



Accident to the Airbus A320 registered **F-HBNK** on 11 September 2016 at Bastia Poretta (2B)

⁽¹⁾Except where
otherwise indicated
times in this
report are local.

Time	11:40 ⁽¹⁾
Operator	Air France
Type of flight	Commercial air transport
Persons on board	Captain, co-pilot, 4 cabin crew 153 passengers
Consequences and damage	Ramp agent injured

Injury to ramp agent when connecting GPU to parked aircraft

1 - HISTORY OF THE FLIGHT

⁽²⁾The ramp agent was
especially in charge
of positioning the
aircraft, securing
the aircraft and
ground activities
and connecting
the GPU.

After the aircraft had come to a standstill on the apron, the ramp agent⁽²⁾ positioned the chocks on the nose landing gear and then on the main left landing gear after engine shutdown and informed the crew of these actions via the ground interphone connection. The crew informed him that the parking brake was released. The ramp agent checked that the aircraft was stabilized, reported this to the crew and authorized the ground support equipment to be brought forward and the docking of the jetways.

He went to the Ground Power Unit (GPU) whose engine was already in operation, picked up the connecting cable and got ready to connect the ground power connector to the aircraft. As the cable was tangled up, he was not able to do this and asked a ground attendant⁽³⁾ to untangle it. He then connected the ground power connector to the aircraft. At this moment, witnesses heard an explosion, the ground attendant saw an electric arc of around 30 cm at the connector and the ramp agent was thrown to the ground. The connector stayed connected to the aircraft.

The ramp agent was quickly cared for by the emergency services. The diesel engine of the ground power unit was shutdown.

2 - ADDITIONAL INFORMATION

2.1 Injuries to persons

The ramp agent had injuries to his right ear and left thigh linked to the explosion and to his subsequent fall to the ground. He had no burn marks.

⁽³⁾This ground
attendant (C2) was in
charge of positioning
the front jetway and
for then unloading
the luggage from
the forward hold.
He passed
close to the GPU
between these
two tasks.

2.2 Description of GPU and procedure for connecting it to aircraft

The GPU used is a ground power unit powered by a diesel engine. It is designed to supply an aircraft with a three-phase 115 V 400 Hz electrical power supply. It can also provide a 28 VDC power supply.

After starting the GPU diesel engine, the operator must check for correct operation of the GPU and wait for the engine rpm to stabilize before connecting the ground power connector to the aircraft.

After connecting the connector, the operator returns to the GPU and holds selector switch S10 of the control panel in the «CLOSE» up position⁽⁴⁾. This action initiates the supply of 115 V 400 Hz power to the connector. The presence of the three-phase voltage on the connector combined with the confirmation of the correct positioning of the connector in the aircraft receptacle via pins E/F is processed by the GPU Generator Control Module (GCM) which authorizes the self-hold of the 115 V 400 Hz power supply and lights up a light situated above selector switch S10. The operator can then release the selector switch which remains in the «ON» intermediate position. When the electrical current is present on the ground power connector, an indicator light lights up at the aircraft ground power receptacle panel. The crew is informed that the GPU is available by a signal in the cockpit and can use it at any time as an alternative electrical power source to the aircraft power system.

⁽⁴⁾This switch has three positions: a down position (OFF), an intermediate position (ON) and an up position (spring-loaded position, CLOSE).



Selector switch S10 and associated light

If the connector is disconnected while the GPU is supplying power to the aircraft, the detection of the opening of the E/F pin secondary circuit interrupts the 115 V 400 Hz supply. Switch S10 then remains in the «ON» position and the connector is no longer supplied with a three-phase voltage.

The disconnecting procedure stipulates that the agent should set switch S10 to the «OFF» position which sends a signal to the GCM to interrupt the power supply, and then physically disconnect the connector from the aircraft.

2.3 GPU maintenance and test procedure

To allow maintenance personnel to check for correct operation of the GPU without it being connected to an aircraft, it is possible to by-pass the pin E and F protection for the self-hold of the power supply by moving selector switch S13 from the «AIRCRAFT OUTPUT» to the «TEST BANK» position. This selector switch can only be accessed after opening the control panel held by two screws. It does not have an action on the initiation of the supply controlled by the «CLOSE» position of selector switch S10.

2.4 Examinations carried out on GPU, cable and ground power connector

Selector switch S10 was found in the «ON» intermediate position.

The control panel was closed by means of the two screws provided for this purpose and selector switch S13 was found in the «AIRCRAFT OUTPUT» position.

The starting switch for the diesel engine was found in the «0» off position. The emergency stop button had not been actuated.

The continuity and isolation tests of the various electronic components of the GPU and in particular those of the GCM did not reveal a GPU malfunction.

The use of the GPU with another connector led to nominal operation, in particular for the GCM and the protections provided to limit the power supply.

The examination of the ground power connector revealed a short circuit located inside the connector itself, between the three phases. This short circuit caused the fusion of the copper on the three phases. There was no defect nor fusion on the neutral. This examination also showed the absence of insulating sheath on the end of the four cables (the three phases and the neutral) at the metal pins.

The cables of pins E and F were in good condition.



Connector pins removed from unit

2.5 Previous incident report

On 22 June 2016 the GPU was involved in an incident. The ramp agent started the tractor without having first removed the GPU tow bar which led to the GPU being moved while it was still connected. It was observed that the GPU ancillary panel on the aircraft was damaged. It was checked and repaired. No action was carried out on the GPU.

2.6 Technical checks on aircraft

The checks and maintenance operations carried out on the aircraft after this event did not reveal any malfunction with the aircraft's ground power receptacle and electrical panel. No subsequent malfunction was recorded.

2.7 Witness accounts

The ground attendant responsible for positioning the front jetway confirmed that he had helped the ramp agent untangle the connecting cable and had stayed close to the cable while the connector was being connected. He added that he had not actuated selector switch S10. He said that the day before there had been a small discharge when handling the connector when it was powered. He specified that procedures do not include handling the connector when it is powered. Even so, he reported the incident. A visual check of the connector was carried out and showed nothing abnormal.

According to several witnesses, after the explosion and the ramp agent being thrown to the ground, the ground power connector remained connected to the aircraft.

2.8 Personal protective equipment

The ramp agent was wearing the following personal protective equipment: high-visibility vest, safety shoes and gloves. The gloves were not provided with electrical protection.

2.9 Similar event

A similar event dating back to 15 April 2017 was reported in accordance with Regulation (EU) No. 376/2014 of the European Parliament and of the Council of 3 April 2014 on the reporting, analysis and follow-up of occurrences in civil aviation.

The ramp agent had encountered difficulties connecting the connector. Once the connection had been made, he asked a ground attendant to power the connector while he had his hand on the cable. This powering of the connector led to an electric arc and the ramp agent was thrown to the ground by the explosion. No anomaly was found on the GPU or on the aircraft.

3 - LESSONS AND CONCLUSION

3.1 Cause of short circuit in ground power connector

The absence of insulating sheath on the end of the cables of the ground power connector was probably due to damage to the connector:

- ☐ following repeated pulling on the cables and not on the connector body to remove the connector or
- ☐ following the incident of 22 June 2016.

The absence of sheath led to a short circuit at the three phases of the connector when the latter was plugged into the aircraft receptacle and supplied with power by the simultaneous actuation of selector switch S10.

3.2 Mechanical action on selector switch S10 simultaneous with connection of connector to aircraft

The fusion of the phase and neutral cables was necessarily the result of power being present in these cables and the existence of an electrical contact between them.

As no defect was observed on the aircraft's ground power receptacle and electrical panel, it was possible to rule out that power was supplied due to a malfunction at the aircraft which would have supplied these cables when they were connected and before the supply of the three-phase current produced by the GPU.

The presence of the three-phase power supply on the connector initially required selector switch S10 to be set to the «CLOSE» position whether or not the connector was connected to the aircraft.

The self-hold of selector switch S10 at «ON» allowing the three-phase supply depended on the actual connection of the connector to the aircraft, as selector switch S13 was found in the «AIRCRAFT OUTPUT» position.

In a situation where the phase and neutral electrical cables in the connector touch each other, the short circuit occurs as soon as a 115 V power supply is applied to the connector, in other words, as soon as the «CLOSE» position of selector switch S10 is used, regardless of whether the connector is connected or not to the aircraft.

Given that the «CLOSE» position of selector switch S10 is spring-loaded when the connector is disconnected, closing the circuit requires this switch to be mechanically held in position for a certain time.

It was established that this mechanical action was concomitant with the connection of the connector to the aircraft, as the connector remained inserted after the short circuit. The probability of such a concomitance in the absence of a voluntary action by another person is therefore very low.

The investigation was not able to determine who had actuated the selector switch.

3.3 Comparison of risks relating to connecting and disconnecting connector to and from aircraft

In the event of the disconnecting procedure being shortened, physically disconnecting the connector is sufficient to cut off the power supply even when S10 is set to «ON». Mechanically setting the selector switch to the «OFF» position aligns the position of the selector switch with the position of the actual supply control. Ground operators may therefore perceive this as a double safety measure and not necessarily see the importance of the sequence proposed by the disconnecting procedure, all the more so when it requires the operator to go back and forwards between the GPU and the aircraft several times.

Conversely, holding the switch in the «CLOSE» position does not provide this redundancy, this single action immediately supplying the connector.

Any deviation from the procedure for connecting the connector to the aircraft with the intention of anticipating the action on selector switch S10 leads to a particularly dangerous situation for all the personnel who are directly or indirectly exposed.

It is therefore essential to recall that:

- ☐ before connecting a GPU to an aircraft, the operator must check that the switch is actually in the «off» position;
- ☐ only one agent connects the connector to the aircraft and this same agent then supplies the aircraft with electricity.

4 - SAFETY ACTIONS

Following the accident, Air France recommends modifying the design of the connector (no gap at the connector and fitting of a heat-shrink sheath at the junction between the connector and the cable) and informing the agents at the Bastia station that the GPU must only be energized once the connector has been connected.

Air Corsica has modified the design of the connector and updated the ground procedure for using the GPU by specifying that the GPU must be operated by a single operator and that it is forbidden to handle the power supply cable when it is energized.