

Upstream Risk Management AS

The art of tough decision making

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Executive summary

- What we do
 - Facilitate use of domain-driven risk informed decision making to solve complex problems
- Why we do it
 - Make the best decision in any situation
- How we do it
 - Couple experience data with the most competent people available forming world-class multidisciplinary teams



Motivation

- Oil and gas industry spending amounts to hundreds of billions of dollars annually
- Are you willing to spend billions of dollars on something without making sure it performs?
- Business idea
 - Always quantify the value of your decisions



Business proposition

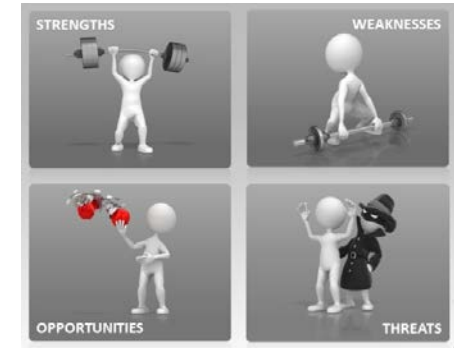
- We offer the ability to quantify less tangible and complex asset risk
 - Safety cost
 - Maintenance and operating expenses
 - Production losses
- Our vision is to provide all key metrics for tough decision making in asset management
 - Through growing suite of products and services based on R&D of solutions developed with clients in the field



Example solution

Our Well Probabilistic Risk Analysis (WPRA) toolbox:

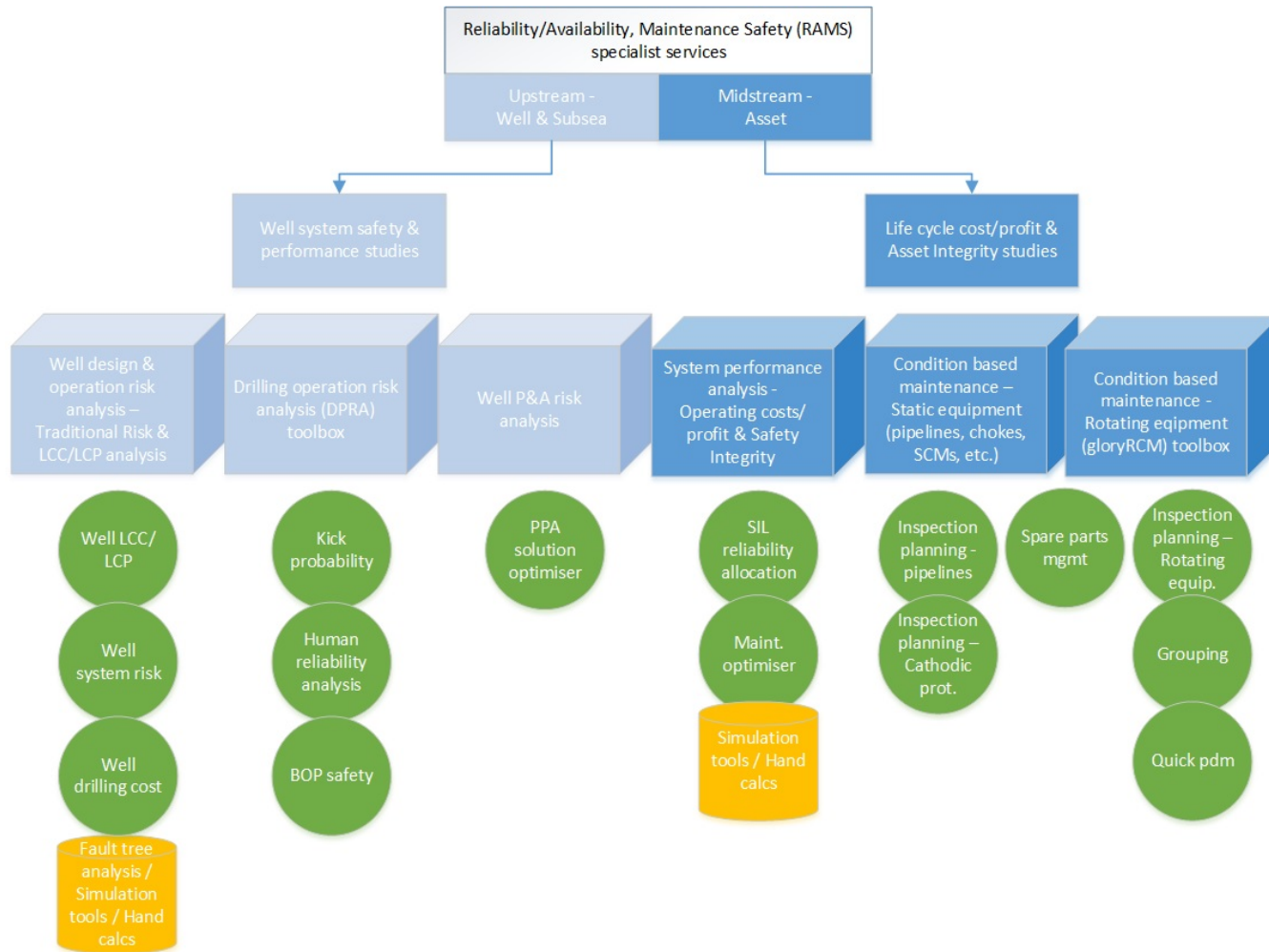
- Well planning
 - Systems design – OPEX/LCC/LCP studies
 - Kick margin / Unconventional drilling: well control design
 - MOC – manage equipment, people, procedures and changes
- Well construction
 - Systems maintenance: LCP, life extension- and retrieval analysis
 - MOC – manage equipment, people, procedures and changes
- Well operation and interventions
 - Systems maintenance: LCP, life extension- and retrieval analysis
 - MOC – manage equipment, people, procedures and changes
- Well abandonment
 - P&A design
 - MOC – manage equipment, people, procedures and changes



«I don't know how it's going, it's very dark down there»



Solutions developed, so far...





For more information please contact

Upstream Risk Management AS

Enterprise no. : 813 379 732 MVA

Achilles certification id: 60229

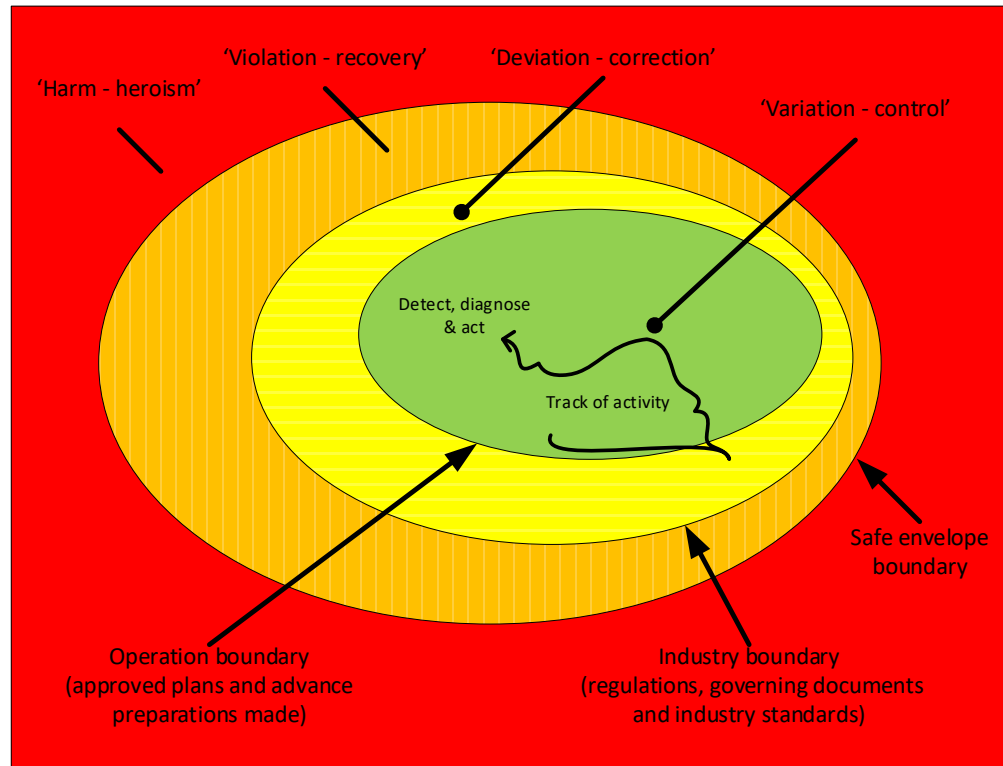
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Key to all our solutions is maintaining the safe envelope



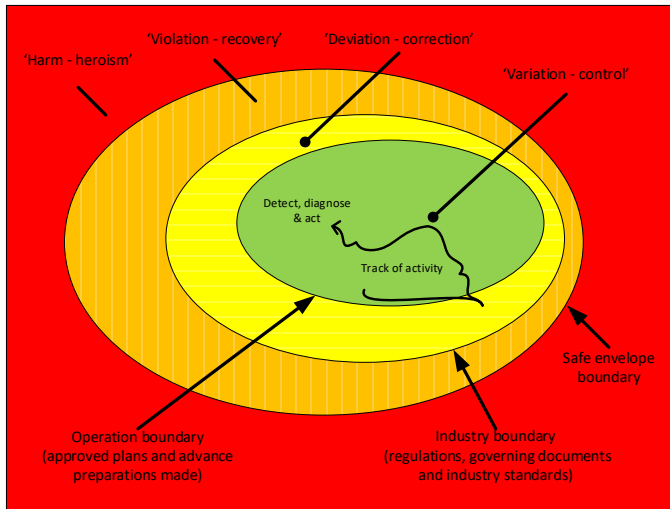
Source: On the role of HMI in human reliability analysis of offshore drilling operations. *Journal of Loss Prevention in the Process Industries*. 2017; 49: 191-208.



Case studies – Planning



- Well planning, for example
 - Well life cycle profit (OPEX/LCC/LCP) studies
 - Ormen Lange, Gunflint, Gjøa, Mariscal Sucre, Gorgon, Goliat, Frøya, Dagny, Corrib, Norg, Sakhalin, Lunskeye, Linnorm, etc.
 - Manage equipment, people, procedures and changes.
 - For example, risk analysis of well kicks or BOP stackup designs



Ex. WPRA LCC^R and WPRA Kick^R tools



Failure data	Repair time data												
Scale	Shape	K	N	Median	Error factor	Lower 5%	Upper 5%	p90	Average p50	p10	p90	p50	p10
1. Annulus valves	2.5E-06	1.5	1	2	4300	1.5							
2. Production valves	2.5E-06	1.5	2	3	4300	1.5							
Upper completion													
3. Tubular	1E-06	2.5	1	1	8760	1.5							
4. DHSV	1E-06	1.1	1	1	4300	1.5							
5. Prod. packer	1E-07	0.9	1	1	4300	1.5							
Lower completion													
6. Sand control	1E-06	0.9	1	1	8760	3							
7. Formation/Stimulation	1E-05	1	1	1	240	1.5							

Design life: 175200
Number of sims: 100
Calc./Refresh
Est
Passcode: 0

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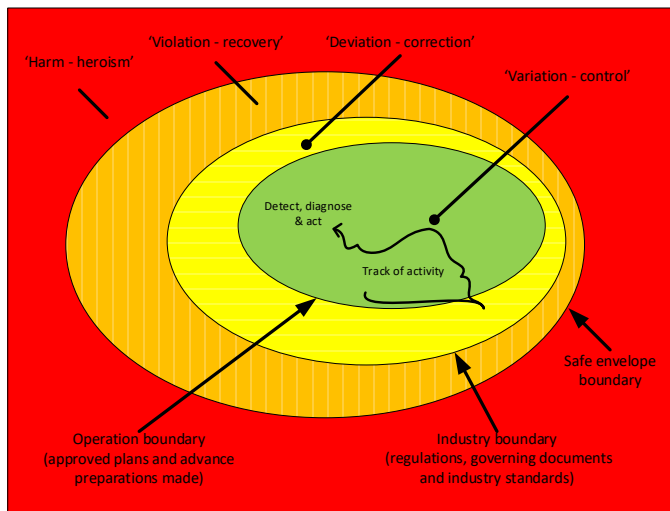
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Case studies – Construction



- Well construction, for example
 - DPRA method: Kick probability, BOP reliability and HRA
 - Quantify blowout risk of well operations including human factors
 - The BOP maintenance and safety trade-off tool



Ex. WPRA-H^R and WPRA-BOP^R tool

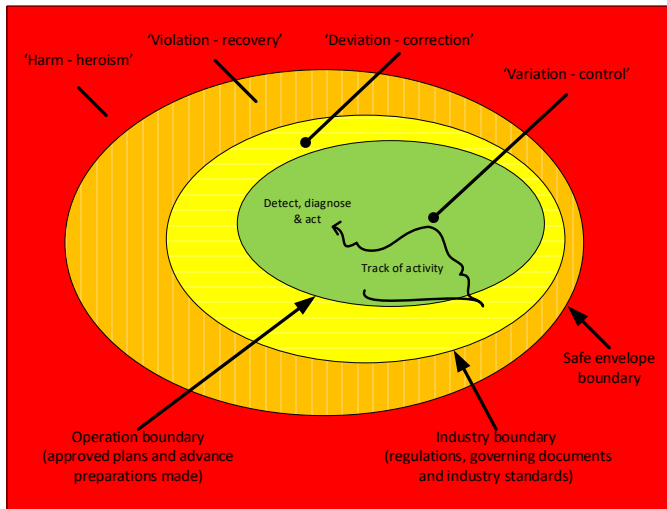




Case studies – Operation



- Well operation/intervention, for example
 - Well system maintenance: Traditional well safety risk analysis / condition based maintenance / residual useful life & LCP studies
 - Varg, Ekofisk, Tune, Snorre, Brage, Eldfisk, Njord, Norg, Gimle, Gullfaks, Gjøa, Joslyn, Goliat, Dagny, Statfjord, +++
- Safety Instrumented System analysis –
 - SIL reliability allocation



Ex. WPRA SIL^R,
WBAD^R and WBA^{OR}
tools

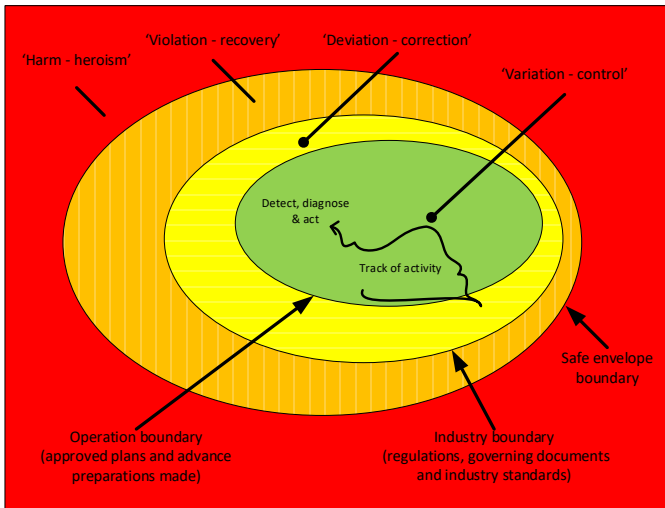
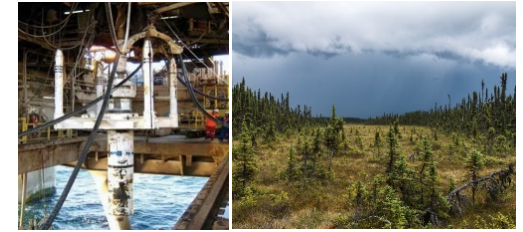


System Components	Failure data	Repair time data	Number of repairs	Repair time distribution											
	Scale	Shape	K	N	Median	Error factor	Lower 5%	Upper 5%	p10	Average	p50	p10	p90	p50	p10
1. Annulus valves	2 5E-06	1.5	1	2	4380	1.5									
2. Production valves	2 5E-06	1.5	2	3	4380	1.5									
3. Tubular	1E-06	2.5	1	1	8760	1.5									
4. DHSV	1E-06	1.1	1	1	4380	1.5									
5. Prod. packer	1E-07	0.9	1	1	4380	1.5									
6. Sand control	1E-06	0.9	1	1	8760	3									



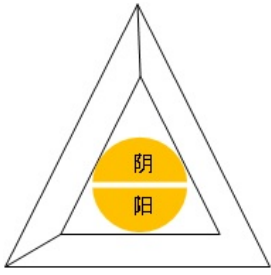
Case studies – Abandonment

- Well abandonment & Legacy wells, for example
 - P&A barrier (or injector) design: Casing internal and external leaks
 - Gullfaks, Gimle
 - P&A costly and regulations may be found grossly disproportionate vs risk - 'shallow shoes' or 'bad cement'



WPRA CBL^R and
WBA^{PAR} tool





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