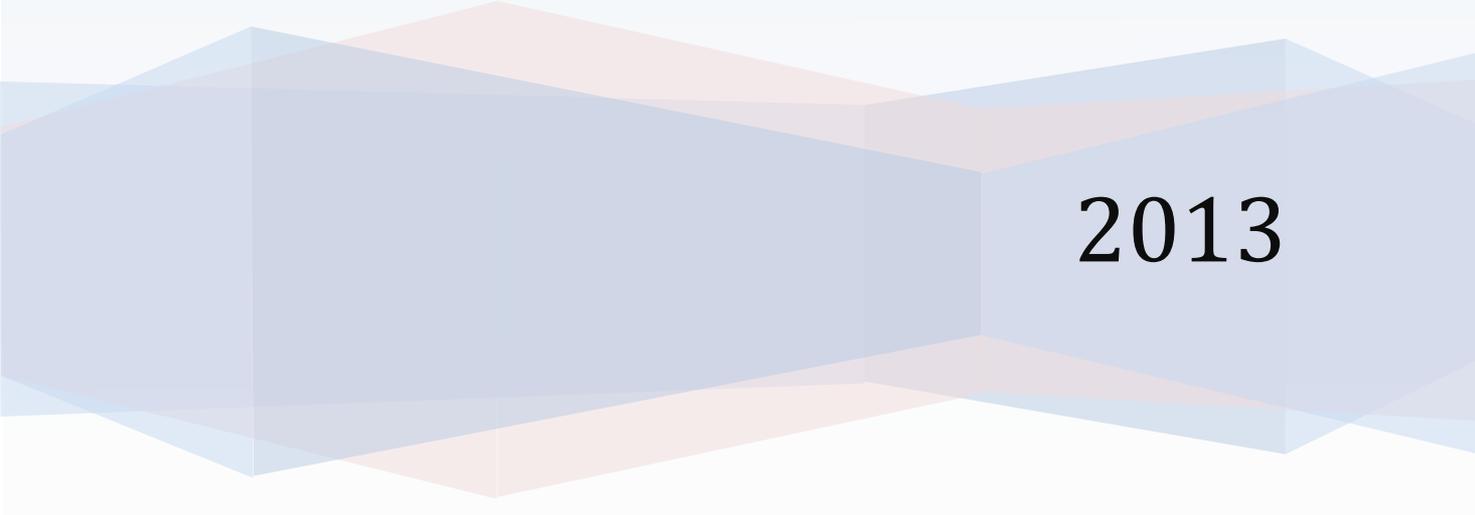


Master student projects

Center for Industrial Asset management



2013

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Title: Risk-based work optimization for deep water drilling operations: Integration of risk analysis, maintenance and human factors on BOP operation

Status:

Abstract: The offshore deep water drilling has attracted global attention since the Macando blowout. It raised worldwide concern on the safety level of oil & gas industry and resulted in directly influence on offshore drilling activity. The thesis start from the introduction of offshore drilling, and the development of global oil & gas market, then come back to China, and generally described the history of offshore petroleum exploration and production in South China Sea and the deep-water activity. Then this thesis centered on the offshore deep water drilling process, cooperated with the general workflow of drilling operation on COSL's 1st deep water drilling unit HYSY981 to build up a general work flow map. Identify the critical activities from risk prospective, clarify the risk level of different activity and find out the related issues that contribute to the risk and efficiency by using different kind of risk analysis tools. The thesis starts from the background of the offshore drilling industry, and introduces current situation and developing trends of offshore deep water drilling. Then the author turns his sight into China and introduces the development process of China offshore petroleum industry. In the following chapter is the theoretical basis of further study. This part discusses drilling risk, maintenance activities, human factors and work optimization, and develops the relationship of them. Use the risk analysis tool, bow-tie diagram and risk matrix, related to the practical operation on the rig, the workflow map is used and choose running/pulling BOP as a specific activity to do further study. Using of the concept of integration of risk analysis, equipment maintenance activities, and human factors to improve the safety level and operation performance. I will conclude from the discussion, and come back to the very basic point: safety and performance issue. By describing the implementation of risk analysis, maintenance activities, and human factors in BOP operation, we could explore their contribution to work optimization and how do they impact on the operation. The author still introduces the success factors and stimulus for work optimization, and then briefly concludes the work optimization points on running/pulling BOP operation. At last, we will provide two simple cases that have been implemented on the rig. Basic risk analysis tools and minor modification has significant contribution on safety and work performance.

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Title: Weather sensitivity of maritime activities on Chinese Shelf

Status:

Abstract: The objective of the thesis is to discuss the weather sensitivity of maritime activities, inter alia, with respect to the aspects of passage planning, load plan-making, and ship maneuvering. As maritime activities represent a high risk industry, the risk analysis is not only a mandatory requirement of the administration but also a need during practice. A risk analysis will also be carried out in this thesis. With the improvement of the state of technology, a myriad of state-of-art technologies and equipment have been applied in oil field service realm, for example, shuttle tankers with DP2 (Dynamic Position System) have been used extensively in the North Sea area of Norway. However, there is none of this kind of shuttle tankers in Chinese costal area yet, therefore, this thesis will also discuss the prospect that such shuttle tanker will be used in Chinese costal area. In recent years, the global climate is getting increasingly unstable. Extreme weather, like typhoons, abnormal temperature, and storm occur frequently. According to a survey, in 2011, the US lost 50 billion dollars and in the recent 17 years, China mainland lost in average 185.9 billons RMB every year due to the damage of weather. Numerous professions for example the oil field service and shipping industry, which we are engaged in, were affected mostly. When it comes to the Chinese costal area, it is also one of the most famous zones of heavy storms and waves in the world. Up to this day, I still remember clearly that on 4th Nov, 2004, due to hash weather, two cargo ships went down in the Bohai Bay, and 44 members of the crew lost their life. At that time, I experienced the rescue activity in personal as the chief officer of a rescue boat. Therefore, there is a need to analyze the weather system and its influence on marine transportation on the Chinese Shelf. The final goal is to lower the risk of a marine operation by use of its advantages and avoidance of its disadvantages. In addition, in order to integrate methodology with practice closely, in the process of the thesis writing, the ships and the business of the Marine and Transportation (M&T) department of COSL will be referenced in discussing subtopics.

Student Name: Lu, Youyu

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Title: DP systems for offshore vessel positioning in deep water

Status:

Abstract: Current industry practices and the suggestions from the literature are that offshore oil exploration and production activities will move into deeper water further from shore. To achieve that, dynamic positioning systems are indispensable. In the past 5 years, there has been a dramatic increase in the number of offshore installations equipped with DP systems. This thesis is focused on comprehensive characteristics, utilities, risk analysis and future trends regarding positioning systems in the offshore oil industry, and figures out the most suitable methods for keeping an offshore installation on location (traditional anchor mooring system, lightweight mooring system, dynamic positioning system). Specifically, this thesis emphasizes on the offshore dynamic positioning system. This method will be investigations to improve the accuracy and reliability of different types of rigs and vessels, as well as improving the safety and efficiency of DP operations. Safe operations of the dynamic positioning of offshore drilling units and support vessels are dominated by two parameters, the resistance against drift-off from position and the robustness of position recovery. The operational facts tell us that DP vessels' loss of position during operations is not rare. Effective ways will be illustrated by evaluating the two parameters and improve the safety accordingly. HAZOPs and FMEA risk analysis methods will be used to evaluate the reliability of the system.

Student Name: Li, Tieli Jr

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Industrial Partner: COSL

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Title: Remote support services using condition monitoring and online sensor data for offshore oilfield

Status:

Abstract: Based on advanced technology in condition monitoring and online sensor data, a new style of operation and maintenance management called remote operation and maintenance support services has been created to improve oil and gas E&P performance. This master thesis will look into how the remote support service is conducted including the concept, design, technology and management philosophies; the current implementation of remote support services in China, Norway and the rest of the world to breaking barriers and creating business values; Explore the performance in LCC, RAM (reliability and maintenance) level perspective and decision making through the using of condition monitoring and online sensor data; study the future development of remote support services and Integrated Operations (IO). The author will study the state of art technology from literatures, company documents and consult to the professors and engineers. A study of remote support services in ABB, SKF and ConocoPhillips will be conducted as an evolution of integrated operations. Further research is needed to face many challenges exist in the practical use of the remote support services through successfully breaking barriers to boundary-less organizations and developing management process and competent employees into the organization. The cultural change is difficult but fatal for the success of the system implementation. The suggested remote operation and maintenance support strategy is not complete for CNOOC and COSL, but gives a conceptual and an academic idea for practical use.

Student Name: Du, Baoli

Academic Advisor: Tore Markeset

Industrial Partner: COSL

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Title: Technology management models for marine seismic acquisition projects

Status:

Abstract: A marine seismic exploration project is a high investment project with complex procedures, state of art management models should be implemented to solve the limitations and problems encountered in marine environment projects. High investments in the seismic exploration need high working efficiency. So the specifics of technology for marine seismic acquisition should focus on how to improve the efficiency of marine seismic exploration. Marine seismic data acquisition vessels are specialized vessels that towing a number of streamers (cables) and air guns, vessels characteristics and stability are all discussed and analyzed in this thesis. Management strategy for equipment procurement and management of the spare parts that support the projects are crucial to any projects, they are the safeguard to make sure the marine seismic exploration follows the plan, and effective ways to reduce cost. An advanced maintenance technology will save lots of money and will be welcomed by all project managers. Maintenance technologies are also discussed in this thesis to give managers a clear concept of equipment replacement, optimize their management. Risk involved in the acquisition project management shall be emphasized by project managers and executors. Risks methodologies used to analyze risks in marine seismic data acquisitions should be concerned by all managers, in this thesis, we mainly focus on operational risk and environment risk.

Student Name: Li, Lei

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Title: Propose an alternative method to generate alarm management KPI utilizing IMS in offshore platforms

Status:

Abstract: Weaknesses regarding alarm management practices have been recognized as partial causes of plant incidents with tragic results, for example the Texas City Oil Refinery explosion in 2005. Necessity in alarm regulation was recognized by industry bodies and norms were created (EEMUA 119, ANSI/ISA 18.2) in order to address this. These norms define a complete alarm management lifecycle, including the definition of an alarm performance monitoring process with the supervision of alarm's key performance indicators (KPI) Alarm KPI generation in oil installations is a complex technological task and generally includes the integration of alarms coming from different sources in the process plant. The Information Management Systems (IMS) as defined in NORSOK I-002 as the natural gathering engine for process data in an offshore installation. The utilization of IMS in Alarm Management Purposes is included in this NORSOK standard. The original driver of this investigation was that Offshore Platforms in the Norwegian Continental Shelf do not utilize IMS for Alarm Management KPI generation, despite their intense utilization of IMS for other purposes. Technical reasons for this practice are not known. In order to evaluate the current capacity of IMS in alarm KPI generation, a minimum required set of KPIs was established although different standards show variations between KPIs. The data structure gathered inside IMS in related to alarms (alarms metadata) was compared against the established set of KPIs. The main study finding conclude that data contained within the IMS structure is currently not enough for generate the priority- related KPIs, mainly because alarm priority is not included in current IMS. In general terms; IMS data structure is not defined by NORSOK and even when included in some industry related regulations (as Statoil TR2258) Alarm Priority is not considered to be part of Alarm metadata. The above finding points to an easy solution and raises questions regarding lack of "data priority" in the IMS data structure. This comes from a lack of regulation in IMS Implementation, mainly because of NORSOK standards.

Student Name: Carlos Villoria

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Title: Spare parts management in Bohai bay

Status:

Abstract: Spare parts management plays a critical part in the Oil and gas (O&G) industry. Traditional asset management could not meet the requirement of present equipment. Due to the complexity of inventory plus limitation of offshore platform, it is one complicated issue to accomplish effective and efficient inventory control for offshore operation. Having reasonable inventory is crucial for improving the continuous efficiency for spare parts and decreasing the maintenance budget, especially for the offshore operations. Inventory analysis requires one criteria to optimize the spare parts stock. Most commonly used models for inventory are spare parts value-usage, criticality, frequency of demand. The combination of management policy and mathematical model is very complicated for the maintenance management. It needs too much mathematical knowledge and is not very efficient in spare parts analysis. Thus one classical model for analyzing the spare part demand is ABC model. A specific example of platform in the Bohai Bay is used to demonstrate the spare parts management condition more specifically. Through systematic inventory analysis, unchangeable spare parts in the last five years account for high percentage. It is mainly composed of spare parts of turbine, compressor, and crane. After reorganization, spare parts on the platform are optimized and it saves much budget and space for platform.

Student Name: Zhigao, Shangguan

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Title: Life cycle cost for modification project

Status:

Abstract: Life Cycle Costing is a commonly used method for evaluating various alternatives and hence, choosing the best solution. This method is not fully utilized in the Front End Loading studies performed by one of the operating company in cooperation with their contractor for the modification of their existing facilities in an oil field. In most of the cases, the proposed technical solutions are often chosen mainly based on the initial acquisition cost, technical compliances and previous experiences. The complete life cycle cost, which shall typically include solution integration, operation and maintenance cost are often neglected. It is important to consider the complete life cycle cost as much as possible. Without having thorough understanding of the associated cost incurred in the life cycle, it is just like viewing only the top of the iceberg by overlooking the hidden cost. The operating company aims to implement the life cycle cost calculation as part of the standard procedures while performing studies in the early phase for their modification projects. It forms a basis for selecting the best technical solutions economically. The purpose of this paper is to propose a practical solution and life cycle cost evaluation for selecting the best technical solution for modification projects. It enables the company to properly document the criteria and calculation as supporting document for decision making in the project. A practical case study is carried out and simplified LCC calculation method is pro-posed. It is also recommended that LCC analysis to be extended to bid evaluation while purchasing new critical equipment during the project execution phase.

Student Name: Teng, Ming Chuin

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Title: Deploying and managing engineering assets: a case study of a Chinese oil service

Status:

Abstract: The author went through the developing history of COSL from 1990s to date and found that with 50% of its engineering assets deploying aboard at 2012, the overseas revenue in that year is counted 31% of the total revenue, this can be recognized as success of engineering assets management of a Chinese State - Owned Company's over-seas' operations. Meanwhile in the process, the challenges and pitfalls the company faced has always been significant due to many reasons such as significant psychic distances, backwards of industry developing level, insufficient of technical capacities and human resources, defects of the management system etc. Nevertheless the author also find through internationalized training, enrollment of highly educated personal, M&A of companies in developed markets, Green field investment in developing markets, building assets management center in places with strategically importance etc., COSL has successfully reacted to those challenges and obtained remarkable international assets management performance according to its scale in the markets. Based on the above findings, the author has also pro-posed several recommendations for the company to achieve better performance in the future such as adjusting HR system to enroll more international talents locally from overseas markets; desalination of the connection with CNOOC group; More M&A investment in technology services companies besides drilling companies ; Investment in engineering assets with deep water and extreme environmental features; building more assets management centers in strategic important locations to create international assets network to support COSL's global marketing participations.

Student Name: Peng, Guicang

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Title: Products and services within asset integrity management in the Norwegian oil and gas industry: Status quo and innovative trends

Status:

Abstract: Owing to commercial opportunities on the Norwegian oil & gas sector, there is a growing demand for products and services for Asset integrity management (AIM). In general, the market demands greater degree of in-novation in AIM. Seeking means to simplify complex work processes and at the same time to have a better under-standing and awareness of inherent risks. The trends for innovative AIM products and services can always be challenged due to such factors as innovation costs, organizational capacity, technological capacity to drive innovation, as well as underlying business growth potential of the innovation. Other challenges or barriers can include financial constraints, regulatory challenges, and conservative clients to invest in revolutionary products. The purpose of this thesis is to map the current status and to elaborate on the future trends for such products and services on the Norwegian shelf (NCS). It includes a comprehensive literature survey on Asset Integrity Management (AIM) within the Global and Norwegian O&G industry. Also, a market survey of available AIM products and services being offered by Norwegian AIM service providers was conducted to review the status quo. In addition, expert opinion from a number of Norwegian AIM service providers was included through questionnaire and informal interviews to validate results emanating from mapping the existing and new AIM products and services within the sector. The work highlights the status and gaps through a thorough analysis of theory and what is currently available in AIM of oil and gas assets. It highlights trends emerging from service providers on the NCS that are demanded by new asset operational scenarios such as integrated operations. In this context, various technological capabilities take a leading role seeking significant value creation opportunities in terms of safety, cost, and production. Interestingly, there appears to be various human, technical and organizational issues such as lack of knowledge and/ or technical competence and conservative attitude of operators that regulates the development and deployment of novel Asset integrity management due to its sensitivity in terms of managing asset related uncertainties and vulnerabilities.

Student Name: Kadiri, Oluwaseun O.

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Title: Evaluation of the Petroleum Safety Authority efforts to reduce the probability and limit the consequences of major accidents at onshore facilities in the Norwegian petroleum industry in accordance with the Seveso Directive

Status:

Abstract: After a number of incidents involving dangerous substances in the 1970s the European Union published the Seveso Directive in 1982, named after an industrial accident in the town of Seveso in Italy in 1976 where a large accident released dioxins into the air. The Directive was revised in 1996 and 2012 after major updates, the so-called Seveso II Directive and Seveso III Directive respectively. Through the European Economic Area Agreement, Norway has agreed to comply with directives from the EU, thus included the Seveso Directive. This is the reason why Norway in 1994 published their first regulation to prevent major accidents in activities involving dangerous substances (Storulykkeforskriften, 2005). In 1999 “Storulykkeforskriften” (the Major Accident Regulations) was published by the Norwegian authorities. In Europe there are over 10 000 companies affected by the Seveso Directive. In Norway in 2012, 93 companies had such large amounts of dangerous substances that they had to provide a security report, and 196 businesses had to report to the authorities (Thorsen, 2013).

In 2004, the security division was separated from the Norwegian Petroleum Directorate, and the Petroleum Safety Authority Norway was formed as an independent regulatory government for health and safety on the Norwegian continental shelf and certain onshore facilities. As part of this process the Petroleum Safety Authority got supervisory authority for the eight facilities for landing and/or industrial processing of oil and gas from the Directorate for Civil Protection and Emergency Planning. The plants are Hammerfest LNG, Nyhamna, Tjeldbergodden, Sture, Kollsnes, Mongstad, Kårstø and Slagentangen. Along with the Climate and Pollution Agency and the Norwegian Industrial Safety and Security Organization, the Petroleum Safety Authority performs audits in accordance with the Seveso II Directive from 1996. A revised version of the Directive, Seveso III, was adopted in 2012 and comes into force in 2015. A revised edition of the Major Accident Regulations is being prepared in accordance with the revised directive from 2012.

The theme of this thesis has been to evaluate the efforts of the Petroleum Safety Authority to reduce the probability and limit the consequences of major accidents at onshore facilities in the Norwegian petroleum industry in accordance with the Seveso Directive. To be able to answer that, an investigation whether the Petroleum Safety Authority meets the intent of the Seveso Directive to reduce the probability and limit the consequences of major accidents caused by dangerous substances at onshore facilities in the Norwegian petroleum industry, was initiated.

As part of the study a comparison of the Seveso II Directive, the Major Accident Regulations and the regulations in the petroleum industry for onshore facilities was performed. In addition, a review was performed of other activities which the Petroleum Safety Authority

performs in order to fulfill the intent of the Directive. The contribution the Directive has on the Petroleum Safety Authority area of jurisdiction in relation to its own regulations was also assessed.

Student Name: Landro, Espen

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Industrial Partner:

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Title: Operations and maintenance of oil and gas platforms under Arctic conditions

Status:

Abstract: In the Master thesis presented here, operations and maintenance challenges for offshore oil & gas (O&G) industry in Arctic regions shall be discussed. As oil prices remain on a high level Arctic oil and gas becomes more interesting. The higher price level allows for development of fields in this challenging remote environment. Understanding the environmental conditions is the key for successful projects. As there is still a lack of experience with equipment in these regions, maintenance of offshore oil and gas platforms will face many challenges. The cold and harsh climate, the remoteness, the poorly developed infrastructure and many other factors require new designs with optimal performance for these conditions. In the first part of this thesis, a general overview of the Arctic development shall be given. This part is followed by a discussion about challenges that developments will face in the Arctic will be discussed. Here especially the cold weather influence, remoteness and other factors are discussed in depth. In the third main part, maintenance of equipment shall be discussed under an Arctic perspective. Emphasis will be put on the selection of an appropriate maintenance strategy, the design for human factors/ ergonomics and the design for performance and availability. In the last part, the Goliat offshore platform will be presented as an industry example. Some of the winterization measures will be discussed.

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Title: Condition monitoring of critical isolation valves on Valhall and Skarv

Status:

Abstract: Condition monitoring of critical isolation valves is a measure BP Norway has initiated to enhance state control of production facilities Valhall and cormorants, so that one can obtain better operating efficiency and reduced risk to personnel, environment and equipment . In this connection, the purpose of this thesis to look at solutions and methods that have been used and examine whether there are opportunities for improvement in condition monitoring of critical isolation valves. This is done by mapping the condition monitoring techniques available for valves which are used in installations at Valhall and Skarv. Furthermore, the task of software that monitors the valves and the architecture of condition monitoring systems, as well as how to combine different functional tests with condition monitoring in order to increase the likelihood that the valve is able to close. BP Norway is in the initial phase of online condition monitoring of isolation valves, so it is difficult to conduct any analysis of the collected data to verify the condition monitoring techniques are preferable. The knowledge base for implementing task was formed through databases, reports and interviews with personnel within BP Norway and from external companies. Foundation was also formed through participation in courses on condition monitoring OFF valves, both at Score AS (Randfontein) and Solberg & Andersen AS (Bergen) . At both facilities, the valves today mainly 12 months. Maintenance interval, where it is carried out visual inspection, functional test and manual leak test. Isolation valves on Valhall will condition monitored via V -MAP (software) that monitors the valves by means of strain gauges and actuator , while the cormorants monitored valves via AMS (software) that uses a FieldVue valve controller (actuator and position measurements) to condition monitoring. Based on what has been mapped by monitoring the various facilities with their advantages and disadvantages, it can be concluded that the systems as they are currently not optimal and that there is no remaining work. The sensors used in monitoring is not optimized and monitoring procedures not followed by suppliers. It is unfortunate that it used different options for online condition monitoring at the two facilities and for further work recommended the following measures in order of priority :

- Apply functions FieldVue device enabling , allowing a controlled can perform " partial stroke " testing and electromagnetic testing. Initially, the cormorants since FieldVue device is already installed, but also on the Valhall if FieldVue devices are installed.
- Install FieldVue units of the critical isolation valves on Valhall.
- Install stationary acoustic emission sensors on all critical isolation valves on both Valhalla and Skarv.
- Install strain gauges on the remaining critical valves at Valhalla, and the critical valves on Skarv.

Student Name: Danielsen, Øyvind

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Industrial Partner: BP

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Title: A maritime perspective on integrated operations in the Norwegian petroleum industry

Status:

Abstract: Over the last few years the production process in the offshore Oil & Gas (O&G) industry has concentrated on innovative subsea solutions. This development has increased the need for advanced multi-purpose Offshore Support Vessels (OSV). Their role in oil field development has widened the intersection between the traditional petroleum and maritime sector, leaving the borderline between them somewhat diffused. This has increased the need for interfacing the two business sectors. As a response to the demand of innovative and efficient solutions, the O&G industry has implemented its novel operation scenario solution, termed Integrated Operations (IO). However, this study shows that the maritime sector is still oblivious to IO and its proven effect in the Norwegian Continental Shelf (NCF). The remarkable difference in the operational approach between the two sectors is a challenging situation as there is a need for a seamless interface between the two operational environments. This study describes the opportunities and limitations of adapting the IO approach into Maritime Asset Management (MAM) and specifically in the OSV management companies. The study has a practical approach to actual maritime operations, using specific problems encountered during normal operations, critical maintenance operations and an environmental initiative project. By the use of three industrial case studies, supported by interviews, the frictional elements in the operational inter-face of the two sectors have been identified. This has enabled the outlining of a new organizational approach to MAM. However, in order to utilize the full potential of IO several identified obstacles needs to be acknowledged by the maritime industry and mitigated through a joint effort and an open and including process. The study outlines 13 recommended actions specified to the authority, the oil field operator and the OSV companies for facilitating full implementation of IO into the maritime sector.

Student Name: Aamodt, Roar

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Title: Material degradation, failure modes and mitigating measures related to life extension of ageing offshore production installations

Status:

Abstract: Several offshore oil and gas installations in the North Sea has been in operation for over 20 years , suggesting that many components and structures have been operating longer than what they were designed for . That top-side piping systems on production installations require extended life , without compromising employee safety and equipment integrity, reliability and productivity. The main task of piping systems, which include pipes and tanks, is to keep the process media under normal operating conditions without the occurrence of any loss of control of these media. In the event of failure of one or more equipment installation integrity will experience a decline. As offshore installations, elderly will increase the likelihood of failure. Failure is a result of the different degradation mechanisms equipment is subjected, where the main degradation mechanisms are corrosion, erosion and fatigue. This can cause cracking, fracture and deformation in pipe systems. To avoid deterioration of plumbing systems on a production installation must be in use controlling and mitigating measures to compensate the relevant degradation mechanisms. Examples of compensatory measures are appropriate material selection and design of piping systems, changing environments, the use of coatings, cathodic protection, monitoring and inspection. Proper use of compensatory measures will result in pipe systems are extended running time, which further helps to extend the operating time of the associated production installation. Materials, design, and measures must be selected from the HSE , operation and maintainability, durability and cost. Compensatory measures must take into account the safety regulations so that the installation's safety is in accordance with the requirements and contamination. Effective management systems can facilitate efficient execution of measures with adequate communication and documentation. Measures such as monitoring and inspection has the potential to improve as technology and software are constantly being developed. Titanium is a material that is becoming increasingly used offshore, since titanium alloys have properties that make them technically correct material for several offshore components. They are virtually immune to corrosion in all types of natural waters and in marine environments, and is therefore advantageous in offshore pipelines . Titanium alloys also have a hardness that allows the pipeline system will have improved resistance to fatigue and deformation.

Student Name: Andreas, Henriksen

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Industrial Partner:

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Title: An evaluation and estimation of stresses on a vessel's side plate and its capacity

Status:

Abstract: History shows that the combination of stresses and pressure in a vessel can cause failure and lead to huge losses, examples of this are the 'Prestige accident' (November 2002) and the 'Energy Concentration accident' (July 1980). In the oil and gas industry structures are often mobilized on the deck of a vessel, transported to a specific location offshore and installed on the seabed. Occasionally these structures are quite large, resulting in their sticking out from the deck. A side plate in the sheer strake area needs to be evaluated, as stresses from the protruding structure, and stresses and pressure from the vessel's global loads, gives in-plane stresses and out-of-plane pressure. In this study, the aim is to establish a simplified approach for estimating stresses that arise from a vessels global loads, evaluate how much these stresses might influence the plate capacity and conclude whether these stresses should be included in a plate capacity check in Subsea 7. At this time, researchers such as Paik, Owen and Mansour are considered as well established researchers in naval society, and their studies will be used to reach a method for finding the arising stresses on plate that occur because of the global vessel loads. The stresses will be estimated by idealizing the vessel as a hull girder and applying beam theory combined with recommendations from Det Norske Veritas. The study shows that there are several key factors to establish these stresses and these factors will be estimated numerically and by computer software. The study shows that a stiffened side plate that is subjected to in-plane and out-of plane stresses and pressure can experience failure modes when the structure on deck results in large stresses. In this study a stiffened plate capacity checks will be evaluated based on Det Norske Veritas (DNV) and NORSOK standards and recommended practices, and are considered as state-of-the-art approaches. The study concludes that both the magnitude of the global stresses and the stiffened plate's characteristics are key factors in determining how much the global stresses influence the capacity of a specified plate.

Student Name: Berntsen, Andreas Askilsrud

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Title: Challenges and solution in subsea field development for the High North and Arctic

Status:

Abstract: Problem / Challenge Estimates indicate that approximately 25% of the world's unexplored hydrocarbon reserves lie beneath the depths of the Arctic regions, with around 1% (1.5 billion ton of oil equivalent) of that lying untapped under the depths of the Norwegian Barents Sea. Concurrently, the high north and Arctic are vaguely understood and lack of infrastructure in these areas makes it hard to gather sufficient data to be able to conduct detailed analysis. Furthermore, the distinct inhabitants and sensitive ecosystem make these regions extremely fragile and sensitive to change, which needs to be carefully considered by companies looking to explore for oil and gas in these areas. This project reviews the currently identified challenges and by conducting hazard identification, failure mode and criticality analyses, different field development solutions are scrutinized. By ranking different best available and qualified technologies (BAQT), it enables engineers to narrow the analysis and go deeper into the details so that one day the untapped resources of the Arctic can be safely and sustainably harvested with the environment at the forefront of their considerations. Project Scope Project scope includes the review of currently identified and acknowledged challenges in the high north and Arctic regions specifically focusing on the Norwegian Barents Sea. This includes the characterization of challenges and putting them into context as to why they pose threats on production systems. To complement the review of the latest field development concepts, a grid analysis helps highlight their strengths and weaknesses as well as their applicability to the high north and Arctic. Following, a hazard and failure mode identification analyses is carried out on the field development concept highlighted through the grid analysis before investigating best available and qualified technology (BAQT) related to the concept.

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Title: Considerations when lifting large module in different geographical areas

Status:

Abstract: Through the years in the oil and gas industry, the marine operations have been developing, and it continuous to develop. More production facilities offshore are under construction, and the activities offshore seem to in-crease rapidly. The operations done offshore are more advanced than ever and as a consequence of this, so does the marine operations, e.g. lifting operations. In this thesis, we will present several considerations when it comes to planning and performing a lifting operation. There are several factors to include in the planning and performing phase of a lift operation. Among them are waves, winds and currents, i.e. weather conditions. The weather conditions are also different in different geographical areas you are operating in. Another important factor is the vessel performing the operation. What is the capability of the vessel's crane? How is the vessel availability? These questions will be discussed in the introduction below. This thesis will be concentrated on two specific areas, The North Sea and Offshore Angola. The reason for choosing these two areas is that they have two completely different sea states. The North Sea is mostly influenced by waves with higher significant heights and wave periods of around 8 to 10s, while offshore Angola has waves with shorter significant wave heights and periods of around 10s to 12s. In this thesis different sea states - , stability - , lifting – and simplified risk analyses will be presented. There will also be presented a simulation with the use of the software OrcaFlex.

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Title: Flexible riser global analysis for very shallow water

Status:

Abstract: Flexible risers are widely used for a range of water depths and can accommodate large floater motions when using a buoyant system. A wide range of buoyancy solutions have been developed for very shallow water (e.g. 30-50 m), shallow water (e.g. 90-110 m) and semi-deep water (e.g. 300-400 m) and in the ranges between these depths. Flexible risers can have different configurations. These different solutions have different characteristics which influence their suitability for a given situation. The pipes should not experience excessive curvature; a limiting value is given by the manufacturer. The system should avoid axial compression in the pipes and contact between the pipes and other structures. This thesis will focus on the challenges and solutions for very shallow water depths (less than 50 m). This thesis will consider the design of dynamic, flexible unbounded riser pipes connecting a subsea pipeline to an FSO turret. The following work will be presented: • Study of flexible riser technology, especially comparing different very shallow water buoyancy systems. • Methodology of design of flexible riser • Parameters effect on flexible riser design • A case study of a typical very shallow water project using dynamic flexible risers: i. Presenting relevant input data for designing the risers. ii. Static and dynamic design and analysis, taking FSO motions and hydrodynamics into account and checking against relevant design codes. Modeling and Dynamic analysis will be performed by using FE software OrcaFlex. Irregular waves are taken into account for the dynamic analysis. The wave spectra will be investigated based on location.

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Title: Hydrate plugs in subsea pipelines and non-invasive methodology for localization

Status:

Abstract: With the growth in global energy demand and the lack of new shallow-water and onshore opportunities, there is growing emphasis on oil and gas production in deep-water environments. A particular challenge for flow assurance engineers is to ensure pipelines remain free from restrictions created during operation. Hydrate plugging, in particular is, one of the major flow assurance challenge, and as oil and gas production moves into harsh and challenging environments, there is a growing challenge to prevent hydrate plug formation. The applicability and efficiency of remediation methods depend on locating an accumulation or plug, and novel techniques for accurate localization and remediation are greatly required. A reflected review of various techniques is discussed in an attempt to propose improvements. The objective of this study is to carry out an interdisciplinary review to investigate whether any existing technology can be adopted to address the challenges of locating hydrate blockages in subsea pipelines. The challenge is complicated by the lack of methods to accurately detect hydrate plugs in subsea pipelines. The safety and economic costs associated with pipeline blockages are compelling the industry to design an innovative means for effective and accurate localization of blockages in offshore pipelines. Here, we indicate the motivation for hydrate science and engineering; that is, the petroleum industries enormous need for solving the challenge of hydrates. This involves teams composed of, among others; physicists, chemists and biologists to understand hydrate origin, as well as teams composed of subsea specialists to develop inhibitory, locating and remediation techniques. In this thesis, emphasis is placed on the major applications of hydrate research: the nature of hydrates, how they occur in pipelines and remediation methods. An introduction of hydrate structures and properties is presented. Subsequently consequences and handling of hydrates in offshore pipelines is discussed. After gaining an understanding of hydrate occurrence in subsea pipelines and having reviewed detection methods related to full hydrate blockages, the advantages and disadvantages of each have been considered. The research conducted indicates that non-invasive technologies exist for detecting full blockages and deposit profiling in liquid filled pipelines, however a more accurate method needs to be developed for locating a full blockage. In gas pipelines a method to both profile deposits within the pipeline and accurately locate a full blockage has yet to be developed.

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Title: Finite element analysis and experimental testing of lifting capacity for GRP cover.

Status:

Abstract: Structures made of glass reinforced plastic (GRP), often abbreviated GRP cover, are used to protect subsea equipment in the oil and gas industry. These structures need to be lifted during fabrication, transportation and during the installation. The present work investigates the lifting capacity of the GRP covers. The aim is to achieve a more accurate analytical estimate of the lifting capacity, with a desire to replace the simplified hand calculations used to-day. In order to investigate the lifting capacity, a lifting point (reinforced lifting holes made of GRP) is studied with both finite element analysis and experimental tests in a hydraulic tensile bench. Three different test setups, Case 1, Case 2 and Case 3 are investigated. Case 1 is a representation of a lift through the splash zone during installation, where the GRP cover is in an upright vertical position. Case 2 is an approximation of a horizontal lift with the lifting point located on top of the cover, causing the lifting point to encounter out-of-plane loads. Case 3 is a representation of a horizontal four-point lift, with the lifting point placed on the side walls. The experimental tests were performed in collaboration with Highcomp AS at Westcon Løfteteknikk in Haugesund. The finite element analysis represents the test setup in the hydraulic tensile bench in order to achieve comparable data. Finite element analysis can reduce cost and time compared with physical experiments. For Case 1, with in-plane loads representing the lifting through the splash zone, the results achieved were within a 2% error margin. For the out-of-plane situation (Case 2) with solid elements, the results were within a 20% error margin. The results from the in-plane and out-of-plane scenarios were used in a capacity evaluation to create a graph which represents all results and takes into account the out-of-plane angle from the lifting slings. This graph is easy to use in design and provides good results. Based on the comparison of the results, it was concluded that the Puck criterion with gradual degradation provides the most accurate estimate for the capacity and that use of this criterion can replace simplified hand calculation and reduce the number of physical experiments in the future. Based on these findings, an improvement study was conducted for a 30 mm laminate with Puck criterion and gradual degradation with a new lay-up consisting of fibers at [0, 90, +45, -45] degrees, compared to the one used today [0, 90]. The results of the new study showed an increase of over 28% for the capacity in Case 1 and an increase of over 16% compared with Case 2. These are interesting results, leading to the conclusion that by introducing the fiber directions + 45 degrees, one can enhance the capacity of the material by about 20%, and it is easy and efficient to implement in a new design of the lifting point used in GRP covers.

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Title: In-place strength assessment of a jacket and effects of an impact with a floating living quarter (flotel)

Status:

Abstract: The primary function of a jacket structure is to support the weight of the topside structure by transferring the weight to the foundation. The jacket structure must also be designed to resist environmental loads (from wind and waves) and also accidental loads, such as boat impact, extreme environmental conditions and earthquake. This thesis presents the results from a strength assessment based on the conceptual design of an eight-legged jacket with V plus X braces pattern and an alternative six-legged jacket with fully X braces pattern. Subsequently, a study was carried out to compare the responses of the two jacket structures when they are subjected to an accidental collision from a floating living quarter (a flotel). To date, extensive research has been carried out on vessel-to-jacket collisions. However, little work has been performed for flotel-to-jacket collisions. This thesis implements the basic design principles of ship collision and several reasonable assumptions. It is expected that the results could provide an overview of how the different potential impact locations and directions will influence the resistance capacity of the jackets. It is also anticipated that this procedure and the assumptions could be a reference for related research in the future.

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Title: Identification of criteria for selection of arctic offshore field development concept

Status:

Abstract: When the decision to study the development of an offshore field is taken, the concept phase of an offshore project development starts. The concept phase consists of the concept screening, conceptual engineering and concept selection stages. While concept screening and conceptual engineering stages represent a specific sequence of engineering calculations to determine technical feasibility and all aspects of each possible development concept for an offshore field, the concept selection stage represents a decision making process where a lot of factors should be considered in order to identify the optimal concept which satisfies all technical, economic and safety requirements along others. According to recent tendency in oil and gas industry, the Arctic offshore area has a great potential for future field developments. However high ecological risks, challenging environment for operation and construction as well as requirements for huge money investments impose accessorial liability on decisions taken in the early phases of the project and especially in the selection of the optimal development concept. The purpose of the thesis is concretization of the Concept selection process for Arctic offshore field development. Identification of the possible criteria influencing the definition of the optimal development concept is carried out. Prioritizing of each criterion according to its importance in the Concept selection process is then performed. Attention is given to the main Arctic specifics and challenges that could affect the field development concept. On the basis of this analysis the concept screening and the conceptual engineering steps for Arctic projects are discussed. The main driving factors for qualifying the development concept are defined. Their effects on the development concept in the Arctic are then considered. In the second part the Concept selection process for the Arctic offshore field development is considered. Criteria influencing the concept selection process were identified. Criteria identification is performed on the basis of wide literature survey which includes industry standards, scientific articles and English and Russian engineering books about offshore field development. Evaluation of the criteria's importance is carried out by the help of experts' judgment method. A questionnaire for criteria evaluation was prepared and a group of relevant people from the industry, who deals with the Arctic offshore field development, weighted each criterion according to their importance in the Arctic offshore concept selection process. As a result, a list of the most important criteria, representing the basis for selection of development concept for Arctic offshore fields, is prepared. The results of the work are presented in the form of a methodological tool for the Arctic offshore concept selection. The model is dedicated to the Concept Phase of the Arctic offshore project. Each stage at that phase is considered in the model. Parameters important in the screening stage are listed. Their imposed limitations on the development concept are identified. A list of criteria for comparison of possible development concepts is included in the model. Thus, the model represents a step by step approach for the implementation of the Concept Phase of an Arctic offshore project. The conclusion summarizes the acquired findings, provides reasonable recommendations for the concept selection of the Arctic offshore fields and gives the scope for the future work.

Student Name: Gordeeva, Tatiana

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Title: Selection of integrated template structures for the Shtokman phase I field development

Status:

Abstract: In this thesis, an analysis of several functioning projects has been carried out, where their specifics were thoroughly studied and conclusions made. One of the important parts of the work was devoted to the requirements to integrated template structures conceived in relevant NORSOK, ISO and DNV standards. The Main elements of Subsea Production Modules are considered in the work, their specific characteristics and components. Arctic metocean conditions that can affect selection, installation and the operational conditions of templates are analyzed. Operations and installation of subsea modules at Shtokman location are considered in the Thesis. 4 scenarios with different numbers of integrated template structures (2, 3, 4 and 6) and different numbers of wellslots in each were suggested and analyzed. For each scenario an analysis of related marine operations for the subsea modules was carried out. A program for installation cost estimates was built that enabled us to find the optimal scenario for the integrated template structures design. Various parameters affecting the cost of subsea infrastructure were analyzed and studied from different perspectives, e.g. geometrical well pattern system, the distance between drilling centers, drilling costs, etc. Risk analysis regarding the threats and consequences is also performed; risk assessment matrices and mitigation actions are established. As a result, a model for selecting an optimal Integrated Template Structure for the arctic/subarctic regions and Shtokman phase I field development was built.

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Title: Offshore Field Development in Cold Climate: with Emphasis on Terminals

Status:

Abstract: It is estimated that 25% of the remaining oil and gas reserves worldwide are held in Arctic regions. The combined effects of a global resource depletion, climate change and technological progress, mean that this natural resource area is now increasingly interesting and commercially attractive. However, numerous challenges are present when it comes to hydrocarbon production in cold climate, not only related to suitable technology, but also to social and environmental issues. Any hydrocarbon development in the Arctic represents, thus, a balance between opportunity and risk. This thesis analyzes a broad range of aspects influencing offshore hydrocarbon field development scenarios in cold climate, emphasizing on terminals as a major building block necessary in the development of a petroleum field. Feasible, safe and cost effective terminal concepts for cold climate areas, face challenges that need specific assessment of technical solutions and operational aspects. Many of these challenges can be managed, though at additional cost, through the application of customized solutions. After having presented and gained the necessary knowledge and insight in the main issues influencing a cold climate terminal, an assessment of different development schemes is carried out, using for this purpose three case studies located in the Barents Sea: Johan Castberg, Snøhvit and Goliat fields. In this context, a quantitative assessment of breakwater stability in cold climate environments has been an important part of the discussions. Finally, given the complex and often unique risk challenges present in cold climate regions, risk assessment arise as an important part of the decision making process, and thus, has been used to understand the sensitivity of different development schemes. The Master thesis, therefore, provides an insight in the following aspects:- Aspects influencing off-shore hydrocarbon field development scenarios in cold climate.- Technical issues influencing a cold climate terminal, with a thorough quantitative discussion of breakwater stability and design in cold climate.- Operational issues influencing a cold climate terminal.- Assessment of the sensitivity of different schemes through case studies analysis.- Risk assessment for identification and evaluation of the main risks involved, applied to the case studies.

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Title: Norwegian pipeline gas from an asset management perspective: Present and Future

Status:

Abstract: With the growth of demand for new energy, natural gas was predicted to be in a golden age, where the energy commodity would act as a transitional energy source (due to its low emission) towards greener energy goals within EU countries. This prediction is losing ground, especially in the short term, where low American coal prices and EU recovering from financial turmoil is affecting the predicted demand for the natural gas, which is relatively expensive under the current pricing policies and practices. Norway is one of the leading natural gas exporters in the world, serving a large portion of Europe's energy demand through its subsea gas pipeline infrastructure. In light of not only global uncertainty, but also with respect to the potential market position, a major question of commercial interest is that what types of challenges are present in a specific critical downstream asset such as a subsea natural gas pipeline when striving to uphold the position as leading gas supplier to Europe. This is also a question of future opportunities in the ongoing energy debate the current economic conditions. This thesis, based on a case study on a section of the large gas transportation infrastructure, examines a wide range of multiple challenges ranging from conflicts of interests between owners and other stakeholders, to the physical third party damages, all of which could possibly challenge and pose risk for the reliability and future demand for Norwegian gas. It elaborates on the current and future threats/challenges when striving for optimal asset availability.

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Title: The role and application of information and communication technology and e-Maintenance in technical integrity management services

Status:

Abstract: In our strenuous age of mass globalization and worldwide competition industries look for new business solutions to gain an advantage over competitor on the global market. Nowadays industrial companies tend to concentrate on their core activities while outsourcing the rest to service providers. In order to achieve better effectiveness and efficiency service suppliers improve their collaboration and relationship forming alliances. Over the last years a number of innovative technologies have been developed for sophisticated industrial solutions. Recent introduction of IO on a Norwegian Continental shelf brought the opportunity to transfer large amounts of data through optical fiber cables between offshore and onshore units. This master's thesis is based on a literature survey and observation of industrial practices. It includes TIMS studies, analysis of the technological requirements for TIMS and how TIMS can be improved further with use of the latest achievements in ICT and e-Maintenance.

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Title: Information analysis of process discipline deliverables in Wind, Oil & gas projects

Status:

Abstract: Large engineering projects produce vast amounts of data and information that needs to be distributed to relevant project personnel, suppliers, and client. How well data and information is collected, stored, and distributed will have a direct consequence for the quality of the project activities and deliverables produced and thus the expenses. The contractor industry in Norway is facing tough competition from companies in Asia to win new contracts. To face this competition, contractor companies like Aibel must rethink how they work and reassess which tools they use to support their engineering processes. Integrated engineering tools are becoming popular in the industry. The tools are meant to help support information operability throughout the entire engineering supply chain. An integrated engineering solution should help all project participant, suppliers, and client utilize the data and information produced and stored with-in a project or as a part of the final project handover. The intension of this thesis was to analyze the activities, deliverables, and interfaces of the process disciplines in engineering projects in Aibel to be able to find GAPS and improvement opportunities from today's situation and the aim of more integrated and collaborative engineering work methods sup-ported by an integrated engineering tool.

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Title: Intelligent oil field work processes: Turning data into effective decisions and actions

Status:

Abstract: The oil and natural gas, due to its important role in the economic construction society development, are sought vigorously by the Government and oil enterprises. However, as a fossil energy, oil and gas resources were formed in the harsh environments, its distribution is highly unevenly with serious heterogeneity. In the 1980s, the breakthrough in drilling and completion and upsurge on improved level of reservoir knowledge, like directional wells, horizontal wells, multi-lateral wells, the application of sequence stratigraphy, EOR technology, oil reservoir development has entered a new historical period proving the possibility to meet the rapid growth in demand for oil and gas. The concept of the digital oilfield and intelligent oilfield, making the construction of oil and gas fields in the complex conditions in the new period ushered in a ray of a new dawn. The wildly application of the computer technology in oil industry makes people can conduct a comprehensive analysis of the development of oil and gas fields, and offers the possibility to optimize the production activities. The network-based information communication technology flourishing in 21st century makes the way people's life and work has undergone enormous changes.

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Title: Learning for the application of IO scenario; Case of a drilling service provider

Status:

Abstract: For O&G producers, to maintain their commercial attractiveness in the energy market, they need to look into their business and value creating process. Some of the mature production platforms have been at their later life cycle and to maintain the production require new technology as the oil in the reservoir is getting less and less. The days when oil gas would flow to the surface after the well is established is long gone. This thesis is forced on the industrial practices of IO and the implications and application possibilities in COSL as a service provider. The objective is to see the real benefit in some of the COSL business environment by analyzing two real cases.

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Title: Identification of safety cultural aspects on drilling rigs with international working environment

Status:

Abstract:

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Title: Development of operation and maintenance procedures for zonal isolation tools

Status:

Abstract:

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Title: Vibration analysis of offshore piping systems under maintenance and modification projects

Status:

Abstract:

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Title: Condition monitoring for subsea processing plant

Status:

Abstract:

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Title: Development of holistic condition monitoring strategy on Gjøa

Status:

Abstract:

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Title: Applying life cycle cost (LCC) analysis to support management of Well logging equipment in COSL

Status:

Abstract:

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Title: Application of risk based inspection (RBI), reliability centered maintenance (RCM) and risk based maintenance (RBM)

Status:

Abstract:

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Title: Exploration on optimizing maintenance management by using condition monitoring on drilling platforms in COSL

Status:

Abstract:

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