Aviation Investigation Final Report

Location:	Pacific Ocean, Pacific Ocean	**Accident Number:**	WPR17LA186
Date & Time:	August 22, 2017, 16:18 Local	**Registration:**	N338AX
Aircraft:	Hawker Siddeley HUNTER MK.58	**Aircraft Damage:**	Destroyed
Defining Event:	Flight control sys malf/fail	**Injuries:**	1 Minor
Flight Conducted Under:	Public aircraft		

Analysis

The civilian airline transport pilot was conducting a cross-country flight with another airplane to participate in a military air defense training exercise. The accident pilot reported that, while flying about 14,000 ft mean sea level (msl), one of the military airplanes started flying alongside his airplane's right wing and then accelerated ahead of his airplane and crossed in front of its flightpath. The military pilot stated that he tried to get the accident pilot's attention so that he could make him aware of his position but that he was unsuccessful. The accident pilot reported that he attempted to follow the military airplane but that it then turned right and passed in front of his flightpath again. The accident pilot added that, as he turned right to follow the military airplane, he heard a "thump," which he attributed to jet wash. His airplane then immediately rolled left. He attempted to counter the left roll by applying right aileron, but the airplane then entered a nose-down attitude and began to spin. The pilot attempted to recover control without success, and he subsequently ejected from the airplane while it was passing through 4,000 ft msl. The airplane subsequently descended into the ocean.

The airplane could not be examined after the accident because the wreckage was not recovered from the ocean. The pilot reported seeing that the magnetic indicators displayed black, which suggests that aileron hydraulic power was being supplied to the ailerons at the time of the loss of control.

Given the evidence, it is likely that, after the accident airplane flew through the military airplane's jet wash, aileron movement was inhibited for reasons that could not be determined, which resulted in the pilot's loss of airplane control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilot's loss of airplane control after flying through another airplane's jet wash during an air defense exercise.

Findings

Aircraft	(general) - Not attained/maintained
Environmental issues	Wake turbulence - Effect on operation
Environmental issues	Wake turbulence - Ability to respond/compensate
Personnel issues	Aircraft control - Pilot

Factual Information

History of Flight

Maneuvering	Aircraft wake turb encounter
Maneuvering	Flight control sys malf/fail (Defining event)
Maneuvering	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On August 22, 2017, about 1618 Pacific daylight time, a Hawker Hunter MK-58, N338AX, was destroyed when it impacted open water about 80 nm southwest of San Diego, California during an exercise with a United States military fighter jet. The airline transport pilot received minor injuries. The airplane was registered to Hunter Aviation International, Inc. and operated by Airborne Tactical Advantage Company (ATAC) under contract with the U.S. Navy as a Public aircraft. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the local flight that departed Point Mugu Naval Air Station, Oxnard, California at 1517.

According to ATAC, their pilots were participating in an adversarial mission in support of an air defense vulnerability period for Carrier Air Wing/ USS Theodore Roosevelt Carrier Strike group assets. The F-35s from the U.S. Air Force's 62nd Fighter Squadron would conduct a defensive counter air mission, while the MK-58s provide adversarial support. On the day of the accident, the accident pilot and his wingman, assigned as Red Air for the exercise, checked in with the Red Air controller and coordinator of the exercise to understand their roles and to obtain the correct radio frequencies. Their goal in the exercise was to overfly the military aviator's ships without being escorted. After an uneventful outbound flight to the theatre area the airplanes were escorted around the aircraft carrier. At times, two FA-18 turbojet fighter airplanes, piloted by naval aviators, would follow behind the pilot and his wingman while the controller issued instructions to observe the navy pilots' responses.

The FA-18 fighters were then relieved by two F-35 fighters. While flying at 14,000 ft mean sea level (msl), one of the F-35s flew alongside and about 1,500 ft from the accident pilot's right wing. Moments later, the F-35 accelerated ahead of the pilot and crossed in front of his flight path from the accident pilot's right side to his left side. The pilot attempted to follow the F-35, but the airplane then initiated a right turn and passed in front of the pilot's flight path again, this time to the right. As the pilot started to turn right to follow the F-35, he heard a "thump", which he dismissed as jet wash. He continued his maneuver and rotated to the right into an approximate 60° angle of bank and began to apply back pressure, but the airplane immediately rolled into a left bank, at which time the F-35 disappeared from his view. The pilot briefly terminated the left-hand roll by applying right aileron but was unable to move the flight controls more than one inch to the right of its center position. He remarked that the right aileron flight control movement felt "jammed" as he can normally move the flight controls to his right knee. The airplane then entered an approximate 35° nose down attitude, at which time the pilot applied back pressure on the flight controls, but the airplane repeated its previous movement and entered a left-hand roll. After about 2 full 360° rotations, the pilot stopped the movement with some right aileron, but the flight controls still would not advance to the right more than one inch beyond its center position. As

he was passing through 4,000 ft mean sea level, the pilot notified his wingman that he was ejecting. He did not observe any unusual sounds or harmonics from the engine during the accident flight.

F-35 Pilot

According to the trailing F-35 pilot, he was assigned to United States Air Force's 62nd Fighter Squadron to support an exercise for the United States Navy with the USS Theodore Roosevelt off the California coastline. During the briefing, he was informed that both he and his lead would be flying as "Blue Air"; their objective was to defend the south, intercept any adversaries coming from the north and escort them back to their airspace. The soft deck for the exercise was 10,000 ft and the hard deck was 5,000 ft. After an uneventful departure, the pilot of an F/A-18 informed the F-35 pilot and his lead that he had rejoined, maintained close visual formation inside of 1,000 ft, on a pair of Hawker Hunters, and asked the F-35s to rejoin on them. The F-35s started to rejoin on the Hawker Hunters as the F/A-18s ceased their engagement of the adversarial fighters. The lead F-35 pilot covered the trailing Hawker Hunter, while the trailing F-35 pilot advanced forward of the lead Hawker Hunter and rejoined off the lead pilot's left wing. The trailing F-35 pilot rocked his wings and the Hawker Hunter pilot acknowledged. After the F-35 pilot informed the controller that the Hawker Hunters were continuing north and the F-35s were going to cease their engagement, the Hawker Hunters reversed course and followed them to the south.

The trailing F-35 pilot rejoined on the accident pilot about 500-800 ft off his right wing and rocked his wings, but the accident pilot did not acknowledge. After another unsuccessful attempt to get the accident pilot's attention, the trailing F-35 pilot accelerated ahead and high of the accident pilot and then descended as he crossed in front of the accident pilot's flight path from right to left and then reversed his turn (from left to right). He estimated from looking over his shoulder that he was about 2,500 ft in front of the accident pilot about this time and slightly higher. Following about 90° of turn and a snap roll the accident pilot appeared to be lining up a gun shot. The accident airplane then rolled inverted in a nose high attitude, which was followed by a snap roll and then a descending right-hand turn. His altitude at the time was approximately 9,500 ft. The airplane subsequently entered a dive, at which time the F-35 pilot engaged him with a simulated ordinance. The accident airplane never recovered from the dive.

Radar data was provided by the Southern California Offshore Range (SCORE) at Naval Air Station North Island, California. The F-35's relayed altimeter data at a 1 hz sampling rate along with its geographic positioning system (GPS) data. Large Area Tracking Range (LATR) pods were mounted to both MK-58s, which reported multiple parameters, including position and altimeter data. The radar displayed data points for "Jest11" (the accident airplane) and "Jest12" (the accident pilot's wingman).

The radar data for Jest11 and Jest12 began at 1530:00 at a radar altitude of about 15,800 ft. Both airplanes turned to a southern heading at 1534:42, followed by a western heading at 1539:35. Jest11 then completed a 180° left turn to a southern heading followed by two 360° right turns before the airplane turned to the southwest at 1553:02, and an approximate altitude of 13,200 ft. About 20 seconds later Jest11 performed a left turn from a southeastern heading at an approximate altitude of 14,500 ft. In the airplane's final minute of flight, it maintained an approximate altitude of 14,800 ft on a southern heading. Several seconds of data are missing between 1616:03 and 1616:09. The last radar data point for Jest11 was captured at 1616:25 at a radar altitude of 14,733 ft. Jest12 remained in the area for about 15 minutes before returning to Point Mugu.

According to a report furnished by ATAC, the LATR pod stopped transmitting about the time the accident airplane flew through the F-35's jet wash. The report stated that the LATR pod is equipped with an uninterruptable power source, capable of powering the pod for several seconds independently of the airplane's power supply.

Pilot Information

Certificate:	Airline transport; Commercial	**Age:**	44,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Single
Other Aircraft Rating(s):	None	**Restraint Used:**	5-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	February 8, 2017
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 5, 2017
Flight Time:	3138 hours (Total, all aircraft), 420 hours (Total, this make and model), 62 hours (Last 90 days, all aircraft), 28 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

The pilot, age 44, held an airline transport pilot certificate with ratings for airplane single-engine land, multi-engine land, instrument airplane and a type rating for Hawker Hunter MK-58. His most recent Federal Aviation Administration (FAA) first-class medical certificate was issued on February 8, 2017, with no limitations. At the time of the accident, the pilot had accumulated 3,138 total flight hours; 420 of which were in the accident airplane make and model.

Aircraft and Owner/Operator Information

Aircraft Make:	Hawker Siddeley	**Registration:**	N338AX
Model/Series:	HUNTER MK.58 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1959	**Amateur Built:**	
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	41H-697452
Landing Gear Type:	Retractable - Tricycle	**Seats:**	1
Date/Type of Last Inspection:	May 11, 2017 Condition	**Certified Max Gross Wt.:**	25000 lbs
Time Since Last Inspection:	41 Hrs	**Engines:**	1 Turbo jet
Airframe Total Time:	3242.6 Hrs at time of accident	**Engine Manufacturer:**	Avon
ELT:	Installed, not activated	**Engine Model/Series:**	203/7
Registered Owner:	HUNTER AVIATION INTL INC	**Rated Power:**	10150 Lbs thrust
Operator:	Airborne Tactical Advantage	**Operating Certificate(s) Held:**	None

The airplane was manufactured by Hawker-Siddeley in 1959 and was originally designed as a single-engine, swept wing, tactical military aircraft, powered by a Rolls-Royce AVON 207, turbojet engine with a full functioning emergency ejection seat. At the time of the accident the airplane was owned by Hunter Aviation International, Inc. and operated by Airborne Tactical Advantage Company (ATAC) as an armed forces Public aircraft. The airplane's most recent conditional inspection was completed on May 11, 2017, at 3,242.6 hours total time in service. At the time of the accident, the engine had accrued about 323 total hours since its most recent overhaul, and a total of 41 flight hours since its recent conditional inspection.

The airplane's flight logbook captured the reported maintenance deficiencies from January 2017 to the date of the accident. A reported deficiency from August 15, 2017 stated that the "aileron trim indication was found inoperative during pre-flight checks." As a result, the position transmission cable, trim motor bellcrank, and trim operating rod were replaced. Additionally, aileron travel was confirmed in accordance with AP101B-1307-1, Section 3, Chapter 4, Figure 11.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 1500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	20 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	20°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	OXNARD, CA (NTD)	**Type of Flight Plan Filed:**	IFR
Destination:	OXNARD, CA (NTD)	**Type of Clearance:**	Unknown
Departure Time:	15:17 Local	**Type of Airspace:**	Warning area

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	31.655277,-118.323059

The airplane impacted open water about 2 nm from its final radar data point. ATAC reported that the debris field was comprised of an oil slick, and no physical remnants of the aircraft. The airplane wreckage was not recovered.

Additional Information

Flight Controls

According to the description in the aircraft manual, the ailerons and elevator are normally hydraulically operated by ON/OFF switches for both, each located on the left side of the instrument panel. Placing the switch in the OFF position activates manual mode. Below are flight control forces derived from the manual for the ailerons and elevator in power ON and power OFF modes:

- Power mode OFF: Lateral – 9 lbs; Forward – 9 lbs; Aft – 7 lbs
- Power mode ON: All directions – 2 lbs

The manual states that full aileron deflection is only 2/3 of that obtained in Power ON with Power mode OFF. Additionally, the flight controls will not auto re-center in Power OFF; but, should auto-re-center in Power ON.

The hydraulic system is comprised of a hydraulic fluid reservoir, engine-driven pump, hand pump, and pressure switch. According to a diagram in the manual, hydraulic fluid is directed from the reservoir by the pump to the ailerons through a main line that also services the brakes, elevator, canopy, landing gear, flaps and speed brake. Unused hydraulic fluid is returned back to the reservoir through a main line.

A hydrobooster, consisting of a servo valve, jack body and a piston, is fitted close to each control surface. Under normal operation, the servo valve opens to admit pressure oil to one side of the jack piston, depending on the direction of movement of the flight control column, while simultaneously the other side opens to return. As hydraulic pressure is directed by the servo valve to one side of the jack piston, the jack moves relative to the piston and deflects the control surface. When control movement ceases, the servo valve closes, which prevents further movement of the jack body and control surface. The magnetic indicators (MIs) show BLACK when hydraulic power is available to the hydroboosters.

According to the manual, the triple pressure gauge will fall below normal range when no service is being operated. Should the hydraulic pump fail, the red HYDRAULIC PRESSSURE failure warning light will illuminate when the system pressure drops below 600 psi. As pressure continues to decrease below 400 psi, the elevator and aileron MIs will shift to WHITE followed by an automatic reversion to manual flight control as the system reaches 200 psi.

If manual controls are selected, or if the hydraulic pressure falls below a specified level, the hydraulic

fluid in the jack is transferred from one side of the piston to the other. This allows the jack body to be moved freely by the control column.

During the accident sequence, the pilot observed his flight control magnetic indicators (MI), which display hydraulic power to the elevator and ailerons. The MIs were obscured by condensation and sun glare, but appeared black, indicating that the airplane was attempting to boost the flight controls by hydraulic power. Power Mode ON was selected for both flight controls when the loss of control occurred. No change was observed in the MIs or the handling of the airplane when the pilot momentarily cycled the Power Mode from ON to OFF and back to the ON position again.

Emergency Procedures

The manual contains an excerpt with instructions for recovering from out of control flight, from both upright and inverted spins. The procedure requires the pilot to first neutralize the rudder and flight controls, and to wait until the airplane recovers from the spin or a recognizable spin develops. Should a recognizable spin develop, the pilot should apply full rudder opposite the direction of rotation and advance the flight controls to the full forward position.

According to the pilot, the procedure for terminating a roll is to apply rudder opposite the direction of rotation. He reported to ATAC that he did not execute this maneuver because he did not have a yaw rate. In the procedure, if the spin persists, the pilot can advance the flight controls to the full forward position and in the direction of the turn needle. The pilot attempted the second procedure but was unsuccessful in remediating the spin. A report of the incident furnished by ATAC stated that he then returned the flight controls to the neutral position after he observed that his airspeed had reached about 350 kts.

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Scott Worthington; Federal Aviation Administration; San Diego, CA Randall Rushworth; United States Air Force; Washington, DC Scott Troyer; Airborne Tactical Advantage Company; Newport News, VA
Original Publish Date:	April 13, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=95870

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