

DATA SUMMARY

LOCATION

Date and time	Saturday, 17 September 2011; 11:12 UTC
Site	Palma de Mallorca Airport (Spain)

AIRCRAFT

Registration	EC-LAJ	LN-RRH
Type and model	AIRBUS A320-214	BOEING B-737-800
Operator	Orbest	SAS

Engines

Type and model	CFM 56-5B4/P	CFM 56-7B26
Number	2	2

CREW

	Pilot	First officer	Pilot	First officer
Age	49	29	46	41
Licence	ATPL(A)	ATPL(A)	ATPL(A)	ATPL(A)
Total flight hours	18,762 h	3,185 h	8,897 h	7,715 h
Flight hours on the type	6,218 h	2,895 h	1,381 h	1,052 h

INJURIES

	Fatal	Serious	Minor/None	Fatal	Serious	Minor/None
Crew			6			7
Passengers			175			174
Third persons						

DAMAGE

Aircraft	Significant	Minor
Third parties	None	None

FLIGHT DATA

Operation	Commercial Air Transport – Scheduled – International – Passenger	Commercial Air Transport – Scheduled – International – Passenger
Phase of flight	Taxi	Taxi

REPORT

Date of approval	28 February 2013
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1. FACTUAL INFORMATION

1.1. History of the flight

An A-320 aircraft, registration EC-LAJ, was stopped at the holding point on the H-2 taxiway, awaiting clearance to enter runway 24R at the Palma de Mallorca Airport to start a flight with destination Cork (Ireland). Its callsign was IWD3262.

Meanwhile, a Boeing B-737-800, registration LN-RRH, was taxiing on the north taxiway, which runs parallel to runway 06L-24R, toward taxiway H-1 to start flight SAS7874, with destination Stockholm. On crossing taxiway H-2, the left wingtip on the Boeing 737-800, LN-RRH, struck the aft section of the Airbus A-320, EC-LAJ.

The crew of the Boeing B-737-800 felt the impact, stopped the aircraft immediately and called the control tower to report that they thought they had hit the Airbus A-320.

The controller sent a marshaller to check whether the two aircraft had impacted. He reported that there had been contact and that the left winglet on the B-737 was stuck on the APU exhaust cone on the A-320.



Figure 1. Photograph of the B-737's winglet caught on the A320's APU exhaust nozzle

The B-737 was pushed with a tractor to free it from the A-320, after which both aircraft returned under their own power to the parking stand in order to have the damage evaluated.

1.2. Injuries to persons

There were no injuries.

1.3. Damage to aircraft

The Airbus A320, registration EC-LAJ, suffered damage to the aft part of the fuselage that required replacing the entire section aft of frame 84, along with the APU exhaust gas pipe and the rail structure holding this part. The firewall on frame 84 also had to be repaired.

The damage to the Boeing B737, registration LN-RRH, was limited to the leading edge on the left wing and part of the skin on the left winglet.

1.4. Personnel information

1.4.1. Aircraft EC-LAJ

Captain

Age:	49 years old
Nationality:	Spanish
License:	ATPL (A), valid until 9/01/2013
Ratings:	• A320 valid until 27/07/2012 • A330 valid until 27/06/2012 • IR valid until 27/07/2012
Class 1 medical certificate:	Valid until 18/10/2011
Total flight hours:	18,762 h
Flight hours on the aircraft type:	6,218 h
Duty time in the previous 30 days:	89 h
Duty time in the previous 24 h:	6.3 h
Rest time prior to the flight:	15:44 h
Start of on-duty time:	06:45 h

First officer

Age:	29 years old
Nationality:	Spanish
License:	ATPL (A), valid until 29/03/2015
Ratings:	• A320 valid until 16/05/2012 • IR valid until 16/05/2012
Class 1 medical certificate:	Valid until 25/06/2012
Total flight hours:	3,185:43 h
Flight hours on the aircraft type:	2,895:43 h
Duty time in the previous 30 days:	75:36 h
Duty time in the previous 24 hours:	9:31 h
Rest time prior to the flight:	15:45 h
Start of on-duty time:	06:15 UTC

1.4.2. Aircraft LN-RRH**Captain**

Age:	46 years old
Nationality:	Swedish
License:	ATPL (A), valid until 30/08/2013
Ratings:	• B-737 300-900 valid until 31/05/2012 • IR/ME/SP valid until 31/05/2012
Class 1 medical certificate:	Valid until 21/07/2012
English language competency:	Level 6
Total flight hours:	8,897 h
Flight hours on the aircraft type:	1,381 h
Duty time in the previous 30 days:	57 h
Duty time in the previous 24 hours:	4 h
Rest time prior to the flight:	10:35 h
Start of on-duty time:	04:35 UTC

First officer

Age:	41 years old
Nationality:	Norwegian
License:	ATPL (A), valid until 31/03/2016
Ratings:	• B-737 300-900 valid until 31/05/2012 • IR/ME/ valid until 31/05/2012
Class 1 medical certificate:	Valid until 10/11/2011
English language competency:	Level 6
Total flight hours:	7,715 h
Flight hours on the aircraft type:	1,052 h
Duty time in the previous 30 days:	47:46 h
Duty time in the previous 24 hours:	4 h
Rest time prior to the flight:	10:35 h
Start of on-duty time:	04:35 UTC

1.5. Aircraft information**1.5.1. Aircraft EC-LAJ**

Type:	Airbus
Model:	A320-214
Serial number:	3889
Year of manufacture:	2009
Airworthiness review certificate (ARC):	Valid until 6/05/2012
Engines, number/type and model:	Two (2)/CFM 56-5B4/P
Dry weight:	38,096 kg
Maximum takeoff weight:	77,000 kg
Dimensions:	• Wingspan: 34.09 m • Length: 37.57 m • Height: 11.76 m • Wheelbase: 7.59 m
Hours:	6,984:53 h
Cycles:	2,610

Last maintenance inspection carried out to the Aircraft was an "A" type (each 750 hours) and took place on 14/09/2011. On that moment the aircraft had 6,905 h.

1.5.2. Aircraft LN-RRH

Type:	Boeing
Model:	B737-800 (with winglets)
Serial number:	34546
Year of manufacture:	2009
Airworthiness review certificate (ARC):	Valid until 2/06/2012
Engines, number/type and model:	Two (2) CFM56-7B26
Dry weight:	62,732 kg
Maximum takeoff weight:	78,999 kg
Dimensions:	• Wingspan: 35.79 m • Length: 42.1 m • Height: 12.6 m • Wheelbase: 5.70 m
Hours:	6,553.38 h
Cycles:	3,633

Last maintenance inspection carried out to the Aircraft was a "600FH" and took place on 15/08/2011. On that moment the aircraft had 6,304 h.

1.6. Meteorological information

The Palma de Mallorca Airport 10:30, 11:00 and 11:30 UTC METARs for the day of the incident were as follows:

171030Z 22010KT 9999 FEW025 28/20 Q1017 NOSIG=

171100Z 22011KT 9999 FEW025 28/19 Q1016 NOSIG=

171130Z 22012KT 9999 FEW025 28/19 Q1016 NOSIG=

These reports indicate that at the time of the collision, around 11:15, the wind was from 220° at between 11 and 12 kt, the visibility was equal or greater than 10 km, there were few clouds at 2,500 ft, the temperature was 28°, the dewpoint 19 °C and the QNH was 1016 hPa.

1.7. Aids to navigation

The taxiways located in the area of the incident, North, H-1, H-2 and H-3, have centerline and edge markings.

The H-1, H-2 and H-3 holding points to runway 24R are indicated using standard markings (stop bars) and lights. The markings were in keeping with configuration B, described in 5.2.10 of the Technical Design and Operating Regulations for Public-Use Aerodromes published in Royal Decree 862/2009, and in 5.2.10 of ICAO Appendix 14, Volume I.

1.8. Communications

1.8.1. Aircraft EC-LAJ and LN-RRH

The crews of both aircraft established contact with ground movement control (GMC) at the Palma Airport to receive their respective taxi clearances.

The crew of the A-320 established contact with ground control North (GMC-N) on 121.9 MHz at 11:04:04 UTC, reporting that they were at stand 108 ready to taxi.

The controller cleared them to taxi and instructed them to “taxi on E, holding point 24R”, which was acknowledged by the crew.

At 11:06:10 the crew of the Boeing B-737 established radio contact with GMC-N to request taxi instructions. The controller instructed them to taxi via F to the runway 24R holding point, which the crew correctly acknowledged.

At 11:07:20 the controller called aircraft A-320 to instruct the crew to monitor the 118.45 MHz frequency, which corresponds to the control tower – departures (TWR-DEP).

At 11:08:03 the GMC-N controller called the B-737 crew to inform them that they were number 1 ahead of the Monarch airplane on the North taxiway. The crew acknowledged “number one ahead of the Monarch”.

At 11:09:51 the GMC-N controller once again called the aircraft to instruct the crew to monitor the 118.45 MHz frequency (TWR-DEP).

There were no further communications until the crew called TWR-DEP at 11:12:46 to report that they thought they had struck another aircraft’s tail. The controller asked them to repeat the information, to which the crew replied that they had hit the tail of the Spanish Airbus that was at the holding point. The controller instructed them to hold

their position and that they were number four behind the Spanish airplane. The crew stated that they would hold their position.

Immediately afterwards, at 11:13:24, the crew of the Airbus A-320 called TWR-DEP to report they were at H-2 and had felt a strong knock to the rear of the airplane and asked the controller if he could confirm whether they had been hit.

The controller replied, "uhh, the BER and the SAS... they came close but I didn't think they'd hit you, uh, could it have been the SAS?"

The A-320 crew replied that the airplane had moved considerably but they did not know whether it had been due to contact or jet blast.

The controller then asked the SAS B-737 crew to report its position. The crew replied that they were almost at "A..."¹ but that they thought they had hit the tail of the airplane to their left, an Orbest.

The controller acknowledged the information and requested their current position, to which the crew of the B-737 replied that they were at H-2, just behind the Airbus.

The controller then informed the crews of both airplanes that he was sending a marshaller to check on the situation.

1.8.2. *Other aircraft*

The aircraft with callsign TOM9FT was cleared to taxi to the runway 24R holding point via gate E at 10:59:39.

Seconds later the controller cleared an aircraft with callsign TOM19K to taxi to the runway 24R holding point via gate G.

At around 11:04:00, the ground controller instructed both aircraft to contact TWR-DEP on 118.45 MHz.

At 11:07:40 the controller called aircraft MON875 to inform its crew that they were number two behind the SAS. This aircraft was transferred to TWR-DEP at 11:09:51.

At 11:08:06 the TWR-DEP controller called aircraft TOM19K to clear them to enter the runway and line up. They were cleared to take off at 11:10:45, with the takeoff taking place at 11:12:00.

¹ This part of the conversation was garbled.

At 11:10:59 the controller cleared aircraft TOM9FT to take off behind TOM19K. TOM9FT took off at 11:16:10, after the impact between the two other aircraft had taken place.

Neither of these aircraft was cleared by the control tower to use taxiway H-1 nor were they assigned a specific holding point.

1.9. Aerodrome information

1.9.1. *Airfield configuration*

The ICAO classification of the Palma de Mallorca Airport is 4-E.

It has two parallel runways, 06R-24L and 06L-24R. The incident took place at the access to the 24R threshold.

Parallel to the 06L-24R runway is a taxiway called "North". The separation between their centerlines is 200 m. Access to the 24R threshold from this taxiway is via three connecting taxiways called H-1, H-2 and H-3. The 24R threshold is displaced 70 m.

The "North" taxiway is 23 meters wide and has centerline and edge markings.

In the ICAO aerodrome map for ground movements, west configuration, "AD 2-LEPA GMC 1.2", featured in the AIP Spain, the hot spots are identified by circles from the taxi point of view. Only one area is identified in taxiway "North", which is at the intersection of the "North" and "Link" taxiways, and which is far away from the area where the incident took place.

The control tower at the Palma de Mallorca Airport is situated near the air side of the terminal building. Its location is such that it could be said that it is located at the geographic center of the airport. The straight-line distance from the control tower to the area of the incident is about 1,700 m. As a result, the position of aircraft in the runway 24R holding area is difficult to discern from the control room.

In the first half of 2007, a study was carried out to identify physical hazards at the airport. This study detected that aircraft stopped at the H-1 and H-2 holding points would violate the (obstacle limitation) surface to the runway 24R approach (the H-3 hold point did not affect the obstacle limitation surfaces). This hazard was classified as "tolerable".

While hazards with this classification are tolerable in this condition, mitigation measures should be taken so as to reduce risk levels as much as is reasonably possible, though given their risk level, the corrective actions need not be carried out immediately.

This is why the option adopted was to move the H-1 and H-2 holding points back 71 m and 59.2 m, respectively, to prevent penetrations into the approach surface (see Figure 2). No timeline was set for this though. This would result in reducing the distance between said holding points and the centerline of the "North" taxiway to an "unacceptable" level.

The decision to proceed with the relocation of the holding points was made in the first half of 2011. A risk management study was conducted in June 2011 to evaluate operations and the possible effects (jet blast, safety distances, etc.) associated with the new locations of the holding points.

Said study was analyzed and approved at a risk identification session held on 16/06/2011 attended by representatives from the control tower, the control center and the airport (airfield, operational safety and infrastructure development).

The study reached the following conclusions:

- Operations at the H-1, H-2 and H-3 holding points must be restricted to Cat. D², E and E size aircraft, respectively.
- Access to the H-1 holding point is allowed only when holding point H-2 is empty.

As a result, it was agreed to allow access to H-1 only if authorized beforehand by the control tower, and to disseminate said operating restriction via a NOTAM until its final publication in the AIP, and via the ATIS.

This last action was not carried out since information that is disseminated by NOTAM or in the AIP cannot be broadcast on the ATIS.

The change in the physical location of the H-1 and H-2 holding points took place in early July 2011, with the work being completed on 8 July.

This change affected not only the markings (erasing the old markings and painting the new ones), but also required relocating the stop bar lights, which were inset into the pavement of the taxiway.

A little over one hour after the incident, a NOTAM was published informing of the closing of taxiway H-1. This was physically indicated in the airfield with the use of traffic cones.

The risk study did not consider the possibility that each aircraft could be assigned a specific holding point, and thus such a situation was not evaluated. The information gathered indicates that this possibility was not considered since the large distance from the control room in the tower precludes clearly identifying any aircraft in the area.

² Based on the code letter (aerodrome reference code), Table 1-1 of Annex 14, "Aerodromes", Volume I, "Design and operation of aerodromes".

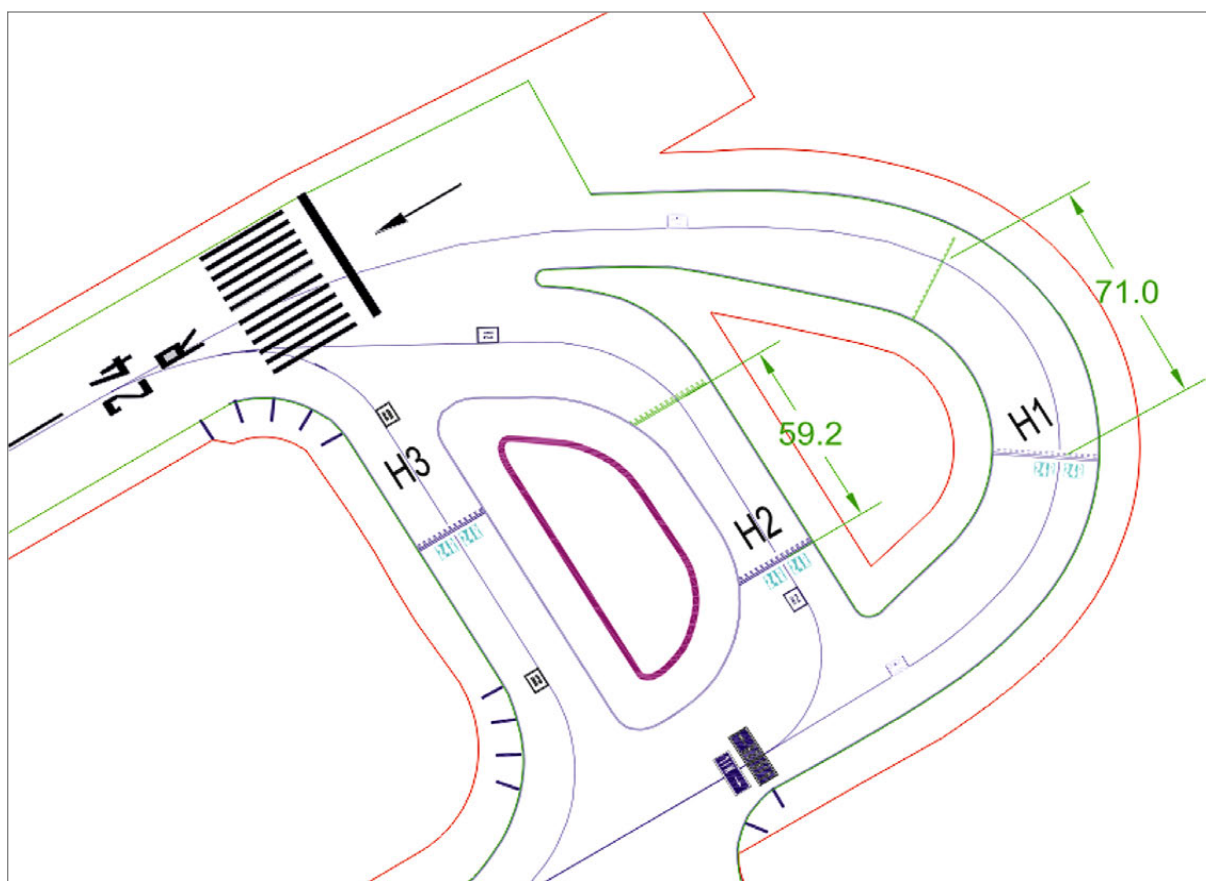


Figure 2. Setback of the H-1 and H-2 holding points

1.9.2. Publication of the restrictions

The table below lists the NOTAMs published involving the publication of restrictions:

Publication date	NOTAM no.	Differences	Valid until
30/06/2011	B4585/11	Initial NOTAM	11/09/2011
30/06/2011	B4590/11	Changes the message. Adds the prohibition of taxiing to H-1 if H-2 is occupied	11/09/2011
16/09/2011	B6407/11	Only changes completion date	Permanent
11/11/2011	B7743/11	Cancellation NOTAM	

The first NOTAM was published on 30 June 2011 at 11:18. Its contents were as follows:

B4585/11 NOTAMN

Q)LECB/QMXXX/IV/M /A/000/999/3933N00244E5

A)LEPA B)1106301118 C)1109010000 EST

E)H1 NOT AVBL WITHOUT ATC PERMISSION FOR DEP TO RWY 24R

Which briefly means that from 11:18 on 30/06/2011 until 00:00 on 01/09/2011, H1 was not available at the Palma de Mallorca Airport without permission from ATC for departures from runway 24R.

The code in the subject line is MXXX which, according to ICAO Doc. 8126, corresponds to movement and landing area – taxiways – others. The purpose qualifier is M (miscellaneous).

This NOTAM was replaced on the same day by another that only modified the restriction as follows: H1 not available without ATC permission for traffic departing from runway 24R. Aircraft waiting to take off from runway 24R cannot taxi to H1 if H2 is occupied.

On 16/09/2011 at 07:30, a new NOTAM was published that replaced the old one and introduced a change with regard to its expiration date, making it permanent (PERM).

Finally, NOTAMC B7743/11 was published on 11/11/2011, which cancelled NOTAMR B6407/11, since its information had been included in Airac AMDT 09/11.

It should be noted that this NOTAM (B6407/11) was issued on 16/09/2011 to replace NOTAM B4590/11, which contained the following information in item “C”, referring to the end of the activity: 1109010000 EST. This means that the estimated completion date was 01/09/2011 at 00:00.

Item 6 in Appendix A to Chapter 6 of the Aeronautical Information Services Manual, ICAO doc. 8126, contains the following instruction: “Any NOTAM which includes an “EST” must be cancelled or replaced before the date-time specified in item C.” If a NOTAM is not cancelled or replaced before its estimated completion date, however, it is not automatically invalidated, since that would require the replacement or cancellation of the NOTAM.

1.9.3. *Process of publishing the closing of taxiway H-1*

At 12:23 on 17/09/2011, that is, one hour and 20 minutes after the incident, a new NOTAM was published informing of the closing of taxiway H-1 until 19/09/2011. Its text was as follows:

B6449/11 NOTAMN
Q)LECB/QMXLC/IV/NBO/A/000/999/3933N00244E5
A)LEPA B)1109171223 C)1109191200 EST
E)TWY H-1 CLSD

At 06:30 on 19/09/2011, NOTAMR B6457/11 was published to replace the previous one, B6449/11, that only modified the qualifier in the “purpose” line from NBO to M.

At 09:15 on that same day, another NOTAMR was published to replace the one issued at 06:30, extending its duration until 23:59 on 31/10/2011.

This NOTAMR was replaced on several occasions, the text of the last one being as shown below, which extends the duration of the taxiway closing until 31/03/2012.

(B0286/12 NOTAMR B8074/11
Q)LECB/QMXLC/IV/M /A /AGA/000/999/3933N00244E5
A)LEPA B)1201131809 C)1203312359 EST
E)TWY H-1 CLSD.)

The closing of the taxiway was eventually indicated with physical markings.

1.9.4. *Other NOTAMs*

A search was conducted at another airport of NOTAMs dealing with similar matters in an effort to compare their codings. The Tenerife South Airport was chosen at random, with three of its NOTAMs shown below:

B7593/11 NOYTAMR B5536/11
Q)GCCCC/QMPLC/IV/BO/A/000/999/2803N01634W5
A)GCTS B)1111071309 C)1202072359 EST
D)0000-0800 18002359
E) ACFT STANDS E-29, E-30, E-31, E-32, J-33, J-34, J-35, I-8A, I-9, H-10, I-11, I-11A AND J-12 CLOSED)

As Item E) indicates, this NOTAM involves the closing of specific parking stands. According to Appendix B of Chapter 6 of ICAO Doc. 8126, the code MP means "aircraft stands" and LC means "closed". According to this same document, this code corresponds to "BO" as the qualifier in the "purpose" field.

B7599/11 NOYTAMR B5535/11
Q)GCCCC/QMXLC/IV/M/A/000/999/2803N01634W5
A)GCTS B)1111071357 C)1202072359
D)NOV 07 1800-2359, NOV 08-30 0000-0800 1800-2359, DEC 01-31 0000-0800 1800-2359, JAN 01-31 0000-0800 1800-2359, FEB 01-07 0000-0800 1800-2359
E) TWY INNER BTN I-9 AND J-12 CLOSED)

This NOTAM refers to the closing of the "inner" taxiway between I-9 and J-12 at specific dates and times. The MX code means "taxiways" and LC "closed", corresponding to an "M" qualifier in the "purpose" field.

B8492/11 NOYTAMR B6236/11
Q)GCCCC/QMAXX/IV/NBO/A/000/999/2803N01634W5
A)GCTS B)1112071116 C)1203070600 EST
E)TAXIING BTN HOLDING POINT A2-2 AND TWY B1 NOT ALLOWED))

This NOTAM informs that taxiing between holding point A-2 and taxiway B1 is not allowed. The MA code means “movement area” and XX is used when the condition is not listed in the NOTAM code. Although Doc. 8126 does not have any indication as to the qualifier to be used with the specific code MAXX, it is typically assigned any of the codes indicated for other combinations of the MA code.

1.9.5. *Process of publishing in the AIP*

On 22 June 2011, the Palma de Mallorca Airport sent the modifications to be made to the AIP for said airport to AENA’s Aviation Information Service (AIS), including those involving the taxiing restrictions for departures from runway 24R.

All of the information received by the AIS service is subject to a verification, processing and preparation process. Once completed, the information is sent to the printer for publication. The entire process can take between one and two months.

This specific information was included in amendment AIP AMDT 09/11, published during the AIRAC cycle of 8 September 2011, and which went into effect on 20 October 2011.

The AIRAC system is based on specific common dates throughout the year on which information goes into effect internationally. There is an interval of 28 days between these dates.

Specifically, item 20, “Local regulations”, Section 5, “Simultaneous capacity limitations at runway holding points”, contained the information shown below:

(1) Restricciones de rodaje para salidas por 24R: TWY H-1 utilizable bajo autorización expresa de ATC para tráfico de salida por 24R. Las aeronaves en espera para despegue por RWY 24R, no podrán rodar hacia TWY H-1 si está ocupado TWY H-2 por otra aeronave.	(1) Restrictions taxiing for departures by RWY 24R: TWY H-1 useable under authorization of ATC traffic for departure by RWY 24R. Holding aircraft for take-off by RWY 24R, are not allowed to taxi to TWY H-1 if it is occupied TWY H-2 by another aircraft.
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1.10. **Flight recorders**

Both aircraft were equipped with cockpit voice recorders (CVR) and flight data recorders (FDR).

The times on the recorders and UTC time were synchronized by using the communications held between the crews and the air traffic control stations.

1.10.1. *Aircraft EC-LAJ*

1.10.1.1. Cockpit voice recorder (CVR)

The aircraft was equipped with a four-channel Honeywell 980-6022-001 cockpit voice recorder (CVR), S/N CVR120-12798. Channels 1, 2 and 3, lasting 30 minutes each, record the signals from the crew's communications microphones. The fourth channel records sounds from the area microphone and lasts 2 hours.

The recorder was downloaded at the CIAIAC's laboratory. The audio information on channels 1, 2 and 3 was of high quality, while that on channel 4 was of medium quality.

The information on channels 1, 2 and 3 was post-incident, since the CVR continued recording after the incident for more than 30 minutes, thus taping over the previous information.

Channel 4, by virtue of its longer duration (2 hours), did contain information from both before and after the incident.

The information recorded during the interval from the moment the CVR started to record at the beginning of the flight until five minutes after the event was transcribed.

The table below shows a summary of the conversations of most relevance to the incident during this time period. All times are in UTC and were obtained by synchronizing the conversations held with ATC.

Time	Source	Contents
11:03:01	CPT	If we're clear let's start 2.
11:03:46	CPT	All right, number 2 engine started ok.
11:03:56	CPT	Starting 1.
11:04:00	FO	Taxi?
11:04:00	CPT	Yes, request taxi, lest someone else...
11:04:04	FO	Good day, Iberworld 3262 at 108 ready to taxi.
11:04:10	FO	Via echo holding point 24 right Iberworld 3262.
11:07:20	TWR	Iberworld 3263 monitor 118.45, have a good flight.
11:07:23	FO	118.45, thank you, good service, good day.
11:07:29	CPT	One's gone, there's the Thomas Cook and two Thomsons left.
11:07:39	FO	Two 75s (Boeing B757).
11:08:42	CPT	There's one more in front. There's three.

Time	Source	Contents
11:08:43	FO	Right, there are three 75s, that's what I was saying.
11:08:45	CPT	I thought there were two.
11:08:47	CPT	I only saw this one and this one.
11:08:49	FO	FO I told you, 10 minutes.
11:08:50	CPT	And there's another one.
11:08:53	CPT	Two blue ones, hey two blue ones.
11:09:20	FO	We have H-2.
11:09:27	CPT	By the low cost in the middle.
11:09:31	FO	He's at H-1. In theory the tower has to authorize that, if not you can't go in there.
11:09:36	CPT	I can't go in where?
11:09:37	FO	No, I'm saying this one who's in H-1.
11:09:38	CPT	Right.
11:09:39	FO	Unless the tower authorizes it, he can't go in there.
11:09:41	CPT	Why?
11:09:42	FO	There's a NOTAM that came out.
11:09:44	CPT	Oh yeah? I didn't know that. Is it permanent?
11:09:48	FO	No, not permanent.
11:09:53	CPT	H-2, there, in the middle.
11:10:04	CPT	So, why? The NOTAM doesn't say why. So if you're not cleared, you can't use H-1 if you're not cleared?
11:10:09	FO	Maybe now you can, but not until very recently, a week ago. I haven't seen it. In theory you couldn't use H-1.
11:10:27	FO	Look, H-1 not available without ATC authorization for traffic departing 24 right. For departing runway 24 right not allowed taxi to H-1 if H-2 is occupied.
11:10:47	FO	He went in there and shouldn't have because H-2 is occupied.
11:10:56	CPT	OK. Anyway, I think they must have that there in case there's one with too much slot so they tell him to go there so he doesn't cover up one of these, and I'll call you.
11:11:09	CPT	Maybe they put that one in there because of the slot, right? Or no?
11:11:13	FO	He's leaving.
11:11:14	CPT	Now he's going in?
11:11:15	FO	That one's going to taxi.
11:11:17	CPT	Let's see if it's that one.
11:11:20	CPT	It's that one because he's clearly moving.

Time	Source	Contents
11:11:30	CPT	This deal with the NOTAMs, there are 200 pages every time and I absolutely refuse to read them.
11:11:39	FO	I think if it's something important it should come out in (garbled).
11:12:28	FO	By the time this one enters the runway we'll be in the lounge at (garbled).
11:12:36	CPT	What was that?
11:12:42	FO	I don't know.
11:12:46		(Sound of the chime on the interphone indicating a call from the passenger cabin).
11:12:49	CPT	What happened?
11:12:50	TCP	I don't know, we got hit back in the tail area.

1.10.1.2. Flight data recorder (FDR)

The aircraft was equipped with an Allied Signal flight data recorder (FDR), P/N: 980-4700-042 and S/N: SSFDR-16667, which was downloaded at the CIAIAC's laboratory.

The graph in Figure 3 shows the trend for lateral and longitudinal accelerations, N2 in both engines, ground speed, heading and keying of the mike switch, from 11:03:52 UTC to 11:13:43 UTC.

The time shown in the graph is from the flight data recorder. When the communications were being synchronized, it was noted that the time on the recorder was out of sync with that of the control tower by one second, meaning that one second has to be added to obtain UTC time.

The crew initiated the engine start sequence at 11:03:05 UTC, starting with the number 2 (right) engine. Around one minute later they started the number 1 (left) engine, meaning that by 11:04:30 UTC, both engines were running at ground idle.

At 11:04:04 UTC, as shown by the VHF key in graph 3, the crew called ground control to report that they were ready to taxi.

At 11:05:00 the airplane started to move, and at 11:06:00 it arrived at the intersection with the "North" taxiway. It then turned right to continue along this taxiway (heading 060). At 11:10:50 UTC, the aircraft reached the runway access area (holding points H-1, H-2 and H-3) and reduced speed to turn left, before coming to a stop at 11:11:00 on a heading of 328°.

The graph in Figure 3 shows that at 11:12:37, there was a small variation in both acceleration values, though slightly greater in the lateral acceleration, possibly due to the collision between the two aircraft.

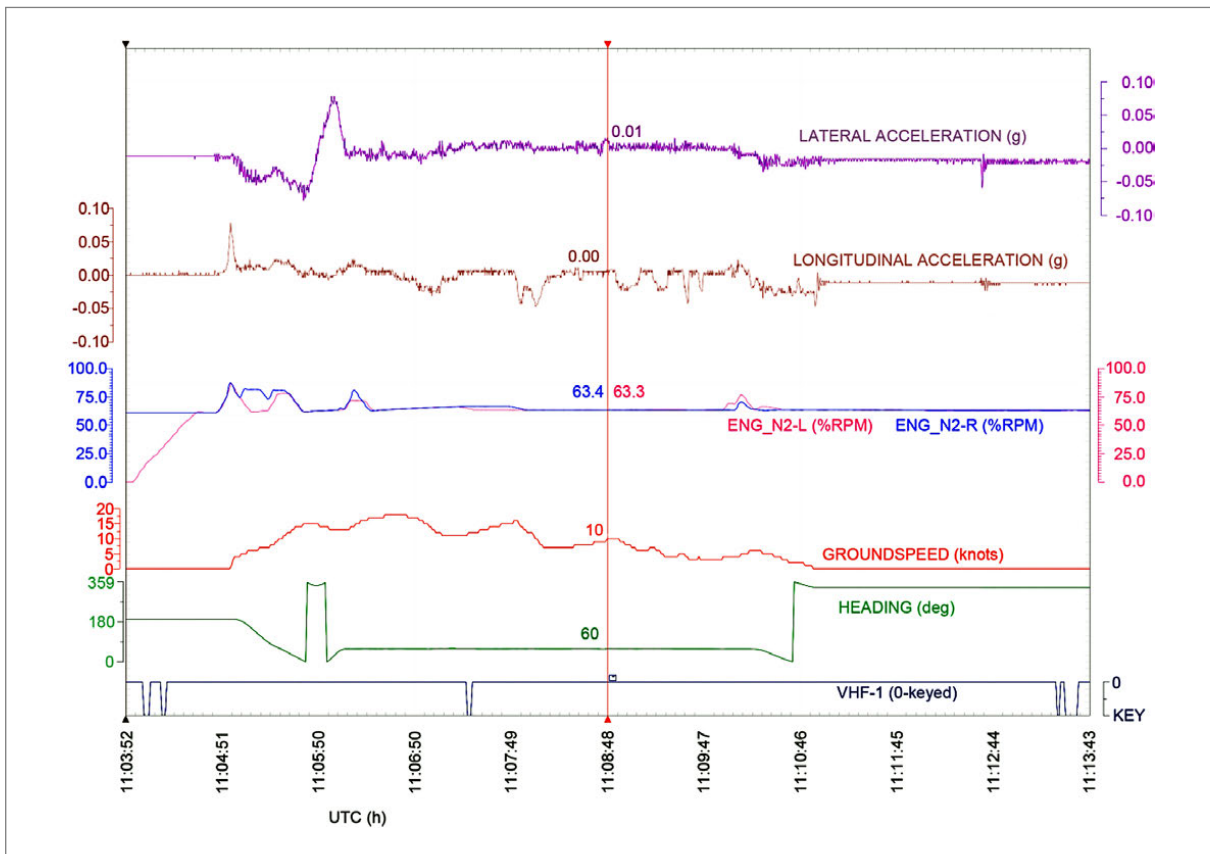


Figure 3. Trend in lateral and longitudinal accelerations, engine N2, ground speed, heading and keying of mike switch for the Airbus A320, registration EC-LAJ

1.10.2. Aircraft LN-RRH

1.10.2.1. Cockpit voice recorder (CVR)

The aircraft was equipped with a four-channel Honeywell 980-6022-001 cockpit voice recorder (CVR), S/N CVR120-12882. Channels 1, 2 and 3, lasting 30 minutes each, record the signals from the crew's communications microphones. The fourth channel records sounds from the area microphone and lasts 2 hours.

The recorder was downloaded at the CIAIAC's laboratory. The audio information on channels 1, 2 and 3 was of high quality, while that on channel 4 was of medium quality.

The information on channels 1, 2 and 3 was post-incident, since the CVR continued recording after the incident for more than 30 minutes, thus taping over the previous information.

Channel 4, by virtue of its longer duration (2 hours), did contain information from both before and after the incident.

The conversations recorded on the CVR were partly in Swedish, Norwegian and English. They were transcribed with assistance from the Swedish Accident Investigation Authority – Statens Haverikommission (SHK).

The SHK transcribed the information corresponding to the period of time spanning from 2:41 minutes prior to the event until 1:11 minutes after the event.

The table below shows a summary of the conversations of most relevance to the incident during this time period. All times are in UTC and were obtained by synchronizing the conversations held with ATC.

Time	Source	Contents	Translated contents
11:10:50	CPT ³	Ja dom tre var det nog inte.	Yes, it probably wasn't those three.
11:11:22	CPT	Vi tar hela banan (också).	We will use the whole runway (also).
11:11:23	FO ⁴	Yes.	Yes.
11:12:03		Ja då har vi verkligen hela banan, flaps med och ??	Yes, then we definitely have the whole runway, flaps with us and ??
11:12:08	FO	Checked.	Checked.
11:12:10	FO	Bränsle.	Fuel.
11:12:37	??	?? (okej) ??	?? (okay) ??
11:13:23	FO	(Då är frågan här)... vi måste nästan titta på detta, alltså...	(Then the question here is]... we should take a look at this...
11:13:26	FO	Ja, ja.	Yes, yes.
11:13:32	CPT	Ja då missar du ditt flyg (nu då).	Well, you will miss your flight (then).
11:13:33	FO	Vi kan icke fly nu.	We cannot fly now.
11:13:34	CPT	Nä.	No.
11:13:35	FO	?? icke fly.	?? Not fly.
11:13:36	CPT	Nä, verkligen inte (fly).	No, certainly not (fly).
11:14:03	CPT	Ja det är kapten. Förmodligen så märkte (några) av er (liten duns) ?? och ?? touchat flygplanet som står precis till vänster här och det innebär att vi måste in och titta på vingspetsarna innan vi kan flyga upp (mot) Stockholm ?? (tillbaka med ?? på flygplatsen och få vidare instruktioner om vilken väg vi ska köra in ?? jag får återkomma till er ?? <i>[Captain talking to passengers on public address.]</i>	This is the Captain. Probably (some of) you noticed a (light bump) ?? and ?? touched the aircraft at our immediate left here and this means we have to go in and have a look at the wingtips before we can fly (towards) Stockholm ?? (back ?? in the airport and receive further instructions about what route to taxi ?? I will be) back with you ?? <i>[Captain talking to passengers on public address?]</i>
11:14:26	FO	Scandinavian 7874 we are at Hotel 2 right now... just behind ?? ...	Scandinavian 7874 we are at Hotel 2 right now... just behind ??...

³ Captain. Spoke in Swedish during the time period in question.

⁴ First officer. Spoke in Norwegian during the time period in question, except when communicating with ATC, which he did in English.

1.10.2.2. Flight data recorder (FDR)

The aircraft was equipped with an Allied Signal flight data recorder (FDR), P/N: 980-4700-042 and S/N: SSFDR-17239, which was downloaded at the CIAIAC's laboratory.

The graph in Figure 4 shows the trend for N2 in both engines, brake pressure, ground speed, heading and longitudinal and lateral accelerations from 11:04:52 UTC to 11:14:31 UTC.

The time shown in the graph is from the flight data recorder. When the communications were being synchronized, it was noted that the time on the recorder was out of sync with that of the control tower by one second ($\text{Time}_{\text{UTC}} = \text{Time}_{\text{FDR}} + 1 \text{ s}$).

As the graph shows, the aircraft started moving at 11:06:30 UTC. The turn onto the "North" taxiway, which is the last turn to the right, was started at 11:09:19 and completed at 11:09:40. It started moving along this taxiway (heading 060), increasing in speed to a maximum of 15 kt. From 11:10:40 on, the captain applied the brakes and the aircraft started to slow, reaching a speed of 3 kt by 11:11:20 UTC.

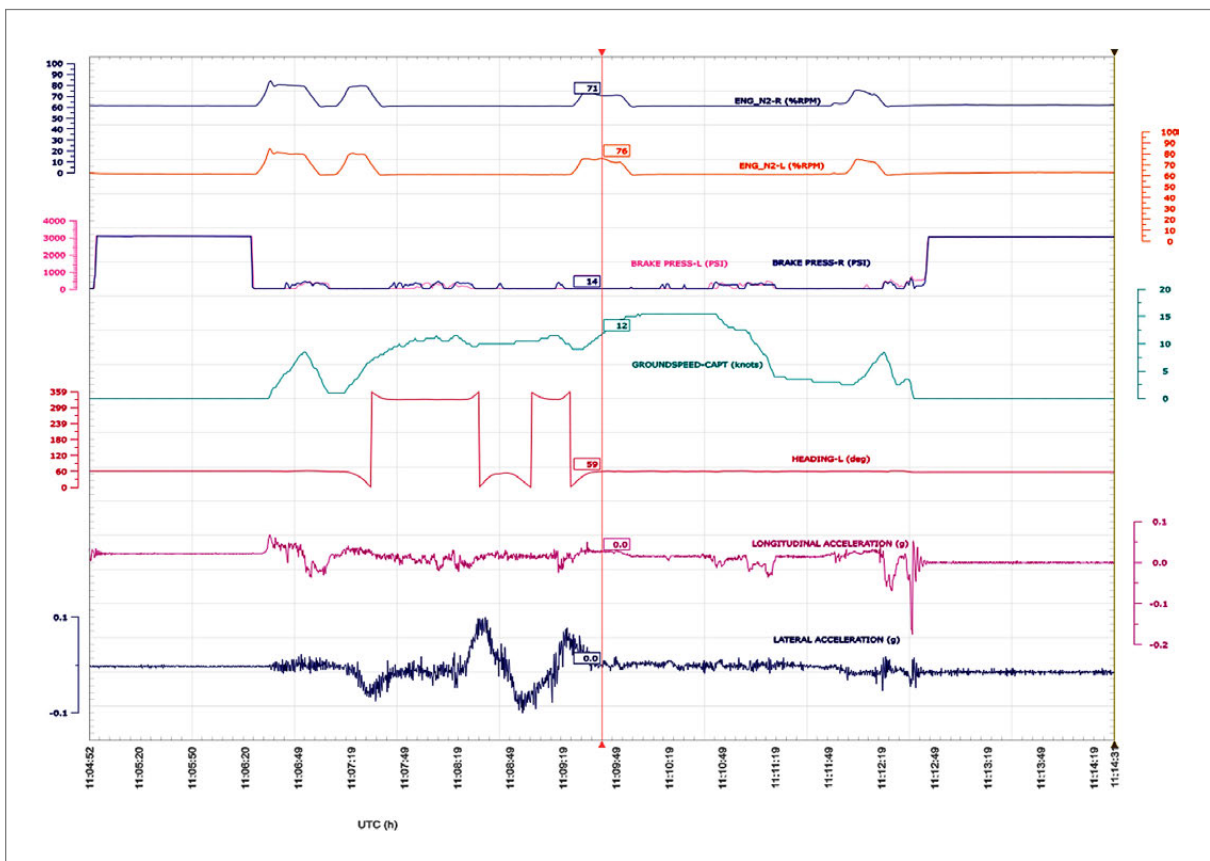


Figure 4. Trend in engine N2, brake pressure, ground speed, heading and longitudinal and lateral accelerations for the Boeing B737, registration LN-RRH

They continued moving slowly for a little under a minute. The speed then increased slightly and, about 20 seconds later, the captain applied the brakes and slowed the aircraft to 2-3 kt.

As the graph in Figure 4 shows, there was a slight variation at 11:12:37 in the lateral and longitudinal acceleration values, followed immediately by a significant increase in brake pressure resulting in the stopping of the aircraft.

Seconds earlier there had been a small variation (increase) in the aircraft's heading, indicative of a slight turn to the right.

1.11. Organizational and management information

1.11.1. *Scandinavian Airlines (SAS)*

Flight preparation

The flight was planned on the morning of the day of the incident prior to takeoff from Stockholm using the "RODOS" flight planning system. All of the available route and aerodrome information was compiled, though no information was found involving taxiing restrictions on the taxiways or runway 24R holding points at the Palma de Mallorca Airport.

The RODOS system relies on Eurocontrol's AIS database as its universal NOTAM provider.

This system has a pre-programmed "pilot" filter that uses the Q code on NOTAMs, specifically the second and third letters, to automatically detect and highlight any new NOTAM that is relevant to the crews. It also uses the "purpose" field such that only those NOTAMs with the N, B or O qualifiers are routed to the crews.

This filter was designed based on those aspects that SAS pilots and flight dispatchers thought would be relevant to operations.

Specifically, the code for the second and third letters in the Palma de Mallorca NOTAM, MX, is one of the codes that is used by the filter.

The system also utilizes another criterion based on the qualifier field such that those NOTAMs with an M are filtered out, since those, based on the definition of that qualifier, are regarded as involving miscellaneous topics that are unsuitable for inclusion in pre-flight information bulletins, unless they are specifically required.

Any new NOTAM that is automatically highlighted (not filtered) by the system is then evaluated by the CPHOW⁵ so as to eliminate any information that is of no operational relevance to the pilots.

⁵ SAS flight dispatch/planning.

The NOTAMs with the taxiing restrictions for holding points H-1 and H-2 were coded QMXXX, and the "purpose" field had an M. As noted earlier, the RODOS system automatically filters out any NOTAMs containing an M in the "purpose" field, which is why the flight dispatch information given to the crew did not include NOTAM B6407/11.

Taxi procedures

OM-A 8.4.1.2.3 states that "an airplane will not normally taxi closer than 1/4 of the aircraft's wingspan to any obstacle".

It also notes the PNF's responsibility to inform the PF whenever the airplane is going to taxi closer than 1/4 of the wingspan to any obstacle located on his side. It also states that taxi markings do not always ensure adequate obstacle clearance and thus must be used with caution.

The aircraft's wingtips are clearly visible from either the left or right seat in the cockpit.

1.11.2. *Orbest*

Flight preparation

This operator does not have a system to filter NOTAMs, meaning that the flight crews receive any published NOTAMs that affect or could affect the flight planned, that is, those involving the departure, destination and alternate aerodromes as well as the planned flight path.

The operator acknowledges that this forces crews to review a very high number of NOTAMs prior to every flight. While this ensures that crews will receive all of the necessary information, the inordinately high volume of information might lead to a non-adequate assessment for them.

1.11.3. *AENA*

Royal Decree 905/1991 of 14 June, which approved the statute of the Spanish airport authority AENA (Spanish Airports and Air Navigation), assigns AENA the task of providing aeronautical information services, among others.

The aeronautical information service (AIS) is provided by AENA through the AIS Office.

The structure, organization and responsibilities of the AIS office are contained in the AIS operations manual, V 3.0, published by AENA, according to which, the AIS office consists of three divisions:

- AIS (central air navigation services).
- The international NOTAM office (NOF), which is part of the central air navigation services.
- The aeronautical information office (AIO) and/or the air traffic services reporting offices (ARO) of airports and control centers.

New proposed NOTAMs are drafted by the affected departments (airports, control centers, etc.) and then sent from the AIO/ARO at these centers to the international NOTAM office (NOF).

The NOF's responsibilities include verifying and approving, if appropriate, the proposed NOTAMs received from the AIS/ARO and other authorized departments and agencies for subsequent distribution as NOTAMs.

1.12. Additional information

1.12.1. *Aeronautical Information Services regulations*

Aeronautical information services on an international level are regulated by ICAO Annex 15, Aeronautical Information Services, by ICAO Doc. 8126, Aeronautical Information Services Manual and by ICAO Doc. 8400, ICAO Abbreviations and Codes.

Doc. 8126 has information on the contents of the fields as well as on the codes for NOTAMs.

Doc. 8400 is the reference document that contains the abbreviations to be used in the NOTAMs.

Among the aspects regulated by the above documents are those involving NOTAMs.

Nationally, Royal Decree 57/2002 of 18 January, which approved the Air Traffic Regulation, and specifically Book VIII, regulates the aeronautical information service. Chapter 5 of said book is devoted to NOTAMs and contains instructions on issuing and distributing NOTAMs, along with general specifications.

The AIS Procedures Manual, V3.0, published by AENA, has more specific instructions on NOTAMs.

To code NOTAMs, ICAO Doc. 8126, Aeronautical Information Services Manual, must be used.

Appendix B in Doc. 8126 has a category index based on the second letter that classifies them into five main groups: AGA (aerodromes, air routes and ground aids), CNS

(communications, navigation and surveillance), ATM (air traffic management), navigation notices and other information.

The AGA group is subdivided into three groups: L (lighting facilities), M (movement and landing area) and F (facilities and services). Given the nature of the "subject", the subgroup in which it belongs is M, which would be the second letter of the code.

The third letter of the code identifies a specific part within the subgroup in question. In this case, subgroup M (movement and landing area) contains 18 different areas, each with its own corresponding letter. Taxiways are assigned the letter X (third letter of the code).

The purpose of NOTAM codes is to classify these documents such that their subject matter (second and third letters) and status (fourth and fifth letters) can be clearly determined.

As a result of the cooperation between the European Organization for the Safety of Air Navigation (EUROCONTROL) and the ICAO, a World AIS Congress was held in Madrid in June 2006 to address the role of the AIS in the constantly changing realm of ATM. At this congress it was noted that computer-based navigation systems, area navigation

6-B-22

Manual para los servicios de información aeronáutica

CATEGORÍA: AGA — ÁREA DE MOVIMIENTO Y ATERRIZAJE (M)

SEGUNDA Y TERCERA LETRAS — SIGNIFICADO Calles de rodaje (especificar)	CÓDIGO MX	Alcance: A					
		Tránsito		Objetivo			
CUARTA Y QUINTA LETRAS — SIGNIFICADO	CÓDIGO	I	V	N	B	O	M
Disponible para operaciones diurnas	AD	x	x				x
Funcionamiento normal reanudado	AK						
Funcionando (o de nuevo funcionando a reserva de limitaciones/condiciones anteriormente publicadas)	AL						
Disponible para operaciones nocturnas	AN	x	x				x
Operacional	AO						
Disponible a solicitud	AR	x	x				x
Totalmente retirado	AW	x	x				x
Completado	CC						
Realineado	CL	x	x				x
Cancelado	CN						
Instalado	CS	x	x				x
Se ha terminado el trabajo	HV						
Prosiguen los trabajos	HW	x	x				x
Cerrado	LC	x	x				x
No pueden usarlo las aeronaves que pesen más de . . . (especificar)	LH	x	x				x
Puede usarse en una longitud de . . . y un ancho de . . . (especificar)	LL	x	x				x
Cerrado para toda clase de operaciones nocturnas	LN	x	x				x
Limitado a . . . (especificar)	LT	x	x				x
Lenguaje claro	XX						

Figura 5. Table from Doc. 8126 of combinations of the fourth and fifth letter for the second and third letter code "MX", associated with taxiways

(RNAV), required navigation performance and ATM requirements made it necessary to include new AIS requirements in terms of the timeliness and quality of information. It was concluded that AIS had to transition to an information management service (AIM)⁶, with new functions, responsibilities and scope, in an effort to satisfy the new needs and be able to address the demand for information and to manage how said information is provided.

The ICAO has drafted a roadmap to transition into this new model that is expected to be implemented in three phases that should be completed by November 2016.

The transition to this new model will require an in-depth revision of all the reference documentation.

1.12.2. NOTAMs

A NOTAM (Notice to Airmen) is a notice distributed by means of telecommunications that contains information concerning the establishment, condition or modification of any aeronautical facility, service, procedure or hazard, a knowledge of which is essential to personnel charged with flight operations. It is distributed via the aeronautical information services.

Figure 6 shows the first NOTAM that was issued concerning taxiing restrictions at the Palma de Mallorca Airport. Each of the fields that comprise a NOTAM is identified. An explanation of each follows.

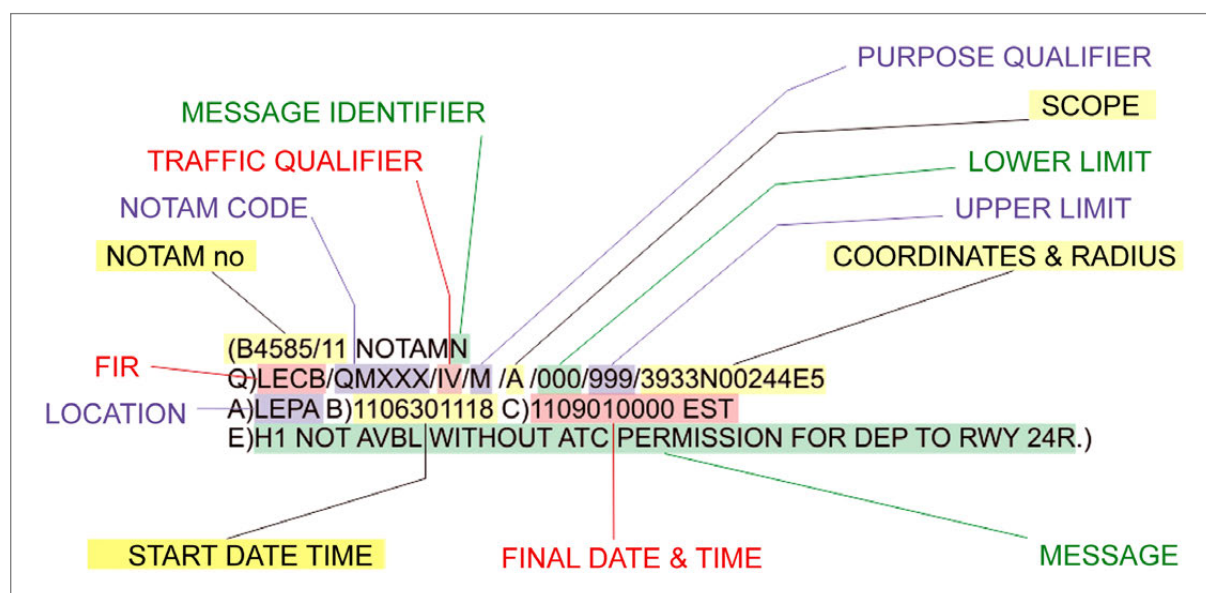


Figure 6. Identification of the fields in a NOTAM

⁶ Aeronautical Information Management.

NOTAM no. Indicates the NOTAM series and number.

Message identifier. After the word NOTAM one of the following letters is used; N if it includes new information, R if it replaces a previous NOTAM, or C if it cancels a previous NOTAM.

FIR. Indicates the FIR to which the information contained in the NOTAM applies.

NOTAM code. Consists of five letters, the first of which is always Q. The second and third letters identify the subject and the fourth and fifth its status or condition, as described in Doc. 8400, ICAO Abbreviations and Codes, and in Appendix B of ICAO Doc. 8126, Aeronautical Information Services Manual. The letters MX signify "movement and landing area, taxiways". The fourth and fifth letters, XX, mean "other".

Traffic qualifier. Refers to the type of traffic that may be affected by the NOTAM. In this case it would be instrumental (I) and visual (V).

Purpose qualifier. This is the "purpose" field. There are five qualifiers, N, B, O, M and K, whose meanings are:

- N, NOTAM selected for the immediate attention of aircraft operators.
- B, NOTAM selected for pre-flight information bulletin (PIB) entry.
- O, NOTAM concerning flight operations.
- M, Miscellaneous NOTAM; not subject for a briefing, but it is available on request.
- K, NOTAM is a checklist.

This field can contain the following qualifier combinations: K, B, BO, NBO or M. Appendix B to ICAO Doc. 8126, Aeronautical Information Services Manual, has guidance on combinations of "purpose" qualifiers depending on the subject and the content of the NOTAM (code). The table included in page 6-B-22 of this manual contains the code for this subject, MXXX, though it does not define any qualifiers for this code.

Scope. May refer to an aerodrome (A), en route (E), nav warning (W) or checklist (K). In this case it is aerodrome.

Lower limit. If the subject does not contain specific height information, 000 will be used for the lower limit.

Upper limit. If the subject does not contain specific height information, 999 will be used for the lower limit.

Coordinates and radius. Indicates the coordinates and the radius of influence in NM. If the scope of the NOTAM is "A", insert the coordinates of the aerodrome reference point.

Location. ICAO location indicator of the place to which the information applies.

Start date and time. Indicates the date and time at which the event begins.

End date and time. Indicates the date and time at which the event ends. The code "EST" indicates that the duration is estimated. If the information is permanent, "PERM" is used.

Message. This is called the text field and it contains the information to be disseminated. It typically uses the abbreviations listed in ICAO Doc. 8400, ICAO Abbreviations and Codes.

1.12.3. *Statements*

The crew members of the SAS aircraft were not interviewed in person and submitted their statements in writing.

SAS – Commander

The planning for the round trip flight between Stockholm and Palma de Mallorca was normal. The information available did not show any unusual circumstances. The flight to Palma was normal.

The stopover in Palma, as well as the activities prior to the return flight, proceeded normally and they were ready to depart before the scheduled time.

They were cleared to taxi to runway 24R via I7, F. When they started taxiing, they requested and obtained confirmation for the clearance.

There was a lot of traffic that day on the apron, so they taxied slowly. There was no pressure from GMC. While taxiing on the North taxiway, they changed the radio frequency to that of the control tower.

He seems to recall that as they were arriving at the runway 24R holding area, there was an airplane at H-3 and an Orbest A320 at H-2. Since the mass of the airplane was relatively high, he wanted to use the full length of runway 24R, meaning he had to access it via H-1.

He steered the aircraft toward H-1 and upon passing by H-3, the first officer asked if they could make it. He immediately realized he was referring to the A320 that was at H-2, so he turned slightly to the right and turned his head left to look at the wingtip on that side. He estimated they had enough room to pass. The aircraft's speed was very

low, on the order of 2-3 kt. They immediately realized that the left wingtip had struck the A320 and quickly stopped the aircraft. They then called the control tower to report the incident.

They communicated with the A320 crew on the control tower frequency and asked them to remain where they were, not to turn on the APU and to turn off their right engine, since its jet blast was directed in their direction.

SAS – First officer

He concurred with the captain that the flight to Palma and the preparations for the return flight to Stockholm proceeded normally.

After being pushed back from stand 46, they requested taxi clearance from ground control (GMC), who authorized them to taxi via F and hold at 24R.

They maneuvered carefully on the apron since there was a lot of traffic and requested confirmation from GMC whether to use I-7 and then F, which GMC confirmed.

As they were arriving at the intersection with the North taxiway, he saw another airplane, a Monarch, taxiing to their left. GMC confirmed that they were number 1. They turned right to continue on the North taxiway to the runway 24R holding point, and he changed the radio frequency to that of the control tower.

As they were arriving at the runway 24R holding point, he saw that there was another aircraft stopped at the H-3 holding point, a TUI Boeing 757, and another airplane, an Orbest A320, stopped at H-2. Also, another aircraft had just left H-1 and lined up on the runway.

As they were passing by H-3, the captain stated his intention to continue toward H-1. He thought they would stop before reaching H-2 because of the airplane occupying it, but when he realized they were not stopping, he asked the captain if they could make it.

Their taxi speed was very low and the captain slowed even more, turning slightly to the right to move further away from the other aircraft, looking outside and saying, "we can make it".

Seconds later he felt the airplane move slightly as the left wingtip struck the tail of the A320, after which the captain immediately stopped the aircraft.

He heard on the radio how the crew from another airplane, possibly the Monarch behind them, reported "SK you hit them".

1.12.4. *Measures taken by AENA*

The first measure adopted was to close taxiway H-1, as noted earlier in point 1.9.3.

Following the incident the airport evaluated the event, identifying several points that were deemed to require corrective actions. These points are summarized below.

- Improve the procedure for tracking the implementation of risk mitigation measures for the dual purpose of monitoring and evaluating the effectiveness of the mitigation measures adopted, and anticipating the possibility that when, for whatever reason, any of the planned measures cannot be implemented, the situation be reevaluated and alternative safety measures established that guarantee an acceptable level of safety.
- Any situation that entails important operational changes at the airport must have input from pilots.
- Propose the installation of a system to monitor and record operations in the movement areas, especially at thresholds.
- Any action involving a change in runway or taxi configuration will preferably be carried out during the low season and must be planned as far in advance as possible, unless prevented by the urgency of the action.

1.12.5. *Measures taken by Scandinavian Airlines (SAS)*

SAS revised its operations manual so as to emphasize the importance of having crews maintain the minimum safety distances while taxiing. Also included in this document were instructions to clarify the differences that exist in regard to minimum distances between taxiing to access a parking stand and a standard taxi procedure.

1.12.6. *Measures taken by Orbest*

Orbest is studying the viability of implementing a NOTAM filtering system.

2. ANALYSIS

2.1. Situation at the runway 24R holding point

At 11:08:06, the controller authorized TOM19K to enter the runway and at 11:10:45 to take off. Then, at 11:10:56, he informed TOM9FT that it was cleared to take off behind TOM19K.

The conversations recorded on the CVR of aircraft EC-LAJ reveal that as the aircraft was arriving at the runway 24R holding area, holding points H-1 and H-3 were occupied,

since they said, "we have H-2, by the low cost in the middle", and seconds later the first officer added, "he's at H-1".

From these same conversations we can infer that TOM19K started entering the runway at 11:11:13.

The communications held with the various control stations also reveal that none of the aircraft was directed or cleared to a specific holding point; rather, it was their crews who decided the holding point through which they would enter the runway, possibly based on the situation at the time of their arrival at the holding area.

Three conclusions can be drawn from this: the crew of TOM19K was not aware of the taxiing restriction in effect for holding point H-1; there were no markings or signs in that part of the airfield that hinted at the existence of the restriction; and the controllers who were in the tower did not realize that there were aircraft using H-1.

2.2. Taxi phase of aircraft LN-RRH

Based on the findings detailed in the previous section, and on the information from the recorder in aircraft LN-RRH, it can be determined that at the time aircraft TOM19K started moving from the holding point at H-1 to enter the runway, aircraft LN-RRH was on the "North" taxiway within 100 m of the holding area. From that position the crew could see perfectly well that aircraft TOM19K was entering the runway from holding point H-1, as the pilot stated (see Section 1.13.3).

The H-2 and H-3 holding points were being occupied by EC-LAJ and TOM9FT.

Thus, when the aircraft arrived at the runway 24R holding area, only holding point H-1 was available, as it had just been vacated by TOM19K, which was on the runway.

In such a situation, the typical way to proceed is as was done by the crew of aircraft LN-RRH, namely to head for the recently vacated holding point, which is the only one that was unoccupied. Moreover, this decision was further conditioned by the fact that the aircraft's weight was relatively high, so it was logical for the crew to try to enter the runway via H-1, which made the full length of the runway available to them.

By the time they were at H-2 they should have noticed the very little clearance available to pass behind the aircraft that was in that holding point, as manifested by the first officer's question, "Can we make it?"

At that moment it should have been obvious that the clearance was less than 1/4 of the aircraft's wingspan, as evidenced by the slight turn to the right made by the pilot, perhaps in an effort to increase the separation between the two aircraft. According to

OM-A 8.4.1.2.3, "an airplane will not normally taxi closer than 1/4 of the aircraft's wingspan to any obstacle", thus the crew should not have continue taxiing.

2.3. Planning of the relocation of the holding points

Although it was known as early as 2007 that the obstacle limitation surfaces were being violated as a result of the location of the H-1 and H-2 holding points, more than four years elapsed (until the first half of 2011) before any actions were taken to correct said violation.

The study to identify the risks associated with moving the H-1 and H-2 holding points was conducted in June 2011, with the physical displacement of these two holding points being carried out in the first two weeks of the following month.

It is worth noting that four years passed without any corrective action being taken to correct the violation of the obstacle clearance surfaces before suddenly, in 2011 and in the span of one month, a risk assessment was conducted, the information to be published in the AIP was written and sent to the AIS, and a NOTAM was published informing of the restriction, since there was no time to disseminate the information via the AIP before the holding points were physically moved. Also of note is the fact that the work itself was carried out during the high season, despite the high seasonality of the Palma de Mallorca Airport, which would seem to indicate that it would have been preferable for the work to have been carried out in the low season.

In light of how the events played out, the impression is that the planning was somewhat hasty, possibly due to the importance given to the execution at the expense of the planning.

This is perhaps why a program to monitor the mitigation measures planned in the risk identification study or to ensure that the restrictions were published (NOTAM/AIP) was not implemented.

As regards this last point, an examination of the way in which the publication of the NOTAMs involving the restriction were published is warranted. NOTAM B4590/11 was published on 30/06/2011, whose estimated validity was extended until 01/09/2011. This NOTAM was replaced by B6407/11, which was published on 16/09/11, that is, 16 days after the supposed expiration of the previous NOTAM.

Although in light of the above information it may seem that NOTAM B4590/11 expired, and thus ceased to be valid on 01/09/2011, it must be noted that a NOTAM with an estimated validity remains valid and active until it is replaced or cancelled. Therefore, on the day of the incident, the restriction contained in said NOTAM was fully in effect.

This circumstance, however, was also in violation of the instructions contained in ICAO Doc. 8126, which states that “any NOTAM which includes an “EST” shall be cancelled or replaced before the date-time specified in Item C)”. This violation occurred in all likelihood due to improper planning that failed to implement a mechanism to track the publication of the information.

The measures adopted by the Palma de Mallorca Airport, listed in 1.13.4, are considered to be adequate to address the deficiencies detected by the investigation into this incident in terms of the planning and tracking of activities.

2.4. Risk evaluation

The study to identify the risks inherent in moving the holding points involved an exhaustive examination of operations with the holding points at their new locations and correctly concluded that said location posed a high risk for collisions between aircraft.

The same study determined the measures to be taken to mitigate this risk, and which primarily entailed restricting access to H-1 if there was an aircraft at H-2.

The study did not analyze the situation further and did not assess the effectiveness of the way in which the corrective measures were implemented.

It is worthwhile to note the factors that had or could have had an influence in this regard:

1. The H-1 taxi restrictions were not physically evident to the crews of aircraft taxiing in that area.
2. The control tower did not assign aircraft to specific holding points.
3. It is impossible to see from the control tower which holding point is being used by an aircraft.
4. The restriction had not yet been distributed via the AIP.
5. The restriction had only been made public through a NOTAM.
6. The corrective measures were not tracked, which meant that the risk arising from not implementing a measure (broadcast via ATIS) was not identified, and that no alternative measures could be taken. This deficiency has already been identified by airport management, which has taken steps to ensure that in the future, corrective measures are properly tracked.
7. Non-involvement from airline representatives. Had they been involved, the suitability of the mitigation measures taken could have been more properly evaluated.

In conclusion, by not broadcasting the restriction on ATIS, its implementation relied solely on dissemination via the NOTAM, there being no additional safety measures in place, thus making for a rather weak implementation.

This conclusion is reinforced by the fact that in the brief period of time analyzed in this report, at least one other aircraft in addition to the one involved in the incident taxied to H-1 without its crew being aware of the restriction and without there being any mechanism that could have alerted them to it.

This incident also indicates that the NOTAM used to broadcast this information was either not received or was not properly handled by the crews.

2.5. Coding of NOTAMs

Although none of the documents indicated in 1.13.1 clearly specifies how the “subject” should be classified, whether according to the nature of the event or to the place where it takes place, a close examination of the category listing contained in Appendix B of Doc. 8126, Chapter 6, reveals that the classification should be based on the location.

The “subject” of the event analyzed in this report involved the “North” taxiway at the Palma de Mallorca Airport, meaning it fell under the AGA classification category.

The code corresponding to the “MX” as the second and third letters allows the combinations of fourth and fifth letters shown in the table in Figure 5. If the condition of the “subject” is not listed in the table, then XX are used as the fourth and fifth letters. In this particular case none of the conditions adequately reflects the condition of the “subject”, which was the taxi restrictions in this area, so the use of the code XX is regarded as appropriate.

Doc. 8126 contains the category AGA – Movement area and landing (M), a combination with the A as the third letter (MA), called “movement area”, the application of which does not seem to be sufficiently clear.

ICAO Annex 14 defines “movement area” as “That part of an aerodrome to be used for the takeoff, landing and taxiing of aircraft, consisting of the maneuvering area and the apron(s).”

Based on this, it seems that the taxiways or any other part of the movement area could be coded using the combination of the specific second and third letters corresponding to it, MX for taxiways, or MA for a generic movement area. Specifically, the subject matter of the case analyzed herein could have been coded as MXXX or MAXX.

Although the ICAO documentation, specifically Doc. 8126, should not be regarded as mere guides for drafting NOTAMs, this should not keep the information and instructions they contain from being as unambiguous as possible, since this would serve to improve and standardize the coding of NOTAMs.

As for the “traffic” and “purpose” fields, the table in Figure 5 includes information on the codes to assign to these fields for every combination of the fourth and fifth letters. It is noteworthy that all possible “states” for the taxiways are assigned the purpose “M”, corresponding to miscellaneous. If, however, the subject had been coded as MA, as described in the above paragraph, the corresponding purpose, according to Doc. 8126, would be N, B, O.

It is noteworthy that, for example, the “MK” combination for the second and third letters, corresponding to movement and landing area – parking area, was mainly assigned the purpose qualifiers “O” and “B”. Thus, for example, the closing of a parking stand, knowledge of which is not vital to crews since parking stands are assigned by the airport, would be assigned a more important operational category (B and O qualifiers) than a taxiway restriction, the existence of which can only be known through a NOTAM since, as in the case at hand, it is not something that is physically recognizable nor is it the object of instructions or information provided by the control tower.

Based on the above, the restriction affecting taxiways H-1 and H-2 at the Palma de Mallorca Airport could have been coded in at least two different ways: MXXX and MAXX. According to Doc. 8126, associated with these codes would be purpose qualifier M in the first case and N, B and O in the second.

The above notwithstanding, we must consider that the tables in Doc. 8126 shows the most frequently used qualifiers for each code letter combination, and should thus be used as a guide to facilitate the coding, but not as a rule, since it is perfectly acceptable to assign different qualifiers from those proposed in the documentation.

In this regard, the office charged with coding NOTAMs should determine whether the qualifier associated with a given subject as per Doc. 8126 is adequate based on the main recipients of the information contained in the message; if not, the most suitable purpose qualifier should be established so that the message reaches its intended recipients.

Once it is accepted that it is up to the coder’s full discretion which qualifier is the best suited to the message, the fact that Doc. 8126 in cases, for example, where MX are the first and second letter, assigns M as the purpose qualifier for all of them, does not make it easy for the coder to assign a different qualifier.

This fact should not, however, result in the reference document’s instructions to be strictly applied, which is what may have happened in the NOTAM containing the taxiing restrictions at the Palma de Mallorca Airport which, in light of its operational importance, should probably have been coded using the letters N, B, O, instead of M.

This flexibility in the assignment of codes in general and of the “purpose” qualifier in particular should not allow for so much freedom as to make it impossible to classify and/or filter NOTAMs.

In this regard, it is worthwhile to consider that the number of NOTAMs published is extremely high, which would force crews to review a vast number of NOTAMs before each flight if these were not filtered beforehand. This is why many operators have implemented automatic information processing systems, which they use to sort the information and, based on this classification, to determine which messages are relevant to their crews and to filter out all those that are not.

As this investigation has revealed, some of the automated information processing systems that are currently in use rely on the letter in the “purpose” field during some phases of the NOTAM sorting process.

Logically the reliability, functionality and accuracy of any type of filter depend to a large extent on the standardization of the fields used.

The investigation into this incident underscores how the ICAO reference documentation on coding NOTAMs provides information and instructions that would have to be qualified as ambiguous. This ambiguity is believed to have contributed to the lack of uniformity in the interpretation of NOTAM codes among the various users of the system.

The review of the relevant reference documentation that will be undertaken as part of the ICAO’s efforts to implement the new information management system (AIM) should allow for all its deficiencies to be identified and corrected.

Considering how long such processes usually take, however, an interim measure intended to clarify the interpretation of the documentation should be developed.

As a result, it would be advisable to issue new guidelines on how to write NOTAMs so as to improve how these messages are coded.

3. CONCLUSIONS

3.1. Findings

- The H-1 and H-2 holding points for runway 24R at the La Palma de Mallorca Airport had been moved back in the first half of July.
- The restrictions affecting the H-1 holding point had been disseminated by NOTAM B6407/11, which was in effect at the time of the incident.
- The Palma de Mallorca Airport did not implement all of the risk mitigation measures that had been planned.
- The Palma de Mallorca Airport did not establish any mechanisms to track the effectiveness of the mitigation measures.
- The two aircraft, LN-RRH and EC-LAJ, were cleared to proceed to the runway 24R holding point without ATC assigning them a specific holding point or authorizing access to the runway via taxiway H-1.

- The control tower did not realize that some aircraft had been using taxiway H-1 without being cleared to do so.
- When aircraft EC-LAJ reached the hold area for runway 24R, holding points H-1 and H-3 were occupied by aircraft TOM19K and TOM9FT, respectively, and H-2 was open.
- When aircraft LN-RRH reached the hold area for runway 24R, holding points H-2 and H-3 were occupied by aircraft EC-LAJ and TOM9FT, respectively, with H-1 having just become available when the aircraft that had occupied it entered the runway.
- The SAS flight planning system filtered out NOTAM B6407/11 since its qualifier was coded as M (miscellaneous).
- The instructions contained in the ICAO reference documentation on NOTAMs regarding how to code the “subjects” are unclear and lengthy.
- The crew of aircraft LN-RRH was unaware of the existence of NOTAM B6407/11, since it had been filtered out by the SAS planning system.
- Aircraft TOM19K entered runway 24R from holding point H-1 without being cleared to do so.
- The first officer of aircraft LN-RRH properly notified the captain of the small separation to aircraft EC-LAJ.
- The captain of aircraft LN-RRH decided to taxi to H-1 behind aircraft EC-LAJ even though the clearance between them was below that specified in the operations manual, 1/4 the wingspan of the aircraft.
- Aircraft LN-RRH reduced its speed and deviated slightly from the taxiway centerline in an effort to increase the separation.
- This separation was insufficient and the left winglet of the SAS aircraft (LN-RRH) struck the APU exhaust cone on the Orbest aircraft (EC-LAJ).
- The crew of aircraft LN-RRH stopped the aircraft immediately and reported the incident to the control tower.

3.2. Causes

The incident was caused by the decision of the crew of aircraft LN-RRH to taxi to the H-1 holding point by crossing behind aircraft EC-LAJ, even though it should have been obvious that the clearance between them was below the minimum specified in the operator’s procedures.

The following factors are deemed to have contributed to this incident:

- AENA’s failure to implement all of the mitigation measures planned, which resulted in the restrictions affecting taxiing aircraft at the Palma de Mallorca Airport being distributed among very few crews.
- The lack of a system for AENA to track & monitor mitigation measures at the Palma de Mallorca Airport.
- Ambiguity in the documentation issued by the ICAO on coding information in NOTAMs.

- The purpose qualifier of the NOTAMs used to inform of the taxiing restrictions contained the letter M.

4. SAFETY RECOMMENDATIONS

- REC 04/13.** It is recommended that the International Civil Aviation Organization (ICAO) publish guidelines to clarify the criteria for assigning purpose qualifiers in NOTAMs so as to improve their standardization.
- REC 05/13.** It is recommended that AENA revise the coding criteria used by the NOF Office for the purpose qualifier so as to ensure they are properly addressed.
- REC 06/13.** It is recommended that Scandinavian Airlines (SAS), while waiting for new guidelines to be published that address current flaws, revise the criteria of its NOTAM information management system so as to prevent the filtering out of NOTAMs that could be operationally important.