Aviation Investigation Final Report

Location:	Tujunga, California	**Accident Number:**	ANC17LA051
Date & Time:	September 2, 2017, 09:48 Local	**Registration:**	N304FD
Aircraft:	Leonardo AW139	**Aircraft Damage:**	Substantial
Defining Event:	Miscellaneous/other	**Injuries:**	2 None
Flight Conducted Under:	Public aircraft		

Analysis

The pilot of the Los Angeles Fire Department (LAFD) helicopter was conducting a water drop during an aerial firefighting mission when the accident occurred. As the helicopter neared the drop area, the pilot slowed to about 20 knots and the helicopter entered an uncommanded right yaw and began to descend. The pilot released the water and the helicopter continued to yaw to the right and descend rapidly. The pilot reported that he had little positive control of the helicopter, and the helicopter contacted trees. After the tree impacts, which resulted in substantial damage to the horizontal stabilizers and tail boom, the pilot regained control, departed the area, and performed an emergency landing nearby.

The pilot reported, and onboard data from the helicopter confirmed, that there were no preimpact mechanical failures or malfunctions with the airframe or engine that would have precluded normal operation.

During the water drop, it is likely that the helicopter encountered radiant heat from the fire and its associated smoke columns, which reduced helicopter performance. Additionally, the helicopter was operating with a quartering tailwind at the time, which was within the critical wind azimuth published by the manufacturer. It is likely that the combination of the increased heat and smoke, adverse wind conditions, a higher helicopter weight due to the water onboard, and the higher torque demand as the result of the helicopter's slower airspeed resulted in the yaw excursion and vertical descent due to a loss of tail rotor effectiveness. As the helicopter continued its flight path out of the area of the gases, heat, and wind, and dropped the water, the pilot was able to regain control of the helicopter.

Review of published LAFD training information and operating procedures revealed no guidance regarding water drop operations or the hazards associated with operating near and around smoke columns.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

A yaw excursion and uncontrolled descent due to loss of tail rotor effectiveness during aerial firefighting operations resulting in an impact with trees. A contributing factor was the pilot's failure to maintain sufficient airspeed, coupled with a quartering tailwind during aerial firefighting operations. An additional factor was the operator's lack of guidance to the hazards associated with aerial firefighting operations near and around smoke columns.

Findings

Environmental issues	Tailwind - Effect on equipment
Environmental issues	High temperature - Effect on equipment
Aircraft	Descent/approach/glide path - Attain/maintain not possible
Organizational issues	Standard operating practices - Operator
Organizational issues	Oversight of operation - Operator

Factual Information

History of Flight

Maneuvering-low-alt flying	Miscellaneous/other (Defining event)
Maneuvering-low-alt flying	Loss of control in flight
Maneuvering-low-alt flying	Attempted remediation/recovery
Maneuvering-low-alt flying	Collision with terr/obj (non-CFIT)

On September 2, 2017, about 0948 Pacific daylight time, a Leonardo (formerly AgustaWestland) AW139 helicopter, N304FD, was substantially damaged when it was involved in an accident in Tujunga, California. The pilot and crewmember were not injured. The helicopter was operated as a public aerial firefighting flight.

On the day of the accident, the pilot arrived at the Los Angeles Fire Department (LAFD) Fire Station 114 at Van Nuys Airport (VNY), Van Nuys, California, about 0730 to begin his duty day. Shortly after arriving, the pilot was tasked with supporting the La Tuna Canyon brush fire response in the Verdugo Mountains. The pilot received a briefing on his mission, which included the communications plan, the airspace deconfliction plan, and which air and ground assets would be involved.

The pilot was seated in the right seat and the crewmember, who was not type-rated in the helicopter and was observing the pilot for training purposes, was seated in the left seat. The flight departed VNY and flew to the Green Verdugo helispot about 2 miles northwest of the accident site.

After landing at the helispot, the helicopter was filled with a half tank of water. The helicopter departed from the helispot and conducted various water drops. The pilot landed back at the helispot, where the helicopter was refueled, and the firefighting tank was filled with a half tank of water. Upon departure from the helispot, the pilot was immediately tasked with structure protection for a residential complex on a southeast-to-northwest-oriented ridgeline.

The residential complex comprised two homes and garages and was located at an elevation about 1,970 ft mean sea level (msl). Ridgelines were to the north and south.

The pilot performed a high reconnaissance orbit over the residential complex with the intent of conducting a water drop from south to north. During the reconnaissance, the pilot noted the prevailing wind (variable and from the east), the smoke conditions, the ground obstructions, and his intended approach and departure route for the water drop. The pilot had previously made several water drops in the general location and reported that he was familiar with the terrain. He noted that the smoke conditions at the time were worse than his previous water drops. He concluded that the path into and out of the target area was between two large smoke columns.

When the pilot was flying from south to north in a descending profile to drop the water, about 100 ft above the trees and about 200 ft south of the residential complex, the helicopter's airspeed progressively reduced to about 20 kts. The helicopter began an uncommanded right yaw and the vertical descent increased. The pilot released the water, and the helicopter continued to yaw to the right and descend rapidly. The pilot reported that he had little positive control of the helicopter. The main rotor blades impacted a eucalyptus tree, and the tailboom and tail rotor system impacted a pine tree. After the tree impacts, the uncommanded yaw appeared to decrease, and the pilot regained control of the helicopter. The helicopter did not impact the ground. The pilot subsequently performed a climbing turn to the northwest, made a mayday call on the radio, and conducted an emergency landing at a large high school athletic field. The pilot shut down the helicopter and both occupants egressed without further incident.

The pilot reported that there were no preimpact mechanical failures or malfunctions with the airframe or engine that would have precluded normal operation. He reported that an airspeed of 40 knots during water release would compensate for the "dynamic firefighting environment conditions that can affect aircraft performance." He also stated that pilots should drop into the wind when at all possible, or at least crosswind, keeping in mind to stay out of the active fire smoke column and always have an escape route.

Smoke Column Hazards

At the time of the accident, there were no published educational documents that addressed the hazards of smoke columns for aerial firefighting aircraft. The Department of Interior and USFS released Interagency Aviation Accident Prevention Bulletin APB 18-02, Smoke Columns Hazards, on March 20, 2018. This document discusses smoke column hazards and states in part:

Smoke columns are the vertical development of smoke emitting from a fire and represent an ascending air column (updraft). It is imperative that aircrews understand the hazards associated with smoke columns during aerial firefighting operations, regardless of aircraft type.

The hot temperatures in a smoke column can significantly reduce aircraft performance. The increase in density altitude can result in hazardous conditions for helicopters such as a loss of tail rotor effectiveness (LTE), settling with power, and decreased power available. The density altitude for performance planning does not include the temperatures of the superheated gases that exist inside of a smoke column.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	58,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	November 1, 2016
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 25, 2017
Flight Time:	(Estimated) 5500 hours (Total, all aircraft), 545 hours (Total, this make and model), 5400 hours (Pilot In Command, all aircraft), 51 hours (Last 90 days, all aircraft), 16 hours (Last 30 days, all aircraft)		

Other flight crew Information

Certificate:	Commercial; Flight instructor	**Age:**	47,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 13, 2016
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	August 23, 2017
Flight Time:	(Estimated) 1265 hours (Total, all aircraft), 12 hours (Total, this make and model), 1202 hours (Pilot In Command, all aircraft), 56 hours (Last 90 days, all aircraft), 18 hours (Last 30 days, all aircraft)		

LAFD training records indicated that the pilot had completed all required training, including a competency check ride on January 25, 2017. The pilot had worked for the LAFD since 1980 and had been a pilot for the LAFD since 1997. In addition to the Leonardo AW139, the pilot was also qualified and current in the Bell 206B helicopter.

Aircraft and Owner/Operator Information

Aircraft Make:	Leonardo	**Registration:**	N304FD
Model/Series:	AW139	**Aircraft Category:**	Helicopter
Year of Manufacture:	2017	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	41528
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	September 2, 2017 Continuous airworthiness	**Certified Max Gross Wt.:**	15432 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo shaft
Airframe Total Time:	121.9 Hrs as of last inspection	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	C126 installed, not activated	**Engine Model/Series:**	PT6C-67C
Registered Owner:	City of Los Angeles	**Rated Power:**	1531 Horsepower
Operator:	Los Angeles Fire Department	**Operating Certificate(s) Held:**	None

Weight and Balance

The LAFD reported that the helicopter was within weight and balance limitations for the duration of the flight.

Simplex Aerospace Model 326 GII Fire Attack System

The helicopter was equipped with a Simplex Aerospace Model 326 GII Fire Attack System (FAS) belly-mounted, 450-gallon capacity water tank for aerial firefighting. The system (serial number 41528) was installed in accordance with FAA supplemental type certificate SR02351LA. A review of the FAA-approved Flight Manual Supplement (FMS) for the system found no published guidance for pilots on optimal airspeeds and altitudes for water dropping procedures.

According to the LAFD, the low-profile design of the FAS requires pilots to adjust their airspeed to match the desired flow rate (the rate at which the water exits the tank). The typical airspeed used for aerial firefighting in the AW139 ranges from 30 to 40 kts, which provides the most effective flow rate and still leaves the helicopter above effective translational lift. While dropping water at airspeeds from 30 to 40 kts is not dangerous or unsafe, slower airspeed requires the pilot to be more vigilant in maintaining situational awareness during the operation.

Maintenance Records

An examination of the helicopter's maintenance records revealed no evidence of any uncorrected mechanical discrepancies with the airframe and engine.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KBUR,732 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	16:53 Local	**Direction from Accident Site:**	227°
Lowest Cloud Condition:	Few / 3900 ft AGL	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.82 inches Hg	**Temperature/Dew Point:**	33°C / 16°C
Precipitation and Obscuration:	Moderate - None - Smoke		
Departure Point:	VAN NUYS, CA (VNY)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Tujunga, CA	**Type of Clearance:**	VFR
Departure Time:	08:30 Local	**Type of Airspace:**	Class G

Density Altitude

The estimated density altitude was about 3,100 ft for the accident site; however, this does not account for the superheated gases and radiant heat in and around the vicinity of the smoke columns at the accident site.

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	34.246387,-118.30027(est)

Flight recorders

Multi-Purpose Flight Recorder

The helicopter was equipped with a Penny & Giles Multi-Purpose Flight Recorder (MPFR). The MPFR was removed from the helicopter and was transported to the NTSB Vehicle Recorders Laboratory in Washington, District of Columbia, for an examination and download.

The system sustained no damage from the accident sequence. No anomalies were noted with the operation of the system and the accident flight data was captured.

Leonardo AW139 Critical Wind Azimuth Sectors

The Leonardo AW139 Rotorcraft Flight Manual (RFM) contains critical wind azimuth from 90° to 135° and from 225° to 270° with the helicopter facing 0°. According to Leonardo, wind blowing from a critical azimuth, and dependent upon the airspeed of the helicopter, could reduce the tail rotor pedal margin that is available to the pilot.

A review of the MPFR data revealed no failures or malfunctions with the airframe and engine. The MPFR data showed a wind calculation by the onboard Flight Management System showing a 7-8 kt wind from 115-120 before the final approach of the water drop.

Organizational and Management Information

Los Angeles Fire Department Organization

The LAFD Air Operations Section is based at LAFD Fire Station 114 at VNY. Their missions include air ambulance, disaster assessment, external lift, fire suppression, search and rescue, support missions for the Los Angeles Police Department, and transportation of high-visibility personnel.

At the time of the accident, there were 61 total personnel assigned to the LAFD Air Operations Section (16 pilots, 12 aeromedics, 30 helitac members, a section commander, an assistant section commander, and one administrative clerk). At the time of the accident, the fleet consisted of four Leonardo AW139 helicopters. Two Bell 206B helicopters were used for HELCO duties and training missions. The LAFD also leased helicopters for firefighting duties.

At the time of the accident, the leadership of the LAFD consisted of the section commander, the assistant section commander, the chief pilot, and the lead pilots. A permanent director of flight operations position was filled by the section commander. The LAFD did not have a full-time chief aeromedic position or full-time platoon duty HELCO position. While the LAFD did have an aviation

safety manager, it was not a full-time, permanent position.

All pilots are sworn members of the LAFD and were initially trained and have worked in the field as firefighters. After completing at least 4 years in the field as a firefighter and obtaining the necessary FAA pilot licenses on their own time, a member may apply for a position as a LAFD helicopter pilot. Once accepted into the program, pilots receive initial city flight training from the LAPD (conducted in Airbus H125 and Bell 206 series helicopters), followed by at least two years of specific LAFD flight training. The LAFD pilot training pipeline takes approximately four years to complete.

Operations

The LAFD has the Aviation Training and Operating Procedures Standardization Manual (ATOPS). ATOPS presents a consolidation of information, procedures, rules, and guidelines, and policy for the operation and support of the LAFD.

Training

The LAFD had an official pilot training manual; however, specific procedures (including conditions and standards) and guidance for water dropping were not listed in the pilot training manual. The manual did not contain guidance about smoke column hazards.

Safety Management System (SMS)

The LAFD had an official SMS in place at the time of the accident. LAFD risk assessments were required to be filled out each day by the alert air crew. A general risk assessment of weather, temporary flight restrictions (TFRs), helicopter maintenance, crew rest, crew currency, and crew pairing were completed by the entire on-duty staff at the mandatory daily morning briefing.

Additional Information

The helicopter sustained substantial damage to the left and right stabilizers and the tailboom from the impact with the trees. Additionally, two main rotor blades, the water tank, and the left and right main landing gear housing assemblies sustained impact damage.

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Matt Rigsby; Federal Aviation Administration AVP-100; Washington , DC Mikael Amura (Accredited Representative); Agenzia Nazionale per la Sicurezza del Volo ; Rome Giorgio Dossena (Technical Advisor); Leonardo ; Cascina Costa Earl Chapman (Accredited Representative); Transportation Safety Board of Canada; Gatineau Claude Beaudry (Technical Advisor); Pratt & Whitney Canada; Longueuil Scot Davison; City of Los Angeles Fire Department; Van Nuys, CA Tony Pircey; City of Los Angeles Department of General Services; Van Nuys, CA Jim Allen; Honeywell Aerospace ; Phoenix , AZ
Original Publish Date:	May 6, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95985