Aviation Investigation Final Report

Location:	Chicago, Illinois	**Incident Number:**	CEN11IA649
Date & Time:	September 17, 2011, 10:45 Local	**Registration:**	C-FGYL
Aircraft:	Airbus Industrie A320-211	**Aircraft Damage:**	Minor
Defining Event:	Sys/Comp malf/fail (non-power)	**Injuries:**	140 None
Flight Conducted Under:	Part 129: Foreign		

Analysis

The first officer's (FO) windshield cracked during cruise flight. The crack subsequently progressed into multiple multidirectional cracks that obscured the FO's view through the window. The flight crew was unable to determine the severity of the cracks and diverted without further incident. A postincident examination of the windshield revealed an area of arcing located along the electrical bus bar at the lower edge of the windshield, near the forward corner. This location coincided with the area in which the power and sensing element wires were routed around the structural glass plies. The area of arcing was surrounded by a cloudy and degraded interlayer, which was consistent with the presence of moisture. A section of the moisture seal was worn and appeared to have been repaired, resulting in moisture ingress. The moisture degraded the interlayer and electrical system resulting in a discontinuity that led to electrical arcing and failure of the heating system causing the windshield cracking. The latest windshield revisions, with part numbers NP-165331-1/-2, are available and include enhancements that reduce the potential for moisture ingress and its subsequent effects on the electrical system.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: The infiltration of moisture into the windshield heating layer that induced arcing in the heating system that subsequently cracked the windshield.

Findings

Aircraft	Flight compartment windows - Failure
Aircraft	Flight compartment windows - Design

Factual Information

History of Flight

Enroute-cruise	Sys/Comp malf/fail (non-power) (Defining event)

On September 17, 2011, about 1045 central daylight time, an Airbus Industrie A320, C-FGYL, sustained minor damage when the copilot's window cracked during cruise at flight level 340 northwest of Chicago, Illinois. The flight crew declared an emergency, and diverted to the Chicago O'Hare International Airport (ORD), Chicago, Illinois, landing about 1113 without further incident. There were no injuries to the 2 flight crewmembers, 4 cabin crewmembers, and 134 passengers. The airplane was registered to GECAS and the flight was operated by Air Canada as flight 791, under the provisions of 14 Code of Federal Regulations Part 129 as a scheduled international passenger flight. Day visual flight rules conditions prevailed for the flight, which operated on an activated instrument flight rules flight plan. The flight originated from the Toronto Pearson International Airport, near Toronto, Ontario, Canada, about 0940, and was destined for the Los Angeles International Airport, near Los Angeles, California.

The operator's incident report stated an 18-inch long crack developed in the first officer's (FO) windshield, extending from the left bottom corner to the top right corner, during cruise flight. The crack subsequently progressed into multiple multi directional cracks that obscured the FO's view through the window. The flight crew was unable to determine the severity of the cracks and how many plies were affected. The flight crew complied with the quick reference handbook guidance and diverted to ORD. The flight crew performed an overweight landing and taxied the airplane to the gate.

The incident windshield, part number NP-165311-8 with serial number 07169H9453; CA122417, was made from laminated glass. The layers, from the outboard surface to the inboard surface; included a Herculite II glass layer coated with a Nesatron anti-ice system and its associated conductive bus bar, a urethane interlayer, a vinyl interlayer, a urethane interlayer, a Herculite II glass layer, a vinyl interlayer, and a Herculite II glass layer.

A NTSB aircraft structures and maintenance specialist oversaw a postincident examination of the windshield at PPG Industries, Inc., near Huntsville, Alabama, on March 9, 2012. The examination revealed that the fracture origin was located at the center of the windshield. An area of arcing was located along the electrical bus bar at the lower edge of the windshield, near the forward corner. This location coincided with the area in which the power and sensing element wires were routed around the structural glass plies. This area of arcing was surrounded by a cloudy and degraded interlayer, which was consistent with the presence of moisture. The moisture seal was worn and the moisture seal upper edge had been repaired. Appearance of the moisture seal's forward and lower edges was consistent with a factory condition.

The latest windshield revisions produced by PPG Aerospace, with part numbers NP-165331-1/-2, are now available and include enhancements that reduce moisture ingress and its subsequent effects on the electrical system.

According the Accredited Representative from the Bureau d'Enquêtes et d'Analyses (BEA), Airbus had issued a Flight Operation Telex (FOT) on May 25, 2011, to inform operators about the issuance of a revised Cockpit Windshield/ Window Cracked operational procedure in case of a cockpit window cracking. The new procedure asked the crew to check if the inner ply is affected by the crack by using either a pen or finger nail. If the inner ply is not cracked, based on the fail safe design, the flight crew can continue the flight, without other restriction.

Pilot Information

Certificate:	Airline transport	**Age:**	50,Male
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	August 17, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	May 17, 2011
Flight Time:	10809 hours (Total, all aircraft)		

Co-pilot Information

Certificate:	Airline transport	**Age:**	38,Male
Airplane Rating(s):	Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	January 14, 2011
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	August 7, 2011
Flight Time:	5419 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Airbus Industrie	**Registration:**	C-FGYL
Model/Series:	A320-211	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Transport	**Serial Number:**	MSN 254
Landing Gear Type:	Retractable - Tricycle	**Seats:**	147
Date/Type of Last Inspection:	September 16, 2011 AAIP	**Certified Max Gross Wt.:**	169500 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo fan
Airframe Total Time:	49660 Hrs at time of accident	**Engine Manufacturer:**	CFM
ELT:	Installed, not activated	**Engine Model/Series:**	56-5A
Registered Owner:	GECAS	**Rated Power:**	
Operator:	AIR CANADA	**Operating Certificate(s) Held:**	Foreign air carrier (129)
Operator Does Business As:		**Operator Designator Code:**	ARNF

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ORD,672 ft msl	**Distance from Accident Site:**	93 Nautical Miles
Observation Time:	10:51 Local	**Direction from Accident Site:**	130°
Lowest Cloud Condition:	Few / 4200 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.3 inches Hg	**Temperature/Dew Point:**	17°C / 6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Toronto (CYYZ)	**Type of Flight Plan Filed:**	IFR
Destination:	Los Angeles, CA (LAX)	**Type of Clearance:**	IFR
Departure Time:	09:40 Local	**Type of Airspace:**	

Airport Information

Airport:	Chicago O'Hare IAP ORD	**Runway Surface Type:**	Asphalt;Concrete
Airport Elevation:	672 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:	14R	**IFR Approach:**	Unknown
Runway Length/Width:	9685 ft / 200 ft	**VFR Approach/Landing:**	Precautionary landing

Wreckage and Impact Information

Crew Injuries:	6 None	**Aircraft Damage:**	Minor
Passenger Injuries:	134 None	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	140 None	**Latitude, Longitude:**	41.978297,-87.910773(est)

Administrative Information

Investigator In Charge (IIC):	Malinowski, Edward
Additional Participating Persons:	Robert Hendrickson; Federal Aviation Administration; Washington, DC David McNair; Transportation Safety Board of Canada; Gatineau, QB, Canada Stirling Macfarlane; PPG Industries, Inc.; Huntsville, AL Alain Agnesetti; French Bureau d' Enquetes et d'Analyses (BEA); Paris, France
Original Publish Date:	November 7, 2012
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=81818