

## Interim Statement

Ref. AAU-2017-01

### SYNOPSIS

<b>Date and time:</b>	Sunday 01 January 2017 at 11:47 UTC
<b>Aircraft:</b>	a. Airbus A320-214. b. Airbus A300B4-622R(F)
<b>Location:</b>	N 50° 55' 36.31" E 003° 35' 01.13"
<b>Type of flight:</b>	a. Commercial Aviation – Passenger b. Commercial Aviation – Cargo
<b>Phase:</b>	a. Cruise b. Climb
<b>Destination:</b>	a. EHAM b. HECA
<b>Injuries:</b>	None
<b>Occurrence type:</b>	Airprox (MAC)

### Abstract

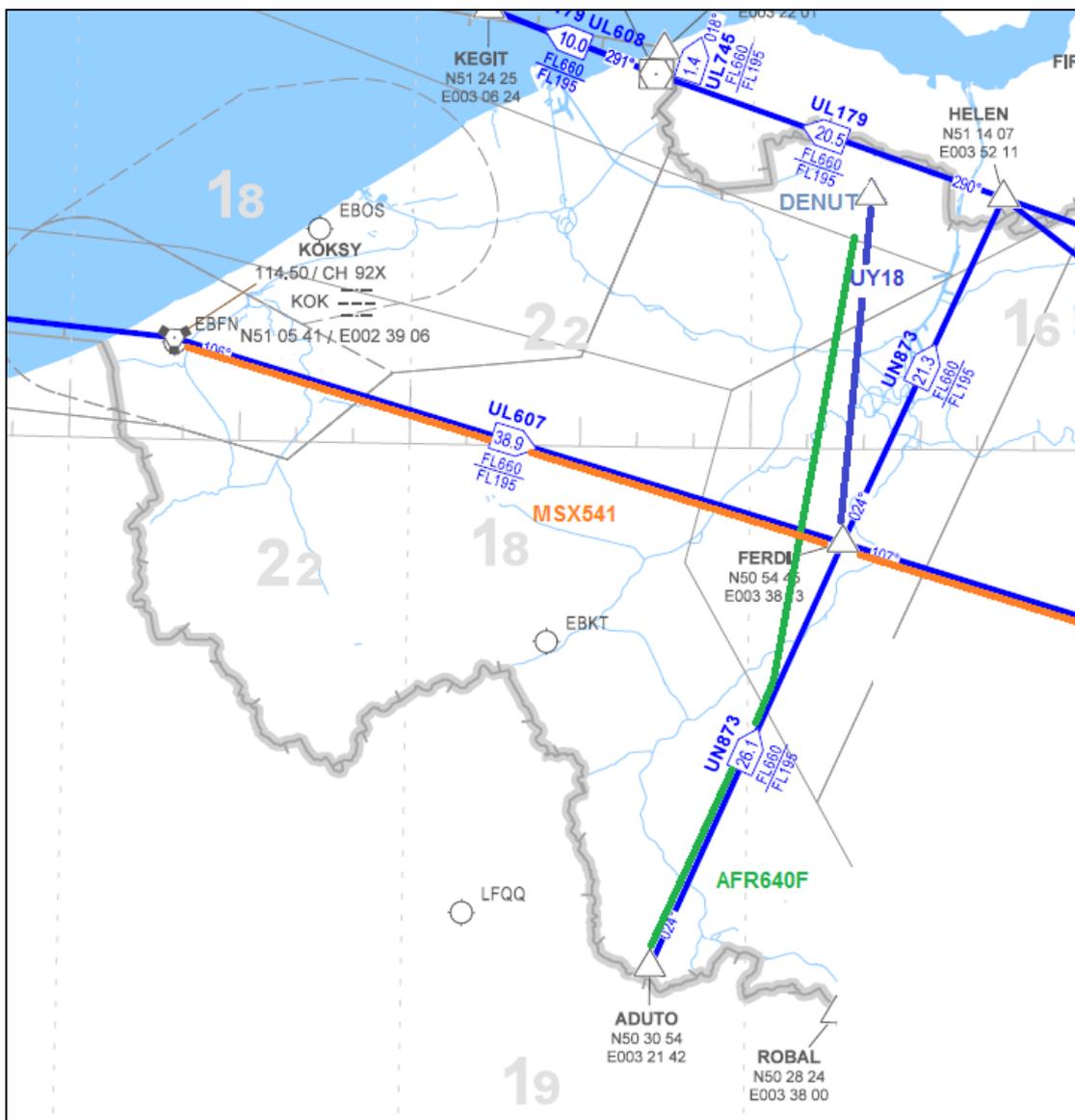
A flight of Egypt Air Cargo (MSX541) departed from EBOS to HECA on 01 January 2017.

A flight of Air France (AFR 640F) departed from LFPG to EHAM.

After take-off from EBOS, MSX541 was climbing to FL210 with a vertical rate of approximately 2500 ft/min.

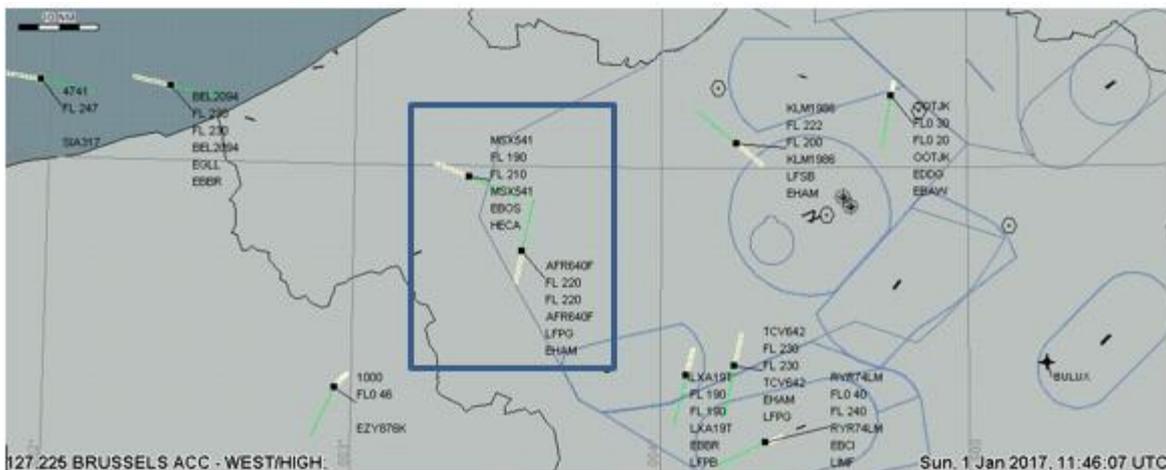
ATC was monitoring both aircraft. The ATC controller's intention was, as he was familiar with the situation, to have the MSX541 passing behind the Air France aircraft. However, MSX541 was climbing faster than usual, due to a light load.

AFR640F was maintaining FL220. The crew called ATC when reaching the Belgian border. The ATC controller instructed AFR640F to fly towards Hamstede before reaching the FERDI waypoint, in order to speed up the crossing.



At 11h45 MSX541 received traffic information about the AFR640F – crossing traffic above from right to left A320 -. The Readback from MSX541 of maintaining FL210 was correct.

Immediately after, AFR640F was advised about the climbing Egypt Air aircraft.



When the 2 aircraft were approaching from each other, the TCAS system initiated a warning in each airplane, first a TA (Traffic Advisory) – indicating the vicinity of another airplane – then a RA (Resolution Advisory) – to require an action (Climb, Descend, Maintain level) from the crew.

There was no visible change of vertical speed of MSX541 after the TA message (generated at 11:46:33).

The RA (Resolution Advisory) downlink message indicates that a Level Off RA was generated for MSX541 between 11:46:39 and 11:46:42.

Note 1: the TCAS system “sees” only the airplane trajectory, regardless of the ATC instructions.

Note 2: In this case, the ATC instructions, followed by the airplane up to this point would lead to a crossing with a 1000 ft vertical separation (the AF airplane flying at 22000 ft, the MSX airplane climbing up to 21000 ft).

TCAS alert was activated on both aircraft:

- The downlink of the TCAS instruction generated on the MSX541 and reported on the radar screen shows the level off “LVL” instruction. The crew of the MSX541 later stated they understood a “CLIMB” instruction. The captain took control from the autopilot and increased the rate of climb up to 3500 ft/min (instead of levelling off).
- On AFR640F, the TCAS generated a CLIMB “CLB” instruction, at 11:46:57 and AFR640F started to climb at 11:47:02 at a rate of 1500 ft/min as required.

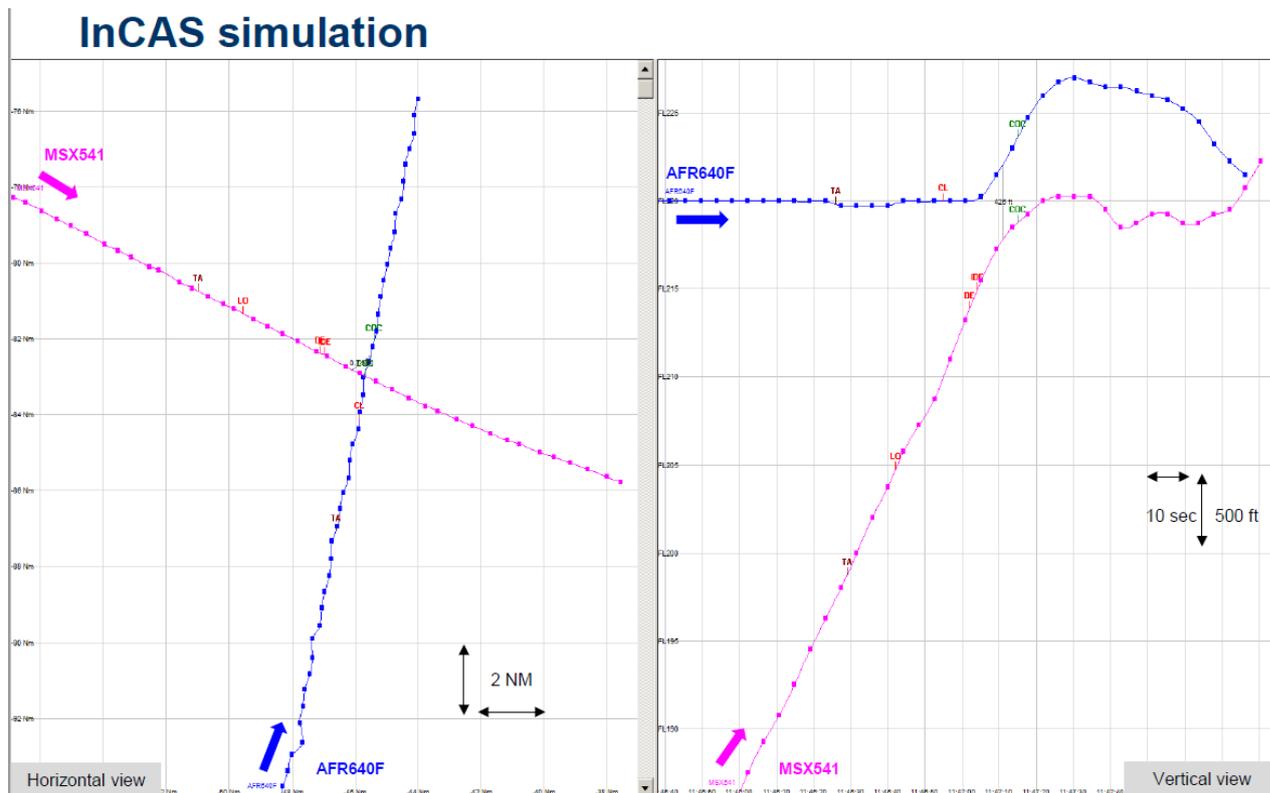
When MSX541 was passing FL213, the TCAS gave a “DESCEND” instruction which was followed immediately by a reduction of the climb rate by the captain of MSX541 (instead of a descend rate of 1500 ft/min).



Both MSX541 and AFR640F received Clear of conflict messages at 11:47:16.

The closest point of approach occurred at 11:47:11. The separation was 0.69 NM and 427 feet. Both aircraft cover this distance in 4 seconds when flying at cruise speed.

Tracks crossed at 11:47:06 with AFR640F passing right to left 1.2NM in front of MSX541 being 522 feet below, still climbing.



### Safety issue identified: Misinterpretation of TCAS RA instructions

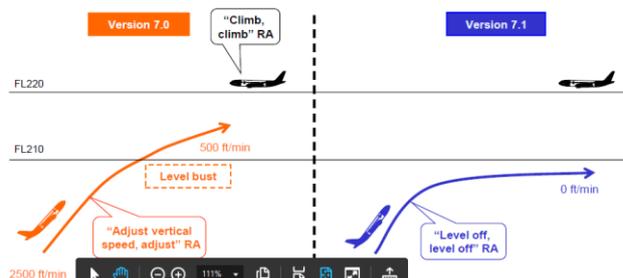
Misinterpretations of TCAS RA instructions were already identified in the past. In particular, the instruction to stop climbing was, in the past, announced by the message “ADJUST VERTICAL SPEED”. In several cases, this announcement was wrongly understood by crews and led to Airprox events.

The TCAS system was therefore modified in order to change the “ADJUST VERTICAL SPEED” announcement to a clearer “LEVEL OFF” announcement.



### “Level off, level off” RA (6/6)

- “Level off, level off” RA will reduce instances of:
  - RAs – as follow up RAs are less likely
  - Level busts as a result of RA





## Misinterpretation of Adjust Vertical Speed RA

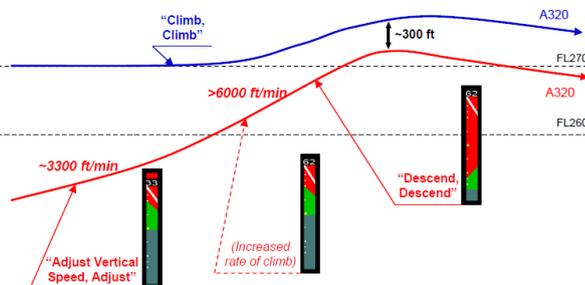
An A320 is level at FL270, heading south. Another A320 is cleared to climb to FL260, heading north. Its rate of climb is about 3300 ft/min. When passing through FL253, its TCAS triggers an initial "Adjust Vertical Speed" RA requiring a reduction in the rate of climb to 1000 ft/min.

However, the flight crew misinterprets the RA and reacts opposite to it: the rate of climb is increased to more than 6000 ft/min, instead of being reduced.

The closure rate increases between the two aircraft and the RA is strengthened to a "Descend" RA. The flight crew follows this second RA but the manoeuvre takes time to be effective.

As a result of the wrong reaction to the "Adjust Vertical Speed" RA, the climbing A320 busts its flight level by 1200 ft and the level A320 receives a "Climb" RA, which the flight crew follows. **The vertical distance is 300 ft with 0.8 NM.**

If the flight crew had correctly reduced the rate of climb as required by TCAS, simulations show that not only would the climbing A320 have been able to level off correctly, but that the A320 1000 feet above would not have received an RA.



(extracts of TCAS II version 7.1 – Overview for pilots)

In this case, both aircraft were equipped with the updated version of TCAS (TCAS II version 7.1.) and all crew members involved (AFR and MSX) received training on the updated equipment.

However, TCAS RA events are not happening frequently and individual crew members are rarely faced with such event, for which the procedure requires a quick and adequate response. Solutions were brought to this potential problem by some airlines (including most Belgian companies) to include a TCAS event during flight simulator exercises.

### Analysis (What if)

Eurocontrol has analysed this event and developed "What-if" scenarios with the inCAS simulation software.

Scenario A: MSX541 responds timely to the initial Level Off RA (nominal 5-sec. delay):

MSX541 would have levelled off at FL207.  
No RA would have been issued for AFR640F.

Scenario B: MSX541 responds to the initial Level Off RA with a delay of 10-sec.:

MSX541 would have levelled off at FL209.  
No RA would have been issued for AFR640F.

*Scenario C: AFR640 responds timely to the Climb RA (nominal 5-sec. delay) and MSX541 climbs as recorded in the real event:*

Vertical spacing at CPA would have increased to 497 feet (i.e. by 71 feet).

*Scenario D: AFR640 not responding to the Climb RA or unequipped and MSX541 climbs as recorded in the real event:*

Vertical spacing at CPA would have reduced to 215 feet (i.e. by 211 feet).

## Progress of investigation

AAIU (Be) has gathered all operational and engineering information from

- Air France, through the Bureau d'Enquête et Analyse
- Egyptair, through the Central Directorate of Aircraft Accident Investigation.
- Belgocontrol
- Eurocontrol

The report, when finalised in the near future, shall be circulated amongst:

- (a) Safety investigation authorities and civil aviation authorities of the States concerned, and the ICAO, according to the international standards and recommended practices;
- (b) Addressees of safety recommendations contained in the report;
- (c) The Commission and EASA,

The ICAO Annex 13 determines a delay of 60 days for the comments.

## About this interim statement

*This interim statement is released in accordance with Regulation (EU) no 996/2010 of the European Parliament and of the Council of 20 October 2010. The regulation states that if the final report cannot be made public within 12 months, the safety investigation authority shall release an interim statement at least at each anniversary of the accident or serious incident, detailing the progress of the investigation and any safety issues raised.*

*It is not the purpose of the Air Accident Investigation Unit to apportion blame or liability. The sole objective of the investigation and the reports produced is the determination of the causes, and, where appropriate define recommendations in order to prevent future accidents and incidents.*