

March 5, 2007

The following are my notes from the window evaluations accomplished in Denver, Colorado on February 26, 2007. The evaluations were to either identify either a root cause or eliminate potential causes to the numerous windshield fractures that occurred on February 16, 2007.

A total of twenty-three (23) windows were reviewed during this visit; 1 Beech King Air main windshield, 3 Embraer EMB-120 main windshields, 7 Airbus narrow body main windshields, 7 CRJ main windshields and 5 CRJ side windows. The flight hours and cycles shown are from PPG records. The time in-service was calculated by determining the days in service (date of removal minus install date) multiplied by the daily utilization rate. All fracture origin measurements are from the center of the fastener line on the noted edge.

WINDOW EVALUATION NOTES

Removed Part and Serial Number: 601R33033-20 / 04199H1301

Serial Number Installed: 06312H7366

Aircraft Registration Number: N724SK / fuselage 10189

Window Service Time: 5,936.60 flight hours, 3,867 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Moderate number of impact markings identified on outer ply outer surface in lower forward corner area (between 12 and 24 impacts)
- Fracture origin was 5.75 inches from the forward edge and 3.13 inches from the lower edge. The impact diameter was measured as 0.020 inch using an optical micrometer.

Removed Part and Serial Number: 601R33033-19 / 04191H9504

Serial Number Installed: 06226H8906

Aircraft Registration Number: N724SK / fuselage 10189

Window Service Time: 5,936.60 flight hours, 3,867 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Moderate number of impact markings identified on outer ply outer surface in lower forward corner area (between 12 and 24 impacts)
- Fracture origin was 3.63 inches from the forward edge and 10.13 inches from the lower edge.

Removed Part and Serial Number: 601R33033-17 / 04202H1409

Serial Number Installed: 06297H6278

Aircraft Registration Number: N724SK / fuselage 10189

Window Service Time: 5,936.60 flight hours, 3,867 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts)
- Fracture origin was 9.06 inches from the upper edge and 15.25 inches from the aft edge.

Removed Part and Serial Number: 601R33033-18 / 04135H4893

Serial Number Installed: 04223H3128

Aircraft Registration Number: N724SK / fuselage 10189

Window Service Time: 5,936.60 flight hours, 3,867 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts)
- Fracture origin was 7.75 inches from the forward edge and 12.25 inches from the lower edge.

Removed Part and Serial Number: 114-384020-4 / 96323H2788

Serial Number Installed: Unknown

Aircraft Registration Number: Unknown, Beech King Air – Great Lakes Aviation

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fractured
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts)
- ~~Unable to positively identify fracture origin, requested windshield be sent to PPG facility for additional evaluation.~~ (see addendum 2)

Removed Part and Serial Number: 601R33033-17 / 04348H4434

Serial Number Installed: 06341H9306

Aircraft Registration Number: N753SK / fuselage 10214

Window Service Time: 4,623.59 flight hours, 3,039 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Window was reported to have fractured during installation of the side window (see following report).
- Moderate number of impact markings identified on outer ply outer surface in lower forward corner area (between 12 and 24 impacts)
- Fracture origin was 15.25 inches from the forward edge and 6.50 inches from the lower edge.

Removed Part and Serial Number: 601R33033-19 / 04334H3285

Serial Number Installed: 06198H5827

Aircraft Registration Number: N753SK / fuselage 10214

Window Service Time: 4,623.59 flight hours, 3,039 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Minimum impact markings identified on outer ply outer surface concentrated on forward quarter of the window (less than 12 impacts)
- Fracture origin was 8.00 inches from the forward edge and 5.75 inches from the lower edge.

Removed Part and Serial Number: 601R33033-21 / 05089H4605

Serial Number Installed: 06198H5780

Aircraft Registration Number: N758SK / fuselage 10222

Window Service Time: 3,896.38 flight hours, 2,615 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Moderate number of impact markings identified on outer ply outer surface in lower forward corner area (between 12 and 24 impacts)
- Fracture origin was 12.44 inches from the lower edge and 12.75 inches from the forward edge.

Removed Part and Serial Number: NP139321-10 / 01213H4709

Serial Number Installed: 04306H9833

Aircraft Registration Number: N410SW / fuselage 7066

Window Service Time: 9,433.95 flight hours, 7,896 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- No part / serial number identification on window. Documented Nesatron number (A17717329) to compare with manufacturing records. Verified that installed window serial number is 01213H4709.
- Fracture origin was 8.00 inches from the forward edge and 5.75 inches from the lower edge.

Removed Part and Serial Number: 601R33033-19 / 04329H3190

Serial Number Installed: 05249H1448

Aircraft Registration Number: N754SK / fuselage 10215

Window Service Time: 4,606.46 flight hours, 3,027 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Minimum impact markings identified on outer ply outer surface (less than 12 impacts)
- Fracture origin was 9.88 inches from the upper edge and 12.06 inches from the forward edge.

Removed Part and Serial Number: 601R33033-17 / 04308H1158

Serial Number Installed: 07044H5533

Aircraft Registration Number: N754SK / fuselage 10215

Window Service Time: 4,506.02 flight hours, 2,971 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- Fracture origin was 12.25 inches from the forward edge and 6.06 inches from the lower edge.

Removed Part and Serial Number: 601R33033-18 / 04231H3790

Serial Number Installed: 04062H6922

Aircraft Registration Number: N746SK / fuselage 10202

Window Service Time: 5,337.28 flight hours, 3,539 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Moderate number of impact markings identified on outer ply outer surface in lower forward corner area (between 12 and 24 impacts)
- Fracture origin was 2.63 inches from the forward edge and 16.38 inches from the lower edge.

Removed Part and Serial Number: 601R33033-11 / 02269H6696

Serial Number Installed: 07002H1986

Aircraft Registration Number: N939SW / fuselage 7742

Window Service Time: 10,289.15 flight hours, 8, 941 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Minimum impact markings identified on outer ply outer surface concentrated on forward quarter of the window (less than 12 impacts)
- Impact depth measured using an optical micrometer as 0.0084 inch.
- Fracture origin was 11.06 inches from the forward edge and 2.75 inches from the lower edge.

Removed Part and Serial Number: NP 151311-2 / 03319H2956

Serial Number Installed: 04117H2989

Aircraft Registration Number: N271YV / fuselage 120271

Window Service Time: 7,290.01 flight hours, 10,247 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- No other impacts identified on outer ply outer surface other than fracture origin
- Fracture origin was 8.75 inches from the forward edge and 7.88 inches from the upper edge.

Removed Part and Serial Number: NP 151311-1 / 04149H6184

Serial Number Installed: 06255H2470

Aircraft Registration Number: N299SW / fuselage 120329

Window Service Time: 4,877.47 flight hours, 7,209 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Minimum impact markings identified on outer ply outer surface concentrated in the lower forward quarter of the window (less than 12 impacts)
- Fracture origin was 9.50 inches from the forward edge and 11.38 inches from the lower edge.

Removed Part and Serial Number: NP 151311-2 / 05265H3005

Serial Number Installed: 06346H9560

Aircraft Registration Number: N299SW / fuselage 120329

Window Service Time: 1,900.55 flight hours, 2,809 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface concentrated on the forward half of the window (greater than 24 impacts).
- Fracture origin was 4.75 inches from the forward edge and 9.63 inches from the lower edge.

Removed Part and Serial Number: NP 165311-8 / 05028H8440

Serial Number Installed: 7816 (STA 320-2-7-1A)

Aircraft Registration Number: N927FR / fuselage 2209

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fractured – no evidence of electrical related cause
- No impact markings identified on outer ply outer surface.
- ~~Unable to positively identify fracture origin, requested windshield be sent to PPG facility for additional evaluation.~~ (see addendum 2)

Removed Part and Serial Number: NP 165311-6 / 02305H9334

Serial Number Installed: 7922 (STA 320-2-7-1A)

Aircraft Registration Number: N923FR / fuselage 2019

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- Fracture origin was 2.50 inches from the forward edge and 7.38 inches from the lower edge. Depth of initial impact was measured using an optical micrometer to be 0.005 inch.

Removed Part and Serial Number: NP 165311-5 / 02072H1582

Serial Number Installed: 57891 (STA 320-2-7-1A)

Aircraft Registration Number: N923FR / fuselage 2019

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- Fracture origin was 8.25 inches from the forward edge and 8.18 inches from the lower edge.

Removed Part and Serial Number: NP 165311-7 / 04087H9325

Serial Number Installed: 58049

Aircraft Registration Number: N807FR / fuselage 2276

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fracture – FOD impact
- Minimum impact markings identified on outer ply outer surface (less than 12 impacts).
- Fracture origin was 5.06 inches from the aft edge and 5.31 inches from the lower edge.

Three other Airbus A320 family main windshields were reviewed as part of the NTSB evaluation of the windows removed from service on February 16, 2007. These three windows were not manufactured by PPG Aerospace Transparencies. Notes were not taken regarding the overall condition nor NTSB determination of the outer ply fractures.

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Lead Product Support Engineer
PPG Aerospace Transparencies

Subsequent to the evaluations accomplished in Denver, Colorado, two windshields were returned to PPG Aerospace Huntsville, AL facility for evaluation. Based on the date of removal, general visual evaluation findings and the aircraft affected, it is logical to conclude that these window removals are the result of the event that occurred on February 16, 2007 in Denver, Colorado.

Removed Part and Serial Number: 601R33033-18 / 04325H2888

Removal Date: February 18, 2007

Serial Number Installed: 06333H8697

Aircraft Registration Number: N754SK / fuselage 10215

Window Service Time: 4,607.46 flight hours, 3,028 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- ~~Fracture origin was 6.69 inches from the upper edge and 11.06 inches from the aft edge~~ (see addendum 2)

Removed Part and Serial Number: 601R33033-1 / 94300H6761

Removal Date: February 17, 2007

Serial Number Installed: 07038H5094

Aircraft Registration Number: N410SW / fuselage 7066

Window Service Time: 31,784.12 flight hours, 26,603 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- ~~Fracture origin was 9.31 inches from the upper edge and 12.75 inches from the aft edge~~ (see addendum 2)

On April 12, 2007, Mr. Clint Crookshanks from the NTSB came to the PPG Aerospace Huntsville, AL facility for evaluation of the two additional CRJ windshield removals noted in the addendum dated March 9, 2007. The two windshields from the evaluation in Denver, CO that a definitive diagnosis could not be made at that time were also reviewed during this visit. The findings for these four units in this addendum supersede those notes of the prior issuances.

New information or revisions to the existing data are shown in italicized font for ease of review.

Removed Part and Serial Number: 601R33033-18 / 04325H2888

Removal Date: February 18, 2007

Serial Number Installed: 06333H8697

Aircraft Registration Number: N754SK / fuselage 10215

Window Service Time: 4,607.46 flight hours, 3,028 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- *Four impacts, randomly chosen, were reviewed to determine diameter and depth. All measurements were made using a self-calibrating optical micrometer.*
- *The four impacts ranged in diameter from 0.002 inch to 0.010 inch. The depths of these impacts were recorded between 0.0017 and 0.0032 inch.*
- The fracture origin was located 12.56 inches from the upper edge and 12.00 inches from the forward edge

Removed Part and Serial Number: 601R33033-1 / 94300H6761

Removal Date: February 17, 2007

Serial Number Installed: 07038H5094

Aircraft Registration Number: N410SW / fuselage 7066

Window Service Time: 31,784.12 flight hours, 26,603 flight cycles

Notes from window evaluation

- Outer ply fracture – FOD impact
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts).
- *Four impacts, randomly chosen, were reviewed to determine diameter and depth. Impact diameters and depths similar to the first windshield were noted.*
- Fracture origin was 9.38 inches from the upper edge and 12.38 inches from the aft edge.
- *The impact at the fracture origin was measured to be 0.012 inch in diameter and 0.0072 inch deep.*

Removed Part and Serial Number: NP 165311-8 / 05028H8440

Serial Number Installed: 7816 (STA 320-2-7-1A)

Aircraft Registration Number: N927FR / fuselage 2209

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fractured – no evidence of electrical related cause
- *Moderate number of impact markings identified on outer ply outer surface on the forward third of the windshield (between 12 and 24 impacts).*
- *The fracture origin was identified near the aft edge. Measurements from the outer edge of the polysulfide moisture seal identified the origin as being located 7.82 inches from the windshield upper edge and 2.32 inches from the aft edge.*
- *The impact at the fracture origin was measured to be 0.008 inch in diameter and 0.0067 inch deep.*

Removed Part and Serial Number: 114-384020-4 / 96323H2788

Serial Number Installed: Unknown

Aircraft Registration Number: Unknown, Beech King Air – Great Lakes Aviation

Window Service Time: Unknown

Notes from window evaluation

- Outer ply fractured
- Multiple impact markings identified on outer ply outer surface across entire surface of the window (greater than 24 impacts)
- *Based on the fracture pattern and Wallner lines, the outer ply fracture origin was logically concluded to be 5.13 inches from the upper edge and 13.38 inches from the forward edge. Measurements are from the centerline of the retainer fastener row.*
- *The impact origin could not be located at suspected fracture origin. Fragments found in the concluded origin support the fracture origin location.*

The evaluation findings of these four windshields were consistent with the other windows evaluated as part of this investigation. No other windows have been identified as being in the population for the February 16, 2007 event.

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