

Investigation report

Report	
Report title Investigation of unintentional disconnection of the gangway on <i>Floatel Endurance</i> on 29 February 2020	Activity number 420002008

Security grading		
<input checked="" type="checkbox"/> Public	<input type="checkbox"/> Restricted	<input type="checkbox"/> Strictly confidential
<input type="checkbox"/> Not publicly available	<input type="checkbox"/> Confidential	

Involved	
Team T-F/T-1	Approved by/date Irja Viste-Ollestad, 18 June 2020 Kjell Marius Auflem, 18 June 2020
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1 Summary

An incident involving the unplanned emergency-lift disconnection of the gangway on Floatel International's *Floatel Endurance (FED)* accommodation unit occurred on 2 February 2020 in connection with operation of this facility on the Martin Linge field. The Petroleum Safety Authority Norway (PSA) decided on 4 March 2020 to investigate the incident.

The incident occurred because the gangway stroke exceeded the seven-metre limit for initiating automatic emergency lift. One person on the gangway when it lifted was able to reach *FED* safely. As a precaution, the *Island Dragon* standby ship was asked to search the area. Assistance in searching for personnel was also requested from a search and rescue (SAR) helicopter. A total of 764 people were on board the three facilities on the field. It took a relatively long time to establish people on board (POB), since manual counting had to be initiated on all three facilities. The decision was taken to airlift 243 people from the Martin Linge A (MLA) platform and the *Maersk Intrepid (MID)* drilling facility to *FED*, since it proved impossible to re-establish the gangway connection.

Under slightly different circumstances, the incident could have resulted in material damage, injury to people and loss of life.

The direct cause of the incident was that *FED* was forced off position. During the period leading up to the disconnection, maximum wave heights close to about 7.5 metres were reported. Waves in this size range can give rise to impulse loads which may set facilities in motion. It is reasonable to assume that the load which led to the loss of position was an effect of superimposed wind waves and swell.

The investigation team's main observations relate to deficiencies in the following areas:

- criteria for interrupting operations
- inaccurate information in the safety video
- control of personnel.

More detailed information is provided in chapter 8.

2 Background

FED is a floating accommodation rig whose primary function is to provide quarters during operations where the need for personnel exceeds available berths on the field/facility. Such requirements can arise in connection with turnaround shutdowns, for example, or the completion phase of field developments. *FED* provides a total of 440 berths.

In connection with the completion of MLA, *FED* has been chartered by Equinor as operator for the field to provide quarters for most of the personnel involved in the work. *FED* is connected to MLA by a gangway installed on *FED* which had been landed at the north-west corner of the platform.

2.1 Description of facility and organisation

When the incident occurred, *FED* was connected to MLA. It and MLA had separate organisations, each with its own offshore installation manager (OIM) in overall charge. *MID* was also connected to MLA.

A governing document entitled *Location-specific operational guidelines* (LSOG) was established when *FED* was connected to MLA. This document includes specified requirements for various actions to be taken in relation to gangway movement and for holding advisory meetings. See the LSOG for *FED* in Figure 1 on the following page.

DP Class 3 Gangway Operations				
Condition	Green	Advisory ⁶	Yellow	Red
Action required ¹	Normal	Notify OIM and Client Rep	Prepare to abandon operations	Abandon operations
Loss of position ²				Any relevant Indication
Gangway stroke ³	Normal	> ±3.0m or if signal lost	> ±4.5m	≥ ±5.5m
Response forecast gangway stroke ⁶ (optimal heading selection)	Normal	> ±4.5 m	NA	NA
Wind speed (Rig Wind sensors)	Normal	> 40 knots	> 50 knots	> 60 knots
Heading ⁵	Normal	Frequent >3°	FE OIM Decision	FE OIM Decision
Gangway elevation ³	Normal	> ±7° or if signal lost	> ±10°	> +13° / -10°
Current speed (DP)	0-2 knots	> 2 knots	FE OIM Decision	FE OIM Decision
Power consumption on each network	<67%	Any relevant PMS warning/alarm for station keeping	Consequence Analysis alarm	Insufficient power for maintaining position
Thrust consumption at each network	<67%	Any relevant PMS warning/alarm for station keeping	Consequence Analysis alarm	Insufficient thrust for maintaining position
DP control system ⁴	3+1	Any relevant failure or loss of performance in any system	< 2+1	Total loss of any system
Position reference systems ⁴	≥ 2+1 independent excluding DGPS		< 2+1 independent	
Wind sensors ⁴	≥ 2+1		< 1+1	
Motion sensors (MRU) ⁴	≥ 2+1		< 2+1	
Heading sensors (Gyro) ⁴	≥ 2+1		< 2+1	
DP-UPS	3+1		< 3+1	
Network	A and B		Loss of one network	
Communications CCR to ECR	3		1	

Footnote:

1. See next page for definition and response matrix.
2. Loss of position e.g. by drive-off, drift-off or black-out of all HV networks.
3. Limits are based on one exceedance of the limit level.
4. +1 Refers to the backup system.
5. "Frequent" means ≥ 3 occasions in 20 min.
6. Advisory Meeting shall be held as soon as possible if weather forecast indicates marginal conditions.

Figure 1. The LSOG for Floatel Endurance on Martin Linge.

Sensors were installed to measure gangway stroke as a result of motion caused by wind and weather, and automated actions had been implemented in the control and monitoring system to ensure gangway disconnection and emergency lift should motion exceed plus/minus seven metres.

Actions were also implemented in the control and management system to alert the dynamic positioning operator (DPO) positioned on the *FED* bridge. Notifications were given for gangway motion (advisory limits) of plus/minus three metres.

Fixed evening and morning meetings were scheduled where the OIMs for all the facilities on the Martin Linge field were among the participants. Weather conditions were a fixed item on the agenda for these meetings.

The LSOG also required advisory meetings to be held for various defined parameters. See Figure 1. Participation in these meetings was determined by the reason they were called.

2.2 Position before the incident

Weather observations between 10.00 and the incident time of 10.45 largely showed wind from east-south-east at strengths in the 19-22 metres per second interval. See Figure 2 below.

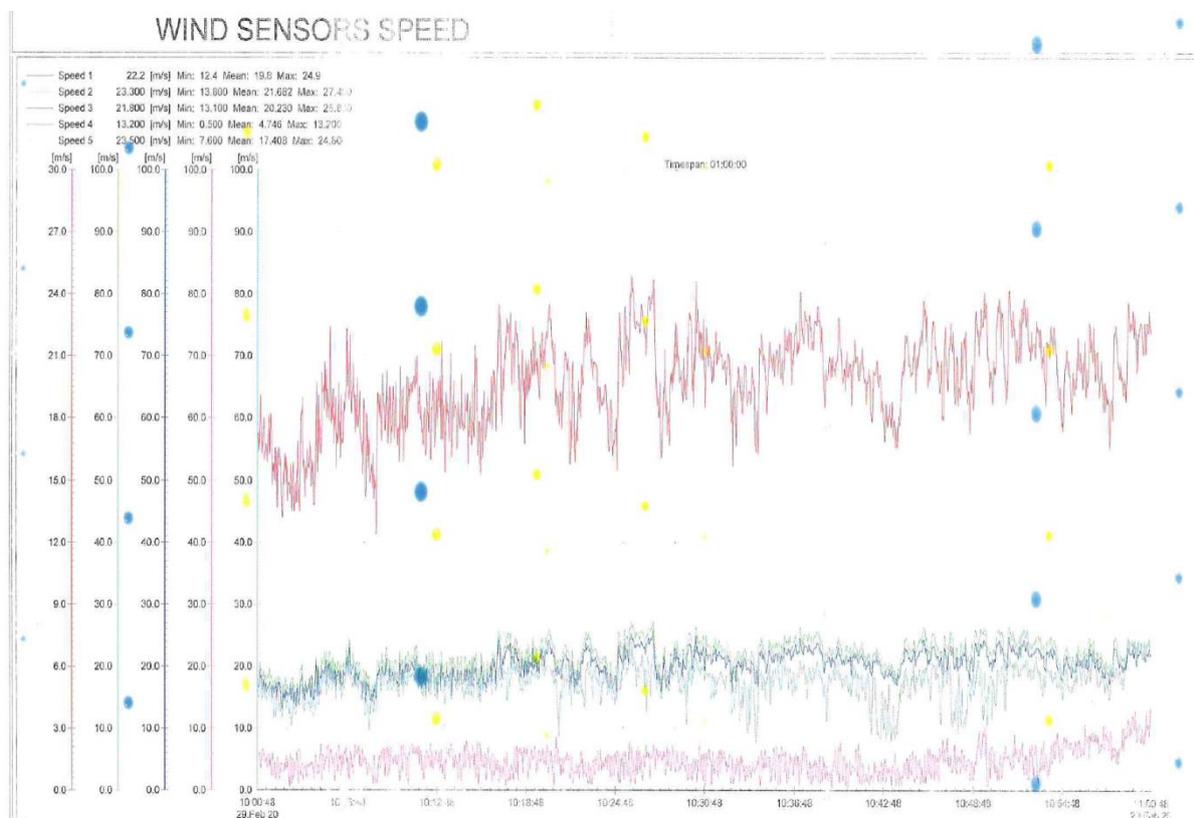


Figure 2. Registered wind speeds.

Observations from weather buoys on the Martin Linge field showed a steady rise in significant wave heights during the night and early morning of 29 February. See Figure 2.

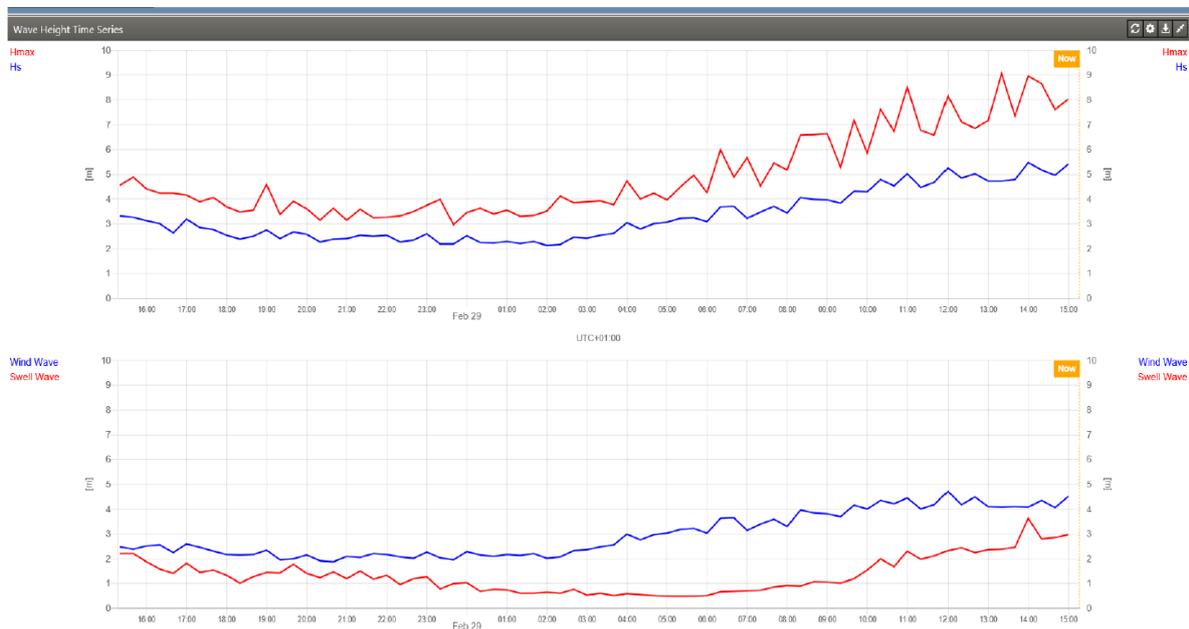


Figure 3. Observed wave heights.

FED received weather forecasts from StormGeo and estimated gangway motion four times a day.

The weather forecast for 29 February reported that wind strength and wave height would continue to increase through the day. Estimated gangway motion also showed an expected increase during the morning. See Figures 4 and 5 for the weather forecast and estimated gangway motion respectively.

Martin Linge : Full Table

0500 forecast issued at 0410 29/02/2020 UTC

Sunrise
06:53 UTC

Sunset
17:16 UTC

Position
60.51° / 2.01°

SYNOPTIC SITUATION SATURDAY 03 UTC

-Storm (Jorge) 955 hPa NW of Ireland, moving slowly NE, Sunday N Scotland, with fronts moving NE across the North Sea on Saturday.

Local Weather Saturday 05:00 to Saturday 17:00

Weather: Light rain, heavy rain soon
 Visibility: 6 - 10 km
 Lightning Risk: Nil
 Fog Risk: Nil
 Max Sustained Wind (Ws10): 35 kts
 Max Significant Wave Height (Hs): 5.0 m

FORECAST

Saturday to Tuesday an intense low pressure from the N Atlantic moves towards Scotland, the Faroe's and later weakening near Iceland. Saturday increasing E'ly winds, at times gale (35 kts), over s-parts and w-parts probably strong gale (40-45 kts) with waves (Hs) up to 6 m. Sunday SE-SW gale winds (35 kts) at times.

Monday to Thursday gradually decreasing winds and waves, but still periods with S-W strong to near gale winds.

WIND/WAVE CONFIDENCE FOR NEXT 48 HOURS

HIGH, from Saturday evening MEDIUM due to an intense low pressure close to the area with uncertain details for winds and waves.

UTC Date Time	CONF	Dir	WINDS				TOTAL SEA		WIND WAVES			SWELL			WEATHER								
			Ws10m	Wg10m	Ws50m	Wg50m	Ws100m	Wg100m	Hs	Hmax	Tp	Tz	H	T	Dir	H	T	Dir	Prec	T2m	Vis	Cp	
		(°)	(kts)	(kts)	(kts)	(kts)	(kts)	(kts)	(kts)	(m)	(m)	(s)	(s)	(m)	(s)	(°)	(m)	(s)	(°)	(mm)	(°C)	(km)	
SAT																							
29/02 05	●	112	29	36	35	42	38	43	2.8	4.9	6.7	5.0	2.1	5.3	124	1.9	8.7	347	0.6	5	10.0		
29/02 06	●	111	30	38	37	45	40	46	3.0	5.2	6.8	5.2	2.3	5.5	120	1.9	8.7	343	0.4	6	10.0		
29/02 07	●	109	31	38	38	45	41	46	3.2	5.6	7.4	5.3	2.5	5.9	120	2.0	8.8	341	0.2	6	10.0		
29/02 08	●	106	31	38	38	45	41	46	3.4	6.0	8.2	5.6	2.6	6.1	119	2.2	8.9	318	0.1	6	10.0		
29/02 09	●	104	31	39	38	46	41	47	3.6	6.3	8.7	5.7	2.7	6.2	118	2.4	9.1	177	0.1	6	10.0		
29/02 10	●	102	32	40	39	47	43	48	3.9	6.8	8.9	5.8	3.0	6.4	118	2.4	9.2	155	0.3	6	10.0		
29/02 11	●	99	32	40	39	47	42	48	4.0	7.0	9.1	5.8	3.1	6.6	117	2.5	9.2	152	0.6	5	10.0		
29/02 12	●	97	32	41	40	48	43	49	4.2	7.4	9.2	5.9	3.2	6.5	111	2.8	9.3	151	1.1	5	10.0		
29/02 13	●	96	32	41	40	48	43	49	4.3	7.5	9.3	5.9	3.2	6.6	109	2.8	9.3	145	1.8	5	10.0		
29/02 14	●	94	32	41	40	48	43	49	4.4	7.7	9.5	6.0	3.4	6.7	108	2.8	9.5	146	2.8	4	9.0		
29/02 15	●	93	33	42	41	50	45	51	4.7	8.2	9.7	6.1	3.6	6.9	108	3.0	9.6	142	3.6	4	8.0		
29/02 16	●	96	34	43	42	51	46	52	4.9	8.6	9.8	6.2	3.8	7.1	110	3.0	9.7	136	4.5	4	7.0		
29/02 17	●	99	35	44	43	52	47	53	5.0	8.8	9.9	6.3	3.8	7.3	110	3.2	9.8	136	5.3	4	6.0		
29/02 18	●	101	36	45	44	53	48	54	5.3	9.3	10.0	6.4	4.3	7.8	117	3.1	9.8	106	6.0	4	4.9		
29/02 19	●	119	31	39	38	46	41	47	5.5	9.6	10.0	6.6	4.7	8.2	130	2.7	9.6	21	6.6	4	4.0		
29/02 20	●	136	25	31	31	37	33	38	5.7	10.0	10.1	6.7	5.0	8.6	139	2.7	9.1	23	7.2	4	3.2		
29/02 21	●	154	19	24	23	28	25	28	5.3	9.3	10.2	6.9	1.7	5.0	160	5.0	9.2	119	6.9	5	3.2		
29/02 22	●	151	20	25	25	30	27	30	4.9	8.6	10.2	6.9	1.0	4.3	162	4.8	9.0	114	5.8	5	5.0		
29/02 23	●	148	21	26	25	31	27	31	4.5	7.9	10.1	6.9	1.4	5.5	151	4.3	9.1	105	3.8	6	8.0		

Figure 4. Weather forecast valid from 05.00 UTC on 29 February 2020.

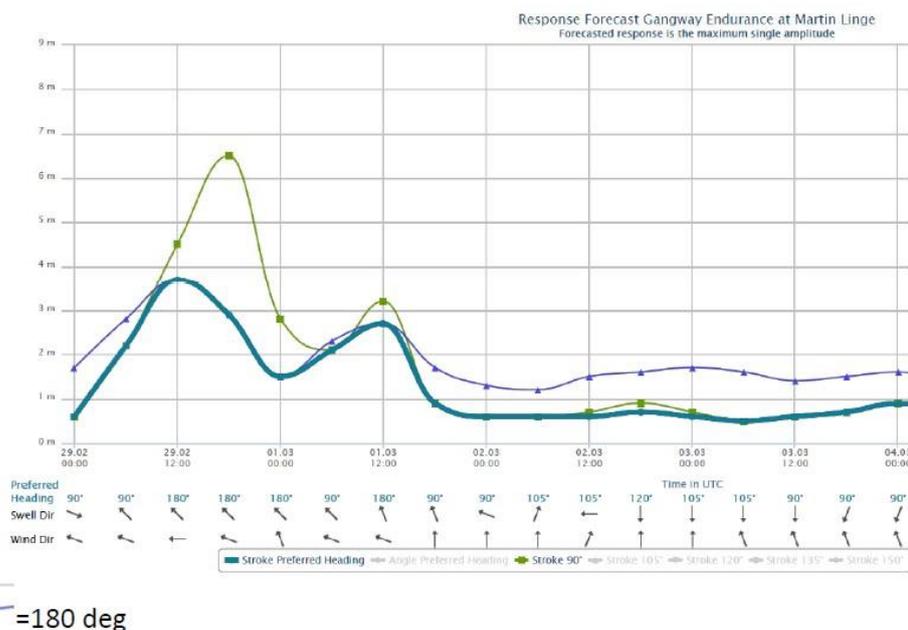


Figure 5. Estimated gangway motion.

2.3 Abbreviations

DP - Dynamic positioning
DPO - DP operator
Epic - Electronic personnel registration system
FED - *Floatel Endurance*
Hs - Significant wave height
Hmax - Maximum wave height
LSOG - *Location-specific operational guideline*
MID - *Maersk Intrepid*
MLA - Martin Linge A
OIM - Offshore installation manager
PA - Public address system
POB - Personnel on board
SAR - Search and rescue
UTC - Coordinated universal time

3 The PSA's investigation

Composition of the investigation team:

- Lars G Bjørheim, structural integrity (investigation leader)
- Anne Marit Lie, logistics and emergency preparedness
- Knut Ivar Hjeljestad, occupational health and safety.

The investigation was pursued through meetings and interviews as well as by reviewing documents. Owing to the Covid-19 pandemic, meetings and interviews had to be conducted via Skype. Personnel from Floatel International, Equinor and Maersk were interviewed in the presence of observers from the respective companies. A total of 13 interviews with durations of up to an hour were conducted.

4 Course of events

FED was connected to MLA by a gangway on 29 February 2020. The weather was becoming rougher and, when the forecasts for the day were discussed in the morning meeting at 07.30, it was decided to change the *FED* heading from 090 to 170 degrees (based on estimated gangway motion). The changes in heading called for a number of practical adjustments in the gangway area by the rope access team. This work was done between 08.00 and 08.33.

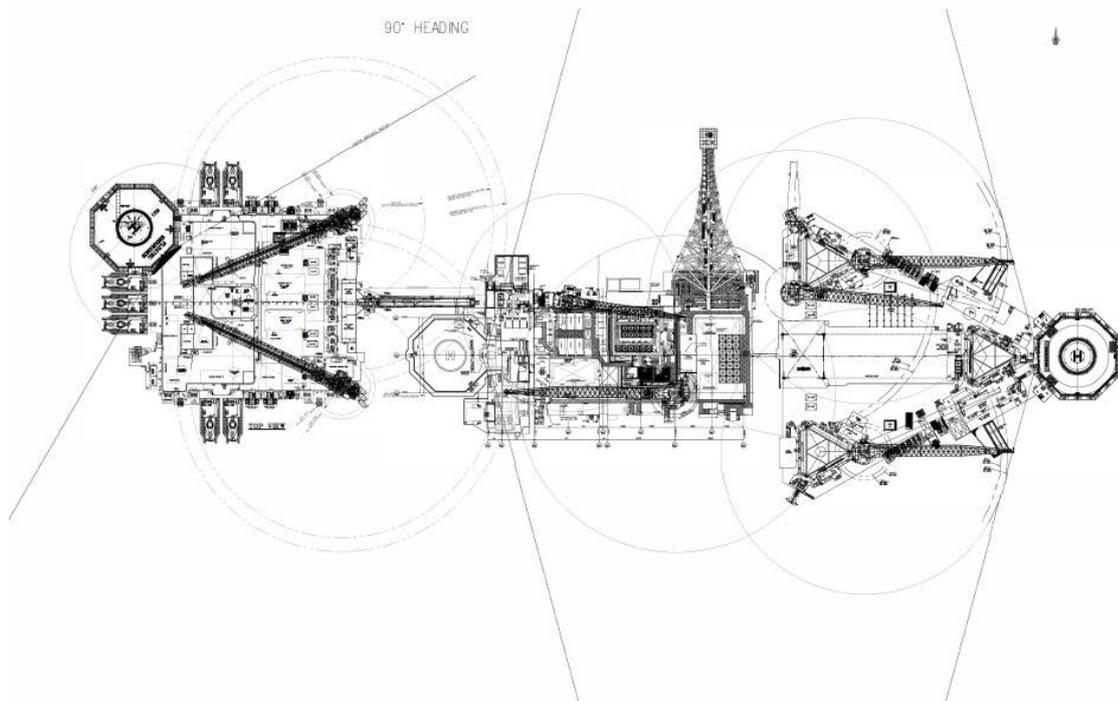


Figure 6. FED with heading of 90 degrees.

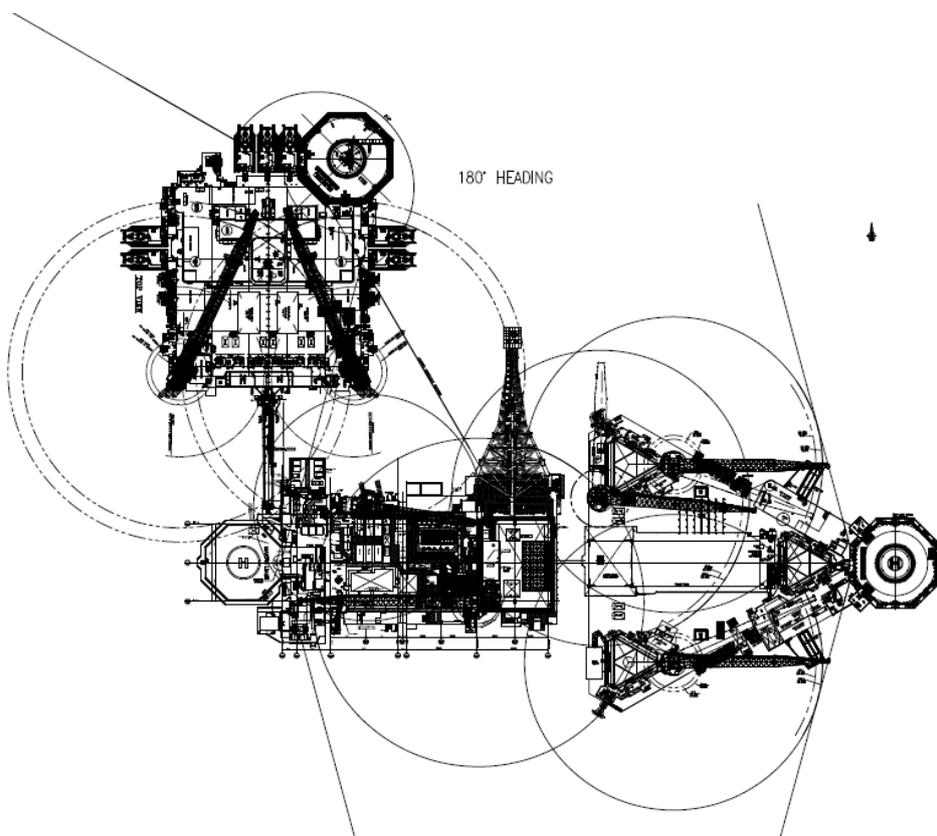


Figure 7. FED with heading of 180 degrees.

According to the LSOG, the advisory limit for gangway motion on *FED* was plus/minus three metres. The gangway had a stroke of four metres at 09.34 and an advisory meeting was held at 10.00. Participants at this meeting included the two DPOs on the bridge plus the OIM for *FED* and the Equinor representative. The decision was taken to monitor the weather and gangway motion. The gangway remained open and the position was monitored. If the gangway stroke increased, another advisory meeting was to be called. The 10.00 meeting was documented.

FED experienced a gangway stroke of 3.4 metres at 10.05. The OIM was called to the bridge and a guard positioned in the gangway cabin. Three gangway motions greater than three metres were subsequently noted up to about 10.30, when the OIM on *FED* decided to recall all workers who were on MLA. The weather was worsening and gangway motion increasing.

An announcement that the gangway would be closed in 45 minutes was made over the PA system on MLA, *MID* and *FED* at 10.35.

At 10.45, the gangway experienced a stroke of seven metres and emergency lift was automatically activated. One person was on the gangway when it lifted, and they were able to get back to *FED* without suffering physical injury.

Weather conditions at this moment were as follows.

Hs 4.5 metres, Hmax 7.5 metres.

Wind 47 knots at 100 degrees.

The gangway was swung away from MLA, owing to concerns that it might hit the platform and cause damage because of the 170-degree heading (see Figure 7). Neither MLA nor the gangway suffered material damage.

The advisory limit specified in the LSOG was registered six times between 09.30 and 10.30 before the emergency-lift incident (see Figure 8).

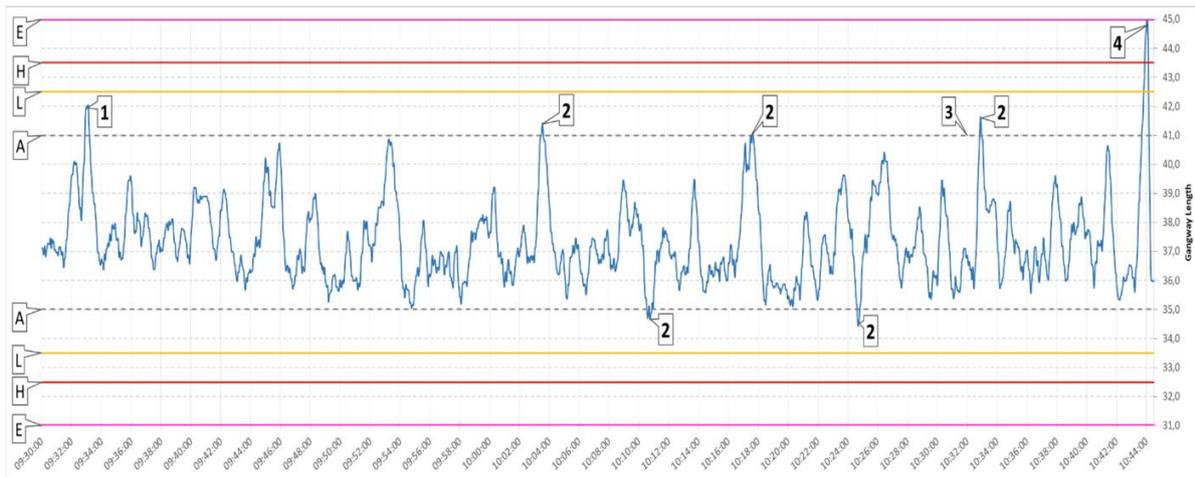


Figure 8. Overview of changes in gangway stroke.

1. Advisory limit exceeded. Advisory meeting called.

2. Advisory limit exceeded.

3. Decision to recall personnel to *FED*

4. Emergency lift

A = LSOG advisory condition: notify OIM and client rep

L = LSOG yellow condition: prepare to abandon operations

H = LSOG red condition: abandon operations

E = Gangway limit value for emergency lift

The emergency lift meant that 243 people accommodated on *FED* were left on *MLA*. Reconnecting the gangway was considered, but weather conditions were too severe and that idea was dropped. It was decided instead that personnel would be transferred by SAR helicopter.

Dealing with and control of the 243 people resident on *FED* who remained behind on *MLA* are described in chapter 7 on emergency response.

5 Potential of the incident

Actual consequences

The emergency lift caused a temporary halt to work on completing *MLA*. It also meant that 243 people had to be transferred by helicopter from *MID* to *FED*.

Potential consequences

The gangway was open for normal personnel traffic when the emergency lift occurred. As a result, the potential consequence has been assessed as personal injury to one or more people.

Personnel who might have been located at the gangway landing or on the gangway risked falling into the sea, with the potential consequence assessed as one-two people losing their life.

During interviews, the investigation team was told that the gangway was actively swung away from MLA by the gangway guard to prevent any risk of hitting the platform. See chapter 4. The incident could therefore also have caused material damage to the gangway and/or MLA.

6 Direct and underlying causes

6.1 Direct causes

FED was forced off position by environmental forces. The unplanned disconnection occurred because gangway length had been stretched beyond the limit for automatic lift.

The LSOG specified that plans to abandon operations should be initiated if the gangway stroke exceeded 4.5 metres and implemented if the stroke exceeded 5.5 metres. Automatic lift would be initiated at seven metres, while the physical limit for gangway length was 7.5 metres.

These limits for planning and implementing operational abandonment were passed without action being taken. Both were exceeded a few seconds apart during the same movement in a north-westerly direction.

Interviewed personnel took the view that *FED* was forced off position by wave forces. The displacement direction corresponded with the forecast direction of the swell.

6.2 Underlying causes

The LSOG defined operational conditions as a function of a number of parameters, including wind speed. However, wave height was not specified as a separate parameter in the LSOG.

A high correlation normally exists between wind and wave height in wind-driven sea states, assuming a given duration and fetch (the length available for wave build-up). In sea states without a significant contribution from swell, wind speed can also serve as a reasonably good parameter for wave height. However, swell made a significant contribution to the sea state at the time of the incident, making wind speed unsuitable as a parameter for describing the sea state.

Before the incident, gangway stroke was observed to exceed the three-metre limit six times in the space of an hour, with the operational condition changing from normal to advisory. See Figure 8. No values were above the limit for yellow condition, when plans were supposed to be made to abandon operation.

Comparing stroke at the zero point for the incident with earlier cases where the limit value for advisory condition was exceeded, it is reasonable to conclude that the

incident was extraordinary – a stroke of seven metres compared with three-four. If the total stroke length (total motion from an extreme position to the subsequent extreme) for the incident is compared with preceding excess limit values for advisory condition, the activation of emergency lift does not appear extraordinary. The total stroke length for emergency lift was about 9.5 metres, while several of the preceding excess limit values had a total stroke length of about six metres.

The DP system is normally designed to counter static and slowly varying forces, and does not respond to first-order wave forces from drag and inertia. These forces change direction, and the mean value over a wave period is zero. Duration of the load in each direction is normally too short to initiate any significant motion.

Figure 9 indicates that *FED* was subject to a high load of short duration (impulse load) which gave the facility a virtually constant speed of about 0.15 metres per second in a northerly direction and an increasing speed in a westerly direction. The response from the DP system did not halt the motion until after the emergency lift of the gangway had been activated.

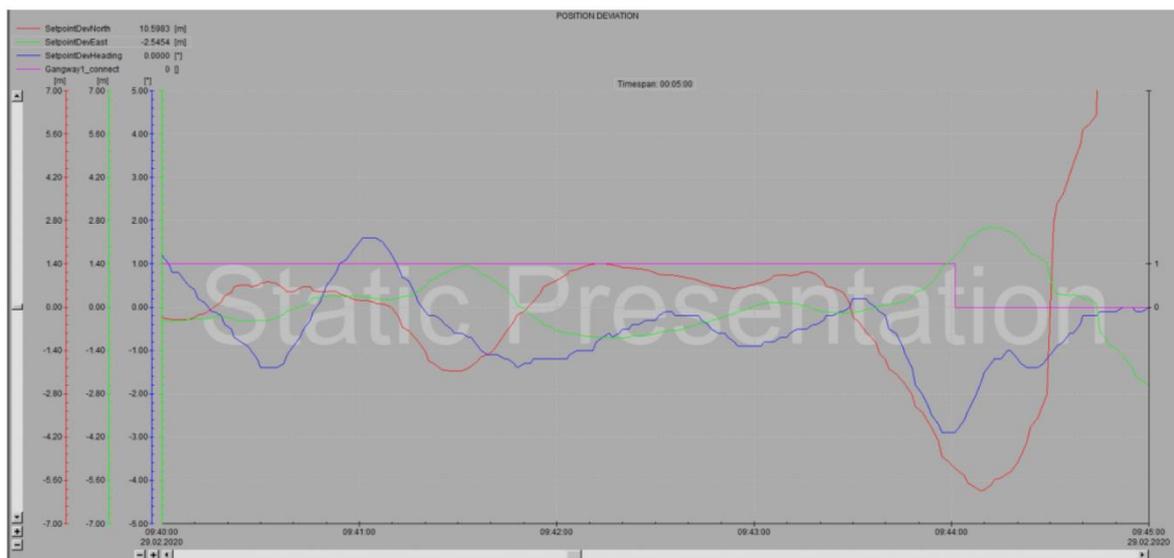


Figure 9. Position and heading for Floatel Endurance during the emergency lift (from the Kongsberg Maritime report: Investigation report – Floatel Endurance – emergency lift, 29 February 2020).

In the period leading up to the incident, maximum wave heights close to 7.5 metres were recorded. See Figure 2. Impulse loads can occur with waves of this height in the form of run-up or slamming against columns, for example. It is reasonable to assume that the load which led to the loss of position and automatic lift of the gangway was an effect of superimposed wind waves and swell. Several of the previous overruns of the threshold value for advisory condition were similar in character to the incident which led to automatic lift, and are therefore considered to have been driven by the same type of load. See Figure 8.

7 Emergency response

Identec is an electronic personnel registration system (in the form of a wristwatch) which had a main base on *MID* and satellites in selected areas on *MLA*. Plans called for the system to be permanently installed on *MLA*, but this process had not been completed when the incident occurred. Everyone working on *MID* and *MLA* had to wear Identec watches.

Epic is an electronic personnel registration system implemented on *FED*. It includes cards hung from the neck which had to be worn by everyone quartered on *FED*.

The safety introduction video (Endurance_okt_2019) shown on *FED* instructed personnel to carry the Epic card showing their cabin number as well as mustering station and lifeboat at all times.

In addition, the video said that all personnel working on *Martin Linge* would receive an RFID watch (Identec). This was to be worn at all times.

During the emergency lift, one person was observed on the gangway and another in the vicinity of the landing area on *MLA*. The OIM on *MLA* therefore decided to search for personnel in the sea around the facility. According to the *MLA*'s action log, SAR Oseberg was called out at 11.00 for this purpose. The OIM *MLA* instructed *FED* and *MID* to sound a general alarm in order to control personnel on board (POB). This was not understood by the *MID* control room, and was first instituted after the OIM *MLA* contacted the OIM *MID* directly. That delayed mustering on *MID*.

Establishing the number of people left on board proved challenging for *MLA*. A total of 243 people from *FED* remained on *MLA*, and dedicated mustering areas on the latter were relatively limited. Two people turned up missing at an early stage in the mustering process. Language challenges also caused delays with personnel control. It took time to understand instructions since part of the workforce had difficulties comprehending communication in Norwegian and English. The Identec watches for electronic registration were packed away in bags and the like, and could not be read by the registration stations on *MLA*. Personnel were told to remain readily available, but a number failed to understand this instruction immediately.

Checks using lists of names were also time-consuming because east European names are typically spelt in a way which was challenging for Norwegian-speaking personnel to read quickly and pronounce correctly.

At one point, one person remained unaccounted for. It transpired that they had a planned transfer from *MID* to *FED*, and had been checked out of Dawinci on the former but had not arrived on *FED* because of the emergency lift. They were therefore not registered in Dawinci on the latter. A full POB control was accordingly instituted on the field. The MLA action log states that this was at 12.50, more than two hours after the incident.

All 243 people left on MLA were transferred in batches to *MID* and airlifted from there to *FED* by a SAR helicopter. According to the MLA action log, this operation was completed by 15.19.

8 Observations

The PSA's observations fall generally into two categories.

- Nonconformities: this category embraces observations which the PSA believes to be a breach of the regulations.
- Improvement points: these relate to observations where deficiencies are seen, but insufficient information is available to establish a breach of the regulations.

8.1 Nonconformities

8.1.1 Criteria for interrupting operations

Criteria had not been established for interruptions which ensured that operations are abandoned through a planned disconnection of the gangway before the probability of position being lost as a result of wave action has arisen.

Grounds

FED was forced off position. That led to the unintentional lifting of the gangway, posing a threat of harm to personnel and equipment.

No breaches have been identified in relation to the applicable LSOG for operating *FED* on the Martin Linge field. The facility was nevertheless forced off position by what was probably a short-lived impulse load from superimposed waves.

The DP system is not normally designed to respond to first-order wave forces from drag and inertia. That makes operation uncertain in sea states where waves may impose impulse loads. Typically, short-lived impulse loads from waves could arise in superimposed sea states and large wave heights. The sea state at the time of the incident comprised a southerly swell and easterly wind sea, with maximum wave heights close to 7.5 metres

According to the time series for the gangway stroke, several similar motions with a total stroke length up to six metres had occurred before the one which led to the emergency lift.

The LSOG is considered to be deficient because it did not specify criteria which indicated that the operation should be abandoned before position was lost and an emergency lift of the gangway occurred.

Requirement

Section 90 of the activities regulations on positioning.

8.1.2 Inaccurate information in the safety video

The safety video shown to new residents on *FED* gave inaccurate information about how a person should act if they found themselves on the gangway when it lifted.

Grounds

The gangway comprised two moveable sections, with the innermost sliding on rails and equipped with stairs for accessing the outermost section. During a lift, the gangway will raise itself and the sections are retracted. Its supplier recommends that people on the gangway during a lift should crouch down and grip the railing.

When arriving on *FED*, new residents were shown a safety video for the facility. This explained that anyone who found themselves on the gangway during a lift should move towards *FED*. Moving during a lift poses a risk of personal injury. Floatel International's investigation report specified that personnel on the gangway should stand still and grip the railing. This does not accord with the safety video's content.

Requirement

Section 18 of the activities regulations on stay on facilities.

8.1.3 Control of personnel

It took a long time to establish control of personnel left on MLA after the gangway had disconnected with an emergency lift.

Grounds

It emerged from interviews that no account had been taken of the possibility that a relatively large number of people might remain on MLA if the gangway disconnected without notice because of an emergency lift. The emergency response organisation on MLA had not drilled in handling more than five to 10 people in the mustering area for personnel who did not belong on the facility, and 243 people in this category made it challenging to secure efficient personnel control.

The electronic Identec personnel registration system had its main base on *MID*, with satellite stations in selected areas of MLA. These did not include all muster areas.

No system was in place for checking personnel on and off between one facility and another which provided a continuous overview of personnel location.

Requirements

Section 18 of the activities regulations on stay on facilities.

Section 23 of the activities regulations on training and drills.

Section 77 of the activities regulations on handling hazard and accident situations.

9 Discussion of uncertainties

Impulse loads from waves can occur in the event of large wave heights, and cover a wide statistical spread.

Wave directions from wind seas and swells are based on wave forecasts from StormGeo, and confirmed by personnel interviewed.

10 Assessment of the player's investigation report

Floatel International's investigation has concentrated on its role in the incident. The report establishes the facts of the course of events, analyses conducted into root causes and barriers, and proposed corrective measures.

The report identifies the following factors as the main causes of the incident:

- "The vessel surge movement due to inconsistent wave, swell and wind directions.
- Confused swell, i.e. multiple wave and wind directions.
- Not sufficient training/introduction of personnel on how to behave on the gangway during an emergency lift-off scenario."

Loss of position

The main causes identified for loss of position correspond to some extent with the PSA team's assessment. However, the team considers surge by the facility to have been driven by an impulse load from superimposed patterns of wind sea and swells. Wind is considered to have made a moderate contribution to the loss of position.

Floatel International has identified an action to revise the LSOG with regard to inconsistent wind, wave and swell directions. The total wave height from superimposed wind sea and swell is not assessed, but impulse loads can occur with larger wave heights.

Emergency lift

Floatel International has identified an action to provide information on how to respond to an emergency gangway lift.

According to the introductory safety video, an alarm will be sounded and the gangway lifted immediately if the weather criteria are exceeded. Anyone on the gangway must return to *FED*. This does not accord with the description in Floatel International's investigation report, which states that people must stand still on the gangway and hold on tightly. See the identified nonconformity in section 8.1.2.

Information about how to behave in connection with an emergency lift must be clear and unambiguous.

11 Appendices

A: The following documents have been utilised in the investigation

Floatel International

1. Presentation from kick-off meeting for the PSA investigation, 16 March 2020
2. Floatel International's investigation report for the incident, doc no 2012-100-REP-0019
3. Statement of facts – gangway disconnection
4. DP logbook – autolift 20200229
5. *DP operations manual*, doc no 5000-302-00
6. *Emergency response manual*, doc no. 5000-307-00
7. *Construction emergency preparedness analysis*, doc no 5000-REP-101-R-100
8. Weather forecast, Martin Linge, 05.00 UTC
9. Data sequences from the helideck monitoring system for 29 February 2020
10. Passenger list for *Floatel Endurance*, printout from Epic, 28 February 2020
11. Muster summary, printout from Epic, 29 February 2020
12. DP screen image on *Floatel Endurance*, 10.44.55, 29 February 2020
13. Printout of gangway sensor registrations, 10:00-10.50, 29 February 2020
14. Printout of wind sensor registrations, 10.00-11.00, 29 February 2020
15. Printout of wave registrations, 15.00-15.00, 28-29 February 2020
16. Alarms and events, 08.39.01-10.50.51, 29 February 2020
17. Advisory meeting form, 29 February 2020
18. Onshore organisation chart, doc no 1000-180-01A1
19. Organisation chart for *Floatel Endurance*

Equinor

1. Synergi case 1610639 – emergency response lesson – autolift gangway between *FED* and MLA

2. Appendix to HSE incident with case no 1610639 – images of action board on MLA
3. Images of gangway landing area on MLA
4. Action log MLA
5. Main log
6. LSOG, Martin Linge-*Floatel Endurance*
7. Bridging document for emergency response for Martin Linge field (MLA, MLB, *Floatel Endurance* and *Maersk Intrepid*), WR2560 version 4
8. Supplement to emergency preparedness on the Norwegian continental shelf – Martin Linge, WR1156 version 6
9. Operational bridging document between Martin Linge and *Floatel Endurance*, doc no PM703-PMS-085-002
10. Martin Linge emergency preparedness analysis – phase 2
11. Organisation chart for Martin Linge
12. E-mail from Equinor dated 11.05.20 with subject "Støyeksponering"

Kongsberg Maritime

1. Investigation report – *Floatel Endurance* – emergency lift, 29 February 2020

Maersk Drilling

1. Incident summary – auto lift of gangway between *Floatel Endurance* and Martin Linge platform
2. Synergi case 2249806 – auto lift of gangway between *Floatel Endurance* and Martin Linge platform
3. Synergi case 2251481 – transfer personnel lost in system