

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA21FA317

MEDICAL

Specialist's Factual Report

November 21, 2022

A. ACCIDENT

Location: Argyle, New York
Date: August 7, 2021
Time: 18:10 Local
Airplane: Rotorway Exec 162F; N162KJ

B. MEDICAL SPECIALIST

Specialist Michelle Watters, MD, PhD, MPH
National Transportation Safety Board, RE-1
Washington, DC

C. DETAILS OF THE 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 reports¹ were reviewed. Other relevant medical and regulatory issues were reviewed.

D. FACTUAL INFORMATION–PILOT

1.0 FAA Medical Case Review

According to the FAA medical certification file, at the time of the accident, the 56-year-old male pilot did not hold a current FAA medical certificate; his last valid medical certificate was a third class medical certificate issued in 2000. His most recent FAA medical certification examination was in 2014. At that exam he reported use of citalopram for seasonal depression and was deferred to FAA. FAA denied his medical certification in 2016 due to his history of bipolar disorder, depression, alcohol dependence, and neurocognitive deficits.

¹ The FAA Forensic Sciences Laboratory has the capability to test for more than 1,300 substances including toxins, common prescription and over-the-counter medications, and illicit drugs. <https://jag.cami.jccbi.gov/toxicology/>

2.0 Autopsy

According to the autopsy report from the Washington County Coroner, Fort Edward, New York, the pilot's cause of death was severe traumatic blunt force injuries, and the manner of death was accident. No significant natural disease was identified.

3.0 Toxicology

Toxicology testing performed by the FAA Forensic Sciences Laboratory on the pilot's cavity blood was positive for ethanol at 0.012 grams per deciliter (gm/dL); ethanol was not detected in his urine. N-propanol was detected in his cavity blood but not in his urine. The sedating antihistamine diphenhydramine was detected at 88 nanograms per milliliter (ng/mL) in his cavity blood and urine. The antidepressant trazodone was detected in his cavity blood at 101 ng/mL and in his urine at 476 ng/mL. The inactive metabolite of the benzodiazepine clonazepam, 7-aminoclonazepam, was detected in his cavity blood at 17 ng/mL and in his urine at 344 ng/mL. The primary major psychoactive compound of cannabis, delta-9-tetrahydrocannabinol (THC), was detected in the pilot's cavity blood at 6.2 ng/mL and his urine at 9.4 ng/mL. THC's psychoactive metabolite 11-hydroxy-delta-9-THC (11-OH-THC) was detected in his cavity blood at 1.2 ng/mL and in his urine at 199.2 ng/mL. THC's inactive metabolite, carboxy-delta-9-tetrahydrocannabinol (THC-COOH), was detected in his iliac blood at 58.3 ng/mL and in his urine at 160.3 ng/mL.

Ethanol

Ethanol is a social drug commonly consumed by drinking beer, wine, or liquor. It acts as a central nervous system depressant; it impairs judgment, psychomotor functioning, and vigilance. Ethanol is water soluble, and after absorption it quickly and uniformly distributes throughout the body's tissues and fluids. The distribution pattern parallels water content and blood supply of the tissue. Ethanol can be produced after death by microbial activity; sometimes in conjunction with other alcohols, such as *propanol*. Extensive trauma increases the spread of bacteria and raises the risk of ethanol production after death.²

Diphenhydramine

Diphenhydramine is a sedating antihistamine (commonly marketed as Benadryl) and is available over the counter in many products used to treat colds, allergies, and insomnia. Diphenhydramine carries the warning that use of the medication may impair mental and physical ability to perform potentially hazardous tasks, including driving or operating heavy machinery. The therapeutic range is 50 to 100 ng/mL and it has a half-life of 3 to 14 hours.³ Diphenhydramine undergoes

² Kugelberg, FC and AW Jones. 2007. Interpreting results of ethanol analysis in postmortem specimens: a review of the literature. *Forensic Science International* 165(1):10-29.

³ Schulz, M, A Schmoldt, H Andresen-Streichert, and S Iwersen-Bergmann. 2020. Revisited:

postmortem redistribution and central levels may be two to three times higher than peripheral levels.⁴ FAA provides guidance on wait times before flying after using this medication; post-dose observation time is 60 hours and the medication is not for daily use.^{5,6}

Trazodone

Trazodone is a medication prescribed to treat depression, anxiety, and insomnia. *Trazodone* can be sedating. It comes with this warning, “*Trazodone* hydrochloride tablets may cause somnolence or sedation and may impair the mental and/or physical ability required for the performance of potentially hazardous tasks. Patients should be cautioned about operating hazardous machinery, including automobiles, until they are reasonably certain that the drug treatment does not affect them adversely.” *Trazodone* is metabolized to an active metabolite, mCPP. *Trazodone* may enhance the response to alcohol, barbiturates, and other CNS depressants. The therapeutic range is 500 to 2,500 ng/mL and it has a half-life of 4 to 7 hours.^{7,8}

Major depression itself is associated with significant cognitive degradation, particularly in executive functioning.⁹ The cognitive degradation may not improve even with remission of the depressed episode, and patients with severe disease are more significantly affected than those with fewer symptoms or episodes.^{10,11} The FAA finds depression and use of antidepressants to be disqualifying, although pilots who can demonstrate they are stable in remission on a small set of medications may be issued a special issuance medical certificate. Bipolar disorder, which is associated

Therapeutic and toxic blood concentrations of more than 1100 drugs and xenobiotics. Additional File 1. *Critical Care* 24(1):195 doi: 10.1186/s13054-020-02915-5.

⁴ Han, E, E Kim, H Hong, S Jeong, J Kim, S In, H Chung, and S Lee. 2012 Evaluation of postmortem redistribution phenomena for commonly encountered drugs. *Forensic Sci Int.* 219(1-3):265-271.

⁵ FAA. 11/13/19. What over-the-counter (OTC) medications can I take and still be safe to fly? OK-20-0302

https://www.faa.gov/licenses_certificates/medical_certification/media/OTCMedicationsforPilots.pdf

⁶ FAA. 7/2/21. [AllergyAntihistamineImmunotherapyMedication.pdf \(faa.gov\)](#)

⁷ National Institutes of Health. US National Library of Medicine. [DailyMed - TRAZODONE HYDROCHLORIDE tablet \(nih.gov\)](#). Updated 6/29/21. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=71961ab1-951d-1493-f76c-2ff25cca2a85>

⁸ FAA. Updated 1/16/19. Forensic Toxicology Drug Information. *Trazodone*. <http://jag.camii.jccbi.gov/toxicology/DrugDetail.asp?did=200>

⁹ Snyder HR. 2013. Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: A meta-analysis and review. *Psychol Bull.* 139(1):81-132.

¹⁰ Nakano Y, Baba H, Maeshima H, Kitajima A, Sakai Y, Baba K, Suzuki T, Mimura M, Arai H. 2008. Executive dysfunction in medicated, remitted state of major depression. *J Affect Disord.* 111(1):46-51.

¹¹ Paelecke-Habermann Y, Pohl J, Leplow B. 2005. Attention and executive functions in remitted major depression patients. *J Affect Disord.* 89(1-3):125-135.

with alterations of mood between manic or hypomanic and depression, is also a disqualifying psychiatric condition for flying.¹²

Clonazepam

Clonazepam, commonly marketed as Klonopin, is indicated for use in treating seizure disorder and panic disorder. The therapeutic range for clonazepam is 5 to 70 ng/mL, and its half-life ranges from 19 to 60 hours. Clonazepam's inactive major metabolite is *7-aminoclonazepam*. Clonazepam carries the warning that use of the medication may impair the physical and mental ability to perform hazardous tasks.¹³

Cannabis

The marijuana plant (*Cannabis species*) contains chemicals called cannabinoids; *delta-9-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. Peak concentrations are often 100 to 200 ng/mL.¹⁴ A study of 14 frequent and 11 occasional users found that cannabis significantly impaired psychomotor function up to 3.5 hours after smoking, although more impairment was reported in occasional smokers.¹⁵

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 are below 5 ng/mL at three hours. The primary metabolite of THC, *11-OH-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

¹² FAA. Last modified 5/25/22. Guide for Aviation Medical Examiners, Decision Considerations - Aerospace Medical Dispositions. Item 47. Psychiatric Conditions - Psychiatric Conditions - Psychiatric Conditions Table of Medical Dispositions. [Guide for Aviation Medical Examiners \(faa.gov\)](https://www.faa.gov/aviation_medical_examiners/guide)

¹³ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Clonazepam. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=258>

Amino-clonazepam (7-). <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=257>

¹⁴ 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>

¹⁵ Desrosiers, NA, JG Ramaekers, E Chauchard, DA Gorelik, and MA Huestis. 2015. Smoked cannabis' psychomotor and neurocognitive effects in occasional and frequent smokers. *Journal of Analytical Toxicology* 39:252-261.

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.¹⁶

E. SUMMARY OF MEDICAL FACTS

The 56-year-old male pilot did not hold a current FAA medical certificate; his last valid medical certificate was a third class medical certificate issued in 2000. At his FAA medical certification examination in 2014, his medical certification was deferred to FAA; in 2016, FAA denied his medical certification due to his history of bipolar disorder, depression, alcohol dependence, and neurocognitive deficits. According to the autopsy report, the pilot's cause of death was severe traumatic blunt force injuries, and the manner of death was accident. No significant natural disease was identified.

Toxicology testing detected ethanol in the pilot's blood at 0.012 grams per deciliter (gm/dL); no ethanol was detected in his urine. N-propanol was detected in his blood. Diphenhydramine, trazodone, and 7-aminoclonazepam were detected in his cavity blood at 88 nanograms per milliliter (ng/mL), 101 ng/mL, and 17 ng/mL, respectively; all three were also detected in his urine. Delta-9-tetrahydrocannabinol (THC) was detected in the pilot's cavity blood at 6.2 ng/mL and his urine at 9.4 ng/mL. 11-hydroxy-delta-9-THC (11-OH-THC) was detected in his cavity blood at 1.2 ng/mL and in his urine at 199.2 ng/mL. Carboxy-delta-9-tetrahydrocannabinol (THC-COOH) was detected in his iliac blood at 58.3 ng/mL and in his urine at 160.3 ng/mL.

Submitted by:

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Medical Officer, RE-1

¹⁶ 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>