DATA SUMMARY

LOCATION

Date and time	**Sunday, 20 November 2011; 12:50 local time[1]**
Site	**Vicinity of point BRICK, Canaries TMA (Spain)**

AIRCRAFT

Registration	**OH-LBR**	**G-TCBA**
Type and model	**BOEING B757-2Q8**	**BOEING B757-28A**
Operator	**Finnair**	**Thomas Cook Airlines**

Engines

Type and model	**PRATT & WHITNEY PW 2040**	**ROLLS ROYCE RB211-535E4-37**
Number	**2**	**2**

CREW

	Captain	First officer	Captain	First officer
Age	**53**	**34**	**57**	**35**
Licence	**ATPL(A)**	**ATPL(A)**	**ATPL(A)**	**ATPL(A)**
Total flight hours	**14,601 h**	**6,783 h**	**16,900 h**	**7,300 h**
Flight hours on the type	**6,262 h**	**3,300 h**	**9,900 h**	**6,200 h**

INJURIES	Fatal	Serious	Minor/None	Fatal	Serious	Minor/None
Crew			**7**			**6**
Passengers			**230**			**217**
Third persons						

DAMAGE

Aircraft	**None**	**None**
Third parties	**None**	**None**

FLIGHT DATA

Operation	**Commercial Air Transport – Non-scheduled – International – Passenger**	**Commercial Air Transport – Non-scheduled – International – Passenger**
Phase of flight	**Descent**	**Descent**

REPORT

Date of approval	**24 October 2012**

[1] UTC is the same as local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On 20 November 2011, a BOEING 757 aircraft, registration OH-LBR and callsign FIN1601, was flying from Helsinki Airport (EFHK) to Tenerife South/Reina Sofia Airport (GCTS).

At the same time, a BOEING 757 aircraft, registration G-TCBA and callsign TCX13CS, was flying from Manchester Airport (EGCC) to Tenerife South/Reina Sofia Airport (GCTS).

Both aircraft were in radar and radio contact with ACC Canaries, Sector NWW, and were on the ORTIS3G standard arrival. Aircraft FIN1601 was at flight level 390 and slightly ahead of aircraft TCX13CS, which was at flight level 370.

At 12:48:10, after the relief of the executive controller post in the NWW sector, the crew of aircraft TCX13CS called the controller requesting to descend, to which the controller informed them to stand by.

At 12:48:20, the controller instructed aircraft FIN1601 to proceed directly to point ODULA and descend to flight level 250.

At that point the label for aircraft TCX13CS disappeared from the radar screen and was replaced by two labels for transponder code 3341, one at flight level 405 and another at flight level 370. The level corresponding to aircraft FIN1601 indicated a flight level of 390.

Just over a minute later, the NWW sector controller called aircraft TCX13CS to inform its crew to descend to flight level 390, to which the crew replied that they were at flight level 370. The controller answered, "Copy, stand by".

The controller then instructed aircraft TCX13CS to turn 30° to the right.

Immediately afterwards the crew of FIN1601 asked the controller to confirm their clearance to descend to flight level 250 and to report they had received a TCAS (Traffic Collision Avoidance System) advisory.

Seconds later aircraft TCX13CS reported the conflict had cleared.

Over the course of the incident the two aircraft approached each other and violated the minimum radar separation distance prescribed for the area.

1.2. Personnel information

1.2.1. *Information on the crew of aircraft FIN1601*

The captain, age 53, had a valid and in force JAR-FCL airline transport pilot license (ATPL) with a B757 rating. He also had a valid and in force class 1 medical certificate. He had a total of 14,601 flight hours, of which 6,262 had been on the type.

The first officer, age 34, had a valid and in force JAR-FCL airline transport pilot license (ATPL) with a B757 rating. He also had a valid and in force class 1 medical certificate. He had a total of 6,783 flight hours, of which 3,330 had been on the type.

1.2.2. *Information on the crew of aircraft TCX13CS*

The captain, age 57, had a valid and in force JAR-FCL airline transport pilot license (ATPL) with a B757 rating. He also had a valid and in force class 1 medical certificate. He had a total of 16,900 flight hours, of which 9,900 had been on the type.

The first officer, age 35, had a valid and in force JAR-FCL airline transport pilot license (ATPL) with a B757 rating. He also had a valid and in force class 1 medical certificate. He had a total of 7,300 flight hours, of which 6,200 had been on the type.

1.2.3. *Information on the ATC personnel*

The NWW sector controller had a valid license and medical certificate. He had an Area Control/Area Radar Control rating for the Canaries control center that was valid since 8 March 2011.

1.3. Aircraft information

1.3.1. *General information*

Aircraft OH-LBR is a BOEING B757-2Q8 model with serial number 28167 and a maximum takeoff weight of 115,893 kg. It is outfitted with two Pratt & Whitney PW 2040 engines. The aircraft had valid and in force registration and airworthiness certificates, as well as a corresponding noise limitation certificate.

Aircraft G-TCBA is a BOEING B757-28A model with serial number 28203 and a maximum takeoff weight of 104,326 kg. It is outfitted with two Rolls Royce RB211-535E4-37 engines. The aircraft had valid and in force registration and airworthiness certificates, as well as a corresponding noise limitation certificate.

Both aircraft were equipped with a Traffic Collision Avoidance System.

1.3.2. *Traffic Collision Avoidance System (TCAS)*

The TCAS II is the only system available on the market that complies with the ICAO's specifications for the Airborne Collision Avoidance System (ACAS II), a safety measure of last resort that was introduced to reduce the collision risk between aircraft.

The system queries the transponders of nearby aircraft and based on the information received calculates flight paths and provides information and advisories to ensure collision avoidance.

The system emits visual and aural warnings when one aircraft enters the protective envelope of another (slightly convergent or divergent flight paths) or when the time calculated for the point of closest approach reaches a limit. When a potential conflict exists between aircraft (traffic alert), the system issues a warning only, and when a conflict exists (resolution advisory), it also provides collision avoidance maneuvers.

When a traffic alert is activated, a yellow symbol appears on the screen showing the position and vertical distance relative to own aircraft. An aural "traffic traffic" warning is also issued.

If there is a conflict between the two aircraft, a resolution advisory is issued and the conflicting traffic is shown on the screen in red, along with an arc with one part in red and another in green that shows that vertical speed at which the aircraft must fly in order to increase its separation with the other aircraft. The aural warning given will depend on the vertical sense (climb or descent) and the rate required.

It should be noted that the resolution advisories issued by the TCAS are coordinated such that the systems on both aircraft cannot generate advisories in the same direction. The table below shows the resolution advisories that can be issued by version 7.0 of the TCAS II.

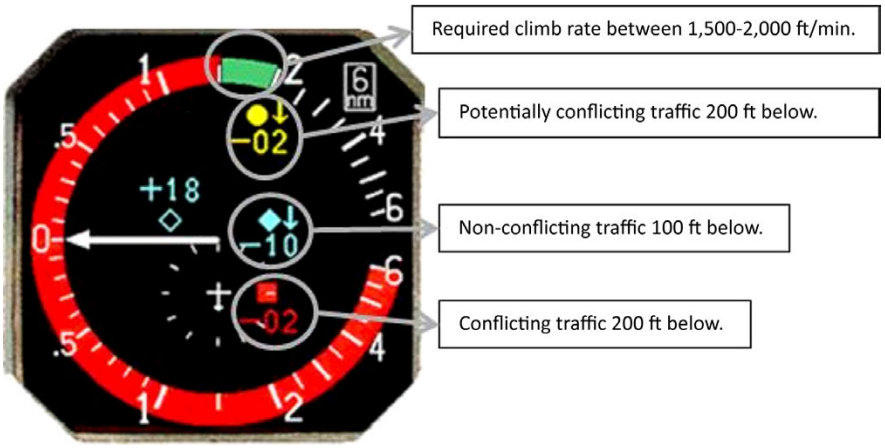

Figure 1. TCAS system display

Upward sense			Downward sense		
RA	Required vertical rate (ft/min)	Aural	RA	Required vertical rate (ft/min)	Aural
Climb	1500	Climb, climb	Descend	– 1500	Descend, descend
Crossing Climb	1500	Climb, crossing climb; Climb crossing climb	Crossing Descend	– 1500	Descend, crossing descend; Descend, crossing descend
Maintain Climb	1500 to 4400	Maintain vertical speed, maintain	Maintain Descend	– 1500 to – 4400	Maintain vertical speed, maintain
Maintain Crossing Climb	1500 to 4400	Maintain vertical speed, crossing maintain	Maintain Crossing Descend	– 1500 to – 4400	Maintain vertical speed, crossing maintain
Reduce Descent[1]	0 – 500 – 1000 – 2000	Adjust vertical speed, vertical	Reduce Climb[1]	0 500 1000 2000	Adjust vertical speed, adjust
Reversal Climb[2]	1500	Climb, climb NOW; Climb, climb NOW	Reversal Descent[2]	– 1500	Descend, descend NOW; Descend, descend NOW
Increase Climb[2]	2500	Increase climb, increase climb	Increase Descent[2]	– 2500	Increase descent, increase descent
Preventive RA	No change	Monitor vertical speed	Preventive RA	No change	Monitor vertical speed
RA Removed	—	Clear of conflict	RA Removed	—	Clear of conflict

1 Replaced by "Level off, level off" in version 7.1
2 Not possible as an initial RA

1.4. Communications

The table below provides the communications maintained by the two aircraft and Sector NWW:

Time	Station	Content
12:34:18	FIN 1601	Canaries hello, FIN1601, level 390
	SECTOR NW	FIN1601 hello, radar contact 11 miles to ORTIS. Fly standard arrival ORTIS3G
	FIN1601	"ORTIS3G, FIN1601."
12:35:20	TCX 13CS	Canaries hello, TCX13CS, level 370
	SECTOR NW	TCX13CS hello, radar contact 6 miles to ORTIS. Fly standard arrival ORTIS3G
	TCX13CS	"ORTIS3G, TCX13CS."
		RELIEF OF CONTROLLER
12:48:10	TCX13CS	TCX13CS require descent
	SECTOR NW	TXC13CS copy sir, stand by
12:48:20	SECTOR NW	FIN1601
	FIN1601	Yes, go ahead for FIN1601
	SECTOR NW	FIN1601, fly direct... uh... ODULA from present position
	FIN1601	Direct ODULA, FIN1601, and ready for immediate descent
	SECTOR NW	Uh... 1601 descend to FL250
	FIN1601	Leaving 390 descending to level 250, FIN1601

Time	Station	Content
12:49:32	SECTOR NW	TCX13CS initial descent flight level 3... 90
	TCX13CS	TCX13CS we are at FL370
	SECTOR NW	TCX13CS co... uh... copy. Stand by
12:49:49	SECTOR NW	FIN1601... uh... TCX13CS... uh... turn 30° right
	FIN1601	FIN1601 please confirm we were cleared to descend to level 250. We had a TCAS RA
	SECTOR NW	FIN1601, yes. Fly direct to ODULA
12:50:17	TCX 13CS	TCX13CS conflict clear
	SECTOR NW	13CS copy sir. Thank you
12:50:46	SECTOR NW	TCX13CS turn right one... 3 0 degrees
	TCX13CS	Right 3 0 degrees, TCX13CS

1.5. Aerodrome information

The Tenerife South/Reina Sofia Airport has one 3,200 × 45 meter asphalt runway in a 08/26 orientation. At the time of the event the runway in use was 08.

Between 28 July and 15 December, the TFS VOR/DME was out of service, as noted in AIP SUP 19/11. This resulted in the modification of some routes in the Canaries TMA that relied on this navaid. Specifically, the standard terminal arrival chart for runway 08 had to be modified.

Figure 2 shows the west part of the chart that was in effect on the date of the event. The part in yellow indicates the arrival route used by aircraft ORTIS3G.

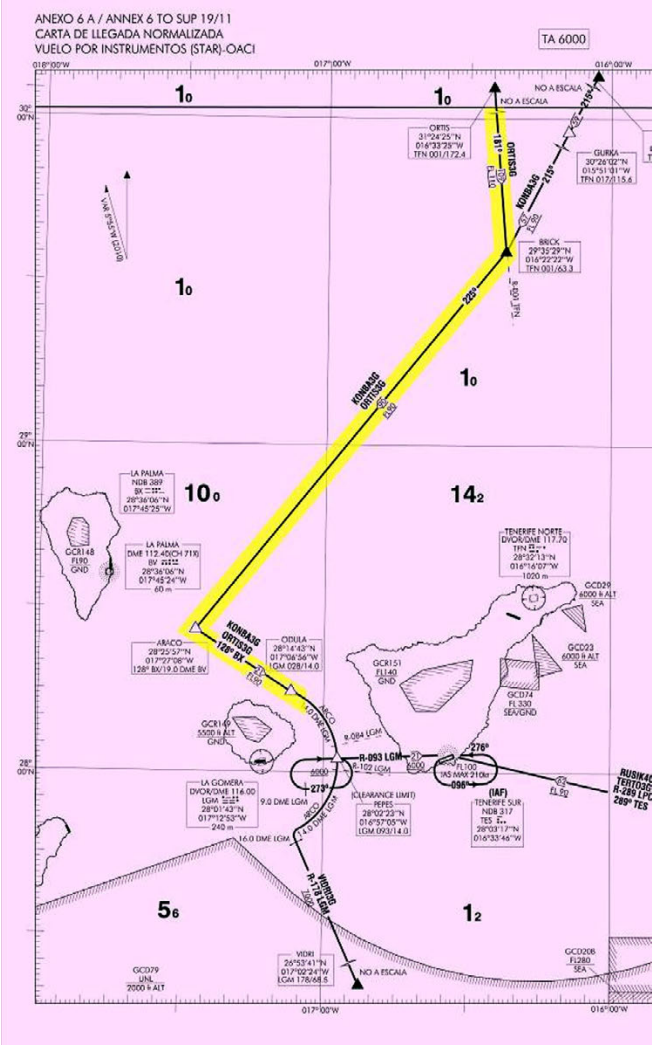

Figure 2. Section of the standard terminal arrival chart for the Tenerife South Airport

1.6. Tests and research

1.6.1. *Statement from the crew of aircraft FIN1601*

The crew of aircraft FIN1601 informed that on starting its descent

to the Tenerife South Airport, when over point BRICK at flight level 370, they received TCAS advisories.

They had the traffic in sight after the TCAS advisories and during the maneuver.

They took the following actions: they disengaged the autopilot and increased the descent rate. They then received a "climb" resolution advisory from TCAS, followed immediately by "maintain vertical speed".

1.6.2. *Statement from the crew of aircraft TCX13CS*

The crew of aircraft TCX13CS stated that after the controller cleared the Finnair aircraft to descend, it was immediately obvious that the aircraft above them was initiating its descent.

They received a TCAS "traffic traffic" advisory, followed by a "descend descend" advisory and then immediately by a "climb, climb now" advisory.

The pilot flying followed the avoidance operating procedures specified for TCAS warnings until he received the "clear of conflict" message.

1.6.3. *Statement from ATC personnel*

The controller stated that aircraft FIN1601 requested to descend 20 NM before reaching point BRICK.

At that time the label shown on the radar display for aircraft TCX13CS was separated, indicating a flight level of 400 in Mode C, which is why he cleared aircraft FIN1601 to descend, since its radar label showed that it was at flight level 390.

When the label once again correlated to aircraft FIN1601, it was reaching flight level 370, as a result of which separation between the two aircraft was lost.

1.7. Additional information

1.7.1. *Report on the InCAS tool*

Eurocontrol drafted a report on this event using version 2.9 of the InCAS[2] tool, which uses radar data to simulate encounters between aircraft and describe the likely actions recommended by the TCAS onboard the aircraft.

[2] Interactive Collision Avoidance Simulator.

Based on this report, the aircraft were on slightly divergent flight paths.

The TCAS was activated when the aircraft flew within the protective airspace of the TCAS, which at that altitude was 1.3 NM and 700 ft.

Aircraft FIN1601, which was descending at 3,300 ft/min, did not receive a traffic alert but rather an "Adjust vertical speed, adjust" resolution advisory, which specified a rate of 0 ft/min. For its part, aircraft TCX13CS received a "Traffic traffic" traffic alert.

Just one second later, aircraft FIN1601 received a "Climb climb" TCAS resolution advisory and TCX13CS a "Descend descend" RA. The rate specified for both aircraft was 1,500 ft/min.

Six seconds later, at 12:49:46, aircraft TCX13CS started to descend with aircraft FIN1601 259 ft above it and descending at a rate of 4,200 ft/min.

At 12:49:52, aircraft FIN1601 was below aircraft TCX13CS and descending at a rate of 4,400 ft/min. At that point it received a "Maintain vertical speed, maintain" TCAS resolution advisory (requiring a rate of between 4,400 and 4,900 ft/min), reversing the sense from the previous advisory. Simultaneously aircraft TCX13CS received a "Climb, climb NOW" advisory that also reversed the sense of the previous advisory.

At 12:49:58, the aircraft received the "Clear of conflict" message.

The similation showed that:

- Aircraft FIN1601 did not receive a traffic alert, instead receiving a TCAS resolution advisory immediately, instructing it to adjust its vertical speed. This aural message was most likely interrupted by the instruction to climb since there was only a one second difference between the two.
- Aircraft FIN1601 did not adequately respond to the TCAS resolution advisory instructing it to "Climb, climb" with a climb rate of 1,500 ft/min, and continued descending instead.
- Aircraft TCX13CS responded adequately in both time and manner to the resolution advisory issued by its TCAS.

1.7.2. *Radar data*

According to the radar information, at 12:45:20, after the turnover at the executive controller station, the radar labels showed that aircraft FIN1601 was at flight level 370, 2,000 ft below that of aircraft TCX13CS, which was at flight level 390.

At 12:48:09, the labels were still properly correlated (see Figure 3). One second later, after aircraft TCX13CS requested to descend, the radar label for aircraft TCX13CS showed it to be at flight level 405 and the one for aircraft FIN1601 at flight level 390 (see Figure 4).

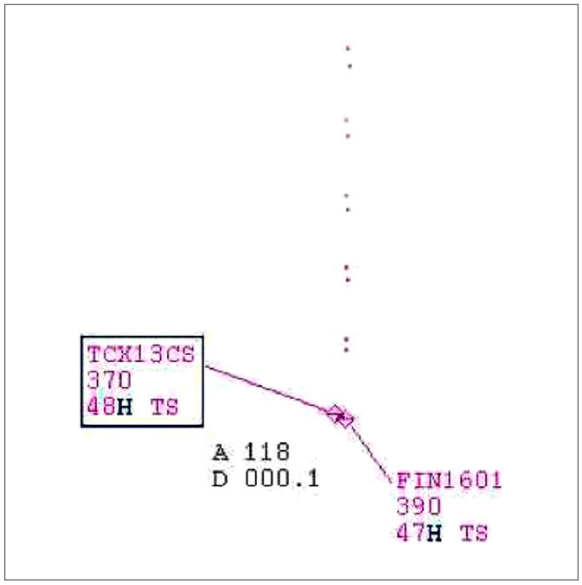

Figure 3. Radar display 12:48:09

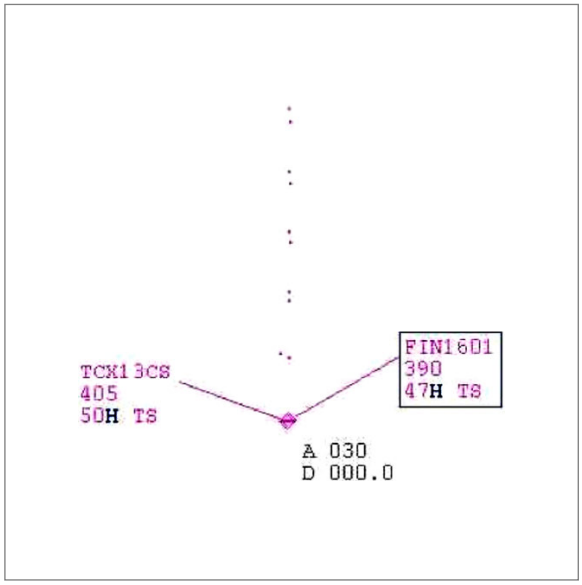

Figure 4. Radar display 12:48:10

At 12:48:15, another label appeared in addition to the others with transponder code 3341 at flight level 370.

Starting at 12:48:20, the label for aircraft TCX13CS disappeared and two labels for transponder code 3341 appeared, one at flight level 405 and another at flight level 370 (see Figure 5).

At 12:48:41, the two labels with code 3341 were still being displayed. In the "authorized flight level" field for the label for aircraft FIN1601, the controller had entered 250 (see Figure 6).

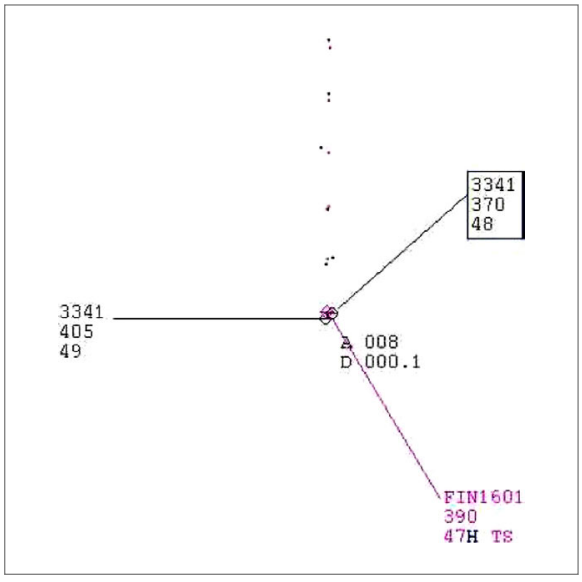

Figure 5. Radar display 12:48:20

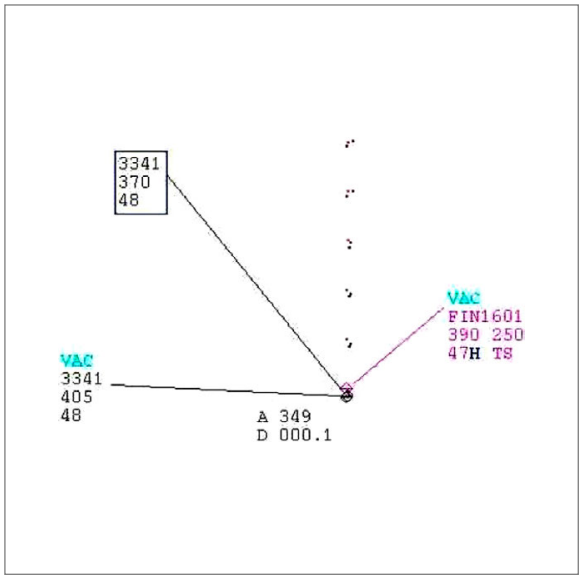

Figure 6. Radar display 12:48:41

The following table shows the progression in the separation distance between the aircraft. The minimum horizontal and vertical distances specified for the airspace in which the aircraft were located were 5 NM and 1,000 ft, respectively.

Time	Flight level FIN 1601	Flight level TCX 13CS	Vertical distance (ft)	Horizontal distance (NM)
12:49:45	375	370	500	0.8
12:49:50	373	370	300	0.7
12:49:55	370	369	100	0.9
12:50:00	364	369	500	0.9

Figure 7 shows a diagram of the separation based on radar data. The final point corresponds to the closest point of approach between the aircraft.

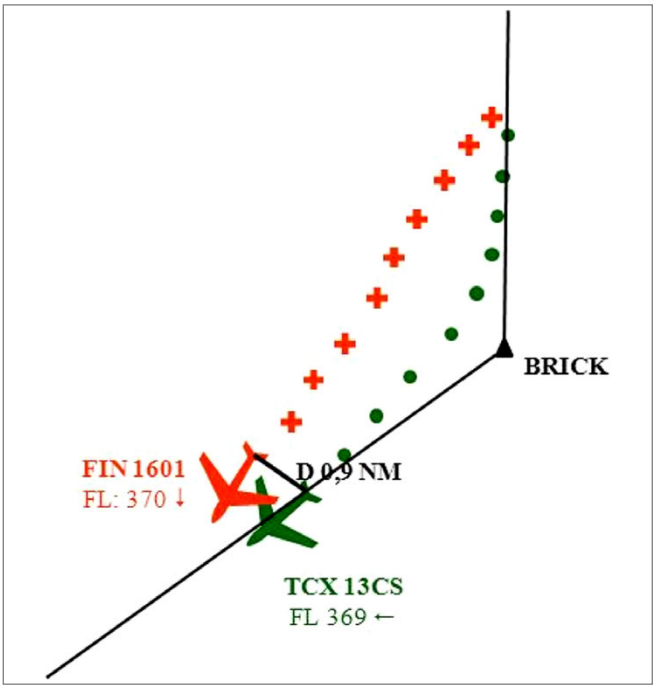

Figure 7. Diagram of the approaching aircraft

1.7.3. *Radar incident technical report*

Based on the report submitted by Aena, an incident occurred that seems to fit the characteristics of garbling sometimes seen in non-Mode S radars when the oblique distances between each aircraft and the respective radars are very similar.

Given this similarity in the distance, an overlap occurred in the reply received by the radars from the aircraft, resulting in new tracks appearing on the screen and in the label for aircraft TCX13CS splitting from the corresponding aircraft symbol.

1.7.4. *Flight progress strips*

In keeping with the Air Traffic Regulations, the flight plan and the control data required in terms of the updated progress of flights supplied to ATS will normally be presented using flight progress strips. The information needed for the efficient operation of a given ATS post is required to be recorded and must be sufficient so that a post can be relieved with as little turnover as possible.

The on-duty controller had flight progress strips on the day of the event. The flight level field on these strips showed that aircraft TCX13CS was at flight level 370 and aircraft FIN1601 at flight level 390.

1.7.5. *Air Traffic Regulations (RCA in Spanish)*

The RCA specifies the following:

2.3.2.2.8.3. Use of ACAS indications

Pilots shall use the indications provided by the ACAS in keeping with the following safety considerations:

a) Pilots shall not engage in any maneuvers with their aircraft for the sole purpose of responding to traffic alerts (TA);
Note – The purpose of a TA is to alert pilots to a possible resolution advisory (RA), to increase their knowledge of the situation and to aid in the visual observation of the potentially conflicting traffic. The traffic sighted visually, however, may not be the one producing the TA. The visual perception of an encounter is subject to misinterpretation, especially at night.

b) After receiving a TA, pilots shall use all of the information available in preparation for adopting the necessary measures should a resolution advisory (RA) be received;

c) In the event of an RA, pilots:

1. Shall immediately respond by following the indications of the RA, unless doing so would endanger the safety of the aircraft;
Note 1 – Stall, windshear and ground proximity warning system alerts take priority over ACAS.
Note 2 - The traffic sighted visually may not be the one producing the RA. The visual perception of an encounter is subject to misinterpretation, especially at night.

2. Shall follow the instructions in the RA even if there is a conflict between the RA and the maneuvering instruction given by air traffic control (ATC);

3. Shall not execute maneuvers in the direction opposite to an RA;
Note – In the event of a coordinated ACAS-ACAS encounter, the RAs are mutually complementary so as to reduce the possibility of a collision. Any maneuvers, or absence thereof, that result in vertical speeds in the

direction opposite to the RA can translate into a collision with the threatening aircraft.

4. Shall, as quickly as possible and as permitted by the flight crew's workload, report the RA to the appropriate ATC station, including the sense of any deviation from the instruction or clearance in effect from ATC.
   Note – Unless reported by the pilot, ATC does not know when the ACAS issues an RA. ATC may issue instructions that inadvertently conflict with the indications given in the RA. As a result, it is important that ATC be notified when its instructions are not followed so as not to conflict with an RA.

5. Shall promptly comply with a modified RA;
6. Shall keep any flight path changes to the minimum necessary when complying with resolution advisories;
7. Shall promptly adhere to the conditions of the ATC instruction or clearance when the conflict is clear;
8. Shall inform ATC when in compliance with the clearance in effect.

4.2.10.2.1. Air traffic control stations shall issue clearances as necessary to satisfy the objectives of preventing collisions and accelerating and maintaining the orderly movement of air traffic.

4.2.23.4. Only that information required for the efficient operation of a certain post shall be recorded on the flight progress strips. This notwithstanding, the information recorded, in addition to being useful for data collection, must be sufficient so that a post can be relieved with as little turnover as possible or so that the air traffic situation can be reconstructed if necessary in the proper sequence.

1.7.6. *ICAO Document 9426, Air Traffic Services Planning Manual*

Item 4.5.1.2 of Document 9426 indicates that when radar monitoring is being used, the controller need only annotate those flight details necessary to maintain a sense of the traffic flow and that allow for a transition to procedural controls in the event of a radar failure.

2. ANALYSIS

The aircraft were on the NWW sector frequency, aircraft TCX13CS at flight level 370 and aircraft FIN1601 at flight level 390. They were cleared to conduct standard terminal approach ORTIS3G.

After the relief of the NWW sector controller, aircraft TCX13CS requested to descend. At that time, possibly because of a garbling problem, the radar display showed an altitude for this aircraft of flight level 405 instead of 370. In an effort to shorten FIN1601's flight path and to have it start its approach with sufficient vertical and horizontal separation with respect to aircraft TCX13CS, the controller instructed aircraft FIN1601 to proceed directly to point ODULA and cleared it to descend to flight level 250, believing it to be below aircraft TCX13CS.

The sector NWW controller's situational awareness was incorrect. Moreover, he did not detect the problem with the radar display when aircraft TCX13CS requested to descend, since its label showed that it was maintaining flight level 405. Flight levels for aircraft in cruise flight end in "0". He did not detect the fault later either, since when he provided the aforementioned instructions to aircraft FIN1601, the screen displayed the label for aircraft FIN1601 along with two others with the (uncorrelated) transponder code 3341, one showing a flight level of 405 and the other 370.

He also did not notice the disagreement between the flight level shown for aircraft TCX13CS on the radar display and the one written on the flight progress strip. These strips are a useful tool for the controller to maintain proper situational awareness of the traffic, particularly when going on duty after a turnover, and to detect potential conflicts.

The facts exposed in the above paragraphs indicate that the controller did not detect the faults in the system, probably due to his insufficient knowledge of the system and of the means available for detecting them. As a result, the investigation has concluded that the level of knowledge controllers have of this matter should be assessed and, if so warranted by the findings, specific training should be added as part of their continuous training program. A safety recommendation is issued in this regard.

The clearance given by sector NWW to aircraft FIN1601 to descend resulted in a violation of the minimum radar separation distance in effect for the airspace in question, which was 5 NM and 1,000 ft. It also triggered advisories in the TCAS onboard the aircraft.

According to the report on the simulation conducted using the InCAS tool by Eurocontrol, aircraft TCX13CS should have received a traffic alert followed by a resolution advisory instructing a descent, to which the crew should have replied promptly. The crew of FIN1601 probably did not receive a traffic alert, being instructed directly to adjust its vertical speed and then to climb. Based on the findings of the simulation, it seems likely that the crew of FIN1601 responded improperly to the resolution advisory and continued to descend. This resulted in both aircraft receiving resolution advisories a few seconds later that were contrary to the initial advisories, instructing TCX13CS to climb and FIN1601 to descend.

According to the Air Traffic Regulations, crews shall immediately respond as indicated by the resolution advisory, even if contrary to ATC's instructions, and shall not execute maneuvers in the direction opposite to that indicated by the TCAS.

Studies of close calls involving aircraft receiving TCAS advisories have revealed that the most unfavorable situation occurs when one crew responds as indicated by TCAS and the other in the opposite direction to that instructed.

This situation could have occurred in this incident, as a result of which a safety recommendation is issued to FINNAIR.

3. CONCLUSIONS AND CAUSES

3.1. Findings

The following conclusions can be drawn from an analysis of the information gathered on the incident:

- The aircrafts' documentation was valid and in force, and they were airworthy.
- The crews had valid and in force licenses and medical certificates.
- The controller had a valid and in force license and medical certificate and had been qualified for the post since March 2011.
- Aircraft TCX13CS was maintaining flight level 370.
- Aircraft FIN1601 was maintaining flight level 390.
- A few minutes after both aircraft contacted sector NWW, there was a relief of the flight controller.
- The controller had flight progress strips that showed the altitudes at which the aircraft were flying.
- When aircraft TCX13CS requested to descend, there was a fault in the radar system, with the radar label showing the aircraft at flight level 405.
- Seconds later the controller cleared aircraft FIN1601 to descend to flight level 250.
- The aircraft approached within a distance that violated the minimum radar separation distance prescribed.
- As it was descending, aircraft FIN1601 received a resolution advisory to adjust its vertical speed, followed a second later by an instruction to climb.
- As for aircraft TCX13CS, it received a TCAS traffic alert and a resolution advisory to descend.
- Aircraft TCX13CS may have initiated the descent as instructed by its TCAS advisory.
- Aircraft FIN1601 may have continued to descend despite the TCAS indication to climb.
- A few seconds later, aircraft TCX13CS had a TCAS resolution advisory in the opposite sense from the previous one, instructing a climb. Aircraft FIN1601 had another descent advisory, reversing the earlier advisory to climb.

- A few seconds later the TCAS on both aircraft indicated that they were clear of the conflict.

3.2. Causes

This incident is regarded as having been caused by the clearance given by the controller to aircraft FIN1601 to descend from flight level 390 to 250, crossing through the flight level being occupied by aircraft TCX13CS, FL370, resulting in a violation of the minimum radar separation distance prescribed.

The following are considered to have contributed to the incident:

A possible garbling problem that made it possible for the label on the radar display for aircraft TCX13CS to show that it was flying at flight level 405.

- The controller's failure to detect the fault that existed with the labels.
- The improper response by the crew of aircraft FIN1601 to the climb advisory issued by its TCAS.

4. SAFETY RECOMMENDATIONS

The investigation into this event revealed possible gaps in the controller's knowledge regarding the faults that the systems can exhibit. In light of the possibility of this circumstance affecting other controllers, a study should be conducted in this regard and corrective measures taken, as appropriate. As a result, the following recommendation is issued:

REC 100/12. It is recommended that AENA ensure that its controllers are aware of the faults that can occur affecting the auxiliary systems used over the course of their jobs and of the way to detect and address said faults.

The investigation into this incident also concluded that the crew of aircraft FINNAIR 1601 acted inappropriately after the activation of the TCAS resolution advisory, as a result of which the following safety recommendation is issued.

REC 101/12. It is recommended that the operator, FINNAIR, as part of the refresher training given to its crews, enhance the training on the procedures to be followed in the event of aircraft encounters resulting in a TCAS activation.