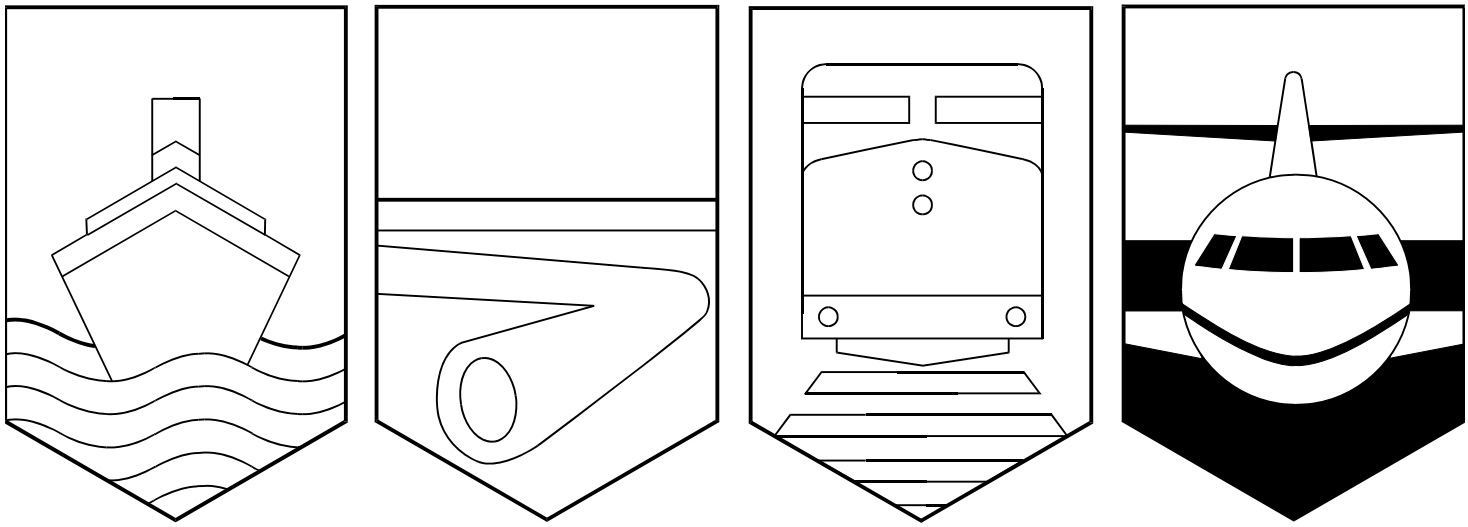
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



AVIATION OCCURRENCE REPORT

RUNWAY OVERRUN

ROYAL AVIATION INC.
BOEING COMPANY 727-217 C-GRYR
ST. JOHN'S, NEWFOUNDLAND
11 MAY 1995

REPORT NUMBER A95A0093

Canada

MANDATE OF THE TSB

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- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board must not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings.

INDEPENDENCE

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Aviation Occurrence Report

Runway Overrun

Royal Aviation Inc.
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Synopsis

The Royal Aviation Boeing 727, flight 4529, landed on runway 11 at St. John's, Newfoundland. The aircraft initially touched down with about 3,500 feet of runway remaining and overran the runway end by 300 feet before coming to a full stop. No evacuation was initiated and there were no injuries to the passengers or crew.

The Board determined that the crew continued with the landing when there was insufficient runway remaining to stop on the runway surface. Contributing to the overrun were ineffective landing technique, excessive altitude and airspeed over the runway threshold, and the use of inappropriate approach limits for a new captain.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

Royal Aviation (ROY)[1] flight number 4529, a Boeing 727-217, was on a sub-charter flight from Toronto, Ontario, to St. John's, Newfoundland, via Halifax, Nova Scotia. The aircraft arrived in Halifax at 1247 Coordinated Universal Time (UTC)[2], but the departure from Halifax was delayed due to the poor weather in St. John's. The weather in St. John's subsequently went above approach-ban limits of 1/4 mile, and ROY4529 departed Halifax. On board were 3 flight crew, 5 flight attendants, and 154 passengers.

On arrival at St. John's, the aircraft was vectored and cleared for a straight-in instrument landing system (ILS) approach to runway 11. During the approach, the flight crew acknowledged the tower report indicating the wind from 010 degrees[3] at 20 knots and the runway visual range (RVR) reading of 2,800 feet. The flight crew reported seeing the runway lights at minimums, at which time the aircraft was slightly left of the runway centre line. The aircraft subsequently drifted to the right of the centre line, and the touchdown was delayed while the aircraft was being realigned. On touchdown, the speed brakes deployed automatically, the captain used firm braking action, and the normal thrust reverse was selected. Shortly thereafter, the flight crew saw the end of the runway approaching, and both the captain and first officer applied maximum braking. Maximum reverse thrust was also applied. The aircraft could not be stopped on the paved runway surface, and came to rest 300 feet beyond the end of the runway. The incident occurred at 1518, during the hours of daylight.

The crew notified the St. John's control tower that the aircraft had overrun the runway, and the tower activated the emergency vehicle response. The crew assessed that there was not a requirement to carry out an emergency evacuation. There was only minor aircraft fuselage damage, and there were no injuries.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	8	154	-	162

[1] See Glossary at Appendix C for all abbreviations and acronyms.

[2] All times are Coordinated Universal Time (Newfoundland daylight saving time plus two and one-half hours) unless otherwise noted.

[3] All headings are in degrees magnetic unless otherwise noted.

Total	8	154	-	162

1.3 Damage to Aircraft

The two pod-mounted engines were substantially damaged because of debris blown upward during the runway excursion. The No. 1 tire on the left main gear blew during the landing roll, and there was minor damage to flaps and fairings.

1.4 Other Damage

Some runway end lights and approach lights were damaged as a result of the aircraft excursion.

1.5 Personnel Information

1.5.1 General

	Captain	First Officer	Second Officer
Age	30	38	28
Pilot Licence	ATPL	CPL	ATPL
Medical Expiry Date	01 Apr 96	01 Sep 95	01 Oct 95
Total Flying Hours	5,400	10,300	2,475
Hours on Type	2,400	1,900	175
Hours Last 90 Days	150	300	150
Hours on Type Last 90 Days	30	300	100
Hours on Duty Prior to Occurrence	6	6	6
Hours Off Duty Prior to Work Period	20	48	72

1.5.2 Captain's Work History

The captain joined Royal Aviation on 27 April 1992 as a second officer on the Boeing 727. He subsequently was upgraded to a first officer on the Boeing 727 and Lockheed L1011 aircraft. On 09 May 1995, he successfully completed his captain's route check on the Boeing 727.

At the time of the occurrence, the captain held an Airline Transport Pilot Licence (ATPL) endorsed for Boeing 727 and Lockheed L1011, a Group 1 instrument rating, and a Category 1 medical. The incident flight was his first flight as a captain on the Boeing 727. The captain had received at least the minimum of 25 hours line indoctrination training before completing a route and line check ride. The captain's training met company and Transport Canada requirements.

1.5.3 First Officer's Work History

The first officer joined Royal Aviation in December of 1993 as a flight engineer on the Lockheed L1011. On 19 December 1994, he successfully completed a route check as a Boeing 727 first officer.

He held a Commercial Pilot Licence endorsed for Boeing 727, a Group 1 instrument rating, and a Category 1 medical. He also held an Aircraft Maintenance Engineer (AME) licence.

1.5.4 Second Officer's Work History

The second officer joined Royal Aviation in November 1994, and on 22 December 1994, he successfully completed a route check as a Boeing 727 second officer. He held an ATPL endorsed for second officer on the Boeing 727, a Group 1 instrument rating, and a Category 1 medical.

1.5.5 Flight Attendants

There were five cabin crew working on Royal Aviation Flight 4529. The in-flight director (IFD) was responsible for cabin safety and cabin service, and for coordinating the duties of the other four flight attendants.

The IFD had three years experience as a flight attendant and had been an IFD on the Boeing 727 for one year.

The other four flight attendants had recently completed the company's flight attendant training program in April 1995. The incident flight was their first flight as crew members on the Boeing 727 aircraft.

1.6 Aircraft Information

Manufacturer	Boeing Company
Type and Model	Boeing 727-217
Year of Manufacture	1975
Serial Number	21056
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	59,730.8 hr
Engine Type (number of)	Pratt & Whitney JT8D-17 (3)
Maximum Allowable Take-off Weight	207,500 lb
Recommended Fuel Type(s)	Jet A
Fuel Type Used	Jet A

The aircraft documentation indicated that, for the occurrence flight, the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The aircraft weight and centre of gravity were within the prescribed limits.

An analysis of the blown No. 1 tire conducted by the TSB Engineering Branch determined that the tire did not rotate during the landing and that plies had been worn away in the central area of the tread. The analysis also determined that the remaining plies were insufficient to contain the tire pressure, causing the fully inflated tire to burst. The nylon material in the tire also showed signs of smearing, which is a common indication after a wet runway landing.

The antiskid was selected to "ON" prior to the landing, and the flight crew reported that the antiskid "INOP" lights did not illuminate at any time during the incident. Maintenance checks of the brake/anti-skid and hydraulic systems conducted after the incident determined that these systems were serviceable.

The reason why the wheel locked could not be determined.

1.7 Meteorological Information

During the three hours prior to the aircraft's departure from Halifax, the St. John's Surface Hourly Weather Reports (SA) reported 100 feet obscured ceilings and 1/8 of a mile visibility. The following special weather observations (SPs) were issued for St. John's:

1317: Ceiling 200 feet obscured and 1/4 of a mile visibility.

1410: Ceiling 200 feet overcast and one mile visibility.

1441: Ceiling 200 feet overcast and 3/4 of a mile visibility.

The regular SA for St. John's issued at 1500 was as follows: ceiling indefinite 200 feet overcast, 5/8 of a mile visibility in drizzle and fog, temperature and dew point 4 degrees Celsius, and wind 350 degrees true at 16 knots.

The flight crew received the 1500 SA from the automatic terminal information service (ATIS), and, while the aircraft was on approach, the St. John's control tower reported that the RVR for runway 11 was 3,000 feet. Prior to landing, the flight crew acknowledged the latest St. John's control tower-reported winds and RVR as follows: wind 010 degrees at 20 knots and a 2,800 foot RVR for runway 11.

At 1525, seven minutes after the incident, the visibility was 1/2 mile and the wind was 350 degrees true at 14 knots, gusting to 21 knots.

1.8 Aids to Navigation

Runway 11 at St. John's is serviced by an ILS. At the time of the occurrence, the ILS was reported to have been functioning properly.

1.9 Aerodrome Information

St. John's Airport is situated on the southeast coast of Newfoundland, at a reference point elevation of 461 feet above sea level (asl). The airport has three runways; runway 11/29, used by the occurrence flight, is 8,500 feet long by 200 feet wide.

Runway 11, an ILS category 1 runway, is equipped with centre-row category 1 high-intensity approach lights, green threshold lighting, white centre-line lighting for the entire 8,500-foot runway length, and red runway-end lighting. At the time of the incident, the runway light strength was selected to the maximum intensity, level 5.

The reciprocal runway, 29, an ILS category 2 runway, is equipped with centre-row, category 2, high-intensity approach lights, green threshold lighting, touchdown zone lighting, white runway centre-line lighting for the first 5,500 feet, alternating red and white for the next 2,000 feet, and red centre-line lighting for the remaining 1,000 feet. The runway end lighting is also red.

1.10 Flight Recorders

The aircraft was equipped with a four-track Fairchild A100 cockpit voice recorder (CVR) and a four-track Sundstrand 573A 82-parameter digital flight data recorder (FDR). The CVR recorded the pilot, co-pilot, and flight engineer audio channels, as well as the cockpit area microphone channel. Hot microphone channels were not recorded. The quality of the CVR recording was good, and the recording covered the time from approximately 10 minutes prior to descent until about one minute after the aircraft came to a stop off the end of the runway.

The flight data on the FDR was of good quality. The FDR recording did not include ILS glide slope or localizer information, nor any other navigation information that could have provided precise aircraft position. Radar data, obtained from the Gander Area Control Centre, and mathematical analysis of derived groundspeed were used to determine the aircraft's longitudinal position in relationship to the runway (see LP 65/95). The aircraft's lateral position with respect to the runway centre line was determined from crew communications and aircraft-heading and roll-attitude data. ILS interception and tracking information was based on crew communications.

1.11 Flight Path Reconstruction

The flight path reconstruction, based on CVR, FDR, radar, and crew information, revealed a number of factors regarding the transition, touchdown, and roll-out phases of the occurrence landing.

On arrival in the area of St. John's, ROY4529 was cleared to the Oscar non-directional beacon (NDB) in anticipation of an ILS approach to runway 11 at St. John's.

As part of the approach briefing, and based on the 1410 ATIS winds, 154 knots indicated airspeed (KIAS) was set on the approach speed bug, and 147 KIAS was selected as the threshold-crossing speed.

The descent and approach toward the Oscar NDB was normal, and, after receiving the 1500 St. John's SA, the crew reviewed the missed-approach procedure. Subsequently, ROY4529 was assigned heading 090 degrees, cleared to 2,100 feet asl, and then cleared for the straight-in ILS runway 11 approach. Shortly after levelling the aircraft at 2,100 feet, the captain disengaged the autopilot, electing to fly the approach manually. Based on the CVR data, the localizer and glide slope were captured normally and no significant problems with the approach to minimums were noted.

During the final stages of the approach, at approximately 150 feet above decision height (DH), the aircraft was maintaining 165 KIAS, on a heading of 098 degrees, with a rate of descent of 900 feet per minute (fpm), and slightly left of the runway centre line. When the first officer made the "one-hundred-above" call, the aircraft was in a seven-degree right-bank turn.

When the first officer called the runway lights visual, the aircraft was at about 600 feet asl or 140 feet above the runway touchdown zone elevation (TDZE), at 168 KIAS, on a heading of 106 degrees, with a rate of descent (sink rate) of 1,000 fpm and slightly left of the runway centre line. Nine seconds before threshold crossing, the captain reduced the aircraft's high descent rate.

Glide slope deviation was not a recorded parameter on the FDR. Although the CVR did not indicate deviation from the glide slope, the increased descent rate approximately nine seconds prior to threshold crossing was indicative of a fly down correction for deviation above the glide path.

On a typical ILS approach, the aircraft descends on a three-degree glide path, reaching DH about 1/2 mile from the threshold. On the incident flight, the aircraft descended through DH just prior to the threshold crossing.

The aircraft crossed the runway threshold at 165 KIAS, 110 feet above TDZE, and on a heading of 109 degrees, drifting to the right of the runway centre line.

A left turn to 103 degrees, using up to 12 degrees of left bank, was required to return the aircraft to the runway centre line, which occurred at about nine seconds and 1,800 feet after runway threshold crossing.

The 50-foot call was made 12 seconds and 2,500 feet beyond the threshold. Engine throttles were reduced from 75 per cent N1 to idle thrust, about 14 seconds after threshold crossing. Touchdown was determined to have occurred at 147 KIAS, and approximately 22 seconds and 5,100 feet after threshold crossing.

Just after touchdown, the armed speed brakes (spoilers) deployed automatically and the thrust-reversers were unlocked. The captain applied firm braking and selected normal thrust reverse. About eight seconds later, the captain called "coming up," at which time the runway end came into view. Maximum reverse thrust was selected by the captain, and both the captain and the first officer applied maximum braking.

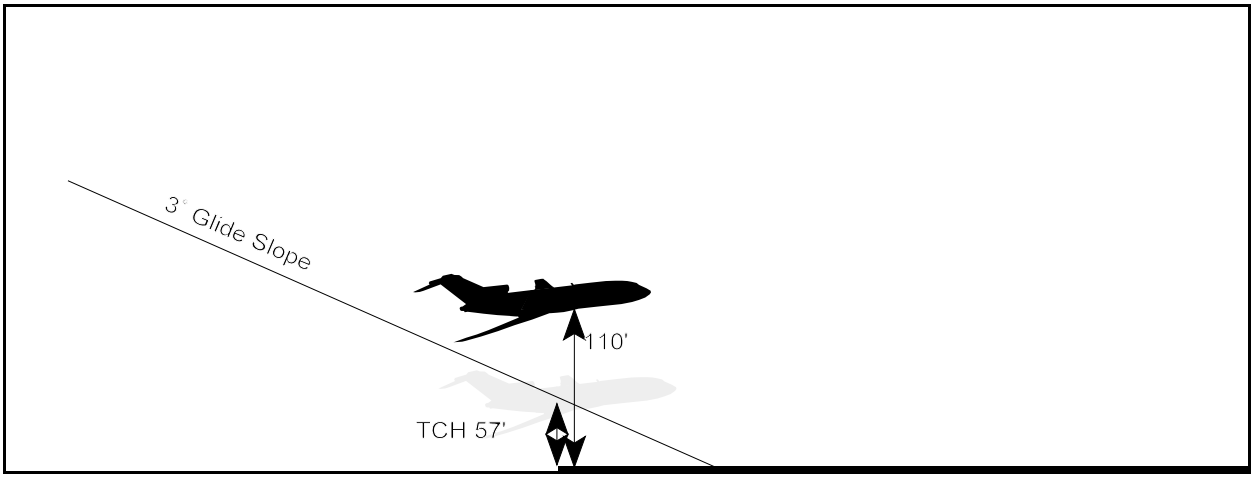


Figure 1 - Actual Height Over Threshold

As the aircraft approached the runway end, it was tracking slightly to the right of the runway centre line. Tire marks originating from the No. 1 main tire were observed on the last 55 feet of runway; these marks extended off the end of the runway, two feet to the right of the runway centre line. Maximum reverse thrust and braking were maintained until the aircraft came to rest about 300 feet beyond the runway end and 21 feet to the right of the runway extended centre line.

1.12 Survival and Evacuation

1.12.1 Decision Not To Evacuate

As the aircraft departed off the end of the runway, there was significant noise from the engines as well as vibrations from the aircraft rolling over the unprepared surface. Once the aircraft was stopped, the captain assessed that an evacuation was not necessary because he saw no fire warnings or other abnormal indications in the cockpit and because he did not see any obstacles in the aircraft's path during the runway excursion. Shortly after the aircraft came to rest, the IFD entered the cockpit, informed the captain that there was a burning smell and some smoke in the cabin area, and asked if an emergency evacuation was to take place. The captain was aware that a significant amount of debris had been blown around by the thrust reversers during the overrun and assumed that some of the debris had probably been ingested by the engines; he looked back into the cabin area and decided not to evacuate, and told the IFD that it was smoke from the brakes.

The emergency response vehicles arrived at the aircraft approximately two minutes after the aircraft had come to rest, and the response personnel confirmed that there was no evidence of fire.

The flight crew advised the tower that buses would be required to disembark the passengers. About 20 minutes later, the right rear cabin door was opened by a flight attendant to provide some fresh air while awaiting the buses. About 45 minutes passed before passenger disembarkment and transport to the airport terminal started. The cabin crew disembarked with the last passengers.

1.12.2 Cabin Attendant Response

The decision to carry out an aircraft evacuation is normally made by the captain, and, once the decision has been made, the flight crew is to advise the cabin crew using prescribed signals.

The IFD, who was sitting in an aft-facing jump seat at the forward left side of the aircraft, reported that, on noticing the aircraft pass considerably more runway side lights than usual before touchdown, he was mentally preparing for an abnormal situation to develop. As the aircraft stopped, he told the flight attendant who was sitting adjacent to him to prepare for the emergency evacuation signal. The abnormal sights and sounds during the landing overrun, the lack of an immediate evacuation call or other notification by the flight crew, and the presence of smoke and a burning smell in the cabin area prompted the IFD to enter the flight deck and request direction as to whether an emergency evacuation was to take place. Based on the captain's decision and in response to several passengers who had released their seat-belts with the intention of standing up, the IFD yelled to the passengers to remain seated, advising them that the smell was only the brakes. Shortly after the IFD advised the passengers to remain seated, the first officer, on the direction of the captain, made a public address announcement for the passengers to remain seated.

The IFD also instructed the other flight attendants to remain at their respective exits and to remain ready for an evacuation in anticipation that such a direction might be given.

Emergency procedures training is provided for flight crews and cabin crews; however, no mutual training is conducted between the two crews, a procedure recommended by Transport Canada. The flight and cabin crew did not debrief after this incident took place.

1.13 Company Weather Limits For New Captains

The company's operations manual (OM) states that the limits published in the *Canada Air Pilot* (CAP) or appropriate publication must be increased by 100 feet and 1/2 mile until such time as the captain has completed 100 hours on type as captain. The company operates under a pilot self-dispatch system, and the minimum requirement to conduct an approach is 1/4 mile visibility.

Although the captain had 2,400 hours on the Boeing 727, this was his first flight as captain. The captain recalled reading about the higher minimum limits for new captains, but the crew had not considered these limits during the flight. The second officer was unaware of the new-captain higher minimum limits. All flight crew members reported that at no time in their company training were the new-captain limits discussed.

The CAP limits for the St. John's ILS approach to runway 11 are 200 foot ceiling and 1/2 mile visibility (RVR 2,600 feet). Therefore, the landing limits for a new captain, when landing on runway 11, are 300 feet and 1 mile visibility. When the occurrence aircraft was positioned to land, the reported weather was 200 feet overcast, visibility 5/8 mile.

1.14 Airspeed Bug Settings

The *Royal Aviation 727 Operating Manual* (AOM), Normal Procedures, Section 3, Page 5, provides direction as to how flight crews are to determine the airspeed bug settings for approach and landing as follows:

Ref	This is the speed for a specific flap configuration which provides adequate stall margin for landing. It is the basis for computing target and threshold speeds.
Target	This is the speed which the approach is flown (sic). It is equal to the Ref speed plus 1/2 the steady headwind component plus the full gust value.
Threshold	This is the speed crossing the threshold. It is equal to Ref speed plus the full gust value.

If the approach is flown in a no-wind condition, the minimum target speed is Vref + 5 knots, and the threshold speed is Vref. This section also states that under certain circumstances, such as terrain induced turbulence, it is acceptable to add half the steady wind value plus the gust without calculating the headwind component.

For the approach and landing into St. John's, the flight crew calculated the speeds based on the landing weight and flap configuration Ref speed of 137 knots, and the ATIS 1410 Special surface winds of 030 degrees at 15, gusting to 25, knots. Using half the steady wind (7 knots) and all of the gust (10 knots), the crew calculated the bug speeds to be 154 knots for the target speed and 147 knots for the threshold speed. The CAP approach diagram for runway 11 at St. John's advises flight crews to anticipate moderate to severe turbulence.

1.15 Approach Procedures

1.15.1 Cockpit Workload Management

The company does not have a standard or procedure for the use of the autopilot when conducting IFR approaches, nor are there regulations or manufacturer's guidance on this issue. However, industry norms dictate that available automation should be used when making approaches in poor weather, specifically because the use of cockpit automation improves the accuracy of the approach and facilitates the transition to the runway landing by reducing pilot workload.

Another technique used by some carriers to enhance the transition from an IFR approach to a visual landing is the pilot-monitored approach. This technique uses traditional flying techniques, wherein the pilot flying (PF) is responsible for maintaining the aircraft on the approach course and descent profile, while the pilot not flying (PNF) monitors the PF's approach. However, in a pilot-monitored approach, the PNF is also responsible for scanning outside the cockpit for the runway environment, and when the necessary visual runway references are acquired, the PNF takes control and lands the aircraft. This technique reduces the workload and better enables the PNF to maintain situational awareness and to be better oriented with the landing environment when the PNF takes control to land the aircraft.

In this occurrence, the approach was being conducted in cross-wind, low ceiling, and low visibility conditions. The captain disconnected the autopilot before the aircraft descended below 2,100 feet asl to fly the approach manually. FDR data and pilots' statements indicate that the runway lights were sighted just as the aircraft reached decision height; at that point, the aircraft was not aligned with the centre line, and the airspeed was 11 knots above the desired speed. In addition, the captain introduced a correction which caused the aircraft to drift right of the centre line.

1.16 Additional Issues

1.16.1 Transition to Landing

The ILS approach is designed in such a manner that, if the aircraft follows the glide slope and localizer, the touchdown point for the aircraft will be approximately 1,000 feet beyond the threshold of the runway. Consequently, when acquiring the appropriate runway visual references, the pilot should transition to visual references and maintain the approach profile to touchdown.

The company's *Boeing 727 Operating Manual* directs that, during the approach phase, the pilot is to fly a well executed approach with the airplane positioned on the glide path and runway centre line and at the speed recommended for existing conditions. The pilot is further directed that, during the flare phase, the pilot should not allow the aircraft to float or drift; and during the touchdown phase, the pilot should get the wheels on the runway at approximately 1,000 feet from the approach end of the runway. The airplane should be flown firmly onto the runway at the aiming point, even if the speed is excessive.

A pilot's decision to continue the approach and landing after reaching DH is based on a number of factors. Any significant deviation from the final approach profile should be cause for considering a

missed approach. Also, the pilot must have and maintain the runway visual, have sufficient visual cues to continue the landing, and have sufficient runway remaining to bring the aircraft to a complete stop.

The company's OM states, in part, that a missed approach shall be initiated when, in the opinion of the pilot-in-command, a safe landing cannot be accomplished within the touchdown zone (the first 3,000 feet of runway) and the aircraft stopped within the confines of the computed stopping distance.

1.16.2 Aircraft Performance

In calculating the landing performance, the flight crew factored in a wet runway condition and calculated the required landing distance to be 6,000 feet for the aircraft weight at the landing field temperature.

Analysis of the FDR data indicated that the aircraft crossed the threshold 110 feet above ground level (agl). The published threshold crossing height (TCH) for the approach to runway 11 is 57 feet agl.

The aircraft manufacturer analyzed the FDR information and compared it with the simulated (predicted) results and with the certification flight tested deceleration values. The results are as follows:

> At 154 knots, the bugged target speed, the predicted total landing distance using certified flare parameters for a wet runway is 5,500 feet.
>
> At 165 knots, the speed that was flown, the predicted total landing distance required was 6,010 feet.
>
> At the speeds and conditions at the time of the incident, the predicted ground roll-out distance from touchdown to stop was 3,750 feet. If the tire blowout had occurred immediately at touchdown, the predicted ground roll-out distance would have increased by 160 feet to 3,910 feet.
>
> FDR data indicate that the aircraft touched down about 5,100 feet beyond the threshold and had an approximate ground roll-out distance of 3,800 feet.

1.16.3 Pilot Training

Although low ceiling approaches and cross-wind landings had been independently demonstrated during the flight crew simulator training, minimum visibility approaches combined with strong cross-winds were not. During company simulator training for new captains, instrument approaches were flown with reference to the published CAP limits. The higher company limits for new captains were not discussed during training or line indoctrination.

2.0 Analysis

2.1 Introduction

Although the failure of the No. 1 main tire resulted in decreased aircraft braking effectiveness and a slight increase in the landing distance required, it was primarily the delayed touchdown that resulted in insufficient runway remaining to stop the aircraft. Therefore, the analysis will concentrate on the approach profile and the captain's decision to continue with the landing.

2.2 Approach Information

When ROY4529 departed Halifax, the St. John's weather was a 200-foot ceiling and 1/4 mile visibility. Since the company operates under a pilot self-dispatch system and the minimum requirement to conduct an approach is 1/4 mile visibility, the captain's decision to depart was procedurally correct.

The 1410 ATIS reported that the visibility had increased to one mile. However, the weather updates after the 1410 ATIS report and the RVR for runway 11 reported by the tower before the aircraft reached DH indicated that the visibility at St. John's was deteriorating.

The captain disconnected the autopilot and continued with a manual approach before descending below 2,000 feet asl. With the deteriorating weather conditions and the gusty cross-wind conditions on final approach, the captain would have been less heavily tasked if he had maintained the aircraft on autopilot and completed a coupled instrument approach. This would have allowed him to spend more time monitoring the approach and preparing for the transition to visual for landing.

When the captain saw the runway and realized that the aircraft was left of the runway centre line, he corrected to the right. This right turn, combined with the left cross-wind, caused the aircraft to drift to the right of the runway centre line. It is likely that when the captain saw the runway, he automatically turned towards it and corrected too far to the right. This, in effect, removed the crab that was maintained for the cross-wind conditions and resulted in the aircraft drifting from the desired track.

At the estimated time of threshold crossing, the aircraft was descending through an approximate altitude of 110 feet agl. This indicates that the aircraft had deviated above the glide slope at some point during the approach. Nine seconds before threshold crossing, the captain reduced the rate of descent of the aircraft; this is likely when the aircraft went above the glide slope.

2.3 New Captain Limits

The captain continued with the approach to runway 11, even though the reported St. John's weather was below the company weather limits for new captains.

The captain never consciously considered the higher minimums for new captains in his decision to continue the approach. During his simulator training, approaches were flown referencing CAP limits and not the higher limits for new captains. It is probable that on the incident flight, the captain referenced the CAP limits.

Training conducted in a simulator is the best opportunity for a company to check a pilot's proficiency, including flying the aircraft down to CAP minimum approach limits. These are the minimum limits that the pilot will be expected to perform to on a normal basis.

Had the captain observed the higher limits during the approach to runway 11, he would have begun a missed approach procedure when he reached those limits. His options then would have been flying a second approach and, if unable to land, flying to his alternate airport.

The intent of the higher limits for new captains is to provide a safety margin until they have acquired experience as a captain on the aircraft type.

2.4 Runway Lighting

The aircraft approached St. John's from the west; therefore, runway 11 provided a straight-in approach to the airport. Since the prevailing winds, although gusty, were approximately 90 degrees to the runway, a landing on runway 29 would not have appeared more favourable and would have taken more time.

The lighting on runway 29 includes touchdown zone lighting, and the last 3,000 feet of runway centre-line lighting is marked with a change from white to red lighting. If the crew had used runway 29, the additional lighting might have aided the crew in better identifying the touchdown zone and the runway remaining.

2.5 Approach Airspeed

The captain and first officer set their airspeed bugs prior to the descent to St. John's. The approach was flown at a speed 11 knots faster than the bug speed of 154 knots, and the aircraft crossed the threshold at a speed 18 knots faster than the threshold crossing speed of 147 knots. Approaches flown at speeds above bug speed can result in the aircraft floating and a delayed touchdown.

The captain did not start reducing engine approach power until the aircraft's deviation from the centre line was corrected and the aircraft was 2,500 feet past the threshold. The pilot reported that the aircraft floated during the flare. The wind was effectively 90 degrees to the runway, and the absence of a headwind component would have caused the aircraft to float further than anticipated. Had the pilot been more firm in landing the aircraft, even with the excessive threshold crossing speed, the floating distance could have been reduced.

2.6 The Landing

The aircraft was to the right of the centre line as it crossed the threshold, and a 12-degree left bank was required before the aircraft was positioned to continue the landing flare. This manoeuvre, coupled with a speed higher than the bug speed and a higher-than-published threshold crossing height, consumed runway and delayed the flare.

The captain believed that there was sufficient runway remaining and continued with the landing. However, because visibility was poor and there was no category 2 runway lighting to rely on, the flight crew members were unaware of the runway distance that had already been overflown. They were also unaware of the runway remaining when the aircraft touched down.

The absence of a headwind, the aircraft's extra height over the threshold and excessive airspeed, and the lack of firm landing techniques contributed to a long float and a delayed touchdown. The result was insufficient runway remaining to stop the aircraft.

The runway end came into sight only after the thrust reversers were deployed; the crew correctly assessed that it was impractical and unsafe to attempt a go-around.

2.7 Cabin Attendant Response

The IFD was prepared for an emergency evacuation signal from the flight crew and had briefed the adjacent flight attendant prior to getting up from his jump seat. When the signal was not given, he correctly responded by approaching the cockpit for instructions. Although all of the other cabin attendants were inexperienced, their recent training prepared them to focus on their crew duties.

3.0 Conclusions

3.1 Findings

1. The flight crew was certified, trained, and qualified for the flight in accordance with existing regulations.

2. The incident flight was the captain's first flight as pilot-in-command since his upgrade to a Boeing 727 captain, two days earlier.

3. The captain flew the ILS approach without the assistance of the autopilot.

4. The aircraft target speed flown throughout the approach was 11 knots above the bug speed.

5. The aircraft crossed the threshold at a speed 18 knots above the required threshold crossing speed.

6. When the crew saw the runway, the aircraft was slightly left of the runway and above the glide slope.

7. While the captain was manoeuvring the aircraft to get back on the runway centre line, the touchdown was delayed.

8. The flight crew was not aware of the aircraft location in relation to the end of the runway at touchdown because of the limited visibility.

9. The captain was not firm with the touchdown, which resulted in an excessively long float; the touchdown occurred 5,100 feet after threshold crossing.

10. The No. 1 main tire blew during the landing because of non-rotation.

11. The brake/anti-skid and hydraulic systems were found to be serviceable after the incident. The reason for the No. 1 wheel lock-up could not be determined.

12. Because the captain was new, his minimum approach limits were to be higher than the CAP limits by 100 feet for the ceiling and 1/2 mile for the visibility.

13. At DH, the captain called landing when the reported meteorological conditions for a landing on runway 11 were below the limits for a new captain.

14. The CAP limits were referenced during company flight crew simulator training; the higher limits for a new captain were not referenced.

3.2 Causes

The crew continued with the landing when there was insufficient runway remaining to stop on the runway surface. Contributing to the overrun were ineffective landing technique, excessive altitude and airspeed over the runway threshold, and the use of inappropriate approach limits for a new captain.

4.0 Safety Action

4.1 Action Taken

4.1.1 Operator Action

Subsequent to the occurrence, the operator indicated the following:

a) crew experience is now reviewed prior to pairing crews;
b) weather limits for new captains are now stressed during recurrent training and will be enforced;
c) crew resource management (CRM) training is now integrated into recurrent training;
d) coupled approaches in low visibility are now included in simulator training;
e) standard operating procedures (SOPs) have been amended to enhance consideration of usable runway, type of approach, lighting, and visual aids;
f) ground school lectures and line indoctrination now place greater emphasis on landing performance field limits, landing speeds, and wind additives; and
g) combined cockpit and cabin crew training will be conducted once a year.

4.1.2 Crew Resource Management

The flight crew of the accident aircraft did not make use of the autopilot during the approach, nor did they use runway 29, which had better lighting. Use of either of these resources might have prevented the runway overrun.

The effective use of all available resources, including equipment, is an integral part of proper CRM. The flight crew had not received training in CRM, nor were they required to. The new Canadian Aviation Regulations, to be promulgated in 1996, will require all airline flight crews to take such training.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Maurice Harquail, authorized the release of this report on 04 April 1996.

Appendix A - Aerodrome Chart

ST. JOHN'S NEWFOUNDLAND

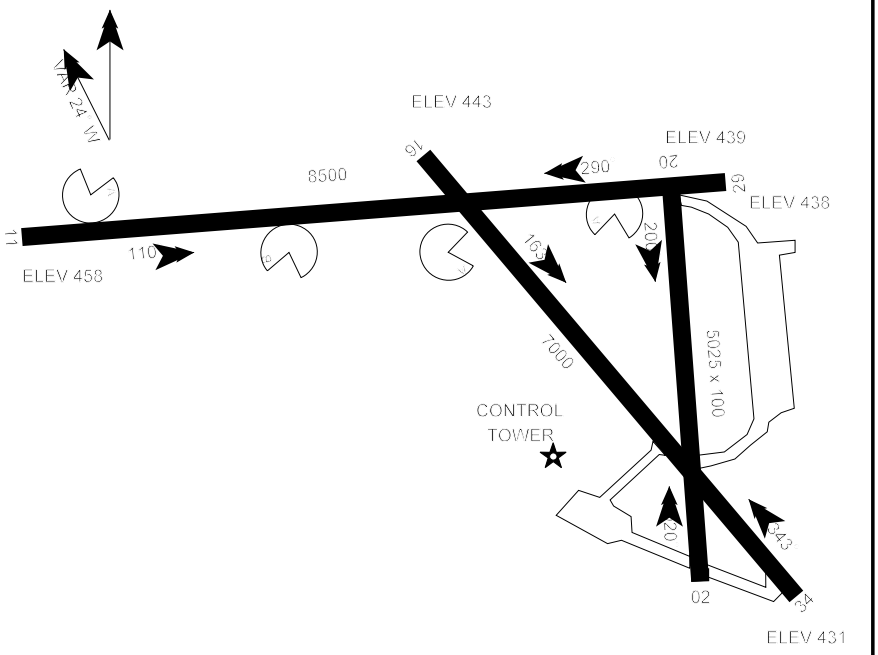
AERODROME CHART

D E M &R

ST JOHN'S NEWFOUNDLAND

VOT	ATIS	TWR	GND	DEP
114.8	128.0 293.8	120.6 236.6 O/T RDO 120.6 (MF 7 NM)	121.9 275.8	GANDER CENTRE 133.15 227.3

DECLARED DISTANCES	02	20	11	29	16	34		
TORA	5025	5025	8500	8500	7000	7000		
TODA	6025	5025	9500	9250	8000	8000		
ASDA	5025	5025	8500	8500	7000	7000		
LDA	5025	5025	8500	8500	7000	7000		



AERODROME CHART CHANGE minima & editorial

ST. JOHN'S NEWFOUNDLAND

EFF 8 DEC 94

ST. JOHN'S NEWFOUNDLAND

Appendix B - List of Supporting Reports

The following TSB Engineering Branch Reports were completed:

LP 65/95 - FDR/CVR Report; and
LP 70/95 - Tire Damage Analysis.

These reports are available upon request from the Transportation Safety Board of Canada.

Appendix C - Glossary

agl	above ground level
AME	aircraft maintenance engineer
AOM	aircraft operating manual
asl	above sea level
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
CAP	Canada Air Pilot
CPL	Commercial Pilot Licence
CRM	crew resource management
CVR	cockpit voice recorder
DH	decision height
FDR	flight data recorder
fpm	feet per minute
hr	hour(s)
IFD	In-flight Director
KIAS	knots indicated airspeed
knots	nautical miles per hour
ILS	instrument landing system
lb	pound(s)
NDB	non-directional beacon
nm	nautical miles
OM	Operating Manual
PF	pilot flying
PNF	pilot not flying
ROY	Royal Aviation
RVR	runway visual range
SA	surface hourly weather report
SOP	standard operating procedure
SP	special weather observation
TCH	threshold crossing height
TDZE	touchdown zone elevation
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
Vref	reference speed

TSB OFFICES

HEAD OFFICE

HULL, QUEBEC*
Place du Centre
4th Floor
200 Promenade du Portage
Hull, Quebec
K1A 1K8
Phone (819) 994-3741
Facsimile (819) 997-2239

ENGINEERING
Engineering Laboratory
1901 Research Road
Gloucester, Ontario
K1A 1K8
Phone (613) 998-8230
24 Hours (613) 998-3425
Facsimile (613) 998-5572

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Dartmouth, Nova Scotia
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24 Hours (902) 426-8043
Facsimile (902) 426-5143

MONCTON, NEW BRUNSWICK
Pipeline, Rail and Air
310 Baig Boulevard
Moncton, New Brunswick
E1E 1C8
Phone (506) 851-7141
24 Hours (506) 851-7381
Facsimile (506) 851-7467

GREATER MONTREAL, QUEBEC*
Pipeline, Rail and Air
185 Dorval Avenue
Suite 403
Dorval, Quebec
H9S 5J9
Phone (514) 633-3246
24 Hours (514) 633-3246
Facsimile (514) 633-2944

GREATER QUÉBEC, QUEBEC*
Marine, Pipeline and Rail
1091 Chemin St. Louis
Room 100
Sillery, Quebec
G1S 1E2
Phone (418) 648-3576
24 Hours (418) 648-3576
Facsimile (418) 648-3656

GREATER TORONTO, ONTARIO
Marine, Pipeline, Rail and Air
23 East Wilmot Street
Richmond Hill, Ontario
L4B 1A3
Phone (905) 771-7676
24 Hours (905) 771-7676
Facsimile (905) 771-7709

PETROLIA, ONTARIO
Pipeline and Rail
4495 Petrolia Street
P.O. Box 1599
Petrolia, Ontario
N0N 1R0
Phone (519) 882-3703
Facsimile (519) 882-3705

WINNIPEG, MANITOBA
Pipeline, Rail and Air
335 - 550 Century Street
Winnipeg, Manitoba
R3H 0Y1
Phone (204) 983-5991
24 Hours (204) 983-5548
Facsimile (204) 983-8026

EDMONTON, ALBERTA
Pipeline, Rail and Air
17803 - 106 A Avenue
Edmonton, Alberta
T5S 1V8
Phone (403) 495-3865
24 Hours (403) 495-3999
Facsimile (403) 495-2079

CALGARY, ALBERTA
Pipeline and Rail
Sam Livingstone Building
510 - 12th Avenue SW
Room 210, P.O. Box 222
Calgary, Alberta
T2R 0X5
Phone (403) 299-3911
24 Hours (403) 299-3912
Facsimile (403) 299-3913

GREATER VANCOUVER, BRITISH COLUMBIA
Marine, Pipeline, Rail and Air
4 - 3071 Number Five Road
Richmond, British Columbia
V6X 2T4
Phone (604) 666-5826
24 Hours (604) 666-5826
Facsimile (604) 666-7230

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