

Part Two of the Spanish Report

KLM, B-747, PH-BUF and Pan Am B-747 N736 collision at Tenerife Airport Spain on 27 March 1977

Report dated October 1978 released by the Subsecretaria de Aviacion Civil, Spain, in both Spanish and English

2.- ANALYSIS AND CONCLUSIONS

2.1 Analysis

On 27 March 1977, a bomb exploded in the terminal building of Las Palmas Airport (Canary Islands) , and for this reason the passenger terminal was evacuated. As there had been a threat of a second explosion, much of the traffic arriving at Las Palmas Airport was diverted to that of Los Rodeos on Tenerife Island. For this reason, the parking area at the latter airport was crowded with aeroplanes.

The RLM Boeing 747, PH-BUF, arrived at Los Rodeos Airport at 1338 and was parked at the end of the taxi runway next to a Braathens Boeing 737 (SAFE). Subsequently, a Sterling Boeing 727, a SATA DC-8 and the Pan American 747, N736, were parked in the same area.

The Pan Am Boeing 747, which arrived at Los Rodeos Airport at approximately 1415, was parked on the taxi runway next to the above-mentioned Braathens Boeing 737, Sterling Boeing 727, SATA DC-8 and the KLM Boeing 747, PH-BUF, which had arrived at Los Rodeos Airport at 1338.

Once Las Palmas Airport had been reopened, the Pan Am N736 aeroplane called the tower requesting permission to start up its engines; in reply, it was told that there was no ATC delay, but that it could have problems taxiing on account of the KLM aeroplane which was ahead of it, and that taxiing on the taxiway would not be possible on account of the aircraft congestion on the main apron.

Indeed, when the time came to taxi, the Pan Am aeroplane was forced, on account of the position of the KLM aeroplane which was blocking its way, to wait for the latter's departure. The three other aeroplanes parked there had already departed.

Approximately one hour later, KLM 4805 requested an estimated departure time. They said that they needed to refuel and that this would take approximately 30 minutes. They filled up with 55 500 L, while the passengers remained on board. Later the KLM aeroplane requested permission to start up its engines, and then clearance to taxi.

It was cleared to taxi towards the holding position of runway 12 and to change its surface frequency of 118.7 to the approach frequency of 119.7.

A few minutes later, the Pan Am aeroplane called again in order to request clearance to start up its engines, and was cleared to do so.

If we keep in mind that the Tenerife-Las Palmas flight is one of about 25 minutes duration, the taking on of 55 500 L of fuel leads us to suppose that the KLM captain thereby wished to avoid the difficulties of refuelling in Las Palmas, with the resulting delay, because a great number of aeroplanes diverted from Tenerife would be going there later. The aircraft could, in fact, have returned to Amsterdam with the fuel it had without refuelling in Las Palmas.

The conversations-which took place between KLM 4805 and the control tower until the aeroplane started to taxi on the main runway were as follows. The times are those taken from the KLM CVR.

Time	Source	Content
1658:14.8	KLM 4805	Approach KLM four. eight zero five on the ground in Tenerife.
1658:21.5	APP	KLM - ah- four eight zero five Roger.
1658:25.7	KLM 4805	We require back track on one two for take-off runway three zero.
1658:30.4	APP	O.K. foureight.zero five... taxi... to the holding position runway three zero taxi into the runway and - ah - leave runway (third) to your left.
1658:47.4	KLM 4805	Roger, sir, (entering) the runway at this time and the first (taxiway) we, we go off the runway again for the beginning of runway three zero.
1658:55.3	APP	O.K. KLM eight zero - ah - correction four eight zero five taxi straight ahead - ah - for the runway and - ah - make - ah - back track.
1659:04.5	KLM 4805	Roger, make a "back track"
1659:10.0	KLM 4805	KLM four eight zero five is now on the runway.
1659:15.9	APP	Four eight zero five roger.
1659:28.4	KLM 4805	Approach, you want us to turn left at Charlie one, taxiway charlie one?
1659:32.28	APP	Negative, negative, taxi straight ahead - ah - up to the end of the runway and make "back track".
1659:39.9	KLM 4805	O.K., sir.

At 1703:14.4, KLM 4805 asked the tower controller if the runway centre lights were in service because, as the weather conditions were becoming worse, he wished to have this information in connexion with the minimum required take-off conditions.

At 1704:58.7, the tower controller, after having checked, replied that the runway centre lights were out of service, while he also passed on this information to the PAA Clipper 1736.

At 1705:27.08, KLM 4805, which was already at the approach end of runway 30, completed the turn in order to face in the direction for take-off.

From this point on, see the diagram (Appendix 5) showing the time correlation between the tower, the KLM 4805 and the Clipper 1736 CVR tapes, as well as the data obtained from the KIM 4805 DPDR during the last 88 seconds.

At 1705:27.98, the engine braking begins and lasts for 2.54 seconds.

At 1705:36.7, the co-pilot finishes the take-off check-list and at 1705:41.22 (67.81 seconds before the impact), a slight forward movement due to opening of the throttle is observed (increase of continued EPR in the four engines). At 1705:41.5, the co-pilot says: "Wait a minute, we don't have an ATC clearance." To which the captain replies, "No; I know that, go ahead,- ask."

At 1705:44.6, KLM 4805 tells the control tower: "Ah - the KLM four eight zero five is now ready for take-off, and we're waiting for our ATC clearance." This message ended at 1705:50.77. This communication was heard in the PAA 1736 cockpit.

At 1705:53.41, the controller gave KLM the following ATC instruction: KLM eight seven zero five - uh - you are cleared to the Papa Beacon, climb to and maintain flight level nine zero .. right turn after take-off proceed with heading zero four zero until intercepting the three two five radial from Las Palmas VOR." The message ended at 1706:08.9. At 1706:07.39, i.e. 0.7 seconds before the message ended, the aircraft captain said, "Yes", and 44.31 seconds before the impact the nos. 3 and 4 engines slightly increased their EPR.

At 1706:09.61, the co-pilot repeated the ATC instructions given by the tower controller, at the following times and as follows:

Time	Source	Content
1706:09.61	KLM 4805 (RD 2)	Ah- Roger, sir, we are cleared to the Papa Beacon flight level nine zero, right turn out zero four zero until intercepting the three two five. We are now at take-off.

At 1706:17.79, the co-pilot's repetition of the ATC instructions ended.

At 1706:11.08, the brakes of KLM 4805 were released. At 1706:12.25, the aircraft captain said, "Let's go ... check thrust", ending this sentence at 1706:16.11.

The following was ascertained from the DFDR data:

- 1706:11.70 (37.33 seconds before impact): it was deduced from the LONG that the aeroplane began to move with longitudinal acceleration.
- 1706:13.99 (35.04 seconds before impact): the EPR have risen above the figures for idling (1.12-1.12-1.14-1.14).
- 1706:14.94 (34.09 seconds before impact): the start of change of course was observed from the HEAD.
- 1706:17.17 (31.86 seconds before impact): from the VANE it can be ascertained that lift had begun. Value reached was 6.800. Air speed was increasing (46.41). Direction straightened out.

From everything that happened during this time, it is seen that while the first officer was repeating the ATC instructions given by the controller, KLM 4805 had already started its ground run, while at 1706:14.00, moreover, the sound of engines starting to accelerate is observed.

At 1706:18.19, the controller replied to the read-back of his ATC clearance in the following way: "O.K.", and at 1706:20.08, i.e. 1.89 seconds later, added: "Stand by for take-off ... I will call you," ending said message at 1706:21.79.

During this time, at 1706:19.35, the KLM 4805 take-off EPR had already been reached and stabilized (1.39 to 1.42).

Simultaneously, in the Pan Am cockpit, on hearing this conversation, the Pilot says "No uh", and the co-pilot says, "and we are still taxiing down the runway, tire Clipper one seven three six". This communication caused a shrill noise in the KLM cockpit, which started at 1706:19.39 and ended at 1706:22.06.

At 1706:25.47, the tower controller confirmed reception of the Pan Am message in the following way: "Papa Alpha one seven three six report runway clear.'" This was audible in the KLM cockpit. The message ended at 1706:28.89.

At 1706:29.59, the PAA replied: "O.K., will report when we're clear." This reply was audible in the KLM cockpit.

The control tower replied, "Thank you", and then the following sentences were spoken in the KLM cockpit:

Time	Source	Content
1706:32.43	C3	Is he not clear, then?
1706:34.10	C1	What do you say?
1706:34.15	PA	Yup
1706:34.70	C3	Is he not clear that Pan American?
1706:35.70	C1	Oh, yes. (emphatic)

At 1706:43.49, the co-pilot intoned the V1 and subsequently on the DFDR PCC the following were observed: a pulling of the control column, with the aeroplane nose pointing up, 16 per cent of the way back from a 44 per cent forward position and from Pitch 2, aeroplane nose pointing up.

At 1706:46.04, i.e., 2.99 seconds before impact, increased direction toward the right is observed in the HEAD; 0.46 seconds later, a curving of the aeroplane to the left is seen in the Roll parameter (ROLL) and, 1.54 seconds before impact, a roll to the right is observed in the Roll Control Wheel Position parameter (RCW).

At 1706:47.44, the captain utters an exclamation, while the impact takes place shortly afterwards.

On listening to the PAA CFR, it may be deduced that its crew saw the KLM aeroplane 9.5 seconds before the impact.

From the actions of the Tenerife Control Tower, it may be inferred that their ordering the KLM aeroplane to leave the runway by the third taxiway was so that they should leave the main runway as soon as possible and proceed along the parallel taxiway. This third taxiway was the first by which it was possible to take the aeroplane off the main runway because access to the parallel taxiway by C-1 and C-2 was not possible on account of the aircraft congestion on the parking apron.

Later, in order to make the manoeuvre easier, the controller chose to order this aeroplane to continue down the right side of the main runway and at the end of same make an 180 degree turn.

Likewise, he indicated to the PAA crew that they should leave by the third taxiway. At first there was some confusion regarding the words "first" and "third". But this was finally dispelled because the controller made the following clarification: "The third one, sir, one, two, three, third one."

The situation deteriorated further when low-lying clouds reduced visibility to the point at which neither aeroplanes taxiing on the main runway, nor some of those located in the parking area, were visible from the tower.

It transpires from careful listening to the KLM CVR that although cockpit operation was correct and the check-lists were adequately kept, there was some feeling of anxiety regarding a series of factors, which were: the time margin remaining to them, to the point of straining the allowable limit of their duty time; the poor and changing visibility which, especially as the runway centre lights were not operative, might prevent the possibility of take-off within the weather limits required by the company; the inconvenience for the passengers, etc. It is also observed that, as the time for take-off approached, the captain - perhaps on account of all these worries - seemed a little absent from all that was heard in the cockpit. He enquired several times, and after the co-pilot confirmed the order to backtrack, he asked the tower if he should leave the runway by C-1, and subsequently asked his co-pilot if he should do so by C-4. On arriving at the end of the runway and making an 180 degree turn in order to place himself in take-off position, he was advised by the co-pilot that he should wait as they still did not have an ATC clearance. The captain asked him to request it, which he did, but while the co-pilot was still repeating the clearance, the captain opened the throttle and started to take off. Then the co-pilot, instead of requesting take-off clearance or advising that they did not yet have it, added to his read-back, "We are now at take-off." The tower, which was not expecting the aircraft to take off as it had not given clearance, interpreted the sentence as, "We are now at take-off position"¹⁾ and the controller replied: "O.K., ... stand by for take-off ... I will call you." Nor did the Pan Am crew, on hearing the "We are now at take-off", interpret it as an unequivocal indication of take-off. However, in order to make their own position clear, they said, "We are still taxiing down the runway." This transmission coincided with the "Stand by for take-off ... I will call you", causing a whistling sound in the tower transmission and making its reception in the KLM cockpit not as clear as it should have been, even though it did not thereby become unintelligible.

The communication from the tower to the PAA aeroplane requested the latter to report when it left the runway clear. In the cockpit of the KLM aeroplane which was taking off, nobody at first confirmed receiving these communications (Appendix 5) until the Pan Am aeroplane responded to the tower's request that it should report leaving the runway with an "O.K., we'll report when we're clear." On hearing this, the KLM flight engineer asked: "Is he not clear then?" The captain didn't understand him and he repeated: "Is he not clear that Pan American?" The captain replied with an emphatic "Yes" and, perhaps influenced by his great prestige, making it difficult to imagine an error of this magnitude on the part of such an expert pilot, both the co-pilot and the flight engineer made no further objections. The impact took place about thirteen seconds later.

¹⁾ *When the Spanish, American and Dutch investigating teams heard the tower recording together for the first time, no one, or hardly anyone, understood that this transmission meant that they were taking off.*

From that moment until the next call to the aeroplanes, the tower took care of Flights IB-185 and the BX-387 and awaited the communication from Pan Am Flight 1736 reporting the "runway clear". It also received information coming from two aeroplanes located in the parking area that there was a fire in an undetermined place on the field, sounded the alarm, informed the Fire Fighting and Health Services, and broadcasted the news of the emergency situation; it then called the two aeroplanes on the runway, without receiving any reply.

The conversations which took place in the Pan Am cockpit and between the aeroplanes and the control tower from 1701:57.0 were as follows. The times were taken from the PAA CVR.

1701:57.0 CL1736 Tenerife the Clipper one seven three six. (1702:00.2)
1702:01.8 APP Clipper one seven three six Tenerife.
1702:03.6 RDO-2 Ah- We were instructed to contact you and also to taxi down the runway, is that correct? (1702:07.4)
1702:08.4 APP Affirmative, taxi into the runway and -ah leave the runway third, third to your left, (background conversation in the tower).
1702:16.4 RDO-2 Third to the left, O.K. (17:02.18.3)
1702:18.4 CAM-3 Third he said.
CAM-? Three.
1702:20.6 APP -ird one to your left.
1702:21.9 CAM-1 I think he said first.
1702:26.4 CAM-2 I'll ask him again.
CAM-? * * *
1702:32.2 CAM-2 Left turn.
1702:33.1 CAM-1 I don't think they have take-off minimums anywhere right now.
1702:39.2 CAM-1 What really happened over there today?
1702:41.6 CAM-4 They put a bomb (in) the terminal, Sir, right where the check-in counters are.
1702:46.6 CAM-1 Well we asked them if we could hold and -uh- I guess you got the word, we landed here **
CAM-? * * *
1702:49.8 APP KLM four eight zero five how many taxiway -ah- did you pass?
1702:55.6 KLM I think we just passed charlie four now.
1702:59.9 APP O.K. ... at the end of the runway make one eighty and report -ah- ready -ah- for ATC clearance (background conversation in the tower).
1703:09.3 CAM-2 The first one is a ninety degree turn.
1703:11.0 CAM-1 Yeah, O.K.
1703:12.1 CAM-2 Must be the third ... I'll ask him again.
1703:14.2 CAM-1 O.K.
1703:16.6 CAM-1 We could probably go in it's ah ...
1703:19.1 CAM-1 You gotta make a ninety degree turn.
1703:21.6 CAM-1 Yeah, uh.
1703:21.6 CAM-2 Ninety degree turn to get around this ... this one down here it's a forty five.
1703:29.3 RDO-2 Would you confirm that you want the clipper one seven three six to turn

left at the third intersection? (1703:35.4).

1703:35.1 CAM-1 One, two.

1703:36.4 APP The third one, sir, one; two, three, third, third one (1703:38.3)..

1703:38.3 CAM-? One two (four).

1703:39.0 CAM-1 Good.

1703:40.1 CAM-1 That's what we need right, the third one.

1703:42.9 CAM-3 Uno, dos, tres.

1703:44.0 CAM-1 Uno, dos, tres.

1703:44.9 CAM-3 Tres - uh - si.

1703:46.5 CAM-1 Right.

1703:47.6 CAM-3 We'll make it yet.

1703:47.6 APP ...er seven one three six report leaving the runway.

1703:49.1 CAM-2 Wing flaps?

1703:50.2 CAM-1 Ten, indicate ten, leading edge lights are green.

1703:54.1 CAM-? Get that.

1703:55.0 RDO-2 Clipper one seven three six (1703:56.4)

1703:56.5 CAM-2 Yaw damp and instrument?

1703:58.6 CAM-1 Ah- Bob we'll get a left one *

1703:59.3 CAM-2 I got a left.

1704:00.6 CAM-1 Did you?

1704:00.9 CAM-2 And -ah- need a right.

1704:02.6 CAM-1 I'll give you a little *

1704:03.8 CAM-2 Put a little aileron in this thing.

1704:05.0 CAM-1 O.K., here's a left and I'll give you a right one right here.

1704:09.7 CAM-1 O.K. right turn right and left yaw.

1704:11.4 CAM-2 Left yaw checks.

1704:12.4 CAM-1 O.K., here's the rudders.

1704:13.6 CAM-1 Here's two left, centre, two right centre.

1704:17.8 CAM-2 Checks.

1704:19.2 CAM-2 Controls.

1704:19.6 CAM-1 Haven't seen any yet!

1704:20.3 CAM-2 I haven't either.

1704:21. CAM-1 They're free, the indicators are checked.
7

1704:24.6 CAM-2 There's one.

1704:25.8 CAM-1 There's one.

1704:26.4 CAM-1 That's the ninety degree.

1704:28.5 CAM-? O.K.

1704:34.5 CAM-? ***

CAM-2 Weight and balance finals?

1704:37.7 CAM (Sounds similar to stabilizer trim).(1704:44.8)

1704:37.2 CAM-1 We were gonna put that on four and a half

1704:39.8 CAM-3 We got four and a half and we weigh five thirty four (sound of stabilizer trim).

1704:44.6 CAM-2 Four and a half on the right.
1704:46.8 CAM-2 Engineer's taxi check.
1704:48.4 CAM-3 Taxi check is complete.
1704:50.5 CAM-2 Take-off and departure briefing?
1704:52.1 CAM-1 O.K., it'll be standard, we gonna go straight out there till we get thirty five hundred feet then we're gonna make that reversal and go back' out to * fourteen.
1704:58.2 APP -m eight seven zero five and clipper one seven ... three six, for your information, the centre line lighting is out of service. (APP transmission is readable but slightly broken.)
1705:05.8 KLM I copied that.
1705:07.7 RDO-2 Clipper one seven three six.
1705:09.6 CAM-1 We got centre line markings (* only) (could be "don't we) they count the same thing as ... we need eight hundred metres if you don't have that centre line... I read that on the back (of this) just a while ago.
1705:22.0 CAM-1 That's two.
1705:23.5 CAM-3 Yeh, that's forty-five there.
1705:25.7 CAM-1 Yeh.
1705:26.5 CAM-2 That's this one right here.
1705:27.2 CAM-1 (Yeh)I know.
1705:28.1 CAM-3 O.K.
1705:28.5 CAM-3 Next one is almost a forty-five, huh yeh.
1705:30.6 CAM-1 But it goes...
1705:32.4 CAM-1 Yeh, but it goes ... ahead, I think (it's) gonna put us on (the) taxiway.
1705:35.9 CAM-3 Yeah, just a little bit yeh.
1705:39.8 CAM-? O.K., for sure.
1705:40.0 CAM-2 Maybe he, maybe he counts these (are) three.
CAM-? Huh.
1705:44.8 CAM-? I like this.
1705:44.8 KLM Uh, the KLM ... four eight zero five is now ready for take-off ... uh and we're waiting for our ATC clearance.
1705:53.4 APP KLM eight seven * zero five uh you are cleared to the Papa Beacon climb to and maintain flight level nine zero right turn after take-off proceed with heading zero four zero until intercepting the three two five radial from Las Palmas VOR. (1706:08.2)
1706:09.6 KLM Ah roger, sir, we're cleared to the Papa Beacon flight level nine zero, right turn out zero four zero until intercepting the three two five and we're now (at take-off). (1706:17.9)

From the foregoing it may be inferred that the Pan Am crew at first had difficulty in understanding "third", thinking that it was "first". In any case, the co-pilot asked again and this doubt was dispelled at 1703:36.4 as the tower controller told him: "The third, sir, one, two, three, the third, third", and the co-pilot confirmed this at 1703:39.2.

As a result of the poor visibility, the crew had difficulty in localizing the exits from the runway whose position they were following on the little map that they had with them. Nevertheless, at 1704:26.4 the captain identified C-1 (which is the 90 degree exit). At

1705:22.0, they also identified C-2. Then, perhaps through error, or thinking that C-4 was an easier exit than C-3, they overshot the exit ordered by the Tower.

From Appendix 5, which gives the time correlation between the conversations taking place with the tower and inside the KLM 4805 and Clipper 1736 cockpits, as well as the data obtained from the KLM 4805 DFDR during the last 88 seconds before impact, the following may be ascertained.

When, at 1706:17.9, RLM 4805 finished reading back the ATC clearance given by the control tower and added, "We are now (at take-off)" and before the controller finished the sentence "O.K.... stand by for take-off, I will call you.", only "...k" is heard in the Pan Am cockpit. The pilot says: "No uh ..." and the co-pilot says "And we're still taxiing down the runway, the Clipper one seven three six..." (1706:23.6). These communications caused a shrill noise in the KLM cockpit, which lasted approximately 3.74 seconds.

During this time the KLM take-off EPR was reached and stabilized (1.39 to 1.42).

At 1706:25.6, the tower controller gave the Pan Am crew confirmation in the following manner: "Roger alpha one seven three six report the runway clear" - to which the Pan Am crew replied at 1706:29.6, "O.K., we'll report when we're clear." The tower replied, "Thank you", but the KLM aircraft had already started its take-off run. The PanAm crew saw the KLM aeroplane approximately 8.50 seconds before the impact. Amidst logical exclamations of alarm they accelerated in order to try to get off the runway, but the collision was already inevitable.

2.2 Conclusions

From all of this it may be ascertained that the KLM 4805 captain, as soon as he heard the ATC clearance, decided to takeoff.

The fundamental cause of this accident was the fact that the KLM captain: 1. Took off without clearance. 2. Did not obey the "stand by for take-off" from the tower.

3. Did not interrupt take-off when Pan Am reported that they were still on the runway.

4. In reply to the flight engineer's query as to whether the Pan Am aeroplane had already left the runway, replied emphatically in the affirmative.

Now, how is it possible that a pilot with the technical capacity and experience of the captain, whose state of mind during the stopover at Tenerife seemed perfectly normal and correct, was able, a few minutes later, to commit a basic error in spite of all the warnings repeatedly addressed to him?

An explanation may be found in a series of factors which possibly contributed to the occurrence of the accident.

1. A growing feeling of tension as the problems for the captain continued to accumulate. He knew that, on account of the strictness in the Netherlands regarding the application of rules on the limitation of duty time, if he did not take off within a relatively short space of time he might have to interrupt the flight - with the consequent upset for his company and inconvenience for the passengers. Moreover, the weather conditions in the airport were getting rapidly worse, which meant that he would either have to take off under his minima

or else wait for better conditions and run the risk of exceeding the aforementioned duty-time limit.

2. The special weather conditions in Tenerife must also be considered a factor in themselves. What frequently makes visibility difficult is not actually fog, whose density and therefore the visibility which it allows can be fairly accurately measured, but rather layers of low-lying clouds which are blown by the wind and therefore cause sudden and radical changes in visibility. The latter can be 0 m at certain moments and change to 500 m or 1 km in a short space of time, only to revert to practically zero a few moments later. These conditions undoubtedly make a pilot's decisions regarding take-off and landing operations much more difficult;

3. The fact that two transmissions took place at the same time. The "stand by for take-off ... I will call you" from the tower coincided with Pan Am's "we are still taxiing down the runway", which meant that the transmission was not received with all the clarity that might have been desired. The whistling sound which interfered with the communication lasted for about three seconds.

The following must also be considered factors which contributed to the accident:

1. Inadequate language. When the KLM co-pilot repeated the ATC clearance, he ended with the words, "we are now at take-off". The controller, who had not been asked for take-off clearance, and who consequently had not granted it, did not understand that they were taking off. The "O.K." from the tower, which preceded the "stand by for take-off" was likewise incorrect - although irrelevant in this case because take-off had already started about six and a half seconds before.
2. The fact that the Pan Am aeroplane had not left the runway at the third intersection. This aeroplane should, in fact, have consulted with the tower to find out whether the third intersection referred to was C-3 or C-4, if it had any doubts, and this it did not do. However, this was not very relevant either since the Pan Am aeroplane never reported the runway clear but, on the contrary, twice advised that it was taxiing on it.
3. Unusual traffic congestion which obliged the tower to carry out taxiing manoeuvres which, although statutory, as in the case of having aeroplanes taxi on an active runway, are not standard and can be potentially dangerous.

Although contributing to the accident, the following occurrences must not be considered direct factors in it: the bomb incident in Las Palmas; the KLM refuelling; the latter's take-off at reduced power; etc.

3.- RECOMMENDATIONS

3.1 Placing of great emphasis on the importance of exact compliance with instructions and clearances.

3.2 Use of standard, concise and unequivocal aeronautical language.

3.3 Avoidance of the word "TAKE-OFF" in the ATC clearance and adequate time separation between the ATC clearance and the TAKE-OFF clearance.