

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, DC 20594

HUMAN PERFORMANCE

SPECIALIST'S FACTUAL REPORT

September 5, 2018

I. ACCIDENT

Operator: Air Methods Corporation, dba Kids Flight
Aircraft: BK 117 B2, N238BK
Location: Perryville, MO
Date: July 1, 2017
Time: 2036 central daylight time (CDT)¹
NTSB #: CEN17FA252

II. PARTICIPANTS²

Specialist: Katherine Wilson
National Transportation Safety Board
Washington, DC

Participant: Chihoon Shin
National Transportation Safety Board
Washington, DC

Participant: Jim Silliman
National Transportation Safety Board
Washington, DC

Participant: Jason Quisling
Air Methods
Greenwood Village, CO

Participant: Michael Stacey
Air Methods
Englewood, CO

¹ All times are reported in local time unless otherwise noted.

² Not all participants were present for all activities.

III. SUMMARY

On July 1, 2017, about 2036 central daylight time, a Messerschmitt-Bolkow-Blohm BK 117 B2, N238BK, helicopter, landed hard and rolled over during an emergency landing to a field near Perryville, Missouri. The pilot, two crew members, and a passenger received minor injuries, and the helicopter sustained substantial damage. The helicopter was owned and operated by Air Methods Corporation, doing business as Kids Flight, as a 14 Code of Federal Regulations Part 135 medical flight. Visual meteorological conditions prevailed at the time of the accident, and a company visual flight rules flight plan was filed. The flight originated from the St. Francis Medical Center (MO50), Cape Girardeau, Missouri, about 2019 and was en route to the St. Louis Children's Hospital (2MU1), St. Louis, Missouri.

IV. DETAILS OF THE INVESTIGATION

The Human Performance Specialist was assigned to the investigation on August 29, 2017, to support the ongoing investigation. Investigative activities included conducting interviews, gathering relevant documentation, and participating in an observational study of an exemplar aircraft. Information relevant to the pilot's pre-accident activities and health; caution and warning panel lights; company training and procedures; and post-accident testing are contained in this factual report.

1.0. History of flight

According to the pilot, he arrived for duty at 1840 on July 1, 2017, and did his preflight of the helicopter. He went into the office about 1857 and was notified of a pending flight. He signed into the company's 411 system to get his flight release at 1900. He waited for his flight release before accepting the flight. He requested a 15-minute delay to complete the paperwork and check the weather. After accepting the flight, he met the crew at the helicopter and conducted a briefing. He then did a walkaround and got in the helicopter, did his standard run-up, and asked the crew if they were ready for takeoff. The crew flew about 25 minutes to St. Francis Medical Center in Cape Girardeau to pick up a patient.

After landing, the pilot released the crew and shut down the helicopter. The pilot did a walkaround and the paperwork for the next leg of the flight. The pilot thought they were on the ground about 35-40 minutes.

The patient was loaded about 2020 and the flight departed from Cape Girardeau for St. Louis. The pilot did a standard run-up and turned the cockpit instrument lighting to "full bright" before taking off. The flight was reportedly uneventful until about 17-18 minutes from Cape Girardeau when the helicopter made a "sudden yaw to the left, with a sudden real sharp bump upward."

The pilot heard the engines winding down and saw the N1s were below 40 percent and decreasing. He also saw three lights on the annunciator panel – number 1 engine low, number 1 generator and battery discharge light. The pilot reported that the helicopter suddenly pitched up again and he applied right forward cyclic, right pedal, and reduced the collective to full down to

“get the aircraft into an autorotative descent.” He maintained the autorotative descent, adjusting his flight path to avoid ground obstacles. There was a ditch near his intended touchdown point so he attempted to float over the ditch but experienced “rotor decay” in ground effect causing the helicopter to fall from about 10 feet off the ground. The pilot thought the helicopter touched down right skid low before both skids touched down and then rolled over. The pilot stated he pulled the power levers to stop and told everyone to egress. After exiting the helicopter, the pilot noticed fuel spilling from the bottom of the helicopter. He returned to the cockpit to turn off all electrical and fuel switches. The pilot assisted the flight medic and nurse while waiting for emergency services to arrive.

2.0. Pilot information³

The pilot had a 2nd class medical certificate dated February 21, 2017, with the limitation “Must wear corrective lenses. Not valid for any class after 2/28/18.”⁴

2.1. Recent activities

The pilot was on duty for the 16 days prior to the accident, in training or working the day shift (0700-1900)⁵; he had 24 hours off before he began working a night shift (1900-0700) on the day of the accident.

It was typical to work 10 days when they were short pilots which they were because pilots were going through training. He would come off his shift then cover their shift.

The day of the accident he slept until about 1130 and did routine activities. He left for work about 1830 and arrived at work about 1840; his duty day was scheduled to start at 1900.

His typical sleep routine when working the day shift or when off duty was to go to bed between 2200 and 2230; he would wake up between 0500 and 0530. In the 3 days preceding the accident, there was nothing out of the ordinary from his routine sleep schedule. He would nap occasionally and reported that he had taken a nap in the 3 days preceding the accident but did not when or its duration. He had no problems sleeping and did not experience excessive tiredness during the day.

When he worked the night shift, he would come home in the morning and try to be in bed before 0800 then would wake up about 1400 or 1500. He would do routine family activities before getting ready for work.

He did not drink alcohol, smoke tobacco products or use illicit drugs.

3.0. Medical and pathological information

³ The pilot’s information was documented through his interview (see attachment 1) and FAA and company records.

⁴ The pilot received an Assisted Special Issuance (ASI) for obstructive sleep apnea, dated May 5, 2017. The ASI noted the pilot had “excellent compliance” with use of a CPAP (continuous positive air pressure) device.

⁵ The pilot was off duty June 11-14, 2017. He was in training June 15-17, 19-20. He worked his normal schedule June 18, 21, 29-30. He picked up a colleague’s duty day June 22-28 and received overtime pay for hours worked.

The pilot was tested for drugs and alcohol about 16 hours after the accident.⁶ The results were negative.

4.0. Caution and Warning Panel Lights

The Ahlers Aerospace, Inc. *Instruction for Continued Airworthiness* (Doc. E99-138), page 6, stated in part:

(D) Caution & Warning Panel – The Caution & Warning Annunciator panel contain amber and red message segments, which are covered by a clear plastic lens. The original lens is covered by a bezel and infrared reducing filter, using the existing hardware. This filter lens does not appreciably change the colors during daylight and night operations, aided or unaided.

The Ahlers Aerospace, Inc. *Cockpit Infrared Filter System* (Doc. E99-151), page 4, Section 1 – General, stated, in part:

The Ahlers Aerospace Cockpit NVG Filtering System is an adjunct to the standard aircraft lighting system. The system contains custom infrared filters installed externally over the cockpit instruments, caution & warning panel, communication & navigation radios, cockpit utility light, magnetic compass and cabin passenger lights. Lighted switches have been modified with IR reducing filters. Cockpit lighting is provided and controlled by the standard aircraft lighting system as installed by the manufacturer. When installed and maintained correctly, the lighting system makes the aircraft NVG compatible.

The Ahlers Aerospace, Inc. *Cockpit Infrared Filter System* (Doc. E99-151), page 4, Section 1 – General, further stated:

B. Caution and Warning Panel Annunciators:

A polycarbonate Infrared Filter Assembly is installed over the face of the existing Caution and Warning panel. The filter segments retain proper function and chromaticity of the caution or warning message segments when viewed during daytime or night operations.

The Ahlers Aerospace, Inc. *Cockpit Infrared Filter System* (Doc. E99-151), page 7, Section 4 – Normal Procedures, stated:

A. Preflight Check: When preparing for night operations add the following procedures to the standard preflight checks.

1. Check windshield, windows, and chin bubble windows for suitability (scratches, gazing, cleanliness, etc.).
2. NVG adjustment and alignment.
3. Adjust lighting as required.
4. Check NVIS lighting for light leakage and compatibility.

⁶ According to a memo from the Air Methods Anti-Drug and Alcohol Program Manager dated July 2, 2017, “the reason testing was not accomplished within the 8 hour timeframe was due to the remote location and time the incident occurred. Mobile DOT testing collectors were not available at the time of the event.

- B. In-flight Operations: Transition to aided operations from unaided operations (and vice versa) as necessary.

The Ahlers Aerospace, Inc. *NVIS Lighting/NVG Compatibility Checklist for Maintenance, Repair and Safety* (Doc. E99-196), page 4, stated:

NVIS Lighting System Ground Evaluation: Daylight Readability

Objectives of Evaluation:

- Evaluate instruments modified by the alternate lighting system, especially those which have been filtered.
- Ensure instruments/gauges are legible under daylight conditions. The NVIS modification should not upset the integrity of the basic aircraft.
- Ensure that color integrity is maintained; that "like" colors are uniform (i.e., there should not be different shades of Red, Amber, Green); and that "different" colors are distinguishable from one another. The NVIS modification should not cause confusion in identifying what type of segment light is illuminated (Warning vs. Caution, Caution vs. Advisory). In some cases, mixing NVIS colors with filtered displays results in different shades of the same colors. For instance, use of "NVIS Red" on Warning panels, together with "Aviation Red" on filtered display/instruments may result in the NVIS Red lights appearing orange or amber. Likewise, use of "NVIS Yellow" for Cautions with existing Amber caution lights creates confusion whether or not a light is a Warning or Caution. Additionally, some NVIS Yellow filters make Yellow or Amber caution lights have a green tinge that could be confusing with Green status lights.

Test Set-Up:

- The aircraft should be placed in full sunlight, preferably during late afternoon or early morning. The aircraft should be positioned such that the sun shines directly onto the instrument panel.
- The evaluator should familiarize himself with aircraft switch positions, locations, and functionality (such as battery/external power, navigation, communication, interior/exterior lighting, mission equipment, etc.) in preparation for the night evaluation.

The Ahlers Aerospace, Inc. *NVIS Lighting/NVG Compatibility Checklist for Maintenance, Repair and Safety* (Doc. E99-196), page 5, Table 1: Daylight Readability Checklist indicated each of the items were completed on November 10, 2008; the report was prepared by Larry Ahlers.

Ahlers Aerospace, Inc.			DOCUMENT NO. E99-196		
SUBJECT: FULL NVIS LIGHTING/NVG COCKPIT COMPATIBILITY CHECKLIST	FSCM/CAGE NO. 3MBT2	DATE 11/10/08	SECTION N/A	PAGE 5	REVISION A

TABLE 1: Daylight Readability Checklist

#	Item	Remarks/Comments
	NVIS Lighting System: A. Flood with Filters? B. Filtered Basic aircraft lighting? C. Post Lights? PHOTOGRAPH THE INSTRUMENT PANEL AND CONSOLES	✓
1.	PRIMARY FLIGHT/NAVIGATION DISPLAYS (§§2x.1321, 1323, 1381, 1543, 1545) - All displays are legible from pilot station(s) with sunlight shining on the display. Evaluate with sun shining on the displays from different angles. - Photograph the displays.	✓
2.	WARNING, CAUTION, & ADVISORY LIGHTS (2X.1322) A. Filtered Master Warning and CAWS warning lights that use NVIS Red are distinguishable as "Red" (not orange/amber) compared to other lights on the instrument panel. B. Filtered Master Caution and CAWS Caution lights are distinguishable as amber/yellow compared to NVIS Red lamps. These lights should not appear green, white or orange. C. All CAWS lighting is bright and distinguishable enough to capture pilot's attention at daylight levels and all sun angles. Photograph the CAWS panel and Master C/W lights.	✓
3.	POWER AND POWERPLANT INSTRUMENTS (§§2x.1337, 1381, 1549) Gauges with filtered material are legible including any colored arcs or limit markings with sun shining on them from different angles. The colors must be distinguishable through the filter material. Photograph filtered displays with questionable readability.	✓
4.	COMM / NAV / OTHER DISPLAYS All filtered displays should be legible from pilot station(s) with sunlight shining on the displays from different angles. Photograph filtered displays with questionable readability.	✓
5.	GENERAL Colors are uniform - there are not different shades of Red, Amber, Yellow, and Green amongst lit annunciators. Photograph lights if there are differences.	✓

5.0. Normal Procedures

The Air Methods BK117A/B Normal Procedures Checklist included the Before Starting Engines and Starting Engines checklists. Step 4 of the “Before Starting Engines” checklist stated “Interior/Exterior lighting...As Required.” Steps 11 and 12 of the “Starting Engines” checklist stated “Prime Pump Switches...OFF” and “Transfer Pump Switches...ON”, respectively. According to the accident pilot, Air Methods had a “do/verify policy” for completing checklists. See attachment 2 for the entire Normal Procedures Checklist.

6.0. Air Methods Training

Air Methods provided both recurrent flight and ground training to its pilots. Recurrent ground school training was provided via PowerPoint on subjects including but not limited to the Crew Compartment which discussed the annunciator panel and main switch panel; Fuel System which discussed the fuel transfer and fuel prime pumps, and the fuel monitoring system; and Night Vision Goggles which discussed night unaided and aided viewing, visual illusion sensitivity, and duty position responsibilities. The accident pilot completed recurrent ground school training on May 16, 2017, and his annual flight checkride on May 17, 2017. Excerpts from ground training modules can be found in attachment 3.

7.0. Post-accident Observational Study

NTSB investigators participated in an observational study at the Air Methods base in Joliet, Illinois, on October 23, 2017. The purpose of the study was twofold: (1) to allow the investigative team to familiarize themselves with the BK117A/B cockpit, instrument displays and start up procedures, and (2) to document the caution/warning panel under various lighting conditions during the BK117A/B startup procedures. The observations are detailed in attachment 4 to this report.

Katherine Wilson
Human Performance Investigator

Attachments

- 1.) Pilot Interview
- 2.) BK117A/B Normal Procedures Checklist
- 3.) Air Methods Training Excerpts
- 4.) Post-Accident Observational Study