

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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MEDICAL

Specialist's Factual Report

September 28, 2023

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. MEDICAL SPECIALIST.....	3
C. DETAILS OF THE INVESTIGATION	3
1.0 PURPOSE	3
2.0 METHODS.....	3
D. FACTUAL INFORMATION.....	3
1.0 FAA MEDICAL CASE REVIEW.....	3
2.0 AUTOPSY REPORT	3
3.0 TOXICOLOGY	4
3.1 FAA Toxicology Results.....	4
3.2 Description of Detected Substance	4
E. SUMMARY OF MEDICAL FACTS.....	5

A. ACCIDENT

Location: Forrest City, Arkansas
Date: October 31, 2021

B. MEDICAL SPECIALIST

Specialist Turan Kayagil, MD, FACEP
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Washington, DC

C. DETAILS OF THE INVESTIGATION

1.0 Purpose

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

2.0 Methods

The Federal Aviation Administration (FAA) medical case review and the pilot's autopsy report and toxicology report were reviewed. Selected investigator reports and relevant regulation and medical literature were also reviewed.

D. FACTUAL INFORMATION

1.0 FAA Medical Case Review

According to the FAA medical case review, the 71-year-old male pilot's last aviation medical examination was on February 17, 1993. At that time, he reported 130 total civilian flight hours. He was 72 inches tall and weighed 200 pounds. He reported no medication use or medical conditions. No significant issues were identified, and he was issued a second-class medical certificate without limitation. This medical certificate subsequently expired. The pilot did not have a valid FAA medical certificate at the time of the crash.

2.0 Autopsy Report

The Arkansas State Crime Laboratory Medical Examiner Division, Little Rock, Arkansas, performed the pilot's autopsy. According to the pilot's autopsy report, his cause of death was multiple injuries and his manner of death was accident. His body weight at autopsy was 263 pounds and his body length was 75 inches. His autopsy identified mild-to-moderate coronary artery disease, with up to 60% narrowing of the

proximal left anterior descending coronary artery and up to 30% narrowing of the right coronary artery by plaque. There was no evidence of any acute clot in the coronary arteries, and the heart muscle had an unremarkable appearance. The autopsy report stated that the heart appeared slightly enlarged in size but otherwise normal in shape and configuration. Heart weight was 490 grams (normal heart weight is roughly 320-570 grams for a male of body weight 263 pounds).¹ The pilot's autopsy did not identify any other significant natural disease.

3.0 Toxicology

3.1 FAA Toxicology Results

The FAA Forensic Sciences laboratory performed toxicological testing of postmortem specimens from the pilot.² This testing detected diphenhydramine at 269 ng/mL in heart blood. Diphenhydramine was also detected in urine.

3.2 Description of Detected Substance

Diphenhydramine is a sedating antihistamine medication widely available over the counter in multiple sleep aids and cold and allergy products. Diphenhydramine can cause cognitive and psychomotor slowing and drowsiness. It often carries a warning that it may impair performance of tasks like driving and operating heavy machinery.^{3,4,5} In one driving simulator study, a single dose of diphenhydramine impaired driving ability more than a blood alcohol level of 0.1 g/dL.⁶ The FAA states

¹ 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 Clin Proc.* 1988;63(2):137-146. doi:10.1016/s0025-6196(12)64946-5.

² The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including toxins, prescription and over-the-counter medications, and illicit drugs.

³ National Institutes of Health National Library of Medicine. Benadryl Allergy Liqui-Gels. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bfeae100-e2d1-4607-be3b-2d9b15cd4f7f>. Updated May 17, 2023. Accessed September 28, 2023.

⁴ 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 28, 2023.

⁵ Moskowitz H, Wilkinson CJ. *Antihistamines and Driving-Related Behavior: A Review of the Evidence for Impairment*. National Highway Traffic Safety Administration. DOT HS 809 714. May 2004. <https://www.nhtsa.gov/sites/nhtsa.gov/files/antihistamines20text.pdf>. Accessed September 28, 2023.

⁶ Weiler JM, Bloomfield JR, Woodworth GG, et al. Effects of fexofenadine, diphenhydramine, and alcohol on driving performance: a randomized, placebo-controlled trial in the Iowa Driving Simulator. *Ann Intern Med.* 2000;132(5):354-363. doi:10.7326/0003-4819-132-5-200003070-00004.

that pilots should not fly within 60 hours of using diphenhydramine, to allow time for it to be cleared from circulation.^{7,8}

Typical treatment concentrations of diphenhydramine in a living person's plasma are about 25 ng/mL to 100 ng/mL, with the drug's concentration in plasma typically being about 1.3 times the concentration in whole blood. The typical elimination half-life of diphenhydramine is about 3-14 hours.^{9,10} Diphenhydramine may exhibit postmortem redistribution which can cause the drug's concentration in heart blood (central blood) to increase after death. The postmortem central-to-peripheral blood diphenhydramine concentration ratio may range from below 1 to above 20 depending on the individual case.¹¹

E. SUMMARY OF MEDICAL FACTS

The 71-year-old male pilot's last aviation medical examination was on February 17, 1993. At that time, he reported no medication use or medical conditions. He was issued a second-class medical certificate without limitation. This medical certificate subsequently expired; he did not have a valid FAA medical certificate at the time of the crash.

According to the pilot's autopsy report, his cause of death was multiple injuries and his manner of death was accident. His autopsy identified mild-to-moderate coronary artery disease, with up to 60% narrowing of the proximal left anterior descending coronary artery and up to 30% narrowing of the right coronary artery. There was no evidence of any acute clot in the coronary arteries, and the heart muscle had an unremarkable appearance. The autopsy report stated that the heart appeared slightly enlarged in size but otherwise normal in shape and configuration. The autopsy did not identify any other significant natural disease. The pilot's

⁷ 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/ame_guide/pharm/dni_dnf. Updated July 10, 2023. Accessed September 28, 2023.

⁸ Federal Aviation Administration. Allergy - antihistamine & immunotherapy medication. Guide for Aviation Medical Examiners. https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/AllergyAntihistamineImmunotherapyMedication.pdf. Updated October 26, 2022. Accessed September 28, 2023.

⁹ Federal Aviation Administration Civil Aerospace Medical Institute. Diphenhydramine. Forensic Toxicology's WebDrugs. <https://jag.cami.jcabi.gov/toxicology/DrugDetail.asp?did=50>. Updated January 16, 2019. Accessed September 28, 2023.

¹⁰ Schulz M, Schmoldt A, Andresen-Streichert H, Iwersen-Bergmann S. Revisited: therapeutic and toxic blood concentrations of more than 1,100 drugs and other xenobiotics. *Crit Care*. 2020;24(1):195. doi:10.1186/s13054-020-02915-5.

¹¹ Han E, Kim E, Hong H, et al. Evaluation of postmortem redistribution phenomena for commonly encountered drugs. *Forensic Sci Int*. 2012;219(1-3):265-271. doi:10.1016/j.forsciint.2012.01.016.

postmortem toxicological testing detected diphenhydramine in urine and at 269 ng/mL in heart blood.

Submitted by:

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