



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

August 19, 2021

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Medical Officer

A. ACCIDENT: ERA21LA102; Vineland, New Jersey

Date/Time: January 11, 2021; 12:30 p.m. (EST)
Aircraft: Kolb Firestar, unregistered
Injuries: 1 Fatal
Flight Conducted under Part 91 personal flight

B. GROUP IDENTIFICATION

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

C. DETAILS OF INVESTIGATION

Purpose

This investigation was performed to evaluate the pilot for medical conditions, the use of medications/illicit drugs, and the presence of toxins.

Methods

The Federal Aviation Administration (FAA) medical case review and the pilot's autopsy and FAA Forensic Sciences Laboratory toxicology report¹ were reviewed. Other pertinent scientific and regulatory issues were reviewed.

FAA Medical Case Review

According to the FAA medical case review, the 64-year-old male pilot had an expired third class medical certificate with the limitation that he must have available glasses for near vision. His most recent FAA medical certification exam was in 2004 and at that time he reported he had accrued 300 total flight hours. He was 71 inches tall and weighed 172 pounds. He reported having hepatitis C and taking interferon and amantadine for treatment. No other significant medical concerns or issues were identified.

¹ See <https://jag.cami.jccbi.gov/toxicology/> for a complete list of tested-for substances.

Autopsy

According to the Office of Gloucester-Camden-Salem Medical Examiner, Sewell, New Jersey autopsy report, the cause of the pilot's death was multiple injuries and the manner of death was accident. The pilot measured 68 inches and weighed about 170 pounds. No significant natural disease was identified.

Toxicology

Toxicology testing performed for the medical examiner's office on the pilot's heart blood detected, marijuana's primary psychoactive compound delta-9-tetrahydrocannabinol (THC) at 5.4 nanograms per milliliter (ng/mL), THC's inactive metabolite carboxy-delta-9-tetrahydrocannabinol (THC-COOH) at 60 ng/mL, methamphetamine at 830 ng/mL, amphetamine at 90 ng/mL, and hydrocodone at 25 ng/mL. FAA Forensic Sciences Laboratory toxicology testing detected THC at 3.1 ng/mL, THC's active metabolite 11-hydroxy-delta-9-THC at 0.9 ng/mL, THC-COOH at 31.1 ng/mL, methamphetamine at 708 ng/mL, amphetamine at 73 ng/mL, hydrocodone at 27 ng/mL, hydrocodone's active metabolite dihydrocodeine, and zolpidem at 9 ng/mL. These compounds were also detected in the pilot's lung, muscle, or liver tissue.

Information on detected drugs

The marijuana plant (*Cannabis* species) contains chemicals called cannabinoids; *tetrahydrocannabinol (THC)* is the primary psychoactive cannabinoid compound. THC's mood-altering effects include euphoria and relaxation. In addition, marijuana causes alterations in motor behavior, time and space perception, and cognition. Significant performance impairments are usually observed for at least 1-2 hours following marijuana use, and residual effects have been reported up to 24 hours.²

THC is rapidly metabolized but the rate of metabolism is not linear and depends on the means of ingestion (smoking, oil, and edibles), potency of the product, frequency of use, and user characteristics. Concentrations of THC peak at the end of smoking and often below 5 ng/mL at three hours. The primary metabolite, *11-hydroxy-delta-9-THC*, is equally psychoactive, but is rapidly metabolized to the non-psychoactive metabolite *THC-COOH*. THC is fat soluble, so is stored in fatty tissues and can be released back into the blood long after consumption. So, while the psychoactive effects may last a few hours, THC can be detected in the body for days or weeks. Very little THC is excreted in urine. Instead, THC-COOH can be found in urine days to weeks after the last use of the drug. Thus, both blood and urine test results do not necessarily reflect recent use and cannot be used to prove that the user was experiencing effects of the drug at the time of testing.^{6,3}

Methamphetamine is a Schedule II controlled substance that is a central nervous system stimulant. It is medically indicated to treat attention deficit hyperactivity disorder (ADHD),

² National Highway Traffic Safety Administration. April 2014 (revised). Drugs and Human Performance Fact Sheets. Cannabis/Marijuana. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf>

³ Compton, R. July 2017. Marijuana-Impaired Driving - A Report to Congress. (DOT HS 812 440). Washington, DC: National Highway Traffic Safety Administration. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf>

narcolepsy, and obesity.⁴ Recreationally, methamphetamine is abused for its euphoric effects and to increase alertness and relieve fatigue. Symptoms of recreational methamphetamine use are more intense with inhalation or injection than with oral administration. In the early phase users experience euphoria, excitation, motor restlessness, reduced fatigue or drowsiness, increased alertness, and poor impulse control. As the initial effects wear off, in the late phase, users commonly experience dysphoria, restlessness, agitation, and nervousness. Effects last 4 to 8 hours with some effects lasting up to 12 hours.⁵

Oral doses of methamphetamine prescribed for indicated medical conditions and dosages produce blood concentrations in the range of 20 to 50 ng/mL. Blood concentrations above 200 ng/L indicate recreational use. The timing of peak blood methamphetamine concentrations depends on the method: oral administration at 3 hours, smoking in a few minutes, and injection almost immediately.⁶ Methamphetamine is metabolized to amphetamine. Methamphetamine's elimination half-life is between 6 to 15 hours and amphetamine has a half-life between 10 and 13 hours.⁷

Hydrocodone is a semisynthetic opioid analgesic indicated to treat moderate to severe pain. Hydrocodone is often prescribed in combination with acetaminophen; one commonly marketed combination is Vicodin. The therapeutic range is between 10 and 50 ng/mL. *Dihydrocodeine* is a commonly found active metabolite of hydrocodone, with an average concentration in blood about 29% of the hydrocodone value. As an opioid, hydrocodone carries a warning for its high risk of addiction, abuse, and misuse. Adverse reactions on the central nervous system from hydrocodone include drowsiness, mental clouding, anxiety, and impairment of mental and physical performance. Dihydrocodeine carries similar warnings and adverse reactions as hydrocodone.^{8,9,10,11}

Zolpidem is a sedative-hypnotic drug indicated for the short term treatment of insomnia and is commonly marketed as Ambien. The therapeutic range is between 25 and 300 ng/mL and it has a half live between 1.4 and 4.5 hours. Zolpidem is a central nervous system depressant and carries

⁴ National Institutes of Health (NIH). U.S. National Library of Medicine (NLM). Updated 2/12/20. [DailyMed - METHAMPHETAMINE HYDROCHLORIDE tablet \(nih.gov\)](https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?id=20222)

⁵ National Highway Traffic Safety Administration (NHTSA). April 2014 (Revised). Drugs and Human Performance Fact Sheets. Methamphetamine (and Amphetamine). <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drughumanperformfs.pdf>

⁶ NHTSA. April 2014. *Ibid*.

⁷ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Methamphetamine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=161>

Amphetamine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=11>

⁸ NIH. NLM. Updated 9/26/18. [DailyMed - HYDROCODONE BITARTATE AND ACETAMINOPHEN-hydrocodone bitartrate, acetaminophen tablet \(nih.gov\)](https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?id=20222)

⁹ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Hydrocodone. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=73>

Dihydrocodeine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=48>

¹⁰ Saitman, A, RL Fitzgerald, IM McIntyre. 2015. Evaluation and comparison of postmortem hydrocodone concentrations in peripheral blood, central blood and liver specimens: A minimal potential for redistribution. *Forensic Science International* 247:36-40.

¹¹ Cardia, L, G Calapai, D Quattrone, C Mondello, V Arcoraci, F Calapai, C Mannucci, E Mondello. 2018. Preclinical and clinical pharmacology of hydrocodone for chronic pain: A mini review. *Frontiers in Pharmacology* 9:1122. doi: [10.3389/fphar.2018.01122](https://doi.org/10.3389/fphar.2018.01122)

the warning that adverse reactions may include drowsiness, prolonged reaction time, dizziness, blurred/double vision, reduced alertness, and impaired driving the morning after therapy.^{12,13}

D. SUMMARY OF MEDICAL FINDINGS

The 64-year-old male pilot had an expired third class medical certificate with the limitation that he must have available glasses for near vision; his most recent exam was in 2004. According to the autopsy report, the cause of death was multiple injuries and the manner of death was accident. No significant natural disease was identified.

Toxicology testing of the pilot's blood detected THC (5.4 and 3.1 ng/mL), 11-hydroxy-delta-9-THC (0.9 ng/mL), THC-COOH (60 and 31.1 ng/mL), methamphetamine (830 and 708 ng/mL), amphetamine (90 and 73 ng/mL), hydrocodone (25 and 27 ng/mL), dihydrocodeine, and zolpidem (9 ng/mL). These compounds were also detected in the pilot's lung, muscle, or liver tissue.

¹² NIH. NLM. Updated 9/5/19 [DailyMed - ZOLPIDEM TARTRATE tablet, film coated \(nih.gov\)](https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?id=225)

¹³ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs. Zolpidem.
<https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=225>