MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS, DE L'AMENAGEMENT DU TERRITOIRE, DU TOURISME ET DE LA MER - BUREAU D'ENQUETES ET D'ANALYSES POUR LA SECURITE DE L'AVIATION CIVILE

Serious incident at Nantes on 21 March 2004 to the MD-83 registered SU-BMF operated by Luxor Air

REPORT

su-f040321a

F O R E W O R D

This report presents the conclusions reached by the BEA on the circumstances and causes of this incident.

In accordance with Annex 13 of the Convention on International Civil Aviation, with Directive 94/56/EC and with Civil Aviation Code (Book VII), the investigation is intended neither to apportion blame, nor to assess individual or collective liability. Its sole objective is to draw lessons from the occurrence which may help to prevent future accidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the BEA to make its reading easier for English-speaking people. As accurate as the translation may be, please refer to the original text in French.

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Glossary

AIS	Aeronautical Information Service
AP	Autopilot
ATIS	Automatic Terminal Information Service
CRM	Cockpit Resource Management
CRNA	Regional ATC Centre
CVR	Cockpit Voice Recorder
DGAC	General civil aviation directorate (Direction Générale de l'Aviation Civile)
DME	Distance Measuring Equipment
DNA	Air traffic control management (Direction de la Navigation Aérienne)
EFIS	Electronic Flight Instrument System
FDR	Flight Data Recorder
FMA	Flight Mode Annunciator
Ft	Feet
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
Hpa	Hectopascal
IAC	Instrument Approach Chart
IAF	Initial Approach Fix
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
Kt	Knots
MAPt	Missed Approach Point
METAR	Meteorological Aviation Report
MSAW	Minimum Safety Altitude Warning
ND	Navigation Display
NM	Nautical Mile
NTSB	National Transportation Safety Board (USA)
PF	Pilot Flying
PNF	Pilot Not Flying
QAR	Quick Assess Recorder
QFE	Atmospheric pressure at aerodrome altitude
QFU	Runway orientation
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
TAF	Terminal Area Forecast
TEMSI	Significant weather forecast chart
UTC	Universal Time Coordinated
VOR	VHF Omnidirectional Radio Range

SYNOPSIS

Date and time
21 March 2004 at 1 h 20 min[1]

Site of incident
On final approach to runway 21
at Nantes Atlantique

Type of flight
Public transport of passengers
International charter flight number
LXO615

Airplane
MD-83 registered SU-BMF

Owner
Airplane Finance Trust

Operator
Luxor Air (Egypt)

Persons on board
2 flight crew, 6 cabin crew
and 104 passengers

Summary:

At night under IMC conditions, the crew performed a non-stabilized approach to runway 21 at Nantes Atlantique airport, deliberately exited the protection envelope in the published procedure then performed a go-around while they were over-flying a built-up area at a height of around four hundred feet.

Injuries	Crew members	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Slight/None	8	104	

[1] Except where otherwise noted, the times shown in this report are expressed in Universal Time Coordinated (UTC). One hour should be added to obtain the time applicable in Nantes on the day of the incident.

1 - FACTUAL INFORMATION

1.1 History of Flight

On Saturday 20 March 2004, the MD-83 registered SU-BMF was undertaking charter service LXO615 between Luxor (Egypt) and Nantes, the arrival at Nantes being originally scheduled for the following day, Sunday, at 9 h 30 min. The airplane arrived at Luxor from Brussels (Belgium) at 18 h 40 min, about sixteen hours late[(2)]. It took off for Nantes at 19 h 45 min. The flight took place without incident.

In accordance with the Romeo ATIS, the crew prepared a VOR DME approach to runway 21. The co-pilot was pilot flying.

At 1 h 07 min 21 s, the CRNA West controller, after coordinating with the Nantes approach controller, vectored the crew directly to ABLAN. The crew read back a route towards the LAROK IAF, and the en-route controller then corrected that to confirm a direct route to ABLAN.

At 1 h 14 min 17 s, the Nantes approach controller confirmed the direct route to ABLAN and asked the crew to descend to level 70.

At 1 h 17 min 19 s, the crew was cleared to descend towards 3,000 ft, and was then cleared for approach at 1 h 23 min 08 s.

The preceding airplane landed at 23 h 17 min. An hour and forty minutes had passed with no airplane movements.

The airplane was then on a 330° heading on autopilot in NAV mode (GPS navigation). The co-pilot selected VOR/LOC mode to intercept the 043° radial inbound on the NTS VOR. The airplane was configured for landing and the Captain told ATC at 1 h 23 min 12 s that he planned to descend from three thousand feet to five hundred feet then, at 1 h 24 min 23 s, that the airplane was established on the approach radial.

The crew then noticed, on the navigation instruments, that there was a variation of about 0.8 NM between the airplane's route and the localizer radial. The VOR CAP indicator was displayed on the FMA. The co-pilot changed the autopilot to HDG SEL to intercept the radial with a selected heading of about 250°.

8 NM DME away, a short time before the airplane crossed the radial, the Captain asked the co-pilot to continue on that heading in order to go around a stormy area that he thought he had identified on the weather radar. The airplane crossed the radial at 1 h 25 min 43 s.

The airplane made its descent at an average rate of descent of a little less than 1,000 ft/min. The crew reported suffering significant turbulence during this phase.

(2) The aircraft was delayed at Brussels by refuelling problems.

At 1 h 27 min 10 s, the controller intervened to say that the airplane seemed to him to be too low. The Captain asked the co-pilot to select ALT HOLD and told the controller that he was maintaining five hundred feet.

In addition, the co-pilot decided to go back towards the radial with an 80° left turn via the HDG SELECT mode.

Coming out of the turn, the airplane probably broke through the cloud layer and a witness then noticed that it was starting a go-around. At 1 h 27 min 33 s, the Captain announced the go-around to the controller.

The airplane climbed towards three thousand feet. As it was passing through the radial on a 170° heading, the controller informed the crew that they could start descending again. The Captain answered that he preferred to perform the approach again. The controller vectored them and gave them the altitude cues during the descent.

The landing and disembarkation of the passengers took place normally. After a twenty-eight minute stop, the airplane took off empty bound for Toulouse, as planned.

1.2 Killed and Injured

Not applicable.

1.3 Damage to Airplane

There was no damage to the airplane.

1.4 Other Damage

There was no damage to third parties.

1.5 Personnel Information

1.5.1 Flight crew

1.5.1.1 Captain

Male, aged 45.

- Licenses: Commercial pilot’s license issued by Venezuela in 1984, validated by Egypt, valid until August 2004.

- Ratings: instructor, Captain on MD-83, Airbus A300-B4, Airbus A320.

- Aeronautical career:

    - from September 1977 to February 1990, co-pilot, then Captain and instructor for the Venezuelan airline Aeropostal;
    - from May 1990 to February 1997, flight engineer for the Venezuelan airline Viasa;
    - from March 1997 to October 2000, co-pilot then Captain for the Irish airline Transaer;
    - from November 2000 to February 2002, Captain and instructor for the Venezuelan airline Laser;
    - from January 2003 to September 2003, Captain for the Egyptian airline AMC;
    - since 11 February 2004, Captain for Luxor Air.

- Experience : 13,359 flying hours, of which 5,657 on MD-83, 33 hours in the previous seven days and 65 hours in the previous month.

1.5.1.2 Co-pilot

Male, aged 31.

- Licenses: Commercial pilot's license issued by Egypt in 2000, valid until 13 June 2004.

- Ratings: MD-83, MD-90.

- Experience: 3,111 flying hours, of which 1,900 on MD-83, 26 hours in the previous seven days and 77 in the previous month.

1.5.2 Air Traffic Controller

Male, aged 49.

- Qualification as first approach controller in April 1994.

- Posted to Nantes in September 1990.

- Shift manager since January 2000.

- Tower manager since September 2003.

- Medical certificate valid until 27 June 2004.

1.6 Airplane Information

Airframe

- Manufacturer: McDonnell-Douglas
- Type: McDonnell -Douglas DC 9-83 (MD-83)
- Serial N°: 53199
- Registration: SU-BMF

Certificate of Airworthiness issued on 4 August 2002, valid until 3 August 2004.

Engines

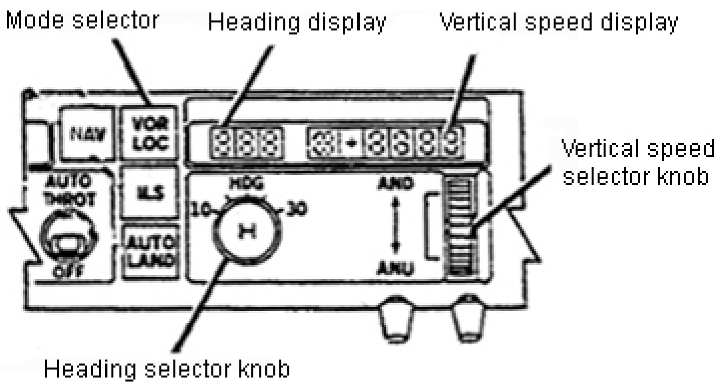
- Manufacturer: Pratt & Whitney.
- Type: JT8D-219.

On-board equipment

The cockpit was equipped and a Sundstrand Mark II GPWS.

Two three-axis autopilots, of which only one at the time is selected at any time, and an auto-throttle allow entirely automatic flying and vectoring.

Parameter display (speed, altitude and vertical speed) and the selection of AP modes are performed via the Flight Guidance Control Panel.



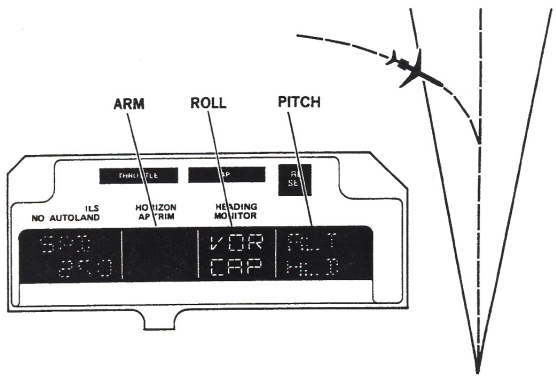
Flight Guidance Control Panel

The data source used by the AP for navigation depends on the display selected on the ND. In addition, to each source corresponds one or more AP activation modes, for example:

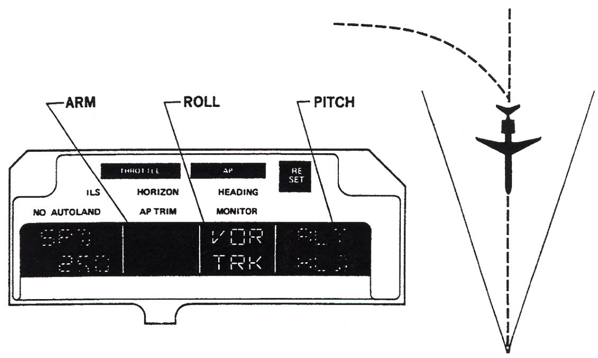
- in MAP[3] display mode, the source for navigation is the GPS and the corresponding AP mode is NAV;
- in ARC[4] or ROSE display mode, the source for navigation is the radial of the radio displayed and VOR/LOC mode is one of the modes used to engage the AP.

In VOR/LOC mode, it is possible to intercept a pre-displayed radial. This interception is performed in three phases:

- ARM: the airplane is ready to intercept and the VOR display appears in the ARM window on the mode annunciator panel;
- VOR CAP: when the airplane reaches the point where it must begin its maneuver, the display changes to VOR CAP in the HEADING MONITORING display on the mode annunciator panel;



- VOR TRK: when the airplane is established on the radial, VOR TRK is displayed in the HEADING MONITORING window on the mode annunciator panel.



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(3) This display mode allows the airplane to be shown in its environment as well as the route followed.
(4) This mode gives an indication on distances and headings.

The instrumentation also includes weather radar with color display. Colors (red, yellow, green) indicate areas of rainfall or obstacles on the ground. Red indicates an area of heavy rainfall or an object on the ground with a high reflective level[5]. The direction of the antenna can be adjusted within a tilt range of plus or minus 15°. It should be noted that at a low height, the area within a few nautical miles around the point indicating the airplane is mainly made up of echoes coming from the ground. This remains true when the antenna is raised to maximum because of reflection from the ground of the secondary radar transmitter lobes.

1.7 Meteorological Conditions

1.7.1 Meteorological conditions observed

General situation over France on 21 March 2004 between 0 h 00 and 2 h 00

A southwest to west airflow was crossing France. At 0 h 00, a cold front centered on a line from Quimper to Paris was moving gradually to the southeast. At 1 h 30 min, it was on a line from Lorient to Alençon. The accompanying precipitation was light.

In front, in the warm sector, an area of broken cloud with light rain was covering the Nantes region. The light drizzle came from the stratocumulus (base at 500 ft, top at 10,000 ft).

Observations at Nantes between 0 h 00 and 02 h 00

On the ground, the wind was from the west at 15 kt, gusting to 25 kt, increasing to 30 then 40 kt towards 4,500 ft. The visibility measured by two transmissiometers at Nantes Atlantique aerodrome was over 1,500 m between 1 h 00 and 2 h 00. Human observation at 0 h 00 noted 3,500 m visibility under light drizzle. Radar echoes of rain at Nantes did not exceed 2 mm/h.

Turbulence in the lower cloud layers must have been light to moderate, as is often the case with a southwest wind. This is confirmed by the extremely variable measurements of the cloud base above the aerodrome.

At 0 h 00, the temperature was 12 °C, the dew point 11 °C, humidity at 94 %. The falling QNH was 1017.5 hPa.

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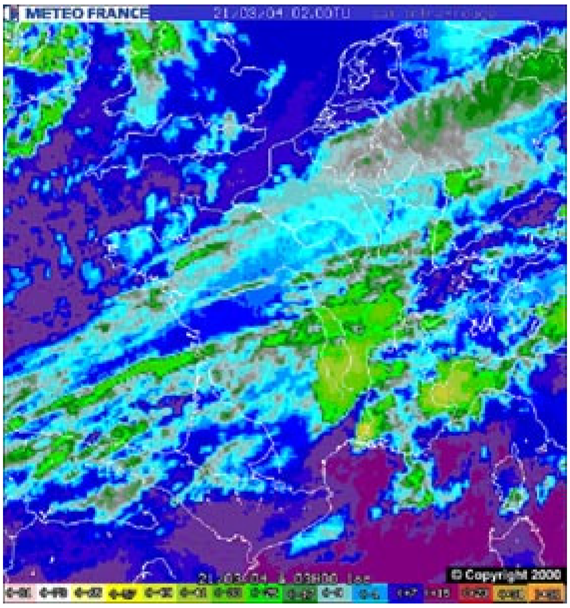
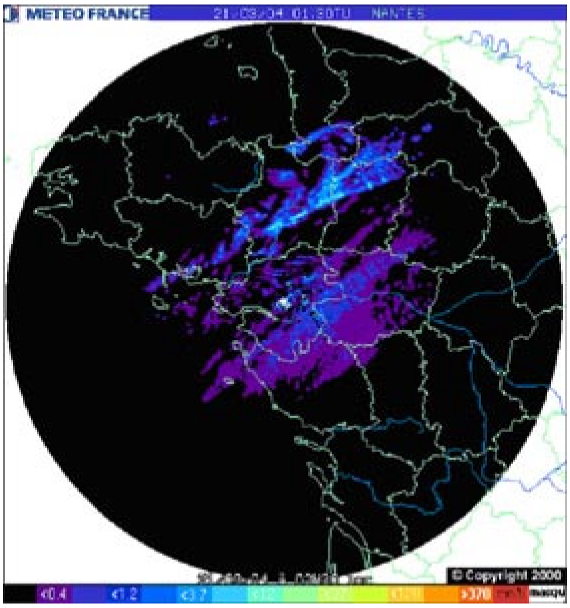
(5) The weather radar, which operates on the SHF frequency band, is designed to show reflection of waves by the rain and is not sensitive to disturbance by radio broadcasts.



Satellite picture showing the position of the cold front on 21 March 2004 at 1 h 30



Radar Image of rain for the Nantes region on 21 March 2004 at 2 h 00

The wind data, recorded every minute, showed, between 1 h 00 and 2 h 00, average wind between 14.7 and 22.5 kt and, between 1 h 25 min and 1 h 35 min, average wind between 14.3 and 18 kt with gusts to between 22.3 and 24.6 kt.

1.7.2 Broadcast meteorological conditions

For the destination aerodrome

The Nantes Atlantique METAR broadcast on 21 March 2004 at 0 h 00 gave wind from 240° at 16 kt, visibility of 3,500 m, light drizzle and a ceiling of 500 ft. The broadcast temperature was 12 °C, dew point 11 °C and QNH at 1017 hPa. No changes were forecast for the two hours following the broadcast.

For the diversion aerodrome

The Paris Charles de Gaulle METAR, broadcast on 21 March 2004 at 1 h 00, gave a wind from 230° at 19 kt, visibility of 8 km, rain, scattered cloud at 600 ft and a ceiling at 1,000 ft, as well as a temperature of 11 °C, dew point 10 °C and QNH at 1010 hPa. No significant changes were forecast.

1.7.3 Flight dossier provided to the crew by the operator

The meteorological dossier provided to the crew on departure from Luxor included the significant charts as well as the forecasts along the route. The forecasts for Nantes showed, between 18 h 00 on 20 March and 12 h 00 on 21 March, a wind from 240° at 15 kt with gusts to 25 kt, visibility of 7,000 m and a ceiling at 1,000 ft; temporarily, between 21 h 00 and 3 h 00, the visibility was forecast as 3,000 m, with rain, drizzle and a 300 ft ceiling, changing between 6 h 00 and 8 h 00 to visibility of 10 km and scattered cloud at 1,200 ft. Finally, between 10 h 00 and 12 h 00, the forecast was for wind from 260° at 20 kt with gusts to 35 kt, visibility of 5,000 m, showers, a 300 ft ceiling and some storms.

1.7.4 Information received in flight by crew

The Romeo ATIS[6] at Nantes gave the following information: wind from 240° at 20 kt, with gusts to 26 kt, visibility of 4 km, light rain and a 800 ft ceiling, temperature of 12 °C and dew point 11 °C, QNH at 1019 hPa and QFE at 1016 hPa.

The Nantes controller provided the following meteorological information:

- at 1 h 14 min 38 s, visibility of around 4,000 m and broken cloud cover between 500 and 900 ft;
- at 1 h 24 min 27 s, a wet runway, surface wind from 260° at 18 kt with gusts to 25 kt;
- at 1 h 32 min 47 s, while he was vectoring the crew towards the beginning of their second approach, visibility of around 6,000 m and a ceiling of about 700 ft;
- at 1 h 39 min 02 s, just before the landing, wind from 260° at 20 kt with gusts to 26 kt.

He also gave the QNH as being 1017 hPa on several occasions.

Note: the control tower does not possess equipment capable of locating storm activity. The controller can only indicate any storms that he can see in the immediate area of the aerodrome.

1.8 Aids to Navigation

Radio navigation aids for the procedure

The approach to Nantes for runway 21 uses the NTS VOR DME on the 115.5 MHz frequency.

The last inspection of the station dated from 27 January 2004. All of the VOR and DME monitor parameters were correct (VOR group 2 and transponder 1 remaining in service). Since then, no VOR or DME warnings have been notified: there were no calls from controllers or messages on the Cat. III panel printer (any condition change leads to transmission of a message).

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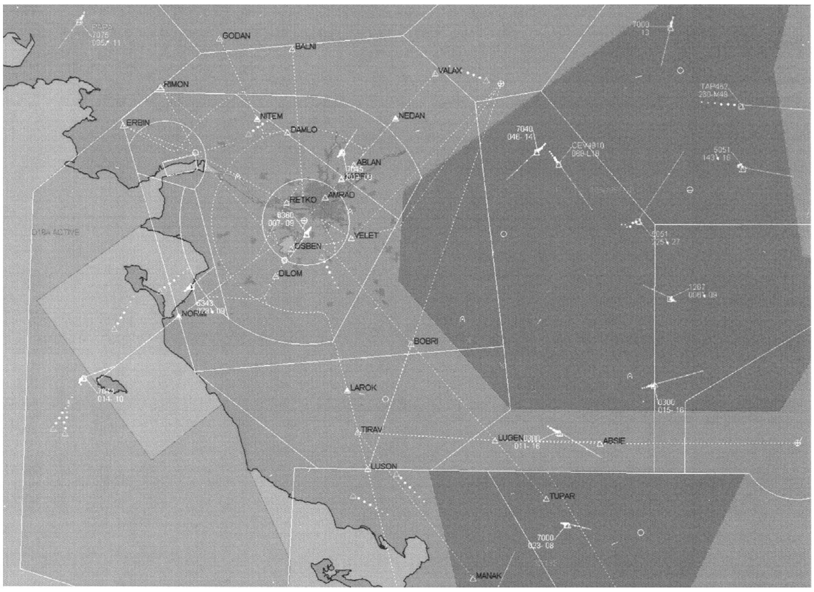
(6) The Romeo ATIS was recorded at 21 h 05. At the time the airplane arrived at Nantes, the Sierra ATIS recorded at 23 h 30 was being broadcast. The Sierra ATIS gave a QNH of 1018 hPa and a ceiling of 700 ft.

After the incident, an inspection of the condition of the VOR and DME took place on 24 March 2004. Nothing was noticed and the Cat. III panel printout showed no change in condition up to that date.

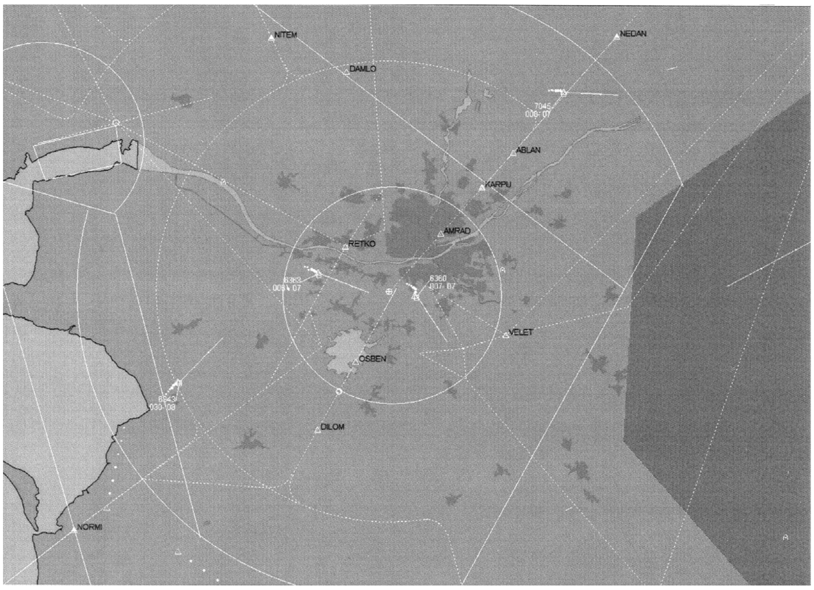
Radar and visualization

Nantes ATC has an IRMA 2000 type image radar that had been in service for a week at the time of the incident. This equipment allows surveillance, assistance and vectoring services (see paragraph 1.17.3) to be provided, with restrictions related to system precision.

The images below provide a black and white representation of the IRMA 2000 display.



Scale 100 NM



Scale 40 NM

This display can be fed data from two sources:

- an offset from the monopulse radar at Roche-sur-Yon that is precise[7] to within 200 meters;
- the STR data coming from the multiple CRNA West radar, located in Brest and associated with tracking. The equipment was developed for en-route control that provides, each time the screen is refreshed, precision of the order of 110 to 120 meters for flight in a straight line and of the order of 250 meters for flight with a curved trajectory.

Two buttons allow the controllers to select the source. There are no particular instructions regarding the choice of the source. In general, they use the STR image, which has the advantage of providing both CAUTRA data (flight designator), tracking and more precise image retention. The offset from the Roche-sur-Yon radar gives greater precision in the lower layers, when the airplane is no longer within range of several radars[8].

The altitude displayed on the radar plot label seen by the controller is provided by reference to 1013.25 hPa. To obtain the aircraft's altitude, the controller must either mentally correct the value of the difference corresponding to the difference between this pressure and the QNH, or hold down a button that allows the altitude to be displayed directly.

The introduction of the IRMA 2000 resulted from a decision taken by the various services that participated in its development (DAC, STNA, CENA). A training program was set up for users. However, during the investigation, it appeared that the users knew relatively little of the system's characteristics and capabilities, and that they did not have the same view of the tasks that can be carried out.

(7) The precision of the radar image depends on the obsolescence of the information, estimated at about three seconds, as well as the intrinsic precision of the measurements. For example, for an airplane flying at a speed of 140 knots, the precision is of the order of 240 meters.
(8) The plot has CAUTRA emulation, though without speed data.

1.9 Telecommunications

The radio communications with Nantes and Brest ATC were recorded. The exchanges between these organizations and flight LXO615 are featured below, as well as the exchanges between Brest ATC and Nantes ATC during the coordination phase.

Communications by telephone between Brest and Nantes ATC centers

Broadcasting Station	Receiving Station	UTC time	Communications
NANTES	BREST	1:05:17	Yes?
BREST	NANTES	1:05:17	You're landing them on 03, I suppose, eh?
NANTES	BREST	1:05:19	Err, no, 21.
BREST	NANTES	1:05:21	Ah, you're on 21?
NANTES	BREST	1:05:22	Yeah.
BREST	NANTES	1:05:22	That's ABLAN, then?
NANTES	BREST	1:05:23	Yeah, ABLAN, yeah.
BREST	NANTES	1:05:24	Okay.
NANTES	BREST	1:05:25	Thanks.

Radio communications with Brest

Broadcasting Station	Receiving Station	UTC time	Communications
LXO615	IN	1:07:00	Brest, Luxor 615, hello.
IN	LXO615	1:07:05	Luxor 615 hello, descend flight level 240 direct ABLAN.
LXO615	IN	1:07:13	Euh… Would you say again the direct to where and flight level 240, direct to euh… LAROK?
IN	LXO615	1:07:21	Luxor 615. Euh… Correction descend flight level 120 and direct to ABLAN, A B L A N.
LXO 0615	IN	1:07:29	ABLAN and 120.
IN	LXO 0615	1:07:41	Luxor 615 for information runway 21 in use in Nantes
LXO 0615	IN	1:07:46	Sure, we had information Romeo, thanks.

Radio communications with Nantes (129.875 MHz)

Broadcasting Station	Receiving Station	UTC time	Communications
LXO615	APP	1:14:15	Nantes, LXO615, hello.
APP	LXO615	1:14:17	Hello, LXO615. Identified, proceed ABLAN direct, descent level 70 initially and expect VOR / DME runway 21.
LXO615	APP	1:14:30	Roger, direct to ABLAN and descent to 70 initially, expect VOR runway 21, information Romeo.
APP	LXO615	1:14:38	Roger, for information, last visibility is about 4000 meters and broken between 500 and 900 feet.
LXO615	APP	1:14:47	OK, thank you.
LXO615	APP	1:17:15	Nantes, LXO615, request further descent.
APP	LXO615	1:17:19	LXO615, descent 3000 feet QNH 1017.
LXO615	APP	1:17:25	3000 feet 1017, LXO615.
APP	LXO615	1:23:08	LXO615, cleared final, report established on 223 radial to Nantes.
LXO615	APP	1:23:12	Roger, cleared final, and cleared procedure. I call you established in the radial 223 to Nantes, leaving 3000 to 500.
LXO615	APP	1:24:23	LXO615, established in the radial 223.
APP	LXO615	1:24:27	Roger, LXO615, you're cleared to land runway 21, runway's wet, and surface wind 260 degrees 18 knots, gusting 25.
LXO615	APP	1:24:39	Roger, cleared to land and … copied the weather.
APP	LXO615	1:27:10	615, you seem to be a bit low on the.. on the slope.
LXO615	APP	1:27:15	OK we're maintaining 500 feet now.
LXO615	APP	1:27:33	Security, go around now, 615.
APP	LXO615	1:27:42	Yes, too low, you are too low, so go around, please, I call you back.
APP	LXO615	1:28:00	You are on the slope now. If you want to descent, you may descent, you're passing 4 miles on final.
LXO615	APP	1:28:21	Oh yeah, ah… We're passing 4 miles on final, we will make another try.
APP	LXO615	1:28:28	Roger, so climb 3000 feet QNH 1017, and expect radar vectors for VOR / DME 21, call you back to turn.
LXO615	APP	1:28:39	Roger, cleared... climb to 3000 feet and expect.
APP	LXO615	1:28:55	LXO615, turn left heading 050.
LXO615	APP	1:29:01	Left heading 050.
APP	LXO615	1:30:40	LXO615, turn left heading 030.
LXO615	APP	1:30:42	Left heading 030, LXO615.
APP	LXO615	1:31:45	615, turn left heading North.

LXO615	APP	1:31:49	Left heading North, LXO615.
APP	LXO615	1:32:47	615, for information, last visibility about 6 kilometers and ceiling about 700 feet.
LXO615	APP	1:32:52	Roger, LXO615.
APP	LXO615	1:33:00	LXO615, turn left heading 270, intercept 223 radial to Nantes, cleared approach.
LXO615	APP	1:33:07	Roger, to approach, re… left heading 270.
APP	LXO615	1:35:19	LXO615, when passing KARPU, you may leave 3000 feet and down 1500 feet initially, I call you back for lower.
LXO615	APP	1:35:28	Roger, 1500 feet initially when passing KARPU, and then you call us back for lower.
LXO615	APP	1:37:40	Approaching to position AM… AMRAD, requesting go to 500.
APP	LXO615	1:37:47	Maintain 1500 till further advice.
LXO615	APP	1:37:50	Roger.
LXO615	APP	1:38:57	Nantes, LXO615, passing position AMRAD.
APP	LXO615	1:39:02	Roger, LXO615, you may descent, you are cleared to land runway 21, surface wind 260 degrees 20 knots gusting 26.
LXO615	APP	1:39:11	Roger, cleared to land.

1.10 Aerodrome Information

1.10.1 Nantes Atlantique aerodrome

Nantes Atlantique is a controlled civil aerodrome open to public air transport. Its reference altitude is ninety feet.

It has a runway 03/21 that is 2,900 meters long and 45 meters wide, equipped with high intensity centre, side and threshold lighting.

Runway 03 is equipped with an ILS allowing category IIIb approaches and approach lights. Runway 21 is not equipped with approach lights and an offset threshold reduces the landing distance available to 2,695 meters. The altitude of the offset threshold is 87 ft. A precision approach path indicator (PAPI) is installed in the touchdown area on this runway.

The control tower operations manual, in the part on night operations, (between 23 h 00 and 6 h 00 local time) states the conditions to take into account in determining the runway in use: « *on arrival, the QFU 03 is mandatory for all aircraft when the tailwind is equal to or lower than 8 kt (6 kt for a single-engine aircraft) and where traffic is low (no more than two aircraft arriving simultaneously at Nantes)* ».

The use of runway 21 for the arrival of flight LXO615 was in accordance with these directives.

1.10.2 Approach procedures

1.10.2.1 General

The regulation governing the design of instrument approach procedures is instruction 20754 DNA of 12 October 1982. This instruction is regularly amended by a group of specialists in order to take into account international specifications (ICAO - DOC 8168).

Design and modification of a procedure are studied by the relevant civil aviation management (the DAC West for Nantes aerodrome). Publication is undertaken by the Aeronautical Information Service in the form of regularly updated bulletins to the AIP (Aeronautical Information Publication).

An Instrument Approach Chart (IAC) ensures that an aircraft flying in the protected areas associated with the procedure and respecting the descent slope will over-fly obstacles at a height that will respect the obstacle clearances specified in the regulations.

1.10.2.2 VOR DME 21 Procedure

The runway 21 VOR DME approach procedure(9) at Nantes (see appendix 2) specifies joining the approach radial from the Initial Approach Fix (IAF), following a DME curve 15 NM from NTS.

The procedure is broken down into four segments:

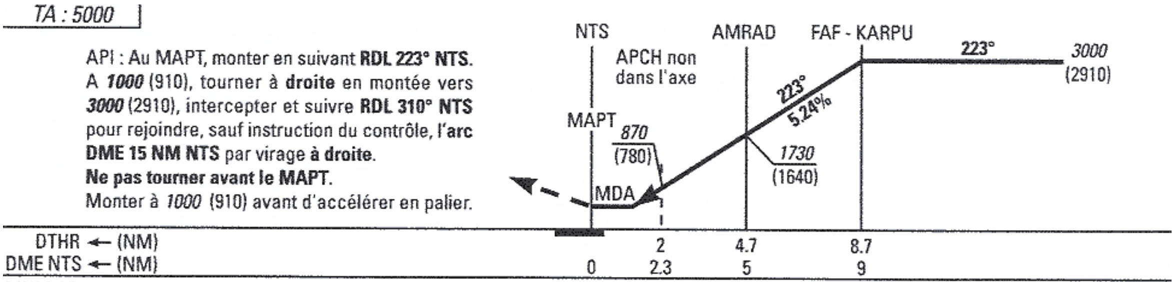
- the initial approach segment: begins at the IAF (LAROK in the case of the arrival of flight LXO615) and ends at ABLAN. It allows the aircraft to join the final approach radial;
- the intermediate approach segment: begins at ABLAN and ends at KARPU. According to instruction 20754 DNA of 12 October 1982, paragraph 1.5.1, « this segment connects the initial approach segment and the final approach segment. On this segment, the aircraft configuration, its speed and corrections in alignment prepare the aircraft for the final approach segment». Paragraph 1.5.3 adds : « The minimum length of time must correspond to 30 seconds flying time at the initial approach speed. »;
- the final approach segment: begins at KARPU at 3,000 ft and ends at NTS;
- the missed approach segment: begins at NTS and ends when the aircraft has reached the minimum altitude to follow the next path (a further approach or a diversion to another aerodrome for example).

(9) The approach does not exactly line up with the extended runway centerline; there is a 13° offset.

After passing KARPU, two fixes are given, accompanied by a minimum clearance altitude:

- AMRAD, located 5 NM from NTS, which must be over-flown at a minimum altitude of 1,730 ft;
- the point located 2.3 NM from NTS, which must be over-flown at a minimum altitude of 870 ft.

In order to help the pilot to control his descent regularly, the approach chart includes a series of indications (distance to NTS, corresponding altitude) that allow him to evaluate the clearance in relation to the published slope and to correct it. Equally, the pilot can determine the descent speed that he needs to select in relation to his ground speed.



MNM AD : distances verticales en pieds, RVR et VIS en mètres. REF HGT : *ALT AD*

CAT	VOR/DME OCH : 357		MVL	
	MDA (H)	RVR	***MDA*** (H)	VIS
A	***450*** (360)	2500	***610*** (520)	1500
B	***470*** (380)	2500	***610*** (520)	1600
C	***500*** (410)	3000	***950*** (860)	2400
D	***520*** (430)	3000	***950*** (860)	3600

DME NTS NM	**8**	**7**	**6**	**5**	**4**	**3**	**2**
ALT	***2685***	***2365***	***2045***	***1730***	***1410***	***1090***	***775***
(HGT)	(2595)	(2275)	(1955)	(1640)	(1320)	(1000)	(685)

After the final approach, the pilot must not descend below the minimum descent altitude (MDA) until he has acquired the external visual references necessary for the landing. He determines his MDA using the approach chart, with reference to the category of his aircraft. For an aircraft in the category of the MD-83, the MDA is five hundred feet.

If these fixes are not acquired before the MAPt at the latest, indicated by the NTS VOR-DME, the pilot must start the go around procedure.

Note: the representation of the procedure on the Jeppesen chart of 4 July 2003 (see appendix 2), used by the crew, differs slightly from the published procedure. There is a risk of confusion between point D2.3 and the start of the level off before the MAPt, and thus between the altitude on passing point D2.3 and the MDA. In addition, the shaded zone indicating the urban area on the IAC chart is not reproduced.

1.10.2.3 Protected areas

The protected area in the procedure is placed on either side of the approach radial represented by the NTS 043° radial. This area is flared, that is to say that the further one goes from NTS, the wider it is. The angle of this flared shape is 7.8°.

Only obstacles located under this area are taken into account when fixing the over-flight heights. An illustration of the protected areas at Nantes is included in appendix 1.

The published descent slope (5.24%) must be followed very closely by the pilot(10). The ICAO in fact recommends that all approaches, including standard approaches, be based on the principles of stabilized approaches. If in the past some approaches could include a series of descents alternating with level flight, which was aimed at neutralizing obstacles, France has since adopted a design policy based on a constant rate of descent. Respecting the slope and the altitudes at the fixes, such as AMRAD and NTS D2.3 replaces the leveling off in the old procedures. This guarantees over-flight of the highest obstacle (in this case the Tour de Bretagne at AMRAD, which reaches a height of 458 ft) while respecting the regulatory clearances.)

Missed approaches are also the subject of a study on obstacle clearance, similar to that undertaken for final approaches.

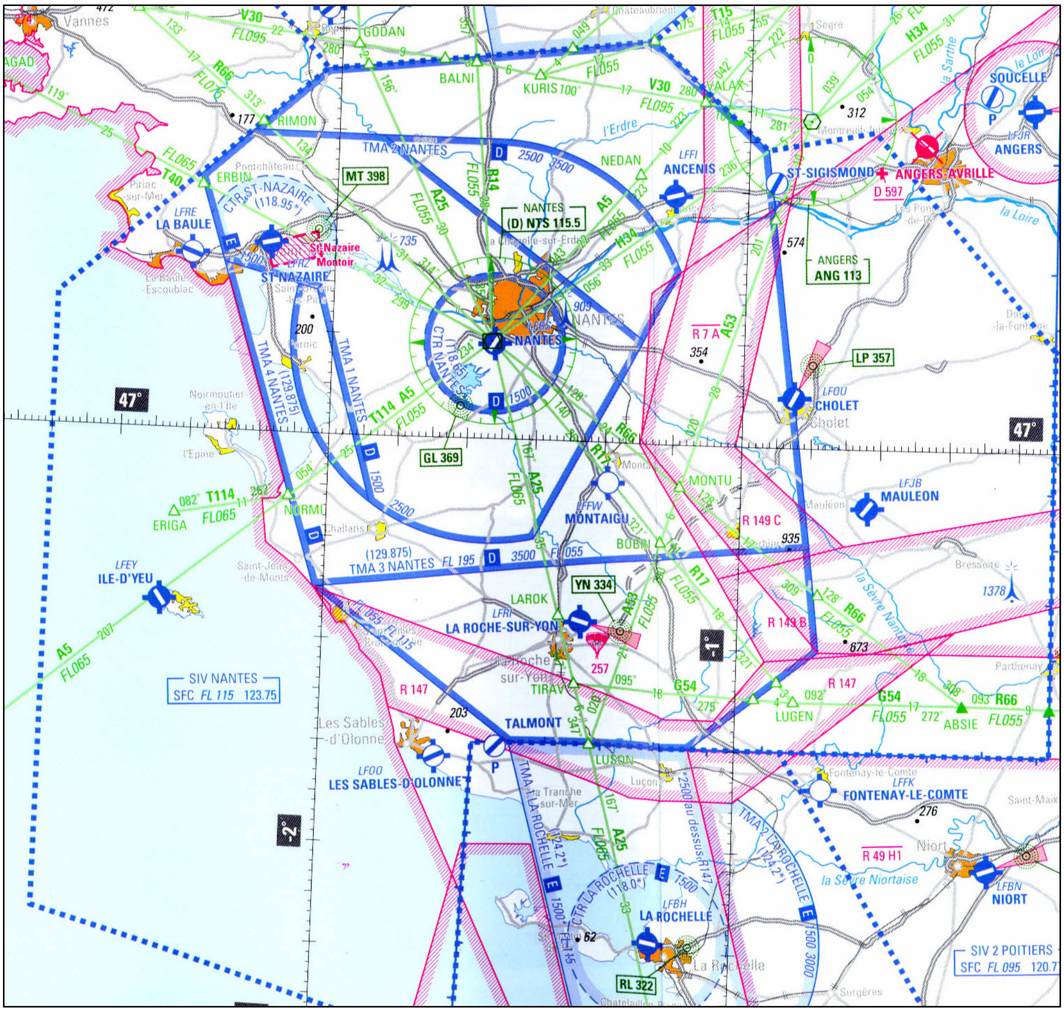
1.10.3 Nantes ATC

General

The Nantes Atlantique ATC provides control, flight information and warning services.

The airspace that it manages consists of a class D CTR centered on the aerodrome, a class D TMA and a Flight Information Service (FIS). A letter of agreement describes exchanges between the CRNA West and Nantes approach control. It states that those portions of airways in class E located within the limits of the Nantes FIS are also managed by Nantes, between the lower limit and flight level 115.

(10) The calculated rate without wind factor to respect the descent profile at a speed of 140 kt is close to 700 ft/min.



The letter of agreement gives Nantes the responsibility for managing aircraft on departure and arrival from aerodromes located within the FIS area: Saint-Nazaire, La Baule, l'Ile d'Yeu, Les Sables d'Olonne, La Roche-sur-Yon, Mauléon, Montaigu, Cholet and Ancenis. It adds that specific procedures exist between the two organizations for flights departing from or arriving at aerodromes close to the FIS area: Rennes, La Rochelle, Niort and Poitiers. For coordination on arrival, the same agreement states that: "*except in specific cases, Brest hands over arrivals to Nantes […] at a flight level equal to or greater than 120, en route to the IAF associated with the standard approach path".*

A portion of the CTR is delegated to the aerodrome ATC.

The aerodrome operations manual states that the transfer from the Approach frequency to the Tower frequency shall be performed at the latest one minute before passing the FAF or FAP. The change of frequency must be performed even when the control positions are grouped together.

The operations manual sets the minimum radar separation at 8 NM, which is in accordance with the national standard. This separation standard is described as the sum of a separation of 5 NM, in accordance with RCA 3, and an allowance for inaccuracy of 3 NM. This notion of inaccuracy described in the manual results from older generation multi-radar data handling and is obsolete. However, given the aircraft maneuvering in the terminal area, a separation of 8 NM has been maintained on approach as the national standard, in the absence of approach radar.

Note: the 8 NM separation may seem to be due to inaccuracy in the radar. In fact it was established so as to take into account the uncertainty on the relative position of two aircraft between two radar screen updates (eight seconds) as well as a safety margin.

Work organization

The control tower has four work stations (SOL, LOC, APP and FIS) that can be grouped together at the LOC position when the workload allows.

The duty roster specifies the presence of two controllers, including a tower manager, between 0 h 00 and 6 h 30 min (local time). The two controllers organize their break times between them. In practice, due to the breaks, it is common for one controller to undertake the control service during this time, the other controller being in the rest room, always available in case of need.

1.11 Flight Recorders

The airplane was equipped with two mandatory flight recorders:

- a Cockpit Voice Recorder (CVR), capable of recording the last thirty minutes of a flight;
- a Flight Data Recorder (FDR), capable of recording the last twenty-five flying hours.

It was not equipped with a QAR, this not being mandatory in Egypt.

Since the airplane had flown about thirty-five hours between the time of the incident and the time when the flight recorders were removed, all the data relating to the incident was lost.

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

1.16.1 Capture of a radial by the autopilot

The crew said that the autopilot failed to capture the NTS 43° radial, though the co-pilot had armed the VOR LOC mode when the airplane arrived at ABLAN. With this mode armed, the autopilot in fact passed into VOR CAP mode and the airplane turned in order to intercept the approach radial, but without lining up on this radial. The VOR TRK mode did not engage. The reconstitution of the airplane track shows that the airplane did follow a 223° path, but 0.8 NM left of the radial. After having told the controller that they were lined up, the Captain checked their position and noticed the gap from the radial. During the interviews, the pilots called this phenomenon “early capture”, something they had already encountered.

The National Transportation safety Board (NTSB) was asked about this phenomenon and undertook some research into it. This showed that the autopilot was designed to intercept the radial at an angle equal to or less than 90°. Beyond this limit, system performance is not determined. The phenomenon that was observed is thus not in contradiction with the autopilot specifications, since the intercept angle was close to 110°.

This limitation is not, however, noted in the airplane’s Flight Manual. Pilots only seem to find out about it through word of mouth.

1.16.2 Reconstitution of the track

Radar recordings

In the absence of FDR data, data from the Roche-sur-Yon secondary monopulse radar was used to reconstitute the airplane’s track. The data was taken from the SNER[11] recordings on the basis of recording format specifications laid down by the STNA. Consequently, it is useful to mention some of the facts on the nature of the radar data read out, as well as on the precision of the track reconstitution. Note that there was no other traffic on approach to the aerodrome during the incident.

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[11] Data recording system developed by the STNA and installed in the main French ATC centers.

Nature of data

The antenna rotation speed of the Roche-sur-Yon radar is 7.5 rpm, which is one rotation every eight seconds. Consequently, the data is sampled every eight seconds.

The geographical coordinates were calculated from the relative positions given by the Roche-sur-Yon radar. Flight level information was transmitted to the radar by the airplane's transponder, the reference being isobar 1013.25 hPa. A QNH correction was performed to obtain an altitude in relation to sea level. The QNH recorded by the radar station at the time of the event was 1017 hPa, which leads to a correction[(12)] of + 105 ft.

Estimation of errors in the position

In the horizontal plane, according to an evaluation by the STNA in December 2002, the radial distance given by the Roche-sur-Yon radar has an uncorrected bias of + 93 m. Further, the 95% probability precision of the radar is 0.02 NM for the radial distance and 0.04 for the azimuth. This adds up, at the time of the go-around, to a precision of 60 m easterly and 60 m northerly.

In the vertical plane the resolution of the flight level parameter is 100 ft, since the onboard computers round the value of the measurement to the nearest hundred feet. This rounding error is therefore less than 50 ft. To this must be added the error in the measurement of the static pressure, generally less than one hectopascal. The addition of these two errors gives an uncertainty of 80 ft in the recorded altitude.

Reconstitution of the track

The radar data was used to reconstitute the airplane's track in three dimensions (see appendices 5 and 6).

After correction of the QNH, the minimum altitude recorded by the radar during the event was 505 ft. Three consecutive points were recorded with this altitude. Vertically below these points, the area topographical altitude is 31 m, about 102 ft. The airplane's minimum height in relation to the ground was thus 400 +/- 80 ft.

Determination of vertical speed

Sampling the radar data shows that the airplane began to descend between 1 h 24 min 47 s and 1 h 24 min 55 s.

(12) In the lower layers a pressure difference of 1 hPa corresponds to a difference in altitude of 28 ft. Thus, the QNH correction is: (1017–1013,25)*28=105 ft.

Readout of data on vertical speed

Given the uncertainty of 80 ft in the altitude values, that relating to the difference between two points is 160 ft. This does not allow reliable calculations to be made on the vertical speed between two successive points (separated by eight seconds), since it results in an uncertainty of 160/8*60 = 1,200 ft/min. Only an average speed calculated over a relatively long period of time gives a sufficiently low level of uncertainty for the result to be significant.

The average vertical speed calculated between the point at 1 h 24 min 55 s (first point recorded in the descent) and the point at 1 h 27 min 10 (last point recorded in the descent) is about 970 ft/min. Taking into account the altitude error, the uncertainty in this vertical speed value is estimated at 70 ft/min.

The vertical profile curve seems to indicate a variation in the rate of descent between 1 h 25 min 35 s and 1 h 25 min 43 s. In addition, the crew stated that they suffered serious turbulence and a high drop rate just before crossing the radial, in other words around the times given above.

The calculation shows that:

- the average vertical speed between the descent point at 1 h 24 min 55 s and the point recorded at 1 h 25 min 35 s was about 730 ft/min, with a high degree of uncertainty, estimated at 240 ft/min ;
- the average vertical speed between the point recorded at 1 h 25 min 43 s and the lowest point on the path at 1 h 27 min 10 s is about 1,030 ft/min, with a degree of uncertainty estimated at 110 ft/min.

Vertical speed hold by autopilot

The NTSB was contacted in order to look for any possible link between AP performance and the vertical profile curve obtained from the radar data. This research indicated that the Vs mode was designed to stabilize the vertical speed at a level within the range defined by the value selected +/- 100 ft/min, that the computer then maintains this stabilized value with a precision of 50 ft/min and that during transition to another vertical speed value, the computer does not allow the target value to be exceeded by more than 100 ft/min. These performances are valid in the majority of turbulent conditions.

Conclusions

The crew stated that they selected a value of 700 ft/min for the beginning of the descent just before KARPU. Given the autopilot’s vertical speed specifications, this value is compatible with the previous calculations between 1 h 24 min 55 s and 1 h 25 min 35 s. However, it is not compatible with the vertical speed values calculated from the data recorded from the radar after 1 h 25 min 35 s.

This leads to two hypotheses: either the crew selected a vertical speed greater than 700 ft/min at the beginning of the descent, or they modified their vertical speed during the descent to a value close to 1,000 ft/min.

Determination of ground speed

Speed information is calculated from the successive positions of the airplane using both a dynamic model (evolutions in the vertical and horizontal planes) and digital filtering methods. In addition, when an airplane at low altitude is only visible on one radar, the information can be less precise and reliable, which is why the recording of ground speed only allows changes in trends to be noted.

Between 1 h 24 min 31 s and 1 h 25 min 42 s the recorded ground speeds varied from 123 kt to 141 kt, with an average close to 131 kt.

Between 1 h 25 min 50 s and 1 h 27 min 25 s the recorded ground speeds varied from 110 kt to 118 kt, with an average close to 113 kt.

This trend indicates a significant reduction in the ground speed, linked to the increase in the head wind (see paragraphs 1.7 and 1.18.1).

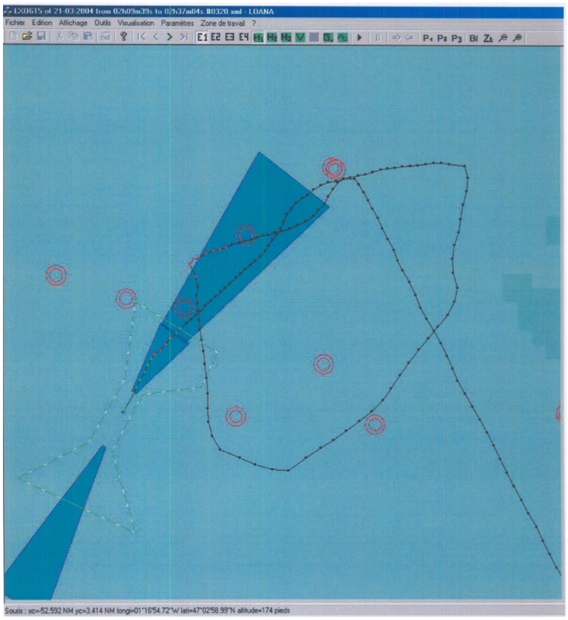
1.16.3 Ground-based altitude alert system

System Description

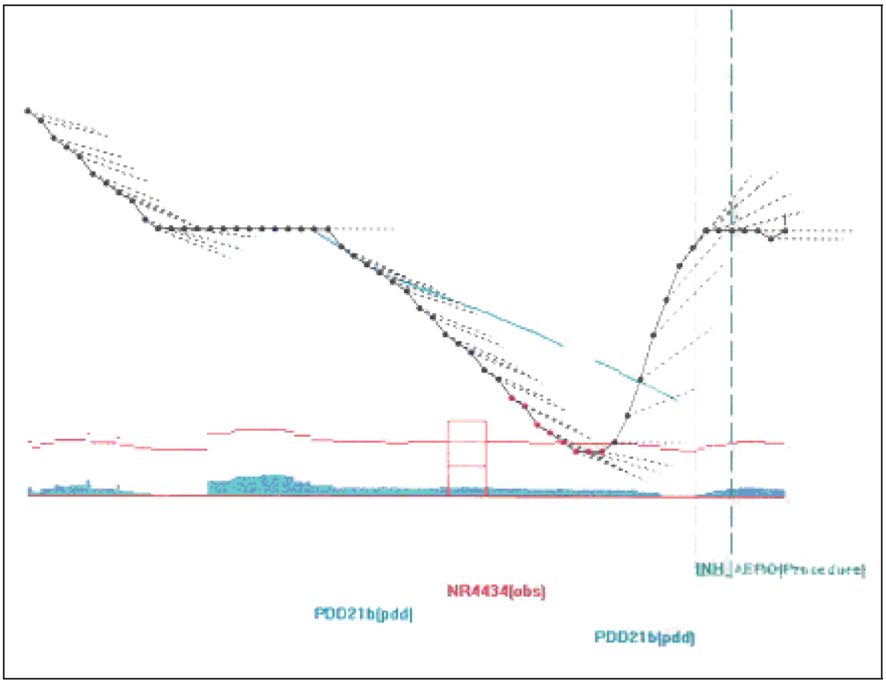
The MSAW is a system that, on the basis of STR radar data and an envelope defined around the approach track, warns the controller in case of dangerous closure by the airplane in relation to the ground. Specific parameters taking into account the environment[13] and procedures are required to give reliable warnings.

The system had been under evaluation at Nantes since 18 March. Since it was not yet operational, the warnings were not passed to the controller. A simulation was done using the radar data. On the graph drawn from this simulation, the red points indicate the radar plots that would have generated an alarm.

[13] The software uses a digital IGN chart that includes charted obstacles as well as an extrapolation of the speed vector.



Radar representation



Side view (vertical plane)

Operational use

After an MSAW warning, several parameters must be taken into account in calculating the time required for the airplane to perform a go-around. The following factors must be taken into account:

- the time for the controller to detect the warning;
- the time required to identify the airplane and transmit a message to the crew, this time being greater if the frequency is busy;
- crew reaction time and the time required for the airplane to change to a climbing path after the go-around.

The average estimated time that corresponds to the total of the above times is forty seconds (CENA data).

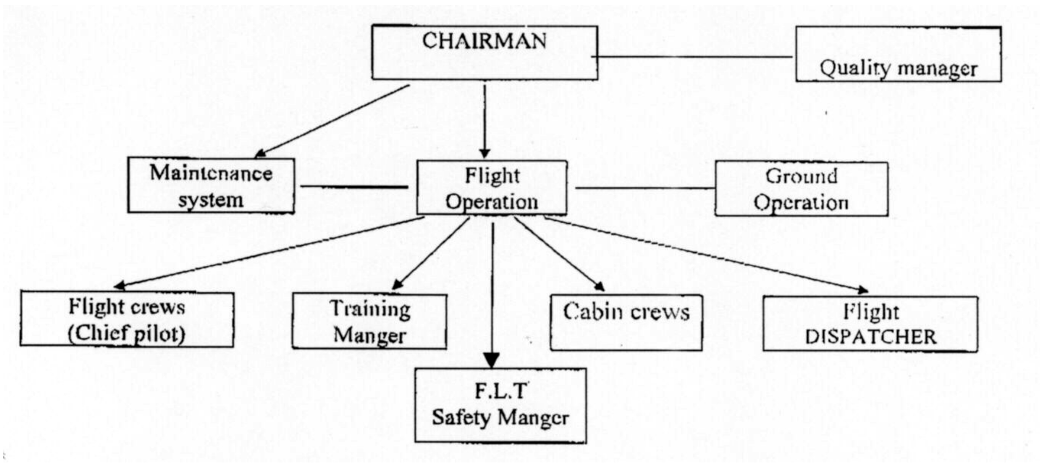
1.17 Information on Organizations and Management

1.17.1 Luxor Air

General

Luxor Air undertakes international charter flights, mainly between Europe and Egypt. It was founded in 2000 and began operations with Boeing 707's. Since 2002, it has been using two leased MD-83's.

Organization on 20 April 2004:



Operations

The operator employs twenty-one pilots. Eleven are Captains and, among these, three are instructors.

The 'General' section in its Operations manual is dated 15 July 2002 and describes the operational procedures, including task sharing. A Director of Safety was named on 1st June 2002 and a Flight safety manual was developed in June 2003. This manual determines measures to be taken to analyze incidents and anonymous reports, as well as the establishment of internal safety audits. No documents relating to feedback have been written, up to now, by the flight safety service.

Task-sharing

The operations manual states that the crew « must carefully monitor the approach path and separation from obstacles ». The airline also obliges its crew to stabilize the approach at one thousand feet at the latest in IMC conditions.
Task sharing for normal procedures with autopilot is described in the operations manual as follows:

Pilot Flying	• ensure track following • select speed, altitude and heading • request the airplane configuration • maintain navigation
Pilot Not Flying	• read the usual check-lists • perform actions ordered by the PF • perform actions on the overhead panel • maintain communications • monitor and cross-check track at all times • monitor changes in flight conditions below 10,000 ft.

It should be noted that a part of the on-board documentation was placed in a baggage locker in the passenger cabin.

Training

Pilot training at Luxor Air is made up of one simulator session per year followed by a check. The program includes non-precision approaches. The pilots are also subject to an annual line check. No cockpit resource management (CRM) training is provided.

Any new pilot must, in order to fly as Captain, if previously a Captain on the same type in another airline, undertake a simulator test then perform at least thirty flying hours with one of the instructors.

1.17.2 Oversight by authorities

The Egyptian Civil Aviation Authorities have established a program of inspections and checks for airlines in accordance with international practices. This program consists of the following elements:

- a weekly inspection of maintenance procedures,
- a monthly check of airplanes (equipment etc.), flying hours and respect of limitations on flight crew flying time,
- a more detailed quarterly inspection of operations,
- random inspections of the airplane on the ramp.

With regard to training, simulators must be approved by the authorities and annual checks must be carried out by approved instructors.

1.17.3 Extracts from ATC regulations

Extracts from the ATC regulations regarding issuing clearance for approaches, information to be supplied on final approach and the use of radar:

Approach clearance

Section 4.4.1.1 of the RCA3 defines approach clearances that a controller can issue. Thus, an aircraft can receive an additional arrival clearance, accompanied by an approach clearance, to fly directly to a given segment of the instrument approach procedure without passing the IAF and begin an approach from this segment. This additional arrival clearance takes into account the minimum safety altitude. The clearance altitude and the heading of the last segment of the arrival track must be compatible with the segment of the procedure that the aircraft is cleared to fly.

There are no further precisions on the meaning of word “compatible”, which it is left to the controller to define.

Furthermore, it is stated in this section that « *If an aircraft indicates that it does not know an instrument approach procedure or if this fact becomes obvious to the ATC organization responsible, the latter must provide all necessary assistance in good time. If the procedure is described, the missed approach procedure is expressly explained if that is judged necessary”.*

Information transmitted by the controller during final approach

Part 4.3.7.3 of the RCA3 specifies the information to be transmitted to aircraft during final approach, which includes:
- onset of danger,
- direction and speed of wind, significant variations.

Specifically the controller must warn aircraft of any storm activity that he may know of.

Use of radar

In the chapter X, the RCA3 defines the use of radar by the controller. It is specified therein that “radar surveillance consists of using the radar to better know the position of aircraft”. This allows, specifically:

- to ensure ATC service, by ascertaining radar separation between two aircraft, where the aircraft controlled benefit from separation;
- to provide the relevant ATC organization with information on any significant deviation, by aircraft, from the clearances they have been given, in particular from routes they have been cleared to follow. Radar assistance service in particular consists of warning aircraft of any such deviations.

Continuous radar surveillance by the approach controller is not imperative.

Chapter IV of the RCA3 stipulates that the Captain is responsible for the prevention of collisions with high terrain except where he is flying under radar vectoring.

The RCA indicates that when the ATC organization has aerodrome radar available, the latter can be used by an aerodrome controller to confirm the visual observation of the position of aircraft in the aerodrome circuit. There is no aerodrome radar at Nantes. Nevertheless, paragraph 2.1.4.2 of the RCA3 specifies that:

- when a part of the airspace neighboring an aerodrome is delegated from the approach control to the aerodrome control, the organization responsible for aerodrome control ensures the approach control service;
- when there is no delegation, an aircraft is transferred from the approach to the aerodrome when it has landed.

It follows that, in all cases, IFR flights are controlled by approach control up to the moment they land. At Nantes, delegation exists and flight LXO615 thus benefited from approach control services, particularly radar assistance.

Description of tasks to be performed by the controller

In addition to radar surveillance, the controller must also undertake the following tasks, before an aircraft lands:

- transmission and verification of meteorological parameters. To this end the controller has a screen to the left of the radar image, with the latest METAR (there is no update between 0 h 00 and 3 h 00), the wind, pressures, the height of the cloud base and the RVR. He must also scan the horizon to evaluate the visibility;

- switching on and adjusting lighting with a touch pad, positioned near his work station;
- visual verification of the runway and the aerodrome.

1.17.4 Procedure followed for notification to the BEA

The Nantes Atlantique aerodrome operations manual indicates the following procedure in case of an aviation incident, particularly following « a risk of collision with the ground or another aircraft»:

- the tower duty manager must inform the ATC office (open 24/7);
- the ATC office must inform the operational duty engineer and the air transport gendarmerie brigade.

Amongst other items, the operations manual has an « incident notification » message, for which one of the recipients is the BEA. It does not specify who should send the message, but in practice the ATC office deals with this.

The definitions of accidents and incidents that are used as the basis for the notification procedures are contained in a document published on 3 June 1957. They do not correspond to those in force in accordance with European Directive 94/56/CE and the Order of 18 April 2003, which state the incidents which must be reported to the BEA.

The controller on duty in the tower after the incident immediately filled out a notification form for a go-around and the non-respect of the procedure, on which he stated that the airplane had passed over the town at six hundred feet, that is to say one thousand feet too low. He did not inform the ATC office of the event.

On the Sunday morning, the Chamber of Commerce and the aerodrome received calls from people complaining of noise disturbance during the night. The tower manager then informed the operational duty engineer towards 13 h 00 that he should expect complaints from nearby inhabitants relating to environmental problems.

The quality control unit is responsible for examining any notification issues. This unit is part of the Quality and Study subdivision. The assistant of the unit being on sick leave at that time, the head of the subdivision was the only person available to deal with handling forms. He did not have time to deal with the form relating to the LXO615 event immediately since other incidents that occurred over the same weekend seemed to him to take priority.

It was on the Tuesday morning that a witness called the duty engineer and described the LXO615 event to him. The latter then asked that the event be treated as a priority. Noting that the minimum over-flight altitude was lower than that entered on the notification form and that there was a significant lateral deviation in relation to the published path, the engineer informed his superiors, then at a meeting in Brest. It was only towards 18 h 00 local time that he was asked to notify the BEA of the event.

1.18 Additional Information

1.18.1 Summary of Testimony

Note: the witnesses were seen a short time after the incident.

The Captain

The Romeo ATIS obtained, the briefing was carried out by the co-pilot for a VOR DME approach to runway 21. The diversion aerodrome was Paris Charles de Gaulle. There was enough fuel and the aerodrome was accessible.

Once en route to ABLAN, the crew got organized so as to arrive at three thousand feet in landing configuration.

The ND was set in MAP mode to the left and ARC mode to the right. The co-pilot armed the autopilot VOR LOC mode and the airplane began a turn to the left. Coming out of the turn, the Captain told the controller that they were established on the radial, then he checked it on the instruments. He told the co-pilot there was a deviation from the radial though the mode displayed on the FMA was VOR CAP.

The co-pilot selected HDG SELECT to intercept the radial. Eight nautical miles out, the Captain checked the parameters and noted a speed of 140 kt and a vertical speed of 700 ft/min. When the airplane was passing the radial, he noticed some red and magenta echoes on the weather radar. At the same time he felt some strong turbulence, large variations in vertical speed and noted gusts of 45 kt on the FMS. He asked the co-pilot to continue on the interception heading to fly around this area.

Troubled by how the approach was going, he thought of a go around but preferred to wait until they had left the area of turbulence.

At around five hundred feet, noticing that the airplane had descended rapidly, he asked the co-pilot to select the ALT HOLD mode. A short time later, he believed that the airplane was stabilized and ordered the go around.

The Captain stated that he had never seen the ground during this approach and added that:

- he had already landed at Nantes, but always with an ILS approach to runway 03;
- he had great confidence in French controllers, especially where meteorological information was concerned;
- he did not carry out the altitude and position checks because he was too preoccupied with the airplane's movements;
- to his knowledge, the altitude indicated on the approach chart on passing AMRAD is not statutory;
- he did not hear any GPWS warnings.

The co-pilot

They were directed towards ABLAN, which they reached in NAV mode, that is to say by GPS, and were cleared for the VOR DME approach. He selected VOR/LOC mode and noticed an early capture of the radial, that is to say that the airplane was parallel to the radial with a one point variation on the display. The meteorological conditions were very adverse (heavy rain, turbulence, indications on the radar and gusts to 45 kt announced by the Captain). He selected HDG SELECT to come back towards the radial but did not remember the heading he had selected.

The descent was carried out at 700 ft/min. The VOR radial was passed so as to avoid the area corresponding to the radar echoes. While the variation of the needle on the VOR receiver was less than one unit, he took the decision to go back towards the radial. During the turn the Captain asked for ALT HOLD and, on exiting the turn, gave the order for the go-around.

The co-pilot added the following points:

- he never saw the ground or heard GPWS warnings;
- the weather radar was set at an angle of about 3°;
- he noticed echoes on the weather radar that might correspond to meteorological phenomena or obstacles;
- he had never previously been to Nantes;
- he attributed the deviations from the path to a lowering of concentration caused by the meteorological conditions.

A person on the ground

An inhabitant of Nantes who was in his garden noticed the noise of an aircraft engine that was accelerating. At the same time, he noticed an airplane, outside of the clouds, coming towards him at low altitude with its landing gear extended. The airplane flew over him and headed towards a ten-floor building located to the south of his property. He saw it turn to the right and begin to climb while the landing headlight lit up the building.

The tower controller

The tower controller had rested between 22 h 30 min and 0 h 30 min (local time) and had then returned to his work station. He was alone at the work station at the time of the incident, his colleague in turn taking a rest in the rest room.

Flight LXO615 arrived about an hour and thirty minutes after the previous flight, also from Luxor. It was late. As the pilot was a foreigner and the airline used the aerodrome rarely, the controller paid particular attention to the first radio contact. The phraseology and the level of English of the pilot made him confident.

The flight was given a direct path ABLAN, which corresponded to usual practice at night. He did not offer radar vectoring, supposing that the crew possessed the necessary means to capture the approach radial. He cleared the airplane to descend to flight level 70 then to three thousand feet. He then cleared them to carry out the final approach.

A short time before the airplane intercepted the NTS 223° radial, he noticed a reduction in speed, then that the turn ended before the radial. When the pilot signaled that he was “established” on the radial, the controller noticed that the airplane was to the left of the radial and that he was veering to the right, that is towards the radial.

At that moment he took his eyes off the IRMA screen and dealt with the preparation of the runway and checking the meteorological parameters, in particular the level of the cloud base that was fluctuating at that time. He also stood up to take a look around the airport horizon.

When he looked back at his screen, he was surprised by the airplane’s altitude, much more so in fact than by its position in relation to the approach radial. He did not remember the exact value. He suddenly felt under increasing stress, not understanding why the pilot had suddenly “dived” in that way.

He ordered the pilot to go around; he didn’t remember that the latter had called this out. From then on, he felt that he was responsible for guiding the crew and managing the flight. Troubled and wondering what to do, he told the pilot, instinctively, that he was on back on the slope and that he could continue his approach. At that moment, the airplane was coming back onto the radial, four nautical miles from NTS.

When the crew informed him that they were making a second approach, he considered that the most urgent thing was for them to gain height, despite the heading, which did not correspond to the path planned for a go-around.

After that, he vectored the aircraft back to the beginning of the final approach. Just before the beginning of the descent, he asked the pilot not to descend below 1,500 feet, specifying that he would call him back to continue the descent.

He added the following points:

- the STR source was selected for radar visualization;
- the instructions for altitude limits that he had given the pilot on the second approach were unusual, since the pilot was responsible for his path on final approach; they were aimed at avoiding another “dive”;
- the radar image loses precision at low altitude;
- the altitude information is given in flight levels (transponder mode C) and it is not possible to mentally systematically evaluate the altitude in relation to the QNH;
- he was not feeling especially tired ;
- it was usual at Nantes to undertake the checks on the weather and the lighting during the first half of the final approach.

1.18.2 Crew Schedule

The crew that performed the flight was the one that had been scheduled before the airplane arrived late at Luxor. The following tables show the pilots' work schedules between 13 and 20 March 2004.

Captain

Date	Start	Finish	Flying hours	Number of legs
13 March 2004	17 h 10 min	4 h 55 min	10 h 35 min	2
15 March 2004	8 h 20 min	21 h 40 min	7 h 40 min	3
18 March 2004	1 h 55 min	14 h 35 min	7 h 23 min	3
20 March 2004	18 h 00 min	8 h 00 min	7 h 55 min	4

Co-pilot

Date	Start	Finish	Flying hours	Number of legs
13 March 2004	13 h 25 min	0 h 45 min	6 h 33 min	3
15 March 2004	5 h 25 min	18 h 15 min	7 h 26 min	3
16 March 2004	17 h 20 min	18 h 15 min	0 h 55 min	1
18 March 2004	15 h 35 min	16 h 30 min	0 h 55 min	1
20 March 2004	18 h 00 min	8 h 00 min	7 h 55 min	4

1.18.3 Indication of hypo vigilance phenomenon

The controller's reaction times (for example, the time lag before his go-around instruction) led to some questions being posed about the possibility of a state of hypo vigilance.

Hypo vigilance lowers individual performance, in particular by increasing the reaction time and tending to favour omission of critical signals. The person subject to it may not perceive this condition.

Studies show that hypo vigilance is favoured by several factors, including:

- night time (especially between 02 h 00 and 06 h 00) due to biological rhythms: it was 02 h 20 min (local time) at the time of the event;
- the time since the last period of deep sleep: about nineteen hours had passed between the controller's last deep sleep (the night before) and the event;
- monotony (low rate of active periods): monotony is linked to the environment and the type of tasks to be performed. Concerning the environment, a low level of lighting, a long period of isolation and automation are all factors. Task monotony appears, for example, during surveillance activity with a restricted field of vision and a low number of stimuli in a given period of time.

All of the working conditions in the control tower on the night of the event corresponded to the above description.

In addition, the controller had taken a break in his duty time between 22 h 30 min and 0 h 30 min (local time), during which he fell asleep for an unspecified time. He was woken up by a pre-set alarm just before he went back on duty. He neither ate nor drank before returning to his control position. Sleep at that time of night consists mainly of deep sleep or slow waves (stages 3 & 4). Being woken up by an outside source during this phase of sleep induces 'torpor' in the subject, or sleep inertia, which lowers the level of performance and wakefulness. This phenomenon is perceived at the moment of waking, then the associated impression goes away, although the level of performance remains lowered for up to two hours after waking up.

1.18.4 Steps taken by the ATC organisation after the incident

After the meeting of the local safety commission on 2 April 2004, it was decided to issue a temporary operational order valid until 31 December 2004, which stated that the controller must « impose a report at AMRAD at 1,730 ft QNH or above, on final approach to runway 21 ».

While expecting further measures to be taken, the commission reminded controllers that *« in the context of ATC assistance, any deviation from the planned route noticed on the radar must be reported to the flight concerned».*

The letter of agreement between Nantes and the CRNA West was also modified, so that in all cases airplanes are directed to the IAF (the phrase « except in specific cases" was removed).

2 - ANALYSIS

2.1 Incident Scenario

Initial approach

The crew familiarized themselves with the Romeo ATIS more than one hour before arrival. They prepared for the VOR DME approach to runway 21 before contacting Brest ATC. The meteorological conditions transmitted confirmed that the aerodrome was accessible.

During coordination between the en-route control center and approach control, the en-route controller suggested, in accordance with usual practice, directing the airplane straight to ABLAN, a point close to the descent point. The approach controller acquiesced. The flight was in fact late and was the only aircraft in the sequence, the previous airplane having landed an hour and a half before.

During the first contact with the pilot, the controller felt he was in a situation of relative confidence, given the quality of the phraseology and the English used. As he had no doubts as to the airplane’s ability to intercept the radial, and thought that by anticipating some clearances he would be helping the pilot, the controller confirmed ABLAN and cleared the airplane to descend, then to perform the final approach.

In accordance with his perception of relations with ATC the Captain, for his part, expected the controller to be directly involved in the approach. As he was used to flying to aerodromes with heavy traffic in France, his previous experience did not lead him to question this supposition. What is more, he was not aware of the limitations on the autopilot regarding the maximum guaranteed intercept angle. Consequently, he accepted the intercept proposed by the controller.

Radial intercept

When the autopilot VOR/LOC mode was engaged, the aircraft turned to line up and, for the reasons mentioned in 1.9.1, positioned itself parallel to the final radial but offset to the left. Over a period of twenty seconds, the crew announced that they were lined up, realized that they were in fact to the left of the radial, engaged HDG SELECT to move back towards the radial, received the landing clearance and began a premature descent. Having given the landing clearance the controller, for his part, proceeded to carry out the checks for the landing, including checking the meteorological parameters, while planning to return to monitoring the aircraft, for the second half of the final approach.

The announcement of the line up led the controller to clear the airplane for landing, which in turn seems to have led the crew to begin the descent, even though the airplane was still half a nautical mile short of KARPU, the final approach point. These chain reactions contributed to a sudden increase in the workload for the crew, already very high due to the shortening of the path.

Decision to leave the radial

When the airplane was getting close to the radial, the Captain asked the pilot to continue on the same heading in order to fly around an area of echoes that were appearing on the weather radar, near the radial. This decision to leave the radial during final approach does not correspond to any procedure.

Given the situation, the meteorological recordings and the specifications of the on-board weather radar, the echoes observed by the crew corresponded to ground obstacles. There were several large buildings in the area the airplane was over-flying, including the « Tour de Bretagne » (see paragraph 1.10.3). Nevertheless, the Captain interpreted the data as storm activity. The meteorological conditions observed by the crew during that phase of the flight seemed to confirm that interpretation. The airplane, in a cloud layer, was passing through an area of turbulence accompanied by rain and gusts of wind. It should be noted that the crew was performing the approach to runway 21 for the first time and that they were not aware of the nature of the area that they were over-flying (a large town with tall buildings), especially as the urban area is not shown on the Jeppesen chart.

Leaving protected areas

The co-pilot performed the maneuver ordered by the Captain, though this maneuver troubled him. In fact, he stated in his testimony that he was not sure that the radar echoes represented meteorological phenomena and it is clear that he did not agree with the decision to fly away from the radial. To his recollection, he did not go further off line than one point on the scale, whereas in fact a reconstitution of the track showed that the needle on the VOR indicator must have reached its stop, and it was he who finally took the initiative to return towards the radial. Subsequently, the conduct of the flight no longer followed a common action plan. The co-pilot was doubtful about the maneuver that he was performing but did not express any objections or propose any other maneuver.

It is impossible to establish exactly where the pilots' attention was focused during this phase, though it appears from their testimony that they were focusing a great deal of their attention on the weather radar and the outside conditions. Furthermore, by deciding to move away from standard procedures, the Captain made it impossible to control cross track distance in relation to the nominal track, as is required in task sharing. Crosschecking was no longer applicable in these circumstances. These same factors contributed to inadequate control of the vertical trajectory.

While the crew were further moving away from the approach radial, they continued their descent at a high rate, as shown in the calculations in 1.16.2. In addition, the heading selected had positioned the airplane into the wind, which was strengthening, and ground speed thus fell considerably. The combination of these factors led the airplane to be well below the vertical approach profile. Six NM from NTS, just before the turn, the airplane was at about 500 feet QNH, whereas the approach chart indicates a passing altitude of 2,000 feet at that distance.

The controller intervened to tell the crew that they were too low. The answer « OK, we're maintaining 500 ft now », confirms that the crew was in a thinking mode based on a descent to the decision altitude, without perceiving that the MDA only ensured protection where the vertical approach profile has been respected. The controller had not initially planned to monitor the airplane's track during that phase. The time that passed before he interpreted the apparently contradictory information (altitude, position and airplane speed, Captain's confident answer) and reacted by ordering a go-around was quite long, about twenty seconds in fact, doubtless caused by both hypo vigilance (see paragraph 1.18.3) and the Captain's reassuring tone.

Taking into account the known height of the clouds and the testimony of the person on the ground, it is likely that, coming out of the turn that had taken it back towards the radial, the airplane came out of the cloud layer and the Captain became aware of their abnormal situation. It was then that he initiated the go-around, which he had already been considering for a while, though without consulting the co-pilot.

When the airplane crossed the radial again after the go-around, the controller proposed that they continue the approach « you are on the slope… you may descent ». This proposal shows the confusion that reigned in his mind. It was after the captain's refusal that he took control of the situation again.

2.2 Working methods

Analysis of the conduct of the flight

It is difficult to determine with any certainty why the co-pilot selected a high descent rate. A desire to reach the decision altitude and then level off cannot be excluded, as it is the case in some classical approaches (see paragraph 1.10.3), in order to get out of the cloud layer and get the ground in sight. The principle of stabilized approaches is now a design standard in France, but internationally both types of approach continue in use, which may lead to errors.

It is notable that the crew descended without initially taking into account the vertical approach profile, then that, throughout the descent, they did not monitor the descent path, in particular the minimum altitudes specified at the AMRAD and D 2.3 NTS points, which were 1,730 and 870 feet respectively. Equally, in doing this, they did not take into account the stabilization level of one thousand feet defined by the operator. During the interviews, the crew showed great concern for the meteorological conditions. The Captain insisted on how uncomfortable this late night arrival in turbulent conditions was for him. The crew did not mention being tired but the flight planning and the pilots' schedule, which meant the flight had been delayed by 16 hours, and the arrival performed late at night suggest that fatigue was one of the factors that contributed to the lack of vigilance demonstrated in the failure to follow the path. In addition, the investigation showed that the Captain was not fully aware of the limits to the protection afforded by the approach design. In particular, he incorrectly interpreted the altitude information associated with the significant points on the approach.

Controller's task management

The controller was confident of the strategy that he had chosen to have the airplane intercept the radial. On the one hand this strategy had worked for the previous flight, and on the other he had been able to observe the airplane slow down, anticipate the turn and position itself parallel to the radial without overshooting it.

Feeling relatively confident, he did not think of continuously monitoring the airplane's track. Further, the organization of his work depended on the fact that he was alone to man the different positions and that he had to switch from one task to another, taking into account a different environment at each stage. He thus took his eyes off of the screen for a long time and stood up during the first part of the final approach. He also had to change the scale on his radar screen when he returned to monitor the airplane's final, after having taken actions relating to checking the runway before the landing. For about one minute the airplane moved away from the radial without any surveillance.

The controller did not feel any fatigue and was not conscious of his likely state of hypo vigilance (see paragraph 1.18.3), which slowed down the accomplishment of each of his tasks.

2.3 Analysis of Systemic Aspects

2.3.1 Operations

Training for VOR DME approaches

The investigation brought to light approximate flying techniques and a lack of knowledge with regard to the limits to the protection afforded by an approach procedure. In addition, the training followed by the pilots for non-precision procedures (which include VOR DME procedures) was limited to two approaches a year in a simulator, with the annual line check possibly adding to this, according to the type of approach performed on the leg. The simulator training does not however completely reproduce operational conditions that can be encountered (meteorology, high ground, for example) and the frequency of training for standard approaches does not appear to be adequate relative to the difficulty of performing these procedures.

Crew resource management

The lack of cross checking, the absence of callouts, the co-pilot's hesitation in expressing his doubts and more generally the lack of overall communication led to a deterioration in the effectiveness in the crew's work.

The decision to move away from the radial, which generated a stressful situation, slowed down the decision-making process and reduced communication between the crewmembers. The co-pilot, surprised by the Captain's decision, went along with the situation throughout the outbound phase. He neither fully participated in nor questioned the Captain's orders.

The pilots had no training in crew resource management, which is not mandatory in Egypt.

Feedback structure

Although the operator set up a feedback structure, the investigation showed that this structure had not produced any formal information for crews. Its existence had also not made it possible to identify the lack of knowledge or procedures brought to light by the incident, for example relating to the one thousand feet stabilization level, task-sharing or the interpretation of information on the weather radar, whereas this is precisely the objective of such a structure.

The fact that, after the incident, the crew did not understand the importance for safety of informing those responsible for flight safety confirms the gap that existed between the structure that had been set up and the reality of flight operations.

2.3.2 Approach control

Radial intercept

Although it is specified that arrivals at Nantes be either directed towards the IAF of the procedure in service or subject to radar vectoring, it had become common practice to direct aircraft directly to an intermediate point. The published procedure includes a long-range DME arc and increases the approach time significantly, which explains why shortcuts were used when traffic was light. Outside of the field of established procedures, this practice left considerable scope to the appreciation of individual controllers and pilots and did not guarantee consideration of all of the parameters determining the design of an approach.

Resource management

The controller, who was dealing with all of the positions alone, was not able to simultaneously take care of all of the tasks associated with approach control. He had to prioritize them, which implies a high degree of personal judgment, to be considered along with his probable state of hypo vigilance.

Radar surveillance

Radar surveillance normally allows aircraft to be notified of any deviations in relation to nominal tracks. For this to be effective:

- it must be based on precise radar information. At Nantes, each time the IRMA 2000 image is updated the plot gives the airplane's position with a level of precision as described in 1.8. If the eight-second update time does not allow separation standards of less than 8 NM to be applied, the information supplied remains usable for surveillance purposes. It is nevertheless necessary that the scale selected by the controller be consistent with the phase of flight being monitored;
- surveillance must always allow a precise representation of the position of aircraft. This was not the case during the incident.

Note: With regard to the MSAW system, its effectiveness depends, among other things, on the time it takes for a controller to deal with the alarm. If the controller had had MSAW during the approach of LX0615, noticing and locating the plot on a screen that he wasn't watching would probably have added an additional time to the forty seconds estimated reaction time (see paragraph 1.16.3).

Crew-controller synergy

Cooperation between the crew and the controller suffered from a lack of comprehension of the expectations and capacities of each party as well as a lack of communication. Mutual confidence and erroneous suppositions by the controller and the crew show each side's need to clarify the operational limitations of the other side and the impact of their actions on the work of others. The Captain could, for example, have let the controller know of his worries about the meteorological conditions and his decision to leave the radial. For his part, the controller was not aware of the operational consequences implied in a direct shortcut to the intermediate approach and the issuing of clearances over a short period of time.

2.3.3 Documentation available to pilots

Flight Manual

MD83 Flight Manuals do not contain any mention of the autopilot 90° limitation for the intercept angle to a radio electric radial. Knowledge of this limitation depends on the personal experience of each pilot and possibly knowledge passed on during training. There is therefore no guarantee that this knowledge is systematic and sufficiently precise.

Approach chart

The current representation of the obstacles and minimum altitudes on the approach chart made it possible for the pilots to interpret the chart erroneously. A modification of the representation in the official French documentation is planned following ICAO work on this point.

3 - CONCLUSIONS

3.1 Findings

- The crew possessed the licenses and qualifications required.

- The aircraft possessed a valid Certificate of Airworthiness.

- The controller on duty at the Nantes control tower possessed the qualifications required.

- The various control positions in the Nantes tower were grouped together and the manning was in accordance with the duty service.

- The crew received the instruction to fly towards ABLAN, to intercept the intermediate approach segment directly, which meant that it intercepted the approach path at an angle close to 110°.

- The autopilot was not able to capture the path; the pilot flying selected an interception heading and began a descent at a high rate that made it impossible to conform to the approach profile.

- When the airplane was joining the approach path, the Captain decided to fly around what he had identified by mistake as storm activity on the weather radar.

- The crew did not carry out the checks related to the airplane’s altitude.

- The maximum deviation from the path was 1.3 NM laterally and 1,000 ft vertically.

- The controller noticed the airplane's deviation from the path tardily.

- The co-pilot took the initiative to return to the approach path. At about the same time, the Captain decided on a go-round.

- The airplane was then noticed by a witness.

- The lowest height the airplane descended to was 400 +/- 80 ft.

- After some confusion, the controller vectored the airplane for a second approach.

- The seriousness of the incident was only understood gradually, which led to late notification to the BEA and the non-preservation of the on-board recordings.

3.2 Causes of the incident

The direct cause of the incident was a combination of different factors that led the crew to abandon standard operating procedures:

- the incorrect interpretation of meteorological data from the weather radar;
- lack of knowledge of protected areas and, more generally, lack of skill in VOR DME procedures;
- improvising an action (deviation from the procedure) without any defined or shared plan of action.

Several factors also contributed to the event:

- lack of training in Crew Resource Management by the operator;
- the weakness of the operator’s feedback structure;
- discomfort and stress due to meteorological conditions;
- the crew's perception of the meteorological conditions, which both led to an erroneous interpretation of the weather radar data and, further, led them to fail to take into account the effects of the wind on the descent profile;
- the difficulty in checking and cross-checking from the time the crew deviated from the final approach path;
- a deviation within the air traffic control organization between the established procedures and practice, which led to some non-published approach paths;
- lack of synergy between the controller and the crew;
- a probable hypo vigilance phenomenon on the part of the controller, who was alone at his work station at the time.

4 - RECOMMENDATIONS

Note: in accordance with article 10 of Directive 94/56/CE on accident investigations, a safety recommendation is intended neither to apportion blame nor to assess individual or collective responsibility in an accident or incident.

4.0 Preliminary Recommendations

Following the incident and based on its initial findings, the BEA issued the following recommendations to the Egyptian Civil Aviation Authorities:

- ***that the Egyptian aviation authorities take urgent steps to ensure that Luxor Air crews are efficiently trained to non-precision approaches and that such training is included into recurrent training programs;***

- ***that the Egyptian aviation authorities take urgent steps to ensure that the Luxor Air's operational documentation contains clear directives related to stabilization altitudes and to vertical and lateral excursions that command to conduct a missed approach;***

- ***that the Egyptian aviation authorities take urgent steps to ensure that the radio-navigation instruments on board the airplane SU-BMF are in a satisfactory condition.***

4.1 Operations

The investigation brought to light serious failings in the application of the VOR DME approach procedure by the crew, as well as a lack of knowledge on their part relating to protection. Such approaches are in fact particularly difficult to perform while, at the same time, the training level of crews remains generally limited. In addition, simulators do not make it possible to reproduce all of the operational conditions that can trouble pilots.

Consequently, the BEA recommends that

- **the Egyptian civil aviation authorities, in the light of the information gathered from this incident, reinforce training courses and practical experience for crews for standard approaches.**

The investigation showed that the lack of reaction by the crew while flying outside the approach limits was partly due to a lack of a precise plan of action and a lack of communication.

Consequently, the BEA recommends that

- **the Egyptian civil aviation authorities make cockpit resource management training courses mandatory.**

The feedback structure in place within Luxor Air did not allow the weaknesses brought to light by this incident to be identified. Further, this structure has provided no formal feedback of information since its creation, either to the pilots or to the Egyptian authorities, and the crew themselves did not realize the importance for safety of informing them of this incident.

Consequently, the BEA recommends that

- **the Egyptian civil aviation authorities ensure that structures for information feedback set up by operators function correctly.**

4.2 Air Traffic Control

The VOR DME 21 approach to Nantes is long and controllers have got used to shortening the arrival paths. This discrepancy has gradually been generalized without reconsidering the procedure.

Consequently, the BEA recommends that

- **the DGAC identify any deviations that may exist in practice in air traffic control procedures compared with those set out in the regulations and analyze the causes of these deviations.**

The management of control tower resources at night, associated with the probable appearance of hypo vigilance in the controller, did not allow the latter to maintain a continuous representation of the airplane's position during final approach.

Consequently, the BEA recommends that

- **the DGAC study methods to be applied at night as well as instructions to be given to control personnel in order to identify and fight against the appearance of states of hypo vigilance.**

The Nantes control tower was recently equipped with an IRMA 2000 radar image. The position information that it gives allows for surveillance and radar assistance. During the course of the investigation, it was noticed that control procedures had not evolved accordingly and that users did not perceive the possibilities that the new equipment offers in the same way.

Consequently, the BEA recommends that

- **when new equipment is introduced, the DGAC modifies the associated procedures and ensures that users are well informed on the capabilities of the system.**

4.3 Miscellaneous

The investigation brought to light some discrepancies between the management of the approach by the crew, on the one hand, and by the air traffic control organization on the other. A lack of communication made it impossible to improve mutual comprehension. Greater knowledge and a better understanding of the operational constraints on each side would certainly contribute to improving flight safety. It would be useful to systematically set up awareness-raising measures relating to the consequences of individual actions by controllers and crews, as is done in CRM training.

Consequently, the BEA recommends that

- **the DGAC introduce notions of air/ground resource management into basic and recurrent training for controllers and pilots. Data from information feedback could be used effectively for this.**

Performance limitations on the autopilot of the MD83 relating to glide capture do not appear in the Flight Manual. Unaware of this limitation, the crew accepted an arrival track that intercepted the intermediate approach path at an excessive angle.

Consequently, the BEA recommends that

- **the FAA ensure that MD83 Flight Manuals be modified so as to make autopilot performance limitations apparent.**

The representation of obstacles on final on the procedure was not adequate to attract the crew's attention. Reflection at the ICAO led to a recommendation to improve the representation of minimum altitudes linked to obstacles on the descent profile.

Consequently, the BEA recommends that

- **the DGAC introduce as soon as possible the representation of obstacles recommended by the ICAO.**

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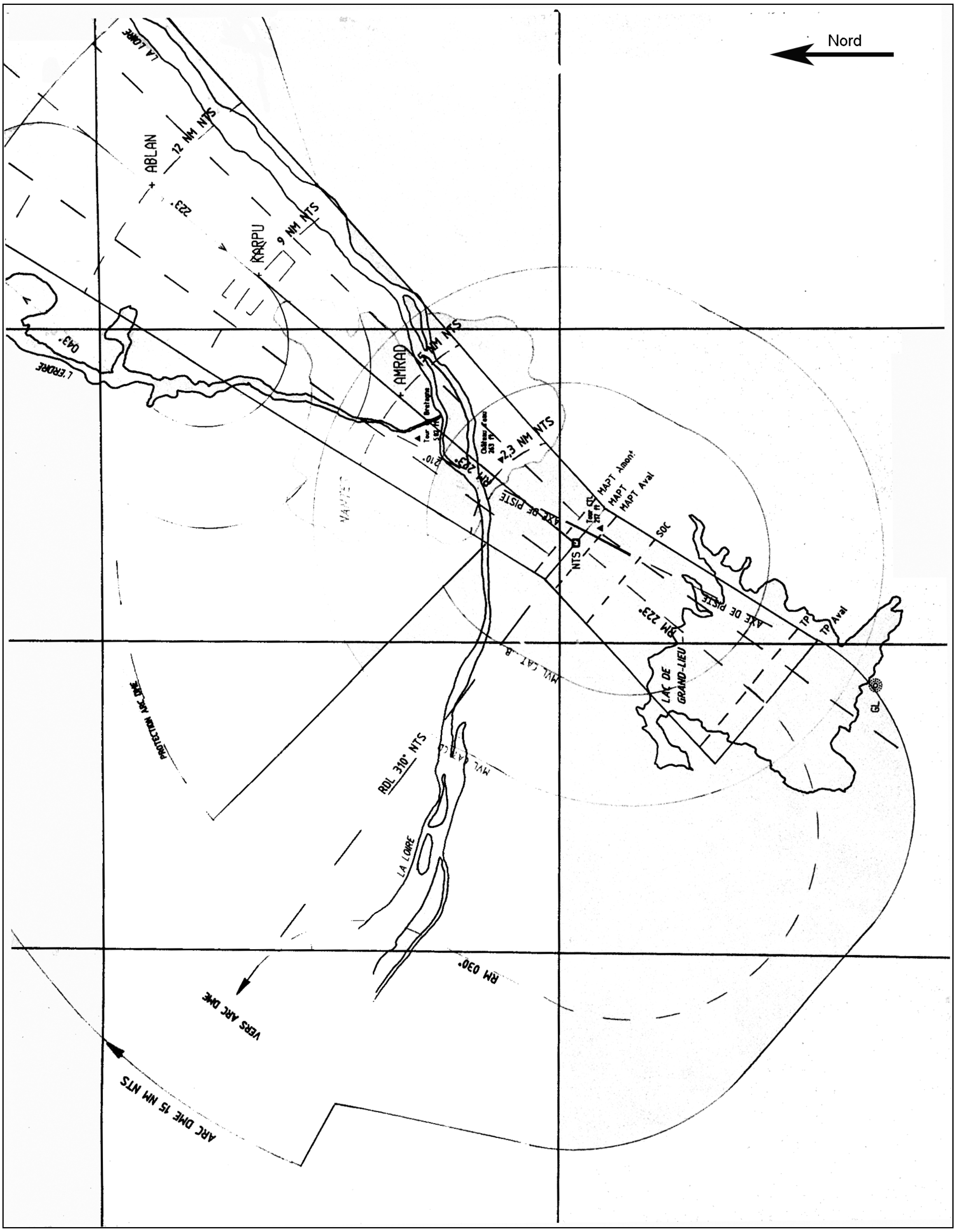
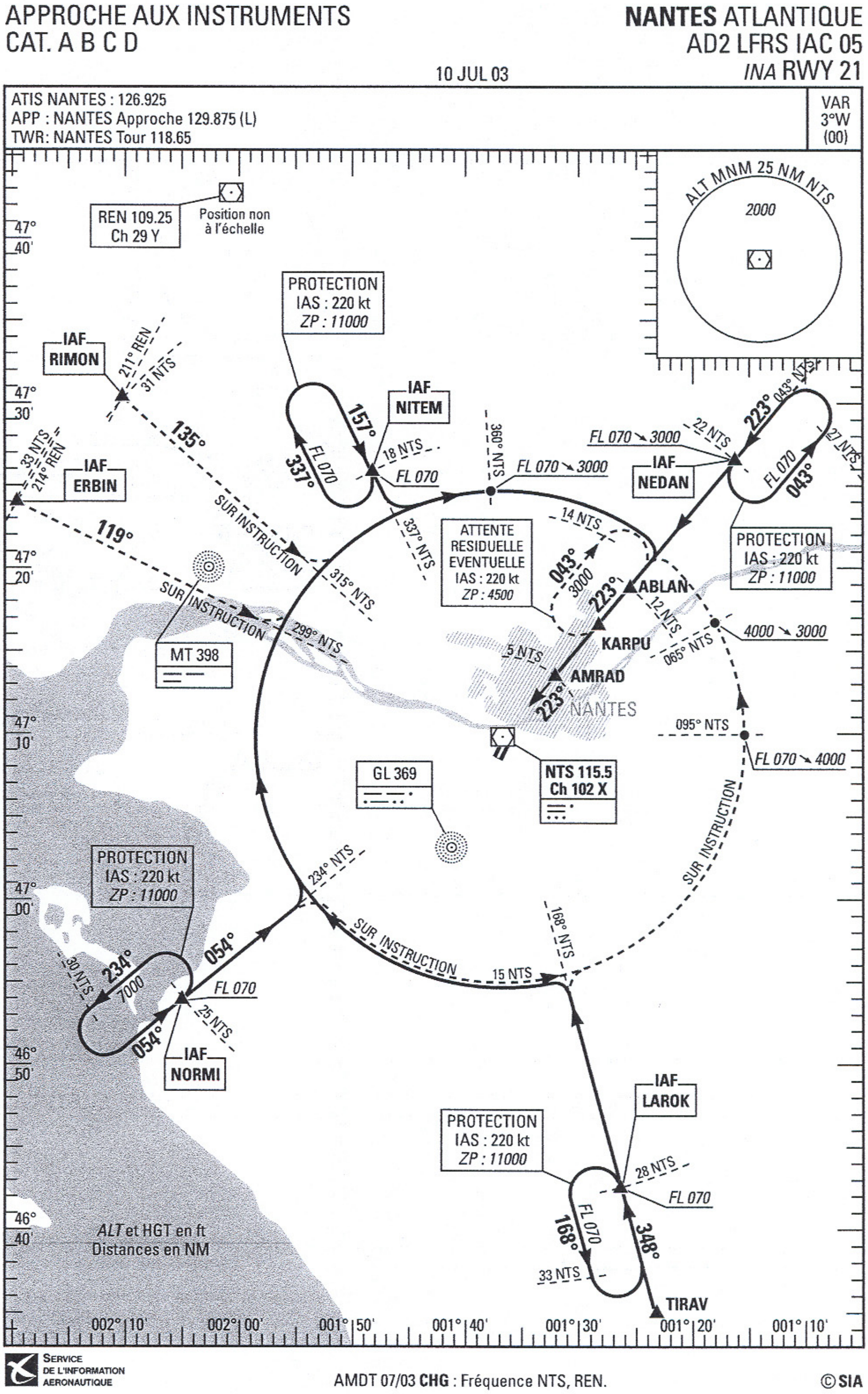
Protected areas



Nantes IAC chart



SERVICE DE L'INFORMATION AERONAUTIQUE
AMDT 07/03 CHG : Fréquence NTS, REN.

Nantes IAC chart

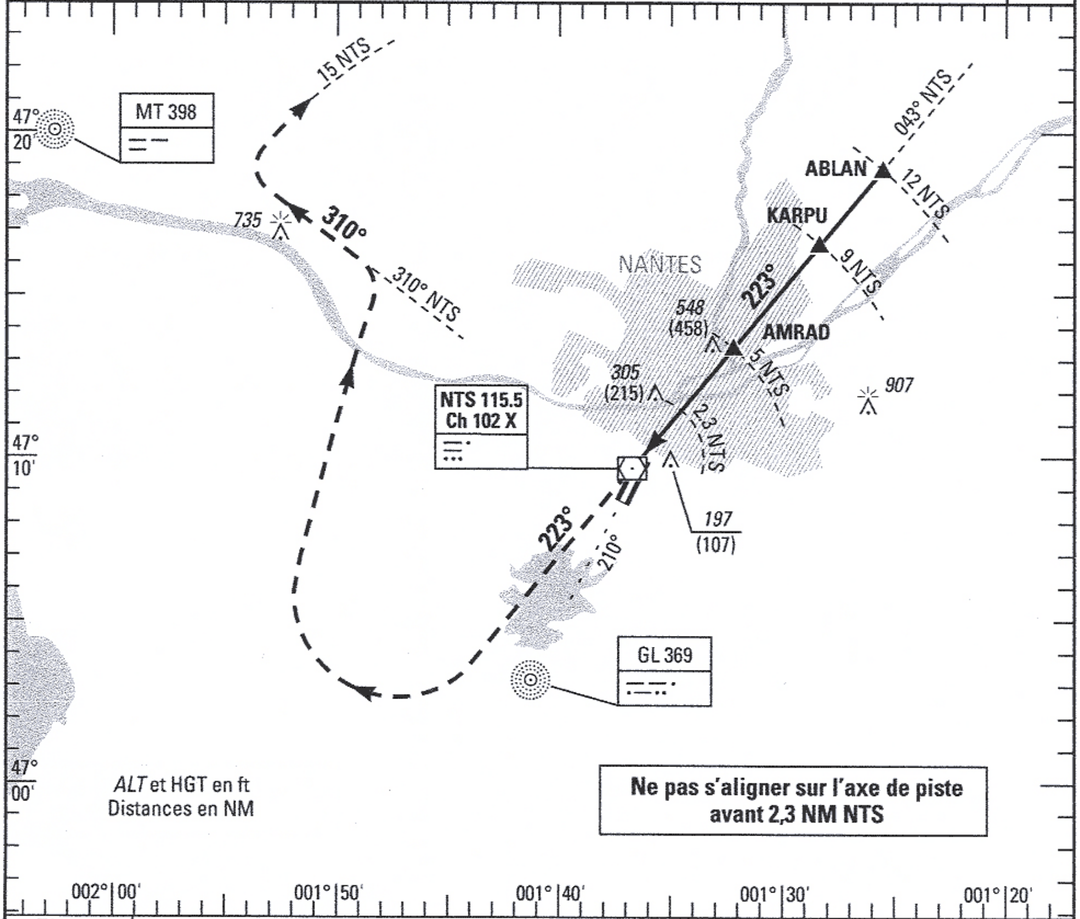
APPROCHE AUX INSTRUMENTS
CAT. A B C D
ALT AD : 90 (4 hPa), *DTHR : 87*

10 JUL 03

NANTES ATLANTIQUE
AD2 LFRS IAC 06
FNA VOR/DME NTS RWY 21

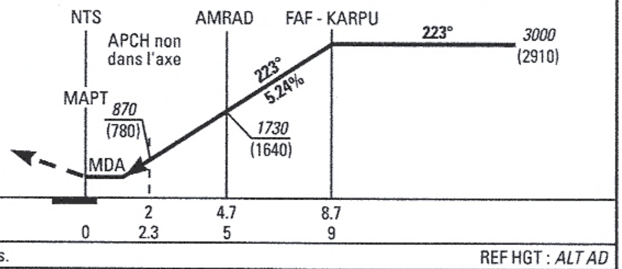
ATIS NANTES 126.925
APP : NANTES Approche 129.875 (L)
TWR : NANTES Tour 118.65

VAR
3°W
(00)



TA : 5000

API : Au MAPT, monter en suivant **RDL 223° NTS**. A ***1000*** (910), tourner à **droite** en montée vers ***3000*** (2910), intercepter et suivre **RDL 310° NTS** pour rejoindre, sauf instruction du contrôle, **l'arc DME 15 NM NTS** par virage **à droite**. **Ne pas tourner avant le MAPT.** Monter à *1000* (910) avant d'accélérer en palier.



MNM AD : distances verticales en pieds, RVR et VIS en mètres.

REF HGT : *ALT AD*

CAT	VOR/DME OCH : 357		MVL	
	MDA (H)	RVR	***MDA*** (H)	VIS
A	***450*** (360)	2500	***610*** (520)	1500
B	***470*** (380)	2500	***610*** (520)	1600
C	***500*** (410)	3000	***950*** (860)	2400
D	***520*** (430)	3000	***950*** (860)	3600

DME NTS NM	**8**	**7**	**6**	**5**	**4**	**3**	**2**
ALT	***2685***	***2365***	***2045***	***1730***	***1410***	***1090***	***775***
(HGT)	(2595)	(2275)	(1955)	(1640)	(1320)	(1000)	(685)

		70 kt	90 kt	110 kt	130 kt	150 kt	170 kt	190 kt
FAF - DTHR	8.7 NM	7 min 27	5 min 48	4 min 45	4 min 01	3 min 29	3 min 04	2 min 45
FAF - MAPT	9.0 NM	7 min 43	6 min 00	4 min 55	4 min 09	3 min 36	3 min 11	2 min 51
VSP (ft/min)		370	480	580	690	800	900	1010

SERVICE DE L'INFORMATION AERONAUTIQUE

AMDT 07/03 **CHG** : Pente, minima.

LFRS/NTE
NANTES/ATLANTIQUE 4 JUL 03 (13-2) **Eff 10 Jul**

JEPPESEN NANTES/ATLANTIQUE, FRANCE
VOR DME Rwy 21

BRIEFING STRIP™

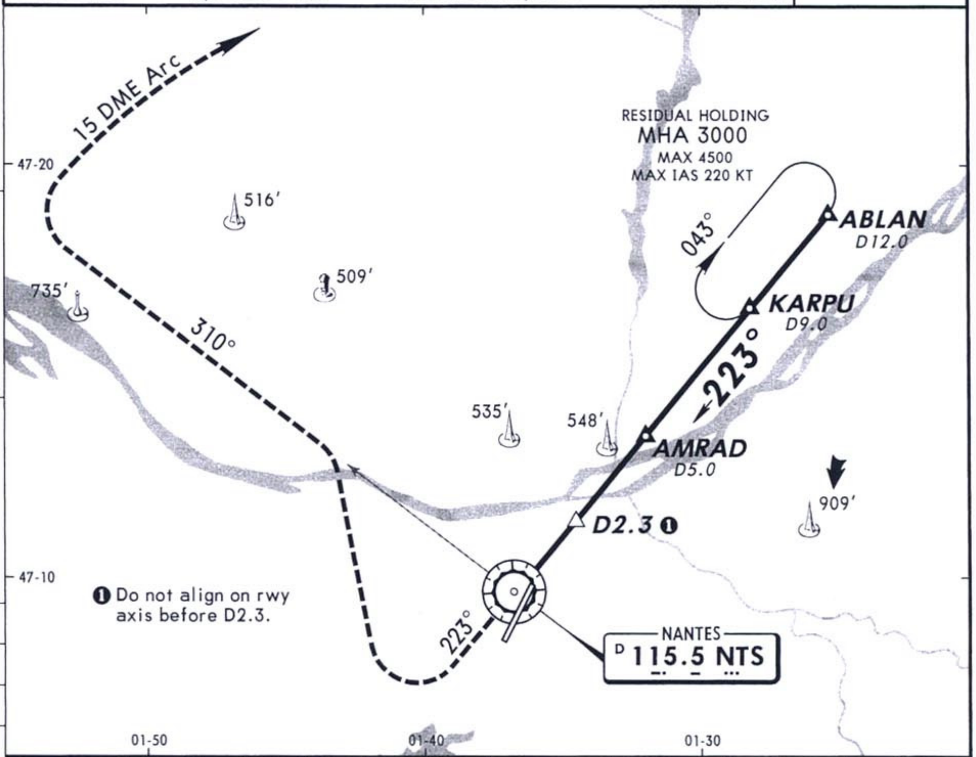
ATIS	NANTES Approach	NANTES Tower	Ground
126.92	129.87	118.65	121.87

VOR NTS	Final Apch Crs	Minimum Alt KARPU	MDA(H)	Apt Elev
115.5	**223°**	**3000'**(2910')	Refer to Minimums	**90'**

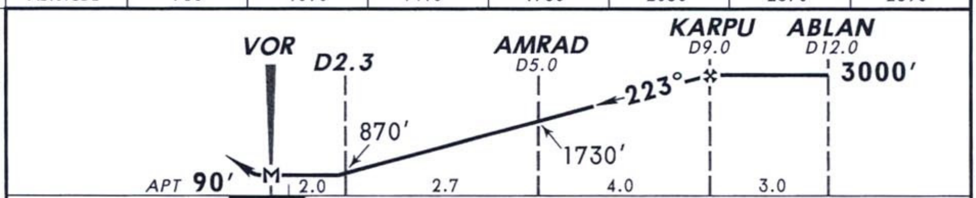
MSA NTS VOR: 2000'

MISSED APCH: Climb on R-223 to 1000', then turn RIGHT climbing to 3000' and intercept R-310. If not otherwise directed turn RIGHT to rejoin 15 DME Arc.
Do not turn before passing MAPt. Climb to 1100' prior to level acceleration.

Alt Set: hPa	Apt Elev: 3 hPa	Trans level: By ATC	Trans alt: 5000'



NTS DME	2.0	3.0	4.0	5.0	6.0	7.0	8.0
ALTITUDE	780'	1090'	1410'	1730'	2050'	2370'	2690'



Gnd speed-Kts	70	90	100	120	140	160
Descent Gradient 5.2%	369	474	527	632	737	843
MAP at VOR						

REIL
PAPI-L

1000' on NTS 115.5 R-223

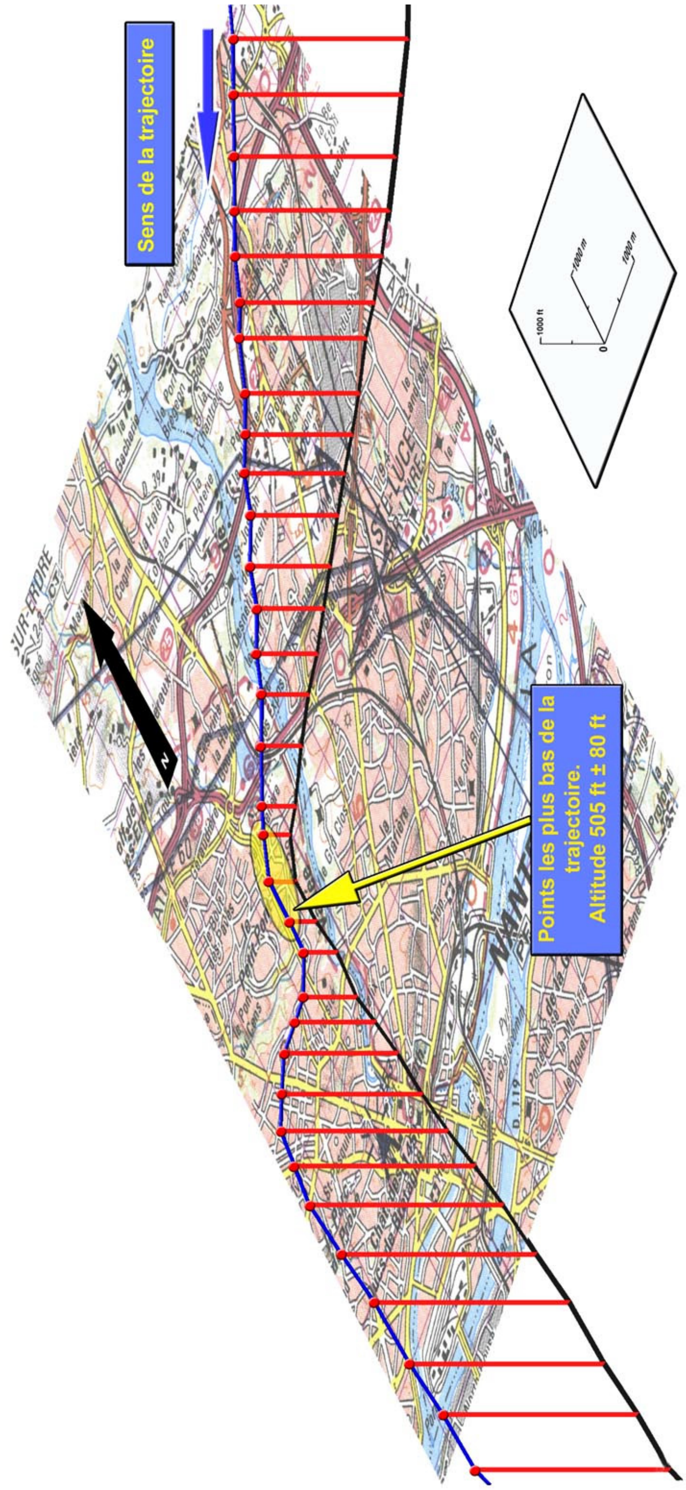
JAR-OPS

	STRAIGHT-IN LANDING RWY 21	Max Kts	CIRCLE-TO-LAND MDA(H)	VIS
	MDA(H) A: **450'**(360') C: **500'**(410') B: **470'**(380') D: **520'**(430')			
A	RVR 2500m	110	610' (520')	2500m
B	RVR 2500m	135	610' (520')	2500m
C	RVR 3000m	180	950' (860')	3000m
D	RVR 3000m	205	950' (860')	3600m

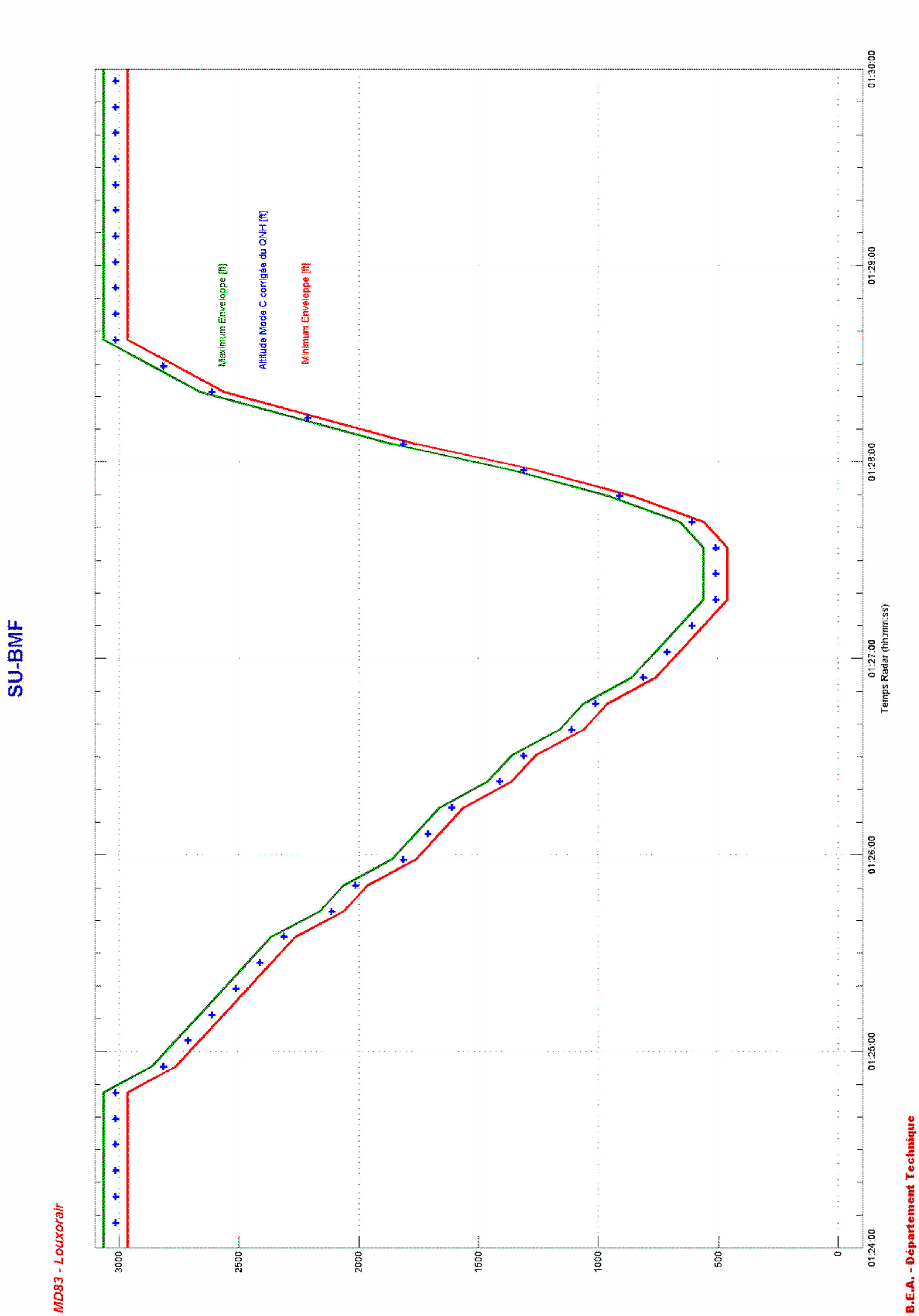
PANS OPS 4

CHANGES: Procedure. Minimums.

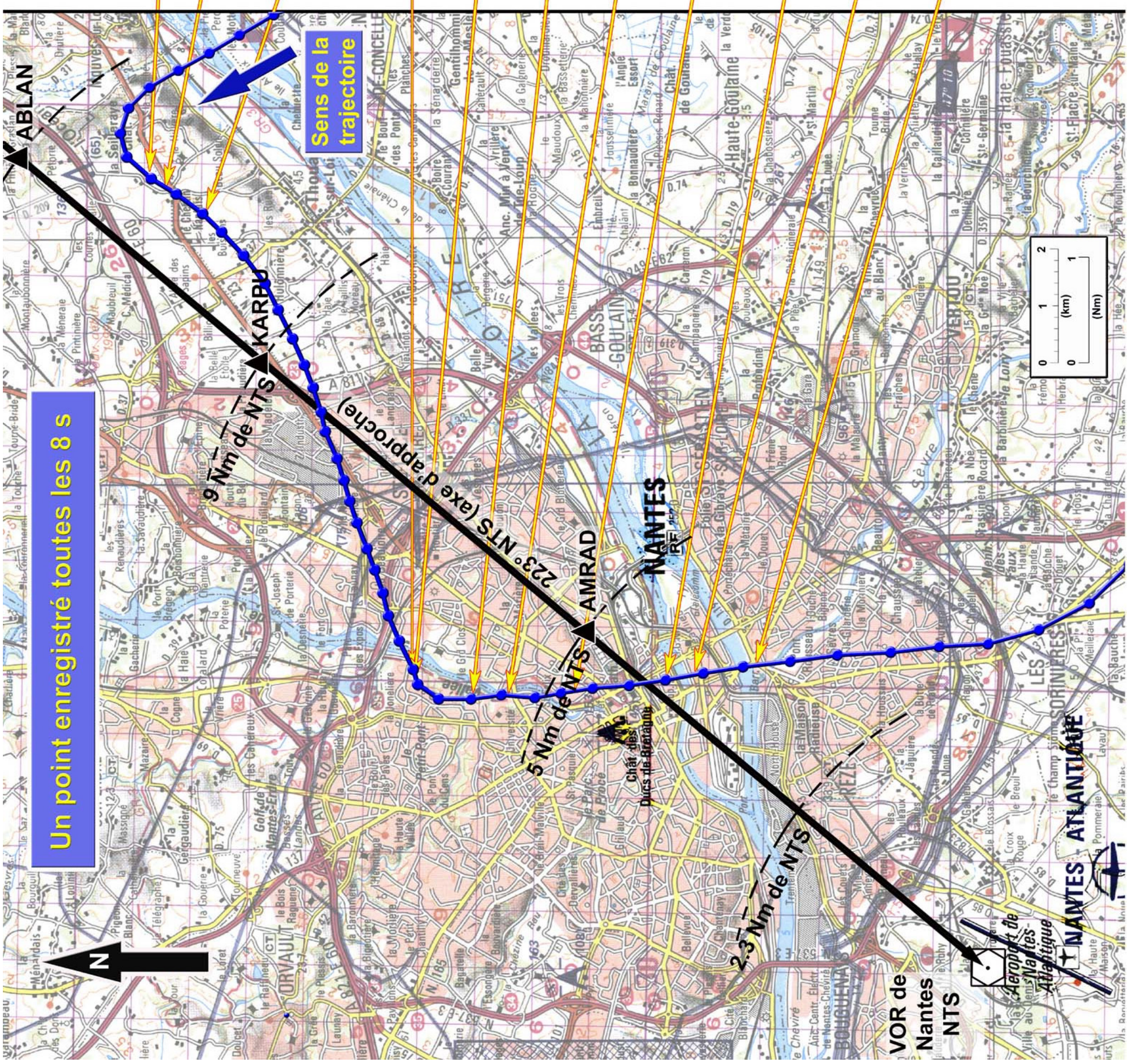
Reconstitution of the vertical path



Reconstitution of the track



Radar data and radio communications



TRANSCRIPTION DES COMMUNICATIONS RADIOTELEPHONIQUES ENTRE LE SERVICE DU CONTRÔLE DE NANTES ET LE LXO615 LE 21/03/2004 SUR 129.875 Mhz telle qu'elle a été fournie par la subdivision qualité de service de Nantes

01:24:23 LXO615 : LXO615, established in the radial 223.

01:24:27 APP : Roger, LXO615, you're cleared to land runway 21, runway's wet, and surface wind 260 degrees 18 knots, gusting 25.

01:24:39 Roger, cleared to land and...copied the weather.

01:27:10 615, you seem to be a bit low on the... on the slope.

01:27:15 OK we're maitaining 500 feet now.

01:27:33 Security, go around now, 615.

01:27:42 Yes, too low, you are too low, so go around, please, I call you back.

01:28:00 You are on the slope now. If you want to descent, you may descent, you're passing 4 miles on final.

01:28:21 Oh yeah, ah...We're passing 4 miles on final, we will make another try.

01:28:28 Roger, so climb 3000 feet QNH 1017, and expect radar vectors for VOR/DME 21, call you back to turn.

01:28:39 Roger,cleared...Climb to 3000 feet and expect.

(Unité de temps : temps ATC)

Wind chart


Pour Sun 21 01UTC Vent 1000HPA Ech01H ALA0.1 21/03/04 00UTC
SUP
FF
Z
Reli
RlfM
RlfG
TrMr
x1.0
47°N