



NASA Headquarters
Washington DC 20546-0001

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Reply to Attn of: Office of the Chief Health and Medical Officer

TO: Timothy Sorensen, Investigator-in-Charge, NTSB

FROM: Dr. J.D. Polk, Chief Health and Medical Officer, NASA

SUBJECT: MEDICAL FACTUAL REPORT FOR ACCIDENT # CEN18FA053

A. ACCIDENT: CEN18FA053 – Oldenburg, IN

On December 16, 2017, about 2058 eastern standard time, a Cessna T210M airplane, N761YZ, impacted trees and terrain following a reported loss of engine power near Oldenburg, Indiana. A post-impact fire ensued and the airplane was destroyed. The pilot, pilot-rated passenger, and passenger were fatally injured. The airplane was registered to N761YZ LLC and operated by the pilot as a 14 *Code of Federal Regulations* Part 91 personal flight. Night visual meteorological conditions prevailed. The flight was operated on an instrument flight rules flight plan and originated from the Columbus Municipal Airport (BAK), Columbus, Indiana, about 2039. The intended destination was the Frederick Municipal Airport (FDK), Frederick, Maryland.

B. GROUP IDENTIFICATION:

The National Aeronautics and Space Administration's (NASA) Office of the Chief Health and Medical Officer was asked to perform this medical assessment by the National Transportation Safety Board (NTSB) secondary to the accident involving an NTSB employed individual. No additional groups were formed for the purpose of this medical investigation.

C. DETAILS OF INVESTIGATION:

Purpose

This investigation was performed to evaluate the pilot and any flight qualified passengers for any medical conditions, the use of any medications/illicit drugs, the presence of any toxins, and the presence of any known environmental or somatosensory human factors that could have contributed to the accident.

Methods

The FAA medical case review, pilot's FAA medical certification file, FAA Bioaeronautical Sciences Research Laboratory toxicology reports, autopsy reports, MRI, CT, and echo reports and scans, interviews, Air Traffic Control recordings, visibility/lighting documentation, and human factors elements were reviewed.

Pilot - Left Seat - Fatal*FAA Medical Case Review*

According to the FAA medical case review, the 63 year-old male pilot was 68 inches tall and weighed 223 (BMI 33) pounds. His most recent FAA medical certification exam was dated 08/30/2016. At that time, he reported 2,972 total flight hours, 74 hours in the last six months as of the date of his exam. The pilot reported medical visits for a screening colonoscopy on 10/01/2015 and a hernia repair on 12/01/2015. He had been on cholesterol lowering medications from 2006 to 2015; with the reason for stoppage of the medication not given. No concerns were reported by the airman and no significant issues were identified by the Aviation Medical Examiner (#12427). The pilot was issued a second class medical certificate with the following limitations: Must wear corrective lenses, possess glasses for near/intermediate vision.

Personal Medical Records

The patient had been seen for elevated LDL cholesterol and had previously been on Crestor with good control. The patient was counseled on increasing weight gain (BMI- 33) and was being followed with intermittent blood pressure checks. He currently was not on Crestor and had lost some weight. Past medical episodes included a history of lumbar strain. List basic medical history and any pertinent procedures and medications. He had undergone a screening colonoscopy in October of 2015 which was negative. Past surgical history included a hernia repair in December of 2015.

Review of Air Traffic Control Recordings

Examination of the recordings from the Air Traffic Control tower reveal an alert and oriented speaker on the radio, with fluid speech albeit with anxious demeanor in communications with the tower during a state of emergency. There is no indication from the recording of any medical impairment (eg-confusion, disorientation, slurred speech, complaints of a medical nature).

Autopsy

The Hamilton County Coroner's Office determined that the cause of death to be multiple blunt force injuries of the head, torso and extremities. In addition, the autopsy identified mild to moderate coronary artery atherosclerosis. Post-crash fire damage to the remains was noted. No evidence for thrombosis or other natural disease that would be contributory were noted.

Toxicology

The Hamilton County Toxicology Laboratory performed testing as part of the autopsy using peripheral blood. Testing revealed carbon monoxide at less than 5-percent hemoglobin saturation. No cyanide was detected. No ethanol (ETOH) was detected. Immunoassay Screen (ELISA) testing of the peripheral blood for Amphetamine, Barbiturates, Benzodiazepines, Buprenorphine, Cannabinoids, Carisoprodol, Cocaine/Metabolites, Fentanyl, Methadone, Methamphetamine, Naltrexone, Opiates, Oxycodone, Tramadol, Tricyclic Antidepressants, Zolpidem, were all negative.

FAA Bioaeronautical Sciences Research Laboratory toxicology analysis revealed the blood specimen to be unsuitable for carbon monoxide testing. The liver and blood specimens were positive for Atenolol ¹(beta blocker- commonly used in the treatment of hypertension, non-sedating or impairing), Azacyclonal² (a known active metabolite of the parent structure compound found in Fexofenadine and Terfenadine), and Fexofenadine (Allegra- an over-the-counter antihistamine used for allergy symptoms). No ethanol (ETOH) was detected in the vitreous.

Passenger - Right Seat – Pilot-Rated Passenger - Fatal

FAA Medical Case Review

According to the FAA medical case review, the 65 year-old male pilot-rated passenger was 69 inches tall and weighed 198 pounds at the time of the last exam. His most recent FAA medical certification exam was dated 10/28/2015. At that time, he reported 1,930 total flight hours, 30 hours in the last six months as of the date of his exam. The pilot reported the use of the following medications: Atorvastatin (generic brand Lipitor- used for reduction of cholesterol and triglycerides), aspirin (generic brand Bayer- salicylate used for pain, fever, inflammation, or cardiac disease prevention), multiple supplements (chondroitin, CoQ10, glucosamine, sennosides, vitamin C, vitamin D3, Vitron C). The airman noted previously reported aortic valve stenosis with subsequent valve replacement, gall bladder cancer and metastatic tumor, pulmonary embolism in December of 2014, gall bladder removal, liver tumor resection (metastatic adenocarcinoma), liver resection and vascular port installation (for chemotherapy regimen) in March of 2015, and surgery and recurrent scans for same. The Aviation Medical Examiner (AME) had the following comments: “Recent cardiac evaluation, as required by previous FAA letter and documentation from the applicant's treating cardiologist, as discussed with Dr. Carter, indicates return to applicant's baseline for cardiopulmonary function”. “Full records from cancer diagnosis, chemotherapy treatment, radiation therapy prophylactic treatment and follow up documentation from the applicant's treating physicians, as discussed with Dr. Carter at the FAA last week, indicate no evidence of recurrence and no plan for continued therapy. The applicant will be closely monitored by his oncologist and primary care team at regular intervals”. The AME reviewed documentation of each respective hospitalization as well as the associated follow-up visits and summary letters from the applicant's cardiologist and oncologist. After the AME exam, the patient had the subsequent

¹ National Institutes of Health. US National Library of Medicine. DailyMed, 2018.
<https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=f36d4ed3-dcbb-4465-9fa6-1da811f555e6>. Accessed 20 August 2018

² Kumar L, et al. Chapter 4- Fexofenadine Hydrochloride. Profiles of Drug Substances, Excipients, and Related Methodology. Vol 34. 2009.

diagnosis of the cancer recurrence. The last exam was conducted by Aviation Medical Examiner (20084). The pilot was issued a third class medical certificate with the following limitations: Must have available glasses for near vision. Not valid for any class after 10/31/2017. The certificate expired on 10/31/2017 and the airman had not applied for BasicMed secondary to cancer recurrence and on-going chemotherapy.

Autopsy

The Hamilton County Coroner's autopsy report documented the cause of death was multiple blunt force injuries of the head, torso and extremities. In addition, the autopsy identified burns to the body of 2nd to 4th degree in nature. The autopsy also revealed that the deceased had significant cancer metastasis, with notable tumors in the perivascular areas. No evidence for thrombus, metastatic brain lesions, or evidence for acute coronary or nervous system disease that would be contributory were noted.

Toxicology

The Hamilton County Toxicology Laboratory performed testing as part of the autopsy. Testing detected carbon monoxide at 8%, and Cyanide was negative. No ethanol was detected. Additionally, the stimulant amphetamine was detected in the serum but not the peripheral blood. Amphetamine is a Schedule II controlled substance that stimulates the central nervous system available by prescription for the treatment of attention deficit disorder and narcolepsy. However, false positives can be seen in the use of certain anti-histamines and pseudoephedrine³. Delta-9-tetrahydrocannabinol (THC) is negative in the serum. The THC inactive metabolite, 9-Carboxy-tetrahydrocannabinol (THC-COOH) is present at a concentration of less than 0.005 mg/L. It should be noted that the concentrations of the parent drug (THC) and its metabolite (THC-COOH) are very dependent on the potency, mass of the patient, formulation, and route of consumption. The metabolite may be detected up to seven days post consumption⁴. Studies show that plasma concentrations of THC decline rapidly and are often less than 5.00 ng/mL at 3 hours. Additionally, most clinical studies have shown that the majority of behavioral and physiological effects return to baseline levels within 3-5 hours after drug use, although some investigators have demonstrated residual effects lasting longer. THC and its metabolite are subject to postmortem redistribution (the movement of the drug from storage tissues back into the blood after death) resulting in blood levels that may be higher than levels immediately prior to death. The family, when interviewed, stated that the patients use of THC orally and the Histamine 2 blockers were secondary to intense nausea and reflux as a consequence of chemotherapy which the patient had restarted due a recurrence of cancer. Immunoassay Screen (ELISA) testing of the peripheral blood for Barbiturates, Benzodiazepines, Buprenorphine, Carisoprodol, Cocaine/Metabolites, Fentanyl, Methadone,

³ Brahm NC, et al. Commonly prescribed medications and potential false-positive urine drug screens. *Am J Health Syst Pharm.* 67 (16) Aug 2010.

⁴ Cook, C.C., Alcohol and aviation. *Addiction.* 92 (5), Abingdon, England), 1997.

Naltrexone, Opiates, Oxycodone, Tramadol, Tricyclic Antidepressants, Zolpidem, were negative with the positive findings noted above.

FAA Bioaeronautical Sciences Research Laboratory toxicology analysis detected no carbon monoxide in the blood. No ethanol was found in the urine. Acetaminophen was detected in the urine at a concentration of 24.65 ug/mL. Atorvastatin (cholesterol lowering medication) was detected in the blood and liver. Famotidine and Ranitidine (H2 blocking medications used for ulcers or severe reflux) were detected in both the blood and liver. Diphenhydramine (brand name Benadryl- used for allergy, itching, and sleep aid) was detected in the blood at 0.099ug/mL. 11-nor-9-carboxy-delta-9-tetrahydrocannabinol was detected in the blood and urine, with concentrations of 0.0024ug/mL and 0.0466 ug/mL respectively. 11-hydroxy-delta-9-tetrahydrocannabinol was NOT detected in blood, but was detected in the urine at a concentration of 0.0142 ug/mL. Of note is the absence of a positive test for amphetamine.

Interview with the Spouse

Because of the complex medical issues found on the review of the medical chart and autopsy, the spouse of the deceased was interviewed in order to gain context and chronology of medical events and pathology. The spouse of the deceased indicated that he had battled gall bladder cancer with metastatic disease. He had endured chemotherapy, surgery and radiation. For a time he had what appeared to be a remission, but unfortunately his cancer had recurred. He recently experienced right thigh pain, which was thought to be a metastatic site on evaluation. He was taking Pepcid and oral THC for nausea secondary to restarting chemotherapy, taking Tylenol for the recurrent nerve pain in the right thigh from the metastasis and Atorvastatin for cholesterol. She stated that he would go to the hospital very early, get treatment, and then go directly to work, without hesitation. The patient was due to start immune therapy for the cancer in the near term. He had no complaints of shortness of breath currently (he had a previous pulmonary embolus for which he recovered), no complaints of chest pain, headache, or neurologic complaints with the exception of pain and mild paresthesia in the right thigh area. He was looking forward to this trip and flying with his friend. He had not smoked cigarettes or used tobacco since college, and his ETOH consumption consisted of an occasional Manhattan, but he had not had alcohol in some time due to the esophageal reflux from the chemotherapy.

Passenger – Rear Seat – Fatal

Medical Case Review

The passenger is not a pilot nor flight-rated, therefore no aviation-related FAA Medical Records available for review. No Personal Medical Records were reviewed for this individual for the purposes of this investigation.

Environmental/Human Factors

Conditions at Accident Site: Visual Conditions

Condition of Light: Night/Dark

Observation Facility, Elevation: HLB, 975 ft msl

Observation Time: 2055 EST
 Distance from Accident Site: 2 Nautical Miles
 Temperature/Dew Point: 5°C / -2°C
 Lowest Cloud Condition: Wind Speed/Gusts,
 Direction: 5 knots, Variable
 Lowest Ceiling: Overcast / 7500 ft agl
 Visibility: 10 Miles
 Moonlight: Visible Crescent, 3%, low luminescence⁵

Review of satellite imagery reveals the Batesville Airport (HLB) where the pilot was attempting to land under emergency conditions is in a rural area, with densely wooded areas to the North and West. The runway runs North to South. No sources of major lighting or urban activity are next to the airport. A farm resides a half mile to the East. With the airport lighting being inactive, and based on the cloud cover, very low lumens of moonlight, and time of night, the area would appear in total darkness at the estimated observation time of the pilot. There are no indications or lighting factors consistent with known visual perceptual illusions (eg- Black Hole Effect)⁶.

SUMMARY OF MEDICAL FINDINGS

The pilot was a 63-year-old male with a history of high cholesterol for which he had been on a statin previously, and hypertension for which he was on a beta blocker. The Hamilton County Coroner's autopsy revealed his coronaries to have a moderate (60%) degree of atherosclerosis, but no acute thrombus. The autopsy revealed the cause of death to be multiple blunt force trauma sustained due to impact. Post-crash fire caused substantial damage to the remains. The toxicology revealed the beta blocker and an anti-histamine (Fexofenadine) frequently taken for allergy symptoms, which is non-sedating. His medical history was otherwise unremarkable for illnesses that would lead to acute impairment.

The pilot-rated passenger was a 65-year-old male who had a history of gallbladder cancer, surgical resection, valve replacement, pulmonary embolus, chemotherapy, and unfortunately a recent recurrence of metastatic disease. The Hamilton County Coroner's autopsy revealed his cause of death to be multiple blunt force trauma sustained due to impact. No evidence for acute thrombosis or coronary disease, or brain metastasis was noted on the autopsy, such that no cause for acute incapacitation is evident. Multiple sites of cancer metastasis along the vascular trunk and peri-aortic/peri-iliac areas are noted. Post-crash fire caused substantial damage to the remains. Per the interview with the family, the patient had restarted chemotherapy, and was experiencing nausea as a side effect, and was about to start immune therapy for his cancer. The toxicology revealed the patient to have a statin in the plasma, but also presence of amphetamine, multiple H2 blockers and the THC inactive metabolite, 9-Carboxy-tetrahydrocannabinol (THC-COOH) present at a concentration of less than 0.005 mg/L.

⁵ <https://www.moongiant.com/calendar/>

⁶ Gibb RW. Visual Spatial Disorientation: Revisiting the black hole illusion. *Aviat Space Environ Med.* 78 (8) Aug 2007.

Review of the Human Factors and Environment of the crash does not reveal the lighting or landscape substrate for Visual Perceptual Illusions such as the Black Hole Effect. There is no lighting that would have illuminated terrain on a visual approach.



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