



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

September 30, 2021

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Medical Officer

A. ACCIDENT INFORMATION

Identification: WPR20LA295

Location: Three Rivers, California

Date: September 4, 2020

B. GROUP IDENTIFICATION

No group was formed for the medical evaluation in this accident.

C. DETAILS OF INVESTIGATION

1. Purpose

This investigation was performed to evaluate the two pilot-rated aircraft occupants for medical conditions, the use of medications/illicit drugs, and the presence of toxins. According to the National Transportation Safety Board (NTSB) investigator in charge (IIC), one of the occupants owned the accident aircraft, but the occupants' roles on the accident flight are unknown.

2. Methods

The Federal Aviation Administration (FAA) medical case review and the autopsy reports for both occupants were reviewed. Toxicology results and selected pre-accident primary care records were reviewed for the aircraft owner. Investigator reports and relevant regulation and medical literature were also reviewed.

3. Findings

a. Pilot-Rated Aircraft Owner/Occupant

I. Medical Case Review

According to the FAA medical case review, the 45-year-old male pilot-rated owner had his last aviation medical examination on May 29, 2007. At that time, he was 33 years old and reported 630 total civilian flight

hours. He reported no medical conditions or medication use. He reported a history of driving under the influence (DUI) in 1994. No significant issues were identified, and he was issued a third-class medical certificate without limitation. That certificate was expired after May 31, 2012, according to FAA regulation.¹

II. Pre-accident Primary Care Records

Selected records were reviewed from a primary care practice that the pilot-rated owner visited to establish care on August 10, 2020. According to the note from that visit, the pilot-rated owner was 68 inches tall and weighed 192 pounds. His documented medical conditions were high blood pressure and heart failure (diminished effectiveness of the heart's ability to pump blood) with dilation of the heart muscle. According to the visit note, he had undergone a heart ultrasound in January 2020 that showed severe mitral valve regurgitation (leakiness) and markedly diminished left ventricular ejection fraction.² The primary care provider noted that the pilot-rated owner had previously been evaluated by a cardiologist, who had discussed the possibility of heart transplantation. No specific symptoms were noted at the primary care visit. The primary care provider documented that the pilot-rated owner was on the medications torsemide, spironolactone, furosemide, sacubitril/valsartan, and metoprolol, which are prescription medications used in the treatment of heart failure and high blood pressure. Those medications are generally not considered impairing. The provider documented a plan to refer the pilot-rated owner to a cardiologist for additional heart failure evaluation.

III. Autopsy

The pilot-rated owner's autopsy was performed by Microcorre Diagnostic Laboratory at the request of the Tulare County Coroner. According to the autopsy report, the cause of death was severe thermal burn injuries. According to the report, the heart weighed 480 grams (upper limit of normal is roughly 470 grams for a male of the pilot's body weight).³ The heart muscle was normal in appearance, with normal ventricular wall thicknesses, normal cardiac chamber sizes, and normal appearing valves. Marked congestion was noted in the lower lobes of both lungs.⁴ The autopsy did not identify any other significant natural disease.

¹ Federal Aviation Administration. Modification of certain medical standards and procedures and duration of certain medical certificates. *Fed Regist.* 2008;73(143):43059-43066.

² Left ventricular ejection fraction (LVEF) is a measure of how effectively the heart squeezes out the blood being pumped to the body. The pilot-rated owner's LVEF was documented as 20-25%, which is consistent with his heart failure diagnosis (normal LVEF is about 50-70%).

³ Skurdal AC, Nordrum IS. A retrospective study of postmortem heart weight in an adult Norwegian population. *Cardiovasc Pathol.* 2016;25(6):461-467. doi:10.1016/j.carpath.2016.07.003.

⁴ Lung congestion refers to a buildup of fluid, one possible cause of which is heart failure.

IV. Toxicology

At the request of the Tulare County Coroner, Central Valley Toxicology, Inc., performed toxicology testing on specimens from the pilot-rated owner. Methamphetamine was detected at 11,000 nanograms per milliliter (ng/mL) in chest blood. The methamphetamine metabolite amphetamine was also detected in chest blood, at 350 ng/mL. Ethanol was detected in chest blood at 0.04 grams percent, which is about 0.04 grams per deciliter (g/dL); ethanol was not detected in vitreous fluid. Metoprolol was detected in chest blood.

The FAA Forensic Sciences Laboratory also performed toxicological testing on specimens from the pilot-rated owner.⁵ Methamphetamine was detected at 13,398 ng/mL in cavity blood and 987 ng/mL in liver. The methamphetamine metabolite amphetamine was detected at 306 ng/mL in cavity blood and 48 ng/mL in liver. Ethanol was detected at 0.032 g/dL in cavity blood and was not detected in vitreous fluid. Metoprolol, torsemide, and valsartan were detected in cavity blood and liver.

V. Descriptions of Detected Substances

Methamphetamine is a central nervous system stimulant drug. Amphetamine is a metabolite of methamphetamine, and is also a central nervous system stimulant. Both methamphetamine and amphetamine are available as prescription drugs used to treat attention deficit hyperactivity disorder, narcolepsy, and occasionally obesity; each may also be a metabolite of certain other medications. Methamphetamine and amphetamine are Drug Enforcement Administration (DEA) Schedule II controlled substances, with a high potential for abuse and dependence. At low doses used as part of appropriate medical treatment, the drugs may improve reaction time, cognitive function, and fatigue, but may cause people to make higher-risk choices. At higher doses, the drugs may have a variety of impairing effects on psychomotor function, cognition, and perception. The drugs typically carry warnings that they may impair the ability to engage in potentially hazardous activities such as driving a motor vehicle. Such impairment can result from drug or withdrawal

⁵ The FAA Forensic Sciences Laboratory tests specimens for over 1,300 compounds including toxins, prescription and over-the-counter medications, and illicit drugs; information about these compounds can be found at the Civil Aerospace Medical Institute WebDrugs website (<https://jag.cami.jccbi.gov/toxicology>).

effects.^{6,7,8} Both methamphetamine and amphetamine are considered “do not issue/do not fly” medications by the FAA.⁹

In addition to being used medicinally, methamphetamine and amphetamine are frequently produced illicitly and abused recreationally by ingestion, snorting, smoking, rectal insertion, or injection. Seeking an intense euphoric effect, abusers typically use much higher doses than are used medicinally. Effects from methamphetamine/amphetamine abuse follow a typical pattern. An abuser may experience early psychological effects including euphoria, excitation, exhilaration, rapid ideas and speech, increased sex drive, restlessness, hallucinations, delusions, psychosis, sleeplessness/reduced tiredness, an increased feeling of alertness, a heightened sense of wellbeing, a feeling of increased physical strength, and poor impulse control. Early physiologic effects may include rapid heart rate, increased blood pressure, increased breathing rate, elevated temperature, dry mouth, abdominal cramps, twitching, dilated pupils, faster reactions, and increased strength. Later, as initial drug effects wear off, an abuser may experience dysphoria, restlessness, agitation, itching, nervousness, paranoia/hypervigilance, irritability, anxiety/nervousness, aggressive/violent impulses, diminished coordination, hallucinations, delusions, scattered thoughts, psychosis, fatigue, and drug craving. Measuring an abuser’s drug level does not help distinguish whether the person is experiencing early versus late effects.⁶

Ethanol is the intoxicating alcohol in beer, wine, and liquor. It can impair judgment, psychomotor performance, cognition, and vigilance.^{10,11,12} FAA

⁶ 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 September 15, 2021.

⁷ National Institutes of Health National Library of Medicine. Methamphetamine hydrochloride. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=f31f580f-1f08-4a0f-b078-0b9e3308f712>. Updated August 15, 2019. Accessed September 15, 2021.

⁸ National Institutes of Health National Library of Medicine. Amphetamine sulfate. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=79b9db39-7cdc-5607-f0ce-ac2a2cfd59d5>. Updated March 1, 2020. Accessed September 15, 2021.

⁹ An open prescription for any DEA controlled substance is disqualifying for FAA medical certification, and the FAA states that pilots should not fly while using any such substance. [Federal Aviation Administration. Guide for aviation medical examiners: pharmaceuticals (therapeutic medications) do not issue - do not fly. Federal Aviation Administration website. <https://www.faa.gov/go/dni>. Updated February 19, 2021. Accessed September 15, 2021.]

¹⁰ Cohen JP, Quan D. Alcohols. In: Tintinalli JE, Ma OJ, Yealy DM, et al., eds. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 9th ed. New York, NY: McGraw-Hill Education; 2020:1222-1232.

¹¹ Spitz WU. Forensic aspects of alcohol. In: Spitz WU, Spitz DJ, eds. *Spitz and Fisher's Medicolegal Investigation of Death: Guidelines for the Application of Pathology to Crime Investigation*. 4th ed. Springfield, IL: Charles C Thomas; 2006:1218-1229.

¹² Cook CCH. Alcohol and aviation. *Addiction*. 1997;92(5):539-555.

regulation imposes strict limits on flying after consuming ethanol, including a prohibition on acting as a crewmember of a civil aircraft while having a blood ethanol level of 0.04 g/dL or greater.¹³ Ethanol also can be produced by microbes in a person's body after death.¹¹

b. Pilot-Rated Non-Owner Occupant

I. Medical Case Review

According to the FAA medical case review, the 82-year-old male pilot-rated non-owner had his last aviation medical examination on June 26, 2020. At that time, he was 78 inches tall, weighed 173 pounds, and reported 38,000 total civilian flight hours. He reported no active medical conditions or medication use. No significant issues were identified, and he was issued a second-class medical certificate without limitation.

II. Autopsy (External Examination)

The pilot-rated non-owner's autopsy was performed by Microcorre Diagnostic Laboratory at the request of the Tulare County Coroner. Due to the severity of thermal injury, the autopsy was limited to an external examination only and no toxicology specimens were available. According to the autopsy report, the cause of death was blunt force trauma injuries.

D. SUMMARY OF MEDICAL FINDINGS

1. Pilot-Rated Aircraft Owner/Occupant

The 45-year-old male pilot-rated owner had his last aviation medical examination on May 29, 2007. At that time, he was 33 years old and reported no medical conditions or medication use. No significant issues were identified, and he was issued a third-class medical certificate without limitation. That certificate had expired.

The pilot-rated owner visited a primary care provider on August 10, 2020. According to the visit note, he had high blood pressure and heart failure with heart muscle dilation, severe mitral valve regurgitation, and a markedly diminished left ventricular ejection fraction. The primary care provider noted that the pilot-rated owner had previously been evaluated by a cardiologist, who had discussed the possibility of heart transplantation. The primary care provider documented that the pilot-rated owner was on the prescription medications torsemide, spironolactone, furosemide, sacubitril/valsartan, and metoprolol, which are generally not considered impairing.

¹³ Office of the Federal Register. 14 CFR 91.17. Electronic Code of Federal Regulations. <https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-91/subpart-A/section-91.17>. Updated September 13, 2021. Accessed September 15, 2021.

The pilot-rated owner's autopsy was performed by Microcorre Diagnostic Laboratory at the request of the Tulare County Coroner. According to the autopsy report, the cause of death was severe thermal burn injuries. The heart weight was 480 grams, and marked congestion was noted in the lower lobes of both lungs. The autopsy did not identify any other significant natural disease.

Two labs performed toxicology testing on specimens from the pilot-rated owner. Both labs detected methamphetamine in cavity blood (11,000 ng/mL and 13,398 ng/mL); one lab detected methamphetamine in liver (987 ng/mL). Both labs detected amphetamine (a metabolite of methamphetamine) in cavity blood (350 ng/mL and 306 ng/mL); one lab also detected amphetamine in liver (48 ng/mL). Both labs detected ethanol in cavity blood (0.04 g/dL and 0.032 g/dL), and neither lab detected ethanol in vitreous fluid. Both labs detected metoprolol in cavity blood. One lab also detected metoprolol in liver, as well as torsemide and valsartan in cavity blood and liver.

2. Pilot-Rated Non-Owner Occupant

The 82-year-old male pilot-rated non-owner had his last aviation medical examination on June 26, 2020. At that time, he reported no active medical conditions or medication use. No significant issues were identified, and he was issued a second-class medical certificate without limitation.

The pilot-rated non-owner's autopsy was performed by Microcorre Diagnostic Laboratory at the request of the Tulare County Coroner. Due to the severity of thermal injury, the autopsy was limited to an external examination only and no toxicology specimens were available. According to the autopsy report, the cause of death was blunt force trauma injuries.