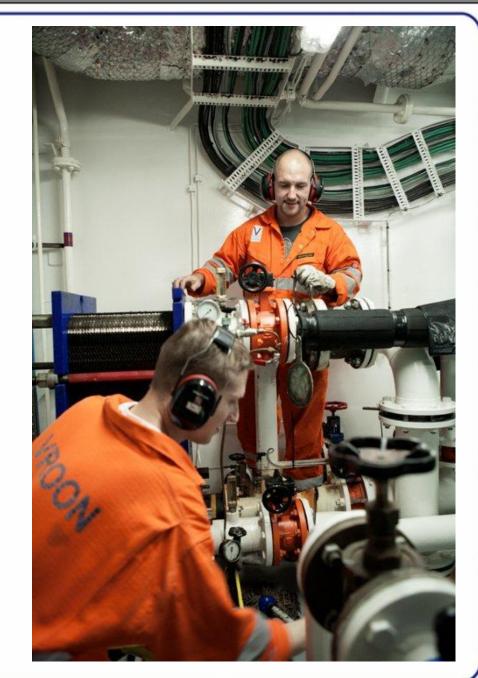


# Maintenance &

## Reliability

Niek Spiljard Vroon Offshore Service 25-9-2014



### **The Fleet**

#### 160 vessels

- 480.000 ton steel
- 320 radar systems
- 960 engines
- 480 propellers
- 8000 pumps
- ??? km cables
- ??? km pipelines



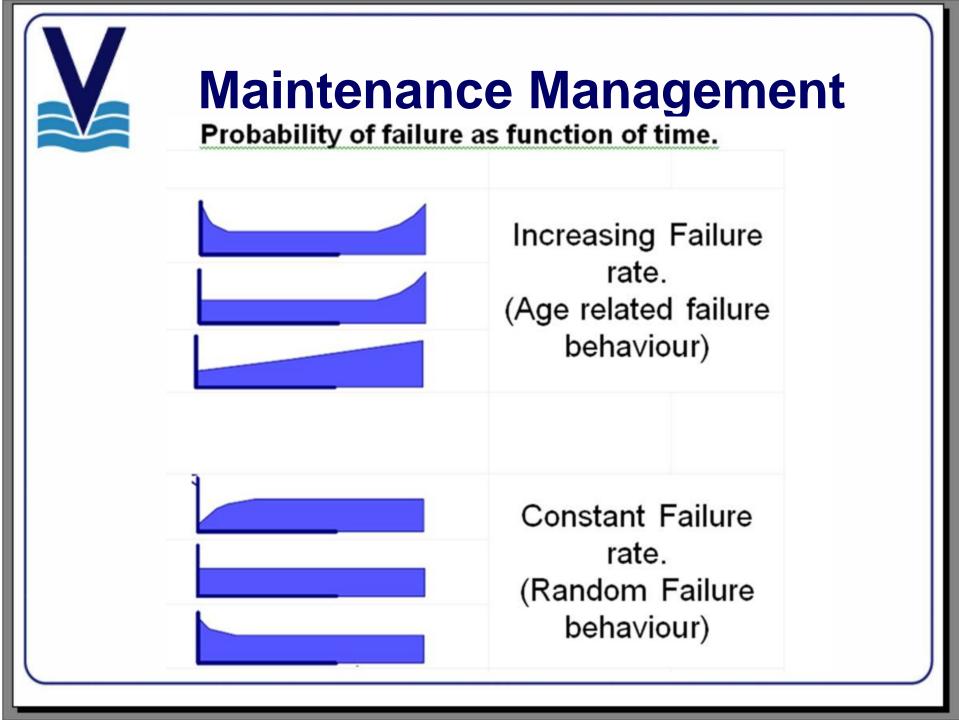




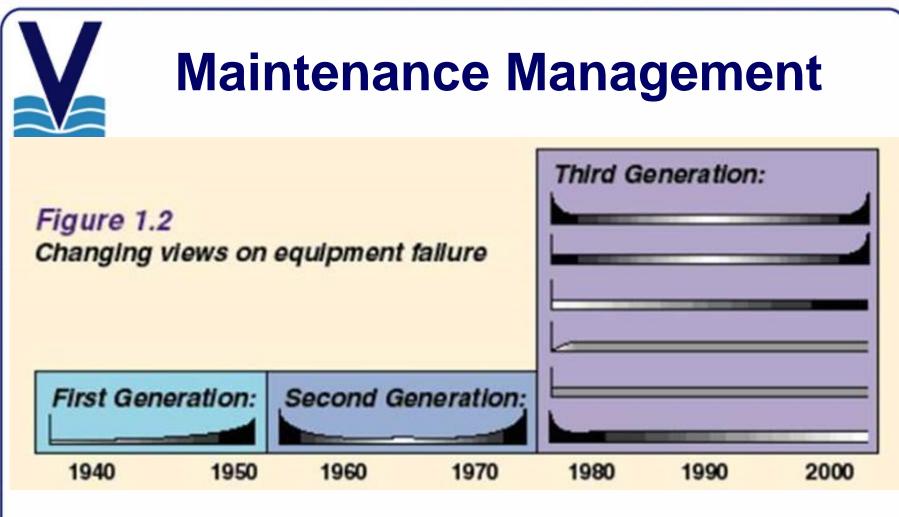
Figure 1.1 Growing expectations of maintenance				Third Generation: • Higher plant availability and reliability			
• Fix it when it broke		Second Generation: • Higher plant availability • Longer equipment life • Lower costs		<ul> <li>Greater safety</li> <li>Better product quality</li> <li>No damage to the environment</li> <li>Longer equipment life</li> <li>Greater cost effectiveness</li> </ul>			
1940	1950	1960	1970	1980	1990	2000	

- Experienced engineers
- Familiar with their equipment
- Planned maintenance system
- Result





Failure Rate pattern studies data							
•	Airlines		US Navy				
	UAL 1968	Broberg 1973	MSP 1982	SUBMEPP 2001			
	4 %	3 %	3 %	2 %			
	2 %	1 %	17 %	10 %			
	5 %	4 %	3 %	17 %			
	11%	8 %	23 %	29 %			
1	7 %	11 %	6 %	9 %			
	14 %	15 %	42 %	56 %			
	68 %	66 %	29 %	6 %			
	89 %	92 %	77 %	71%			
Studies showed that actual failure pro	bability b	behaviour	was mo	re diversifie			



 According Lloyds: third generation maintenance management systems are used on less than 2% of the world fleet.



Figure 1.3 Changing maintena	<ul> <li>Third Generation:</li> <li>Condition monitoring</li> <li>Design for reliability and maintainability</li> </ul>					
First Generation: • Fix it when it broke	<ul> <li>Second Generation:</li> <li>Scheduled overhauls</li> <li>Systems for planning and controlling work</li> <li>Big, slow computers</li> </ul>		<ul> <li>Hazard studies</li> <li>Small, fast computers</li> <li>Failure modes and effects analyses</li> <li>Expert Systems</li> <li>Multiskilling and teamwork</li> </ul>			
1940 1950	1960	1970	1980	1990	2000	

### **Reliability Centred Maintenance**

#### RCM

- Check your system
- What is the result of a component failure
- What is the failure rate pattern of each individual part/component.
- Is there redundancy in the system
- Do we require any condition monitoring

#### **Result:**







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