

### 4.2.3

Recording the engine parameters which allow engine speed to be determined only every four seconds slowed down and complicated some work essential for the technical investigation. This characteristic also tends to mask certain facts during examination of incidents for which it would not be possible to devote as much time and effort as for the 25 July 2000 accident. In contrast to Air France's Concorde aircraft on the day of the accident, British Airways aircraft are equipped with recorders that allow the parameters from all four engines to be recorded every second. Consequently, the BEA recommends that:

- **Air France equip its Concorde aircraft with recorders capable of sampling at least once a second the parameters that allow engine speed to be determined on all of the engines.**

### 4.2.4

The technical investigation brought to light various malfunctions relating to the operation of the aircraft, for example the use of non-updated flight preparation data, the absence of archiving of certain documents or incomplete baggage management. Equally, omitting the left bogie spacer was a consequence of non-respect of established procedures and of the failure to use the appropriate tool. Consequently, the BEA recommends that:

- **the DGAC undertake an audit of Concorde operational and maintenance conditions within Air France.**

## 4.3 General Recommendations

Beyond specific improvements to Concorde, the investigation showed the need for progress in safety in various areas. This general progress is the subject of the following recommendations.

### 4.3.1

Tests and research undertaken in the context of the investigation confirmed the fragility of tyres against impacts with foreign bodies and the inadequacy of the tests in the context of certification. Recent examples on other aircraft than Concorde have shown that tyre bursts can be the cause of serious damage. Consequently, the BEA recommends that:

- **the DGAC, in liaison with the appropriate regulatory bodies, study the reinforcement of the regulatory requirements and demonstrations of conformity with regard to aviation tyres.**

### 4.3.2

The investigation showed that a shock or a puncture could cause damage to a tank according to a process of transmission of energy from a projectile. Such indirect processes, though known about, are complex phenomena which had never been identified on civil aircraft. Equally, the ignition of the kerosene leak, the possible forward propagation of the flame, its retention and stabilisation occurred through complex phenomena, which are still not fully understood. Consequently, the BEA recommends:

- **the DGAC, in liaison with the appropriate regulatory bodies, modify the regulatory certification requirements so as to take into account the risks of tank damage and the risk of ignition of fuel leaks.**

#### **4.3.3**

In France, airport operations manuals contain instructions based on the ICAO recommendations concerning the inspection of movement areas. However, there are not yet any national regulations concerning their surveillance. The DGAC is currently studying the implementation of such regulations. The accident showed that the presence of objects on this area presented a risk to safety. It also showed that the presence of certain objects on the runway might not be identified by any preventative measures. Consequently, the BEA recommends that:

- **the DGAC ensure the rapid implementation of programmes for the prevention of debris on aerodromes. These programmes should involve all organisations and personnel operating on the movement area,**

the ICAO study the technical feasibility of an automatic detection system for foreign objects on runways.

#### **4.3.4**

The loss of a metallic strip by the Continental Airlines DC10 has been identified as resulting from maintenance operations that were not in accordance with the rules of the art. Consequently, the BEA recommends that:

- **the FAA carry out an audit of Continental Airlines maintenance both in the United States and at its foreign sub-contractors.**

#### **4.3.5**

The technical investigation again brought to light the current difficulty in identifying and analysing certain crew actions, certain selector noises and visual alarms. On several occasions, the BEA and its fellow agencies abroad have recommended the installation of video recorders inside cockpits. This point was examined in September 1999 at the ICAO during the "Investigation and Prevention of Accidents" divisional meeting (AIG 99) and the meeting formulated recommendation 1.2/4 "Video recordings in the cockpit", requesting that propositions be sent to the flight recorder expert group (FLIREC). Consequently, the BEA recommends that:

- **the ICAO fix a precise timetable for the FLIREC group to establish propositions on the conditions for the installation of video recorders on board aircraft undertaking public transport flights.**

#### 4.3.6

The investigation showed that the cabin crew had certainly perceived significant changes in their environment. It is therefore possible that communications between the cabin crew or attempts to communicate with the cockpit occurred. Exchanges between members of the cabin crew are not, however, recorded and the recording made in the cabin was cut off by the Flight Engineer at 14 h 14 min. Consequently, the BEA recommends that:

- **the ICAO study the procedures for recording specific exchanges between cabin crew members and exchanges between the cockpit and the cabin.**

#### 4.3.7

The investigation showed that the crew were probably never conscious of the origin of the fire nor of its extent. A comparable situation frequently occurs in the case of accidents due to damage to the structure of an aircraft. Consequently, the BEA recommends that:

- **the DGAC, in liaison with the appropriate regulatory bodies, study the possibility of installing devices to visualise parts of the structure hidden from the crew's view or devices to detect damage to those parts of the aircraft.**

#### 4.3.8

The investigation showed that the lateral acceleration suffered by the Concorde crew as a result of the surges on engines 1 and 2 were different from the values recorded at the aircraft's centre of gravity, these values being reproduced on flight simulators. The faithfulness of the simulation is an important part in the quality of training. Consequently, the BEA recommends that:

- **the DGAC, in liaison with the appropriate regulatory bodies, study the possibility of modifying the regulatory requirements relating to new flight simulators so that they accurately reproduce the accelerations really experienced in the cockpit.**

#### 4.3.9

Investigators and their advisers worked on the wreckage for several days without knowing that the accident site was polluted by asbestos used on the aircraft. They were therefore not equipped with special protective clothing, which may have long-term consequences on their health. This type of problem was examined at the ICAO in September 1999 at the "Investigation and Prevention of Accidents" divisional meeting (AIG 99) and the meeting formulated recommendation 8/1 "Information and training on the dangers of accident sites". Consequently, the BEA recommends that:

- **the ICAO put recommendation 8/1 of the AIG 99 meeting into practice in the shortest possible time and, while waiting for the results of this work, that the primary certification authorities ask manufacturers to immediately identify all potentially dangerous substances in case of an accident which are used in the manufacture of aircraft under their responsibility and to mention them in an explicit manner in documentation.**