

WELLMASTER™

WELL PERFORMANCE ANALYTICS

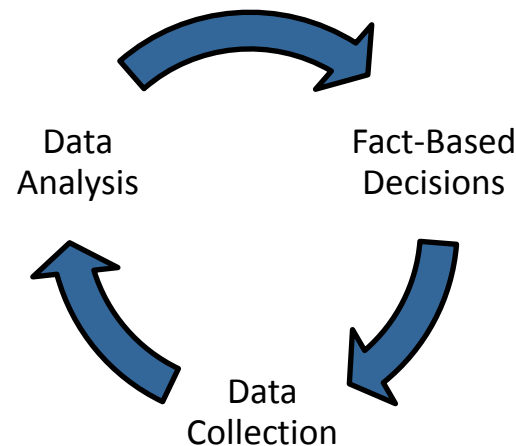
Reliability Management System (RMS)

presented by

Asbjørn Andersen



- **Collect experience data**
 - Installation time, failure time, pull time, failure modes, etc.
- **Make reliability data through data analyses**
 - MTTF, λ , R(t), PFD, etc.
- **Fact-based decisions (purpose)**
 - Benchmarking, product improvements, system risk analyses, etc.



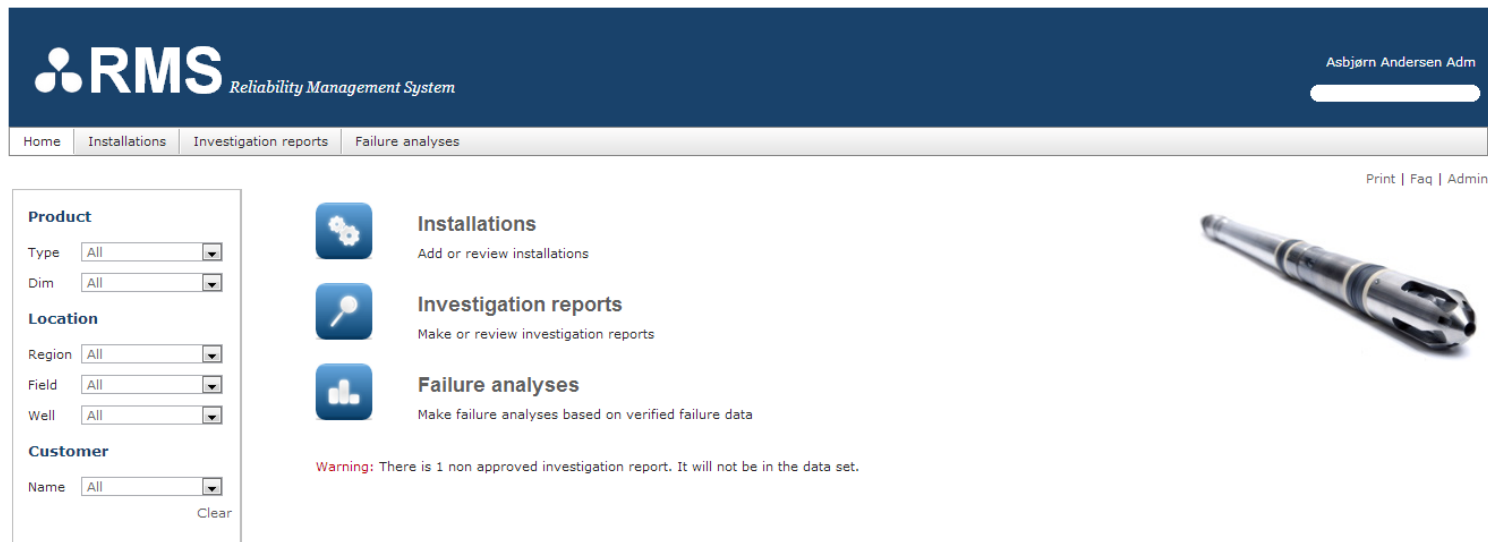
- **World's largest repository of well experience data**
- **Managed by ExproSoft and organized as a JIP for oil companies**
- **Data collected for**
 - More than 20 years
 - More than 5,000 completion strings
 - More than 30,000 well-years
- **The data is used for**
 - Vendor benchmarking
 - Selection of well configurations based on risk
 - Selection of well configurations based on OpEx

Should we select a GLV from vendor A or vendor B?

Can the ASV be replaced with other measures without compromising the safety?

What are the life cycle intervention costs for well A versus well B?

- **RMS for technology providers**



RMS Reliability Management System

Asbjørn Andersen Adm

Home | Installations | Investigation reports | Failure analyses

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Product

Type

Dim

Location

Region

Field

Well

Customer

Name

Clear

Installations
Add or review installations

Investigation reports
Make or review investigation reports

Failure analyses
Make failure analyses based on verified failure data

Warning: There is 1 non approved investigation report. It will not be in the data set.




■ Installations

- Product information (SN, design features, etc.)
- Location (region, field, well, depth, interfaces)
- Operational conditions
- History for current and historical installations (sent, installed, failed, pulled, etc.)
- Operational experiences (positive and negative)

■ Investigation reports

- Qualitative description of each failure
- Carefully selected failure cause categories for adequate analysis filter setting

■ Analyses

- Reliability analysis  Reliability trends, data for tender submissions
- Availability analyses  Data for SAR reports and SIL calculations
- Failure statistics  Advises for equipment and procedure improvements

Make it as simple as possible without compromising the user needs

Filter setting

- Key factor for realistic data

Results

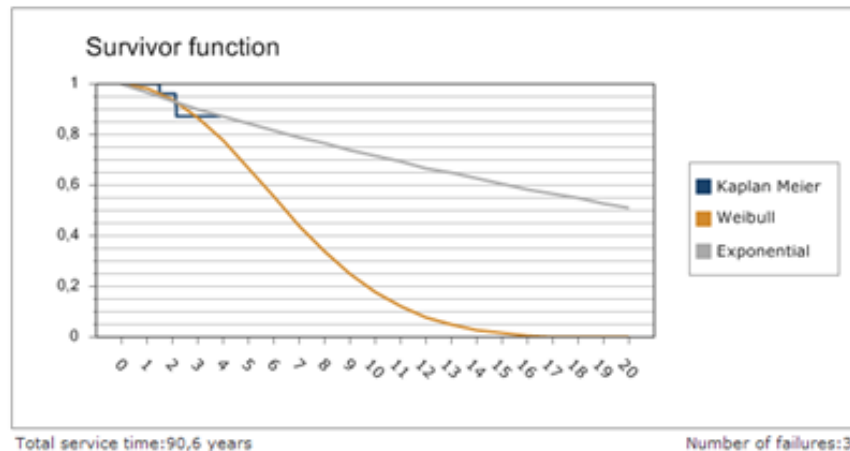
- Failure rate
- MTTF (industry standard)
- MTTF (realistic estimate)
- Survivor function

Analysis filter

Installed after	22.01.2005	» more
Installed before	22.01.2013	» more
Burn-in period	6 days	» more
Estimated wear-out	20 years	» more
Failure modes	All	» more
Failure type	Operational failures	» more
Root cause	All	» more
Reporting	All	» more

Results

Mean failure rate	3,778 failures per 10 ⁶ hours	» more
Mean time to failure (MTTF) - industry standard	30,2 years	» more
Expected time to failure - observed	≥3,6 years	» more
Expected time to failure - realistic estimate	6,8 years	» more



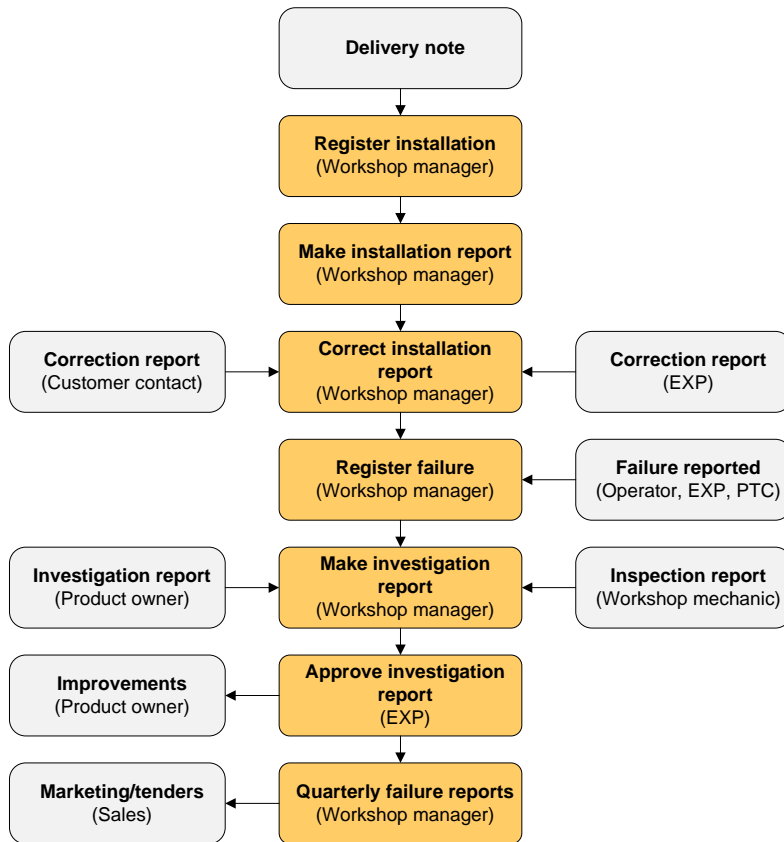
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- **Key software features for added value**
 - Admin tool for control of roles, responsibilities and access
 - Warnings related to non-approved investigation reports
 - Equipment with non-approved investigation reports will not provide service time
 - Installation reports are adapted to each specific product
 - Integrated support system (what, why, how)
 - Appendices can be attached to installation and investigation reports
 - Data can be exported to Excel
 - List of FAQ

- **Fixed price for the standard version software**

- **Annular software license, support and maintenance costs**
 - Hosting at a web server for optimum conditions related to security updates, back-up and availability
 - Keep the web page up to date according to new standards and known security risks
 - Keep the software compatible with new versions of other user software like operating systems
 - Enhancements to existing functionality such as search algorithm's or speed optimization
 - Fault diagnosis, correction, testing and implementation of code updates to resolve faults
 - Monitoring and maintenance of the source code and all other aspects of its management
 - Phone support for questions about the software
 - Assist user for reconstruction of data upon user failures
 - Free assistance (limitations) for adding new product types

The RMS work flow



Interface with other systems

- RMS inherits the product SN from the PDM system
- RMS is the operational system

Any incident during operation is traceable back to the FAT tests, material certificates, component SN, etc. in the PDM system by searching on the product SN

- **Save time and increase service level by instant access to data**
 - Current and historical installations
 - Operational experiences (positive and negative)
 - Approved investigation reports
 - Reliability analysis
- **Use reliability data for product and procedure optimization**
- **Provide operators with reliability data upon request**

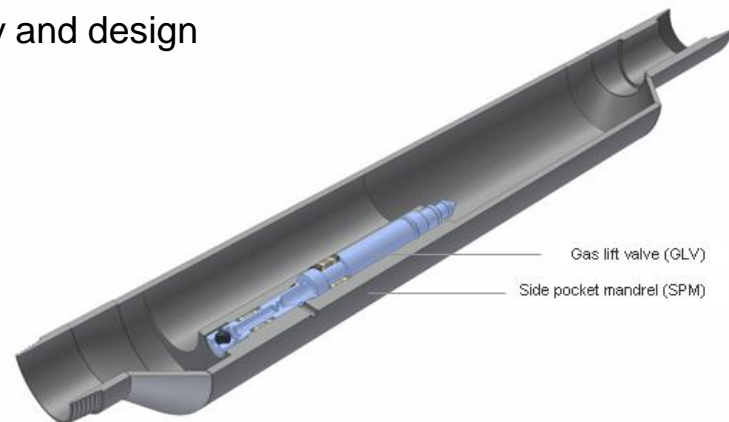


Increased market shares and profit

- **Requirements in operators governing documents**
 - Vendors shall have an updated register of all serial numbers (SN) applied in operation
 - Vendors shall have an archive system for rapid equipment information upon request
 - Vendors shall improve reliability based on operational and maintenance experiences
 - Vendors shall collaborate with the operator in the process of improving reliability
- **Purchase of equipment**
 - Operators prefer to do business with vendors able to provide data upon request and vendors able to learn from operational experiences
- **Re-purchase of equipment**
 - Failures have less impact on operators re-purchase of equipment as long as the vendors are genuinely concerned with understanding the failure causes followed by remedial actions to prevent re-occurrence
- **Profit**
 - Reliability is probably the most important attribute for well and subsea technology from a life cycle profit point of view

■ Additional RMS services

- Approval of investigation reports for unbiased and trustworthy analysis results
- Suggest actions for improved reliability (products and procedures)
- Suggest vendor roles and responsibilities related to reliability management
- Recommend how to communicate reliability data with operators
- Make safety analysis reports (SAR) as basis for SIL calculations
- Develop client specific software functionality and design
- Additional encryption



These services are offered by separate contracts

- **Independent 3rd party verification of new technology**
 - Extensive FMECA's (methodology based on 20 years practical experience)
 - On-site qualification test witnessing
 - Supported by the knowledge management system www.exprobase.com

