FINAL REPORT

AAIU Synoptic Report No: 2006-008
AAIU File No: 2004/0057
Published: 22/05/2006

In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Accidents, on 30 October 2004, appointed Jurgen Whyte as the Investigator-in-Charge to carry out a Field Investigation into this occurrence and prepare a Synoptic Report.

Aircraft Type and Registration:	Eurocopter SA 365N, EI-MIP
No. and Type of Engines:	2 x Turbomeca Arrial 1C
Aircraft Serial Number:	6119
Year of Manufacture:	1984
Date and Time:	21 October 2004 @ 08.47 hrs local time
Location:	Platform Bravo, Kinsale Gas Field
Type of Flight:	Scheduled Platform Support Flight
Persons on Board:	Crew - 2 Passengers - Nil
Injuries:	Crew - Nil Passengers - Nil
Nature of Damage:	Slight over torque of 3.3%
Commander's Licence:	ATPL(H)
Pilot Flying Licence:	ATPL(H)
Commander's Flying Experience:	4,235 hours of which 2,800 were on type
Pilot Flying Experience:	10,362 hours of which 1,100 were on type
Information Source:	Report submitted by the Operator. AAIU Investigation.

SYNOPSIS

The helicopter was on a scheduled platform support flight from Cork Airport (EICK) to Platforms Alpha and Bravo in the Kinsale Gas Field. Following a rotors running passenger drop on Platform Bravo, the helicopter was subjected to intense squall activity, which necessitated the pilot flying (PF) initially inputting a roll correction, and then approximately 1 second later applying collective and lifting the helicopter airborne. With only limited visual clues available, due to the intensity of rain and hail, the PF fought to retain control of the helicopter, while in close proximity to the deck. The helicopter was then flown out of the squall and back to Cork Airport. A subsequent technical inspection determined that the helicopter gearbox had been slightly over-torqued. There were no injuries. This Report makes two Safety Recommendations.

FINAL REPORT

1. FACTUAL INFORMATION

1.1 History of the flight

EI-MIP was tasked with a routine scheduled platform transfer flight from Cork Airport to the Kinsale Gas Field. Prior to departure, the flight crew checked and accepted the Cork Terminal Area Forecast (TAF) and the Cork METAR-Actual (**See Section 1.4**). Due to the prevailing wind conditions, the co-pilot, who was an experienced Captain, acted as pilot-flying (PF) for left seat take-off/landings on the platforms. A total of 2 flight crew and 4 passengers was onboard as EI-MIP lifted off (08.12 hrs) and routed direct southeast to the coast and onwards to Platform Alpha. The flight crew observed lightning activity west of the field and some light showers off-shore.

After an uneventful landing on Platform Alpha at 08.34 hrs, the 4 passengers disembarked and another 4 passengers and 1 Helideck Loading Officer (HLO) boarded for the short 2-3 minute transfer to Platform Bravo. EI-MIP lifted off Platform Alpha at 08.38 hrs.

During this particular transfer, the Commander, pilot-not-flying (PNF) right hand seat, observed an active Cb (Cumulonimbus cloud type[1]) on his onboard radar, southwest of Platform Bravo, but judged that it would not interfere with the planned routing and landing.

EI-MIP landed into wind (205°) on Platform Bravo at 08.42 hrs. As this platform was unmanned, the HLO disembarked (with rotors running) to check the equipment prior to letting the passengers off. During disembarkation of the passengers, the PF visually identified a heavy squall/shower in his one o'clock position, approximately 1 nautical mile (nm) southwest of the platform. With the passengers still transiting the helideck, the Commander made the HLO aware of the imminent weather and requested him to speed up the process of clearing the deck. On receipt of the "thumbs-up" from the HLO, the flight crew finished the pre-lift-off checklist, which included collective lock disengaged and auto-pilot (AP) engaged. But with the approaching squall blocking the take-off path, the flight crew decided to remain on deck until it passed.

As the squall approached the platform, the helicopter rocked and shook violently. Fearful of a rollover, the PF initially applied a roll correction, and then approximately one second later, applied collective and lifted the helicopter off the deck. With only limited visual clues available, due to the intensity of the rain and hail, the PF fought to retain control of the helicopter, while in close proximity to the deck. The helicopter was then flown out of the squall and away from the platform. With concern that the helicopter may have been over-stressed, EI-MIP returned to Cork Airport, where a technical examination determined that the gearbox had been over-torqued by a small margin.

1.2 Damage

No damage was incurred to EI-MIP as a result of this event. The Integrated Helicopter Usage Monitoring System (IHUMS) recorded a slight over-torque of the gearbox of approximately 3.3%.

[1] The name cumulonimbus comes from the Latin words 'cumulus (a heap) and 'nimbus' (rainy cloud) but it covers a wide range of conditions. The larger Cb clouds are potentially the most dangerous features of the atmosphere; they can produce violent up and down currents, destructive turbulence and very severe icing. The downdraughts may reach the ground with sufficient force to blow down trees and the outflow may produce squalls strong enough to blow over grounded aircraft. A Cb can generate hundreds of lightening strikes, cover the ground in inches of hail and produce intensely destructive tornadoes in certain regions of the world.

1.3 Other Damage

There was slight wind damage to a lifeboat on the upwind side of the platform.

1.4 Weather Information

1.4.1 General

Met Éireann, the Irish Meteorological Service, Aviation Services Division, at Shannon Airport, supplied the following weather information.

General Situation:

Ireland and the UK lay under the influence of a low pressure system. The main surface low was centred at approximately 56.5N 03E (973hPa), with a secondary minor low centred at approximately 53N 15W (983hPa). The main frontal trough associated with this system pushed away to the east and the area of concern lay in an unstable Southwesterly flow. At the time of the event, a very active showery trough was moving through the area.

Surface Wind: 210-30 kt gusting 40-45kt.

Gradient Wind: 210-45kt

Weather: Very active showers in the region. Thunderstorm activity was reported at Cork Airport at 09.00 hrs (L) indicating the very high level of instability of the airmass. Under very active situations sudden strong downdraughts can occur beneath active Cb cells causing temporary severe turbulence.

Radar Images: Radar images at 08.45 hrs (L), as presented at **Appendix A,** show very active shower activity in the vicinity of the Kinsale gas platforms around the time of the event.

Temperature: Circa 11ºC. However, in a heavy shower the air temperature would fall significantly (possibly 5-7ºC.)

Dew Point: Circa 7ºC.

1.4.2 METAR (Actual) Cork Airport

21 Oct 2004 at 06.00 hrs UTC (07.00 hrs local)

Wind 210º/06kt 10+ km FEW 1,800 ft Cb, Scattered (SCT) 3,500 ft, Temperature 5º, Dew Point 5º, QFE 990 hPa, No significant change (NOSIG).

1.4.3 Terminal Area Forecast (TAF) Cork Airport

21 Oct 2004 at 03.00 hrs UTC (add 1 hr for local time) 04.00 to 13.00 hrs 240º-08 kt, 10+km SCT 2,000ft, TEMPO rain showers (SHRA) SCT 2,000ft Cb becoming 04.00-06.00 hrs 200º-020 kt, becoming 09.00-12.00hrs 230º-020 kt.

A SIGMET (Significant meteorological information) valid 21 Oct 2004 08.45 to10.45 hrs UTC (add 1 hr for local time) and issued at 08.40 hrs warned of embedded TS south of a line N51.00 W01200 to N53.00 W00500. This SIGMET was not issued on foot of the event, rather as a result of the developing weather.

1.4.4 Valentia Tephigram (06.00 hrs UTC)

Tephigram for Valentia provides the following information:

- The freezing level was about 5,300 ft.
- Whilst there was a shallow inversion at the surface level (most likely caused by nocturnal radiation), the general character of the ascent showed clear and significant conditional instability at the medium and high levels in the troposphere.
- The tropopause was at about 350 hPa pressure level.
- The atmosphere was 'moist' to the tropopause and there was little vertical directional shear in the wind.

1.4.5 Weather derived from other sources

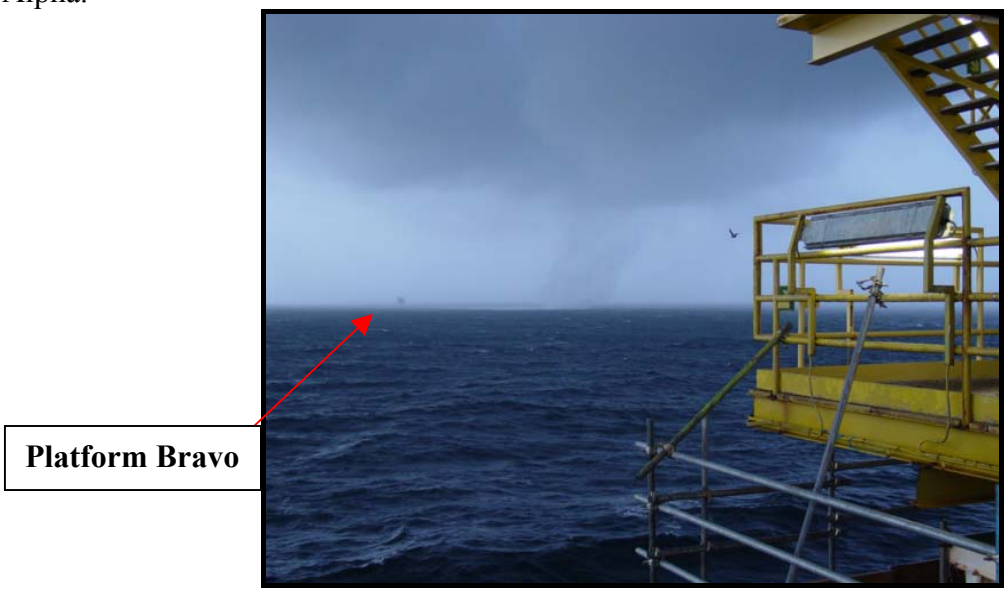
Platform Alpha, which is located 3 nm east-northeast of Platform Bravo, has an automatic weather monitor. Samples are taken every ten minutes and the following two samples span the time of the actual event (approx 08.47 hrs)

Time	Wind Direction	Speed	Wind Direction	Gust	Visibility
08.40	212º	36 kt	213º	39.9 kt	5620 m
08.50	205º	30.4 kt	208º	34.2 kt	6320 m

At 06.09 hrs, weather observed at Platform Alpha was; wind 223º/34 kts, visibility more than 10+ km, cloud base at 17,910 ft, outside air temperature +11.4ºC, and air pressure (QFE) 987.3mb. The only weather related instrument on Platform Bravo is a windsock, which provides wind direction for take-off and landing. Wind speed is not measured.

1.4.6. Weather Photographs

Photograph No. 1 was taken from Platform Alpha as the weather event had just passed Platform Bravo. The general wind direction at the time was 225º/35 kts. The track of the weather system originated southwest of Platform Bravo, passed directly overhead and tracked north-northeast at approximately 35 kts. **Photograph No. 2** shows the weather event passing northeast of Platform Alpha.



Photograph No. 1

Photograph No. 2

1.5 Flight Recorders

Data from the Flight Data Recorder (FDR) and the Integrated Health Usage Monitoring System (IHUMS) was made available to the Investigation (**See Appendix B**). The following general information was determined:

EI-MIP landed into wind on Platform Bravo at 08.43:52 hrs on a heading of 205º and remained running on the deck in a steady state for approximately 3 minutes, while the HLO off-loaded the passengers. At 08.46:54 hrs, pitch, roll, and yaw parameters indicated that the helicopter was influenced by turbulent wind conditions. The first significant upset during the on deck turbulent state occurred at 08.47:04 hrs, where the helicopter rolled left 7º and the heading yawed right 3º to 208º. During the following second, roll increased further to 13º left and the heading yawed further right to 229º. As cyclic and collective/torque was applied to counteract the roll, the helicopter became (intentionally) airborne (08.47:07 hrs) to 3 feet over the deck, roll moved from 13º left to 27º right and heading yawed further right to 280º.

Over the next 8 seconds:

Pitch: Just after becoming airborne the helicopter pitched nose down to -3.5º and then to nose down -9º. The helicopter then pitched nose up to +11º and on to +14º, before transferring back to -21º nose down as the initial phase of the fly away was conducted. Nose down pitch reduced as the climbout was established and maintained.

Roll: Transfered from 27º right to 31º left, 11º right, 13º left, 12º right, 12º left, and then stabilized level during the established climbout.

Heading (M) Heading moved from 280º back left to 261º, increased right again to 284º and then reduced slowly left to a steady heading of 245º on the established climbout.

Torque: Between 40% - 70% of torque was applied in becoming airborne over the deck. Torque then reduced down to 38% before increasing progressively to the maximum applied of 103.3% during the flyaway. Torque then reduced back to between 86% and 78% in the established climb.

Atmospheric Pressure: The FDR readout showed significant variations in atmospheric pressure on and over the deck during the short period of the event (**See ANALYSIS Section 3.1**).

Deck Temperature: Ranged from 2.1ºC – 2.5ºC

The helicopter was subjected to turbulent conditions on the deck for approximately 8-10 seconds prior to becoming airborne. The helicopter passed over the helicopter deck edge approximately 10 seconds after the first application of collective input.

2. ADDITIONAL INFORMATION

2.1 Offshore Platforms General

Helidecks are basically flat plates and so are relatively streamline structures. In isolation they would present little disturbance to the wind flow and helicopters would be able to operate to and from them in a more or less undisturbed air environment.

Difficulties arise when the wind has to deviate around the bulk of the offshore installation plus structures attached to the infrastructure such as cranes, drilling derricks and exhaust stacks. This causes large areas of flow distortion, accelerated winds and turbulent wakes/eddies. An air gap, separating the helideck from the superstructure beneath it, encourages the disturbed airflow to pass under the deck leaving a relatively linear and clean flow over the top. See Figure 1 below courtesy of CAA Paper 2004/02 - Helideck Design Considerations- Environmental Effects.

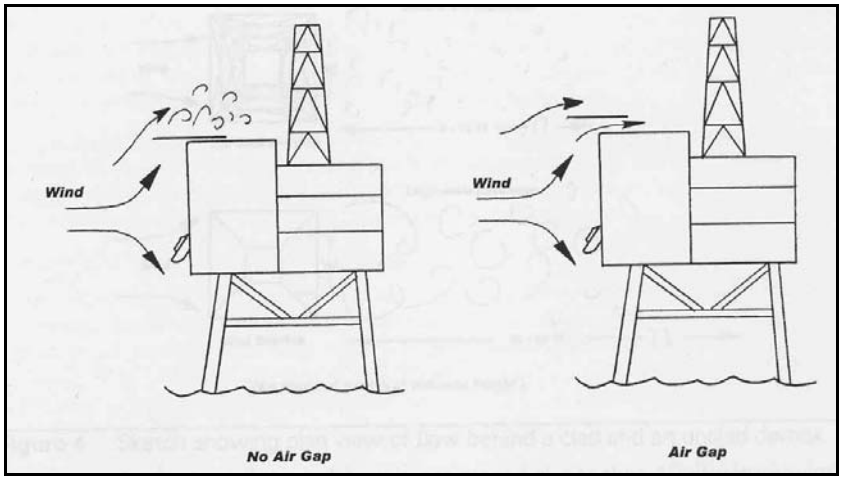


Figure 1

It is essential that the air gap is preserved throughout the installations' operational life, and does not become a storage area for bulky items that might obstruct the free flow of the air through the gap.

2.2 Platform Bravo

The original design of Platform Bravo dates back to 1976. The helicopter deck is approximately 144 ft above mean sea level (amsl) and has a non-skid landing surface dimension of 18.5 metres by 19.7 metres. There is a clear narrow air gap running north/south underneath the helideck (**Photograph No. 3).** The air gap is approx 8 feet in height, but it also accommodates on either side, the east and west shelters that serve to facilitate helideck operations by storing necessary equipment and providing an area where passengers can don survival suits and life jackets. In addition, there are a number of water tanks located in the area together with fire fighting equipment associated with helideck operations **(See Figure 2.)**.

Photograph No. 3 Bravo Platform

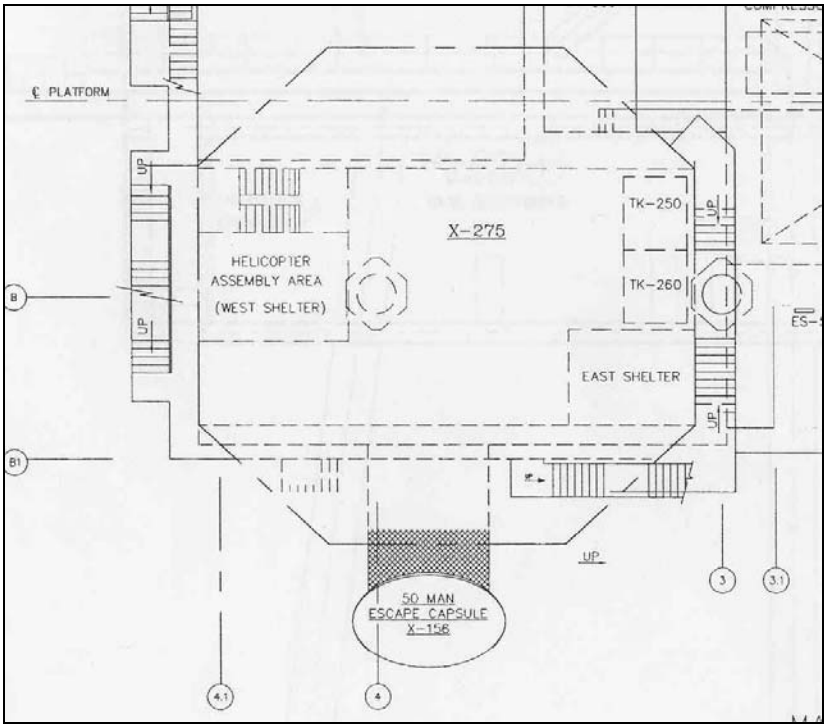


Figure 2. Overhead view of deck with associated installations.

The specification for design and fabrication of the helicopter deck was done in accordance with sub-section 5.3 of the UK Department of Energy publication, " Guidance on the design and construction of offshore installations". The aforementioned UK Guidance was first published in 1974 and predates the UK Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 437, which provides guidance on standards for offshore helicopter landing areas. CAP eventually replaced the section of the Guidance that dealt with helicopter deck design.

On conversion of Platform Bravo to a Normally Un-Manned Installation (NUI) in 2001, the Irish Aviation Authority (IAA) arranged for the British Helicopter Advisory Board-Helidecks (BAHB) to do the first post-conversion inspection. The Inspection was carried out in accordance with CAP 437 and BHAB requirements for Offshore Helicopter Decks. The helicopter deck was found to be suitable for helicopter operations and was issued with a certificate to that effect. Since the post-conversion inspection, the helideck installation is inspected annually by the Chief Pilot of the operating company on behalf of the IAA using a standard checklist. The Inspection (checklist) is based on CAP 437 and is in conformance with the International Civil Aviation Organisation (ICAO) Annex 14, Vol 2, Heliports. The helicopter deck installation had been inspected annually up to the time of this particular event and received satisfactory certificates for helicopter deck operations.

2.3 Heli Deck Wind Limitations

The Operator's laid down wind limits for operations to and from the Offshore Platforms are as follows:

- Arrival and departure wind limit is 60 kts.
- Shutting down and starting up maximum wind speed is 45 kts. Wind must be within +/- 20 degrees of the ahead wind or 35 kts from all other directions.
- Maximum Deck motion is +/- 2 degrees pitch.

2.4 Adverse Weather

The Operator's Air Operations Manual Part A - Para 8-3.8 covers in detail, "Adverse and Potentially Hazardous Atmospheric Conditions," and includes appropriate guidance on Thunderstorms, Icing, Turbulence, Windshear, Rain, Snow, and Other Precipitation.

2.5 Previous Incident

EI-MIP was involved in a similar type event back in 1998 on Platform Alpha. The helicopter was shutdown and parked unsecured (not tied down to deck) with winds generally blowing 25 kts from the southwest. Flight crew, resting below, were called to check the helicopter as the wind speed was occasionally recorded up to 52 kts in passing showers. When the flight crew arrived on the deck they found the helicopter lying on its side, extensively damaged.

3. ANALYSIS

3.1 The Actual weather Event

Photographs No. 1 and 2 could support a view that the event was a waterspout or tornado, however, this is not definitive. The winds encountered could also have been caused by a substantial Cb downdraught and the picture is reflective of a gust front rather than a waterspout or tornado. The radar picture (**Appendix A**) shows widespread Cb activity in the general area at the time of the incident.

The 06.00 hrs UTC (07.00 Local) Tephigram for Valentia is presented at Section 1.4.4. These conditions, which could reasonably be assumed to apply in general terms to the Platform area at the time of the incident, indicated the potential for deep convection, especially if associated with a dynamic lifting mechanism. Such lifting could have been provided by a trough line located just off the southwest coast at 06.00 UTC (07.00 Local) and which was moving in an easterly direction at 35 kts.

Cb downdraughts from such convective events would have been significant, especially considering that radar analysis indicates that there were isolated thunderstorms in the area at the time. However, the lack of directional wind shear and the "moist" character of the atmosphere in the vertical would be negative signals for a tornado. The variation (per second changes) of atmospheric pressure recorded over the deck during the short time of the event were too extreme to be a real representation of atmospheric changes and are considered more likely to be caused by other localised effects that impacted the static ports at the time of reading. The readings were not related to general atmospheric pressure changes and do not provide support for the contention that the event was a tornado.

Note that such severe Cb downdraughts can cause significant directional shifts from that expected from the gradient wind. While it cannot be ruled out completely, a tornado or waterspout was unlikely to have occurred in the circumstances and a severe Cb downdraught most likely caused the weather event.

3.2 Forecasted Weather

The low-level significant weather chart issued by Shannon and valid for 06.00 UTC (07.00 Local) indicated widespread Cb and shower activity. This chart has a standard warning, which states that Thunderstorms (TS) and Cb imply moderate to severe turbulence and icing (MOD/SEV TURB and ICING). Severe turbulence would be associated with significant downdraughts.

The most intense radar echoes were off the south coast, so that thunderstorm activity, insofar as it existed, would have been south of the coast. This intensive area did pass near the Cork Airport area producing an isolated thunderstorm at 08.00 hrs UTC (09.00 Local). A SIGMET was issued at 09.40 hrs (Local) on foot of this developing weather south of the field. Apart from that, Cork experienced mainly light showers and this is what was forecasted in the relevant TAFs. With respect to wind, the forecast direction matched that which was observed, with the speed generally over-forecast in the earlier part of the period (i.e. the forecast wind speed was higher than that reported in the METARs – forecast 16-18 kts actual 9-11 kts after 09.00 hrs UTC). Visibility, weather, cloud amount and type was generally as forecast and was well within the flightcrews weather limits as laid down in the Operators' Air Operators Manual.

3.3 Operational Aspects

The weather gathered and accepted by the flightcrew was relevant to the immediate vicinity of Cork Airport and not representative of the Kinsale Gas field, which is located approximately 33 nm southeast of the airport. A forecast specific to the gas field may have highlighted the developing intense Cb activity. However, such a specific forecast may not have fully identified the intensity of the weather that was experienced during this particular event.

Just after departure from Platform Alpha, the Commander/PNF did identify Cb activity on his onboard radar southwest of Platform Bravo, but considered that it would not interfere with the intended landing.

Whilst disembarking the passengers (with rotors running), the flightcrew became concerned about a heavy squall/shower, which was approaching from the southwest. The likelihood is that this particular heavy squall/shower was that which was detected on the onboard radar while enroute to the platform. This concern was expressed to the HLO and a request was made by the flightcrew to the HLO to expedite the transfer, in order that the helicopter could depart prior to the squalls arrival at the platform. As the helicopter was preparing for take-off, the squall closed in on the platform and blocked the departure path. As a result of this the flightcrew decided to remain running on the helideck until the squall passed through. This decision was in compliance with the Operator's guidance on taking off in adverse weather conditions.

The intensity of the squall was such that the helicopter was subjected to and influenced by turbulent conditions, which were likely to roll it over. The intervention of the PF in getting the helicopter airborne no doubt saved the helicopter from rolling over and the PF showed exceptional skill in recovering the helicopter under near Instrument Meteorological Conditions (IMC) and in close proximity to the platform.

Helicopters parked on the ground or with blades running can be vulnerable to passing adverse weather such as Cb's. Fenestron type helicopters (such as the incident aircraft) can also suffer from fish-tailing in crosswinds due to the large surface area of the vertical fin. Landing on an elevated site such as a rig or platform can exacerbate the problem. The strong, turbulent, and downdraughting winds/conditions normally associated with Cb's can be further influenced when coming into contact with large isolated flat-sided structures such as oil rigs and platforms.

Providing a clear air gap between the helideck and the superstructure does encourage disturbed air to pass under the deck, leaving a relatively linear and clear airflow over the top. Both Platform Alpha and Bravo were designed and fabricated in accordance with the required specifications of the day, and both helidecks have retained their operating certificate annually since they came into service. A clear 8 ft high airgap does exist underneath the centre of these helidecks, however, shelters, water tanks and fire fighting equipment are also accommodated on either side of the airgap. Essentially, the layout of these shelters and the other equipment located within the airgap, is in accordance with the original design of the facility. However, in the light of two recent 'turbulent deck' events, it is considered possible that under extreme wind conditions, the inclusion of ancillary structures in the area beneath the helideck, is affecting the full efficiency of the air gap.

Ultimately, the lesson to be learnt in this particular event is that it is difficult for forecasters and flightcrew alike to fully predict the true intensity of Cb activity and coupled with the known risks associated with flying through and/or in close proximity to Cb's, they should be avoided were possible. This is particularly relevant when operating to and from isolated and elevated landing sites.

4. Safety Recommendations

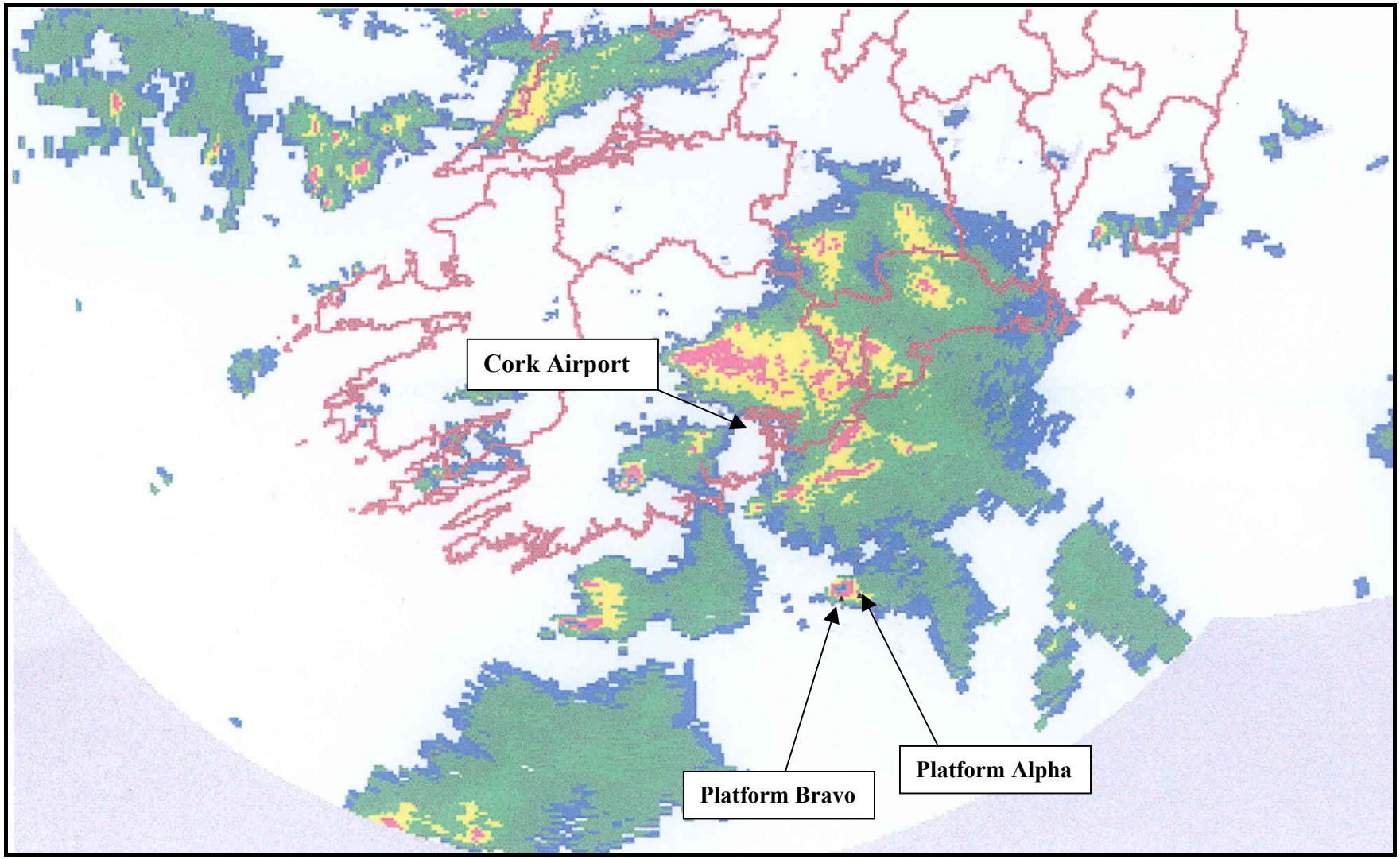
It is recommended that:

1. The Helicopter Operator should ensure that a forecast specific for the Kinsale Gas Field is included in the flight planning of transfers to and from the Platforms. **(SR 02 of 2006)**

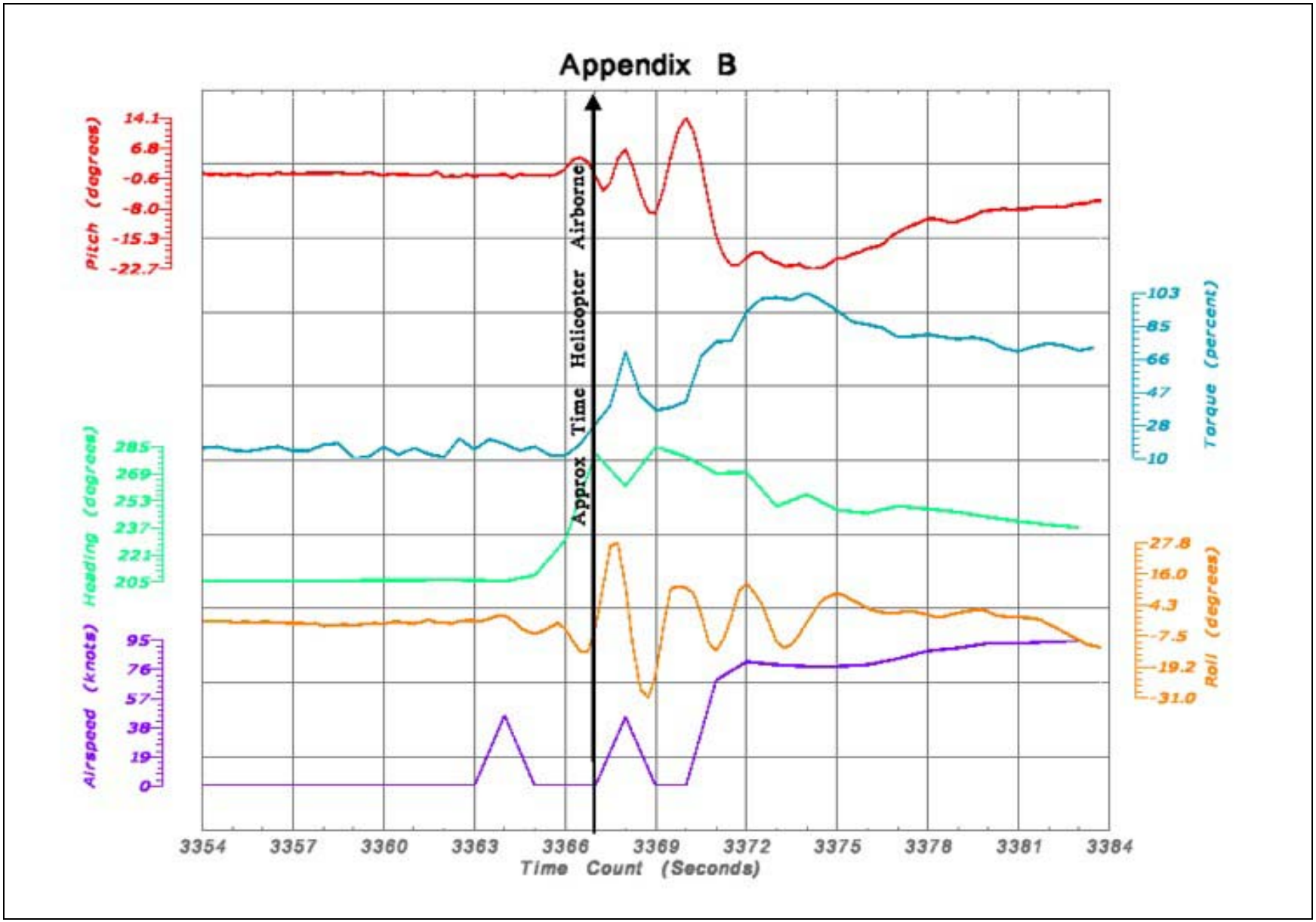
2. Met Éireann, in providing a forecast specific to the Kinsale Gas Field, should take cognizance of the difficulties experienced by flightcrews when operating to and from the Platforms as highlighted in this Report. **(SR 03 of 2006)**

Appendix A

Radar Picture Taken 08.45 hrs Local



Note: Intense Cb activity (Red Colour) can be seen in the vicinity of both Platforms around the time of the event.


Appendix B
Approx Time Helicopter Airborne
Pitch (degrees)
14.1
6.8
-0.6
-8.0
-15.3
-22.7
Torque (percent)
103
85
66
47
28
10
Heading (degrees)
285
269
253
237
221
205
Roll (degrees)
27.8
16.0
4.3
-7.5
-19.2
-31.0
Airspeed (knots)
95
76
57
38
19
0
3354
3357
3360
3363
3366
3369
3372
3375
3378
3381
3384
Time Count (Seconds)