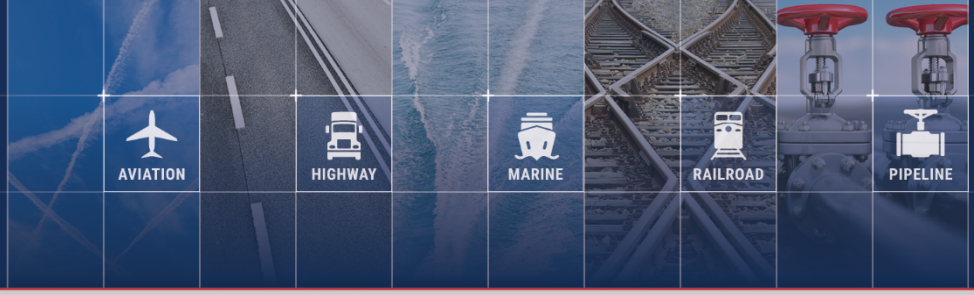

Aviation Investigation Final Report

Location:	Los Angeles, California	**Incident Number:**	DCA20IA034
Date & Time:	December 4, 2019, 19:15 Local	**Registration:**	N71HD
Aircraft:	Airbus AS 350 B2	**Aircraft Damage:**	Minor
Defining Event:	Midair collision	**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The helicopter was operating under the provisions of 14 CFR Part 91 as an electronic news gathering flight, under visual flight rules, within Class G airspace. The pilot heard a noise which he first thought might be a bird strike, and made a precautionary landing. Post flight examination led the pilot and operator to believe they collided with a drone.

A search by ground and electronic methods did not locate a drone.

Laboratory examinations indicated that the shape and dimensions of the damage to the horizontal stabilizer were consistent with the configuration and dimensions of many popular small drones. A small mark inside the larger round dent was consistent with the propeller shaft diameter of common small drones.

Infrared examination revealed material transfer of polycarbonate polymer, which is a commonly used construction material of small drones. Although many items which could come in contact with the helicopter as ground FOD, are manufactured of polycarbonate (e.g. safety glasses, light lenses), the shape and configuration of the indentations and scuffs were very consistent with a small drone.

The reported collision occurred in Class G airspace, but higher than the 14 CFR Part 107 regulatory maximum of 400 feet agl for small drones. A provision in Part 107 allows for operations above 400 feet if the drone is within 400 feet laterally of a tall structure. Downtown Los Angeles was approximately ¼ mile away from the collision site, therefore, although the altitude and location are not authorized for drones without a waiver, it is not inconceivable that a drone operator could have been operating near the tall buildings, and deviated or exceeded the lateral requirements.

Although no drone was located, preventing complete certainty, all the available evidence was consistent with a collision with a small UAS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: an inflight collision with a hard object of polycarbonate construction, with size and features consistent with that of a small UAS (drone).

Findings

Environmental issues	Aircraft - Effect on equipment
Aircraft	Horizontal stabilizer - Damaged/degraded

Factual Information

History of Flight

Enroute	Midair collision (Defining event)

On December 4, 2019, at 7:15 pm, pacific standard time (PST), the pilot of an Airbus AS-350-B2 helicopter, N71HD, reported colliding with an unknown object at 1,100 feet above mean sea level (msl) in the vicinity of Los Angeles City Hall. The pilot conducted a precautionary landing at a nearby helipad. Post-flight examination revealed minor damage to the right horizontal stabilizer and tail rotor blade. The pilot and operator reported that no visible evidence of a bird strike was apparent, and believed that the aircraft collided with a small unmanned aircraft (sUAS, or drone).There were no injuries to the pilot or two passengers. The helicopter was operated by Helinet Aviation Services as an electronic news gathering flight for ABC7 News in Los Angeles. The helicopter was operated under visual flight rules under 14 *Code of Federal Regulations* (*CFR*) Part 91. Night visual meteorological conditions prevailed at the time of the incident.

The pilot reported that it was fully night conditions, and that it was difficult to make out individual lights in the area due to high concentration of city lights. He reported that he was transitioning between story locations at 1,100 feet mean sea level (msl) cruising at 100 to 110 knots. He noted some clouds above but none in his immediate area. He said did not see anything prior to hearing the loud noise. He attributed what he might have mentioned as a flash of light as actually from his own strobes reflecting off the main rotor blades.

He described the area of the event as east of City Hall bounded by Los Angeles St, Alameda St, Cesar Chavez Ave, and East 2nd St. This location was passed on to the Los Angeles Police Department to conduct a search of the area. No drone was found.

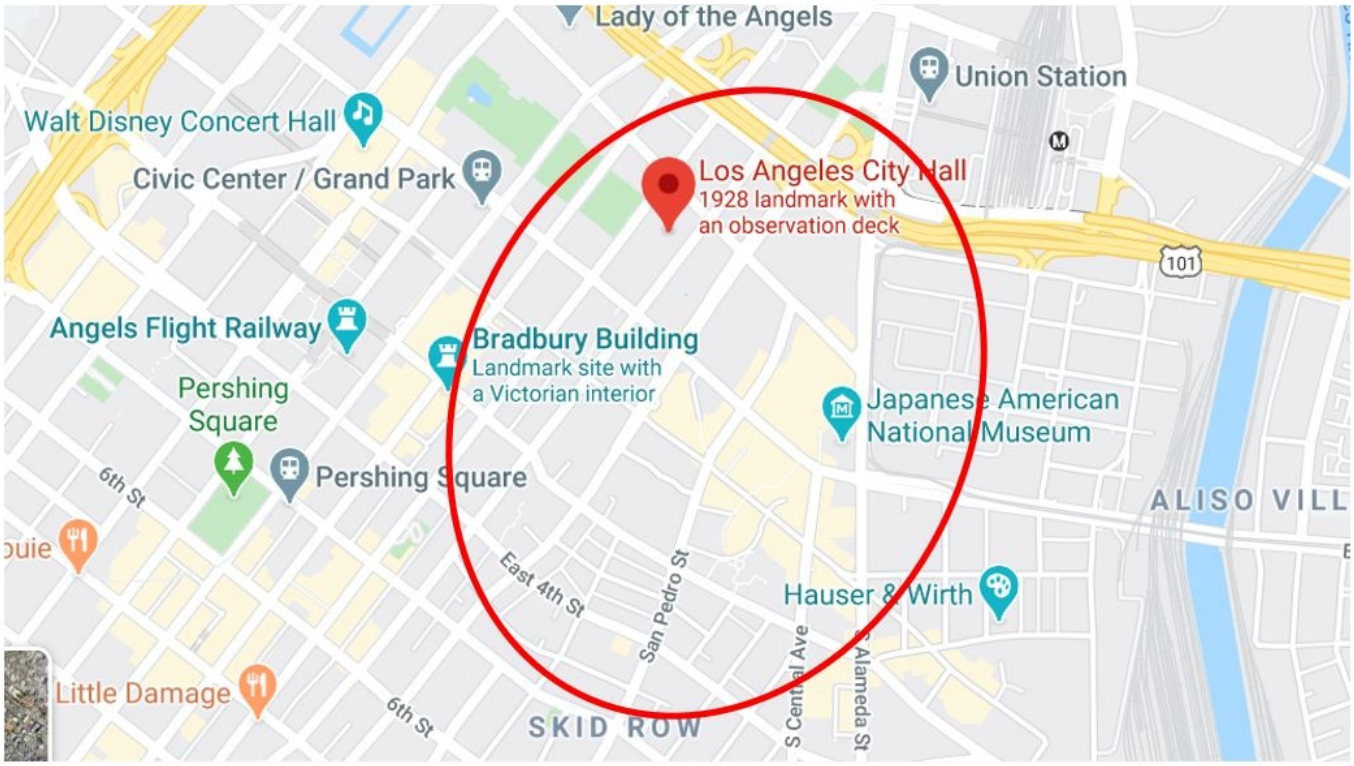

Figure 1 – Reported area of collision

The operator reported that the onboard cameras were stowed and did not record video at the time of the reported collision. The operator and NTSB investigator conducted a search of social media for any possible indications of a lost drone in the area, nothing definitive was found. Two drone detection companies were operating in the area, but did not have any targets in the area at the time of the report. Both companies reported less than complete coverage of the area.

Although the reported location was in Class G airspace, the FAA was queried for any sUAS airspace authorizations active in the nearby Class B, there were none.

There was a small round dent which partially punctured the leading edge of the horizontal stabilizer. Further dents and scuff marks were approximately 6 to 8 inches outboard of the round dent on the leading edge and along the upper surface. One of the tail rotor blades exhibited a small gouge in the composite surface approximately mid-chord.

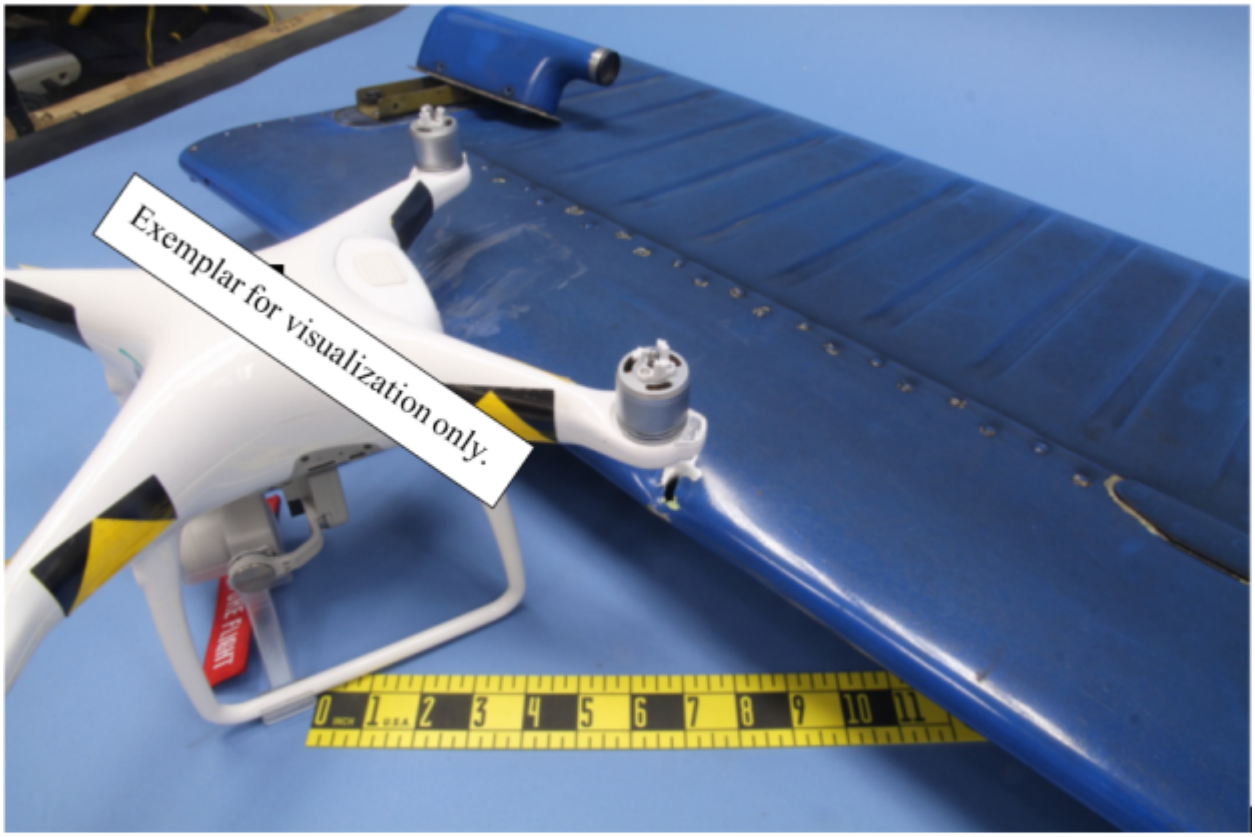

Figure 2 – Damage to helicopter

The helicopter pilot held an FAA commercial pilot certificate, with rotorcraft-helicopter and helicopter instrument rating, and had logged 3,753 hours. He held an FAA first class medical certificate.

The pilot reported that he has experienced bird strikes in the past. He said he had never seen a small drone while flying the helicopter.

Information

Certificate:	**Age:**
Airplane Rating(s):	**Seat Occupied:**
Other Aircraft Rating(s):	**Restraint Used:**
Instrument Rating(s):	**Second Pilot Present:**
Instructor Rating(s):	**Toxicology Performed:**
Medical Certification:	**Last FAA Medical Exam:**
Occupational Pilot:	**Last Flight Review or Equivalent:**
Flight Time:	

Aircraft and Owner/Operator Information

Aircraft Make:	Airbus	**Registration:**	N71HD
Model/Series:	AS 350 B2 No Series	**Aircraft Category:**	Helicopter
Year of Manufacture:	2004	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	3849
Landing Gear Type:	Skid	**Seats:**	6
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	
Airframe Total Time:		**Engine Manufacturer:**	
ELT:		**Engine Model/Series:**	
Registered Owner:	Helinet Aviation Services Llc	**Rated Power:**	
Operator:	Helinet Aviation Services Llc	**Operating Certificate(s) Held:**	On-demand air taxi (135)

The Airbus (Eurocopter) AS-350-B2 is a 6 seat single engine helicopter, powered by a Turbomeca Arriel 1D1 turboshaft engine. The main rotor blades rotate clockwise as viewed from above. It is in wide use in electronic news gathering, law enforcement, air tour, and observation roles. N71HD was delivered in May of 2005 to Helinet.

The KLAX surface observation at 6:53 pm reported wind from 270 degrees at 8 knots, visibility 10 miles, with few clouds at 1,100 feet and 3,600 feet.

The helicopter was equipped with a SpiderTrax flight following system, which indicated the helicopter passing northeasterly in the vicinity of LA City Hall at 7:15 pm at 1,104 feet msl (approximately 828 above ground level (agl)).

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:			
Departure Point:	Burbank, CA (KBUR)	**Type of Flight Plan Filed:**	
Destination:	Los Angeles, CA	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Minor
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	33.942501,-118.408058

Tests and Research

NTSB Materials Laboratory

The horizontal stabilizer and tail rotor were sent to the NTSB Materials Laboratory for examination. Visual examination was consistent with an inflight hard-body impact. The dent and scuff marks were compared to the dimensions of common small drones and were consistent with the distance and orientation between the motor and center fuselage/battery compartment (Figure 3).

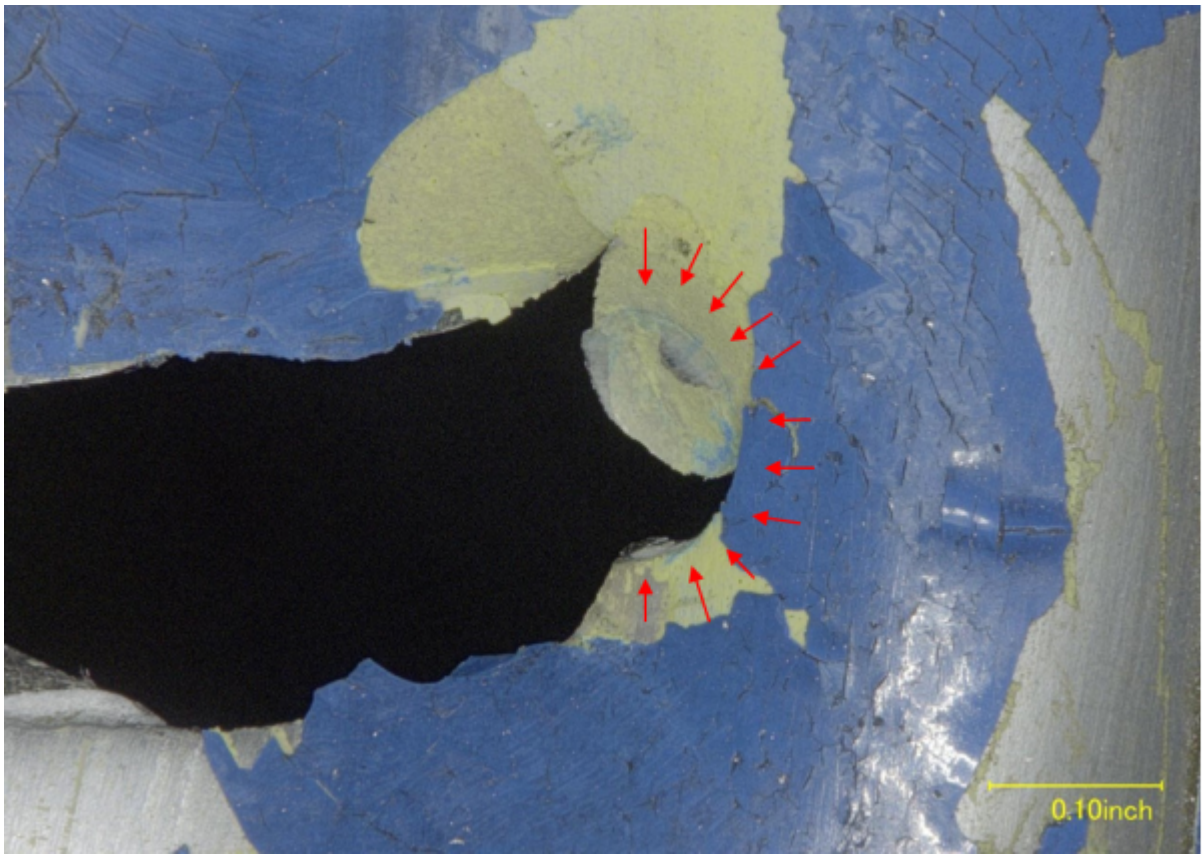

Figure 3 – Angled view comparing common drone to impact marks. The drone in the photo is an exemplar of a popular drone used to illustrate size comparison. Numerous manufacturers and models of drone fall into this size class. Does not necessarily depict the actual collision object.

Ultraviolet light inspection revealed no evidence of biological material. The dented region exhibiting material transfer was examined using Fourier-transform infrared spectroscopy (FTIR). The white and gray areas were probed, and the data were contrasted with an area of the painted stabilizer skin surface away from the impact zone. In subtracting out the spectrum peaks from the control area away from the impact zone, several peaks consistent with a different or foreign material were noted. These peaks were consistent with a polycarbonate polymer. Examination of an exemplar popular drone indicated the primary construction material is polycarbonate. (Polycarbonate plastics are used in many other common items, such as safety glasses or light lenses.)

Under magnification, inside the round dent, a small circular indentation was noted of approximately 0.125 inches (~3 mm) in diameter, exhibiting tears and cracking around its circumference (Figure 4). These features were consistent with fore-to-aft impact with a hard, cylindrical object. The propeller shafts on many common small drones are approximately 3 mm in diameter.

Figure 4 – Small indentation inside larger dent

Impact Dynamics Study

The damaged portion of the horizontal stabilizer was sent to the National Institute for Aeronautical Research (NIAR) impact dynamics lab (part of the FAA UAS Center for Excellence.) NIAR scanned the damaged component and created a finite element model (FEM) of the stabilizer. The FEM was entered into their impact kinematics simulation with a representative model of a common small drone. The resultant damage was similar to that of the incident, although the calculated relative speeds were higher than those reported by the helicopter pilot. NIAR researchers noted that the collision model they used was of one specific small drone - different construction materials or mass of the colliding object could account for the difference. A small contribution from rotor wash could also contribute.

Regulations

14 CFR 107.29 *"Daylight operation"* states:

(a)No person may operate a small unmanned aircraft system during night.

However, this provision is subject to FAA waiver:

14 CFR 107.205 *List of regulations subject to waiver.*

(b)Section 107.29- Daylight operation.

14 CFR 107.51 *"Operating limitations for small unmanned aircraft"* states:

(b)The altitude of the small unmanned aircraft cannot be higher than 400 feet above ground level, unless the small unmanned aircraft:

(1)Is flown within a 400-foot radius of a structure; and

(2)Does not fly higher than 400 feet above the structure's immediate uppermost limit.

Other Information

The NTSB has investigated three events in which a collision with a drone was positively confirmed DCA17IA202AB, DCA18IA264AB, and DCA20IA081AB. At the time of this report, the NTSB has gathered information on two other reported collisions in which evidence was consistent with an inflight collision with an sUAS. Numerous other reports were found to be birds, foreign object damage, or maintenance issues. None of these events resulted in substantial damage or injuries.

Kauai Napali Coast, Hawaii, February 9, 2018

On February 9, 2018, at 14:30 Hawaiian standard time, the pilot of an Airbus EC130-B4 helicopter, N11QK, reported striking a small unmanned aircraft while conducting an air tour in the vicinity of Nu'alolo Kai, on the Kauai Napali Coast, at 2,900 feet mean sea level (msl). Visual flight rules conditions prevailed. There were no injuries to the pilot or six passengers. Three small scratch marks were evident on the right side door of the helicopter.

The pilot reported that as the helicopter was descending in a right turn near a canyon and hiking trail, he noticed a drone to his left. He continued the right turn to avoid it, then began to turn back in a continuing descent toward the ocean when a another drone struck the right side of the helicopter. He assessed that the helicopter was handling normally, and continued the tour flight with no incident. Law enforcement was notified. Swabs of the scratched area were examined for organic residue, none was found. In discussion with the tour operator and local law enforcement, it was recognized that the Nu'alolo Kai hiking trail is very popular with drone operators and drones are often seen in the area. The airspace is Class G, with steep rugged terrain.

Aurora, Oregon, May 29, 2018

On May 29, 2018, at 18:55 pacific daylight time, the pilot of a Cessna 170, N3193A, reported that he struck a small unmanned aircraft while enroute at 2,000 feet near the Aurora State Airport (KUAO), Aurora, Oregon. The pilot continued the flight to Kent, Washington, and landed with no further incident. The airplane exhibited a small round dent in the leading edge of the right wingtip fairing, and a concave dent in the outer leading edge of the wing. No drones were found by the FAA or Aurora Airport and other local authorities.

The wingtip was examined at the NTSB Materials Laboratory. The dent exhibited characteristics of hard body impact damage and there was no organic residue. An FEM of the wingtip was developed by the NIAR laboratory and put into the impact dynamics simulation with a representative model of a common small drone. The modeling resulted in damage consistent with the physical evidence at normal cruise speeds for a Cessna 170.

Administrative Information

Investigator In Charge (IIC):	English, William
Additional Participating Persons:	
Original Publish Date:	June 29, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this incident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100660

Aviation Investigation Final Report

Location:	Los Angeles, California	**Incident Number:**	DCA20IA034
Date & Time:	December 4, 2019, 19:15 Local	**Registration:**	UNK
Aircraft:	UNKNOWN UNKNOWN	**Aircraft Damage:**	
Defining Event:	Midair collision	**Injuries:**	
Flight Conducted Under:	Unknown		

Analysis

The helicopter was operating under the provisions of 14 CFR Part 91 as an electronic news gathering flight, under visual flight rules, within Class G airspace. The pilot heard a noise which he first thought might be a bird strike, and made a precautionary landing. Post flight examination led the pilot and operator to believe they collided with a drone.

A search by ground and electronic methods did not locate a drone.

Laboratory examinations indicated that the shape and dimensions of the damage to the horizontal stabilizer were consistent with the configuration and dimensions of many popular small drones. A small mark inside the larger round dent was consistent with the propeller shaft diameter of common small drones.

Infrared examination revealed material transfer of polycarbonate polymer, which is a commonly used construction material of small drones. Although many items which could come in contact with the helicopter as ground FOD, are manufactured of polycarbonate (e.g. safety glasses, light lenses), the shape and configuration of the indentations and scuffs were very consistent with a small drone.

The reported collision occurred in Class G airspace, but higher than the 14 CFR Part 107 regulatory maximum of 400 feet agl for small drones. A provision in Part 107 allows for operations above 400 feet if the drone is within 400 feet laterally of a tall structure. Downtown Los Angeles was approximately ¼ mile away from the collision site, therefore, although the altitude and location are not authorized for drones without a waiver, it is not inconceivable that a drone operator could have been operating near the tall buildings, and deviated or exceeded the lateral requirements.

Although no drone was located, preventing complete certainty, all the available evidence was consistent with a collision with a small UAS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this incident to be: an inflight collision with a hard object of polycarbonate construction, with size and features consistent with that of a small UAS (drone).

Findings

Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Enroute	Midair collision

On December 4, 2019, at 7:15 pm, pacific standard time (PST), the pilot of an Airbus AS-350-B2 helicopter, N71HD, reported colliding with an unknown object at 1,100 feet above mean sea level (msl) in the vicinity of Los Angeles City Hall. The pilot conducted a precautionary landing at a nearby helipad. Post-flight examination revealed minor damage to the right horizontal stabilizer and tail rotor blade. The pilot and operator reported that no visible evidence of a bird strike was apparent, and believed that the aircraft collided with a small unmanned aircraft (sUAS, or drone).There were no injuries to the pilot or two passengers. The helicopter was operated by Helinet Aviation Services as an electronic news gathering flight for ABC7 News in Los Angeles. The helicopter was operated under visual flight rules under 14 *Code of Federal Regulations* (CFR) Part 91. Night visual meteorological conditions prevailed at the time of the incident.

The pilot reported that it was fully night conditions, and that it was difficult to make out individual lights in the area due to high concentration of city lights. He reported that he was transitioning between story locations at 1,100 feet mean sea level (msl) cruising at 100 to 110 knots. He noted some clouds above but none in his immediate area. He said did not see anything prior to hearing the loud noise. He attributed what he might have mentioned as a flash of light as actually from his own strobes reflecting off the main rotor blades.

He described the area of the event as east of City Hall bounded by Los Angeles St, Alameda St, Cesar Chavez Ave, and East 2nd St. This location was passed on to the Los Angeles Police Department to conduct a search of the area. No drone was found.

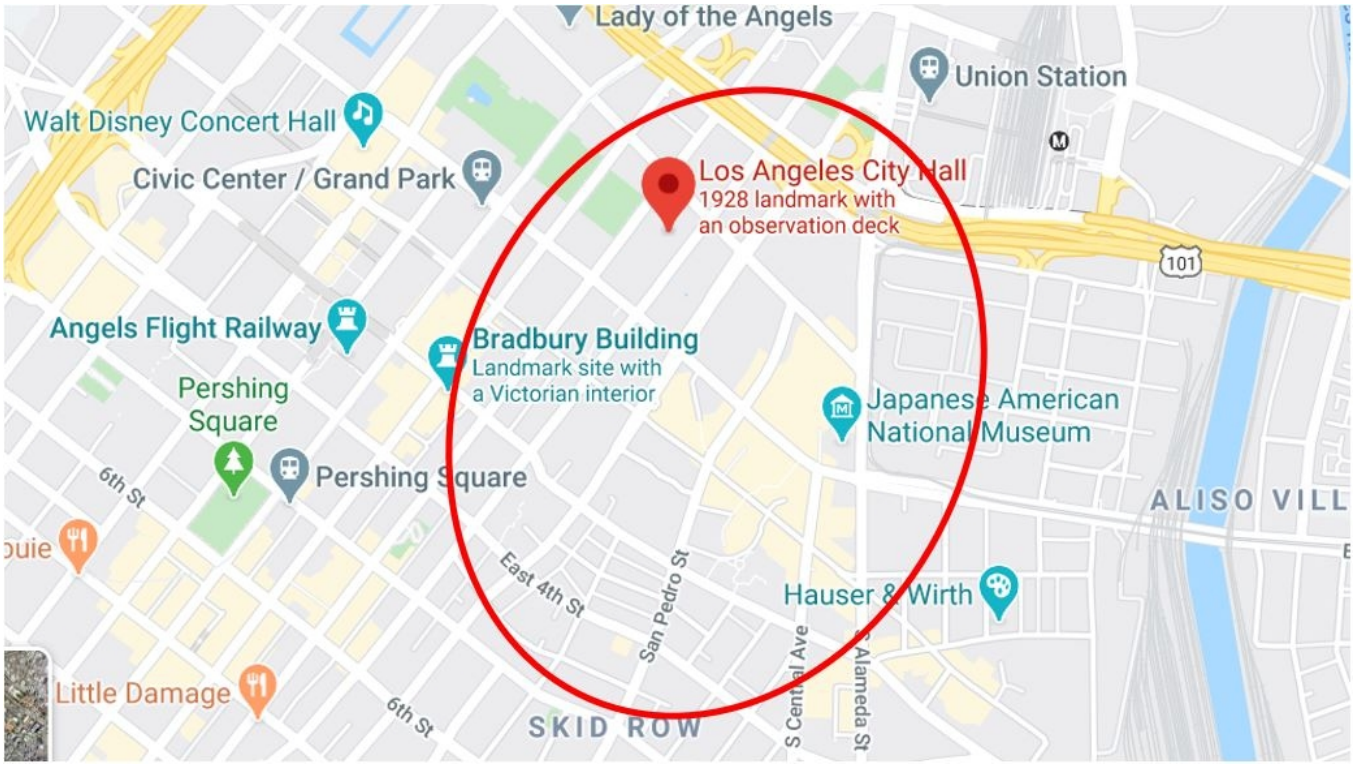

Figure 1 – Reported area of collision

The operator reported that the onboard cameras were stowed and did not record video at the time of the reported collision. The operator and NTSB investigator conducted a search of social media for any possible indications of a lost drone in the area, nothing definitive was found. Two drone detection companies were operating in the area, but did not have any targets in the area at the time of the report. Both companies reported less than complete coverage of the area.

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There was a small round dent which partially punctured the leading edge of the horizontal stabilizer. Further dents and scuff marks were approximately 6 to 8 inches outboard of the round dent on the leading edge and along the upper surface. One of the tail rotor blades exhibited a small gouge in the composite surface approximately mid-chord.

Figure 2 – Damage to helicopter

The helicopter pilot held an FAA commercial pilot certificate, with rotorcraft-helicopter and helicopter instrument rating, and had logged 3,753 hours. He held an FAA first class medical certificate.

The pilot reported that he has experienced bird strikes in the past. He said he had never seen a small drone while flying the helicopter.

Information

Certificate:	**Age:**
Airplane Rating(s):	**Seat Occupied:**
Other Aircraft Rating(s):	**Restraint Used:**
Instrument Rating(s):	**Second Pilot Present:**
Instructor Rating(s):	**Toxicology Performed:**
Medical Certification:	**Last FAA Medical Exam:**
Occupational Pilot:	**Last Flight Review or Equivalent:**
Flight Time:	

Aircraft and Owner/Operator Information

Aircraft Make:	UNKNOWN	**Registration:**	UNK
Model/Series:	UNKNOWN	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Unknown	**Serial Number:**	unk
Landing Gear Type:		**Seats:**	
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	
Airframe Total Time:		**Engine Manufacturer:**	
ELT:		**Engine Model/Series:**	
Registered Owner:	unk	**Rated Power:**	
Operator:	unk	**Operating Certificate(s) Held:**	

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Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	
Precipitation and Obscuration:			
Departure Point:		**Type of Flight Plan Filed:**	
Destination:		**Type of Clearance:**	Unknown
Departure Time:		**Type of Airspace:**	

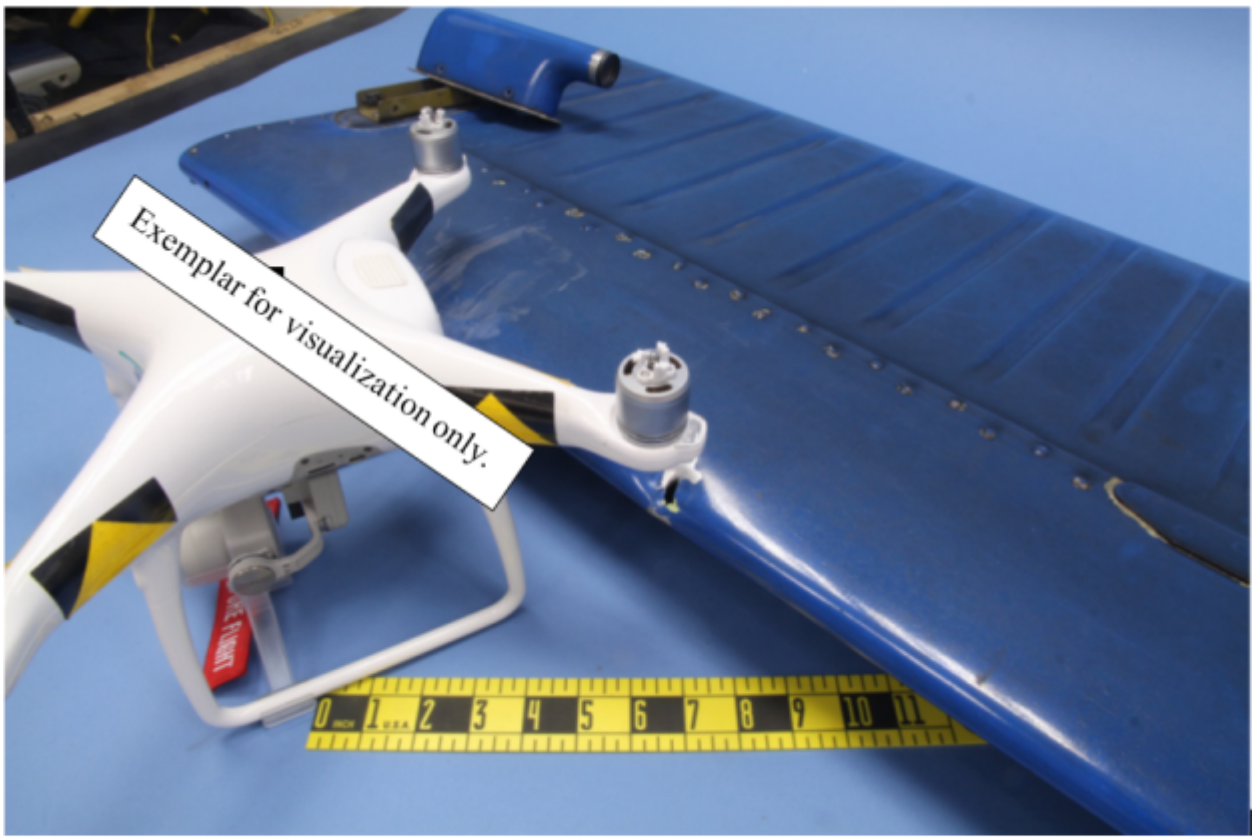
Wreckage and Impact Information

Crew Injuries:	N/A	**Aircraft Damage:**	
Passenger Injuries:		**Aircraft Fire:**	Unknown
Ground Injuries:		**Aircraft Explosion:**	Unknown
Total Injuries:	N/A	**Latitude, Longitude:**	33.942501,-118.408058

Tests and Research

NTSB Materials Laboratory

The horizontal stabilizer and tail rotor were sent to the NTSB Materials Laboratory for examination. Visual examination was consistent with an inflight hard-body impact. The dent and scuff marks were compared to the dimensions of common small drones and were consistent with the distance and orientation between the motor and center fuselage/battery compartment (Figure 3).



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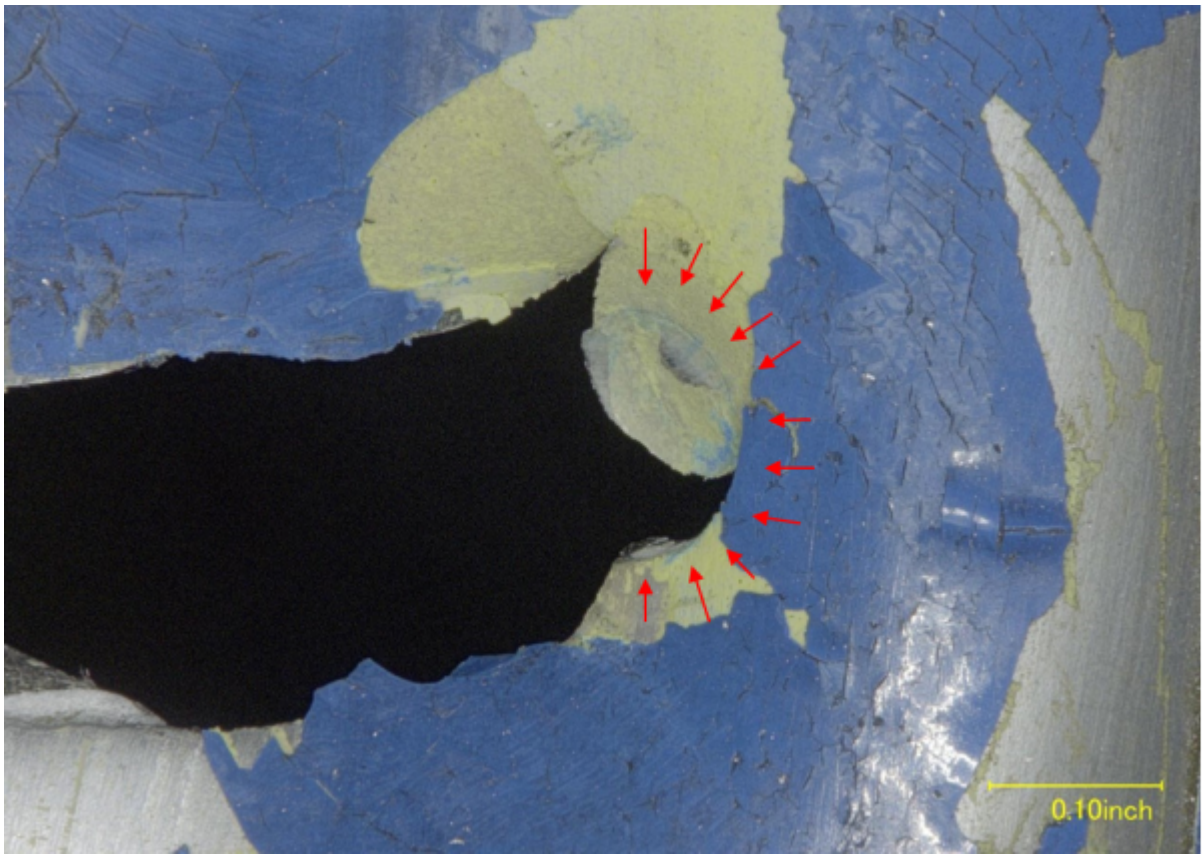

Figure 4 – Small indentation inside larger dent

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Other Information

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On May 29, 2018, at 18:55 pacific daylight time, the pilot of a Cessna 170, N3193A, reported that he struck a small unmanned aircraft while enroute at 2,000 feet near the Aurora State Airport (KUAO), Aurora, Oregon. The pilot continued the flight to Kent, Washington, and landed with no further incident. The airplane exhibited a small round dent in the leading edge of the right wingtip fairing, and a concave dent in the outer leading edge of the wing. No drones were found by the FAA or Aurora Airport and other local authorities.

The wingtip was examined at the NTSB Materials Laboratory. The dent exhibited characteristics of hard body impact damage and there was no organic residue. An FEM of the wingtip was developed by the NIAR laboratory and put into the impact dynamics simulation with a representative model of a common small drone. The modeling resulted in damage consistent with the physical evidence at normal cruise speeds for a Cessna 170.

Administrative Information

Investigator In Charge (IIC):	English, William
Additional Participating Persons:	
Original Publish Date:	June 29, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this incident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100660