

UNITED STATES AIR FORCE
GROUND ACCIDENT INVESTIGATION
BOARD REPORT



20th COMPONENT MAINTENANCE SQUADRON
20th FIGHTER WING
SHAW AIR FORCE BASE, SOUTH CAROLINA

TYPE OF ACCIDENT: Fitness Assessment Fatality

LOCATION: Shaw Air Force Base, South Carolina

DATE OF ACCIDENT: 29 May 2019

BOARD PRESIDENT: Brig Gen Michelle L. Hayworth, USAF

Conducted IAW Air Force Instruction 51-307




DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
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13 DEC 2019

ACTION OF THE CONVENING AUTHORITY

The report of the ground accident investigation board, conducted under the provisions of Air Force Instruction 51-307, that investigated the 29 May 2019 mishap at Shaw Air Force Base, South Carolina, involving the fatality of an Airman assigned to the 20th Component Maintenance Squadron following a fitness assessment, complies with applicable regulatory and statutory guidance, and on that basis is approved.

 JAMES M. HOLMES
General, USAF
Commander

On 19 December 2019, the Board President approved non-discretionary redactions to Tab X.

People First... Mission Always...

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
GROUND ACCIDENT INVESTIGATION

FITNESS ASSESSMENT FATALITY
SHAW AIR FORCE BASE, SOUTH CAROLINA
29 MAY 2019

On 29 May 2019 at approximately 2150 hours local (L) time at Shaw Air Force Base (AFB), South Carolina (SC), the Mishap Airman (MA), an active duty Senior Airman assigned to the 20th Component Maintenance Squadron, 20th Fighter Wing, Shaw AFB, SC, experienced respiratory complications after completing the 1.5-mile timed run component of his Air Force Fitness Assessment (FA). Despite the subsequent efforts of Physical Training Leaders (PTLs), Shaw AFB Emergency Medical Services (EMS), and medical personnel from two civilian hospitals, the MA's condition deteriorated over the next three days, culminating in multi-organ system failure and cardiac arrhythmia. The MA passed away at 0847L on 1 June 2019, with family by his side.

On the day of the mishap, the MA, and the PTL who administered his FA, arrived at the Shaw AFB Main Fitness Center at 2100L. After reviewing the MA's Fitness Screening Questionnaire, the PTL cleared him to test, and the MA completed the abdominal circumference, push-ups, and sit-ups components before driving to the outdoor track located behind the Education Center for his 1.5-mile timed run. At the track, the PTL checked the weather on his cell phone and cleared the MA to begin his run since the temperature was in the low eighties. At 2135L, the MA began his run and, when finished, lowered himself to the ground. When PTLs approached him to see how he was doing, the MA was responsive and able to answer questions; however, his medical condition quickly deteriorated and PTLs dialed 9-1-1 for emergency services at 2153L. Shaw AFB medical personnel first responded to the scene at 2156L and found the MA unresponsive and in respiratory distress. Additional medical personnel began resuscitation measures and transported the MA to Prisma Health Tuomey Hospital (PHTH) in Sumter, SC. Upon arrival at PHTH at 2223L, the MA was evaluated in the Emergency Department and then admitted to the Intensive Care Unit (ICU) with a diagnosis of respiratory arrest.

On 30 May 2019, the MA was transferred to the ICU at Prisma Health Richland Hospital (PHRH) in Columbia, SC, where he was deemed to be in stable, but critical condition. Over the next two days, the MA's condition continued to deteriorate and his diagnosis included hypoxic respiratory failure, rhabdomyolysis, acute kidney failure, myocardial infarction (heart attack), liver failure, and hemodynamic shock. The MA's multi-organ system failure was followed by cardiac arrhythmia. The MA passed away at 0847L on 1 June 2019. The PHRH physician listed the MA's cause of death as suspected dehydration, acute hypoxic respiratory failure, esophageal intubation, and abdominal compartment syndrome. Following the MA's death, the Army Medical Center at Fort Gordon, Georgia, conducted an autopsy. The medical examiner's autopsy report listed cause of death as a cardiac arrhythmia from cardiomegaly (enlarged heart) with Sick Cell Trait as a contributing factor, and stated the manner of death was from natural causes.

SUMMARY OF FACTS
Fitness Assessment Fatality
29 May 2019

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ACRONYMS AND ABBREVIATIONS

9 AF	9th Air Force	FSS	Force Support Squadron
14 WS	14th Weather Squadron	GAIB	Ground Accident Investigation Board
20 CMS	20th Component Maintenance Squadron	IAW	In Accordance With
20 FSS	20th Force Support Squadron	ICU	Intensive Care Unit
20 FW	20th Fighter Wing	L	Local
20 MDG	20th Medical Group	MA	Mishap Airman
AC	Abdominal Circumference	mmHg	Millimeters of Mercury
ACC	Air Combat Command	mph	miles per hour
AED	Automated External Defibrillator	MRI	Magnetic Resonance Imaging
AF/A1	Deputy Chief of Staff for Manpower, Personnel, and Services	NREMT	National Registry of Emergency Medical Technicians
AFB	Air Force Base	OPA	Oropharyngeal Airway
AFFMS	Air Force Fitness Management	PCM	Primary Care Manager
AFI	Air Force Instruction	PHA	Preventive Health Assessment
ALS	Advanced Life Support	PHRH	Prisma Health Richland Hospital
BLS	Basic Life Support	PHTH	Prisma Health Tuomey Hospital
BMT	Basic Military Training	PTL	Physical Training Leader
		PTL-A	Physical Training Leader-Advanced
BPM	Beats Per Minute	PTL-B	Physical Training Leader-Basic
BVM	Bag Valve Mask	SC	South Carolina
CPR	Cardiopulmonary Resuscitation	SCD	Sickle Cell Disease
CT	Computed Tomography	SCT	Sickle Cell Trait
ECC	Emergency Communications	SF	Security Forces
EMS	Emergency Medical Services	TAF	Terminal Aerodrome Forecast
EMT	Emergency Medical Technician	UFPM	Unit Program Fitness Manager
ET	Endotracheal	USAF	United States Air Force
F	Fahrenheit	WBGT	Wet Bulb Globe Temperature
FA	Fitness Assessment	WIT	Witness
FAC	Fitness Assessment Cell	x-ray	Radiographic Imaging
FSQ	Fitness Screening Questionnaire		

The above list was compiled from the Summary of Facts, the Index of Tabs, and Witness Testimony (Tab V).

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 11 June 2019, General James M. Holmes, Commander, Air Combat Command (ACC), appointed Brigadier General Michelle L. Hayworth as Board President of a Ground Accident Investigation Board (GAIB) to investigate the death of the Mishap Airman (MA), who died from medical complications following an Air Force Fitness Assessment (FA) at Shaw Air Force Base (AFB), South Carolina (SC) (Tabs X-21 to X-23 and Y-3). The GAIB convened from 11 September 2019 through 4 October 2019, and was conducted in accordance with (IAW) Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, dated 18 March 2019 (Tab Y-3). Additional members of the GAIB included a Lieutenant Colonel legal advisor, a Captain medical member, and a Staff Sergeant recorder (Tab Y-3). Subject Matter Experts appointed to assist the GAIB included a Technical Sergeant from the meteorology field, and a Staff Sergeant from the bioenvironmental engineering field (Tab Y-7 to Y-8).

b. Purpose

IAW AFI 51-307, this GAIB conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force ground accident, to prepare a publicly-releasable report, and to obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action (Tabs Y-3 and BB-50).

2. ACCIDENT SUMMARY

On 29 May 2019 at approximately 2150 hours local (L) time, at Shaw AFB, SC, the MA, an active duty Senior Airman assigned to the 20th Component Maintenance Squadron, 20th Fighter Wing, Shaw AFB, SC, experienced respiratory complications after completing the 1.5-mile timed run component of his Air Force FA (Tabs V-8.3, V-8.15 to V-8.17, V-9.6, and AA-4). Initially, the MA was responsive and answered Physical Training Leader (PTL) questions; however, his medical condition quickly deteriorated (Tab V-8.17 and V-9.7). At 2153L, a PTL dialed 9-1-1 for emergency services when the MA became unresponsive and had increased difficulty breathing (Tabs V-9.7 to V-9.8 and AA-6). At 2156L, the first Shaw AFB medical personnel arrived, and at 2159L, additional Shaw AFB medical personnel arrived, began resuscitation measures, and transported the MA to Prisma Health Tuomey Hospital (PHTH) in Sumter, SC (Tabs V-1.4 to V-1.6, X-25, and AA-6, and CC-14). On 30 May 2019, PHTH transferred the MA to Prisma Health Richland Hospital (PHRH) in Columbia, SC, for a higher level of care (Tabs V-4.15, X-16, and CC-17). The MA's condition continued to deteriorate, culminating in multi-organ system failure and cardiac arrhythmia (Tab X-22 to X-23). The MA passed away at 0847L on 1 June 2019, with family by his side (Tab X-22).

3. BACKGROUND

a. Air Combat Command (ACC)

Headquartered at Joint Base Langley-Eustis, Virginia, ACC is one of ten major commands in the United States Air Force (USAF) (Tab CC-2). ACC organizes, trains, and equips Airmen who fight in and from multiple domains to control the air, space, and cyberspace (Tab CC-2). As the lead command for fighter, command and control, intelligence, surveillance and reconnaissance, personnel recovery, persistent attack and reconnaissance, electronic warfare, and cyber operations, ACC is responsible for providing combat air, space, and cyber power and the combat support that assures mission success to America's warfighting commands (Tab CC-2).



b. 9th Air Force (9 AF)

Headquartered at Shaw AFB, SC, 9 AF is a Numbered Air Force under ACC (Tab CC-5). It was activated on 5 August 2009 and is responsible for organizing, training, and equipping its headquarters to be a deployable, operational-level Joint Task Force and its subordinate commands to prepare for and execute expeditionary taskings (Tab CC-5). Additionally, 9 AF commands eight wings and three direct reporting units in the Southeastern United States, ensuring the operational readiness of more than 400 aircraft (Tab CC-5).



c. 20th Fighter Wing (20 FW)

Located at Shaw AFB, SC, the 20 FW operates the USAF's largest combat F-16 Fighting Falcon wing (Tab CC-5). The wing is capable of meeting all operational requirements worldwide, maintains a state of combat readiness, and operates as the host unit at Shaw AFB by providing facilities, personnel, and material (Tab CC-8). The 20 FW consists of over 3,700 officer, enlisted, and civilian personnel (Tab CC-5).



d. 20th Component Maintenance Squadron (20 CMS)

Located at Shaw AFB, SC, the 20 CMS delivers mission-ready Airmen providing the worldwide standard for quality aircraft components and support in order to generate combat aircraft anytime, anywhere (Tab CC-11 and CC-12). The 20 CMS supports the 20 FW, a combat-ready wing of approximately 79 F-16CM Fighting Falcons and equipment (Tab CC-11). The squadron maintains jet engines; accessories; avionics components and systems; and a test, measurement and diagnostic equipment laboratory in support of three fighter squadrons (Tab CC-11).

e. Prisma Health Tuomey Hospital (PHTH)

Founded in 1913, PHTH is a 301-bed, Joint Commission accredited institution in Sumter, SC (Tab CC-14). PHTH is part of the region's largest nonprofit health care resource, caring for more than 60 percent of residents of Sumter, Lee, and Clarendon counties (Tab CC-15). PHTH meets the needs of the community through acute care, outpatient services, and a comprehensive health promotion and disease prevention program (Tab CC-13). Included in PHTH's facilities are a 30-bed nursery, an expanded Intensive Care Unit (ICU), 10 operating suites, an Outpatient Surgery Center, an award-winning Day Surgery Unit, a Women and Infants Pavilion, and a satellite medical park (Tab CC-14). The PHTH medical staff includes more than 150 physicians representing more than 25 medical specialties (Tab CC-14).

f. Prisma Health Richland Hospital (PHRH)

Located in Columbia, SC, PHRH is a 641-bed regional community teaching medical center (Tab CC-17). PHRH treats more than 225,000 patients every year and has more than 4,200 employees and a medical and dental staff of more than 900 providing a wide range of primary and specialty health care services (Tab CC-17). PHRH areas of excellence include behavioral care, cardiology, obstetrics, oncology, orthopedics, neonatology, robotic assisted surgery, and trauma (Tab CC-18).

g. Air Force Physical Fitness Program

Air Force members are responsible for being physically fit and maintaining the standards set forth in AFI 36-2905, *Fitness Program*, 365 days a year (Tab BB-4). The goal of the fitness program is to motivate all members to participate in a year-round physical conditioning program that emphasizes total fitness, to include proper aerobic conditioning, muscular fitness training, and healthy eating (Tab BB-4). The Air Force FA uses an overall composite fitness score and minimum scores per component based on aerobic fitness (1.5-mile run or 2.0-kilometer walk), body composition (abdominal circumference (AC) measurement), and muscular fitness component (push-ups and sit-ups) to determine overall fitness (Tab BB-15). Members must earn a composite score of 75 or greater, and meet the component minimums (score necessary in each component to achieve an overall passing FA score) based on age and gender (Tab BB-15 and BB-24). Frequency of the FA is based on the Airman's previous fitness score (Tab BB-25). Airmen test biannually if their last fitness assessment score was 75-89.99 points out of 100 points, and test annually if their score was 90 or more points out of 100 (Tab BB-23 to BB-25). Airmen are individually responsible for knowing when their FA is due and ensuring it is scheduled so that they remain current (Tab BB-13).

A number of different personnel oversee and implement the Fitness Program (Tab BB-10 to BB-11). With respect to the mishap FA, the relevant positions are:

(1) Unit Fitness Program Manager (UFPM). UFPMs must be Physical Training Leader-Basic (PTL-B) certified, complete UFPM and PTL training annually, schedule individuals for FAs, and augment the Fitness Assessment Center (FAC) to conduct official FAs (Tab BB-10).

UFPMs also provide the Fitness Screening Questionnaire (FSQ) to Airmen to complete prior to any official or command-directed unofficial/practice FA (Tab BB-10). Airmen will complete the FSQ no earlier than 30 days before an assessment (Tab BB-10). UFPMs also review completed FSQs prior to allowing any Airman to conduct an official FA and refer any Airman with high-risk responses on the FSQ to a health care provider (Tab BB-10).

(2) PTL-Bs. PTL-Bs must obtain PTL-B certification prior to administering any FAs, complete Basic Life Support (BLS) training prior to attending FA procedures training, maintain BLS currency while serving as a PTL, and complete all refresher training annually for the duration of appointment as a PTL (Tab BB-11). BLS training includes Cardiopulmonary Resuscitation (CPR) and Automated External Defibrillator (AED) certification (Tab BB-27). BLS certification is valid for two years; however, a valid certificate must be provided by the member at the time of the PTL-B refresher training to satisfy the requirement for an additional year (Tab BB-11).

h. Air Force Squadron Revitalization Implementation Plan

On 1 June 2018, the Secretary of the Air Force, Chief of Staff of the Air Force, and Chief Master Sergeant of the Air Force signed out a *Squadron Revitalization Implementation Plan* (Tab BB-32 to BB-39). The implementation plan was organized around three independent and mutually supporting lines of effort: (1) Focus on the Mission, (2) Strengthen Squadron Leadership and Culture, and (3) Take Care of Airmen and Families (Tab BB-33). An action under “Strengthen Squadron Leadership and Culture” was to “Improve Squadron Fitness” (Tab BB-36 to BB-37). It tasked the Air Force Deputy Chief of Staff for Manpower, Personnel, and Services (AF/A1) to push authority for administering FAs for all members to squadron leadership (Tab BB-37). On 9 August 2018, the AF/A1 signed a memorandum titled, *Administering Unit Fitness Assessments*, stating that effective immediately, units were thereby authorized to test Airmen within the same unit or Personal Accounting Symbol code (Tab BB-40 to BB-41). Unit commanders electing to conduct internal testing when administering official FAs were required to provide the local Force Support Squadron (FSS) with a memorandum indicating their intent to test internally, ensure certified and appointed PTLs conduct official FAs on a certified track or course, and ensure PTLs are trained and certified IAW AFI 36-2905 through the servicing FSS or FAC (Tab BB-40).

i. Sick Cell Trait (SCT)

Sickle Cell Disease (SCD) and its variants, which include SCT, are a class of inherited genetic disorders characterized by the presence of abnormal hemoglobin S (Tab X-4). The hemoglobin molecule is responsible for carrying oxygen to the tissues and returns carbon dioxide back to the lungs (Tab X-4). The normal adult hemoglobin A1 molecule is made up of four protein molecules (globin chains) which consist of two alpha globulin chains, two beta globulin chains, and heme (iron) (Tab X-4). The sickle hemoglobin S results from a single amino acid substitution (glutamic acid for valine) in the beta globulin chain that predisposes the hemoglobin molecule to deform to a sickle-like shape when deoxygenated (Tab X-4).

Factors that promote sickling include severe dehydration from decreased oral intake of fluids and/or increased fluid loss (vomiting, diarrhea, sweating), hypoxia (low oxygen in the blood being carried to the tissues), hypotension (low blood pressure), high intense physical activity, temperature extremes, high altitude, poor conditioning, and older age (Tab X-5). Once triggered, a sickling crisis is a severe and potentially life threatening event whether the individual has SCT or SCD (Tab X-5). Unlike normal red blood cells that are round and can easily pass through blood vessels, sickled red blood cells are rigid and can block blood vessels (Tab X-5). This may lead to rhabdomyolysis (the rapid breakdown of muscle tissue starved of blood), which can result in blood chemistry problems and potentially sudden death (Tab X-5).

Since SCD is significantly more serious and requires ongoing medical care, it is a condition that precludes military service (Tab X-6). SCT is a medical condition that does not currently preclude military service, and individuals with SCT can usually safely participate in normal physical activity and sports (Tab X-6). The relative risk of exertion-related sudden death in African American recruits with SCT is 28 times that of African American recruits without SCT, and 40 times that of all recruits (Tab X-5). There is an age-related increase in the death rate for those with SCT, and the death rate of a 28-29 year old is eight times higher than that of a 17-18 year old (Tab X-5). The higher death rate may be attributed to the additive effects of kidney damage and papillary necrosis (cell death) (Tab X-5). Recommendations for individuals with SCT include building endurance slowly and performing workouts with frequent rest periods (Tab X-5). It is also important to maintain adequate hydration with water and to adjust physical activity for ambient heat and altitude (Tab X-5 to X-6).

j. Rhabdomyolysis

Rhabdomyolysis is characterized by striated muscle breakdown and necrosis (death), with subsequent release of potentially toxic intracellular contents into the circulation (Tab X-6). The spectrum of presentation ranges from asymptomatic to life-threatening with extreme elevation of creatine kinase, electrolyte imbalance, and subsequent acute renal failure (Tab X-6). Factors that cause exertional rhabdomyolysis include strenuous activity, intense repetitive exercise, and exercise in unconditioned individuals (Tab X-7). These events occur more often in extreme environments (temperature and/or humidity) (Tab X-7). Individual factors that have been known to promote rhabdomyolysis include dehydration and SCT (Tab X-7). These conditions, especially when combined, can cause clinically significant rhabdomyolysis, which causes pain, muscle swelling, and organ damage, including the potential for acute renal kidney failure (Tab X-6 to X-7). Early recognition of rhabdomyolysis and prompt management of complications are crucial to a successful outcome (Tab X-7).

4. SEQUENCE OF EVENTS

a. Events Preceding the Mishap

Per the MA's request, the 20 CMS UFPM scheduled his official FA for 29 May 2019, and the PTL who administered the FA (PTL1), agreed with the MA on a 2000L start time (Tab V-8.10 and V-10.13). On 29 May 2019, the MA had the day off of work to prepare for his Weighted Airmen Promotion System test, which was scheduled for 30 May 2019 (Tab V-8.10, V-11.5, and

V-11.7). At approximately 1930L, the MA arrived at his work center and found PTL1 at his desk (Tab V-8.10). PTL1 checked the weather via an application on his cell phone and told the MA he would have to wait at least one hour to take his FA because the temperature was too high at 87 degrees Fahrenheit (F) (Tab V-8.10 to V-8.11). PTL1 and the MA then agreed to meet at the Shaw AFB gym at 2100L (Tab V-8.11).

b. Mishap and Immediate Response

At 2100L, the MA and PTL1 arrived at the Shaw AFB Fitness Center and before beginning the FA, PTL1 reviewed the MA's FSQ, which he signed on 29 May 2019 (Tabs V-8.9 to V-8.11, and AA-2 to AA-3). Since the MA's answers to the FSQ questions did not prevent him from taking his FA, PTL1 cleared the MA to take his official FA (Tabs V-8.9 and AA-2).

PTL1 first conducted the body composition component of the FA in the Fitness Center men's locker room (Tab V-8.12). The MA's AC measurement earned him the maximum 20 points for body composition (Tabs V-8.12, AA-4, and BB-24). The MA then completed 56 push-ups, for a score of 9.5 out of 10 (Tabs V-8.12 and AA-4). PTL1 noted the MA was not overly tired or hunched over following his push-ups and gave him a few minutes to rest before beginning the sit-up portion of the FA (Tab V-8.12). Next, the MA completed 53 sit-ups for a score of 9.5 out of 10 (Tabs V-8.13 and AA-4). PTL1 noted the MA was a little tired, but not hunched over or showing signs of anything wrong (Tab V-8.13). After completion of the muscular fitness components, PTL1 and the MA drove separately to the outdoor track located behind the Education Center for the 1.5-mile timed run (Tab V-8.13 to V-8.14).

Upon arriving, PTL1 observed approximately four other individuals at the track (Tab V-8.15). He then approached an individual (PTL2), who stated he was there to conduct an unofficial FA on a member of his squadron, and that the member had approximately a lap and a half remaining (Tab V-8.15). PTL1 relayed this information to the MA and told him he had time to stretch before beginning his run (Tab V-8.15). At approximately 2130L, PTL1 checked the weather via an application on his cell phone (Tab V-8.14). PTL1 stated the temperature was either 81 or 82 degrees F (Tab V-8.14). PTL1 called the Bioenvironmental Engineering Flight to get the official wet bulb globe temperature (WBGT); however, there was no answer (Tab V-8.14). He did not call the Airfield Weather Operations Flight for the official observed weather or WBGT because he had been told that they cannot give the WBGT (Tab V-8.14). Based on his personal observations, and a temperature of either 81 or 82 degrees F from his cellular phone application, PTL1 concluded the temperature was low enough to conduct the FA (Tab V-8.14). PTL1 stressed to the MA to say something if he was feeling ill (Tab V-8.27). PTL1 also asked him how he was feeling and the MA responded, "good, just ready to get this done" (Tab V-8.27).

At approximately 2135L, the MA began his 1.5-mile timed run (Tab V-8.15 to V-8.16). PTL1 watched the MA as he was running and at the completion of each lap he called out the lap number and his time (Tab V-8.16). PTL1 did not notice the MA acting strange in any way while he was running (Tab V-8.16). Out of the corner of his eye PTL2 was also watching the MA as he ran and stated that the MA had a good pace and that he did not notice anything in the way the MA was running to cause concern (Tab V-9.5). The MA completed his run with a time of 13 minutes and 25 seconds, which gave him a score of 42.3 out of 60 on the aerobic fitness

component, and an overall FA score of 81.3 out of 100 (Tabs AA-4 and BB-24).

After crossing the finish line, the MA lowered himself to the ground into a sitting position and then laid on his back with his knees bent and arms behind his head (Tab V-8.16). PTL1 asked him if he was good and the MA responded: “Yeah, just give me a couple seconds” (Tab V-8.27). From the bleachers where he was sitting, PTL2 asked if they were good and they said they were (Tab V-9.6). After PTL2 noticed that the MA was still on the ground, he told the MA and PTL1 they should get up so the MA could get better air (Tab V-9.6). Noticing that the MA was still conscious, but really exhausted, PTL2 decided to walk over to make sure the MA was okay (Tab V-9.6). The MA attempted to get up on his own, but was unsuccessful so PTL1 and PTL2 lifted the MA and moved him to a nearby bench (Tab V-8.17). PTL1 then ran to his vehicle to get a bottle of water; however, the MA was unable to lift the bottle on his own (Tab V-8.18). Noticing that the MA’s condition had started to deteriorate, PTL1 asked him three times if he needed an ambulance (Tab V-8.19). The MA responded “No” the first two times, but the third time he responded “Yes” (Tab V-8.19). At 2153L, PTL2 dialed 9-1-1 from his cell phone and relayed the nature of the situation (Tabs V-9.7 and AA-6). While waiting for EMS personnel to respond, PTL1 and PTL2 kept the MA sitting upright on the bench and continued to talk to him (Tab V-8.19 and V-9.7). The MA began to go in and out of consciousness and PTL1 and PTL2 noticed that the MA’s breathing had started to slow down, so PTL2 began sternum rubs in an attempt to keep him conscious (Tab V-8.19 and V-9.7). PTL2 also checked the MA for a pulse and after finding a faint pulse, PTL1 and PTL2 laid the MA on the ground in case they needed to perform CPR (Tab V-9.8). Once the MA was laying on the ground, PTL2 continued sternum rubs until the first medical personnel arrived at 2156L (Tabs V-9.8 to V-9.9 and AA-6).

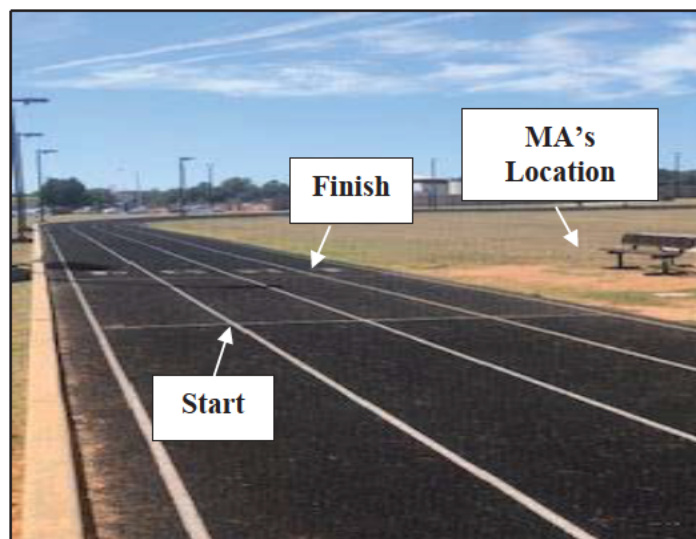


Figure 1 – Location of MA in Relation to the Track (Tab Z-3)

A Sumter County Police Department dispatcher answered PTL2’s call to 9-1-1 and transferred the call to the Shaw AFB Emergency Communications Center (ECC) at 2153L (Tabs V-9.7, V-13.2, AA-6, and CC-21). The ECC dispatched Shaw AFB emergency responders and Security Forces (SF) personnel arrived at 2154L and secured the site immediately around the MA (Tabs V-6.4 and AA-7). The Shaw AFB Fire Department arrived on scene at 2156L in the Rescue 3

vehicle with two Emergency Medical Technicians (EMTs), hereinafter referred to as EMT1 and EMT2 (Tabs V-2.3, V-3.5 to V-3.6, and AA-6). When they reached the MA, EMT2 noticed the MA was having difficulty breathing so he placed a pulse oximeter on the MA's finger to check his oxygen saturation level and heart rate (Tab V-3.7). EMT2 also noted the MA's eyes were open, but he wasn't responsive so he rubbed the MA's chest and pinched his traps (shoulder) in an attempt to get a response; however, the MA did not respond (Tab V-3.7). While he was doing that, EMT2 looked down at the pulse oximeter and noticed the MA's oxygen saturation level was 74 or 76 percent so EMT2 prepared to give supplemental oxygen via a non-rebreather mask (Tab V-1.4 and V-3.7 to V-3.8).

At 2157L, a paramedic and EMT, hereinafter referred to as Paramedic1 and EMT3 respectively, departed from Building 1044, located behind the Medical Group building, and arrived on scene in the Medic 3 vehicle, an ambulance, at 2159L (Tabs V-1.4, V-4.6 to V-4.7, and X-25). Once parked, Paramedic1 and EMT3 got out of the vehicle, walked around to the back of the ambulance, and after grabbing the stretcher, cardiac monitor/defibrillator, and jump bag moved expeditiously to the MA (Tab V-1.4 and V-4.7). At 2200L, Paramedic1 reached the MA and took medical control as the primary caregiver since paramedics are certified at a higher level of care (Tabs V-2.7 and X-25). Paramedic1's initial assessment of the MA's condition was that he was clammy, not breathing adequately, and was unresponsive but had good radial and carotid pulses (Tab V-1.6). Paramedic1 immediately directed EMT2 to use a Bag Valve Mask (BVM) to assist ventilations because the MA was having agonal respirations (breathing three to four times per minute) (Tab V-1.5). EMT2 initiated, and continued, BVM ventilations during the 10-20 seconds it took Paramedic1 and EMT3 to get the MA to the ambulance (Tab V-1.6, V-3.8, and V-4.9). During this time, EMT3 noticed the MA had good chest rise and falls as air was going in and out of his lungs (Tab V-4.9).

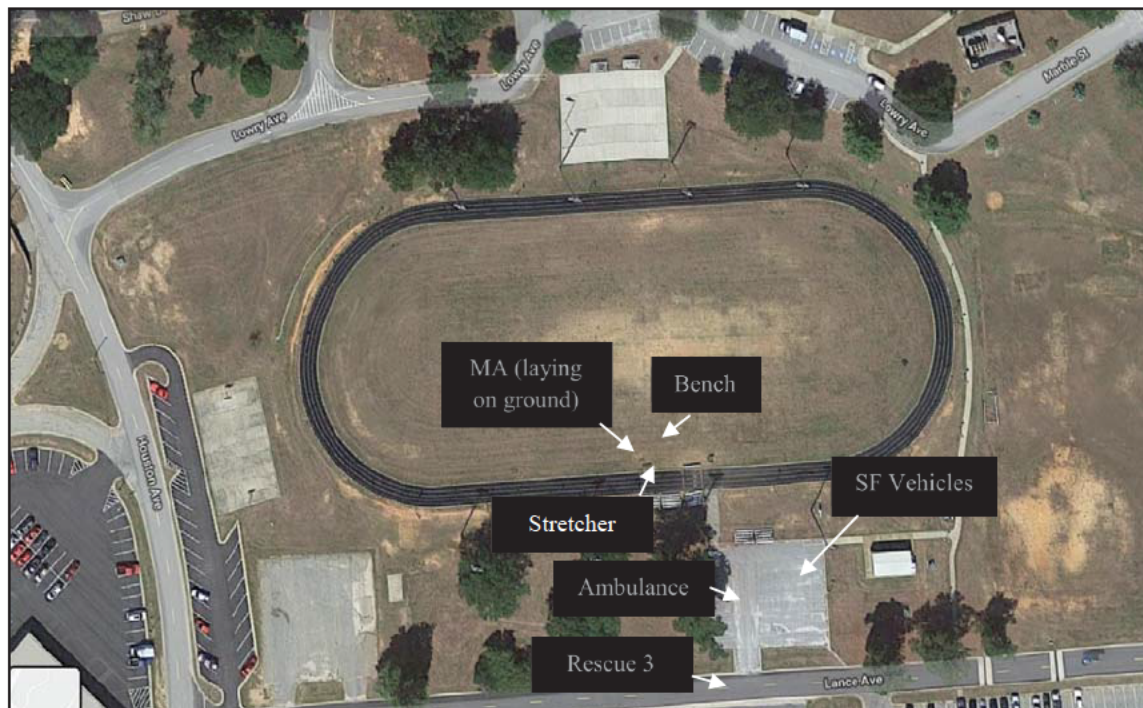


Figure 2 – Location of MA and EMS Vehicles (Tab Z-4)

c. Transport to Prisma Health Tuomey Hospital

With regard to medical care given to the MA inside the ambulance, witness statements differ on the timing of the endotracheal intubation (ET) (Tab V-1.9, V-3.9, and V-4.11 to V-4.12). According to Paramedic1, the ET occurred in the ambulance while still on scene, and the ambulance did not leave the parking lot until the ET tube was in place (Tab V-1.9). However, according to EMT2 and EMT3, once the MA was placed in the ambulance, it immediately departed for PHTH and intubation took place en route (Tab V-3.9 and V-4.11). EMT3 stated he believed the ambulance was already off base when Paramedic1 started to intubate the MA (Tab V-4.11).

According to documentation, the ambulance departed for PHTH at 2207L (Tab X-25). EMT2 drove so that Paramedic1 and EMT3 could both continue to provide care to the MA (Tab V-3.9 and V-4.9). In the ambulance, EMT3 switched out the Fire Department oxygen tank for the tank at the foot of the stretcher and Paramedic1 took over BVM ventilations (Tab V-4.11). EMT3 confirmed MA had good chest rise and fall, and confirmed carotid pulses were present (Tab V-4.10 to V-4.11 and V-4.19). Paramedic1 then inserted an Oropharyngeal Airway (OPA) and resumed BVM ventilations (Tab V-1.7). At the same time, EMT3 grabbed the cardiac monitor, placed AED pads on the MA, and confirmed radial pulses were present (Tab V-1.7 and V-4.10 to V-4.11). The AED did not advise a shock (Tab V-4.19). At 2202L, EMT3 recorded the MA's first full set of vitals: Blood pressure was 70 over 50 millimeters of Mercury (mmHg), heart rate was 116 Beats Per Minute (BPM), respirations were approximately four breaths per minute, and oxygen saturation was 77 percent (Tabs V-1.7, V-4.10, X-11, and X-26). Once the OPA was in place, the MA's oxygen saturation started to improve into the 80s, but since it was still not within American Heart Association guidelines of 94 percent or higher, Paramedic1 decided to perform an ET (Tab V-1.7 and V-1.13). Paramedic1 asked EMT3 to pick up the MA's shoulders to give her a better view of his vocal cords (Tab V-1.8 and V-4.12). Paramedic1 then inserted an ET tube through the vocal cords and EMT3 confirmed correct tube placement by listening to lung sounds, seeing condensation of the tube, and noting that the MA's oxygen saturation levels were in the high 90s (Tab V-1.8 and V-4.12 to V-4.13). When Paramedic1 and EMT3 attempted to put the commercial ET tube holding device in place there was some resistance, so they took the commercial device off and Paramedic1 held the ET tube in place manually (Tab V-1.8 and V-4.12).

Paramedic1 told EMT2 to radio Sumter County EMS dispatch to have them intercept the ambulance with an Advanced Life Support (ALS) unit in the event they needed assistance (Tab V-1.9, V-3.10, and V-4.12). At 2209L, Sumter County EMS received the call and dispatched an ALS unit to intercept the MA's ambulance en route (Tab V-1.9 and V-3.10). At 2210L, EMT3 recorded the MA's second full set of vitals: Blood pressure was 76 over 56 mmHg, heart rate was 140 BPM, respirations were 16 breaths per minute, and oxygen saturation was 88 percent (Tabs V-1.8 to V-1.9 and X-26). At 2213L the Sumter County EMS ALS unit met up with the MA's ambulance (Tab V-1.9 and V-3.10). The Sumter County EMS paramedic, hereinafter referred to as Paramedic2, boarded the MA's ambulance and it was back en route at 2215L (Tab V-1.9 to V-1.10). Paramedic1 provided Paramedic2 with a report of the MA's condition and asked him to confirm ET tube placement (Tab V-1.10 and V-4.14). After listening to lung and bowel sounds, and palpating the MA's abdomen, Paramedic2 confirmed the ET tube placement

was good (Tab V-1.10 and V-4.14). At 2221L, EMT3 recorded the MA's vitals a third time: Blood pressure was 88 over 54 mmHg, heart rate was 144 BPM, respirations were 16 breaths per minute assisted, and oxygen saturation was 98 percent (Tabs V-1.10 and X-26). Paramedic1 also called in a radio report to PHTH's Emergency Department stating they were inbound emergent traffic with a 30-year-old male patient in respiratory arrest (Tab V-1.10). Paramedic1 also reported the MA's vitals and that he was intubated with an ET tube (Tab V-1.10 to V-1.11). PHTH Emergency Department told them to proceed directly to Trauma Room One upon arrival (Tab V-1.11).

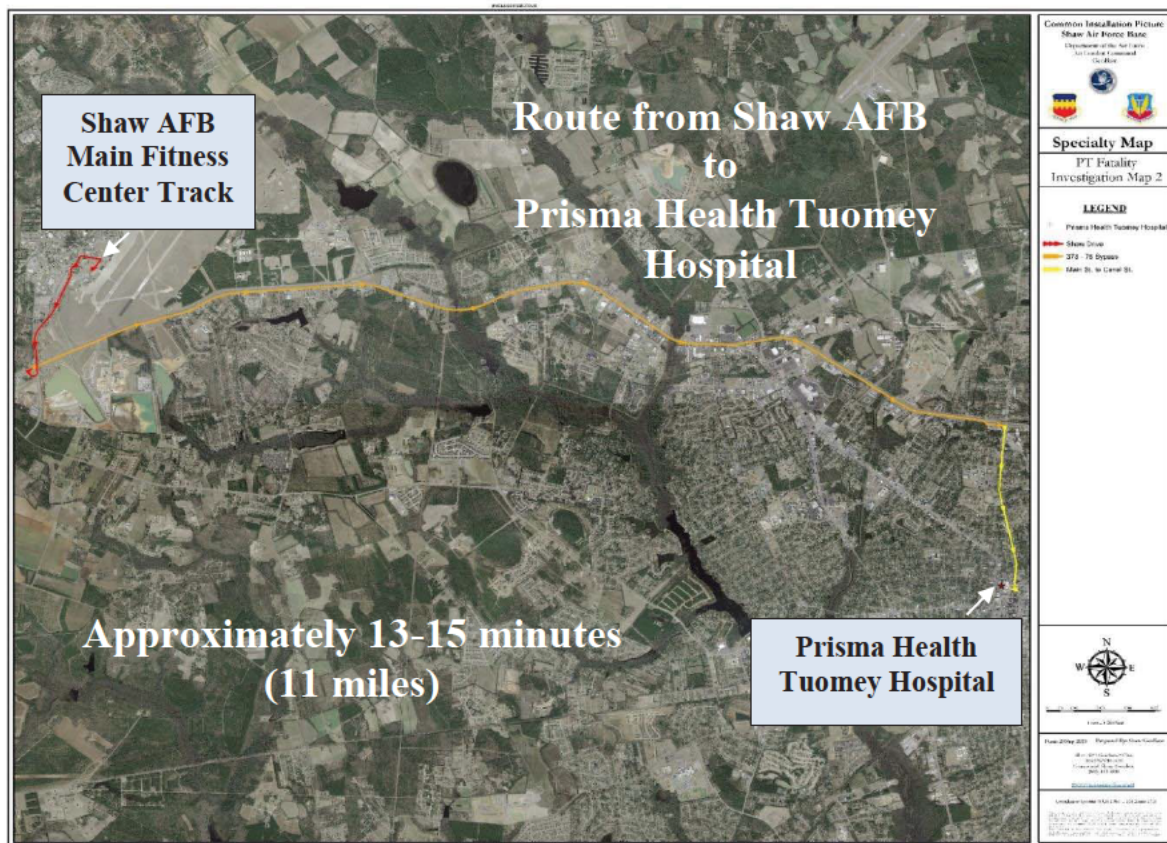


Figure 3 - Route Ambulance took from Shaw AFB to PHTH (Tab Z-5)

d. Medical Treatment at Prisma Health Tuomey Hospital

At 2223L on 29 May 2019, the ambulance arrived at PHTH (Tabs V-1.9 and X-25). EMT2 and EMT3 guided the stretcher to Trauma Room One as Paramedic1 continued BVM ventilations and Paramedic2 held the ET tube in place (Tab V-1.11 and V-4.14). Once in Trauma Room One, Paramedic1 provided the report on the MA's care to a respiratory therapist and a nurse (Tab V-1.11). The doctor walked in while Paramedic1 was giving her report, listened, and asked if they ever lost pulses (Tab V-1.12). Paramedic1 responded that they never lost pulses on the MA (Tab V-1.12). At 2226L, the MA was admitted to the PHTH ICU with a diagnosis of respiratory arrest (Tab X-14).

PHTH medical providers noted the MA had abdominal distention and were concerned that the ET tube was placed in the esophagus instead of the trachea (Tab X-12). With documented concerns of esophageal intubation in the MA's medical record, the Emergency Department physician re-intubated the MA (Tab X-12). The MA's initial documented vitals were: Blood pressure was 98 over 51 mmHg, heart rate was 145 BPM, respiratory rate was 33 breaths per minute, and oxygen saturation was 100 percent on a mechanical ventilator (Tab X-12). Continued medical care in the Emergency Department included administration of normal saline and medications to assist the MA's breathing (Tab X-9). At 2238L the MA had a chest radiographic image (x-ray) which showed no acute process and successful intubation (Tab X-9). Laboratory results revealed elevated Creatine Kinase (used as a marker for muscle breakdown), elevated cardiac troponin I (suggested myocardial infarction (heart attack)), and elevated creatinine (suggested kidney dysfunction) (Tab X-10).

On 30 May 2019, ICU physicians updated the MA's diagnosis to include: (1) Acute respiratory arrest, (2) Metabolic acidosis, (3) Acute kidney injury, and (4) Hyperglycemia (elevated glucose) (Tab X-15). A PHTH discharge summary reported transfer to PHRH at 0337L on 30 May 2019 for a higher level of care secondary to lactic acidosis and acute respiratory failure (Tab X-16). The document indicated the MA was discharged in a stable but critical condition, with a guarded prognosis (Tab X-16).

e. Medical Treatment at Prisma Health Richland Hospital

After transfer to the PHRH ICU on 30 May 2019, the MA's first documented set of vitals were: blood pressure of 120 over 88 mmHg, heart rate of 104 BPM, respiratory rate of 30 breaths per minute, and oxygen saturation of 79 percent (Tab X-16). As critical care continued, physicians updated the MA's problem list to include poor neurologic function, concern for myocardial infarction with elevated troponin, acute respiratory failure, lactic acidosis, and acute kidney injury (Tab X-16 to X-17). Laboratory results between 30 May and 1 June documented continued elevated levels of potassium, with concern for the possibility of dangerous cardiac arrhythmias; elevated Creatine Kinase, consistent with rhabdomyolysis; elevated liver enzymes, which suggested liver failure; and elevated creatinine, which was consistent with worsening acute kidney injury (Tab X-14 to X-15).

Given the MA's critical condition, the ICU physician consulted PHRH palliative care (Tab X-20). Palliative care is a medical specialty focused on improving the quality of life of both a patient (relief from symptoms/pain) and the family by offering a support system (Tab X-20 to X-21). After a PHRH palliative team conversation with the family, the MA remained in a full code status, meaning medical personnel would perform all interventions needed to get the MA's heart started if he went into cardiac arrest (Tab X-21).

On 30 May, when the MA's renal (kidney) failure progressed to the point where it was not responsive to medications and fluids, PHRH consulted Columbia Nephrology, the South Carolina Midlands area's largest nephrology practice (Tab X-20). Based on Columbia Nephrology's recommendation, the PHRH ICU physician started continuous renal replacement therapy (a form of hemodialysis that functions like a kidney) (Tab X-20). The MA also received medications to treat his low blood pressure, severe hyperkalemia (elevated potassium) induced low heart rate, and metabolic acidosis (low blood pH) (Tab X-5 and X-19 to X-20). Despite

medical interventions, the MA's condition continued to deteriorate and he passed away at 0847L on 1 June 2019 with his family at his side (Tab X-22).

f. Search and Rescue

Not applicable.

g. Recovery of Remains

Not applicable.

5. MAINTENANCE

Not applicable.

6. EQUIPMENT, VEHICLES, FACILITIES, AND SYSTEMS

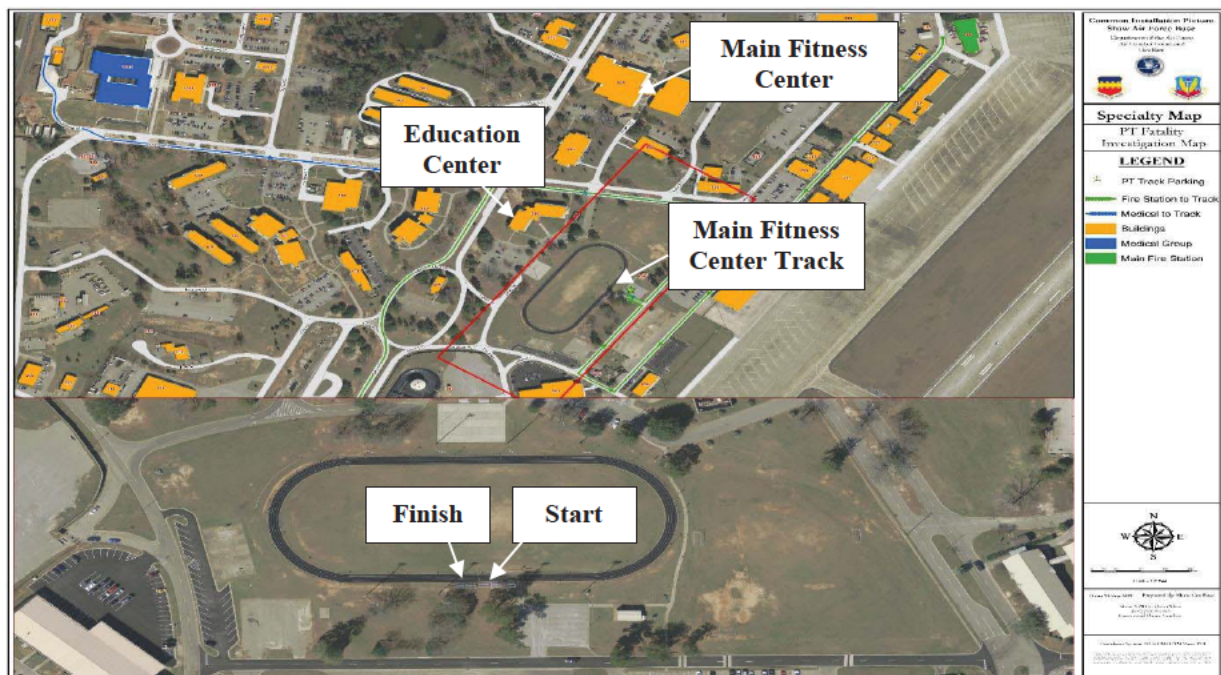


Figure 4 – Shaw AFB Main Fitness Center Track (Tab Z-6)

The 1.5-mile timed run was conducted outdoors at the Shaw AFB Main Fitness Center track located at 398 Shaw Drive (behind the Education Center) (Tabs V-8.13 and AA-8). The 1.5-mile run is five full laps and 99.54 percent of the sixth lap (Tab AA-8).

EMT1 and EMT2 from the Shaw AFB Fire Department were the first emergency medical responders to the scene and arrived in the Rescue 3 vehicle (Tab V-2.3 and V-3.6). At the start of their 48-hour shift on 28 May 2019, EMT2 verified Rescue 3 had all required equipment (Tab V-3.3 to V-3.4). Paramedic1 and EMT3 from the 20th Medical Group (20 MDG) arrived at the

scene in the Medic 3 vehicle, an ambulance (Tabs V-1.2, V-1.4, and V-4.5 to V-4.7). At the beginning of their shift on 29 May 2019, EMT3 inspected the ambulance (for example, checked lights/sirens), checked functionality of the equipment in the ambulance, and conducted a check of supplies (Tab V-4.4). Medic 3 passed the vehicle inspection, equipment, and supply checks (Tab V-4.4 to V-4.5).

At the scene, EMT2 used a pulse oximeter and BVM (Tab V-3.7 to V-3.9). Once MA was in the ambulance, Paramedic1 and EMT3 used a BVM, supplemental oxygen, OPA, cardiac monitor, automated blood pressure cuff, peripheral intravenous catheter, endotracheal tube, and prepared for the use of an AED if necessary (Tab V-1.5 to V-1.8 and V-4.8 to V-4.13).

7. ENVIRONMENTAL CONDITIONS

a. Forecasted Weather

On 29 May 2019, the 26th Operational Weather Squadron at Barksdale AFB, Louisiana, issued three 30-hour Terminal Aerodrome Forecasts (TAF) for Shaw AFB (0300L, 1100L, and 1900L) (Tab W-3). A TAF is a format for reporting weather forecast information, particularly as it relates to aviation, incorporating a 5-nautical mile radius from the center point of the airfield (Tab W-3). The 0300L TAF weather forecast conditions for 1800L to 2300L were: Winds at 7 miles per hour (mph) from the Southwest, a maximum temperature of 102.2 degrees F at 1700L, and Partly Cloudy skies (Tab W-3). The 1100L TAF weather forecast conditions for 1800L to 2300L were: Winds at 17 mph, gusting to 23 mph from the West, and 7 mph winds from the West after 2000L; a maximum temperature of 100.4 degrees F at 1700L; and partly cloudy skies (Tab W-3). The 1900L TAF weather forecast conditions for 1900L to 2300L were: Winds at 8 mph from the West, a maximum temperature of 98.6 degrees F (having passed at 1700L), and clear skies (Tab W-4).

b. Observed Weather

The 14th Weather Squadron (14 WS), located in Asheville, North Carolina, maintained surface weather observations for Shaw AFB (Tab W-5). The 14 WS received this data from an AN/FMQ-19 Automatic Meteorological Station located at Shaw AFB (Tab W-5). At 2100L on 29 May 2019, the observed weather conditions were: Temperature of 86 degrees F, dew point of 63 degrees F, and calm winds (Tab W-5). At 2200L on 29 May 2019, the observed weather conditions were: Temperature of 82 degrees F, dew point of 66 degrees F, and winds at 5 mph from the South (Tabs W-6).

c. Other Environmental Conditions

Not applicable.

d. Restrictions, Warnings, and Procedures

IAW AFI 36-2905, paragraphs A6.2.13 and A6.2.15, the maximum wind speed allowed for a FA is less than or equal to 15 mph sustained, or less than or equal to 20 mph gusting, and the WBGT must be less than or equal to 86 degrees F at the start of the run/walk (Tab BB-29). The WBGT

is a composite temperature used to estimate the effect of temperature, humidity, wind speed, and solar radiation on humans (Tab BB-28). The WBGT is used by industrial hygienists, athletes, and the military to determine appropriate exposure levels to high temperatures (Tab BB-28).

At 1036L, the Bioenvironmental Engineering Flight issued a Black Flag warning due to a WBGT reading of 92 degrees F (Tab W-7). Once a Black Flag warning is established, flag warnings do not change for the remainder of the day; however, WBGT readings are available upon request daily between 0730L and 1630L (Tab W-7). IAW AFI 48-151, *Thermal Injury Prevention Program*, paragraph 3.2, when the Bioenvironmental Engineering Flight is not available, the Heat Index can be used for risk assessment purposes even though it doesn't directly correlate with WBGT (Tab W-7 and Tab BB-53). The Heat Index is calculated using only the temperature and relative humidity, and does not account for the mean radiant temperature (the sun) (Tab W-7). Per request from the GAIB, the Bioenvironmental Engineering Flight computed the Heat Index to provide environmental conditions data for the night of 29 May 2019 (Tab W-7). At 2100L on 29 May 2019, the temperature was 86 degrees F with a heat index of 83.1 degrees (Green Flag condition), and at 2200L, the temperature was 82 degrees F with a heat index of 79.63 degrees (White Flag condition) (Tab W-7).

8. PERSONNEL QUALIFICATIONS

a. Mishap Airman

The MA was a reliable, humble, smart, heartwarming, and respected member of the 20 CMS (Tab V-11.4 and V-12.3). His squadron commander remembered him as an above average Airman and his immediate supervisor praised him for being a hard worker who was level headed and proactive (Tab V-5.8 and V-11.4). The MA joined the USAF in 2015 and during his career was awarded two Air Force Achievement Medals (Tab T-19). His accomplishments earned him honors as the 31st Maintenance Squadron Airman of the Quarter in 2017, and were crucial to the 20th Fighter Wing earning the 2018 Meritorious Unit Award (Tab T-19). The MA never failed a FA, and received two "Excellent" scores and three "Satisfactory" scores (Tab T-19).

b. Physical Training Leaders

PTL1 had completed all required training: BLS, which includes CPR and AED certification, and PTL-Advanced (PTL-A), both of which are required before completing PTL-B training (Tabs BB-10 and T-12 to T-14). PTL1 completed the most current PTL-A training on 2 May 2019 and PTL-B training on 3 May 2019 (Tab T-12 to T-13). PTL2 had also completed all required training: PTL-A on 20 February 2019 and PTL-B on 28 February 2019 (Tab T-15 to T-16).

c. Emergency Medical Services Personnel

EMT1 had current certifications as an EMS professional with the National Registry of EMTs (NREMT) and a BLS Provider (Tab T-6 to T-7). EMT2 had current certifications as an EMS professional with the NREMT and a BLS Instructor (Tab T-8). Paramedic1 had current certifications as an EMS professional with NREMT, an Advanced Cardiovascular Life Support Instructor, a Pediatric ALS Instructor, a BLS instructor, a National Association of Emergency

Medical Technicians Instructor for Pre-Hospital Trauma Life Support, and a Prehospital Trauma Life Support Provider (Tab T-3 to T-5). EMT3 had current certifications as an EMS professional with NREMT, a BLS Instructor Trainer, a BLS Instructor, and a First Aid/CPR/AED Instructor (Tab T-9 to T-11).

d. Treating Physicians

PHTH, previously Palmetto Health Tuomey, and PHRH, previously Palmetto Health Richland, are both fully accredited by the Joint Commission on Accreditation of Healthcare Organizations (Tab CC-19 to CC-20). The primary PHTH Emergency Department physician attended Columbia University College of Physicians and Surgeons Medical School, completed training at the University of Virginia, and was certified with the American Board of Family Medicine with state licensure in South Carolina (Tab X-24). The primary PHTH Internal Medicine physician graduated from the Medical College of Georgia School of Medicine and specialized in Internal Medicine and Geriatric Medicine, with state licensure in South Carolina (Tab X-24).

MA's primary PHRH ICU physician graduated from the University of South Florida's College of Medicine and from the University of Illinois Medical Center Internal and Emergency Residency (Tab X-24). This physician also completed a critical care fellowship at Cooper Health System, Cooper Hospital University Medical Center, and had board certifications in Internal, Critical Care, and Emergency Medicine with state licensure in South Carolina (Tab X-24). All other physicians involved with MA's care and treatment were appropriately supervised, licensed, and board certified (Tab X-24).

9. MEDICAL FACTORS

a. Lifestyle

On his 25 February 2019 PHA, the MA reported vigorous, light, and moderate physical activity two days a week, for a duration of 20 minutes per day on the days he worked out (Tab X-9). The MA also reported a well-balanced diet with no use of over-the-counter medications (Tab X-9). On 29 May 2019, the urine drug screen taken by PHTH was negative (Tab X-14). The MA was not known to have used supplements or energy drinks (Tab V-12.4 to V-12.5). The autopsy report also stated there was no evidence of nutritional supplement use (Tab X-22).

At the end of January 2019, the MA and a co-worker/friend (WIT2), began going to the gym together, and leading into February they went every night after work (Tab V-12.4). Their workout plan consisted of upper body and arm strength conditioning on Mondays, Wednesdays, and Fridays, with cardiovascular exercise on Tuesdays and Thursdays (Tab V-12.4). The MA also adopted healthier eating habits (salads and smaller meals), drank gallons of water daily, and stopped drinking alcohol (Tab V-12.4). In preparation for his FA on 29 May 2019, the MA and WIT2 continued to work out together and WIT2 shared running tips he had gotten from his track coach on how to break down the run into different segments and control breathing (Tab V-12.4 to V-12.5).

b. Pre-Mishap Medical Conditions

On 23 July 2015, a blood sample obtained at Basic Military Training (BMT) confirmed the MA was positive for SCT (Tab X-9). The MA was counseled on the diagnosis of SCT and instructed on the nature, likely course, and transmission of the disorder, as well as behaviors to engage in to prevent and mitigate complications regarding SCT (Tab X-9). While at BMT, the MA signed an acknowledgement of this risk on Standard Form 600, *Chronological Record of Medical Care* (Tab X-9).

Potentially relevant medical factors with respect to SCT included a series of medical evaluations regarding lower extremity pain (Tab X-9). On 15 February 2018, the MA self-disqualified during an official Air Force FA for having difficulty breathing and leg pain (Tab X-9). The medical provider arranged for a next day follow-up appointment with his Primary Care Manager (PCM) who provided the MA with a written memorandum requesting a retake of his official FA in one week and instructed him on the importance of adequate hydration (Tab X-9). On 23 February 2018, the MA took another official FA which he did not finish (Tab X-9). There is no documentation for why he did not finish or documentation in his medical record of any care given (Tab X-9).

On 25 February 2019, the MA completed his required annual Preventive Health Assessment (PHA) IAW AFI 44-170, *Preventive Health Assessment*, paragraph 2.1.1 (Tab X-9 and BB-31). No provider concerns were identified with this PHA (Tab X-9). On 13 March 2019, the MA scheduled a medical appointment regarding pain in his right leg after playing basketball, and pain that made it difficult to run (Tab X-9). The medical provider placed him on a two-week medical profile for no high-impact, running, or competitive sports (Tab X-9). On 17 April 2019, a medical provider evaluated the MA for right leg pain that started after running, and x-rays showed potential for a stress fracture (Tab X-9). On 23 April 2019, the MA had a Magnetic Resonance Imaging (MRI) of both lower extremities which showed no evidence of a stress fracture (Tab X-9). On 2 May 2019, the MA was evaluated for pain in his left ankle following running (Tab X-9). The MA had a laboratory evaluation which included a comprehensive metabolic panel, complete blood count, uric acid, Erythrocyte Sedimentation Rate (measures degree of inflammation present in the body), and Antinuclear Antibodies screen with rheumatoid factor (test to help evaluate a person for autoimmune disorders), and x-rays of the left ankle (Tab X-10). The medical provider prescribed an anti-inflammatory to help with the pain and placed the MA on 48-hours quarters (Tab X-10). The x-rays of the left ankle showed soft tissue swelling without fracture (Tab X-10). Based on laboratory results at that time, the MA did not have evidence of kidney disease or elevated blood sugar (Tab X-10).

c. Injuries and Pathology

According to a medical review of the facts and circumstances of this mishap, Shaw AFB EMS personnel noted that the MA was in severe respiratory distress following his 1.5-mile timed run (Tab X-21 and X-25 to X-27). Initial vital signs demonstrated hypotension (low blood pressure), poor respiratory effort, and hypoxia (low oxygen saturation) that required immediate critical actions, such as endotracheal intubation, en route to the PHTH Emergency Department (Tab X-21 and X-25 to X-27). Upon arrival at PHTH, medical providers noted the MA had abdominal distention and were concerned that the ET tube was placed in the esophagus instead of the trachea

(Tab X-12). Documented concerns of esophageal intubation in the MA's medical record led to the Emergency Department physician's decision to re-intubate the MA (Tab X-21). Per the history and physical from the Emergency Department physician, the MA was noted to be in severe respiratory failure and remained unresponsive with a Glasgow Coma Scale of three (severe neurologic impairment) (Tab X-12). The MA also received saline given the concern for dehydration, and insulin given his initial elevated blood glucose level (Tab X-12). The MA was admitted to the PHTH ICU with a diagnosis of respiratory arrest and remained in respiratory failure on mechanical ventilation (Tab X-14). As care continued in the ICU, laboratory results led to an updated problem list which included acute respiratory arrest, metabolic acidosis (low blood pH), acute kidney injury, and hyperglycemia (elevated blood glucose) (Tab X-14 to X-15). The MA's acute kidney injury was due to a combination of factors which included dehydration, intravascular hypovolemia (low blood pressure), and developing muscle breakdown (rhabdomyolysis) with deposition of myoglobin in the kidney (Tab X-16). Results of a hemoglobin electrophoresis also confirmed SCT (Tab X-15).

The MA was transferred to the PHRH ICU on 30 May 2019 for a higher level of care secondary to lactic acidosis and acute respiratory failure, and he remained on mechanical ventilation (Tab X-16). Analysis of laboratory results supported acute kidney injury as evidenced by elevated serum creatinine and electrolyte derangements, such as hyperkalemia and metabolic acidosis (Tab X-19). The MA's acute kidney injury and electrolyte disorders did not improve with initial resuscitation of fluids and he remained anuric (no urine output), requiring continuous renal replacement therapy (Tab X-20). His Troponin I was initially elevated and progressively worsened despite continued resuscitation, which was consistent with the MA having some degree of myocardial infarction (heart attack) (Tab X-19). The MA's liver enzymes progressively worsened, which was consistent with liver failure (Tab X-19). The cause of the liver failure was likely secondary to shock liver and blood flow under systemic stress (Tab X-19). When the body is under systemic stress, the cardiac output may not be enough to supply the demands of the critical organs (heart and brain) so the body would give preferential blood flow to those organs and decrease blood flow in the splanchnic circulation (liver and gastrointestinal tract) (Tab X-19). The dramatic increase in the MA's Creatine Kinase level in less than 24 hours, as well as elevated phosphorus, elevated potassium, acidosis, and low calcium supported the diagnosis of rhabdomyolysis (Tab X-21). A CT of the MA's abdomen and pelvis demonstrated global ischemia (restriction in blood supply) to his intra-abdominal organs (Tab X-19 and X-21).

The death certificate, completed by the PHRH ICU physician, documented the cause of death as suspected dehydration, acute hypoxic respiratory failure, esophageal intubation, and abdominal compartment syndrome (Tab X-22 and X-29). The death certificate also listed an unknown type of bowel cleanser listed under "Other Significant Conditions;" however, there was no substantiating evidence to indicate the use of a bowel cleanser in witness statements or medical documents (Tab X-22 and X-29).

On the autopsy report, dated 3 June 2019, the medical examiner listed the MA's cause of death as a cardiac arrhythmia from cardiomegaly (enlarged heart), and stated the manner of death was natural (Tab X-22). The medical examiner's autopsy microscopic examination findings with respect to pertinent organ systems included: massive liver necrosis (dead tissue), spleen congestion with partial autolysis (disintegration of cells), kidney tubular autolysis (disintegration

of cells), mild congestion of the lung, and scattered myocyte hypertrophy in the heart (enlarged heart cells) (Tab X-23). The medical examiner's report also listed SCT as a contributing factor to the MA's death (Tab X-22).

10. OPERATIONS AND SUPERVISION

a. Operations

After taking command of the 20 CMS, the Commander signed a memorandum on 25 July 2017 titled *Commander's Fitness Assessment Guidance* (Tabs V-5.3 to V-5.4 and BB-42 to BB-43). He stressed that every Active Duty member is personally responsible for maintaining physical fitness, knowing when they are due for a FA, handling their profile status (if applicable), and scheduling the assessment (Tab BB-42). He also provided guidance on actions squadron members must take to avoid losing qualified personnel to FA failures (Tab BB-42 to BB-43).

As of 9 August 2018, AF/A1 gave squadron leadership the authority to administer Air Force FAs for their squadron members (Tab BB-40). On 22 March 2019, the 20 CMS Commander signed a memorandum stating that starting on 1 April 2019, 20 CMS would assume the responsibility to conduct official FAs for Airmen within the unit (Tab BB-44). The memorandum stated that the squadron would follow all policies in AFI 36-2905, and did not include any restrictions on what days or times FAs could be conducted (Tab BB-44).

b. Supervision

At the time of the mishap, two FSQ versions existed: One in AFI 36-2905, and one on the Air Force Fitness Management System (AFFMS) web site (Tab AA-10 to AA-14). Question 1 on both versions of the FSQ asked whether Airmen experienced a list of symptoms/problems for which they had not been "medically evaluated and cleared for unrestricted participation in a physical training program" (Tab AA-10 and AA-13). In addition, Question 1d on the AFI 36-2905 version of the FSQ asked about "other medical problems that had not been evaluated, optimally treated, or already addressed in an AF Form 469, *Duty Limiting Condition Report*," and listed heart disease, SCT, and asthma as examples of such medical problems (Tab AA-13). However, Question 1d on the AFFMS version of the FSQ asked about "other medical problems, not already addressed in an AF Form 469, that may prevent you from safely participating in this test or achieving a satisfactory score" (Tab AA-10). This version of the FSQ did not list any medical problem examples (Tab AA-10). The FSQ the UFPD emailed to the MA on 24 May 2019 to fill out was the AFFMS version of the FSQ (Tabs V-10.13 and AA-10). Based on the MA's "No" answer to Question 1 on the AFFMS FSQ version, PTL1 cleared MA to take his official FA (Tabs V-8.9 and AA-2).

At approximately 2130L, PTL1 checked the weather via an application on his cell phone (Tab V-8.14). Based on his personal observations and a temperature of either 81 or 82 degrees F on his cell phone application, PTL1 concluded the temperature was low enough to conduct the FA (Tab V-8.14). After the MA began going in and out of consciousness and had difficulty breathing, PTL1 and PTL2 dialed 9-1-1 once they perceived the MA was in immediate need of EMS personnel care (Tab V-8.19 and V-9.7).

11. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

- (1) AFI 51-307, *Aerospace and Ground Accident Investigations*, dated 18 March 2019.
- (2) DHA-PI 6025.14, *Active Duty Service Member (ASDM) Erythrocyte Glucose-6-Phosphate Dehydrogenase Deficiency (G6PPD) and Sickle Cell Trait (SCT) Screening Program*, dated 6 December 2018.
- (3) AFI 36-2905, *Fitness Program*, dated 21 October 2013, incorporating change 1, dated 27 August 2015.
- (4) AFI 44-170, *Preventive Health Assessment*, dated 30 January 2014, certified current 19 January 2016.
- (5) AFI 48-151, *Thermal Injury Prevention Program*, dated 7 April 2016.

NOTICE: The Air Force publications listed above are available digitally on the Air Force Departmental Publishing Office website at: <http://www.e-publishing.af.mil>, and the Defense Health Agency publication is available at <https://health.mil> under Reference Center, then Policies.

b. Other Directives and Publications Relevant to the Mishap

Not applicable.

c. Known or Suspected Deviations from Directives or Publications

(1) The FSQ used by Shaw AFB at the time of the mishap and given to the MA was not the AFI version of the questionnaire (Tab AA-2 to AA-3 and AA-13 to AA-14). AFI 36-2905 provides the correct FSQ in Attachment 4 of the AFI (Tab AA-13 to AA-14). Question 1d of the AFI 36-2905 version of the FSQ asks if there are other medical problems that have not been “evaluated, optimally treated, or not already addressed in an AF Form 469, that may prevent someone from safely participating in a FA,” and lists heart disease, SCT, and asthma as examples (Tab AA-13). Shaw AFB used the FSQ version available for download on the AFFMS web site, in which Question 1d did not specifically list SCT as an example of such medical problems (Tabs V-10.13 and AA-10).

(2) IAW AFI 48-151, paragraph 3.2.7, the primary measure of heat stress for the Air Force remains the WBGT (Tab BB-53). In addition, AFI 36-2905, paragraph A6.2.15, states the WBGT must be less than or equal to 86 degrees F at the start of the walk/run and to consult with base environmental engineering, base weather, or civilian agencies to determine environmental conditions. (Tabs V-8.11 and Tab BB-29). Per AFI 48-151, paragraph 3.2.7, the Heat Index can be used for risk assessment purposes when bioenvironmental engineering is not available to provide the WBGT (Tab BB-53). At the time of the mishap, PTL1 got the temperature from an application on his cellular phone (Tab V-8.11 and V-8.14). He called the Bioenvironmental Engineering Flight to get the WBGT, but he did not get an answer (Tab V-8.14). He did not call base weather for the official observed weather or WBGT (Tab V-8.14).

(3) Per AFI 36-2905, paragraph 2.12.5.2, the Installation Commander has the responsibility to approve the 1.5-mile run/2.0-kilometer walk assessment course in conjunction with the local Civil Engineer Squadron, FSS, and Wing Safety (Tab BB-5). The 20th Civil Engineer Squadron verified the Shaw AFB Main Fitness Center track, Wing Safety concurred with the course verification, and the 20th Force Support Squadron Commander recommended that the 20 FW Commander approve the course (Tab AA-8 to AA-9). However, there was no documentation that the 20 FW Commander approved the course (Tab AA8 to AA-9).


Date: 2019.11.26 16:45:00 -08'00'

26 November 2019

MICHELLE L. HAYWORTH
Brigadier General, USAF
President, Ground Accident Investigation Board

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* Tabs A through S of the GAIB report are to be identical to Part 1 of the Safety Investigation Board (SIB) report's Tabs A through S; however, ACC did not complete a SIB report on this medical mishap.