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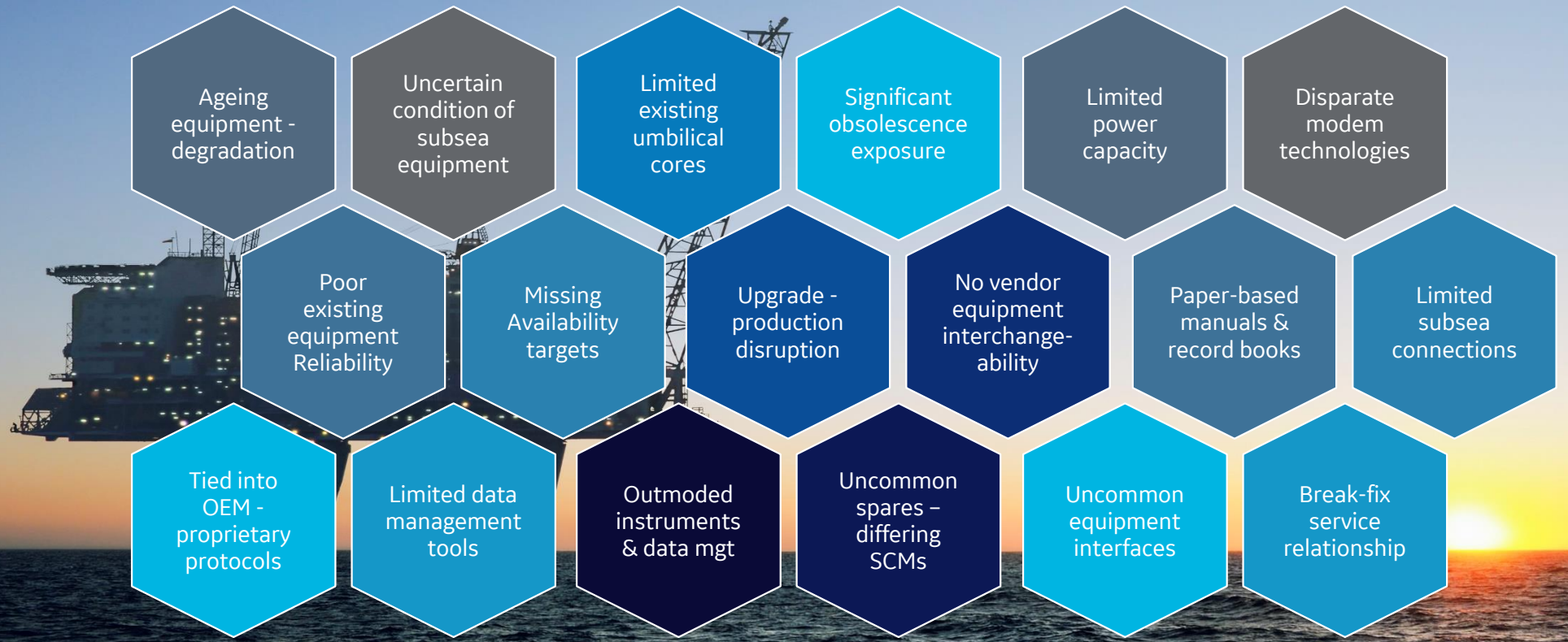
# Life of Field

## obsolescence Management

**October 15, 2018**

# Brownfield assets

## Challenges for the operator… Life of Field

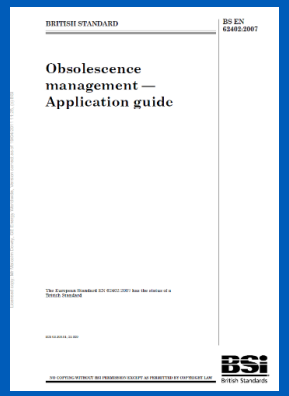


# Brownfield assets

## Obsolescence – Transition from availability from the original manufacturer to unavailability (Ref: JOS 3428B)

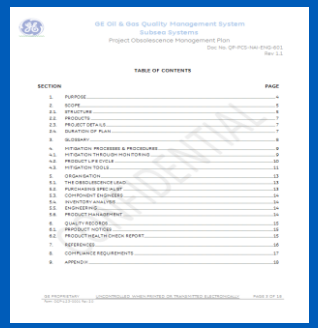
Obsolescence Management Guide

IEC 62402




Project Obsolescence Management Plan

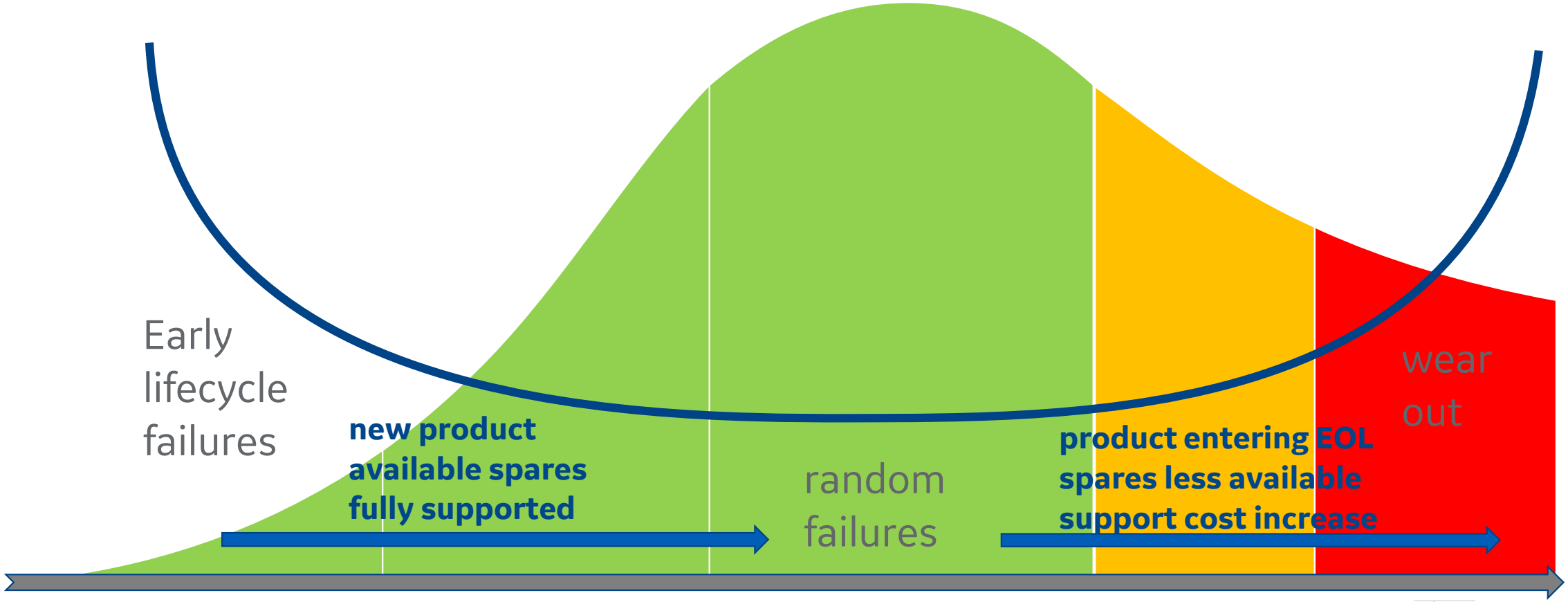
QP-PCS-NAI-ENG-601




Joint Operator Specification

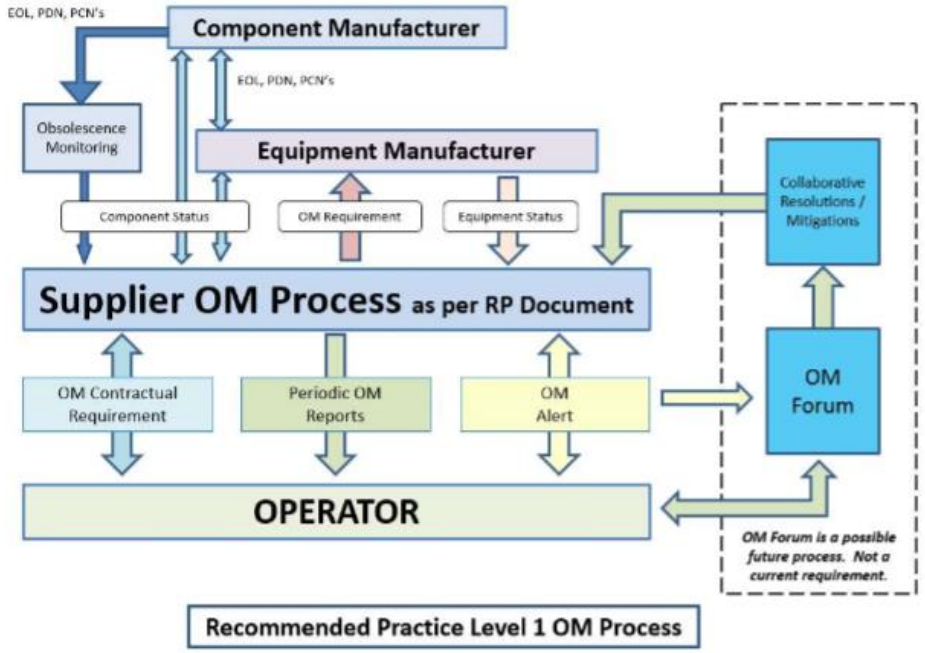
3428A+B

# Obsolescence Management & Product Life Cycle Profiling Risk

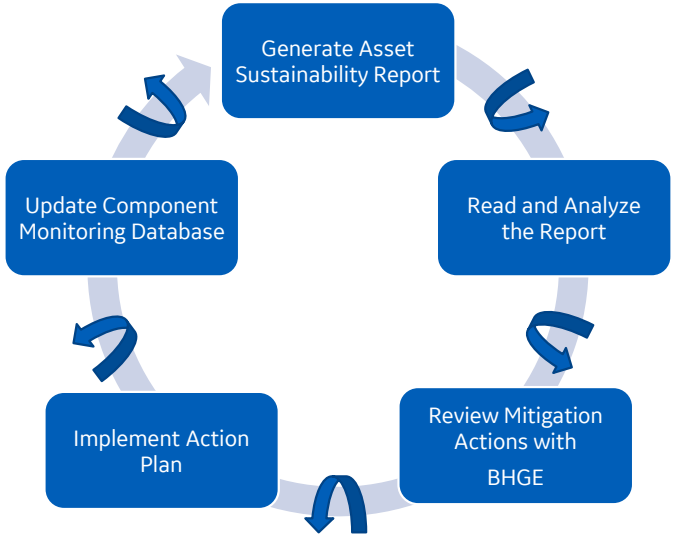




1st Generation, brand new unopened - $37000

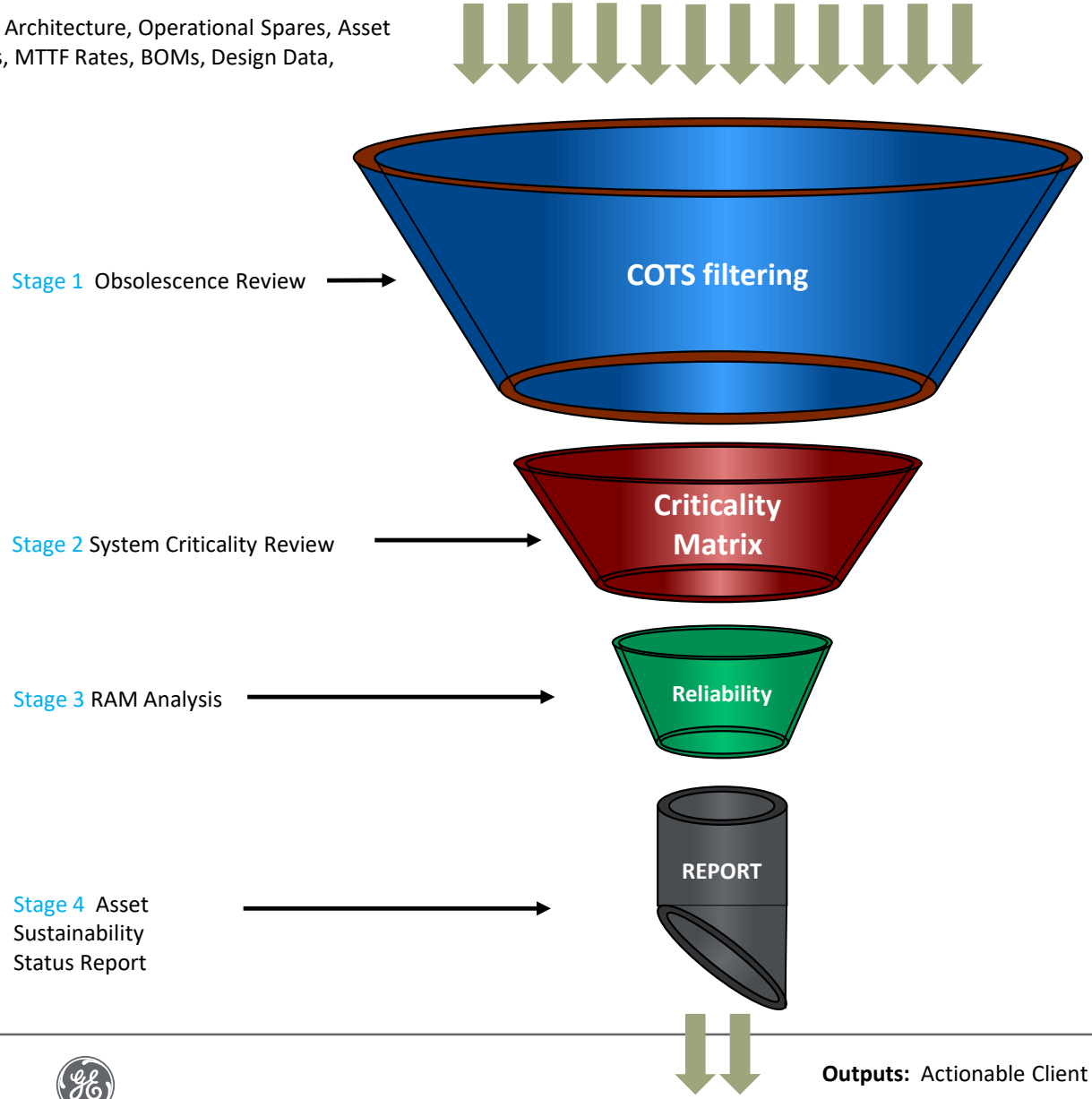



Ref: JOS 3428B




Ref: BHGE

**Inputs:** Field Architecture, Operational Spares, Asset Health Status, MTTF Rates, BOMs, Design Data, FMECA




Stage 1 Obsolescence Review

Stage 2 System Criticality Review

Stage 3 RAM Analysis

Stage 4 Asset Sustainability Status Report

~ 28,000 **Components**

~ 7,000 **Components**

~ 50-200 **Components**

What's in Scope?
Where's the cut off?

- Operator specific

Commercial Off The Shelf (COTS)

- Power Supply Units
- Circuit breakers
- Switches

The easy stuff right?

What if?

- Location
- Spares
- Operations

Reliability

- Likelihood?

**Outputs:** Actionable Client Recommendations

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# Risk Based Criticality Analysis

- Risk based methodology conforming to:

  Joint Operator Obsolescence Management Specification, 3428B

  (BP, Chevron, INPEX, Equinor, Total, Woodside)

- Components risk profiling considers:
  - Stock Levels
  - Stock Consumption Rate
  - Number of Manufacturing Sources
  - Years to End Of Life (YTEOL)
  - Operational Impact Criticality

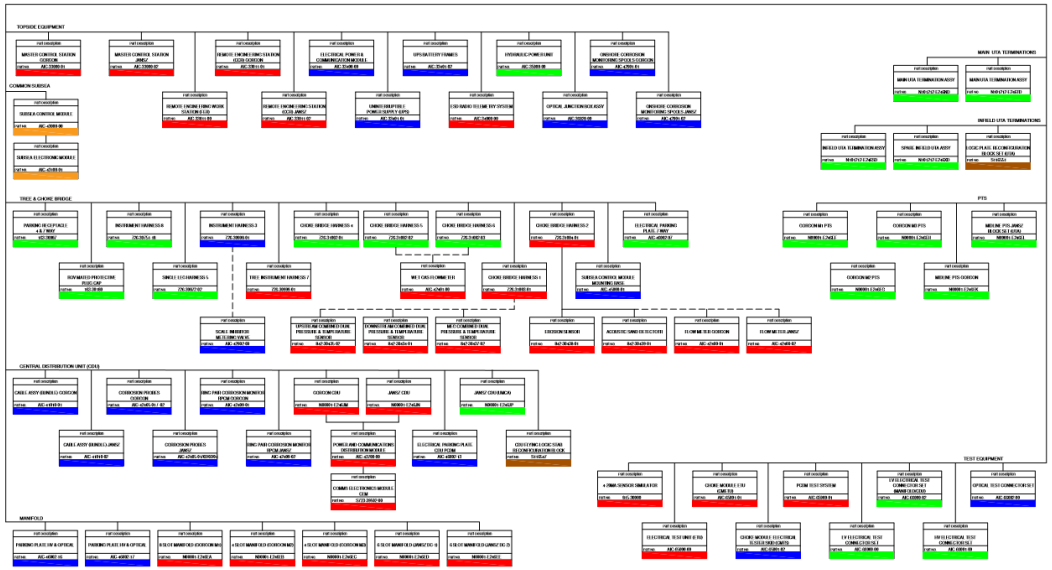
**Probability Matrix**

| Years To End Of Life (YTEOL) | | |
|---|---|---|
| > 4 Years | 2092 | Low |
| EOL / NRND | 22 | Medium |
| Obsolete | 10 | High |

| Stock Availability vs. Consumption Rate | | |
|---|---|---|
| | 0 | Low |
| | 1562 | Medium |
| | 562 | High |

| Years TEOL | Low | Medium | High |
|---|---|---|---|
| High | 0 | 4 | 6 |
| Medium | 0 | 7 | 15 |
| Low | 9 | 1540 | 541 |

Stock 's Consumption



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# Obscolescence RAM modeling

Spare parts availability have significant impact to production availability (ratio of production to planned production (ISO 20815))
To increase obsolescence awareness, dedicated „spare parts" driven RAM analysis proposed.

Objectives of RAM modeling:

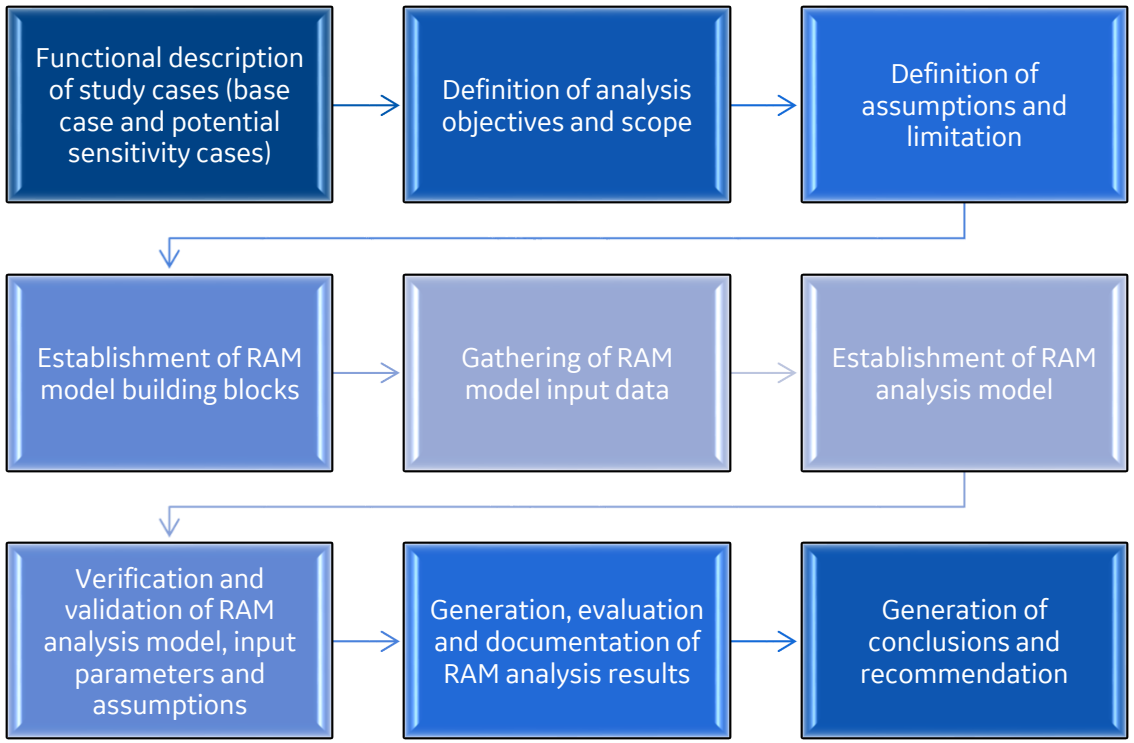
- Estimate the impact of obsolescence to Production availability
- Provide evidence of spare parts holding
- Minimize of production availability losses due to lack of spare parts

Results of MAROS®:

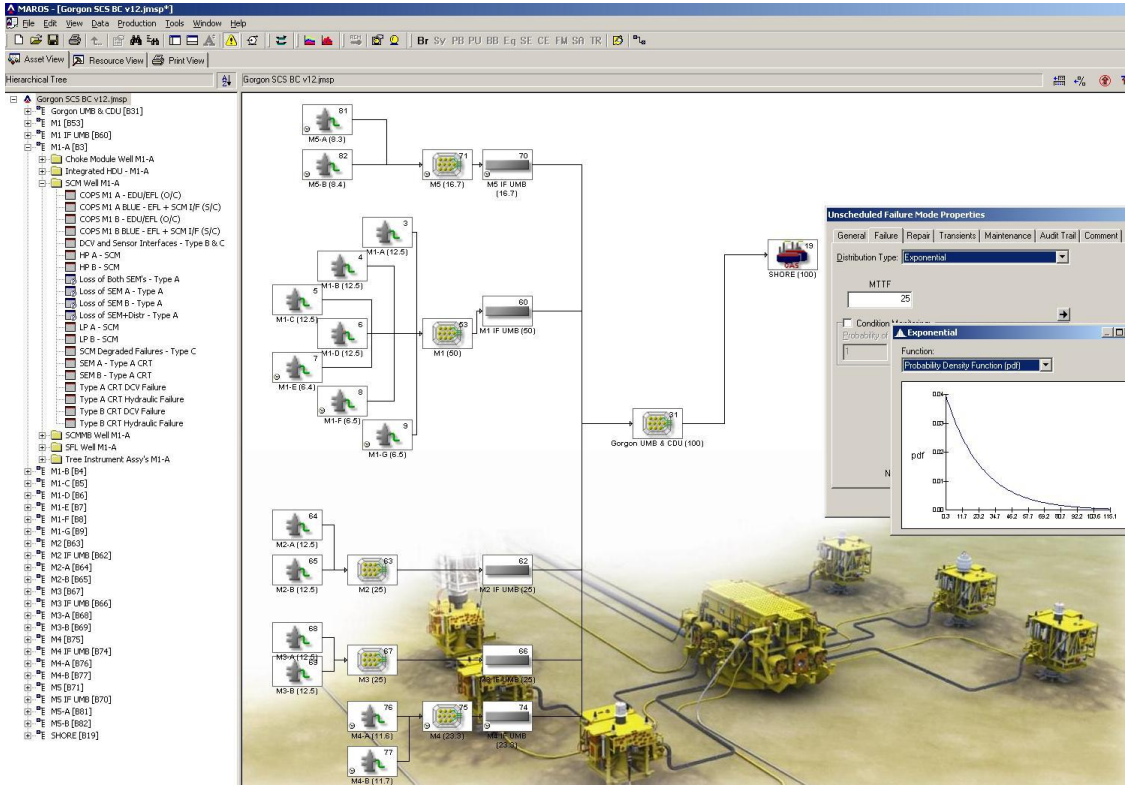
- Comparison of Production availability of different „What if..." Scenarios:
  - No. Of Spares available, thorought the project life
  - Lead time – duration of restock
  - Start and duration of „obsolescence" etc.

# RAM Model

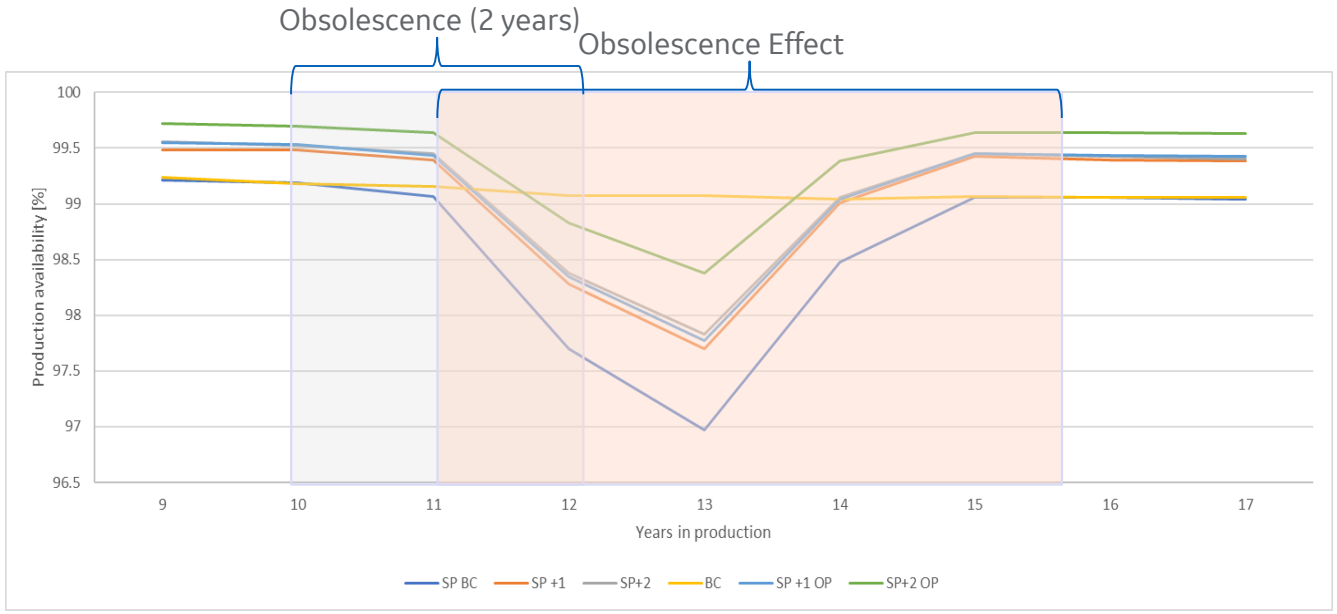
## Main Steps




## Subsea RAM Model



# Results (case example)




Study case:

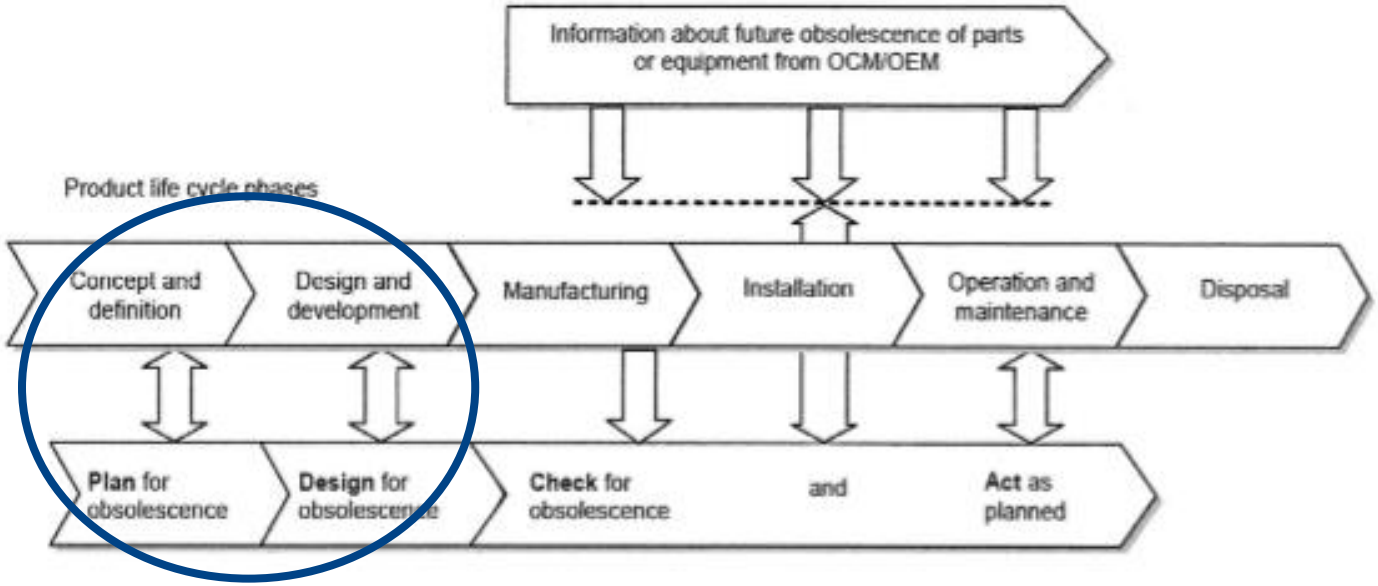
- Obsolescence starts in 10 year, duration 2 years.
- The spare parts lead time increased from 9 month to 18 months

| Case | Spare # | Restock level |
|---|---|---|
| BC (no obsolescence) | 2 | 1 |
| SP BC | 2 | 1 |
| SP+1 | 3 | 1 |
| SP+1 (OP) | 3 | 2 |
| SP+2 | 4 | 1 |
| SP+2 (OP) | 4 | 2 |

Conclusions:

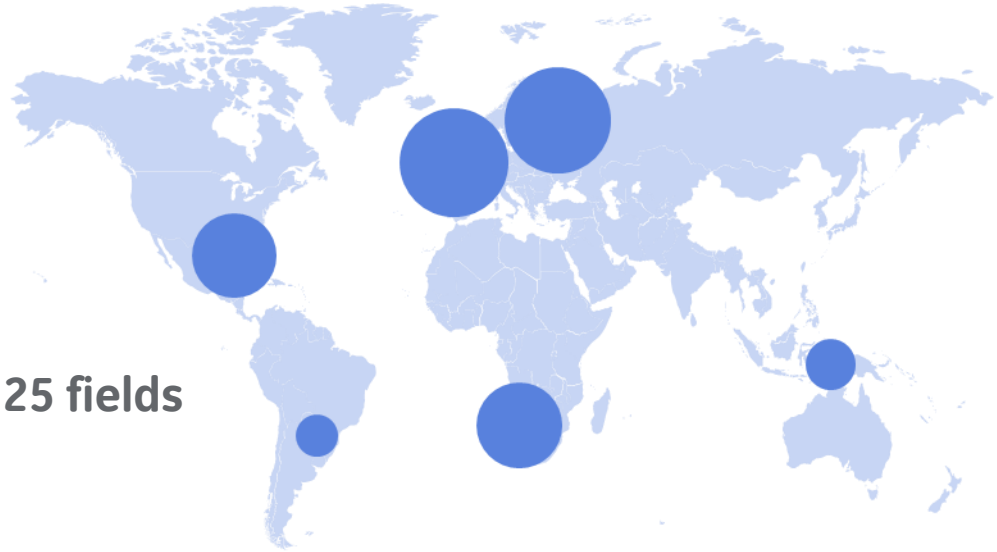
- Issues, with the spare parts availability, is foreseen from year 10, but the actual effect on production is visible, since year 11th and last for 4 years, until the situation normalize.
- The effect is visible with delay, because there were available parts in stock.
- The solution to avoid the potential drop in production:
  - is to either plan the obsolescence in advance and have ready solution (which will not affect the restock schedule)
  - Increase number of available, spare module, so always will be available module

# Design



# Legacy BHGE Control Systems

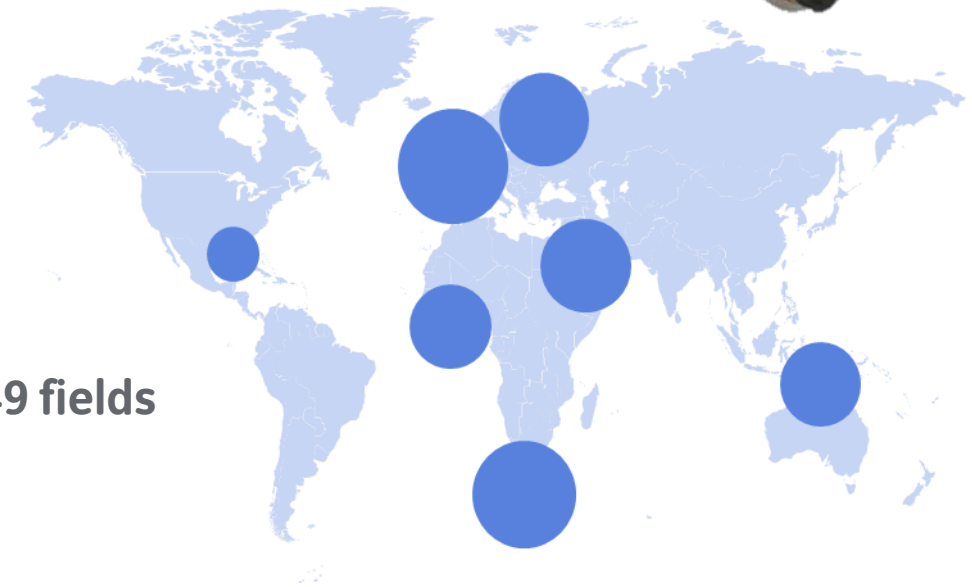
## Pre 2000 fields



25 fields

400+ SEMs still in active production

## Post 2000 fields

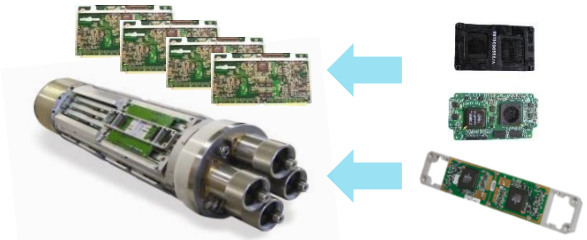


49 fields

1,500 SEMs into the 2020's

# Controls roadmap

**SemStar5 – Designed for Obsolescence**
Common Single Board Computer on hot-swappable card
Chip 20% utilization - FPGA latent capacity
Commercial RTOS: QNX - 25 years BHGE experience
Expandable modular SEM platform
Integrated PLM & Obsolescence Mgt tools



Subsea Obsolescence Management JIP

bp Chevron INPEX Statoil TOTAL woodside

TLS Through Life Support

Controls for BHGE Compact XT
API 17 F rev 4
Multiband, long-offset Copper comms
Legacy 'SEMulation': SEM2K MD
eActuator Control (iFocus)
Safety Systems (HIPPS)
Legacy 'SEMulation': SEM2K PTP

All Electric Control System JIP
Split Controls for BHGE Compact XT JIP
Safety Systems (SIL2 PSD)
DC input
High Voltage Switching
Reduced power consumption
Closed Loop controls – subsea processing
Integrated sensing – DAS/DTS/Naxys

Legacy 'SEMulation': SEM3
Legacy 'SEMulation': SEM4
Comms Filtration
Subsea Transformer

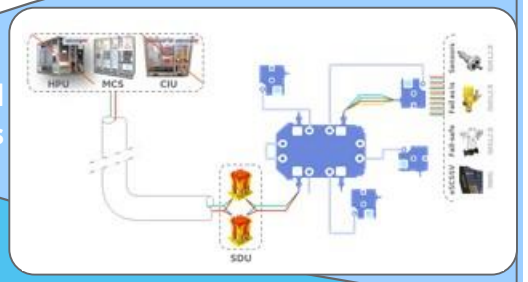
SemStar5-R
Automated Test Equipment
Subsea Routing and Power Switching
Production SEM

Volume (SEM variants)

SEM2K

SemStar5

Distributed Controls




2000 SEM2K
2007 SemStar5 Eth./ SIIS
2011 SemStar5 Deployed
2014 TRL7
Today
2020 All-Electric
2024 Distributed Controls

PC-based
2012
PLC
'SMCS'

**Key**
Complete
Planned or underway



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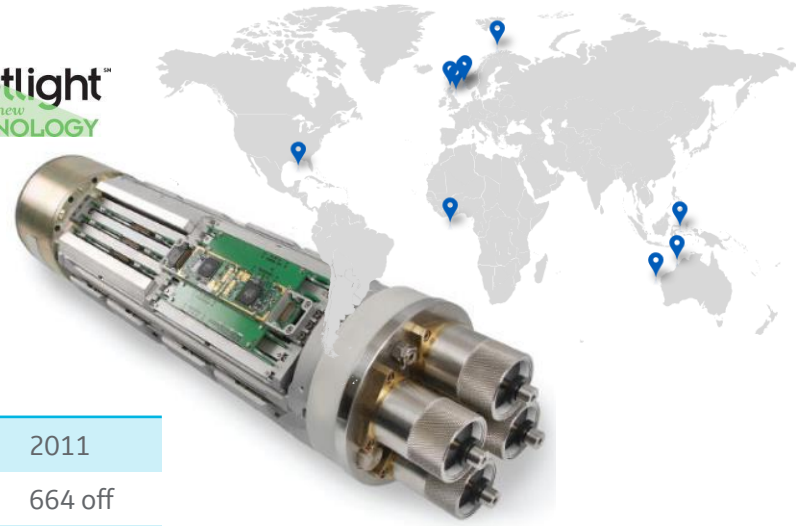
# SemStar5 Platform

## Designed for Reliability & obsolescence mgt

**Common platform:** S43100-00

- Communications and routing
- Sensor and valve control
- Power management / switching
- Electric actuation control
- Safety-system control (HIPPS/PSD/IWOCS)
- Pump / processing control
- Backwards Compatible for legacy field swap-out

Spotlight on new TECHNOLOGY



| | |
|---|---|
| Installed | 2011 |
| Ordered | 664 off |
| Delivered | 406 off |
| Deployed | 226 off |

**Installed:** Statoil TVCM, Nexen GEAD, Chevron IDD, Apache Julimar, INPEX Ichthys, ENI OCTP, Apache Beryl, Exxon Balder, Statoil Snorre B, Statoil Troll B, Stone Pompano, ENI Ghana

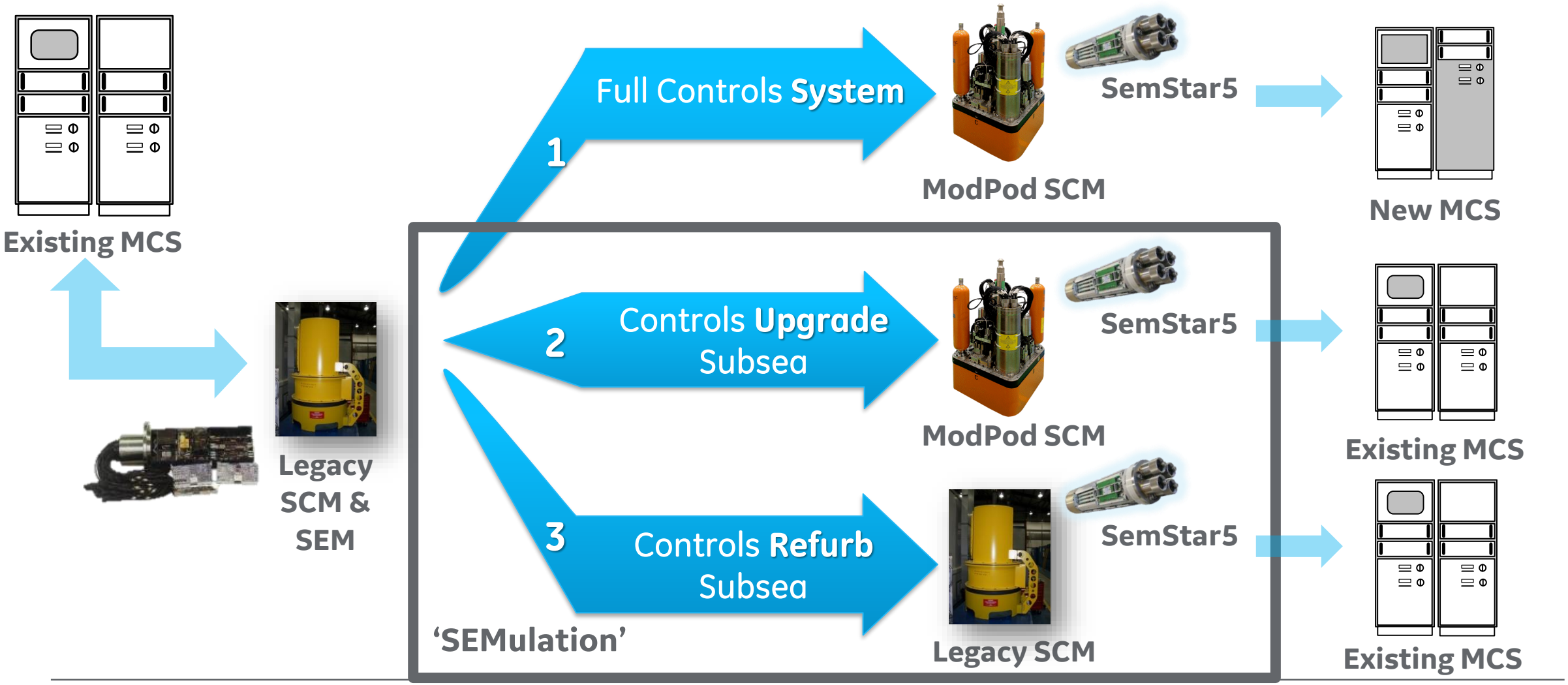
TCP/IP Open communications
Step-change for industry in SEM Reliability
MTBF 10x OREDA average

# BHGE Equipment upgrades

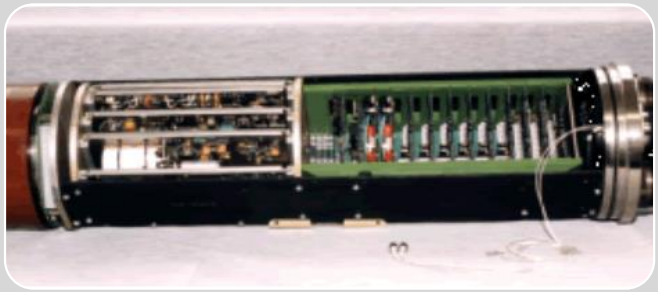
**“Square peg in a round hole”**

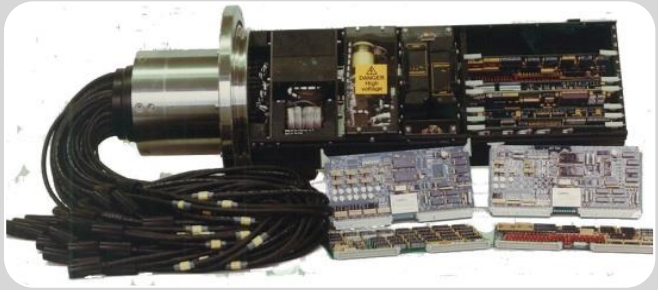
**Reuse of existing SCM base plate and cover including tools**

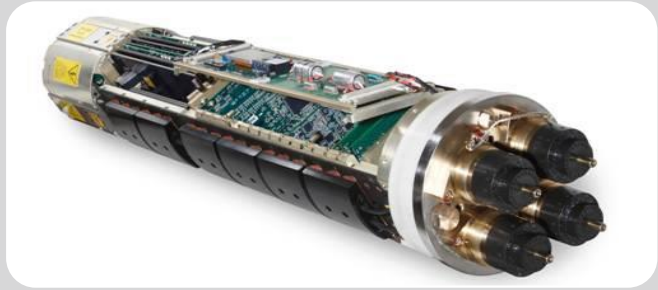
# BHGE Equipment upgrades – options



# ‘SEMulation’ – project technology insertion







**Statoil Snorre B**
SEM4

Profibus Legacy comms
Bespoke SemStar5
Limited application

**ExxonMobil Balder**
SEM3

TC57 Legacy comms

S/W Now configurable for all SEM3 Projects

**Cooper Sole**
SEM2K

SEM2K software on SemStar5 hardware

SEM2K S/W consistent across projects

**Reliable partner over Life-of-Field**

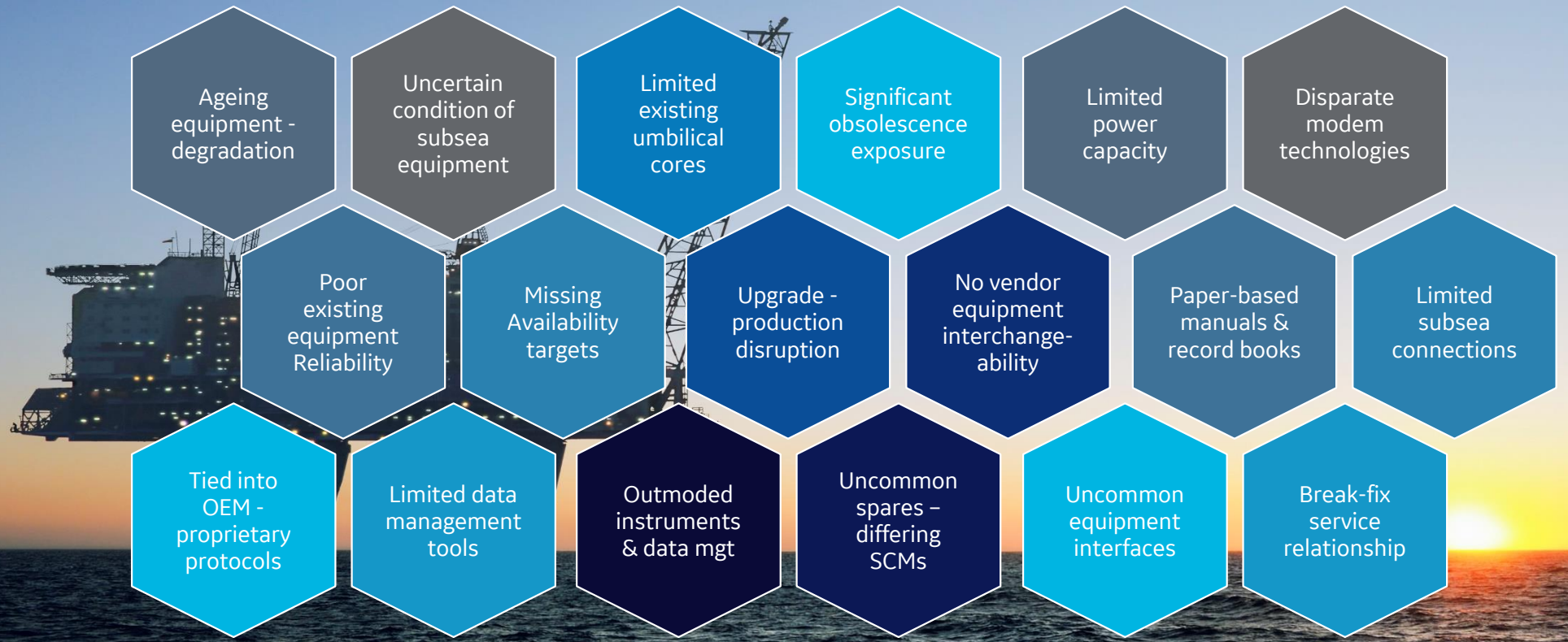
# Standard Master Control Station (SMCS)

## Product Overview

- *Real Time Control System on industrial PC hardware*
- *The technology runs on a protected layer (under Ring 0 / on a Kernel) which ensures the run time behaviour is un-affected by the demands of higher level applications.*
- *Standard software architecture based on three abstraction layers:*
    1. ***Com Master:*** *responsible for all communications with the assets, including protocol negotiation, message composition and transmission, prioritization, queuing, response decoding and other auxiliary communication related functionalities*
    2. ***Logic Engine:*** *The 'brain' of the control system, responsible for the correct operation of the system and its components such as valves, chokes, interlocks etc.*
    3. ***Interface Manager:*** *enabling the Real Time Control (RTC) system to interface to virtually any other application or software service, using the industry standard OPC-UA communication protocol (expandable to other protocols). Compatible with MDIS.*
- *Bumpless data transfer between Real Time Controllers ensuring seamless duty/standby negotiation (supported by a dedicated gigabit Ethernet link that ensures real-time synchronisation and controls transfer as required)*
- *Hardware agnostic s/w architecture, backward compatible to legacy systems*
- *Scalable solution, supporting up to 30 wells on a single cabinet (expandable if required)*
- *Supports Cimplicity and WonderWare HMIs products (e.g. InTouch and System Platform)*
- *Virtual EDGE device, with seamless integration to analytics platforms*

# Brownfield assets

## Challenges for the operator… Life of Field

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