

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 777-336ER, G-STBA
No & Type of Engines:	2 General Electric Co GE90-115B turbofan engines
Year of Manufacture:	2010 (Serial no: 40542)
Date & Time (UTC):	2 July 2021 at 0945 hrs
Location:	London Heathrow Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 16 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	17,000 hours (of which 10,300 were on type) Last 90 days - 91 hours Last 28 days - 24 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A FIRE CARGO AFT warning illuminated during the pre-start procedures. The crew were advised by RFFS to conduct a rapid disembarkation via an airbridge. One cabin crew member suffered minor injuries during the disembarkation.

The fire warning was triggered when a short circuit in the battery pack of a refrigerated container in the aft cargo hold caused heating of cables and smoke. Safety action was taken by the operator and container manufacturer to reduce the probability that damage to a container would lead to such an event again.

History of the flight

During the pre-start procedures a FIRE CARGO AFT warning illuminated, and the fire bell audio warning sounded. The crew actioned the FIRE CARGO AFT checklist from the Quick Reference Handbook (QRH). If the aircraft is on the ground with cargo doors open the FIRE CARGO AFT checklist states that the checklist should only be accomplished if there is an actual fire. Therefore, the additional co-pilot on the crew was asked to go to the cabin and investigate. He initially went to the rear of the aircraft cabin and looked out from the windows to the area of the rear cargo door. He could see that the door was open but at this point there were no signs of fire or any fumes in the cabin. He returned to the flight deck and reported these findings to the commander.

The additional co-pilot then went outside the aircraft to liaise with the loading crew and to ascertain if there was an actual fire. Due to the long airbridge jetty there was a significant elapsed time before the co-pilot reached the ground. On board, the cabin crew reported to the commander that there were acrid fumes in the passenger cabin. The commander decided to pause the FIRE CARGO AFT checklist to instead commence the SMOKE, FIRE AND FUMES checklist. Shortly after the FIRE CARGO AFT occurred, the indications cleared indicating that the relevant condition was no longer being sensed.

A public address (PA) broadcast was made to alert the cabin crew and a PAN call was made by RTF to alert ATC and to request fire service assistance. The PA to the crew was an *'Attention Crew! At Stations'* call which is intended to prepare the cabin crew to respond to an emergency situation. It requires all cabin crew members to go to their allocated seating positions adjacent to exit doors. So, in response to the call some of the crew were positioned toward the rear of the aircraft in the area of the fumes.

As the additional co-pilot approached the rear cargo hold, he saw two of the loading team running clear of the aircraft. They reported to him that there were acrid fumes in the rear cargo hold. Immediately after this conversation, the RFFS arrived and the co-pilot had a brief discussion about the situation with the RFFS commander. The RFFS commander then told the co-pilot that he wished the aircraft to be cleared of personnel.

The additional co-pilot returned to the aircraft to pass on the direction for a precautionary disembarkation of the aircraft via the air bridge which was connected to the left No 2 passenger door. After informing the commander, the additional co-pilot was directed to inform the cabin crew. The APU was shut down and the aircraft secure checklist was completed, and the crew left the aircraft via the airbridge. During the disembarkation one of the cabin crew tripped on a cargo net which was being used to secure cargo in the passenger cabin. The total time from the fire warning sounding to all crew being off the aircraft was approximately 8 minutes.

Organisational information

The use of the *'Attention Crew! At Stations'* Call is described in Part B of the Operator's Operations Manual (OMB). The relevant section is shown in Figure 1.

The OMB gives the information at Figure 2 for the use of a rapid disembarkation PA. The commander was aware of this PA but considered its wording to be inappropriate for the situation.

ALL
3.2.1 Hazard Call

On the ground, if a potentially hazardous event occurs that requires all cabin crew to have an increased level of alertness, the Commander shall make the announcement:

"ATTENTION CREW! AT STATIONS!"

This announcement should be made as soon as the aircraft has come to a stop with the parking brake set. It should be prioritised alongside any initial technical actions required by QRH and/or electronic checklists. The announcement can be used on the ground from when the aircraft doors are closed for departure until the aircraft doors are opened for disembarkation.

The 'increased level of alertness' is in addition to the Cabin Crew Safety Focus Period ("SEATS") that cabin crew must observe during each take-off and landing safety focus period, as specified in *OM B General Procedures 1.5.2 Cabin Crew Safety Focus Periods*.

Figure 1*Use of 'Attention Crew At Stations'*

ALL
3.5.8 Rapid Disembarkation

If a situation develops which warrants a rapid disembarkation but not an evacuation via the slides and a suitable means of exit exists, (e.g. jetty or steps) the following will apply:

The commander will:

- Call the SCCM to the Flight Deck using the standard alert signal; and
- Give NITS brief;
- Make an announcement to the crew and passengers, using the PA.

"ATTENTION, ATTENTION, THIS IS AN IMPORTANT ANNOUNCEMENT. ALL PASSENGERS MUST LEAVE THE AIRCRAFT VIA NEAREST BOARDING DOOR IN A QUICK AND ORDERLY MANNER. LEAVE ALL PERSONAL ITEMS BEHIND".

Note: The SCCM may make this announcement if flight crew are not present.

The SCCM will:

- Report to the Flight Deck for NITS briefing;
- Assist with passenger disembarkation;
- When cabin clear, will liaise with the Commander and brief cabin crew.

The cabin crew will:

Following the announcement made by the Commander or SCCM:

- Stop passenger boarding.
- Encourage passengers to leave quickly through nearest available boarding door and leave personal items behind.
- Check cabin and toilets clear.
- Assemble at boarding door and await instructions.

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Figure 2

Rapid Disembarkation Procedure

Cargo investigation

The rear hold cargo was removed from the aircraft and examined by the RFFS. A refrigerated container was identified as the source of the fumes. The back wall of the container was opened by the RFFS and the container battery pack confirmed as the source. After the RFFS had disconnected the batteries, the container was taken to a warehouse at Heathrow and then subsequently returned to the manufacturer for further examination.

The manufacturer's investigation report stated that:

'the smoke was a consequence of improper handling of the container, which led to a short circuit of two of the batteries. The short circuit was caused by a significant impact/collision on the back of the container, where the affected batteries are located.'

Photographs of the damage are at Figure 3.

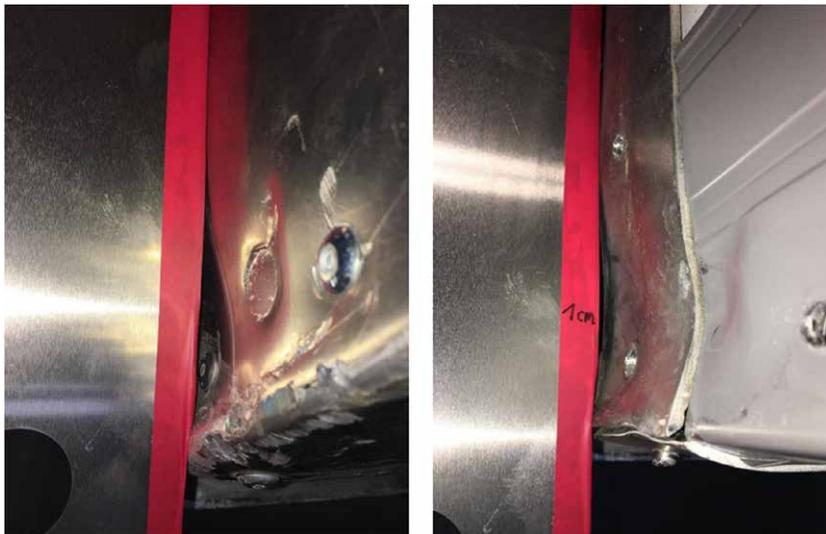


Figure 3

Impact damage to container

In the opinion of the manufacturer the damage was the result of a significant impact to the container, beyond what should be expected in routine handling. The deformation caused a bracket in the battery compartment to be torn from its mounting. The manufacturer made the following finding:

'As one of the brackets to secure the batteries had been compromised, the batteries were able to shift sideways which led to the battery cables/poles rubbing against a secondary securing bracket. As a result, the battery cables sheared and heated which led to a short circuit as expected. This prevented any further incident to the container electrics that would lead to a fire outbreak. The heating of the cables caused the smoke which highlighted the incident to the ground handler.'

The manufacturer described the cables as “short circuit proof” and gave the following information:

'The safety systems designed to prevent a fire have worked correctly. The observed smoke is due to the heated battery cables which were a result of the short circuit. These short-circuit-proof cables are designed to perform in such a way that in the event of a short circuit, smoke is produced, but no fire. This prevents any further damage to other parts of other container, the area surrounding the container and the aircraft too. The short-circuit-proof cables functioned as expected in instance.'

Data recorded by the container indicated it had last been charged between 0755 and 0839 hrs on 2 July 2021. At that time no abnormalities were recorded and there were no reports of smoke being observed. The manufacturer believed, therefore, there was no short circuit at that point.

Analysis

The FIRE CARGO AFT warning QRH checklist directs that, with the cargo door open, the aircraft's cargo fire extinguishers should only be discharged if the presence of a fire can be confirmed. The commander sent the extra pilot on the crew to investigate the situation while he and the co-pilot actioned the QRH and communicated the issue to ATC. On hearing reports of fumes in the cabin, the commander decided to action the QRH checklist for SMOKE, FIRE AND FUMES. In common with the FIRE CARGO AFT checklist the actions are principally intended for situations where the aircraft is in flight. The QRH did not therefore present any step-by-step path of action to the crew. The fact that the warning cleared shortly after its appearance indicated to the commander that the situation may not be serious, and he was conscious of gathering evidence to clarify decision making and avoid precipitate action.

The *'Attention Crew! At Stations'* PA is intended for use after doors close and directs all of the cabin crew to take their allocated positions next to aircraft exit doors. Some crew members were therefore redeployed from the forward to the aft cabin, into the vicinity of the aft cargo hold. In retrospect, the commander considered that a PA telling the cabin crew to prepare for a rapid disembarkation would have been more appropriate.

The operator does have a standard PA for rapid disembarkation via boarding doors rather than evacuation slides. However, the wording of that is very much directed at a situation with passengers on board. In this case, with only cabin crew aboard, the commander felt that the standard wording may have only added confusion rather than giving clear direction to the crew.

When the additional co-pilot informed the commander of the advice from the RFFS, the commander then directed him to return to the cabin and tell the cabin crew to leave the aircraft.

The examination of the container indicated that it been subject to a collision which caused damage to a battery bracket. The damage allowed the batteries to move position and

cause a short circuit. The electrical system had been designed to tolerate this damage, though the subsequent heating of the battery cables produced the smoke that triggered the FIRE CARGO AFT warning.

Conclusion

A short circuit in the battery pack of a refrigerated container loaded in the aircraft aft cargo hold caused heating of cables in the pack and, therefore, smoke to be produced. The smoke was detected by the aircraft fire detection systems and a FIRE CARGO AFT warning was triggered. The crew disembarked through the boarding door.

Safety Action

Following this event, the following Safety Action was taken:

The container manufacturer decided to consider reinforcing the battery attachment and, if necessary, make modifications to improve the functionality and safety of the container.

The operator decided to consider introducing a comprehensive damage check on all similar containers before they are loaded onto aircraft.