

No. 14

Trans Canada Airlines, Canadair C4-1 and a RCAF Harvard MK. II, involved in collision over outskirts of Moose Jaw, Saskatchewan, Canada, on 8 April 1954. Report of Board of Inquiry, Ref. AC-5-34, Department of Transport, Canada

Circumstances

Trans Canada Air Lines scheduled west-bound flight to Vancouver, carrying 4 crew and 31 passengers, had been cleared by Air Traffic Control on an IFR flight plan and was flying at 6 000 feet on Green Airway No. 1 between Winnipeg and Calgary, when at 1003 hours MST, a collision occurred with a Harvard which had taken off from RCAF Station, Moose Jaw, on a solo navigation training exercise. At the time of the collision the Harvard aircraft was crossing the airway on a northerly course. The collision was observed by witnesses who shortly afterwards heard an explosion.

Wreckage from both aircraft covered an area of about 1 square mile, and the largest portion fell on a house which was destroyed by the fire that ensued. The only occupant of the house and the occupants of both aircraft were killed.

Investigation and Evidence

The portion of the flight immediately prior to the accident was reconstructed and superimposed on a mosaic photograph. From this it was seen that the TCA aircraft was proceeding in a westerly direction on the right-hand side of the centre line of the airway at a height of 6 000 feet.

At 0957 hours MST a Harvard aircraft took off from Runway 13 at RCAF Station, Moose Jaw, to carry out a navigation cross-country exercise. After take-off a right-hand turn was executed conforming with the right-hand circuit then in effect for RCAF Station, Moose Jaw, and on the assumption that the aircraft carried out the requirements of the navigation exercise, a steady climb on track (031°T) across the airway would have been started. This would have occurred at about 1000 hours MST. At this time (1000 hours MST) both aircraft would have been about 14 miles apart with a relative speed of approach of about 270 mph. The cross-country exercise on which the Harvard was engaged involved an initial climb to 9 000 feet. From approximately 1000 hours MST onward the aircraft were on collision courses, the collision taking place at 6 000 feet at 1003 hours, i. e. three minutes later. Thus the Harvard was airborne only six minutes before the accident. It is accepted that the collision occurred at 6 000 feet as the flight plan was for that height and only thirteen minutes before the TCA aircraft had given his position as by Regina at 6 000 feet.

There were no survivors to the accident in either of the two aircraft from whom evidence regarding the collision could be obtained. However, eye-witnesses agreed that the aircraft were on converging courses on the airway, the Harvard crossing the airway north-bound and the TCA aircraft west-bound and no action to avoid collision was taken.

The Board was aware that the provision of an adequate field of view has long been a difficult problem for designers and considered that there might be a blind spot in either or both aircraft.

A Vector diagram showing the collision tracks of the two aircraft was prepared and this showed that the line of sight prior to the collision from the Harvard to the TCA aircraft was about 50 degrees to the right from dead ahead and similarly the line of sight from the TCA aircraft to the Harvard was about 23 degrees to the left from dead ahead. This suggested that there might be blind spots in either or both aircraft along the line of constant bearing thus preventing either pilot from seeing the other aircraft. As a result, the Board proceeded to Montreal

to examine the field of vision from the Canadair C4-1 type of aircraft from the pilot's seat and obtained a diagram from TCA which was prepared at the request of the Board. This diagram illustrated that from the captain's seat of the TCA aircraft there is an upright member of the structure of the windows (window post) causing a blind spot 6 degrees in width from the pilot's eye and whose centre line is 16 degrees to the left from dead ahead. In other words the line of bearing between the two aircraft comes within only 4° of the blind spot.

Similarly the angle of depression from the pilot's position between the horizontal line of sight and the lower structure of the windows was found to be about 13-14 degrees. The gradient of climb of the Harvard aircraft was computed and found to be of the order of 4-1/2 degrees.

While these figures are based on the pilot holding his head in a fixed position, it was recognized that for reasons of comfort, the pilot will change his position from time to time and thus cause the position of the blind spot to move.

Any variation in the seat position will cause a considerable change in the angle of depression, but it was realized that a pilot will adjust his seat to suit his own personal preference.

If there was an adequate field of view and as no avoiding action was taken, the pilots might well have been preoccupied with other matters related to the operation of their aircraft. In discussing this aspect, the Board considered that a continuous lookout may not always be feasible, or even sufficient, in view of the speeds of modern aircraft. This pointed out the need for altitude separation of aircraft even in VFR weather when crossing airways. Recommendation No. 1 refers.

Consideration was given to increasing the height of the uncontrolled or free airspace below the airway from the present 700 feet to some figure such as 2 000 feet. This idea, however, was rejected due, inter alia, to the serious interference that this would cause flights operating in accordance with Instrument Flight Rules particularly in approaches preparatory to landing.

The air navigation exercise being undertaken by the RCAF pilot required that he should climb to 9 000 feet en route to his first turning point. The track of the aircraft led directly across the airway at an altitude commonly used by scheduled aircraft. The Board was cognizant of the policies leading to the use of airports which were built on airways for the British Commonwealth Air Training Plan and that there is salvage value in the use of these airports, but nevertheless considered that their continued use for training constitutes a hazard to other traffic.

The Board considered that in the interest of maintaining a proper lookout, as required by the Air Regulations, the practice of allowing passengers on the flight deck in scheduled aircraft while en-route should be discouraged, as should the custom of the pilots leaving the cockpit to mingle with the passengers.

In order that concerted action might be taken to prevent such accidents in future, the Board considered that its recommendations should be brought to the attention of both the RCAF and ICAO.

The speed of approach of modern aircraft, especially jet aircraft, is such that the time available to pilots between sighting another aircraft and taking evasive action is so small that the human machine may be unable to maintain safety in flight under some conditions when reliant on human senses alone. Accordingly, the Board considered the possibility of adapting some war-time or post-war proximity warning device for use on aircraft and considered that this field should be explored by the Telecommunications Division of the Department of Transport.

Probable Cause

1. Failure on the part of the pilots of both aircraft to maintain a proper lookout, the onus of responsibility for keeping out of the way being with the Harvard aircraft as it had the other on its own right side.

2. The Harvard aircraft in crossing the airway climbed through altitudes normally used by aircraft flying along the airway.

3. The Board, up to the present, has been unable to determine whether the window post on the left side of the Canadair C4-1 aircraft hid the Harvard aircraft from view, but there are indications that this was possible.

Recommendation

It is recommended that:

1. Series V.A.N.O. 2, be cancelled and a new A.N.O. issued as follows: when an aircraft is in level cruising flight at 1 000 feet or more above the surface of the ground or water, it shall be operated in accordance with the following cruising altitudes:

a) For VFR flights. The cruising altitudes specified herein shall be complied with in so far as possible while maintaining the separation from cloud minima specified in Air Navigation Orders, Series V, No. 3.

1) Along designated airways or air routes - at the even or odd thousand foot level appropriate to the direction of flight, as in Table 1 below;

2) Across designated airways or air routes:

i) at an altitude of 500 feet above an even or odd thousand foot level, and

ii) in level flight, and

iii) at an angle of at least 45 degrees to the airway or air route.

3) Elsewhere - at the altitude level appropriate to its direction of flight, as in Table 2 below.

b) For IFR flights

1) Within designated airways and air routes

i) under IFR weather conditions: unless otherwise authorized by air traffic control, at the even or odd thousand foot level appropriate to the direction of flight as in Table 1 below;

ii) under VFR weather conditions: at the even or odd thousand foot level appropriate to the direction of flight as in Table 1 below.

2) Elsewhere - at the altitude level appropriate to its direction of flight as in Table 2 below.

NOTE: All altitudes in the Tables below are ABOVE MEAN SEA LEVEL.

TABLE 1

GREEN or RED Airways or Air Routes

Eastbound - ODD thousand foot levels (3 000, 5 000, etc.)
Westbound - EVEN thousand foot levels (2 000, 4 000, etc.)

AMBER or BLUE Airways or Air Routes

Northbound - ODD thousand foot levels (3 000, 5 000, etc.)
Southbound - EVEN thousand foot levels (2 000, 4 000, etc.)

TABLE 2Magnetic TrackCruising Altitude

0° - 89° inclusive	-	ODD thousands of feet (3 000, 5 000, etc.)
90° - 179° inclusive	-	ODD thousands of feet plus 500 feet (1 500, 3 500, etc.)
180° - 269° inclusive	-	EVEN thousands of feet (2 000, 4 000, etc.)
270° - 359° inclusive	-	EVEN thousands of feet plus 500 feet (2 500, 4 500, etc.)

2. Elementary Flying Training be conducted clear of airways and that flying training establishments be located at points at some distance from the airways.

3. All airlines be required to amend their Operations Manuals to include clauses to the effect that the pilots are required to remain at the controls and maintain a proper lookout within a radius of 25 nautical miles from an airport, also persons other than the flight crew shall not be permitted on the flight deck within the aforementioned area, except as may be required for the safe or efficient operation of the aircraft.

This recommendation does not reflect any conclusions that either pilot was absent from the flight deck at the time of the accident to the TCA aircraft.

4. The above recommendations be drawn to the attention of the Department of National Defence for their consideration and such action as they may deem necessary.

5. A study be made to determine the field of vision from the pilot's cockpit of all Canadian civil aircraft with a view to establishing the adequacy of such field of vision.

This recommendation was made in view of the doubt that exists regarding the adequacy of such field of vision, together with the increased speed of closing of present day aircraft.

6. Recommendation No. 5 be brought to the attention of ICAO for their consideration.

7. A collision warning device to warn the pilot of the proximity of other aircraft be developed.

Consideration was given to radar devices, but it was thought that such devices would not be economically practicable at this time.

It was considered that under VFR conditions it would be preferable to develop an aid to vision, e. g. flashing light, special paint, rather than a cockpit warning device which may distract the pilot from maintaining a proper lookout.