NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 23, 2016

Specialist's Factual Report

HUMAN PERFORMANCE

ERA15MA259AB

I. ACCIDENT

Location:	Moncks Corner, South Carolina
Date:	July 7, 2015
Time:	1101 eastern daylight time (EDT)[1]
Airplane A:	Lockheed Martin F-16CM (Death 41)
Airplane B:	Cessna 150M (N3601V)

II. HUMAN PERFORMANCE SPECIALIST

Katherine Wilson
Human Performance and Survival Factors Division (AS-60)
National Transportation Safety Board
Washington, DC 20594

III. SUMMARY

On July 7, 2015, at 1101 eastern daylight time, a Cessna 150M, N3601V, and a Lockheed-Martin F-16CM, operated by the U.S. Air Force (USAF), collided in midair near Moncks Corner, South Carolina. The Cessna was destroyed during the collision, and both the private pilot and passenger were fatally injured. The damaged F-16 continued to fly for an additional 3 minutes until the pilot activated the airplane's ejection system. The F-16 was destroyed following the subsequent collision with terrain and post-impact fire, while the pilot landed safely and was uninjured. Visual meteorological conditions prevailed, and no flight plan was filed for the Cessna, while the F-16 was operating on an instrument flight rules flight plan. The Cessna departed from Berkeley County Airport (MKS), Moncks Corner, South Carolina, at 1057, and was destined for Grand Strand Airport (CRE), North Myrtle Beach, South Carolina;

[1] All times are reported in local time unless otherwise noted.

the personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. The F-16 had departed from Shaw Air Force Base (SSC), Sumter, South Carolina about 1020.

IV. DETAILS OF THE INVESTIGATION

The human performance specialist joined the investigation on August 26, 2015, to support the ongoing investigation. The specialist worked with the investigator-in-charge, and operations and air traffic control investigators to gather factual data. The Human Performance Specialist's Factual Report contains documentation relevant to the air traffic controller and F-16 pilot involved in the accident; their backgrounds, pre-accident activities, and training; and available regulations and guidance related to midair collisions and the concept of see-and-avoid.

V. FACTUAL INFORMATION

1.0 CHS Radar Room Controller

The controller in the radar room at the time of the accident had been working at CHS since February 2008 and had received her control tower operator certificate in July 2008. She was qualified on all positions at CHS and was also an on-the-job instructor (OJTI).

The controller's most recent second class medical certificate, issued by the FAA, was dated May 21, 2014, and had no limitations. According to her FAA medical records, item 18m. Mental disorder of any sort; depression, anxiety, etc. was marked yes. The reason provided was for participation in OWCP[2] from December 2009 until February 2010 for a near miss incident in December 2009.

According to Google Maps, the commute from her home in Moncks Corner, South Carolina, to CHS was about 30 minutes.

She did not smoke or drink alcohol and reported no difficulties sleeping. The controller stated that in the 12 months preceding the accident, she had no major changes to her personal life, financial situation, or health, good or bad, that would have impacted her performance the day of the accident.

She was not tested for drugs or alcohol after the accident.

1.1 CHS Radar Room Controller's Recent Activities

On Friday, July 3, 2015, the controller did not recall what time she went to bed or whether she had any difficulties falling asleep or staying asleep that night. There was no cellular telephone activity after 1813. She was off duty that day.

On Saturday, July 4, she did not recall when she woke up or how she slept. Cellular telephone records indicated activity beginning at 1140 until 1952, with breaks in activity longer

[2] Office of Worker's Compensation Program.

than an hour from 1152 until 1438 and 1525 until 1717. She did not recall her activities that day but she worked from 1600 until midnight on local control, ground control and approach control TRACON positions. During her shift, she had breaks from 1702 until 1725, 1805 until 1914, 1953 until 2008, and 2100 until 2119. Her time on station was 5 hours and 42 minutes. She did not nap during the day. She did not recall when she went to bed after her shift ended or whether she had any difficulties falling asleep or staying asleep.

On Sunday, July 5, she did not recall when she woke up or how she slept. Cellular telephone records indicated activity beginning at 0809 until 2257, with breaks in activity longer than an hour from 1018 until 1149, 1247 until 1454, 1455 until 1501, 1502 until 1632, 1636 until 1926, 1959 until 2107, and 2121 until 2257. She did not recall her activities that day but she worked from 1300 until 2230 on the local control and approach control TRACON positions. During her shift, she had breaks from 1451 until 1518, 1630 until 1721, 1802 until 1838, and 1924 until 2033. Her time on station was 6 hours and 27 minutes. She did not nap during the day. She did not recall when she went to bed that night or whether she had any difficulties falling asleep or staying asleep.

On Monday, July 6, she did not recall when she woke up or how she slept. Cellular telephone records indicated activity beginning at 0745 until 2144, with breaks in activity longer than an hour from 0758 until 0915, 0927 until 1203, 1517 until 1635, 1833 until 1913, and 1915 until 2144. She did not recall her activities that day but said she worked from 0745 until 1545 on the location control position. During her shift, she had breaks from 0913 until 0957 and from 1159 until 1545. Her total time on station was 3 hours and 28 minutes. After work, she had an activity at church from 1800 until 2000. She did not nap during the day. She did not recall when she went to bed that night or whether she had any difficulties falling asleep or staying asleep.

On Tuesday, July 7, she woke up at 0440 and worked from 0600 until the accident occurred on the approach control TRACON position. During her shift, she had breaks from 0700 until 0747 and 0832 until 0925. Her total time on station was 3 hours and 25 minutes. She did not recall what she had for breakfast prior to her shift but said she usually had cereal and coffee. Cellular telephone records indicated activity prior to the accident from 0855 until 0858.

1.1.1 Controller Training Records

The controller's most recent proficiency training was completed on March 24, 2015, and covered two topics: "Lowcountry Shelf Boundary Changes Memo" and "Atlantic Route(s) 7-12-25, CHS ATCT Memo." She satisfactorily completed her 1 year OJTI evaluation skill check on July 7, 2014. A review of her records for the 3 years preceding the accident indicated she received proficiency training on safety alerts/traffic advisories in February 2012, July 2012, and December 2013.

She satisfactorily completed ATCT/ARTCC OJT on the CIC (controller in charge) position on April 25, 2010.

Following the accident, she completed ATCT/ARTCC OJT for recertification on all positions on August 22-23, 2015.

2.0 F-16 Pilot

The F-16 pilot was the chief of mobility assigned to the 55th Fighter Squadron at Shaw Air Force Base (AFB), Sumter, South Carolina, and had been in that position for 11 months. He had been in the USAF for 12 years and previous duty stations included Laughlin AFB, Luke AFB, Aviano Air Base, Creech AFB, Holloman AFB and Kunsan Air Base. He also held a private pilot certificate.

He had previously flown to CHS.

He wore contact lenses and was wearing them at the time of the accident. He did not have any problems with his helmet or visor during the accident flight.

2.1 F-16 Pilot's Recent Activities

His sleep pattern varied with his flying schedule but if he was flying during a day shift, he would typically go to bed about 2100 and would try to get 8 and a half hours of sleep if able. He reported needing 8 to 8 and a half hours of uninterrupted sleep to feel rested.

He did not recall the times he went to bed and woke up during the time period from July 4-7, 2015. He did not recall any disruptions to his sleep during in the days preceding the accident. He reported his activities during that period were normal other than he had family visiting him. In the 3 months prior to the accident, he did not recall any external pressures or life stressors that would have affected his performance the day of the accident.

He had previously flown the F-16 on June 30 and July 1, 2015. He did not work July 2-5. On Saturday, July 4, he did not recall when he woke up but estimated he slept about 8 hours. He reported eating breakfast and having a cup of coffee. He engaged in family activities during the day and prepared for the holiday, and went to bed about midnight. He did not take any medications or supplements, including over the counter, that day. He drank two beers that evening. He did not use any tobacco products.

On Sunday, July 5, he awoke about 0500 to take a family member to the airport and then returned home and slept about 4 more hours. He did not eat breakfast but did eat lunch. He engaged in family activities during the day and ate dinner about 1830. He did not recall when he went to sleep but stated he got 8 hours of continuous sleep and slept "very well". He did not take any medications or supplements, including over the counter, that day. He did not use any alcohol or tobacco products that day. He estimated his exertion that day as "very light."

On Monday, July 6, he did not recall when he awoke but departed for work at 0730 and reported for duty at 0750 for his flight medical annual physical. He at lunch about 1200 and had a caffeinated soda. He recalled becoming aware of the operational check flight (OFC) that afternoon. He left work about 1800 and had dinner about 1830. He did not take any medications or supplements, including over the counter, that day. He did not use any alcohol or tobacco products that day. He estimated his exertion that day as "very light."

On July 7, he awoke about 0700 and said he got about 8 hours of continuous sleep. He slept "very well". He ate breakfast and drank a cup of coffee about 0730, left for work at 0745 and reported for duty at 0800. He estimated his exertion since awakening as "none." He did not use any tobacco products prior to the accident.

3.0 Midair Collision/See and Avoid Guidance

A number of online resources are available to pilots to minimize their risk of a midair collision.

3.1 Seeandavoid.org Website

According to the 'About Us' page, the website is funded by the FAA and Air National Guard, and offers "a centralized, credible website that provides civilian and military pilots with reciprocal information and education on airspace, visual identification, aircraft performance, and mutual hazards to safe flight; with the ultimate goal of eliminating midair collisions and reducing the close calls."

3.2 US Air Force Base MACA Programs

The seeandavoid.org website also provides links to existing military mid-air collision avoidance (MACA) programs and additional information can be found through the base websites.

The CHS MACA program brochure can be downloaded at: http://seeandavoid.org/Home/MilitaryFacility?id=359. Additional information on CHS AFB midair collision avoidance can be found at http://www.charleston.af.mil/library/maca/index.asp.

The Shaw AFB MACA program can be downloaded at: http://seeandavoid.org/Home/MilitaryFacility?id=362. Additional information on Shaw AFB midair collision avoidance can be found at http://www.shaw.af.mil/Library/Mid-AirCollisionAvoidance.aspx.

3.3 FAA Regulations/Guidance

3.3.1 Federal Regulations

Title 14 of the Code of Federal Regulations (14 CFR) part 91 Section 91.113 sets forth the concept of "See and Avoid" and states, in part:

> (b) *General.* When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear.

Section 91.113 further states, in part:

(e) *Approaching head-on.* When aircraft are approach each other head-on, or nearly so, each pilot of each aircraft shall alter course to the right.

3.3.2 Advisory Circular

FAA Advisory Circular 90-48D "Pilots' Role in Collision Avoidance" dated 4/19/16 states:

> **1 PURPOSE.** This advisory circular (AC) is issued for the purpose of alerting all pilots to the potential hazards of midair collisions and near midair collisions (NMAC), and to emphasize those basic problem areas related to the human causal factors where improvements in pilot education, operating practices, procedures, and improved scanning techniques are needed to reduce midair conflicts.

The AC can be downloaded at: http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_90-48D.pdf [last retrieved on May 10, 2016].

3.3.3 Aeronautical Information Manual

The Aeronautical Information Manual (AIM) chapter 5 "Air Traffic Procedures," section 5 "Pilot/Controller Roles and Responsibilities," subsection 5-5-8 "See and Avoid," states:

> **a. Pilot:** When meteorological conditions permit, regardless of the type of flight plan or whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles**.**
> **b. Controller:**
> 1. Provides radar traffic information to radar identified aircraft operating outside positive control airspace on a workload permitting basis.
> 2. Issues safety alerts to aircraft under their control if aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain, obstructions, or other aircraft.

3.3.4 Faasafety.gov

Faasafety.gov provides educational resources for pilots on various topics, including "How to Avoid a Mid Air Collision" (P-8740-51). The resource provides the profile of midair collisions, causes of midair collisions, limitations of the human eye, appropriate internal and external scanning techniques, and a collision avoidance checklist. For additional information, see https://www.faasafety.gov/gslac/ALC/libview_normal.aspz?id=6851 [last viewed on May 10, 2016.

3.4 NTSB Safety Alert

In May 2015, the NTSB published a Safety Alert titled "See and Be Seen: Your Life Depends on It" which provides tips on what pilots can do to minimize the risk of a midair collision. The safety alert can be downloaded at: http://www.ntsb.gov/safety/safety-alerts/Documents/SA_045.pdf [last retrieved on May 10, 2016].

3.5 ATSB Transport Safety Report

The Australian Safety Transport Bureau (ATSB) published a Transport Safety Report titled "Limitations of the See-and-Avoid Principle," first printed in 1991 and reprinted in 2004. Following a midair collision between two general aviation airplanes in Queensland, the Bureau of Air Safety Investigation (predecessor to ATSB) conducted an evaluation on the practicability of the see-and-avoid principle in controlled and uncontrolled airspace. The findings are summarized in the safety report and can be downloaded at: https://www.atsb.gov.au/publications/1991/limit_see_and_avoid.aspx [last retrieved on May 10, 2016].

3.6 AOPA Safety Advisor

In 2004, AOPA published a Safety Advisor titled "Collision Avoidance" providing pilots with strategies and tactics to minimize the risk of a midair collision. The article describes various topics such as the physiology of vision, risk of a midair collision by phase of flight, avoidance strategies, and collision avoidance technology. The article concludes with a "collision avoidance checklist" for pilots to consider prior to a flight. The Safety Advisor can be downloaded at: http://www.aopa.org/-/media/files/aopa/home/pilot-resourses/asi/safety-advisors/sa15.pdf?la=en [last retrieved May 10, 2016].

VI. LIST OF ATTACHMENTS

Attachment 1 – CHS Controller Interview Summary
Attachment 2 – USAF Interim Safety Board (ISB) Interview with F-16 Pilot
Attachment 3 – USAF Accident Investigation Board (AIB) Record of Interview with Chief ATC Automation