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When is a Hard Landing Hard?

It can be a difficult decision to report a hard landing when doubt exists, but the ensuing inspection may uncover damage that could endanger a later flight.

Delay report 890630-01/1295E. Delay 20:48 hours. Returned from Flight: Flap Asymmetry.

It was just one simple line in a Boeing 747 delay report, yet it caused more inconvenience than one would suspect. One inconvenience was to the passengers, who already had suffered a seven-hour delay before the first takeoff, caused by a hydraulic leak above the bulk cargo compartment ceiling. And, of course, not a good show for the company either — 97,000 pounds of fuel had to be dumped. But this was not all. The flap asymmetry, although simply phrased, later became a serious problem.

The problem surfaced during climbout after the takeoff from Amsterdam, when the aircraft started to show peculiar behavior after it shuddered slightly during flap retraction. A cabin crew member reported that the left-hand inboard aileron had hit the inboard flap with visible damage, and the decision was made to return to Amsterdam.

Broken Parts in Flap System

What caused the flap and aileron to hit each other soon became clear. In flap track number 3 (the outboard track of the inboard flap) on the left-hand wing, a few rods had failed and the complete assembly was substantially deformed. Also, flaptrack number 4 (inboard track, same flap) had not escaped from damage; there too, a rod had failed. An examination of all available data plus a reconstruction on another aircraft resulted in the following sequence of events:

- A few days before the takeoff in question, the aircraft had made a hard landing with no less than 1.91 G as indicated on the aircraft condition monitoring system (ACMS) printout. The trigger for a warning is set at 1.6 G. As required, a hard landing inspection was performed but no problems were found.

- During the last landing before the incident, the ACMS had also produced a printout, which reflected a 1.75-G landing. However, the crew did not consider this landing to have been excessively hard, which they noted in the maintenance log. The ACMS was thought to have suffered from a hiccup and the complaint was dealt with accordingly.

- Data obtained later, however, shows that the landing had indeed been hard and had caused damage. The (partly established, partly assumed) facts are that during the first hard landing, most probably the aft flap forward actuating rod (Figure 1) overloaded, although with no visible damage. This assumption is supported by earlier problems with such rods, as reported by Boeing Commercial Airplane Group to all operators in a service letter that resulted in installation of rods with increased wall thickness from then on (June 1986). Because of the good experience KLM had with the rods (or rather the lack of bad experience), retrofitting was not considered necessary.

- Before or after the second hard landing, the actuating rod failed because of the forces exerted at some four inches from the rod-end at the geneva cam side. This may have been the result of the hard landing, but could also be the result of misrigging of the length of the rods, or both. The failure of the rod also caused some damage, for a hole covered by tape was discovered in the canoe. The hole was clearly made by something from the inside and could only have been caused by the broken rod.

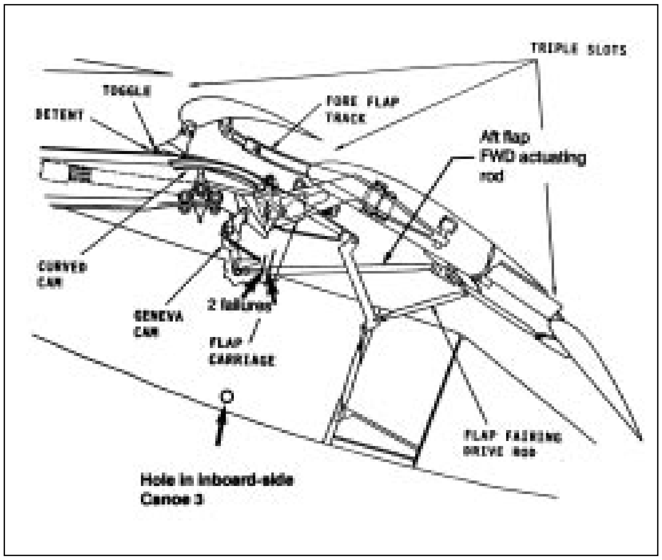


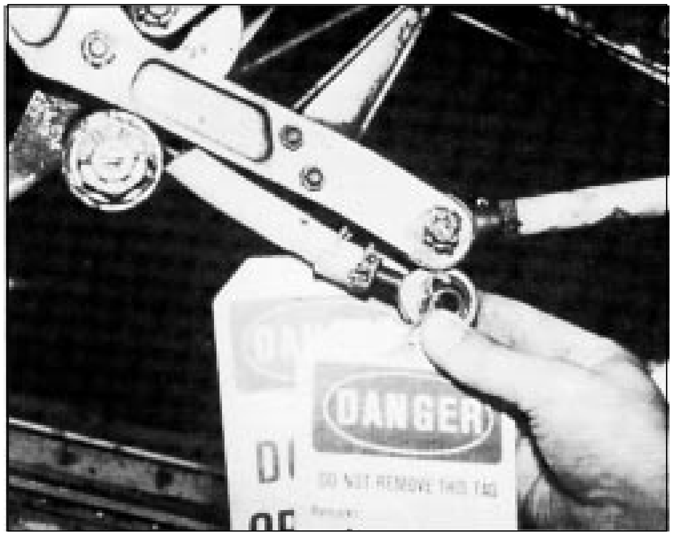
Figure 1

- Prior to departure, the flaps were extended without any problem because of the lack of airload. During retraction after takeoff, the remaining four inches of the actuator rod were trapped between the geneva cam and the cam support shaft (photograph) and failed once more, near the rod-end. The airload pushed the flap sideways, causing the number 3 canoe drive fitting to split open. Also, the broken number 3 actuating rod buckled and the same rod in canoe number 4 failed. The flap became jammed against the aileron, damaging the latter to such an extent that this, too, had to be replaced, together with a host of other parts.

Hard Landing Inspection?

What signaled the beginning of this damaging chain of events was the write-up about the ACMS recording a hard landing, accompanied by the crew's statement that the landing was not hard and suggesting that the ACMS was in error.

However, the crew's statement should not have precluded further inspection, for the maintenance manual simply states that a *hard landing inspection is required after an ACMS **or** a pilot report.* In other words, a hard landing



inspection should have been accomplished after the first hard landing, and since this requires the flaps to be checked, the failure would probably have been discovered.

Perhaps there is a belief that a pilot's write-up always overrules an ACMS warning and that the reason why nothing was done was because some persons may believe the ACMS printout to be less important. There is only one situation where the ACMS readout can be disregarded — a high sink rate prior to landing with a DC-10, which also triggers the ACMS and produces an automatic printout. If then (and only in such a situation) the crew reports that the landing itself was not hard, no inspection is required.

This would be the end of this article, if it were not for another action that was not done according to regula-

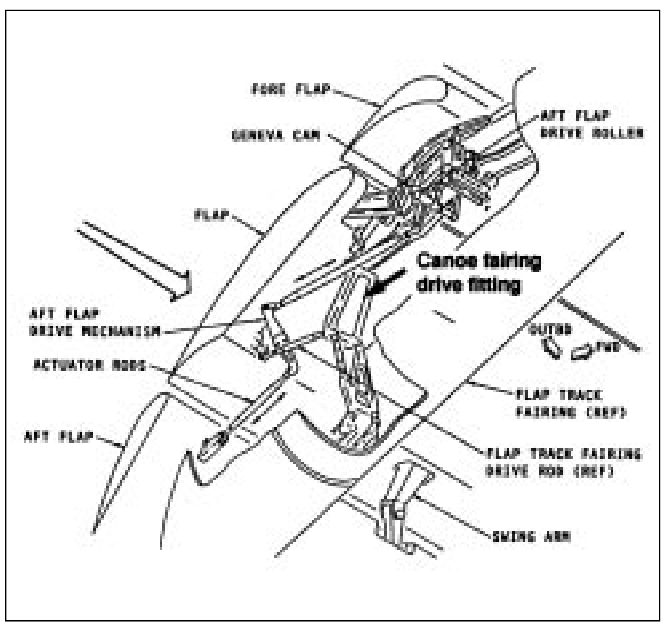


Figure 2

tions. The hole in the canoe and the high-speed tape over it raise some questions. The tape definitely had been installed only shortly before the incident. Remnants of the canoe honeycomb material were found on the remaining parts of the actuating rod, proving beyond doubt that the hole was made by the then already failed rod. Why was no check carried out to determine what caused the hole?

What Was Done About It

The incident caused some actions to be taken. First, it was determined that the hard landing inspection criteria could do with some clarification. This will be done by adding an extra statement that **either** an ACMS printout **or** a pilot's complaint is enough to warrant a hard landing inspection. In this respect, the flight department will be requested to refrain from "negative" information such as "the landing was not considered hard." Furthermore, KLM is evaluating (on the basis of all data about the broken rods), whether to retrofit all systems with rods having increased wall thickness. ♦

(Adapted from the KLM Engineering and Maintenance Division's TIP-Technical Information Program *in the interest of sharing aviation safety information with the worldwide aviation community.)*

Readback Error

A mixup in callsigns almost caused a midair collision between two air carriers.

(Adapted from an Advisory Alert issued by the New York Air Route Traffic Control Center.)

"Damn! That airplane was close!" said the captain of Flight XYZ 946 after he sharply banked his Boeing 737 to avoid missing the DC-10 descending through 946's flight path and airspace.

How could this happen in the most advanced air traffic control system in the world? It happened because callsigns often sound similar, especially in high-density traffic areas. The callsigns in this article are fictitious but the incident is real.

Flight XYZ 946 was eastbound, maintaining 27,000 feet, en route from Chicago to Pittsburgh. Flight CBA 1115 departed Charlotte for Cleveland and was northwest-bound at 28,000 feet on a course that would cross Flight 946's flight path. Flight ABC 716 was eastbound at FL330 en route to LaGuardia, New York. The flight crew of CBA 1115 was nearing the point where they would normally be cleared for descent. (see Figure 1)

Incident sequence:

- ATC issues a clearance to ABC 716 to descend to 25,000 feet. "ABC seven sixteen descend and maintain flight level two five zero."
- The flight crew of CBA 1115, anticipating a descent clearance, acknowledges the clearance issued to ABC 716. "Descend to two five, oh, eleven fifteen."

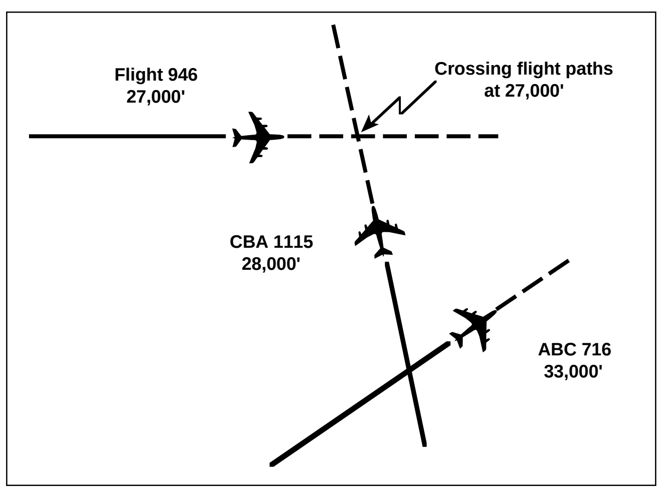


Figure 1

- The flight crew of ABC 716, hears CBA 1115 acknowledge the clearance but assumes that the clearance was actually for CBA 1115 and therefore, does not respond.

- The air traffic controller hears the acknowledgement, but fails to recognize the incorrect flight response.

- CBA 1115 descends across the flight path and through the altitude maintained by XYZ 946.

What caused the incident?

- Similar callsigns. (CBA-ABC)

- Anticipation of a decent clearance by the crew of CBA 1115.

- Failure of the CBA 1115 crew to acknowledge with a complete callsign.

- The assumption of the ABC 716 crew that the clearance was not for them.

- Failure of air traffic control to recognize the incorrect callsign in the readback.

In response to this and other incidents, a five-day communications/readback survey was conducted by ATC facilities throughout the Untied States. The survey noted 7,700 incorrect readbacks. The errors were categorized in the areas of altitude, frequency, heading/route, crossing point, altimeter, speed, accepted clearance for another aircraft and others. Errors were made by all users of the ATC system including air carriers, general aviation, air taxis and the military. Air traffic controllers corrected errors accordingly.

During the five-day survey, fourteen operational errors (defined as an incident when required separation was compromised) were reported. One of the fourteen (seven percent) was the result of a readback error. For the past year, 15 percent of all operational errors were related to readbacks. Communication in the form of readbacks is a vital segment of the air traffic control system. We need to be aware that readback errors are occurring in great numbers. We must recognize that any communication or readback error has the potential to cause a catastrophe. All of us — pilots, controllers, instructors and certifiers — need to respond individually to resolve the problem.

The quality assurance staff at New York is involved in a program to emphasize the seriousness of the communication/readback problem. The Advisory Alert is used in conjunction with a series of controller briefings to increase controller awareness of this problem. ♦

(For more information contact Dick Marakovits, New York ARTCC air traffic manager, 516-737-3418)

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