



THE REPUBLIC OF CROATIA

**Air, Maritime and Railway Traffic Accident Investigation Agency**

**Air Traffic Accident Investigation Department**

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# **FINAL REPORT**

**ON SERIOUS INCIDENT OF THE AIRCRAFT  
BOEING 737-800,  
registration TC-AMP**

**Croatian airspace – 7 miles west of LQBI,  
2 October 2018**



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## OCCURRENCE INFORMATION

Type of the occurrence:	Serious incident
Date	2 October 2018
Local time :	14:57 LT
Place:	Croatian airspace – 7 miles west of LQBI
Type of the aircraft:	Aeroplane
Manufacturer / model:	Boeing / 737-800
Registration:	TC-AMP
Owner:	Legal entity
Operator:	Pegasus Airlines
Number of persons on board:	178 (6 crew members and 172 passengers)
Injuries:	One person with minor injuries
Damage to the aircraft:	Minor damage

## INVESTIGATION

AIA received the first information about the accident on the same day from Zagreb Airport Franjo Tuđman and Croatia Control (HKZP)

AIA investigators started the inspection on site on the same day, interviewed people involved in the serious incident and the investigation was opened.

A press release was issued with basic information about the occurrence. Upon completion of the investigation, this Final Report was issued.

AIA issued one Safety recommendation to the operator.

## SUMMARY

On 2 October 2018, at approximately 14:57 hours local time on the flight PGT93J from Istanbul to Paris, of the company Pegasus Airlines, a minor explosion of an electronic evaporator of one of the passengers occurred, followed by an outbreak of a small fire that was immediately extinguished successfully.

Upon entering the Croatian airspace, the aircraft requested redirection of the flight and landing at the Zagreb Airport Franjo Tuđman.

## 1. FACTS AND INFORMATION

### 1.1. FLIGHT INFORMATION

On 2 October 2018, a Boeing 737-800 aircraft, operated by the company Pegasus Airlines, departed from Istanbul Sabiha Gökçen Airport (LTFJ) towards Paris - Orly Airport (LFPO). The flight took place without problems, up to the point of entry into the airspace of the Republic of Croatia (7 miles west of Bihać Airport (LQBI)).



Around 12:30, at the cruise altitude, the pilot informed the competent flight control that he wishes to redirect the aircraft towards Zagreb Airport Franjo Tuđman (LDZA), due to a cabin fire and smoke indication in the rear luggage compartment.

Following the flight control instructions, after 25 minutes the aircraft landed at Zagreb Airport.

## 1.2. INJURIES

Injuries	Crew	Passengers	Others
fatal	0	0	0
serious	0	0	0
minor / none	0	1	0

## 1.3. DAMAGE TO THE AIRCRAFT

The aircraft sustained minor material damage in the form of burned passenger seatbelt on the seat no. 21D.

## 1.4. OTHER DAMAGE

No other damage occurred during the accident in question.

## 1.5. PERSONAL INFORMATION

### 1.5.1. Captain

Male person, Greek citizen born in 1959. He has a total of 2700 flight hours on the aircraft type Boeing 737-800, and has been flying with the subject company since August 2015.

### 1.5.2. First officer

Male person, Turkish citizen born in 1991. He has a total of 250 flight hours on the aircraft type Boeing 737-800, and has been flying with the subject company since May 2018.

### 1.5.3. Passenger information

Male person, Turkish citizen born in 1958, with residence in the French Republic. The person does not speak English language.

## 1.6. AIRCRAFT INFORMATION

Registration: TC-AMP  
Serial number: 40723  
Manufacturer: Boeing  
Type: 737-800  
Width: 35.71 m



Height:	12.55 m
Maximum take-off weight:	72000-79000 kg
Cruise speed:	829 km/h

The Boeing 737-800 is an aircraft manufactured by the US company Boeing as an extended version of the 737-700 aircraft. The first aircraft was delivered in 1998. About 5000 of these aircrafts were produced. Many companies use it for regular scheduled and charter passenger transport (Picture 1).



Picture 1 – Boeing 737-800 of the company Pegasus

#### **1.7. METEOROLOGICAL INFORMATION**

Meteorological conditions had no influence on the developments in the serious incident in question

#### **1.8. NAVIGATIONAL INFORMATION**

The planned flight was taking place in accordance with the IFR flight plan PGT93J up to the moment of the subject event. After the event, the flight was redirected to Zagreb Airport, through direct communication between the aircraft crew and the competent controller.



## **1.9. COMMUNICATION**

For the purposes of the Investigation, the sound recording of the communication of PGT93J flight crew with competent flight control were used.

By listening to the sound recording no deficiencies in following the prescribed procedures were established. The communication between the crew and the competent flight control was clear and direct.

## **1.10. AIRPORT INFORMATION**

After the subject event and putting the situation under control, the pilot decided to redirect the aircraft from the planned route towards Paris and land at Zagreb Airport due to precautionary measures.

Air traffic control notified the competent airport services of the intention of the subject aircraft and put the airport on standby.

Zagreb Airport is a civilian/military airport. The infrastructure contains two passenger buildings, and the runway, direction 05-23.

At the time of the landing of the aircraft, the firefighting category 6 was active at the airport.

## **1.11. FLIGHT DATA RECORDERS**

The aircraft was equipped with the flight data recorder and the cockpit voice recorder. Data from the above recorders were not used for the purposes of the Investigation.

## **1.12. MEDICAL INFORMATION**

In the subject serious incident, one passenger, also the owner of the electronic evaporator in question, sustained minor injuries in the forms of finger burns on both hands. The passenger refused medical attention after landing.

No other crew member or passenger requested medical attention or complained of their medical condition.

## **1.13. FIRE**

After the minor explosion of the electronic evaporator, the passenger's personal bag was ignited (Picture 2). During the burning of the bag, a damage occurred to the passenger seatbelt which was burnt (Picture 3).



Picture 2 – Damaged passenger’s personal bag

The cabin crew had applied lithium battery fire extinguishing actions in accordance with the applicable procedures. After the fire was extinguished by the cabin halon fire extinguisher, the entire electronic evaporator was placed in water to lower the temperature of the batteries, as required by the prescribed procedures (Picture 4).

The fire was extinguished by a fast reaction of the cabin crew who applied the extinguishing procedure; “Lithium Battery Fire Extinguishing”, CCM (Cabin Crew Manual), No: PG-KH-EK-001, Paragraph 3.1.2.6., Revision 0.

After the fire was extinguished, the cabin was filled with smoke.



Picture 3 – Burnt passenger seatbelt on the seat no 21D



Picture 4 –The electronic evaporator cooled in water after the explosion



## **1.14. ADDITIONAL INFORMATION**

### **1.14.1. Passenger's statement**

The passenger, the owner of the electronic evaporator, stated that during the flight the evaporator was connected to a portable battery via USB cable for charging. After he fell asleep at one point he heard an explosion which woke him up. Then he saw his personal bag burning in his lap.

He reacted by hitting the bag with his hands trying to put out the fire. During this firefighting attempt, he sustained finger burns.

The passenger purchased the subject evaporator a year ago in France.

### **1.14.2. Pilot's statement**

During cruising, after about 1 hour and 40 minutes of flight, the purser contacted the pilots via intercom, informing them that the explosion and fire of electronic evaporator of one of the passengers had occurred in the cabin and that the fire was successfully extinguished.

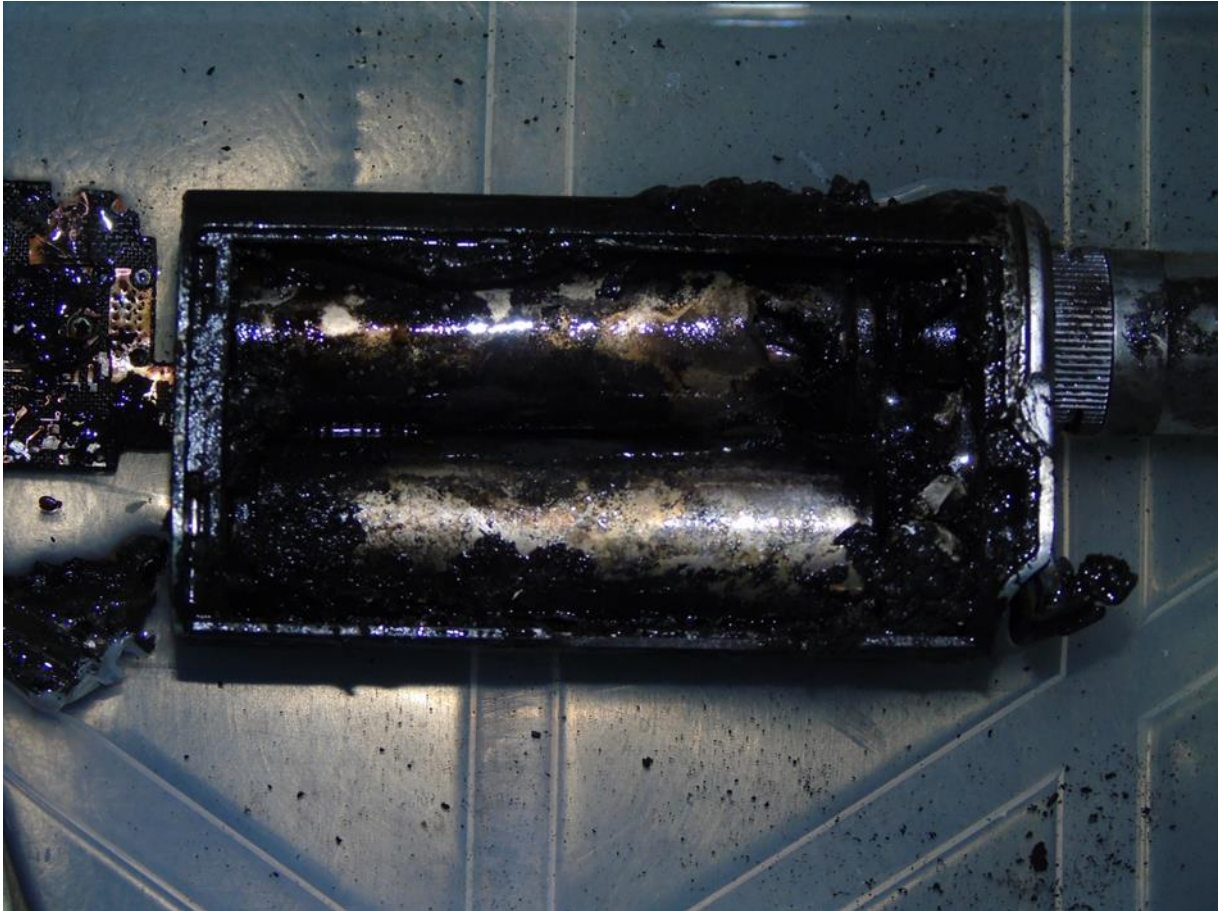
Shortly after receiving the information, an indication of the presence of smoke in the rear baggage compartment switched on in the cockpit. Since at that time the pilots did not know whether the two events were related, they applied the procedure of activating the fire system in the rear baggage compartment, QRH (Quick reference Handbook), Chapter 8.15.

Once the situation was put under control, the pilots decided to redirect the aircraft to Zagreb Airport as precautionary measure.

### **1.14.3. Lithium-ion batteries PN: 18650**

Lithium-ion batteries 18650 (Picture 5) are batteries with high energy density and high specific energy. They are used in many electronic devices. The disadvantage of these batteries is, among others, the manner of charging. If they are charged without controlling the input voltage and the input current, they represent a potential danger. Therefore, special chargers and constant monitoring during the charging process are recommended for charging lithium-based batteries.

By charging lithium-ion batteries via USB cable, i.e. without the intended charger, overheating and explosion can occur if the battery condition is not monitored, because this charging mode does not control the input voltage and current parameters.



Picture 5 – Lithium-ion batteries 18650 after the explosion on the aircraft in question

#### **1.14.4. Electronic evaporator**

Electronic cigarettes and electronic evaporators are used as a replacement for conventional cigarettes worldwide. The electronic evaporator contains liquid which, by passing over the heater, produces steam that is inhaled. Lithium or lithium-ion batteries are used for operation of the heater, therefore the device itself is classified as a Portable Electronic Device (PED), and its transportation by air is subject to IATA Dangerous Goods Regulations (DGR), paragraph 2.3.5.9 and 2.3.5.17.

The passenger on the subject flight possessed the Electronic evaporator model Sirius 200W, manufactured by Modefined, which was connected to an external battery of an unknown manufacturer during the flight via USB cable.

The evaporator was powered by two rechargeable lithium-ion batteries type 18650.



#### 1.14.5. Transportation of dangerous goods (lithium-ion batteries)

Transportation of devices containing lithium or lithium-ion batteries in international air traffic, and informing passengers on the mode of transport thereof in times of serious incidents, was regulated by several international regulations at European and Global level.

##### 1.14.5.1. IATA (International Air Transport Association)

The method of transportation of lithium batteries and manner of handling thereof are described by IATA in the following documents:

- Dangerous Goods Regulations, Revision 59
- IATA Cabin Operation Safety, Best Practices Guide 2015
- IATA Passenger Provision for Small Vehicles Powered by Lithium Batteries

##### 1.14.5.2. ICAO (International Civil Aviation Organization)

ICAO has issued several documents on the subject matter, such as:

- ICAO Annex 14, Aerodromes, Volume I
- ICAO Document 9284 – Technical Instructions for the Safe Transport of Dangerous Goods by Air)
- ICAO Document 9481 – Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods
- ICAO Electronic Bulletin EB 2017/23 – Portable Electronic Devices

##### 1.14.5.3. EASA (European Aviation Safety Agency)

Regulation (EU) 956/2012 at the European level defines standards related to Passenger Safety Instructions in the form of passenger safety briefings and safety cards on board aircraft. The regulation clearly instructs operators to include in their safety instructions information related to the transport of lithium-ion batteries and/or devices powered by them.

EASA has also issued several SIB (Safety Information Bulletin) documents from 2011 until today, warning on the growing problem of transporting lithium batteries or devices powered by lithium batteries. Issued bulletins are listed below.

##### **SIB no 2010-30R1:**

SIB no 2010-30R1 was issued on 31.03.2011. The Bulletin points to the documents issued by ICAO (International Civil Aviation Organization) and the FAA (Federal Aviation Administration). It applies to all helicopters and aircrafts where lithium batteries can be transported as cargo.

##### **SIB no 2015-28:**

SIB no 2015-28 was issued on 16.12.2015, regarding “Passenger Awareness on the risks of Lithium Batteries”. The reason for issuing the SIB was to raise the awareness of passengers about the risks of using lithium batteries, due to the increased number of incidents involving lithium batteries. The said



SIB covered airports and aircraft operators, as well as the manner of informing passengers of the risks which can arise from the use of lithium batteries.

Those regulatory documents state, among other, that electronic cigarettes or electronic evaporators may only be transported in the aircraft cabin, and not in the baggage compartment, and should not be charged during flight.

#### **SIB no 2017-04R1:**

This SIB was issued on 19.12.2019, and warns airline operators of the risks associated with the transport of PED (Portable Electronic Devices) in passenger luggage carried in the cargo area and the recommended actions regarding the transport of PEDs and lithium batteries.

#### **1.14.6. Safety instruction to passengers from the operator**

During the year 2017, the Turkish Aviation Authorities DGCA launched a safety study involving all Turkish operators regarding Passenger safety cards. In the year 2018, the DGCA rendered a conclusion on the update and release of new Passenger Safety Cards that comply with EASA CAT.OP.MPA.170 regulation and ICAO Doc. 10086 regulation.

At the time of the serious incident, the operator in question was using the old Passenger safety cards, and at the moment of publication of this document is the final stage of issuing new Passenger safety cards.

The operator also informs passengers about the mode of transport of PEDs, during passenger tickets sale, and issues separate brochures to raise passengers' awareness about potential problem of transporting lithium and lithium ion batteries.

## **2. ANALYSIS**

### **2.1. ANALYSIS OF THE COURSE OF EVENTS**

During flight at cruising altitude, the electronic evaporator of one of the passengers exploded, and the smaller fire occurred. At that point, the cabin crew followed the procedure of fire extinguishing pursuant to the CCM (Cabin Crew Manual) in force at that time, No: PG-KH-EC-001, paragraph 3.1.2.6, Revision 0.

The explosion and fire resulted in smoke in the cabin of the aircraft, which reached the rear baggage compartment through the ventilation system. The presence of smoke in the rear baggage compartment activated the Cargo Smoke Detection System. Since at that moment the crew was unaware of the direct connection between the explosion of the electronic evaporator and the smoke detection in the luggage compartment, they applied the procedure for activating the fire extinguishing system in the luggage compartment.

After the completed extinguishing procedures, the crew requested the redirection of the flight for precautionary measures to the Zagreb Airport.

By analysing the course of events, it can be concluded that the crew acted in accordance with the applicable procedures.



## **2.2. REGULATIONS OF TRANSPORT OF DANGEROUS GOODS**

At the time of the serious incident, current regulations prohibit the use of electronic cigarettes or evaporators in an aircraft, as well as charging of pertaining batteries, in accordance with the IATA (International Air Transport Association) Dangerous Goods Regulations, Revision 59.

Passenger, the owner of the electronic evaporator did not comply with applicable regulations.

## **3. CONCLUSION**

### **3.1. FINDINGS**

During the investigation, AIA established the following:

- The passenger possessed an electronic evaporator powered by two lithium-ion batteries;
- The passenger charged the lithium-ion batteries while they were installed in the electronic evaporator via USB cable through the external portable battery;
- After the explosion, the cabin crew took firefighting actions in accordance with the applicable procedures;
- The pilot crew acted in accordance with the applicable procedures regarding the presence of smoke in the baggage compartment;
- In accordance with applicable regulations, the transport of lithium-ion batteries by passengers or crew is only permitted in the cabin, not in the luggage compartment;
- Charging lithium-ion batteries during flight is not permitted pursuant to the applicable regulations;
- Minor material damage occurred to the aircraft;
- The passenger sustained minor injuries.

### **3.2. CAUSE**

It can be concluded with great certainty that the cause of the subject serious incident was the overheating of lithium-ion batteries due to improper charging, which resulted in the explosion of the lithium-ion batteries.

## **4. SAFETY RECOMMENDATIONS**

Safety recommendation shall in no case create a presumption of blame or liability for an accident, serious incident or incident.

Considering the circumstances that led to the serious incident, the Air, Maritime and Railway Traffic Accident Investigation Agency, Air Traffic Accident Investigation Department, issues to the operator the following Safety recommendation:



**AIN04-SR-14/2019**

The operator, the company Pegasus Airlines, should implement the new Passenger safety cards that comply with the international standards and norms, such as EASA CAT.OP.MPA.170 and ICAO Doc. 10086, and with the conclusions of the DGCA Safety Study.

Investigator in Charge

Dejan Ćurik