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INVESTIGATION REPORT

Serious incident to Airbus A321
registered **TC-OBZ**
on 26 September 2013
during approach to
Deauville-Normandie aerodrome
operated by **Onur Air**

BEA
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SPECIAL FOREWORD TO ENGLISH EDITION

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation.
As accurate as the translation may be, the original text in French is the work of reference.

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Glossary

A/THR	AutoTHRust
AAL	Above Aerodrome Level
EASA	European Aviation Safety Agency
AFS	Automatic Flight System
AIP	Aeronautical Information Publication
ALT	ALTitude
AMSL	Above Mean Sea Level
AMSR	Minimum radar safety altitudes (Altitudes Minimales de Sécurité Radar)
AP	Automatic Pilot
ASR	Air Safety Report
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
ATS	Air Traffic Services
BGTA	Air transport police brigade (Brigade de Gendarmerie des Transports Aériens)
CAST	Commercial Aviation Safety Team
CFIT	Controlled Flight Into Terrain
CPL	Commercial Pilot Licence
CRM	Cockpit / Crew Resource Management
ACC	Area Control Centre
AOC	Aircraft Operator Certificate
CTR	Control Traffic Region
CVR	Cockpit Voice Recorder
DGAC	French civil aviation authority (Direction Générale de l'Aviation Civile)
DME	Distance Measuring Equipment
DSNA	French air navigation services provider (Direction des Services de la Navigation Aérienne)
FD	Flight Director
E-GPWS	Enhanced Ground Proximity Warning System
FAF	Final Approach Fix

FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FCU	Flight Control Unit
FDR	Flight Data Recorder
FL	Flight Level
FMS	Flight Management System
FPA	Flight Path Angle
F-PLN	Flight PLaN
FPV	Flight Path Vector, "bird"
FSF	Flight Safety Foundation
GNSS	Global Navigation Satellite System
GTA	Air transport police (Gendarmerie des Transports Aériens)
HDG	HeaDinG
IAF	Initial Approach Fix
IFR	Instrument Flight Rules
IRMA	Aircraft movement radar display (Indicateur Radar de Mouvements d'Aéronefs)
ILS	Instrument Landing System
LDA	Landing Distance Available
LOC	LOCalizer
LPC	License Proficiency Check
OM	Operating Manual
MCDU	Multifunctional Control and Display Unit
MDA/H	Minimum Descent Altitude/Height
METAR	METeorological Aerodrome Report
MSAW	Minimum Safe Altitude Warning
MVL	Visual manoeuvring (circling) (Manœuvre à Vue Libre)
ND	Navigation Display
NM	Nautical Mile
NPA	Non Precision Approach
NTSB	National Transportation Safety Board
ICAO	International Civil Aviation Organization
OPC	Operator Proficiency Check
OPS	Flight OPerationS

PA	Precision Approach
PAPI	Precision Approach Path Indicator
PARC	Performance-based operations Aviation Rulemaking Committee
PBN	Performance Based Navigation
PF	Pilot Flying
PFD	Primary Flight Display
PLA	Precision Like Approach
PM	Pilot Monitoring
PNC	Cabin crew (Personnel Navigant Commercial)
PNT	Flight crew (Personnel Navigant Technique)
PRO	Manual containing criteria for drawing up instrument flight procedures
QAR	Quick Access Recorder
QFE	Atmospheric pressure at aerodrome elevation
QFU	Magnetic orientation of runway
QNH	Atmospheric pressure adjusted to mean sea level according to Standard Atmospheric Conditions
RCA	Air traffic regulations (Règlement de la Circulation Aérienne)
RNAV	Area Navigation
RNP	Required Navigation Performance
RVR	Runway Visual Range
SMS	Safety Management System
SOP	Standard Operating Procedures
RDPS	Radar Data-Processing System
TAWS	Terrain Awareness and Warning System
TMA	Terminal manoeuvring area
TOGA	Take Off / Go Around
TRI	Type Rating Instructor
TRK	TRacK

UTC	Universal Time Coordinated
V/S	Vertical Speed
VIS	VISibility
VFE	Maximum flap-extended speed
VMC	Visual Meteorological Conditions
VMI	Instrument meteorological visibility

BEA

Synopsis

Time	09:18[1]
Operator	Onur Air
Type of flight	Commercial Air Transport - Passenger
Persons on board	Captain (PF), copilot (PM), 5 cabin crew, 220 passengers
Consequences and damage	None

[1]Unless otherwise stated, all times given in this report are in UTC. One hour should be added to obtain the legal time applicable in Metropolitan France on the day of the event.

Near collision with ground in last turn during a visual approach

The crew of charter flight OHY 1985 (non-scheduled commercial IFR flight) was about to begin the descent to Deauville in VMC conditions. The aircraft was flying in controlled airspace. The crew was preparing for an ILS approach to land on runway 30. The captain was flying the aircraft; it was his first flight to this aerodrome.

On first contact with the Deauville approach ATC, the crew was informed that the runway in use had changed and that another aircraft was preparing to take off towards them. Several options were available for landing on runway 12: a GNSS approach, an ILS 30 approach followed by visual manoeuvring (circling) or a visual approach.

The crew announced a visual approach on the radio but prepared for a visual manoeuvring procedure. When the controller requested the crew to call back at the beginning of the downwind leg, the PF interpreted this message as an order to turn right. From this point on, the crew no longer followed a standard procedure but mixed up the visual manoeuvring (circling) procedure with the visual approach procedure. They descended to the MDA (1,100 ft AAL) in the downwind leg and then continued the descent in the final turn under the final approach slope. The minimum recorded altitude was 528 ft (i.e. 49 ft above the aerodrome) at a distance of 3 NM from the runway threshold.

The controllers did not watch the aircraft's flight path on the final approach. The crew's response to the occurrence of TAWS alerts probably prevented a collision with the coast.

The BEA issued a safety recommendation to EASA to promote recurrent training on visual approach procedures.

ORGANIZATION OF THE INVESTIGATION

On the morning of Friday 27 September 2013, the BEA was informed by the GTA that a witness located in the Villerville sea tower had seen an aircraft flying over the sea at low altitude the day previously. An initial analysis of the recorded RDPS data seemed to confirm the event. As a result, the BEA immediately requested information from the Turkish authorities and the Onur Air representatives in Paris and, as a precautionary measure, the preservation of the contents of the flight recorders equipping the aircraft.

On 30 September, on the basis of the statements received and preliminary data, the BEA opened a safety investigation in accordance with Annex 13 to the Convention on International Civil Aviation and 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.

On 1 October 2013, the BEA officially notified the Turkish authorities. Pending confirmation of the circumstances of the event, it was considered a serious incident. On 4 October 2013, the Turkish authorities forwarded the raw data from the aircraft's QAR to the BEA. On 7 October 2013, eleven days after the event, a first analysis of this data confirmed the seriousness of the incident.

On 19 November 2013, in accordance with the provisions of Annex 13, the Turkish authorities appointed an accredited representative, who was associated with the investigation as the representative of the State of Registry.

The BEA investigation team worked in cooperation with the aircraft manufacturer, the DSNA, the airline and the Turkish investigation authorities.

1 - FACTUAL INFORMATION

1.1 History of the flight

On Thursday 26 September 2013, the Airbus A321 registered TC-OBZ operated by Onur Air took off from Izmir (Turkey) bound for Deauville-Normandie aerodrome (France). It was a charter flight, call sign "OHY 1985", with 220 passengers on board. On the approach to Deauville, the captain in the left seat was the pilot flying. The copilot (PM) managed the radio communications.

The approach ATC and Deauville tower ATC positions are grouped together. One controller carries out the approach, control tower and control tower manager functions while another controller performs the telephone coordination functions.

Runway 30 was in use. The crew of flight JAF 640 departing from Deauville contacted the control tower to request a take-off on runway 12. The controller announced wind 070° 4 kt and accepted a departure on runway 12. The crew indicated they would be ready in 30 to 40 minutes, i.e. around 9:00.

At 8:48:26 the crew of flight JAF 640 requested the meteorological information for runway 12. The controller reported wind 070° 4 to 9 kt, visibility 5,000 m, and no significant cloud. Runway 30 was still in use.

At 8:51, the controller received the strip announcing the arrival of flight OHY1985 and indicating an arrival time at Deauville at 9:13.

At 09:02:15, the crew of flight JAF 640 requested a startup clearance for Runway 12. The reported wind direction was 080° 4 kt. The controller changed the runway in use at Deauville, which became runway 12. At 9:04:46, ATIS A was changed to B and then C (*cf. Appendix 4*).

Flight OHY 1985 was cruising at flight level FL200, at a speed of 234 kt and a heading of 302°. The AFS was configured as follows: AP number 1, FD and A/THR engaged in ALT, HDG and SPEED guidance modes. The crew of flight OHY 1985 listened to the Deauville ATIS A which announced that runway 30 was in use, there was a visibility of 2,600 m and no wind. The crew prepared for an ILS approach to land on runway 30. About 40 NM from Deauville, the Paris en-route control centre cleared the start of descent to flight level FL70 with a direct track to DODIM, the IAF for the instrument approach to runway 30. The descent was initiated in "Open Descent" mode by selecting flight level FL70 on the FCU and pulling the knob, with a target speed adjusted to 260 kt. The airbrakes were deployed, and the target speed was reduced to 250 kt.

At 9:07:03, the crew of flight OHY 1985 contacted the Deauville approach ATC, which confirmed that the aircraft was visible on the radar.

The visibility and wind conditions were changing. Visibility had significantly improved.

As the runway in use had changed, the controller proposed the GNSS approach procedure for runway 12 to the crew. The airbrakes were retracted. The crew replied that they were going to make a visual approach. The controller cleared them for a visual approach to runway 12 with a direct track to DVL. The target speed was increased to 280 kt.

At 9:08:05, the crew requested confirmation for runway 12. The controller confirmed and proposed two options: either the GNSS procedure or a visual approach. The crew replied that they would perform a visual approach because they were not qualified for GNSS procedures. The ILS frequency selected corresponded to that of the ILS 30 at Deauville. It was deselected [2] around 30 seconds later.

At 9:09:02, the crew asked whether the downwind leg should be flown left-hand or right-hand. The airbrakes were extended. Several exchanges with the Deauville approach ATC allowed the crew to confirm the flight path to be followed during the visual approach. The crew was cleared, as soon as the field was in sight, to make a right turn to a left-hand downwind leg located to the north of the field. The target speed was reduced to 260 kt.

At 9:10:20, the aircraft was cleared to descend to an altitude of 3,000 ft. The target speed was decreased to 240 kt, the air brakes were retracted, the altitude of 3,000 ft was selected, and the target speed was again reduced to 230 kt.

At 9:11:33, while the aircraft was 10 NM from DVL and at an altitude of 9,400 ft in descent, the ground spoilers were armed, the landing gear was down, the managed speed selected and the flaps extended in position 1.

At 9:12:12, the airbrakes were activated (which disabled the ground spoilers), the flaps were extended to position 2 and the target speed was set at 200 kt.

At 9:12:59, the crew of flight JAF 640 was cleared to backtrack runway 12 counter-QFU and line up for take-off.

At 9:13:05 (point ❶ of Figure 1), at the request of the approach controller, the crew of flight OHY 1985 switched to the Deauville tower frequency. The tower informed the crew that an aircraft was backtracking on the runway (it was flight JAF 640) and requested they call back when in the left-hand downwind leg for runway 12.

At 9:13:33, the AP switched to altitude capture vertical guidance mode (the aircraft was approaching the target altitude previously set at 3,000 ft). The crew then selected the AFS "open descent" mode and the A/THR switched from "thrust" mode to "speed" mode. The managed speed was selected, the altimeter setting 1015 corresponding to the Deauville QNH was displayed and the airbrakes were retracted.

At 9:13:38 (point ❷ of *Figure 1*), the crew announced that they had the runway in sight and that they were starting their right turn. The aircraft was then situated at 9 NM from the field (i.e. around 2 NM from DVL) at an altitude of 3,700 ft in descent to 3,000 ft. Heading 333 degrees was selected, which changed the horizontal mode of the AP to hold heading, and a target speed of 180 kt was selected.

At 9:14:32 (point❸ of *Figure 1*), close to the altitude of 3,000 ft, the crew requested further descent. The Deauville tower controller cleared for a descent at their convenience. The target altitude [3] of 1,100 ft was selected and the aircraft started to descend in V/S mode with several adjustments of the target vertical speed made on the FCU, with values ranging from 450 to 1,150 ft/min. A heading of 300 degrees and a target speed of 170 kt were selected.

[2]This frequency was selected again at 9:20:36 for the final approach to runway 30.

[3]The altitude of 1,100 ft corresponds to the minimum descent altitude (1,070 ft) of the MVL procedure, i.e. a height of 628 ft above the displaced threshold of runway 12.

At 9:16:25 (point❹ *Figure 1 and Figure 3*), the controller cleared the crew of flight JAF 640 to take off from runway 12. The controllers' attention then turned to the take-off in progress. They no longer watched the manoeuvres of the Onur Air flight.

At 9:16:37, the controller said he will call the crew back to clear them to turn into the final approach.

At 9:16:57 (point❺ *Figure 1 and Figure 3*), the AP began the altitude capture while the aircraft passed from an altitude of 1,300 ft to 1,100 ft. The tower controller asked the crew to extend the downwind leg as there was a take-off on runway 12 - it was still the flight JAF 640. The aircraft was 2 NM north of the runway centreline and had exceeded the displaced threshold of runway 12 by 0.8 NM.

At 9:17:29 (point❻ *Figure 1 and Figure 3*), the crew was cleared to turn left to align with the runway. The aircraft was then 2.3 NM from the threshold. The crew no longer had the runway in sight but could see the surface of the sea as well as the coast. The ground spoilers were armed. A descent rate of 650 ft/min was selected (which caused the autopilot to switch to V/S mode) and the aircraft started to turn to the left with a heading of 275°. The managed speed was engaged. The flaps were extended to position 3. A descent rate of 450 ft/min was engaged and a target heading of 229 degrees was selected.

At 9:17:50 (point❼ *Figure 1 and Figure 3*), the aircraft was at an altitude of 972 ft, at a speed of 162 kt, on heading 278° and at a distance of 4 NM from the threshold of runway 12. The crew disconnected the AP and the FDs, displayed the go-around altitude of 3,000 ft on the FCU, and positioned the flaps to full out. The flight path vector called "bird"[(4)] was displayed on the PFD. The crew selected a track of 119 degrees corresponding to the QFU of runway 12. In addition to the heading display on the PFD, the track (green line between the aircraft symbol and the green mark of the actual track, cf. Appendix 12) was displayed on the ND screen in ARC mode[(5)]. The copilot changed the scale of his ND from 20 NM to 10 NM.

At 9:18:39, flight JAF 640 in initial climb was 2.4 NM from the threshold of runway 12 and at an altitude of 2,000 ft. The ATC cleared the crew of JAF 640 to climb to level 100 and for a direct track to LGL.

At 9:18:44 (point❽ *Figure 1 and Figure 3*), the TAWS "terrain ahead" alert[(6)] was triggered for about 8 seconds. The PF reacted by initially making a nose-up input on the sidestick corresponding to 1/3 of the maximum travel. The aircraft pitch changed from 0.5° nose-down to 12° nose-up. At 9:18:52 (point❾ *Figure 1 and Figure 3*), a second "Terrain ahead pull up" type alert was triggered for about 7 seconds. At this moment, the aircraft was at a minimum recorded altitude of 528 ft (i.e. 49 ft above the aerodrome) at a distance of 3 NM from the runway threshold. The PF reacted by again making a nose-up input corresponding to 1/3 of the maximum travel of the sidestick. The aircraft pitch increased by 10° towards 16° nose-up.

[(4)]The flight path vector called "bird" represents the lateral and vertical flight path of the aircraft with respect to the ground. On the lateral display of the PFD, it indicates the drift angle. On the vertical display of the PFD, it indicates the actual angle of the flight path (angle of climb or descent).

[(5)]In the Onur Air FCTM and the Airbus SOP, it is recommended to select the ROSE mode on the ND in order to know your position with respect to the runway.

[(6)]The TAWS alerts triggered audible and visual signals (see appendix 13).

The aircraft regained altitude. The crew recovered visual contact with the runway and noticed that they were to the left of the centreline. As the aircraft, which was still climbing, approached the coast, the PF started a right dog leg. The controller saw the aircraft had an unusual attitude and asked if a go-around was engaged. The crew replied that they were landing. The aircraft passed above the approach slope indicated by a PAPI. At about 1.5 NM from the runway threshold and at an altitude of 1,144 ft, the PF resumed the descent by decreasing the pitch to a value of -1° nose-down and started the last turn to the left by banking the aircraft to a value of 33° to align with the runway centreline.

A TAWS "sink rate" alert was triggered for about 3 seconds. The captain decided to discontinue the approach. He decreased the rate of descent by applying a nose-up input for 2 to 3 seconds corresponding to 2/3 of the maximum travel of the sidestick. The aircraft pitch changed from -3° nose-down to + 2.5° nose-up. The crew explained on the radio that they had lost sight of the runway due to the sun. They requested and obtained clearance for a visual approach on runway 30.

The aircraft flew over the runway at a height of 300 ft. The crew retracted the flaps to position 3 and then the PF started a right-hand turn after passing the Deauville facilities. The aircraft climbed to a height of 1,100 ft on heading 150-degrees and then started a left-hand turn to align with runway 30. At the end of the turn, the crew selected the flaps in the fully extended position and the TAWS glideslope alert was activated for about two seconds. At 9:23:28, the aircraft landed on runway 30.

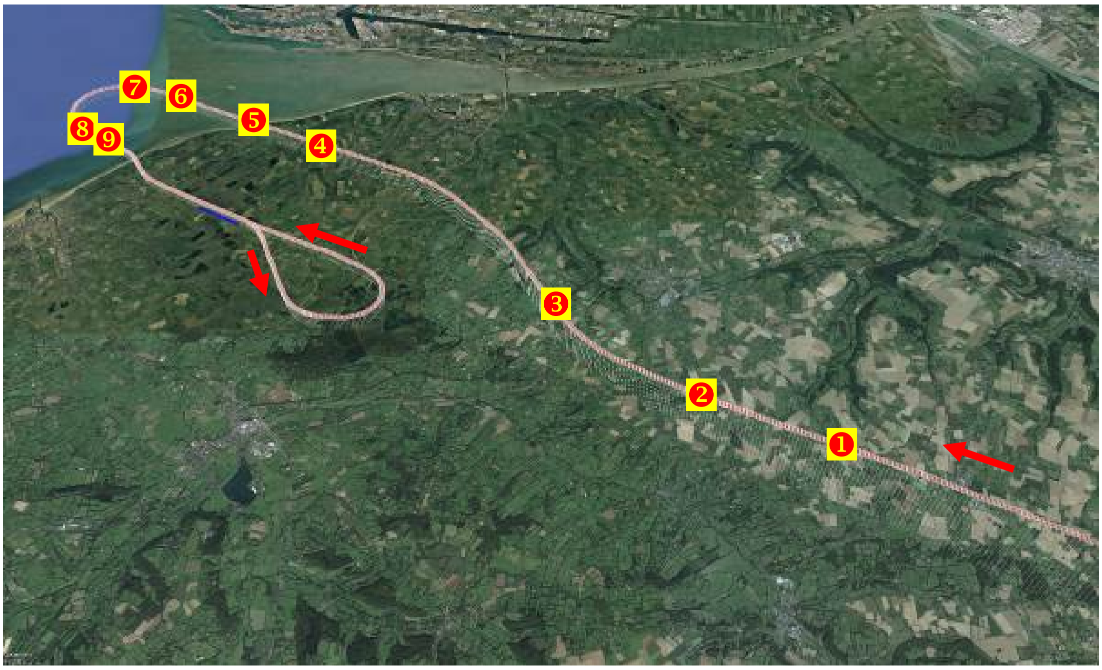


Figure 1: flight path of the incident (approach) based on QAR data

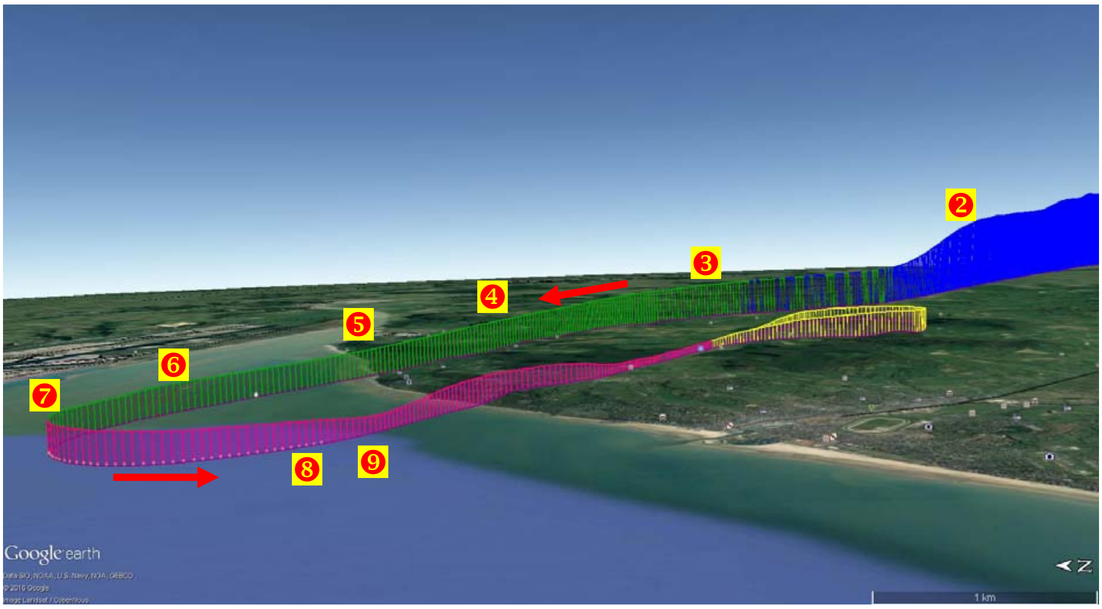


Figure 2: flight path of the incident (side view) based on QAR data

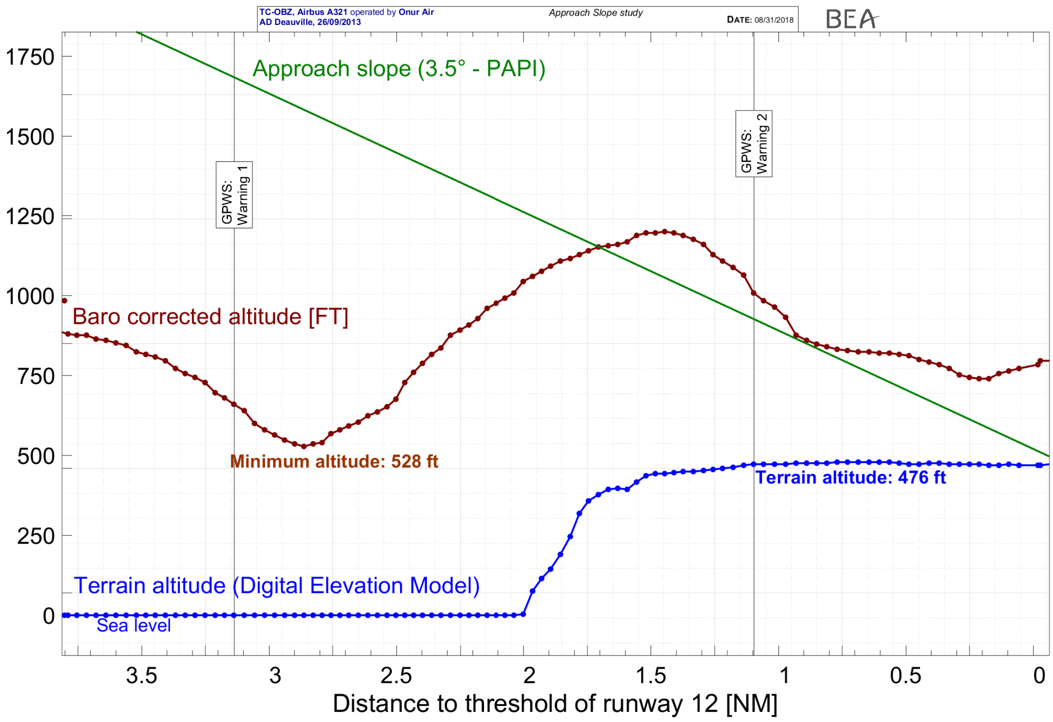


Figure 3: flight path of the incident (final phase of approach) based on QAR data

1.2 Injuries to persons

	Injuries		
	Fatal	Serious	Minor/None
Crew members	-	-	7
Passengers	-	-	220
Others	-	-	-

1.3 Damage to aircraft

No damage.

1.4 Other damage

No damage.

1.5 Personnel information

1.5.1 Flight crew

Prior to the incident flight, the captain and copilot had completed 13 flights together, including two flights in February 2013, nine flights in August 2013 and two flights on 21 September 2013.

1.5.1.1 Captain

Male, 35 years old.

- Airline Transport Pilot License ATPL (A) No TR-A-05403 issued by the Turkish Civil Aviation Authority on 17 August 2007;
- type rating A319/A320/A321 obtained on 17 August 2007;
- other type ratings: Casa CN-235 in 2006, Cessna T-37 in 2000 and SIAI Marchetti SF260-D in 1999;
- end of conversion training on 2 July 2011;
- last line check on 24 February 2013;
- last operator proficiency check on 27 May 2013;
- last CRM training on 16 April 2013;
- class 1 medical certificate issued on 14 February 2013 valid until 14 February 2014;
- last simulator training session with visual approach on 9 May 2012.

Experience

- total: 7,025 flight hours, of which 1,347 as captain only with Onur Air;
- on type: 6,124 flight hours, including 1,347 as captain;
- in the previous year: 945 hours;
- in the previous three months: 312 hours[7], 99 landings, 100 take-offs;
- in the previous seven days: 29 hours, 6 landings, 7 take-offs.

Captain with Onur Air since 5 June 2012.

[7]The airline company Operating Manual authorizes a maximum of 300 flight hours per quarter (three consecutive calendar months).

1.5.1.2 Copilot

Male, 61 years old.

- Commercial Pilot License CPL (A) No TR-A-05175 issued by the Turkish Civil Aviation Authority on 17 October 2005;
- type rating A319/A320/A321 obtained on 07 February 2011;
- other type ratings: MD 80-88 in 2006;
- end of conversion training on 6 March 2006 (arrival at Onur Air);
- last line check on 28 March 2013;
- last operator proficiency check on 30 June 2013;
- last CRM training on 4 December 2012;
- class 1 medical certificate issued on 25 September 2013 valid until 25 March 2014.

Experience

- total: 8,043 flight hours;
- on type: 2,008 flight hours as copilot with Onur Air;
- in the previous year: 911 hours;
- in the previous three months: 257 hours, 69 landings, 70 take-offs;
- in the previous seven days: 29 hours, 6 landings, 7 take-offs.

Copilot with Onur Air since 6 March 2006.

1.5.2 Deauville-Normandie Air Traffic Services Personnel

1.5.2.1 Approach controller

Male, 52 years old.

- "Aerodrome Control Instrument" rating with "Tower Control" and "Radar" endorsements LFRG/ZZ ADI/TWR RAD issued on 15 June 2010 valid until 27 June 2014;
- "Approach Control Surveillance" rating with "Radar" endorsement LFRG/ZZ APS/RAD issued on 28 June 2010 valid until 27 June 2014;
- instructor endorsement issued on 25 January 2003 valid until 27 June 2015;
- English language endorsement (level 4) issued on 14 May 2008 valid until 14 May 2014.

Experience

- in the previous three months: 23 shifts representing 215 hours;
- in the previous month: 12 shifts representing 113 hours;
- in the previous seven days: no activity.

1.5.2.1 Coordinating controller

Male, 32 years old.

- "Aerodrome Control Instrument" rating with "Tower Control" and "Radar" endorsements LFRG/ZZ ADI/TWR RAD issued on 21 December 2010 valid until 23 January 2014;
- "Approach Control Surveillance" rating with "Radar" endorsement LFRG/ZZ;
- APS/RAD issued on 24 January 2011 valid until 23 January 2014;
- instructor endorsement issued on 1 November 2004 valid until 30 October 2015;
- English language endorsement (level 4) issued on 8 February 2008 valid until 2 September 2016.

Experience

- in the previous three months: 25 shifts representing 232 hours;
- in the previous month: 11 shifts representing 109 hours;
- in the previous 7 days: two shifts representing 21 hours;
- In the previous 24 hours: one shift representing 11 hours.

1.6 Aircraft information

This Airbus A321 was purchased by Onur Air and registered TC-OBZ on 1 February 2013. Rolled off from the Airbus assembly lines in 1998, it was previously operated by Sky Airlines.

Manufacturer	AIRBUS
Type	A321-231
Serial Number	811
Registration	TC - OBZ
Entry into service	1998
Airworthiness certificate	No 2680 of 1 February 2013 issued by the Turkish Civil Aviation Authorities
Last C inspection Operation	03 February 2012 34,077 flight hours and 23,695 cycles
Last A inspection Operation	13 September 2013 38,602 flight hours and 25,397 cycles

1.7 Meteorological information

At the time of the event, the weather conditions at Deauville-Normandie aerodrome estimated by Météo France were the following: wind 080° 5 kt with maximum gusts of 8 to 10 kt, visibility 7,000 m, 2 to 3 octas of Stratocumulus with base at 5,400 ft, surmounted by 5 to 6 octas of Cirrus with base above 25,000 ft.

The Deauville ATIS "C" transmitted over the radio at 9:04 indicated wind 070° 4 kt, visibility 6,000 m and the presence of mist.

The controllers located in the Deauville control tower estimated somewhat misty conditions and a visibility in the north sector of around 5,000 m.

Villerville's sea tower personnel, located about 2 NM north-west of the aerodrome, reported visibility above sea level greater than 14,000 m and said that the mist lifted at around 08:00.

The captain reported a clear sky, a little mist but very good visibility. He said that he could see the runway at a distance of approximately 20 NM coming from the east of the field.

The sun was roughly located on the runway 12 centreline, 29 degrees above the horizon at an azimuth of 135 degrees.

1.8 Aids to navigation

The navigation means available to carry out an instrument approach to Deauville-Normandie aerodrome are:

- ❒ a VOR call sign DVL located to the east of the field on the runway centreline at 6.5 NM from the displaced threshold of runway 30;
- ❒ a Category-I ILS DME call sign FD for approaches to runway 30.

This equipment was in good working order at the time of the incident.

1.9 Communications

At the time of the incident, the PM was in contact with the Deauville-Normandie control tower.

Previously, he had successively been in contact with the en-route control sectors UZ and TH of the ACC/N, then with the Deauville approach controller.

A transcript of the ATIS A, B, C and communications between the Deauville approach/tower and the crew is included in Appendix 4.

The striking points of the telecommunications are:

- following the change in QFU, the crew of flight OHY1985 announced that they were going to carry out a visual approach, cleared by the controller who asked them to report when in the left hand downwind leg;
- during the arrival of the Onur Air flight, the controller dealt with the take-off of flight JAF640;
- to ensure separation with the take-off, the controller extended the downwind leg of Onur Air and then cleared it for the final approach on runway 12;
- two minutes later, the controller asked the crew if they were flying a go-around;
- the crew first replied that they were landing, then announced that they had aborted the landing and finally asked for and obtained clearance for a visual approach on runway 30.

After the incident, the BGTA, alerted by the personnel of the Villerville sea tower of the aircraft's abnormal manoeuvres, called the Deauville ATC and informed them of the seriousness of the incident. The striking points from this telephone call are:

- the sea tower personnel told the BGTA that they had the feeling that the aircraft was going to make a sea landing and that it was below the sea tower;
- the Deauville ATC told the BGTA that the crew was performing a visual approach and therefore that there was no imposed flight path.

1.10 Aerodrome Information

The Deauville-Normandie aerodrome is located to the south of the Seine estuary at a reference altitude of 479 ft. It is equipped with a 12/30 runway 2,550 m long and 45 m wide with two displaced thresholds. The displaced threshold for runway 12 is 2 NM from the Channel coast at an altitude of 472 ft. The LDA is 2,100 metres. The magnetic heading of runway 12 is 119°.

The different approach procedures in Deauville are:

- for runway 30: ILS 30, LOC 30, VOR 30 or RNAV (GNSS) 12 followed by an MVL 30;
- for runway 12: RNAV (GNSS) 12 or ILS 30, LOC 30, VOR 30 followed by an MVL 12.

There is no meteorological service on the aerodrome. The departmental meteorological centre is located in Caen. Information from an automated station located 50 m north of the displaced threshold of runway 30 is displayed in the Deauville control tower: wind direction and speed (mean, minimum, maximum), instrument meteorological visibility (VMI), instrumental measurements of runway visual range (RVR) and cloud base height, air and dew point temperature, atmospheric pressures (QNH and QFE) and the automatic METAR.

Runway 12/30 is equipped with:

- white high- and low-intensity edge lighting;
- low-intensity bars at the end of the runway consisting of 16 red lights and 6 green lights;
- flashing lights at displaced thresholds 12 and 30;
- green low-intensity edge bars and a red high-intensity end bar at the displaced thresholds;
- a precision approach path indicator (PAPI) for approaches to runway 12, set at an angle of 3.5 degrees (slope 6.1%);
- high-intensity approach lights on runway 30.

The Deauville approach controller has RDPS data displayed on an IRMA 2000. This data comes from the ACC/W which uses the data from the Avranches, Tours, Paris, Boulogne and La Roche sur Yon secondary radars. Radar plots can be displayed from flight level -10 (-1,000 ft QNH 1013) and for all higher flight levels.

A direction finder is located 50 m north of the displaced threshold of runway 30.

The systems and markings on runway 12/30, the radar display and the radio navigation equipment associated with the Deauville approaches were in good working order at the time of the incident.

1.11 Flight recorders

The aircraft was equipped with:

- two flight recorders in accordance with the regulations in force: a flight data recorder (FDR) and a cockpit voice recorder (CVR);
- a quick access recorder (QAR);
- a terrain awareness and warning system (TAWS).

The content of the two regulatory recorders was not recovered by the BEA:

- it was not necessary to remove the FDR because the data recorded in the QAR is identical;
- as the aircraft had flown again after the event without the CVR being removed, the voice recording of the event was not kept.

1.11.1 Quick Access Recorder

This is a solid state recorder that contains a copy of the data recorded by the FDR. The recorded data was given to the BEA on 4 October 2013 as a CSV file, before a copy of the QAR raw data content was provided on 7 October 2013.

The information contained in this recorder was decoded from the table referenced m128d6ia_A321, according to the specifications of the manufacturer.

1.11.2 Terrain Awareness and Warning System

- manufacturer: Honeywell (E-GPWS);
- model: E GPWS Mark V;
- type number: 965-0976-003-206-206;
- serial number: 7073;
- application software version: 206.3;
- configuration software version: 206.2;
- terrain base version: 469.

This is a protection system designed to alert crews about a potential collision hazard with the ground or terrain. This system records the alerts it generates. The content of the computer memory was read using the manufacturer's software (EGPWSATP.PRG) on 30 December 2013 by the airline. An operational test was carried out at the same time. The results of the reading and the operational test were transmitted to the BEA on 21 January 2014.

1.11.3 Analysis of QAR parameters

The curves of the event can be found in Appendix 9.

1.11.3.1 Flight path of the aircraft

The 3D flight path of the aircraft, represented in Figures 1, 2 and 3, was calculated from the positioning parameters (latitude and longitude) recorded in the QAR. It was consistent with the statements and the radar tracks recorded by the air traffic service systems.

1.11.3.2 TAWS alerts presented to crew

The analysis of the QAR highlighted three instances of TAWS alerts being emitted during the two approaches:

- the first corresponds to a warning and a predictive alert. However, their exact type cannot be determined by only using the information recorded by the QAR;
- the second corresponds to a basic mode warning. The BEA GPWS simulation module made it possible to identify that all the conditions for the activation of a M1 sinkrate alert were present: the rate of descent of the aircraft was considered too great with respect to its height;
- the third corresponds to a warning from another basic mode. The data recorded by the QAR showed that the second approach to land on runway 30 was carried out with the support of automatic landing systems (ILS). The aircraft was too low as it approached the runway centreline, which corresponds to the conditions for the activation of a M5 glideslope alert.

1.11.4 Analysis of TAWS parameters

The data saved in the E-GPWS computer is not time-stamped. Only an operating time counter exists. The flight was identified based on:

- the alerts sought for;
- the time intervals between these alerts;
- an estimated flight time between the event and the date at which the computer was downloaded.

The data obtained at the end of the download was used to:

- identify the type of warning and alert emitted in the first instance: a warning related to the height of the aircraft relative to the terrain it was going to hit (Terrain ahead), followed by an alert requesting a climb due to this relief (Terrain ahead Pull up);
- validate the type of warnings issued in the two other instances.

1.12 Wreckage and impact information

Not applicable.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

Not applicable.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

Not applicable.

1.17 Organizational and management information

1.17.1 Operator

1.17.1.1 General and organization

ONUR AIR is a Turkish charter company founded in 1992 and which, at the time of the incident, operated 22 Airbuses: nine A320s, nine A321s, and four A330s. It mainly serves Europe. It is SHT-145 approved (Turkish maintenance regulations) and at the time of the incident had filed with EASA for PART 145 approval for the maintenance of these aircraft.

At the time of the Incident, Onur Air held an AOC dated 19 April 2013.

Its operational organization is governed by the Turkish national regulations SHT OPS-1, whose compliance with EU OPS[8] is confirmed by the Turkish authorities. It is structured with type entities and technical managers (non-exhaustive list):

- quality;
- flight operations;
- maintenance;
- SMS;
- training.

The Head of Air Operations is the Vice-President of operations[9]. He directs the company's operational policy and ensures regulatory compliance. He ensures that the Human Factor principles are taken into account. He is in charge of implementing an incident analysis system as well as the appropriate measures in the event of serious incidents.

The training manager is responsible for the training policy within the airline. He is responsible for the standardization of instructors and documentary records relating to the training of pilots. He ensures that the CRM principles are incorporated in pilot training.

The SMS Manager reports directly to the Accountable Manager. He runs a 9-person structure responsible for collecting and analysing all the airline's flights. Three PNT and three engineers analyse all the flights, three deal with the management of the flight analysis. The SMS reference is ICAO doc 9859 AN/474[10]. The SMS director is a captain/TRI and the other two PNT are copilots. He is also responsible for the management of the ASRs and for the appropriate processing of these in case of an incident. He also handles the distribution of security information within the airline. He is independent of the other directors in order to be able to interact independently with his colleagues.

1.17.1.2 Information from Operating Manual

Part A

Incident management

Any incident must be reported to the VP-OPS without delay. Recorders must be preserved in case of a serious incident. Among the notification criteria are manoeuvres to avoid a collision with the terrain and any TAWS alert when the aircraft was closer to the ground than normal.

Aerodrome categories

Aerodromes are divided into three categories from A to C in ascending order of difficulty. The Deauville aerodrome is classified as Class B. In this case, prior to flight, the captain must familiarize himself with the documentation (Jeppesen) of the area and the route and must fill in an RACF[11] which since the incident has become the OFP[12]. He certifies via this form that he has completed this self-training and has acquired sufficient knowledge of the area and the routes.

[8] Council Regulation (EEC) No 3922/91 of 16 December 1991 on the harmonization of technical requirements and administrative procedures in the field of civil aviation.

[9] VP-OPS.

[10] https://www.icao.int/safety/SafetyManagement/Documents/Doc.9859.3rd%20Edition.alltext.en.pdf

[11] Route and Aerodrome Competence Form.

[12] Operational Flight Plan.

GNSS approach approval

At the time of the incident, the airline was not approved for GNSS procedures. It applied for approval to the Turkish Civil Aviation Authority on 10 April 2014.

Conditions for the implementation of visual approaches and visual manoeuvrings (circling)

Visual approaches have a minimum ceiling/visibility of 1,500 feet AAL/5,000 meters. Visual manoeuvres have a minimum ceiling/visibility of 600 feet AAL/2,400 meters. The Operating Manual specifies that visual flight manoeuvres may be carried out when cleared by air traffic control. When weather conditions are such that a visual approach or a visual manoeuvre can be carried out, one procedure is not preferred to another.

The stabilization minima fixed by the airline are:

- for visual manoeuvring: 500 ft AAL;
- in all other cases, including visual approaches: 1,000 ft AAL.

In case of non-stabilization at this minimum, a go-around is compulsory.

During interviews with the airline's management, the latter indicated that the usual practice for flying an approach during a visual manoeuvre is to descend to the MDA. This information does not appear in the Operating Manual and has not been confirmed in writing by the company.

Composition of crews and task sharing

Captains must hold an ATPL and and copilots must have at least a CPL. The age limit for flight crews is 65 years.

The sharing of tasks in the cockpit between the PF and the PM is clearly defined so as to leave the PF as free as possible to fly the aircraft in all flight phases[13].

The PF should pay particular attention to:

- flying the aircraft;
- compliance with SOPs;
- compliance with flight safety instructions;
- speed and altitude constraints;
- respecting airspaces;
- preparing the aircraft for each procedure segment;
- correct use of checklists.

If other activities or a particular event distract the PF from flying the aircraft, s/he must transfer the controls to the PM by saying "you have control" and the PM must confirm "I have control".

[13] Chapter 4.6 “Role of PF/PM and task sharing” in company Operating Manual.

The PM should pay particular attention to:

- monitoring the flight;
- supporting and monitoring the PF;
- observing airspaces;
- monitoring aircraft systems;
- using aircraft systems in coordination with the PF;
- radio communications;
- selecting, identifying and verifying radio navigation aids under the PF's instruction;
- preserving the information necessary for the flight.

The sharing of tasks must be strictly observed. For example, the PF must not handle radio communications unless necessary. The PM must not select radio navigation aids without asking the PF.

Part B

The Operating Manual refers to the FCOM/FCTM for visual manoeuvring, visual approach, TAWS alert and go-around procedures. Extracts from Onur Air's FCOM/FCTM, compliant with Airbus SOPs, are shown below.

The division of tasks between the PF and PM is not described for each action but only generally in Part A of the Operating Manual.

Visual Manoeuvring (Circling)

The secondary flight plan must be completed and include the landing runway. The initial let-down must end at the latest at the MDA with the aircraft configured to flaps in position 3, landing gear down and airbrakes armed. Speed F must be entered as a FAF constraint. When beginning the turn, the crew must select TRK FPA (Bird ON), bank 45° for 30 seconds and maintain speed F. In the downwind leg the crew must activate the secondary flight plan and start CHRONO abeam the threshold. They must fly for 3 seconds for every 100 ft of height. They must then turn with a bank of 25°. When they intercept the approach slope, they must extend flaps to CONF FULL and complete the Landing Check List. The AP must be disconnected and the FDs removed before final descent.

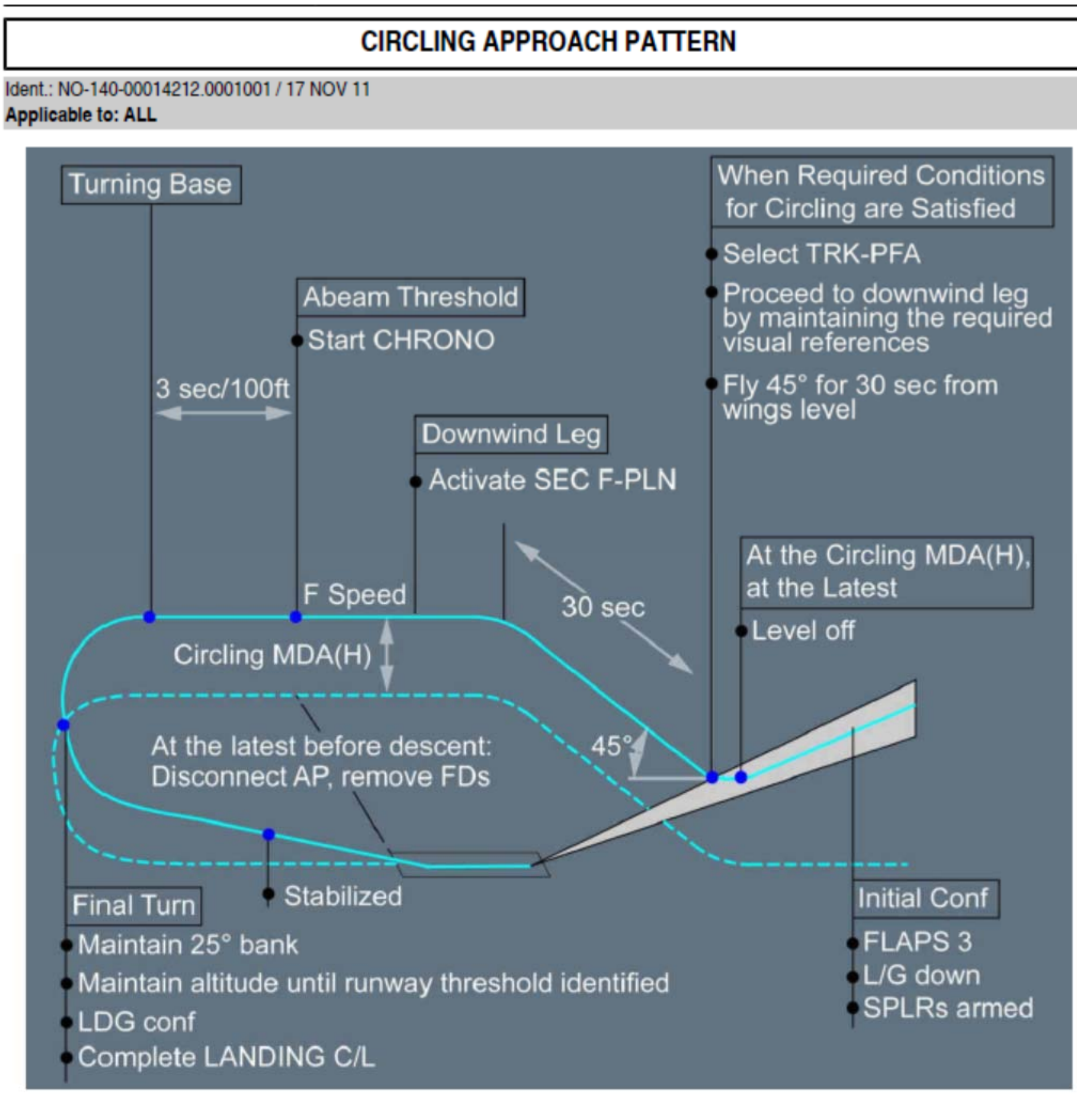


Figure 4: MVL procedure (excerpt from Onur Air FCTM)

Table summarizing MVL actions

MVL segments	Actions
Initial configuration	• Landing runway entered in the secondary flight plan SEC F-PLN • Flaps extended in position 3 • Landing gear down • Airbrakes armed • A/THR activated in SPEED mode • F-SPEED selected
Turn to downwind leg (visual references in sight at MDA at the latest)	• Maintain altitude • Select TRK-FPA mode • Select track at 45° from final approach centreline (turn towards downwind leg) • Start CHRONO as soon as wings are level

MVL segments	Actions
Start of downwind leg (after 30 seconds)	• Select track parallel to final approach centreline (downwind turn)
During downwind leg	• Activate secondary flight plan SEC F-PLN
Abeam the runway threshold	• Start chrono
End of downwind leg (after 18 seconds for Deauville at MDA)	• Select track perpendicular to final approach centreline (base turn)
End of base leg, last turn	• Turn with a bank angle of 25° • Maintain altitude until runway visual references have been clearly identified • Landing configuration • Landing Check List
At latest, before start of descent	• Disconnect AP • Remove FDs • A/THR still on
Final approach	• Stabilisation as early as possible, before 500 ft AAL

A caution specifies that the flight crew must conduct the flight within the circling area, while maintaining required visual references at all times (*cf. figure 5*).

Onurair A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	PROCEDURES NORMAL PROCEDURES STANDARD OPERATING PROCEDURES - APPROACH

CAUTION	The flight crew must conduct the flight within the circling area, while maintaining required visual references at all times.

Figure 5: Circling approach caution message (Excerpt from Onur Air FCOM)

Visual Approach procedure

A Visual Approach is performed at an altitude of 1,500 feet without AP, without FD, with the Bird and Autothrust in managed mode. The ND may be used as an aid for visualizing the flight path but the external visual references must be systematically used.

The aircraft integrates the beginning of the downwind leg. At the beginning of the downwind leg, the approach phase is activated (with the landing runway) in the MCDU, the speed must be managed and the altitude of the go-around must be selected. Flaps are then extended to configuration 1. Abeam the threshold, the crew must start CHRONO for 45 s (+/- depending on wind). The flaps must be set to CONF 2 before the start of the base turn. During the base leg, the aircraft is put into descent and landing gear deployed. The flaps are set to CONF 3 and then FULL while checking the VFE. The approach must be stabilized at 500 ft.

If stabilisation is not achieved before this lower limit, go-around is mandatory.

The FCTM recommends banking 20° in the base turn and a rate of descent of 400 ft/min progressively increasing to 700 ft/min once established on the approach slope. Using the ND as a flight path aid in ROSE NAV mode with the scale set to 10 NM can help the pilot view the flight path.

visual approach

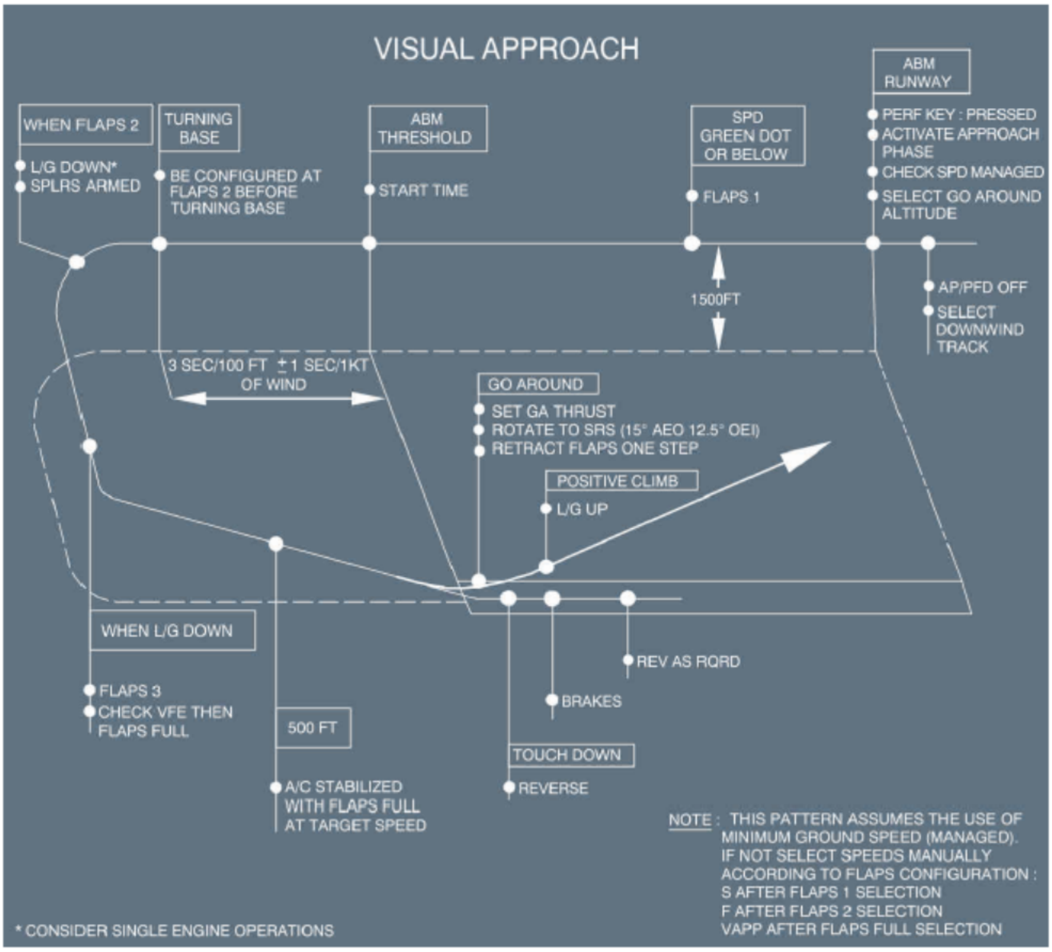


Figure 6: Visual approach procedure (excerpt from Onur Air FCTM)

Table summarizing visual approach actions

Visual approach segments	Actions
Initial configuration before start of downwind leg	• Switch off AP • Remove FDs • Activate Bird • A/THR activated in SPEED mode • Select managed speed • Select track corresponding to downwind leg on FCU • Select altitude of downwind leg to correspond to 1,500 ft AAL on FCU
Start of downwind leg (abeam threshold of runway QFU in opposite direction to landing)	• Select go-around altitude
During downwind leg	• Extend flaps to position 1 as soon as speed permits • Extend flaps to position 2 as soon as speed permits and at latest before end of downwind leg
Abeam the runway threshold	• Start chrono
End of downwind leg (after 45 seconds)	• Base turn
During base leg	• Deploy landing gear • Arm speedbrakes • Extend flaps to position 3 • Extend flaps to fully extended (after checking VFE)
Last turn to intercept runway centreline	• Start turn with initial bank of 20° • Descend with initial rate of descent of 400 ft/min
Final approach	• When established on the approach slope: rate of descent approx. 700 ft/min • Aircraft configured for landing at Vapp before 500 ft AAL (the airline has set the stabilisation lower limit to 1,000 ft AAL)

Reaction to a TAWS alert

TAWS alerts may be considered as cautionary in the following conditions: "When a warning occurs during daylight VMC conditions, if positive visual verification is made that no hazard exists, the warning may be considered cautionary. Take positive action until alert stops or until safe trajectory is ensured."

In all other cases, the initial actions in the event of a "PULL UP" alert are to switch off the AP, pull and maintain full backstick, engage TOGA thrust, check that speedbrakes are retracted and keep wings level.

In the event of a "TERRAIN AHEAD" alert, the procedure is to stop descent and, if necessary, adjust the flight path by climbing or turning.

In the event of a "SINK RATE" – "DON'T SINK" alert, the procedure is to adjust the pitch attitude and thrust to silence the alert.

CAUTION	During night or IMC conditions, immediately apply the procedure. Do not delay reaction for diagnosis. During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert stops, or until a safe trajectory is ensured.

■ **"PULL UP" - "TERRAIN AHEAD PULL UP"**

Simultaneously:

AP....................OFF
PITCH....................PULL UP

Pull to full backstick and maintain in that position.

THRUST LEVERS....................TOGA
SPEED BRAKES lever....................CHECK RETRACTED
BANK....................WINGS LEVEL or ADJUST

Best climb performance is obtained when close to wings level. Then, for "TERRAIN AHEAD PULL UP" only, and if the crew concludes that turning is the safest way of action, a turning maneuver can be initiated.

- **When flight path is safe and the warning stops:**
  Decrease pitch attitude and accelerate.
- **When speed is above VLS, and vertical speed is positive:**
  Clean up aircraft, as required.

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN":**

Adjust the flight path, or initiate a go-around.

■ **" TERRAIN AHEAD":**

Adjust the flight path. Stop descent. Climb and/or turn, as necessary, based on analysis of all available instruments and information.

■ **"SINK RATE" – "DON'T SINK":**

Adjust pitch attitude and thrust to silence the alert.

■ **"TOO LOW GEAR" - "TOO LOW FLAPS":**

Perform a go-around.

■ **"GLIDE SLOPE":**

Establish the aircraft on the glideslope, or switch OFF the G/S mode pb-sw, if flight below the glideslope is intentional (non precision approach (NPA)).

Figure 7: TAWS alert procedure (excerpt from Onur Air FCOM)

Part C

Deauville is a Category B aerodrome (cf. *Part A above*). It is stated that only approaches to runway 30 may be carried out[(14)].

Part D

Part D concerning training was approved on 06 September 2013.

Crews are trained in CRM principles in initial and recurrent training.

As part of currency training, once a year crews follow a computer-assisted theoretical training course, which includes in particular a refresher course on normal operating procedures, including visual approaches and visual manoeuvres. In addition, crews are required to take one flight simulator training session every six months (LPC "License Proficiency Check" or OPC "Operator Proficiency Check"). There are three currency training programs for LPCs and OPCs. Visual approaches are included in the LPC-2, LPC-3, OPC-1 and OPC-3 programmes which means that crews carry out four simulator visual approaches every three years. Visual manoeuvring training is performed at MDA. Flight simulator training in TAWS alerts is mandatory once a year.

(14) This means that the published direct approaches on runway 12 (GNSS approaches) cannot be carried out. On the other hand, all the other approaches for runway 12 are possible (visual manoeuvring after a published approach on runway 30 and visual approach).

1.17.2 Air operations regulations

1.17.2.1 Issues related to crew flight duty time limitations

The laws and regulations in force at the time of the incident include:

- Decree No 3348 (Article 12) concerning agents under the authority of the Turkish Ministry of Transport;
- Decree No 2920 (Articles 100, 101 and 102) of the Turkish Civil Aviation Code;
- Turkish Air Transport Regulations (SHY-6A, Articles 50 and 108).

The provisions of these laws and regulations are reiterated in the airline's Operating Manual Part A.

The flight duty time corresponds to any period during which an individual works on an aircraft as a crew member. The time starts from the moment when the aircraft begins moving for the purpose of a flight until it comes to a complete stop on the tarmac at the arrival aerodrome ("block time"[(15)]).

(15) The time between when an aircraft leaves its parking place with the intention of taking off and when it comes to a halt in its designated parking position and all engines or propellers are stopped.

Flight time limitations are as follows:

- 36 hours per week (7 consecutive days);
- 110 hours per calendar month;
- 300 hours per quarter (three consecutive calendar months);
- 1,000 hours per calendar year.

At the time of the incident, there were differences between the laws and regulations in force in Turkey and those in Europe.

European flight time limitations are defined in the Air Ops Regulation (EU) No 965/2012[16], Article 8, which refers to Article 8(4) and Subpart Q of Annex III to Regulation (EEC) No 3922/91. It states that the operator shall ensure that the total block times of the flights on which an individual crew member is assigned as an operating crew member does not exceed 900 block hours in a calendar year and 100 block hours in any 28 consecutive days.

[16]Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

1.17.2.2 Crew training for GNSS approaches

ICAO Doc 9613, the Performance-based Navigation (PBN) manual states that operators must have a pilot training programme addressing RNAV (Area Navigation) or RNP (Required Navigation Performance) procedures to carry out this type of operation. It is not required that training in the preparation and flying of RNAV (GNSS) approaches is included in initial training for instrument flight procedures. In this case an additional RNAV(GNSS) approved training course is required for all pilots carrying out this type of approach.

By 25 August 2020[17], under European regulations, PBN training will become mandatory in initial instrument flight training.

[17]Commission Regulation (EU) No 2016/539 of 6 April 2016 amending Regulation (EU) No 1178/2011 as regards pilot training, testing and periodic checking for performance-based navigation.

1.17.3 Air traffic regulations

1.17.3.1 Visual manoeuvring

The manual containing the criteria for drawing up instrument flight procedures (PRO) defines the expression "visual manoeuvring" as the visual flight phase following completion of an instrument approach, to bring the aircraft into position for landing on a runway which is not suitably located for a straight-in approach (i.e. the alignment or descent gradient criteria cannot be met). A distinction is made between visual manoeuvring (circling) and visual manoeuvring using prescribed track (VPT). An area called the "visual manoeuvring area" is an area in which obstacle clearance is taken into consideration for visual manoeuvring.

ICAO Doc 8168 V1 states that a circling approach is a visual flight manoeuvre. The conditions differ in each case because of variables such as runway configuration, final approach path, wind speed and meteorological conditions. It is therefore not possible to design a single procedure that can be used in all circling approach scenarios. After initial visual contact, the basic assumption is that the runway environment must remain visible while the aircraft is at minimum descent altitude or height (MDA/MDH) for a circling approach. The runway environment notably includes the threshold lights, approach lighting or other markings associated with the runway. If visual contact is lost during a circling approach following an instrument approach procedure, the specified missed approach procedure for this procedure shall be applied. The transition from the visual manoeuvring (circling approach) to the missed approach procedure must start with a climbing turn inside the visual manoeuvring area in the direction of the landing runway, in order to climb back to the circling approach altitude or higher, immediately followed by interception and execution of the missed approach procedure.

1.17.3.2 Visual approach

At the time of the accident, French Air Traffic Regulations RCA 3[18] and ICAO doc 4444 Procedures for Air Navigation Services, defined a visual approach as an approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

RCA 3 states that an aircraft in IFR flight may not carry out all or part of a published or approved instrument approach procedure in order to carry out a visual approach with visual reference to the terrain if the following conditions are met:

- the pilot sees the aerodrome;
- the pilot can maintain visual contact with the ground;
- the pilot considers that the visibility and ceiling allow a visual approach and that landing is possible;
- at night, the ceiling is not below the minimum sector altitude or, where appropriate, the altitude of the flight path to join the runway circuit;
- in controlled airspace, the pilot has received clearance for a visual approach;
- the pilot complies with any specific instructions for the visual approach to the given aerodrome and with the manoeuvre restrictions in the direction of the runway issued by the air traffic control service.

A pilot may conduct a visual approach even in the absence of an instrument approach procedure.

When performing a visual approach, the aircraft continues to benefit from air traffic services corresponding to the airspace class in which it is flying.

A visual approach clearance may be requested by the pilot or proposed by the controller.

The conditions in which the controller may propose a visual approach, particularly weather conditions, are established by the competent authority of the air traffic services.

The visual approach clearance may be subject to the pilot's acceptance of the manoeuvre restrictions in the direction of the runway issued by the air traffic control service, irrespective of any specific or local instructions pertaining to the visual approach at the given aerodrome.

The air traffic control service shall continue to ensure the applicable separation in the given airspace between the aircraft which has been given the visual approach clearance and the other aircraft.

1.17.3.3 Vectoring prior to visual approach

Clearance for visual approach will only be granted once the pilot has reported that he can see the aerodrome, at which time vectoring is usually terminated.

[18] French decree of 6 July 1992 regarding procedures for air traffic service providers for aircraft operated as general air traffic.

1.17.3.4 Interruption or cessation of radar control

RCA 3 states that an aircraft, which has been notified that the radar control is being ensured in its respect, must be notified immediately when the radar service is interrupted for any reason or ceases to be ensured.

More generally, ICAO doc 4444 defines "radar contact" as the situation in which the radar position of a given aircraft is seen and identified on a situation display. It states (paragraph 8.6.7.1) that an aircraft which has been informed that it is provided with ATS surveillance service should be informed immediately when, for any reason, the service is interrupted or terminated.

1.17.3.5 Minimum Descent Altitude

RCA 3 defines the minimum descent altitude/height (MDA/H) as the altitude or height specified, in a conventional approach or an indirect approach, below which descent must not be performed without visual references.

ICAO doc 8168 Procedures for Air Navigation Services defines the minimum descent altitude (MDA) or minimum descent height (MDH) as a specified altitude or height in a non-precision approach or circling approach below which descent must not be made without the required visual reference. An associated note defines the “required visual reference” as that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.

1.17.3.6 ATIS

Instruction No 10120 of 16 March 1993 on the operating instructions for the Automatic Terminal Information Service (ATIS) indicates that the information disseminated by ATIS is updated as soon as a significant change occurs. A non-limiting list defines specific criteria for renewing messages. A QFU change is not included in this list. RCA 3 also states that the approach control body indicates the instrument approach procedure in service at the first contact or by using the ATIS and that the runway in use shall be indicated as soon as possible after the communication between the aircraft and the approach ATC is established if it is different from that indicated on the ATIS.

1.17.3.7 Choosing QFU

In accordance with RCA 3 paragraph 5.3.2.2.1 and paragraph 5.3.2.2.2 and ICAO doc 4444 paragraph 7.2.2, the controller may decide on the choice of the QFU by taking into account, in particular, wind speed and direction (no threshold value defined), the position of the sun, and the approach aids available.

RCA 3 states that, in principle, an aircraft takes off or lands into a headwind unless safety or air traffic conditions indicate that another direction is preferable.

If the runway in use is not considered satisfactory by the PF, the latter may request to use another runway. However, this clearance shall be granted only if it is compatible with the other aircraft operating in the aerodrome traffic at a given moment, except in cases of emergency.

ICAO Doc 4444 states that normally, an aircraft will land and take off into wind unless safety, the runway configuration, meteorological conditions and available instrument approach procedures or air traffic conditions determine that a different direction is preferable. In selecting the runway-in-use, however, the unit providing aerodrome control service shall take into consideration, besides surface wind speed and direction, other relevant factors such as the aerodrome traffic circuits, the length of runways, and the approach and landing aids available.

1.17.3.8 Priority between arrival and departure

According to RCA3 paragraph 5.6.1 and ICAO doc 4444, an aircraft landing or in the final stages of an approach to land shall normally have priority over an aircraft intending to depart.

1.17.3.9 Visual monitoring by controllers of aircraft in aerodrome circuits

ICAO doc 4444 defines the air traffic control service as a service provided for the purpose of:

- preventing:
  - (1) collisions between aircraft;
  - (2) collisions on the manoeuvring area between aircraft and obstacles.
- expediting and maintaining an orderly flow of air traffic.

It is stated that the objectives of the air traffic control service, as defined in Appendix 11 to the Convention on International Civil Aviation, do not include prevention of collision with terrain[19]. The procedures prescribed in this document do not relieve pilots of their responsibility to ensure that any clearances issued by air traffic control units are safe in this respect.

[19] Doc 4444 Foreword paragraph 2.1, note 2.

ICAO doc 4444 states that aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between:

- aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits;
- aircraft operating on the manoeuvring area;
- aircraft landing and taking off;
- aircraft and vehicles operating on the manoeuvring area;
- aircraft on the manoeuvring area and obstructions on that area.[20].

[20] Paragraphs 7.1.1.1 and 7.1.1.2.

Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system when available. The control of aerodrome traffic is principally based on the aerodrome controller's visual observation of the manoeuvring area and the vicinity of the aerodrome.

1.17.3.10 Differences between French regulations and the ICAO

Unlike ICAO documentation, the RCA3 does not explicitly state that the aerodrome controller must conduct a visual watch of all the aircraft in the circuit. However, the AIP does not specify a difference between the French regulations and doc 4444 with respect to the monitoring and visual watching of aircraft in the aerodrome circuit.

1.17.4 Air Traffic Services (information from the Deauville approach control centre Operations Manual)

1.17.4.1 Manning control tower cab

Depending on traffic requirements, the Control Tower Manager, or the PC Controllers[21] working together, in the absence of the Tower Manager, shall adopt a grouped or ungrouped configuration.

[21]Premier Controller rating means the controller is qualified for all the centre control positions.

1.17.4.2 Choice of runway in use

The runway in use designated by the aerodrome controller is considered to be the one that, at a given time, is most suitable for take-offs and landings.

Information other than wind (strength and direction) to be considered are:

- usable approach and landing aids;
- position of the sun;
- density of traffic;
- direction of traffic arrival;
- initial climb gradient;
- instructions concerning the aerodrome environment (overflight of city, nuisances, etc.).

It is stated in the Deauville Operations Manual that the change of QFU requires the updating of the ATIS. Aircraft already in contact (arrival or departure) will be informed of the change. The vehicles near the runway (maintenance, works, etc.) will also be notified. The appropriate lighting will be implemented.

If the runway in use is not considered satisfactory by the captain, the latter may request the use of another runway. However, this clearance shall be granted only if it is compatible with the other aircraft operating in the airport traffic at a given moment, except in cases of emergency.

The approach will be informed of any changes to the runway.

The ground and tower controller section of the Deauville Operations Manual states that the Standard Instrument Departure Procedures (SIDs) on runway 12 are preferred.

1.17.4.3 Management of ATIS

If a change of QFU occurs, it is necessary to modify the current ATIS and to ensure at the first contact, that the pilots have received up-to-date information.

The information is updated as soon as a significant change occurs, in particular for any indicated variation in the following:

- wind: ± 30° or 5 Kt;
- VIS: exceedance of VMC limit values;
- present weather: appearance/disappearance of rain, snow, hail, storm, squall;
- clouds: all changes;
- temperatures: ± 1°C;
- pressure: ± 1 hPa.

In addition, the information will be renewed hourly to ensure its credibility.

1.17.4.4 Working method for visual approach

The visual approach is defined in RCA 3 paragraph 4.3.3 as an approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

The visual approach clearance can be given after agreement between the 2 bodies (approach and tower). A visual approach clearance may be requested by the pilot or proposed by the controller to allow an aircraft in IFR flight not to perform or not to complete a published instrument approach procedure by carrying out an approach in visual reference to terrain.

The visual approach clearance may be subject to the pilot's acceptance of the manoeuvre restrictions in the direction of the runway, issued by the air traffic control service, irrespective of any specific or local instructions pertaining to the visual approach at the given aerodrome.

At Deauville, the conditions under which the controller can propose a visual approach are as follows:

- visibility greater than five kilometres;
- ceiling at least equal to the minimum sector altitude;
- by day only.

The pilot can only accept a visual approach if the conditions for executing the visual approach are met at the time of the visual approach clearance.

1.17.4.5 Airspaces and infrastructures

A class-D TMA 1, 2 and 3 control area is managed by the Deauville approach.

TMA 1, 2 and 3

- the Deauville class-D TMA 2 extends from 2,500 ft AMSL to FL 085;
- the TMA is managed by the Deauville Approach;
- radio equipment: Deauville Approach, frequency 120.350 MHZ.

A Class D control area is associated with the Deauville aerodrome.

The lateral and altitude limits are the following:

- ❒ lateral limit (see Deauville-Normandie area chart in Appendix 10);
- ❒ vertical limit: SFC/2,500.ft AMSL.

The intensity of the runway lighting can be selected by the controller according to the meteorological conditions described in the table below.

Brightness to be displayed **Weather conditions**	**Lighting off**	**B1≈1%**	**B2≈10%**	**B3≈30%**	**B4≈100%**
Night	No	V ≥ 1,500	800 ≤ V < 1,500	200 ≤ V < 800	V < 200
Very dark day	V ≥ 2,500	1,500 ≤ V < 2,500	800 ≤ V < 1,500	400 ≤ V < 800	V < 400
Normal day	V ≥ 2,500		1,500 ≤ V < 2,500	800 ≤ V < 1,500	V < 800
Bright day	V ≥ 5,000		2,500 ≤ V < 5,000	1,500 ≤ V < 2,500	V < 1,500

V = value in meters of VIS or RVR

NOTES: For horizontal visibilities greater than 800 m, during the night period, the light intensity of the approach lights may be reduced by one brightness unit in order to reduce the haze effect.

RVRs below 800 m are assumed to be determined using visibility meters (the RVR value is then based on a reference light intensity of 10,000 Cd).

Brightnesses B1, B2, B3 and B4 correspond to an increasing variation in the luminous intensity of the lamps of 1 to 100 %.

1.17.4.6 Radar means

An IRMA 2000, consisting of a display screen and a mouse, has been installed in Deauville since 2007 on both the tower west approach and east approach positions. The radar data is provided by a single source, the ACC/W RDPS, from the ground to FL325.

The tag associated with each radar plot continuously displays the flight level of each aircraft. This is an altitude relative to the 1,013 hPa setting. An ALTI key (pushbutton type) instantly displays the QNH altitude of the aircraft.

The Minimum Radar Safety Altitudes (AMSR) are applicable to IFRs and VFRs (in the case of radar vectoring, for example under radar assistance). The AMSRs are different from the minimum sector altitudes (radius 25 Nm) of published instrument procedures, also available on IRMA.

The AMSR values[22] are:

- 3,000 ft north east of Le Havre;
- 2,200 ft or 2,900 ft south of Caen;
- 2,000 ft everywhere else.

The Deauville approach uses radar surveillance, radar assistance and radar vectoring to provide the control, flight information and alert services:

- radar surveillance: consists in using the radar to better know the position of the aircraft;
- radar assistance: consists in using the radar to provide aircraft with information on their position or deviations from their track;
- radar vectoring: consists in using the radar to provide aircraft with specified headings enabling them to follow the desired flight path.

The Deauville airfield is not equipped with a Minimum Safe Altitude Warning system (MSAW)[23].

[22] cf. appendix 11 Deauville AMSR chart.

[23] In visual approach, there is no mandatory requirement to provide the MSAW service (cf paragraph 2.2.2.3.4 RCA 3). If an MSAW system had been available, the flight would no doubt have been subject to manual inhibition as soon as it was cleared for a visual approach (DSNA / DO 5951/08 states that in a visual approach the flight must be the subject of a manual inhibition if there is no inhibition area in the parameter settings).

1.17.4.7 Safety event notification procedures

The Deauville Operations Manual states that any occurrence in which an accident appears to have been narrowly avoided in the context of an aircraft approaching the terrain or an obstacle, such as a quasi Controlled Flight Into Terrain (quasi CFIT), must be the subject of an Event Notification Form (FNE). In addition, it shall be notified to the Operations Duty Officer (RPO) as soon as possible and no later than three hours after the occurrence of the event.

The Tower Manager monitors the occurrence of events and reports any serious dysfunction or incident to his/her immediate superior or to the Operations Duty Officer. Since the specific manning of the Control Tower Manager position is not provided for in the duty chart, some of these tasks cannot be ensured or supervised in real time by the Tower Manager. In this case s/he will be assisted by the Air Traffic Head, his/her deputy or a PC controller.

1.18 Additional information

1.18.1 Witness statements

1.18.1.1 Captain

The following elements are based on the report transmitted by the captain to his airline.

Air traffic control cleared the descent late and transferred the aircraft too high for a landing on runway 30, 20 NM from the aerodrome. The runway in use was changed and the controller requested a GNSS approach on runway 12. The captain requested and was cleared to carry out a visual approach.

The meteorological information available to the crew was as follows: a visibility of 2,600 m, a temperature of 15 degrees and a dew point of 15 degrees. At the end of the approach, visual contact with the runway was lost due to the sun. At this point, as the aircraft continued its descent, a terrain warning was triggered. After regaining altitude, in the final approach, visual contact with the runway was restored but the aircraft was too high. During the descent, a new sink rate warning was triggered. The captain then assessed the situation: the runway was short, the aircraft was high, and the sunlight conditions were unfavourable. He decided to regain altitude and carry out a approach on runway 30.

Visual contact with the ground was maintained throughout the descent, whereas the runway was lost from sight several times. At no time was safety jeopardized. The report was produced taking into account the triggering of the alerts, for information.

The following elements were collected during an interview with the captain

The captain was flying (PF). It was his first flight to Deauville. The flight proceeded normally until the middle of the descent. Given the ATIS, the crew carried out a briefing for an ILS approach on runway 30. The visibility was very good and the sky clear.

Due to traffic, the aircraft descended 10 NM too late. The captain considered that the performance of the aircraft still enabled the descent but under less comfortable conditions for the passengers.

The Deauville approach announced a change of runway because traffic was waiting to take off from runway 12. Since the crew had not been trained in GNSS procedures, they requested a visual manoeuvre. At this time, the captain's strategy was to follow an ILS approach on runway 30 to 1,100 ft, the minimum descent altitude, i.e. a height of 600 ft, and then perform a standard visual manoeuvre for runway 12. The captain indicated that he had to abandon this strategy when the approach controller requested he turn right to allow the departing aircraft to take off.

The crew saw the runway at a distance of about 20 NM from the facilities. The aircraft was stabilized at an altitude of 3,000 ft. The captain estimated that the right turn started too early. Then, he descended to an altitude of 1,100 ft. Just before turning into the base turn, the controller requested that they extend the downwind leg because of the traffic taking off. The crew agreed, considering that safety was not compromised because they could see the runway very well in spite of a little mist, the aircraft was flying over the sea and there were no clouds.

The captain lost sight of the runway but assumed that the controllers at the Deauville tower were managing the situation and could see him visually or by radar. During the last turn, he maintained eye contact with the coast, but not with the runway. He began the descent at a vertical speed between 300 and 500 ft/min. While searching for the runway, the TAWS was triggered. The captain indicated that it was a "terrain ahead" alert, which called more for caution than for immediate reaction like the "terrain" alert and, as a result, this alert could be ignored when the ground was in sight. A second alert was triggered: "terrain ahead pull up". The captain thought it was a false alert. He reported that he had already been quite often confronted with this type of false alert. He remembers reading, at this moment, a minimum altitude of 680 ft. He asked the copilot to confirm that he could see the ground and that the aircraft was separated from any obstacle and then decided to proceed with the landing.

He nosed-up the aircraft smoothly and climbed to an altitude of about 1,000 ft. The crew could see the runway in front of them on the right. The pilot aligned the aircraft on the runway centreline but considered he was too high for a safe landing. He decided to abort the landing and requested a visual approach for runway 30.

The captain specified the following:

- he was familiar with the visual approach and visual manoeuvre procedures. He had already performed more than a hundred procedures of this nature;
- he decided on a landing on runway 30 because it seemed more suitable in his opinion;
- at no time did he feel that he was taking a risk;
- he had already flown many times with the copilot;
- in the case of a counter-QFU landing, he saw no benefit in carrying out a visual approach. He preferred a standard visual manoeuvre procedure, which consists in using the ILS down to the minimum descent altitude and then in following a circuit pattern;
- he felt that he had been pressured into carrying out a visual approach by the controllers. He accepted because the visibility was greater than 10 km.

1.18.1.2 Copilot

The copilot claimed his retirement rights in the days following the incident. He refused to participate in the interviews proposed by the BEA.

The following elements come from the report transmitted by the flight copilot to his airline and are translated as follows:

In accordance with the ATIS, we were supposed to carry out an ILS approach on runway 30 followed by a left-hand MVL for a landing on runway 12. During the downwind leg, the Deauville ATC wanted us to extend the downwind leg, we continued to follow the downwind leg until he asked us to turn left.

During the base turn, the captain started the descent, I displayed the runway heading 119 at the captain’s request.

The captain asked me if I could see the runway, for a brief moment during which we could not see it. During our turn to the QFU of the runway, we had a Sink Rate alert.

We pulled on the control column, in accordance with the ND, the runway centreline was a little to our right, we resumed altitude, turned right and saw the runway in front of us. The sun was in the south-east, almost on the runway centreline and the visibility was "fuzzy", "not clear".

The captain decided to go-around and informed the tower that we were going to land on runway 30, we obtained clearance for runway 30.

After landing, and a half-turn at the end of the runway, we accessed the tarmac by taxiway B, and parked the aircraft in the parking area.

1.18.1.3 Staff in control tower of Deauville aerodrome

All the control positions were grouped together and managed by a pair: one ATC performed the coordinator function and the other, on the radio, the tower ATC, approach ATC and tower manager functions.

The tower manager ATC said that the decision to change the runway in use was very probably due to the fact that the wind appeared to be well established in the east. As an aircraft was about to take off on runway 12, he felt it was better to change the runway in use in order to avoid having Onur Air fly a holding pattern. He proposed a GNSS approach on runway 12 to the crew, which made it possible to separate the flight paths of the two departing and arriving aircraft. However, he had to change his strategy when the crew of the Onur Air flight requested a visual approach. He then decided to wait until the arriving aircraft was in the downwind leg to clear the departing aircraft for take off.

The controllers saw the Onur Air flight as it made its right turn to the downwind leg and kept eye contact until the end of its downwind leg. Their attention then shifted to the aircraft taking off.

When his attention returned to the Onur Air flight, the coordinator saw the aircraft approaching, at a very low altitude, off-centre in relation to the runway and with a pitch-up attitude. He informed his colleague who asked the crew if they were performing a go-around. The aircraft then flew a low pass vertical to runway 12. Finally, the controller responded favourably to the request for clearance to land on runway 30, considering that he should not interfere with the control of the flight and that the pilot was in the best position to choose an option.

The controllers could not remember with certainty the lighting status of runway 12. As a general rule, under day conditions, the lighting is switched on at position B2 and the flashing lights at the displaced threshold are switched off.

Neither of the two ATCs was aware of the seriousness of the event and did not consider it necessary to notify it.

1.18.1.4 Staff in the lookout at the Villerville sea tower

The witness was located in the sea tower lookout, at an altitude of 420 ft. He saw the aircraft flying at low altitude north-east of the sea tower, with a relative bearing of about 30 degrees to true north. The aircraft made a turn and then aligned on the sea tower with a relative bearing of about 310 degrees. The witness observed the aircraft with binoculars and felt that the aircraft was below his observation point, and about to land. The aircraft flew a low pass vertical to the sea tower and then made a “dog leg” manoeuvre.

The sea tower staff immediately reported the incident by telephone to the Gendarmerie des Transports Aériens (air transport police) at Deauville aerodrome.

1.18.2 Measures taken by aircraft manufacturer since incident

The Airbus FCOM manual (cf. Appendix 8) was amended in March 2016.

In contrast to the procedures in force on the day of the incident, the TAWS red alerts such as "Pull up", "Terrain ahead pull up" and "Obstacle ahead pull up" must now systematically lead to the following initial actions: disconnect AP, pull to full backstick, thrust lever to TOGA, check that the airbrakes are retracted and keep the wings level. They are no longer only considered as cautions when the flight is by day in VMC and the crew can see obstacles.

Procedural adjustments based on environmental conditions have been retained for amber TAWS ("caution") alerts.

The TAWS alert procedure update was released by Airbus to operators in March 2016. Onur Air's training department issued this update to pilots on 22 April 2016 by e-mail. The content of the FCOM and QRH was updated on 10 May 2016.

1.18.3 Previous events related to flying a visual approach

The BEA conducted searches for similar events in the BEA and EASA ECCAIRS databases[24] as well as from the NTSB and ICAO databases. The search criteria were as follows: event after 1 January 2000 occurring to an aircraft engaged in commercial air transport on approach or landing and with key words relating to visual approach, MVL, visual manoeuvring or TAWS alerts.

Six accidents[25] related to flying a visual approach, the details of which are given in Appendix 14 were subject to safety investigation reports.

The investigation reports show that these accidents result from inadequate speed and/or approach slope management associated with the inability of the crew to decide to abort the unstabilized approach.

1.18.4 Studies on non-precision approaches

1.18.4.1 CAASD[26] statistical analyses on precision/non precision approach safety level

In 1997, the CAASD carried out a statistical analysis[27] on the safety benefits of precision approaches (PA) versus non-precision approaches (NPAs). This analysis is based on a study conducted by the Flight Safety Foundation (FSF) based on the 1984-1993 period in the ICAO member states, the data from the NTSB accident database for the 1986-1996 period, and a cost-benefit analysis of the WAAS[28] by the team in charge of implementing GNSS navigation. It showed that 5% of the approaches made by airlines were NPAs and that the risk of accidents in NPA is 9 times higher than in PA. It concluded that, for public transport, PAs were safer than NPAs and that 68 % of CFITs could have been avoided if a PA had been available.

[24] European Coordination Centre for Accident and Incident Reporting Systems.

[25] This list is not exhaustive.

[26] Research and Development Centre funded by the United States federal government and operated by the MITRE Corporation, founded in July 1958. It provides support and technical advice to the FAA.

[27] "Safety Benefits of Precision vs Non Precision Approaches", CAASD, MITRE, 22 September 1997.

[28] Air navigation system developed at the request of the US administration to improve the performances of the GNSS (Wide Area Augmentation System).

In 1999, the CAASD carried out a new study[29] on accidents occurring during a NPA. One of the objectives of this study was to assess the extent to which a PA improved safety compared to a NPA. It concluded that, from a global perspective, PAs were significantly safer than NPAs for airlines. More specifically, in North America, the accident risk was six times higher for NPAs than for PAs although only 5% of US approaches were NPA.

[29]"An evaluation of Accidents Involving Nonprecision Approach", CAASD, MITRE, October 1999

1.18.4.2 Presentation by Boeing during 26th International Congress of Aeronautical Sciences

In 2008, during the 26th International Congress of Aeronautical Sciences (ICAS 2008), Boeing presented a paper[30] highlighting the value of performing precision approaches or approaches similar to precision approaches (PLAs - Precision Like Approaches).

It is stated in this document that the FSF has highlighted the risks of NPAs in various publications and, in particular, in an ALAR guide[31] in which it is shown, for example, that more than half of the accidents and serious incidents involving CFITs occurred during NPAs. Other studies have shown that NPAs are five times more dangerous than PAs. These results have led to a call to accelerate the worldwide implementation of constant angle or PLA approaches and the training of pilots in these procedures.

[30]"The safety gained by equipment and procedures used to perform constant angle approaches", Captain Dave Carbaugh, The Boeing Company, ICAS 2008 paper.

[31]"Approach and Landing Accident Reduction.

Boeing stated in their paper that non-precision approaches are the most difficult to carry out and require a much higher level of concentration and teamwork than for an ILS approach. There are about a dozen different techniques for NPAs in contrast to ILS precision approaches. Many factors can affect unprepared pilots when a NPA is required, including:

- a descent too early: the study of NPA incidents shows that the highest risk comes from a premature descent;
- an ATC that clears the descent too early or requests a turn too late or keeps the aircraft too high. This leads the crew to precipitate the flying of the approach;
- a late change in the runway;
- poor teamwork that dramatically increases the risks in a non-precision approach;
- failure to comply with SOPs for the approach and landing which leads to incorrect configurations, excessive speeds or excessive descent rates through 1,000 and 500 feet, and violation of minimum altitudes.

Finally, the impact of the arrival of the GNSS in the 1990s is addressed in the document. It is reported that with its extremely high navigation performance and the ability to monitor its integrity, the GNSS system has strongly influenced the way non-ILS approaches are performed. Two methods are recommended today for these non-ILS approaches depending on the geometry of the approach and the aircraft equipment. The first method is to use the autopilot final approach modes (LNAV/VNAV). This method is applicable for all approaches defined in the FMS navigation database. It makes it possible to follow a PLA. The second method is to use the FLS - IAN modes. The FLS modes on Airbus and IAN on Boeing apply to all non-ILS direct approach procedures defined in the FMS navigation database. The main aim of these modes is to carry out these approaches as if they were an ILS, i.e. the procedures followed by the crews are almost identical: same sequence of actions, same checks and same displays. According to Boeing, both these methods make it possible to assert that all non-ILS approaches should no longer be considered NPAs. Non-ILS approaches performed as ILS approaches should be considered as PLAs. This explains the change of vocabulary concerning NPAs to "ILS-like" then PLA. Boeing has said that since the accident rate in NPAs is four to eight times higher than in PAs, it makes sense for an airline to give priority to PLAs

1.18.4.3 PARC[32]/CAST[33] report on operational use of flight path management systems

In 2013, a FDAWG[34] consisting of PARC and CAST members produced a report[35] on the operational use of flight path management systems.

Several themes for improving safety were highlighted, including the use of aircraft in manual mode. Weaknesses were particularly evident in the transition phases from automatic mode to manual mode and in the definition, improvement and currency of manual flight.

In particular, during the interviews and other contacts, the Working Group noted a great deal of concern about manual flight training and currency particularly in certain phases of flight such as visual approaches or crosswind landings.

Several safety recommendations were issued in the report, including one concerning the use of aircraft in manual mode. The goal was to develop and implement standards and guidelines for the maintenance and enhancement of knowledge and skills, notably:

- ❒ pilots must have the opportunity to refine their knowledge and practice manual flying;
- ❒ training and the proficiency check should directly include manual flying;
- ❒ the operators' flight path management policy must support and match the training and practices associated with the type of aircraft.

[32] PARC, a platform for the aviation community of the United States, advises the FAA in relation to regulations and especially facilitates the transition towards a national air space system based on PBN.

[33] CAST (Commercial Aviation Safety Team) is a joint government-industry initiative, co-chaired by a representative from United Airlines and from the FAA. Its objective is to reduce the risk of fatalities in commercial aviation in the United States and to promote new governmental and industrial safety initiatives around the world.

[34] Flight Deck Automation Working Group6.

[35] "Operational use of flight path management systems", PARC, CAST, FDAWG, 5 September 2013.

1.18.4. DGAC statistical study on safety levels in precision/non-precision approaches

In 2016, the DGAC carried out a comparative statistical study on the safety level of precision approaches compared with other types of approaches. The study examined the total number of accidents in approach from 2009 to 2013 around the world.

A survey was conducted among French commercial operators. It shows that for these operators in 2016, the types of approach can be broken down as follows:

- precision approach: 75 %;
- visual approach: 20 %;
- instrument non-precision or GNSS approach: 5 %.

When comparing the data from the statistical study and the survey and using a 1997 MITRE calculation method from the United States, it appears that over the 2009-2013 period, the risk of accidents in instrument non-precision and GNSS approaches is at least 7 times that of precision approaches.

1.18.5 Performance of a GNSS procedure on Airbus

On Airbus, GNSS procedures are NPAs (conventional approaches). They can be performed either in selected mode (NAV-FPA with the bird) or in the FINAL APP. In the latter mode and if the procedure is defined, it is a PLA. The PFD displays the approach as if it were an ILS approach. The two main advantages with the FINAL APP mode are: the approach is performed as an ILS with, in addition, the approach slope being monitored by the crew and it is direct, facing the runway and not facing the counter-QFU.

1.18.5.1 NPA technique on Airbus A321

The Airbus Crew Training Manual describes the procedure for NPA, in particular the R-NAV approaches (see Appendix 3).

The general strategy for NPAs is to carry them out as if they were an ILS ("ILS alike") with the same mental picture or image and a similar procedure. Rather than being linked to an ILS beam, the AP/FD guidance modes and the associated monitoring data are linked to the FMS F-PLN consolidated by raw data. This explains why crews must check the validity of the FMS data, the accuracy of the FMS, the F-PLN (lateral and vertical), and the proper sequencing of the navigation legs. The use of the AP is recommended for all NPAs as this reduces crew workload and facilitates monitoring the procedure and flight path.

Lateral and vertical managed guidance (FINAL APP) can be used if the following conditions are met:

- the approach is defined in the navigation database;
- the crew has crosschecked the approach with the published procedures;
- the final approach has not been modified by the crew.

Table summarizing actions to be performed in GNSS approach procedure

Key points in GNSS approach procedure	Actions to be taken
Initial approach	• The AP/FD modes to be used and the parameters to be monitored during the approach depend on the accuracy of the navigation. • If the GPS PRIMARY LOST message appears, the crew must abort the approach if the visual references are not sufficient. • It is recommended to use the FD bars for approaches using vertical guidance (FINAL APP). • The FPV ("bird") is used for approaches using the FPA as guidance.
Intermediate approach before intercepting the final approach path	• It is essential to have a correct F-PLN. The lateral navigation modes always guide the aircraft according to the active F-PLN leg and the vertical modes ensure that the vertical deviation VDEV is always zero (VDEV is calculated using the remaining F-PLN to destination). • The crew monitors the correct sequencing of the F-PLN, especially if the HDG mode is selected and checks that the TO WPT, displayed in the upper right corner of the ND, is the most likely and consistent. • When on radar vectors for interception (cf. figure 8), the crew uses DIR TO FAF with RADIAL INBND. This simulates an ILS beam that will be intercepted by the lateral guidance modes. In this case, the VDEV is realistic, XTK is relative to the beam and the ND displays are complete.

Key points in GNSS approach procedure	Actions to be taken
Intermediate approach, cleared for interception of the final approach path – managed approach	• Press APPR on FCU. • On the FMA, APP NAV is activated and FINAL is armed. • The VDEV display ("brick") is activated and represents the vertical deviation. • The conditions for engaging the FINAL APP mode must be met. (A white arrow on the ND at the FMS prediction point for engaging the FINAL APP mode indicates that all conditions are not met).
Intermediate approach, cleared for interception of the final approach path – selected approach	• Select the correct TRK on the FCU. • Once established on the final flight path, the selected track compensates for the drift. • The intercept path of the final approach is monitored with the corresponding raw data.
Final approach	• It is essential that the crew does not modify the final approach on the F-PLN page of the MCDU.
Managed final approach	• FINAL APP is activated and the FMS manages the lateral and vertical guidance. • The crew monitors the final approach using the start of descent symbol on the ND, the PFD FMA, the VDEV, the XTK and the F-PLN on the ND.
Selected final approach	• The FPA must be displayed on the FCU at the latest 1 NM before the start of final descent point.
On reaching minima	• When the MDA is reached, the altitude value is displayed in amber. • If the visual acquisition conditions are not present, the crew flies a missed approach. • If the visual conditions are present, the AP and FDs are disconnected, the "bird" and the track corresponding to the runway QFU are selected, and the approach continues as a visual approach.

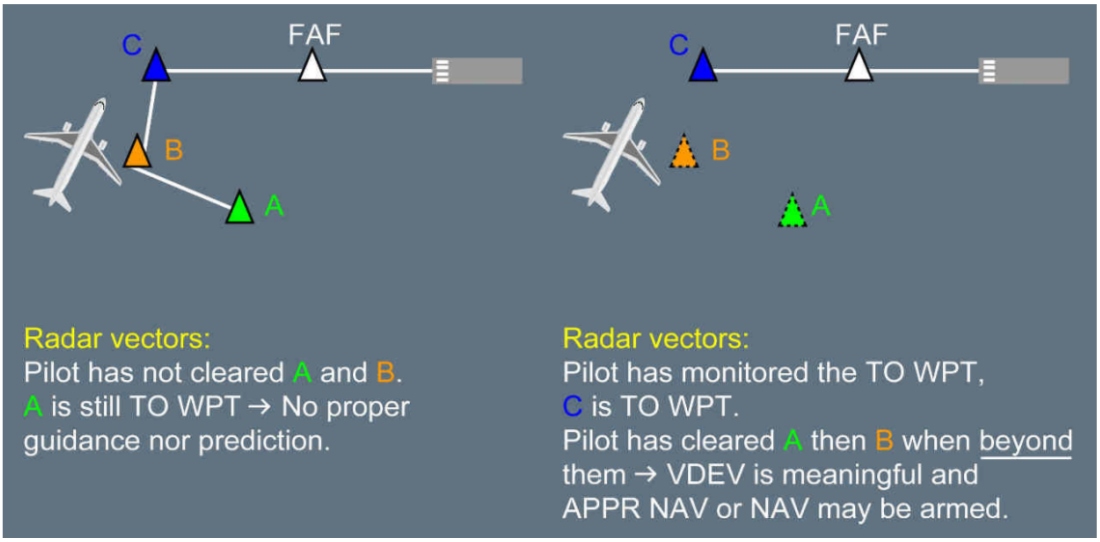


Figure 8: F-PLN sequence in approach

1.18.6 Safety actions implemented since date of incident

1.18.6.1 Development of use of GNSS approaches

On first contact with the Deauville approach ATC, it was suggested the crew use a GNSS approach for runway 12 as part of a change in the runway in use.

The crew declined on the grounds that they were not qualified for that type of procedure.

If it had been possible to perform the GNSS procedure as a precision approach ("ILS alike"), the crew could have positioned the aircraft directly on the centreline of the aerodrome runway without relying on a visual approach procedure, which is trickier to carry out and statistically involves greater risks.

In order to fully benefit from the development of GNSS 3D[36] approach procedures at aerodromes that are not equipped with conventional radio-navigation means on all the approach paths being used, crew qualification and air transport operator approval must be developed.

To date, however, there is no requirement to include training in the preparation and implementation of RNAV (GNSS) approaches in initial training programs for instrument flight ratings. In this case an additional RNAV(GNSS) approved training course is required for all pilots carrying out this type of approach.

European regulations make this training compulsory during the initial training in instrument flight ratings by 25 August 2020 at the latest.

[36]In accordance with the ICAO resolution (A37-11), which set 2016 as the date by which States must have developed GNSS procedures with vertical guidance on their IFR QFU, the French DGAC adopted an implementation policy of 3D GNSS approaches on almost all of their QFU on fields accommodating significant commercial traffic. Moreover, EASA plans to publish a new version of the AUR part, dedicated to “airspace” requirements and which will require States to develop PBN procedures with vertical guidance on the QFU not provided with precision approaches as from January 2020.

Concerning the approval of airline companies for the GNSS approaches, the tenth edition of Annex 6 of the Convention on International Civil Aviation, applicable since 10 November 2016, no longer recommends specific approval except for operations based on navigation specifications involving a compulsory authorization in PBN. In the same vein, taking into account the experience gained and the degree of maturity reached in approach operations using the Global Navigation Satellite System, in order to ease the financial and administrative burden weighing unnecessarily on aircraft operators in the general aviation sector and to ensure consistency with the latest international safety standards, Regulation (EU) No 1199/2016[37] has modified Regulation (EU) No 965/2012 by significantly reducing the number of cases in which a specific approval is required[38].

Due to the fact that these provisions modify the initial crew training and significantly reduce the need for approval for airline companies, they are likely to contribute to generalizing the use of RNAV (GNSS) approaches by equipped aircraft.

On the other hand, there is currently no GNSS onboard requirement, allowing GNSS approaches (RNP APCH according to the ICAO terminology).

2 - ANALYSIS

The lack of a CVR recording which could be analysed and the refusal of the copilot to participate in the interviews proposed by the BEA limited the possibilities of analysing the crew's behaviour during the flight.

2.1 Scenario

From making contact with Deauville to the start of the downwind leg

The crew of charter flight OHY 1985 (non-scheduled commercial IFR flight) was about to begin the descent to Deauville in VMC conditions. The aircraft was flying in controlled airspace. The crew was preparing for an ILS approach to land on runway 30. The captain was flying the aircraft; it was his first flight to this aerodrome.

On first contact with the Deauville approach ATC, the crew was informed that the runway in use had changed and that another aircraft was preparing to take off towards them. Several options were available for landing on runway 12: a GNSS approach, an ILS 30 approach followed by an MVL or a visual approach. The Deauville controller, who was concerned about ensuring the separation between the departing aircraft and the arriving aircraft, suggested the GNSS procedure, which would free the take-off path. This type of approach, however, was not authorized by the airline company.

An MVL procedure appeared to be the best option available to the captain. In fact, he was accustomed to using this procedure when landing on a counter-QFU.

Numerous radio communications show that the crew wanted to be sure of the flight path to follow in order to clarify the direction of the turn and the position of the downwind. The communications suggest that the crew and controller agreed on a visual approach, however the word "circling" used for an MVL was pronounced by the crew.

[37]Commission Regulation (EU) No 2016/1199 of 22 July 2016 amending Regulation (EU) No 965/2012 as regards operational approval of performance-based navigation, certification and oversight of data services providers and helicopter offshore operations, and correcting that Regulation.

[38]A specific approval is required for RNP AR APCH operations.

The strategy of the PF was to follow the ILS 30 to the MDA and then perform an MVL for runway 12. However, the ILS 30 was disabled and the PM called out a visual approach. The investigation was unable to determine whether at this moment it was an error of phraseology or a misunderstanding between the crew members.

In order to separate the two aircraft, the approach controller asked the crew to call him back as soon as the field was in sight in order to turn to the downwind leg.

On first contact, the tower controller asked the crew to call back when in the downwind leg and informed them that an aircraft was backtracking on runway 12. In his interview, the captain indicated that he abandoned the MVL option because he interpreted this message as an order to turn right.

From this point on, the crew no longer followed a standard approach procedure. The crew's actions and the path followed seem to be guided by both visual approach procedures and MVL procedures. The aircraft joined the downwind leg of runway 12 and descended to the MDA of the MVL.

From the downwind leg to the decision to abort the landing on runway 12

As the aircraft taking off had not freed the runway, Deauville ATC asked the crew to extend the downwind leg.

After receiving clearance to turn left, the crew continued the descent as they searched for visual contact with the runway. The TAWS "terrain ahead" alert was triggered. The PF made a nose-up input on the sidestick, which had the effect of reducing the rate of descent. A second "terrain ahead pull up" type alert was triggered. The crew, who had kept visual contact with the coast, considered that there was no immediate danger of collision with the ground and decided not to proceed with a go-around. However, in the specific case of a seaward approach to Deauville, the external visual references are insufficient to accurately estimate the height in relation to the terrain.

The aircraft flew over the sea at an altitude of 528 ft, which is only 49 ft above the ground elevation. Without acting on the thrust, the PF increased the pitch of the aircraft which regained altitude. The Deauville controllers, whose attention was focused on the aircraft taking off, did not see the descent of the aircraft in the last turn.

From the decision to abort the landing on runway 12 to the touchdown on runway 30

The aircraft flew over the coast at a low altitude (about 600 ft). The crew regained visual contact with the runway and tried to line up with the approach slope and the runway centreline. Deauville ATC saw the aircraft had a pitch-up attitude and asked if it was going around. The copilot replied that they were continuing with the landing. When a TAWS "sink rate" type alert was triggered, the captain, bothered by the sun and seeing that he would not be able to stabilize the aircraft, finally decided to abort the landing.

The crew requested and obtained clearance for a visual approach on runway 30. Unlike the abort approach procedure which specifies climbing to an altitude of 3,000 ft to safely prepare for a new approach, the PF flew over the runway at a height of 300 ft, turned to the right, climbed to an altitude of about 1,500 ft, and then turned left to land on runway 30.

2.2 The approach

The crew told the Deauville controller that they were going to follow a visual approach procedure. However, at first, the initial approach configuration and flight path were similar to an MVL (flaps extended in position 2[39], landing gear down, airbrakes armed, autopilot active, flight path on centreline of runway)

[39]The initial configuration of the flaps for an MVL is position 3.

Subsequently, the descent to an altitude of 1,100 ft corresponded to the MDA, the target altitude of an MVL (in a visual approach, the altitude of the downwind leg is 1,500 ft above the ground, i.e. 2,000 ft in the case of Deauville). The airline company trained its crews to descend to the MDA in MVL, which is why the aircraft was so low when in the downwind leg. Although this practice complies with regulations, it causes the aircraft to fly along a flight path close to the ground. It unnecessarily reduces the safety margins when the weather conditions allow flight at a higher altitude.

The downwind leg was extended at the request of the Deauville ATC, which is possible in a visual approach, but which must result in aborting the MVL approach, since the aircraft is no longer protected from obstacles.

From the end of the downwind leg, while the aircraft was 900 ft below the recommended altitude for this type of approach, the crew's actions were similar to those for a visual approach, among others a descent with a rate of the order of 400 ft/min. This resulted in the aircraft passing under the final approach slope and finding itself at a minimum recorded altitude of 528 ft (49 ft above the aerodrome) at a distance of 3 NM from the runway threshold. The flight path followed was such that without the crew's reaction following the occurrence of the TAWS alerts, the aircraft would have probably collided with the coast around twenty seconds later.

Although they had announced a visual approach, the crew had prepared for an MVL. In the case of a counter-QFU landing, the captain usually follows the flight path associated with an MVL. He interpreted the controller's request to call back at the beginning of the downwind leg as an implicit order to turn. This request disrupted the chosen approach strategy: the crew aborted the MVL procedure to switch to a visual approach. However, selecting the MDA as the target altitude in the downwind leg indicates that this transition was not completely carried out.

This mix-up between the two procedures may be related to the crew's initial confusion about the flight path to follow to reach the downwind leg. This confusion created a difference in representation between the ATC and the crew with respect to the flight path that the aircraft must follow and persisted despite the radio communications to check this point.

2.3 Awareness of situation in vertical plane

During the last turn and when the aircraft began the final descent, the crew lost sight of the runway. The captain asked the copilot to display track 119° on the ND, corresponding to the QFU of runway 12. The copilot then changed the scale of his ND from 20 NM to 10 NM. It is likely that during this phase of the flight the copilot's attention was focused on the horizontal position of the aircraft and on the search for the runway at Deauville.

Deauville aerodrome is located at an altitude of 500 feet, next to the sea. The final approach on runway 12 takes place over the water. However, when flying over the sea, crews may have a tendency to fly too low because the external visual references are insufficient to accurately estimate height. In the case of this incident, the aircraft flew at an altitude lower than the Villerville sea tower located approximately 2 NM north-west of the aerodrome.

The crew reported that they had kept visual contact with the coast and the sea surface during the last turn. At no time did they feel that they were in danger of a collision with the terrain, all the more so because they thought they were being visually or radar monitored and that their flight path was protected. They did not know that they were below the minimum operating altitude of the Deauville radar. The controllers in the Deauville tower, whose attention was focused on the take-off in progress, did not observe the aircraft's manoeuvres.

Only the appearance of the TAWS alerts made the crew aware of the aircraft's situation in the vertical plane and of the need to correct its flight path.

2.4 Decision to abort approach

The airline Operating Manual states that a visual approach can only be continued if the final approach is stabilized at a height of 1,000 ft, i.e. an altitude of 1,500 ft at Deauville. The last turn was made at an altitude below the visual approach stabilization floor (1,100 ft, MDA for the MVL procedure). In this context, the procedure for checking the stabilization of the aircraft in the final approach when clearing 1,000 ft was no longer effective.

When the TAWS alerts were triggered, the captain reacted in accordance with the procedure with a nose-up input to stop the descent and modify the aircraft's vertical path. However, he simply corrected the pitch without readjusting the thrust, since he was not aware of the existence of a real risk of collision with the terrain. When the second TAWS "terrain ahead pull up" alert was triggered, he said that he asked the copilot to confirm that he could see the ground and that the aircraft was separated from any obstacle and then, after that confirmation, decided to proceed with the landing.

At the time of the incident, it was stated in the airline's procedures that TAWS alerts could be ignored when the flight took place in daylight conditions and the crew could see any obstacles[40]. The occurrence of the TAWS "terrain ahead pull up" alert indicates an immediate risk of collision with the ground and potentially a loss of control of the flight path in the vertical plane. The crew does not necessarily have the resources to fully analyse the situation. This is why, since March 2016, the occurrence of a "terrain ahead pull up" alert automatically involves a go-around procedure (see 1.18.2), even in the context of a flight by day in visual flight conditions.

[40] This is the procedure that was recommended by Airbus at the time of the incident.

After recovering visual contact with the runway and attempting to rejoin the final approach path, the captain decided to abort the landing. It seems that the occurrence of a TAWS "sink rate" alert and the sun on the centreline bothering him were the basis for his decision.

The aircraft finally landed a few minutes later on runway 30 at Deauville. The aborted approach path followed after aborting the landing on runway 12, seems to be slightly improvised, with insufficiently controlled safety margins with respect to the obstacles (overflight of the runway at a height of 300 ft).

2.5 GNSS approaches and visual approaches

The crew, which was preparing for an ILS approach in order to land on runway 30 at Deauville was required to carry out a non-precision approach. As the runway in use had changed, the controller proposed the published GNSS procedure for runway 12. However, as the airline company had not yet been approved for this type of approach, the crew was forced to choose between the two remaining options: an approach to runway 30 followed by an MVL or a visual approach to runway 12. Both of these options includes a circuit pattern and a reconfiguration to manual flight to align with the runway centreline and the approach slope.

This situation does not pose any questions from a regulatory point of view. The controller may designate at a given moment the runway best suited for take-offs and landings. The change occurred when flight OHY 1985 had not started the approach and the ATIS was updated as recommended in the Deauville Air Navigation Services Operations Manual. The forecast meteorological conditions were compatible with a visual approach and theoretically the crew could have requested the use of runway 30 if they considered runway 12 to be unsatisfactory. In addition, the crew had received regular training in carrying out visual approaches by means of theoretical reviews and practical simulator sessions. The implementation of a visual approach should therefore not have posed any major difficulties.

However, studies (see chapter 1.18.4) have shown that the transition phases from automatic pilot mode to manual mode are particularly difficult. More generally, statistical analyses of non-precision approaches show that the risk of accidents in a non-precision approach is of the order of 4 to 8 times higher than that of a precision approach. Boeing stated in their presentation that non-precision approaches are the most difficult to carry out and require a much higher level of concentration and crew teamwork than for an ILS approach. The ICAO encourages controllers to "... exercise caution in initiating a visual approach when there is reason to believe that the flight crew concerned is not familiar with the aerodrome and its surrounding terrain."[(41)].

[(41)]Doc 4444 paragraph 6.5.3.2.

The GNSS associated with the technological developments in on-board guidance systems now makes it possible to carry out non-precision approaches defined in the FMS navigation database as if they were precision approaches ("ILS alike" or "precision like"). In this context, and with a view to improving flight safety, it seems logical (see chapter 1.18.4.2) to focus as much as possible on carrying out these approaches as precision approaches rather than non-precision approaches which include MVL and visual approaches.

On the day of the incident, it would have been better if the airline crew had been in a position to perform a GNSS approach on runway 12 by following an "ILS alike" procedure (see chapter 1.18.5) rather than being forced to perform an MVL or visual approach, non-precision procedures which are statistically riskier. More generally, insofar as the airline company has approval, the crew is qualified and the aerodrome has a GNSS procedure, with a suitably equipped aircraft, it is highly desirable to follow an "ILS alike" approach based on the GNSS rather than a visual approach.

3 - CONCLUSIONS

3.1 Findings

- the aircraft had a valid airworthiness certificate;
- the review of the FDR data did not reveal any failures or anomalies that may have contributed to the incident;
- the maintenance documentation did not show any system failures incompatible with the planned flight;
- the crew held the necessary licenses and ratings to accomplish the flight;
- the Deauville controllers held the necessary licenses and ratings for their control position;
- this was the captain's first flight to Deauville aerodrome;
- at the beginning of the descent, the crew prepared for an ILS approach to runway 30;
- on first contact with Deauville, the controller informed the crew that the runway in use had changed and proposed a GNSS approach to runway 12;
- the crew was not qualified to perform a GNSS approach;
- the airline company had not yet been approved by the Turkish civil aviation authorities for GNSS approaches;
- the copilot requested and was granted a visual approach for runway 12;
- contrary to their call-out, the crew prepared for an ILS 30 approach followed by an MVL for runway 12;
- from the time when the controller instructed them to turn at the beginning of the downwind leg in order to free the centreline for the take-off from runway 12, the crew no longer followed a standard procedure but mixed up the MVL procedure with a visual approach procedure;
- the airline company instructs its crews to descend to the MDA in MVL, whatever the weather conditions;
- due to a take-off on runway 12, the ATC asked the crew to extend the downwind leg;
- the crew descended the aircraft in the last turn, at the end of the downwind leg, thereby passing under the MDA of the MVL, and a fortiori under the recommended altitude for a visual approach;
- the crew lost sight of the runway at the end of the downwind leg while maintaining constant visual contact with the ground or the surface of the sea;
- the TAWS "terrain ahead" and then "terrain ahead pull up" alerts were triggered in the final approach to warn the crew of a risk of the aircraft colliding with the coast;

- the minimum recorded altitude was 528 ft (i.e. 49 ft above the aerodrome), when the aircraft was at a distance of 3 NM from the runway threshold;
- during the downwind leg and final approach, none of the controllers at the Deauville tower noticed the aircraft's low altitude, their attention being focused on the aircraft taking off;
- the crew recovered visual contact with the runway after regaining altitude and decided to continue the landing;
- the sun was located on the runway centreline, which probably bothered the crew;
- on short final, a TAWS "sink rate" alert led the captain to decide not to continue the landing on runway 12;
- at no point during the flight were the captain or the controllers aware of the seriousness of the incident;
- the crew did not immediately inform the airline company of the incident but after the return flight issued an ASR related to the triggering of the TAWS "sink rate" alert;
- the Villerville sea tower staff felt that the aircraft was below their observation point, and was about to make a sea landing, and immediately reported the incident by telephone to the Deauville airport BGTA;
- at the time of the incident, it was stated in the airline company procedures, in accordance with those recommended by the manufacturer, that TAWS alerts could be ignored when the flight was carried out under visual flight conditions and the crew could see the obstacles;
- the airline Operating Manual states that a visual approach can only be continued if the final approach is stabilized at a height of 1,000 ft, i.e. an altitude of 1,500 ft at Deauville.

3.2 Causes of serious incident

The crew announced a visual approach on the radio but prepared for an MVL procedure. When the controller requested the crew to call back at the beginning of the downwind leg, the PF interpreted this message as an order to turn right. From this point on, the crew no longer followed a standard procedure but mixed up the MVL procedure with the visual approach procedure. They descended to the MDA (1,100 ft AAL) in the downwind leg and then continued the descent in the final turn under the final approach slope. The minimum recorded altitude was 528 ft (i.e. 49 ft above the aerodrome) at a distance of 3 NM from the runway threshold.

The serious incident was caused by:

- an incomplete transition from the MVL procedure to the visual approach procedure. The crew kept the MDA as their target altitude in the downwind leg;
- a loss of awareness of the aircraft's situation in the vertical plane. The crew commenced and continued the descent under the final approach slope. However, when flying over the sea, crews may have a tendency to fly too low because the external visual references are insufficient to accurately estimate height;
- the crew and the ATC represented the flight path which the aircraft was to follow to reach the downwind leg differently. The controller expected a flight path corresponding to a visual approach while the crew initiated an MVL procedure.

The controllers did not watch the aircraft's flight path on the final approach. The crew's response to the occurrence of TAWS alerts probably prevented a collision with the coast.

4 - SAFETY RECOMMENDATION

Note: in accordance with the provisions of Article 17.3 of Regulation 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, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations report to the authority in charge of safety investigations that have issued them, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.

4.1 Recurrent training on visual approach procedures

The flight path followed and the actions of the crew show a mixture between two procedures: circling (MVL) and the visual approach. This being said, the captain stated that he had complete control of both these procedures and had already carried them out more than 100 times. His initial and recurrent training included pedagogical objectives specific to the control of approach and circling procedures.

Nevertheless, he was not used to using the visual approach procedure to land on an opposite-QFU which led him to mixing up the visual approach and circling procedures.

For some operators, however, visual approaches are infrequent. In the absence of specific training, their crews therefore have little experience in carrying out this type of approach.

In addition, the development of GNSS-based instrument approach procedures is becoming more widespread, and providers of navigation services are gradually decreasing the number of Cat 1 ILS deployed in France in order to control costs. In France, the DSNA [Air navigation services directorate] has set itself the objective of "retaining only a minimal network of ILS Cat 1 systems"[42].

[42] DSNA activity report for 2016 – p.23.

As a result, conventional radio-navigation facilities could gradually be withdrawn from service, leaving only visual approaches as the sole alternative to GNSS approaches.

A survey of French operators carried out by the French Civil Aviation Authority (DGAC) in 2016 showed that visual approaches are still frequently carried out.

Consequently, the BEA recommends that:

- **EASA draws the attention of airlines to the need to take into account in their risk-mapping, the skills that may in practice be required during visual approaches, according to the airports they serve. [Recommendation 2018-003]**

LIST OF APPENDICES

Appendix 1

DEAUVILLE-NORMANDIE INSTRUMENT APPROACH CHART
RNAV GNSS RWY 12

AIP
FRANCE

AD2 LFRG IAC 05
25 JUL 13

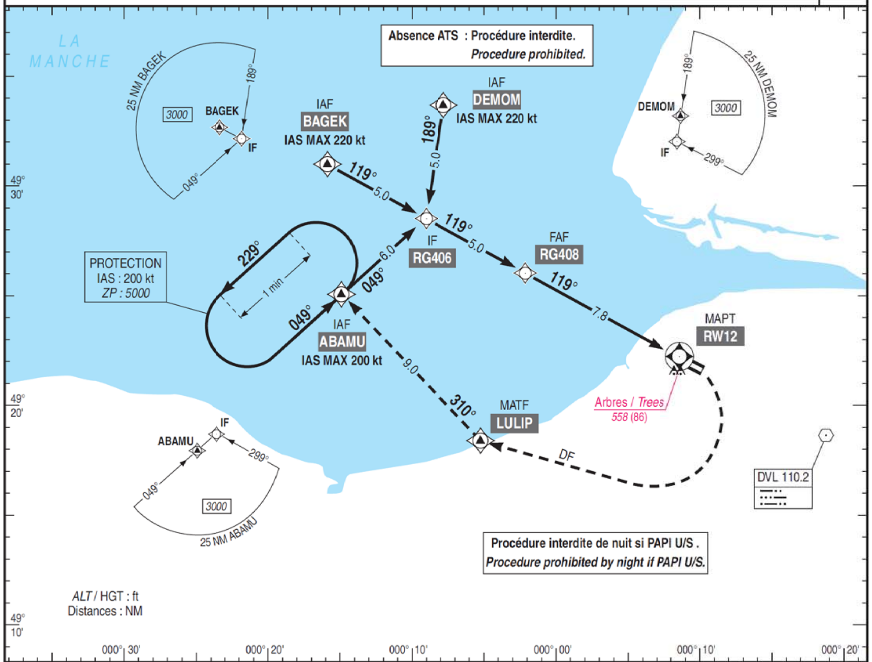
APPROCHE AUX INSTRUMENTS
Instrument approach
CAT A B C D
ALT AD : 479, **DTHR : 472 (17 hPa)**

DEAUVILLE NORMANDIE

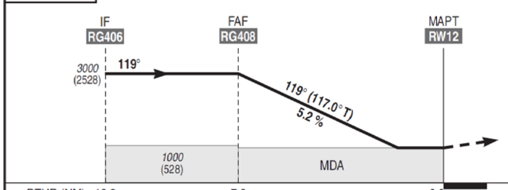
RNAV (GNSS) RWY 12

ATIS : DEAUVILLE : 119.175
APP : DEAUVILLE Approche/*Approach* 120.350
TWR : DEAUVILLE Tour/*Tower* 118.3

VAR
2°W
(05)



TA : 5000



API : Au **MAPT**, tourner **à droite** direct vers **LULIP en montée**, puis poursuivre vers **ABAMU** en montée vers *3000* **(2528)**, afin d'intégrer **l'attente RNAV ABAMU** ou **suivre instructions CTL**. Monter à *1300* **(828)** avant d'accélérer en palier.

*Missed APCH : At **MAPT**, turn **right** direct to **LULIP climbing**, then proceed to **ABAMU** climbing up to **3000 (2528)**, to enter **ABAMU RNAV holding pattern** or **follow CTL instructions**. Climb up to **1300 (828)** prior to level acceleration.*

→ DTHR (NM) 12.8 — 7.8 — 0.0

MNM AD : distances verticales en pieds, RVR et VIS en mètres./*Vertical distances in feet, RVR and VIS in metres.* REF HGT : *ALT DTHR*

CAT	LNAV : 378		MVL/*Circling*		MVL/*Circling* absence ATS HJ seulement/*only*	
	MDA (H)	RVR	***MDA*** (H)	VIS	***MDA*** (H)	VIS
A	**850** (380)	1500	**900** (440)	1500	**1000** (520)	1500
B		1500	**970** (500)	1600	**1000** (520)	1600
C		2000	**1070** (600)	2400	**1130** (670)	2400
D		2000	**1170** (700)	3600	**1170** (700)	3600

DIST RW12 NM	**7**	**6**	**5**	**4**	**3**	**2**	**1**
ALT	***2765***	***2470***	***2175***	***1880***	***1585***	***1290***	***995***
(HGT)	(2293)	(1998)	(1703)	(1408)	(1113)	(818)	(523)

Observations / *Remarks* : Panne de guidage GNSS lors de l'approche, voir partie GEN IAC / *Loss of GNSS guidance during approach, see part GEN IAC.*

FAF - MAPT 7.78 NM	70 kt 6 min 40	85 kt 5 min 29	100 kt 4 min 40	115 kt 4 min 03	130 kt 3 min 35	160 kt 2 min 55	185 kt 2 min 31
VSP (ft/min)	340	420	490	565	640	790	910

SERVICE DE L'INFORMATION AERONAUTIQUE

VSS
X

AMDT 08/13 **CHG** : Consigne, TA.

Appendix 2

ONUR AIR'S FCOM CONCERNING VISUAL APPROACHES AND VISUAL MANOEUVRING

■ **If visual references are sufficient:**

CONTINUE...ANNOUNCE
AP...OFF
FD...OFF

- *The PF orders the PNF to set both FDs OFF.*

RUNWAY TRACK...CHECK/SET

- *If needed, the PF orders the PNF to set the runway track.*

■ **If visual references are not sufficient:**

GO AROUND...ANNOUNCE

- *Initiate a go around.*

Ident.: PRO-NOR-SOP-18-C-E-00014554.0002001 / 29 MAY 13
Applicable to: ALL

MANAGEMENT OF DEGRADED NAVIGATION

● **For VOR and NDB approaches in NAV FPA, if lateral guidance is not satisfactory:**

- Be prepared to continue the approach with reference to appropriate raw data by reverting to TRK FPA.

● **For RNAV(GNSS) approaches, with LNAV minima:**

- Use the appropriate remaining AP/FD in the following cases, if external visual references are not sufficient to proceed visually:
  • GPS PRIMARY LOST on one ND
  • NAV ACCUR DOWNGRAD on one FMGS
- Discontinue the approach in the following cases:
  • GPS PRIMARY LOST on both NDs
  • XTK > 0.3 nm
  • NAV FM/GPS POS DISAGREE on ECAM
  • NAV ACCUR DOWNGRAD on both FMGS

CIRCLING APPROACH

Applicable to: ALL
Ident.: PRO-NOR-SOP-18-C-F-00014570.0001001 / 29 MAY 13

GENERAL

The circling approach is the visual phase of an instrument approach to bring an aircraft into position for landing on a runway which is not suitably located for a straight-in approach.

Appendix 3

EXCERPTS FROM AIRBUS' FCOM AND FCTM ON GNSS APPROACHES

■ **If visual references are not sufficient:**

GO AROUND..ANNOUNCE

- *Initiate a go around.*

APPROACH USING FINAL APP GUIDANCE

GENERAL

The following items are to be performed in addition to previous SOP chapters in the following cases:

- RNAV(GNSS) approaches with LNAV and LNAV/VNAV minima
- Conventional approaches based on VOR or NDB using FINAL APP guidance.

Note: *For RNAV(RNP), Refer to APPR using FINAL APP for RNAV(RNP)*

AIRCRAFT EQUIPMENT

For RNAV(GNSS) approaches, 1 FMS must be operative in GPS PRIMARY.
In addition, the following equipment is recommended:
1 MCDU, 1 FD, 1 PFD and 1 ND on the PF side, and both FCU channels.

DESCENT PREPARATION

WEATHER AND LANDING INFORMATION..OBTAIN

- *The FMS does not take into account the effect of low OAT on the vertical profile. Therefore, vertical managed guidance may not be used below a minimum OAT. This minimum OAT is either indicated on the approach chart, or defined by the Operator.*

Note: *For RNAV(GNSS) approach with LNAV VNAV minima, use of QNH from a remote station is prohibited.*

F-PLN A page.. CHECK

- *0,1 degree of difference between the MCDU and the charted final vertical path is acceptable*
- *1 degree of difference between the MCDU and the charted final lateral track is acceptable*
- *3 degree of difference between the MCDU and the charted final lateral track is acceptable for conventional radio NAVAID approach.*

PROG page..COMPLETE

- *Insert the reference RWY threshold in the BRG/DIST field for position monitoring during approach.*

PREFACE

Criteria: SA

This chapter deals with some characteristics of the Non Precision Approach (NPA).

NPA are defined as:
- VOR approach
- NDB approach
- LOC, LOC-BC approach
- R-NAV approach.

APPROACH STRATEGY

Criteria: SA

The overall strategy of NPA completion is to fly it "ILS alike" with the same mental image or representation and similar procedure. Instead of being referred to an ILS beam, the AP/FD guidance modes and associated monitoring data are referred to the FMS F-PLN consolidated by raw data.
LOC only approach is the exception where LOC mode and localizer scale are to be used. This explains why the crew must ensure that the FMS data is correct, e.g. FMS accuracy, F-PLN (lateral and vertical) and proper leg sequencing.
The use of AP is recommended for all non-precision approaches as it reduces crew workload and facilitates monitoring the procedure and flight path.

LIMITATIONS

Criteria: SA

Lateral and vertical managed guidance (FINAL APP) can be used provided the following conditions are met:
- The approach is defined in the navigation database
- The approach has been crosschecked by the crew with the published procedure
- The final approach is not modified by the crew.

Depending on the aircraft configuration, the use of FINAL APP, NAV V/S, NAV/FPA modes is not permitted with the autopilot on to perform NPA approaches if one engine is inoperative (for more information, *Refer to FCOM/LIM-22-10 Use of NAV and FINAL APP Modes for Approach*). Only FD use is permitted.
In others words, if the use of the autopilot is preferred, its use will be limited to TRK/FPA or HDG V/S modes.

Appendix 4
TRANSCRIPT OF ATIS A, B AND C

Transcript of ATIS "A"

Transmitting Station	Receiving Station	UTC	Communications	Comments
ATIS LFRG		07h09'05"	Bonjour Ici Deauville, information ALPHA enregistrée à 7h10 UTC Approche ILS, piste 30 Piste 30 en service Niveau de transition 5-0 Attention Risque Aviaire Le vent est calme Visibilité 2600 mètres Temps présent brume présence de Tower Cumulus Température + 15 Point de rosée +15 QNH 1014 Fox Echo 998 Informez Deauville au premier contact que vous avez reçu ALPHA. Merci. Good morning, This is Deauville information ALPHA recorded at 0-7-1-0 UTC Expect ILS approach runway 3-0 Runway 3-0 in use Transition level 5-0 Caution Bird hazard Wind is calm Visibility 2600 meters Present Weather mist Tower cumulus Temperature +1-5 Due point +1-5 QNH 1-0-1-4 Fox Echo 9-9-8 Inform Deauville at first contact that you received ALPHA. Thank you.	

Transcript of ATIS "B"

Transmitting station	Receiving Station	UTC	Communications	Comments
ATIS LFRG		09h03'12"	Deauville info Bravo enregistré à 9h00 APP ILS 30 en service Niveau de transition 50 Présence d'oiseaux Vent 80°4kts Visibilité 5000m avec un peu de brume Pas de nuages significatifs Tempé 17 Point de rosée 15 QNH 1015 FE 998 Informez au premier contact que vous avez reçu Bravo Deauville information Bravo Recorded at 0900 ILS Approach RWY 30 in use Transition level 50 Bird hazard Wind 080°4kts Visibility 5000m with fog No significative clouds Temperature17 Due point 15 QNH 1015 QFE 998 Inform at first contact that you have received Bravo	

Transcript of ATIS "C"

Transmitting station	Receiving Station	UTC	Communications	Comments
ATIS LFRG		09h04'46"	Deauville info Charlie enregistré à 9h00 UTC Prevoyez APP ILS piste 30 suivi d'une MVL 12 Piste 12 en service Niveau de transition 50 Attention risque aviaire Le vent 70°4kts Visibilité 6 km Présence de brume Pas de nuages significatifs Tempé 17 Point de rosée 16 QNH 1015 FE 998 Informez Deauville au premier contact que vous avez reçu Charlie merci Good morning this is Deauville information Charlie Recorded at 0900 UTC Expect ILS Approach RWY 30 then circling for RWY 12 RWY 12 in use Transition level 50 Caution bird hazard Wind 070°4kts Visibility 6 km with (incomprehensible) and mist No significative clouds Temperature17 Due point 16 QNH 1015 QFE 998 Inform Deauville at first contact that you have received Charlie	

APPENDIX 5

TRANSCRIPT OF RADIOTELEPHONE COMMUNICATIONS
ON DEAUVILLE APPROACH FREQUENCY

ATC recording transcription

Registry :	**TC-OBZ**
Aircraft type :	**A321**
Manufacturer :	**Airbus**
Operator :	**Onurair**
Date and place of the event :	**26 September 2013, AD Deauville**
SIB :	**BEA**

Revising follow-up

Dates	Remark
29/11/2013	Preliminary transcription
21/04/2017	Complement of the transcription

FOREWORD

The following is the transcript of the elements which were understood from the work on recorded radiotelephonic messages from Air-traffic Control (ATC).

The reader's attention is drawn to the fact that the recording and transcript of ATC messages are only a partial reflection of events. Consequently, the utmost care is required in the interpretation of this document.

Remark: The only transcribed messages were between Deauville Tower, Beauty 640 and Onurair 1985. The other ATC messages were not related to the event.

GLOSSARY

UTC Time	Origin : ATC Transcript
( )	Word or group of words with doubtful
(*)	Word or group of words not understood

UTC time	Locutor	Message	Remarks, warnings, …
09h07min00		Beginning of transcription	
09h07min03	OHY 1985	Deauville, Onurair one nine eight five bonjour, descending flight level seven zero	First Officer speaking
09h07min09	Deauville Tower	Bonjour Onurair one nine eight five, radar contact. Could you make a GNSS approach runway one two, because I have another departure on runway one two in five minutes	
09h07min22	OHY 1985	We can make visual approach runway one two, Onurair one nine eight five	First Officer speaking
09h07min26	Deauville Tower	Roger, so you proceed Delta Victor Lima, descend level seven zero and call you back for lower	
09h07min36	OHY 1985	Proceeding Delta Victor Lima and descending seven zero, Onurair one nine eight five	First Officer speaking
09h08min04	OHY 1985	Onurair one nine eight five, can you confirm runway zero one two for us?	Captain speaking
09h08min09	Deauville Tower	Yes, runway one two in use so you can proceed for GNSS one two if you want, or a visual approach one two by...heu...left downwind runway one two	
09h08min25	OHY 1985	So we don't have... approved for GNSS so we will go with visual approach, Onurair one nine eight five	Captain speaking
09h09min01	OHY 1985	Deauville, Onurair one nine eight five would you say right or left downwind?	First Officer speaking
09h09min07	Deauville Tower	It will be a left downwind for runway one two, when you will have the field in sight	
09h09min13	OHY 1985	Left downwind for runway one two, Onurair one nine eight five	First Officer speaking
09h09min51	OHY 1985	Just for confirmation, Onurair one nine eight five, do you make the base turn to the left, confirm, heu we will... do the... circling to the right. By the meaning it's, we'll go to the north of the airfield	Captain speaking
09h10min04	Deauville Tower	It's correct one nine eight five, when you will see the airfield, you turn right for making the left downwind	
09h10min12	OHY 1985	Copied Sir thank you	Captain speaking
09h10min37	Deauville Tower	Beauty 640, you have a problem?	
09h10min40	BEAUTY 640	Heu negative, just... we are starting now the engine, Beauty 640	
09h10min44	Deauville Tower	Ok	

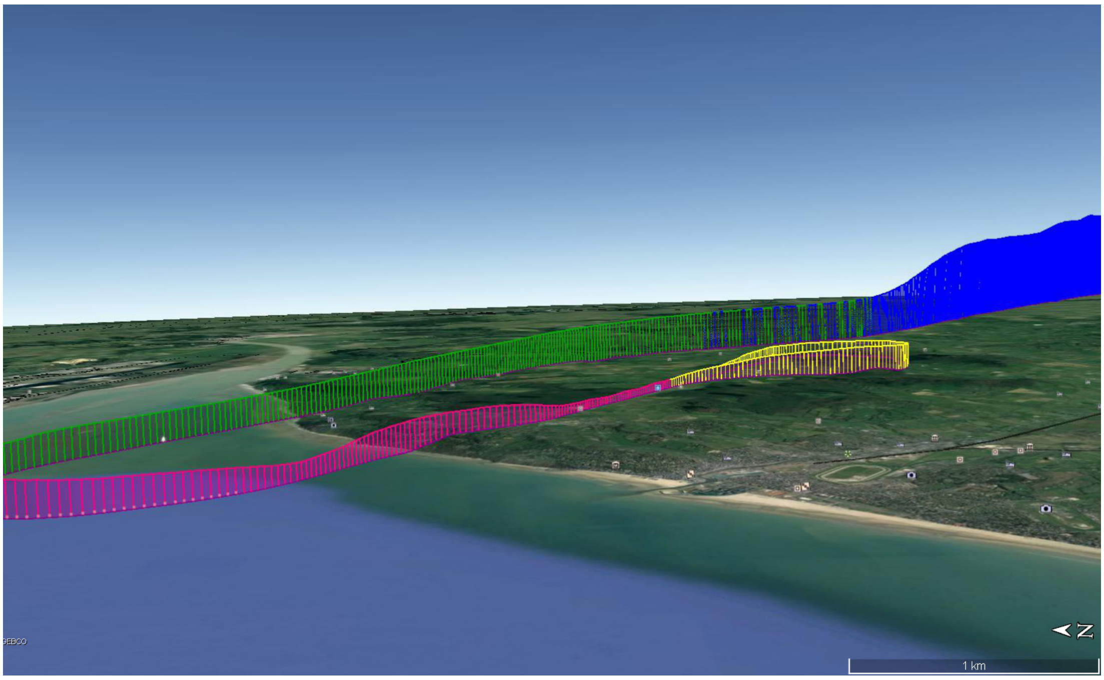
UTC time	Locutor	Message	Remarks, warnings, …
09h11min20	Deauville Tower	One nine eight five, descend three thousand feet, one zero one five	
09h11min24	OHY 1985	One zero one five, descending three thousand feet, Onurair one nine eight five	First Officer speaking
09h11min54	Deauville Tower	One nine eight five, you report field in sight for the left downwind	
09h12min01			
09h12min01	OHY 1985	**[Captain]**:We will call you field in sight (*), **[First Officer]**:we will call you when runway in sight, Onurair one nine eight five	Both pilots are talking at the same time: first speech is Captain, second speech is First Officer.
09h12min50	BEAUTY 640	And Beauty 640, request taxi	
09h12min52	Deauville Tower	640, taxi holding point One Bravo, backtrack runway 12, line up and I call you back for your clearance	
09h12min59	BEAUTY 640	Ok taxi to One Bravo to backtrack runway 12, Beauty 640	
09h13min05	Deauville Tower	Onurair one nine eight five call me back on 118.3	
09h13min09	OHY 1985	118.3, Onurair one nine eight five	First Officer speaking
09h13min23	OHY 1985	Deauville, Onurair one nine eight five	First Officer speaking
09h13min25	Deauville Tower	Yes, one nine eight five reading you five and report left downwind for runway one two, there is a 737 backtracking runway one two	
09h13min38	OHY 1985	Runway in sight and we are beginning to right turn, Onurair one nine eight five	First Officer speaking
09h13min43	Deauville Tower	Beauty 640, ready to copy?	
09h13min46	BEAUTY 640	Heu... ready to copy Beauty 640	
09h13min49	Deauville Tower	You will climb level 60 on runway heading and the squawk 7611	
09h13min56	BEAUTY 640, Ok	on runway heading, climbing flight level 60, squawking 7611, Beauty 640	
09h14min02	Deauville Tower	It's correct, line up 12 and wait	
09h14min05	BEAUTY 640	Line up runway 12 and wait, Beauty 640	
09h14min13	OHY 1985	(*) the right turn, Onurair one nine eight five	First Officer speaking
09h14min17	Deauville Tower	Roger, one nine eight five, you are alone in the circuit, you'll report left downwind	
09h14min23	OHY 1985	Call you left downwind, Onurair one nine eight five	First Officer speaking
09h14min32	OHY 1985	Request further descent	First Officer speaking
09h14min35	Deauville Tower	Descent at your convenient, one nine eight five	
09h14min38	OHY 1985	We will descent at our convenient, thank, Onurair one nine eight five	First Officer speaking

UTC time	Locutor	Message	Remarks, warnings, …
09h16min12	BEAUTY 640	Beauty 640, we are ready on runway 12	
09h16min18	Deauville Tower	640, line up and clear to take off runway 12, wind 080°, 5 to 8 kts	
09h16min25	BEAUTY 640	Okay, cleared for take-off runway 12, Beauty 640	
09h16min37	Deauville Tower	One nine eight five, I'll call you back to turn on final	
09h16min42	OHY 1985	Onurair one nine eight five, (*) to downwind, call you when turn	First Officer speaking
09h16min56	Deauville Tower	One nine eight five, extend a little bit your downwind, there is a taking off on runway one two, and I call you back to turn on base	
09h17min05	OHY 1985	We are extending the downwind and waiting for your turning clearance, Onurair one nine eight five	First Officer speaking
09h17min29	Deauville Tower	One nine eight five, you are number one, you will report final, you can turn now	
09h17min35	OHY 1985	Number one and beginning to turn left for establish, Onurair one nine eight five	First Officer speaking
09h18min39	Deauville Tower	BEAUTY 640, climb level 100, turn right direct LAIGLE	
09h18min44	BEAUTY 640	Climbing flight level 100 and right to LAIGLE, Beauty 640	
09h19min24	Deauville Tower	One nine eight five, you are going around ?	
09h19min27	OHY 1985	We are (landing)	First Officer speaking
09h19min43	OHY 1985	Go around, Onurair one nine eight five	First Officer speaking
09h19min46	Deauville Tower	Cleared to land, zero seven zero degrees, five to eight knots	
09h19min49	OHY 1985	Onurair one nine eight five, (*) request circle to land for runway three zero, we are not able to land in 12 now	Captain speaking
09h19min56	Deauville Tower	Ok, going around and you make another visual approach, or you make a GNSS approach?	
09h20min04	OHY 1985	(*) request visual for runway three zero, because of the sun, we could not see the runway one two one the circling we lost the runway	Captain speaking
09h20min16	Deauville Tower	Ok, so you make a visual approach for runway three zero, the wind is 070°, 5 kts, and you report final	
09h20min24	OHY 1985	**[First Officer]**: Call you final... **[Captain]**:Call you final ...heu we can make a visual approach for runway three zero, Onurair one nine eight five and we (*)	Both pilots are talking at the same time: first speech is First Officer, second speech is Captain
09h20min31	Deauville Tower	(No you cannot turn) as you want and you report final three zero	
09h20min38	OHY 1985	Call you final runway three zero	Captain speaking
09h20min42	Deauville Tower	BEAUTY 640, contact Paris 124.850	

UTC time	Locutor	Message	Remarks, warnings, …
09h20min47	BEAUTY 640	124.85, Beauty 640, merci monsieur au revoir	
09h20min51	Deauville Tower	Au revoir	
09h22min03	OHY 1985	Turning final for runway three zero, Onurair one nine eight five	First Officer speaking
09h22min07	Deauville Tower	One nine eight five, you are cleared to land, runway three zero, wind zero eight zero degrees, five knots	
09h22min13	OHY 1985	Zero eight zero degrees, five knots, Onurair one nine eight five	First Officer speaking
09h23min58	Deauville Tower	One nine eight five, make a one eighty backtrack	
09h24min02	OHY 1985	We'll backtrack from turning at end of the runway, Onurair one nine eight five	First Officer speaking
09h24min25		End of transcription	

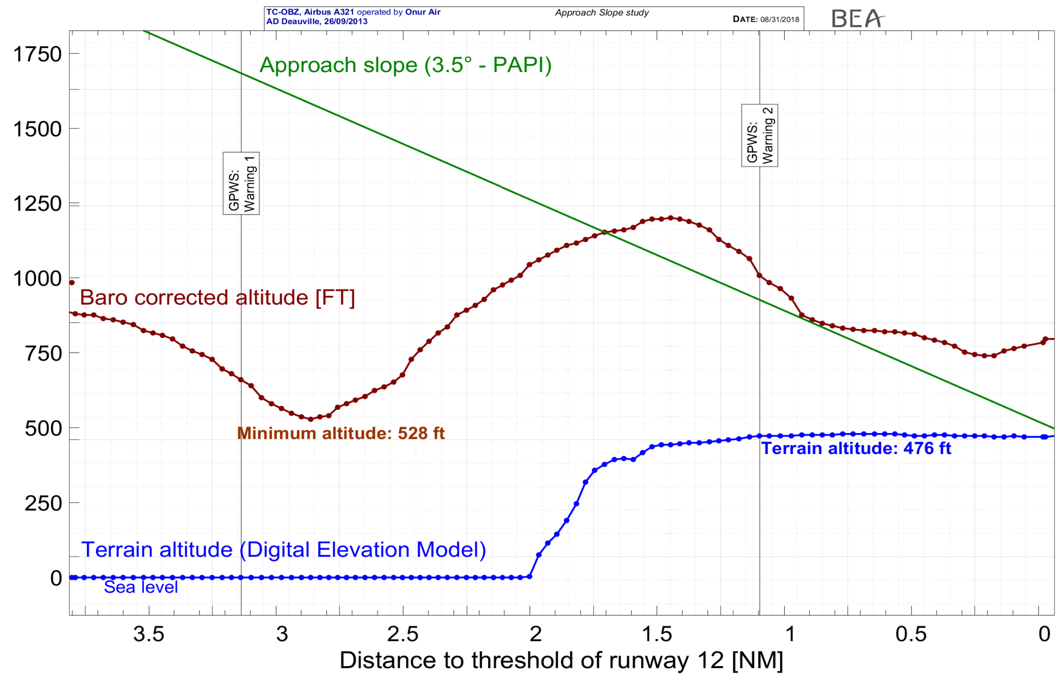
Appendix 6

GEOGRAPHICAL PATH OF FLIGHT BASED ON QAR DATA



Appendix 7

VERTICAL SECTION OF PATH OF LAST PART OF FLIGHT BASED ON QAR DATA



Appendix 8

QRH 34.05 TAWS AND FCOM PROCEDURES APPLICABLE ON DAY OF INCIDENT AND NEW TAWS PROCEDURE

EGPWS ALERTS

Ident.: PRO-ABN-34-00012453.0002001 / 18 DEC 12
Applicable to: MSN 0640, 0676-0792, 0810-0811, 0916-1509

CAUTION	During night or IMC conditions, immediately apply the procedure. Do not delay reaction for diagnosis. During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert stops, or until a safe trajectory is ensured.

■ **"PULL UP" - "TERRAIN AHEAD PULL UP"**

Simultaneously:

AP...OFF
PITCH...PULL UP

Pull to full backstick and maintain in that position.

THRUST LEVERS...TOGA
SPEED BRAKES lever...CHECK RETRACTED
BANK...WINGS LEVEL or ADJUST

Best climb performance is obtained when close to wings level. Then, for "TERRAIN AHEAD PULL UP" only, and if the crew concludes that turning is the safest way of action, a turning maneuver can be initiated.

- **When flight path is safe and the warning stops:**
  Decrease pitch attitude and accelerate.
- **When speed is above VLS, and vertical speed is positive:**
  Clean up aircraft, as required.

■ **"TERRAIN TERRAIN" – "TOO LOW TERRAIN":**

Adjust the flight path, or initiate a go-around.

■ **" TERRAIN AHEAD":**

Adjust the flight path. Stop descent. Climb and/or turn, as necessary, based on analysis of all available instruments and information.

■ **"SINK RATE" – "DON'T SINK":**

Adjust pitch attitude and thrust to silence the alert.

■ **"TOO LOW GEAR" - "TOO LOW FLAPS":**

Perform a go-around.

Continued on the following page

EGPWS WARNINGS

2 Ident.: PRO-ABN-34-00016878.0019001 / 17 MAR 16
Applicable to: ALL

- **"PULL UP" - "TERRAIN AHEAD PULL UP" - "OBSTACLE AHEAD PULL UP"**

Simultaneously:

AP	OFF
PITCH	PULL UP

L2 Pull to full backstick and maintain in that position.

L1 THRUST LEVERS	TOGA
SPEED BRAKES lever	CHECK RETRACTED
BANK	WINGS LEVEL or ADJUST

L2 Aircraft achieve the best climb performance when the wings are as level as possible.

If the "TERRAIN AHEAD PULL UP" or "OBSTACLE AHEAD PULL UP" aural alert triggers, a turning maneuver can be initiated if the flight crew concludes that turning is the safest action. The PULL UP maneuver must be performed before the turn towards the safe direction, as climbing increases the terrain clearance.

Onurair A318/A319/A320/A321 QUICK REFERENCE HANDBOOK	ABNORMAL AND EMERGENCY PROCEDURES	34.05A 30 MAY 13

EGPWS ALERTS

CAUTION	During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis. During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert stops or a safe trajectory is ensured.

■ **″PULL UP″ - ″TERRAIN AHEAD PULL UP″:**

Simultaneously:

AP.. OFF
PITCH.. PULL UP
Pull to full backstick and maintain in that position.
THRUST LEVERS.. TOGA
SPEED BRAKES lever.. CHECK RETRACTED
BANK.. WINGS LEVEL or ADJUST

- **When flight path is safe and the warning stops:**
  Decrease pitch attitude and accelerate.
- **When speed is above VLS, and vertical speed is positive:**
  Clean up aircraft as required.

■ **"TERRAIN TERRAIN" - "TOO LOW TERRAIN":**

Adjust the flight path or initiate a go-around.

■ **″TERRAIN AHEAD″:**

Adjust the flight path. Stop descent. Climb and/or turn, as necessary, based on analysis of all available instruments and information.

■ **"SINK RATE" - "DON'T SINK":**

Adjust pitch attitude and thrust to silence the alert.

■ **"TOO LOW GEAR" - "TOO LOW FLAPS":**

Perform a go-around.

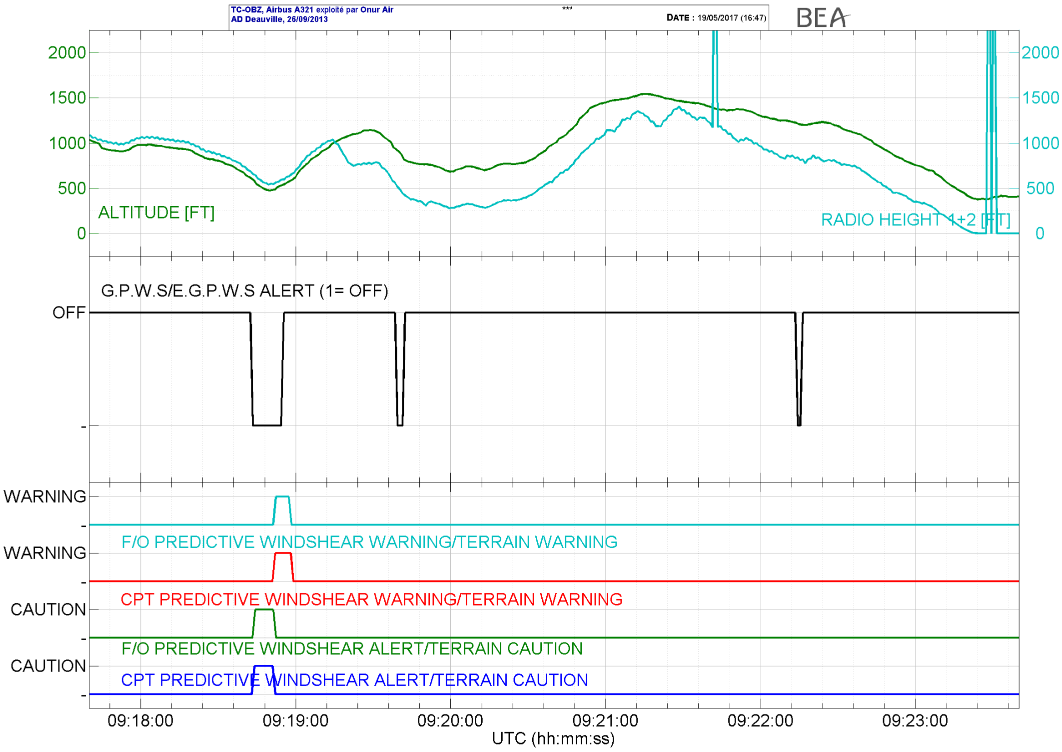
■ **"GLIDE SLOPE":**

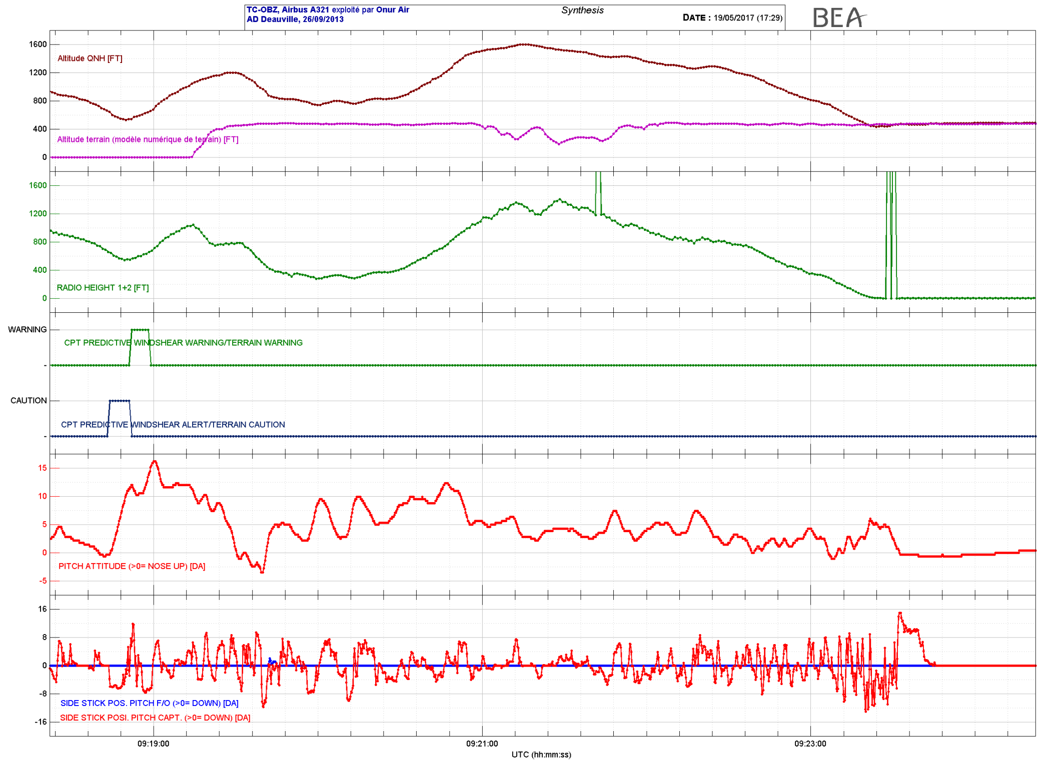
Establish the aircraft on the glideslope, or set the G/S MODE pb to OFF, if flight below the glideslope is intentional (non precision approach (NPA)).

OHY MSN 0811 **TC-OBZ**

Appendix 9

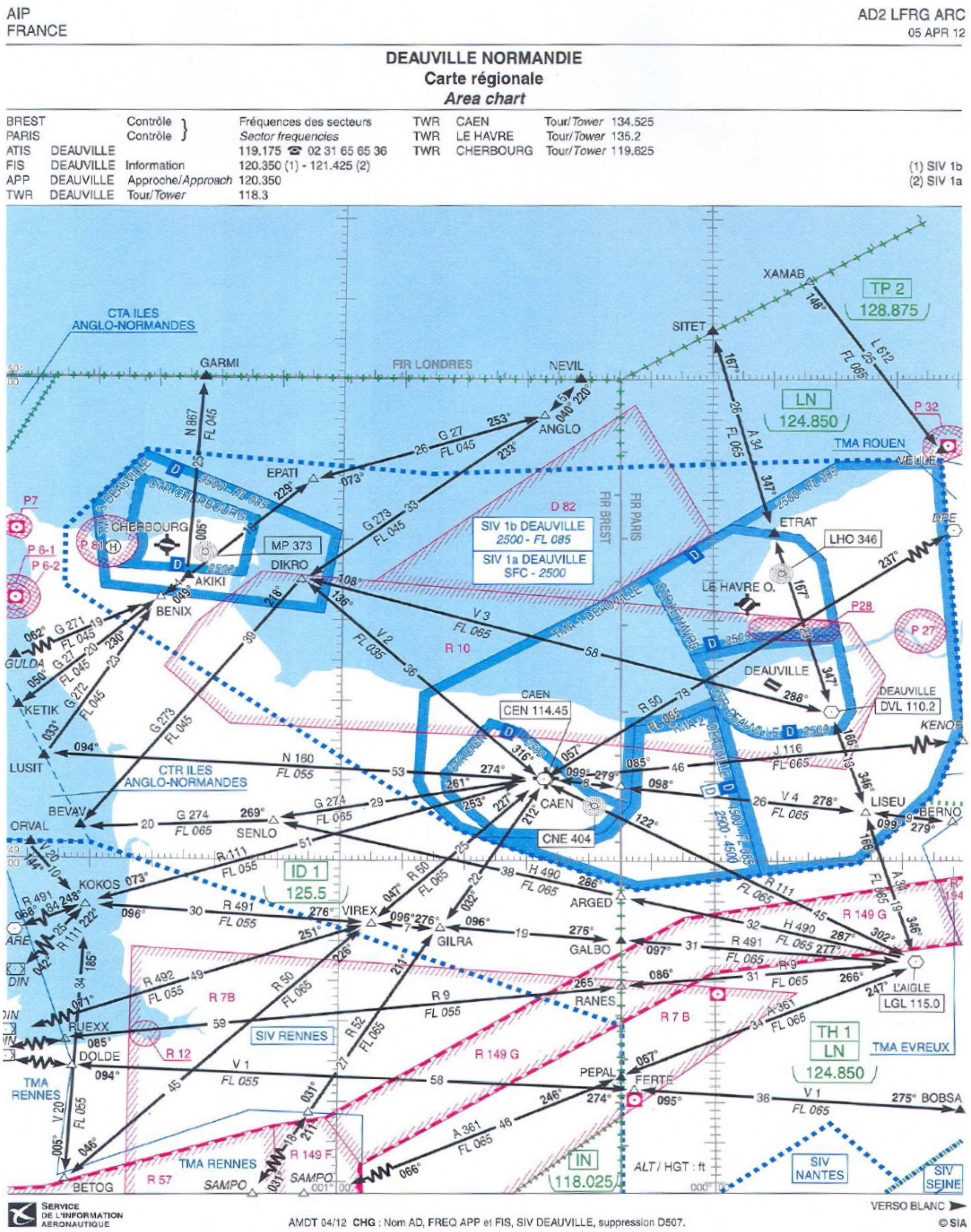
GRAPHS BASED ON QAR PARAMETERS




TC-OBZ, Airbus A321 exploité par Onur Air
AD Deauville, 26/09/2013
Synthesis
DATE : 19/05/2017 (17:29)
BEA
Altitude QNH [FT]
Altitude terrain (modèle numérique de terrain) [FT]
RADIO HEIGHT 1+2 [FT]
WARNING
CPT PREDICTIVE WINDSHEAR WARNING/TERRAIN WARNING
CAUTION
CPT PREDICTIVE WINDSHEAR ALERT/TERRAIN CAUTION
PITCH ATTITUDE (>0= NOSE UP) [DA]
SIDE STICK POS. PITCH F/O (>0= DOWN) [DA]
SIDE STICK POSI. PITCH CAPT. (>0= DOWN) [DA]
09:19:00
09:21:00
09:23:00
UTC (hh:mm:ss)

Appendix 10

DEAUVILLE-NORMANDIE AREA CHART



Appendix 11

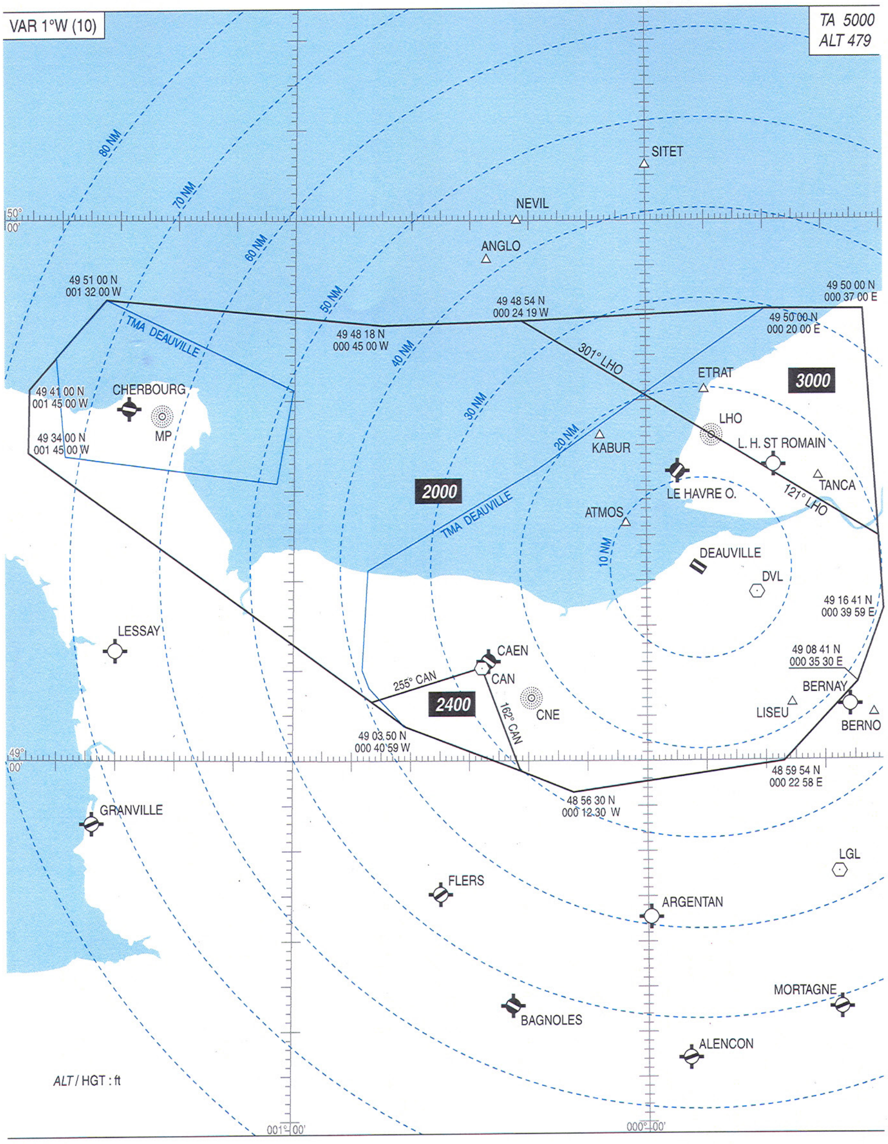
DEAUVILLE-NORMANDIE MINIMUM RADAR SAFETY ALTITUDES CHART

AIP
FRANCE

AD2 LFRG AMSR
07 MAR 13

DEAUVILLE NORMANDIE
Altitudes Minimales de Sécurité Radar
Minimum Radar Safety Altitudes

APP	DEAUVILLE	Approche/*Approach*	120.350
ATIS	DEAUVILLE		119.175
FIS	DEAUVILLE	Information	120.350 - 121.425



SERVICE DE L'INFORMATION AERONAUTIQUE

AMDT 03/13 **CHG :** Indicatif VOR CAN.

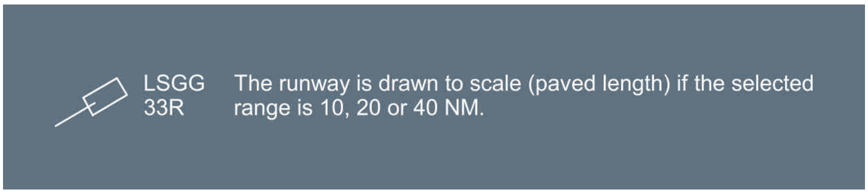
Appendix 12

ONUR AIR'S FCOM CONCERNING INDICATIONS ON ND

(6) Airport

Airport included in the flight plan:

- If the runway is not specified, the airport is represented by a star and the identification is displayed in white.
  Example: * LSGG
- If the runway is specified, it is represented by an oriented runway symbol in white.



Optional airport information
The airports that are not displayed as part of the flight plan may be called for display (ARPT pb on the EFIS control panel).
They are represented by a star and the identification in magenta.

(7) ILS Course (Magenta)
When the pilot pushes the LS pb-sw on the EFIS control panel, and if an ILS station has been selected, the display shows an ILS course symbol.

(8) ILS Marker Beacons
The screen shows these as waypoints (diamonds).

When the aircraft overflies a marker beacon, the corresponding symbol flashes:
Blue for the outer marker.
Amber for the middle marker.
White for the inner marker.

(9) Cross Track Error
This is the aircraft's lateral deviation from the active leg of the flight plan (related to the great circle route). It is indicated in nautical miles (NM), with the letter R (right) or L (left), according to the position of the aircraft with respect to the flight plan.

(10) Track line
This line appears in green only in the ROSE NAV or ARC mode when HDG or TRK has been selected on the FCU.

Appendix 13

ONUR AIR'S FCOM CONCERNING TAWS ALERTS

Onurair A318/A319/A320/A321 FLIGHT CREW OPERATING MANUAL	AIRCRAFT SYSTEMS NAVIGATION GPWS - EGPWS FUNCTIONS

TERRAIN AWARENESS AND DISPLAY

Ident.: DSC-34-70-30-00001417.0003001 / 17 MAR 11
Applicable to: MSN 0811, 0916-0963, 1008

The Terrain Awareness and Display (TAD) function computes a caution and a warning envelope in front of the aircraft, which varies according to aircraft altitude, nearest runway altitude, distance to the nearest runway threshold, ground speed, and turn rate. When the boundary of these envelopes conflicts with the terrain, memorized in the database, the system generates the relevant alert:

Alert Level	Aural Warning	ND (*Refer to DSC-31-45 Flags and Messages Displayed on ND*)	Local Warning
Warning	**TERRAIN AHEAD, PULL UP**	- Automatic terrain display See * - Solid red areas - TERR AHEAD (red)	The pb light comes on, on each pilot's instrument panel.
Caution	**TERRAIN AHEAD**	- Automatic terrain display pop up See * - Solid yellow areas - TERR AHEAD (amber)	

* When the TERR pb-sw ON, ND is selected ON, and ARC or ROSE mode is selected, the terrain is displayed on the ND. The terrain is displayed in various densities of green, yellow, red, or magenta, depending on the threat. (*Refer to DSC-31-45 Flags and Messages Displayed on ND*). If an alert is generated (caution or warning) when TERR pb-sw ON ND is not selected, the terrain will be automatically displayed and the ON light of the TERR pb-sw ON ND will come on.

<u>Note:</u> *1. When TERR pb-sw ON ND is selected, the weather radar image is not displayed.*
2. The relative height of the aircraft is computed using the Captain's BARO setting. Thus, the Terrain Awareness Display (TAD) does not protect against BARO setting errors
3. The TAD and Terrain Clearance Floor (TCF) functions operate using the FMS 1 position. Thus, the system does not protect against FMS 1 position error.

If the FMGS detects low navigation accuracy, then the enhanced modes of the EGPWS are automatically deactivated. The 5 GPWS modes remain active.

TERRAIN AWARENESS AND DISPLAY

Ident.: DSC-34-70-30-00001417.0002001 / 17 MAR 11
Applicable to: MSN 0640, 0676-0792, 0810, 1004

The Terrain Awareness and Display (TAD) function computes a caution and a warning envelope in front of the aircraft, which varies according to aircraft altitude, nearest runway altitude, distance to

Appendix 14
LIST OF EVENTS RELATED TO A VISUAL APPROACH

Accident which occurred in the United States on 5 March 2000, to Boeing 737-300, registration N668SW

The NTSB determined that the probable cause of the accident was the flight crew's excessive airspeed and flight-path angle during the approach and landing and its failure to abort the approach when stabilized approach criteria were not met. Contributing to the accident was the controller's positioning of the airplane in such a manner as to leave no safe options for the flight crew other than a go-around maneuver.

Accident which occurred in the United States on 16 October 2001, to Embraer 145-LR, registration N825MJ

The NTSB determined that the probable cause of the accident was the captain's failure to maintain airspeed which resulted in an inadvertent stall/mush, and hard landing. Factors were the failure of both pilots to follow company CRM and flight manual procedures, and the captains improper approach briefing.

Accident which occurred in the United States on 26 July 2002, to Boeing 727-232, registration N497FE

The NTSB determined that the probable cause of the accident was the captain's and first officer's failure to establish and maintain a proper glidepath during the night visual approach to landing. Contributing to the accident was a combination of the captain's and first officer's fatigue, the captain's and first officer's failure to adhere to company flight procedures, the captain's and flight engineer's failure to monitor the approach, and the first officer's color vision deficiency.

Accident which occurred in Slovenia on 24 May 2010, to Embraer ERJ 145-MP, registration F-GUBF

The BEA determined that the crew cleared to carry out a visual approach decided to turn onto the base leg at a distance too close to the runway given the altitude, which positioned the aircraft on final above the final approach path and with a high calibrated airspeed. The continuation of the unstabilised approach, with turbulent conditions, led to the hard landing. The Captain's overconfidence combined with the copilot's passive attitude following the handover of control on final approach generated a cockpit authority gradient. In these conditions, the crew did not consider missing the approach despite the identification of several EGPWS warnings and the unmet stabilisation conditions. The following factors also contributed to the accident:

- ❐ the absence of an update of the arrival briefing after being cleared to perform a visual approach;
- ❐ during visual approach, the crew's assessment of the situation without using the information available. This information is even more useful in a mountainous environment where the terrain can distort the assessment of the approach path to follow;
- ❐ task sharing between the crew. It was indeed less easy for the PF, sitting in the right hand seat, to find his bearings visually on the ground during turns onto base leg and on final.

Accident which occurred in Pakistan on 28 July 2010, to Airbus A321, registration AP-BJB

The Pakistan safety investigation board determined that the cause of the accident was a CFIT. By deciding to continue the landing in difficult weather conditions, the crew did not follow the specified procedures which led the aircraft to fly over the ground at low altitude.

Accident which occurred in the United States on 6 July 2013, to Boeing 777-200ER, registration HL7742

The NTSB determined that the probable cause of this accident was the flight crew's mismanagement of the airplane's descent during the visual approach, the pilot flying's unintended deactivation of automatic airspeed control, the flight crew's inadequate monitoring of airspeed, and the flight crew's delayed execution of a go-around after they became aware that the airplane was below acceptable glidepath and airspeed tolerances. Contributing to the accident were:

- the complexities of the autothrottle and autopilot flight director systems that were inadequately described in the manufacturer's documentation and the airline company's pilot training, which increased the likelihood of mode error;
- the flight crew's nonstandard communication and coordination regarding the use of the autothrottle and autopilot flight director systems;
- the pilot flying's inadequate training on the planning and executing of visual approaches;
- the pilot monitoring/instructor pilot's inadequate supervision of the pilot flying; and
- flight crew fatigue which likely degraded their performance.

A chapter of the analysis is devoted to manual flying. It is stated that not all approaches can be flown or completed using automation. For example, some runways have offset LOC approaches, which require that the A/P be disconnected and the airplane aligned with the runway manually. Occasionally, partial runway closures displace runway thresholds by significant amounts, as much as 3,000 to 4,000 ft, requiring A/P disconnect and manual landing. Certain charted visual approaches, such as the Parkway Visual Approach to runways 13L/R at New York's John F. Kennedy International Airport or the River Visual Approach to runway 19 at Ronald Reagan Washington National Airport, require manual flight. Additionally, normal instrument approach navigational signals may experience failures or anomalies requiring the flight crew to disconnect the A/P and continue manually.

Pilots must have both training and recent experience in manually manipulating the controls so as to have the skill and confidence to perform manual flight maneuvers safely.

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