



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

LANDING GEAR SYSTEM EXAMINATION

WPR18LA153

Accident Date: May 20, 2018
Exam Date: July 24, 2018

This document contains 10 embedded images

A. ACCIDENT

Location: KSJC
Date: May 20, 2018
Aircraft: Piper PA-24 N244TW, Serial # 24-554
NTSB IIC: Michael Huhn

B. EXAMINATION PARTICIPANTS:

Michael Huhn
Air Safety Investigator
NTSB
Western Pacific Region

C. ACCIDENT SUMMARY

On May 20, 2018, about 1950 Pacific Daylight Time, a Piper PA24-250, N244TW, sustained substantial damage shortly after landing at Norman Y. Mineta San Jose International Airport (SJC) San Jose, California. According to the pilot, he had placed the landing gear switch in the DOWN position while on downwind, and the green instrument panel light that indicated the landing gear was down was illuminated. He landed normally, and when the airplane had slowed to about 30 mph, all 3 landing gear collapsed.

Landing gear operational checks were conducted at KSJC on June 28, 2018. Those results are documented separately.

This document covers the system examination results after the airplane was disassembled and transported to Plain Parts in Pleasant Grove CA.

D. EXAMINATION DETAILS

1.0 Background Information

- The stabilators and wings had been removed from the fuselage to enable transport to the recovery/storage facility
- The MLG push-pull cables were disconnected from their MLG bellcranks in the MLG wells, and coiled/stowed in the fuselage
- The landing gear motor/transmission assembly was disconnected from its fuselage mount
- The NLG was stowed/retracted in the NLG well
- The 2 MLG were stowed/retracted in their respective MLG wells (secured by strapping ribbon)
 - o Per Piper design, the MLG protrude about 2-3 inches below the lower wing mold line when fully retracted

- For the examination, the 3 LG were released and allowed to move to their respective extended positions
 - Each MLG extended freely since it was no longer connected to the drive mechanism
 - The NLG extended freely once the emergency gear release mechanism was used to decouple its linkage from the motor drive

2.0 Examination Information

- All 3 landing gear assemblies were observed to contain their respective downlock springs
 - Each MLG had a single spring
 - The NLG was equipped with 2 downlock springs
- When extended, the MLG and NLG springs were observed to be under some tension (not relaxed), indicating that they were functional
 - The spring tensions were not measured
 - The NLG spring extension was measured; the spacing between adjacent spring coils was measured to be about 4/64 inches
 - The manufacturer's nominal NLG spring extension value was not determined, and it is not known whether the manufacturer specifies that value or any other measure of spring condition
- All 3 LG were observed to fully extend so that their respective stops in their overcenter links were all in contact/abutted, which is the proper design condition
 - For the MLG, this condition was the same as observed in the 6/28/18 KSJC tests
 - The NLG stop position/condition was different from the KSJC tests- in those previous tests, neither the L nor the R NLG stops were properly abutted, indicating that the NLG was not fully extended and locked
 - The net effect of this new NLG overcenter stop condition would be to increase the force required to unlock the NLG, because the NLG was now fully and properly extended and locked
 - The NLG unlock force increase was not able to be determined because the forces in the KSJC and this configuration were not able to be measured
- Both MLG assemblies were able to be manually swung up and down with minimal resistance, consistent with proper bungee strength and operation
- The motor and transmission assembly was removed from the airplane and examined
 - All components were intact and exhibited no external damage
 - All transmission gears were well lubricated, rotated readily, and meshed well
 - No metal shavings or fragments were observed in the gear lubricants or housings
 - No transmission gears exhibited any signs of damage or wear
- The rod, lever, and bellcrank assemblies just downstream of the motor/transmission assembly were all undamaged, and did not exhibit any visible wear
 - All were properly attached and secure
 - No excessive play was observed in any of the connections, system links, bearings, or attachments
 - All appeared appropriately lubricated



Figure 1 - Dual NLG Downlock Springs



Figure 2 - NLG Downlock Spring (NLG fully extended)



Figure 3 - Gear Motor and Transmission



Figure 4 - Placard on Emergency Gear Handle

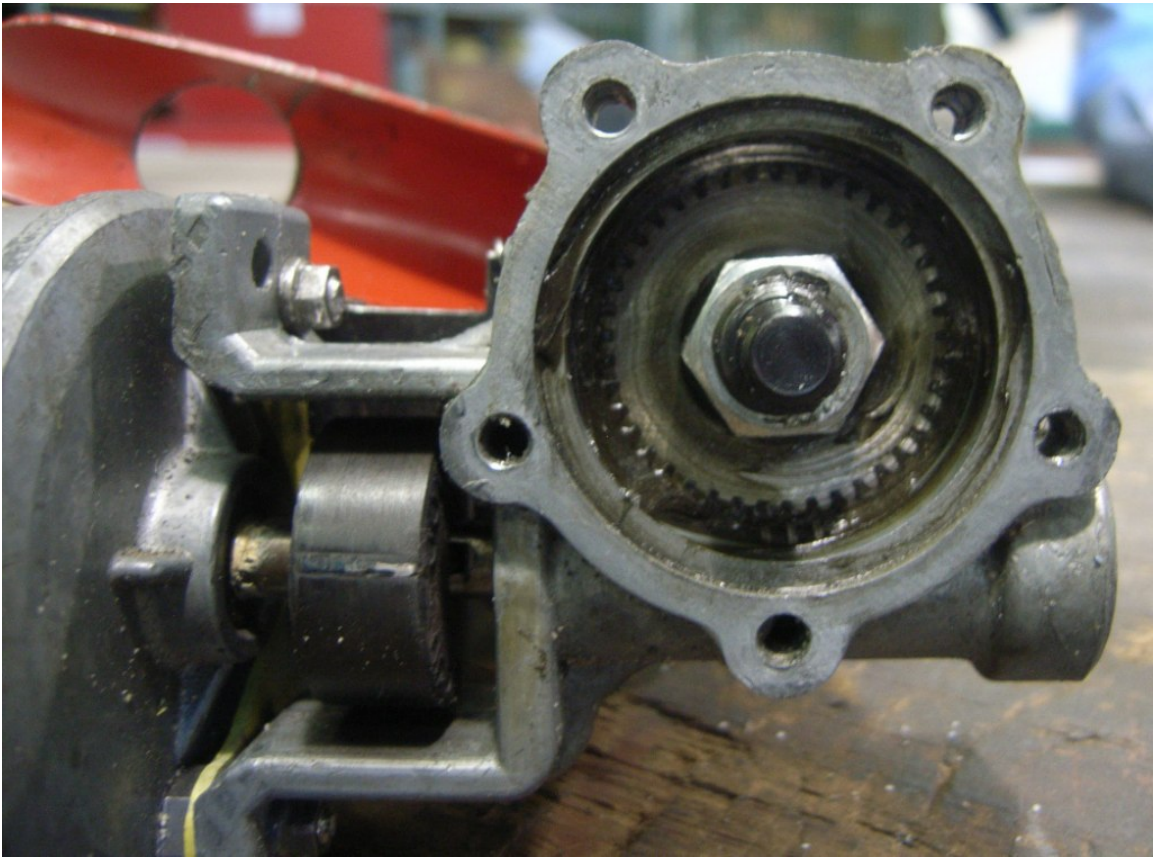


Figure 5 - Transmission Internal Gears



Figure 6 - Main Drive Gear

3.0 Findings

- The fact that the MLG overcenter stops were properly abutted but the NLG stops were not after the LG was cycled down (both electrically and manually) indicated that the LG system was not in a properly rigged condition ('misrig' or 'out-of-rig')
- Review of the system design indicated that such an out-of-rig condition is a result of changes to the system geometry
- System geometry changes can be the result of:
 - o Damaged components or relevant structure
 - o Worn components
 - o New or reinstalled components (proper or improper)
 - o Adjustments
- Because no damaged, worn, improper, or improperly installed components, or relevant structural damage was observed, the reason(s) for, and timing of, the out-of-rig condition could not be determined
- These examination results precluded an explanation of the differences between the system behavior recounted by the pilot and the post accident operation in the hangar at KSJC

4.0 Maintenance Information

- Review of airframe (then registered as N5493P) maintenance records back to November 1, 1994 (TT 1,906 hrs) did not include any landing gear rigging entries
- The records indicated that in December 1998 (TT 1,945 hrs) the airplane was repaired for an apparent gear-up landing, during which the wings had been removed and reinstalled
 - o Such maintenance would likely necessitate a LG rigging effort or check, but the records did not indicate that any was accomplished
- In February 2002 (TT 2,219 hrs) the "landing gear up limit switch" was adjusted
- The airplane was repainted to its current scheme in October 2013 (TT 2,368 hrs)
- The landing gear motor was replaced in August 2014 (TT 2,461 hrs)
- The main landing gear bungees were replaced in April 2017 (TT 2,821 hrs)
- A placard on the emergency gear lever stated that the landing gear motor was replaced on April 27, 2017, but there was no corresponding entry in the maintenance records
- The most recent annual inspection was completed on May 18, 2018 (TT 2,918 hrs)
- All annual inspection entries referenced compliance with AD 77-13-21 (landing gear bungee inspection (100 hrs) and replacement (500 hrs/5 years))

Aircraft Record General Information

Manufacturer PIPER Model PA-24-250
 Serial 24-554 Registration Number N5493P
 Date of Manufacture 11-20-58

Engine(s) currently installed:

Manufacturer LYCOMING Model O-540-A1A5 Serial L-522-40
 Manufacturer _____ Model _____ Serial _____

Propeller(s) currently installed:

Manufacturer HARTZEL Model HC 82 VK-1P1
 HUB Model 8433-7 Serial _____ Serial _____
 Blade Model _____ Serial A-4988 Serial A-5552 Serial _____
 Blade Model _____ Serial _____ Serial _____ Serial _____

BOOK # 2 COMMENCING 11-1-94

© ASA 1993

Figure 7 - Airframe Log Inside Cover

DATE 19__	RECORDING TACH TIME	TODAY'S FLIGHT	TOTAL TIME IN SERVICE	Description of Inspections, Tests, Repairs and Alterations Entries must be endorsed with Name, Rating and Certificate Number of Technician or Repair Facility. (See back pages for other specific entries.)
				<i>AIRFRAME LOG ENTRY PERFORMANCE AIR AIRFRAME LOG ENTRY</i> 12/2/98 Tach 1945.45, Removed wing's to facillitate repair of lower fuselage skin's P/N's 20615-04, 20615-03, 20600-19, 20600-13, 20600-17, 20898-00, 487-588, 494-060, 20893-00. Replaced all damaged belly antenaes with new, touched up paint to match original, reinstalled wings and replaced all worn hardware and locking devices. All work done IAW PA-24 service manual and AC43.13. Installed InterAv alternator per STC SA334SW, Installed Electronic's international's SR-8A engine scanner and Fuel pressure/flow instrument per STC's SA4302NM and SA00068SE. Installed Lopresti Stabilator modification kit per STC SA00618AT, Installed LoPresti "Speed Spats" main gear fairing per STC SA3105SO. Installed Toe brake kit and Single gear leg gear struts. See 337's this date to reflect above installations. Landing gear transmission overahualed by Webco Aircraft See yellow tag, replaced gear bungees and CW AD note 77-13-21. Resealed and serviced all landing gear struts. Performed gear swings and emergency extensions o.k. Removed motor mount for repair by Kosola and associates CRS #HER229M, reinstalled using all new hardware. Replaced forward spar cover fabric, Continued Over →

© ASA 1993

Figure 8 - Wing Removal Entry

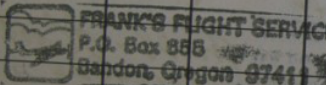
DATE	RECORDING TACH TIME	TODAY'S FLIGHT	TOTAL TIME IN SERVICE	Description of Inspections, Tests, Repairs and Alterations Entries must be endorsed with Name, Rating and Certificate Number of Technician or Repair Facility. (See back pages for other specific entries.)
2002	ANNAI			
2/8/02	2219.4		2219.4	(cont) By feel, All checked Airworthy. Installed new P/N 10600 BAARke living ON RH MAIN gear. Cycled Ldg gear + manual Dropped. Adj Ldg Gear up Limit switch per sm. Cleaned and serviced Ldg gear. Lubed A/C Lubricated throttle cable + primer. Patched CRACK in Lower RH. Cowling nose hood
				I certify that this <u>AIRCRAFT</u> has been inspected in accordance with <u>ANNAI</u> Inspection and was determined to be in airworthy condition. <u>IA</u>

Figure 9 - Gear Up Limit Switch Entry

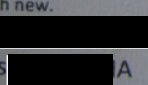
N5493P October 29, 2013 Tach 32.6 AFTT 2367.9 Removed all aircraft windows and installed with new. One piece windscreen P/N W/G-2051-250. Installed in accordance with STC # SA208GL installation instructions; FAA form 337 completed this date. Removed interior, headliner, side panels, seats, carpet, had reupholstered with new materials, and reinstalled; materials meet FAR 23.853 and FAR 23 Appendix (F). see material certificate. Installed Aircraft Spruce and Specialty Co. glare shield, P/N 05-03931 in accordance with STC # ST01327LA; FAA form 337 completed this date. Installed Bob Fields Aerocessories manual inflatable door seal kit in accordance with STC# SA4179WE; FAA form 337 completed this date. Installed Mountain View Aviation door steward kit in accordance with STC SA01120SE; FAA form 337 completed this date. Removed King KA 134 audio Panel and installed new PS Engineering PMA6000 Audio panel; installed in accordance with AC 43.13 1B and 43.13 2B, unit FAA-TSO C50c, C35d; no weight and balance change necessary, equipment list updated and POH supplement. Aircraft prepped for paint, repainted with Nasson PBE Viper blue and Nasson TOY404 white. Checked flight controls for balance in accordance with Piper Maintenance Manual chapter 4, reinstalled flight controls with new hardware. Replaced fuel tank quantity placards with new. Patrick Williams  A	ORION AVIATION Maintenance
--	--

Figure 10 - Airplane Paint Entry

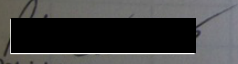
DATE 19__	RECORDING TACH TIME	TODAY'S FLIGHT	TOTAL TIME IN SERVICE	Description of Inspections, Tests, Repairs and Alterations Entries must be endorsed with Name, Rating and Certificate Number of Technician or Repair Facility. (See back pages for other specific entries.)
N244TW April 6, 2017 Tach: 491.3 AFTT: 2821.5				
Annual Inspection completed in accordance with FAR 43 Appendix (D) and the Piper maintenance manual. Replaced ELT battery with new BP-1010, Inspected and tested ELT IAW FAR 91.207(D) and found it to operate correctly battery replacement due May 2019. Complied with AD 68-05-01 muffler inspection, no defects noted, Next due TT 2871.5. Complied with AD 68-13-03 fuel cell and drain inspection, no defects noted, Next due TT 2921.5. Complied with AD 75-12-06 forward spar inspection, no defects noted, Next due TT 2921.5. Complied with AD 77-13-21 main gear bungee replacement, inspection due TT: 2921.5. Complied with AD 94-13-10 Stab. torque tube fitting inspection, no defects noted, Next due TT 2921.5. Replaced induction air filter with new P/N BA-3205, serviced brakes and battery, jacked aircraft and completed retraction and extension check, normal and emergency, checked good. Lubricated flight control hinges and rod ends. AD'S checked thru BW2017-06. See attached log for details. I certify this aircraft has been inspected in accordance with an Annual inspection and was determined to be in an airworthy condition.				
 Patrick Williams AP [redacted] IA				SA 1993

Figure 11 - Penultimate Annual Entry

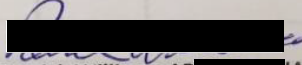
DATE 19__	TOTAL TIME IN SERVICE	Reference of Major Repairs and Major Alterations To FAA Form ACA-337 by Date, or to the Work Order by Number and the Approving Agency
N244TW May 18, 2018 Tach: 588 AFTT: 2918.2		
Annual Inspection completed in accordance with FAR 43 Appendix (D) and the Piper maintenance manual. Inspected and tested ELT IAW FAR 91.207(D) and found it to operate correctly battery replacement due May 2019. Complied with AD 68-05-01 muffler inspection no defects noted, next due TT 2968.2. Complied with AD 68-13-03 fuel cell and drain inspection, No defects noted, Next due TT 3018.2. Complied with AD 75-12-06 forward spar inspection, no defects noted, Next due TT 3018.2. Complied with AD 77-13-21 main gear bungee inspection, inspection due annually, replacement TT 3121.5. Complied with AD 94-13-10, Stab. Torque tube fitting inspection, no defects noted, Next due TT 3018.2. Replaced induction air filter with new P/N BA-3205, replaced right main tire with new, resealed left brake caliper, replaced left and right brake linings with new, serviced brakes and battery, Jacked aircraft and completed retraction and extension check, normal and emergency checked good. Lubricated flight control hinges and rod ends. AD'S checked thru BW2018-10 See attached AD log for details. I certify this aircraft has been inspected in accordance with an Annual inspection and was determined to be in an airworthy condition.		
 Patrick Williams AP [redacted] IA		

Figure 12 - Most Recent Annual Entry