Rapporterte hendelser med dynamisk posisjonering på norsk sokkel

Arne Kvitrud, 2020.

I forbindelse med RNNP gjøres det en årlig gjennomgang av hendelser som er rapportert til Petroleumstilsynet. Av hendelser som gjennomgås er de med dynamisk posisjonering (DP). Gjennomgangen danner grunnlag for teksten i de årlige RNNP-rapportene. Samtidig danner lista også grunnlaget for presentasjoner til næringen i ulike fora.

Nummereringen nedenfor med 1-14 er som i artikkelen Kvitrud, Arne. "Learning from Dynamic Positioning Events." *ASME 2019 38th International Conference on Ocean, Offshore and Arctic Engineering*. American Society of Mechanical Engineers Digital Collection (OMAE), 2019. Artikkelen inneholder flere detaljer om hendelsene, men også drøftinger. Nummerne 15-23 er ikke med i artikkelen.

1. West Venture at Troll in 2014

15 January 2014 the semi West Venture drilled at Troll field in the Northern North Sea for Statoil. She was disconnected from the well. They lost several reference systems and six out of eight thrusters. The DP systems were immediately taken over manually by the DP operator. The incident did not lead to loss of position. Updates of dynamic data on the DP consoles partially stopped. The logs reported a storm of networking events, indicating interference in data traffic on one of the networks. Network channels on nodes detected errors on incoming messages and data collisions with outgoing messages. This resulted in significant increase in network traffic caused by data retransmissions. The DP application consisted of several nodes that exchange data over the networks. The DP application was designed to select away thrusters and reference systems, if relevant data from other nodes was not updated within 15 seconds. The critical data sets did not reach the recipient's node within 15 seconds (ABB, 2016).

2. Floatel Superior on the Kvitebjørn field in 2014

28 January 2014 the flotel (semi) Floatel Superior operated in close vicinity to the Kvitebjørn jacket. The significant wave height was 4.5m. Based on the wave conditions, the gangway was closed, but not disconnected and bridge guards were established. Floatel Superior moved 6,3 meters away from Kvitebjørn caused by a wave, and the DP system started to take her back. Because of the heavy use of the thrusters against the Kvitebjørn facility, the drive off prevention was activated, and the autolift function activated. No one were on the walkway when it lifted. An unsatisfactory evaluation of the wave conditions contributed to the incident (Statoil, 2014a, 2014b and 2014c).

3. Skandi Gamma at the Troll field in 2014

11 September 2014 the vessel Skandi Gamma worked for Stena Drilling at the Troll field. She was next to the semi Stena Don and unloaded deck cargo, when the boat suddenly blacked out and lost machine power for four minutes. The boat drifted slowly towards the platform and touched the platform twice. Local damage occurred on railings and lights (Statoil, 11.9.2014). The significant wave height was 0,8m at Troll A (eKlima.no).

4. West Navigator at the Ivory location in 2014

6 December 2014 the drill ship West Navigator drilled at the Ivory location in the Norwegian Sea for Centrica (Centrica Energi, 2015). The platform waited on weather, connected to the well, and had started to plug. The significant wave height was 3,7m. A sudden significant

change in wind direction occurred with an increase in wind velocity. The vessel heading was adjusted to face the wind, but then the vessel was forced off location. She experienced a horizontal position deviation of 46m. As the vessel had passed the maximum allowable distance from the well, the automatic disconnect system activated and the drill pipe was cut, the BOP closed and the riser disconnected from the BOP to prevent damage to the platform and the well. More than 230 m^3 oil based mud in the riser drained out through the bottom of the riser and was deposited on the sea bed. The spill was classified as red chemicals. The control of the vessel's position was regained quickly. The emergency disconnect system worked as it should and the relevant procedures were followed. The investigation highlighted (Centrica Energi, 2015): The DP systems ability to maintain adequate position was exceeded, inadequate location specific station keeping guidelines and planning tools, the vessel did not perform as anticipated in the conditions encountered and lack of containment devices to prevent loss of mud from the riser when disconnected.

5. Transocean Barents at Ormen Lange field in 2015

12 March 2015 the semi Transocean Barents drilled at the Ormen Lange field in the Norwegian Sea (Transocean, 2015a and 2015b) for Shell. Several alarms came on high consumption on the thrusters, while the weather was steadily increasing in line with weather forecasts. The significant wave height was 6,8m. Immediately prior to the incident, a series of large waves hit the platform. The bridge got several alarms. Then the DP system rejected all the reference systems, and started the automatic emergency shut down function, according to design, as the platform had exceeded the set "prediction error rejection limit". This indicated that there had been more than five meters difference in the position estimated by the mathematical model and the position given by the reference systems. The maximum excursion from the wellhead position was 35m. The lower marine riser package separated from the BOP stack, and the well was secured. 66m^3 mud was released to sea, as 36m^3 oil based mud, 20m^3 soap and 10m^3 base oil. Transocean (2015a) concluded that the DP system navigated only on mathematical models and were therefore unable to find setpoint fast enough to avoid disconnection. They had two DGPS, one hydro acoustic reference system and one DGPS in monitoring mode.

6. Safe Boreas at Edvard Grieg field in 2015 (two cases)

5 October 2015 the flotel (semi) Safe Boreas operated for Lundin close to the Edvard Grieg production platform (jacket), when she was hit by a wave. The significant wave height was 4m and the wind speed 16m/s. The roll was 3 degrees and pitch 2,5 degrees. The gangway telescope extended 5m in 15 seconds, it triggered an autolift of the walkway. The autolift was caused by a combination of the vessel being astern of the set point and the list and trim of the vessel causing further extension of the bridge. The activation of the gangway alarms was late, and allowed too little time for reaction by the DP operators. No personnel were on the walkway, and cables and hoses had been removed in preparation for a scheduled disconnection (Prosafe Offshore, 2015).

4 December 2015 the telescopic gangway autolift function was activated due to compression beyond the autolift limits. The weather at the time of the incident was wind 16 m/s and 3,9 meters significant wave height. Prior to the autolift, and the maximum excursion of the gangway telescope had been three metres. The vessel was slightly off position (2,5 meters) towards the platform. Immediately prior to the autolift the vessel began to pitch forward approximately three degrees, causing compression of the gangway. The roll reached about 4,2 degrees just prior to the autolift. The first stage alarm for compression was passed, followed quickly by the second stage alarm, and compressed further to the autolift limits. It caused the autolift, as it was designed to do. At the time of the second stage alarm, a person crossed the bridge, but returned

on hearing the alarm. No one was on the gangway when the actual autolift occurred (Prosafe Offshore, 8.1.2016 and 28.1.2016).

7. Songa Equinox at the Troll field in 2015 (two cases)

24 December 2015 the semi Songa Equinox drilled at the Troll field in the Northern North Sea for Statoil (Songa Offshore, 2016). Due to increasing weather, it was decided to secure the well. The platform was hit by a wave train with Hs at 6,7m, that pushed the platform 38m out of position. The platform was pushed off at a rate that the DP system did not recognize as possible, and rejected all the position reference systems. A manual emergency shut down was initiated. The DP system used 11 seconds to recalculate the reference systems input to the DP position computing model. During the 11 seconds of recalculating, the DP system operated in a mode where the DP model used input based on the last position, velocity and heading to calculate where it should be. The rejection of the reference systems was according to the design of the system, and did not affect the position recovery, since the thrusters worked towards bringing the platform back to the original well location for the period in which the reference systems were rejected. The lower marine riser package was disconnected. Approximately 73 m^3 of water based mud were lost to sea. Songa Offshore (2016) concluded that the systems and personnel did what they were supposed to do during the incident.

30 December 2015 Songa Equinox drilled at the Troll field in the northern North Sea for Statoil. She lost position due to lack of thrust to keep position in the actual weather conditions. The riser and the lower marine riser package hang under the platform at a depth 320m. It drifted in survival draft about 0,5 m/s. All the technical systems were operational (Statoil, 2015). The significant wave height was 6,6 meters and the wind velocity 24m/s at Troll A (eKlima.no).

8. Transocean Spitsbergen on the Wisting field in 2016

16 March 2016 Transocean Spitsbergen drilled at the Wisting field in the northern Norwegian Sea for OMV. She waited on weather. The significant wave height was 7m. The platform got a rapid movement of 19 meters, causing the reference systems to be rejected. The DP system recalibrated within six seconds and green status was restored with a stable position. The circle for "red zone" was set to 20 meters. The riser angle was two degrees, and within the riser disconnection criterion (OMV, 2016).

9. Songa Endurance on the Troll field in 2018

7 January 2018 Songa Endurance was on the Troll field in the northern North Sea for Statoil. She waited on weather before anchor handling. A DP box test (change of position set points) was performed in survival draft. The platform got a roll movement of 8,5 degrees. Two risers and one landing joint moved unintentionally, and hit the aft deckhouse bulkhead. No personnel were exposed to the moving risers. The incident occurred as a combination of several factors (Songa Offshore, 2018), such as:

- Increased platform motions in survival draught,
- The DP controller created a variable DP current during the testing, that indicates that the DP model was affected by the testing (station keeping performance and thruster usage). The excessive use of thrusters increased the pitch and roll motions.
- An unfavourable platform heading with swell. The forecasted swell was a significant wave height of 1,9m and Tp of 10,5 seconds.
- Effects from free surfaces in liquid tanks,
- The effects from environmental loads.

The root causes were missing guidelines for when to perform DP tests, unclear requirements for slack tanks, and competence related to operational decisions (Songa Offshore, 2018).

10. Island Wellserver on the Åsgard field in 2017

20 October 2017 the vessel Island Wellserver did well stimulation on the Åsgard field in the Norwegian Sea for Statoil. She got an unintended stop of an azipull thruster, and drifted off. The drifting resulted in an emergency quick disconnect. The umbilical termination head was disconnected, and the valves on the BOP closed. The thruster failed due to short circuit on an electric motor. An error in the thruster control software was the direct reason that the device failed to hold position. The thruster control software limited the power take-off when propel water was directed towards close-up thruster. This was done to avoid loads on the thrusters and power loss. This restriction could not be repaired when the thruster stopped. The software was updated after upgrading of the electrical motor. The root cause was lack of quality of testing of the DP systems in a degraded situation (Island Offshore, 2017).

11. Bucentaur on Valhall Flanke West in 2017

12 June 2017 the vessel Bucentaur was doing soil sampling at Valhall Flanke West in the North Sea for Aker BP. She experienced a thruster pitch alarm, followed by a drive off, and lost position. The main events leading up to loss of position happened in 17 minutes. The DP system was operating in auto position (surge, sway, yaw locked). The consequences were a broken drill pipe. Aker BP (2017) concluded on six potential critical factors:

1) Fault in the pitch control loop - thruster pitch command signal. There was a difference between the pitch commands and feedback for port azimuth thruster at the time of incident.

2) The emergency stop of the port azimuth thruster was not activated when the first alarm was received.

3-6) Faults in the pitch control loop. Several errors were registered from the port azimuth pitch control. Contact errors were detected on a terminal block for a card in the azimuth thruster cabinet.

12. Island Patriot at Valhall field in 2018

14 April 2018 the vessel Island Patriot did well stimulation at Valhall IP in the North Sea for Aker BP. The significant wave height was 2-3m. She was connected to the platform with a signal cable and a high-pressure hose. The vessel then moved unintentionally. The DP system was inadvertently instructed to move the vessel to its previous set point. The vessel moved of its current position in a forward direction at a speed of 0,14 m/s. The movement caused tension in the cable, and the junction box fell into the sea. The cable was cut and the high-pressure hose were rolled into the vessel. The cable and the junction box ended on the seabed (Aker BP and StimWell, 2018).

13. Deepsea Stavanger at the Skarv field in 2018

21 April 2018 the semi Deepsea Stavanger drilled at the Skarv field for Aker BP. She drifted out of position and came marginally outside the red circle set to 11 meters. The weather in the field was 15 m/s wind and 5,2m significant wave height. The automatic emergency disconnection was aborted by operator when he saw that the platform was about to stop close to the red limit. The platform moved automatically back to position and maintained position. The root causes (Odfjell, 2018) were lack of training, and that other users had reserved electric power for their own use, and not enough power was available for the thrusters.

14. West Phoenix at the Kristin field in 2018

4 November 2018 the semi West Phoenix drilled for Equinor on the Kristin field in the Norwegian Sea (Equinor, 2018 and Seadrill, 2018). The platform had eight anchors in a thruster assisted mooring. It got salt water leakage in one of its generators cooling system. It again led to a short-circuited generator. The power of four of eight side propellers were out of service until the ATA system was reconfigured, with six of eight side propellers operative. All eight

side propellers were operational 25 minutes later. Throughout the incident, the platform went up to seven meters of location, and was in green status (up to eight meters).

15. Pioneering Spirit at the Yme field in 2016

22.8.2016 the Yme topside was removed by the ship Pioneering Spirit. During the move-out after lift, the Pioneering Spirit started swaying sideways pushing the caisson in the East and West direction several times with increasing displacement. In a severe starboard sway just before the caisson were free from the wellhead fork on the MOPU, a guide on the wellhead fork broke and the caisson swung back to its neutral position. The riser caisson, with the drill pipes, was bent about 2,85m. The vessel was new and testing and tuning of the DP system was not properly performed to reflect all potential operational scenarios. Repsol: Caisson Deflection Investigation-Structural Assessments, 29.12.2016 and Repsol: Additional information to Yme AfC – hook-up and commissioning, 22.4.2020.

16. Safe Zepyrus at the Johan Sverdrup field in 2019

15.2.2019 (Prosafe, 2019) the flotel Safe Zepyrus experienced loss of position and a gangway autolift at the Johan Sverdrup field. The wind was 19m/s and the significant wave height 2.1m. While completing the six hours DP check list. The DP-operator checked the status of the backup station. By a mistake the control was transferred to the backup system. Upon noticing this the DP operator then transferred the control back to the main DP-system, however the thrusters while running and ready, were not enabled in the main DP-system resulting in numerous DP alarms being activated and the vessel drifting off location. The red lights on the bridge were turn on, and activated the DP red alert. The unit was four meters from it's the initial setting point. Manual control was taken over the thrusters and the unit was moved outside the safety zone.

17. Viking Lady at the Skarv field in 2019

19.3.2019 (Eidesvik, 2019) the vessel Viking Lady was performing cargo operations on auto DP alongside starboard side Skarv FPSO for Aker BP. The vessel was then instructed to aft cargo operation area starboard side. When in position, there were unstable signals from both DGPS's and fanbeam reference system, and the RADIUS was enabled as reference into the DP system. Shortly after, the DP system made an unexpected vessel move or change of heading causing the port stern to move closer to Skarv FPSO. The closest point was estimated to approximately 5-8 meters. The master took manual control of the vessel until they regained auto position on DP. Eidesvik concluded that the unexpected movement by DP system was caused by use of a reference system with wrong configurations.

18. Sjoborg på Statfjordfeltet i 2019

Fartøyet Sjoborg mistet retning og posisjon og drev inn i Statfjord A. Skipets master og antenner traff livbåtstasjonen på Statfjord A, og skipssiden traff ett av skaftene. De direkte utløsende årsakene til hendelsen var avdrift som følge av manglende motorkraft og at operasjonen foregikk på lo side (værsiden). Det var flere bakenforliggende årsaker som ledet til tap av kraften.[1] Sjoborg traff dekket på Statfjord A med en hastighet på ca. 0,2m/s og betongsøylen med ca. 0,4m/s.

[1] For flere detaljer se vår gransking - Roger L. Leonhardsen, Anita Oplenskedal og Lars G. Bjørheim: Gransking av kollisjon mellom forsyningsfartøyet Sjoborg og Statfjord A den 7. juni 2019, Petroleumstilsynet, 15.11.2019. Rapporten er lagt ut på våre hjemmesider ptil.no.

19. COSLPromoter på Trollfeltet i 2019

10.12.2019 klokka 11:50 var Hs 5,8m, vinden var 61 knop og strømhastigheten var 3,8 knop. Den lå på gul status med «Drift off warning SWB1, conseq. 66%» klokka 11:25. Roll/pitch-damping was activated, but deselected by the system when thruster forces passed 80% at 11:45. Den flyttet seg så fra 12m ute av posisjon til 23m på ca. ett minutt. EDS ble aktivert klokka 11:50:03. Grensen var 20m. Elements referanse: 2020/279-17. Trolig er det havstrømmen som har trukket den av posisjon.

20. Deepsea Stavanger på *Æ*rfugl for Aker BP i 2020

25.01.2020 falt 2 av 4 tilgjengelige satellittbaserte posisjonsreferansesystemer ut. De har i tillegg to hydro-akustiske systemer, ett av disse var ute av drift. Under feilsøking på de satellittbaserte systemene ble også det hydro-akustiske systemet sjekket. Det ene operasjonelle hydro-akustiske systemet "frøs" under feilsøking. Dermed var kun 2 av 6 referanse system for posisjonering tilgjengelig og riggen gikk i gul status på dynamisk posisjonering. Operasjonelt hadde riggen ikke borerør gjennom BOP og var klargjort for frakopling frem til rigg var tilbake i grønn status på DP. Kongsberg Seatex har informert om at en annen rigg og 6 skip som opererer i området fra Haltenbanken til Barentshavet også rapporterte om tilsvarende problemer i nærliggende tidsrom. Elements: 2020/376-5.

21. Deepsea Nordkapp på Nidhogg (6506/5-1S) for Aker BP i 2020

21.2.2020 drifted she off location due to loss off DP control to thrusters. The DSN was currently set up for upcoming weather, well secured and riser was displaced to sea water. The unit was in the "connected non-drilling" phase, all ready for a potential disconnect of LMRP. During the morning hours, the rig experienced an error with gyro no. 4, which is placed in the backup control room as part of the DP class 3 equipment. They had an offset of 7-8m and a heading deviation of 5 degrees. It was decided by the DPOs on watch, that they wanted to transfer the DP command from main DP system to backup DP system to see if the gyro issue could be solved from the backup station. DPO No 2 went to the backup control room and established contact with DPO No 1 by use of UHF. Once contact was established, the DPO NO2 switched to backup DP command by use of "emergency button" on the backup DP station. DPO No 1 immediately informed the DPO No 2 about many alarms sounding in the central control room (bridge), and asked for the command back to the main DP. DPO No 2 then switched the "emergency button" back to main DP control and transferred command back to central control room. DPO No 2 than went in to the central control room and observed that the thrusters were not enabled on the DP desk. Position offset at that time was about 6 meters. DPO No 1 was busy with acknowledging alarms on thruster panel. The DPO No 2 enabled all thrusters on the DP desk, and the DP system started to ramp up all thrusters to stop the rig speed. The initial investigation revealed that the maximum offset from initial position (well) was 13.5 meters (red limit was 12m). The unit than came back to well position and the situation was under control. The incident did not trigger the disconnect sequence of the LMRP, although the red circle was set at 12 meters. The reason for this is that the auto EDS system is disabled when transferring command to BU DP system (as per design) and manual initiation was not carried out due to communication between DPOs and drill floor. Rig draft: Operation, Sea: Hs 6.3m and Wind: 33 knots. Odfjell: Investigation repost level 2, Rig out of position – Deepsea Nordkapp 21.02.2020, Bergen, 3.4.2020. Elements: 2020/601.

22. Floatel Endurance på Martin Lingefeltet i 2020

29.2.2020 oppstod det i forbindelse med operasjon av boliginnretning på Martin Linge feltet, en uplanlagt frakopling «emergency lift» av gangbroa. Løftet av gangbroen kom som en følge av at utslaget på gangbroen oversteg sju meter, grensen for automatisk broløft. Det var en person på broen da den ble løftet. Vedkommende kom i sikkerhet på Floatel Endurance. Totalt oppholdt det seg 764 personer på de tre plattformene på feltet. Det tok forholdsvis lang tid å få POB-kontroll da det måtte initieres manuell telling på alle tre plattformene. Fram mot hendelsen var signifikant bølgehøyde omkring 4,5 meter. Det er nærliggende å anta at lasten som ledet til tap av posisjon, var en effekt av overlagret vindsjø og dønning. The roll logging shows that the wave at the time of the emergency lift was a double peaked wave with longer period, i.e. causing more force on the vessel than the previous waves. Hendelsen er gransket av Ptil.[2] Elements: 2020/643.

23. Energy Swan på Brage for Wintershall i 2020

15.5.2020 Etter avsluttet bulklasting av diesel til Brage fra Energy Swan ble overføringsslange kuttet like over weak-link på slange. Overføringsslangen var drenert og koblet av på fartøyet og enden av slange hang i krok på kran på Brage. Fartøyet lå på DP mode på nordside av Brage med vind fra nordvest (303 grader) på ca. 22 knop. I det kranen skulle løfte av slangen fra fartøyet kom det brått en kraftig vindbyge med styrke 48 knop (lest av på Miros). Fartøyet driftet da av lokasjon mot plattformen og en satt kontrollen i manuell for å komme vekk ifra plattformen. I det fartøyet hadde fart vekk i fra plattformen hektet slangen seg i pullerten akter på styrbord side og slet av. Det anslås at det var 150 liter diesel i slangen og noe av dette ble spylt over dekk på fartøyet og resten til sjø. Diesel er i fareklasse 4 dvs. rødt mht. miljøet. Elements: 2020/1099.

[2] For flere detaljer se vår gransking - https://www.ptil.no/contentassets/c45e279e9a594056bcdaadd98416bbb1/2020_643_rapport-equinor-floatel-international-gransking-floatel-endurance.pdf. Rapporten er lagt ut på våre hjemmesider ptil.no.