



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

STRUCTURES GROUP FACTUAL REPORT

May 3, 2017

A. ACCIDENT: ERA17FA066

Operator: Key Lime Air, flight LYM308
Location: Camilla, GA
Date: December 5, 2016
Time: 2222 Eastern Standard Time
Aircraft: Fairchild SA227-AC
Registration Number: N765FA

B. STRUCTURES GROUP

Chairman: Clinton R. Crookshanks
National Transportation Safety Board
Denver, Colorado

Member: Kristin Bradley
Federal Aviation Administration
Fort Worth, Texas

Member: James Norton
M7 Aerospace, LLC
San Antonio, Texas

Member: Darwin Thomason
Key Lime Air
Englewood, Colorado

C. SUMMARY

On December 5, 2016, about 2222 eastern standard time, a Fairchild SA227-AC, N765FA, operating as Key Lime Air flight LYM308, was destroyed during a descent and subsequent inflight breakup near Camilla, Georgia. The airline transport pilot was fatally injured. Night instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed. The flight originated at Northwest Florida Beaches International Airport (ECP), Panama City, Florida, and was destined for Southwest Georgia Regional Airport (ABY), Albany, Georgia. The on-demand cargo flight was conducted under the provisions of 14 Code of Federal Regulations Part 135.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane

The Fairchild SA-227AC Metro is a twin engine, propeller driven, low wing, pressurized airplane (Figure 1¹) originally equipped to carry 19 passengers. The airplane is of all metal construction, has a cruciform tail and is equipped with a retractable tricycle landing gear system. The airplane is powered by two Garrett TPE-331 engines and has a maximum takeoff weight of 14,000 pounds. The airplane is 59.35 feet long, has a wingspan of 57 feet and a tail height of 16.66 feet. The accident airplane was configured to carry only cargo. A photo of the accident airplane is shown in Figure 2.

The Metro fuselage is a typical semi-monocoque structure composed primarily of aluminum alloy frames, skins, stringers, and bulkheads. Locations longitudinally along the fuselage are denoted by fuselage stations (FS) measured in inches from the datum (FS 0.000) located at the forward bulkhead, Figure 3. The fuselage is divided into 3 major sections that join together at production splices. The forebody structure extends from FS 0.000 to FS 126.060 and includes the cockpit. The constant section structure extends from FS 126.060 to FS 493.247 and includes the entry door, emergency exits, passenger windows, cargo door and the wing attach points. The aftbody structure extends from FS 493.247 to FS 659.975 and includes the attach points for the vertical stabilizer. The radome is installed on the bulkhead at FS 0.000 and extends forward to FS -28.940. The fuselage is pressurized between the forward pressure bulkhead at FS 69.310 and the aft pressure bulkhead at FS 631.310. The fuselage stringers in the constant section are numbered from 1 at the top centerline to 15 at the bottom centerline on both the right and left sides of the fuselage, Figure 4. The wing is attached to the lower portion of the fuselage at four points, 2 on the main spar and 2 on the rear spar.

The SA-227AC wing is a twin-spar arrangement with integral fuel tanks and removable flaps and ailerons. Locations along the span are denoted by wing stations (WS) measured in inches from the datum (WS 0.000) at the centerline of the airplane, Figure 5. The main wing is of a one-piece design with continuous main and rear spars from WS 266.000 LH to WS 266.000 RH. The spars are built-up I-beam structures constructed of aluminum alloy with titanium alloy and steel alloy reinforcements on the upper and lower spar caps. The wing attach fittings on both the main and rear spars are located at WS 27.103 RH and LH. Five-foot wing extensions are attached to the outboard end of each wing (WS 266) to increase the span to 57 feet. The ailerons are installed

¹ All Figures are presented in Appendix A to this report.

along the trailing edge between WS 172.100 and WS 266.000 (RH and LH) and the flaps are installed along the trailing edge between WS 29.428 and WS 172.100 (RH and LH).

The airplane is equipped with conventional horizontal and vertical stabilizers composed primarily of aluminum alloy components in a cruciform arrangement. The vertical stabilizer is a cantilever design with two spars that are attached to bulkheads in the aft fuselage. A cable driven rudder and trim tab are attached to the aft spar of the vertical stabilizer. Locations along the span of the vertical stabilizer and rudder are denoted by stations (STA) measured in inches from the horizontal waterline 0.0 plane that is located at the center of the constant fuselage section, Figure 6. The horizontal stabilizer is a one-piece design with continuous forward and aft spars. The horizontal stabilizer rear spar is attached to the vertical stabilizer forward spar with a trunnion bolt. The stabilizer pivots around the trunnion bolt changing the angle of incidence of the stabilizer and providing pitch trim for the airplane. The pitch trim is controlled electrically by switches on the control yokes that actuate two motor operated jackscrews mounted to the top of the fuselage and to the horizontal stabilizer forward spar. All aluminum cable driven elevators are attached to the horizontal stabilizer rear spar and fastened together at the center splice plate hinge point. Locations along the span of the horizontal stabilizers are denoted by stations (STA) measured in inches from the datum (WS 0.000) at the centerline of the airplane, Figure 7.

2.0 Accident Aircraft Examination

S/N: AC-765

TAT: 24,233.7 hours (prior to accident flight)

TAC: 40,077 cycles (prior to accident flight)

The main wreckage was located about 3.4 miles east-southeast of Camilla, Georgia, and contained the fuselage, center wing section, and both engines. The wings outboard of the nacelles, wing extensions, empennage, ailerons, and cargo door separated from the airplane during the accident sequence and were recovered away from the main wreckage, Figure 8. The outboard wings, wing extensions, ailerons and empennage were in a relatively concentrated area of wreckage about 0.45 mile southwest of the main wreckage, Figure 9. The cargo door was recovered about 0.10 mile southwest of the main wreckage. The group examined the recovered wreckage at the Atlanta Air Salvage facility in Griffin, Georgia, February 28 – March 2, 2017. The group focused on the outboard wings, empennage, and aft fuselage for the examination. The engines, wing center section, and forward fuselage were not examined but suffered extensive fire damage.

The left outboard wing separated from the airplane just outboard of the nacelle near wing WS 99 and the left wing tip extension separated from the outboard wing near WS 266. All the left outboard wing structure was recovered away from the main wreckage. There was green paint transfer on the upper surface of the left wing between about WS 174 and WS 302 and diagonal scratching and gouging between about WS 198 and WS 248. The leading edge was separated into several pieces between about WS 99 and WS 266. There was a distinct diagonal crease in the wing running from about WS 186 at the leading edge to about WS 214 at the trailing edge with the portion of wing outboard of the crease deformed upward. The wing structure between about WS 99 and WS 174 exhibited substantial twisting and crushing damage in a fore-aft direction. The lower left wing skin was separated into several pieces and reconstructed in the hangar. The two rows of 10 fuel access

panels in the lower left wing skin were reconstructed. The inboard most fuel access panel in the aft row (panel 1) was not identified and panels 1, 2, and 9 in the forward row were not identified. The left wing forward upper spar cap remained attached to the outboard wing from about WS 99 to WS 266 and the inboard portion was deformed up and aft. The lower forward spar cap between about WS 99 and WS 174 was separated from the wing and exhibited S-bending. The left wing rear spar upper spar cap was fractured near WS 137 and the inboard portion was not identified. The lower rear spar cap was fractured near WS 146. The portion of lower rear spar cap from about WS 115 to WS 146 was separated and deformed up and aft. The rear spar cap inboard of about WS 115 was not identified. The left aileron was separated from the wing and recovered in three pieces; one from about WS 175-202, one from about WS 205-220, and one from about WS 220-266. The left aileron trim tab remained attached to the inboard aileron piece. The left aileron bell crank and control rods remained attached to the left wing rear spar. The left wing tip extension separated from the left outboard wing near WS 266. The attach fittings were intact with the bolts installed. The rear spar upper and lower and forward spar lower fittings were pulled from the wing tip extension and the forward spar upper fitting was pulled from the outboard wing. There was a large semi-circular impact impression in the leading edge of the wing tip extension between about WS 266 and WS 302. The leading edge was deformed down and aft in this area.

The right outboard wing separated from the airplane just outboard of the nacelle near WS 99 and the wing tip extension separated from the outboard wing near WS 266. All the right outboard wing structure was recovered away from the main wreckage. There was green paint transfer on the upper surface of the right wing between about WS 148 and WS 296 and diagonal scratching and gouging between about WS 206 and WS 266. The leading edge remained attached to the right outboard wing but was deformed down and aft between about WS 188 and WS 266. There was a hole in the leading edge between about WS 176 and WS 204. The wing structure between about WS 99 and WS 162 exhibited substantial twisting and crushing damage in a fore-aft direction. The lower right wing skin was mostly intact. The inboard most fuel access panel in the aft row (panel 1) was separated but identified and the 9 remaining aft row panels were intact. The 10 panels in the forward row were intact. There was green paint transfer on panels 2 and 3 from the aft row. The right wing upper forward spar cap was separated between about WS 99 and WS 150 and deformed up and aft. The lower forward spar cap between was intact between about WS 95 and WS 266 and the inboard end exhibited upward deformation. The right wing rear spar was fractured near WS 133 and deformed forward inboard of about WS 174. The portion of right wing rear spar between about WS 99 and WS 133 was not identified. The right aileron was separated from the wing and only the inboard portion was recovered from about WS 175 to WS 225. The right aileron trim tab remained attached to the inboard aileron piece. The right aileron bell crank with about 32 inches of the outboard control rod attached was separated from the right wing. The right wing tip extension separated from the right outboard wing near WS 266. The forward spar upper and lower and rear spar upper attach fittings were intact with the bolts installed and the fittings were pulled from the wing tip extension. The bolt for the lower aft attach fitting was fractured and the fitting was pulled from the wing tip extension but not recovered.

The fuselage aft of about FS 332 was examined by the group. There was significant fire damage to the fuselage between about FS 332 and FS 438 (the forward cargo door frame) with some areas consumed by fire. The fuselage came to rest at the impact site on its right side and suffered lateral crushing damage. The cargo door separated during the accident sequence and was recovered away

from the main wreckage. There was an area of crushing damage, skin fracture, paint transfer, rubber transfer, metal smearing, scratching, and gouging about 2 feet wide running diagonally from about stringer 4 on the right side (S-4R) near FS 422 over the top of the fuselage and around the left side to about S-7L near FS 474 on the cargo door, Figure 10. The aft lower corner of the cargo door was deformed outboard with a diagonal crease running from about 22 inches above the lower edge on the aft side to about 15 inches forward of the aft edge on the lower side. The lower portion of the aft cargo door sill was also deformed outboard. The aft lower cargo door click-clack was deformed in an outboard direction with mechanical damage to the receptacle. There was an additional area of crushing damage, skin fracture, paint transfer, rubber transfer, metal smearing, scratching, and gouging about 2 feet wide running diagonally from about S-3L near FS 491 (the aft cargo door frame) over the top of the fuselage and around the right side to about S-8R near FS 535, Figure 11. The flanges for the dorsal fin on the top of the fuselage were flattened to the right between about FS 467 to FS 491. The attach fittings for the pitch trim actuator remained installed on the upper fuselage and the actuator rod ends were installed in the fittings. The rod ends were fractured from the trim actuator. The trim actuator was not recovered. There was a hole cut in the aft fuselage between about FS 548 and FS 564 and between about S-4L and S-12L during recovery to retrieve the cockpit voice recorder. There was a bulkhead installed at FS 530 providing the front wall for an avionics rack in the aft fuselage. The rack and bulkhead sustained lateral crushing damage. There was crushing damage evident on the right side of the bulkhead and rack coincident with the location of the area of external fuselage damage.

The horizontal stabilizers separated from the airplane during the accident sequence and were recovered away from the main wreckage. The attach fittings for the pitch trim actuator remained installed on the horizontal stabilizer forward spar and the rod ends were installed in the fittings. The rod ends were fractured from the trim actuator. The left horizontal stabilizer was mostly intact but the inboard 12 inches of forward spar was pulled from the structure and remained with the right horizontal stabilizer. There was leading edge crushing in an aft and down direction between about left horizontal stabilizer STA 3 and STA 36. The left horizontal stabilizer rear spar was pulled from the structure inboard of about STA 48. A portion of the inboard rear spar remained attached to the pivot fitting on the vertical stabilizer and a section of the rear spar between about STA 20 and STA 48 was separated. The left elevator was intact and installed on the horizontal stabilizer between the center and outboard hinges. The portion of the left elevator outboard of the outboard hinge including the counterweight was separated. The inboard portion of the left elevator between the control horn and the center hinge was separated and not recovered.

The right horizontal stabilizer was mostly intact but damaged. The forward spar was installed between about STA 12 on the left side to the right horizontal stabilizer tip. The leading edge was crushed aft and down between about STA 3 and STA 60. There was scratching, gouging, and metal smearing on the upper skin surface and the stabilizer structure was crushed downward between about STA 33 and STA 64. The right horizontal stabilizer forward spar was fractured near STA 60. There was a small area of red paint transfer on the upper leading edge near STA 22. The right horizontal stabilizer rear spar was pulled from the structure inboard of about STA 29. A portion of the inboard right rear spar remained attached to the pivot fitting on the vertical stabilizer. The right elevator was separated from the stabilizer. The inboard elevator between the control horn and the center hinge was recovered. The elevator from the center hinge to the outboard end including the counterweight was not recovered.

The empennage, vertical stabilizer, and rudder were recovered in several pieces away from the main wreckage. The lower 65 inches of vertical stabilizer forward spar remained attached to the fuselage canted bulkhead and the bulkhead was pulled from the fuselage along the rivet line. The horizontal stabilizer pivot fitting remained attached to the vertical stabilizer forward spar. About 29 inches of the right horizontal stabilizer rear spar and about 20 inches of the left horizontal stabilizer rear spar remained attached to the pivot fitting. The upper end of the vertical stabilizer forward spar was deformed aft near vertical stabilizer STA 180. The vertical stabilizer dorsal fin from the top of the fuselage to about STA 142 was crushed, deformed, and fractured aftward into the vertical stabilizer forward spar. The vertical stabilizer leading edge from STA 142 to STA 180 was crushed aft.

The fuselage/empennage structure was mostly intact from about FS 582 to the aft end at FS 660. The lower fuselage skin was fractured along the ventral fin and the fin was separated. Two segments of the ventral fin were recovered. The vertical stabilizer up to about STA 174 without the forward spar was attached to the empennage along with the rudder up to about STA 171. Most of the elevator control horn remained captured in the vertical stabilizer but the pivot point control arms were fractured and remained installed on the aft side of the horizontal stabilizer pivot fitting. The upper vertical stabilizer and rudder were separated into many pieces and recovered away from the main wreckage. There was a semicircular impact impression on the vertical stabilizer and rudder between about STA 174 and STA 187, Figure 12. The vertical stabilizer rear spar was deformed aft beginning near STA 174 and was fractured near STA 196. The center portion of the rudder between about STA 171 and STA 196 was separated and had a distinct impact impression on the leading edge. The upper portion of the rudder above about STA 196 was separated and the rudder counterweight was separated from the rudder. The upper portion of the vertical stabilizer above about STA 174 was separated. The vertical stabilizer tip cap was separated.

All the fracture surfaces examined had a dull, grainy appearance consistent with overstress separation. There was no evidence of pre-existing cracking noted at any of the separation points.