



REASSESSMENT OF THE RESPONSES TO AVIATION SAFETY RECOMMENDATION A91-19

Aileron overbalance

Background

On 15 September 1988, a Hawker-Siddeley HS-748, was in cruise flight at 3,000 feet in visual flight conditions while on an instrument flight rules flight to Ottawa International Airport from Montreal/Dorval Airport. Coincident with a remark by the captain pointing out a ground feature, the aircraft commenced a full aileron deflection roll to the left. The aircraft rolled through 465 degrees and descended to impact, with a final speed of approximately 290 knots. In the last stages of the accident manoeuvre, a maximum vertical acceleration of approximately 4.7g was recorded. Both crew members on board were killed, and the aircraft was destroyed.

The investigation determined that the aileron control system was asymmetrically rigged, making it susceptible to aerodynamic overbalance. The operator had not conducted the required post-maintenance flight tests of the aileron control response.

Contributing to the accident were the design of the aileron system; ambiguous and incomplete maintenance instructions; a lack of published information for flight crew concerning aileron system performance and possible emergencies; and the presence of factors which may have led to the development of flight crew fatigue.

As a result of the investigation of this occurrence, the TSB forwarded six recommendations to TC; four dealt with aircraft aileron overbalance, and two centered on manufacturer notices-to-operators (NTO).

The Board concluded its investigation and released Aviation Investigation Report A88H0011 on 18 June 1991.

TSB Recommendation A91-19 (June 1991)

The control-wheel force required to restore the ailerons toward neutral during the first portion of the flight upset should have been within the capability of either crew member. Indeed, the crew did neutralize the ailerons just before impact when the force required would have been at a maximum. Even though large control-wheel forces might not be required to recover from an overbalance situation, unexpectedly experiencing such handling characteristics is potentially dangerous. Had the flight crew of the accident aircraft been aware of the potential for aileron aerodynamic overbalance and of the recovery action required, they might have been better prepared to neutralize the ailerons before the aircraft entered an unusual attitude.

NTO No. 5 had cautioned that, if the ailerons were not rigged properly, they might remain at full travel and assistance from the pilot would be required to recentre the control wheel. Although the NTO had stated that its contents should be brought to the attention of all HS 748 pilots, an amendment to the flight manual and crew manual would have been a more effective means of communicating this information to pilots because these are the documents that pilots rely upon for aircraft handling information.

Although this accident has sensitized the HS 748 community to the potential for aileron aerodynamic overbalance, to ensure a continuing awareness, and to better prepare pilots, the TSB recommends that

The Department of Transport ensure that the HS 748 Flight Manual and Crew Manual are amended to include appropriate warnings regarding the possibility of aileron aerodynamic overbalance and procedures to be followed should it be encountered.

TSB Recommendation A91-19

Transport Canada's response to Recommendation A91-19 (February 1992)

Transport Canada understands the TSB concern for flight crew continued awareness.

TC issued a Service Difficulty Advisory following the accident to C-GFFA in 1988. This was a notice to Canadian operators of HS748 aircraft to call attention to the information provided by the manufacturer concerning aileron maintenance and to encourage operators to follow rigorously and completely those instructions.

In response to this Recommendation, the Advisory has been revised to include a warning to flight crews regarding the possibility of aileron aerodynamic overbalance and procedures to follow should it be encountered, with instructions that a copy be attached to the HS748 Aircraft Flight and Crew Manuals.

TSB assessment of Transport Canada's response to Recommendation A91-19 (March 1992)

Since the HS 748 is manufactured outside of Canada, TC does not have authority over the contents of the British Aerospace Maintenance Manual; hence, they will forward recommendation A91-16 to the Civil Aviation Authority (CAA) of the United Kingdom and ask them to take action on this matter. This action, combined with the aircraft manufacturer's proposed revision to the HS 748 Maintenance Manual and TC's proposed amendments to the Maintenance Control Manuals, address the intent of recommendations A91- 16, A91-17 and A91-18 regarding maintenance information.

With respect to A91-19, TC indicates an understanding of TSB's concern for flight crews' continued awareness of aileron aerodynamic overbalance; however, their proposed action misses the intent of the recommendation. TC plans to re-issue a revised Service Difficulty Advisory (SDA) to address the continued awareness aspect. SDAs are non-mandatory notifications issued primarily to bring potential airworthiness problems to the attention of operators. SDAs are not normally reviewed by pilots and do not require amendments of the pilots' source documents, the HS 748 Flight Manual and Crew Manual.

With respect to TSB Recommendations A91-16, A91-17, and A91-18, the TC response indicates action that should address the intent of these recommendations. Therefore, this portion of the response is considered to be satisfactory. However, the proposed use of a non-mandatory, non-aircrew notification to promote aircrew awareness does not address the intent of recommendation A91-19.

Therefore, the portion of the TC reply pertaining to Rec A91-19 is considered to be **Unsatisfactory**.

TSB reassessment of Recommendation A91-19 (November 1996)

The revised Service Difficulty Advisory (SDA) has increased pilot awareness; however, a change to the flight manual is preferable for long term awareness.

Therefore, the response to Recommendation A91-19 is assessed as **Satisfactory in Part**.

TSB reassessment of Recommendation A91-19 (November 1997)

While the revised SDA has increased pilot awareness, a change to the flight manual would be preferable for long term awareness. However, no such change is proposed.

Therefore, the assessment remains as **Satisfactory in Part**.

As such, **Further Action is Unwarranted** with respect to A91-19 and the status is set to **Inactive**.

TSB review of Recommendation A91-19 deficiency file status (April 2014)

The Board requested that A91-19 be reviewed to determine if the deficiency file status was appropriate. After an initial evaluation, it was determined that the safety deficiency addressed by Recommendations A91-19 needed to be reassessed.

A request for further information was sent to Transport Canada and a reassessment will be conducted upon receipt of Transport Canada's response.

Therefore, the assessment remains as **Satisfactory in Part**.

Consequently, the status of Recommendation A91-19 is changed to **Active**.

Transport Canada's response to Recommendation A91-19 (August 2017)

TC agrees in principle with the recommendation.

Although TC did not follow the letter of the recommendation, the safety deficiency has been eliminated through an alternative approach.

Transport Canada Civil Aviation (TCCA) reviewed chapter 27 of all current BAe Systems HS748 Aircraft Maintenance Manuals (AMM) related to aileron rigging and flight testing following disturbance of the aileron system. After the release of the TSB report A88H0011, all manuals have been amended to clarify aileron rigging require a flight test following aileron system disturbance, and provide explicit parameters for the flight test.

BAe Systems has also removed Notice to Operators (NTO) No.5 from their list of published documents. TC believes the AMM requirement for a flight test, “When an aileron is changed or repaired, or if the aileron or aileron tab rigging has been adjusted for any reason...” eliminates the risk that Recommendation A91-19 was intended to address and satisfies the intent of the recommendation for the following reasons:

- The AMM amendments address the root cause of aileron aerodynamic overbalance;
- The AMM amendments in the “Test Flight Aileron Handling” section, highlight to the flight crew the aileron overbalance flight characteristics;
- There is no record of re-occurrence of aileron aerodynamic overbalance within the Canadian fleet since the release of Investigation Report A88H0011 and the subsequent safety actions carried out by the type certificate holder.

In view of the fact that aileron imbalance in flight operations has been eliminated, it is neither necessary nor appropriate to include procedures, or any other instructions, relating to the condition in the Aircraft Flight Manual (AFM).

TC also sought information on the number of HS 748 aircraft operating. There are 19 HS 748 aircraft registered in Canada, but only seven are flying. The aircraft has become difficult and expensive to maintain so operators are phasing them out of service in favour of newer aircraft types. Those that are flying are, for the most part, operated in a cargo-only configuration.

TC believes that the risk associated with this recommendation is very low and will shortly be eliminated.

TSB reassessment of Transport Canada’s response to Recommendation A91-19 (February 2018)

In its response, TC indicates that the safety deficiency identified in Recommendation A91-19 regarding the potential for aileron aerodynamic overbalance with HS-748 aircraft has been addressed for the following reasons:

- The HS-748 AMMs were amended to address the risk of aileron aerodynamic overbalance. The amended AMMs now require and provide explicit parameters for a flight test in order to verify the in-flight handling and performance of the aileron system when it is changed or repaired, or if the aileron or aileron tab rigging has been adjusted for any reason;
- Only 19 HS-748 are still registered in Canada, with only 7 aircraft actively flying. Due to the age of the fleet and the cost associated with maintaining these aircraft, the likelihood of any of the remaining aircraft reverting back to active flying status is very low; and
- There has been no reoccurrence of aileron aerodynamic overbalance since the publication of Recommendation A91-19.

Although the HS 748 Flight Manual and Crew Manual were not amended to include appropriate warnings regarding the possibility of aileron aerodynamic overbalance and procedures to be followed should it be encountered, the Board believes that the limited number of HS-748 still in operation, paired with the actions taken by TC, have substantially reduced the risks associated with the safety deficiency identified in Recommendation A91-19.

Therefore, the Board considers the response to the recommendation to be **Fully Satisfactory**.

Next TSB action

This deficiency file is **Closed**.