14 May 2025

Bridging the Gap - Translating Operational Requirements to System Specifications Using Opus Suite

Younes Lousseief, Systecon AB

”Pick a number”

Requirements on a future naval capability
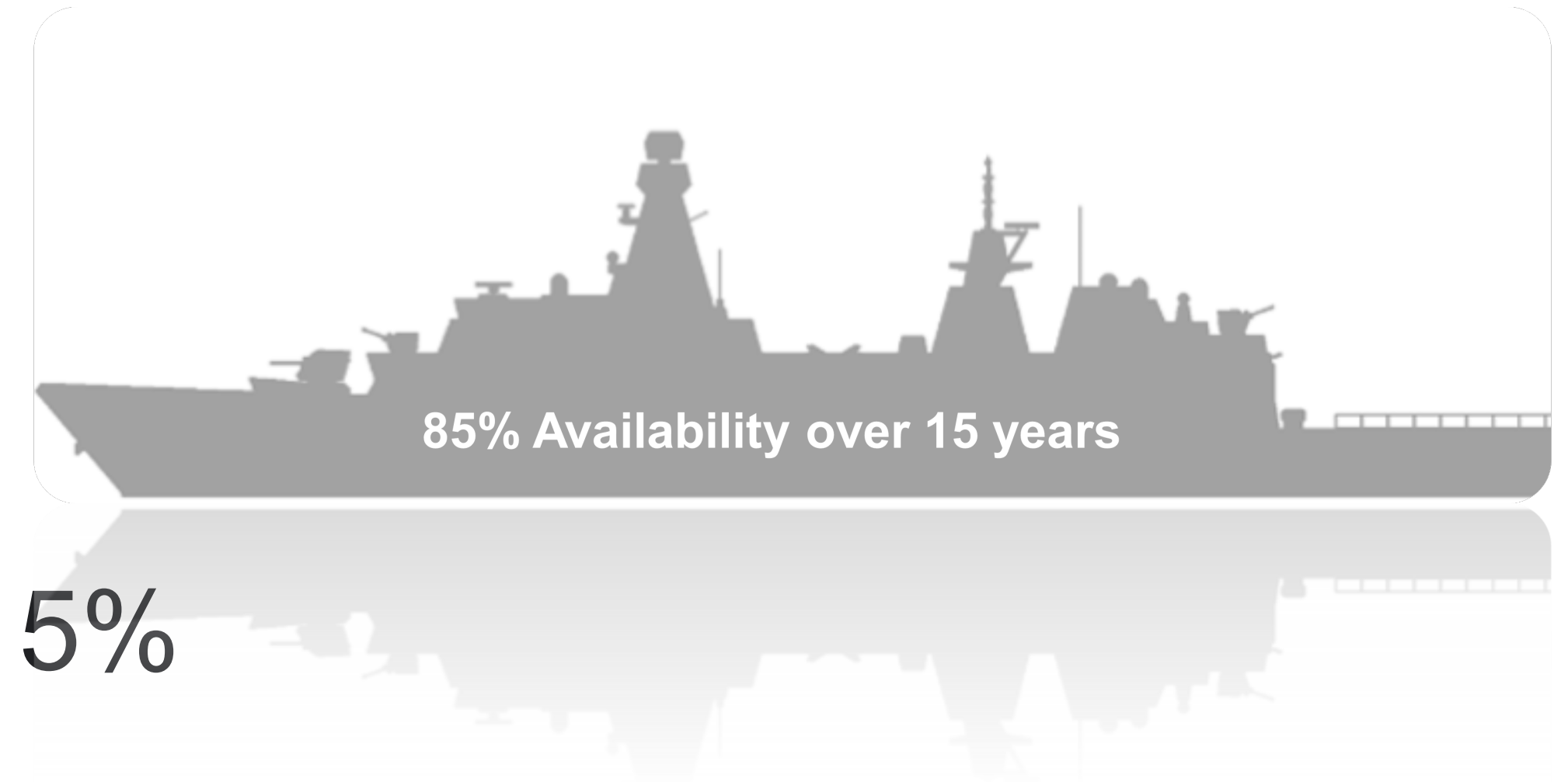
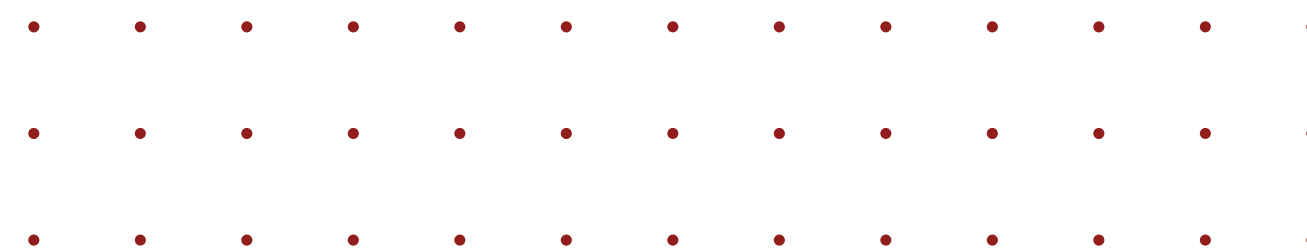**85% Availability over 15 years**

What can we do with this?

What can we do with this?

Let's calculate

85% Availability over 15 years

Availability = 85% → Unavailability = 15%

15 x 8760 x 0,15 ≈ 20 000 hours of downtime

How to distribute it?

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Glossary

Reliability & Supportability

MTBF = Mean Time Between Failure
MTBM = Mean Time Between Maintenance

MTTR = Mean Time To Repair
MTTM = Mean Time To Maintain

MLDT = Mean Logistics Delay Time
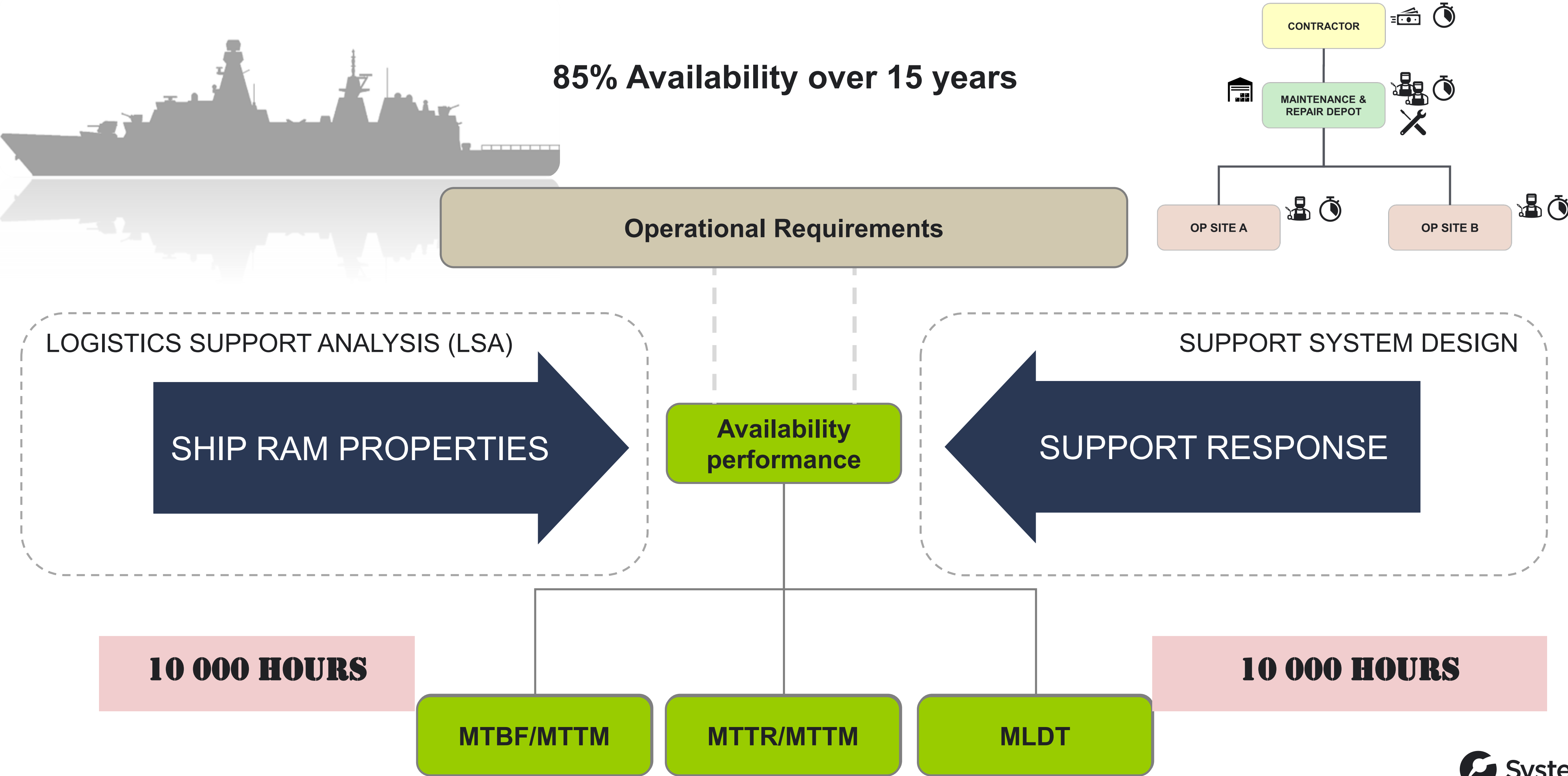
Operations

A = Availability
OPH = Operating Hours
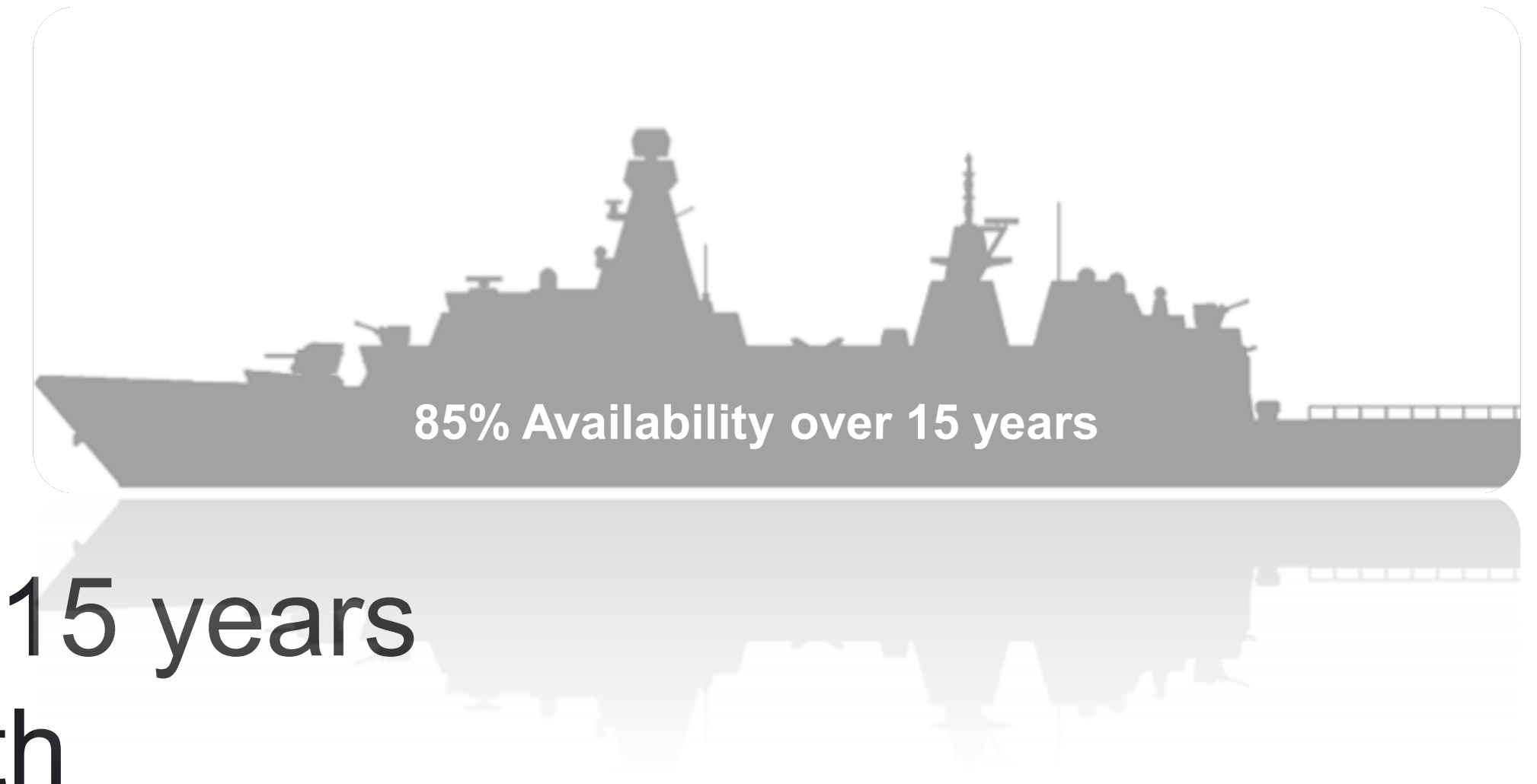MSUCC = Mission Success rate
NSYS = Fleet size

Cost

LCC = Life Cycle Cost

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First attempt: Split the time equal

85% Availability over 15 years

CONTRACTOR

MAINTENANCE & REPAIR DEPOT

OP SITE A		OP SITE B

Operational Requirements

LOGISTICS SUPPORT ANALYSIS (LSA)

SHIP RAM PROPERTIES

Availability performance

SUPPORT SYSTEM DESIGN

SUPPORT RESPONSE

10 000 HOURS

10 000 HOURS

MTBF/MTTM	MTTR/MTTM	MLDT

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What can we do with this?

Let's calculate

85% Availability over 15 years

10 000 hours inherent downtime over 15 years
<u>Assumption</u>: Normal mission = 1 month

Which gives us 10 000 h / (15 years x 12 m) = 55 hours / month
Is 55 hours downtime per 1 month mission time acceptable?

NO!

<u>Acceptable</u>: 5 h downtime per mission (month)

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Second attempt: Redistribution

85% Availability over 15 years

CONTRACTOR

MAINTENANCE & REPAIR DEPOT

OP SITE A

OP SITE B

Operational Requirements

LOGISTICS SUPPORT ANALYSIS (LSA)

SHIP RAM PROPERTIES

Availability performance

SUPPORT SYSTEM DESIGN

SUPPORT RESPONSE

1 000 HOURS

19 000 HOURS

MTBF/MTTM

MTTR/MTTM

MLDT

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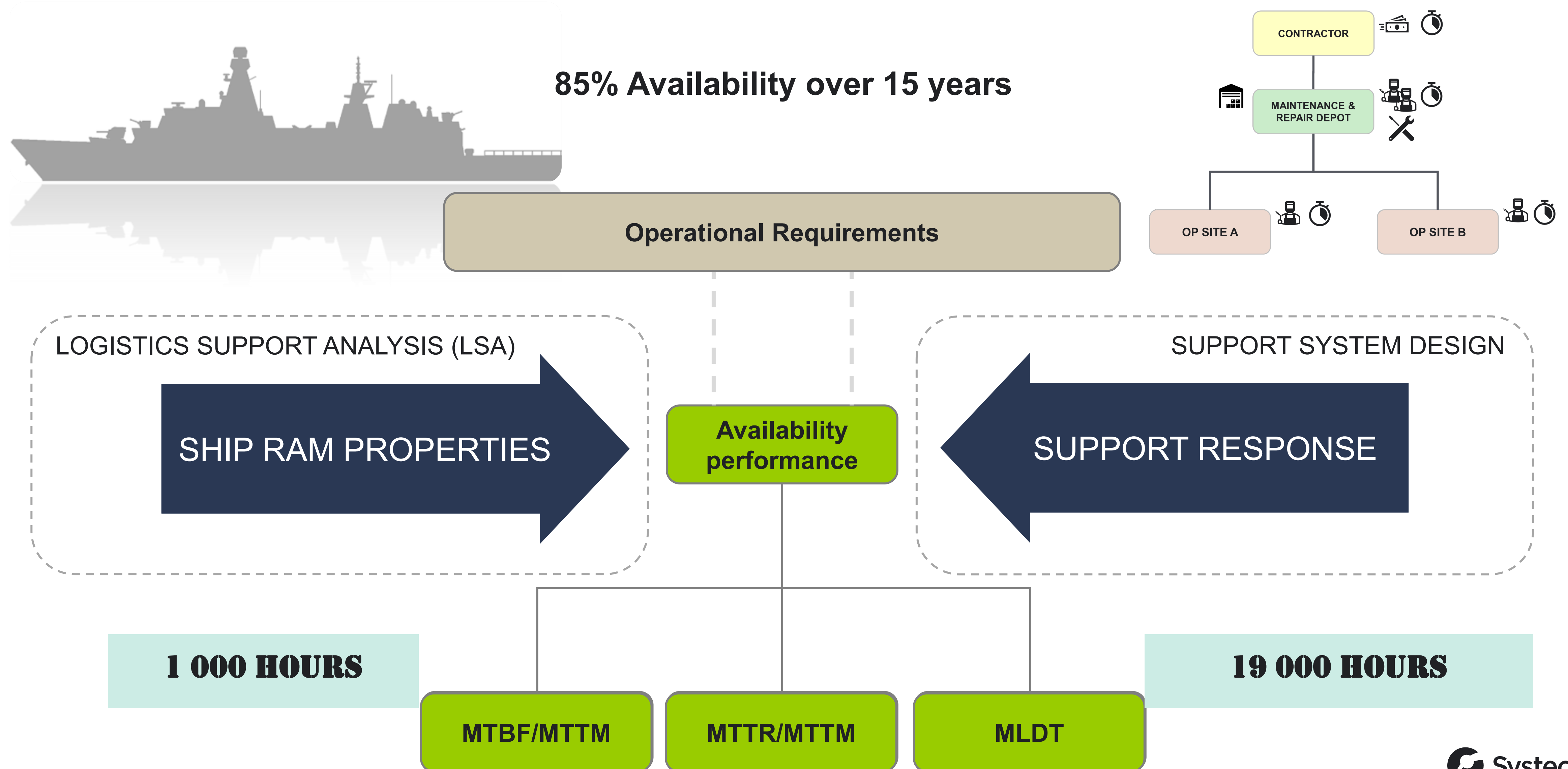
Revisiting the stakeholders

Requirements on a future naval capability

85% Availability over 15 years

But we must be able to say more about the operational requirements.

Revisiting the stakeholders
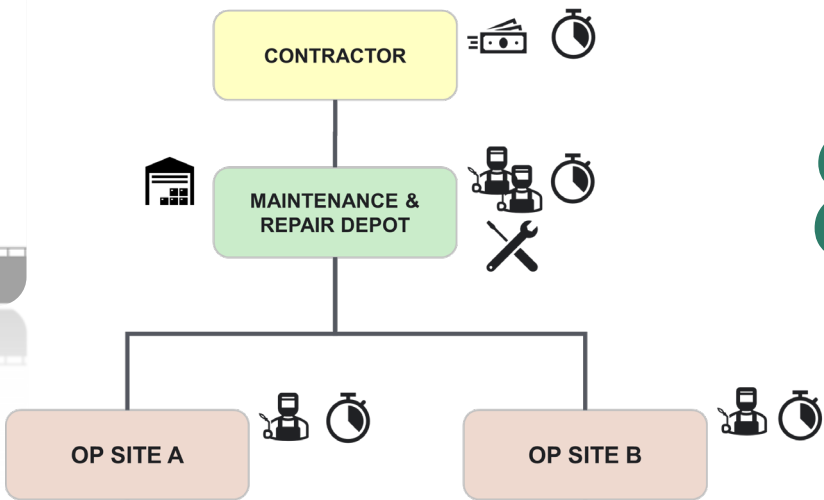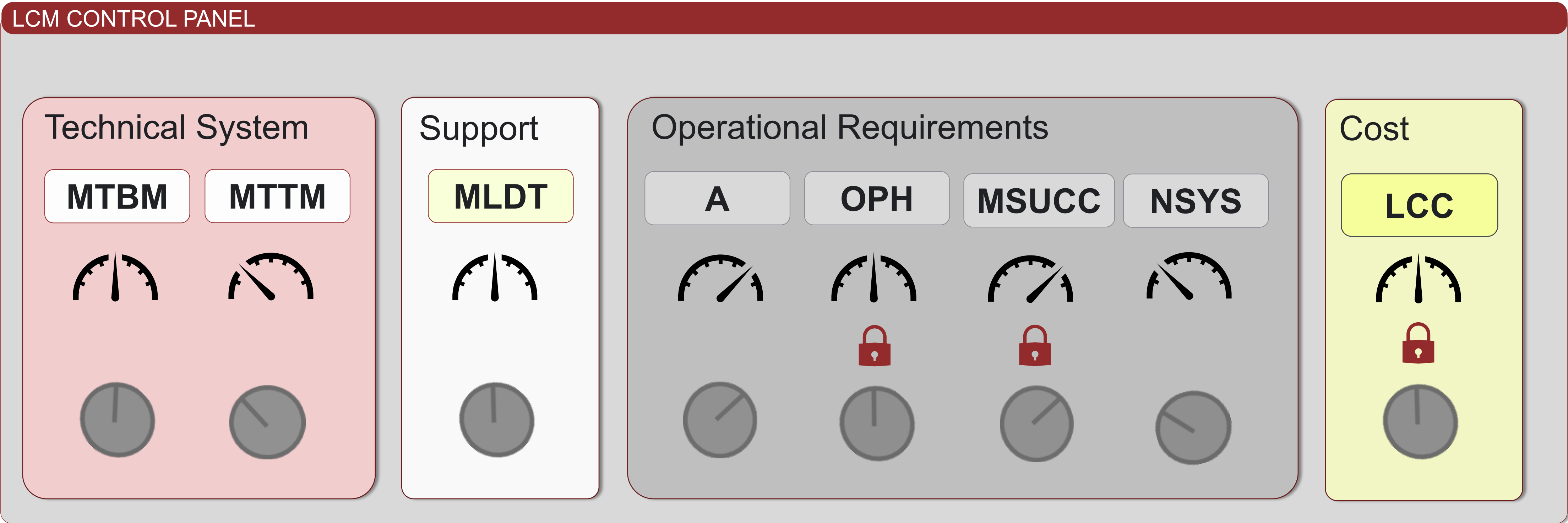
Based on requirements, experience and similar ships

- 30 day mission period
- 300 days at sea per year → 10 missions
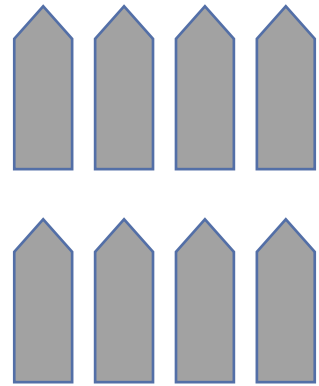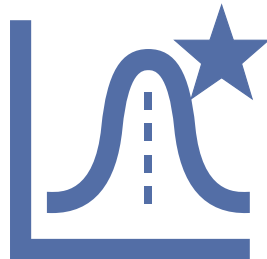- 3 weeks of annual maintenance
- 6 weeks Major overhaul every 5 years
- ......

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Revisiting the stakeholders

Based on requirements, experience and similar ships

10 x 30 days → 7 days in port
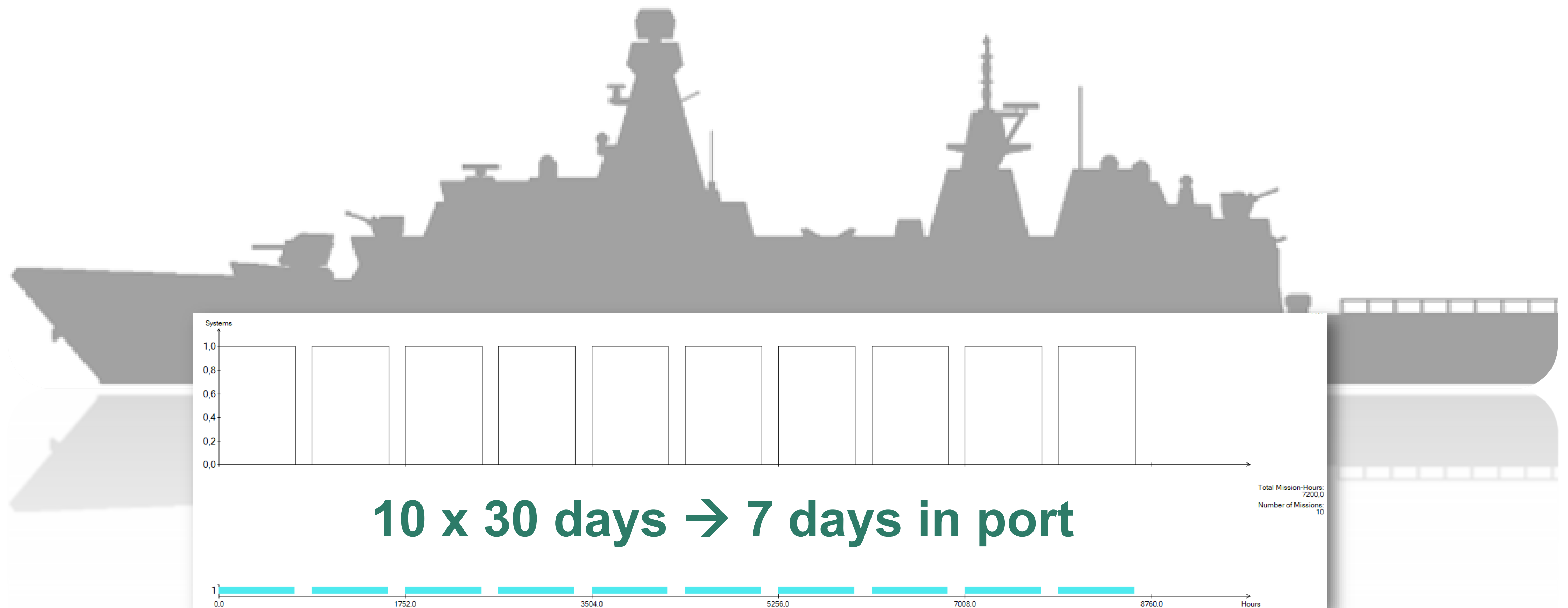
What "knobs" can I turn on?

LCM CONTROL PANEL

Technical System
- MTBM
- MTTM

Support
- MLDT

Operational Requirements
- A
- OPH
- MSUCC
- NSYS

Cost
- LCC

CONTRACTOR

MAINTENANCE & REPAIR DEPOT

OP SITE A   OP SITE B

85%   7200 H   10 MISSIONS

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Test the requirements

SHIP · MTBM · MTTM

Input Data

Fleet size: 8 ships

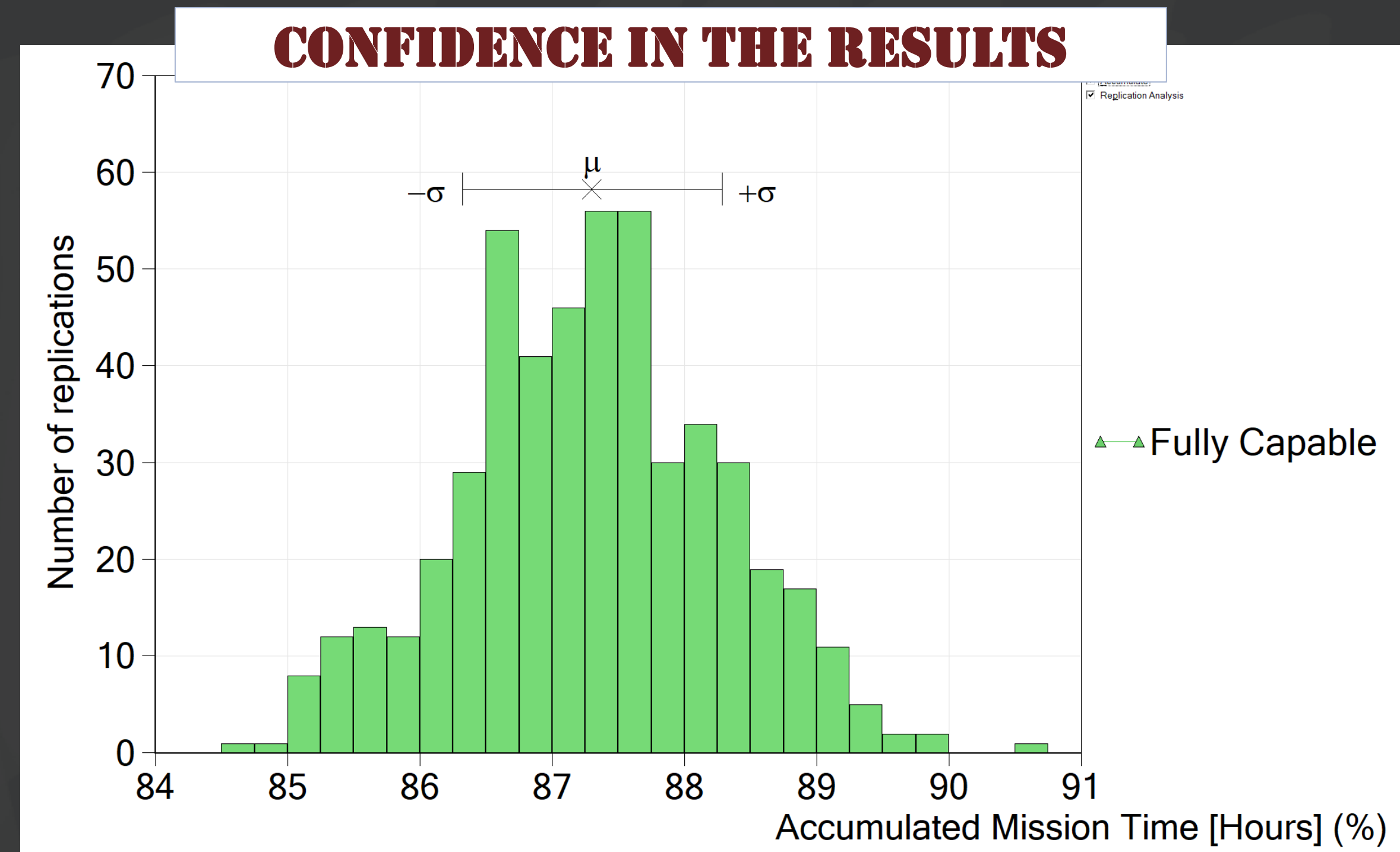Failure Rate: 1 per mission

Onboard Repair: 5h
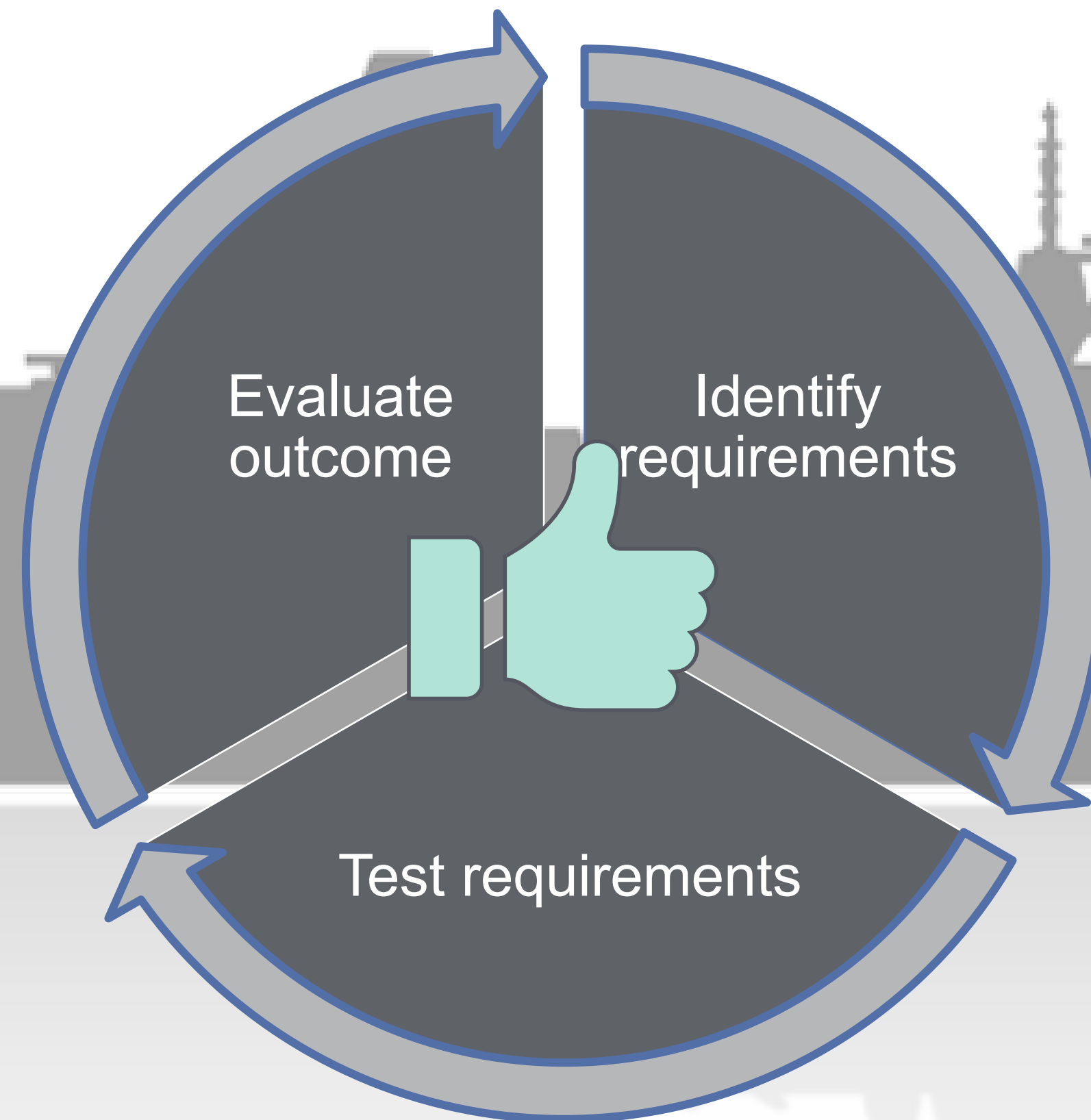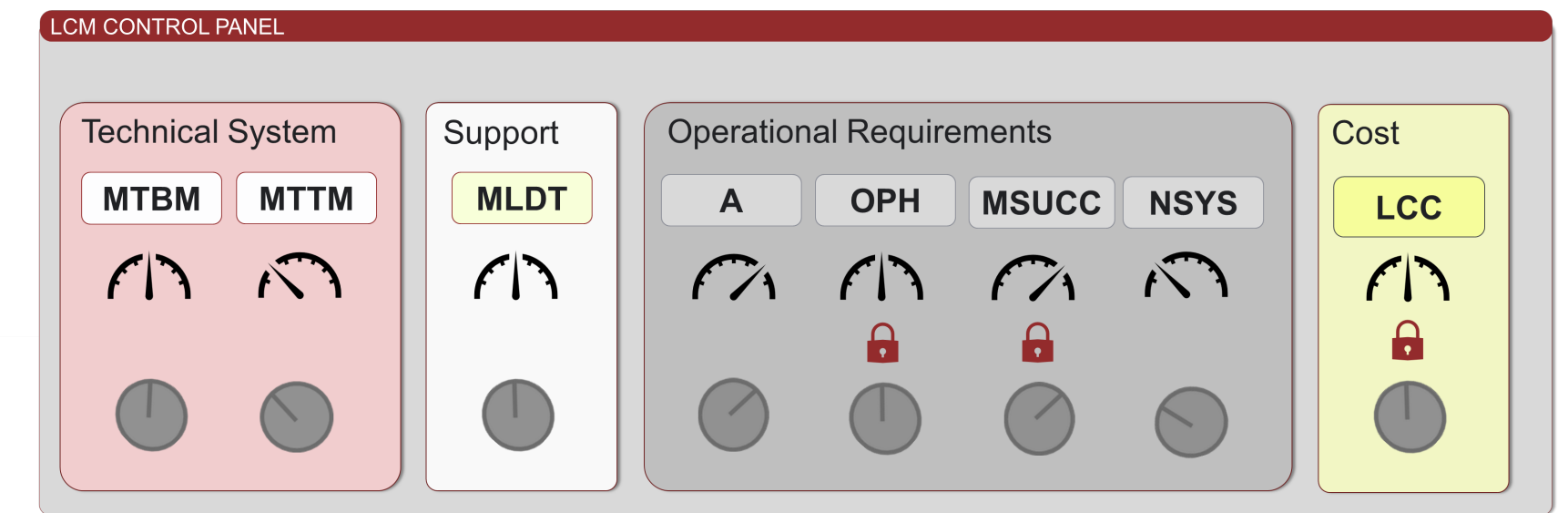
Annual OH: 3 weeks

5-yr Major OH: 6 weeks

1 dry dock

SHIP PERFORMANCE

MISSION ACCOMPLISHMENT

UNAVAILABILITY
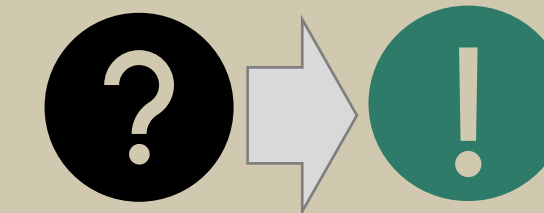
by Systecon

opus suite

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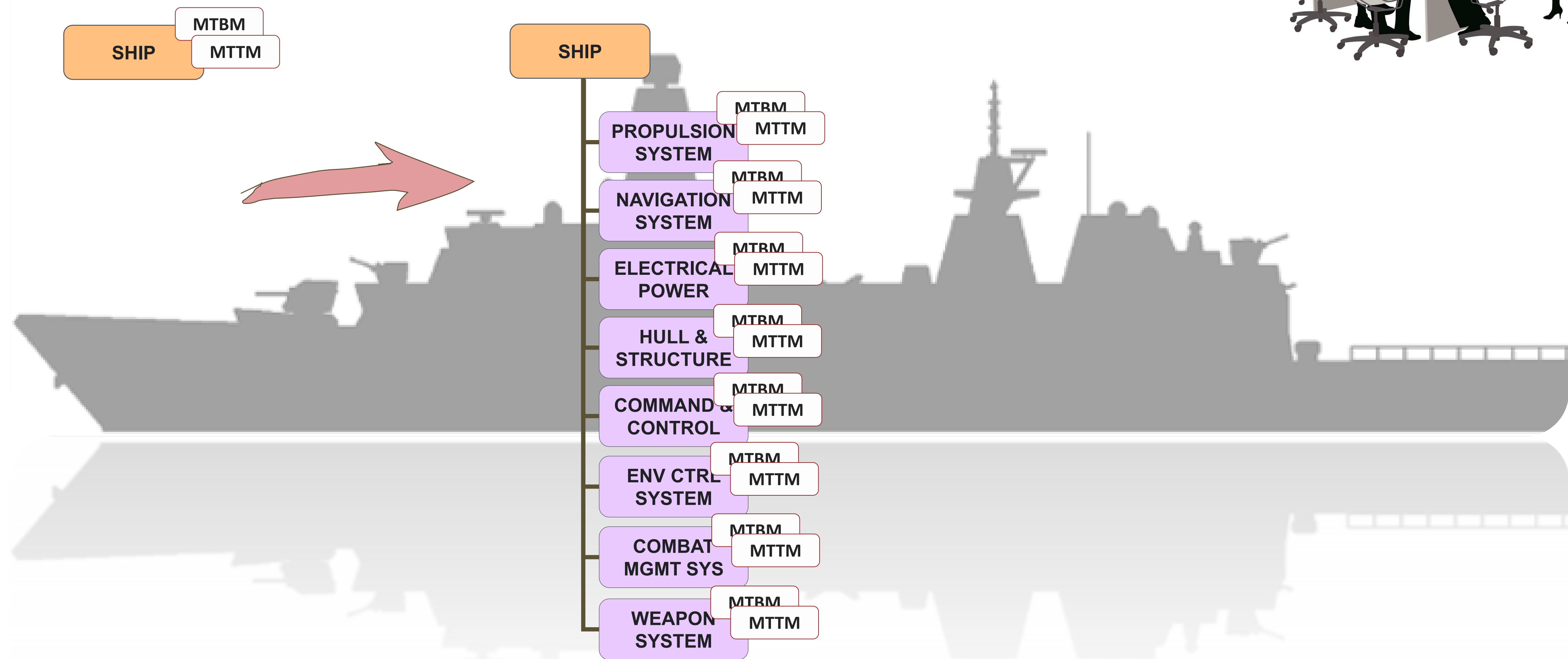# Test the requirements

An iterative process

Evaluate the results

Questions we can answer now:

- Is the fleet size big enough?

- Are the maintenance requirements reasonable with only 1 dry-dock?

- Is the reliability enough for the required operations pattern?

- Is the operational results satisfactory?

Next phase

Break down the ship in functions

| SHIP | MTBM |
| | MTTM |

SHIP

PROPULSION SYSTEM — MTBM / MTTM

NAVIGATION SYSTEM — MTBM / MTTM

ELECTRICAL POWER — MTBM / MTTM

HULL & STRUCTURE — MTBM / MTTM

COMMAND & CONTROL — MTBM / MTTM

ENV CTRL SYSTEM — MTBM / MTTM

COMBAT MGMT SYS — MTBM / MTTM

WEAPON SYSTEM — MTBM / MTTM

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Beyond Availability

Capability analysis

Mission operational modes
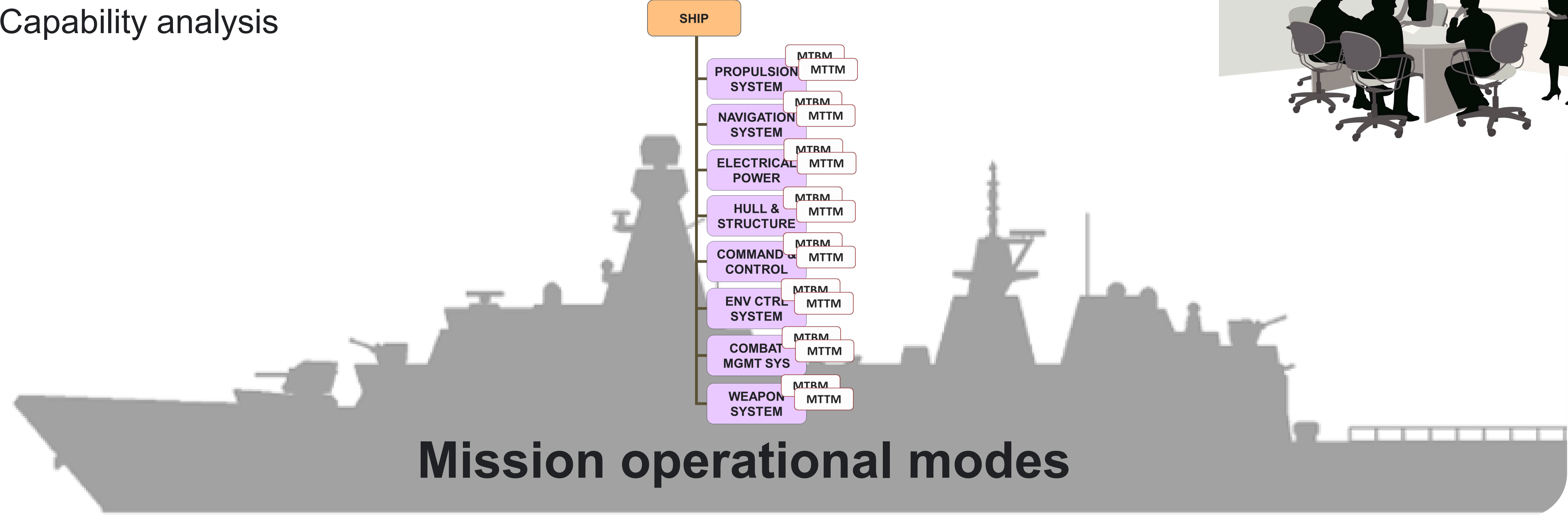
ISR	Intelligence, Surveillance, and Reconnaissance (ISR)
ASW	Anti-Submarine Warfare (ASW)
MIO	Maritime Interdiction Operations (MIO)
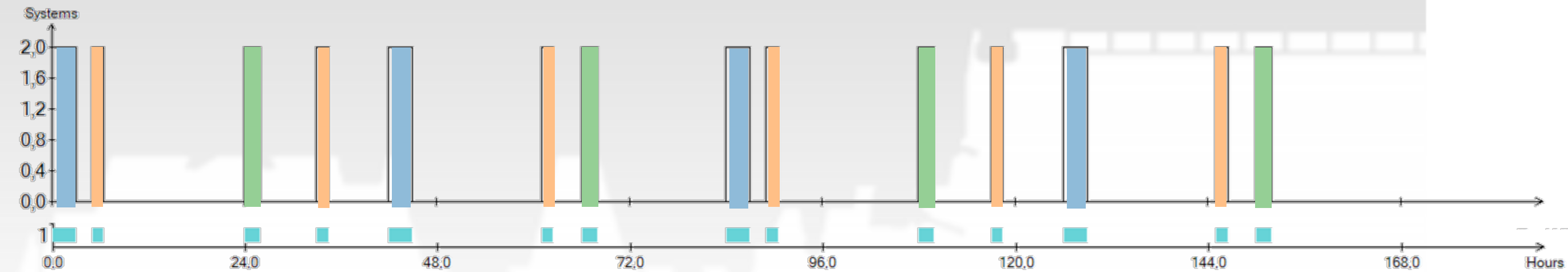
Test the requirements

Again: An iterative process

LCM CONTROL PANEL

| Technical System		Support	Operational Requirements				Cost
MTBM	MTTM	MLDT	A	OPH	MSUCC	NSYS	LCC

Identify requirements

Test requirements

Evaluate outcome
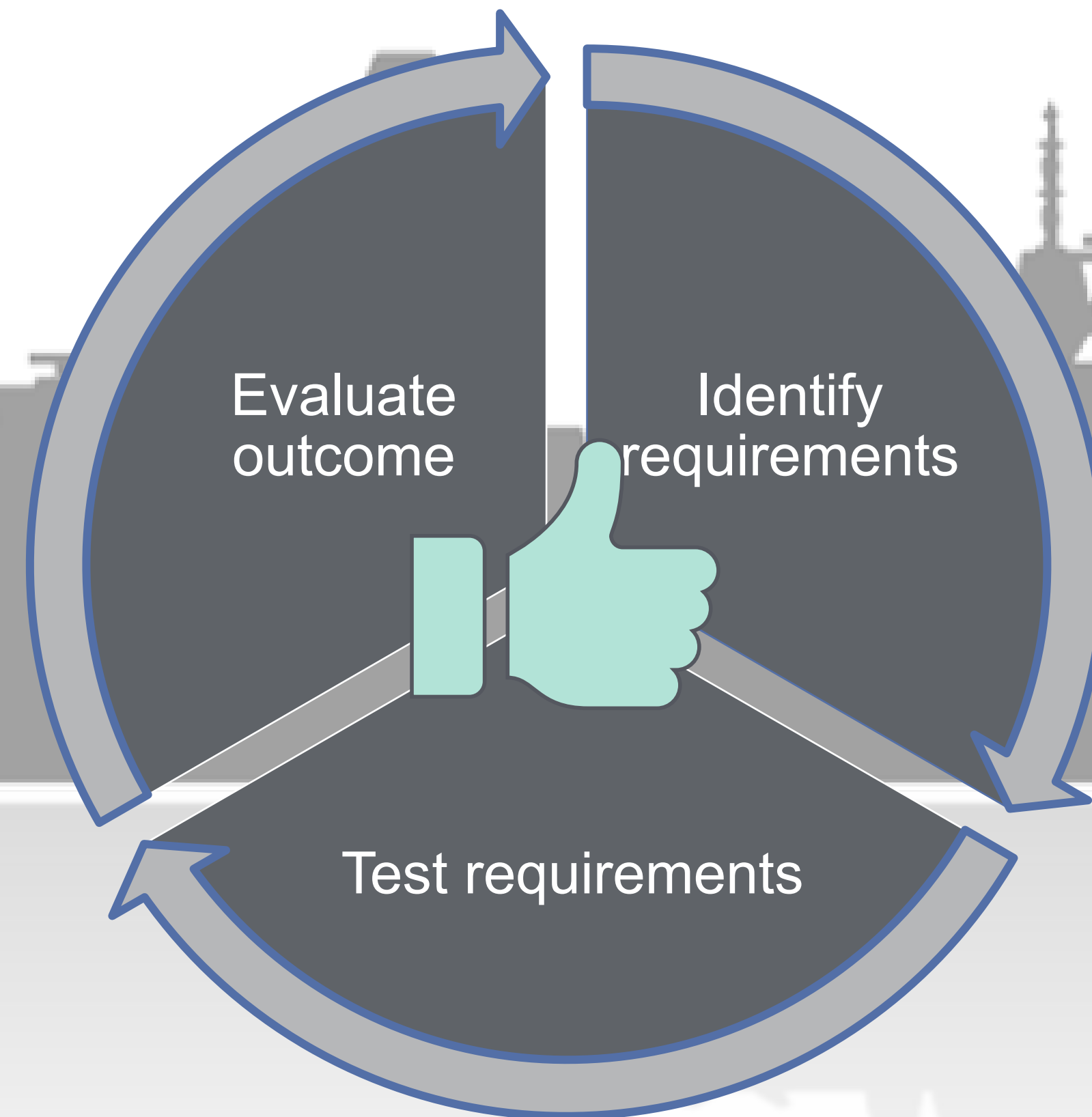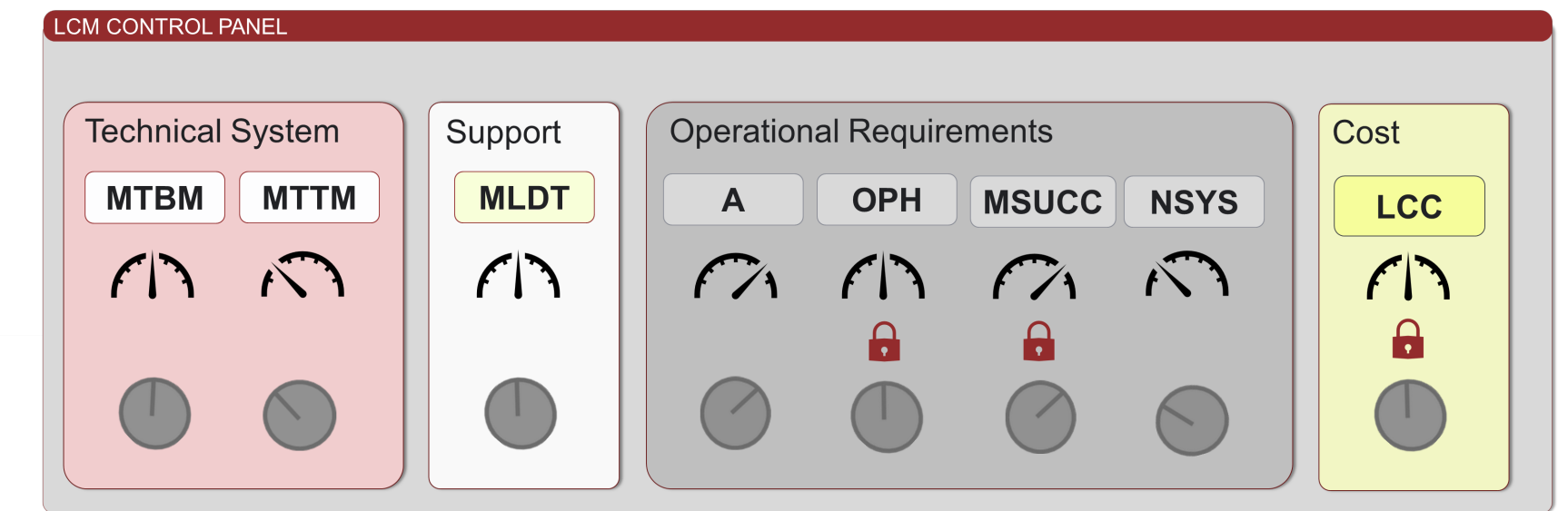
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Collaboration

Industry

- System data
- Maintenance Concept
- Logistics Support Solution
- Spare Parts Strategy
- Resources
- System knowledge

Operator

- Operational Needs
- Operational Concept
- Usage Profiles
- Logistics Support Solution
- Fleet data
- User knowledge
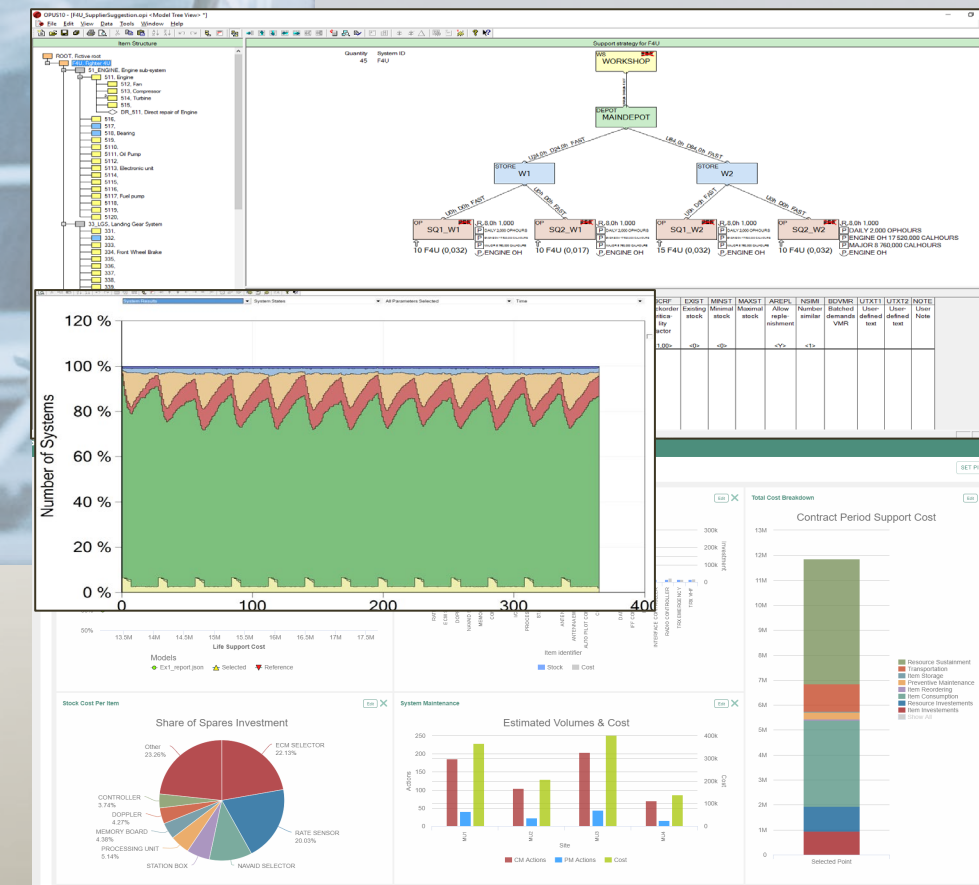
**Common understanding
Shared commitment
Risk under control**

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Key takeways

1   A "number" can mean a lot of things.

Breaking down and evaluate requirements can generate better requirements.

Equip yourself with a model right from the start.

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Grazie per l'attenzione

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