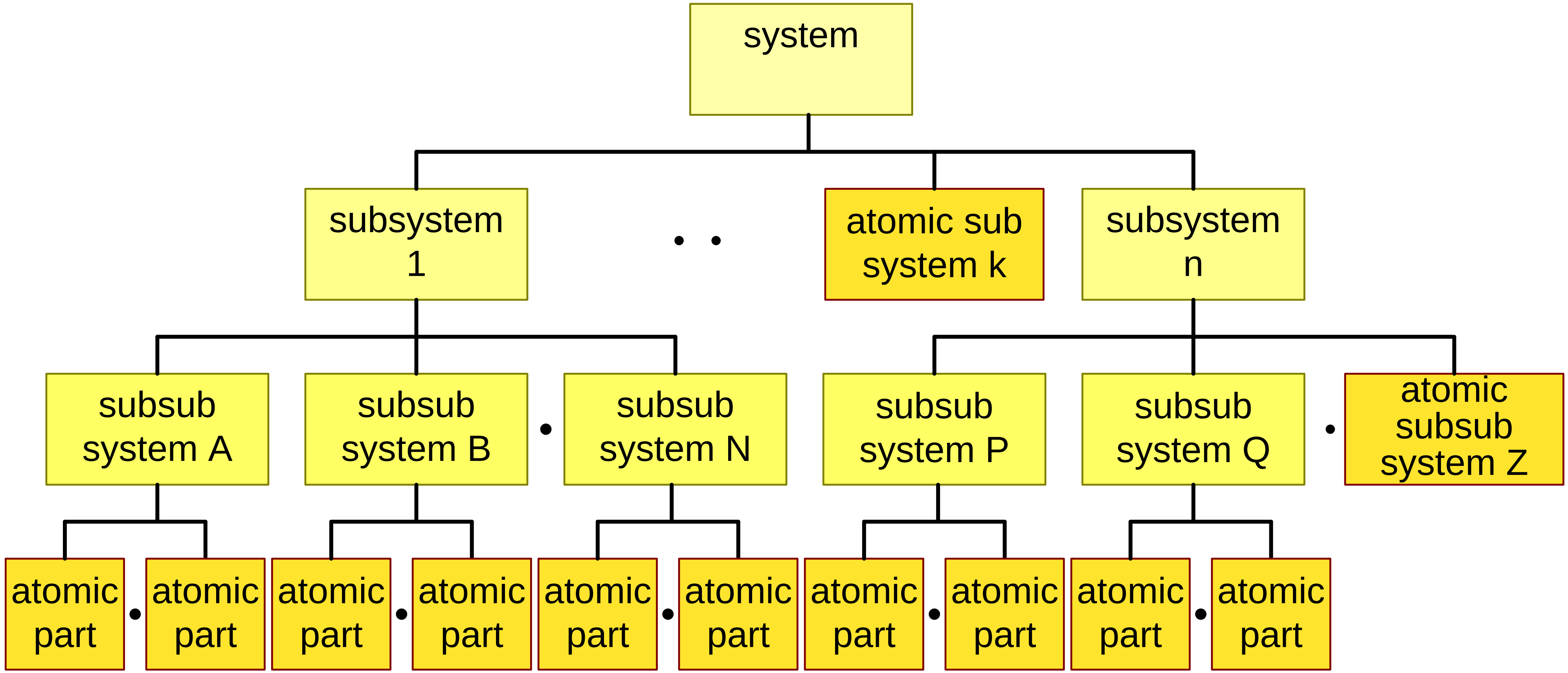
Engineering



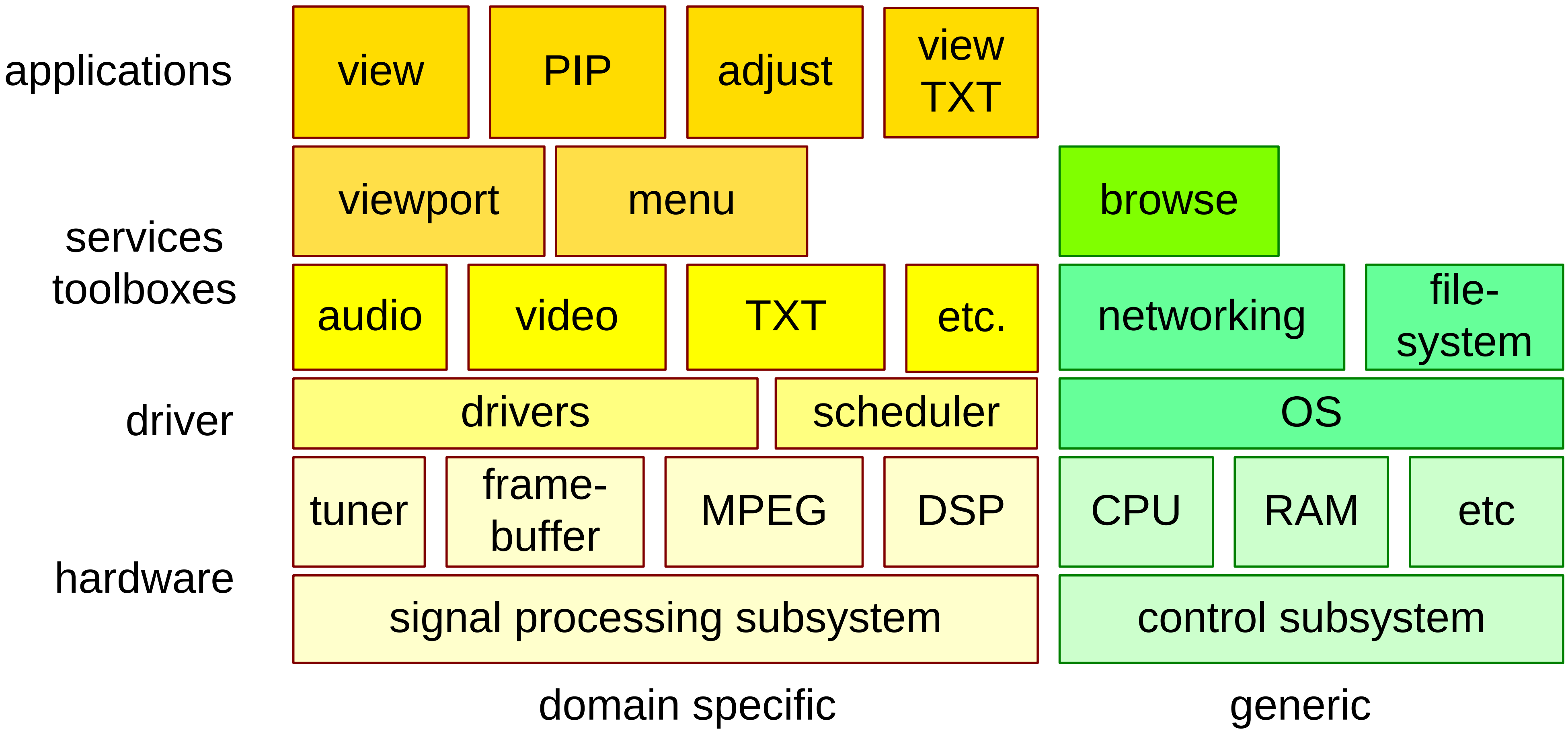
Example Physical Decomposition



Partitioning is Applied Recursively



Software plus Hardware Decomposition



Guidelines for Partitioning

the part is cohesive

functionality and technology belongs together

the coupling with other parts is minimal

minimize interfaces

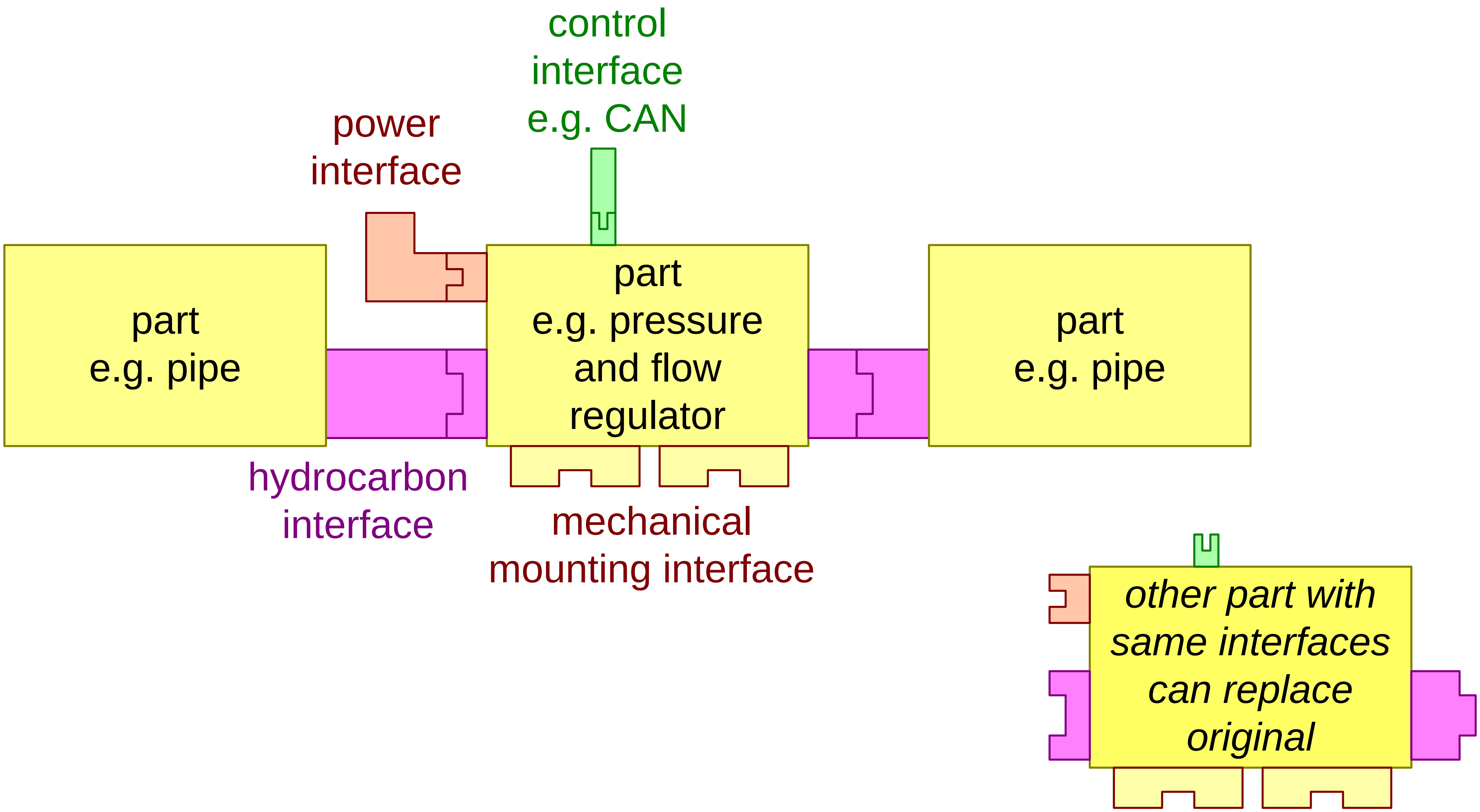
the part is selfsustained for production and qualification

can be in conflict with cost or space requirements

clear ownership of part

e.g. one department or supplier

Decoupling via Interfaces



The Ideal Modularity

System is composed

- by using standard interfaces
- limited catalogue of variants (e.g. cost performance points)

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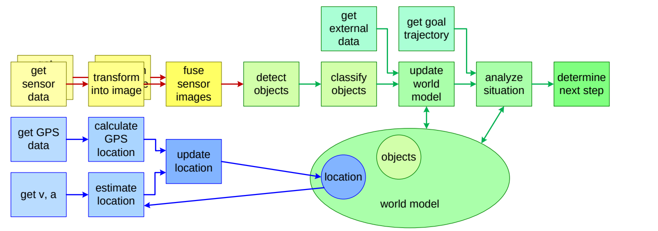
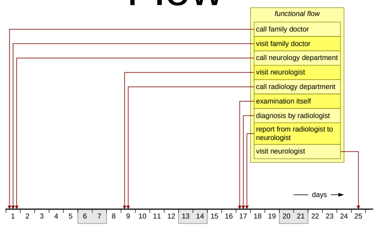
SPFmodularityGame

Overview of Visualizations of Dynamic Behavior

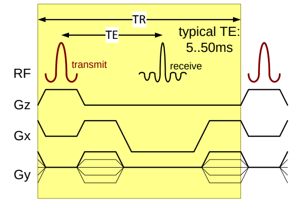
Information Transformation Flow



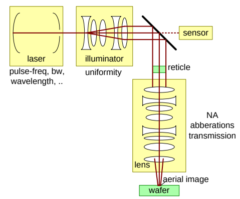
Timeline and Functional Flow



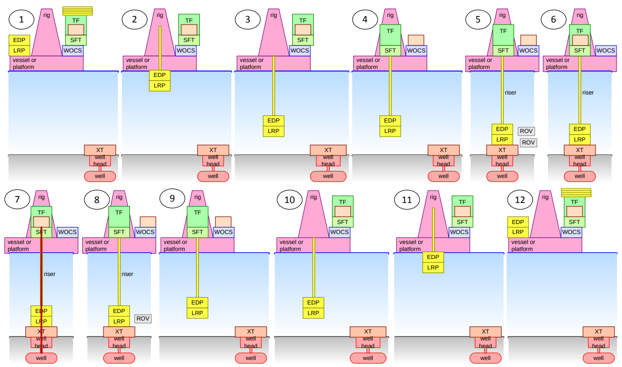
Signal Waveforms



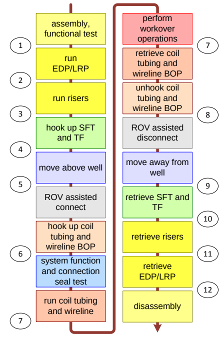
Flow of Light



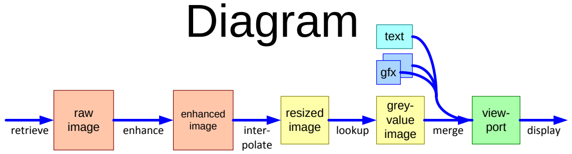
Concrete “Cartoon” Workflow



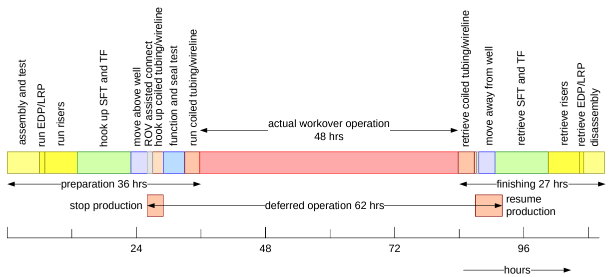
Abstract Workflow



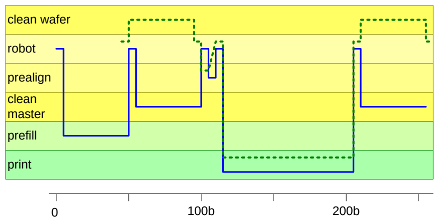
Information Centric Processing Diagram



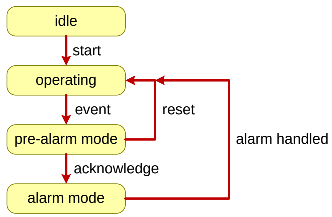
Timeline of Workflow



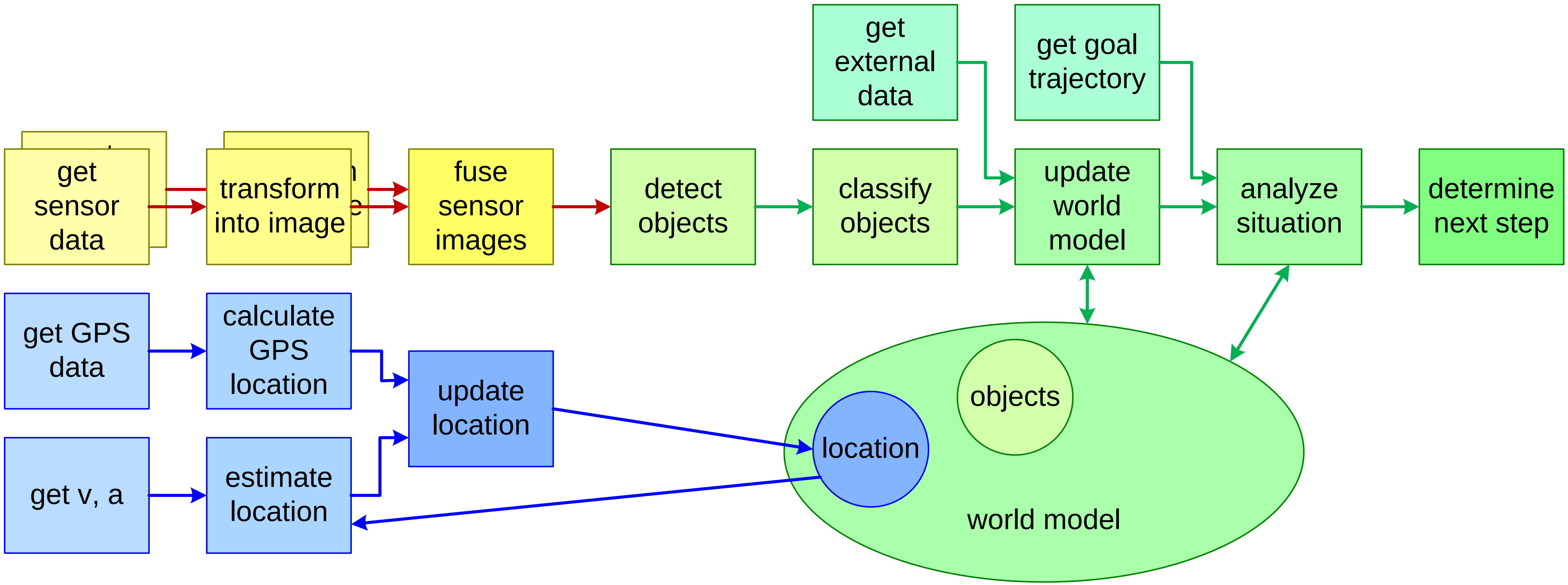
Swimming Lanes Concurrency and Interaction



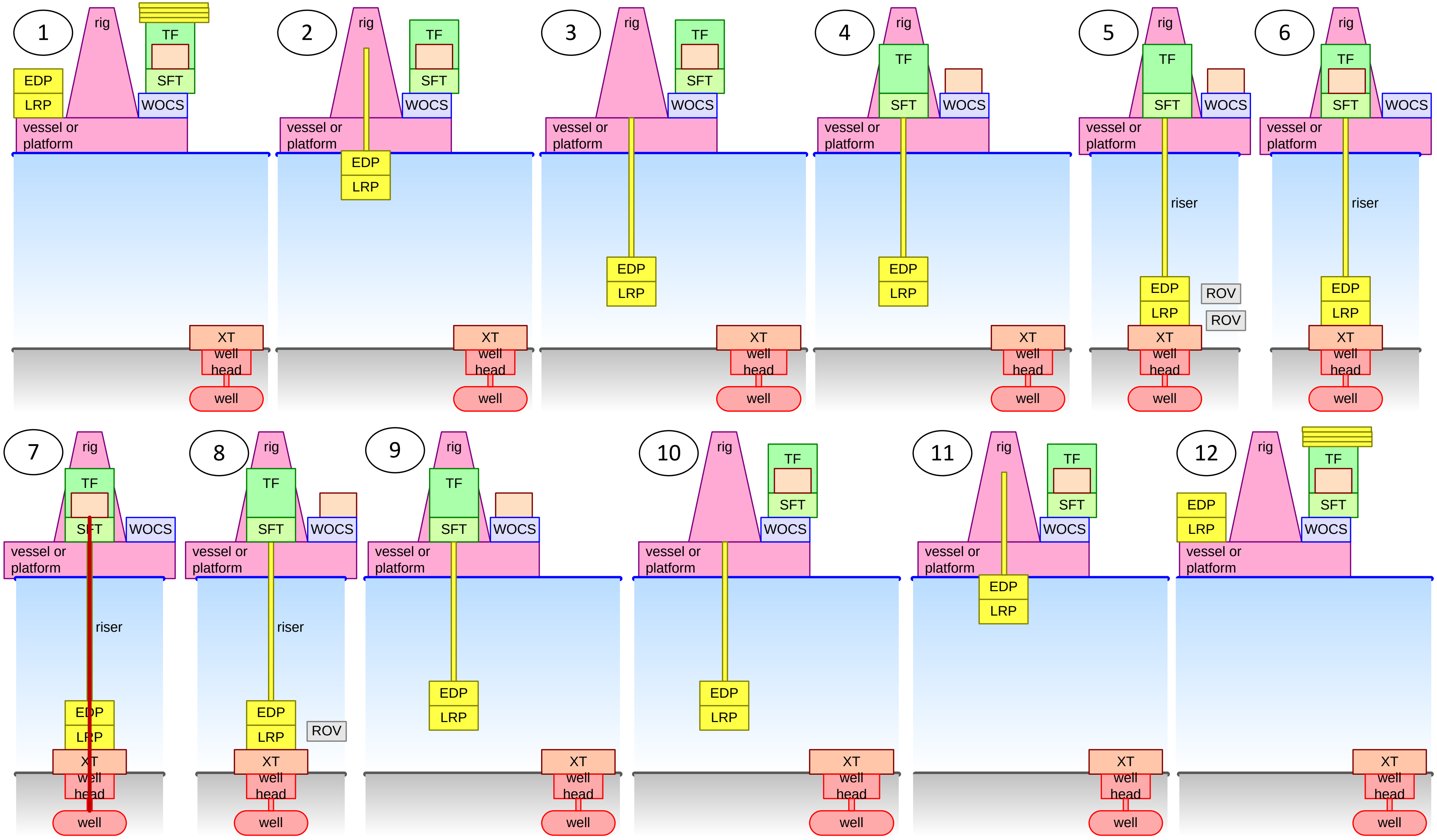
State Diagram



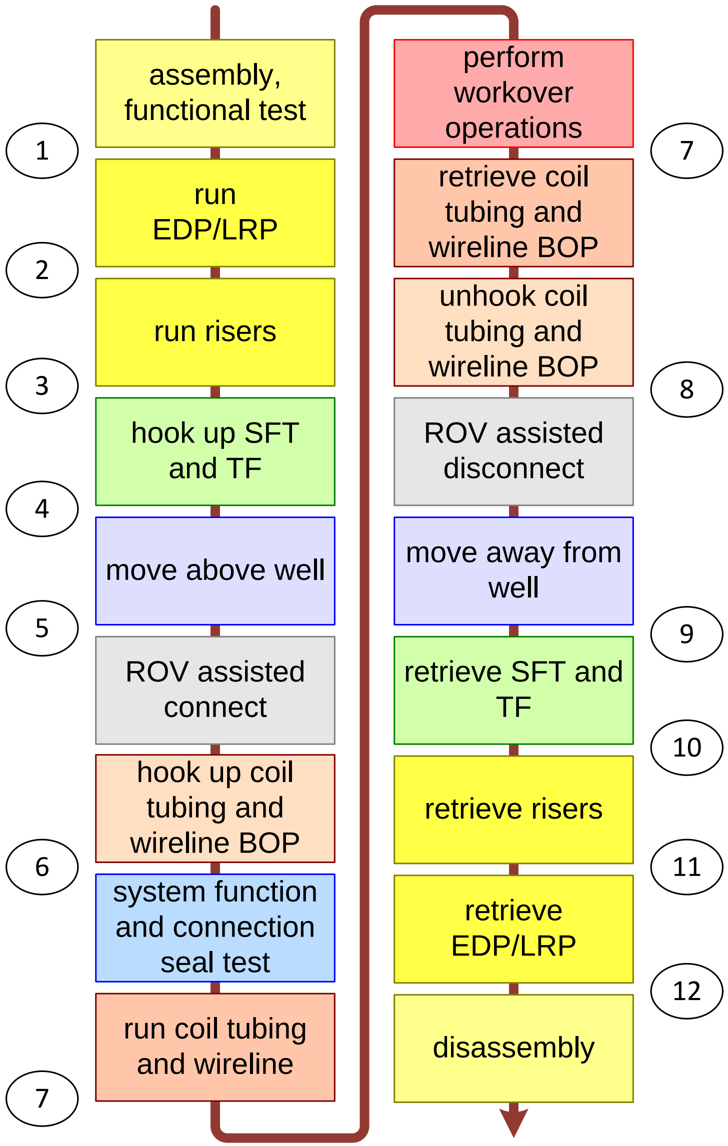
Example Functional Model of Information Flow

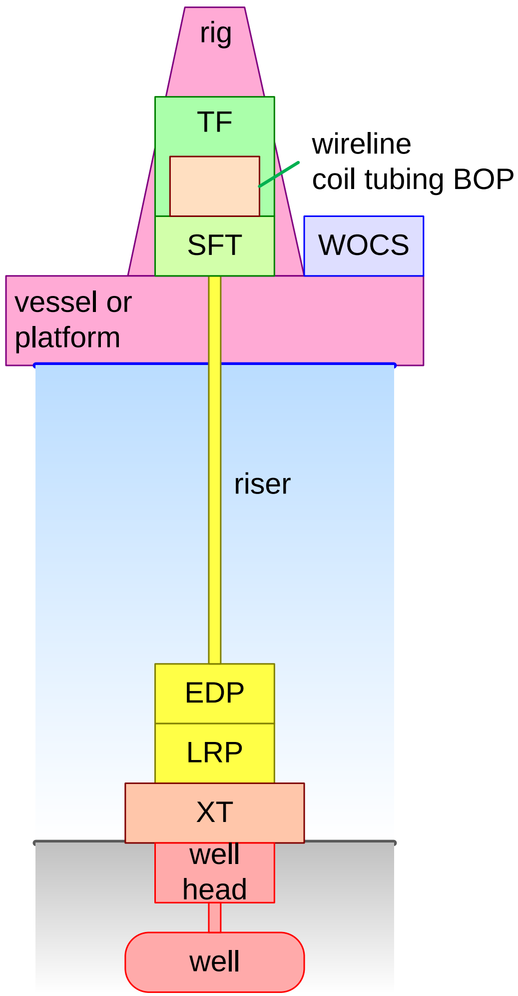


”Cartoon” Workflow



Workflow as Functional Model





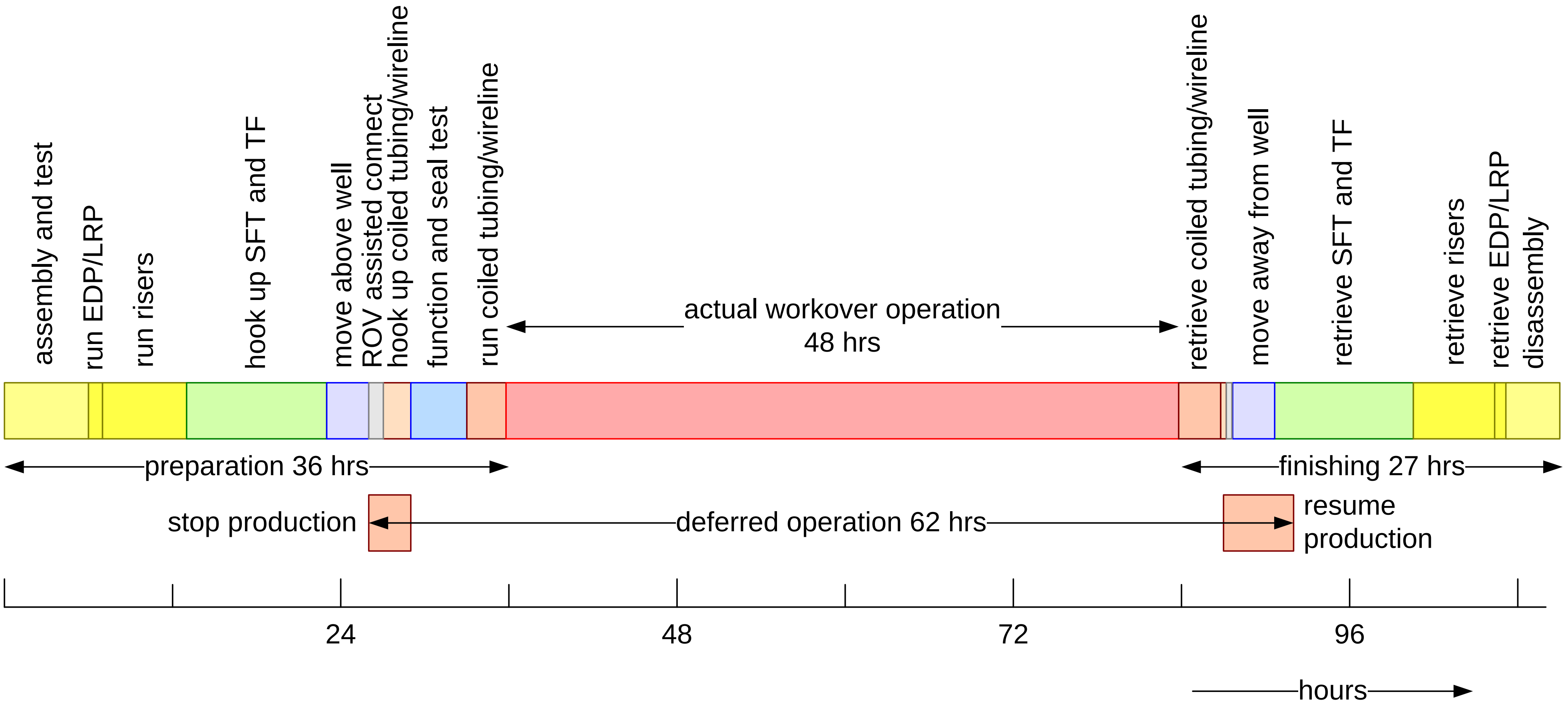
Workflow as Timeline

assumptions:

running and retrieving risers: 50m/hr

running and retrieving coiled tubing/wireline: 100m/hr

depth: 300m



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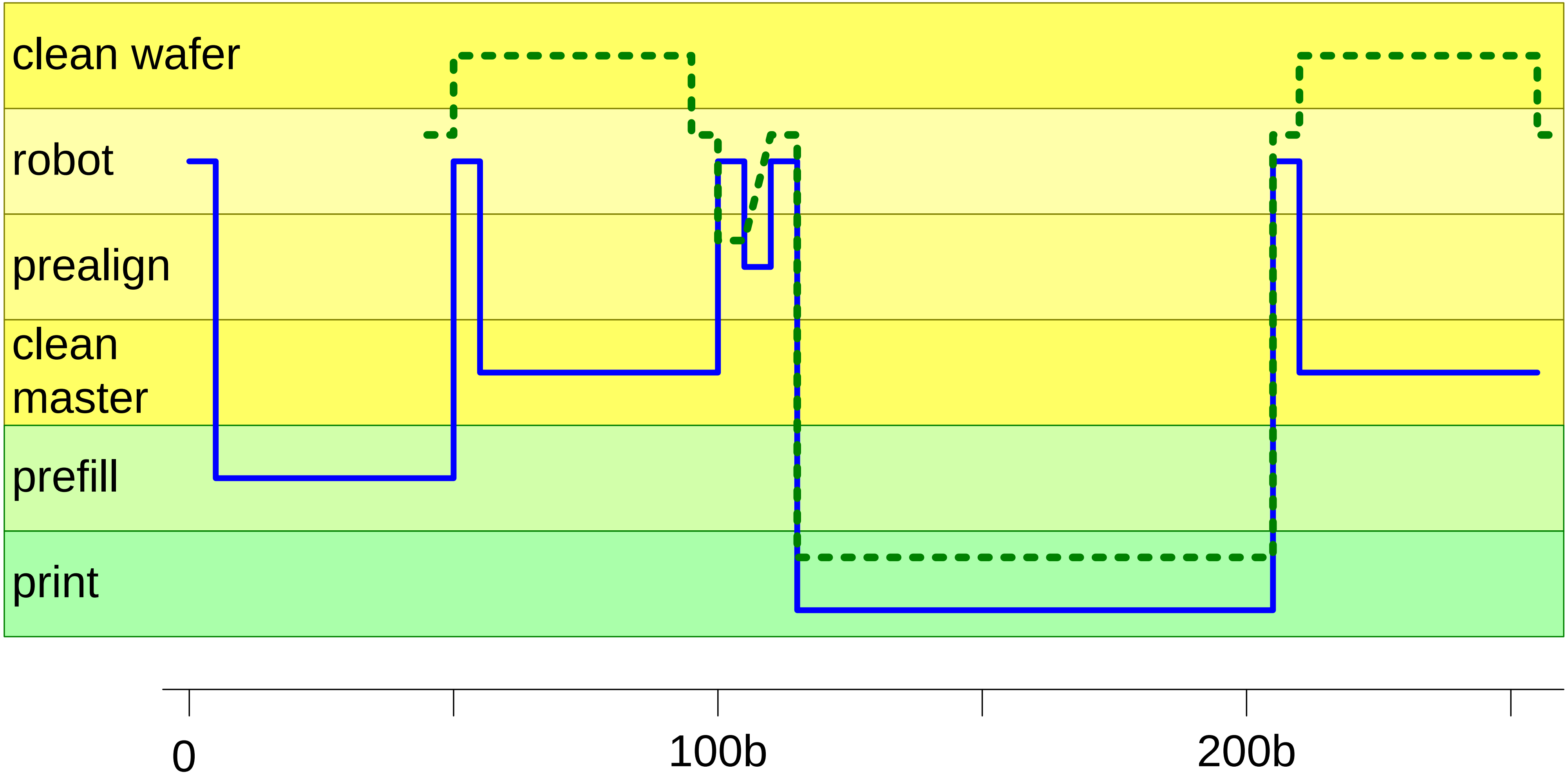
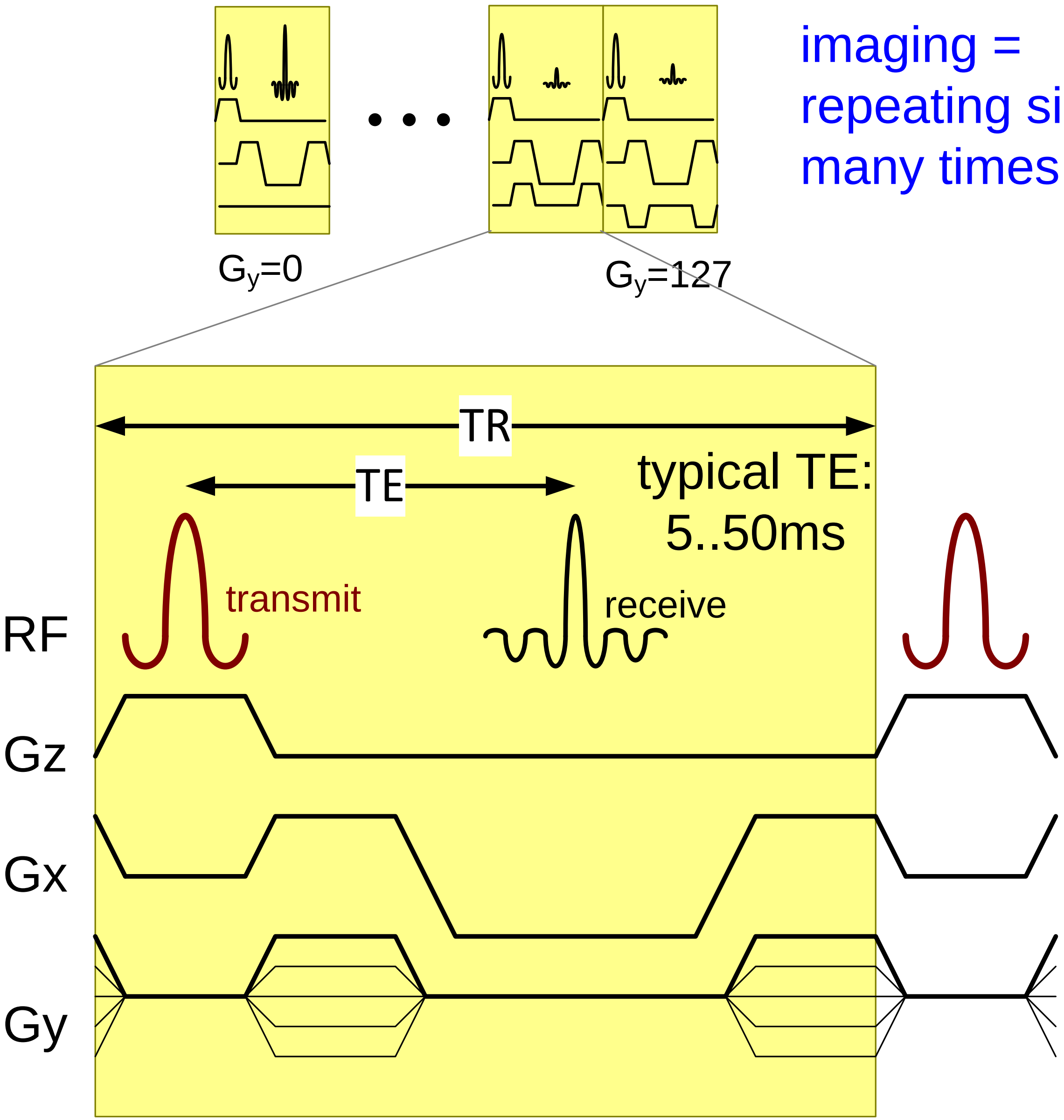
SSMEtypicalWorkoverOperationTimeline

Swimming Lane Example

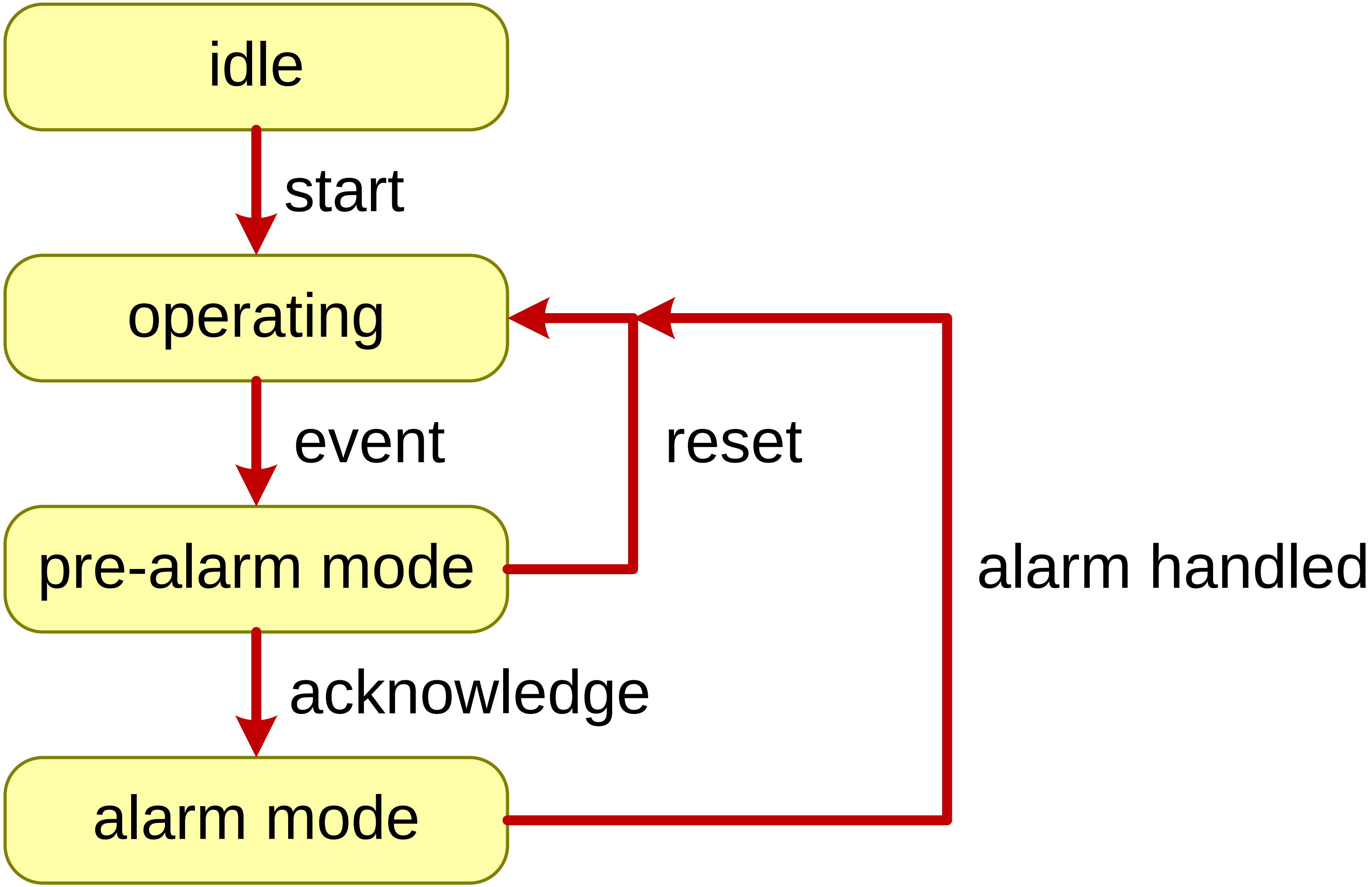


Example Signal Waveforms



imaging =
repeating similar pattern
many times

Example State Diagram



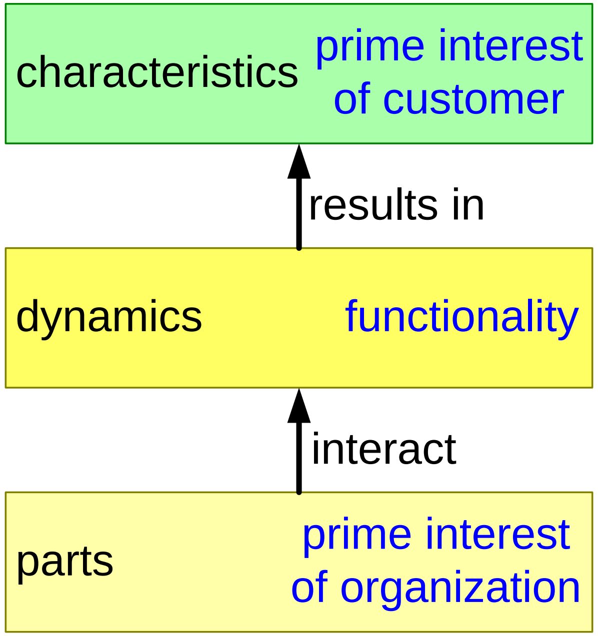
Quantification

Size	2.4m * 0.7m * 1.3m
Weight	1450 Kg
Cost	30000 NoK
Reliability	MTBF 4000 hr
Throughput	3000 l/hr
Response time	0.1 s
Accuracy	+/- 0.1%

many characteristics of a system, function or part can be quantified

*Note that quantities have a **unit***

Summary of Architecting Introduction



Architecting = **considering**

parts and

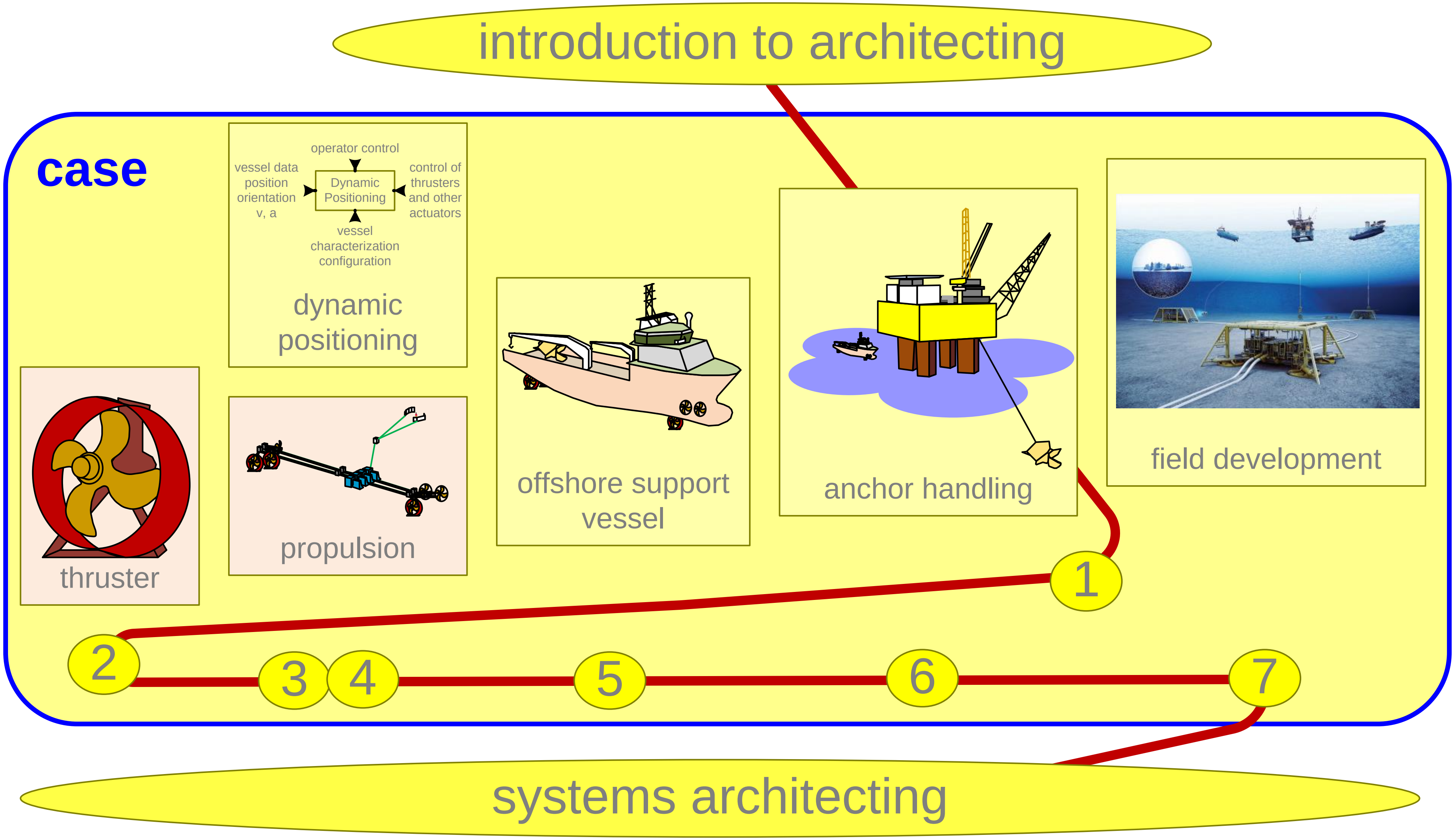
dynamic behavior and

quantified characteristics

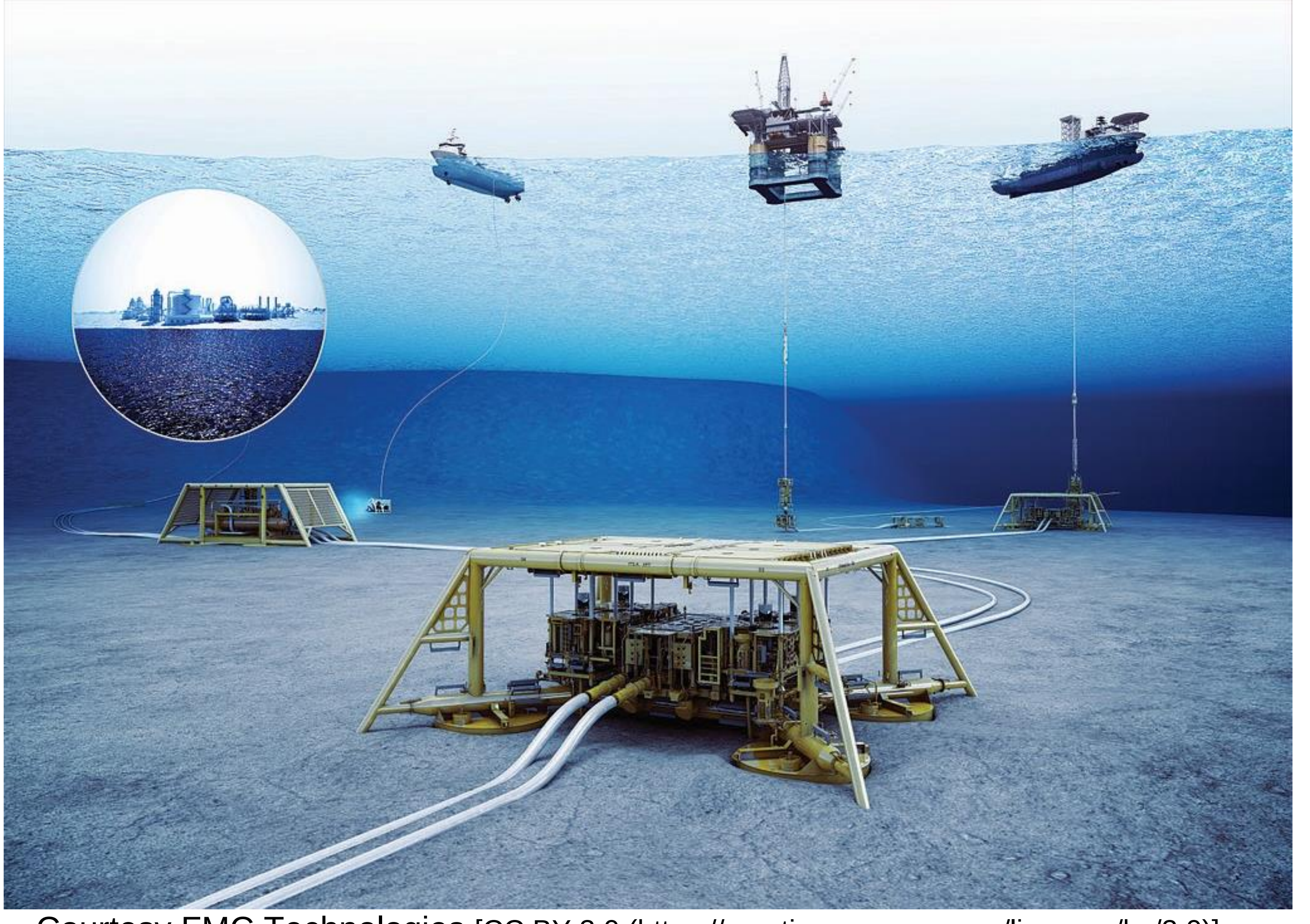
dynamic behavior is the core of **understanding**;
unfortunately it is often **missing**

quantification makes issues **specific** and **tangible**;
it can be **scary** ☹

The Case: Anchor Handling in Field Development

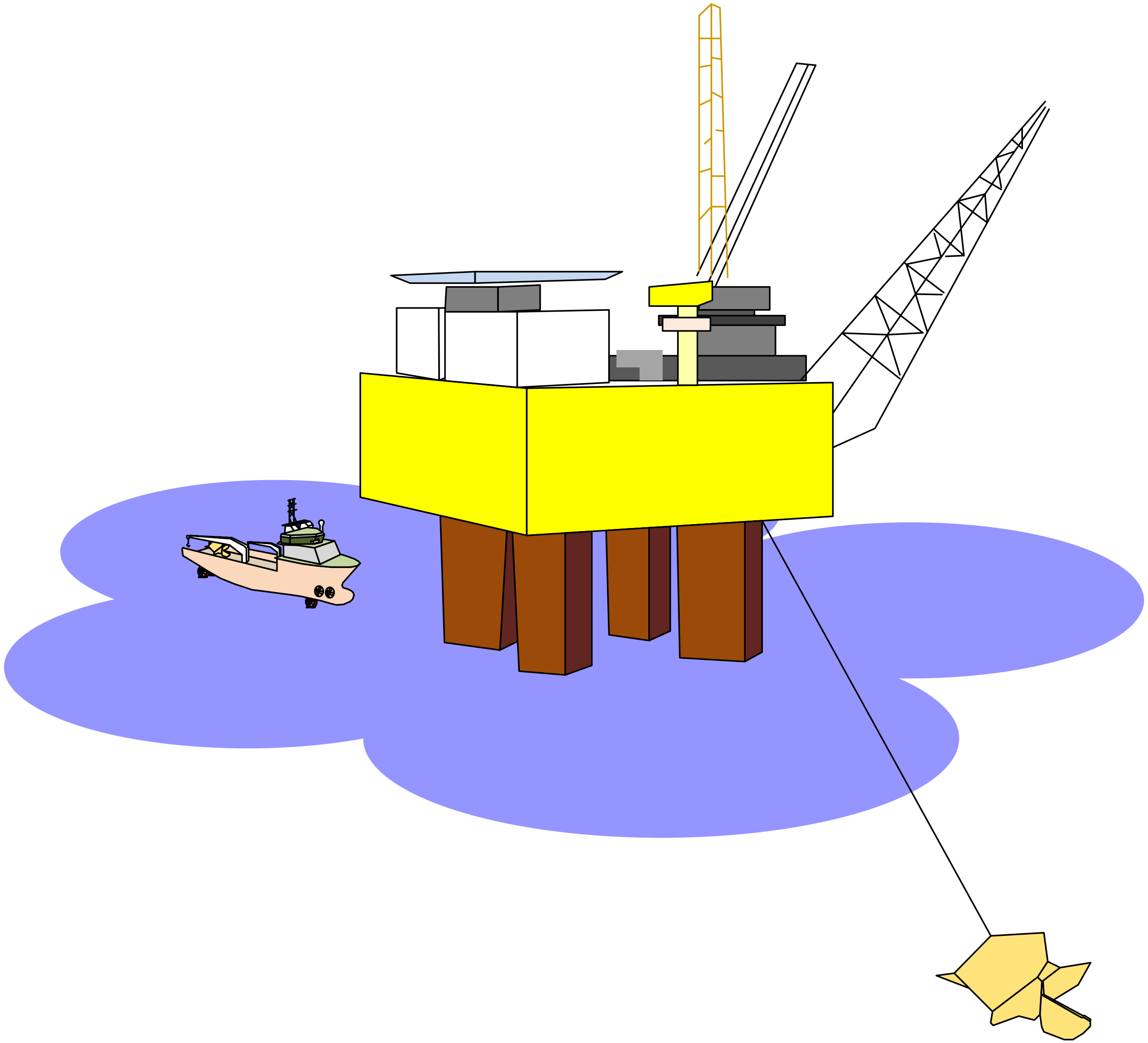


Our Case: Offshore subsea Field Development



Courtesy FMC Technologies

Mission: Anchor the Platform



Worksheet: Note 3..5 Main Functions and KPPs per Level

	main functions	key performance parameters
thruster		
propulsion		
dynamic positioning		
offshore support vessel		
anchor handling		
field development		

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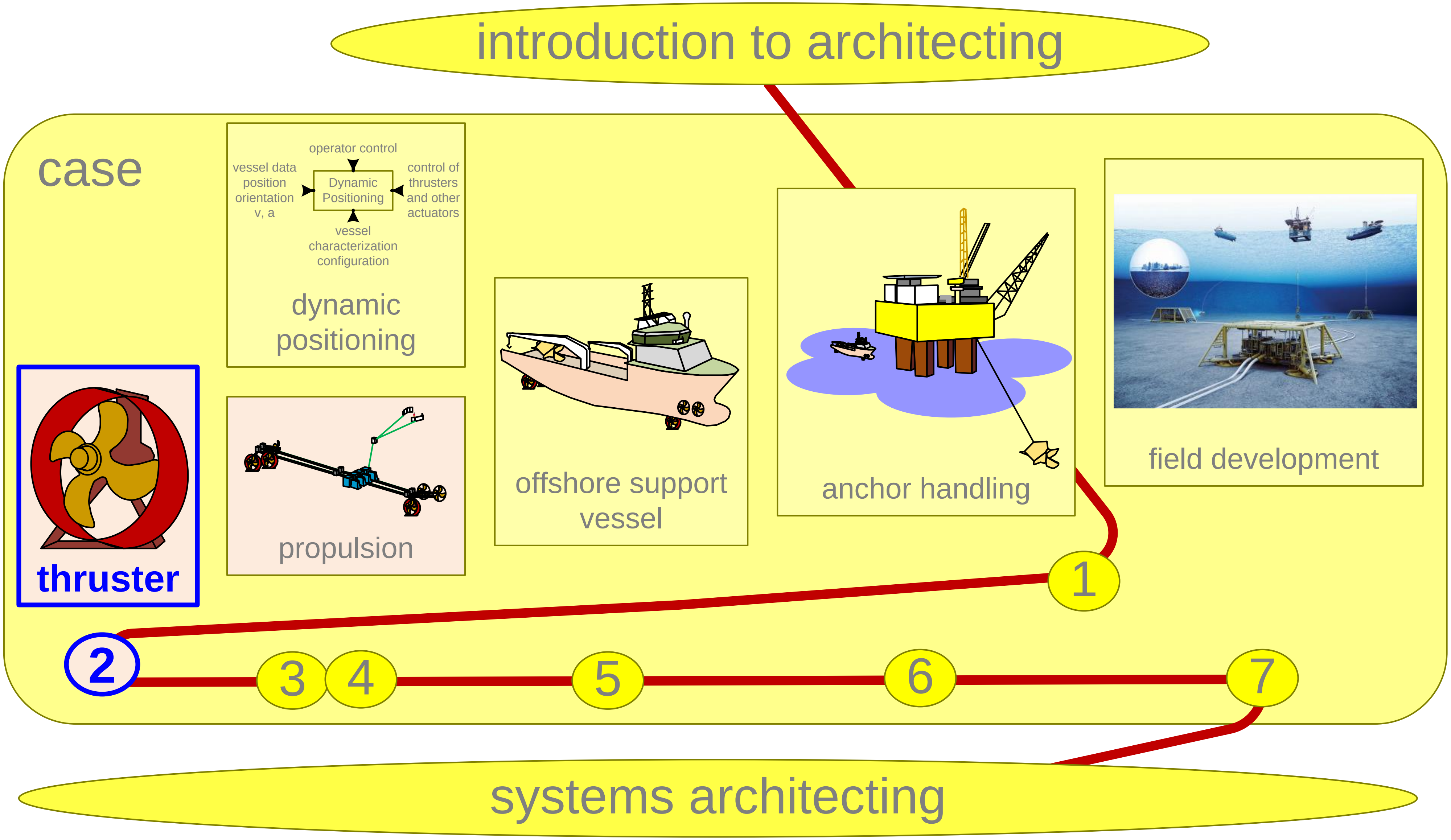
FTTFworksheet

The Thruster

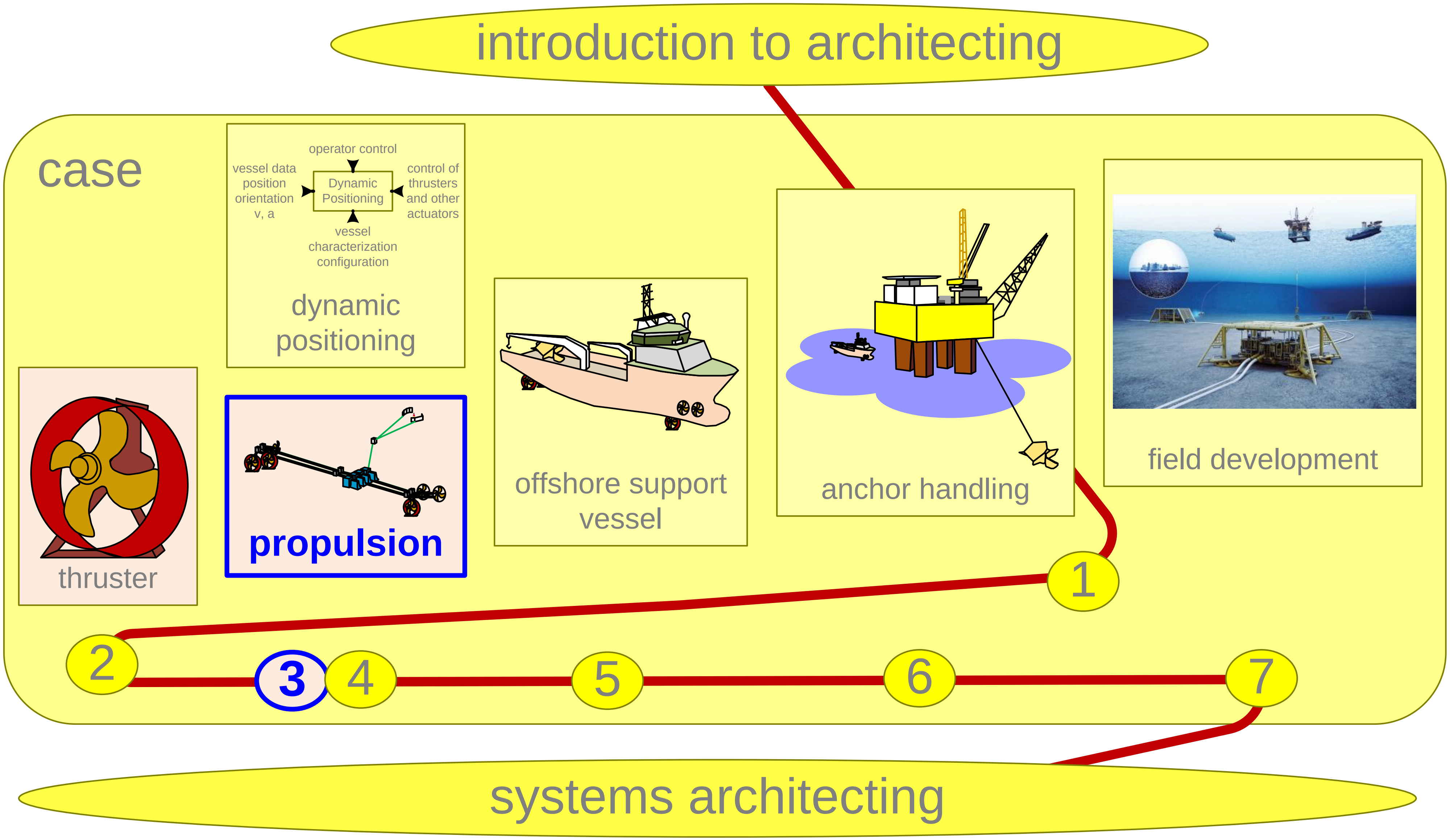


Thruster Diagram

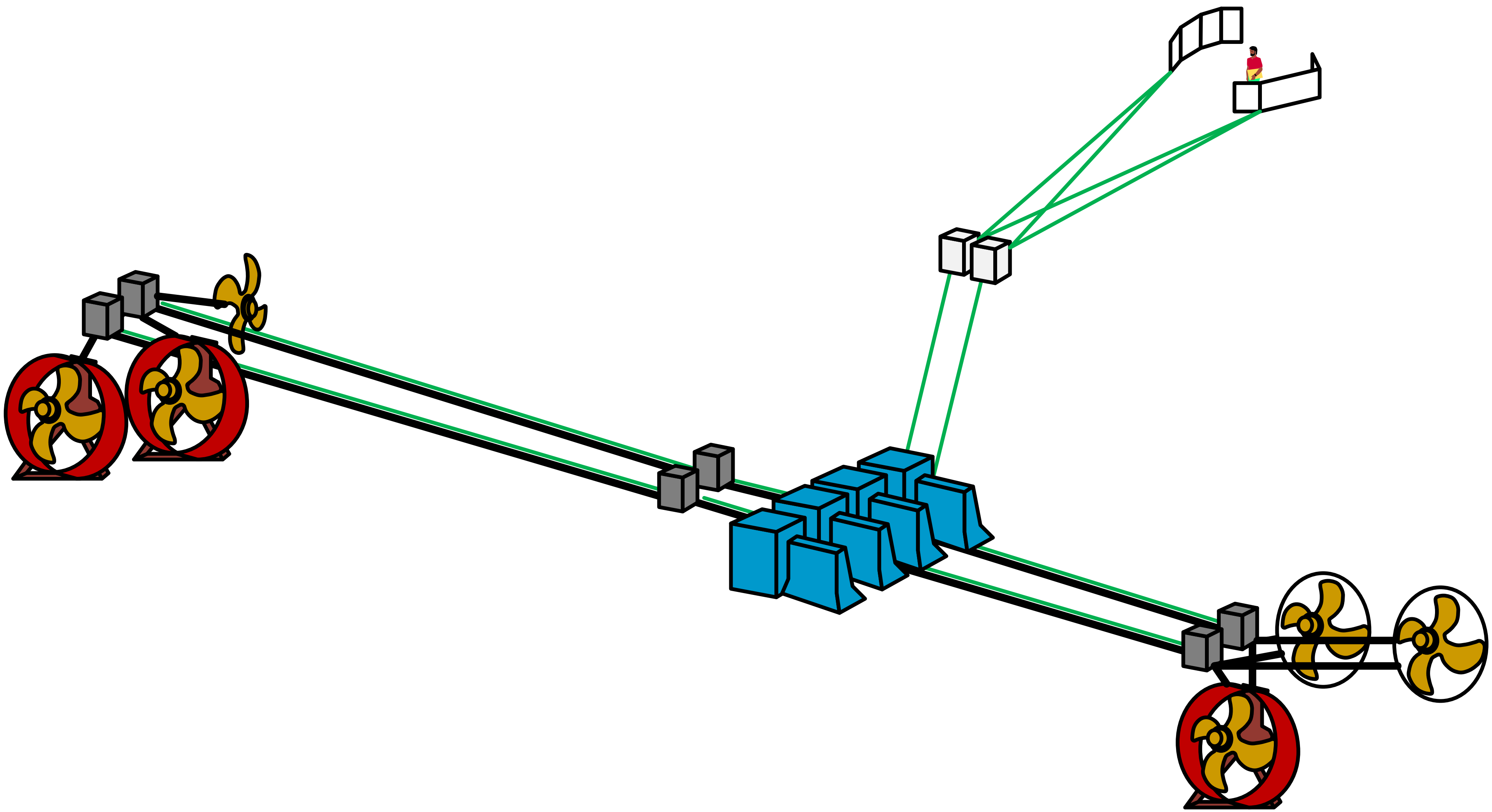
What are the 3 to 5
Main Functions
of the **thruster**?

What are the 3 to 5
Key Performance Parameters
of the **thruster**?

Propulsion


introduction to architecting
case
operator control
vessel data
position
orientation
v, a
Dynamic
Positioning
control of
thrusters
and other
actuators
vessel
characterization
configuration
dynamic
positioning
thruster
propulsion
offshore support
vessel
anchor handling
field development
1
2
3
4
5
6
7
systems architecting

Propulsion Diagram

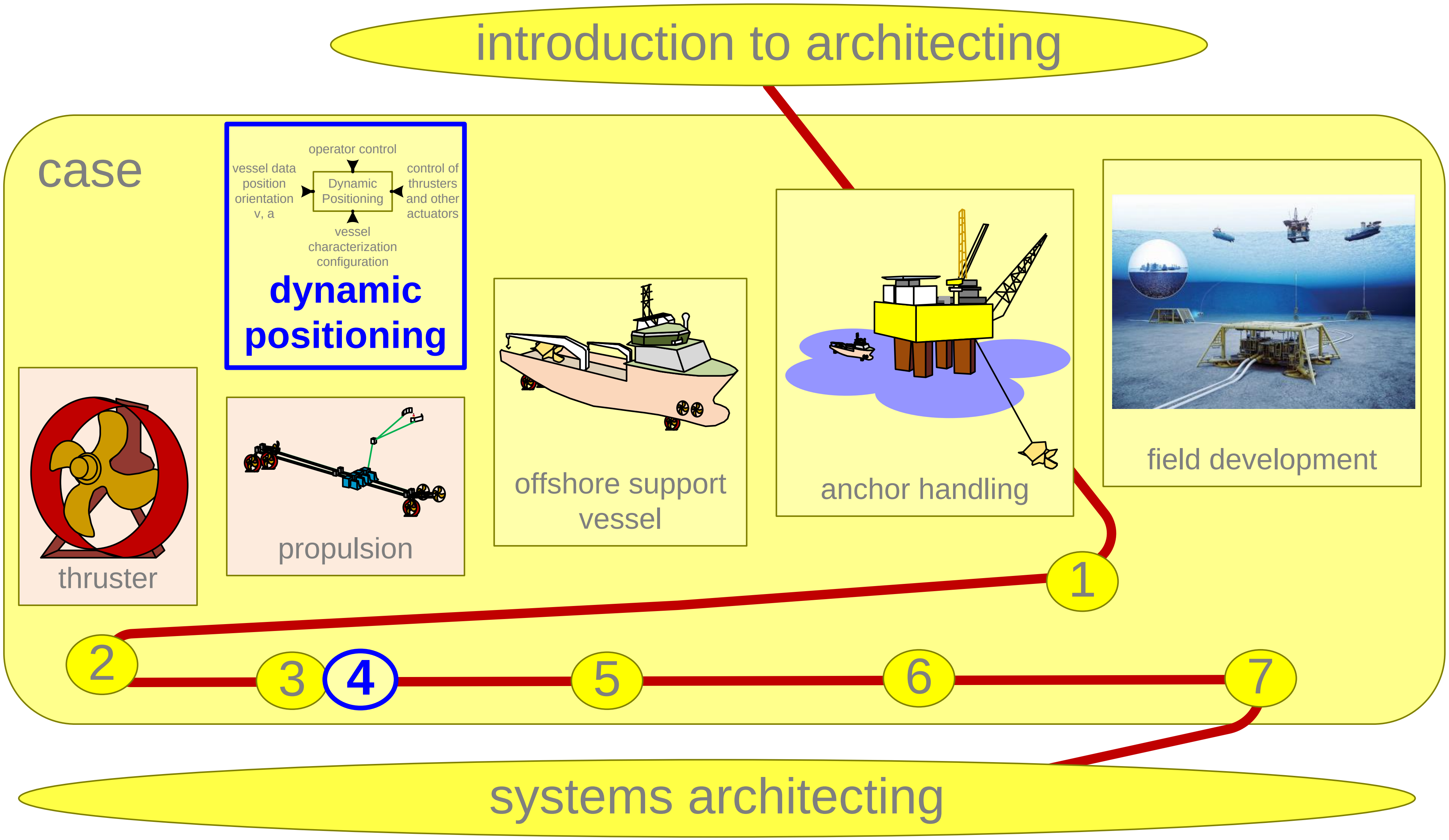


Questions Functionality and Performance Propulsion

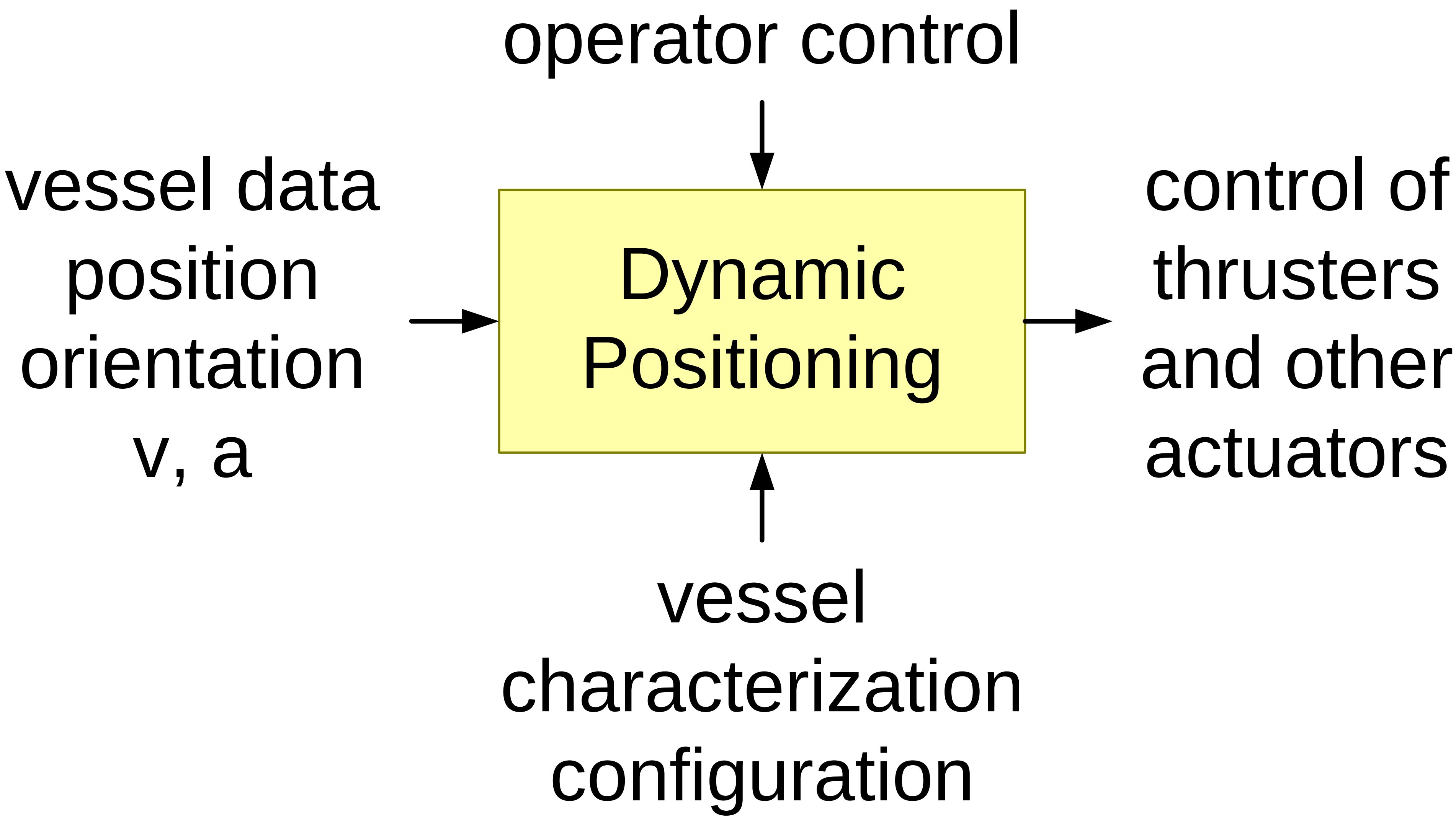
What are the 3 to 5
Main Functions
of the **propulsion** system?

What are the 3 to 5
Key Performance Parameters
of the **propulsion** system?

Dynamic Positioning



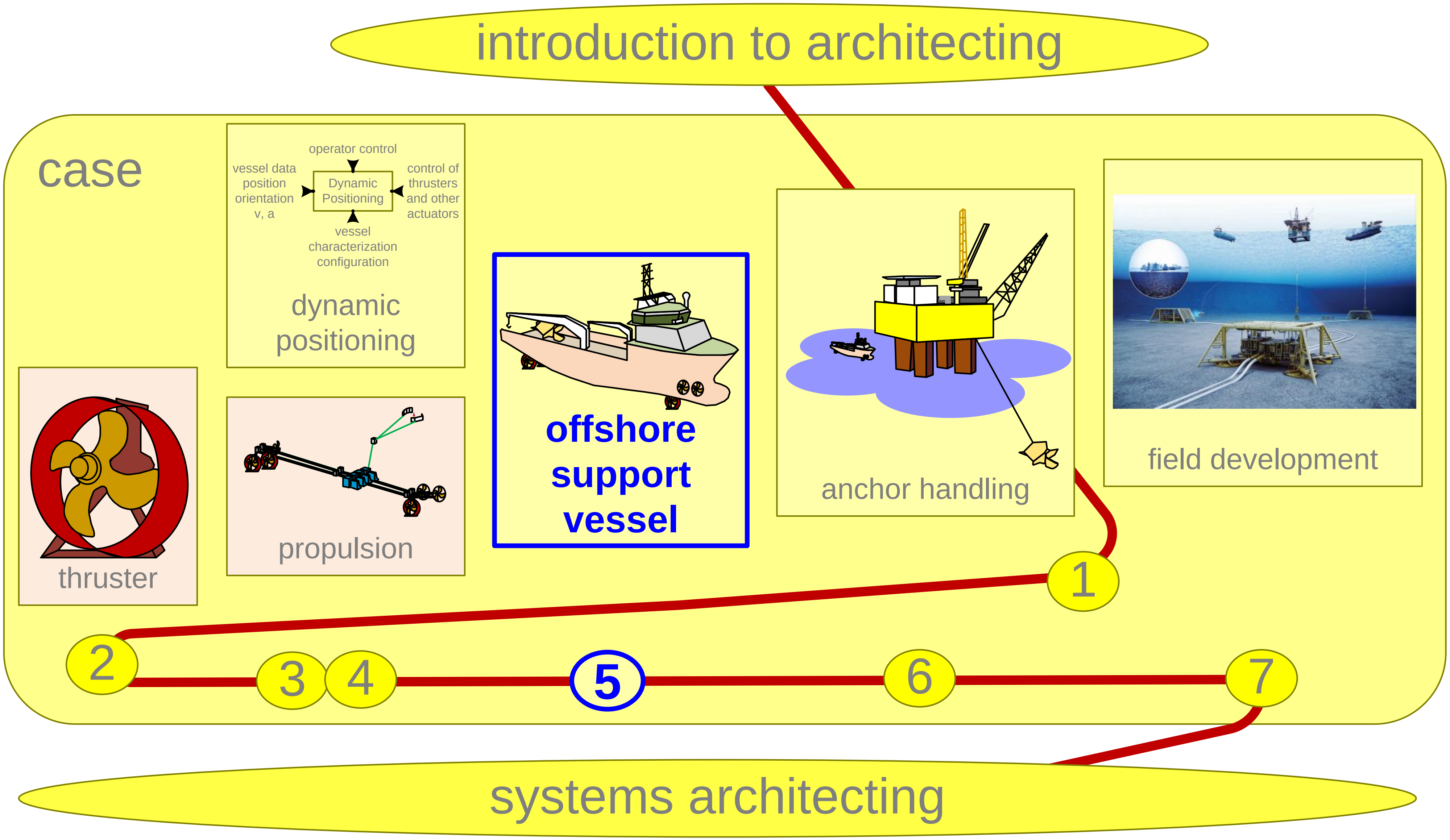
Dynamic Positioining Input-Process-Output



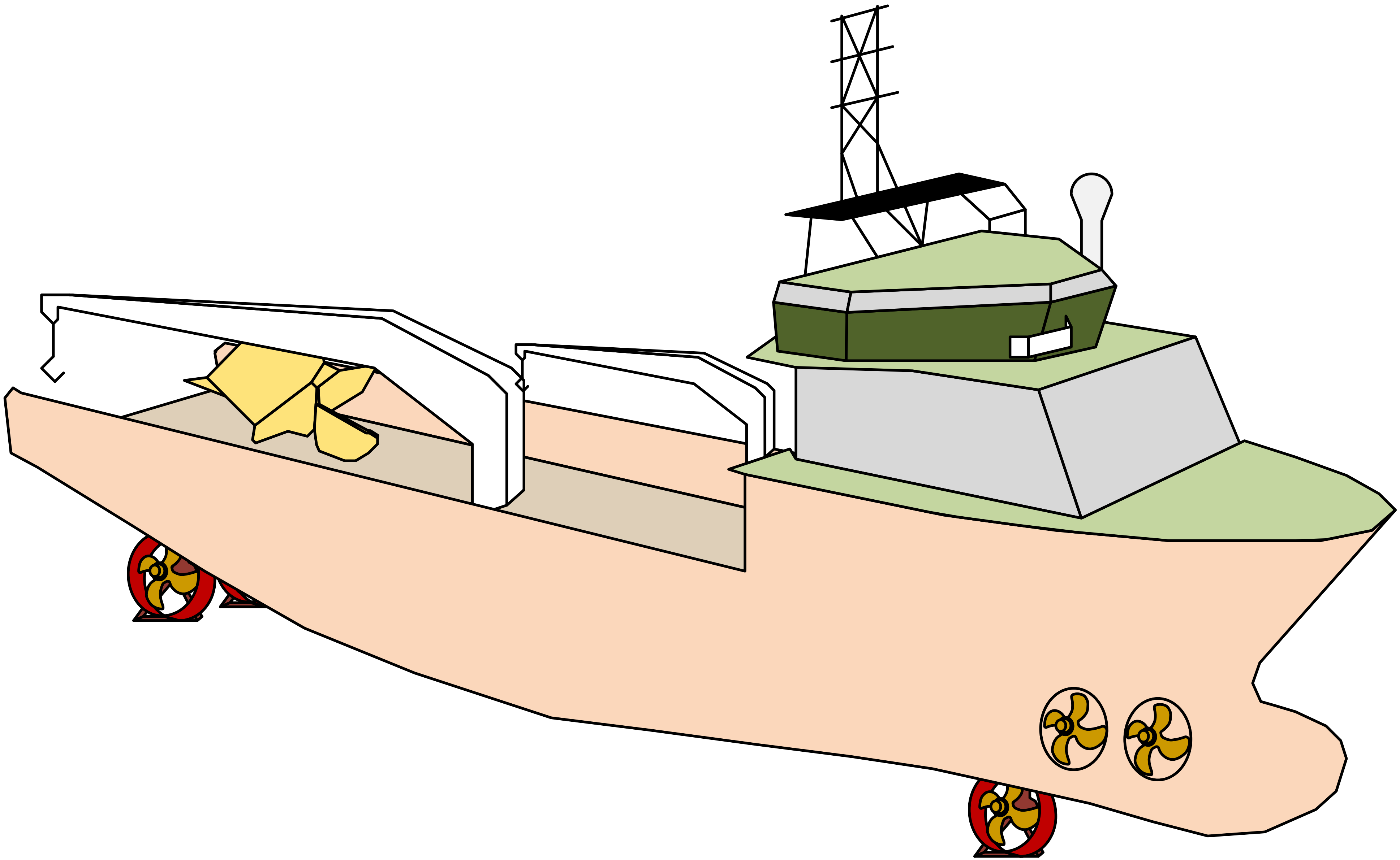
What are the 3 to 5
Main Functions
of **dynamic positioning**?

What are the 3 to 5
Key Performance Parameters
of **dynamic positioning**?

Offshore Supply Vessel



Offshore Supply Vessel Diagram

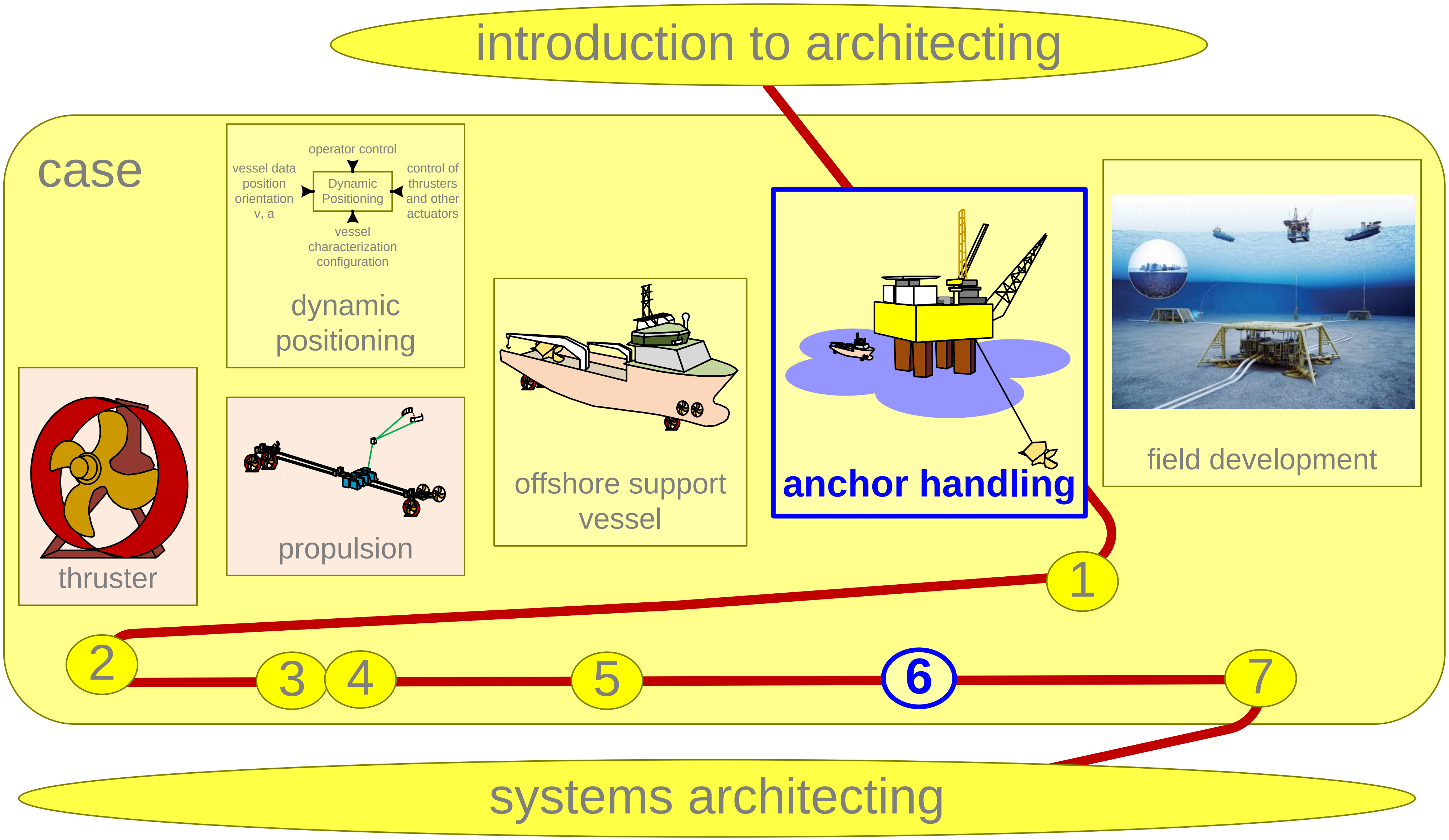


Questions Functionality and Performance Vessel

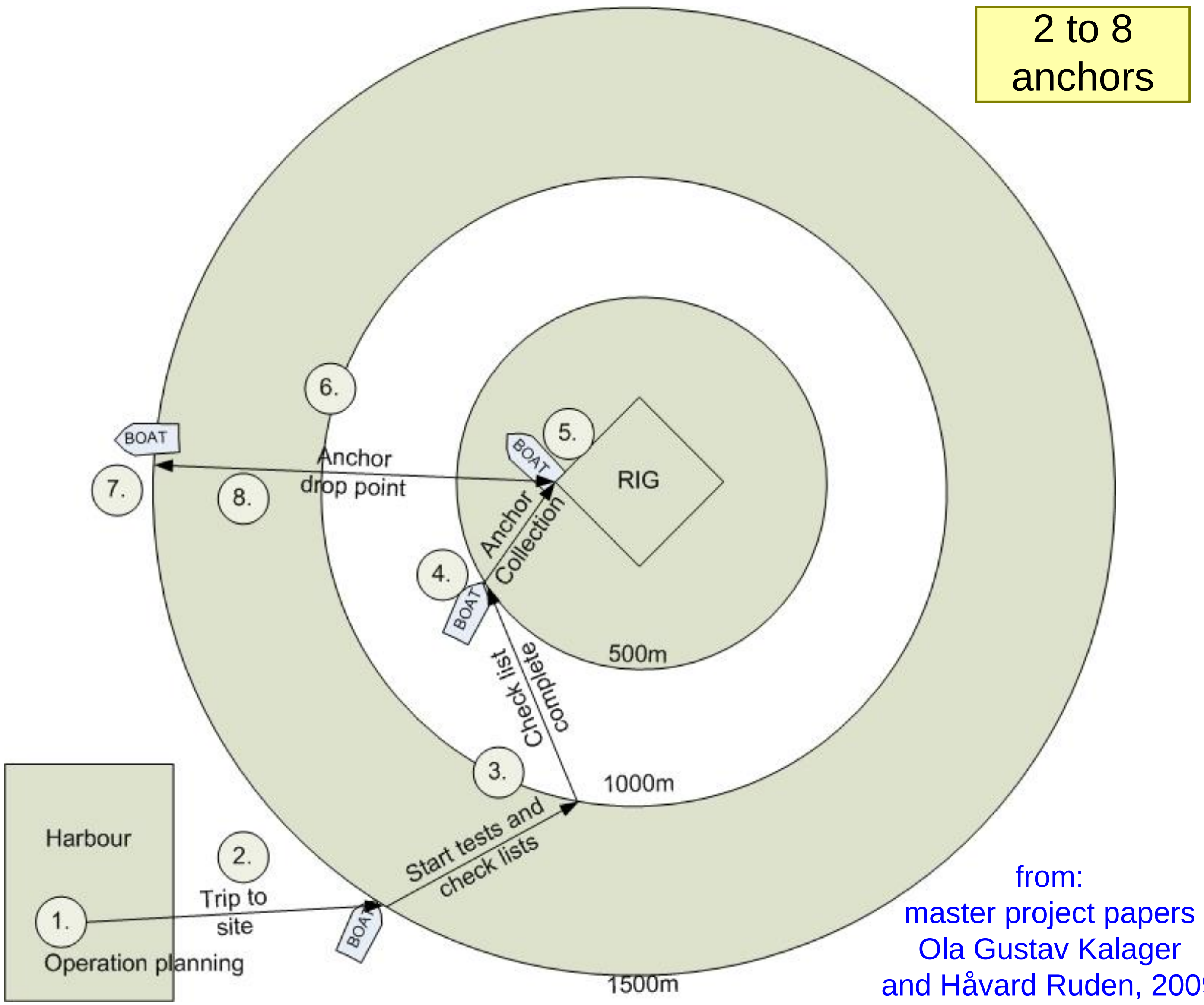
What are the 3 to 5
Main Functions
of the **vessel**?

What are the 3 to 5
Key Performance Parameters
of the **vessel**?

Anchor Handling



Anchor Handling Workflow (Where)

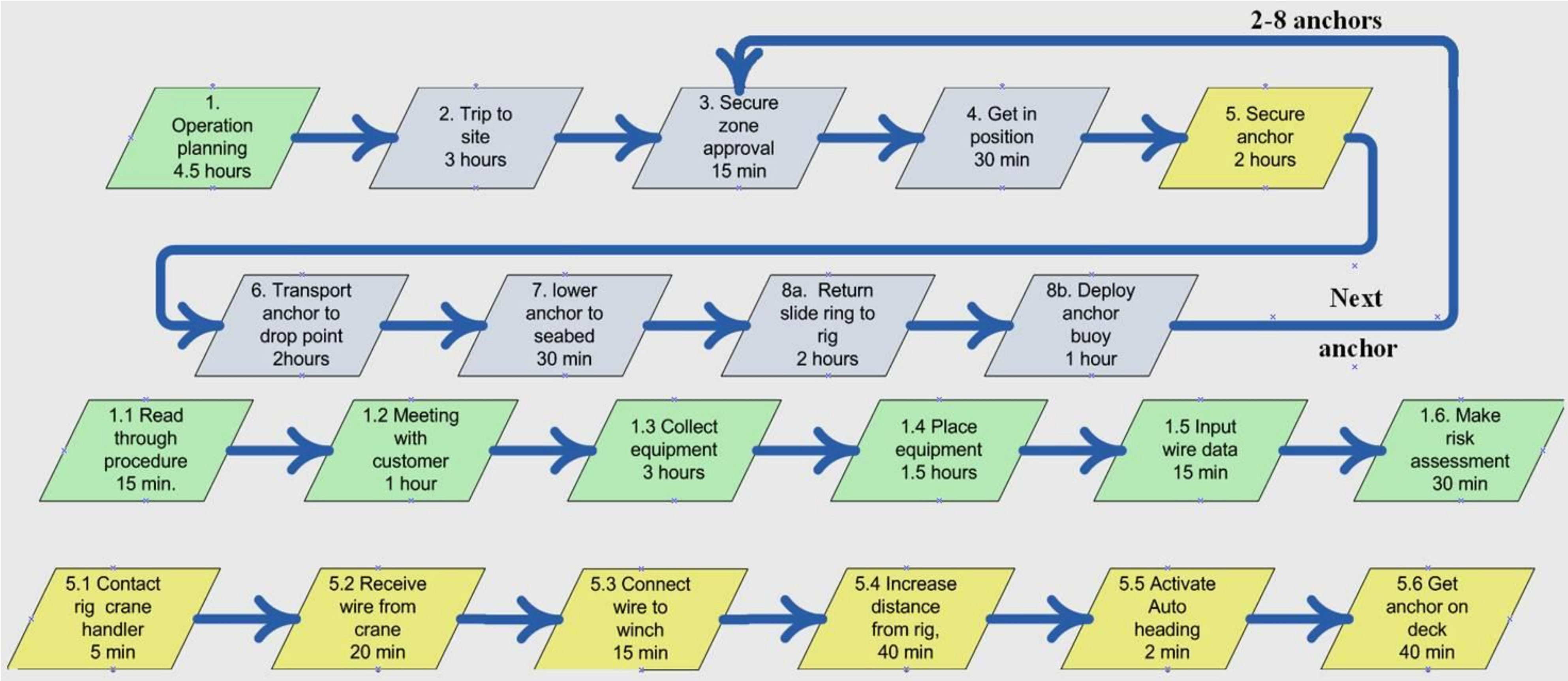


from:
master project papers
Ola Gustav Kalager
and Håvard Ruden, 2009

What are the 3 to 5
Main Functions
of **anchor handling**?

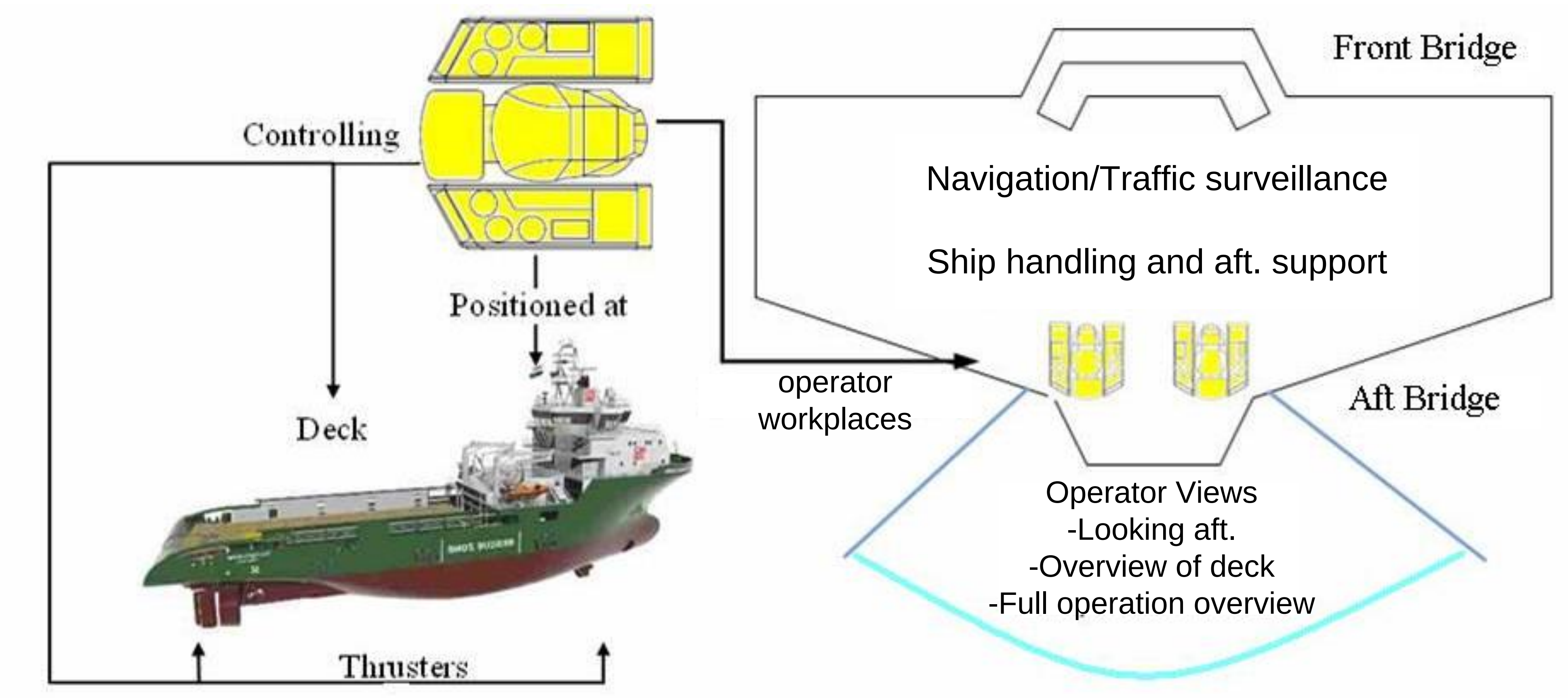
What are the 3 to 5
Key Performance Parameters
of **anchor handling**?

WorkFlow of Anchor Handling (What, When)



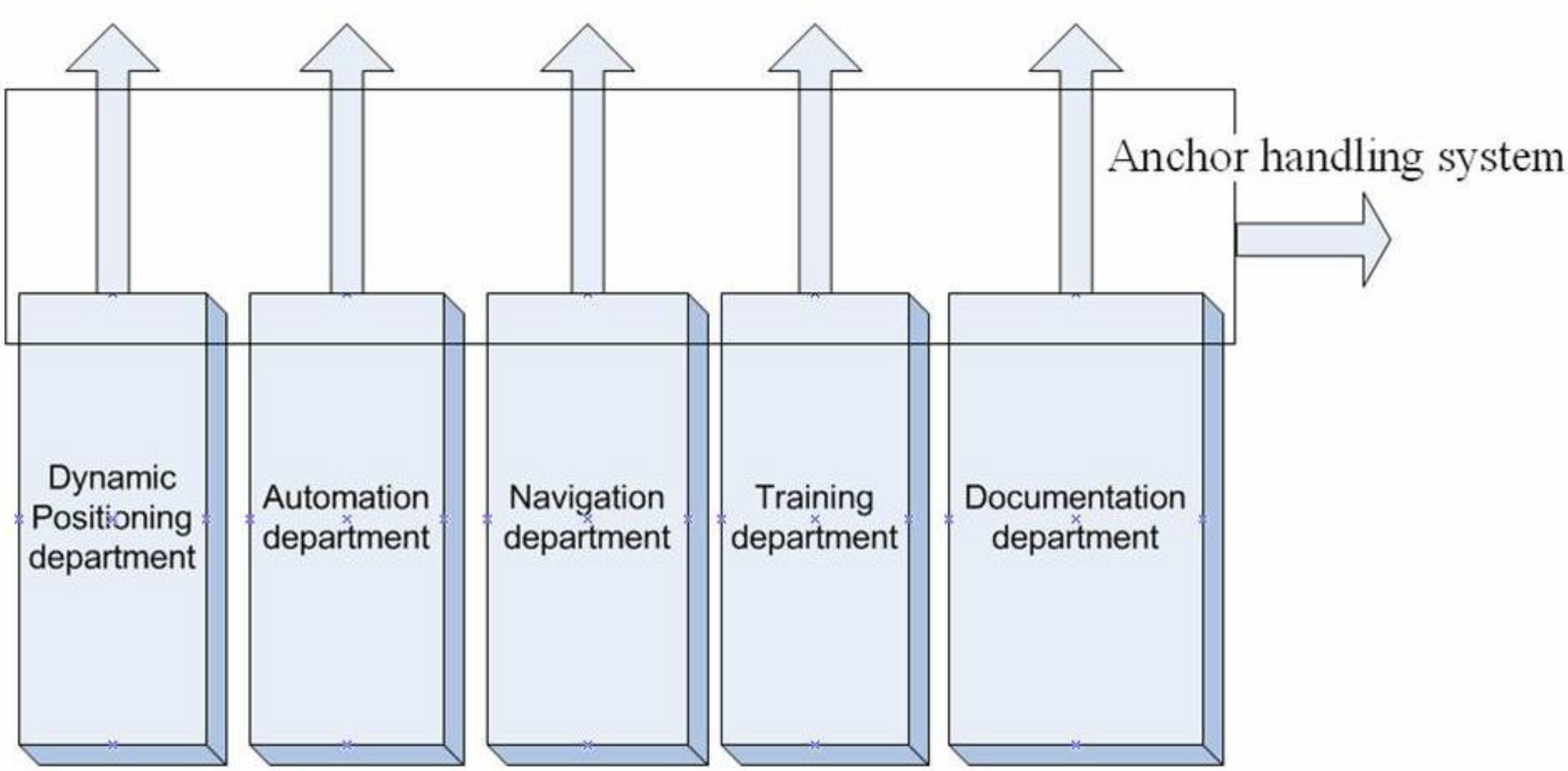
from: master project paper Håvard Ruden, 2009

Control from Operator Stations



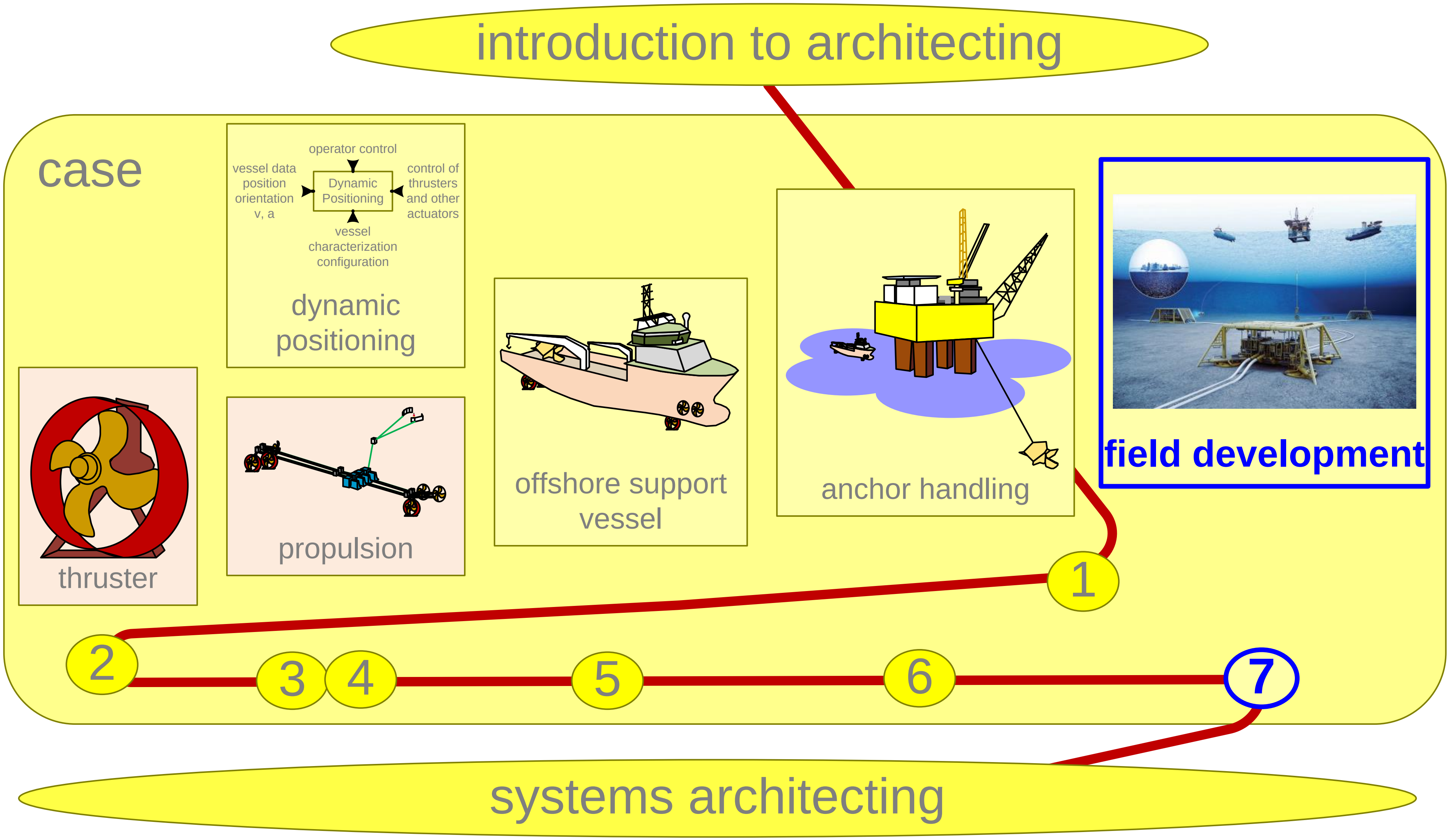
from: master project paper Håvard Ruden, 2009

Work Breakdown Anchor Handling

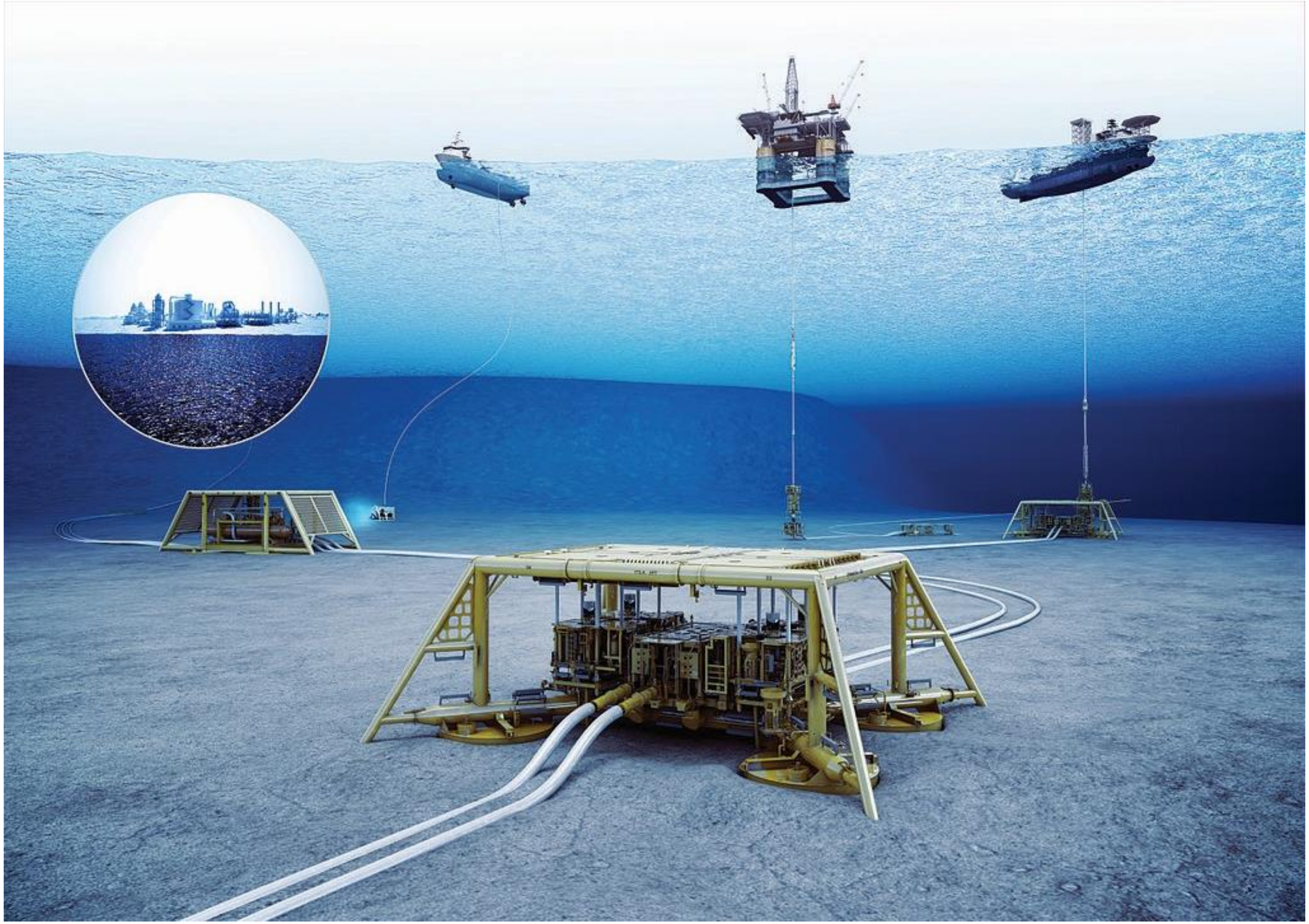


from: master project paper Håvard Ruden, 2009

Field Development



Field Artist Impression



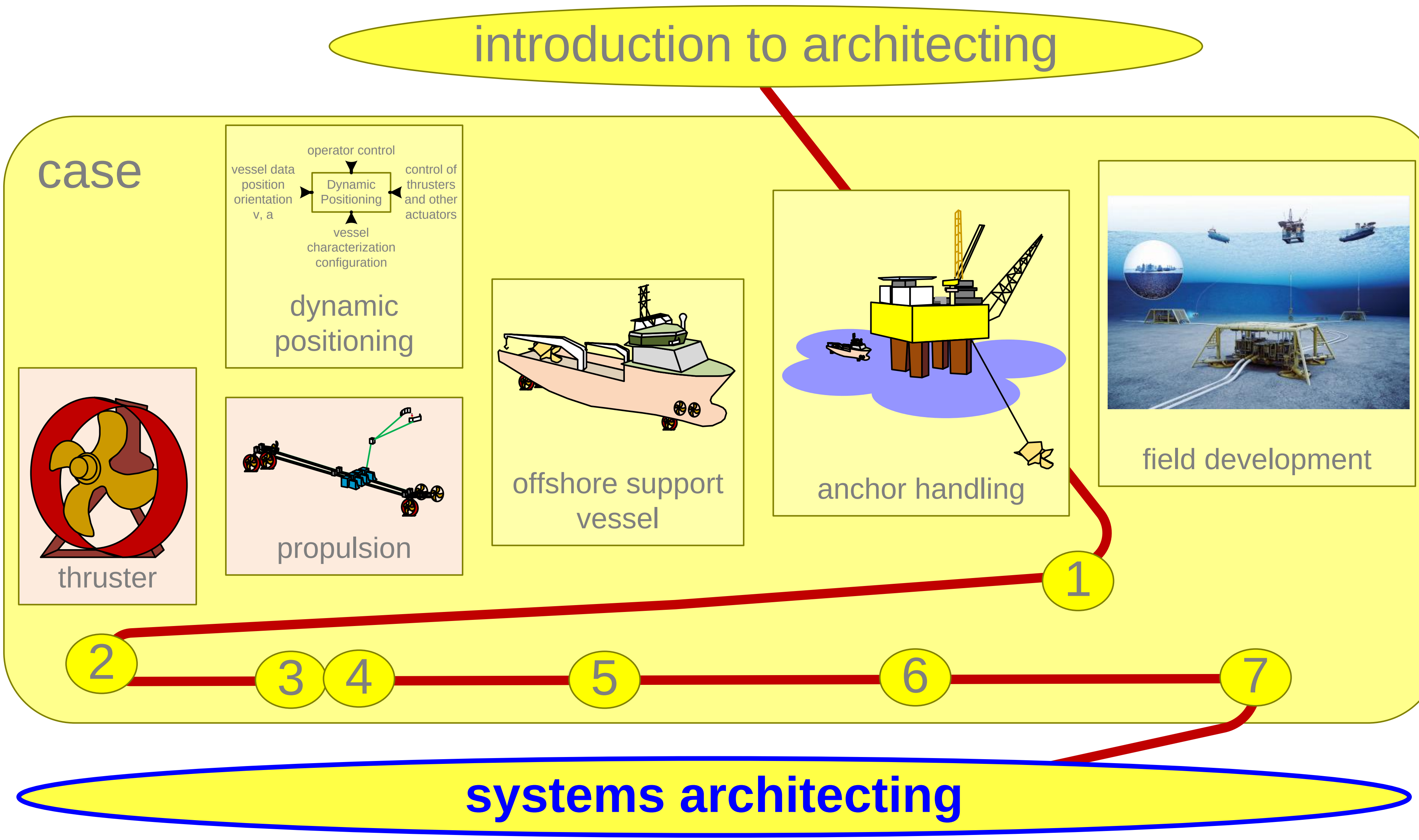
Courtesy FMC Technologies

Questions Functionality and Performance Field Development

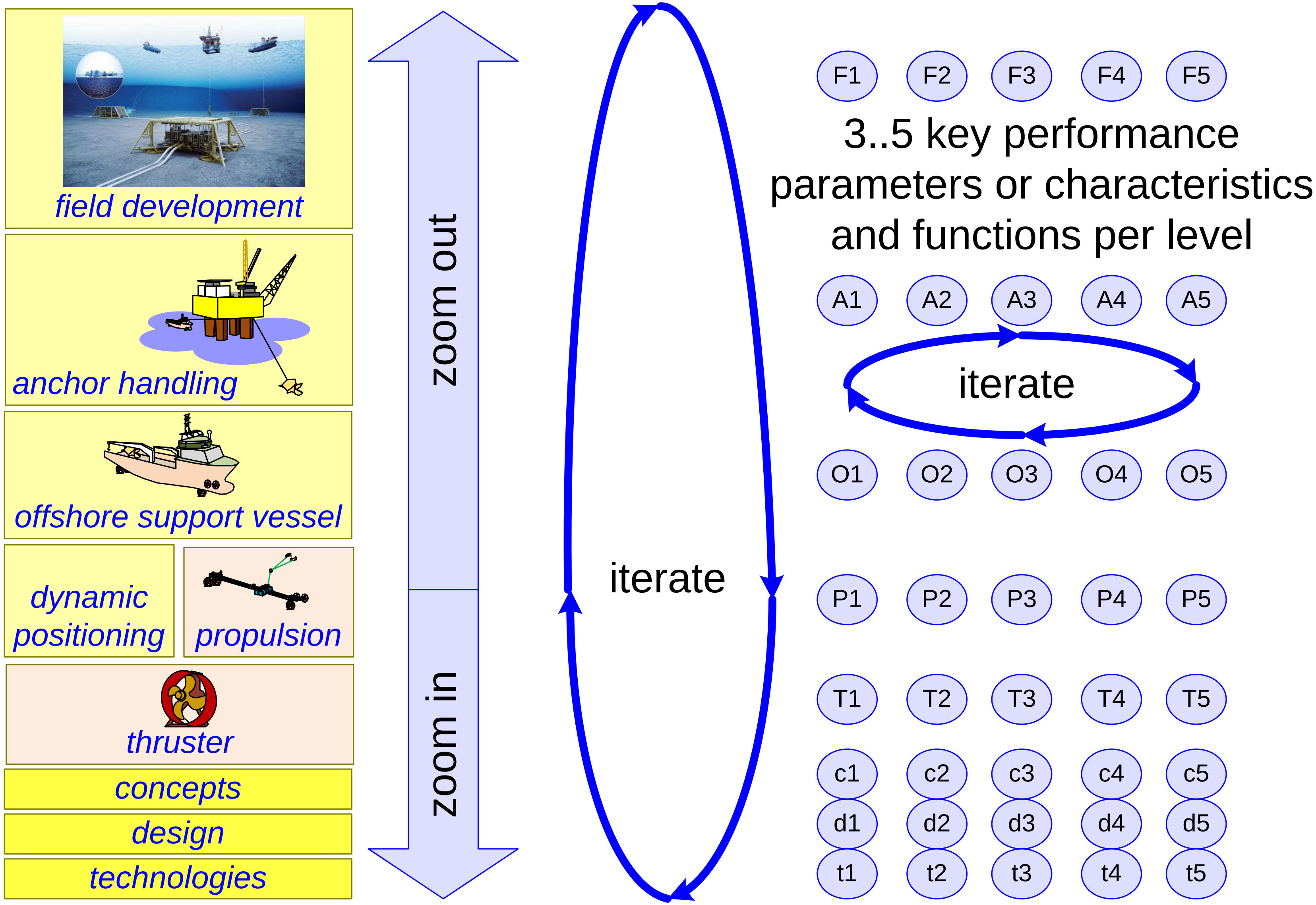
What are the 3 to 5
Main Functions
of **field development**?

What are the 3 to 5
Key Performance Parameters
of **field development**?

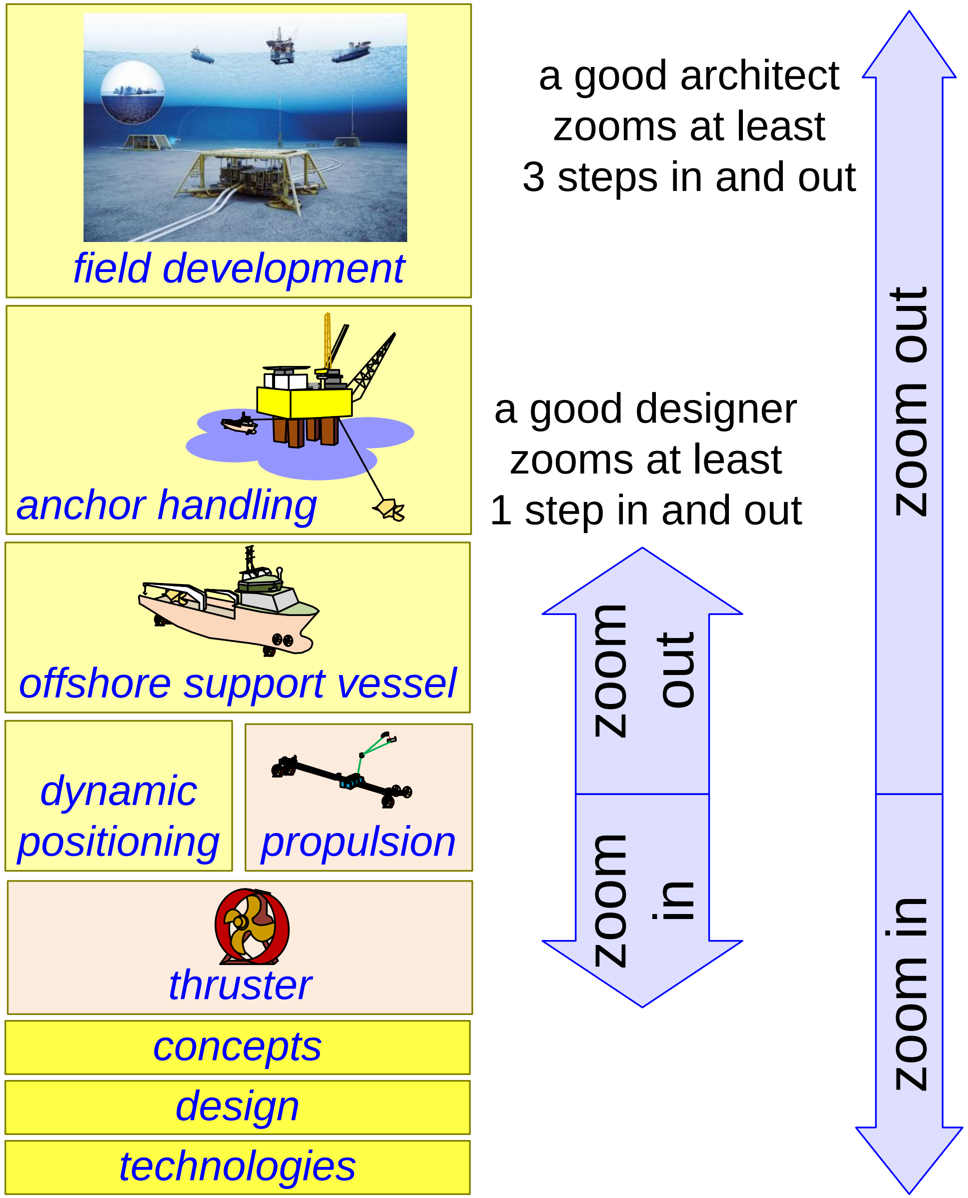
Systems Architecting



DP Architecting: ca. 8 Orders Zoom in-out



Summary



All designers and architects

need to consider

- parts (static)
- dynamic behavior (functionality)
- quality attributes (performance parameters, quantification)