

No. 40Trans-Canada Air Lines Lockheed Super-Constellation aircraft, crashed near  
Brampton, Ontario, Canada, on 17 December 1954Circumstances

On the night of 17 December 1954, at 2132 EST the Trans-Canada Air Lines Flight from Tampa, Florida, with a crew of 7 and 16 passengers, landed in farm country some eleven miles west of Toronto (Malton) airport during an instrument approach to Runway 10 and was progressively demolished through impact with trees during a run of some two thousand feet. There were no fatalities but the crew and passengers suffered injuries which varied from minor to serious. Fuel spilled from the aircraft and caught fire and some of the wreckage also caught fire. When the fuselage came to rest there was a flash fire within the cabin which caused burn injuries to some of the passengers and one stewardess, but it was some time before this main portion of the wreckage began to burn.

Investigation and Evidence

Earlier in the day the same crew had flown the same aircraft on a scheduled operation from Montreal, P.Q., to Tampa, Florida, with an intermediate stop at Toronto, Ontario. This flight had departed from Montreal at 0902 EST and arrived at Toronto after 1 hour and 33 minutes of flying time. There was a stop at Toronto which lasted for approximately 1 hour. The aircraft departed for Tampa at 1157 EST and arrived at 1643 EST. This section of the flight was very slow because the winds aloft were very much greater than had been forecast.

During the entire duration of flight from Montreal to Tampa the aircraft and all the equipment therein, including the engines, functioned normally and satisfactorily to the best of the crew's knowledge.

There was a stop of 1 hour 20 minutes at Tampa. During this time the captain visited the meteorological office and filed his flight plan for the return trip from Tampa to Toronto. The headwinds which he encountered on the flight down were still blowing and he estimated a return flight time of only 3 hours 15 minutes.

The flight departed from Tampa and was airborne at 1810 EST (6.10 p.m.). The flight plan called for a cruising altitude of 21 000 feet which would keep the aircraft well above all local United States air traffic and would, in fact, keep it mostly above the weather. One hour and forty minutes prior to take-off the weather map indicated a southerly flow at the surface from Tampa to Buffalo. Between Buffalo and Toronto there was a weak warm front lying across the route of the flight. This weak front was moving northward and weakening to such an extent that six hours later it could not be identified. By that time, however, a new warm front had developed across the route roughly midway between Tampa and Toronto. A cold front running roughly north and south along the 85° meridian lay to the west of the route of the flight, one hour and forty minutes prior to the take-off. This cold front moved steadily eastward and six hours later (2230 EST) rain was falling across the whole of southwestern Ontario, and southward across the Great Lakes and down into New York, Ohio and Pennsylvania. These were the conditions approximately one hour after the flight had crashed.

The weather conditions as briefly described were not expected to lead to any unusual or abnormal atmospheric conditions at the height (21 000 feet) of the flight. It was anticipated that the flight would be mostly on top of the weather, especially for the northern portion of the route where the cloud top was expected to be around 13 000 feet. In descending, it was to be expected that the aircraft would run through layers of cloud, the first at 13 000 feet, down to a few hundred feet above the ground where the ceiling was expected to be about 600 feet, variable between 400 feet and 800 feet. On the whole, the weather conditions were acceptable for this type of aircraft and the navigational facilities available. The low ceiling at Toronto (Malton) indicated that an ILS approach would be necessary on Runway 10.

After reaching Erie at 2103 EST, the flight was cleared to descend and it left 19 000 feet at 2104 EST, and began a continuous descent during which time it picked up extra speed.

The Toronto Area Traffic Control Centre assumed control of the flight from the Cleveland Centre, after the aircraft had passed Long Point. At 2112 EST the Trans-Canada Air Lines radio operator, who had been communicating with the flight advised the ATC Centre that the aircraft had reported reaching 13 000 feet and was requesting further clearance.

At 2114 EST the Toronto ATC Centre issued its first clearance to the flight - "ATC clears Flight 661 to the ILS outer marker, Runway 10, cross Ash descending the outer marker at four thousand, no delay expected".

TCA radio recorded that at 2119 EST the flight reported approaching the Ash and descending and was changing to the tower frequency. From this time on all communications with the aircraft were handled by the control tower.

According to the tower incident log, the flight called the tower at approximately 2123 EST to report that it was by the Ash intersection. At this time the tower acknowledged and informed the flight that the Runway was 10, the surface wind 15 mph at 110° and the altimeter setting was 29.65 inches. This was acknowledged and the captain and the first officer set their altimeters accordingly.

Just prior to arriving at the Ash the two range receivers were tuned in. The captain's, the red receiver, was tuned to the Toronto range so that in the event of a missed approach he could use the range to reorientate himself. The first officer's receiver, the green one, had been tuned to the outer marker of Runway 10 so that the aircraft could home onto the marker.

The aircraft crossed the Ash intersection at 9 000 feet or slightly lower, at an indicated airspeed of close to 250 knots. The true airspeed at this height would be about 284 knots which, with the tail wind then blowing, gave a speed over the ground of the order of 332 knots (382 mph). The indicated airspeed for cruising during the earlier stages of the flight was in the neighbourhood of 190 knots or slightly higher. This figure gives some idea of the extra speed picked up during the descent prior to the Ash.

In view of the height and slight additional speed, the captain called to the flight engineer that he had the power and from then on the captain adjusted the power himself in order to control more closely his speed and rate of descent. The aircraft was at this time travelling on a magnetic course of 039° flying along the southwest leg of the Toronto radio range station. Approximately three and a quarter minutes after crossing the Ash the aircraft was over the range station at about 6 000 feet and the captain had decreased the indicated airspeed to about 210 knots. The captain immediately put the aircraft into a 20° banked turn to the left towards the outer marker, continuing at the same time to lose altitude and to decelerate the aircraft to 190 knots so that the flaps could be lowered to the take-off position (190 knots being the maximum speed at which this can be done). At the same time the captain called for the "in range" checks to be done and the "fasten seat belts" and "no smoking" sign was switched on as part of these checks.

At the conclusion of the turn from the range station, the captain established the aircraft on a course of 320° and shortly thereafter the flight passed through the localizer east of the outer marker. The captain did not make a correction to the course and continued for some time to fly on 320° until at length the first officer gave a hand signal to indicate a further turn to the left. Simultaneously with this signal the captain commenced another 20° banked turn to the left. Just about this time, or slightly earlier, the speed was down to 195 knots and the captain lowered the flaps to the take-off position. The aircraft was then at about 5 500 feet.

Half way through the turn the aircraft passed by the outer marker. The captain and the first officer were aware that they were some distance north of the marker, because the ADF (aircraft direction finding) needle of the green range receiver was swinging slowly around pointing to the bearing of the marker from the aircraft. At the same time the captain could hear the beeping of the Campbell Cross marker in the background. When the aircraft was heading 280° the ADF needle indicated that the outer marker was exactly on their beam. The aircraft must

have been too far from the outer marker to receive a marker signal, which they would have done if they had passed close to it. The captain does not remember getting a marker signal and the first officer implied that there was no marker signal. The altitude of the aircraft was by this time down to between 4 000 and 5 000 feet and the speed was about 190 knots. Through the tower the aircraft reported to Toronto Area Traffic Control that the flight was by the outer marker, outbound at 4 000 feet. The time was 2123 EST. The control tower operators were under the impression that the flight had reported by the Ash at 3 000 feet and were consequently surprised to hear the flight say it was not at the outer marker at 4 000 feet. Accordingly, the tower acknowledged the message and asked the flight to confirm that it was at 4 000 feet. The flight replied immediately "affirmative at four". On one or two occasions subsequent to passing the range station the captain had checked the wing leading edges for ice deposits by turning on the sealed beam lights used for illuminating the leading edges. No icing conditions were encountered during this approach pattern.

The captain brought the aircraft out of its turn, onto the bisector heading, a course of 235°, and continued towards the localizer with speed and altitude progressively decreasing. The flight passed through the localizer at about 165 knots indicated airspeed and at an altitude of 4 000 feet. It was about this time that the captain lowered the undercarriage which helped also to reduce the airspeed. The tower then called the flight to report that another TCA aircraft had just landed (at 2125 EST) and had encountered a cloud ceiling of 300 feet ragged. At 2126 EST the Toronto Area Traffic Control Centre issued its second and final clearance to the flight, which was transmitted by the tower and acknowledged by the aircraft at 2127 EST about one minute after it had passed through the localizer. This clearance indicated that the flight was number one on the approach and was cleared to the Toronto Airport for an ILS approach on Runway 10 and was to report on leaving 3 000 feet.

After crossing the localizer and noting a full scale deflection of the localizer needle, the captain continued on course (235°) for some fifty seconds before he began his procedure turn, a 20° banked turn to the right which would eventually take him back to intersect the localizer once more. The indicated airspeed was now down to 135 knots and half way through the procedure turn the first officer, who was doing all the radio transmissions from the aircraft, called the tower that they were through 3 000 feet. The time was 2129 EST. The landing lights had been lowered at an indicated airspeed of about 150 knots just about the time that the flight was acknowledging its clearance to the airport. They were not switched on, however, and the practice would be to do so when the aircraft broke through the overcast and became "contact". Some time during the procedure approach pattern, the captain had taken a precipitation check by switching on the white nose lights to determine whether it was raining or snowing. The aircraft continued to descend at about 600 feet per minute.

The flight returned to the localizer and the captain began a 45° turn to the right to align the aircraft with the localizer inbound on a course of 100°. The captain overshot the localizer slightly, not enough to give a full-scale deflection of the localizer needle, and he made immediate course corrections to 120° and then 110° to bring the aircraft back on the correct course in the middle of the localizer beam. The aircraft was at 2 500 feet when it first cut the localizer and this occurred shortly before 2130 EST.

The flight continued to fly along the localizer beam towards the outer marker still descending, and as the 2 000 feet altimeter reading was being neared, the first officer picked up the microphone and called the tower to say that they were at 2 000 feet inbound. The time was 2131 EST. There is some question as to whether this report was initiated by the first officer or by the tower.

As soon as the first officer put down his microphone, he glanced up and noticed that the altimeter read 1 800 feet. As they had not yet intersected the glide path and were still beyond the outer marker, TCA regulations require a minimum altitude of 2 000 feet to be maintained. The first officer appreciated the situation and drew the captain's attention to it by pointing to the "2" on the altimeter. The captain acknowledged by nodding his head and raising his right thumb. He immediately instructed his first officer to carry out the "before-landing" check.

Just prior to this the captain believes the control tower called him and made some reference to the high-intensity approach lights which were full up and would be turned down when the flight so requested. The controller in the tower denies that any such message was sent.

The pre-landing check occupies the first officer for about 45 to 50 seconds, during which time he calls for certain checks from the flight engineer and makes a number of checks himself. The flight engineer is only occupied for about five to ten seconds, and about fifteen seconds after he had completed his portion of the checks he noticed that his altimeter read 1 500 feet.

The first officer, on completing his pre-landing check, put down his check list and returned his attention to the flight instruments. He noted first that the glide path needle was in the full up position, indicating that they were well below the glide path, second, that the airspeed was at 130 knots and finally that the altimeter read 800 feet. He immediately had a feeling of panic and looked at the ADF needle, noting that they had not yet gone by the outer marker. The first officer put out his hand and pointed to the ADF needle and yelled to the captain that they had not gone by the outer marker. As he lowered his hand the aircraft struck the ground and almost simultaneously the first trees. The height of the terrain at this point is 800 feet. The time was about twelve seconds after 2132 EST. At this time the control tower called the flight to give information on the runway conditions but received no reply. Being unaware of the extent of the damage to the aircraft, the captain decided against trying to climb away and called to the first officer to cut the switches. The first officer noted that they were headed for a large tree and he threw up his arm. They hit the tree as the captain finished speaking and the first officer remembered nothing more. He was unable to comply with the order to cut the switches.

The complete flight from Montreal to Tampa and return, via Toronto, involves approximately 12 hours' flying. With stops on the ground included, this entails a total time of about 15 hours. This should be increased by another hour, bringing the total to 16 hours, because the crew must report at Dorval one hour before flight time in order to check the weather and file a flight plan. It was considered that this is a long day for a crew to be on duty, but pilots do not consider it to be particularly arduous provided that adequate rest has been secured prior to the flight.

Approximately one week prior to the flight in question the captain returned from leave. During the ensuing week he made one round trip to Bermuda and two round trips to Tampa, involving a total flying time for the three trips of 43 hours. He was off duty for two days, on Tuesday and on Thursday, the day prior to the flight in question. The captain spent Thursday evening quietly. He remained at home, going to bed at about 10 p.m. and reading until 11 p.m. The first officer's evidence revealed that the captain was reading his Flight Manuals. The first officer had been visiting friends in Dorval and had dropped in on the captain before going to bed himself.

The captain was feeling quite fit when he reported at Dorval on the morning of 17 December. During the previous week he had suffered no illness or indisposition and was not tired or unwell in any way prior to the flight of the 17th. He held an A-1 medical category which was confirmed at his last medical inspection on 10 December, one week prior to this flight.

There is evidence in the captain's testimony that at or about the Ash intersection he prepared for the task ahead of him which would demand all his skill and attention. He took over the power, was flying the aircraft himself and gave instructions for the in-range and before-landing checks to be carried out. He himself checked for ice on the leading edges once or twice and checked the precipitation. He was not feeling tired or unwell or under any stress.

Despite the tower operator's belief that the flight had reported by the Ash at 3 000 feet, the testimony of the crew and the Board's own studies lead them to the conclusion that the aircraft must have crossed the Ash at between 8 000 and 9 000 feet.

In establishing the times and events that happened subsequent to the Ash, the Board was somewhat hampered initially by the absence of clear unequivocal records from the control tower. The tower was equipped with a recorder to provide a permanent record of all messages transmitted from the tower. This equipment is inspected once a week to confirm its serviceability.



One of its major reasons for being there is for just such an accident as that under investigation by the Board. Unknown to the tower controllers, the recorder had been inoperative for some three days due to a broken wire. A controller could quite readily ascertain at any time if the equipment was working by playing back a small portion of the record. This was not done during the three days prior to the crash and no records were therefore available of the tower controller's message to the flight, other than those written by hand by the controllers immediately after the crash and based on their memory of the events that took place. These were not completely satisfactory. Fortunately, the Area Traffic Control Centre could supply accurate times and details of the clearances sent to the aircraft, but there remained some conflicting evidence regarding some of the messages exchanged between the tower and the flight.

From the probable flight path calculated by the Board it was evident that the captain made little, if any, allowance for the wind after turning from the range station towards the outer marker. The course of 320° which he flew caused the wind to drift him steadily to the right. It was appreciated that the tower gave him a surface wind of only 15 mph blowing from 110° but the captain knew he had had strong (90 knot) winds from the south to south-west and he should have made some allowance for these, since he was still between 5 000 and 6 000 feet high. It is difficult to understand why the captain held a steady heading at this point and why he did not use the green ADF needle to home on the outer marker, since it was tuned to it. This is the course which he should have followed in accordance with good airmanship. This would have brought him directly over the outer marker and outbound along the localizer.

The first officer appreciated all this and at length indicated to his captain that a left turn should be initiated. By the time they passed by the outer marker they were about four miles north of it. The captain then turned to a course of 235° intending to cut across the localizer, which bears 280°, at a 45° angle. But here again the strong winds from 220° continued to drift the aircraft to the right and with more effect now because the aircraft was travelling more slowly than it had been earlier. The net result of this was that the aircraft was carried much further west than the captain had imagined. He was aware that the time from the outer marker to the localizer was rather long.

The captain continued across the localizer and out, for what he testified was fifty seconds, before commencing his procedure turn. Actually, from the Board's studies it was evident that he flew out for more nearly two minutes and fifty seconds. He completed his procedure turn and was successful in aligning the aircraft on the localizer inbound after a small initial swing across it. The aircraft was then about nine and one-half miles out beyond the outer marker. Good airmanship would have placed it only three or four miles out from the marker, or maybe five under adverse conditions. The captain himself places five miles as an acceptable limit for this distance but was of the opinion that he was six miles out when he finished his procedure turn on the night of 17 December.

Despite the appreciable distance that the aircraft was beyond the outer marker, a safe successful landing could still have been effected if the TCA and the Department of Transport flight regulations had been adhered to. The ADF needle was still pointing ahead, indicating that they had yet to pass through the outer marker. The glide path needle was fully up, indicating that they were still below the glide path. The regulations prescribe that the aircraft must not be taken below 2 000 feet until the aircraft has flown in sufficiently to intercept the glide path, after which it can follow the glide path down to the runway. In any case, the outer marker of Runway 10 is not to be crossed at less than 1 600 feet altitude. There is a final TCA regulation which concerns the ceiling at Malton. The minimum altitude to which an approaching aircraft shall descend without becoming contact is 300 feet. The elevation of Malton is 565 feet. Accordingly, if an aircraft on the approach reaches 865 feet without breaking out below the overcast, power is to be increased and the aircraft climbed away.

The aircraft was just below 2 500 feet when established on the localizer inbound. If the captain had been using his ILS instrument properly he would, if he flew level, shortly see the glide path needle descend from its full up position. If he continued in level flight the needle would descend below the horizontal, indicating that he had flown through the glide path and was now above it.

The captain continued his descent to 2 000 feet and on down to 1 800 feet. He acknowledged the warning message from his first officer, who pointed to the altimeter and who, in his testimony, also says that he drew the captain's attention to the ADF needle still pointing ahead to the outer marker. The captain appears to have ignored the importance of the message, which may have been acknowledged more as a reflex action than as an indication of understanding. In any case, he took no action. He stated that there was no question that he misread the altimeter as 2 800 feet instead of 1 800 feet. The captain ordered the before-landing check to be carried out and during this time, unfortunately, the check list held by the first officer obscured the flight instruments from him for about one minute.

The flight engineer's altimeter is always set at 29.92 inches, the standard sea level pressure. Under the atmospheric conditions at Malton, at the time of the crash, sea level pressure was 29.65 inches and the flight engineer's altimeter would, accordingly, read too high and an indication of 1 500 feet thereon would correspond actually to a true height above sea level of only 1 245 feet (445 feet above the terrain at the scene of the crash). At the known rate of descent of the aircraft 1 245 feet would be reached at about 45 seconds after 2131 EST or approximately ten to twenty seconds after the engineer completed his portion of the pre-landing check. This corresponds reasonably closely with his testimony (15 seconds) regarding the time at which he noted 1 500 feet. Further, at the rate of descent then occurring the aircraft would descend through the 445 feet, which it was above the terrain, in 27 seconds. In the flight engineer's testimony he stated that the crash occurred about 30 seconds after he noted 1 500 feet on his altimeter. From this evidence the Board concludes that the first officer's altimeter and the flight engineer's altimeter were in reasonable accord and were functioning correctly and that the first officer's altimeter was correctly registering the height above sea level during the descent to the ground.

Instead of climbing back to 2 000 feet, as he should have done, or holding at 1 800 feet or even 1 600 feet, the minimum altitude for going through the outer marker, the captain continued to descend and even when he reached 865 feet, the Company's "minimum" for Malton, he still continued to descend and flew on down into the ground. He appears to have ignored the readings of the ADF needle, the glide path needle and the altimeter. The captain stated that to his knowledge he did not fall asleep at the controls, nor did he daydream or become inattentive. He admitted the possibility of a fixation on one or more instruments to the exclusion of others. The captain heard the first officer shout the warning that they were not by the outer marker yet, but it seemed to have no implication of imminent danger to him.

The Board believed that the captain was not using his ILS glide path needle as an aid to the approach and, under the impression that he was much closer to the airport than he really was, was descending at a steady rate along the localizer expecting at any minute to see the approach lights.

#### FINDINGS

On the basis of all available evidence, the Board finds that:

1. The Trans-Canada Air Lines, Super-Constellation aircraft and all the members of its flight crew were properly certificated and the flight was properly dispatched.
2. The aircraft had been properly maintained, and there was no evidence of fire, structural or mechanical failure or malfunctioning of any component prior to the crash.
3. The Control Tower and the Area Traffic Control Centre at Malton were properly manned with certificated Controllers.
4. The outgoing message recording equipment in the Control Tower had been inoperative for the last three days prior to the accident due to unserviceability, unknown to the Tower Controllers.
5. The accident occurred in poor weather when the ceiling had fallen to about 300 feet ragged at Malton, but was still within the approved limits.

6. Another TCA aircraft landed at 2125 EST, approximately seven minutes prior to the crash. The pilot of this aircraft also carried out an ILS landing on runway 10 and reported no difficulty and stated that the ILS equipment was functioning properly.
7. Approximately 30 minutes after the crash, air traffic movement was resumed at Malton and a number of aircraft landed successfully, using the ILS equipment on runway 10. The first pilot to land touched down approximately 50 minutes subsequent to the crash. He reported no difficulty in his approach and stated that the ILS equipment was functioning properly.
8. The ILS equipment at Malton Airport is continuously monitored by radio technicians on duty at the airport. Their evidence indicates that the equipment was functioning normally and was in almost continuous use during the evening of 17 December.
9. The crew of the aircraft understood what the weather conditions were to be during the flight and at Malton.
10. The captain had a medical category denoting physical fitness for the renewal of an Airline Transport Pilot Licence which was confirmed at his most recent medical examination on 10 December, one week prior to the flight in question. This medical examination was conducted by an Approved Department of Transport Medical Examiner at Montreal. Subsequent to the crash, examination of the captain by a Medical Board has revealed that: "It is the considered opinion of the Medical Board that the captain was not suffering from a mental or physical condition that would interfere with the safe performance of his duties."
11. The first officer, despite his duties which involved "In-Range" and "Pre-Landing" checks during the approach pattern, displayed an alertness concerning the procedures carried out by the captain, and on three separate occasions indicated to the captain conditions which required correction.
12. The captain of the aircraft showed poor airmanship in the execution of his approach pattern, in that he made inadequate allowance for the strong prevailing wind and failed to utilize the ADF receiver to home on the outer marker.
13. The captain failed to carry out an approved ILS let-down and, in so far as the position and the altitude of the aircraft were concerned, he ignored the indications of the ADF needle tuned to the marker, the ILS glide path needle and the altimeter.
14. The captain ignored the warning from his first officer that he had descended below the regulation height.
15. The captain was under the impression that he was very much closer to the airport than he actually was.
16. The captain broke the regulations regarding the minimum altitude at which the glide path is to be intersected, the minimum altitude at which the outer marker is to be crossed, and the minimum altitude to which the aircraft may descend on the approach at Malton without becoming contact, and continued his descent until he flew into the ground.

#### Probable Cause

The Board of Inquiry found that the accident was caused by negligence on the part of the captain.

#### RECOMMENDATIONS

The Board of Inquiry has already referred to the fact that messages transmitted from the Control Tower were not recorded because of equipment unserviceability. In view of the importance of the records provided by this equipment in cases of emergency, the Board is of the opinion that more frequent checks of the equipment should be carried out than once a week to ensure its serviceability at all times.

At the present time, existing equipment is designed to provide a record of outgoing messages only. The Board believes that this is inadequate and there should be available a record of all two-way communications carried out between aircraft and the Control Tower. The Board recommends that consideration be given to the installation of such equipment.

The Board has been impressed by the importance of the time element in its investigation of this accident. The Board observed that all Traffic Control personnel are time conscious in that messages received and transmitted are given a referenced time. At the same time, the Board recognizes that this timing is provided by jump-clocks, which can be in error by as much as plus or minus 30 seconds. It is further evident that the various control agencies involved in the passage of an aircraft in flight may not have their time references synchronized. This also applies to the aircraft's own time clock.

The growing speed of air transportation and the gradual introduction of turbine engined aircraft would indicate a need to improve the accuracy of the methods of recording the time and to adopt a uniform time reference. The Board's inquiry indicated that in many cases, the time recorded by hand applied not to the position of the aircraft, but to the time at which the Controller wrote the message down. An attempt should be made to ascribe to the position report from the aircraft the precise time at which it reported.

The weather reported for the flight from Tampa to Malton was an accurate forecast of the weather encountered both during the flight and at its terminal point. The weather conditions at Malton were steadily deteriorating and it is to be noted that the flight arrived at Toronto when the weather conditions were at their worst. However, these conditions at Malton Airport were still within the approved limits for ILS approach. The conditions persisted for several hours subsequent to the crash although it is believed that the ceiling lifted to between 500 and 600 feet during this time. Aircraft continued to make ILS approaches on Runway 10 throughout the night.

The Board had the impression, when the captain was giving testimony, that he was vague in describing the technique which he employed to carry out an ILS landing. In examining the evidence provided by the captain regarding his behaviour during the approach to Malton Airport, there are a number of actions which he took which indicated that he was fully alert to the task which engaged him. At the same time, there are a number of things he failed to do, which indicated at least a lack of alertness.

In the fact of a possible lack of alertness, the Board had to consider whether or not the basic techniques and procedures which the captain was employing during his approach were of an approved nature. The Board had the impression that the captain may have been using a method of approach which ignored the Glide Path needle and would not be approved by the Company or the Department of Transport. If the aircraft had not been so much further from the outer marker than the captain believed, it is quite conceivable that some other method of approach, which ignored the glide path needle and which he may have been using, might have led to a successful landing.

The Board recommended that Trans-Canada Air Lines and other operators should check more closely the procedures adopted by their pilots in the conduct of ILS approaches, what techniques they use and what instruments they observe. The Board is aware that it could be argued that had GCA equipment been installed and in use at Malton on the night of 17 December, this accident might have been avoided. On the other hand, a recent accident at Idlewild Airport in the United States occurred under a GCA approach due, it is believed, to a failure of the pilot to obey the instructions of the GCA Controller. The Board did not wish to enter into the discussion of GCA versus ILS, but pointed out that the success of either system still depends on rigid adherence on the part of the pilots to the approved procedures.

The Board gave careful consideration to the total flying time and time on the ground involved in the round trip from Montreal to Tampa and return. It was admitted that it is a



long working day, but it is less arduous than a typical Transatlantic flight. The Board found itself in agreement with the Company in concluding that if the crew have had adequate rest on the day preceding, the flight is not a particularly arduous assignment with modern flight equipment.

The Board gave most careful consideration to the question of inter-communication between the captain and the first officer during periods of flying which demand more than normal concentration, such as an instrument approach. The first officer was aware of the breaking of a Company regulation at a time when the condition had not yet become critical. He adopted the existing standard procedure to draw the attention of his captain to this condition. He received an acknowledgment from the captain and was therefore entitled to assume that the captain had received and understood his message. It is obvious from the sequence of events that the captain paid little attention to what his first officer was trying to indicate to him, and despite his acknowledgment, he made no deduction regarding the message from his first officer and certainly took no corrective action. Later, when the condition had become critical, the first officer still adopted standard procedure, pointing to the necessary instrument to bring to the attention of the captain, who was doing the flying, the imminent danger that threatened them. If, instead, the first officer had quickly assumed control of the aircraft, it is quite possible that disaster could have been averted.

The Board considered quite strongly that the present standard procedure is unacceptable when an emergency exists, and recommends to Trans-Canada Air Lines and all other operators that consideration be given to a method of inter-communication between the crew which shall be more positive and less subject to inattention or misunderstanding at such a time.

The whole problem raises the question of the relationship between the captain and the first officer. The Board is aware that the captain of the aircraft is usually a man with extensive flying experience, who is fully cognizant of the superiority of this experience over that of his first officer. The tradition has been established that the first officer is very much the junior in the cockpit; and to some extent, this is as it should be. However, this had led to a condition where the first officer has some hesitation in interrupting the captain to say or do anything which might be taken as a criticism of the performance of his captain. Particularly is this the case when the captain is involved in concentrated flying as during an ILS approach, and it is believed that many first officers have been reprimanded for interrupting the captain at such times. Under the circumstances, therefore, for a first officer to take over the controls from the captain to avert disaster would be considered a drastic step. Despite this situation, the only reason for carrying two pilots in the cockpit is in order that the load and responsibility can be shared and the safety of the flight increased.

The Board recommends that Trans-Canada Air Lines and all other operators re-examine this problem to see if there is not a better method of defining the responsibility of the first officer to his captain when the safety of the flight is in question and corrective actions are to be taken.