

FINAL REPORT

OF

THE EMERGENCY EVACUATION

ON UL 557 / 11.04.2001

AT COLOMBO AIRPORT

KATUNAYAKE

To : Mr. Lal Liyanaarachchi
Director General Of Civil Aviation/Chief Inspector Accidents

18th February 2002

Dear Sir,

EMERGENCY EVACUATION OF UL-557/ 11TH APRIL 2002

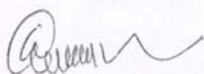
Pursuant to section 266 (1) & 267 Of the Air Navigation Regulations, you appointed us as the Inspectors of Accidents & gave us the powers to conduct the above incident. The attached is the final report of the said incident for your kind perusal & information.

Aircraft Model : Airbus A 330

Aircraft Registration : 4R ALD

Nature of Accident: Smoke ingestion into the cabin resulting in evacuation of the aircraft which led to a death & injuries to passengers.

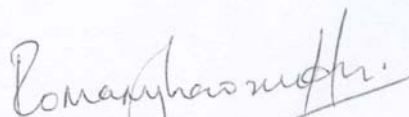
Thank you,



Mr. N A N Senaratne



Mr. Priyantha Fernando



Ms. Romany Lawrence-Hewa

EMERGENCY EVACUATION OF UL 557 - 4R-ALD

11TH APRIL 2001 AT COLOMBO AIRPORT

Synopsis

On 11 April at about 0613 local time, UL 557, an A330 was to depart from Colombo airport and proceed to Frankfurt, Germany. On board there were 18 passengers in Business Class and 120 in Economy. The crew consisted of two Captains (one was a relief Captain), one First Officer and 11 flight attendants. While taxiing out for departure, prior to entering the runway, the aircraft rapidly filled with smoke, which resulted in the Captain ordering an emergency evacuation of the aircraft. The cause of the smoke was the result of a failure of a bearing in the APU, which resulted in considerable APU oil being released into the bleed air system. During the emergency evacuation four passengers sustained injuries, one of whom expired four days after the accident as a result of head injuries sustained during a fall from the emergency evacuation slide.

1.0 Factual Information

1.1 History of the Flight

There was a flight crew of two Captains and one first officer assigned to the flight. The relief Captain was seated in the business class section of the aircraft prior to the incident in a seat assigned to flight crew as a rest facility. When the relief Captain noted the smoke he proceeded to the cockpit to see if he could assist the crew.

A passenger was seated in the jump seat of the aircraft – a ten year old boy whose mother was seated in business class.

Engine start commenced at 0558 and all was normal until the aircraft commenced taxiing. While taxiing for takeoff from runway 22 at Colombo, the EVAC light and horn sounded at about 0605 local time (neither the purser or Captain had commanded the system to activate). While the flight crew/cabin crew were able to silence the horn, the EVAC light remained illuminated, so the aircraft was halted. The Cabin Crew had completed the emergency demonstration and the pre recorded before take-off announcement was active when the Evacuation Alert, with chimes and horn activated. The Purser advised the Captain that the EVAC light in the cabin was illuminated and the Captain advised him to ignore the light (he had not activated the system), as the matter was being discussed by Engineering. Engineering advised the Captain to reset CIDS CB's after which the EVAC light extinguished. After resetting the circuit breakers the EVAC horn again sounded briefly.

The Captain continued taxiing the aircraft and after completing the Before Take-off check was cleared by ATC to position on the runway. At this stage the crew noticed the smell of burning oil followed by smoke and the aircraft was stopped before the holding line for Runway 22 on taxi way alpha and the parking brake set.

At the same time numerous Cabin Crew advised the Captain of excessive smoke in the cabin through the interphone, after which the Purser entered the cockpit to advise the Captain of the situation. The Captain could at this point see that the cabin smoke was quite thick and he advised the Purser that he would be conducting an emergency evacuation. In some parts of the aircraft the smoke was so thick that Cabin Attendants could not see across the aircraft and had difficulty seeing how to activate the doors.

The crew had donned their oxygen mask and the Captain requested the Evacuation Checklist. He completed the checklist from memory as the first officer was contacting ATC to advise them of the emergency evacuation. After completion of the checklist a flight attendant arrived and asked the Captain if everything was all right. The Captain indicated that all was in order and that the Flight Attendants should depart the aircraft as well.

The doors were opened as follows:

L1 door – The Purser opened the door in armed mode, the slide inflated, and passengers were evacuated.

R1 door – Leading Steward opened the door in armed mode, the slide inflated and passengers were evacuated. The First Aid Box was taken.

L2 door – Leading Steward opened the door in armed mode. The Slide did not fall out. He pulled the manual inflation handle, the slide inflated and the passengers were evacuated. It was noted after the evacuation that there were numerous pairs of shoes at this door, as the Leading Steward at this door had requested passengers to remove their shoes prior to evacuating the aircraft.

R2 door – Flight Stewardess (G2) opened the door in armed mode. The slide fell out but did not inflate. She did not pull the manual inflation handle. She shouted to the L/S opposite saying that the exit cannot be used. At the same time, she blocked the exit and redirected passengers. (Note: After approximately 10 – 15 minutes it was noted by crew outside the aircraft that the slide inflated)

L3 door – Flight Stewardess (S4) opened the door in armed mode. The slide pack did not fall out. She did not pull the manual inflation handle. She blocked the exit and redirected passengers. ((Note: After approximately 10 – 15 minutes it was noted by crew outside the aircraft that the slide inflated)

R3 door – Flight Stewardess (S2) opened the R3 door in armed mode, slide inflated and passengers were evacuated.

R4 door – Leading Stewards (L/S 3) opened the door in armed mode. He had to push the door and finally kick it to get the door to open. The slide inflated. After he evacuated all passengers (in his area) he went to R3 to assist. As he felt the slide was too steep and unsafe for passengers, he blocked the exit and redirected passengers to other exits. The First Aid box was taken by the flight attendant.

L4 door – Leading Stewards (G4) opened L4 door in armed mode. He also had to push the door and finally kick it to get the door opened. The slide inflated and the passengers were evacuated.

POST EVACUATION

The passengers had gathered in 3 areas near the L4, R4 doors and towards the front of the aircraft. Some passengers tended to drift towards the runway and the Cabin Crew had to shout and get them to move away.

Cabin crew assisted the passengers who were injured assisted by a passenger who was a nurse.

A child who had sustained a serious head injury was carried by a cabin crewmember towards some buildings, accompanied by the mother. En-route to the buildings they were met by the ambulance which was coming behind the fire truck. The child and mother were then dispatched by the ambulance to receive medical care

The first passenger who evacuated from L1 had broken her ankle, so the Cabin Crew carried the passenger away from the aircraft. After approximately 30 minutes a 2nd ambulance arrived and the injured passenger was sent in this ambulance.

There was a passenger who was pregnant who had started bleeding. This passenger was sent to the Terminal Medical Center in a Ramp Service Vehicle.

It took approximately 35 minutes before a bus arrived and approximately 45 minutes for all passengers to be dispatched to the Terminal Building.

1.2 Injuries to Persons ✓

There were four passengers with significant injuries. The first passenger evacuating down L1 fractured her ankle. Another passenger suffered a miscarriage. A child passenger was unconscious after the evacuation due to a head injury. A forth passenger fell off the slide and sustained a head injury. All passengers recovered from their injuries with the exception of the forth passenger who died from his head injury four days after the incident.

1.3 Damage to Aircraft ✓

There was no damage to the aircraft.

1.4 Other Damage

The smoke was a result of the failure of load compressor thrust bearing which was damaged allowing oil ingestion into the APU bleed air duct. The APU was subsequently removed and sent for detailed investigation.

1.5 Personnel Information

There were three flight crew (one of whom was a relief Captain) and eleven cabin crew on board the aircraft. All crew were fully qualified for the flight. The aircraft was departing from the main base and all crew had received adequate rest prior to the flight.

1.6 Aircraft Information

The aircraft 4R ALD is an A330 that was acquired new from Airbus Industries approximately 15 months prior to the accident. The C1 check had been completed between the 20th and 26th of March at A/F hours 5562.36.

Prior to undertaking flight UL557 on 11 April, the aircraft had operated to Male, returning to Colombo at 0120. There were no reported defects and the aircraft was released for flight UL557 at 0550 as scheduled.

Sri Lankan utilises GTCP 331-350 Auxiliary Power Unit that was installed in the aircraft in January 2000. The APU had completed 2805hours/2413 cycles prior to the accident. During the past year there had been three defects on the APU, none of which could be related to the failure that subsequently occurred.

1.7 Meteorological Information

The weather at the time of the incident was clear but as a result of the reduced visibility in the early morning light the tower was unable to see the aircraft which was at the far end of the airfield.

1.8 Aids To Navigation

Not pertinent.

1.9 Communications

The investigator listened to the tapes of communications from the tower. Various communications channels such as ground, air, fire and rescue, SriLankan Airlines and area mike were available. The information below does not contain details of all transmissions but only those that were considered pertinent to the investigation.

Tower

0613.02 - 1st Officer contacted the airport tower to advise them that they would need to hold on the taxiway.

0613.30 - 1st Officer makes further contact with the tower to advise that they will be conducting an emergency evacuation. The tower personnel did not understand the implications of an emergency evacuation and it required four communications with the tower before it was understood that the emergency evacuation would take place on the taxiway.

0616.30 – tower makes 1st attempt to contact SriLankan 557. Additional seven attempts made later to try contact the flight crew of the aircraft

0626.00 – SL 264 cleared to land on Runway 22. Advised that there is a disabled aircraft holding short on taxiway Alpha and that an Emergency Evacuation is being carried out.

0628.17 – SL 264 advises the tower that a group of passengers is standing close to the runway 22 end.

Fire station/fire vehicles

0614.40 – Fire station advised that Airbus 330 on Alpha emergency local

0615.36 - Full emergency declared

0628.27 - Fire 4 request tower to contact Sri Lanka engineering to come and open the cargo holds

0629.00 - Fire 4 requested by tower to keep the passengers back from the runway

0630.46 – Fire 4 advise that passengers clear of the runway but that smoke is coming from cargo hold of aircraft – again request tower to contact SriLankan engineering.

0635.30 – Fire 4 again request tower to contact SriLankan engineering to open cargo doors as fire may be in the hold.

0638.20 – Fire 4 advise tower that SriLankan engineering have yet to arrive

0640.00 – Fire 4 advise tower that SriLankan engineering have arrived

Tower Mike

0618.38 – Tower contacts the radar ATC to ask what is an emergency evacuation

0619.41 – Radar asked by tower to inform duty manager

0627.30 – Tower advise that they are Local Standby due to emergency evacuation

0629.27 – Tower advises that they are Local Standby

0634.10 – Full emergency declared

1.10 Aerodrome Information

Not pertinent.

1.11 Flight Recorders

The Flight Data Recorder was secured but due to the fact that the information on the FDR was not pertinent, it was released by DGCA to Sri Lanka. The CVR was sent to DGAC France who provided a tape of the recording. With the exception of radio transmissions, the audio quality of the tape was not good. However, the CVR did confirm the statements of the flight crew who were interviewed after the incident.

1.12 Wreckage and Impact Information

Not pertinent.

1.13 Medical Information

Not pertinent.

1.14 Fire

While there was considerable smoke involved due to the large amount of APU oil that was released into the bleed air system, there was no fire.

1.15 Survival Aspects

Not pertinent.

1.16 Tests and Research

The APU was removed from the aircraft and sent to Honeywell for investigation.

The Manufacturer has carried out a detailed study during dismantling and investigation of the failed unit in presence of Operator's representative. Their report indicates that this failure is unique and typical. There was no lapse on the part of maintenance hinted by the manufacturer for this failure.

The investigation revealed that the Load Compressor thrust bearing was damaged creating excessive axial movement of the Load compressor Rotating Group.

It was observed that installed thrust bearing revealed heavy rub indications on the aft end of the inner race and a fracture on the aft end of the bearing cage. The forward side of the bearing retainer showed rub damage that was caused by the contact with thrust bearing inner race. The rubbing machined the bearing retainer sufficiently to intersect the oil supply receptor port on the left side of the retainer. The intersection resulted in a through hole of the oil supply port. The oil nozzle was machined close to the size of the oil port due to rubbing with the inner race. This effectively increased the oil supply to the bearing allowing oil migration into the Load Compressor bleed path.

Manufacturer has issued an Operator Information Telex on 24th April 2001 and further issued a revision on 9th July, where in they have mentioned that the investigation team is actively

reviewing several design change options to ensure that failure of the APU Load Compressor bearing will not lead to similar oil migration into the aircraft bleed system. Final design change selection will be completed in Sept 2001.

1.17 Additional Information

A Post Flight Report was requested for the accident aircraft. From the Post Flight Report downloaded subsequent to the incident it is observed that "APU Oil chip detection" class 2 fault message was generated by the ECB at 0003 UTC i.e five minutes after the first engine start. This message being of Class 2 was not known to the commander. When A.P.U bleed was used for cabin pressurisation the leaked oil in the bleed duct was sent to the cabin creating smoke condition.

2.0 Analysis

2.1 General

The evacuation of the aircraft was required due to the large quantity of smoke presence of unknown origin. Fortunately, there was no fire to contend with and the aircraft with only 138 passengers was only about half full. This enabled the aircraft to be evacuated in a timely manner despite some of the difficulties encountered.

2.2 Evacuation Issues

2.2.1 Three of the slides did not activate automatically and while one of these slides was manually activated the other two slides (R2, L3) were not and as a result those two doors were not available for evacuation. Most likely the manual activation of these slides would have been successful based on the fact that approximately 10 minutes after the evacuation was completed both slides inflated. In addition, door R3 was blocked in error by a crew member as he was not aware that the inflated slide would be quite steep. While aircraft are certificated with sufficient door capacity to permit evacuation of all passengers within one minute thirty seconds, with half the doors blocked, there have been many instances where the rapid spread of a fire has not permitted all passengers to egress the aircraft in a timely manner. In addition, in the case where the aircraft is fully loaded and there is a fire outside the aircraft, it is imperative that all doors on the opposite side of the fire are available.

2.2.2 One of the flight attendants requested the passengers to remove their shoes at the door prior to evacuating the aircraft. While this was previously the practice at Sri Lankan airlines it was changed a year prior to the incident. The removal of the shoes at the door of the aircraft would seriously delay the evacuation of the passengers from that door of the aircraft.

2.2.3 The jump seat is not certified for the carriage of passengers, yet a ten year old child was occupying the jump seat at the time of the accident. In the event of an emergency there is no flight attendant to assist with the evacuation of a passenger in this seat of the aircraft, nor does the jump seat contain a passenger briefing card or drop down mask. In an emergency situation the flight crew are required to perform critical duties and having a passenger in the jump seat, especially a child, can only be a distraction to the performance of these duties. The Captain indicated that during the evacuation he did gesture to the child to leave the cockpit.

The relief Captain, although part of the flight crew, was seated in a Business Class seat. This seat is reserved for the flight crew to provide a rest facility when free from duty. Upon noting the smoke he proceeded to the cockpit to see if he could assist the flight crew. While the Operations Manual does not require him to be in the cockpit for the takeoff or landing, if he had been seated in the cockpit from the start of the flight he would have been better positioned to assist the crew as required.

2.2.4 There were numerous instances where the lack of clear communications resulted in delays in the implementation of the Airport Emergency Plan. The first of these occurred as a result of the lack of understanding by tower staff of an Emergency Evacuation. When the first officer informed the tower that there was smoke in the aircraft and that they would be conducting an emergency evacuation the tower cleared the aircraft to taxi. Later the two controllers are heard discussing with each other what is an emergency evacuation and they contacted the radar controller (a senior controller) to ask him what is an emergency evacuation. Well after the aircraft has been evacuated the tower attempted on numerous occasions to contact the aircraft, not fully understanding the implications of an emergency evacuation (no one is on board the aircraft).

As a result of this lack of knowledge a full emergency was not declared until 0634, almost 20 minutes after the emergency evacuation. In addition, an aircraft was cleared to land on runway 22 even though the tower was not aware of the status of 138 passengers who were located in the threshold area of runway 22. It was only later, after the tower was informed by the SriLankan flight which had just landed that there were numerous passengers located at the edge of the runway, did they ensure that the runway was clear.

The communications between the fire crews and the tower were also imprecise and as a result there was considerable delay in the arrival of Sri Lankan staff to open the cargo holds. While the fire staff requested Sri Lankan engineering to come and open the cargo hold, during the early requests no mention was made by the fire staff of the urgency of the situation (smoke was coming from the cargo hold and it was suspected that there may be a fire in the hold).

It is noted that at 0603 the maintenance electronic reporting system, recorded a Oil Chip Detection in the APU, which was probably a result of the bearing failure releasing metal into the system, thereby activating the message. Although oil was most likely being released into the APU bleed system, it would not be released into the aircraft bleed system as the engines were running and the bleeds selected to engines. It would be about 10 minutes later when, just prior to takeoff, the first officer selected bleeds to APU, that the large amounts of accumulated oil in the APU bleed system would be released into the aircraft bleed system. The Flight Crew are not aware of any Class 2 Messages as these are not considered critical items requiring maintenance action. If the message had been a Class 1, the crew would have been alerted, would shut down the APU and could have returned to the gate for maintenance inspection. This would be especially important for ETOPS.

3.0 Conclusions

3.1 Due to the failure of a bearing in the APU, oil was permitted to seep into the APU bleed system.

3.2 While there was a warning of the bearing failure, this was not known to the flight crew as it was a Status 2 message (only Status 1 Messages are displayed to the flight crew).

3.3 Prior to take-off, as the SOP for Sri Lanka is to conduct the takeoff with APU Bleed - On, the first officer selected bleeds on APU.

3.4 Considerable oil had accumulated in the system and when in contact with the hot APU bleed air, considerable smoke was released into the cabin and cockpit.

3.5 Due to the large volume of smoke released into the cabin/cockpit for which the source was unknown, the Captain was left with no choice but to conduct an emergency evacuation.

3.6 During the evacuation four passengers sustained injuries due to the hazards associated with evacuation of the aircraft utilising emergency slides. One passenger later died as a result of his injury.

3.7 A passenger was sitting on the cockpit during the incident.

3.8 The relief Captain was seated in business class where a seat is provided for relief crew to rest.

3.9 There were some delays to the evacuation of the passengers due to the fact that two slides did not inflate. Also, at another door, egress of passengers was delayed, as passengers were required to remove their shoes.

3.10 An aircraft was allowed to land on runway 22 even though passengers were located at the edge of the runway and the status of the incident aircraft was not clearly understood.

3.11 Airport Emergency response plan was not effectively implemented due to lack of effective communications and lack of understanding of the nature of the emergency situation.

3.12 As there was no fire or many serious injuries, the delays in implementation of the Airport Emergency response plan did not have serious consequences.

4.0 Recommendations

4.1 A full investigation of the failure be conducted by the manufacture and modification of the system be examined to prevent migration of oil into the bleed system.

4.2 The manufacture be requested to upgrade the message ATA 462134 – Oil Chip Detection to Status 1.

4.3 Regulations and/or company Operations Manual to be amended, to clearly state that no passengers are to be seated in the cockpit.

4.4 Regulations and/or the company Operations Manual to be amended to require the relief pilot to be in the cockpit from start to top of climb and again from top of descent to shutdown.

4.5 The Cabin Crew training programme be reviewed and amended as appropriate to ensure that Cabin Crew are provided with hands on training on both the automatic and manual opening and activation of doors/slides.

4.6 The Cabin Crew training programme to be reviewed and amended as required to ensure that emphasis is placed on the timely evacuation of passengers.

4.7 Training to be provided to air traffic controllers and other airport staff as required, on the emergencies that could be encountered by aircraft and the implications of these emergencies on air traffic control and airport operations.

4.8 Air Traffic Control procedure to be reviewed to ensure that during emergency situations that priority is given to the emergency situation as opposed to the normal flow of traffic.

4.9 The Airport Emergency Response Plan to be reviewed to ensure that deficiencies outlined in this report are rectified. In addition, the plan should be tested with a mock scenario to validate it's effectiveness.