

## AIRPROX REPORT No 2011007

Date/Time: 1 Feb 2011 0919Z

Position: 5144N 00021E (9.5nm NE LAM)

Airspace: LTMA (Class: A)

Reporting Ac Reporting Ac

Type: EMB170 A319

Operator: CAT CAT

Alt/FL: FL70↑ FL80

Weather: VMC CLAC IMC CLBL

Visibility: NR NR

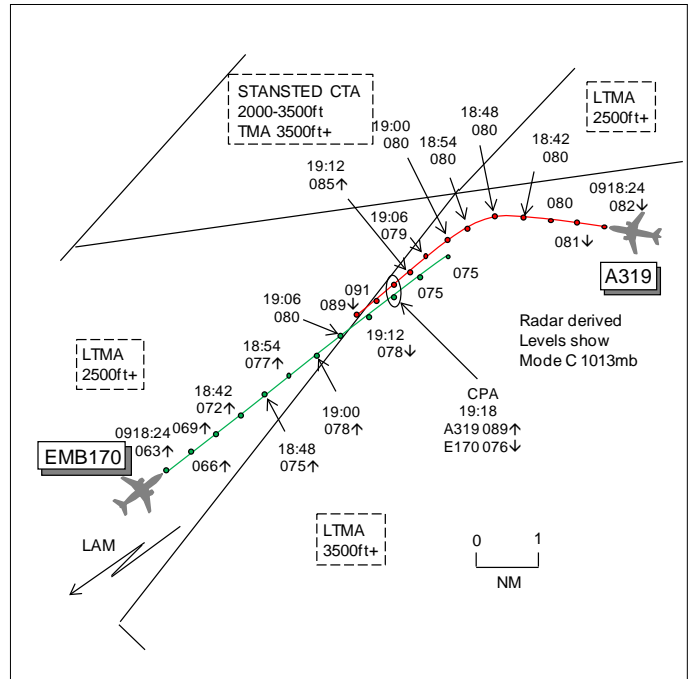
Reported Separation:

100ft V/1nm H 150ft V/2nm H

Recorded Separation:

100ft V/1.9nm H or

1300ft V/0.2nm H



**BOTH PILOTS FILED**

### PART A: SUMMARY OF INFORMATION REPORTED TO UKAB

**THE EMB170 PILOT** reports outbound from London/City, IFR and in communication with London on 118.825MHz, squawking with Modes S and C. About 10nm NE of LAM, heading 050° at 250kt climbing through FL70 for FL90, both crew noticed a descending ac on TCAS range 10nm on a reciprocal heading. The traffic quickly became 'proximate' and was visually acquired as they were 2000ft above cloud in VMC. They then received instructions from ATC with avoiding action to 'level-off' and within a few seconds received a TCAS RA to climb. The PF actioned the RA and the PNF informed ATC "EMB170 c/s TCAS RA". PNF had the ac visual at 12 o'clock same level and watched it pitch up rapidly and climb. The PNF commanded PF to descend and within a second TCAS commanded a reversal rapid RA descent. The other ac passed 100ft higher and slightly to their L, about 1nm away. He assessed the risk as high. TCAS was very useful in that they acquired the traffic visually before an RA was issued. ATC issued avoiding action at the same time as the TCAS RA so TCAS was followed. The crew was surprised by the reversal command from the TCAS.

**THE A319 PILOT** reports inbound to Heathrow IFR and in communication with London, squawking with Modes S and C. About 10nm NE of LAM while turning L from heading 300° towards LAM at 220kt and level at FL80, a TCAS TA was received owing to climbing traffic. The frequency was very busy so they were unable to notify ATC. Initially TCAS commanded a 'descent' RA so AP and PD were disengaged and the ac was started in a descent. ATC told the climbing flight to stop climb and, as a result, TCAS then changed to a 'climb' RA, demanding +5500fpm. At the time they were 1000ft above cloud between layers in IMC. The RA procedures were followed until they levelled at FL90 clear of the traffic, the other ac passing 150ft lower and 2nm laterally. ATC were informed and they descended back to their original level. He assessed the risk as high.

**THE LTC NE RADAR CONTROLLER** reports working as the NE/LAM controller in a relatively light but complex traffic situation with a Coordinator in position. The A319 was on a heading to pass N of LAM in order to provide lateral separation from a CAT B flight operating to the E of LAM at FL100. Thames Radar transferred the EMB170 flight to him on a heading against an inbound flight to them

through LAM. He climbed the EMB170 to FL90 underneath the CAT B ac without reference to the A319 and routed the A319 direct to LAM when it was clear of the CAT B. At the same time he had a Northolt to London/City positioning flight which was cruising at altitude 4000ft whilst Luton Tower telephoned the Coordinator requesting a release on a CLN departure. In order to facilitate this release he discussed with the Coordinator a plan involving the Coordinator calling Heathrow INT N to shortcut the flight to LAM through the Heathrow RMA. Concurrently an Elstree outbound flight called on frequency outside CAS and he issued a squawk and identified the ac as per SOPs. He spotted his mistake when the EMB170 was passing FL72 and when he attempted to pass avoiding action no reply was received. He again attempted to pass avoiding action and was met with a garbled response, possibly from both subject flights, indicating a TCAS RA. The flights quickly passed and reported back under his control.

**ATSI** reports that the Airprox in Class A CAS between an A319 and an Embraer E170 (EMB170) was reported by both pilots, NE of LAM at FL080.

The A319 was inbound London Heathrow from Prague and was in contact with LTC NE under a RCS. The EMB170 had departed London City Airport on a flight to Stockholm Arlanda and was in contact with LTC NE under a RCS.

LTC NE (LAM, LOREL and NE Deps sectors combined) was being operated by a single tactical controller supported by the LTC N Coordinator. There were no reported unserviceabilities and the controller was using Debden surveillance data on the situation display. The NE controller was on the first morning duty of a six day cycle. The controller had been detached from watch for the previous 2 cycles on operationally related projects so his last operational duty had been 2 weeks previous. The NE controller described the traffic levels as light with a high level of complexity.

ATSI had access to the following in the course of its investigation: LTC NE controller's report, A319 and EMB170 pilot reports, transcription of the LTC NE frequency (118.825MHz), recording of LTC Group Supervisor N's deskside, recorded area surveillance, ANSP unit report, TCAS Performance Assessment (NATS), Aircraft Operator's timeline of events [QAR download] and interview with the LTC NE controller.

The NE controller reported briefing as normal at the start of duty (0700 UTC). The controller's first session of the day was a busy 30min session commencing at 0730 on LTC NW, which the controller and his colleagues felt had gone well. The Controller reported that it was not unusual for the NE sectors to be band-boxed after the 'first-wave' of morning traffic. The controller took over from a trainee at 0900 and recalled being informed that a Category B flight was coming in to the sector to be worked at FL100. The controller was using the NE Deps situation display with the adjacent (LOREL) screen filtered to show LAM inbound and the smaller Essex planning screen above. On taking over, the controller described the traffic situation as 'normal' and 'quiet'.

At 0910:57 the A319 flight called LTC NE passing FL217 in the descent to FL150, having been transferred from LTC E 50nm E of LAM. The ac was following the LAM3A arrival for Heathrow. The LTC NE controller acknowledged the call. The previous ac into the LAM hold was in the process of being vectored off the stack by Heathrow INT N and there were no other ac inbound to LAM.

The controller described the A319 flight's first call as 'a bit early' but 'nothing unusual'. At the time, the controller was climbing a Luton DVR departure above its Standing Agreement level, which would have been MSL to LTC S, to LAC S15 levels. He did not remember whether he or the Coordinator initiated the coordination sequence for this ac. Other traffic at this time were 2 Heathrow BPK departures, 2 London City N'bound departures and a London City inbound via LAM. Due to the prevailing traffic the controller's focus of attention was in and around BPK. A non-standard positioning flight to London City (via BPK) had also just become airborne from Northolt.

At 0911 Elstree aerodrome called the LTC Group Supervisor N, requesting a clearance for a BE36 departure. The Elstree representative informed the GS that the flight would be '*ready in a few*

minutes'. The GS issued squawk 3411 with instructions to remain outside CAS, on track BPK and contact 118-825MHz.

LTC MATS Part 2 (GEN-144) states that Elstree will contact FDS NE to confirm that an appropriate flight plan is held. The allocated SSR code will be passed and the flight activated using the ETD provided. The MATS Part 2 also states (NTH-34) that for Elstree departures requesting clearance to enter CAS, Elstree will contact LTC Luton Approach who will coordinate an airways joining clearance with TMA N (the traffic having free-called Luton Approach and been placed under an appropriate service, NTH-29).

At 0912:32 the NE controller instructed the A319 flight to descend FL80 to be level 5nm before LAM. This was read-back correctly. The controller noted that the decision to give a level restriction to the A319 was predicated on the expectation that the Cat B flight would remain W of LAM at FL100. The controller reported previous dialogue with LTC Heathrow INT regarding ensuring adequate separation was assured by TMA for LAM inbounds against Cat B traffic. The controller recalled looking at the strips to descend the A319 and did not recall assimilating the actual position of the Cat B flight. The controller reported that Cat B flights operating in the vicinity of, but mainly W of LAM, were not an uncommon daily experience (described as 75% of the time).


The A319 fps was moved underneath the Cat B fps in the fps bay (see table below). The high-level Luton DVR departure was to be turned and transferred, a Stansted DVR departure had become airborne and he had resolved a conflict between a London City departure and London City arrival.

LTC Heathrow INT called NE to say that the Cat B flight was 'on-task': its location now being SE of LAM. Upon assimilating this, at 0913:59, the controller instructed the A319 flight to turn R 15°. The A319 was 33nm E of LAM and the pilot read-back the instruction stating that the new heading would be 280°. The controller stated that the heading would take it N of the standard inbound route and enable the A319's descent through the level of the Cat B flight. The controller noted that if the LAM sector had been operated independently then coordination would have been required with LTC NE Deps. In the present configuration this was not necessary. (Throughout the period of events the A319 was the only ac associated with the LAM sector; all other traffic was associated with NE Deps or LOREL). Heathrow INT N was controlling the Cat B flight. The NE controller stated that this was not unusual for these flights, particularly as they generally stayed W of LAM. The controller recalled that the Cat B fps stated '10 SE LAM' as the tasking area. For Cat B flights E of LAM, NE may elect to work the flight. The controller recalled there being only one Cat B fps, which was in the LAM fps bay. He could not recall there being, and was fairly certain there was not, a strip in the BPK bay.

Thames Radar requested approval to place a London City CLN departure (the EMB170) on a heading to vector against an inbound to London City via LAM; this was approved. The NE controller stated that the normal SID track of these departures would take the ac S of LAM before turning NE'ly. The SID climbs to altitude 4000ft. The controller stated that his default way of working London City CLN departures was to 'look at LAM, climb to MSL' and stated that it was a technique he taught his trainees. The EMB170 strip was located under the BPK designator.

The controller reported nothing untoward about the strip display\*:

LOREL	BPK	LAM	
	EGGW DVR dep ↑170		
	EGLC outbound	A319 ↓80	SND
	EGLC inbound	Cat B 100	
	EMB170 4A (EGLC-ESSA) 050°		



\* diagram for illustrative purposes and not wholly representative of all fpss.

At 0917:05 the EMB170 flight called LTC NE passing altitude 3300ft climbing to 4000ft on a heading of 050°. The EMB170 was tracking towards LAM, approximately 1nm SW of the VOR. At this time the NE controller was dealing with Luton ATC's second attempt to request release for a CLN departure and in discussion with the N Coordinator regarding accommodation of Luton's request.

The NE controller instructed the EMB170 flight to continue on its present heading and climb FL90 (which the controller stated was against the Cat B flight at FL100). The controller reported a 'fastest finger first' situation for Northolt and Luton departures via BPK, given the route convergence and altitude constraints in the area. The controller reported that the Northolt departure to London City had been released and then Luton subsequently called for a release but were instructed, "Negative, will call you back". Once the Northolt departure was airborne the controller reported that it was not unusual to receive a follow-up call from Luton Tower, as they could see the departure from Northolt airborne on their ATM. After the second call from Luton the controller recalled entering into a discussion with the N Coordinator about how to accommodate the Luton departure 'for expediency of the traffic'.

At 0917:40 the BE36 flight departure from Elstree called LTC NE, c/s only. The BE36 was squawking 7000, rather than the pre-assigned code '3411'. 7000 codes were filtered out from the NE controller's display. The NE controller asked the BE36 flight to confirm its altitude believing that the ac may be beneath the surveillance coverage on the sector. The BE36 pilot replied, "...just climbing up to two thousand three hundred two thousand four hundred er towards BPK..." The NE controller instructed the BE36 flight to select Mode A 3411 with ident. This instruction was read-back initially by the Northolt-London City positioning flight, closely followed by the BE36 pilot's reply.

The controller believed the MATS Part 2 procedures for Elstree departures were for the aerodrome to call FPS S and, via the Coordinator, be passed a release time, squawk and any other information (such as remain clear). A tick would be placed against the squawk by the ATSA. There was no such tick on the NE controller's fps. The controller recalled that usually Elstree departures would be seen as code-c/s converted data blocks before the flight called on frequency. When the BE36 pilot called, the controller's initial thoughts were 'who?' and he started to look for a strip. The Coordinator was also looking on the situation display and pointed out a filtered-out position display symbol in the vicinity of Elstree. When the controller issued the 3411 squawk to the BE36 flight he recalled momentarily being confused as he believed he heard a foreign accent take the call (which was the Northolt – London City flight).

Immediately after hearing the BE36 pilot's reply the controller, at 0918:22, stated, "*Thank you. Break. [A319 c/s] resume own navigation direct to LAM*". The controller recalled that saying 'thank you' was an indication to himself that his doubt about the errant read back had been cleared. At this time the A319 and EMB170 were 8nm apart: the A319 on heading 280° passing FL082 for FL080 with the EMB170 8nm SW of the A319 climbing through FL063 for FL090. The EMB170 was between the A319's present position and LAM. When questioned about this point in the sequence of events the controller believed a certain amount of tunnelling had taken place i.e. only the Cat B flight and A319 figured in his visual scan – not the EMB170. The EMB170 was not in a 'normal position'.

After instructing the A319 flight to resume own navigation to LAM the controller's attention then turned back to the BE36 stating, "*(BE36 c/s) you're identified two miles er southwest of Brookmans Park it's a Basic Service only outside controlled airspace*". The BE36 pilot responded at 0918:37 by asking if the controller wished the ac to route towards LAM before CLN.

STCA between the EMB170 and A319 activated at 0918:42 as the NE controller responded to the BE36 pilot's question.

Immediately prior to recognising the conflict the controller's intention was to issue a joining clearance to the BE36 flight. The controller could only recall seeing 'the situation' e.g. the conflict, he could not recall if STCA had alerted him to the fact or not. He immediately realised his error and instructed the EMB170 flight, "*(EMB170 c/s) avoiding action stop climb immediately*" (0918:49). The controller recalled his immediate thought was to stop the EMB170. He believed he said 'stop climb' because the ac was still climbing. His next immediate thought was 'that's vertical avoidance – do something laterally'.

The NE controller then gave lateral avoiding action to the EMB170 flight at 0918:52, “(EMB170 c/s) *avoiding action turn right heading one eight zero degrees*”. The EMB170 pilot responded, “TCAS R A”.

The NE controller was aware of the MATS Part 1 requirements for non-intervention in TCAS encounters. He knew not to give avoiding action to the A319 and recalled accepting that the situation was now ‘hands-off’. There then followed an unidentified transmitter switch non-modulation as the STCA changed to a high-level alert.

The EMB170 received a Traffic Alert (TA) at 0918:39 and, gaining a visual sighting of the A319, slowed its ROC. The crew reported that the NE controller’s instruction to ‘stop climb’ (0918:49) had no bearing on the crew’s actions as at 0918:51 the EMB170 received an RA ‘Climb’ [‘Maintain v/s – crossing’]. Additionally, the NE controller’s lateral avoiding action at 0918:52 was not heard in the cockpit due to cockpit noise. Post incident the crew of the EMB170 described how they had initially observed their closure with the A319 and took the precaution to reduce their ac’s ROC. They recalled that the controller’s “stop climb” instruction came as the first TCAS RA was received – the latter being followed as per company SOP. The crew also clarified that the EMB170 TCAS generated ‘RA reversal’ came after the Pilot-Non-Flying had observed the A319’s change in pitch attitude.

The A319 crew recalled that, prior to the encounter, they had been aware of the EMB170’s clearance to FL90 and therefore remained vigilant. The A319 received a TA at 0918:39 as the ac commenced its L turn and this was upgraded to a RA ‘Monitor v/s’ at 0918:52 before 1sec later at 0918:53 it changed to an RA ‘Descend’ [‘Descend, crossing descend’]. The A319 crew reported that all RA commands were followed as per company SOP.

The TCAS software used on both ac, when calculating the geometry required to avoid conflict, factors in a 5sec delay in pilot response to a commanded RA and reduces the anticipated response time in an RA-reversal to 2.5sec.

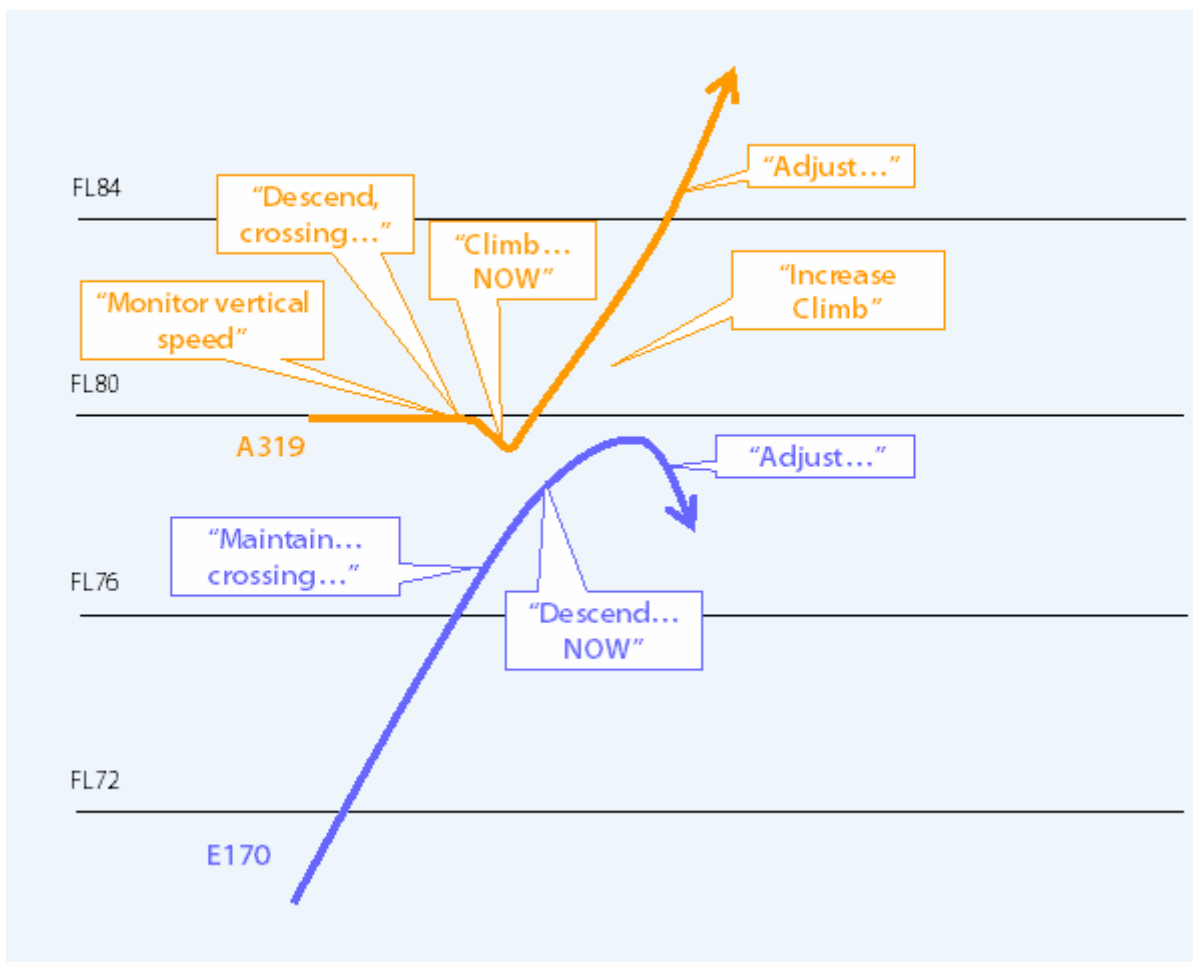
At 0918:57, the EMB170 received an RA reversal, being instructed to descend [‘Descend now’] and 1sec later at 0918:58 the A319 also received an RA reversal to climb [‘Climb, climb now’]. The A319’s TCAS also then instructed an ‘Increase climb, increase climb’ at 0919:02.

At 0918:59 the Northeast controller asked the A319 flight, “(A319 c/s) *have you got TCAS?*” There was another unidentified transmitter switch non-modulation, and 6sec later the NE controller transmitted, “(A319 c/s) *London*”, which was answered by the A319 crew, “...TCAS RA”. The NE controller requested that the A319 crew report when clear of conflict.

Surveillance analysis at 0918:39 shows the EMB170 climbing through FL069 when it received a Traffic Alert; the A319, level at FL080, receives its TA at the same time. The EMB170 continued its climb to FL075, at which point at 0918:51 the first RA (“Climb”) was received. The ac were laterally separated by 4.7nm and the A319’s L turn was not observed to be taking effect yet. Seven seconds later as the EMB170 reached FL077 [0918:58] the RAs were reversed: the distance between the ac now being 3.7nm. Separation was lost at 0919:00 with only 2.8nm and 200ft between the ac. The A319 was then recorded as descending for a short period [between 0919:00 and 0919:06 from FL080 to FL079: separation 100ft/1.9nm] before climbing 600ft in 6sec [0919:12 separation 700ft/1nm] and eventually passing FL089, when vertical separation was restored at 0919:18. At this time, the CPA, the ac passed abeam each other by 0.2nm, 1300ft apart.

At 0919:26 the EMB170 flight reported clear of conflict and at 0919:30 the A319 flight reported, “*clear of conflict returning to Flight Level 80*”.

At 0919:38 the EMB170 flight was instructed to resume its own navigation to CLN and at 0920:01 the A319 flight was transferred to Heathrow Director.



Graphic above courtesy of Eurocontrol from an ACAS II Bulletin.

The NE controller was relieved at 0920:31.

There were no external factors affecting the controller's performance prior to the incident. Operationally, the controller's traffic mix was complex including:

- Non-standard Northolt to London City positioning flight
- Request from Luton for a departure release
- Category B flight operating in an area not usual for the task
- Facilitation of climb for traffic exiting to LAC S15
- EMB170, London City CLN departure, off-SID route to facilitate a London City inbound
- Elstree departure: airborne without the allocated Mode A code and calling LTC Northeast direct
- All other standard TMA traffic.

The A319 was the only ac into the LAM hold and was transferred to the NE sector 50nm prior to the hold. The controller's interaction with the aircraft on its route to LAM was minimal: one descent instruction and one heading instruction.

The EMB170 was off-route and not where the controller would normally expect it to be. The controller, usually having a habit of climbing these departures to MSL only, chose to climb the EMB170 to FL090, underneath the Cat B flight at FL100.

All displays were functioning correctly and the fps outfall was normal for the sector.

The BE36 was an unpre-empted addition to the controller's traffic. As the ac was not displaying the allocated Mode A code it was not immediately apparent to the controller. ATSI were unable to determine why the BE36 was not displaying the 3411 squawk passed to the Elstree representative. ATSI could not determine if there was evidence of the BE36 flight having called LTC Luton Approach prior to its call to NE.

As the controller finished dealing with the BE36 he chose to instruct the A319 flight to resume its own navigation to LAM as it was now beneath the Cat B flight. The controller's next intended action was to join the BE36 into CAS.

In instructing the A319 flight to resume its own navigation the controller did not to ensure separation with the EMB170. The controller did not detect, from the situation display, the presence of the EMB170 between the A319 and LAM. Hence the controller's description of 'tunnelling' of information, resulting in him not integrating all the information available to him i.e. the presence of the EMB170 display symbol.

The controller had forgotten the presence of the EMB170, having previously climbed it underneath the Cat B flight and through the level of the A319. This omission was likely caused by an overload in working memory at the time – his capacity and plans having been changed whilst dealing with the BE36.

As the event occurred, the controller attempted to issue avoiding action; however once the EMB170 stated that it was acting in accordance with a TCAS RA, the controller allowed the ac to act upon their TCAS instructions without further interruption.

The rapid evolution of the encounter prompted several TCAS resolution commands in each ac. All of which were followed in accordance with procedure by both crews.

The Airprox occurred on the LTC NE sector, 10nm NE of LAM at FL080 when the NE controller turned an A319 into conflict with an EMB170. The A319 flight was at FL080 and had been instructed to resume its own navigation to LAM. The EMB170 was climbing to FL090 on a heading of 050°. The minimum distance between the ac at 0919:12 was 1.0nm/700ft (approximately 6116ft ac-to-ac distance). The event was recovered by TCAS.

Analysis of the incident determined that the controller, having experienced a tunnelling of the information displayed to him, did not integrate the position of the EMB170 into his decision to turn the A319 towards LAM.

The controller, being competent in accordance with unit procedures, experienced a complex workload comprising of non-standard flights, non-standard ac routings, a request to join CAS from an unanticipated Elstree departure and operational pressures to release ac from Luton.

The issues concerning the Elstree departure have been addressed by LTC and Elstree: namely, unit personnel have been reminded of the correct procedures for departures and the AIP has been updated to advise pilots that they are to call LTC Luton Approach on departure.

Recommendations:

There are no CAA ATSI recommendations as a result of this incident.

ATSI note that a comprehensive investigation by the ANSP, in conjunction with the Aircraft Operator, has produced a set of actions and recommendations including:

Alignment of procedures for Elstree, TC North, Luton Approach and the General Aviation community.

Lesson learning and training scenario activities; including unit safety day events and dissemination throughout the unit in accordance with their Safety Management System.

Incorporation of aspects of this event into pilot/controller interface meetings.

Presentation of this event, the subsequent findings and outcomes to the EUROCAE Working Group responsible for TCAS.

The incident has also been recommended for the purposes of lesson learning and TCAS training by the ac operator.

## **PART B: SUMMARY OF THE BOARD'S DISCUSSIONS**

Information available included reports from the pilots of both ac, transcripts of the relevant RT frequencies, radar video recordings, reports from the air traffic controllers involved and reports from the appropriate ATC and operating authorities.

Members commended the comprehensive ATSI report which had covered all aspects of the Airprox thoroughly. The controller had acknowledged not taking the A319 into account when he cleared the EMB170 flight to climb to FL90, beneath the Cat B flight at FL100, and this placed the 2 subject flights into conflict and had caused the Airprox. He had not detected the potential for conflict from the fpps or radar display and the situation was compounded when he released the A319 flight to resume its own navigation towards LAM. Pilot Members agreed that both crews had shown excellent SA and airmanship during the encounter, particularly when faced with a TCAS reversal. The CAT Members and the FOI Advisor agreed that it is known to be difficult to create realistic simulator training for RA reversals occurring against a single ac; the usual scenario used involved 2 separate ac. The EMB170 crew had noticed the A319 on TCAS and realised that their flightpaths were in conflict. They had received a TA, visually acquired the A319 early and reduced their ROC. A pilot Member informed the Board that the crew's actions were the natural reaction when faced with traffic converging from above but that the TCAS TA was only the first part of the ACAS algorithm, effectively a 'heads up' to get ready to react if an RA follows. In this case the ACAS system calculated that a 'crossing climb', through the A319's level was the best resolution for the EMB170 and generated an RA to that effect; the EMB170 crew had only just started to reduce their ROC at the time. The crew followed the TCAS guidance, cognisant of the controllers 'stop climb' instruction, and informed him of the RA after an avoiding action turn had been issued. The A319 had received coordinated TCAS guidance, a momentary 'monitor v/s' before a 'descend' RA was generated. However these RAs were reversed 6sec later, the EMB170 crew seeing the A319 'pitch-up' just before receipt of their 'descend' RA. The Board considered whether it had been the EMB170's reduced ROC immediately prior to the first climb RA that resulted in the subsequent reversal. While it was possible that the reduced ROC may have had an effect, the Board noted that the ROC did not reduce below 500ft/min and the A319's left turn towards LAM also contributed to the changing geometry. As it was, both crews reacted promptly to the new RAs, the A319 crew achieving a 600ft increase in level in 6sec whilst the EMB170 crew stopped their climb and achieved a 200ft descent. Shortly thereafter, the ac passed with 1300ft of vertical separation, displaced by 0.2nm. These prompt and robust actions taken by the crews were enough to allow the Board to conclude that any risk of collision had been quickly and effectively removed.

## **PART C: ASSESSMENT OF CAUSE AND RISK**

Cause: The LTC NE controller did not take the A319 into account when he climbed the EMB170 into conflict with it.

Degree of Risk: C.