Drive Results.

Case Study: Complex Systems Engineering

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IBM

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Introduction

Purpose of the presentation: Will be to illustrate how our systems engineering best practice can align to an industry standard for supporting a globalized engineering project in a multi vendor environment.

Agenda:

- Background to the industry challenge
- How we adapted to an industry standard
- The IBM technical solution that we created

Objectives:

- To be inspired by others adapting to change

The Oil and Gas Industry

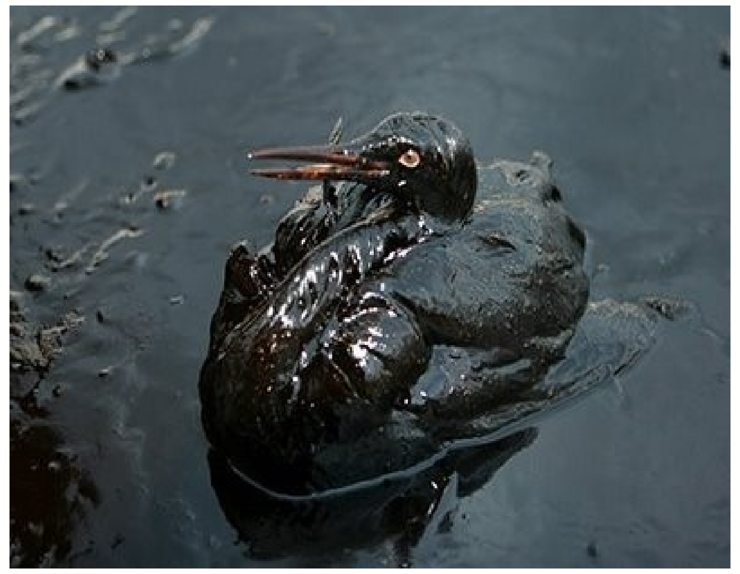
As the industry advances in its exploration for new stocks of crude and gas, we are seeing new complexities evolving into engineering designs for improved operations a greater depths.

The risk are now found in the digital content!

We want to help prevent this..

..as you go deeper

Platform Explosion



Environmental Disaster

Project Over runs

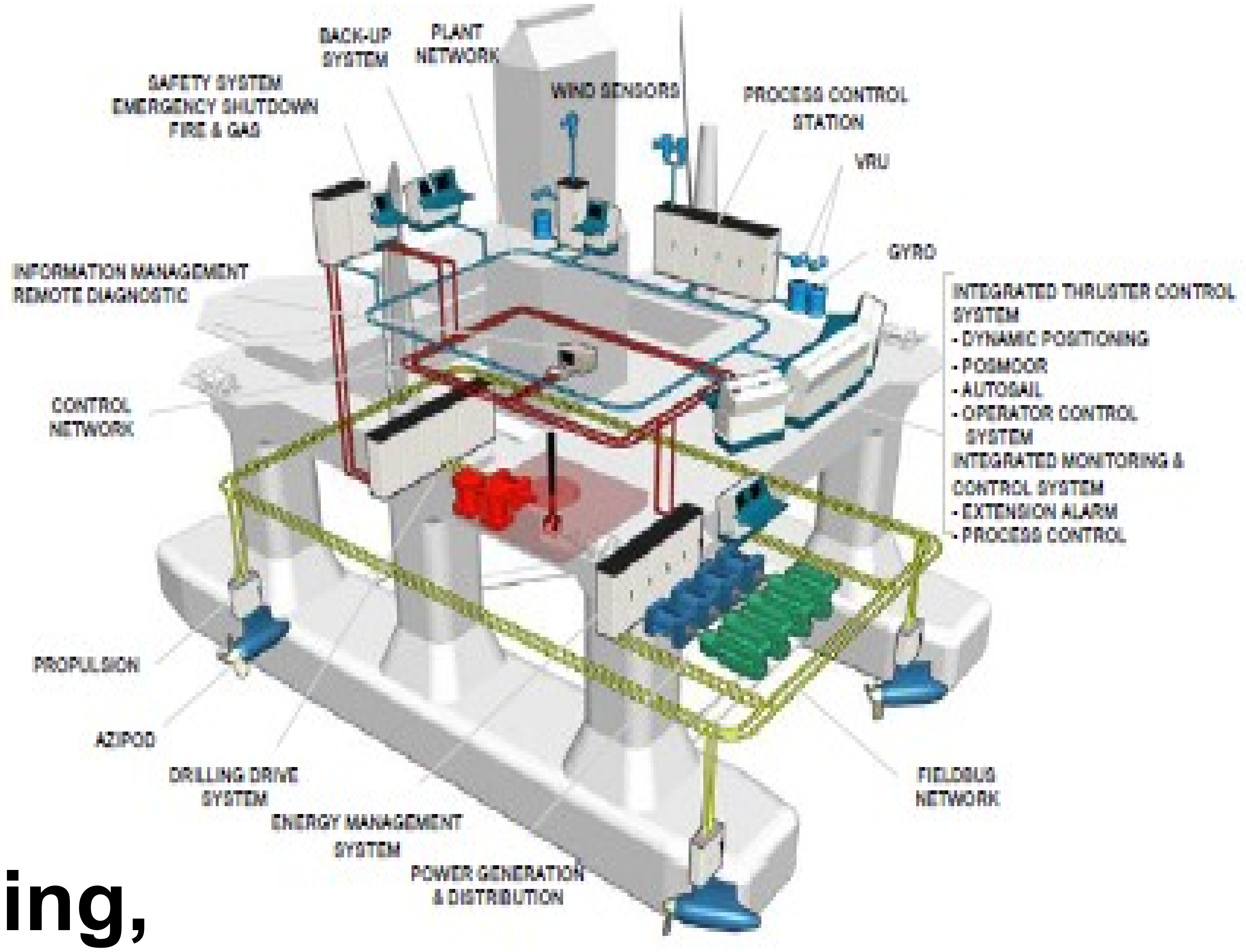
Production Down time

Software dependency changes the risk picture for advanced platforms and sub sea production assets

+ Facts and Figures

- The **Blow out Prevention Control System** contains approx. 200,000 lines of code
- The **Dynamic Positioning System** contains 500, 000 lines of code
- The **Drilling Control System** has more than 500,000 lines of code
- The **Power Management system**, the safety systems and the **Integrated Automation Systems** have together more than 380,000 lines of code
- This is without the **SCADA** communication systems

An experienced programmer can program, test and verify 10-15 lines per day !

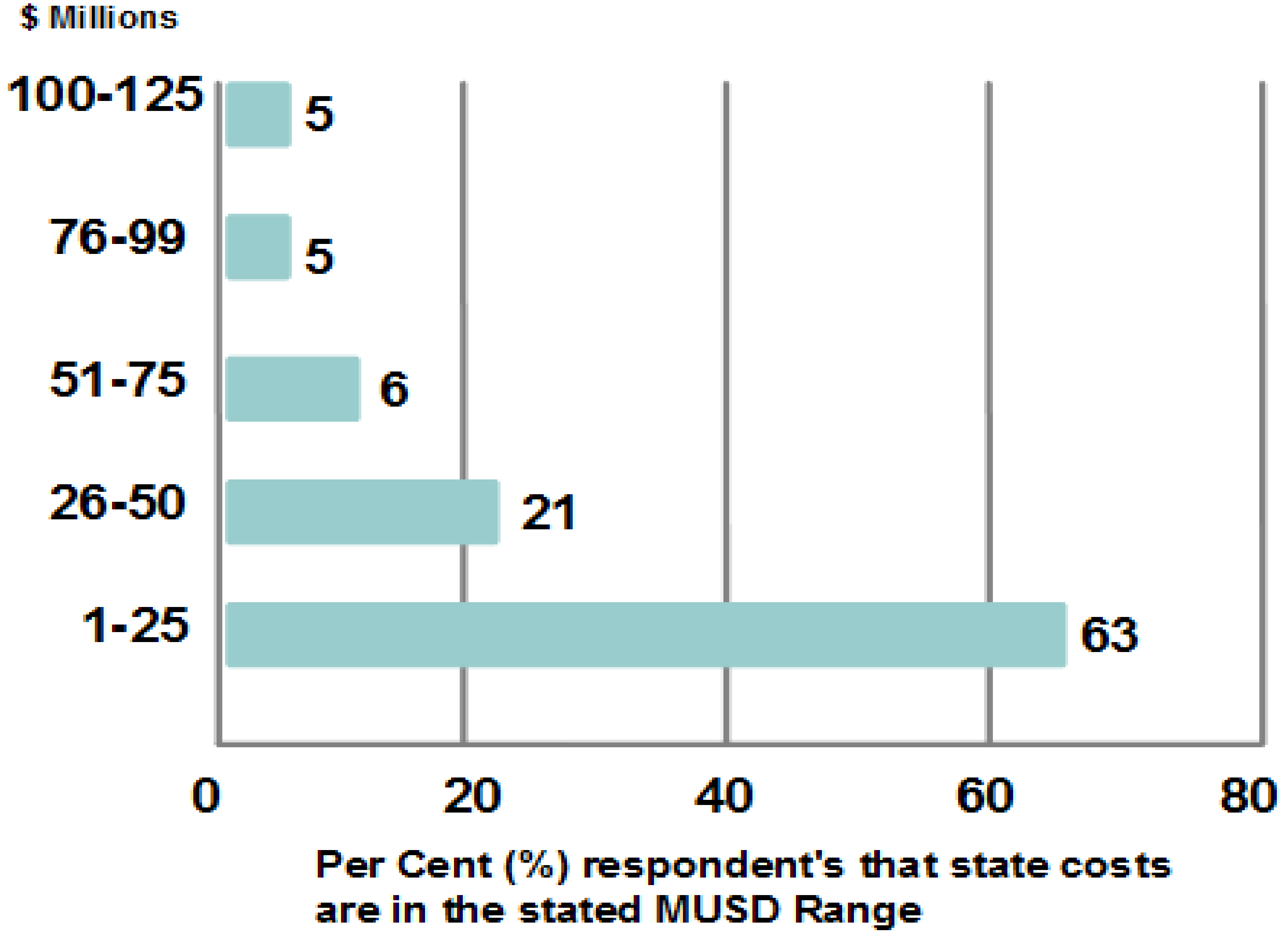


Direct Challenges:

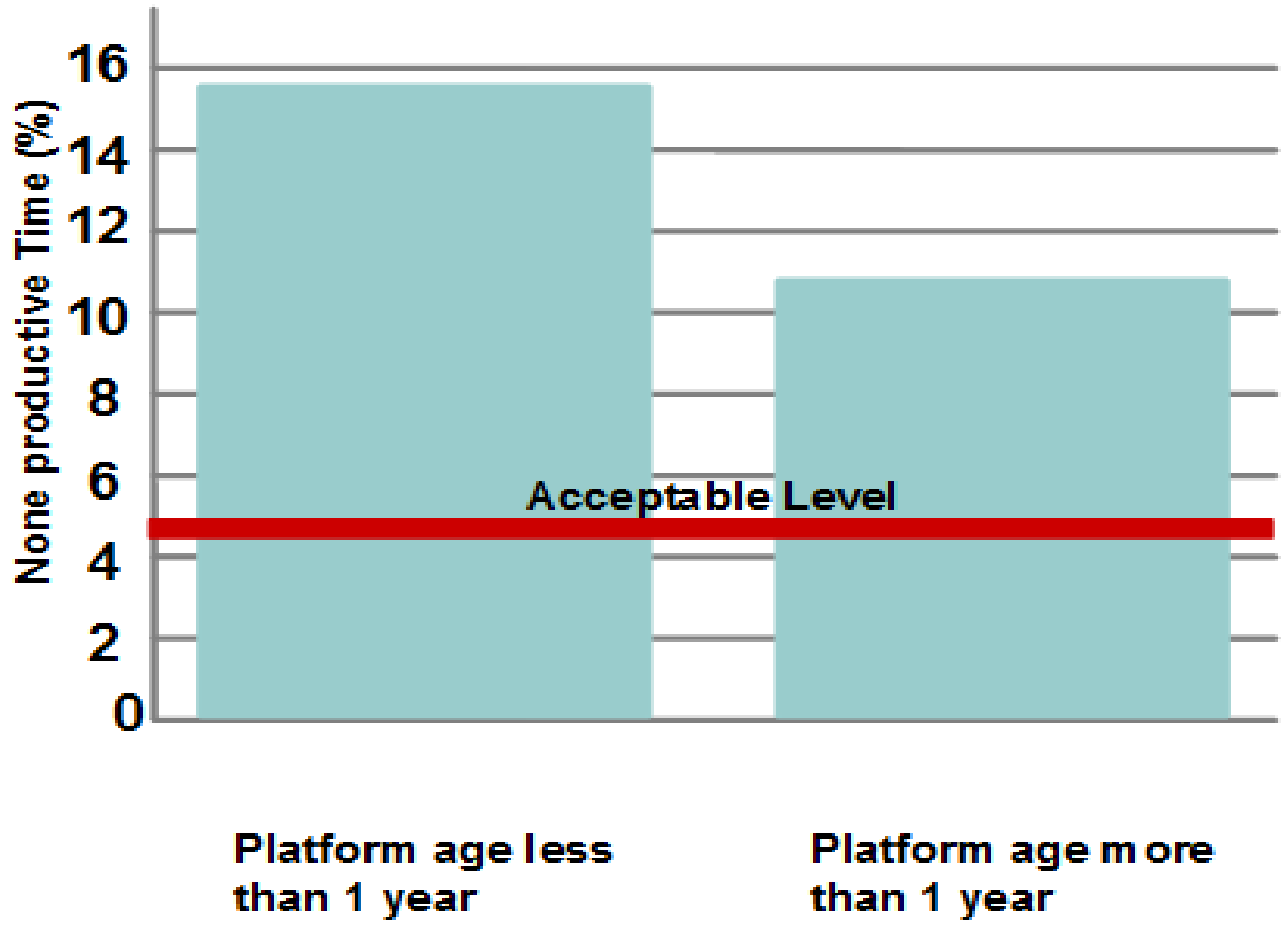
- **Developing philosophies for Designing, Developing, testing and integration of software**
- **Collaborating across engineering teams and having complete control over engineering data and artifacts.**
- **Increasing efficiency across the lifecycle of a System and SW assets**

Non Productive Time (NPT) is a serious problem for drilling units

NPT COSTS ARE HUGE



NPT LEVELS ARE TOO HIGH



Source: Third Annual Benchmarking Report, Athens group & ModuSpec, 2011, IBM´s Analysis

Software is critical for operations in the maritime and energy industries - the listing of a converted tanker is an illustrative example

In 2002 a converted tanker almost sank due to malfunction of the ballast system

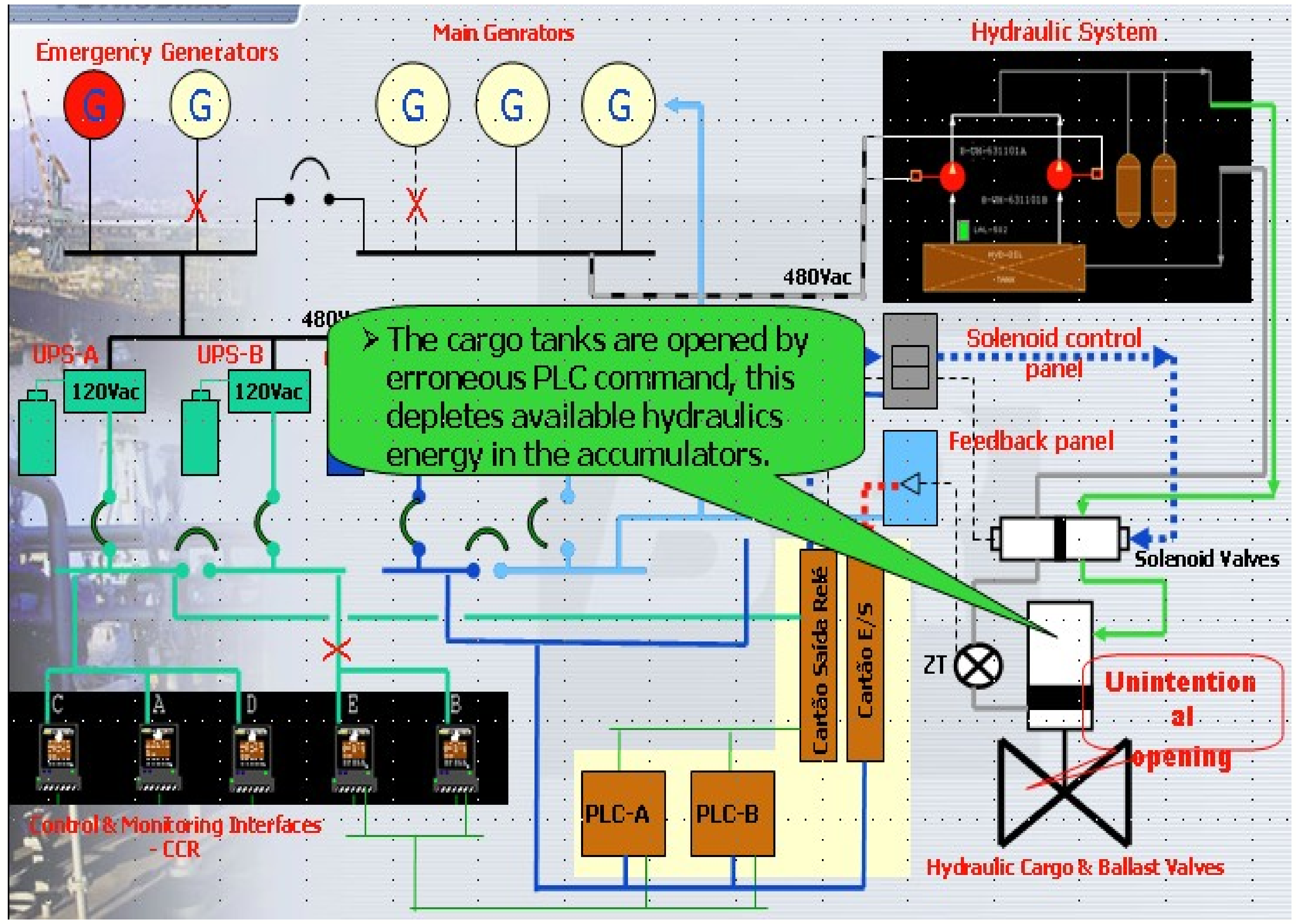
The ship stabilized at a 32 degrees since the cargo tanks were only using 1/3 of the capacity

DNV supported the investigation panel that was set up to identify the cause of the incident

Inadequate programming of the valve control system was identified as the root cause of the malfunction of the ballast system

Source: Den Norska Veritas ISDS 2012 presentation

DNV found that a software failure was the root cause



1.The incident was triggered by a failure in the main generator

2. Except from the valve control system, all other systems responded correctly to the power failure

3. In the valve control system a programmable Logic Controller (PLC) unit misinterpreted the 0 mA signal

4. The Software error in the PLC caused all valves to open – which destabilized the ship

The circumstances of this failure are not unique:

•The PLC software was delivered by a globally recognized leading supplier of control systems
•The original software had been modified by a sub-supplier
•No one ever checked the supplier that programmed the error into the system
•The errors were not picked up in the performed tests

Source: Den Norska Veritas ISDS 2012 presentation

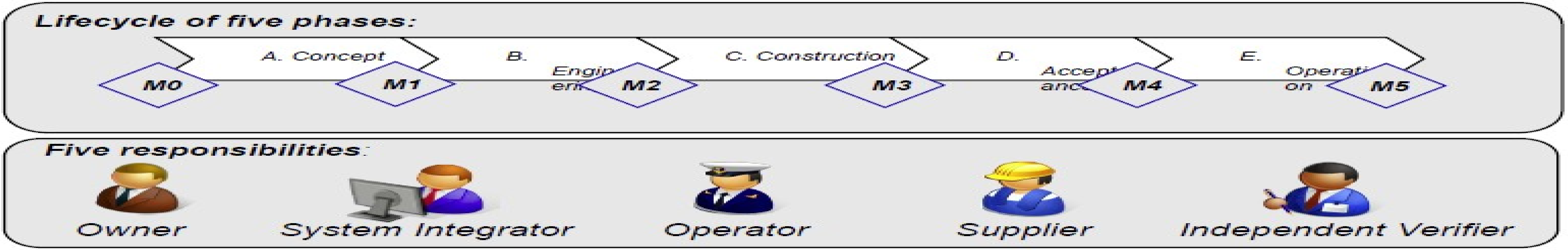
DNV´s OS D-203, Integrated Software Dependent Systems…

A Process Model describing best management and technical practices for software development and systems integration

- Promotes practices proven effective in other industries
- Establishes common expectations for quality assurance

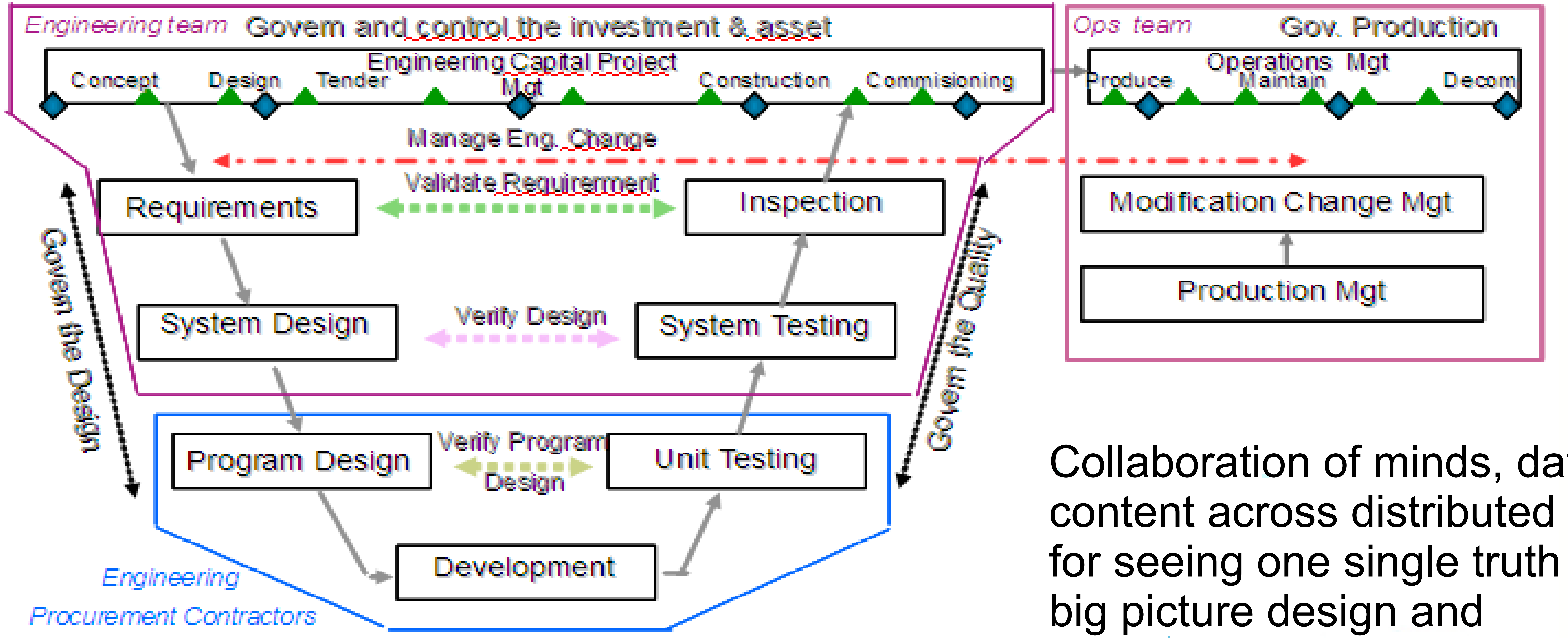
Targeted to offshore units and special ships built to a new or an established design – uses appropriate terminology, organization, etc.

- Based on similar models accepted in other industries, e.g., CMMI: aerospace
- ISO/IEC 15504 (SPICE): automotive
- IEC 61508, Part 3: railways
- ISO 9001: quality management systems



Turning a process model and standard, Into day to day workting methodologies…

Continuous Engineering across the lifecycle of an asset

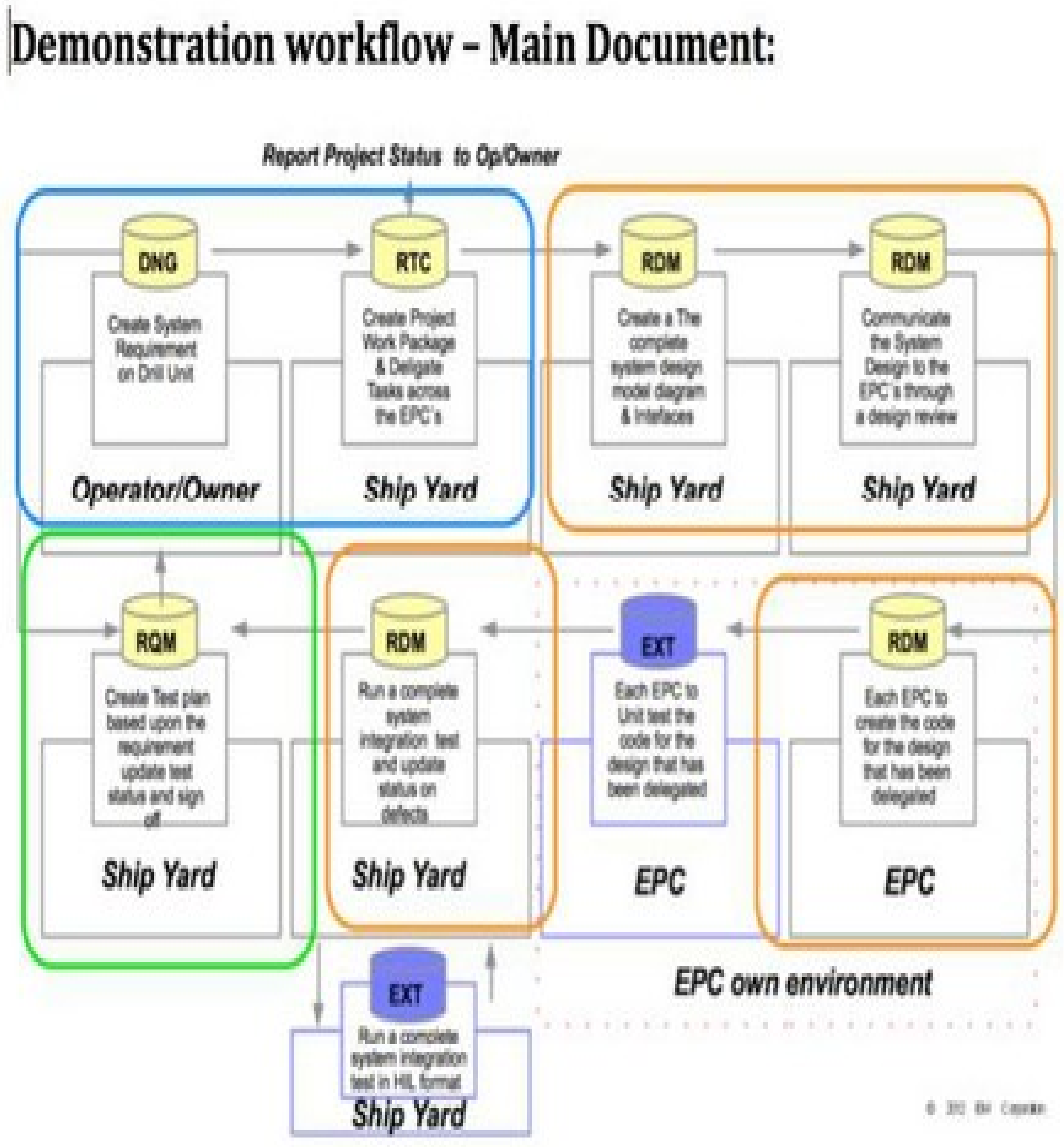


Collaboration of minds, data & content across distributed teams for seeing one single truth of the big picture design and controlling change

Standards, Methods, Tools = Realization

Engineering Project Collaboration:

- The mgt of a stakeholder requirements structure & definition for a globalized engineering project
- The creation of project work packages with delegated tasks and work plans
- The need for a model driven design for specifying block components and interfaces in a common system of systems design whilst aligning to a global collaborative design review process.
- The creation and follow up test plans that are aligned back to requirements for illustrating compliant engineering
- The governance of engineering change to the configuration across the project and systems lifecycle
- The governance and follow up of status from the key project deliverables and key performance indicators



The Business case of this transformation can create substantial value also for yards, suppliers, owners and operators in many forms. Financial improvements help us in making our decisions on any investments needing to be taken

Efficiency gains at the yards

Studies of long-term effects provide evidence on performance improvements

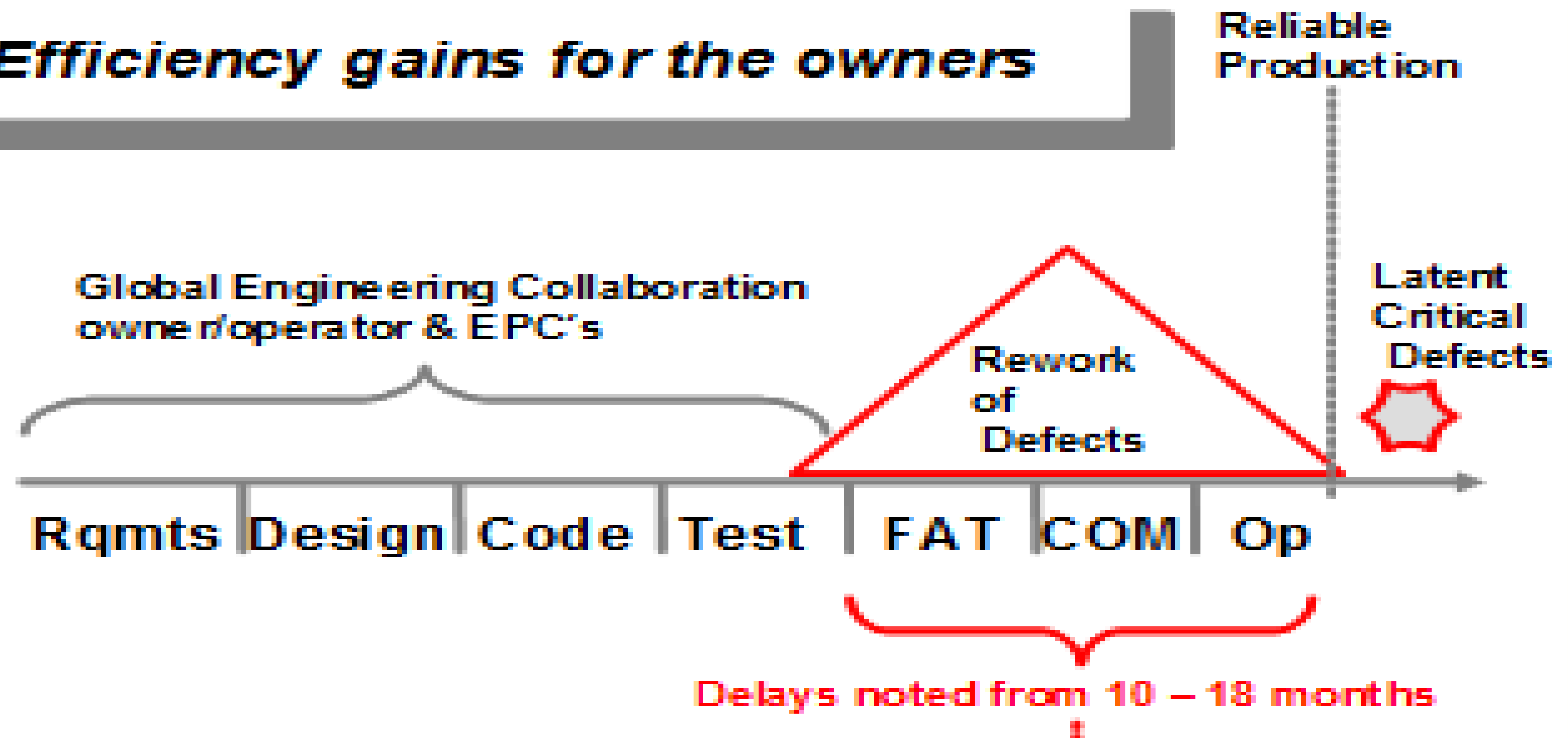
• *Cost reduction:*	*34%*
• *Schedule accuracy:*	*50%*
• *Productivity increase:*	*61%*
• *Quality improvement:*	*48%*

Example:

Automation systems developed that are complex, and include HW and SW

Improvements over a 2 years period:
- *Cost reduction: 30%*
- *Return on investment: 5:1*

Efficiency gains for the owners



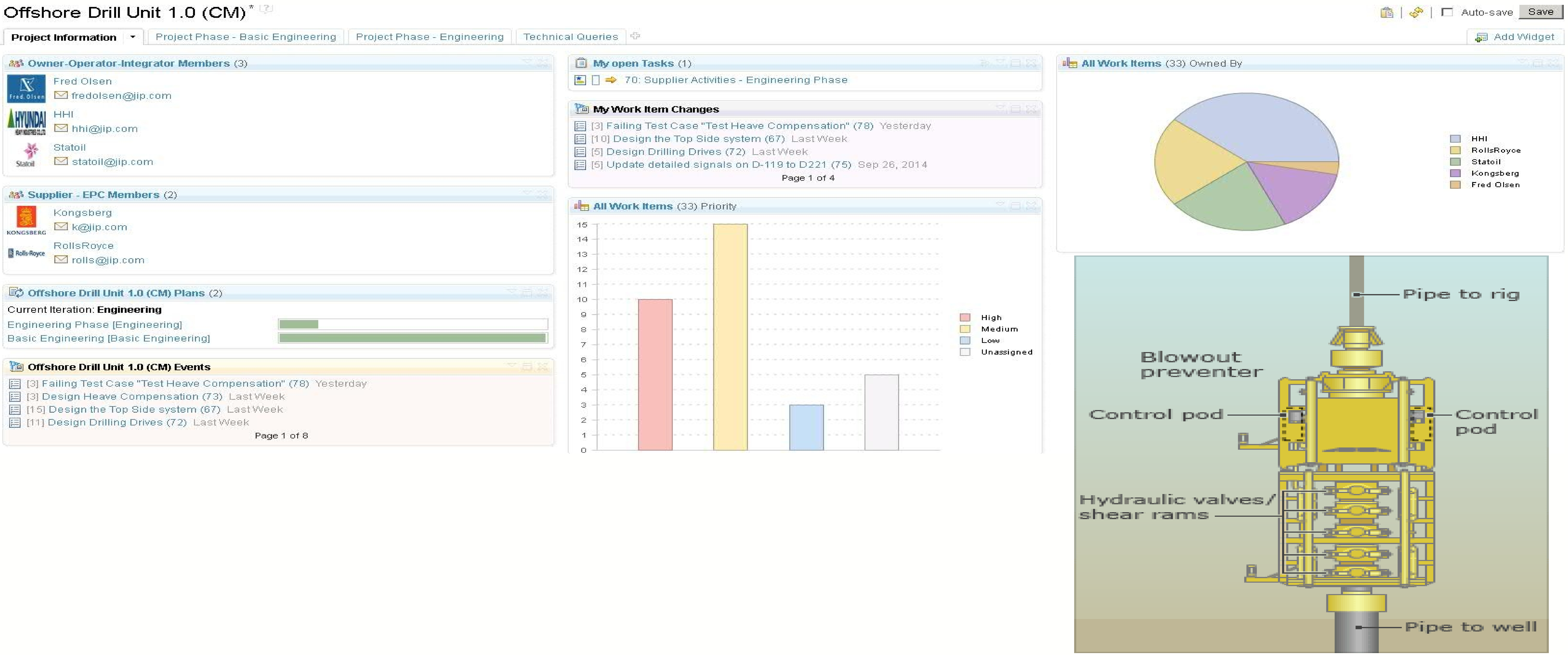
IBM's approach reduces the likely delay in operations

•Estimated value of avoiding delay is $15 million

– assuming $ 500k per day in avoided non productive time costs

sources: SEI Report:: Performance Results of CMMI-Based Process Improvement, August 2006
Capers Jones, Software Quality and Software Economics, Software Tech News, April 2010
Barry Boehm, Software Engineering Economics, Prentice Hall, 1981
F. Shull, Victor, Basili, et al., What We Have Learned About Fighting Defects, IEEE Symposium of Software Metrics, 2002
David Card, Managing Software Quality with Defects, Crosstalk, March 2003

Time for a Quick Demo



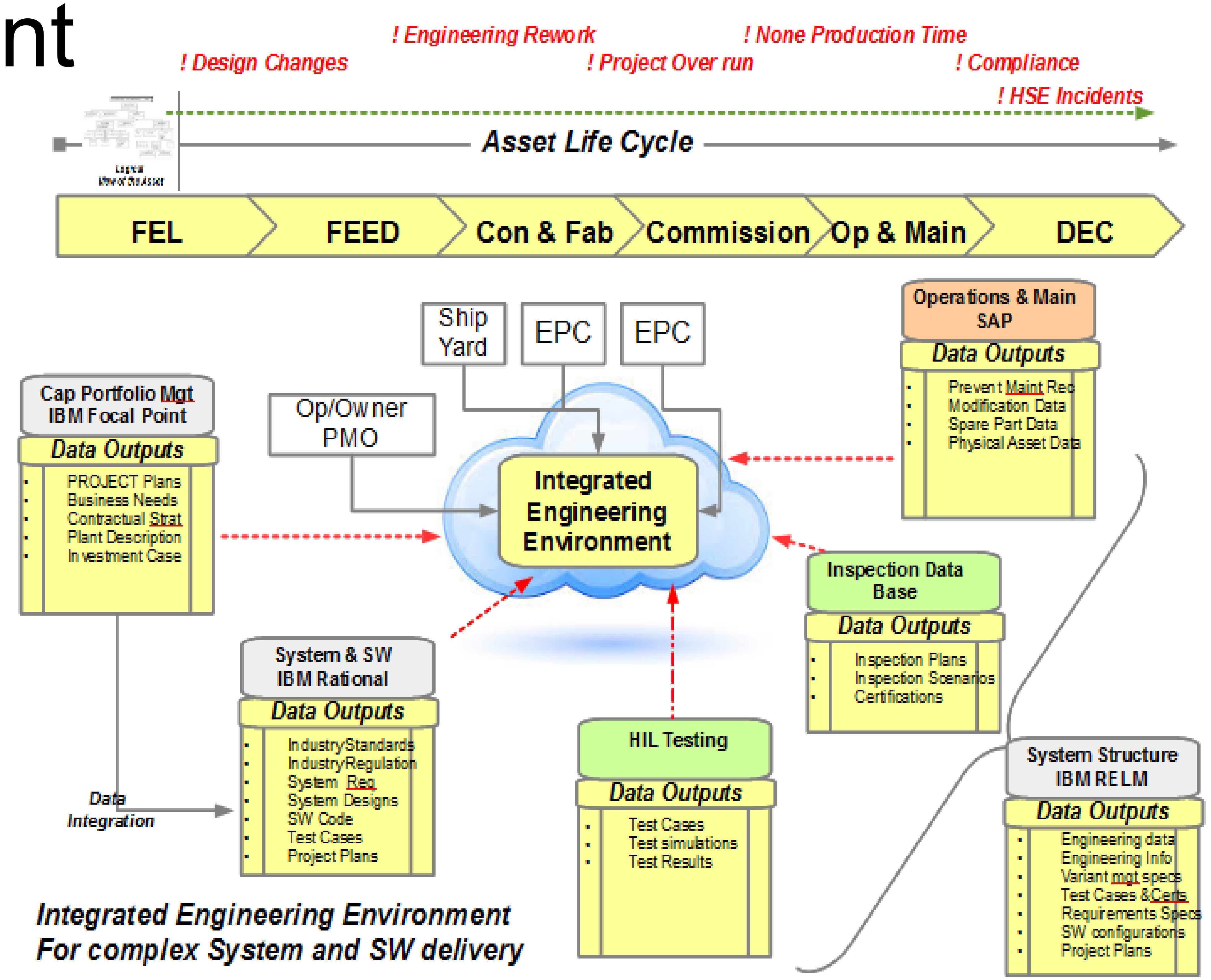
IBM

IBM can provide a direct support for the deployment of an integrated engineering environment

IBM have all the capabilities of helping engineering projects

increase productivity,

quality and bring safety to operations through and integrated environment for complex system and sw projects



With the ever increasing demand for smarter operations the increase of embedded sw and systems will continue to grow. Don't let this be the Achilles heel of your future

Source of data used

sources:

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