Aviation Investigation Final Report

Location:	Abingdon, Virginia	**Accident Number:**	ERA22LA145
Date & Time:	March 6, 2022, 23:59 Local	**Registration:**	N29VA
Aircraft:	Airbus Helicopters MBB-BK 117 C-2	**Aircraft Damage:**	Substantial
Defining Event:	Landing area undershoot	**Injuries:**	1 Serious, 2 None
Flight Conducted Under:	Public aircraft		

Analysis

The helicopter pilot had just completed a night public-use medical flight to a hospital and was returning to the base airport along with two flight paramedics. The pilot initiated the takeoff and increased power to enter a hover, at which time he observed (via engine instrumentation) an uncommanded surge (increase) in power, which he also heard. The pilot continued the liftoff into a low hover and found that, despite the momentary power surge, all engine parameters and flight controls appeared normal, so the flight continued to its operational base.

The pilot arrived at the base without any en-route anomalies and maneuvered the helicopter in the ramp area to align with a landing dolly connected to a tractor. The maneuver required the pilot to complete a right sidestep over the dolly. When visual alignment was attained, the maneuver required the pilot to reduce power to allow the skids to settle on the dolly.

During the sidestep maneuver, the pilot felt a skid touch down momentarily; however, he heard an engine surge that was similar to what he experienced during takeoff. Simultaneously, the helicopter abruptly entered a steep nose-low attitude and right bank and began rotating to the right 180° opposite of the direction of landing. The pilot lowered the collective and pulled the cyclic aft, and the helicopter impacted terrain about 50 ft east of the dolly's original location. (During the accident sequence, the dolly had been lifted and rotated from its original orientation and position.) Neither flight paramedic reported hearing or feeling an anomaly with the engines at any point during the flight.

Postaccident examination of the helicopter and its engines revealed no evidence of preimpact mechanical malfunction or failure. The flight and throttle controls operated normally during postaccident testing. Both engines were removed from the helicopter and operated in an

engine test cell. The engines produced normal power, and an uncommanded engine surge could not be duplicated when the engines were operated at various power settings.

Several witness marks were observed on the left edge, right top, and underside of the dolly, portions of which were painted yellow. Examination of the helicopter's skids revealed evidence of yellow paint transfer on the inboard forward area of the left skid. Additional yellow paint transfer was observed on the right skid forward area and rearward top portions. The forward portion of the right skid had sheared off; yellow paint transfer and an indentation were observed within that portion.

Available evidence suggests that the helicopter skids were misaligned during the attempted landing on the dolly, and the right skid likely fell into the dolly's 3.5-ft-wide center gap, which resulted in a rapid loss of helicopter control. This likelihood is consistent with the pilot's report that the helicopter abruptly entered a nose-low attitude and right bank. The helicopter likely dragged the dolly and tractor during the bank to the right before breaking free of the dolly and impacting terrain. The dolly and its design is no longer sold by the manufacturer without a center plate that covers the gap.

The pilot had been awake for more than 17 hours and on duty for about 16 hours, and he was completing his fifth flight of the day as part of the operator's standard 24.3-hour shift. The length of the shift was based on the number of qualified pilots on staff and the need to maintain continuous operational coverage. The standard shift started at 0800 and ended at 0820 on the next day.

The landing maneuver required precision from the pilot under normal circumstances; however, he was attempting the landing at night (a time when limited lighting would be available) and at the end of a long duty day. In addition, the accident occurred about midnight, a time when the pilot likely would have been experiencing fatigue based on his sleep schedule.

Although the pilot reported that he was not fatigued, research has shown that performance decrements can occur after 17 hours of continuous wakefulness. Further, flying multiple flight segments can be more fatiguing than flying a single, longer segment. Therefore, the pilot was likely fatigued at the time of the accident due to his time since awakening, the time of day, and the multiple flight segments that he flew on the day of the accident. The operator's 24.3 hour shift practices did account for total task time limitations, however, other than a pilot self-reporting that they were fatigued, there were no limitations preventing pilots from initiating flights after being awake for total durations, or times during the night, when fatigue is commonly experienced.

Several factors contributed to the pilot's misalignment of the helicopter skids: the pilot's fatigue, the operator's scheduling practices, and the dolly's design with a center gap.

Following the accident, the operator reduced the standard scheduled shifts from 24.3 hours to a maximum of 16 hours and 12 hours where staffing permits. In addition, the operator no longer utilizes landing dollies that possess a center gap.

Probable Cause and Findings

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

The pilot's misalignment of the helicopter skids while landing on a dolly at night, which resulted in the skids becoming entangled with the dolly and a loss of control. Contributing to the accident was the pilot's fatigue as a result of the time the accident occurred, his total time awake, the multiple flight segments flown, and the operator's pilot scheduling practice. Also contributing to the accident was the center gap design of the landing dolly.

Findings

Aircraft	Descent/approach/glide path - Incorrect use/operation
Personnel issues	Situational awareness - Pilot
Personnel issues	Fatigue due to work schedule - Pilot
Organizational issues	Task scheduling/workload - Other government
Environmental issues	Dark - Contributed to outcome
Environmental issues	Ground equipment - Contributed to outcome

Factual Information

History of Flight

Landing-flare/touchdown	Landing area undershoot (Defining event)
Landing-flare/touchdown	Attempted remediation/recovery
Landing-flare/touchdown	Loss of control in flight
Landing-flare/touchdown	Collision with terr/obj (non-CFIT)

On March 6, 2022, at 2359 eastern standard time, an Airbus Helicopters Deutschland GmbH, MBB-BK 117-C-2 helicopter, N29VA, was substantially damaged when it was involved in an accident at Virginia Highlands Airport (VJI), Abingdon, Virginia. The pilot sustained serious injuries, and the two flight paramedics were not injured. The helicopter was operated by the Virginia Department of State Police (VSP) as a public aircraft.

The pilot reported that his duty day started at 0800 and that he had completed four air medical transportation flights before receiving a call at 2200 for a patient transfer from Lonesome Pine Hospital (VG50), Big Stone Gap, Virginia, to Holston Valley Hospital (3TN5), Kingsport, Tennessee. The flights from VJI to VG50 and from VG50 to 3TN5 occurred without incident.

During the return flight from 3TN5 to VJI, the pilot reported that, on liftoff, he “slowly pulled up on the collective,” and “the helicopter became light on the skids.” The pilot then noticed “what sounded like a surge in the engines,” and the engine power needles “surged upward.” The pilot asked the flight paramedic seated in the front seat whether he heard the noise, but he could not recall whether the paramedic responded to the question. (After the accident, the paramedic reported that he heard the pilot’s question but that he did not hear the engine surge.) The pilot continued the liftoff into a hover, evaluated the engine instruments, and noted normal indications. The helicopter then proceeded en route to VJI without incident.

At VJI, the pilot conducted a visual approach to runway 6 and entered a hover taxi via a taxiway that led straight toward the VSP ramp hangar, and landing dolly . When the helicopter entered the ramp environment, the pilot completed a pedal turn to orient the helicopter 180° opposite the direction of the taxiway. The pilot then performed a side-step maneuver to align the skids and fuselage with reference points on the dolly and its tractor. The pilot reported that he saw the reference points, descended the helicopter to descend; afterward, he briefly felt what he thought was a skid touchdown on the dolly; simultaneously, the pilot heard what he thought was an engine surge similar to the one earlier in the flight.

The helicopter abruptly entered a nose-low attitude and right bank, causing the helicopter to become oriented opposite the direction that it had been facing for landing. The pilot observed terrain and hangars ahead, so he applied aft cyclic and abruptly lowered the collective. The

helicopter subsequently impacted terrain. Figure 1 provides an overview of the helicopter's flight track and sidestep maneuver to land on the dolly.

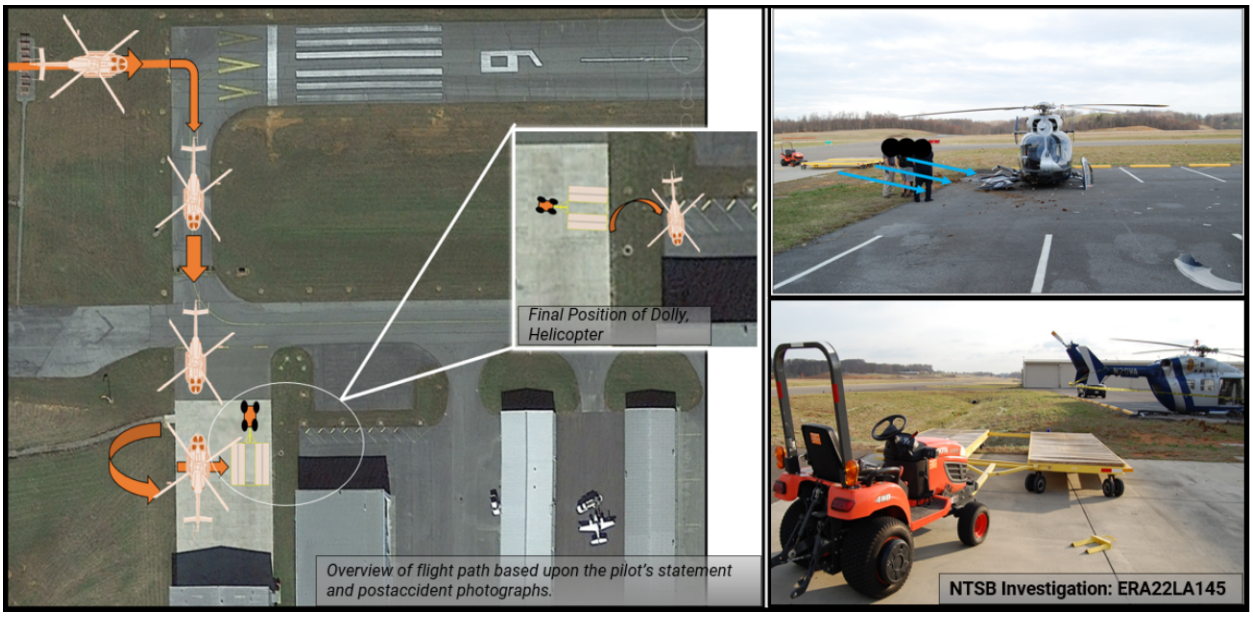

Figure 1 - Overview of the flight track to land on the dolly along with postaccident photographs (Source: Virginia State Police).

The helicopter came to rest upright, the skids had collapsed, and the dolly was found near the area where the helicopter impacted terrain. The helicopter came to rest about 50 ft to the east of the original dolly position. The engines continued to run afterward. The pilot shut down the helicopter, and he and flight paramedics had no difficulties evacuating. Neither flight paramedic reported hearing or feeling an anomaly with the engines at any point during the flight.

Postaccident examination of the helicopter and its engines revealed no evidence of preimpact mechanical malfunction or failure. The flight and throttle controls operated normally during postaccident testing. Both engines were removed from the helicopter and operated on an engine test cell. The engines produced normal power, and an uncommanded engine surge could not be duplicated when the engines were operated at various power settings.

The landing dolly, portions of which were painted yellow, sat 18 inches from the ground on wheels and was manufactured with an open center gap that was 3.5 ft wide. Figure 2 provides an overview of the landing dolly (shown in yellow) and shows how the accident helicopter would look atop it when properly positioned.

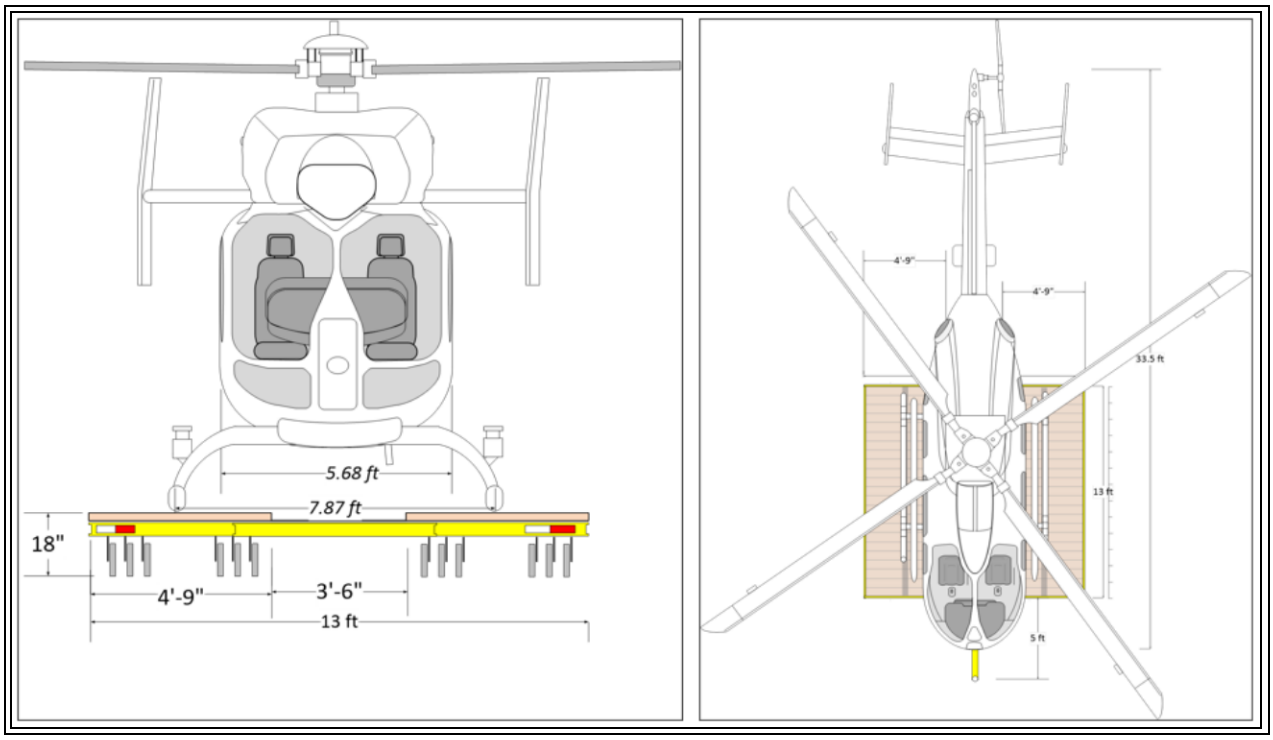

Figure 2- Forward view of the helicopter and top-down view of the dolly with the helicopter atop (Source: Airbus Helicopters). Note: The three-dimensional model was developed using National Transportation Safety Board measurements.

The landing dolly sustained impact-related twisting and deformation. Several witness marks were observed on the left edge, right top, and underside of the dolly. Examination of the helicopter's skids revealed evidence of yellow paint transfer on the inboard forward area of the left skid. Additional yellow paint transfer was observed on the right skid forward area and rearward top portions. The forward portion of the right skid had sheared off; yellow paint transfer and an indentation were observed within that portion.

The landing dolly manufacturer reported that the center-gap style was about 10- to 12-years old at the time of the accident. The manufacturer reported that, about 2015, the dolly's standard equipment included a center metal plate to prevent helicopters or their occupants from falling into the center gap. The VSP aviation division commander reported that the base's replacement dolly was equipped with a center plate.

According to the VSP aviation division commander, VJI was one of three operating bases in the state. The base's primary missions were public emergency medical evacuation flights (Med-Flight) and law enforcement operations; all flight operations were conducted with public aircraft as public-use operations. Such operations were not required to comply with 14 *Code of Federal Regulations* Part 91 or 135.

Review of the VSP scheduling standard operating procedures found that pilots assigned to Med-Flight operations worked 24.3-hour duty shifts. The length of the shift was based on the number of qualified pilots on staff and the need to maintain continuous operational coverage.

The standard Med-Flight shift started at 0800 and ended at 0820 on the next day. On the day of the accident, the pilot awoke at home at 0630 and arrived at VJI about 0800 to begin his 24.3-hour shift. The pilot reported that his total task time was 8 hours 27 minutes during five mission flights (including the accident flight). (The standard operating procedures defined task time as the time necessary to complete the flight, including preflight, the flight, postflight, and postflight paperwork. Supervisor approval was required to exceed 10 hours of task time.

The pilot's total duty period, from the time that he began his shift at 0800 to the accident time, was 15 hours 59 minutes. The pilot's total time awake on the day of the accident was 17 hours 29 minutes, and he did not take a nap during this period.

During postaccident interviews, the pilot reported that he could not recall exceeding 10 hours of task time while working with VSP. The pilot reported "no pressure" from supervisors to accept a mission if he was tired. The pilot added that, if he had felt tired before the accident flight, he would have reported that to his supervisors, and he would not have conducted the flight. The pilot thought that fatigue was not a factor in the accident and recalled that, even though he flew multiple flights on the day of the accident he did not "feel too bad" then.

The VSP aviation division commander reported that, after the accident, multiple scheduling procedures had been revised. He reported that VSP eliminated 24.3-hour pilot shifts at each Med-Flight base and that VJI currently conducts 12-hour pilot shifts with 24 hours of mission coverage. VSP pilots at other bases work shifts up to 16 hours until additional pilots can be hired and trained.

Pilot Information

Certificate:	Commercial	**Age:**	53,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	June 23, 2021
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 10, 2020
Flight Time:	2548 hours (Total, all aircraft), 615 hours (Total, this make and model), 2456 hours (Pilot In Command, all aircraft), 28 hours (Last 90 days, all aircraft), 18 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Airbus Helicopters	**Registration:**	N29VA
Model/Series:	MBB-BK 117 C-2 NO SERIES	**Aircraft Category:**	Helicopter
Year of Manufacture:	2010	**Amateur Built:**	
Airworthiness Certificate:	Normal; Transport	**Serial Number:**	9374
Landing Gear Type:	None; Skid	**Seats:**	5
Date/Type of Last Inspection:	December 2, 2021 Annual	**Certified Max Gross Wt.:**	7905 lbs
Time Since Last Inspection:	85.5 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	3650.2 Hrs at time of accident	**Engine Manufacturer:**	Turbomeca
ELT:	C126 installed, not activated	**Engine Model/Series:**	Arriel 1E2
Registered Owner:	VIRGINIA DEPARTMENT OF STATE POLICE	**Rated Power:**	691 Horsepower
Operator:	VIRGINIA DEPARTMENT OF STATE POLICE	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	VJI,2070 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	00:15 Local	**Direction from Accident Site:**	176°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	0 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.09 inches Hg	**Temperature/Dew Point:**	14°C / 10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Kingsport, TN (3TN5)	**Type of Flight Plan Filed:**	None
Destination:	Abingdon, VA (VJI)	**Type of Clearance:**	None
Departure Time:	23:41 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	VIRGINIA HIGHLANDS VJI	**Runway Surface Type:**	
Airport Elevation:	2087 ft msl	**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Serious, 2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious, 2 None	**Latitude, Longitude:**	36.683111,-82.038971

Administrative Information

Investigator In Charge (IIC):	Gerhardt, Adam
Additional Participating Persons:	Richard Brady; FAA/ FSDO; Charleston, WV Axel Rokohl; German Federal Bureau of Aircraft Accident Investigation; Braunschweig, OF Erell Verleyen ; Bureau d'Enquêtes et d'Analyses (BEA France); Paris, OF Shawn T. Rivard; Virginia State Police; Richmond, VA
Original Publish Date:	June 8, 2023
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=104725