

NTSB Accident Number: CEN20CA193

Aircraft: N5179D

AIRFRAME EXAMINATION REPORT

Date: 06/05/2020

The week of June 1-5, 2020 a Post-Accident Airframe Examination was carried out under the supervision of SMAT Safety Manager Lyle Reffey by:

- Duane Linsley A&P [REDACTED] IA
- Robert Hovenden A&P [REDACTED] IA

Initial observations of damage caused by the accident without disassembly (Further examination required):

- Right MLG wheel outer bead has some gravel rash / wear from contacting the pavement during ground loop. No further external damage observed to MLG or fuselage. Tire remained inflated.
- Right aileron has a damaged upper and lower trailing edge skins plus a bent forward aileron spar on the outer 15”.
- Right wing has a buckled upper and lower outboard skin between wing station 190.0 and 208.0
- (Unknown if wing spar was affected, but no external indications of distortion)
- Right metal wing tip fairing has minor buckle on the lower surface in vicinity of the aileron.
- Right elevator upper and lower skin has slight buckle in the vicinity of outboard hinge.
- Suspected buckle to right elevator forward spar at the outer hinge point.
- Elevator horn contacted the ground and has minor wear, this pushed it in causing interference with the horizontal stabilator.
- Tail wheel tire has significant (approx. 50%) wear from 18 hours of flight. Most is suspected to be major abrasion from tail wheel shimmy as evident from markings left on the pavement during the accident.
- (Observation / not verifiable) Tail spring has lost its original profile since installation. Bowing of rear 10” of the spring before tail wheel head has increased, this in turn changed the castor angle of the tail wheel. No original measurements were taken of the serviceable spring

prior to installation, but previously it was closer to a neutral castor angle at gross weight and positive castor angle when the aircraft was empty. No heavy landings have been reported in the 18 hours of initial operation, and it is unknown if the harsh tail wheel shimmy and ground loop caused the spring angle to change, or if the spring has just lost its tension.

Examination items as requested by Mr. Michael Hodges, Air Safety Investigator – NTSB:

1) Inspection carried out of the flight control systems for general condition, cable runs, routing, tensions and travels. No defects found other than accident related items listed above. Refer to TCDS 3A13 for travel limits and Cessna 100 Series Service Manual D138R1-13 for instructions.

- Rudder: 24° right, 25° left
- Elevator: 25.3° up, 21.5° down
- Flaps: 38.5° down
- Ailerons: Right 19° up, 16° down. Left 20° up, 15.0° down

A) Rudder pedals and associated linkages inspected for condition and operation, no issues found. Function check carried out including attempting to side load copilots left pedal to jam the rudder, operationally tested normal with feet situated on the pedals and inside the pedal side tab. Pedal is installed correctly and unobstructed in all conditions. Note that the co-pilots left pedal does come in close proximity to the center console side carpet, as standard from factory. Refer images below.



SMAT 1958 C182A N5179D Copilots pedals/1959 C182B example shows contact between carpet and pedal

- 2) Brake operational check carried out and system inspected, found serviceable. Brake linings and discs are in excellent condition. Brake fluid is at the appropriate level.
 - 3) Main landing gear operation is as per normal and no damage observed. Wheel alignment check carried out and found to be within limits. Refer to Cessna Service Manual D138R1-13 Figure 5-9.
 - Tail wheel operational taxiing test carried out and found serviceable.
 - Tail wheel friction was tested using a spring scale and found to be 7lbs. Cessna calls for 5-6lbs tail wheel friction but this was set slightly higher during maintenance to help prevent shimmy caused by too low of a tension.
 - Aircraft taxis straight with minimal control input, tail wheel responds directly to rudder pedal control input. Aircraft steers to the left and right as per normal. Tail wheel castors / breaks as per normal with full rudder input and then realigns easily.
- A) As no faults have been found with the aircraft, the cause of the tail wheel shimmy can only be noted as opinions / possible causes for such condition.
- King pin / tail wheel negative castor angle can contribute to a greater tendency to shimmy. As mentioned previously the tail spring shows signs of increased bowing leading to a negative 9° king pin / castor angle under current conditions with no pilots, 40gal fuel and 100lbs ballast in the baggage area.
Ideally this should be 0° or slightly positive under gross weight.
 - Tail wheel shimmy is not an uncommon occurrence especially when landing on pavement and the tail wheel is not perfectly aligned on touchdown.

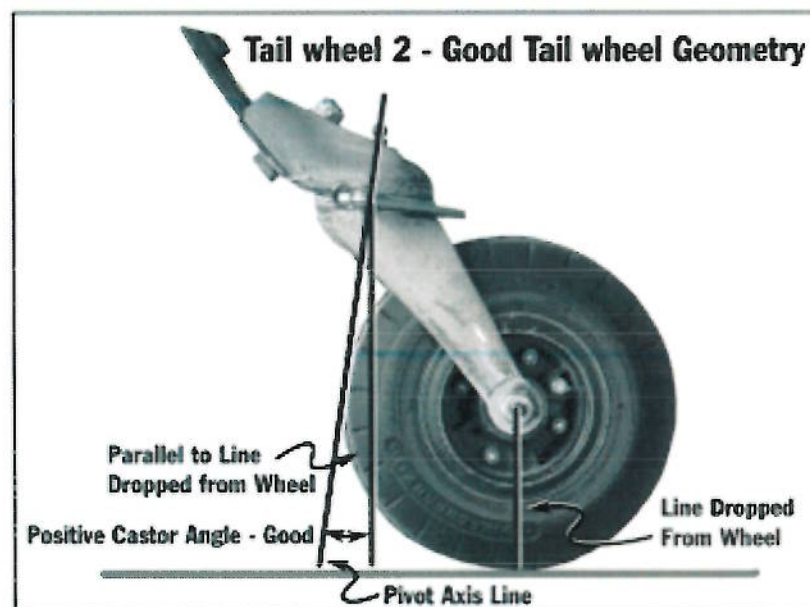
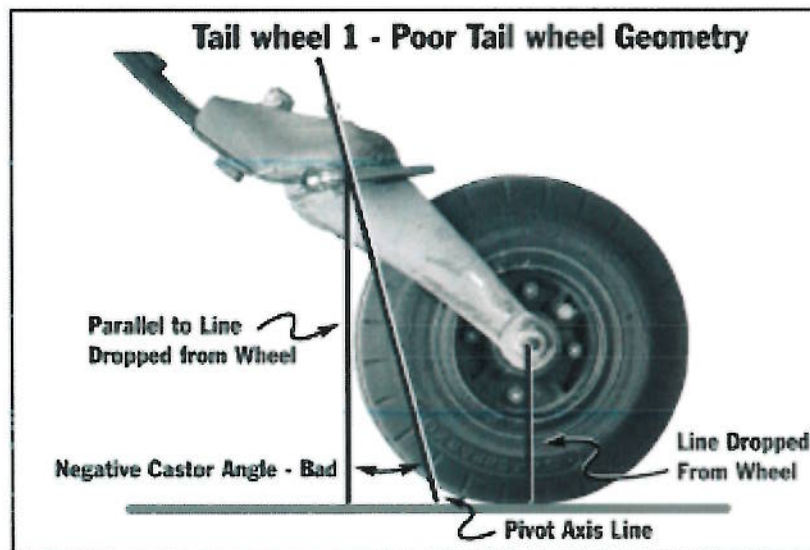
Guidance information as removed from “Alaskan Bushwheels 3200 Series Tailwheel Shimmy Checklist, Revision A, 3/18/2016”

Common causes of shimmy (Not listed in any order)

1. Uneven tire wear
 - Tire was in relatively new condition with only 18 hours of operation and minimal landings.
2. Incorrect tire pressure
 - Tire was inflated to 55 psi

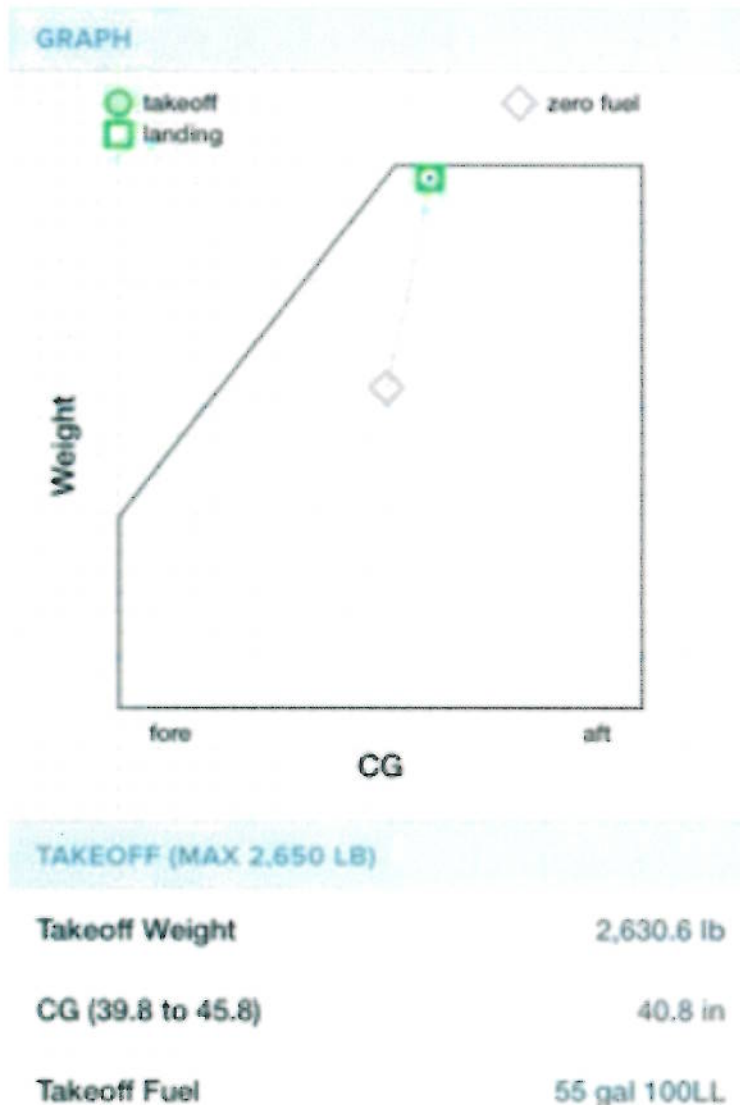
3. Chain tension too slack or too tight (should have as little slack as possible while still ensuring no tension on the spring in the neutral position)
 - Chains are not part of this installation. Direct cable connection.
4. Incorrectly sized tension springs or incorrect configuration for aircraft
 - Tension springs are correct as per Cessna IPC and in good condition.
5. Head bolt castle nut over-torqued (internal binding) or under-torqued (internal slop)
 - Head bolt tension set correctly
6. Tail spring of incorrect size, type, or number of leaves
 - Tail spring is correct as per Cessna IPC for Cessna 180. Tubular type with Scott 3400 Tail wheel.
7. Incorrect size tail spring mounting bolt (should be an AN7)
 - Not applicable for tubular spring
8. Tail spring to fuselage mounting bolt is loose (should have no play)
 - Not applicable for tubular spring
9. Excess wear on brass bushing within the fork
10. Steering arm bent or at improper angle
 - Tail wheel assembly was in serviceable condition and had been fully disassembled, cleaned and inspected 18 hours previously. All internal components either replaced or in good serviceable condition.
11. Connector spring connected straight to rudder horn and not eye-bolts (if eyebolts are applicable on your aircraft)
 - Not applicable as there is no connector spring
12. Worn internal compression springs in the tail wheel head
 - Internal compression springs new
13. Internal flat spring worn or improperly shimmed
 - Internal flat spring shimmed correctly and in serviceable condition.
14. Tail wheel head to tail spring bolt loose (especially for single hole 3200's)
 - Not applicable on 3400 models with tubular spring and two attach bolts.
15. Rudder and tail wheel not in alignment with one another
 - Rudder is aligned with the tail wheel with direct connection by control cable.
16. Wheel damaged, out of round, or imbalanced
 - Pre-accident the wheel was in serviceable condition with only minor abrasion wear. Tire inflation is checked regularly.
17. Excessive ground speed at touchdown or during 3-point roll
 - Pilots reported stall horn on during 3-point touchdown (about 55 mph)

18. Lack of internal lubrication (grease zerks located on head and axle bolt for lubrication)
- Tail wheel was recently assembled and greased correctly.
19. Tail wheel is incomplete or has been reassembled incorrectly
- Tail wheel is assembled correctly
20. Too much negative castor angle (not enough tail spring arch)
- Refer previous notes. Negative castor angle found to be -9° at 2125lbs aircraft weight (No pilots, 40gal fuel and 100lbs ballast in baggage area)



21. Overloaded or far aft CG (excessive weight on tail wheel flattens tail spring)

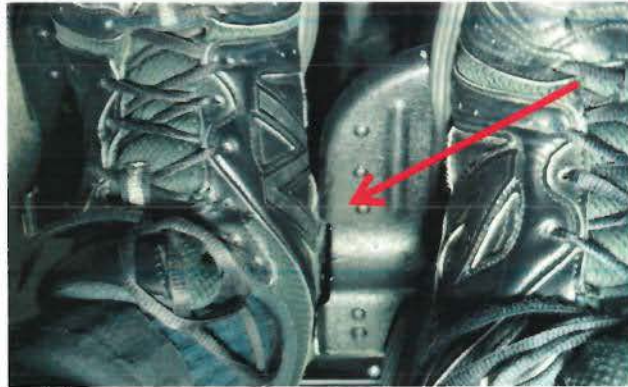
- On landing the aircraft was 110# below Max Gross Wt and had a CG of 40.3", which was within the CG limits. (Photo from pilot's ForeFlight app)



22. Grease packed into pocket between wheel halves unevenly causing imbalance

- Wheel is not imbalanced, and it's unknown if grease is inside halves without disassembly.

- 4) No pre-accident mechanical malfunctions or failures exist with the airframe.
- 5) No uncorrected mechanical discrepancies exist with the airframe maintenance records.
- 6) Additional Observations
 - A) The pilot shared that after the accident he discovered an inside seam in his left shoe had been torn. It is unknown when this actually occurred. They are leather shoes with double-stitched seams. The pilot sat in the right seat (seat occupied during accident) and tests were conducted to determine if the left shoe could have moved between the rudder pedals and been caught. After several attempts, the torn seam in the shoe was caught by the right rudder pedal. It was determined that during the violent tailwheel shimmy, the shoe could have moved to a point where the right rudder pedal caught on that seam, preventing movement of both rudder pedals, and keeping the left rudder pedal depressed.



I hereby certify that the above information is complete and accurate to the best of my knowledge.

[Redacted Signature]

Lyle Reffey – SMAT Safety Manager

[Redacted Signature]

Duane Linsley – A&P [Redacted Signature] IA

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Robert Hovenden – A&P [Redacted Signature] IA