4 - RECOMMENDATIONS

4.1 Preliminary Recommendation

On the basis of the initial facts established by the investigation, the BEA and the AAIB issued the following safety recommendation concerning the aircraft on 16 August 2000.

"The technical investigation into the accident to Concorde F-BTSC operated by Air France which occurred at Gonesse on 25 July 2000, conducted by the BEA with the participation of representatives of the AAIB, has so far established the following facts:

- during the take-off run the front right tyre of the left main landing gear was destroyed between V1 and VR, probably after having run over a piece of metal;
- the destruction of the tyre caused damage, either directly or indirectly, to the aircraft structure and systems, causing the aircraft to crash less than one minute and thirty seconds after the destruction of the tyre. The damage sequence and the connections between the various events have not yet been fully established. However, the effect of these events was:

- *one or more punctures in at least one fuel tank resulting in a major fuel release;*
- *ignition of the released fuel and an intense fire throughout the remainder of the flight. This fire started a few seconds after the destruction of the tyre;*
- *a loss of thrust on one, and then two engines.*

The crew had no means of assessing the fire or of taking action to extinguish it.

Further, in-service experience shows that the destruction of a tyre during taxi, takeoff or landing is not an improbable event on Concorde and that such an event may cause damage to the structure and systems. However, such destruction had never caused a fuel fire.

The accident which occurred on July 25 2000 showed that the destruction of a tyre - a simple event which may recur - had catastrophic consequences in a very short time without the crew being able to recover from the situation.

Consequently, without prejudice to further evidence that may come to light in the course of the investigation, the BEA and the AAIB recommend to the Direction Générale de l'Aviation Civile of France and the Civil Aviation Authority of the United Kingdom that:

- ***the Certificates of Airworthiness for Concorde be suspended until appropriate measures have been taken to guarantee a satisfactory level of safety with regard to the risks associated with the destruction of tyres."***

This recommendation was immediately accepted by the airworthiness authorities in France (DGAC) and United Kingdom (CAA) and the Concordes' Certificates of Airworthiness were suspended.

The investigation confirmed the validity of this general recommendation and the reasoning behind it. Elements identified by the investigators during their work were systematically provided to the airworthiness authorities, the manufacturers and the operators, so as to

allow them to define measures to be taken to return the aircraft to service. It was in this context that the airworthiness authorities defined the following measures:

- Installation of flexible linings in tanks 1,4,5,6,7 and 8.
- Reinforcement of the electrical harnesses in the main landing gear bays.
- Modification of Flight Manual procedures so as to inhibit power supply to the brake ventilators during critical phases of flight and revision of the MMEL to ensure that technical operational limitations cannot be applied for the tyre under-pressure detection system.
- Installation of Michelin NZG tyres and modification of the anti-skid computer.
- Modification of the shape of the water deflector and removal of the retaining cable.
- A ban on the use of volatile fuels and an increase in the minimum quantity of fuel required for a go-around.

4.2 Recommendations Specific to Concorde

The investigation did not bring to light the need for any other urgent recommendations. However, on several points, some improvements specifically linked to Concorde seem desirable in the light of information from the investigation. These improvements, which are the subject of the following recommendations, were brought to the attention of the French airworthiness authorities and were taken into account in the context of the aircraft's return to service.

4.2.1

For any transport aircraft, it is essential that feedback, through analysis of in-service incidents, be as effective as possible. Taking into account the small number of aircraft in service and their limited operations, in-service experience on Concorde is particularly limited. It is, however, both an ageing and a complex aircraft. It has been noted that the rate of malfunctions in certain systems or equipment was higher than current rates on other aircraft. Consequently, the BEA recommends that:

- **the airworthiness authorities, the manufacturers and the operators of Concorde reinforce the means available for the analysis of the functioning of aircraft systems and in-service events and for the rapid definition of corrective actions.**

4.2.2

The Concorde Flight Manual stipulates that a red alarm must lead to an immediate reaction by the crew.. In the same manual, dealing with an engine fire is consistent with this general instruction. However, the Air France Operations Manual requires that no action be taken before reaching four hundred feet. Consequently, the BEA recommends that:

- **Air France ensure that the emergency procedures in the section on Concorde utilisation in its Operations Manual be coherent with the Flight Manual.**