National Transportation Safety Board
Office of Research and Engineering
Washington, DC 20594

ERA22FA343

MEDICAL

Specialist's Factual Report

May 9, 2023

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A. ACCIDENT

Location: Andalusia, Alabama
Date: July 29, 2022
Time: About 14:02 Central Daylight Time

B. MEDICAL SPECIALIST

Specialist: Turan Kayagil, MD, FACEP
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

1.0 Purpose

This investigation was performed to evaluate the surviving pilot for potentially impairing/incapacitating medical conditions and substances.

2.0 Methods

The pilot's Federal Aviation Administration (FAA) medical certification file, post-accident emergency treatment records, and selected personal medical records were reviewed. Results were reviewed from toxicological testing performed by the Federal Aviation Administration (FAA) Forensic Sciences laboratory of specimens collected during the pilot's initial post-crash hospital care. The pilot underwent a United States Department of Transportation (DOT) post-accident urine drug test one day after the crash; the Medical Review Officer (MRO) report of this test was reviewed, as was the MRO report of a DOT pre-employment urine drug test. Selected National Transportation Safety Board (NTSB) investigator reports and relevant regulation and medical literature were also reviewed.

D. FACTUAL INFORMATION

1.0 FAA Medical Certification File

According to his FAA medical certification file, the 47-year-old male pilot's last aviation medical examination before the crash was on April 21, 2022. At that time, he reported 3,100 total civilian flight hours. He was 70 inches tall and weighed 164 pounds.[1] He reported no medication use or active medical conditions (he had

[1] This height and weight are similar to the heights (67-70 inches) and weights (163-165 pounds) documented in hospital records from the day of the crash/following day.

reported a history of seasonal allergies at previous exams). No significant issues were identified, and he was issued a second-class medical certificate without limitation.

The copy of the FAA medical certification file reviewed for this investigation was made available for NTSB review on January 12, 2023, and contained a personal statement about the crash that the pilot provided to the FAA. The pilot stated that he had no symptoms before the flight and felt hydrated but ate light meals in the morning and afternoon and continued to stay hydrated. He stated that, about 15 minutes after departure, he started a normal descent for landing, and noticed feeling warm, observing perspiration on his wrist. He stated that he looked for an alternate landing area and heard the flight nurse call for him to "come up" or "pull up." That was the last detail he remembered before the crash. He stated that the only medication he had used prior to the crash had been bismuth subsalicylate for a stomach flu he had experienced 2 days prior.[2]

2.0 Toxicology

2.1 DOT Pre-Employment and Random Testing

The pilot underwent DOT pre-employment urine drug testing in August 2020. The MRO report of the results was reviewed. It documented that testing was negative for tested-for substances.[3]

According to an e-mail from the pilot's employer, the pilot had been enrolled in the employer's DOT random testing pool but had not been selected for random drug or alcohol testing during his employment prior to the crash.

2.2 Post-Crash FAA Toxicology

At the request of the NTSB, the FAA Forensic Sciences laboratory performed toxicological testing of specimens collected during the pilot's initial post-crash hospital care.[4] Ethanol was detected in blood at 0.024 g/dL and in urine at 0.08 g/dL.

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[2] Bismuth subsalicylate, sometimes marketed as Pepto-Bismol, is a medication available over the counter for treatment of upset stomach and diarrhea, and is not generally considered impairing.

[3] Tested-for substances on DOT urine drug testing are marijuana metabolites, cocaine metabolites, amphetamines, opioids, and phencyclidine (PCP), in accordance with 49 Code of Federal Regulations (CFR) § 40.85, as detailed at 49 CFR § 40.87. As described at 49 CFR Part 40 Subpart G, an MRO is a licensed physician trained to act as an independent and impartial "gatekeeper" in the drug testing process and to advocate for the accuracy and integrity of the process. The MRO provides a quality assurance review of the testing process for the specimens under the MRO's purview, and determines whether there are legitimate medical explanations for any non-negative laboratory results. After verifying results, the MRO provides a report to the employer of the results as verified. In the event of a positive laboratory result, if the MRO determines that a legitimate explanation for the result exists (such as a valid prescription or a drug administered during post-accident medical treatment), the MRO must report the verified result as negative.

[4] The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including

Benzoylecgonine was detected at 165 ng/mL in urine but was not detected in blood. Cocaethylene was detected in urine but not in blood.

A medication was detected that is commonly found in over-the-counter red-eye-relief drops and is not generally considered impairing. Additionally, two naturally occurring volatile substances were detected at levels too low to be impairing or to have specific significance. Also, two other drugs were detected that had been administered to the pilot during his prehospital care after the crash, as verified from hospital records.

According to hospital records, the pilot's initial hospital blood collection was at 15:39 Central Daylight Time (CDT) on the crash date, and his initial hospital urine collection was at 17:29 CDT on the crash date.

2.3 Post-Crash Hospital Toxicology

According to records from the pilot's post-crash hospital care, urine collected from the pilot at 17:29 CDT on the crash date underwent a hospital urine drug screening test. This screening test did not detect any tested-for substances.[5] The pilot was not tested for ethanol as part of his post-crash hospital care.

2.4 DOT Post-Accident Drug Testing

A urine specimen was collected from the pilot on the afternoon of July 30, 2022 (the day after the crash), for DOT post-accident drug testing. The MRO verified the results as being negative for tested-for substances.[3] The pilot did not undergo DOT post-accident alcohol testing.

2.5 Descriptions of Detected Substances

Ethanol is the intoxicating alcohol in beer, wine, and liquor. It can adversely affect judgment, coordination, perception, cognition, and vigilance. Even in a small amount, ethanol can impair pilot performance, and the number and seriousness of

toxins, prescription and over-the-counter medications, and illicit drugs. Some of these substances are listed at https://jag.cami.jccbi.gov/toxicology.

[5] The laboratory report listed tested-for substances as: amphetamines, barbiturates (secobarbital), benzodiazepines (oxazepam), cannabinoid (11-nor-delta 9-THC-9), cannabinoid (carboxylic acid), cocaine (benzoylecgonine), methadone, opiates (morphine), PCP, propoxyphene, and cotinine. The stated threshold for detection of benzoylecgonine was 300 ng/mL.

pilot errors tends to increase with blood ethanol level.[6,7,8] FAA regulation imposes strict limits on flying after consuming ethanol, including prohibitions on piloting a civil aircraft within 8 hours of drinking ethanol or while having a blood ethanol level of 0.04 g/dL or greater.[9] Once ethanol has been absorbed into the bloodstream, it is typically eliminated at a rate of about 0.01 to 0.035 g/dL per hour, depending on individual metabolism.[10]

Benzoylecgonine is an inactive metabolite of cocaine.[11] Cocaine (which was not detected in this case) is a stimulant drug that is commonly used illicitly by recreational users who may snort it, smoke it, inject it, ingest it, or apply it to gums / mucous membranes. Users may seek euphoric effects, feelings of increased alertness, strength, and decisiveness, and appetite suppressant effects. Cocaine is also occasionally used in healthcare settings as a topical agent to produce local anesthesia and vasoconstriction during ear, nose, and throat (ENT) procedures. Cocaine is a Schedule II controlled substance under federal law, with a high potential for abuse and dependence.[11,12] It is a prohibited drug under FAA drug and alcohol regulations for on-demand operators.[13]

Impairing effects that occur early after recreational cocaine use may include dizziness, restlessness, poor impulse control, and increased risk taking. Attention, perception, coordination, decision making, and task execution may be impaired by effects of cocaine and cocaine withdrawal. Cocaine has a myriad of physiological effects, ranging from stimulant effects during use to depressant effects during withdrawal, and the drug increases the risk of cardiovascular problems such as heart

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[6] Federal Aviation Administration. Aeromedical factors. In: *Pilot's Handbook of Aeronautical Knowledge*. FAA H 8083 25B. Oklahoma City: United States Department of Transportation, Federal Aviation Administration, Airman Testing Standards Branch, AFS-630; 2016. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/19_phak_ch17.pdf. Accessed May 5, 2023.

[7] Federal Aviation Administration. Fitness for flight. In: *Aeronautical Information Manual (AIM) Basic with Change 1, 2, and 3*. Washington, DC: United States Department of Transportation, Federal Aviation Administration, Mission Support Services, Policy Directorate, AJV−P; 2022. https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap8_section_1.html. Accessed May 5, 2023.

[8] Cook CCH. Alcohol and aviation. *Addiction*. 1997;92(5):539-555.

[9] 14 *Code of Federal Regulations* § 91.17.

[10] Jones AW. Evidence-based survey of the elimination rates of ethanol from blood with applications in forensic casework. *Forensic Sci Int*. 2010;200(1-3):1-20. doi:10.1016/j.forsciint.2010.02.021.

[11] Couper FJ, Logan BK. Drugs and Human Performance Fact Sheets. National Highway Traffic Safety Administration. DOT HS 809 725. April 2014 (Revised). https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf. Accessed May 5, 2023.

[12] Drug Enforcement Administration. Cocaine. Drug Fact Sheets. https://www.dea.gov/factsheets/cocaine. Updated March 3, 2023. Accessed May 5, 2023.

[13] 14 *Code of Federal Regulations* Part 120.

attack, abnormal heartbeat, and stroke.[11,14] Cocaine is metabolized with an elimination half-life of about 35 to 90 minutes in blood (possibly longer in chronic heavy users), and the major inactive metabolite benzoylecgonine is excreted from blood with an average elimination half-life of about 7.5 hours.[15] Benzoylecgonine may be detected in urine for days after last cocaine use. Symptoms from crashing or withdrawing after stopping cocaine use may last for days to weeks.[11]

Cocaethylene is a psychoactive substance that forms in a person's body when cocaine is metabolized in the presence of ethanol. Cocaethylene has effects similar to those of cocaine and has a slightly longer elimination half-life in blood. Some people who use cocaine and ethanol together may seek to enhance, prolong, or modulate cocaine's effects.[16,17]

3.0 Personal Medical Records

3.1 Hospital Treatment Records

According to hospital treatment records, the pilot was transported to the emergency department (ED) by air ambulance following the crash. According to the ED physician's note, a coworker of the pilot who had been onboard the accident helicopter told the provider that the pilot had passed out, and that he had been commenting about not feeling good for the past couple of days. According to the trauma surgery physician's note, the pilot stated that he had become lightheaded and dizzy while operating the helicopter, and then had awoken on the ground after the crash.[18] The pilot stated that he had experienced nausea, vomiting, and diarrhea multiple times the day before the crash, and believed that he might be dehydrated. The pilot reported no home medications, no illicit drug or heavy alcohol use, and no significant medical history.

The pilot was admitted to the hospital and underwent evaluation for injury and syncope (loss of consciousness). His workup included laboratory tests,

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[14] Schwartz BG, Rezkalla S, Kloner RA. Cardiovascular effects of cocaine. *Circulation*. 2010;122(24):2558-2569. doi:10.1161/CIRCULATIONAHA.110.940569.

[15] Moolchan ET, Cone EJ, Wstadik A, Huestis MA, Preston KL. Cocaine and metabolite elimination patterns in chronic cocaine users during cessation: plasma and saliva analysis. J Anal Toxicol. 2000;24(7):458-466. doi:10.1093/jat/24.7.458..

[16] Jones AW. Forensic drug profile: cocaethylene. *J Anal Toxicol*. 2019;43(3):155-160. doi:10.1093/jat/bkz007.

[17] Pergolizzi J, Breve F, Magnusson P, LeQuang JK, Varrassi G. Cocaethylene: when cocaine and alcohol are taken together. *Cureus*. 2022;14(2):e22498. doi:10.7759/cureus.22498.

[18] According to the cardiologist's notes from the hospitalization, the pilot stated that he had become warm and sweaty prior to losing consciousness and had turned on the air conditioner; he remembered being told twice to pull up.

electrocardiography, cardiac monitoring, and imaging. Imaging included computed tomography (CT) scans of his head, face, cervical spine, chest, abdomen, and pelvis, as well as CT angiography of his neck. The pilot underwent magnetic resonance imaging of his cervical and thoracic spine and was seen in consultation by a neurosurgery provider for a neck injury which was diagnosed as a ligamentous sprain. The pilot also underwent an echocardiogram and was seen in consultation by a cardiologist for syncope.

No definitive cause of the pilot's syncope was identified. Laboratory studies showed a mild elevation of troponin (a potential marker of damage to heart cells) on the day after the crash. The next day, the consulting cardiologist noted that the echocardiogram was normal and there were no positive findings from a cardiology standpoint. The pilot was cleared for discharge from a cardiology perspective with a plan in place for outpatient 30-day cardiac event monitoring. The cardiologist noted that tilt-table testing for vasovagal syncope might be considered once the pilot's neck injury was recovered.

The pilot was noted to have elevation of the liver transaminase enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) on the day of admission, to 522 IU/L and 295 IU/L, respectively.[19] CT imaging showed diffuse fatty liver without evidence of traumatic liver injury or other liver or biliary abnormality. AST and ALT were re-checked the next day and remained abnormal but showed some improvement to 282 IU/L and 197 IU/L.

The pilot was discharged from the hospital 3 days after the crash, on August 1, 2022, with instructions to follow up with his primary care provider. Neurosurgery office follow-up for his neck injury was also planned.

3.2 Primary Care Records

The NTSB requested records from the pilot's most recent primary care provider for a period from 3 years before the crash date through January 19, 2023.

According to the reviewed records, the pilot's only visit to the primary care provider before the crash was on April 29, 2022, to establish care as a new patient. At that time, the pilot reported a history of seasonal allergies (treated with over-the-counter medication that is not generally considered impairing) and obstructive sleep apnea (OSA).[20] The provider noted that the pilot was compliant with continuous

[19] Normal reference ranges for AST and ALT were given by the hospital laboratory as 5-34 IU/L and 11-55 IU/L, respectively. The remainder of the comprehensive metabolic panel was normal, as were coagulation studies and a complete blood count (including red blood cell mean corpuscular volume of 87.2 fL).

[20] In OSA, a person's upper airway soft tissues collapse during sleep, causing the person to have repeated episodes during which breathing temporarily stops (apnea) and/or becomes ineffective (hypopnea), potentially resulting in nonrestorative and fragmented sleep. FAA medical certification in OSA is subject to case-by-case FAA

positive airway pressure (CPAP) treatment for his obstructive sleep apnea.[21] The pilot denied daytime drowsiness but reported difficulties sleeping during the day when switching between day and night work shifts, and the provider prescribed a sedating medication to be used as needed for sleep. Of note, labs collected on the visit date included normal AST and ALT results.

The reviewed records documented one primary care visit after the crash date. This visit was November 2, 2022, for follow up and routine medical management. The provider noted the pilot's helicopter crash and injury. However, neither the pilot's syncope nor his abnormal hospital liver enzymes were among the topics addressed at the primary care visit.

The primary care records documented that the pilot reported that he did not use any illicit or recreational drugs, and that his alcohol consumption was occasional. The primary care records did not include any CPAP usage reports.

3.3 Other Medical Records

The NTSB requested post-crash records from the practice of the cardiologist who consulted on the pilot in the hospital, through September 13, 2022. These records did not document any post-discharge follow-up visit by the pilot with the cardiology practice in that time frame. However, records from the pilot's outpatient 30-day cardiac event monitoring were contained in the post-crash cardiology records, the hospital records, and the FAA medical certification file. The records from the cardiac event monitoring indicated that the pilot underwent monitoring over a period from August 1, 2022, to August 30, 2022, with a total time monitored of 10 days 17 hours. A monitoring report signed by a cardiac electrophysiology physician noted no significant abnormal findings or pilot-reported symptoms.

The pilot provided the NTSB with documentation pertaining to his OSA from his ENT physician. An April 2023 letter from the ENT physician stated that the pilot was followed for OSA, had been using an oral appliance since 2015, was compliant with the oral appliance, and was getting relief from his mild OSA. A March 2023 office visit note added that the pilot had not had a recent sleep study. There was no indication in the ENT documentation that the oral appliance had any recording or monitoring capability.

review of the underlying condition and the effectiveness of treatment.

[21] The information that the pilot was using CPAP conflicts with documentation from the pilot's ENT physician stating the pilot's OSA was being treated with an oral appliance (see D.3.3 below).

E. SUMMARY OF MEDICAL FACTS

The 47-year-old male pilot's last aviation medical examination before the crash was on April 21, 2022. At that time, he reported no medication use or active medical conditions. He was issued a second-class medical certificate without limitation. According to records from the pilot's ear, nose, and throat physician, the pilot had mild obstructive sleep apnea (OSA) and was getting relief from an oral appliance which he had been using to treat the OSA since 2015. The pilot did not report his OSA to the Federal Aviation Administration (FAA).

Following the crash, the pilot was hospitalized. He was evaluated for his injuries as well as for a syncopal episode that he and a witness onboard the helicopter reported had precipitated the crash. His hospital evaluation did not identify a definitive cause of his syncope. He was discharged and underwent outpatient 30-day cardiac event monitoring, which did not find any significant abnormality.

The FAA Forensic Sciences laboratory performed toxicological testing of specimens collected during the pilot's initial post-crash hospital care. Ethanol was detected in blood at 0.024 g/dL and in urine at 0.08 g/dL. Benzoylecgonine, an inactive metabolite of cocaine, was detected at 165 ng/mL in urine but was not detected in blood. Cocaethylene, a substance that forms in a person's body when cocaine is metabolized in the presence of ethanol, was detected in urine but not in blood. According to hospital records, the pilot's initial hospital blood collection had been at 15:39 Central Daylight Time (CDT) on the crash date, and his initial hospital urine collection had been at 17:29 CDT on the crash date.

On the day of the pilot's hospitalization, he was noted to have elevation of the liver enzymes AST and ALT, to 522 IU/L and 295 IU/L, respectively. Imaging showed diffuse fatty liver without evidence of traumatic liver injury. The liver enzymes showed some improvement the next day. The pilot was not tested for ethanol while he was in the hospital. The pilot's liver enzymes and syncope were not among the topics addressed during his November 2022 follow up visit with his primary care provider.

Submitted by:

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