



**AVIATION INVESTIGATION REPORT
A05O0112**



MISRIGGED ELEVATOR TRIM TABS

**FLIGHT OPTIONS LLC
RAYTHEON/HAWKER 800XP N829LX
TORONTO/LESTER B. PEARSON INTERNATIONAL
AIRPORT, ONTARIO
02 JUNE 2005**

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report

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Toronto/Lester B. Pearson International

Airport, Ontario

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Summary

The Raytheon 800XP aircraft (registration N829LX, serial number 258466) had recently undergone painting and reassembly at Flying Colours/Rapid Aircraft Repair Inc. in Peterborough, Ontario. On the first flight following the work, the aircraft departed Peterborough for Buffalo, New York. During the initial climb, as the aircraft speed neared 190 knots indicated airspeed (KIAS), the aircraft ran out of nose-down trim authority. The speed was kept below 190 KIAS and the crew hand flew, diverting to Toronto/Lester B. Pearson International Airport to inspect the aircraft. During the approach to Toronto, the rudder began to vibrate and seize, and the flight crew declared an emergency. The aircraft landed at approximately 1348 eastern daylight time without further incident. An inspection revealed that the elevator trim controls were incorrectly rigged.

Ce rapport est également disponible en français.

Other Factual Information

The weather at the time of the occurrence was good visual meteorological conditions (VMC). Weather was not a factor in the occurrence.

The pilot-in-command (PIC) was seated in the left seat. He held a valid United States (US) airline transport pilot licence, and his latest aviation Class 1 medical certificate was issued on 17 March 2005. As of June 2005, the PIC had accumulated approximately 6029 total flying hours with 2280 hours on type.

The second-in-command (SIC) was seated in the right seat. He held a valid US airline transport pilot licence, and his latest aviation Class 1 medical certificate was issued on 27 April 2005. As of June 2005, the SIC had accumulated approximately 8600 total flying hours and 1800 hours on type.

On 04 May 2005, the aircraft had been flown to Flying Colours/Rapid Aircraft Repair Inc. in Peterborough to be repainted. Flying Colours is an aircraft paint shop. Rapid Aircraft Repair Inc. is an approved maintenance organization (AMO). As per Rapid Aircraft Repair Inc. procedures, the aircraft was inspected on arrival and any discrepancies were noted. This was performed by a senior aircraft maintenance engineer (AME) who had company aircraft certification authority (ACA) and several years of experience on the aircraft type. The aircraft was then disassembled by a crew of AMEs and apprentices in preparation for paint stripping.

As part of the disassembly, the landing gear doors and flight controls were removed. When the elevators were removed, the elevator trim control rods – two on each of the left and right horizontal stabilizers – were also removed. The removal of these control rods is not required; however, if they are not removed, they are susceptible to damage because they extend beyond the back of the horizontal stabilizer when the elevator is removed.

Removal of the elevator trim control rods was accomplished by loosening the jam nuts at the rod eye end fitting where it attaches to the screw jack fork end and unscrewing the control rods from the eye end fitting. The senior AME removing the rods counted the number of full turns required to remove the rods and marked this number on a tag that was securely attached to each rod (Figure 1). This would later aid in the reassembly of the aircraft.

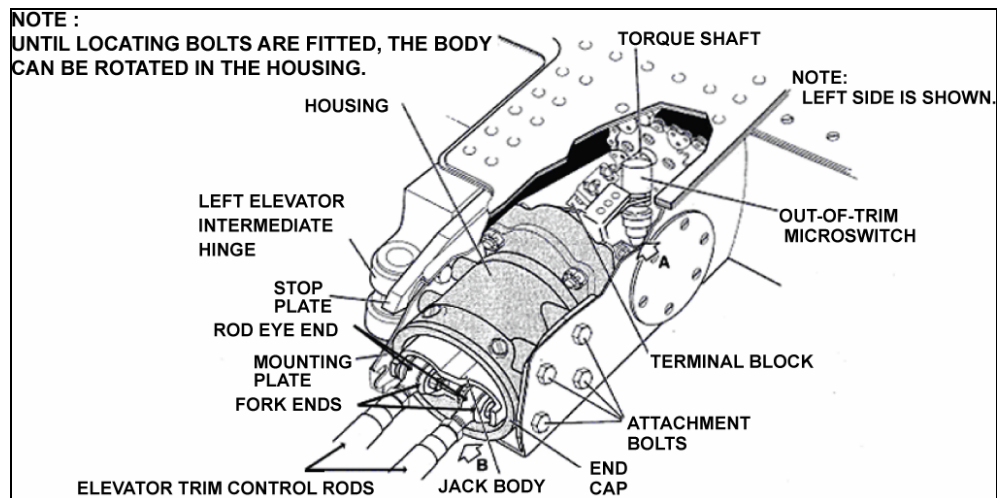


Figure 1. Elevator trim jack

After paint stripping, the aircraft was again inspected for discrepancies that may have been hidden by paint, and the required repairs were completed. The aircraft was then masked and prepared for painting.

Following painting, the aircraft was prepared for reassembly. This included removing all tape and paper used to protect areas not to be painted. The aircraft was reassembled and prepared for delivery.

During the reassembly, the elevator trim control rods were reinstalled by screwing the control rods back onto the rod eye ends using the same number of turns as when they had been removed. The flight controls were then checked to ensure they all moved in the correct direction, and the control rods and rod eye ends were then locked accordingly. The director of maintenance carried out an independent inspection of the aircraft's affected systems, the paperwork was completed, and the aircraft was returned to service.

The incident flight was the first flight for N829LX after the painting, and the flight crew spent several hours inspecting the aircraft. This included checking all the flight controls for correct operation and direction of travel. They noted no discrepancies in the flight controls, but found two unrelated, minor discrepancies, and a piece of masking tape.

Following the incident flight, the aircraft was quarantined until a TSB investigator, a company Flight Options Quality Assurance Inspector, and company mechanics could examine the aircraft. As part of this examination, an access panel on the vertical stabilizer was removed to check the rigging of the elevator trim tab. Removing the access panel permitted access to the elevator control quadrant for insertion of a rigging pin. It was observed by all parties that the access panel, including the screws, had been painted while installed, and that it had not previously been removed.

To check the flight control rigging, the elevator was pinned at the neutral position and the elevator trim wheel was set to 35 degrees, as per the maintenance manual. The maintenance manual, 27-30-00, Figure 504, indicated that the elevator trim tab trailing edges should fair flush with the trailing edge of the elevator when set as indicated above. However, both the left and

right trim tab trailing edges were 0.250 inches below the trailing edge of the elevator, giving the aircraft a nose-up trim condition. Next, the trim wheel was rotated to maximum nose-down trim (against the mechanical stops). When the wheel reached its stop, the trim tab's trailing edge was still slightly below the elevator's trailing edge. As such, with full nose-down trim selected, the aircraft was rigged in a nose-up condition.

The rudder and rudder trim system were run through full travel several times, and no faults were found. As a precaution, the panel shroud was repositioned, increasing the distance between the panel and the rudder cables. As well, the rudder spring strut was lubricated.

Section 571.02 of the *Canadian Aviation Regulations* (CARs) requires that all work performed on an aircraft be completed in accordance with the manufacturer's recommendations, or equivalent practices. A review of the aircraft and work order documents showed that Flying Colours/Rapid Aircraft Repair Inc. had signed that all flight controls had been installed and locked in accordance with the applicable aircraft maintenance manual chapters. However, the maintenance manuals require that, when installing flight controls, the rigging must be checked. To check the rigging, rigging pins and incidence boards¹ are required. To use the rigging pins requires removal of the access panel that had not been removed. Additionally, Flying Colours/Rapid Aircraft Repair Inc. did not own a set of rigging pins or incidence boards. They indicated that they could borrow them if required, but they felt that these items were not required for this particular job. The rationale for this was that there were no reported flight control problems when the aircraft arrived, the aircraft was reassembled back to the way it was received, and the rigging should not have changed. The rigging and checking of the flight controls was not completed as per the maintenance manual, and, therefore, the work performed on the aircraft did not meet the requirements of Section 571.02 of the CARs.

Section 571.10 of the CARs and Airworthiness Notice C010² require that work that disturbs engine or flight controls be inspected for correct assembly, locking and sense of operation by at least two persons, and that the technical record contain the signatures of both persons. This procedure is to ensure that these critical systems are assembled correctly before flight. The independent inspection must be completed before the maintenance release. The paperwork for N829LX indicated that this inspection was completed. However, the investigation found that the person performing the inspection looked for correct locking, but did not check the correct assembly and sense of operation.

Findings as to Causes and Contributing Factors

1. The elevator trim tabs were not rigged in accordance with the aircraft maintenance manual, resulting in a misrigged condition and a lack of sufficient nose-down trim authority.

¹ A tool used for checking the angle of incidence of aircraft wing, stabilizer and flight control surfaces.

² Airworthiness Notification C010 Edition 2, dated 10 October 2001.

2. Maintenance was performed without adherence to the applicable standards of airworthiness as required by Section 571.02 of the *Canadian Aviation Regulations*.
3. The independent control inspection was not carried out in accordance with the standards described in the *Canadian Aviation Regulations* or Airworthiness Notification, resulting in the misrigged controls being undetected.
4. Incorrect maintenance release statements were entered in the aircraft documents.

Safety Action Taken

As a precautionary measure, Transport Canada issued to Rapid Aircraft Repair Inc. a notice of suspension on 10 June 2005, conducted a special audit of Rapid Aircraft Repair Inc. on 14 June 2005, and issued an amended suspension on 21 June 2005. On 27 June 2005, Transport Canada rescinded the notice of suspension, subsequent to immediate corrective actions being implemented.

On 22 August 2005, Transport Canada received a corrective action plan from Rapid Aircraft Repair Inc., which addressed long-term corrective actions.

Following the occurrence and subsequent audit by Transport Canada, Rapid Aircraft Repair Inc. hired a director of quality assurance and designated this person as the person responsible for maintenance (PRM). The company then amended or implemented various processes involving aircraft maintenance, as follows:

- amended its quality assurance program to ensure closer scrutiny in all aspects of maintenance than was previously possible;
- implemented a process for regular discussions on process control;
- implemented the process of a full control-travel check before disassembly; consequently, this process revealed that many aircraft received to work on had controls not rigged within the specified limits;
- implemented additional training on human factors, improving the reporting of potential problems; and
- the company is in the process of implementing a Safety Management System (SMS).

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 09 August 2006.