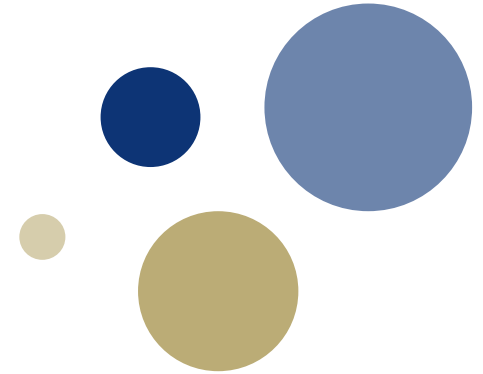




NTNU – Trondheim
Norwegian University of
Science and Technology



Self-introduction and PhD plan

Aibo Zhang
03.11.2017

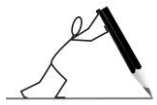
CONTENT



1. Self-Introduction

2. Previous work

3. PhD plan



Introduction

Name: Aibo Zhang

张爱波

Hometown:

Shandong, China

山东，中国





Education



Master's degree Institution:

China University of Petroleum-
Beijing

College:

Mechanical and Transportation
Engineering

Major:

Safety Science and Engineering

CONTENT

1. Self-Introduction



2. Previous work

3. PhD plan



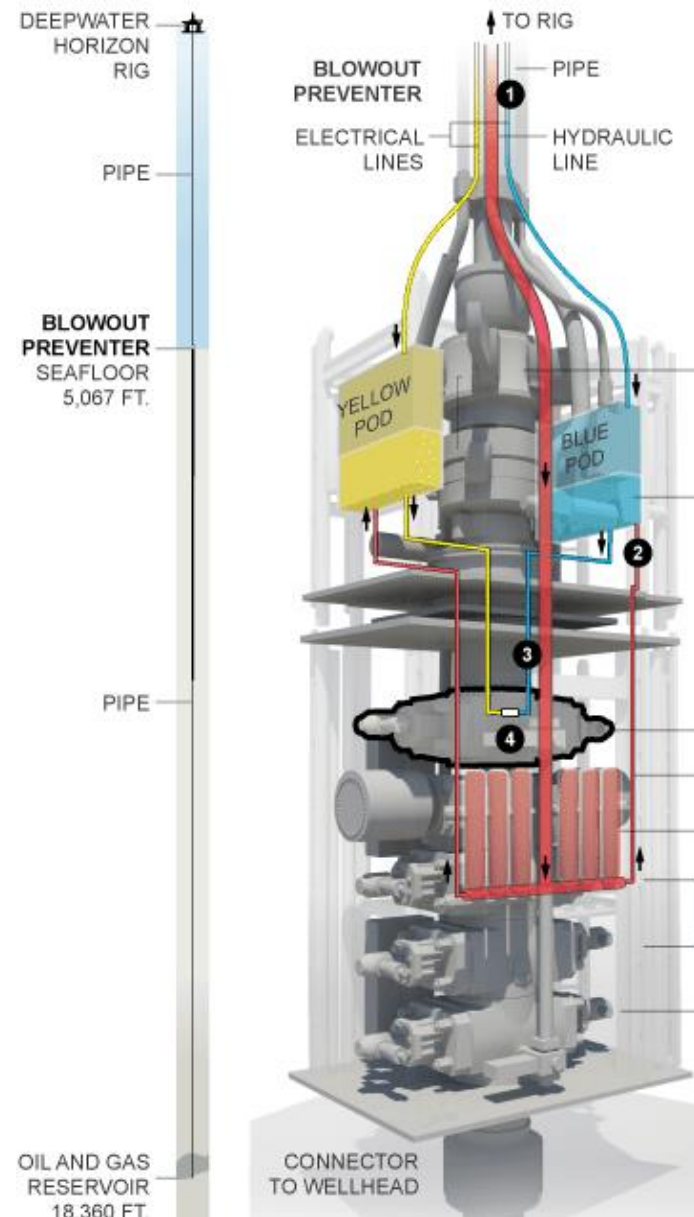
Previous work

Research Focus:

Offshore well control equipment
reliability and integrity assessment

Master's thesis topic:

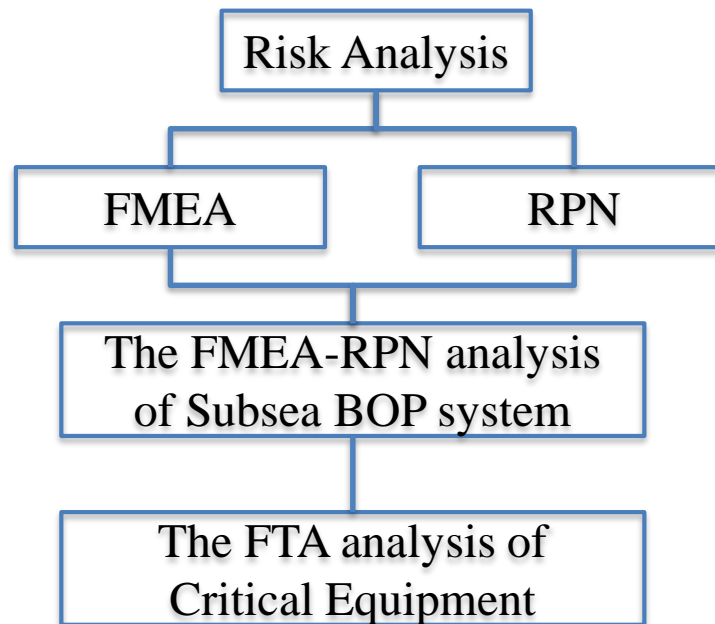
Evaluation Method of Offshore
Blowout Preventer Integrity
Assessment Based on Risk
Assessment



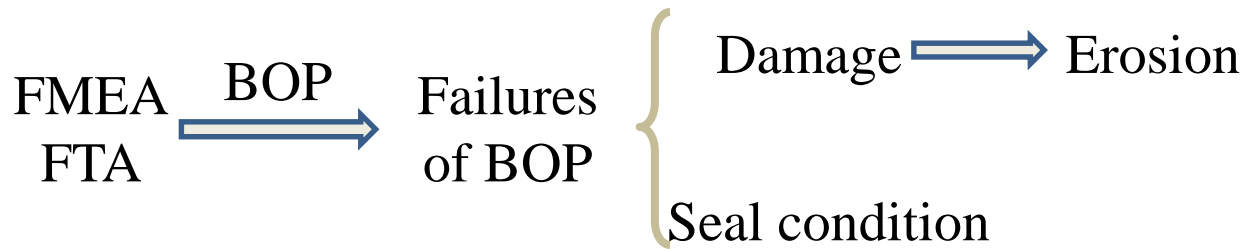
Research experience

1. **Project Title:** Risk Control of Deepwater Gas Field Drilling and Completion Options

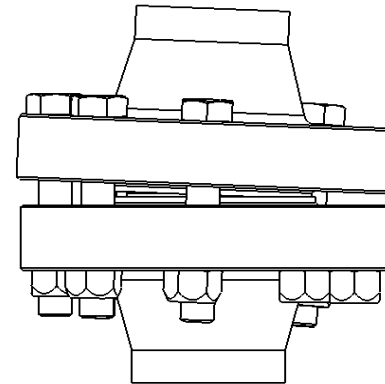
Brief: Researching on the evaluation of **BOP reliability**



Safety Evaluation of Subsea BOP



Inner cavity erosion of RAM BOP

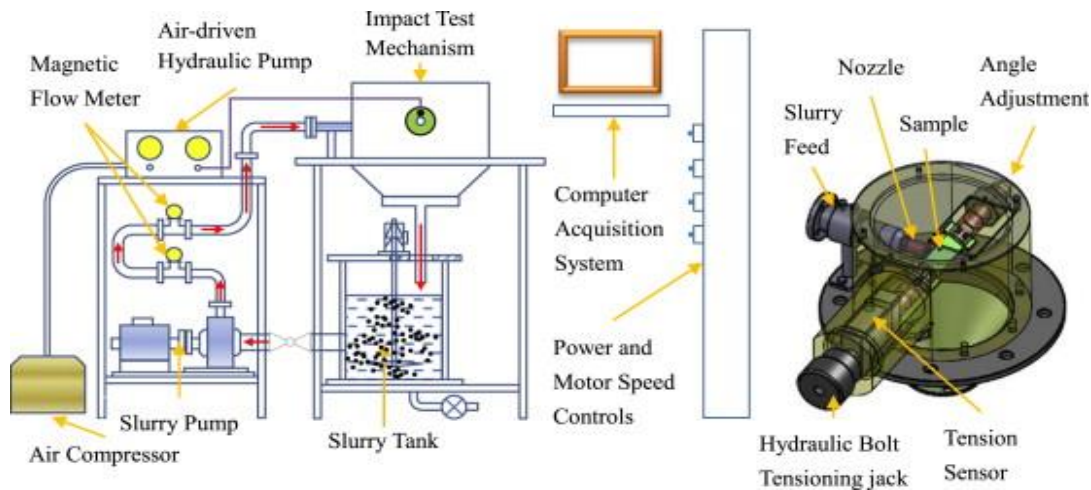


The flange under the non-uniform bolts pre-tightening

2. Project Title: Non-metallic materials and safety monitoring technology

Brief: Researching the corrosion and erosion mechanism of high pressure manifold key components;

Researching the main influence factors of the mechanism of corrosion and erosion.



Schematic diagram of the erosive wear testing system

Testing method:

Metal magnetic memory

Main influence factors:

- ◆ Impacting Velocity
- ◆ Tensile Stress
- ◆ Impacting angles
- ◆ Materials

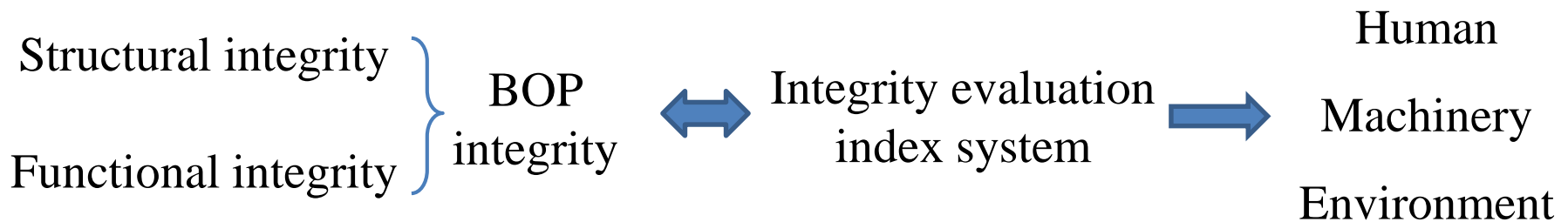
Research experience

3.Project Title: Assessment Technology Research of Well Control Equipment

Brief: Researching on the evaluation of **BOP reliability and integrity**;

Developing **the software** of well control equipment integrity management.

BOP integrity



Integrity management software

The screenshot displays the Integrity Management Software interface, which is divided into several functional windows:

- 系统参数 (System Parameters):** Shows a schematic diagram of a well system with various components like valves and pipes.
- 井控管汇状态评估 (Well Control Manifold Status Evaluation):** Displays a graph of '检测结果' (Detection Results) showing pressure fluctuations over time.
- 管汇完整性信息 (Manifold Integrity Information):** A table listing inspection details for different equipment.

序号	设备编号	检测部位	检测时间	梯度峰值	损伤状态	安全等级	维护周期	处置措施	使用记录	原始数据
1	001	环形防喷器	2016/11/1...	1.67	中度缺陷...	较危险的	3个月	立即维修...		C:\User...
2	002	压井管汇直管	2016/9/23...	0.03	无缺陷或...	安全的	一年	无		C:\User...
3	002	环形防喷器	2016/11/1...	1.67	中度缺陷...	较危险的	3个月	立即维修...		C:\User...
4	004	压井管汇直管	2016/9/23...	0.05	无缺陷或...	安全的	一年	无		C:\User...
5	001	闸板防喷器	2016/11/1...	1.88	中度缺陷...	较危险的	3个月	立即维修...		C:\User...
6	006	压井管汇直管	2016/9/23...	0.1	无缺陷或...	安全的	一年	无		C:\User...
7	007	压井管汇直管	2016/9/23...	0.3	轻度缺陷...	可忽略的	一年	无		C:\User...
8	008	压井管汇直管	2016/9/23...	1.3	中度缺陷...	较危险的	一年	无		C:\User...
9	009	压井管汇	2016/9/23...	0.8	轻度缺陷...	可忽略的	一年	定期检查		C:\User...
10	010	三通	2016/9/23...	1.5	中度缺陷...	较危险的	一年	立即维修...		C:\User...
11	011	三通	2016/9/23...	3.3	严重缺陷...	危险的	三个月	停机检修...		C:\User...
- 海上防喷器完整性管理软件 (Offshore Blowout Preventer Integrity Management Software):** The main application window with a menu bar including '系统参数', '状态检测', '可靠性评价', '事故后果计算', '完整性管理', '事故数据库', '个人信息', and '退出'.
- 事故查询 (Accident Query):** A form for searching accident records. It includes fields for '序号' (10), '事故编号' (0010), '事故发生时间' (2005年07月06日), and '事故地点' (美国墨西哥湾). A table below lists accident details.

序号	事故编号	事故发生时间	事故地点	失效部位	事故经过简述	事故原因分析	事故损失
1	0001	2007/6/2	欧洲北海海	阀门/定位失效	Transocean...	物体坠落	无人伤亡
2	0002	2006/7/17...	美国墨西哥湾	张紧器	01:00水下...	错误操作...	
3	0003	2006/11/4...	美国墨西哥湾	阀门球部分	01:00水下...	人为失误...	
4	0004	2007/3/12...	美国墨西哥湾	隔水管张紧器	伸缩接头处	三次飓风...	
5	0005	2007/2/9...	美国墨西哥湾	柔性接头	8:00正在...	隔水管总成...	
6	0006	2007/1/17...	美国墨西哥湾	张紧器	01:00水下...	错误操作...	无人伤亡
8	0008	2006/9/20...	欧洲北海海	阀门/定位失效	运输过程中...	阀门/定位失效	无人伤亡
9	0009	2009/3/19	美国墨西哥湾	上层环形防...	在进行完井...	物体坠落	严重的设
10	0010	2005/7/5	美国墨西哥湾	隔水管	2005年7月5...	钻井发声器	无伤亡
- 标准 (Standards):** A window for managing standards. It includes a '标准目录' (Standards Directory) table.

序号	标准名称	标准编号	标准级别	存放位置
1	防喷器的检查和维修	SY/T 6160-2008	行业标准	
2	旋转防喷器	Q/CFPC 36-2002	企业标准	
3	防喷器判废技术条件	Q/CFPC 41-2001	企业标准	
4	节流和压井系统	SY/T 5323-2004	行业标准	
5	防喷器检查和维修	SY/T 6160-2014	行业标准	

CONTENT

1. Self-Introduction

2. Previous work



3. PhD plan

Research plan

Topic: Hybrid prognostics and health management for safety-critical systems in infrastructures

-supervisor: Yiliu Liu

-co-supervisor: Anne Barros

Key words: Prognostics and health management(PHM)

safety barriers

safety-critical systems

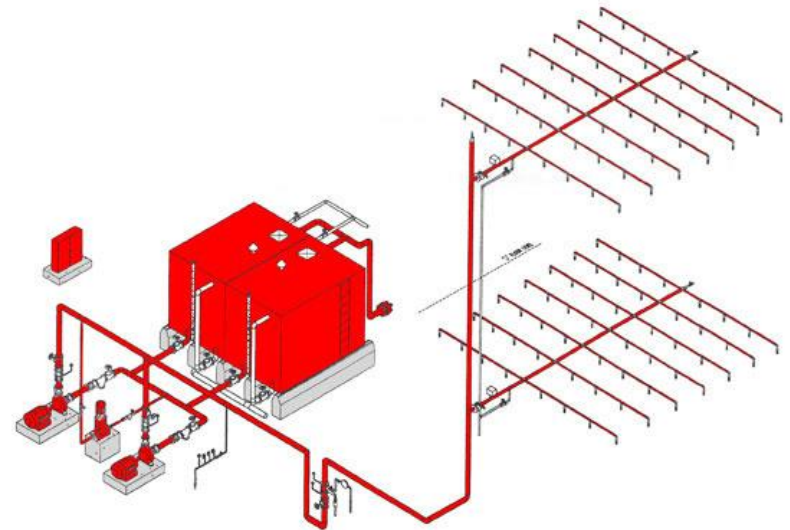
◆ Mostly in a **dormant** mode

⇒ gives **uncertainty** about their
operationality when demanded

◆ **Periodically** tested or inspected

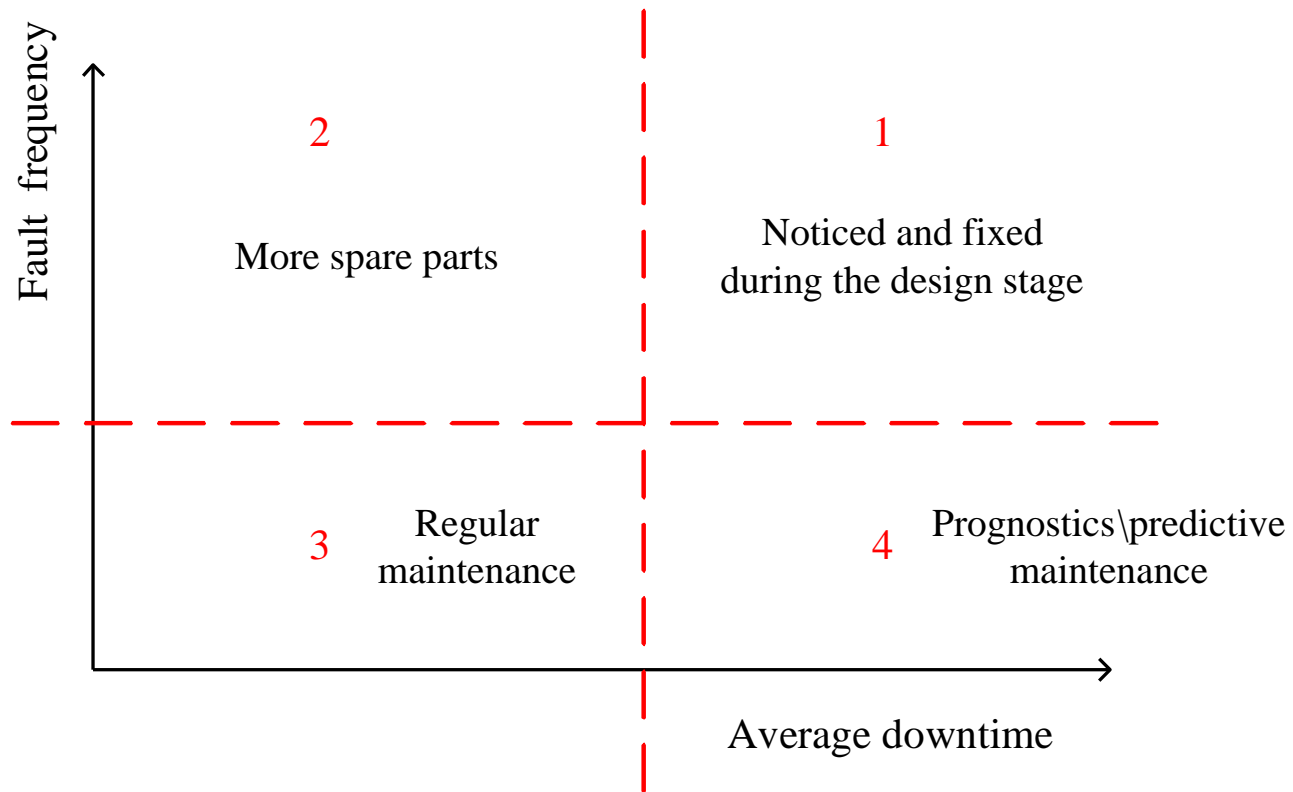
⇒ periodic tests and inspections are
inaccurate;

About **33%** of failures per year of fire
suppression systems was the result of
an inadequate inspection*.



Simplified illustration of a fire
sprinkler system

*D. Dieken, Inspection, testing and maintenance of fire protection systems at industrial plants, Process Saf Prog 18(1999),151-155.



Four quadrant chart for identifying systems

Maintenance types characteristics

Maintenance	Reactive	Preventive	Predictive
Frequency	On demand	Scheduled, time- or cycle-based	Condition based
Labor cost	high	high	Low
Labor utilization	high	Low	low
Parts cost	high	medium	Medium
Throughput impact	high	medium	Low
Urgency (Acceptable resolution timeframe)	High (minutes to hours)	low (days to weeks)	Very low (depends on impact)

*Barajas L G, Srinivasa N. Real-time diagnostics, prognostics health management for large-scale manufacturing maintenance systems[C]//Proc. ASME International Manufacturing Science and Engineering Conference. 2008, 2: 85-94.

Challenges:

1. Observation of degradation for safety-critical systems

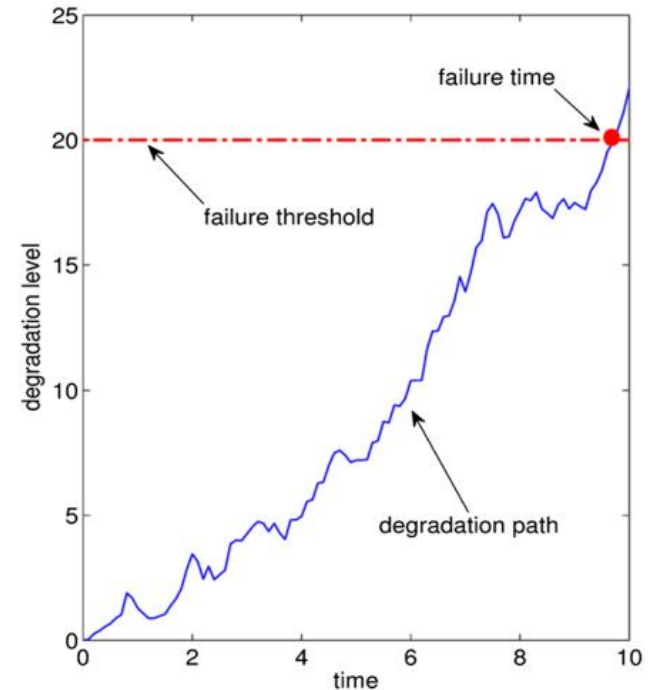
- Assume the degradation as exponential distribution

2. Evolving environment(EE)

- EE changes the conditions, degradation and failure occur.

3. Uncertainty

- obtain component failure rates
- Reliability information for systems especially in a dormant mode



An illustration of traditional degradation-threshold failure

Thanks for your attendance!