



Air Tractor, Inc.
Accident Investigation

AIRFRAME ACCIDENT REPORT

NTSB Accident Number:

CEN16LA292

Date & Location of Accident:

7/29/16
Sac City, IA

NTSB REQUESTED CONFIDENTIAL:

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PREPARED BY:

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Air Tractor, Inc.

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Air Tractor, Inc. Accident Investigation

FACTUAL INFORMATION

AIRCRAFT:

AT-402 manufactured in 1989
402-0720
N1016G

DATE & TIME:

7/29/16
~09:15 am local (CDT)

INJURIES:

Fatal

LOCATION:

Approx. 4.3 miles S of Sac City, IA
N 42.35971° W 94.98480° (Crash site)

PILOT:

Mark James Watson, 44
[REDACTED]
Burlington, IA 52601-9346

OPERATOR:

Watson Ag Aviation LLC
[REDACTED]
Burlington, IA 52601

NTSB INVESTIGATOR:

Josh Lindberg
Central Region
4760 Oakland St. Suite 500
Denver, CO 80239
[REDACTED]

FAA INVESTIGATOR:

Josh Rohrer
Des Moines FSDO
[REDACTED]

INSURANCE:

Michael Staszal
McLarens Aviation
[REDACTED]

SALVAGE:

Myers Aviation
Oshkosh, WI

OTHER CONTACTS:

OTHER CONTACTS:



Example of AT-402B in Flight (AT-402 similar)

The information contained in this report is the result of travelling to the accident site on 7/30/16 under the supervision of FAA FSDO Inspector Josh Rohrer. This examination was conducted before the wreckage removal by the salvage company.

This report is subject to revision as additional information becomes available. The intent of this report is to provide details relating to the investigation of the subject accident. This report is not to be shared with any person outside the scope of this official investigation.

GENERAL OBSERVATIONS OF WRECKAGE AND ACCIDENT SITE:

Arrival at the accident scene was at approximately 9:00 am on 7/30/16. The wreckage was located in a corn field on the west side of Sierra Avenue, south of Sac City, IA. The corn in the field was approximately 7 feet tall.

The aircraft was confirmed to be N1016G which is a 1989 Air Tractor model AT-402 serial number 402-0720. The hourmeter mounted in the instrument panel showed 7,008.3 hours.

According to the FAA Inspector on scene, the field being treated ("target field") was directly north of the accident site and located on the east side of the Sierra Avenue. There were multiple obstacles in the area between the target field and the accident site.

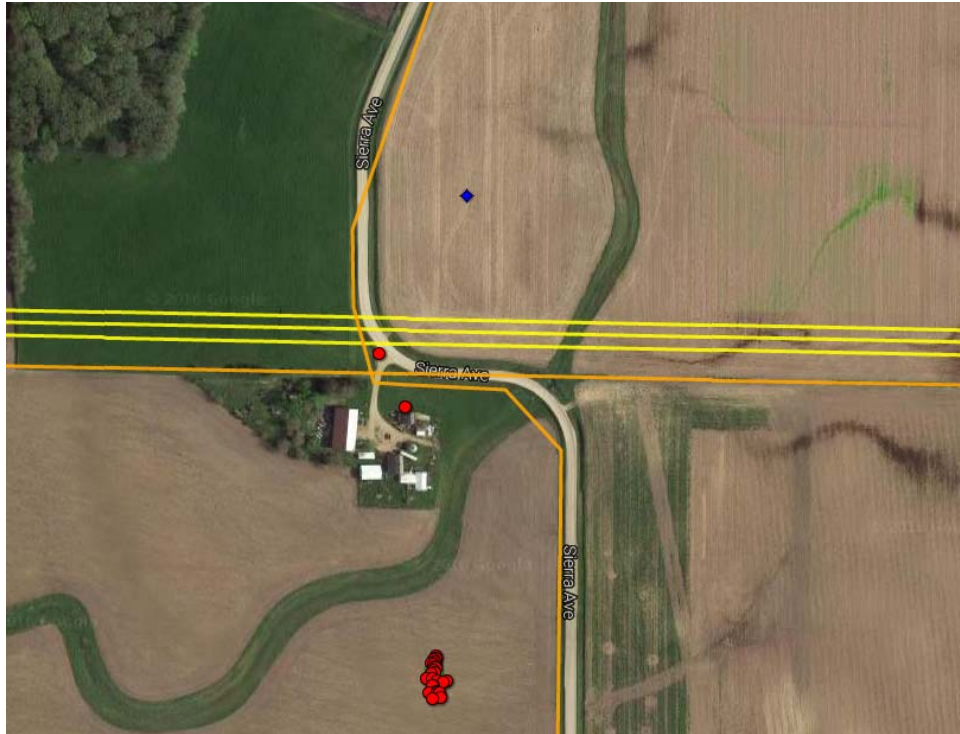
A large set of cross-country power transmission lines ran through the south edge of the target field. These lines were running east-west approximately 150 feet north of the southern boundary of the field. The lines consisted of common H pole configuration with 3 pairs of current carrying lines underneath two ground or "static" lines at the top of the poles.

A second set of power transmission lines, parallel to the first, ran directly along the south boundary of the target field. This set of lines consisted of single poles with cross arms carrying 4 wires.

There was also a set of local power distribution lines which ran along the western edge of the target field then crossed to the western side of Sierra Avenue, following Sierra Avenue as it curved toward the east and back toward the south.

At the southwest corner of the target field, there was a farm with several large barns and some

tall trees.



Aerial view of the accident site. The target field is marked with a blue diamond. Aircraft wreckage is marked with red circles. Power lines are marked in yellow and orange.



View near southwest corner of the target field showing multiple obstacles

The wreckage was located 750 feet south of Sierra Avenue. The wreckage debris trail was oriented from north to south. The wreckage had cut a swath through the corn upon impact and this area was generally devoid of foliage except for some areas of corn stalks that had been snapped off near the ground.

The impact angle into the field could not be determined because the path cut through the corn by the first responders proceeded through this area. The debris path was straight and began with components from the belly of the aircraft, including the landing gear, spray pump, engine air scoop, and towing brackets. There was a slight smell consistent with jet fuel around the site and the earth was damp from the initial impact area to the center of the primary wreckage. This damp earth smelled of a combination of fuel and agricultural chemical.

There was no signs of pre- or post-crash fire.

The primary aircraft wreckage was significantly distorted from its pre impact state. The center fuselage between the firewall and the cockpit was destroyed and scattered around the fuselage wreckage. The fuselage was bent so that the aft fuselage nearly touched the trailing edge of the left wing. The engine and engine mount remained connected to the wreckage but were severely damaged.

The center of the wreckage was approximately 75 feet from the initial impact area. The debris trail and position of the wreckage are consistent with a low-angle impact of moderate speed. The evidence suggests that the aircraft impacted in a wings-level upright attitude with a very high yaw angle. It is difficult to determine exactly what the impact yaw angle was, but the following facts were gathered:

- the maximum width of the swath cut through the corn was about 34 feet
- the wingspan of the AT-402 is 49 feet
- the aircraft length is about 30 feet from spinner to rudder trailing edge
- the spray booms, which were mounted to the bottom of the wings were found laying lengthwise along the debris trail
- the distortion of the fuselage, engine, and the damage to the underside of the wing all support a right-wing first direction of travel



Wreckage viewed from initial impact point



Closer view of wreckage

FUSELAGE:

All aspects of the fuselage were damaged by impact forces, with the most severe damage being concentrated in the center of the fuselage between the firewall and the cockpit area. This portion of the fuselage exhibited damage from the torqueing of the fuselage relative to the wing. The chemical hopper is a major component of this area of the aircraft. The hopper extends from the aft side of the firewall to the forward wall of the cockpit and instrument panel. The hopper was split with the hopper top, hopper lid, and various pieces of the hopper walls scattered to the southern end of the wreckage. The aft wall of the hopper remained with the fuselage wreckage with the instrument panel still attached.



Fuselage Wreckage



Detail of Center Fuselage Wreckage

Aft of the cockpit area, the fuselage was generally in one piece, but with significant deformation. This deformation consisted of torsional and bending deflection of the aft fuselage.

This aircraft was equipped with a four point pilot restraint system. The restraints were found in the aircraft buckled with both shoulder harness attachments engaged. The lap belt had been cut by first responders on the left side of the buckle.



Lap Belt & Shoulder Harness Buckle

The shoulder harness straps had separated from the attachment points at the lap belt. There was also some fraying of the shoulder harnesses, but no failure, at an area near the top of the seatback. The condition of the shoulder harness webbing material appeared to be damaged

from UV exposure.



Ends of Shoulder Harness Straps

The cockpit area of this aircraft was found with the forward wall and windshield no longer in place. The forward wall of the cockpit is part of the hopper structure and was laying adjacent to the fuselage as described earlier in the Fuselage section of this report. Attached to this section of the hopper is the instrument panel. Despite the separation of the shoulder harnesses that was mentioned earlier, a review of the instrument panel showed no indications of a head impact. There was no significant panel damage and there was no hair or flesh found on the panel.



Cockpit Wreckage

EVIDENCE OF WIRE STRIKE:

This aircraft was equipped with a single piece windshield which consists of a single curved piece of clear acrylic. There is an aluminum bar in front of the windshield and a deflector cable connecting the top of the canopy to the top of the vertical fin. These two items are provided to add some protection against wire strikes.



Typical AT-402 showing aluminum bar and deflector cable

The aluminum bar was found in the debris field, along with the rudder, and was severely damaged. The bar was no longer attached to its lower base. At the upper end, the tubular support structure had separated from the cockpit overturn structure and remained attached to the bar. A piece of the deflector cable, approximately 6 feet long, remained attached to the top of the bar.



Aluminum bar as found (overturn structure and cable attached)

The bar had a deep chamfer on the righthand edge that ran the entire length of the part. The

cable that was attached to the bar exhibited abrasion and damage. This is consistent with a wire impact that was deflected by the bar, over the canopy, and onto the cable. An aftermarket GPS antenna was also missing from the top of the canopy. The markings on the canopy indicated that the antenna was dislodged by a rearward scraping action, possibly from a wire strike.



Detail of the bar showing chamfered edge

The markings on the bar indicate that the wire strike was asymmetric. This may have been due to any of several factors such as hitting the wires at an acute angle, hitting the wires with a significant amount of yaw angle (sideslip), or hitting the wire near an anchor point (e.g. utility pole). An asymmetric wire impact is typically the most damaging type of impact because the unbroken wire creates a sawing action as it slides across the airframe. This results in high lateral forces, an increase in airframe damage, and a lessened tendency to break the wire.



Detail of canopy damage, wire contact damage (red circle), and missing antenna (red arrow)

The aluminum bar was bent into a rough V-shape with an inside angle of about 45 degrees. This bend was toward the lefthand side of the aircraft. This is consistent with an asymmetric wire strike that was not deflected over the canopy.

The upper righthand corner of the cockpit overturn structure exhibited an impact mark consistent with a wire strike. This impact mark showed significant signs of the sawing motion mentioned earlier.

Another strong sign of wire strike was the damage to the vertical fin and rudder. The top 15 inches of the vertical fin was separated from the aircraft. This separation was a clean, slicing cut. The top portion of the vertical fin was found near one of the barns near the power lines. A portion of the deflector cable remained attached to the top of this piece of vertical fin.



Damage to the vertical fin

The rudder received a gouge approximately 4 inches deep into the hingeline. The location of this damage is consistent with the separation line of the vertical fin. The rudder separated from the vertical fin at the hingeline and was found beneath the power lines. The aft end of both rudder control cables were attached to the rudder control horn and both sides of the horn were deformed 90 degrees down. This is indicative that the rudder separated from the vertical fin before breaking the rudder cables. Due to the force required to break these cables (~2,400 lbs minimum per side), it is expected that both rudder pedals were pulled aft with significant force and speed before the cables separated.

A review of the preceding information leads to the conclusion that there were multiple wire strikes in this accident chain. At least one wire was deflected over the canopy and at least one wire collapsed the aluminum bar and contacted the front of the cockpit overturn structure. The evidence also supports that the contact with the wires was asymmetric in nature.



Damage to the rudder



Deformation of the rudder control horn

LANDING GEAR:

Both main landing gear had been separated from the fuselage. In both cases, the main wheel/tire/brake combination also separated from the steel landing gear springs. The left wheel and gear spring were found near the initial impact point in the debris trail. The righthand gear spring was found near the left wingtip of the wreckage with the righthand wheel located on the south side of the fuselage wreckage.

There were some abrasions and paint removal on the landing gear springs that had some

characteristics of a wire strike, although other causes of these marks could not be ruled out.

The tailwheel assembly had separated from the tail spring. This separation occurred as a tensile overload fracture of the two mounting bolts. The tailwheel assembly remained attached to the aircraft by the 3/32" tailwheel unlock cable and came to rest on top of the righthand horizontal stabilizer brace. No marks were apparent on the tail spring or tailwheel assembly

WINGS:

The right and left wings remained connected together at the center splice joint. There were no notable impact marks on the leading edge or upper surface of the wings. The inboard leading edges of both wings were deformed aft and upward slightly. All wing skins had some general damage.

The bottom of the wings displayed heavy crush damage to the skins. All of the aluminum flap and elevator hinges, along with the hangers for the spray booms, were bent toward the lefthand wingtip. The outboard half of the righthand flap had been bent under the inboard half.

All of this evidence strongly supported the conclusion that the aircraft slid along the ground laterally in a right wing forward direction.

Both of the ailerons and flaps remained installed on the wings in their normal locations.

Both wing fuel tanks were ruptured at the inboard end. The fuel caps were in place and tightly installed.



Right Wing



Underside of Right Wing



Left Wing

EMPENNAGE:

The condition of the vertical fin and rudder were described earlier in the "Evidence of Wire Strike" section.

The horizontal stabilizers and elevators were found with little damage and remained intact on the aft fuselage.

FLIGHT CONTROLS:

Flight control continuity was established to the extent possible by the condition of the wreckage. Establishing flight control continuity was performed under the supervision of Inspector Josh Rohrer of the Des Moines FSDO

Elevator Controls

The elevator controls are manually operated by steel and aluminum pushrods connecting the control stick to the elevator control horns through two control idlers. The elevator controls were found to be damaged, but continuous, from the control stick to the elevators. The elevators were found properly attached to the horizontal stabilizers at all hinge points.

Rudder Controls

The rudder controls are manually operated by a pair of stainless steel cables running directly from the rudder pedal assemblies to the rudder control horns. The rudder controls were found as follows.

Both rudder pedals remained attached to their pivot points with the rudder cables and adjustment brackets remaining in place. The rudder cables were traced back into the aft fuselage and found to be properly routed to the point that both cables were found to be frayed. This frayed "horse tail" end of the cables is an indicator of tensile overload.

The rudder was located separately at the accident site. The horn plate remained installed on the bottom of the rudder. Instead of in its normally flat layout, the horn was bent into a U-shape. The aft end of the rudder cables were attached properly to the horns. Only about 15 inches of each cable remained attached to the rudder. The ends were frayed, matching the horse-tail pattern of the forward portion of the cable.



Rudder horn with separated cables

Aileron Controls

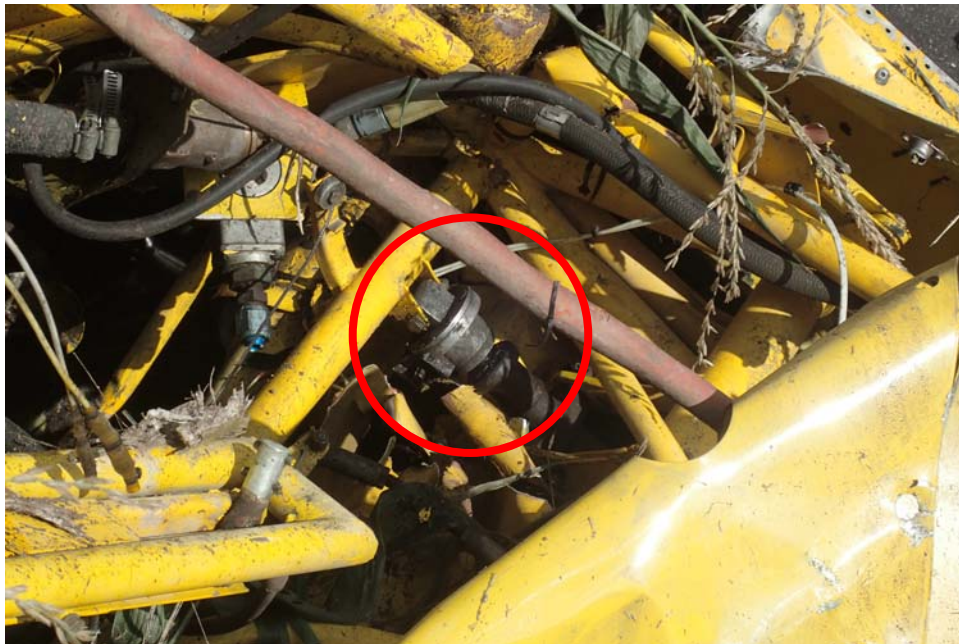
The aileron controls are manually operated by steel and aluminum pushrods connecting the control stick to the aileron control horns through a torquetube and multiple bellcranks and idlers. In addition, the AT-402 ailerons incorporate a drooping feature that partially lowers both ailerons in conjunction with deployment of the flaps. The aileron drooping controls are documented below under "Flap System". The primary aileron controls were found as follows.

The control stick is attached directly to a floor-mounted torquetube through an aluminum socket. This connection was found intact. From this cockpit torquetube, the lefthand aileron controls were continuous through the upper pushrod and fuselage bellcrank. From this fuselage bellcrank, a long aluminum pushrod runs through the trailing edge of the wing. The inboard end of this pushrod was separated from the rodend bearing due to bending loads. The rodend bearing remained installed on the bellcrank with all hardware properly installed. From this separation, the controls were continuous to the lefthand aileron control horn.

From the cockpit torquetube, the righthand aileron controls were continuous through the upper pushrod and fuselage bellcrank. From this fuselage bellcrank, the controls were continuous to the righthand aileron, except that the inboard end of the long aluminum pushrod had separated due to bending/tensile overload where the wing had been pulled loose from the fuselage.

Flap System

The flap actuator was found in the retracted position, indicating that the flaps were retracted at the time of the impact. The electric flap motor was broken free of the gearbox assembly.



Retracted Flap Actuator

The flap torquetube which interconnects the left and right flaps was intact and properly installed. Control continuity to the right flap was found to be intact, except there was damage to the flap arm connection to the torque tube. One of the two attaching bolts had torn loose from the torque tube. The bolt remained installed in the flap arm. This damage was from an

outward pull on the flap arm and is consistent with the deformation of the surrounding fuselage/wing components

Control continuity to the left flap was found to be intact, with significant damage throughout the system.

The lefthand and righthand aileron drooping systems were found to be continuous except for a break in one of the four pushrods. All hardware and connections were found installed. The pushrod break was consistent with tensile/bending overload.

Trim Systems

This aircraft was equipped with a trim system for the elevator controls only. The trim system was heavily damaged during the impact and fuselage deformation so that trim control positions at the time of impact could not be reliably ascertained. The trim system was found to be continuous at all points.

POWERPLANT:

The engine was substantially damaged during the impact, although it remained attached to the engine mounts and the engine plenum bulkheads. There was some crush damage to the engine exhaust case. The engine had separated at the "C" flange, revealing the interstage baffle and the power turbine wheel. The power turbine had damage to all blades and the interior of the engine showed significant rotational signatures.



Detail of Engine Interior (looking aft through the separation at the "C" flange)

The propeller hub and spinner remained attached to the engine flange. Only one blade remained attached to the hub. The two other blades were not found at the scene. FAA Inspector Rohrer stated that the two blades had been present in the debris field on his previous visit to the scene on the day of the accident. Local law enforcement was called to

begin an investigation into the missing blades.



Engine Wreckage as Found

DISTURBANCE OF WRECKAGE:

No portion of the wreckage was removed by me during my involvement in this accident investigation. My disturbance of the wreckage was limited to handling components to the extent necessary for identification and documenting their condition, including removing inspection covers/access panels if necessary and cutting the wing skins to view interior components. I did not make any modification to the aircraft wreckage that would result in loss of evidence.

FAA Inspector Josh Rohrer took possession of the CPU component of the Satloc Bantam system GPS system. This unit was removed from the wreckage by separating its mounting plate from the installed vibration isolators. The unit appeared to be undamaged.



Detail of GPS Unit after removal from wreckage