



Nr 10
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Incidents in Air Transport

Aerodrome Traffic

Aircraft traffic around an aerodrome is a dynamic situation requiring the continuous interpretation of information by pilots and controllers. From this interpretation they construct a representation of the situation that enables them to anticipate changes in the traffic and to plan their actions. However, those involved may have different interpretations of this reality, which can lead to errors. Given the variety, density and complexity of traffic moving around an aerodrome, these errors are hard to identify and to correct rapidly, particularly as the systems available to prevent these dangerous situations remain limited.

Runway Confusion at Montpellier

Background

Environment

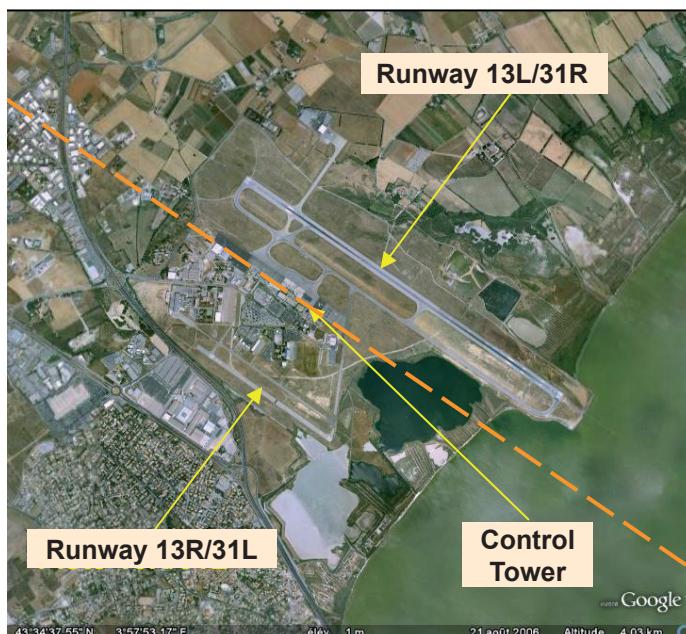
Montpellier Méditerranée airport has parallel runways, 1,115 metres apart. Main runway 13L/31R is 2,600 metres long and 50 metres wide. The secondary runway 13R/31L is 1,100 metres long and 30 metres wide. The latter is dedicated to aircraft with maximum takeoff weight under 5,700 kg. The «31» runways are used in preference.

The boundary separating these two sectors is parallel to the runways and goes through the control tower.

The zone of responsibility for controller LOC1 includes, in particular, runway 13L/31R (and respectively 13R/31L for controller LOC2), its ancillary equipment, the final approach flight path and the aerodrome traffic circuit.

The two LOC1 and LOC2 frequencies may be grouped together on the LOC1 frequency.

The controller in each LOC position has no knowledge of traffic in the other sector. An assistant LOC controller can provide coordination between the two LOC controllers when it is necessary, for example in the event of possible interference between traffic in the two sectors. Given the distance between the two runways, under VMC conditions, aircraft on final approach for the two runways are considered separated.



⁽¹⁾The LOC controller, also called «tower controller» is

⁽²⁾Left hand visual approaches to 31R are favoured because they enable over-flying of areas with high population density to be avoided.

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Air traffic control

The air traffic control service inside the TMA (class D) is provided by Montpellier approach control. The CTR (class D where use of a mode A + C transponder is mandatory) comprises two sectors that extend from the ground to an altitude of 2,250 ft. They are managed by two separate control positions:

- a northern sector (controller LOC1⁽¹⁾);
- a southern sector (controller LOC2).

Instrument approach procedure
Only the main runway enables instrument approaches to be performed. In an East-facing configuration, the approach for

runway 13L is VOR/DME type. In a West-facing configuration, several instrument approach procedures can be carried out, one of which is a precision approach to runway 31R.

Unless otherwise indicated by ATC, aircraft on left hand visual approach for runway 31R⁽²⁾ must maintain 4,000 ft downwind as far as the coast to reduce noise pollution. They are transferred from the approach frequency to LOC1 frequency when downwind.

First Case

Sequence of flights

⁽³⁾The pilot who enrolled in one of the clubs based at the airport two months before the incident knew little about the airport.

⁽⁴⁾There was no RA TCAS, the aircraft was at a height below 900 ft. In descent, the TCAS switches to mode «TA ONLY» below 900 ft.

⁽⁵⁾The safety net, STCA, is software intended to attract the controller's attention to the possibility of a conflict between two or more aircraft.

The pilot of a DR 400⁽³⁾ coming from the West contacted the LOC2 controller for a landing on runway 13R. He was authorised to join a right hand aerodrome traffic circuit downwind behind another aircraft. The latter was following a trajectory converging on the flight path for runway 13R to avoid overflying a built-up area.

While following the same trajectory, the DR 400 pilot, on the base leg, lost sight of the aircraft in front. While looking for it, he noticed runway 13L, which he confused with 13R, and adjusted his flight to put himself on final approach for this runway.

At the same time an A321 coming from Paris and on VOR DME approach for runway 13L was transferred to the LOC1 frequency. The crew noticed the DR 400 late and performed an avoidance manoeuvre⁽⁴⁾. It continued its approach as far as landing. The DR 400 pilot became aware of his error and landed on runway 13R. The A321 crew and the DR 400 pilot estimated that they had come within twenty metres of each other.

Additional Information

Confusion between runways 13L and 13R
Between 2005 and 2007, six aircraft in VFR on an aerodrome traffic circuit significantly overran the flight path for the runway on which they were supposed to land. These runway confusions did not lead to close proximity with other traffic. At least four of them were detected by external visual observation by one of the LOC controllers on duty.

Aerodrome traffic circuit on runway 13R
As a general rule, aerodrome traffic circuits do not have strictly defined dimensions. For runway 13R they are performed using turns to the right. By agreement between all those involved, aircraft based at the airport perform a convergent downwind leg in order to avoid overflying villages. This causes aircraft to turn directly onto the final



Tracks followed on aerodrome circuit for runway 13R

approach, the base leg being shortened.

Radar equipment

The two LOC positions have a radar screen. Information coming from RTS (see box below) is almost never used by the LOC controllers because of problems with low altitude radar tracking at Montpellier. The safety net⁽⁵⁾ of CRNA (Regional Air Navigation Centre) at Aix-en-Provence is available to Montpellier but is not suited to approach and airport traffic.

Testimony

There was no assistant LOC controller on the day of the incident. The LOC1 controller, whose attention was occupied by an aircraft on runway 13L that was carrying out a takeoff failure exercise, had not seen the DR 400 interfere with the A321 on final approach.

The LOC2 controller saw the DR 400 go into a turn while it was approaching the 13R final approach flight path. «Considering that it was lined up on runway 13R», his attention moved away from this aircraft.

The DR 400 pilot indicated that this was the first time he had made an approach to runway 13. He did not remember having been warned about particular features of the aerodrome traffic circuit for this runway.

What is a Radar Treatment System (RTS)?

To provide radar surveillance, radar assistance and radar vectoring functions, the ATC organisations at the main French airports are equipped with an air traffic display system that presents the positions of aircraft (called tracks) on a screen constructed from successive radar detections of the aircraft. Depending on the radar environment, the tracks can be supplied directly by a single radar, by a local RTS or by that based in a regional control centre (Aix-en-Provence in the case of Montpellier). From information coming from several radar stations, the latter system creates an image representing the aerial situation in the area of responsibility for the regional control centre. In certain cases, this image may not match the specific needs for approaches or airport traffic.

Lessons Learned

Surveillance by ATC

A tower controller cannot perform continuous visual surveillance of each aircraft circling the airport. It is particularly difficult to locate aircraft rapidly when they are far from the planned circuit. Surveillance by the LOC2 tower controller does not therefore constitute an adequate safety barrier to prevent the entry of light aircraft into the adjacent sector and interference with the approach flight path to runway 13L.

Use of radar

The information presented on a radar display screen does not constitute an essential aid for providing airport control service but may be used to confirm the visual observation of the positions of aircraft circling the airport. However, this information is not used because of numerous errors in radar tracking that make it difficult to identify course deviations and to follow flights during turns when circling the airport.

Improvements in quality of the radar treatment system and implementation of a suitable conflict detection tool are being assessed and could help controllers in their surveillance tasks.

Runway confusion

The aerodrome traffic circuit for runway 13R actually performed by pilots based at the airport does not correspond with the applicable documentation. The convergent downwind leg that they perform increases the risks of overrunning the flight path for runway 13R and entering the northern sector. The absence of a base leg in the event of extending the downwind leg also makes it more difficult for the controller to anticipate the trajectory of aircraft on the circuit. An aerodrome traffic circuit for

13R with a less convergent downwind leg remains under review.

To make VFR pilots more aware of the environment encountered during approaches to runways 13L and 13R and in order to try and limit overruns of the flight path for runway 13R, the Air Traffic Services are asking pilots in clubs based at Montpellier airport to perform training flights on runways 13R and 13L with an instructor before being approved. Ground-based courses are also given in training organisations. The Air Traffic Service has also circulated a poster to clubs.



Poster distributed to aeroclubs

As the runways are considered as separate, pilots approaching one runway do not benefit from traffic information regarding the circuit for the other runway. This reduces vigilance and anti-collision surveillance. Since the incident, when runways 13 are in service, ATIS contains the following information: «activities on secondary runway».

Air control services

The decree relating to air traffic services states that air traffic control service is provided to all traffic flying around controlled airports. Airport traffic includes the movements of aircraft taking place at the edges of these airports.

Chapter 2 of the procedures for air traffic organisations (RCA 3) specifies that air traffic services provide separation between VFR and IFR flights in class B or C airspace and on the runway of a controlled airport. Traffic information between VFR and IFR flights is provided in class D airspace and in traffic circling a controlled airport. «The airport control tower sends clearances and information to aircraft moving in the airport traffic in order to prevent collisions between aircraft in flight in the airport circuit, [...] aircraft in the process of landing and taking off.» For this «the airport controller must follow progress of any flight in the airport circuit.»

Second case

Sequence of flight

An A320 from Paris was descending towards Montpellier airport. The co-pilot was PF. ATIS mentioned that runway 13L was in use and the wind was calm. The LOC1 and LOC2 frequencies were grouped together on the LOC1 frequency.

The crew was cleared by the approach control to an RNAV point located to the West of the airport. From this the crew concluded that runway 31R was now in use and obtained clearance from the controller for a visual «left hand» approach to this runway⁽⁶⁾. At the start of the downwind leg, the crew was transferred to the LOC1 controller frequency who told them that they were number one and asked them to maintain an altitude of 4,000 ft as far as the coast. Passing the RNAV point had put the aircraft on the downwind leg, 5NM from the flight path for runway 31R. The PF started the descent after crossing the coast and one minute later turned onto the base leg.

A DR 400 arrived at the end of the left hand downwind leg for runway 31L. The controller told it that it was number one for this runway. He then authorised the crew of the A320 to land on runway 31R. They turned and lined up on the secondary runway by mistake. When the controller saw the A320 on final approach for 31L at a height of about 400 ft, he ordered a go around⁽⁷⁾ then informed the crew that they were lined up on the secondary runway. He asked them to turn to the right for a visual aerodrome circuit. The approach and the landing on runway 31R then took place normally.

Additional Information

Weather conditions

⁽⁸⁾The RCA3 makes it possible for the controller to switch on the illuminated markings in daytime. For its part the airline asked for them to be switched on only in the dark.

⁽⁹⁾These measures would enable the two runways to be distinguished in so far as runway 13R/31L has neither illuminated markings nor PAPI.

Illuminated approach and runway markings

The illuminated markings for runway 31R include lights on the simplified approach ramp (420 metres) as well as threshold, edge and end of runway lights. They were turned off⁽⁸⁾. Runway 31R is not equipped with PAPI.

There are no illuminated markings on runway 31L.

Testimony

Up until the go around request, the two A320 pilots thought they were on final approach for runway 31R. The PNF, in the left seat, indicated that before going into final approach, the increase in his workload during the base leg had not left him much time to look outside the aircraft. The PF stated that he was paying particular attention to control the speed and the descent path.

Lessons Learned

Identification of runways

At the time of the incident, the surface of runway 31L was lighter than that of 31R and contrasted better against the ground environment. Runway 31L is also shorter and narrower than 31R, so that their proportions do not appear markedly different.

The operator's internal investigation report mentioned that «the operating manual does not mention the risk of runway or airport confusion on visual approach though the risk of in-flight collision is described in it.» This report also states that the operating manual «could lead one to believe, incorrectly, that identification of the runways poses no particular problem and therefore did not need to be mentioned.»

At the end of the last turn, the aircraft was lined up on the secondary runway. The crew, who expected to see a runway in front of them, was influenced by this apparent confirmation and was no longer in doubt despite the apparent inconsistencies with the ILS information. Distinctive marking of the two runways could have avoided confusion.

Installation of PAPI on runway 31R or the daytime use of illuminated markings⁽⁹⁾ could help formal identification of the runway.

Crew task sharing

During the change in landing direction, the crew did not consider modifying the allocation of tasks to perform the left hand visual approach. It was not so easy for the PF, seated on the right, to visually locate the ground during the last left hand turn.

Surveillance by the controller

The position of the tower controller (seated with his back to the circuit for runway 13R/31L because of radio frequency grouping), the quality of radar image as well as the absence of markings on the final approaches over the sea all make

it difficult to follow aircraft flight paths on visual approach and immediately detect potential runway confusion. However, visual surveillance enabled action by the controller on short final approach.

Measures taken by the airline

The airline published a flight safety bulletin

The environment of a pair of parallel runways is very unusual. The example of Montpellier shows that in spite of all the measures that were taken, there is an increased risk of collision in the event of confusion. To make the procedures as effective as possible, pilots must consider the possibility of confusion during each arrival.

for all its crews. This bulletin described the incident and tackled the risk of runway confusion on visual approach.

This risk and the concept of airport and runway identification are mentioned in the instructions on «operational conditions for visual approaches».

Ambiguous Sequence in Aerodrome Traffic Circuit

History of Flights

Runway 07R at Brest aerodrome was in use. Weather conditions allowed visual approaches. The sequence described below involved the following aircraft:

1. a CRJ 100 coming from Marseille that joined the left hand downwind leg after having been authorised to make a visual approach;
2. a B737 being used for training and performing takeoff-landing exercises⁽¹⁰⁾;
3. a CRJ 700 coming from Lyon, in contact with the approach controller for a left hand visual approach. The Captain was PF.

Two other aircraft were also on the tower frequency:

4. a DR 400 coming from Morlaix and waiting to the South;
5. a Cessna Caravan that was departing on a VFR flight to Ouessant.

When the crew of the CRJ 100 contacted the tower controller, they received the following information: «You will be number 2. The leading aircraft is a B737 starting the north downwind leg.» The crew indicated that they could see the B737 and then received the following instruction: «So you are number two behind and you call back on final approach. Adjust your flight accordingly.» The crew read back.

One and a half minutes later, the crew of the CRJ 700 was transferred to the tower frequency. They received the following information when the B737 was on the runway: «You will be number two. The leading aircraft, a B737 on initial climb runway 07R. Call back when you see it.» The crew replied that the B737 was in sight and then received the following instruction: «So you are number two behind. You will call back on final approach. Adjust your speed accordingly.» The crew read back: «We're

adjusting based on the B737 taking off and we will be number two.» Just afterwards, the controller cleared the crew of the CRJ 100 to land. The crew of the CRJ 700 deduced that they were number two behind the CRJ 100 on final approach, that the B737 was departing and that they should adjust their speed based on this takeoff. The controller had not explicitly told the crew of the CRJ 700 that the B737 was performing takeoff-

⁽¹⁰⁾Only the communications between the controller and the crew of this aircraft were conducted in English.

Figure 1

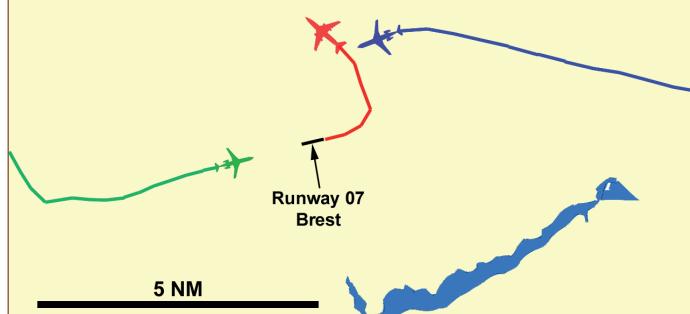


landing exercises and was returning to the downwind leg (figure 1).

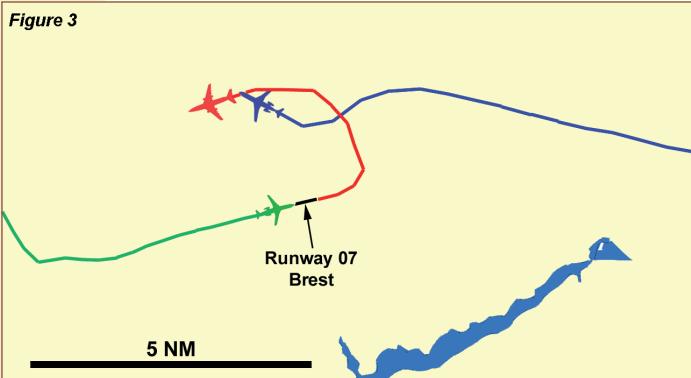
The controller successively indicated to the DR 400 pilot to continue holding, confirmed to the B737 crew that they were number one and authorised the Cessna Caravan crew to take off.

The crew of the CRJ 700 suddenly saw the B737 cut across its course and position

Figure 2



itself behind them on the downwind leg; it received a TA on its TCAS. The crew of the CRJ 700 performed an avoidance manoeuvre to the left (figure 2). Observing that there was insufficient separation⁽¹¹⁾ and that its speed was greater,



6

⁽¹¹⁾Calculated separation between the aircraft at this moment was 200 ft and 0.7 NM.

⁽¹²⁾In reality, the B737 was using runway 07.

it requested authorisation to make a delaying «360» to the right (figure 3).

The controller authorised it and specified: «for your information, the B737 was lined up on final approach for a touchdown.» The crew of the CRJ 700 read back.

The crew of the Cessna Caravan that had taken off was authorised to climb to 1,000 ft and received traffic information from the CRJ 700 on the base outward leg. Coming out of the «360» the CRJ 700 TCAS triggered a new ADVISORY alarm (separation 800 ft and 1 NM) because of the Cessna Caravan's proximity. At the same time, the crew received traffic information on the Cessna Caravan.

Additional Information

Approach

Approach is managed by the military control organisation at Landivisiau. For visual approaches to runway 07R, aircraft under IFR rules are transferred to the tower at 3,000 ft.

Clearance for visual approach

On the approach frequency, the crew of the CRJ 700 had received the following traffic information: «Number two on approach behind a CRJ 100.» On this same frequency, the crew of the CRJ 100 told them⁽¹²⁾ «that a Boeing was turning on 25.»

The approach controller first authorised the crew of the CRJ 700 to perform a visual approach, then told them that the tower controller refused this approach because of the large amount of traffic. Finally, he cleared it again shortly before the frequency transfer

Training flights

To enable traffic regulation, the aerodrome operating manual requires that training flights should be submitted to the head of air traffic for his agreement, after the manager's opinion from the airport operator, in this case the local chamber of commerce.

The head of air traffic and his deputy were not available in the days preceding the incident. In this context, the airport operator accepted the B737 training flight without informing the ATC. As a result, the disruption caused to traffic management by the training flight could not be anticipated.

Clearance for Visual Approach

Execution conditions for a visual approach under IFR rules are defined in the regulations in paragraph 4.3.3.1 of RCA 3. A pilot may execute a visual approach even in the absence of instrument procedure.

The air traffic control organisation continues to ensure the applicable separation between aircraft executing a visual approach and other aircraft within the relevant airspace. In airport traffic, separation is ensured by traffic information that should enable the captain to avoid collisions (cf. «Air control services» box).

Visual Separation Clearance

RCA 3 indicates that visual separation clearance is given to an aircraft in controlled flight in relation to another aircraft in controlled flight:

- under VMC conditions;
- in class D or E airspace, during climb or descent;
- below FL 100 or below 1,000 ft, if transition altitude is above 10,000 ft;
- at the request of the pilot, including for an aircraft departing or arriving;
- with the agreement of the pilot in the other aircraft.

Traffic information must also be supplied to the crew of the other aircraft.

The crew receiving visual separation clearance ensures separation between the two aircraft.

While visual approaches generally allow an appreciable time saving, they remain no less delicate an exercise requiring specific preparation and careful execution, given the performance characteristics of airliners and that pilots are not used to performing them.

Operators define procedures that generally include the following elements:

- visual approach must be considered at the arrival briefing stage;
- all available radio methods must be used;
- during the approach, the PNF must check piloting, course and safety altitude aspects;
- the crew must ensure strict outside surveillance to avoid a collision.

The main risk identified for visual approach is a stabilisation error on final approach. Identification errors of runways or aircraft can also arise. In addition, free flight paths lead to increasing the risk of proximity between aircraft. In this case, some confusion can arise between visual approach clearance and visual separation clearance, because the methods used for anti-collision, traffic information and collision avoidance provided by pilots are the same in both cases.

Lessons Learned

Terminology

The traffic information provided to the crew of the CRJ 700 described it as «number two» behind the CRJ 100 according to the approach controller and behind the B737 according to the LOC controller. In reality, the CRJ 700 was in third position for landing behind these two aircraft. This error led the crew of the CRJ 700 to think that it was in second position behind the CRJ 100.

The tower controller asked the crews of the CRJ 100 and CRJ 700 to adjust their flight and their speed. This terminology led the captain of the CRJ 700 to think that this was implicit visual separation clearance, even if the conditions weren't right. This did not encourage the crew to make a visual search for the B737. This ambiguity arose in part

from the similarity in anti-collision assurance methods between visual approach and visual separation (cf. previous page).

Traffic information

The track of the B737 was unusual and could cause surprise. The tower controller had not told the crew of the CRJ 700 that the B737 was performing takeoff-landing exercises and should be returning to the downwind leg. The crew of the other CRJ had mentioned the presence of the B737 on the approach frequency. This message, not having otherwise been the subject of formal traffic information, could have been interpreted differently by the two members of the crew, without creating any doubt, at a time when the PNF's workload was increasing.

Proximity on Final Approach

History of flight

Runway 31 was in use at Pau. Visibility was good against a cloudy background. There were scattered clouds at 4,000 ft. Traffic in the CTR was dense and radio communications followed each other without interruption on the tower frequency⁽¹³⁾.

The pilot of a DR 400 was taking off to perform aerodrome circuits. A B737⁽¹⁴⁾ was arriving for an ILS approach on runway 31. The controller cleared an A320 to take off. He told the pilot of the DR 400 in the middle of the right hand downwind leg that he was «number two behind a B737 that is arriving at four nautical miles final approach⁽¹⁵⁾». He told him to call back when he had it in sight. The DR 400 pilot replied «Roger, I will call back when it's in sight,» without specifying the aircraft to be identified. The controller

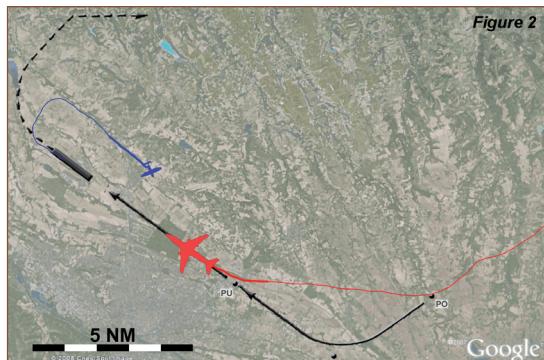


Figure 2

(13) The tower controller was under instruction, supervised by an instructor seated beside him.

(14) Only the communications with the crew of this aircraft were conducted in English.

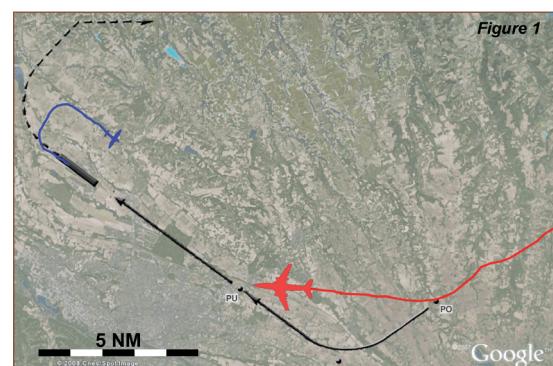
(15) Its real position was 6.8 NM from threshold of runway 31 when intercepting the flight path.

At 3 NM, the B737 crew saw the converging DR 400 and aborted its approach.

On seeing the B737, the DR 400 pilot performed an avoidance manoeuvre (figure 3).



Figure 3



told the crew of the B737 that a DR 400 was on a right hand downwind leg (figure 1).

One minute later the B737, at 4 NM on final approach, was cleared to land. The DR 400 pilot, who thought he had flown the extension of the downwind leg far enough, turned onto the base leg (figure 2).

The pilots of the two aircraft estimated that the aircraft were about 200 metres apart, confirmed by the radar data. The pilot of the DR 400 indicated by radio having understood that he was number two behind the A320 at takeoff.

Additional Information

Traffic management

The controller indicated that he sometimes asked pilots circling the airfield to extend the downwind leg to avoid conflict with aircraft on final approach. He had not asked the DR 400 pilot to do so because he thought that the traffic information transmitted was sufficient to avoid a conflict.

ATC

Controllers have indicated that the traffic, although dense, had not caused a work overload.

During the five minutes before the incident, the controller handled seven aircraft, of which two carried parachutists, one was an A320 whose departure was affected by the landing of the parachutists, the DR 400 and the B737.

Radar image

The tower controller indicated that because of the go-around announcement by the B737, he looked for the image of the DR 400 on his screen but did not find it.

The radar image presented to the tower controller uses tracks supplied by STR⁽¹⁶⁾ at Bordeaux. A NOTAM stated: «Radar

⁽¹⁶⁾See box on page 2.

service restricted in CTR Pau, TMA and SIV Pyrenees below 3000ft AMSL: occasional loss of radar contact». Loss of radar detection for the DR 400 happened when the courses crossed.

Lessons Learned

Terminology and read back

Lack of precision on the position of the B737 and partial read back of the instruction to «call back when in sight» had led the DR 400 pilot and the controller to have different representations of the situation. It can be difficult for a general aviation pilot to interpret information relating to public transport aircraft, for example to know that at 4 NM an airliner is about two minutes from landing.

It is also difficult for the crew of a public transport aircraft to locate a light aircraft and ensure visual separation after having received traffic information.

The messages in English from the crew of the B737 at 4 NM on final approach and from the controller authorising them to land were not understood by the DR 400 pilot. As a result, his attention was not drawn to the position of the B737 at the moment when it turned onto the base leg.

Traffic Information

RCA 3 indicates that in class D airspace, IFR-VFR separation is the responsibility of captains, based on traffic information. The airspeeds of transport aircraft make traffic surveillance and maintenance of separation particularly delicate. This surveillance is only effective if crew attention is directed by clear, complete and relevant traffic information. In contrast to traffic information, authorisations (clearances) and instructions from control must be read back in a way that indicates clearly that they have been understood and will be executed. The controller listens to the read-back to ensure that the flying crew has correctly received and understood the message. He immediately intervenes to correct any possible discrepancy revealed by the read-back.

ICAO document 4444 on air traffic management provides standard expressions to be used. In France, the reference document for training is the terminology training manual (http://www.sia.aviation-civile.gouv.fr/asp/frameset_fr.asp?m=26), which does not include all the expressions from ICAO document 4444. The instruction «CALL BACK IN SIGHT OF (type and position)», currently used, does not appear in any of these documents. In the same way, the instruction «ADJUST» only exists, according to these documents, for the rate of descent.

The standard terminology expressions do not claim to be complete but, when circumstances are different, communications between pilots and controllers must be made using clear language, in as explicit and precise a way as possible in order to avoid any risk of confusion. The incidents reviewed above confirm that ambiguities in terminology and reading back can lead pilots to have a different representation of their position in the sequence from that of the controller. Differences in experience and habits between pilots can accentuate these disparities.