Aviation Investigation Final Report

Location:	San Jose, California	**Accident Number:**	WPR18LA153
Date & Time:	May 20, 2018, 19:50 Local	**Registration:**	N244TW
Aircraft:	Piper PA24	**Aircraft Damage:**	Substantial
Defining Event:	Landing gear collapse	**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot had rented the airplane and conducted an uneventful personal flight earlier that day. He departed later that afternoon, destined for an airport a few hundred miles away. According to the pilot, after the airplane was established on the downwind leg, he extended the landing gear and observed that the landing gear position indicator light was illuminated green, which denoted that the landing gear was down and locked into position. He verified that indication on the base leg. The approach and touchdown were normal and uneventful, and the pilot then began to brake the airplane. When the airplane was traveling about 30 mph, the landing gear "suddenly collapsed." The airplane slid on its belly and came to a stop on the runway, which resulted in substantial damage to the fuselage.

During recovery of the airplane, the cockpit landing gear handle was found to be in the fully down position. Initial postaccident examination of the airplane revealed that the two main landing gear (MLG) could be fully extended via the normal cockpit landing gear handle but that the nose landing gear (NLG) did not fully extend, the extension motor did not shut off, and the green cockpit indicator light did not illuminate. Manual attempts to fully extend the NLG by pulling it forward were unsuccessful. Aft-directed light-to-moderate force applied to the NLG tire resulted in unlocking the two MLG, which allowed all three gear to be retracted via manually pushing on the NLG. These results demonstrated that the landing gear system was susceptible to uncommanded retraction when the system was not properly adjusted. The reason for the failure of the NLG to fully extend and lock after the accident could not be determined, and the investigation could not determine if this condition existed before the accident.

During subsequent examination, the NLG was mechanically isolated from the rest of the landing gear system. Subsequent landing gear travel tests in this configuration revealed that all three landing gear were able to be independently moved into their respective fully extended and locked positions. When the NLG was fully extended, it was more difficult to dislodge by aft pressure to the NLG tire than during the previous examination. The NLG travel change that resulted from mechanically isolating the NLG indicated that after the accident, there was some physical constraint that limited NLG travel and prevented downlock; however, the investigation was unable to determine the nature or cause of the NLG

travel constraint. If the constraint was present before the accident, it is likely that the landing gear motor would not have shut off, the green cockpit light would not have illuminated, and the NLG would not have fully extended to the locked position when the pilot extended the landing gear. The reasons for the differences between the preaccident landing gear functionality reported by the pilot and the postaccident observations of landing gear functionality could not be determined.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A landing gear retraction during the landing rollout for reasons that could not be determined based on the available evidence.

Findings

Not determined	(general) - Unknown/Not determined
Aircraft	Gear extension and retract sys - Not specified

Factual Information

History of Flight

Landing-landing roll	Landing gear collapse (Defining event)

On May 20, 2018, about 1950 Pacific daylight time, a Piper PA24-250 airplane, N244TW, sustained substantial damage shortly after landing at Norman Y. Mineta San Jose International Airport (SJC), San Jose, California. The private pilot was not injured. The airplane was registered to two private individuals, and was operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed at the time of the accident and no flight plan was filed. The flight had originated from French Valley Airport (F70), Murrieta/Temecula, California about 1730.

According to the pilot, he had rented the airplane from Plus One Flyers, located at McClellan-Palomar Airport (CRQ), Carlsbad, California. Early on the day of the accident, the pilot flew the airplane from CRQ to F70, and landed uneventfully. He departed F70 that afternoon, destined for SJC. Near the "Pruneyard" visual flight rules (VFR) reporting point, he contacted the SJC air traffic control tower (ATCT), and was instructed to cross midfield at 2,000 ft. After he crossed over the airport, he entered a right downwind leg for runway 30R.

Once stabilized on the downwind leg, the pilot reduced the engine power, extended the landing gear, and verified that the landing gear position indicator light was illuminated green, which denoted that the landing gear was down and locked into position. The pilot began a descent and turned onto base leg, and then again verified that the landing gear was down and locked. He confirmed with SJC ATCT that he was cleared to land, and turned final for runway 30R. The approach and touchdown were normal and uneventful, and the pilot then began to brake the airplane. About the intersection of runway 30R and taxiway Echo, when the airplane was traveling about 30 mph, the landing gear "suddenly collapsed." The airplane slid on its belly, and came to a stop approximately 150 ft beyond taxiway Echo.

After the ATCT controllers determined that the airplane was immobilized, and verified that the pilot was uninjured, the controllers dispatched airport safety personnel to assist. The airplane was lifted and towed to a secure location on the airport. Subsequent examination by Federal Aviation Administration (FAA) inspectors determined that the there was substantial damage to the airplane fuselage structure.

Pilot Information

Certificate:	Private	**Age:**	34,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	November 15, 2015
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	December 17, 2017
Flight Time:	(Estimated) 250 hours (Total, all aircraft), 9 hours (Total, this make and model)		

The pilot held a private pilot certificate with a single-engine land rating. He reported a total flight experience of about 250 hours, including about 87 hours in complex airplanes, and about 9 hours in the accident airplane make and model. His most recent flight review was completed in December 2017. His most recent FAA third-class medical certificate was issued in November 2015.

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N244TW
Model/Series:	PA24 250	**Aircraft Category:**	Airplane
Year of Manufacture:	1958	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	24-554
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	May 18, 2018 Annual	**Certified Max Gross Wt.:**	2800 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	2918 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	C91 installed, not activated	**Engine Model/Series:**	O-540 SERIES
Registered Owner:	WILLIAMS PATRICK D	**Rated Power:**	250 Horsepower
Operator:	Plus One Flyers	**Operating Certificate(s) Held:**	None

The airplane was manufactured in 1958, and was equipped with a Lycoming O-540 series piston engine. The airplane was purchased by its current owners in 2013, who placed it on leaseback to Plus One Flyers. According to the maintenance records, the most recent annual inspection was completed on May 18, 2018. At that time the airplane had accumulated a total time in service of about 2,918 hours. The maintenance records indicated that all applicable FAA airworthiness directives (AD), including AD 77-

13-21 for the main landing gear bungees, had been complied with.

Landing Gear System

The tricycle-style landing gear (LG) is electrically controlled during normal operation by a landing gear handle on the instrument panel, and electrically actuated by a single motor-transmission mounted in the cockpit floor. All 3 LG are mechanically interlinked, and move in unison. Once adjusted by a technician, their geometric inter-relationship is fixed, and can only be altered by re-adjustment, or mechanical deformation of one or more of the system components.

When extended, each LG assembly is locked in place by an overcenter link assembly, whereby the integral stops on each LG assembly prevent overtravel during extension, while ensuring that each LG assembly is fully extended. The travel of each LG assembly and its links during extension is governed by mechanical adjustment of the system's respective links. Nose LG (NLG) travel is accomplished by adjustment of the NLG actuating rod and rod end assembly that extend forward from the landing gear motor-transmission assembly.

Each LG assembly has a microswitch which closes upon full extension of its respective LG assembly. When properly adjusted, microswitch closure occurs when the overcenter stops are in contact with one another. The three microswitches are wired in series. Closure of all three microswitches is required to complete an electrical circuit that allows passage of an input signal that is used to stop the extension motor, and to illuminate the green instrument panel light that denotes that the landing gear is fully extended.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	SJC,62 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	19:53 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Few / 2000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 6000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.95 inches Hg	**Temperature/Dew Point:**	14°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Murrieta, CA (F70)	**Type of Flight Plan Filed:**	
Destination:	San Jose, CA (KSJC)	**Type of Clearance:**	Unknown
Departure Time:	17:30 Local	**Type of Airspace:**	Class C

The 1953 SJC automated weather observation included winds from 240° at 8 knots, visibility 10 miles, few clouds at 2,000 ft, scattered clouds at 3,200 ft, a broken cloud layer at 6,000 ft, temperature 14°C, dew point 8°C, and an altimeter setting of 29.95 inches of mercury.

Airport Information

Airport:	Norman Mineta San Jose KSJC	**Runway Surface Type:**	Concrete
Airport Elevation:	62 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	30R	**IFR Approach:**	None
Runway Length/Width:	11000 ft / 150 ft	**VFR Approach/Landing:**	Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	37.363056,-121.928611(est)

The airplane came to rest upright on the runway, with all 3 LG retracted almost completely into their respective wells. According to technicians from a repair facility on SJC who were summoned to recover the airplane from the runway, they found the cockpit LG handle to be in the fully DOWN position. The technicians did not move or cycle any cockpit controls, including the LG handle, prior to lifting the airplane for recovery. As the airplane was lifted off its belly, all three LG moved from their retracted to their partially extended positions. One technician then manually pulled the NLG forward as far as able towards its extended position, and this caused the two MLG to fully extend and lock. The emergency LG extension system was intact and undisturbed, and all other system components were securely attached, and showed no evidence of failure or disconnect.

The airplane was towed to the repair facility ramp on its gear, and examined for damage. Several skins were ground through, and several underlying fuselage frames incurred substantial damage from the slide on the runway. Visual inspection of the 3 wheel wells and LG linkage components therein did not reveal any obvious failures, or disconnected or damaged hardware. The RMLG tire and wheel had scuff marks on their outboard sides.

Initial Landing Gear Cycle Tests

The airplane was raised on jacks, auxiliary electrical power was provided to the airplane, and the instrument panel (normal) LG handle was raised to the "UP" position. The gear retracted normally, the gear motor shut off, and the amber LG cockpit status light illuminated (per normal operation). Attempts to extend the gear via the normal handle and system were only partly successful; the gear extended, but the motor continued to run, and the green indicator light (denoting gear fully extended) did not illuminate. Manual attempts to fully extend the NLG were unsuccessful. This process was repeated, with

the same results. The green bulb was confirmed to be functional.

With the gear extended and the electrical power off, the 3 LG were manually manipulated to try to unlock and move them towards the retract position. The 2 MLG were unable to be moved when they were pushed inboard, the normal retraction direction. Light to moderate kicks in the aft direction on the NLG tire caused the system to unlock, and all 3 gear to move in their respective retracting directions. The gear moved freely, and could be manually pushed up to nearly the retracted position, and the process was repeatable.

When the gear was extended via the normal system, the MLG overcenter stops were observed to be in contact with one another, but the NLG drag link overcenter stops were observed to not be in contact with one another, indicating incomplete extension of the NLG. Concurrent with this condition, the NLG microswitch assembly was observed to not be actuated to the closed position. Proper rigging of the airplane LG system requires all 3 overcenter stops to be locked. Reasons for improperly rigged LG include damaged components or structure, worn or improper components, or improper maintenance.

The NLG actuating rod, rod end, and locknut assembly did not appear to have been altered after the airplane was repainted, and no components were observed to be damaged. The reason(s) for the observed conditions and test results were not able to be determined.

Post Recovery Examination and Tests

The airplane was recovered and transported to an off-airport facility for detailed examination; that recovery necessitated the disconnection of the MLG push-pull cables from their MLG bellcranks in the MLG wells, and the disconnection of the landing gear motor/transmission assembly from its fuselage mount. This mechanically separated NLG travel from MLG travel. All 3 LG were free to travel between their retracted and extended positions. The springs and bungees associated with all 3 LG were present, intact, and functional.

All 3 LG were observed to be able to be fully extended so that the stops and microswitches in their respective overcenter links were all closed, which is the proper design rigging condition. For the MLG, this condition was the same as observed in the pre-recovery tests and exam. However, this post-recovery NLG stop position condition was different from the pre-recovery tests and exam. The net effect of this new NLG overcenter stop condition was observed to increase the force required to unlock the NLG, because the NLG was now completely extended and locked.

The investigation was unable to determine the specific reason(s) that prevented the NLG from being fully extended after the accident but before it was separated from the rest of the LG system.

Examination of the motor and transmission assembly revealed that all components were intact, and exhibited no external damage. Disassembly revealed that all transmission gears were well lubricated, rotated readily, and meshed well, with no metal shavings, fragments, or other indications of excessive wear present. The NLG actuating rod, lever, and bellcrank assemblies downstream of the motor/transmission assembly were all undamaged, and did not exhibit any visible wear.

The absence of damaged, worn, improper or improperly installed components, or relevant airframe

damage, prevented determination of the reason(s) for, and timing of, the observed differences between the pre-recovery and post-recovery test and examination results.

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Wilbert Robinson; FAA; San Jose/Los Angeles, CA Kathryn Whitaker; Piper Aircraft; Vero Beach, FL
Original Publish Date:	June 3, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97355