Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

SERIOUS INCIDENT
BAe 125-800B, N1310H
Co. Kerry, Ireland
16 June 2015

An Roinn Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

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[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.
[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.
[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

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In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents on 16 June 2015, appointed Mr Paul Farrell as the Investigator-in-Charge to carry out an Investigation into this Serious Incident and prepare a Report.

Aircraft Type and Registration:	**BAe 125-800B, N1310H**
No. and Type of Engines:	**2 x Honeywell TFE-731**
Aircraft Serial Number:	**258253**
Year of Manufacture:	**1994**
Date and Time (UTC)[4]:	**16 June 2015 @ 15.35 hrs**
Location:	**Co. Kerry, Ireland**
Type of Operation:	**Commercial Air Transport**
Persons on Board:	**Crew - 2 Passengers - 3**
Injuries:	**Crew - 0 Passengers - 0**
Nature of Damage:	**None**
Commander's Licence:	**Airline Transport Pilot Licence (ATPL) issued by the US Federal Aviation Administration (FAA)**
Commander's Details:	**Male, aged 32 years**
Commander's Flying Experience:	**4,000 hours, of which 1,600 were on type**
Notification Source:	**Duty Manager, Shannon ATC**
Information Source:	**AAIU Report Form submitted by the Pilot, AAIU Field Investigation**

[4] **UTC**: Co-ordinated Universal Time. All timings in this report are quoted in UTC; to obtain the local time add one hour.

SYNOPSIS

The Aircraft departed Runway (RWY) 26 at Kerry Airport (EIKY) for a transatlantic flight to Gander (CYQX), Newfoundland, Canada. Shortly after departure, as it was passing 1,800 ft, the aircraft contacted Shannon low level control. When requested to confirm their squawk[5] and passing altitude, the Flight Crew read back the correct squawk and stated that they were level at Flight Level[6] Two Hundred. The Controller was concerned that the aircraft had levelled out at 2,000 ft and was tracking towards high ground in the Slieve Mish area of Co. Kerry. The controller then instructed the Flight Crew to climb to Flight Level Three Zero Zero and to expedite their climb until they were through four thousand feet. The Flight Crew complied with this instruction and the flight proceeded without further incident.

NOTIFICATION

The AAIU was immediately informed about the event by the Shannon Air Traffic Control Duty Manager.

1 FACTUAL INFORMATION

1.1 History of the Flight

N1310H filed an IFR[7] flight plan to operate from EIKY to CYQX on 16 June 2015. Prior to engine start the Flight Crew informed the EIKY Tower Controller "*OK we'll be ready and we're loading up bags now and we'll probably be ready for an engine start in the next five minutes*". The EIKY Tower Controller responded "*Roger understood start up is approved so with a QNH of One Zero Two Four the Kerry QNH One Zero Two Four information kilo next report ready for taxi*". The Flight Crew of N1310H acknowledged this saying "*We'll give you a call when we're ready thank you*".

Following engine start the EIKY Tower Controller called "*November One Three One Oscar Hotel Kerry Tower*" and the Flight Crew responded "*Go ahead for Thirteen Ten Hotel*". The EIKY Controller then said "*I have your full oceanic clearance if you're ready to copy*" and received the response "*I'm ready*". The Tower Controller then passed the following clearance "*November One Three One Oscar Hotel cleared Kerry to Charlie Yankee Oscar Quebec via VENER Five Five north Zero Two Zero west Five Five north Zero Three Zero west Five Four north Zero Four Zero west Five Two north Zero Five Zero west TUDEP that's Tango Uniform Delta Echo Papa to cross VENER at time One Five One Three plus or minus Two minutes Flight Level Three Four Zero Mach decimal Seven Three*".

There followed three unsuccessful attempts by the EIKY Tower Controller to obtain a read back of the clearance from the Flight Crew. Finally, the Flight Crew transmitted "*Ah let me try this mic is this any better*" to which the EIKY Tower Controller responded "*Affirm initially I got the start of your transmission and then it blanked out just a blank sound dead air so if you can just give the read back again please*".

[5] **Squawk**: A four digit code assigned by ATC for this particular aircraft. The Pilot inputs the code on the aircraft transponder system and thereafter that code is transmitted by the aircraft for ATC identification purposes.
[6] **Flight Level**: Three-digit representation of aircraft altitude referenced to standard pressure.
[7] **IFR**: Instrument Flight Rules.

The Flight Crew then read back "*Sure must be a bad mic on the left side ah alright we're cleared to Charlie Yankee Quebec X-ray VENER Five Five north Twenty west Five Five north Thirty west Five Four north forty west Five Two north Fifty west TUDEP cross VENER One Five One Three plus or minus Two minutes Flight Level Three Four Zero Mach Seven Three*". The EIKY Tower Controller replied "*Affirm the read back is all correct and it will be off runway Two Six I'll have your climb out instructions on line up Two Six you can expect a direct track for VENER I'll have a stop climb for you on taxi*".

At 14.28 hrs, in accordance with normal practice, the EIKY Tower Controller contacted Shannon Low Level (Planning) control by phone requesting "*a climb out for him off Two Six please...if I can get on track to VENER it would be fantastic*". At 14.29:30 hrs the Shannon Low Level Data Assistant responded "*Okay Kerry, November One Three One Zero Hotel is cleared from Kerry to Gander via VENER, Flight Level Three Four Zero, squawk Six Three Zero Four and on track to stop at Flight Level Two Zero Zero*". The EIKY controller read back "*Okay so he's cleared to destination on track VENER Flight Level Three Four Zero and he's cleared on track to VENER to stop climb Flight Level Two Zero Zero*" and at 14.29:45 hrs the Shannon Low Level Data Assistant responded "*That's it*".

While taxiing, the Flight Crew called "*Just wanna verify for One Zero Hotel cleared to back taxi for runway Two Six*". The EIKY Tower Controller responded "*November Zero Hotel affirm back track line up Two Six and eh your climbout instructions now and squawk if you're ready*". The Flight Crew acknowledged saying "*Standing by*". The EIKY Tower Controller then advised "*One Three One Zero Hotel you're cleared on track to VENER stop climb Flight Level Two Hundred squawk Six Three Zero Four*". The Flight Crew then read back "*Okay cleared direct to VENER climb maintain Flight Level Two Hundred and squawking Six Three Zero Four in the meter back taxiing for Two Six One Zero Hotel*". The EIKY Controller replied "*One Zero Hotel read back correct report ready for departure*".

Subsequently, the Flight Crew advised "*Tower now from Hawker One Three One Zero Hotel is ready for Two Six*". And the Tower Controller responded "*One Three One Zero Hotel cleared for takeoff surface wind Two Hundred at Seven knots*". The Flight Crew Acknowledged "*Cleared for takeoff on runway Two Six One Zero Hotel*".

Shortly after takeoff the Tower Controller called *"November One Three One Zero Hotel airborne time Three Five contact Shannon now on One Two Four decimal Seven good evening*" and the Flight Crew responded "*Twenty Four decimal Seven good day*".

At 14.36:28 hrs, the Flight Crew called Shannon Low Level Control saying "*Shanwick good afternoon Hawker November One Three One Zero Hotel Flight Level Two Zero Zero direct Vener*". Shannon acknowledged "*November One Three One Zero Hotel Shannon control confirm squawk and passing altitude*". At 14.36:40 hrs the Flight Crew replied "*Ah we are level Flight Level Two Zero Zero and squawking Six Three Zero Four*". Shannon Low Level Control then said "*November One Three One Zero Hotel Shannon radar contact and just confirm your passing altitude*". At 14.36:51 hrs the Flight Crew replied "*We were cleared only to Flight Level Two Zero Zero*". Shannon Low Level Control persisted "*Okay sir that's copied but your passing altitude...your current altitude*". At 14.36:59 hrs the Flight Crew replied "*And we confirm that we are cleared up to Flight Level Zero Two Zero… Two Thousand feet*".

At 14.37:05 hrs Shannon Low Level control responded "*November One Three One Zero Hotel ah negative climb Flight Level Three Zero Zero*". The Flight Crew responded "*Flight Level Three Zero Zero*" and Shannon Low Level Control then called *"And November One Three One Zero Hotel, you can caution high ground…if you can expedite your climb till flight till correction …through Four Thousand feet*". At 14.37:20 hrs the Flight Crew replied "*Expediting through up to Flight Level Three Zero Zero*".

Subsequently, at 14.38:16 hrs Shannon Low Level Control contacted N1310H and enquired "*Okay I just want to confirm with you your cleared Flight Level initially which you were given by Kerry…your climb out instruction.. was that to Two Thousand feet or to Flight Level Two Zero Zero*". The Flight Crew replied "*We read back Flight Level Zero Two Zero… Two Thousand feet*". Shannon Low Level Control went on to say "*Okay, that's copied thank you, Kerry seem to think that they gave you Flight Level ...ah… Two Zero Zero so we might have to ...ah...report that just to let you know*". The Flight Crew replied "*Okay*".

1.2 Interview with EIKY Tower Controller

The Investigation interviewed the EIKY Tower Controller. His account of events is consistent with the recorded information. He advised that when aircraft have departed and transferred to Shannon, EIKY Tower routine practice is to listen to the aircraft transmissions on the Shannon frequency following handover. Due to topographic constraints regarding antenna line-of-sight it is not possible to hear the Shannon transmission. He informed the Investigation that as soon as he heard N1310H's Flight Crew reporting level he knew that something was wrong. He immediately rang Shannon Low Level and was reporting the situation to the assistant when the Direct line rang from the Shannon planning Controller. Telephone recordings show that the Shannon Low Level Planning Controller asked "*Can you see that One Zero Three Hotel*". The EIKY Tower Controller replied "*I can still see him yeah he's going through cloud there now he was cleared to Flight Level Two Zero Zero*". The Shannon Low Level Planning Controller continued "*I know he stopped at Two Thousand and the Mish Mountains are there at Two Thousand Eight Hundred is he above them can you see*". The EIKY Tower Controller responded "*He's just gone into cloud there now*".

1.3 Interview with Shannon Low Level Planning Controller

The Shannon Low Level Planning Controller informed the Investigation that once N1310H "*checked in*" he followed standard procedure to "*check the Mode C*[8] *for Mode C verification purposes and we need to check the squawk*". He said that the squawk was correct but the Mode C was not correct as the Flight Crew was reporting Flight Level Two Hundred.

Being aware that EIKY is surrounded by high ground he referred to the standard ICAO VFR[9] map for the Kerry quadrant and quickly determined that the highest terrain towards which the aircraft was tracking was of the order of 2,800 feet. He immediately alerted the Low Level Tactical Controller that there was high ground ahead on N1310H's track and that the aircraft needed to climb. Coincidentally, High Level Control proposed, via the automatic label system, that the aircraft could climb up into their airspace at Flight Level Three Hundred.

[8] **Mode C**: secondary surveillance radar (SSR) response from the aircraft incorporating the aircraft pressure altitude at intervals of the closest 100ft.
[9] **VFR**: Visual Flight Rules

The Planning Controller said that when the Tactical Controller cleared N1310H up to Flight Level Three Hundred the introduction of the new Flight Level seemed to snap the Flight Crew out of the Flight Level Two Hundred/Flight Level Zero Two Zero cycle. He said that he again conveyed his concern to the Tactical Controller regarding the high ground and that the climb should be expedited through Four Thousand feet, and the Tactical Controller relayed this to N1310H.

1.4 Report from Pilot in Command of N1310H

The Pilot in Command of N1310H was based in the United States. The Investigation contacted the US National Transportation Safety Board (NTSB) and asked that the Pilot would contact the Investigation. The Pilot made contact with the Investigation and on request completed an AAIU Report Form.

According to the Pilot's Report Form "*Our altitude climb instruction was "climb level Two Hundred". We read back the clearance and began the departure. As we began to climb we had some confusion as to what the altitude clearance limit was as we were unsure what level Two Hundred meant. We levelled at Two Thousand feet to ensure we didn't exceed any altitude limits. We contacted departure control and informed them we were level, they questioned what altitude we were climbing through and we clarified that we were level. There was some question from ATC regarding what altitude we were cleared up to by Kerry and we informed the controller that we were unsure but were level at Two Thousand. He further cleared us to Flight Level Three Zero Zero and to expedite through Four Thousand Five Hundred, and we immediately began climbing. The flight continued on without incident*".

1.5 Aircraft Track

Shannon ATC provided the Investigation with the data files from its ATM (**A**ir Traffic Management) Su**R**veillance **T**racker **A**nd **S**erver (ARTAS). The Investigation extracted the data for N1310H and used it to produce an image of the aircraft's track as it departed from EIKY (**Appendix A**).

1.6 Previous Events at EIKY and EIKN

The AAIU previously investigated a serious incident near Kerry Airport (EIKY) in July 2009 where a Controlled Flight into Terrain (CFIT) by a business jet was averted by a prompt external intervention (AAIU Synoptic Report No: 2010-012). The lack of radar information at EIKY was determined by the Investigation to be a contributory factor in that occurrence and a Safety Recommendation was made that:

> *The licensee of Kerry Airport, in conjunction with the Irish Aviation Authority, should review the provision of radar information to support the air traffic control service provided by Kerry ATS unit.* (IRLD2010016)

In 2013 the AAIU investigated an AIRPROX event at Ireland West Airport, Knock (EIKN) on 13 April 2013 (AAIU Synoptic Report No: 2014-005). During that investigation the issue of the provision of Radar information to enhance a controller's overall situational awareness was again considered.

At that time the Irish Aviation Authority informed that investigation that:

> *Kerry and Ireland West Airport at Knock (IWAK) have now procured and received Air Traffic Monitor (ATM) equipment. Both Air Navigation Service Providers will commence operations using radar data supplied from the Irish Aviation Authority's surveillance systems located in the Shannon area. At a later stage, subject to National Supervisory Authority (NSA) acceptance, data from local ADS-B receivers procured as part of this programme will also be integrated into their ATM. At present both Kerry and IWAK are awaiting completion of the commissioning and testing of their radar data lines to Shannon.*
>
> *Kerry provided a draft safety case to the NSA in January 2014 and comments have been provided in response (IWAK are collaborating with Kerry in terms of the development of their safety documentation). A training programme for operational personnel is under development and will be submitted to the NSA shortly. Subject to NSA acceptance, it is anticipated that both Kerry and IWAK will deploy the ATM monitors operationally in late Q1 or Q2 of 2014*.

On foot of that information, AAIU Synoptic Report No: 2014-005 recorded "*An updated position with regard to the provision of radar information has determined that both EIKY and EIKN are at the final stages of deploying air traffic monitors operationally by Q2 of 2014. Therefore the Investigation considers that no further safety recommendation is required in that regard*".

On 31 July 2015, the current Investigation visited the EIKY Air Traffic Control tower. During that visit the Investigation found that the ATM monitor in EIKY Control Tower was not operational and the Investigation was also informed that the ATM monitor in IWAK Control Tower was not operational either. There was no certainty around the timescale for completion of the project.

REGULATION (EU) No 996/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC sets out in relation to Safety Recommendations that "*Each entity receiving a safety recommendation, including the authorities responsible for civil aviation safety at the Member State and Union level, shall implement procedures to monitor the progress of the action taken in response to the safety recommendations received*".

In response to a Draft Report, on 25 February 2016, the Investigation was informed that "*Both the EIKY ATM and the EIKN ATM have been subject to ANSP pre-operational evaluation testing since the start of October 2015. Additionally from that date, both ATM systems were permitted by the IAA SRD to be used to identify if aircraft were conforming to their ATC clearances*". Also on 25 February, the Investigation was informed that, in accordance with SR

2010016, on 27 October 2015 the IAA Air Navigation Services Provider signed a formal contract to provide surveillance data information to EIKY.

1.7 Procedural Changes since the Occurrence

N1310H was on an IFR flight but, because it was routing direct to VENER, it was not following a Standard Instrument Departure (SID) procedure, three of which are published for EIKY in the IAA's Aeronautical Information Publication.

Since this event occurred, ATC personnel at EIKY and EINN have been in close contact as part of their own investigation and Safety Management System processes. As a result, the Investigation was informed that new procedures have been devised and adopted for non-standard IFR departures from EIKY. Specifically, in relation to non-standard IFR departures from RWY 26, the new procedures which were published as a Kerry Air Traffic Services Notice of Change state "*Aircraft on Non-standard departures from runway 26 should be cleared to maintain the runway centreline until 4500 ft (to ensure terrain clearance) prior to commencing any turn* […] *Departing IFR Aircraft on nonstandard climb outs should be requested to report an altitude at or above the applicable MSA prior to being handed over to the Shannon frequency*".

1.8 Standard ATC Phraseology

The International Civil Aviation Organization (ICAO) prescribes standard phraseology for all communications between pilots and controllers. These standards can be found in ICAO Annex 10, Volume II, *Communication Procedures including those with PANS* status, Chapter 5 and in ICAO Doc 9432 – *Manual of Radiotelephony* which states, *inter alia*:

> *5.2.1.4.1.1 All numbers, except as prescribed in 5.2.1.4.1.2, shall be transmitted by pronouncing each digit separately.* […] *FL 200 transmitted as Flight Level Two Zero Zero.*
>
> *5.2.1.4.1.2 All numbers used in the transmission of altitude, cloud height, visibility and runway visual range (RVR) information, which contain whole hundreds and whole thousands, shall be transmitted by pronouncing each digit in the number of hundreds or thousands followed by the word HUNDRED or THOUSAND as appropriate. Combinations of thousands and whole hundreds shall be transmitted by pronouncing each digit in the number of thousands followed by the word THOUSAND followed by the number of hundreds followed by the word HUNDRED.* […] *altitude 800* […] *transmitted as eight hundred*.

In 2006, Eurocontrol published the 'European Action Plan for Air Ground Communications Safety'. The plan set out that "*Clear, unambiguous, timely and uninterrupted communications are central to the efficient and safe management of air traffic. In time, controller pilot data link communications (CPDLC) will replace voice as the medium for passing a large proportion of information, intentions, requests, and instructions between pilots and controllers, but voice communications will always have a role to play in emergency situations and in tactical intervention. Not surprisingly, communications related problems are a factor in many flight safety incidents. This Action Plan specifically addresses the subject of*

Air-Ground Communications Safety (AGC Safety) and is the result of the combined efforts of organisations representing all areas of airline operations – International Federation of Air Traffic Controllers' Associations, Flight Safety Foundation, European Cockpit Association, European Regions Airline Association and EUROCONTROL. European Commission (EC) supports the plan and Eurocontrol Agency will continue working with the EC".

In relation to the transmission of numbers the plan contains very specific recommendations:

> *10.5. Except as stated in the next paragraph, all numbers should be transmitted by pronouncing each digit separately. In the English language, pronunciation should follow the standard ICAO recommendations to avoid the confusion of digits (in particular, the spoken words "Two" and "Three" are often confused as are the spoken words "Five" and "Nine").*
>
> *10.6. Numbers used in the transmission of altitude, cloud height, visibility and runway visual range (RVR) information, which contain whole hundreds and whole thousands, should be transmitted by pronouncing each digit in the number of hundreds or thousands followed by the word HUNDRED or THOUSAND as appropriate* [underlining for emphasis was added by this Investigation].

The plan also notes that:

> *11.1. The UK CAA has adopted certain non-standard phraseology designed to reduce the chance of mishearing or misunderstanding RTF communications. This phraseology is not in accordance with ICAO but is based on careful study of the breakdown of pilot/controller communications. Some other European countries have also adopted similar non-standard phraseology.*
>
> *11.2. The following paragraphs taken from the UK Manual of Radiotelephony summarise the main differences.* […]
> *(c) When transmitting messages containing Flight Levels each digit shall be transmitted separately. However, in an endeavour to reduce 'level busts' caused by the confusion between some levels (100/110, 200/220 etc.), levels which are whole hundreds e.g. FL 100, 200, 300 shall be spoken as "Flight level (number) HUNDRED". The word hundred must not be used for headings.*

The Investigation asked the IAA if the UK CAA's non-standard phraseology had been adopted in Ireland. The IAA informed the Investigation that "*Ireland has not published any differences from ICAO Annex 10 Aeronautical Communications, Volume II and therefore the standard phraseology is used in the State. In accordance with EU Regulation 1035/2011 Annex II, ANSPs are required to comply with the provisions of ICAO Annex 10, Volume II".*

On 3 April 2014, The US Federal Aviation Administration (FAA) published ORDER JO 7110.65V, which "*prescribes air traffic control procedures and phraseology for use by personnel providing air traffic control services*".

In relation to Altitudes and Flight Levels that Order prescribes "*2−4−17. NUMBERS USAGE* […] *Altitudes or flight levels: 1. Altitudes. Pronounce each digit in the number of hundreds or thousands followed by the word "hundred" or "thousand" as appropriate* […] *2. Flight levels. The words "flight level" followed by the separate digits of the flight level* […] *2−4−18. NUMBER CLARIFICATION a. If deemed necessary for clarity, and after stating numbers as specified in para 2−4−17, Numbers Usage, controllers may restate numbers using either group or single-digit form. EXAMPLE− "One Seven Thousand, Seventeen Thousand".*

In this particular event the Shannon Low Level Data Assistant gave the clearance as "[…] *Flight Level Two Zero Zero* […]", and that is what the EIKY Tower Controller read back. Subsequently, the EIKY Tower Controller gave the clearance to the Flight Crew as "[…] *Flight Level Two Hundred* […]" and that is what the Flight Crew read back.

The European Action Plan for Air Ground Communications Safety also contains the following, "*Failure to question instructions […] If there is any doubt as to the content of a clearance, or its meaning is not clearly understood, pilots must obtain clarification or confirmation*".

Finally, the Investigation notes European Aviation Safety Agency, Notice of Proposed Amendment (NPA) 2015-14, Acceptable Means of Compliance (AMC) and Guidance Material to Commission Regulation (EU) 2015/XXX laying down the common rules of the air and operational provisions regarding services and procedures in air navigation (SERA[10] Part C). NPA 2015-14 provides AMC radiotelephony examples that include, *inter alia*, the use of the "*hundred*" phraseology for Flight Levels.

2 ANALYSIS

2.1 Communications between EIKY Controller and Shannon Low Level Data Assistant

Before N1310H departed, the EIKY Tower Controller contacted Shannon Low Level Control requesting "*a climb out for him off Two Six please...if I can get on track to VENER it would be fantastic*". The Low Level Data Assistant provided the clearance, "*Okay Kerry, November One Three One Zero Hotel is cleared from Kerry to Gander via VENER, Flight Level Three Four Zero, squawk Six Three Zero Four and on track to stop at Flight Level Two Zero Zero*". The EIKY controller read back "*Okay so he's cleared to destination on track VENER Flight Level Three Four Zero and he's cleared on track to VENER to stop climb Flight Level Two Zero Zero*".

At 14.29:45 hrs the Shannon Low Level Data Assistant responded "*That's it*". The underlined portions highlight that the Low Level Data Assistant and the EIKY Tower Controller both understood that the clearance was to Flight Level Two Zero Zero.

[10] **SERA**: Standardised European Rules of the Air, an initiative under Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 (OJ L 281, 13.10.2012, p. 1).

2.2 Communications between EIKY Controller and Flight Crew of N1310H

The EIKY Tower Controller then contacted N1310H saying "[…] *your climbout instructions now and squawk if you're ready*". The Flight Crew acknowledged saying "*Standing by*". The EIKY Tower Controller then advised "*One Three One Zero Hotel you're cleared on track to VENER stop climb Flight Level Two Hundred squawk Six Three Zero Four*". The Flight Crew then read back "*Okay cleared direct to VENER climb maintain Flight Level Two Hundred and squawking Six Three Zero Four in the meter back taxiing for Two Six One Zero Hotel*". The EIKY Controller replied "*One Zero Hotel read back correct report ready for departure*". The underlined portions highlight that the EIKY Tower Controller and the Flight Crew both understood that the clearance was to Flight Level Two Hundred.

2.3 Communications between Shannon Low Level Control and Flight Crew of N1310H

When N1310H was initially asked by Shannon Low Level Control to confirm its passing altitude the Flight Crew stated "*we are level Flight Level Two Zero Zero*". When asked again, the Flight Crew replied "*We were cleared only to Flight Level Two Zero Zero*". When asked for a third time the Flight Crew replied "*and we confirm that we are cleared up to level Zero Two Zero … Two Thousand feet*".

In his written report to the Investigation the Pilot in Command of N1310H stated "*As we began to climb we had some confusion as to what the altitude clearance limit was as we were unsure what level Two Hundred meant. We levelled at Two Thousand feet to ensure we didn't exceed any altitude limits. We contacted departure control and informed them we were level, they questioned what altitude we were climbing through and we clarified that we were level. There was some question from ATC regarding what altitude we were cleared up to by Kerry and we informed the controller that we were unsure but were level at Two Thousand".*

There is no recording of the Flight Crew informing Shannon Low Level Control that they were unsure of their stop climb Flight Level. Furthermore, when the EIKY Tower Controller gave them the climb out instruction to "*stop climb Flight Level Two Hundred*" they read it back and they did not question it or request clarification. The Investigation also notes that having initially advised Shannon Low Level Control that they were "*level Flight Level Two Zero Zero"* and *"We were cleared only to Flight Level Two Zero Zero*", it appears that the Flight Crew may have realised that there was a problem when they transmitted "*we confirm that we are cleared up to level Zero Two Zero … Two Thousand feet*".

2.4 Standard Phraseology

In this particular event the Shannon Low Level Data Assistant relayed the clearance as "[…] *Flight Level Two Zero Zero* […]", and that is what the EIKY Tower Controller read back. Subsequently, the EIKY Tower Controller gave the clearance as "[…] *Flight Level Two Hundred* […]" and that is what the Flight Crew read back. When queried by Shannon Low Level Control as to their passing altitude the Flight Crew Reported "*Ah we are level Flight Level Two Zero Zero."* When queried again, the Flight Crew reported "*We were cleared only to Flight Level Two Zero Zero*". The fact that these first two replies are both in the single digit form i.e. "*Two Zero Zero*" leads the Investigation to believe that the Flight Crew had correctly interpreted their initial clearance to "[…] *Flight Level Two Hundred* […]".

Consequently, the Investigation does not believe that non-standard phraseology played a role in the Flight Crew's misinterpretation of their cleared Flight Level.

Evidence that the Flight Crew were confused can be found from the Pilot-in-Command's statement which says "*we informed the controller that we were unsure"*; however, there is no recording that this actually happened.

In fact, it appears that it was only following three direct inquiries in quick succession from Shannon Low Level Control that the crew identified that they were confused about their cleared level. When the Shannon Low Level Control enquired for a third time the Flight Crew reported "*And we confirm that we are cleared up to Flight Level Zero Two Zero… Two Thousand feet*". This was a change from the Flight Crew's two initial reports that they were level at "*Flight Level Two Zero Zero*" and probably reflects a realisation of their behalf that they had correctly heard and recorded "*Flight Level Two Hundred/Flight Level Two Zero Zero*", but that they had misinterpreted its meaning. This is supported by the fact that the Flight Crew did not at any stage request a clarification of their cleared Flight Level which, if they were confused or concerned, would be good airmanship and is the practice advocated by Eurocontrol.

The Investigation also notes that the Flight Crew's transmissions featured several instances of single digits being read back in group form e.g. "*Two Zero*" read back as "*Twenty*", "*Three Zero*" as "*Thirty*", "*Four Zero*" as "*Forty*", "*Five Zero*" as "*Fifty*", "*One Two Four decimal Seven"* as "*Twenty Four decimal Seven".* It therefore appears that, although it is not ICAO standard phraseology, the Flight Crew were comfortable working with grouped digits and should not have had a difficulty interpreting "*Flight Level Two Hundred*".

2.5 Previous Safety Recommendation regarding ATM Monitor

The lack of an operational ATM monitor in the tower at Kerry airport was not a factor in this particular event. Notwithstanding this, the Investigation notes that in 2010, as part of an investigation into a near Controlled Flight Into Terrain (CFIT) event near EIKY in 2009, the AAIU recommended that "*the licensee of Kerry Airport, in conjunction with the Irish Aviation Authority, should review the provision of radar information to support the air traffic control service provided by Kerry ATS unit*" [AAIU IRLD2010016].

The issue of radar information at EIKY and EIKN was revisited three years later in the context of an AIRPROX investigation at EIKN, in 2013. The IAA informed that investigation that "*it is anticipated that both Kerry and IWAK* [EIKN] *will deploy the ATM monitors operationally in late Q1 or Q2 of 2014".*

Based on that Response the Investigation into the 2013 AIRPROX elected not to make a Safety Recommendation stating "*An updated position with regard to the provision of radar information has determined that both EIKY and EIKN are at the final stages of deploying air traffic monitors operationally by Q2 of 2014. Therefore the Investigation considers that no further safety recommendation is required in that regard*".

On 31 July 2015, more than a year after the end of Q2 of 2014, the Investigation learned, during a visit to the EIKY control tower, that the air traffic monitors which the AAIU believed had been operational since Q2 2014, and which the AAIU had first recommended in 2010 were still not operational and at that time there was no certainty around the timescale for completion of the project.

In response to a Draft Report, on 25 February 2016, the Investigation was informed that "*Both the EIKY ATM and the EIKN ATM have been subject to ANSP pre-operational evaluation testing since the start of October 2015. Additionally from that date, both ATM systems were permitted by the IAA SRD to be used to identify if aircraft were conforming to their ATC clearances*". Also on 25 February, the Investigation was informed that, in accordance with SR 2010016, on 27 October 2015 the IAA Air Navigation Services Provider signed a formal contract to provide surveillance data information to EIKY. However, as of the date of this Final Report, this Safety Recommendation remains Open. Accordingly, the Investigation issues a Safety Recommendation to the Irish Aviation Authority in this regard.

Safety Recommendation No. 1

The Irish Aviation Authority should expeditiously conclude all activities within its remit in relation to the introduction into service of air traffic monitors at Kerry and Knock (Ireland West) Airports.

(**IRLD2016002**)

The Investigation notes that REGULATION (EU) No 996/2010 stipulates "*Each entity receiving a safety recommendation, including the authorities responsible for civil aviation safety at the Member State and Union level, shall implement procedures to monitor the progress of the action taken in response to the safety recommendations received".* The original Safety Recommendation (IRLD2010016) was issued in 2010 and addressed, *inter alia*, to the IAA. In 2014, the IAA informed the AAIU that the final stages of deploying the Air Traffic Monitor were expected to be completed by Q2 2014. On 31 July 2015 the project was not complete nor was there any certainty around its likely completion date. This raises concerns around the procedures which the IAA has implemented "*to monitor the progress of the action taken in response to the safety recommendations received"*.

The Investigation accordingly issues a Safety Recommendation to the Irish Aviation Authority in this regard.

Safety Recommendation No. 2

The Irish Aviation Authority should review its procedures to monitor the progress of the action taken in response to Safety Recommendations received.

(**IRLD2016003)**

2.6 Other Considerations

In this case Controller monitoring identified the potential conflict. However, the Investigation discussed with Shannon ATC personnel the introduction of a technological barrier in the form of a conflict alert within the ATC system(s) that would alert a controller to potential terrain conflicts and emerging CFIT scenarios. In a wide ranging discussion the issues of adoption of a standard for terrain topography and the problems of spurious (so called "nuisance") alerts lessening the effectiveness of such a system were discussed. Since that discussion the Investigation was informed that new co-ordination procedures have been introduced for the monitoring of non-standard departures from EIKY (**Section 1.6**) and for the handing over of such aircraft to Shannon ATC. Accordingly, the Investigation does not make any Safety Recommendations in relation to procedural changes or the incorporation of new conflict alerts into the ATC systems.

3 CONCLUSIONS

(a) Findings

1. N1310H was on a non-standard instrument departure from RWY 26 at EIKY.

2. The aircraft was cleared on a direct track to VENER with an instruction to stop climb at "*Flight Level Two Hundred*".

3. Shortly after departure the aircraft was transferred to Shannon Low Level Control and the Flight Crew advised ATC that they were at "*Flight Level Two Zero Zero*".

4. The Kerry Controller used non ICAO-standard phraseology when he relayed the stop climb Flight Level he received from Shannon, "*Flight Level Two Zero Zero*", to the Flight Crew as "*Flight Level Two Hundred*".

5. The phraseology used by the Kerry Controller is that advocated by the UK CAA and some other European ATC agencies to minimise possible confusion when assigning a clearance to a Flight Level which ends in two zeroes.

6. The exchanges between ATC and the Flight Crew indicate that the Flight Crew understood, correctly, that Flight Level Two Hundred was Flight Level Two Zero Zero.

7. The aircraft levelled at Two Thousand Feet, contrary to its clearance.

8. Any confusion on the Flight Crew's behalf did not originate from the non-standard phraseology.

9. In their written report after the event the Flight Crew indicated that they did not understand what Flight Level Two Hundred meant.

10. At no time did the Flight Crew seek clarification from ATC regarding their stop climb Flight Level.

(b) Probable Cause

1. The aircraft levelled at Two Thousand feet in close proximity to mountainous terrain, contrary to ATC clearance.

(c) Contributory Cause(s)

1. The Flight Crew misinterpreted Flight Level Two Hundred as Two Thousand feet.

2. Clarification was not sought from ATC regarding the assigned stop climb Flight Level.

4 SAFETY RECOMMENDATIONS

No.	It is Recommended that:	Recommendation Ref.
1.	The Irish Aviation Authority should expeditiously conclude all activities within its remit in relation to the introduction into service of air traffic monitors at Kerry and Knock (Ireland West) Airports.	IRLD2016002
2.	The Irish Aviation Authority should review its procedures to monitor the progress of the action taken in response to Safety Recommendations received.	IRLD2016003

View Safety Recommendations for Report 2016-005

- END -

Appendix A

Flight path (from ARTAS data) of N1310H as it departed EIKY

Note: The labels comprise a UTC timestamp and the aircraft altitude in feet, based on the airfield pressure on the day (1024 hPa)

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No. 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

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