

In April of this year the Federal Aviation Administration approved the new battery systems of the 787-8 Dreamliner, and after having been grounded for three months, the aircraft were cleared for take-off. Boeing dealt with serious problems when complications occurred with the batteries of the 787. Looking back, Boeing did not only solve the problems it was facing, but the aviation company took an additional step and announced the final assembly of the 787-9 Dreamliner.

TEXT Shahrzad Hosseini, Student Aerospace Engineering, President of the 20th Aviation Department

PROBLEM SCENARIO ANALYSIS

Since January of this year, the Boeing 787 Dreamliner faced two incidents in which the lithium ion batteries of the aircraft overheated and resulted in failure. The FAA ordered a general grounding of the aircraft which put both the Boeing Company and its Dreamliner customers in a serious situation. The last time the FAA had ordered such a general grounding was in the year 1979 after a fatal crash of a McDonnell Douglas DC-10.

In an official statement, the FAA said: "The in-flight Japanese battery incident followed an earlier 787 battery incident that occurred on the ground in Boston on January 7, 2013. The airworthiness directive is prompted by this second incident involving a lithium ion battery. The battery failures resulted in release of flammable electrolytes, heat damage, and smoke on two model 787 airplanes. The root cause of these failures is currently under investigation. These conditions, if not corrected, could result in damage to critical systems and structures, and the potential for fire in the electrical compartment."

With approximately sixty airliners depending on the Boeing's Dreamliner, the company was under quite an amount of pressure since a grounded aircraft is financially far from ideal for the airline and can lead to severe situations. Yet, safety is the most important factor in commercial aviation and therefore the FAA grounded the young Dreamliner 787-8 which had been in service for less than two years.

"The safety of the flying public is our top priority and we won't allow the 787 to return to commercial service until we're confident that any proposed solution has addressed the battery failure risks", said an Administrator of the FAA Michael P. Huerta, in his speech on safety and efficiency in February of this year.

PLAN OF ACTION

The aviation company has spent more than 100,000 working hours since the beginning of this year, on not only solving this problem but also to ensure an unfailing future for the aircraft's battery systems.

First of all, a complete knowledge of the

battery failure had to be obtained before any further steps could be taken. A team of Boeing engineers, investigators of the National Transportation Safety Board, the Japan Transport Safety Board and battery experts from various fields were assigned to analyze the batteries of the Dreamliner and to perform a variety of tests. According to Boeing, the Dreamliner has become the most tested commercial airplane ever built.

FOCUSING ON SOLUTIONS

The main focus of the analysis and engineering to recover and renew the battery systems of the Dreamliner was to prevent and isolate a possible occurring fault. Yet, a broader plan of action was needed to satisfy this focus since parts of production, operations and testing were adjusted and improved.

A new steel enclosure system is designed, such that if the battery were to overheat, the rest of the aircraft will not be affected and consequently act as a threat to its safety. According to Boeing Commercial Airplanes President and CEO Ray Conner, "This is a comprehensive and permanent solution with multiple layers of protection. The ultimate layer of protection is the new enclosure, which will ensure that even if a battery fails, there is no impact to the airplane and no possibility of fire. We have the right solution in hand and we are ready to go."

THREE LAYERS OF PROTECTION

The multiple layer protection which was announced to be the solution of the Dreamliner battery issues consist primarily of the following components. The first step of improvement is in the manufacturing field. The build processes for the cell and battery are enhanced and so are the production tests of these components. The next part of the solution is applied in the design phase, in which the company has implemented charger design improvements, tightened the voltage range and worked on the design of the battery. As mentioned before, the part that is added and thus new in the overall battery system is the enclosure system. This system is designed to deal with any type of battery failure and tests have shown that it even has the ability to contain a full-battery failure.

GETTING THE 787'S BACK IN THE AIR

When the improved batteries were approved by the U.S. Federal Aviation Administration in April of this year, it was time for customer service and installing the new systems on the 787s. With the Dreamliner customers being spread



Figure 2. Special operations vehicles surround the 787 Dreamliner after a fire broke out.

worldwide, Boeing sent teams around to install the new and improved battery systems. A number of fifty airplanes needed to be visited by the teams, in seventeen cities and nine countries. Per airplane, the work time demands a total of five days. Ray Conner: "The Boeing team is ready to help get our customers' 787s back in the air where they belong". The approval of the FAA also began a new phase of production deliveries, and the factory now has an increased production rate of seven airplanes per month.

EXTENDING THE 787 FAMILY

Improving the 787-8 Dreamliner has not been the only focus of Boeing in the past months but the company has extended the Dreamliner with a longer version of the aircraft. In June the final assembly of the 787-9 commenced and with 355 of this new Dreamliner family member ordered worldwide, the first flight is scheduled for the second half of 2013.

The new Dreamliner will carry forty extra passengers and will use 20% less fuel compared to similar sized aircraft, and allow an additional 550 kilometers of flight.

FOCUS OF COMMERCIAL AVIATION IN-DUSTRY

The 787 Dreamliner started out as Boeing's innovative aircraft which was marked by its efficiency and environmentally friendly properties. The major setback which the company had to deal with required intensive analysis, engineering and labor. In the future, new technology will inevitably bring along new complications and concerns for any aviation company. New systems will be presented and technology will further evolve. Our main focus, which marks our responsibility in the aviation industry, is to create an environment for passengers to fly on our wings safely. \Rightarrow

CONTACT LVD-VSV@student.tudelft.nl

References

- www.boeing.com
- www.newairplane.com
- www.bbc.co.uk/news/business
- www.smh.com.au

Aviation Department

The Aviation Department of the Society of Aerospace Engineering Students 'Leonardo da Vinci' fulfills the needs of aviation

enthousiasts by organising activities, like lectures and excursion in the Netherlands and abroad.

