

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 787-9, G-ZBKF	
No & Type of Engines:	2 Rolls-Royce Trent 1000-J2 turbofan engines	
Year of Manufacture:	2016 (Serial no: 38622)	
Date & Time (UTC):	1 October 2020 at 0800 hrs	
Location:	En route to London Heathrow Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 10	Passengers - 53
Injuries:	Crew - None	Passengers - None
Nature of Damage:	No aircraft damage	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	49 years	
Commander's Flying Experience:	21,200 hours (of which 2,092 were on type) Last 90 days - 111 hours Last 28 days - 35 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft was approaching the top of descent when the cabin crew saw smoke emanating from a passenger seat. It was discovered that a mobile phone had fallen down the side of the seat and had been crushed in the seat mechanism. The cabin crew extinguished the fire and the aircraft continued to its destination. There was no damage to the aircraft.

There have been several reports of similar events occurring leading to smoke in the cabin. There are currently no seat design requirements to prevent electronic devices from becoming trapped in seats. Manufacturers and regulators are aware of this issue but it has proven challenging to find a workable solution. The EASA and the SAE International Seat Committee have taken safety action to develop new design standards and recommended practices. A Safety Recommendation is made to the CAA to improve seat design regulations.

History of the flight

The aircraft was flying from Miami International Airport, USA to London Heathrow Airport. Approximately 40 minutes before landing the flight crew made an announcement that woke a passenger. The passenger moved her seat from the flat-bed position to a more upright position then left her seat to use the washroom. One of the cabin crew asked the passenger if she could stow the bedding whilst the passenger was away from her seat. As she removed the bedding, she smelt a strong odour and noticed a charging cable which was plugged in to the seat socket with the other end down the side of the seat. The smell,

which she described as “sulphur”, was getting stronger so she attracted the attention of the Senior Cabin Crew Member (SCCM). At this point they heard a “hissing” sound and a large plume of grey smoke emitted from the seat in a “tornado” motion. They remembered seeing an orange glow in the seat area amongst the smoke.

The crew member retrieved a BCF¹ fire extinguisher and fire gloves for the SCCM and asked a third crew member to switch the seat power off. The SCCM pulled back the seat padding exposing a device trapped in the seat mechanism. She discharged several bursts of BCF into the device. The crew member then collected a water extinguisher and filled an ice bucket with water. The third crew member contacted the flight crew.

Shortly before receiving the call from the cabin crew the flight crew smelt an acrid odour on the flight deck. The cabin crew informed the commander that thick smoke was emanating from a seat in the forward cabin and that they had initiated their firefighting drill. The flight crew started the SMOKE, FIRE OR FUMES checklist and evaluated their diversion options. The third pilot went back to the cabin to assist.

After the SCCM had discharged the BCF, the smoke quickly dissipated and the crew were able to clearly see a red mobile phone trapped in the seat mechanism. The crew attempted to remove the device but it was jammed. There was very little heat coming from the device. They checked for secondary heat sources but did not find any. The cabin crew updated the commander.

As the source of the smoke had been identified and extinguished and the aircraft was now only 20 minutes from landing at Heathrow the commander decided to continue to Heathrow. He made a PAN call to alert ATC and ensure the fire service met the aircraft on landing. He also made an alert call² to the cabin crew and gave a NITS briefing³. He then made a further announcement to the passengers. One cabin crew member remained in the vicinity of the seat with an extinguisher to hand for the remainder of the flight. The aircraft landed normally at Heathrow.

After landing the fire service boarded the aircraft and removed the device from the seat (Figure 1). There was no damage to the aircraft.

Footnote

¹ Bromochlorodifluoromethane

² An ‘Alert call’ is a call made to the cabin crew to alert them all to an abnormal situation.

³ NITS is an acronym used for briefing the cabin crew about an abnormal situation, it stands for Nature, Intentions, Time and Special instructions.



Figure 1
Mobile phone retrieved by the fire service after landing

Operator's procedures

The operator's operations manual contained the following information regarding Portable Electronic Devices (PEDs) and lithium battery hazard:

'The potential hazard from these batteries occurs as a result of over-charging or rapid energy release (short circuit). Fumes and gases will be emitted prior to the battery igniting. The resultant over heating of the cells can result in a cell 'thermal runaway'. This is where the cells within the battery ignite in a chain reaction.

Incidents have occurred as a result of:

- *Structural deformation caused by crushed, physically or electrically abused lithium batteries; in extreme cases PEDs have been known to ignite. Damage could be caused by seat mechanisms crushing misplaced PEDs.*
- *Overheating lithium batteries due to overcharging.*

CAUTION: A lithium battery has a higher likelihood of catching fire during or following charging.'

The manual specifies that passengers may use PEDs throughout the flight but that:

'When not being used PEDs must be switched off and disconnected from the seat power.

PEDs must not be charged while sleeping.

Cabin crew are not required to check that all devices are switched-off or in 'flight safe' mode, however they are expected to inform passengers of the appropriate requirements.'

The following PAs are made to inform passengers about the use of PEDs:

Prior to departure – 'DURING THE FLIGHT, ALL ELECTRONIC DEVICES MUST BE DISCONNECTED FROM THE SEAT POWER WHEN NOT IN USE.'

During the safety demonstration – 'TAKE CARE YOUR DEVICE DOES NOT GET LOST WITHIN YOUR SEAT. IF IT DOES PLEASE DON'T MOVE IT BUT LET ONE OF YOUR CABIN CREW KNOW. DEVICES MUST BE SWITCHED OFF AND DISCONNECTED FROM THE SEAT POWER SOCKET WHEN NOT BEING USED IN FLIGHT.'

During the initial climb and again 40 minutes before landing - 'IF YOU ARE SEATED IN OUR FIRST OR CLUB WORLD CABIN, PLEASE TAKE CARE THAT YOUR PERSONAL ELECTRONIC DEVICE DOES NOT OBSTRUCT THE ADJUSTMENT OF YOUR SEAT. IF IT DOES GET LOST WITHIN YOUR SEAT, PLEASE DO NOT MOVE THE SEAT AND LET ONE OF US KNOW.'

The manual contains the following instructions for lost PEDs:

'Report all PEDs lost in seat mechanisms in the AML. This ensures engineering will remove the item prior to the next flight. Clarify with the passenger: Identity of the item, Exact location where item may have dropped or slipped, Has the seat been moved since misplacing the item

CAUTION: Electrically operated seats with trapped PEDs should NEVER be moved electrically or manually.'

In addition to the operator's standard firefighting procedure the manual contains the following advice relating to PEDs fires:

'Use a BCF extinguisher to extinguish and prevent flames spreading to additional flammable materials.

Take a suitable container or empty metal toilet bin to the location. Don fire gloves. When considered safe to do so place the device inside the container and immerse the PED in water or other non-flammable liquid.'

CAUTION: Water should not be used on, or in the immediate vicinity of, any other piece of electrical equipment.'

Operator's investigation

The operator considered that the incident had been managed appropriately by the crew. However, it identified the following aspects which it will review to determine if any change is required to its procedures or training:

- The SCCM becoming directly involved in fighting the fire instead of allowing the crewmember that found the fire to fight the fire.
- The crewmember did not douse the device with water because they believed this would damage the seat electrics or impact on the spill hazard zone.

Operator's seat design

The seat type involved was designed approximately ten years ago. They were designed to limit the chance of a PED becoming trapped, but it was found to be challenging to remove the risk completely. Additionally, since they were designed, PEDs have become smaller, batteries have become more powerful and the number of devices passengers carry has increased. Since they were first designed the operator has made further improvements to the seat to further reduce the likelihood of devices becoming trapped in the mechanism.

EASA safety information bulletin

In December 2015 the EASA published a safety information bulletin⁴ regarding passenger awareness of the risks of lithium batteries. It recommends that:

'Aircraft and aerodrome operators make passengers aware of the risks caused by PED as a result of the battery being potentially short-circuited or damaged if caught in the movable part of seats, and that they should call a staff member when such situation occurs and/or whenever any abnormal situation is suspected, either on board the aircraft, or at the aerodrome.'

Other events

The CAA reviewed its Mandatory Occurrence Report database and found 166 previous reports of PED's becoming trapped in passenger seats in the last five years. Of these events 42 resulted in a fire or smoke in the cabin.

Boeing reviewed its safety reporting database and, among the reports of PED failures, was able to confirm three specific events where PEDs were trapped in a seat. Much of what had been reported did not detail trapping within a seat or was vague in the event description but, in these three instances, the events were managed with existing crew procedures.

Footnote

⁴ Available at <https://ad.easa.europa.eu/ad/2015-28> (accessed 15 December 2020)

Seat design requirements

Neither the CAA, the EASA nor the FAA currently require seats to be designed to prevent PEDs from becoming trapped or crushed. The EASA reported that this is a known issue and seat manufacturers have tried to design seats to minimise the risk. However, it has been challenging to design moving seats that eliminates the chance that a device can fall into its mechanism.

Following this investigation, the EASA requested the SAE International⁵ Seat Committee to develop design standards and/or recommended practices to address the issue. It reported that the committee intends to update the Aircraft Seat Design Guidance and Clarifications document (SAE ARP 5526) and incorporate this in the initial release of the Performance Standard for Seat Furnishings in Transport Aircraft document (SAE AS6960). The publication of these documents is planned for late 2021.

Analysis

A passenger's mobile phone became trapped in the seat mechanism and was crushed when the seat was adjusted. This damaged the battery, generating flames, smoke and fumes. The cabin crew were able to extinguish the fire using their existing procedures.

The operator makes announcements to passengers on all flights with electrically powered seats to try to prevent PEDs becoming lost in seats, as recommended by the EASA. They have also tried to design the seats to limit the chance of PEDs being crushed in the mechanism. However, these events continue to occur. The CAA has received 166 reports of PEDs lost in passenger seats in the last five years. A quarter of these events resulted in fire or smoke in the cabin, demonstrating that this is a significant hazard to the safety of the aircraft.

There are currently no CAA or EASA requirements to design seats to prevent damage to PEDs which become accidentally trapped, despite this being a known issue. The SAE international seat committee is taking safety action to develop design standards and/or recommended practices to address the issue. The AAIB makes the following Safety Recommendation to ensure these design standards and/or recommended practices are developed and adopted:

Safety Recommendation 2021-017:

It is recommended that the Civil Aviation Authority require that passenger seats in commercial air transport aircraft are designed to minimise the chance of portable electronic devices becoming crushed in mechanisms.

Footnote

⁵ SAE International is a global association of engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries. One of their purposes is the development of voluntary consensus standards.

Safety Action

The EASA has requested that the SAE International Seat Committee develop design standards and/or recommended practices for the design of seats on commercial air transport aircraft to minimise the chance of portable electronic devices becoming crushed in mechanisms

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