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INVESTIGATION REPORT

Serious incident

on 27 June 2016
at Marseille-Provence (Bouches-du-Rhône)

Near mid-air collision between
Airbus A319 registered **F-GRHX**
operated by **Air France**
and Airbus Helicopters AS532
registered **F-ZWBS**

BEA
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pour la sécurité de l'aviation civile

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SPECIAL FOREWORD TO ENGLISH EDITION

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

Contents

Glossary

AIP	Aeronautical Information Publication
AP	Auto Pilot
ATC	Air Traffic Control
A/THR	Auto Thrust
ATPL(A)	Airline Transport Pilot Licence (Aircraft)
CVFDR	Cockpit Voice Flight Data Recorder
CVR	Cockpit Voice Recorder
DGAC	French civil aviation authority
DME	Distance Measuring Equipment
DSNA	French air navigation service provider
DTI	Engineering and innovation department
E-GPWS	Enhanced Ground Proximity Warning System
FCOM	Flight Crew Operating Manual
FD	Flight Director
FDR	Flight Data Recorder
FL	Flight Level
FMS	Flight Management System
FPV (Bird)	Flight Path Vector
HDG	HeaDinG
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
METAR	METeorological Aerodrome Report
MSAW	Minimum Safe Altitude Warning
ND	Navigation Display

PAPI	Precision Approach Slope Indicator
PC	Qualified controller
PF	Pilot Flying
PM	Pilot Monitoring
RA	Resolution Advisory
RCA	French air traffic regulations
RVR	Runway Visual Range
SNA S/SE	Air navigation service South-South-East
STCA	Short Term Conflict Alert
TA	Traffic Advisory
TCAS	Traffic alert and Collision Avoidance System
UTC	Universal Time Coordinated
VASIS	Visual Approach Slope Indicator System
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range

Synopsis

Time	15:56[1]
Operators	1- Air France 2- Airbus Helicopters
Type of flights	1 - Commercial air transport (passenger) 2 - Checkout flight before delivery
Persons on board	1- Captain (PF), first officer (PM), 3 cabin crew, and 127 passengers 2- A test pilot and a test flight engineer
Consequences and damage	None

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

Near mid-air collision

On 27 June 2016 at 15:45, the crew of the A319 registered F-GRHX, undertaking flight HOP25PG from Bordeaux-Aquitaine airport (Gironde) bound for Marseille-Provence airport, were performing a visual approach to runway 31R.

A helicopter registered F-ZWBS, returning from a checkout flight under VFR east of the installations, was in descent to 1,500 ft towards the entry points of the aerodrome traffic circuit. As the helicopter transponder had failed during the flight, air traffic control only had primary radar contact on the aircraft. In the base leg, the Cougar crew started hover flight without informing the controller of this. Radar contact on the helicopter was lost. The Cougar headed toward the MS point and the two aircraft crossed paths without the crews being informed of their respective presence. The crews of the two aircraft made visual contact after crossing flight paths. The minimum separation values measured were 0.19 NM horizontally and 240 ft vertically.

The near collision was the result of a combination of the following factors:

- no segregation measures being taken by the air traffic control with respect to the Cougar which had to operate without a transponder, in dense airport traffic where the compatibility of IFR and VFR traffic is based on traffic information and visual contact between crews;
- non-compliance with the aerodrome circuit altitude by the Cougar crew;
- Cougar crew not advising that they were bringing the helicopter into hover and an inaccuracy in their position reports which meant that the controller constructed an erroneous mental representation of the situation and thus provided unsuitable traffic information;
- controllers not being given information about the existence of zones where primary radar returns are not displayed.

Contributing to the serious incident were:

- absence of an overall sequencing strategy for inbound VFR and IFR traffic;
- work load which did not allow the tower controller to sufficiently anticipate the arrival of the HOP flight;
- excessive flexibility in the management of parallel runways;
- a congested tower frequency due to the density of the traffic, and the use of non-standard phraseology which did not allow the HOP flight crew to contact the controller and benefit from traffic information in due time;
- possible overconfidence between the tower controllers and the Cougar crew, professionals based on the platform, which may have led to less rigorous practices in providing accurate position reports and in the use of these reports for traffic management.

The BEA has addressed five safety recommendations to the DSNA concerning the following aspects:

- spatial and temporal segregation of flights which have a failed transponder;
- information to Marseille-Provence controllers regarding the performance restrictions or limitations of their display equipment and in particular, the primary radar;
- assessment of the possible extension of this measure to other air traffic units;
- implementation of procedures in the Marseille-Provence tower and approach units so that flights are managed as part of a shared traffic sequencing strategy;
- analysis of the implementation, at Marseille-Provence, of work methods to safely sequence traffic on one of the two parallel runways.

ORGANISATION OF THE INVESTIGATION

The BEA was informed of the event on Thursday, 28 June 2016 at 18:50. Given the preliminary elements collected, the incident was considered as serious and in accordance with Regulation (EU) No 996/2010[(2)], the BEA opened a safety investigation.

[(2)]Regulation of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC.

1 - FACTUAL INFORMATION

1.1 History of the flights

Note: the following elements are based on witness statements, the flight recorders from both aircraft and the ATC recordings (exchanges and radar). The key moments of the event are numbered with a colour for each of the two aircraft. These numbers are shown on the two flight paths in this chapter.

On 27 June 2016 at 15:43:19, the crew of the A319, registered F-GRHX from Bordeaux-Aquitaine airport (Gironde) bound for Marseille-Provence airport (Bouches-du-Rhône), contacted the Marseille-Provence approach controller and reported that they were at FL 150 on the FJR report point. The approach controller asked them to expect an ILS Z approach for runway 31R. The crew read this back.

At 15:47:08, the crew reported that the installations were in sight and that they wished to carry out a visual approach. The approach controller acknowledged and asked the crew to turn left 10° and then a few seconds later, to descend to FL 100.

At 15:48:56, the crew of a AS532 Cougar helicopter registered F-ZWBS, call sign Cougar India, returning from a VFR checkout flight to the east of the installations, contacted the Provence info controller. The crew indicated that they were heading back to the Echo point and the field (point ❶ with equivalent ❶, off map). The info controller replied "*Roger India, descend 1,500 ft.*"[(3)] The crew replied that they were descending to 1,500 ft. As the helicopter transponder had failed during the flight, air traffic control only had primary radar contact on the aircraft.

[(3)] See VAC chart in appendix 2.

At 15:49:14, the info controller asked the Cougar crew to contact the tower controller. As the tower frequency was busy, radio contact was made by the Cougar crew at 15:50:33 (point ❷ with equivalent ❷, off map). The tower controller informed the crew that he only had a primary blip and asked them to join the right hand base leg 31. The controller also asked the crew to report when they had visual contact on an A320[(4)] which was 12 NM from the field in order to position themselves behind it. The crew read this back.

[(4)] This was a Lufthansa flight in ILS approach for runway 31R.

At 15:51:29, the Cougar crew reported visual contact on the Airbus. The tower controller confirmed the position of the aeroplane "*10 o'clock for 5 NM*" and asked the Cougar crew to position themselves behind it. The crew read back the message.

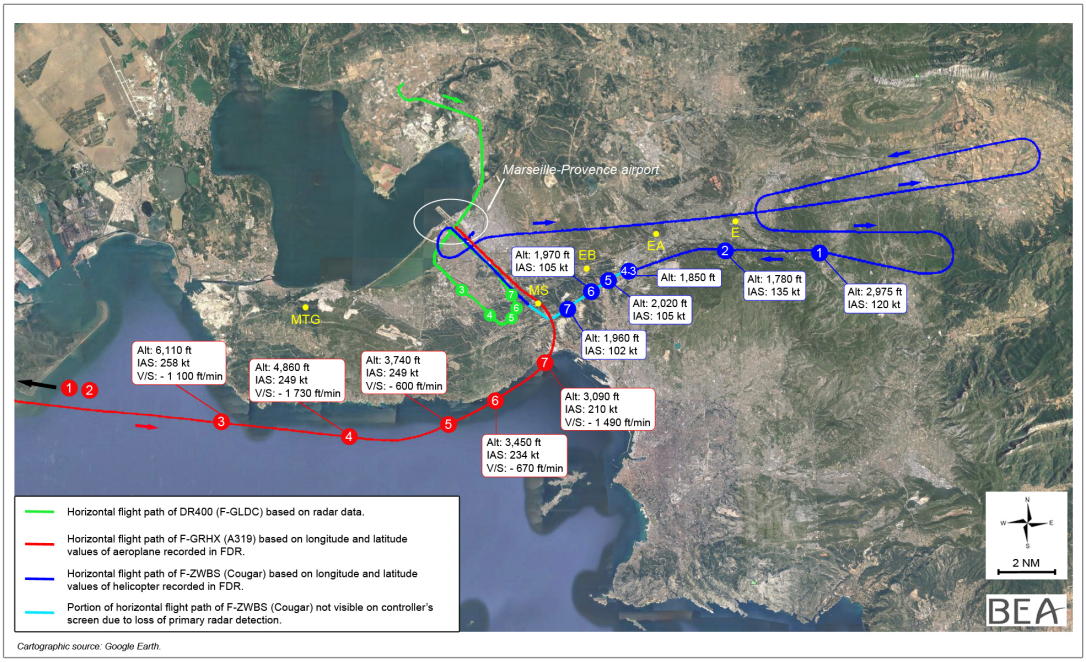
At 15:51:40, the approach controller asked the A319 crew to turn to heading 090 and cleared descent to 5,000 ft. He also informed the crew that they were number two behind an aeroplane situated at their twelve o'clock at around 15 NM, on the approach (Lufthansa flight). The crew acknowledged, specifying that they "*had the traffic on the TCAS.*"

At 15:51:58, the pilot of a DR400[(5)], in contact with the tower controller, in the aerodrome circuit, reported that he was in the left-hand downwind leg "*for 31.*" Not having obtained a reply from the controller, he repeated his call at 15:52:14. The tower controller then asked him to expect runway 31L and to report when he had visual contact on an A320 at 9 NM on final (Lufthansa flight) in order to position himself behind it. The pilot read this back.

[(5)] Registered F-GLDC.

At 15:52:25, the crew of the A319 informed the approach controller that they were in sight of the preceding flight (Lufthansa flight). The controller asked them to "*expect visual finish behind this traffic.*"

At 15:52:36, the tower controller asked the Cougar crew to report on final approach for runway 31R behind the A320 (Lufthansa flight) and informed them of the DR400 in the downwind leg for the parallel runway. The Cougar crew read back the message.



At 15:52:54 (point ❸), the approach controller cleared the crew of the A319, if they were in sight of the preceding traffic, to carry out a left-hand visual approach to runway 31R and then cleared them to descend to 4,000 ft QNH. The crew read back this message.

Between 15:52:56 and 15:53:50, the Cougar crew started hover flight (points ❸ and ❹). At 15:53:11, there was no radar contact on the helicopter on the controller's display. It was at 1,850 ft[(6)]. This position and altitude information was not given to the tower controller by the crew.

[(6)]Information from Cougar FDR.

At 15:53:37, the tower controller informed the Cougar crew that he no longer had radar contact on them. The crew replied that they were at the EA point (in reality they were 1.7 NM away, 214° to the EA point).

At 15:53:54 (point ❹), the approach controller cleared the crew of the A319 to descend to 2,500 ft QNH and to turn onto the base leg when they wanted to. He then asked them to contact the tower controller.

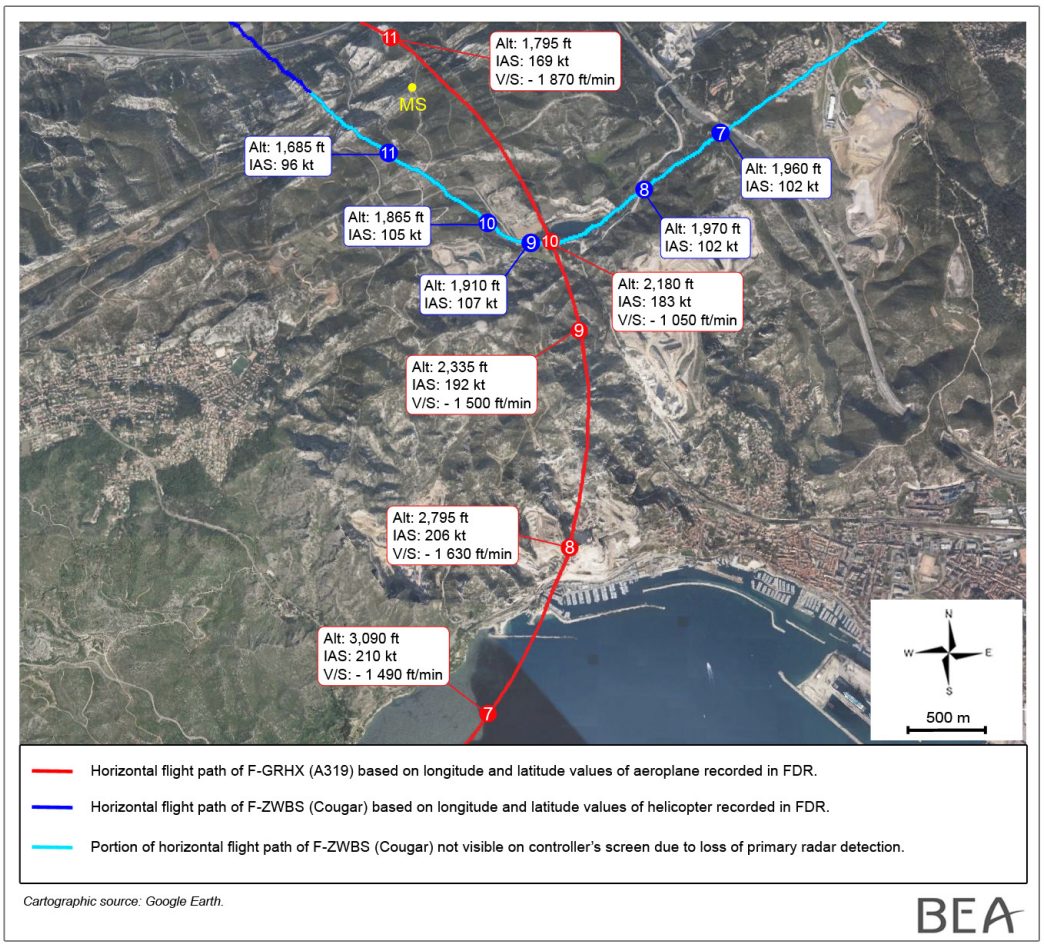
The AP was disconnected at 15:54:15, the FD at 15:54:19 and the A/THR at 15:54:26.

At 15:54:42 (point ❺), the crew of the A319 contacted the tower controller and reported that they were in the left-hand base leg for runway 31R, "*still with visual contact on preceding traffic*" (Lufthansa flight). The tower controller did not reply, gave clearance to land to the crew of the Lufthansa flight which was on short final and then asked the Cougar crew if they had visual contact on a DR400 which was on final for the parallel runway.

At 15:55:08 (point ❻), the Cougar crew replied that they could not yet see the DR400 and that they were arriving at the MS point. In reality, they were 2 NM away, 77° to the MS point at 1,970 ft. The tower controller, thinking that the Cougar was arriving at the MS point and thus on the centreline of runway 31R, asked the crew to make a "*small dog leg to the left*" for runway 31L[(7)] and to position themselves behind the DR400 which was a little further forward of the MS point. He asked them to report when they had visual contact. The crew read this back.

The analysis of the Cougar CVR shows that from the point that this traffic information is supplied and up to 15:56:35, the discussions between the Cougar crew members solely concerned the search for visual contact with the DR400.

At 15:55:44 (point ❼), the tower controller again asked the Cougar crew to report when they had visual contact on the DR400. The Cougar crew replied that they will call back and requested the position of the DR400. The controller replied that the latter was on a long final for runway 31L.



[(7)] The tower controller said that this runway change was to let him authorize take-offs from runway 31R.

At 15:55:56 (point ❽), the crew of the A319 took the first opportunity given to them on the tower frequency[8] to indicate that they were arriving on final for runway 31R. The tower controller asked them to report on short final for runway 31R and informed them of "*two traffic on parallel, a DR400 followed by a helicopter*." The crew read back the message.

[8] The tower frequency was busy for 80 % of the time between 15:50 and 16:02.

At 15:56:11 (point ❾), the crew of the A319 informed the tower controller that the helicopter had just flown under them. The controller acknowledged.

At 15:56:19 (point ❿), the tower controller told the Cougar crew that in the absence of radar contact, it was difficult for him to provide traffic information. He informed them of the presence of an A319 at the MS point on final for the main runway. The crew did not reply. It was during this communication that the minimum separation values were reached. They were 0.19 NM horizontally and 240 ft vertically.

The analysis of the Cougar CVR shows that at this time, the crew were discussing the possible position of the DR400. It also shows that the crew acquired visual contact on the DR400 at 15:56:35 and that five seconds later, they discovered with surprise, the presence of the A319 whose flight path they had just crossed[9] *(point ⓫).*

[9] This information is not reported to the tower controller.

At 15:57:03, the A319 crew were cleared to land on runway 31R.

At 15:57:15, the tower controller informed the Cougar crew that he had radar contact on them again and asked them to report on short final for runway 31L.

At 15:57:23, the Cougar crew reported that they were established on the centreline of runway 31L and that they will call back in short final. Following the request from the tower controller, the crew replied that they had visual contact on the DR400 which was preceding them on the same runway.

At 16:00:24, the Cougar crew were cleared to land on runway 31L.

1.2 Injuries to persons

1.2.1 A319 registered F-GRHX

	Injuries		
	Fatal	**Serious**	**Minor/None**
Crew	-	-	5
Passengers	-	-	127
Others	-	-	-

1.2.2 Cougar registered F-ZWBS

	Injuries		
	Fatal	**Serious**	**Minor/None**
Crew	-	-	2
Passengers	-	-	-
Others	-	-	-

1.3 Damage to aircraft

None

1.4 Other damage

None

1.5 Personnel information

1.5.1 A319 crew information

The captain (PF on the flight) and the first officer of the A319 had both been based at Marseille for the last four years. They formed part of around 30 crew members who ensure flights for Air France from this airport.

On the day of the incident, the captain, aged 44, had logged 11,752 flight hours. He had logged 5,292 flight hours on type of which 5,251 as captain. He held an ATPL (A) issued by the French authorities, valid up to 30/04/2017.

The first officer, aged 33, had logged 4,457 flight hours on the day of the incident. He had logged 3,761 flight hours on type.

1.5.2 Cougar crew information

The crew consisted of a test pilot and a test flight engineer.

The pilot had joined Eurocopter[10] in March 2006. At the time of the incident he was aged 49 and had logged 9,175 flight hours on numerous different helicopter types, of which 7,525 hours as pilot in command and 1,100 hours on type.

[10] Became Airbus Helicopters in 2014.

1.5.3 Air traffic controller information

The tower position was manned by a controller and an assistant in accordance with local requirements.

The tower controller, also called local or "Loc" controller, was aged 55 at the time of the incident. He had arrived at Marseille in July 2011 and had obtained his PC qualification in October 2014. This qualification allowed him to hold all the tower and approach control positions.

The "Loc" assistant was aged 31 at the time of the incident. He had arrived at Marseille in May 2007 and was qualified as PC since November 2009.

Both had started duty at their positions a little over one hour before the incident.

1.6 Aircraft information

Not applicable.

1.7 Meteorological information

The meteorological conditions were the following:

- wind from 320° at 20 to 25 kt;
- CAVOK;
- temperature 29 °C;
- QNH 1015 hPa.

1.8 Aids to navigation

No malfunction of the radionavigation equipment was reported the day of the event.

1.9 Communications

The crew of the A319 were successively in radio contact with the Marseille-Provence approach and then the tower.

The Cougar crew were successively in radio contact with the flight information service and then with the Marseille-Provence tower.

The transcript of the radiocommunications is available in appendix 1.

1.10 Aerodrome information

The Marseille-Provence aerodrome is equipped with two parallel paved runways.

Runway 31R/13L is 3,440 metres long and 45 metres wide.

Runway 31L/13R is 2,370 metres long and 45 metres wide.

The day of the incident, runways 31R and L were in use.

The relevant Marseille-Provence aeronautical charts for understanding this event are available in appendix 2.

1.11 Flight recorders

The time taken to make the notification and the departure of the A319 for the following flight meant that the CVR was not removed within the allotted timeframe (two CVR operating hours). The flight data from the QAR was read out by the operator and then transmitted to the BEA on 2 July 2016. The data contained that regarding the event flight.

The Cougar was equipped with a combined voice and flight data recorder, the data of which was read out by Airbus Helicopters and sent to the BEA on 5 July 2016. The data contained that regarding the event flight.

The messages taken from the CVR were included in the transcript of the radio exchanges between the crew and the ATC (see appendix 1).

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 Congestion of frequency

The calculations carried out to determine the percentage of time that the tower frequency was busy give a value of 80% between 15:50 and 16:02. This particularly high rate is partly due to a momentarily high traffic load. An examination of the radio exchanges established that the use of non-standard phraseology, in French, during this phase, also contributed to increasing the time spent on the frequency.

Due to the busy frequency, the Cougar crew, invited by the Provence information controller to contact the tower controller at 15:49:15 were only able to actually make this contact at 15:50:34.

The crew of the A319, transferred by the approach controller to the tower controller at 15:54:01, were only able to contact the tower at 15:54:44, as the frequency was busy due to an exchange between the tower controller and the crew of a civil defence aircraft taking off. The tower controller did not immediately reply to the call from the A319 crew and favoured exchanges with the other aircraft that he had on the frequency (landing of Lufthansa flight, management of Cougar, departure of Ryanair flight). The A319 crew were only able to repeat their message one minute fourteen seconds after their first call. During this lapse of time they had covered around 5 NM. On making their second call, they were no more than 1 NM from the helicopter, i.e. at approximately 20 seconds from crossing it's flight path. It was during these 20 seconds that the information concerning traffic on final approach for the parallel runway was given to them and their flight paths crossed.

1.16.2 Loss of helicopter primary radar blip from display

Unlike secondary radars which require the presence of transponders on the aircraft, primary radars use the echo principle. They emit electromagnetic wave pulses and detect the return of these pulses after their reflection on the targets. The difference in time between the emission and reception determines the distance of the target from the antenna. The position of the antenna when it receives the echo and a calculation correction (the antenna is continuously turning) determines the target's bearing. This target is then represented by a luminous symbol, also called primary radar blip, on the radar screen.

It was this blip which momentarily disappeared from the controller's screen.

A study carried out by the technical department of the Marseille air navigation services came to the following conclusions:

- Primary detection radar TRAC 2000, located at Vitrolles, has parameter settings to detect moving targets (detection of radial speed of targets) and eliminate fixed returns.
- On the helicopter starting hover flight at 15:53, the radar no longer detected a moving "*target*" and consequently eliminated the blip corresponding to the helicopter. The radar then needs at least three "*consistent*" blips to recreate a track. When the helicopter came out of its hover flight, its path very closely followed a concentric circle with respect to the centre of the radar. In these conditions, the radial speed was low, even non-existent. On top of this, the radar cross-section of the helicopter was small. The reflection of the helicopter's radar signal was lost in the clutter (noise, unwanted echoes, etc.). The creation of a new track was thus delayed.
- The weather conditions also played an important role. The wind (in the present case from 320° at 20 to 25 kt) causes tree movement and movement on the water surface. The primary radar, which detects the ground, thus generates a multitude of pre-blips which have above zero radial speeds which are comparable to moving targets. This results in a considerable increase in the radar load, indeed in radar saturation. Mechanisms known as load checks are then triggered to make the coefficients used more restrictive for the calculation of the detection threshold.

Consequently, it is very probable that all of these factors led to the primary radar echo of the helicopter not being displayed from 15:53:11 to 15:56:56.

A study carried out in 2006 by the DTI of the DGAC to assess the radar detection at Marseille had observed, in particular, that there were detection losses of helicopter movements to and from the aerodrome.

These specificities were not brought to the attention of the controllers.

1.17 Organizational and management information

1.17.1 Aerodrome control

1.17.1.1 General functions

The aerodrome control tower transmits authorizations and information to aircraft operating in the airport traffic in order to:

- prevent collisions between:
  - aircraft flying in the aerodrome circuit;
  - aircraft operating in the manoeuvring area;
  - aircraft landing and taking off;
  - aircraft and vehicles operating in the manoeuvring area;
  - aircraft in the manoeuvring area and obstructions in that area.
- expedite and maintain an orderly flow of air traffic.

1.17.1.2 Prevention of collisions

Collisions are prevented between IFR and VFR flights and between VFR flights in the aerodrome traffic. A separation is ensured between all the aircraft in the landing area and in addition, the aerodrome controller takes measures to mitigate dangers due to wake turbulence and blast effect.

It is the captain's responsibility to avoid collisions with other aircraft using the traffic information.

Aerodrome traffic information must be supplied each time conflictual situations are foreseeable. The information is kept up to date with the positions of the aircraft, their foreseeable manoeuvres or following a new authorization being given.

1.17.2 Management of parallel runways in daylight VMC conditions

1.17.2.1 Regulatory provisions: RCA

RCA 3[(12)] states that two parallel runways in use can be chosen to carry out the following simultaneous manoeuvres:

- simultaneous landings on the two runways;
- simultaneous take-offs on the two runways;
- landing on one runway and simultaneous take-off on the other.

Paragraph 5.3.2.4.1 of RCA 3 indicates that in VMC conditions, two parallel runways can be chosen as runways in use if the following minimum distances are complied with between the runway centrelines:

- 120 metres
  - the two runways are paved and of a length less than 1,000 m or are not paved;
- 150 metres
  - one of the runways is paved and its length is equal to or more than 1,000 but less than 1,500 metres, the other runway meeting the same criteria or not being paved;
- 210 metres
  - at least one of the runways is paved and its length is equal to or more than 1,500 metres. However, on an aerodrome where there are only flights in day VFR conditions, different values can be defined after a specific study, for single-engine propeller aircraft and gliders. In this case, special or local instructions are put in place.

1.17.2.2 Management of parallel runways at Marseille-Provence airport

The Marseille-Provence air traffic control operations manual specifies that the centre-to-centre distance due to the orientation of the runways varies between 300 and 340 metres.

[(12)] French decree of 21 April 2017 regarding the rules and procedures for air traffic services provided to aircraft manoeuvring in accordance with general air traffic rules, known as "*RCA 3*".

Runway 31R/13L is preferential. The minimum distance between the runway centrelines is more than the regulatory 210 metres. Consequently, both runways can be simultaneously used in VMC conditions. However, when two aircraft cohabit the aerodrome circuit and are manoeuvring on parallel runways, a crew cannot turn into the base leg until they have visually acquired the aircraft manoeuvring on the parallel runway. As soon as this visual contact is obtained, the Loc controller advises the crew of the other aircraft of the manoeuvre of the aircraft in the base leg, specifying that the aircraft in the base leg has visually acquired them.

Note: the simultaneous use of two runways requires the Loc controller to keep in mind problems produced by a go-around which is always possible (direction of turn) and the wake turbulence.

The operations manual specifies that the working method does not require any runway specialization. The choice of runway assignment strategy is left to the controllers and tower manager.

1.17.3 Visual approach

1.17.3.1 Regulatory aspects

RCA 3 sets out in paragraph 4.3.3.1 that:

- an aircraft in IFR flight has the possibility of not carrying out all or part of a published or approved instrument approach procedure in order to carry out a visual approach with visual reference to the terrain if the following conditions are met:
  - The pilot sees the aerodrome.
  - The pilot can maintain visual contact with the ground.
  - The pilot considers that the visibility and ceiling allow a visual approach and that landing is possible.
  - At night, the ceiling is not below the minimum sector altitude or, where appropriate, the altitude of the flight path to join the runway circuit.
  - In controlled airspace, the pilot has received clearance for a visual approach.
  - The pilot complies with any specific instructions for the visual approach to the given aerodrome and with the manoeuvre restrictions in the direction of the runway issued by the air traffic control unit. When performing a visual approach, the aircraft continues to benefit from air traffic services corresponding to the airspace class in which it is flying.

The following paragraph (paragraph 4.3.3.2) indicates that a visual approach clearance may be requested by the pilot or proposed by the controller. The conditions in which the controller may propose a visual approach, particularly weather conditions, are established by the competent authority of the air traffic services.

The visual approach clearance may be subject to the pilot's acceptance of the manoeuvre restrictions in the direction of the runway, issued by the air traffic control unit, irrespective of any specific or local instructions pertaining to the visual approach at the given aerodrome. The air traffic control unit shall continue to ensure the applicable separation in the given airspace between the aircraft which has been given visual approach clearance and the other aircraft.

Communications are transferred to the aerodrome controller at a point or moment when information regarding the essential local traffic, if applicable, and the clearance to land or any other instruction can be given to the aircraft in a timely way.

1.17.3.2 Provisions in force at Marseille-Provence airport

The Marseille operations manual incorporates the same national regulatory provisions and adds information specific to the aerodrome:

- If a visual approach clearance is accompanied by a manoeuvring limitation in the direction of the runway (type of circuit, altitude, etc.), this limitation must be given after the visual approach clearance.

Example: " *…after MTG, cleared left-hand visual approach runway 31R, descend 2,500 ft.*" This is different from "*descend 2,500 ft, cleared left-hand visual approach runway 31R.*" In the latter case, the visual approach is not limited by the level when it starts.

A visual approach can only be given by the approach after coordination with and approval from the Loc controller. The direction of the visual approach will be indicated during the coordination.

Unless otherwise coordinated, the inbound IFR traffic to Marseille-Provence is transferred to the Loc controller once established on the procedure; or in visual approach, and released from traffic:

- at the latest:
  - when passing the MS point in configuration 31;
  - in the last turn if in visual approach.

There is a chart concerning the visual approach for the Marseille-Provence airport, published in the AIP France (see chart AD2 LFML ENV 01 in appendix 2). This mentions the recommended levels and speeds for visual inbound flights from the north and west:

- for visual approaches via MJ: IAS ≤ 210 kt, FL ≤ 5,000 ft;
- for visual approaches via threshold 31: IAS ≤ 210 kt, FL ≤ 2,500 ft.

They do not apply to the inbound visual approach of the HOP flight arriving from due west as not covered by the provisions of this chart.

1.17.3.3 Procedures in force at Air France

The Air France operations manual incorporates in full, the regulatory provisions mentioned in paragraph 1.17.3.1.

Information about the conditions for performing a visual approach has been added:

- RVR or visibility of more than 800 metres;
- AP and FD off;
- use of relevant navigation means (FMS, radio-electrical equipment, VASIS, PAPI) in order to avoid any confusion over the runway or aerodrome and at least one validated radionavigation equipment item to calibrate the final glidepath;

- ❒ the pilots augment their monitoring on the final approach, particularly with respect to VFR traffic;
- ❒ at night, the pilots must have the EGPWS and display the "*terrain*" function on at least one ND.

"*Field charts*" (LIDO charts) are produced for the crews. The Marseille-Provence airport chart draws the crew's attention in particular to:

- ❒ a steep glidepath for runway 31L/R;
- ❒ significant helicopter activity in the aerodrome circuit and around the runways;
- ❒ dense VFR traffic in the vicinity

There is a LIDO visual approach chart for northern arrivals passing either vertically over or to the west of the installations (see appendix 3). These charts comply with the provisions of the AIP chart.

For western arrivals, there is no chart support and the crews perform a "*complete*" visual approach[13].

[13]Cf paragraph 1.18 Witness statements

1.17.4 Transponder

1.17.4.1 Carrying rules

In France, these rules are fixed by decree[14], in line with ICAO Annex 10 (Aeronautical Telecommunications).

[14]French decree of 21 June 2001 regarding communication, navigation, monitoring and collision avoidance equipment installed on-board aircraft flying in the flight information regions of metropolitan France.

They specify, in particular, that all aircraft in VFR must be equipped with a mode A+C transponder with altitude encoder or a mode S transponder, level 2, with at least an altitude encoder, in class B, C and D airspace. Concessions exist. The airspace in which the A319 and the Cougar were manoeuvring is class D and there was no applicable concession in this case.

1.17.4.2 Total transponder failure

This decree sets out that when an aircraft with a failed transponder is in a region where carrying a transponder is compulsory, the air traffic units must endeavour to ensure the continuation of the flight to the destination aerodrome specified in the flight plan.

However, in certain situations, whether in terminal areas or en route, the continuation of the flight may not be possible, in particular if the failure is identified shortly after take-off. The aircraft may be requested by either the operator or by the air traffic service units to return to its departure aerodrome or an acceptable aerodrome.

When the failure is detected before take-off from an aerodrome where repair is not possible, the aircraft must be cleared to fly by the most direct route possible to the closest aerodrome where the repair is possible.

When issuing clearance to such an aircraft, the control units must take into account the density of the existing or forecast traffic and may have to modify the departure time, flight level or planned route.

1.17.4.3 Transponder and safety systems

The transponder is an equipment item carried on the aircraft which allows secondary radars to identify it and determine its position in the airspace. Long used for this sole purpose, nowadays it is also used to support various safety and recovery systems such as the TCAS, STCA[15] and MSAW[16] for example.

1.18 Additional information

1.18.1 A319 crew witness statement

This flight was a "*standard*" flight which they were used to performing. Clearance to carry out a visual approach was requested at around FL 150 once the runways were in sight. Their flight was behind a Lufthansa flight in ILS approach which they also had in sight. The flight was carried out with the autopilot until they were cleared for a visual approach. This clearance was, according to the crew, not given very early (a little after MTG). As soon as the clearance was issued, the automatic flight systems (AP, A/THR and FD) were disengaged. The crew then used the FPV[17].

The path selected passed over the sea to avoid flying over the coast. It aimed to intercept the ILS before the MS point. The aeroplane was "*a little high*" during this approach as they were late in leaving the IFR path. The crew used the air brakes to recover the slope. As control had not asked them to regulate their speed, they optimized it in accordance with the aeroplane preceding them while complying with the regulatory limit fixed at 250 kt below FL 100. The transfer to the tower occurred when the aeroplane was en route to the base leg, still slightly above the glidepath, approximately "*one dot above the glide*." The wind was northerly at 25 to 30 kt which helped with the recovery of the glidepath. The first time that they contacted the tower and did not get a response, the aircraft was still in descent, slightly above the glidepath. The frequency was then busy but they had visual contact on the Lufthansa flight situated at around 5 NM ahead of them and which they thought was the only traffic which concerned them.

At the second radio contact, arriving on the centreline of runway 31 right, they were informed of a DR400 followed by a helicopter on the parallel runway, thus on the left side. The captain looked at the ND for a possible TCAS contact but did not see anything. When looking for visual contact on the left, he saw the helicopter "*at the tip of the left wing*", approximately 150 to 200 ft below them. He very clearly saw the helicopter pilot but did not know if the helicopter pilot saw him. Once they had crossed flight paths, he checked the flight elements, the flight was on the correct approach path so he decided to not go around and continued the approach.

The crew specified that during all of the approach, they only had in mind the Lufthansa flight which preceded them. There was no time pressure. The flight was on time. They were then going to perform a flight between Marseille-Provence and Paris Orly airports.

[15] Short term conflict alert system used in air traffic control. It generates a visual alert on the controller's radar screen allowing him/her to take conflict resolution measures.

[16] System to prevent the risk of collision with the terrain, in use in certain approach control centres. If there is a risk of an aircraft colliding with the terrain, this system generates an alert on the controller's screen who then contacts the crew. The VFR codes and the codes of the aircraft in visual approach are inhibited.

[17] Commonly referred to as "*bird*", it is used, notably, to fly a non-precision approach path.

The crew said that there was only a visual approach chart issued by the operator for northern arrivals (only arrivals used before the opening of the transverse routes). For the western arrivals , it was a "*complete*" visual approach, i.e. without the support of a chart. The crew used the ILS as a support on the ND which meant that they had a path reference. This is managed with respect to the MS point once the visual approach clearance has been obtained. This means, in particular, that the distance with respect to the centreline is shown on the ND. The MS point is usually flown over at 1,600 ft.

The crew specified that the visual approach was very often carried out by crews based at Marseille-Provence and less by "*outside*" crews. If the visual approach clearance is given early, the circuit can be short via MTG and then over the motorway. If not, as was the case here, the long circuit is used, flying over the sea south of the coast up to the turn into the base leg.

He added that there was a wide variety of traffic and activities at the Marseille-Provence airport (IFR flights, IFR in visual approach, civil defence flights, Airbus Helicopters test flights and general aviation VFR flights). The cohabitation of this traffic was based on traffic information being supplied to facilitate visual contact and TCAS information. The crew underlined the risk associated with aircraft "*crossing flight paths*" in the left circuit for the right runway and vice versa, a situation that they considered uncomfortable, even with visual contact, in a flight phase where actions follow on from each other and where concentration must be at its maximum.

1.181 Cougar crew witness statement

The crew indicated that they were working "*in the area*", in contact with the information controller, at 5,000 ft as part of a checkout flight before customer delivery. The transponder had failed during the flight. Air traffic control had been informed of this. The crew returned to the airfield via the Echo and EA points. They were informed of the presence of the Airbus at 12 NM. They were asked to report when in sight of the Airbus and to position themselves behind it for an approach to runway 31R. They then hovered in the EA point area to ensure their separation behind the Airbus which, according to them, was "*still quite far away.*" They next continued the flight to the MS point and climbed a little to avoid the wake turbulence from the Airbus. They were then asked to position themselves for an approach to runway 31L behind a DR400 . Before turning into the final leg, the test flight engineer carried out a "*visual scan*" on the left in order to ensure safety before turning into the final leg. This action is systematically carried out before each turn. The crew were then monopolized for quite a long time, by the search for the DR400 which they were not able to locate. They saw the DR400 as they were flown over by the Airbus about which they had received no information. It came as a complete surprise. The crew said later on that they had seen the Airbus, after crossing paths, overhead, slightly to the right, in descent at an estimated distance of 100 meters horizontally and 150 ft vertically.

1.18.3 Air traffic controller witness statement

The tower position was manned by a controller and an assistant in accordance with local requirements.

Both had started duty at their positions a little over one hour before the incident.

They indicated that the visual approach had been coordinated "*well in advance*" by the approach, specifying that it is the tower which is responsible for issuing visual approach clearances according to traffic. At that instant, the current traffic permitted it. The Cougar had a failed transponder. The controllers had primary radar contact on it.

This contact was lost at around the EA point. The Loc assistant visually looked for it in the sector of the EA point and then the MS point but did not find it despite the very good visibility. The two controllers considered that despite there being no radar contact, the helicopter, given its position report at the EA point, could be integrated in the traffic, even with respect to the visual approach in progress.

For them, the situation was simple: a DR400 in the left-hand downwind leg for runway 31L, an Airbus operated by Lufthansa in ILS for runway 31R, the Cougar behind this Airbus and the A319 in visual approach behind the Cougar. There were also take-offs to be integrated according to the inbound traffic.

When the crew of the A319 contacted the tower, the controller heard this call. He chose, however, to issue a landing clearance to the Lufthansa flight crew and to ensure that the Cougar crew saw the DR400. These messages had, according to him, priority with respect to the inbound A319 which was still "*quite far away*." It was at this moment that the helicopter crew reported that they were at the MS point.

The controller, thinking that the Cougar was arriving on the centreline, then redirected it to runway 31L behind the DR400 in order to allow take-offs on runway 31R.

When in the second call the crew of the A319 reported that they were on the final approach for runway 31R, the controller gave them traffic information about the DR400 and the helicopter which he thought was aligned on runway 31L.

When the crew reported that they had just dangerously crossed paths with the helicopter, it came as a complete surprise to the controllers.

The controller specified that the workload was initially average but had suddenly increased with a complex take-off sequence and the preparation of a runway inspection. He added that, as a consequence, he did not have the mental availability to analyse the inbound speed of the A319 which was higher, according to him, than usual visual approach speeds. He also specified that in general, controllers are more vigilant with respect to leisure VFR flights than VFR flights performed by professionals (civil defence pilots and Airbus Helicopters test pilots) used to the platform. Thus they were very surprised by the difference between the position reported by the Cougar crew and their actual position.

2 ANALYSIS

2.1 Development of conflictual situation

The Cougar returned to the airfield with a failed transponder without manoeuvring restrictions or specific integration conditions from the air traffic control. The tower controller considered that the primary detection on this aircraft and the crew's position reports would suffice for monitoring the progression of the flight and its integration into existing traffic. In the tower controller's mind, the Cougar was number two for runway 31R behind an Airbus operated by Lufthansa.

At the same time, the approach controller was vectoring the crew of an A319 for a visual approach on runway 31R. He informed the crew that they were number two behind the Lufthansa flight situated at their twelve o'clock at 15 NM. The vectoring of the A319 was not accompanied by manoeuvring or speed conditions. For the approach controller, the only traffic in front of this aeroplane was the Lufthansa flight. This led him to authorize the A319 crew to integrate the base leg "*when they wanted to*."

The result of these exchanges is that for 3 min 34 s[(18)], both the A319 and Cougar crews were number two behind the Lufthansa flight and adjust their flight accordingly. This situation was facilitated by the absence of integrated management of all the traffic by the tower and approach. Although the approach controller coordinated with the tower controller to obtain the tower controller's acceptance for the visual approach, it was not accompanied by an overall strategy ensuring the organization of all the traffic. Each controller thus sequenced their traffic in their own work volume without really taking into account the traffic in progress or expected in the adjacent airspace.

Bringing the Cougar into hover around the EA point then led to the loss of the display of the primary radar contact on this flight. A visual search carried out from the control tower was not able to locate the helicopter although visibility was good and the controllers knew that a helicopter of this type was visually detectable at this distance. This did not alert the controllers: there was no switch from a normal management mode to a degraded management mode.

From this moment, the tower controller mentally visualized the progression of the Cougar in the circuit. The absence of information from the crew about entering hover flight along with the transmission of imprecise position information meant that the controller imagined the helicopter much further forward from its actual position.

Thus when the helicopter crew reported that they were arriving at the MS point, thus on the centreline of runway 31R, the tower controller, wishing to allow the planned take-offs on this runway, redirected the helicopter to runway 31L. From this moment, in his mind, the centreline of runway 31R was free. In reality, the helicopter was 2 NM north-east of the centreline of runway 31R and will only cross it one minute later.

[(18)] At 15:51:29, the tower controller asked the Cougar to position itself behind the Lufthansa flight for runway 31R.
At 15:51:40, the approach controller informed the HOP flight that they were number two behind the Lufthansa flight for runway 31R.
At 15:55:14 , the tower controller redirected the Cougar to runway 31L behind the DR400.

At the end of the base leg, the test flight engineer, sitting in the left seat of the helicopter, made a "*visual scan*" to the left to ensure the safety of the helicopter before making a right turn into the final leg. Crews normally carry out this safety action in this flight phase. This visual search did not detect the A319 arriving higher up, at ten o'clock to the helicopter, without a sufficient difference in relative speed to facilitate its visual detection. The nose of the Airbus was, during this phase, directed towards the helicopter, consequently the outline of the aeroplane was difficult to detect. The small amount of contrast of a white aeroplane against a blue background did not facilitate this visual detection either. The helicopter crew then concentrated on searching for the DR400 behind which they had to position themselves. Their visual field thus remained directed towards a one o'clock to two o'clock sector. The crew were unable to locate the DR400 and remained focused on this search. During this phase, the A319 arrived behind and above the helicopter. The crew of the A319 were not yet on the frequency. The helicopter crew were not aware of the arrival of this aeroplane.

When the A319 crew contacted the tower controller, they did not obtain a response. The tower controller favoured at this moment, exchanges with other crews. For him, there was no urgency in replying to the A319 crew, the centreline of runway 31R was clear and the flight was still quite far away in the base leg without conflictual traffic. When the A319 arrived on the final approach, it was slightly above the nominal glideslope at an indicated airspeed of 210 kt, in speed reduction. The tower frequency remained busy and the A319 crew were not able to repeat their message. In the crew's mind, the only flight which concerned them was the Lufthansa flight situated ahead and with which they had had visual contact since the beginning of the approach.

The possibility of the crew visually spotting the helicopter was made difficult because it was painted in camouflage colours and was manoeuvring under the A319 against a background principally composed of scrubland. The closing speed between the two aircraft of approximately 300 kt also did not facilitate the application of the "*see and avoid*" principle.

In addition, the A319 crew were not informed of the presence of the helicopter by means of its TCAS equipment as the helicopter transponder was not operating.

As soon as there was a slot on the frequency, the A319 crew made their second call and reported that they were on the final approach. The tower controller gave them traffic information with respect to the situation that he thought was as follows: the DR400 followed by the helicopter were on final approach for runway 31L. In reality, the helicopter was going to cross the centreline of runway 31R. It was just after this message that the two aircraft crossed paths. Only the A319 crew saw that they had crossed but too late to initiate an evasive action.

It should be noted that if the helicopter had crossed the centreline at the height of the runway circuit, the crossing margins would have increased even though these margins would have still been small and insufficient.

All the safety barriers were inoperative. The collision was avoided "*by chance*."

2.2 Safety systems linked to transponder

The transponder failure prevented the secondary detection of the Cougar. This failure also meant that the conflict detection systems such as the STCA and TCAS did not trigger. In this case, the STCA would have generated a warning on the controller's screen permitting the controller to inform the crews of the conflict risk. As for the TCAS, it would have generated a TA and then if applicable a RA onboard the A319.

The installation of a second transponder on the Cougar (as is generally the case on airliners) would have probably allowed the Cougar path to be displayed and the functionality of the conflict detection systems to be kept. However, the widespread installation of two transponders seems difficult, notably on light aircraft.

2.3 Loss of primary radar contact

The loss of primary radar contact on the helicopter was first caused by it entering hover flight. Subsequently, the display of the primary radar blip did not become effective again due to the filtering criteria specific to the radar processing.

A study carried out in 2006 had notably concluded that primary detection on helicopter movements was occasionally lost inbound or outbound from the aerodrome. These specificities were not brought to the attention of the controllers.

Consequently, the control did not take any specific precautionary measure with respect to the Cougar with a transponder failure, by applying spatial-temporal segregation for example. The controllers considered that the presence of the primary blip allowed them to continue to ensure the due service and the integration of the flight in the aerodrome circuit.

2.4 Management of parallel runways

Numerous types of traffic cohabit on the Marseille-Provence airport: IFR flights, IFR in visual approach, civil defence flights, Airbus Helicopters test flights and general aviation VFR flights.

The incident occurred in class D airspace. In this type of airspace, the compatibility between IFR and VFR traffic is based on traffic information being supplied to facilitate the acquisition of visual contact between aircraft. This principle is also the basis by which air traffic control manages the parallel runways. Thus, a crew cannot turn into the base leg until they have visually acquired the aircraft manoeuvring on the final approach on the parallel runway. As soon as the visual contact is obtained, the tower controller informs the other crew of the aircraft's manoeuvre in the base leg, specifying that the crew of the aircraft in the base leg has visual contact on them. Although this is a regulatory practice, it seems fragile, notably in dense airspace. In numerous situations it is difficult to acquire and then maintain visual contact between aircraft at all moments.

Provisions relating to the assignment of runways to VFR flights do not exist in the Marseille air traffic control operations manual. It is done according to the traffic and the needs of the tower controllers regardless of the VFR flight inbound sector. While such a practice allows a certain flexibility, it can also, as in the present case, lead to flights crossing paths on the final approach centrelines, by applying the "*see and avoid*" principle which does not always guarantee safety[19]. It can also lead to aircraft overtaking each other on parallel centrelines at small distances and may cause, in addition to a possible wake turbulence problem, a feeling of insecurity among the users.

[19] "*Mid-air collisions 1989-1999*" study carried out by the BEA, available via the link: https://www.bea.aero/uploads/tx_scalaetudessecurite/mid.air.collisions_01.pdf

2.5 Frequency congestion and phraseology

The tower frequency was busy for 80% of the time between 15:50 and 16:02 which is a very high degree of congestion. In this lapse of time, this meant that the Cougar crew were unable to have quick contact with the tower controller after their transfer by the flight information sector. It also meant that the A319 crew were unable to make contact with the tower controller and thus benefit from traffic information in due time.

An examination of the radio exchanges established that the use of non-standard phraseology, in French, also largely contributed to increasing the time spent on the frequency. This can be explained by a propensity for French parties to talk more without there being a real need or added value for the traffic management, sometimes even to the detriment of the precision and conciseness of the messages.

2.6 "Base" effect

The crews involved in this event were based at the Marseille-Provence airport.

On an airport with dense traffic, as is the case at Marseille-Provence, the wish to optimize traffic and keep it fluid may lead the various actors to operate with lower safety margins. Progressively, skills are developed, habits created and the levels of mutual trust between operators are reinforced. The locally-based crews, for example, become familiar with the terrain and may be less vigilant with respect to the path or speed adopted. The controllers may also monitor to a lesser degree the flying of these paths and reduce internal coordination. These habits also lead to a less formal language being adopted on the frequency with more implicit elements or digressions. This event thus underlines the fragilities in the current approach practices on the Marseille-Provence airport. Adaptations which work well on a daily basis may be deficient on an unplanned event occurring, if there is not a real awareness of the associated risk and of the need to switch to another mode of operation.

Here the risk caused by the Cougar transponder failure was probably underestimated. The excessive confidence in the primary radar (in the absence of information about its limitations) as well as confidence in the crew reporting (reinforced by the fact that it was a professional crew) may have led the controllers to overestimate the possibility of knowing the position of the aircraft.

3 – CONCLUSION

3.1 – Findings

- The crews held the necessary licenses and ratings to carry out the flight.
- The aircraft met the conditions for issuing a valid airworthiness certificate.
- The A319 operated by HOP, arriving from Bordeaux, was carrying out a visual approach for Marseille-Provence runway 31R.
- The AS532 Cougar helicopter was returning to the airport after a VFR check-out flight and was in contact with the tower controller.
- The helicopter transponder had failed during this flight. The air traffic control only had primary contact on it after this failure.
- The tower controller asked the Cougar crew to report on the final approach for runway 31R behind the A320 operated by Lufthansa.
- The approach controller cleared the crew of the A319 for a left-hand visual approach to runway 31R behind the Lufthansa flight.
- The tower controller asked the crew of the AS532 to report on the final approach for runway 31R behind the Lufthansa flight.
- The crew of the AS532 entered hover flight without informing the control of this. The primary radar contact on the helicopter was lost.
- The crew of the A319 were transferred to the tower controller and reported that they were in the left-hand base leg for runway 31R. The controller, busy with managing other traffic, did not reply to them.
- Following a position error given by the crew of the AS532, the tower controller thought that they were arriving on the centreline of runway 31R and asked the crew to position themselves for runway 31L.
- The crew of the A319 contacted the tower controller as soon as they had the possibility to do so and advised that they were arriving on final for runway 31R. The tower controller asked them to report on short final for runway 31R and informed them of "*two traffic parallel, a DR400 followed by a helicopter*." The crew read back the message.
- The crew of the A319 informed the tower controller that the helicopter had just flown under them. They had acquired no visual contact on this helicopter prior to this.
- The helicopter crew had not acquired visual contact on the A319 before crossing flight paths.
- Due to the failure of the helicopter transponder, no anti-collision system had been triggered.
- The minimum separation values were 0.19 NM horizontally and 240 ft vertically.

3.2 Causes of serious incident

The near collision was the result of a combination of the following factors:

- No segregation measures being taken by the air traffic control with respect to the Cougar which had to operate without a transponder, in dense airport traffic where the compatibility of IFR and VFR traffic is based on traffic information and visual contact between crews.
- Non-compliance with the aerodrome circuit altitude by the Cougar crew.
- Cougar crew not advising that they were bringing the helicopter into hover and an inaccuracy in their position reports which meant that the controller constructed an erroneous mental representation of the situation and thus provided unsuitable traffic information.
- Controllers not being given information about the existence of zones where primary radar returns are not displayed.

The following factors contributed to the serious incident:

- Absence of an overall sequencing strategy for inbound VFR and IFR traffic.
- Work load which did not allow the tower controller to sufficiently anticipate the arrival of the HOP flight.
- Excessive flexibility in the management of parallel runways.
- Very busy tower frequency due to the density of the traffic, and the use of non-standard phraseology which did not allow the HOP flight crew to contact the controller and meant that they did not obtain traffic information in due time.
- Possible overconfidence between the tower controllers and the Cougar crew, professionals based on the platform, which may have led to less rigorous practices in providing accurate position reports and in the use of these reports for traffic management.

3.3 Measures taken after incident

Immediate precautionary measures were taken by the SNA S/SE, Air France and Airbus Helicopters.

3.3.1 Measures taken by SNA S/SE

- it is strictly forbidden to perform visual approaches when an aircraft has a transponder failure;
- it is strictly forbidden to take-off without a transponder;
- any inbound aircraft with a transponder failure will be held until the runway circuit is free.

These measures are definitive.

3.3.2 Measures taken by Airbus Helicopters

- it is strictly forbidden to take-off without a transponder;
- in the event of a transponder failure in flight, the ATC will be informed and the published VFR paths will be scrupulously complied with;
- if it is necessary to leave a published altitude (turbulence for example), prior clearance will be requested from the ATC.

3.3.3 Measures taken by Air France

- Visual approaches temporarily stopped as soon as the operator had knowledge of the event, pending definitive measures.
  Given the measures taken by the SNA S/SE and Airbus Helicopters, the suspension of visual approaches was lifted on 8 July 2016.
  A "*Safety First*" article devoted to the incident was published the same day.
- The visual approach speed on the Marseille-Provence airport is now limited to 210 kt.

4 - SAFETY RECOMMENDATIONS

Note: in accordance with the provisions of Article 17.3 of Regulation No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations report to the authority in charge of safety investigations that have issued them, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.

4.1 Transponder failure

The near collision was detected neither by air traffic control, neither by the crews, nor by the A319 TCAS. The collision was only avoided by chance. One of the causes of this near collision was the control accepting an aircraft without transponder in a class D airspace, in dense traffic conditions, without implementing helicopter manoeuvring conditions or restrictions with a view to separating it from the rest of the traffic. The situation was made worse by there being no display of primary radar returns for this flight.

The transponder, the aircraft identification system, also acts as a support for various onboard or ground safety systems (e.g. TCAS, STCA, MSAW). Consequently, a transponder failure will render these systems deficient and must be considered as a failure which can have major consequences on the overall safety level in a dense environment.

Consequently, the BEA recommends that:

- **the DSNA establish a procedure so that when justified by the density and/or complexity of traffic in the airspace, spatial and temporal segregation measures are implemented by the air traffic control for any flight with a transponder failure, until it can be safely integrated in the traffic.**
  [Recommendation FRAN2018-011]

4.2 Loss of primary radar detection

The investigation showed that by accepting an aircraft without transponder, the control thought that they could continue to provide the traffic information service based on the primary blip. The loss of the display of the primary radar blip on this aircraft impaired this strategy.

A study carried out in 2006 had notably concluded that primary detection on helicopter movements was occasionally lost inbound or outbound from the aerodrome.

These specificities were not known by the controllers.

Consequently, the BEA recommends that:

- **the DSNA ensure that the Marseille-Provence controllers are informed of the performance restrictions or limitations of their display equipment and in particular, the primary radar. [Recommendation FRAN2018-012]**

- **the DSNA assess the need of extending this measure to other air traffic units. [Recommendation FRAN2018-013]**

4.3 Traffic sequencing strategy

This incident was also caused by the absence of an overall strategy in the scheduling of inbound traffic. The tower and approach controllers managed the traffic for which they were responsible in their own airspace without a real peripheral vision. This situation led to the various actors, pilots and controllers, having only an incomplete or erroneous vision of the situation.

Consequently, the BEA recommends that:

- **the DSNA ensure that procedures are implemented in the Marseille-Provence tower and approach units so that flights are managed as part of a shared traffic sequencing strategy. [Recommendation FRAN2018-014]**

4.4 Management of parallel runways

It is on the basis of traffic information and visual contact between aircraft, the principle applicable in class D airspace between IFR and VFR flights, that the inbound traffic is sequenced for the parallel runways.

The investigation showed that this principle, based on the ability of the human eye to detect a "*target*", could be deficient and that it constituted an insufficient safety barrier, notably in dense airspace with a large variety of traffic.

The investigation also showed that the assigning of runways for landing was not carried out according to precise working methods and that it could generate risk situations by leading aircraft to cross paths on the final approach or overtake each other on the centerlines of parallel runways.

Consequently, the BEA recommends that:

- **the DSNA study the implementation, at Marseille-Provence, of work methods to safely sequence traffic on one of the two parallel runways. [Recommendation FRAN2018-015]**

5 - SAFETY LESSONS

5.1 Approach speed

The investigation showed that the approach speed of the A319, in visual approach, even if it was regulatory, had remained high (210 kt at 3,000 ft, 180 kt at 2,000 ft) with respect to the aircraft's manoeuvres in class D airspace on an aerodrome with dense VFR traffic and where visual contact between IFR and VFR flights serves as a basis for preventing collisions.

The Air France instructions, moreover, draw the crew's attention to the significant helicopter activity in the aerodrome circuit and around the runways and to the dense VFR traffic in the aerodrome vicinity.

This could not be unknown to the crew who were, furthermore, based at Marseille.

The speed of the A319 also distorted the tower controller's judgement in the projection he had made. It was also not the sort of speed to facilitate the application of the "*see and avoid*" principle by the crew.

It is important that the crews adopt speeds compatible with the "*see and avoid*" principle when manoeuvring in airspace where IFR and VFR flights cohabit.

5.2 Accuracy of position reports

In class D airspace as well as in the aerodrome traffic, the prevention of collisions between IFR and VFR flights is essentially based on supplying the crews with traffic information. Based on this information, crews are then responsible for avoiding collisions with other aircraft.

Traffic information must be supplied by the air traffic control each time conflictual situations are foreseeable. It is kept up to date according to the positions of the aircraft and their foreseeable manoeuvres.

The investigation showed that the tower controller, not knowing that the helicopter was in hover and provided with inaccurate position reports by the crew, had constructed an erroneous mental picture of the situation.

It is essential for safety that crews provide accurate and reliable reports and that any change to the flight path is indicated to the air traffic control.

APPENDICES

Appendix 1
Transcript of ATC and Cougar CVR recordings

Appendix 2
Marseille-Provence aeronautical charts

Appendix 3
Air France charts

Appendix 1
Transcript of ATC and Cougar CVR recordings

FOREWORD

The following is the transcript of the elements which were understood from the work on the control unit (ATC) radio communication recording.

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

Note: The transcript has been left in French in order to respect the nature of the radio exchanges.

GLOSSARY

UTC time	Origin: ATC transcript
[xxx]	Controller of frequency used (e.g.: **[TWR]**).
P1	Pilot 1
P2	Pilot 2
(!)	Curse
( )	The words or groups of words in brackets could not be determined with certainty
(*)	Indistinguishable words or groups of words

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:30:00	Start of recording			
15:43:00	Start of transcription			
15:43:19	**[HOP25PG] to [Provence Approach]:** Provence bonsoir, Air Hop 25 Papa Golf on est standard FL150, on est sur (Fréjorgues)			
15:43:25		**[Provence Approach] to [HOP25PG]:** Air Hop PG, bonjour, toujours 150, prévoyez approche ILS Z, 31 droite		
15:43:31	**[HOP25PG] to [Provence Approach]:** 150, on prévoit ILS Z, 31 R, est-ce qu'on pourrait faire Martigues de la position?			
15:43:35		**[Provence Approach] to [HOP25PG]:** Non, il y a les militaires qui bombardent		
15:47:08	**[HOP25PG] to [Provence Approach]:** Provence, Air Hop 25 PG, pour information, on est en vue des installations, on est preneur à tout moment d'une approche à vue			
15:47:15		**[Provence Approach] to [HOP25PG]:** Reçu HOP PG, tournez à gauche de 10°		
15:47:18	**[HOP25PG] to [Provence**			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
	Approach]: On prend 10° gauche, Air Hop PG, on est au niveau 150			
15:47:21		**[Provence Approach] to [HOP25PG]:** Papa Golf, descendez maintenant FL 100		
15:47:25	First contact between TWR and F-GLDC: conversation of 56 sec			
15:48:45	Conversation of 31 sec between F-NS and TWR: Traffic information with F-DC			
15:48:51	**[Cougar India] to [Provence Info South] :** Provence, Cougar India			
15:48:55		**[Provence Info South]:** Oui je vous écoute		
15:48:56	**[Cougar India] to [Provence Info South]:** India, on a terminé, on prend un cap retour vers Echo et le terrain			
15:49:00		**[Provence Info South]:** Reçu India, en descente vers 1500 ft		
15:49:02	**[Cougar India] to [Provence Info South]:** On descend vers 1500 ft			
15:49:09				APP clears HOP25PG to descend to FL 70
15:49:14		**[Provence Info South]:** Cougar India, passez avec la Tour sur 133.10, bonne soirée		
15:49:17	**[Cougar India]**			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
	to [Provence Info South]: Merci de même, bonne soirée			
15:49:28	Conversation of 36 sec between F-DC and TWR: traffic information with F-NS			
15:50:05	Conversation of 27 sec between F-NS and TWR: Separation with F-DC			
15:50:20				APP asks HOP25PG to turn 10° by the left and to descend to 5,000 ft, QNH 1015
15:50:33	**[Cougar India] to [TWR]:** La tour, le Cougar India, rebonjour			
15:50:36		**[TWR] to [Cougar India]:** Cougar India, bonjour. Donc, j'ai un plot primaire, vous rentrez en étape de base main droite 31, et vous me rappelez visuel sur un Airbus 320 qui est actuellement 12 NM sud du terrain, pour vous positionner derrière		This Airbus A320 is operated by Lufthansa
15:50:53	**[Cougar India] to [TWR]:** C'est bien pris, je vous rappelle quand je vois l'Airbus pour me positionner derrière			
15:50:57				**CVR Cougar_P1:** Bon ok il est à gauche donc on a le temps
15:51:06				**CVR Cougar_P1:** Hey ben, 12Nm. Ça c'est de l'info!
15:51:07	TWR transfers F-NS			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:51:14	Conversation of 15 sec between TWR and Lufthansa 09Y			
15:51:23				**CVR Cougar_P1:** Ah je le vois, il est là-bas
15:51:26				**CVR Cougar_P2:**Ah oui, visuel,
15:51:27				**CVR Cougar_P1:** 10h
15:51:27				**CVR Cougar_P2:** Je l'ai
15:51:29	**[Cougar India] to [TWR]:** India visuel de l'Airbus, 12 NM finale			
15:51:32	**[HOP25PG] to [Provence Approach]:** Provence du HOP PG, pour votre information vous pensez qu'on pourra faire une à vue courte, une longue...? Qu'est-ce que vous anticipez?			
15:51:33		**[TWR] to [Cougar India]:** Cougar India, donc dans vos 2h, correction dans vos 10h pour 5NM vous vous positionnez derrière en finale 31		
15:51:40		**[Provence Approach] to [HOP25PG]:**Tout est relatif PG vous savez, volez au cap 090, descendez 5000 ft 1015		
15:51:43	**[Cougar India] to [TWR]:** On se positionne derrière en finale 31 deux, India			
15:51:47				**CVR Cougar_P2:** Oh

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
				ben il y a le temps
15:51:49				**CVR Cougar_P1:** Comme tu dis, il y a le temps
15:51:52				**CVR Cougar_P1:** Ah tiens si je lui fais ça, qu'est-ce qu'il me fait, est-ce qu'il s'arrête là ou pas?
15:51:56		**[Provence Approach] to [HOP25PG]:** Papa Golf, vous êtes numéro 2 et le numéro 1 est à vos midi pour une quinzaine de nautiques sur la procédure		
15:51:57				**CVR Cougar_P1:** Je vais faire un Alt Ground Speed, je vais voir ce qu'il fait
15:51:58			**[F-GLDC] to [TWR]:** Fox Delta Charlie, en vent arrière main gauche pour les 31	
15:52:02				**CVR Cougar_P1:** Est-ce qu'il fait une trans auto?
15:52:03	**[HOP25PG] to [Provence Approach]:** D'accord c'est copié PG, on l'a au TCAS, merci			
15:52:04				**CVR Cougar_P1:** Est-ce qu'il va chercher le stationnaire?
15:52:09				**CVR Cougar_P2:** Heu... (on va voir)

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:52:11				**CVR Cougar_P1:** J'ai bien l'impression
15:52:14				**CVR Cougar_P1:** Quand t'appuie dessus comme ça, en vitesse c'est très surprenant, il réduit (*)
15:52:14			**[F-GLDC] to [TWR]:** Fox Delta Charlie, en vent arrière main gauche pour les 31	
15:52:19		**[TWR] to [F-GLDC]:** Fox Delta Charlie, prévoyez la piste 31 gauche à l'arrivée et vous me rappelez visuel sur un Airbus 320 9NM finale et vous vous positionnez derrière ce trafic		
15:52:19				**CVR Cougar_P2:** Il va chercher le stationnaire
15:52:22				**CVR Cougar_P2:** Ben oui
15:52:22				**CVR Cougar_P1:** ça alors!
15:52:25	**[HOP25PG] to [Provence Approach]:** Hop PG, on est en vue du précédent			
15:52:28		**[Provence Approach] to [HOP25PG]:** Reçu PG, prévoyez de finir à vue derrière traffic		
15:52:29			**[F-GLDC] to [TWR]:** Fox Delta Charlie,	

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
			on prévoit la 31 Gauche et on rappellera une fois visuel sur le trafic en finale	
15:52:31	**[HOP25PG] to [Provence Approach]:** C'est copié			**CVR Cougar_P2:** Aller je te sors le train
15:52:32				**CVR Cougar_P1:** Ouais s'il te plait
15:52:36		**[TWR] to [Cougar India]:** Cougar India donc je confirme, derrière le 320, vous vous présentez en finale 31 droite et je vous signale un DR400 en vent arrière main gauche sur la parallèle		
15:52:43	*Elvira flight path info: loss of Cougar India radar contact on primary radar*			
15:52:46	**[Cougar India] to [TWR]:** Bien pris. Donc on se positionnera derrière l'Airbus sur la 31 droite et pour l'info du DR400 sur la parallèle			
15:52:54		**[Provence Approach] to [HOP25PG]:** Hop PG, donc si vous voyez le précédent, autorisé approche à vue main gauche 31 droite		
15:52:57	**[HOP25PG] to [Provence Approach]:** Autorisé approche à vue main gauche 31 droite, derrière le précédent, Air Hop PG, merci			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:53:00	Conversation of 26 sec between TWR and Ryanair 61XB, ready for departure			
15:53:02				**CVR Cougar_P1:** Ouais alors quand tu fais ça, il se met en stationnaire, il fait comme une trans auto, ça c'est énorme ça
15:53:04		**[Provence Approach] to [HOP25PG]:** Correct, pour le moment 4000, 1015, cause Istres. Je vous rappelle dans la minute pour plus bas		
15:53:09	**[HOP25PG] to [Provence Approach]:** Ok, initialement 4000 ft, 1015, Air HOP PG			**CVR Cougar_P2:** C'est pas mal
15:53:18				**CVR Cougar_P2:** Par contre en statio, je trouve qu'il est pas agréable du tout
15:53:20				**CVR Cougar_P1:** Non, en stationnaire, il est pas agréable, avec ce vent en tout cas
15:53:23	Conversation of 10 sec between TWR and Lufthansa 09Y: "Report short final, for information departure ahead and for information light aircraft on downwind for parallel runway"			
15:53:24				**CVR Cougar_P1:** Il y a 25kts, il est pas agréable du tout
15:53:37		**[TWR] to [Cougar India]:** Cougar India, j'ai plus le contact radar pour info		

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:53:39	**[Cougar India] to [TWR]:** Oui on est sur Echo Alpha			
15:53:42		**[TWR] to [F-GLDC]:** Fox Delta Charlie, visuel sur le 320 qui arrive en finale sur la principale ?		
15:53:48			**[F-GLDC] to [TWR]:** Fox Delta Charlie, on a le visuel	
15:53:50		**[TWR] to [F-GLDC]:** Fox Delta Charlie, vous pouvez virer derrière ce trafic en étape de base main gauche, pour la piste 31 gauche, le vent au sol, 330°, 22 à 29 kts		
15:53:54		**[Provence Approach] to [HOP25PG]:** Hop PG, la descente 2500 ft, 1015, vous irez en base quand vous voulez, la TWR 33.1		
15:53:58			**[F-GLDC] to [TWR]:** On virera derrière le trafic en finale pour la 31 gauche, Delta Charlie	
15:54:00	**[HOP25PG] to [Provence Approach]:** 2500 ft, 1015 et 33 10 la TWR, Air HOP PG, à toute à l'heure			
15:54:07				**CVR Cougar_P2:** Oui il est très désagréable en stationnaire
15:54:09	Conversation of 32 sec between Dragon 131 and TWR. Dragon reports ready for take-off on 31			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:54:42	**[HOP25PG] to [TWR]:** La tour bonjour Air Hop 25 Papa Golf, étape de base main gauche, 31 droite, toujours visuel sur le précédent			Note: no TWR response to HOP025PG message
15:54:47				
15:54:48	*Elvira flight path info: Cougar India visible again on primary radar*			
15:54:49	TWR clears Lufthansa A320 to land on 31R			
15:55:01		**[TWR] to [Cougar India]:** Cougar India, vous avez visuel sur un DR400 qui arrive en finale sur la parallèle?		
15:55:08	**[Cougar India] to [TWR]:** Heu pour l'instant non pas encore, là je suis en train de... j'arrive Mike Sierra actuellement			
15:55:13		**[TWR] to [Cougar India]:** Reçu Cougar India, et bien vous faites une petite baïonnette à gauche pour la 31 gauche, vous vous positionnez derrière un trafic DR400 qui est un peu en aval de Mike Sierra, vous me rappelez contact visuel		
15:55:21	*Elvira flight path info: loss of Cougar India radar contact on primary radar*			
15:55:25	**[Cougar India] to [TWR]:** Oui je vous rappelle quand j'ai visuel du DR400, India			
15:55:28				**CVR Cougar_P1:** Tu le vois?
15:55:29				**CVR Cougar_P2:** Non non c'est

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
				un autre que j'ai vu
15:55:30	Conversation of 11 sec between Ryanair 61XB and TWR to change frequency			
15:55:35				**CVR Cougar_P1:** Je lui ai mis le loc comme ça il va travailler. On va chercher le DR400 mais il doit être là-bas
15:55:40				**CVR Cougar_P2:** Oui
15:55:44		**[TWR] to [Cougar India]:** Cougar India, vous me rappelez visuel sur le DR400		
15:55:46	**[Cougar India] to [TWR]:** Je vous rappelle quand je le vois, India			
15:55:48	**[Cougar India] to [TWR]:** Il est où dans son circuit?			
15:55:51		**[TWR] to [Cougar India]:** Et bien en longue finale 31 gauche		
15:55:53	**[Cougar India] to [TWR]:** Longue finale 31 gauche, bien pris			
15:55:56	**[HOP25PG] to [TWR]:** Air Hop Papa Golf, on arrive en finale 31 droite			
15:55:59		**[TWR] to [HOP25PG]:** Papa Golf rappelez courte finale piste 31 droite pour information j'ai deux trafics sur la parallèle, un DR400 suivi d'un hélicoptère		
15:56:05	*Elvira flight path info: Cougar India visible again on primary radar*			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:56:06				**CVR Cougar_P2:** Ok visuel sur le DR400
15:56:07	**[HOP25PG] to [TWR]:** On rappelle courte finale 31 droite, on avait copié Air Hop Papa Golf			
15:56:09				**CVR Cougar_P1:** Tu le vois?
15:56:09				**CVR Cougar_P2:** Oui je le vois
15:56:11	**[HOP25PG] to [TWR]:** Pour information l'hélicoptère vient juste de nous passer en dessous			
15:56:12				**CVR Cougar_P2:** Il au-dessus de la ville
15:56:14				**CVR Cougar_P1:** Moi je le vois pas
15:56:14		**[TWR] to [HOP25PG]:** Reçu Air Hop Papa Golf		
15:56:19				**CVR Cougar_P1:** Alors il est où?
15:56:19		**[TWR] to [Cougar India]:** Cougar India, donc comme j'ai pas le contact radar, c'est un peu difficile de faire des infos		
15:56:21				**CVR Cougar_P2:** Alors attend, bouge pas
15:56:24		**[TWR] to [Cougar India]:** Un Airbus 319 arrive à Mike Sierra en finale		No response from Cougar to control traffic information

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
		pour la principale		
15:56:27				**CVR Cougar_P2:** Il est verticale du parking avant la piste
15:56:30	**[HOP25PG] to [TWR]:** Air Hop Papa Golf, heureusement qu'il avait pas de TCAS parce que c'est pas passé très très loin			
15:56:31				**CVR Cougar_P1:** Alors le parking...
15:56:31				**CVR Cougar_P2:** Il est sur la pel... tu le vois il se détache sur la pelouse à gauche de la piste
15:56:33	**[HOP25PG] to [TWR]:** Il y aurait eu forcément un RA là			
15:56:35				**CVR Cougar_P1:** Ah oui vu, ok, c'est bon
15:56:40				**CVR Cougar_P1:** Oh (!) l'avion, il est pas passé loin (!)
15:56:42				**CVR Cougar_P2:** Ouais ouais, c'est l'autre il nous a fait couper
15:56:42	Lufthansa A320 has landed and transfers to ground			
15:56:49				**CVR Cougar_P2:** Lui je l'avais pas vu
15:56:50				**CVR Cougar_P1:**(!) C'est hallucinant
15:56:54				**CVR**

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
				Cougar_P2: Lui je l'ai pas vu
15:56:55				**CVR Cougar_P1:** Ouais non mais il a pas de radar, on n'a pas de transpondeur, c'est vrai que ça fout la (!)
15:56:58		**[TWR] to [HOP25PG]:** Hop Papa Golf autorisé atterrissage piste 31 droite, 330°, 22kts, maximum 29		
15:57:01				**CVR Cougar_P1:** (!) le mec d'Air France, il a dû avoir peur quoi
15:57:03	**[HOP25PG] to [TWR]:** Autorisé atterrissage 31 droite Air Hop Papa Golf			
15:57:07	**[Cougar India] to [TWR]:** India, on est établi sur la finale 31 gauche			Message not heard by ATC
15:57:15		**[TWR] to [Cougar India]:** Cougar India, alors moi j'ai toujours pas de contact radar... Ah je reçois à l'instant donc vous me rappelez courte finale piste 31 gauche		
15:57:18				
15:57:23	**[Cougar India] to [TWR]:** Oui ben écoutez on est établi sur la finale 31 gauche et on vous rappelle en courte			

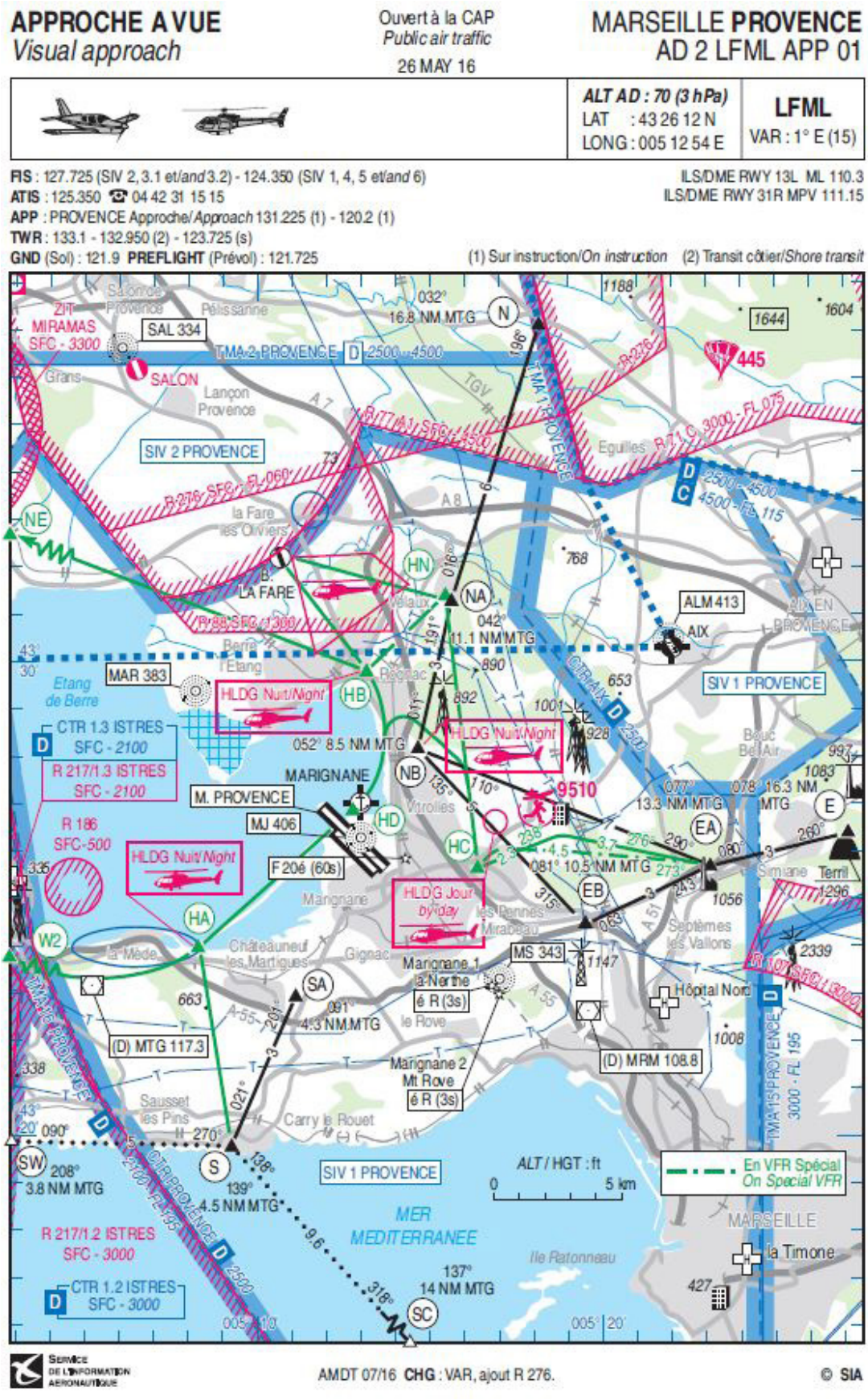
UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:57:28		**[TWR] to [Cougar India]:** Reçu donc vous avez visuel sur le DR400 qui vous précède sur la même piste?		
15:57:31	**[Cougar India] to [TWR]:** Oui j'ai visuel sur lui India			
15:57:33		**[TWR] to [Cougar India]:** D'accord		
15:57:35				**CVR Cougar_P1:** (!) le mec d'Air France il a dû avoir peur
15:57:37				**CVR Cougar_P2:** Ben oui
15:57:40		**[TWR] to [F-GLDC]:** Fox Delta Charlie, autorisé atterrissage 31 gauche, confirm bien à gauche, 330°, 22 kts, maximum 29 et un 319 en courte sur la parallèle		
15:57:49			**[F-GLDC] to [TWR]:** Autorisé atterrissage piste 31 gauche et bien reçu pour le trafic sur la piste parallèle	
15:57:53				**CVR Cougar_P1:** Et mais l'avion il sort d'où, le Air France?
15:57:54				**CVR Cougar_P2:** Je ne sais pas
15:57:55				**CVR Cougar_P1:** L'autre était à 12 Nm, il n'y avait personne derrière

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
15:57:57				**CVR Cougar_P2:** Ben oui
15:58:00				**CVR Cougar_P1:** Ben fallait pas qu'il nous mette à gauche
15:58:01				**CVR Cougar_P2:** Ben oui
15:58:12				**CVR Cougar_P2:** Le DR400 n'est toujours pas posé
15:58:15				**CVR Cougar_P1:** Non, non. Bon on va réduire la vitesse
15:58:33				**CVR Cougar_P1:** Je me demande si l'avion à 12 Nm c'était pas le 2eme
15:58:35				**CVR Cougar_P2:** Ouais je pense. mais alors donc l'info du 1er il nous l'a donné tardivement et on a confusionné les deux
15:58:39				**CVR Cougar_P1:** Ouais ouais ouais, ça devait pas être le bon alors
15:58:52				**CVR Cougar_P2:** Ok le DR400 a touché
15:58:56	**[HOP25PG] to [TWR]:** Air Hop Papa Golf, c'est contrôlé, on prendra à droite. Pour votre information, le DR400 n'avait			

UTC time	Cougar India/HOP25PG	ATC	Other aircraft	Comments
	pas non plus de TCAS			
15:59:02		**[TWR] to [HOP25PG]:** Papa Golf, non enfin il avait un mode C par contre		
15:59:07	**[HOP25PG] to [TWR]:** D'accord ok, parce qu'on n'avait vu ni l'hélicoptère, ni le DR400. Et l'hélico pour information, il a dû passer peut-être à 100 ou 200 ft juste en dessous de nous			
15:59:14		**[TWR] to [HOP25PG]:** Reçu Papa Golf, contactez le sol 121.9 au revoir.		
15:59:17	**[HOP25PG] to [TWR]:** 21.9			
15:59:18				**CVR Cougar_P2:** Oui mais il nous a pas donné d'altitude, rien donc heu...
15:59:22				**CVR Cougar_P2:** Ça c'est le contrôle qui aurait dû nous diriger là
15:59:28		**[TWR] to [Cougar India]:** Cougar India donc le DR400 encore sur la piste, ça va se libérer lentement, vous ajustez la vitesse?		
15:59:36	**[Cougar India] to [TWR]:** Oui j'ajuste India, j'ajuste (*)			
15:59:40		End of transcription		
16:15:00		End of ATC recording		

Appendix 2

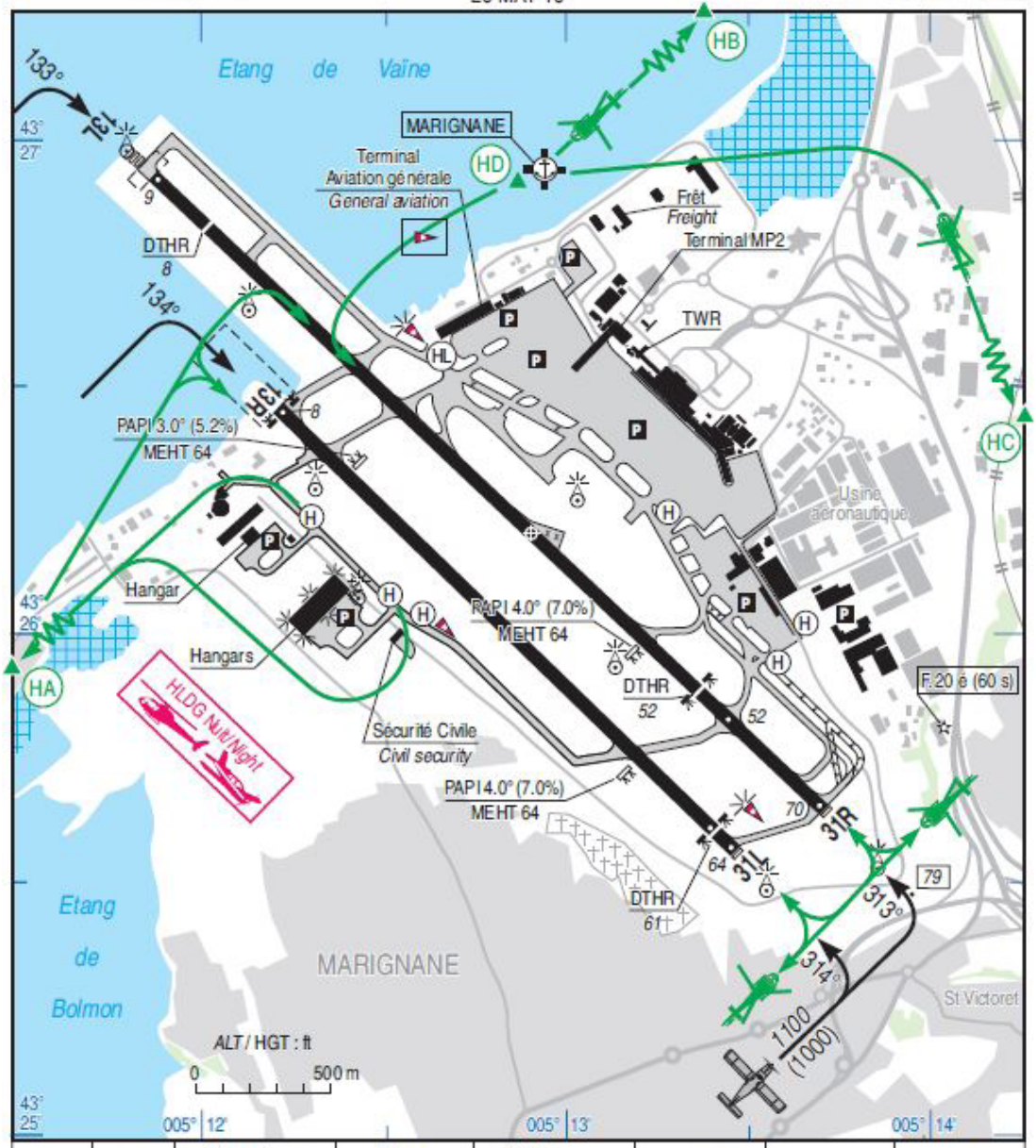
Marseille-Provence aeronautical charts



MARSEILLE **PROVENCE**
AD 2 LFML ATT 01

ATTERRISSAGE A VUE
Visual landing

26 MAY 16



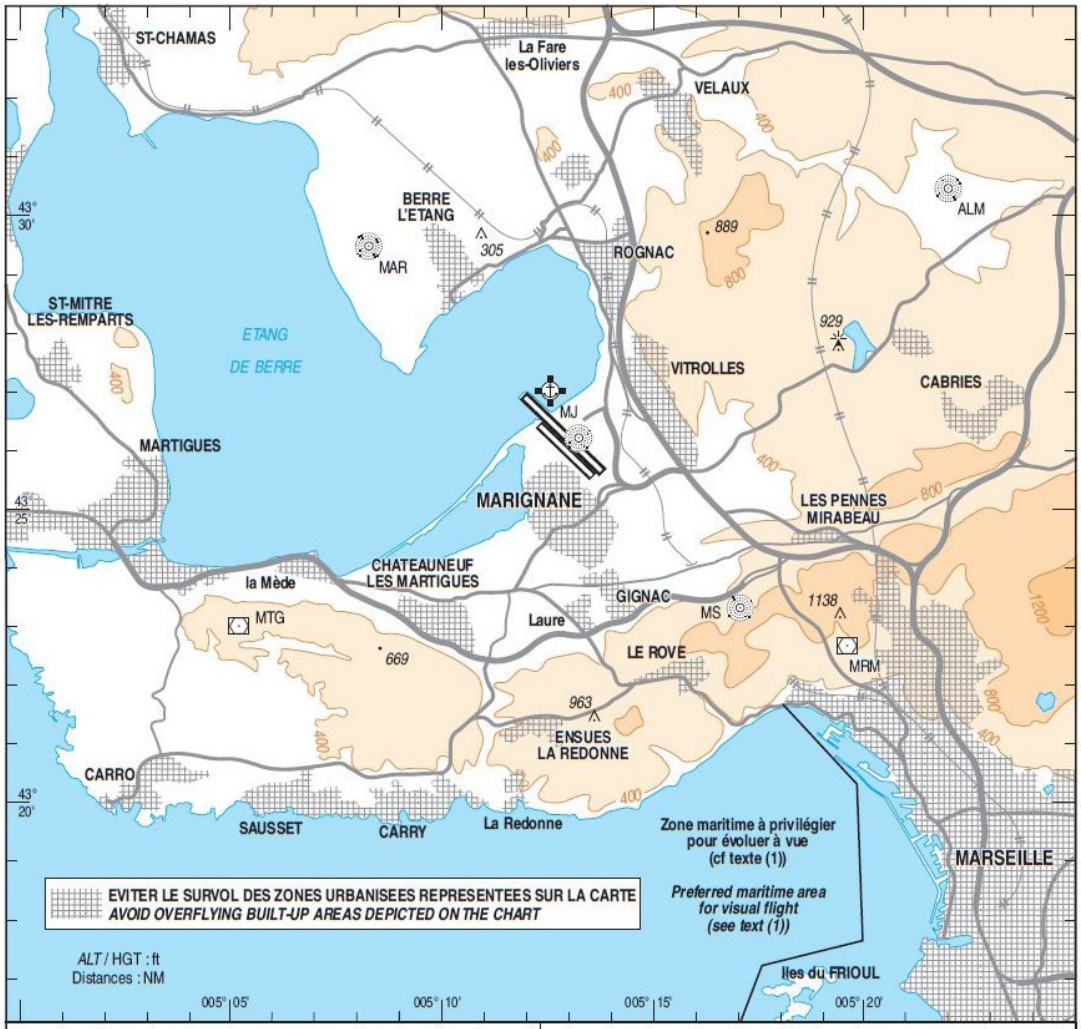
RWY	QFU	Dimensions *Dimension*	Nature *Surface*	Résistance *Strength*	TODA	ASDA	LDA
13L	133	3440 x 45	Revêtue *Paved*	71 R/C/W/T	3500	3500	3160
31R	313				3500	3440	2780
13R	134	2370 x 45	Revêtue *Paved*	68 F/C/W/T	2370	2370	2370
31L	314				2670	2370	2265

Aides lumineuses :
HI ligne APCH RWY 13L
HI RWY 13L / 31R
HI RWY 13R / 31L

Lighting aids :
RWY 13L APCH centerline : LIH
RWY 13L / 31R : LIH
RWY 13R / 31L : LIH

SERVICE DE L'INFORMATION AERONAUTIQUE

AMDT 07/16 **CHG** : QFU, dimensions piste, THR 13L, distances déclarées et CWY 31R.



CONSIGNES, SAUF IMPERATIF DE SECURITE :

RWY 31 L/R
En finale et en courte finale, pour minimiser les nuisances sonores sur la commune de St Victoret, la trajectoire des aéronefs ne devra pas se situer sous la pente du PAPI (7 %).

Arrivées du Nord et de l'Ouest:
Approche à vue **main droite :**
- IAS/FL recommandés à **VENTA**, IAS < 250 kt, FL ≤ 070.
- CAT A/B : étape de base entre **Vitrolles** et **les Pennes Mirabeau**.
- CAT C/D : étape de base au Sud des **Pennes Mirabeau**.

Approche à vue **main gauche :**
- Approche à vue interdite entre 2200 et 0500 (ETE : - 1 HR).
- Approche à vue via **MJ (cf plan (1))** :
  IAS/FL recommandés à MJ : IAS ≤ 210 kt, FL ≤ 5000.
- Approche à vue via travers **THR 13** :
  IAS/FL recommandés travers THR 13 : IAS ≤ 210 kt, FL ≤ 2500.

Arrivées du Sud et de l'est :
Approche à vue interdite à l'EST du RDL 178° MRM / 358° MRM.

RWY 13 L/R
Approche à vue **main gauche** : interdite.
Approche à vue **main droite** : interdite au Sud de MTG VOR.

INSTRUCTIONS, EXCEPT FOR SAFETY REQUIREMENT :

RWY 31 L/R
On final and short final approaches, to minimize noise pollution above St Victoret, ACFT path shall not to be below PAPI gradient (7 %).

Northern and Western arrivals :
***RH** visual approach :*
- *Recommended IAS/FL over **VENTA**: IAS < 250 kt, FL ≤ 070.*
- *CAT A/B : base leg between **Vitrolles** and **les Pennes Mirabeau**.*
- *CAT C/D : base leg South of **les Pennes Mirabeau**.*

***LH** visual approach :*
- *Visual approach prohibited between 2200 and 0500 (SUM: - 1 HR).*
- *Visual approach by **MJ (see map (1))** :*
  recommended IAS/FL IAS ≤ 210 kt, FL ≤ 5000.
- *Visual approach abeam **THR 13,** recommended IAS/FL abeam THR 13 :*
  IAS ≤ 210 kt, FL ≤ 2500.

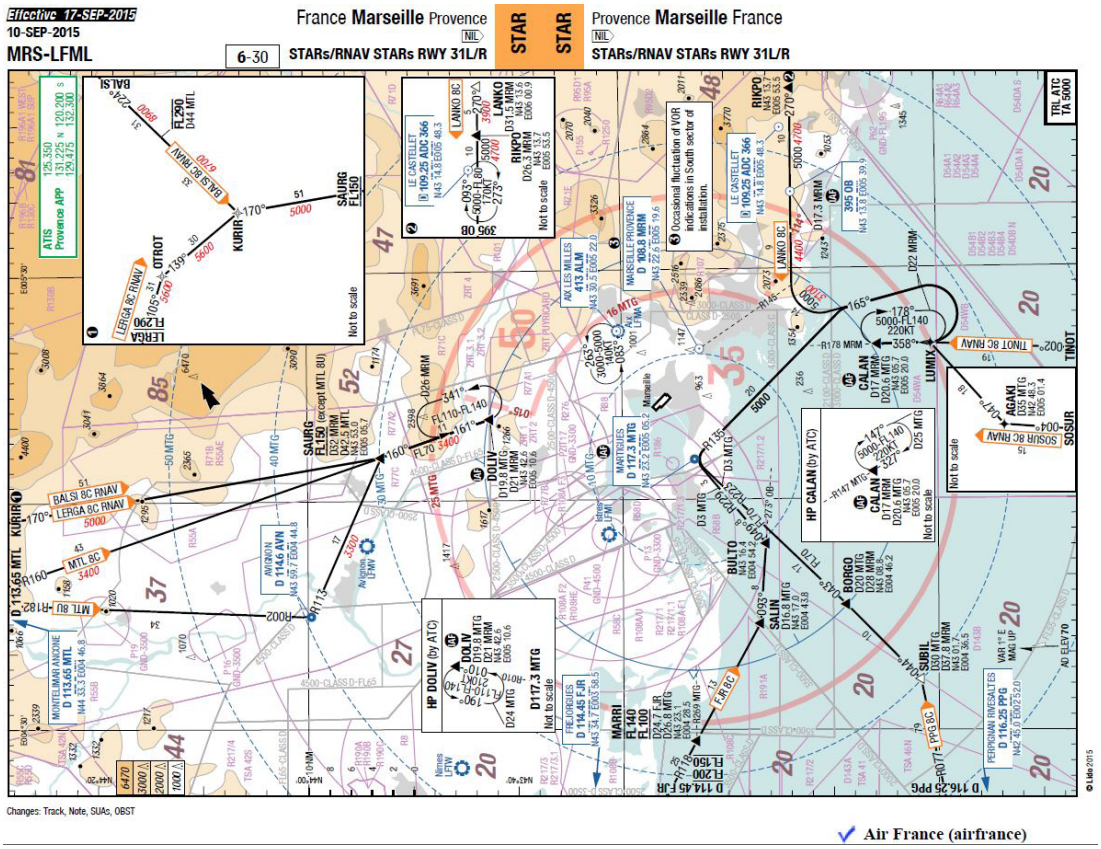
Southern and Eastern arrivals :
Visual approach prohibited EAST of RDL 178° MRM / 358° MRM.

RWY 13 L/R
***LH** Visual approach : prohibited.*
***RH** Visual approach : prohibited South of MTG VOR.*

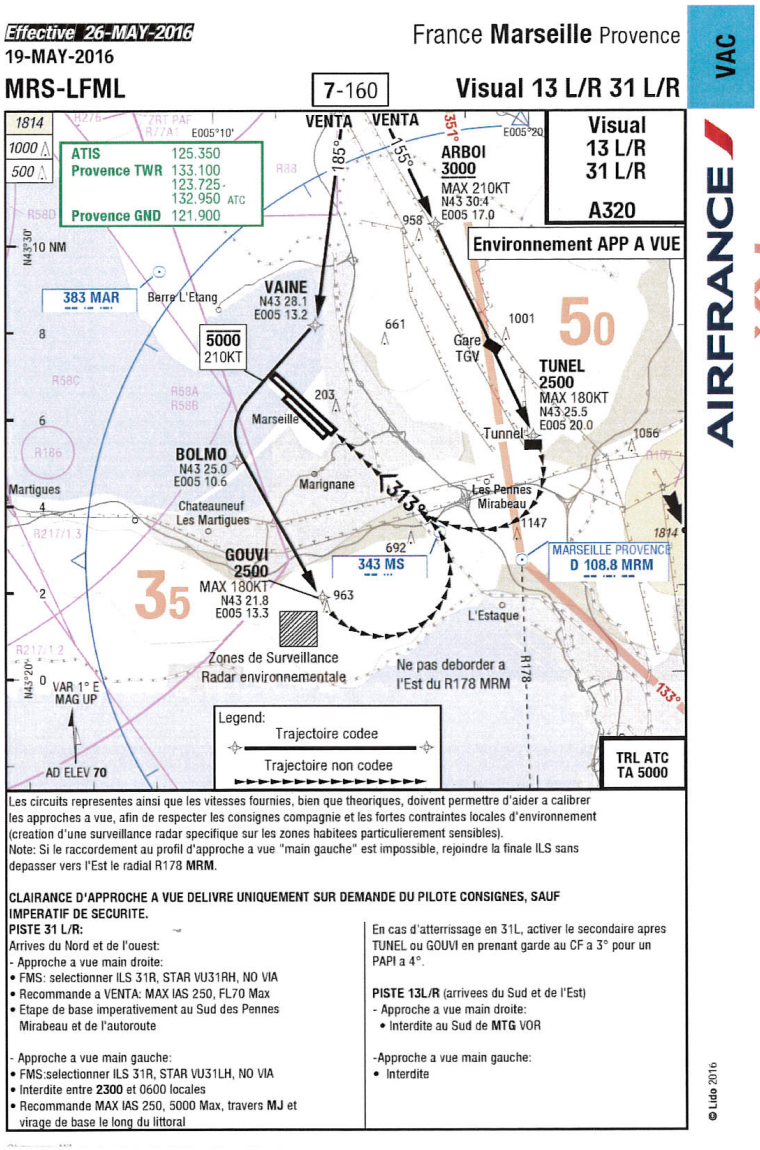
SERVICE DE L'INFORMATION AERONAUTIQUE

AMDT 09/17 **CHG :** HOR, NDB ALM.

Appendix 3
Air France charts



Air France (airfrance)


Effective 26-MAY-2016
19-MAY-2016
France Marseille Provence
MRS-LFML
7-160
Visual 13 L/R 31 L/R
VAC
AIRFRANCE
Visual
13 L/R
31 L/R
A320
Environnement APP A VUE
ATIS 125.350
Provence TWR 133.100
123.725
132.950 ATC
Provence GND 121.900
VENTA
VENTA
ARBOI
3000
MAX 210KT
N43 30.4
E005 17.0
VAINE
N43 28.1
E005 13.2
5000
210KT
383 MAR
Berre L'Etang
TUNEL
2500
MAX 180KT
N43 25.5
E005 20.0
Gare TGV
Tunnel
BOLMO
N43 25.0
E005 10.6
Marseille
Marignane
Martigues
Chateauneuf Les Martigues
Les Pennes Mirabeau
GOUVI
2500
MAX 180KT
N43 21.8
E005 13.3
343 MS
MARSEILLE PROVENCE
D 108.8 MRM
L'Estaque
Zones de Surveillance Radar environnementale
Ne pas deborder a l'Est du R178 MRM
VAR 1° E
MAG UP
AD ELEV 70
Legend:
Trajectoire codee
Trajectoire non codee
TRL ATC
TA 5000
Les circuits representes ainsi que les vitesses fournies, bien que theoriques, doivent permettre d'aider a calibrer les approches a vue, afin de respecter les consignes compagnie et les fortes contraintes locales d'environnement (creation d'une surveillance radar specifique sur les zones habitees particulierement sensibles).
Note: Si le raccordement au profil d'approche a vue "main gauche" est impossible, rejoindre la finale ILS sans depasser vers l'Est le radial R178 MRM.
CLAIRANCE D'APPROCHE A VUE DELIVRE UNIQUEMENT SUR DEMANDE DU PILOTE CONSIGNES, SAUF IMPERATIF DE SECURITE.
PISTE 31 L/R:
Arrives du Nord et de l'ouest:
- Approche a vue main droite:
• FMS: selectionner ILS 31R, STAR VU31RH, NO VIA
• Recommande a VENTA: MAX IAS 250, FL70 Max
• Etape de base imperativement au Sud des Pennes Mirabeau et de l'autoroute
- Approche a vue main gauche:
• FMS:selectionner ILS 31R, STAR VU31LH, NO VIA
• Interdite entre 2300 et 0600 locales
• Recommande MAX IAS 250, 5000 Max, travers MJ et virage de base le long du littoral
En cas d'atterrissage en 31L, activer le secondaire apres TUNEL ou GOUVI en prenant garde au CF a 3° pour un PAPI a 4°.
PISTE 13L/R (arrivees du Sud et de l'Est)
- Approche a vue main droite:
• Interdite au Sud de MTG VOR
-Approche a vue main gauche:
• Interdite
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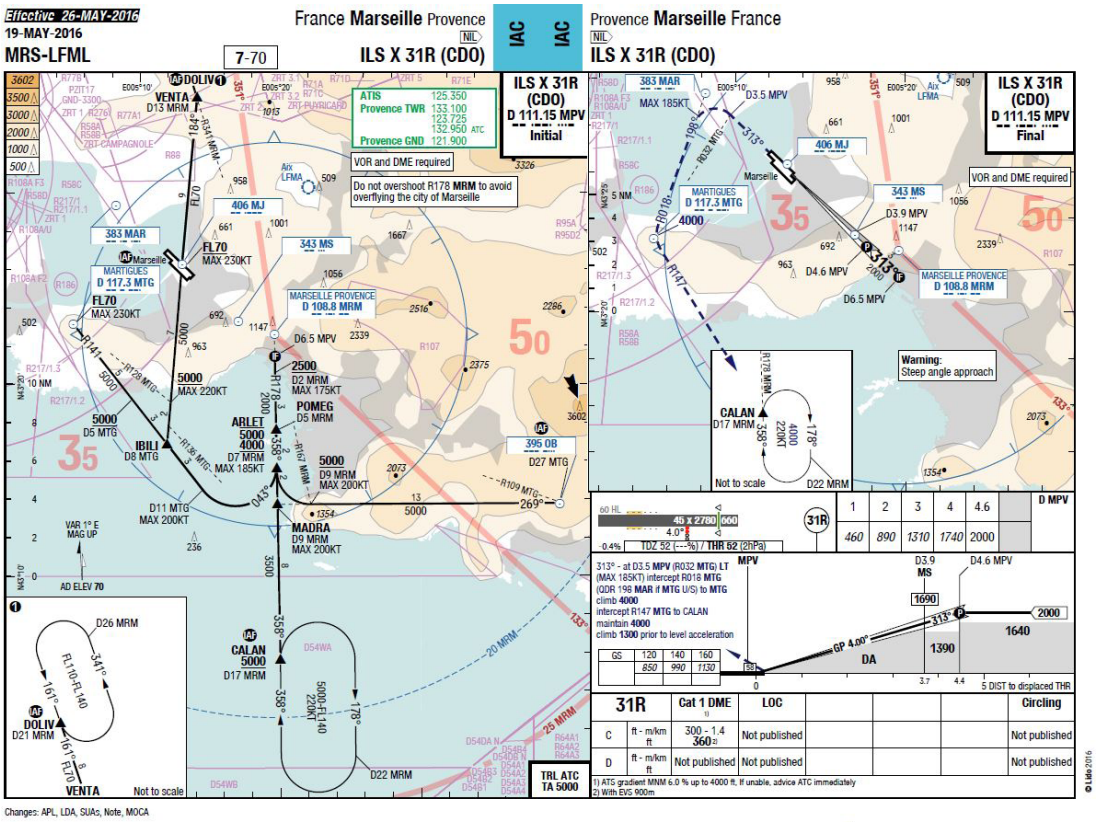

Air France (airfrance)

BRIEFING SECURITE DES VOLS

AERODROME DE CATEGORIE "B"

EAO disponible sur le MOS Player

Eléments majeurs de la catégorisation :

- Analyse des vols :
  - Windshear.
  - Alarme SINK RATE piste 31L/R.
  - Approche à forte pente piste 31L/R.
  - Approches non stabilisées.
  - Existence d'un EOSID.

GENERAL

AERODROME

- Relief environnant > 1500' AAL. (Est de l'aérodrome)
- Activité hélicoptère significative dans le circuit de l'aérodrome et aux abords des pistes.
- Péril aviaire ou animal. Large rassemblement d'oiseaux sur la plateforme et aux environs.
- L'ATIS Provence/Avignon informe que la zone planeur Provence est active le cas échéant.

MET

- Tous QFU : Windshears fréquents et vent arrière dans certains cas.
- Orages pendant l'Eté.

ATC

- RWY 31 : Vent arrière fréquent. (Retour équipage)

ARRIVAL

STAR

- Trafic IFR/VFR important aux alentours (ISTRES, SALON, AVIGNON, AIX, ORANGE, ...)

CCI

Marseille

France

C-04

16-JUN-2016

MRS-LFML

AIRFRANCE

COMPLEMENT OPERATIONNEL

GENERAL

AERODROME

Survol de Marseille

- Interdiction du survol de Marseille. Restez à l'ouest du R178 MRM.

COMMUNICATIONS

Fréquence Compagnie

- 131.850 (AFR)
- ATIS : tel 04 42 31 15 15

DIVERS

A320 Sharklets

- Seuls les deux parkings 4B et 8C sont compatibles A320 Sharklets.

ARRIVAL

APPROCHE / ATTERRISSAGE

GPWS

- Informer systématiquement l'ATC de toute alarme (hors approche à vue) en précisant dès que possible le lieu de l'alarme et la vitesse. Remplir un ASR.

Pistes 31 L/R

- Vent arrière possible en début de finale par vent sol secteur Ouest et régime de Sud en altitude.

Procédures dérogatoires

Pente de descente en finale > 6,5%

- ILS 31 R
- NDB 31 R

Changes: Revised

Air France (airfrance)

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