



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

MEDICAL FACTUAL REPORT

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Medical Officer

A. ACCIDENT: CEN16FA114 - Abilene, Texas

On March 1, 2016, about 0830 central standard time, an experimental amateur-built Ohlgren RV 6A airplane, N419B, impacted terrain during takeoff from runway 35 at the Elmdale Airpark (82TS), near Abilene, Texas. The airline transport pilot and his passenger were fatally injured. The impact with terrain destroyed the airplane. The airplane was registered to and operated by the pilot as a 14 *Code of Federal Regulations* (CFR) 91 personal flight. Day visual meteorological conditions prevailed in area of the accident site about the time of the accident, and the flight was not operated on flight plan. The flight was destined for Henderson, Nevada, and was originating from 82TS at the time of the accident.

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 pilots for any medical conditions, the use of any medications/illicit drugs, and the presence of any toxins.

Methods

The FAA medical case review, pilot's FAA medical certification file, FAA Bioaeronautical Sciences Research Laboratory toxicology reports, and autopsy reports.

Pilot - Left Seat - Fatal

FAA Medical Case Review

According to the FAA medical case review, the 63-year-old male pilot was 66 inches tall and weighed 200 pounds. His most recent FAA medical certification exam was dated February 16, 2016. At that time, he reported 8,010 total flight hours. The pilot reported he used no medications and the examination did not identify any significant medical issues. The pilot was issued a second class medical certificate with a limitation requiring him to have glasses available for near vision.

Personal Medical Records

The pilot's most recent VA mental health evaluation was for refill of medications and transfer of care to a new VA system, dated January 13, 2016 (one month before his most recent FAA medical certification examination.) During the evaluation, the patient reported having had at least 5 psychiatric hospitalizations since 2011. His diagnoses included depression, a personality disorder, anxiety disorder, and a history of sporadic cannabis abuse. He reported he had been a pilot for airlines in cargo but now was on disability. Following evaluation, the psychiatrist documented the pilot's current diagnoses included major depression, recurrent, currently mild; generalized anxiety disorder, and a history of insomnia. The treatment plan included cognitive, supportive, and behavioral therapy. His prescribed medications on that visit were bupropion and venlafaxine for depression; and buspirone, clonazepam, and hydroxyzine for anxiety.

Bupropion is an antidepressant used to treat depression and help patients quit smoking, often marketed with the names Wellbutrin and Zyban.¹ It carries two warnings: 1) a dose dependent risk of seizures; and 2) may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery).² Bupropion's half-life ranges from 4 to 24 hours; it is transformed to a less active metabolite hydroxybupropion. In depressed patients, the maximum improvement in symptoms occurred at plasma levels between 50 and 100 ng/ml.³

Buspirone is a prescription anti-anxiety medication marketed as Buspar. It carries the following precaution: "Studies indicate that buspirone hydrochloride tablets are less sedating than other anxiolytics and that it does not produce significant functional impairment. However, its CNS effects in any individual patient may not be predictable. Therefore, patients should be cautioned about operating an automobile or using complex machinery until they are reasonably certain that buspirone treatment does not affect them adversely."⁴

Clonazepam is a Schedule IV benzodiazepine sedative used in the treatment of seizures and panic disorder. It carries the warning, "Since clonazepam produces CNS depression, patients receiving this drug should be cautioned against engaging in hazardous occupations requiring mental alertness, such as operating machinery or driving a motor vehicle."⁵

Hydroxyzine is a prescription sedating antihistamine used for treatment of anxiety and severe itching marketed under various names including Vistaril and Atarax. It

¹ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2018. BUPROPION. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=c192f7bf-f38c-0f11-bd14-61f3e8e3bc28> Accessed 01/02/2018

² Federal Aviation Administration. Forensic Toxicology Drug Information. Bupropion. <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=20> Accessed 01/02/2018

³ Baselt RC Disposition of Toxic Drugs and Chemicals in Man, 10th Edition. Bupropion. Pages 300-303 Copyright 2014, Biomedical Publications, Seal Beach, California.

⁴ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2018. BUSPAR- buspirone hydrochloride. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=33accd6b-10a6-5bd3-e054-00144ff88e88&audience=consumer> Accessed 01/02/2018

⁵ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2018. CLONAZEPAM. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=acbce0e8-5098-4785-943b-8bdb5ff17fab> Accessed 01/02/2018

carries the following precaution: "Since drowsiness may occur with use of this drug, patients should be warned of this possibility and cautioned against driving a car or operating dangerous machinery while taking [hydroxyzine]. Patients should be advised against the simultaneous use of other CNS depressant drugs, and cautioned that the effect of alcohol may be increased."⁶ Therapeutic levels range from 22 to 78 ng/ml. It is metabolized in the liver its half-life ranges from 12 to 27 hours and a primary metabolite is cetirizine (another sedating antihistamine).⁷ Blood hydroxyzine concentrations averaged 170 ng/ml in 10 persons arrested for impaired driving.⁸

Venlafaxine is a prescription antidepressant, anti-anxiety, anti-panic disorder medication marketed as Effexor. As with many anti-depressant medications, it carries a black box warning of clinical worsening of depression and emergence of suicidal thought and behaviors after starting medication.⁹ The medication is generally not considered impairing at therapeutic levels which are considered to range from 71 to 232 ng/ml. It is metabolized in the liver and metabolites include norvenlafaxine and a o-desmethylvenlafaxine; its half-life ranges from 30 to 120 hours.¹⁰

Medications found on scene

Examination of the airplane wreckage identified a plastic bag containing marijuana and three prescription pill bottles containing buspirone for anxiety, hydroxyzine for anxiety, and venlafaxine for mood. The bottles were labeled with the pilot's name and filled by a VA outpatient clinic pharmacy.

Autopsy

The Tarrant County Medical Examiner determined the cause of death was massive blunt force trauma and the manner was consistent with accident. In addition, the autopsy identified moderate to severe coronary artery atherosclerosis. The heart weighed 439 grams; average for a male his weight is 371 grams with a range from 281 to 489 grams.¹¹ Atheromatous deposits narrowed the left anterior descending coronary artery by 20%, the circumflex by 60% and the right coronary by 70%. The undamaged cardiac muscle was described as grossly unremarkable. Additionally, the autopsy documented hepatic steatosis (fatty liver) and mild peripheral atherosclerosis.

⁶ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2017. VISTARIL- hydroxyzine pamoate. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=c271f97f-040e-492b-9194-2c8b74675a95&audience=consumer> Accessed 09/11/2017

⁷ Baselt RC *Disposition of Toxic Drugs and Chemicals in Man*, 10th Edition. Hydroxyzine. Pages 1026-1027. Copyright 2014, Biomedical Publications, Seal Beach, California.

⁸ Jones AW et al. Concentrations of Scheduled Prescription Drugs in Blood of Impaired Drivers: Interpreting the Results. *Ther Drug Monit*; Volume 29, Number 2, April 2007

⁹ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2017. EFFEXOR XR- venlafaxine hydrochloride. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=53c3e7ac-1852-4d70-d2b6-4fca819acf26&audience=consumer> Accessed 09/12/2017

¹⁰ Baselt RC *Disposition of Toxic Drugs and Chemicals in Man*, 10th Edition. Venlafaxine. Pages 2099-2102. Copyright 2014, Biomedical Publications, Seal Beach, California.

¹¹ Kitzman DW, Scholz DG, Hagen PT, Ilstrup DM, Edwards WD. Age-related changes in normal human hearts during the first 10 decades of life. Part II (Maturity): A quantitative anatomic study of 765 specimens from subjects 20 to 99 years old. *Mayo Clinic Proc.*, 1988. 63(2): p. 137-46.

Toxicology¹²

The Tarrant County Toxicology Laboratory performed testing as part of the autopsy.¹³ Testing of a cavity blood specimen detected hydroxyzine at 8,298 ng/ml, venlafaxine at 20,393 ng/ml, and norvenlafaxine at 784 ng/ml. Additionally, a urine specimen was positive for hydroxyzine, venlafaxine, and norvenlafaxine. The urine also screened positive for tetrahydrocannabinol (THC), but confirmatory testing was not conducted. Descriptions of the drugs detected are in a following paragraph.¹⁴

FAA Bioaeronautical Sciences Research Laboratory toxicology testing detected tetrahydrocannabinol (THC), the primary psychoactive compound in marijuana, in lung at 1373 ng/ml, in brain at 22 ng/ml, in liver at 121 ng/ml, and in cavity blood at 56 ng/ml.¹⁵ Tetrahydrocannabinol carboxylic acid (THC-COOH), the primary inactive metabolite, was detected in lung at 102 ng/ml, in brain at 25 ng/ml, in liver at 1361 ng/ml, in urine at 807 ng/ml, and in cavity blood at 21ng/ml. Additionally, testing detected buspirone in urine, cetirizine in urine and cavity blood, hydroxyzine in urine, and venlafaxine and its metabolite o-desmethylvenlafaxine in muscle in liver.

Buspirone, hydroxyzine, and venlafaxine are described above. Marijuana is a psychoactive CNS depressant, illicit drug. Delta-9-tetrahydrocannabinol (THC) is the primary active chemical in marijuana with reported therapeutic levels as low as 1.00 ng/ml. THC has an inactive metabolite, 9-Carboxy-tetrahydrocannabinol (THC-COOH).¹⁶ Concentrations of parent drug (THC) and metabolite (THC-COOH) are very dependent on pattern of use as well as dose. Concentrations vary depending on the potency of marijuana and the way the drug is used; however, peak plasma concentrations of 100-200 ng/mL are routinely encountered shortly after smoking. Plasma concentrations of THC decline rapidly and are often less than 5.00 ng/mL at 3 hours. Most behavioral and physiological effects return to baseline levels within 3-5 hours after drug use, although some investigators have demonstrated residual effects in specific behaviors up to 24 hours, such as complex divided attention tasks. In long term users, even after periods of abstinence, selective attention (ability to filter out irrelevant information) has been shown to be adversely affected with increasing duration of use, and speed of information processing has been shown to be impaired with increasing frequency of use.¹⁷ Finally, THC is subject to postmortem redistribution which is the movement of the

¹² Drug levels were converted to ng/ml for comparison purposes

¹³ Tarrant County Toxicology laboratory toxicology laboratory screens for multiple drugs and toxins using ELISA. All drugs reported undergo confirmation by GC/MS (Gas Chromatography-Mass Spectrometry), LC/UV (Liquid Chromatography-Ultraviolet detection) and/or LC/MS (Liquid Chromatography-Mass Spectrometry). See <http://access.tarrantcounty.com/en/medical-examiner/sections/chemistry-and-toxicology-laboratory.html> for additional information.

¹⁴ According to the Tarrant County Chief Toxicologist, the laboratory does not typically quantitate THC levels in postmortem cases.

¹⁵ The FAA Bioaeronautical Sciences Research laboratory tests for more than 1300 substances including toxins, common prescription and over-the-counter medications as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0> for a complete listing.

¹⁶ Federal Aviation Administration. CAMI toxicology Drug Information for: Marijuana <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=154> Accessed 08/24/2017

¹⁷ National Highway Traffic Safety Administration. Drugs and Human Performance Fact Sheets. Marijuana. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf> Accessed 12/22/2017

drug from storage tissues back into the blood after death resulting in blood levels that may be higher than levels immediately prior to death.¹⁸

Buspirone, hydroxyzine, and THC are all central nervous system (CNS) depressants, in combination each drug may enhance the CNS depressant effects of the other drugs.¹⁹

Passenger - Right Seat - Fatal

FAA Medical Case Review

The 33-year-old male passenger did not have an FAA pilot or medical certificate.

Autopsy

The Tarrant County Medical Examiner's autopsy report documented the cause of death was massive blunt force trauma and the manner was accident. No significant natural disease was described.

Toxicology

Tarrant County Toxicology was conducted as part of the autopsy.¹³ Testing detected ethanol at 0.127 g/dl in femoral blood, 0.150 g/dl in vitreous, and 0.115 g/dl in urine. Additionally, the stimulants amphetamine and methamphetamine were detected in urine but not in femoral blood.

FAA Bioaeronautical Sciences Research Laboratory toxicology analysis detected ethanol at 0.126 g/dl in femoral blood, 0.141 g/dl in vitreous, and 0.126 g/dl in urine.²⁰ No drugs were detected in femoral blood.¹⁵

Ethanol is primarily a social drug that acts as a central nervous system depressant commonly found in beer, wine, and liquor. After ingestion and absorption, ethanol is quickly distributed throughout the body's tissues and fluids fairly uniformly. The distribution pattern parallels the water content and blood supply of each organ. It is also produced after death by microbial activity.²¹ In addition to impairing judgment, attention, and response times, ethanol, at doses between 0.06 gm/dL and 0.10 gm/dl blood alcohol concentration, significantly impairs the user's ability to maintain upright posture and balance. The exact etiology of this is unclear but it appears to be related to both the visual and mechanoreceptive sensations associated with upright posture.

D. SUMMARY OF MEDICAL FINDINGS

The 63-year-old male pilot was issued a second class medical certificate on February 16, 2016. On that examination he denied any medical concerns or the use of medications. Personal medical records from an examination in January 2016 documented a history of multiple psychiatric hospitalizations, recurrent major depression, currently mild; generalized anxiety disorder, and a history of insomnia. His prescribed medications included bupropion (considered potentially impairing) and venlafaxine (generally not considered impairing) for depression; and the potentially impairing medications buspirone, clonazepam, and hydroxyzine for anxiety. The Tarrant County Medical Examiner determined the cause of death was massive blunt force trauma and the manner

¹⁸ Holland MG, et al. Postmortem redistribution of Δ^9 -tetrahydrocannabinol (THC), 11-hydroxy-THC (11-OH-THC), and 11-nor-9-carboxy-THC (THCCOOH) *Forensic Sci Int.* 2011 October 10; 212(1-3): 247–251.

¹⁹ Lexicomp Online® 2017, Lexi-Comp Online™ Interaction Analysis, Hudson, Ohio: Lexi-Comp, Inc.; Accessed 09/12/2017

²⁰ The volatile concentrations are determined by headspace gas chromatography at a cut off of 10 mg/dL.

²¹ Federal Aviation Administration. CAMI toxicology Drug Information for: Ethanol <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=60> Accessed 9/12/2017

was consistent with accident. The report documented cardiomegaly (an enlarged heart) with moderate to severe coronary artery atherosclerosis but did not identify ischemic heart muscle damage. Tarrant County toxicology testing detected the potentially impairing sedating antianxiety medication hydroxyzine at 8,298 ng/ml; the antidepressant medication venlafaxine at 20,393 ng/ml and its metabolite norvenlafaxine at 784 ng/ml in cavity blood. FAA Bioaeronautical Sciences Research Laboratory toxicology testing detected the potentially impairing psychoactive compound tetrahydrocannabinol (THC) in lung at 1373 ng/ml, in brain at 22 ng/ml, in liver at 121 ng/ml, and in cavity blood at 56 ng/ml. Tetrahydrocannabinol carboxylic acid (THC-COOH), THC's primary inactive metabolite, was detected in lung at 102 ng/ml, in brain at 25 ng/ml, in liver at 1361 ng/ml, in urine at 807 ng/ml, and in cavity blood at 21ng/ml.

The 33-year-old male passenger was not a pilot. The Tarrant County Medical Examiner determined the cause of death was massive blunt force trauma and the manner was consistent with accident. Toxicology testing in two laboratories detected ethanol ranging from 0.126 - 0.127 g/dl in blood and 0.141 - 0.150 g/dl in vitreous.