AVIATION INVESTIGATION REPORT
A00O0279

INCIDENT—RUNWAY OVERRUN

ANTONOV AIRLINES

ANTONOV124-100 UR-82029

WINDSOR AIRPORT, ONTARIO

18 DECEMBER 2000

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

Aviation Investigation Report

Incident—Runway Overrun

Antonov Airlines
Antonov 124-100 UR-82029
Windsor Airport, Ontario
18 December 2000

Report Number A00O0279

Synopsis

An Antonov 124-100, call sign ADB505F, was chartered by Air Foyle Ltd., to pick up 40 tonnes of auto parts from Windsor, Ontario, for delivery to Oostende, Belgium. The aircraft was owned and operated by the Antonov Design Bureau. The crew conducted an instrument landing system approach to Runway 25 at Windsor Airport, and the aircraft touched down an estimated 3400 feet past the runway threshold, at about 2333 eastern standard time. During the landing roll, the aircraft overran the runway and stopped approximately 340 feet past the end of the runway, 20 feet from the airport boundary fence. There were no injuries, and the aircraft sustained minor damage. Emergency response services responded approximately 40 seconds after the aircraft stopped.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

On 18 December 2000, an Antonov 124 (AN124) aircraft, call sign ADB505F, departed on an instrument flight rules flight from Montréal (Mirabel), Quebec, to Windsor, Ontario, to pick up 40 tonnes of auto parts for delivery to Oostende, Belgium. The aircraft is owned and operated by the Antonov Design Bureau (ADB). The cargo flight was chartered by Air Foyle Ltd., a company based in the United Kingdom. On board were 20 crew members, including a general sales agent from Air Foyle Ltd.

The aircraft landed on Runway 25 in Windsor after an instrument landing system (ILS) approach in instrument meteorological conditions. The weather at 2300 eastern standard time,[1] 33 minutes before the occurrence, was reported as follows: wind 080° true at 4 knots; visibility 1.5 statute miles in light snow; broken cloud at 900 feet above ground level (agl); overcast cloud at 1300 feet agl; temperature -9°C; dewpoint -10°C; and altimeter 29.83 inches of mercury. Approximately 20 minutes before the AN124 landed, the centre 120 feet of the runway were reported as being 90% covered with traces of loose snow and 10% ice patches. The remaining 80 feet of the runway was 75% covered with 1 inch of loose snow and 25% ice patches. Snow ploughing and sweeping were in progress immediately before the aircraft arrived. The aircraft touched down an estimated 3400 feet past the threshold. The flight crew was unable to stop the aircraft in the remaining 4450 feet of runway. The aircraft overran the runway and came to rest about 340 feet beyond the end of the runway, 20 feet from the airport boundary fence. Indications of tire skid marks left by the aircraft started about 100 feet before the end of the runway, slightly left of the runway centreline. The incident occurred during the hours of darkness

at 2333.

[1] All times are eastern standard time (Coordinated Universal Time [UTC] minus five hours) unless otherwise noted.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	20	-	-	20
Total	20	-	-	20

1.3 Damage to Aircraft

The aircraft sustained minor damage that required repair to the right nose-gear oleo bracket and replacement of the right fuselage landing light.

1.4 Other Damage

The antenna and the monitoring array of the ILS equipment were damaged. The ILS was rendered inoperative for approximately three weeks before being reinstated into service on the morning of 08 January 2001. Three runway end lights were also broken.

1.5 Personnel Information

	Captain	First Officer
Age	37	46
Pilot Licence	Airline transport	Airline transport
Medical Expiry Date	03 October 2001	18 December 2001
Total Flying Hours	8000	10 500
Hours on Type	2000	200
Hours Last 90 Days	150	200
Hours on Type Last 90 Days	70	180
Hours on Duty Prior to Occurrence	6	6
Hours Off Duty Prior to Work Period	18	18

1.5.1 General

The ADB AN124-100 flights normally operate with three pilots (a captain, a first officer, and a third pilot in the crew rest area), one navigator, two flight engineers (the aircraft has two flight engineer crew positions), and one radio officer.

At the time of the occurrence, the captain was flying from the left pilot seat and the first officer was occupying the right pilot seat. The third pilot was seated in the crew rest area and did not observe the landing.

All of the flight crew were operating on the same schedule. At the time of the incident, the crew had been on duty for about six hours. Before the flight, they had had a rest period of about 18 hours in Montréal.

1.5.2 Pilot Flying

The pilot flying (the captain) obtained his pilot licence in 1984. He had flown several aircraft types and had been a test pilot on the AN-26, AN-32, AN-38 and AN140 aircraft. He had been flying the AN124-100 for approximately eight years and had acquired about 2000 hours of flying time on that aircraft. He held a valid airline transport pilot licence (ATPL) issued by the Ministry of Transport of Ukraine. The captain had flown to Windsor airport about five times in the past two years.

1.5.3 Pilot Not Flying

The first officer was the pilot not flying. He obtained his pilot licence in 1973 and had flown a number of Russian-built aircraft. He began flying on the AN124-100 in 2000 and acquired 200 hours of flying time on that aircraft. He held a valid ATPL issued by the Ministry of Transport of Ukraine.

1.5.4 Other Crew

The navigator, the two flight engineers, and the radio operator all possessed valid licences, appropriate for their duties, issued by the Ministry of Transport of Ukraine.

1.5.5 Crew Training

Antonov Airlines has a senior chief pilot and a chief pilot for each aircraft type—AN-12, AN-22, AN-24, AN-26, AN-32, AN-38, AN124, and AN140. When the airline hires a pilot, each section conducts its own training. After the training is completed, another company check pilot conducts line indoctrination and the final check ride. The AN124 has been described by training personnel and pilots as being very easy to handle for an aircraft of its size. The AN124 tends to be very light on the controls.

Antonov Airlines has an extensive simulator program for initial and recurrent training on the AN124. The simulator also serves as a ground-based procedures trainer for crew training. Full motion simulator training consists of all emergency procedures, with the aircraft in different configurations in visual meteorological conditions and instrument meteorological conditions. The airline has a "pilot-monitored approach" policy and procedure included in its simulator training syllabus.

English language training is provided for the airline's flight crews. Pilots, navigators, and radio operators must all meet minimum standards of comprehension and speaking before they are permitted to conduct international flights. Radio communication is conducted by the radio operators, whose English skills are expected to be better than those of the pilots.

1.6 Aircraft Information

Manufacturer	Antonov Design Bureau

Type and Model	AN124-100
Year of Manufacture	1991
Serial Number	19530502630
Certificate of Airworthiness	20 November 2000
Total Airframe Time	5844 hours
Engine Type (number of)	Lotarev D-18T(4)
Maximum Allowable Take-off Weight	392 000 kg
Recommended Fuel Type(s)	Jet A-1
Fuel Type Used	Jet A-1

1.6.1 Weight and Balance

The aircraft maximum landing weight is 336 000 kg. The landing weight at Windsor was calculated as 290 000 kg (290 tonnes). The centre of gravity during the flight remained inside the normal limits of 30 to 41% mean aerodynamic chord.

1.6.2 AN124-100 Performance Data

The AN124-100 aircraft flight manual contains charts to enable crews to calculate landing distances for various weights and weather conditions. The charts provide an estimate for the amount of runway required from 50 feet above the runway threshold to a full stop with a 1.67 factor applied. Based on the flight manual chart and the weather conditions at the time of the overrun, including the 4-knot tailwind, the captain calculated an estimated factored landing distance of 6890 feet. For calculations, the normal touchdown point is considered to be 984 feet from the threshold.

Another landing distance chart in the aircraft flight manual provides data on the distance required from touchdown to a complete stop. The captain calculated this stopping distance to be about 3280 feet. There is no safety factor applied, and no correction is provided for reduced braking friction as a result of a contaminated runway. The AN124 minimum allowable braking coefficient of friction (BCF) chart indicated that 0.40 was the lowest allowable value for landing.

The ILS approach was flown using 30° flaps (full) and 17° slats. The normal approach speed for landing is 145 knots. The flight crew planned to use 148 knots during the approach. The 148-knot speed was set by a "bug" on the pilots' airspeed indicators; however, the final approach segment was flown at an indicated airspeed of 151 knots. From decision height to threshold crossing, the approach speed remained, for the most part, above the normal speed of 145 knots.

1.6.3 Systems Review

The flight engineers indicated that during the flight and the landing they observed normal system performance with no failures noted on the aircraft's system monitoring display. The landing at Windsor was reported to be smooth and normal. Switches in the main gear provide an on-ground signal. The aircraft must be in the ground mode for brakes and automatic spoilers to operate.

1.6.4 Spoiler System

The spoiler system consists of 16 hydraulically actuated panels in the rear portion of the wings. If armed, the outboard 8 panels extend automatically to the 45° up position when the aircraft touches down (when the on-ground switch in the main gear is triggered). When the 60° position is selected, which requires the additional action of moving a safety limit device and moving the spoiler handle, the 8 inboard spoiler panels also extend. Shortly after touchdown, the captain ordered the manual selection of all spoilers to the 60° up position. The spoiler system operated normally, consistent with lever selection, during the landing at Windsor.

1.6.5 Wheels and Brakes

The 20 main wheels are equipped with antiskid brakes. The brake pedals have two positions: normal and maximum. Normal braking is achieved at an approximate two-thirds pedal position where a small detent is felt; maximum braking is achieved when the brake pedals are pushed fully forward. The antiskid system operated normally, and no directional control problems were reported by the flight crew during the landing roll. Approximately 44 seconds elapsed between touchdown and runway excursion, during which time maximum braking was applied. None of the tires were worn beyond their wear indicator. Substantial tire skid marks were found slightly left of the runway centreline, beginning approximately 100 feet before the end of the runway and continuing to the runway end.

1.7 Meteorological Information

The weather report for Windsor at 2200 (METAR CYQG 190300UTC) was as follows: wind 040° true at 3 knots; visibility 1.5 statute miles in light snow; scattered cloud at 600 feet agl, broken ceiling at 1100 feet, overcast at 2000 feet; temperature -9°C, dewpoint -11°C; altimeter setting 29.87 inches of mercury.

The report for Windsor at 2300 (METAR CYQG 190400UTC) was as follows: wind 080° true at 4 knots; visibility 1.5 statute miles in light snow; broken ceiling at 900 feet, overcast at 1300 feet; temperature -9°C, dewpoint -10°C; altimeter setting 29.83 inches of mercury. The flight crew received this report approximately 28 minutes before landing.

A special observation for Windsor issued at 2312 was as follows: wind 090° true at 4 knots; visibility 2 statute miles in light snow; few clouds at 800 feet, overcast at 1300 feet.

The Windsor 2300 automatic terminal information service was as follows: wind 080° magnetic at 4 knots; visibility 1.5 statute miles in light snow; ceiling 1300 feet overcast; temperature -9°C, dewpoint -10°C; altimeter setting 29.83 inches of mercury. The flight crew received this report 16 minutes before landing.

As the flight crew reported by the Windsor non-directional beacon 3.8 nautical miles on final for landing (1 minute 14 seconds before touchdown), the tower transmitted one final weather report to the crew as follows: "wind 100° magnetic at 6 knots, altimeter setting 29.82 inches of mercury, and no other change since the last transmission."

1.8 Aids to Navigation

There were no indications of problems with the ILS at Windsor. The system was used by three aircraft (including the occurrence aircraft) in the 30 minutes before the occurrence.

1.9 Communications

Radio communications between the flight crew and air traffic control (ATC) were normal throughout the flight. During the en route flight, 17 minutes before touchdown, the AN124 flight crew were advised by ATC that braking action was reported as "moderate" by a Hercules C-130 flight crew that landed 22 minutes before the AN124. The crew were also advised by ATC that an airport maintenance specialist (AMS) would verify the runway friction index on the landing runway and that a Canadian runway friction index (CRFI) report would be communicated to them before their arrival. ATC further advised that a braking action report would be requested from an Airbus A319 expected to land 10 minutes before the AN124 arrival. The AN124 flight crew replied that they would monitor the frequency in anticipation of the updates.

The AMS relayed a CRFI report of 0.30 to ATC 16 minutes before the AN124 landed. ATC then communicated this information to the Airbus flight crew; however, there was no direct controller/pilot communication of this information to the AN124 flight crew. Furthermore, ATC did not request a braking action report from the Airbus flight crew that landed 10 minutes before the occurrence. However, a runway surface condition report was passed to the AN124 flight crew 50 minutes before landing. The report was as follows: "runway condition Runway 25, two hundred foot ploughed and swept, 100 per cent loose snow less than one eighth of an inch, and snow ploughing and sweeping are in progress."

After the aircraft came to rest off the end of the runway, approximately 30 seconds elapsed before ATC established that the aircraft had gone off the end of the runway. A code Red One was immediately initiated for the emergency response services to proceed to the site.

1.10 Aerodrome Information

Windsor Airport is certified by Transport Canada and is operated by Serco Aviation Services Inc. The field elevation is 622 feet above sea level. The airport has two intersecting runways, 07/25 and 12/30, but only Runway 07/25 is suitable for large aircraft operations. The AN124 used Runway 25, which has an asphalt surface 7850 feet long by 200 feet wide. The landing distance available is 7850 feet.

The only ILS approach available at Windsor is to Runway 25. The ILS threshold crossing height (TCH) is published at 50 feet in *Canada Air Pilot* and in the air charts used by the flight crew. The ILS has a 3° glidepath. The runway heading is 249° magnetic, and the magnetic variation at Windsor is 6° West.

Many airports throughout Canada, including Windsor, are equipped with mechanical and electronic decelerometers that are used to obtain an average of the runway friction measurement. The average decelerometer reading of each runway is reported as the CRFI. Because of mechanical and operational limitations, runway friction readings produced by decelerometer devices may result in inaccurate readings under certain surface conditions.
The recommended landing distances in Figure 2 take into account the reduction in landing distances when reverse thrust is used. Representative low values of reverse thrust effect have been assumed; hence, the data may be conservative for properly executed landings by some aircraft with highly effective thrust reversing systems.

The recommended landing distances in the CRFI table are based on standard pilot techniques for minimum distance landings from 50 feet, including an approach from a 3° glideslope, a firm touchdown, minimum delay

to nose lowering, minimum delay time to deployment of ground lift dump devices, minimum delay time to application of brakes and reverse thrust, and sustained maximum antiskid braking until stopped. If any of the above are "not properly executed", the required landing distance will increase.

Twenty minutes before the AN124 landing, the runway surface conditions were as follows: centre 120 feet, 90% trace of loose snow and 10% ice patches; the remaining 40 feet on each side of the runway centre, 75% covered with 1 inch of loose snow and 25% ice patches. An AMS conducted three runs at different locations on the landing runway 15 minutes before the AN124 touchdown to measure the CRFI. The average reading for the runway was reported as 0.30. This friction index report for the runway was not passed to the AN124 flight crew, but ATC advised them 3 minutes before landing that the runway was covered with light snow. Shortly after the occurrence, some members of the crew inspected the runway and reported that it was slippery for walking. Light snow was falling after the occurrence.

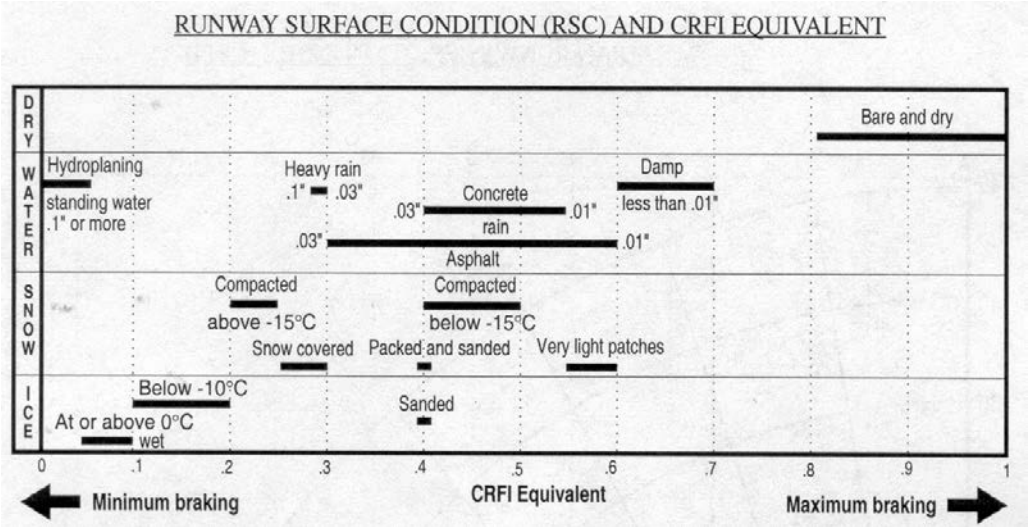
TABLE 2

Canadian Runway Friction Index (CRFI)
Recommended Landing Distances
(Reverse Thrust)

	Reported Canadian Runway Friction Index (CRFI)													
Landing Distance Bare and Dry Unfactored	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.27	0.25	0.22	0.20	0.18	Landing Field Length Bare and Dry	Landing Field Length Bare and Dry
	Recommended Landing Distances (with Reverse Thrust)												60% Factor	70% Factor
1800	3130	3200	3270	3350	3450	3560	3690	3790	3860	3970	4060	4150	3000	2571
2000	3500	3580	3660	3760	3870	4000	4160	4270	4350	4480	4580	4700	3333	2857
2200	3740	3830	3930	4040	4160	4310	4480	4600	4690	4840	4950	5080	3667	3143
2400	4130	4220	4330	4460	4590	4760	4950	5080	5180	5340	5460	5600	4000	3429
2600	4480	4590	4710	4840	4990	5170	5380	5520	5630	5810	5940	6080	4333	3714
2800	4740	4860	4990	5130	5300	5490	5710	5860	5970	6160	6300	6450	4667	4000
3000	5100	5230	5370	5530	5710	5920	6170	6340	6460	6670	6820	6990	5000	4286
3200	5480	5620	5780	5960	6160	6390	6660	6840	6980	7210	7380	7560	5333	4571
3400	5780	5930	6100	6290	6510	6750	7040	7250	7390	7640	7820	8020	5667	4857
3600	6080	6250	6430	6630	6860	7130	7440	7660	7820	8080	8270	8490	6000	5143
3800	6380	6560	6750	6970	7210	7500	7830	8060	8230	8510	8720	8940	6333	5429
4000	6590	6770	6970	7200	7450	7750	8100	8330	8510	8800	9010	9250	6667	5714

Application of the Canadian Runway Friction Index (CRFI)

CRFI readings of 0.40 or less, which represent low braking coefficients of friction, are required to be reported as a special notice to airmen. The CRFI of 0.30, obtained 16 minutes before the overrun, was not reported on the notice to airmen system because the Windsor airport was closed immediately after the occurrence.



1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

The AN124 cockpit voice recorder (CVR) tape was retrieved and sent to the TSB Engineering Laboratory for analysis. The tape provided a recording of the last two hours of flight. Six tracks were recorded: the pilot interphone, the co-pilot interphone, the two flight engineers, the navigator, and the radio operator. ATC's communication of the CRFI to the Airbus flight crew was not recorded on the AN124 CVR.

The flight and the procedures followed were routine until the aircraft was below the decision height of 200 feet agl. From 60 metres (approximately 200 feet) until touchdown, about 24 seconds elapsed.

There was no indication of an aircraft system problem.

1.11.2 Flight Data Recorder

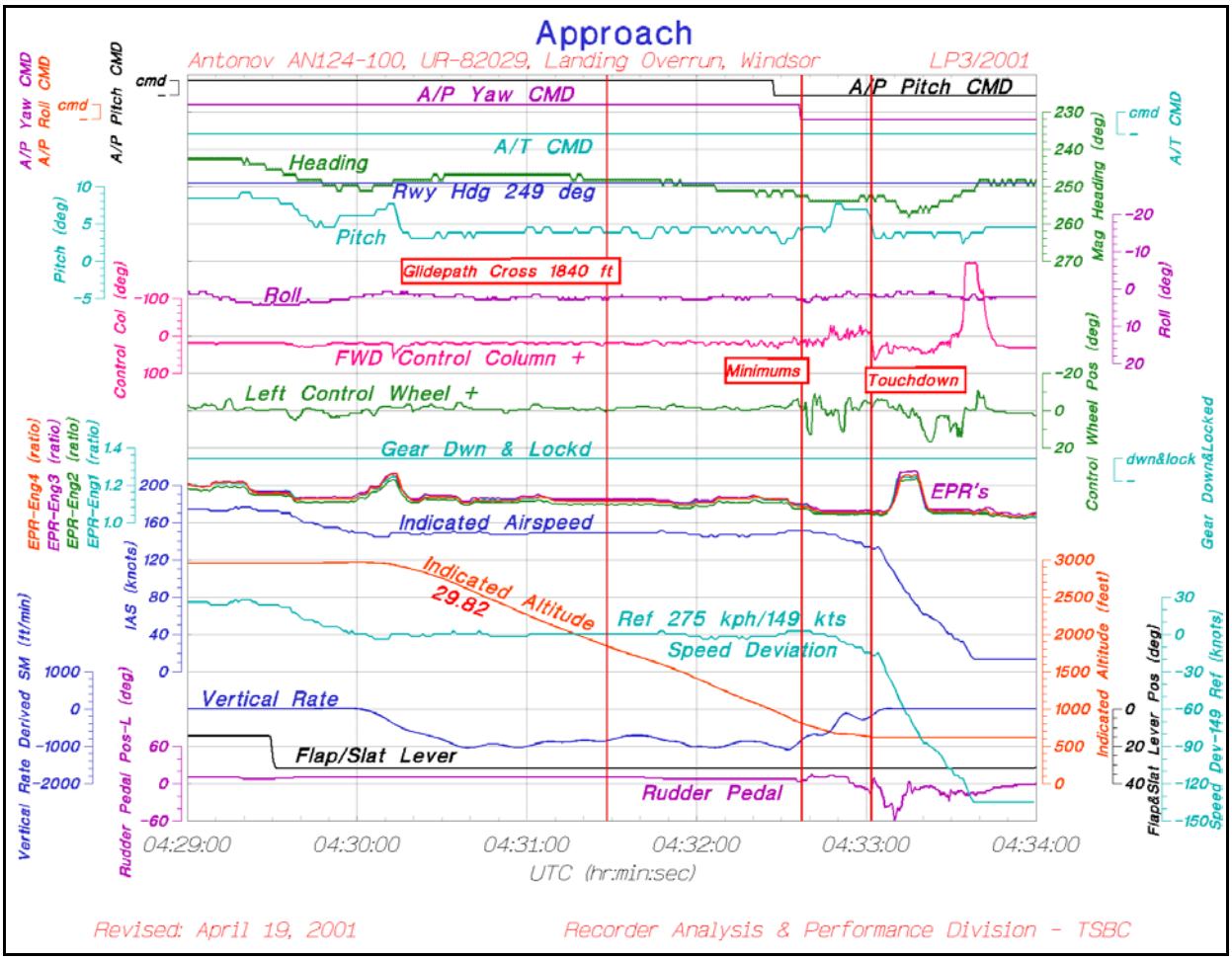
The AN124 was fitted with a digital flight data recorder (FDR), serial number 0412884, which TSB investigators sent to the TSB Engineering Laboratory. The Engineering Laboratory was not equipped to download the FDR, so it was forwarded to Ukraine. The FDR data was electronically sent back to the TSB for analysis. The Engineering Laboratory generated a computer flight reconstruction to facilitate the analysis.

The FDR contained approximately three hours of data and recorded approximately 200 parameters. The data did not suggest any failures of any systems. The aircraft speed at decision height (200 feet agl) was 151 knots, 6 knots faster than the recommended speed of 145 knots. The TCH was approximately 70 feet agl at 147 knots. The published TCH is 50 feet agl.

Based on the flight reconstruction, the aircraft floated during the flare and touched down firmly (1.7g vertical acceleration) at 133 knots, about 3400 feet past the threshold, with about 4450 feet of stopping distance remaining to the end of the runway. The estimated required landing distance, as calculated by the captain, was 6890 feet. This calculated distance is based on a TCH of 50 feet agl and a touchdown point of 984 feet past the threshold.

The wheel brakes were applied and reverse thrust selected 1.4 seconds after touchdown, and the thrust reversers deployed 4.3 seconds after touchdown. At that point, the aircraft was about 4400 feet from the threshold at 125 knots. Approximately 14 seconds after reverse thrust was selected and at 76 knots, in accordance with standard operating procedures, the thrust levers were moved to reverse idle.[2] The longitudinal g on landing indicated an average of -0.15g throughout the landing roll. The recorded longitudinal g deceleration data suggested that the aircraft braking system was functioning. Fifteen seconds after the deactivation of reverse thrust, the aircraft went off the end of the runway at about 30 knots.

After the aircraft came to a stop, the thrust levers were moved to the forward idle position.



[2] Reverse idle is selected at 76 knots to prevent engine damage.

1.12 Organizational and Management Information

All foreign air operators must hold a valid foreign air operator certificate (FAOC) issued by Transport Canada in accordance with the *Canadian Aviation Regulations* to operate in Canada. ADB has held a valid FAOC since February 1991.

2.0 Analysis

2.1 Introduction

The aircraft overran the end of the runway by about 340 feet at approximately 30 knots. The ground past the end of Runway 25 was soft, causing the aircraft to decelerate quickly. Damage to the aircraft was minimal.

The analysis will discuss the probable reasons for the overrun, specifically addressing the following topics: landing long, the effect of the snow on the runway, the braking friction performance, the techniques used by the crew, and the communication between the crew and the Windsor tower controller.

2.2 Approach and Landing

The ceiling and the visibility at Windsor Airport were low enough that flying other than a precision approach would probably not result in a landing. The wind favoured Runway 07; however, only a non-precision, circling, non-directional beacon approach was available to Runway 07. Thus, the decision was made to fly the ILS approach to Runway 25 and land with a 4-knot tailwind. Landing with a tailwind caused an increase in the landing distance. The flight crew flew a stable approach to the decision height. Considering all landing parameters, including the tailwind, performance charts indicate that sufficient runway would have been available to stop the aircraft on a bare, dry runway had the aircraft been landed at the normal touchdown point of about 1000 feet from the threshold. The long landing contributed directly to the overrun.

A number of factors contributed to the delayed touchdown. From the decision height, where the autopilot was disengaged in accordance with standard operating procedures, the aircraft was flown an average of 6 knots faster than the normal approach speed, and it crossed the threshold about 20 feet higher than the normal 50 feet agl. The task of landing the aircraft was more difficult than normal, given the instrument meteorological conditions, the darkness, and the flight crew's relative unfamiliarity with the aerodrome.

2.3 Stopping Performance

When the captain used the performance charts to calculate the required landing distance, he assumed that braking action would be normal. The calculated factored landing distance was 6890 feet, based on a firm touchdown within 984 feet of the threshold, minimum delay for nose lowering, spoiler deployment, thrust reverser deployment, and sustained maximum antiskid braking until stopped. Although the aircraft landed long, based on the calculation done by the captain for a bare, dry runway, the aircraft should have been able to stop within the remaining runway available, because the unfactored stopping distance was 3280 feet. However, referencing CRFI Table 2 (Figure 2), the unfactored landing distance of 4125 feet (calculated factored landing distance of 6890 feet divided by 1.67) more than doubles when a CRFI of 0.30 is applied, to approximately 8350 feet.

Runway 25 has 7850 feet of landing distance available. Based on these numbers, and considering that the aircraft overran the runway by only 340 feet, the aircraft braking action was appreciable. This assessment is corroborated by the fact that two large aircraft (a Hercules C-130 and an Airbus A319) landed in similar conditions within the 22 minutes preceding the occurrence (with one aircraft reporting braking action as "moderate"), and the fact that an AMS conducted three runway friction evaluation runs just before the overrun, with an average result of 0.30.

There were no indications that the aircraft brakes were not functioning normally. Although the centre 120 feet of runway were covered by a trace of loose snow that degraded braking action, the longitudinal deceleration of the aircraft averaged -0.15g throughout the landing roll, even after deactivation of reverse thrust, suggesting that aircraft braking action was considerable. The AN124 left substantial tire skid marks approximately 100 feet before exiting the runway, also indicating appreciable braking action.

2.4 Communications Between ATC and the Flight Crew

The word "moderate" is not standard terminology used to describe braking action. It is used to describe a weather-related condition typically associated with precipitation, icing, or turbulence. International Civil Aviation Organization procedures for air navigation services state that, when describing aerodrome information, the terminology used to report braking action should be relayed using the terms, "Good, Medium, Poor, Unreliable, or any combination of these". Although the *Air Traffic Control Manual of Operations* (ATC MANOPS) recommends passing on reports as they are received, forwarding the non-standard phraseology "moderate" from the Hercules C130 flight crew to the AN124 flight crew could have possibly induced confusion or misinterpretation on the part of the AN124 flight crew, not being fluent in English. Previous information passed to the crew regarding runway condition and other aircraft landing without incident likely led the crew to believe that braking action was adequate for a normal approach and landing.

As initially proposed and acknowledged by the AN124 flight crew, ATC did not follow up on the intention to request a braking action report from the Airbus that landed 10 minutes before the AN124 touched down. This report was to be passed to the AN124 flight crew to enhance their situational awareness of the runway surface. Although the flight crew were aware of snow on the runway, marginal visibility in light snow, and a light tailwind, it cannot be determined if the absence of a braking action report from the Airbus contributed to the outcome of this occurrence.

ATC MANOPS provisional directive 9709, supplementing Part I, Article 169, states that ATC must inform concerned aircraft of runway conditions that may affect flight safety and must issue the most recent runway surface condition for the applicable runway as received from the responsible airport authority. The CRFI report of 0.30 issued to ATC by the AMS 16 minutes before this occurrence was not passed on to the AN124 flight crew; however, it was passed to the Airbus flight crew. It was not determined why this communication was not recorded on the AN124 CVR, although the radio operator advised ATC that he would be monitoring the frequency. The AN124 flight crew advised that they would have diverted the aircraft to the alternate airport had they known that the CRFI was below 0.40.

3.0 Conclusions

3.1 Findings as to Causes and Contributing Factors

1. The aircraft touched down 3400 feet past the threshold of Runway 25 and could not be stopped in the remaining 4450 feet.

2. Because of the weather minima on Runway 07, the aircraft was landed with a 4-knot tailwind component on Runway 25. The aircraft was about 20 feet higher and about 6 knots faster than recommended when it crossed the threshold of Runway 25. Consequently, the aircraft touched down well beyond the normal touchdown point.

3. The runway was covered with a trace of loose snow, which reduced braking friction and lengthened the landing roll.

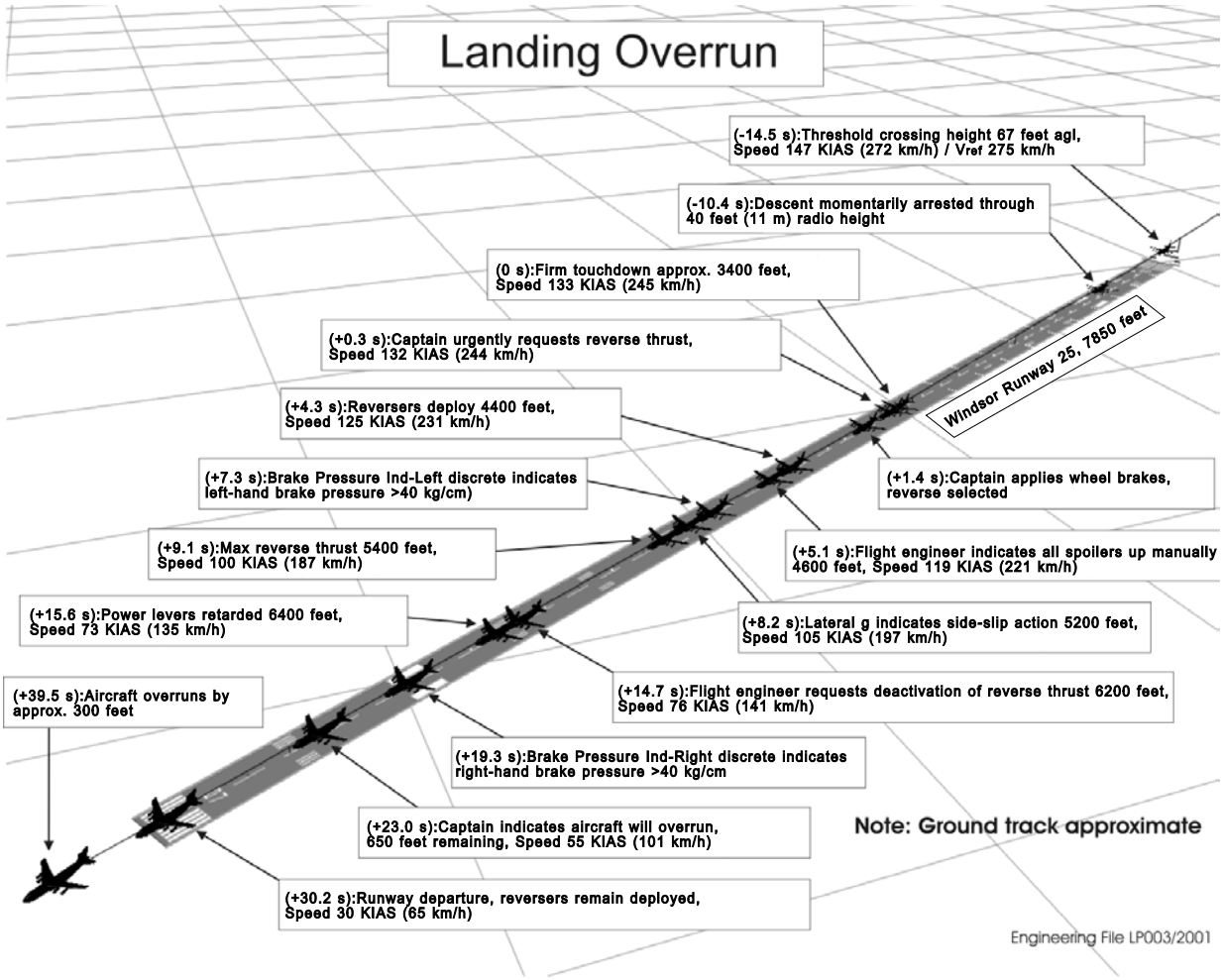
4. The Canadian runway friction index (CRFI) report of 0.30, issued to air traffic control by the airport maintenance specialist, was not passed to the AN124 flight crew. This resulted in the flight crew decision to land at Windsor when a diversion to an alternate airport might have been conducted had the flight crew been aware of the CRFI.

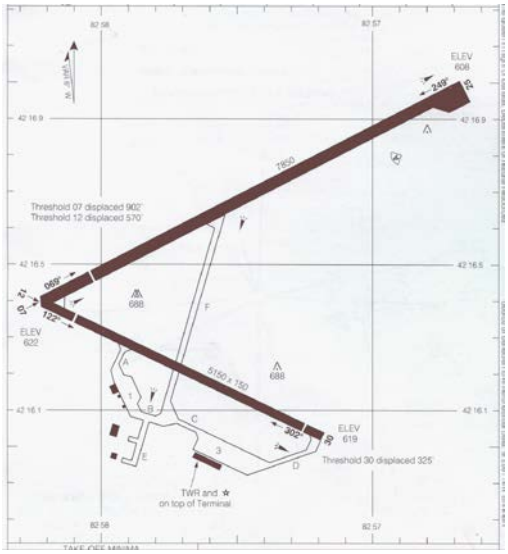
3.2 Findings as to Risk

1. At the time of landing, the only information about runway braking action that was passed to the flight crew was that braking action was "moderate", a non-standard and perhaps confusing term. Air traffic control did not inform the flight crew of the CRFI of 0.30 or the runway braking action of the Airbus.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 08 January 2002.

Appendix A—Landing Overrun and Windsor Airport





Appendix B—List of Supporting Reports

The following TSB Engineering Laboratory Report was completed:

LP003/2001—CVR and FDR Flight Recorders

This report is available upon request from the Transportation Safety Board of Canada.

Appendix C—Glossary

ADB	Antonov Design Bureau
agl	above ground level
AMS	airport maintenance specialist
ATC	air traffic control
ATC MANOPS	*Air Traffic Control Manual of Operations*
ATPL	airline transport pilot licence
BCF	braking coefficient of friction
cm	centimetres
CRFI	Canadian runway friction index
CVR	cockpit voice recorder
FAOC	foreign air operator certificate
FDR	flight data recorder
g	G-load factor
ILS	instrument landing system
kg	kilogram
KIAS	knots indicated airspeed
km/h	kilometres per hour
m	metres
s	second
TCH	threshold crossing height
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
V_{ref}	reference speed
'	minute(s)
"	second(s)
°	degree(s)
°C	degrees Celsius