DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR MOBILITY COMMAND

Freedom 250

10 JUN 2026

ACTION OF THE CONVENING AUTHORITY

The report of the Accident Investigation Board, conducted under the provisions of AFI 51-307, *Aerospace and Ground Accident Investigations*, current as of 6 April 2023, that investigated the 8 July 2025 mishap at Seymour-Johnson Air Force Base, North Carolina, involving a KC-46A, T/N 17-6033, assigned to the 22 Air Refueling Wing, McConnell Air Force Base, Kansas, substantially complies with the applicable regulatory and statutory guidance and on that basis is approved.

GERALD A. DONOHUE
Major General, USAF
Deputy Commander (Convening Authority)

UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

KC-46, T/N 17-6033

344TH AIR REFUELING SQUADRON
22D AIR REFUELING WING
MCCONNELL AIR FORCE BASE, KANSAS

LOCATION: SEYMOUR JOHNSON AIR FORCE BASE, NORTH CAROLINA

DATE OF ACCIDENT: 8 JULY 2025

BOARD PRESIDENT: COLONEL KEVIN E. WHITE

Conducted IAW Air Force Instruction 51-307

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

KC-46, T/N 17-6033
SEYMOUR JOHNSON AIR FORCE BASE, NORTH CAROLINA
8 JULY 2025

On 8 July 2025, at approximately 1652 Zulu (Z) / 1252 local time (L), Mishap Aircraft 1 (MA1), a KC-46A, tail number (T/N) 17-6033, assigned to the 22d Air Refueling Wing, McConnell AFB, Kansas, conducted an aerial refueling (AR) mission over the Atlantic Ocean, approximately 100 miles off the coast of Virginia with Mishap Aircraft 2 (MA2), an F-22, T/N 08-004156 and six other fighter jets, all assigned to Joint Base Langley-Eustis (JBLE), Virginia. During an AR attempt with MA2, MA1 experienced nozzle binding of the boom in MA2's receptacle. Upon release, the boom rapidly flew upward and struck the fuselage of MA1, causing damage to MA1's Auxiliary Power Unit (APU) and tail-cone, and critical failure of the boom shaft structure, which ultimately departed the aircraft and fell into the ocean. There were no fatalities, injuries, or damage to civilian property. The estimated damages to MA1 were $9,979,567.

The Accident Investigation Board President found, by a preponderance of the evidence, that the cause of the mishap was the mishap boom operator's (MB1's) manual control inputs to the air refueling flight control stick (FCS), resulting in an excessively out of trim air refueling boom (ARB) that caused a radial force to be applied to the ARB nozzle and the nozzle to then become bound inside the receiver's air refueling receptacle. This subsequently produced an unrecoverable boom fly-up rate upon release from the receptacle, striking MA1 and causing a critical failure of the boom structure which then departed MA1 in flight.

Additionally, the Accident Investigation Board President found, by a preponderance of the evidence, one factor substantially contributed to the mishap:

- Failure of Mishap Fighter Pilot 1 (MFP1) to account for the KC-46A stiff boom characteristics, causing an excessive closure rate

Under 10 U.S.C. § 2254(d) the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability by the United States or by any person referred to in those conclusions or statements.

SUMMARY OF FACTS AND STATEMENT OF OPINION
KC-46A, T/N 17-6033
SEYMOUR JOHNSON AIR FORCE BASE, NORTH CAROLINA
8 JULY 2025

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

22 ARW	22d Air Refueling Wing
344 ARS	344th Air Refueling Squadron
AAR	Air-to-Air Refueling
ACU	Actuator Control Unit
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFMES	Air Force Medical Examiner System
AFSEC	Air Force Safety Center
AFTO	Air Force Technical Order
AIB	Accident Investigation Board
ALAS	Automatic Load Alleviation System
AMC	Air Mobility Command
APU	Auxiliary Power Unit
AR	Aerial Refueling
ARB	Air Refueling Boom
ARCA	Air Refueling Certification Agency
ARCC	Air Refueling Control Computer
ARO	Air Refueling Operator
AROI	Air Refueling Operator Instructor
AROS	Air Refueling Operator Stations
BDA	Battle Damage Assessment
BP	Board President
BPO	Basic Post-Flight
CAT	Category
DRI&R	Deficiency Reporting, Investigation, and Resources
EDT	Eastern Daylight Time
FCS	Flight Control Stick
FOD	Foreign Object Debris
GVI	General Visual Inspection
HBRLI	High Boom Radial Load Indicator
HFACS 8.0	Human Factors Analysis and Classification System
IFOC	In-Flight Operation Check
INOP	Inoperable
JBLE	Joint Base Langley-Eustis
L	Local Time
L HYD SYS PRESS	Left Hydraulic System Pressure
L HYD QTY	Left Hydraulic Quantity
MA	Mishap Aircraft
MB	Mishap Boom Operator
MC	Mishap Crew
MDS	Mission Data System
MFIP	Mishap Fighter Instructor Pilot
MFP	Mishap Fighter Pilot
MP	Mishap Pilot
MS	Mishap Sortie
MSL	Mean Sea Level
NATO	North Atlantic Treaty Organization
PLI	Pre-Launch Inspection
PR	Pre-Flight Inspection
PRD	Pilot-Reported Discrepancies
RAIS	Refueling Alert Indication System
RVS	Remote Vision System
SAR	Search and Rescue
TCS	Telescope Control Stick
TCTO	Time Compliance Technical Order
TH	Thru-Flight Inspection
T/N	Tail Number
TO	Technical Order
Z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 11 September 2025, Lieutenant General Rebecca J. Sonkiss, Deputy Commander, Air Mobility Command (AMC), appointed Colonel Kevin E. White as Board President (BP) to conduct an aircraft accident investigation of a mishap that occurred on 8 July 2025 involving a KC-46A aircraft off the coast of Virgina (Tab Y-3). The BP conducted the aircraft accident investigation in accordance with Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, at Joint Base McGuire-Dix-Lakehurst, New Jersey, and Seymour Johnson Air Force Base (AFB), North Carolina, from 24 September 2025 through 19 December 2025. Board members included a Legal Advisor (Major), a Recorder (Staff Sergeant), a Maintenance Member (Staff Sergeant), and a Boom Operator Member (Senior Airman) (Tabs Y-3-6, Tabs Y-11-12).

b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this Accident Investigation Board conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force aerospace accident, prepare a publicly releasable report, and obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action.

2. ACCIDENT SUMMARY

On 8 July 2025, a United States Air Force KC-46A Pegasus, tail number T/N 17-6033, MA1, assigned to the 22d Air Refueling Wing, McConnell AFB, Kansas, operated by a crew assigned to the 22d Air Refueling Wing, departed McConnell AFB on a training mission to air refuel four flights of two F-22As assigned to JBLE, Virginia. The scheduled flight profile was a single-ship departure from McConnell AFB to Air Refueling track 636 off the coast of Virginia, air refueling F-22As for approximately one hour before returning to McConnell AFB. At approximately 1652 Zulu (Z) / 1252 (L), while refueling with the fifth F-22A, MA2, piloted by an F-22A student pilot, MFP1, MA1 experienced nozzle binding of the boom in MA2's air refueling receptacle. Upon release of the nozzle from MA2, the air refueling boom rapidly flew upwards and struck the bottom aft portion of MA1's fuselage resulting in a critical failure of the refueling boom structure just forward of the flight controls. The air refueling boom departed the aircraft in flight. There were no fatalities, injuries, or damage to civilian property. MA2 landed safely at JBLE and MA1 emergency diverted and safely landed at Seymour Johnson AFB, North Carolina. The estimated damage to MA1 was $9,979,567.

3. BACKGROUND

a. Air Mobility Command

Air Mobility Command (AMC) is a Major Command headquartered at Scott AFB, Illinois (Tab DD-3). AMC provides unrivaled airlift, air refueling, aeromedical evacuation, global air mobility support and Global Mobility Mission Command to project, connect, maneuver and sustain the Joint Force to achieve national objectives (Tab DD-3). The command is composed of approximately 110,000 Active Duty, Air Force Reserve, Air National Guard, and civilian employees, and 13 different airframes (Tab DD-3).

b. 22d Air Refueling Wing

The 22d Air Refueling Wing (22 ARW) is the host unit of McConnell AFB, Kansas (Tab DD-5). The wing's primary mission includes the delivery of global refueling capabilities, both conventional and unconventional, to U.S. armed forces, North Atlantic Treaty Organization (NATO) and coalition allied aicraft (Tab DD-5).

c. 344th Air Refueling Squadron

The 344th Air Refueling Squadron (344 ARS) is one of three air refueling squadrons within the 22d Operations Group, conducting refueling and airlift operations with the KC-46A Pegasus (Tab DD-7).

d. KC-46A Pegasus

The KC-46A is the first phase in recapitalizing the U.S. Air Force's aging tanker fleet (Tab DD-9). With greater refueling, cargo and aeromedical evacuation capabilities, the KC-46A provides aerial refueling support to Air Force, Navy, Marine Corps and partner-nation receivers (Tab DD-9). The KC-46A is able to refuel most fixed-wing, receiver-capable aircraft (Tab DD-9). The KC-46A is equipped with a refueling boom driven by a fly-by-wire control system, and is capable of fuel offload rates required for large aircraft (Tab DD-9). Its hose and drogue system adds additional mission capability that is independently operable from the refueling boom system (Tab DD-9). The Boom Operator controls the boom during refueling operations (DD-9).

e. Air Refueling Operations

The objective of air refueling operations is to enhance effectiveness by extending the range, payload, and endurance of the receiver aircraft (Tab BB-4). Successful air refueling operations depend on three major factors (Tab BB-4). The first factor is equipment compatibility (Tab BB-4). Aircraft requiring air refueling must be fitted with probes or receptacles and fuel systems compatible with the characteristics of the tanker aircraft (Tab BB-4). The second factor is performance capability (Tab BB-4). It is essential for tanker and receiver aircraft performance to be compatible in terms of air refueling speeds and altitudes (Tab BB-4). The last factor is procedural compatibility (Tab BB-4). Tanker and receiver aircraft must employ pre-planned and compatible procedures for rendezvous, making contact, fuel transfer, and departure (Tab BB-4).

f. KC-46A Specific Air-to-Air Refueling Procedures

For KC-46A air-to-air refueling, the boom operator deploys the boom from the stowed position and extends the telescoping portion of the boom 12 feet to perform an initial flight control check (BB-6). While the receiver stabilizes in the astern position, the boom operator selects the appropriate Remote Vision System (RVS) scene for environmental conditions on the primary 3D display (BB-6). When the boom operator clears the receiver aircraft for contact or provides the radio-silent visual signal, the receiver moves from the stabilized astern position to the boom contact position (BB-6, BB-8). Closure to contact must be slow and stable (approximately 1 foot per second) with the receiver stabilizing in the contact position (BB-6). The boom operator will verify that the selected RVS scene remains stable (BB-6). If the scene degrades or visual cues are not discernable, the boom operator will return the receiver aircraft to the astern position and re-evaluate scene selection before clearing the receiver to proceed to the contact position (BB-6). The receiver then maintains its position within the boom's operating envelope (BB-6).

The KC-46A automatically defines receiver aircraft envelope limits based on Boom-Operator-inputted receiver type (Tab BB-10). Each receiver has a specifically defined refueling envelope (Tab BB-10). The Boom Actuator Control Unit (ACU) monitors the boom position and rate of motion to remain within each receiver's defined envelope (Tab BB-10). Should the receiver aircraft approach the envelope limits, the boom control system initiates a disconnect prior to the boom exceeding an envelope limit (Tab BB-10). The boom disconnect limit is reduced for some receiver aircraft because of individual receptacle characteristics (Tab BB-10).

When contact position is achieved, the boom operator flies the boom to the receiver aircraft's receptacle using the FCS and extends the boom telescope to make contact (BB-6). Locking toggles in the receptacle operate to hold the boom nozzle in contact (Tab BB-6). The receiver then maintains its position within the boom's operating envelope (Tab BB-6). The digital fly-by-wire system has an Automatic Load Alleviation System (ALAS) (Tab BB-6). The ALAS reduces radial forces on the nozzle and receptacle; this permits a larger air-to-air refueling (AAR) envelope without nozzle binding (Tab BB-6).

g. Nozzle Binding

Nozzle binding is defined as mechanical impedance on the boom nozzle that keeps it from free flight. (Tab B-11). This impedance occurs when the boom nozzle is stuck in the receiver's receptacle, but the boom is not fully engaged by the toggles due to the geometric shape of the receptacle area (Tab BB-11).

h. Breakaway Procedures

A breakaway is an emergency separation of tanker and receiver aircraft in or near the contact position (Tab BB-14). It may be necessitated due to erratic flight by the receiver, a tanker or receiver aircraft malfunction, the receiver under-running the tanker, or an excessive rate of closure between the tanker and the receiver (Tab BB-14). Upon a breakaway being called, the affected tanker or receiver aircraft must immediately disconnect and act in accordance with published guidance to separate (Tab BB-14-15).

4. SEQUENCE OF EVENTS

a. Mission

On 8 July 2025, the mishap crew (MC) was scheduled to fly MA1 on a local training mission from McConnell AFB, Kansas, with aerial refueling on air refueling track 636, and returning back to McConnell AFB (Tab K-36). The MC was originally scheduled to refuel four flights of two F-22As (Tab K-36).

b. Planning

The MC conducted initial mission planning the day prior to the Mishap Sortie (MS) in which attempts to contact the receiver aircraft command post were made but were unsuccessful. (Tab R-147). On the day of the MS, the MC briefed the mission details in accordance with briefing guides and additional discussion about new AR procedures (Tab R-13, Tab R-147).

c. Preflight

The MC was composed of an Evaluator Pilot and Aircraft Commander (MP1), a First Officer undergoing Mission Certification Training (MP2), a Mission Pilot (MP3), an Instructor Boom Operator (MB1), and a Mission Boom Operator (MB2) (Tab AA-3). The MC arrived at Base Operations at McConnell AFB on 8 July 2025 at 0600L/1100Z for a crew brief (Tab R-153). Upon arrival at the aircraft, the MC reviewed the active Air Force Technical Order (AFTO) 781 series of forms revealing the air refueling boom (ARB) roll position appeared to be inaccurate or lagging with no corrective action annotated (Tab U-7-13, Tab R-154, Tab R-13). After discussion amongst the MC, they elected to accept MA1 and do a flight control check of the ARB in-flight prior to conducting air refueling (Tab R-147). Another attempt was made by MB1 to attempt to get into contact with MA2s command post regarding training objectives and air refueling operations details but was unsuccessful (Tab R-13, Tab V-7.4). Nothing of additional significance was noted by the MC during the preflight inspections, ground operations, or departure (Tab R-147).

MA2 was piloted by a student pilot (MFP1) as part of a three-ship formation led by an Instructor Pilot (MFIP) and another student pilot (MFP2). Originally scheduled as a two-ship, MFP2 joined the formation due to maintenance issues with their flight lead, making it a three-ship formation (Tab R-73).

d. Summary of Accident

On 8 July 2025, at approximately 1308Z, MA1 departed McConnell AFB, Kansas as scheduled (Tab M-10, Tab K-36). MA1 was planned to conduct AR with four flights of two F-22As, which changed to two flights of two and one flight of three (Tab K-36, Tab R-73). The F-22As, to include MA2, departed from JBLE, Virginia (Tab K-36).

At approximately 1545Z, MA1 arrived at air refueling track 636 at an altitude of 24,000 ft and prepared for air refueling (Tab M-11). At this time, MB1 conducted a boom flight control check in accordance with the Prep for Contact Checklist and assessed the ARB (Tab R-33). Upon completion of the boom flight control check, MB1 noticed slight lagging of the boom roll RVS overlay indications (Tab R-33). This assessment was discussed by the MC, ultimately leading to MB1 being comfortable to begin AR operations despite a Caution directing boom operators to discontinue AR if boom roll RVS indications appear to lag (Tab R-33, Tab V-3.9). Parameters were set amongst the MC to continue or discontinue air refueling based on receiver aircraft stability (Tab R-37, Tab R-159). During AR with the first four receivers, each receiver received their offload with nothing significant being noted by the MC (Tab R-33).

At approximately 1645Z, MA2, and her wingmen, rendezvoused with MA1 to begin AR operations. Due to mission objectives, MFIP instructed MA2 to conduct AR with MA1 first (Tab R-73). MB1 then cleared MA2 to the astern position, with MFIP and MFP3 being cleared to the left observation position (Tab R-33, Tab R-34). Prior to the mishap event, MA2 conducted three approaches into contact, two of which leading to emergency separations (Tab R-34). During the first approach into the contact position, MB1 was able to effectively make contact with MA2. MB1 recognized forward movement toward the inner disconnect limit, verbalized a "back four" correction over the primary frequency, then subsequently called for an emergency separation (Tab

R-34). On the second approach into contact, MB1 directed MA2 to return to the astern position due to instability. The third approach consisted of a successful contact with MA2, subsequently leading to another emergency separation called by MB1 (Tab R-34).

At approximately 16:52:30 (approximately 11.5 seconds prior to the disconnect in the mishap event), MA2 was established in contact at 24,000 ft while traveling 310 knots and was stable within the aerial refueling envelope (Tab CC-9). ALAS performance was performing as expected resulting in low radial forces on the ARB nozzle (Tab CC-9). MB1 gave many verbal corrections to MFP1 throughout the contact to include one instance of "up four" and three instances of "back four" (Tab S-29).

At approximately 16:52:40 (approximately 1.5 seconds prior to disconnect), MA2 progressed forward 7 ft in 10 seconds and continued to trend towards the inner telescope disconnect limit (Tab CC-9). MB1 commanded MFP1 over the air refueling primary frequency "up four" followed by a "slow closure" one second later (Tab S-29). MB1 applied inputs on the FCS generating increased vertical loads; however, the load magnitude was still below the threshold to trigger the HI-LOAD visual annunciation (Tab CC-9).

At approximately 16:52:41 (approximately 0.4 seconds prior to disconnect), MB1's commands on the FCS increased vertical loads triggering the HI-LOAD visual annunciation (Tab CC-9). 0.4 seconds later, MB1 commanded a normal disconnect via the FCS prior to MA2 reaching the automatic inner disconnect limit (Tab BB-17, Tab CC-9). MB1 simultaneously applied large TCS retract and FCS fly up commands, resulting in high vertical forces on the ARB nozzle before it cleared the edge of MA2's receptacle (Tab CC-9). The ARB nozzle was bound in MA2's receptacle at this time (Tab CC-9).

At 16:52:42 (approximately 0.4 seconds after disconnect), the vertical forces on the nozzle exceeded the maximum sensor value triggering an ALAS warning message and deactivating ALAS (Tabs CC-9-10).

At approximately 16:52:44 (2.4 seconds after disconnect), MB1 called for an emergency separation by calling, "BREAKAWAY, BREAKAWAY, BREAKAWAY" over the air refueling primary frequency (Tab S-29). MA2 was still engaged with the bound ARB nozzle but began to move aft, extending the telescoping tube and increasing the tension force on the ARB nozzle (Tab CC-10).

At approximately 16:52:44 (3.1 seconds after disconnect), the nozzle force exceeded an annunciation threshold value, triggering a boom caution message (Tab CC-10). The boom elevator control surface continued to wind up to trailing edge down and the boom rudder control surfaces continued to wind up to trailing edge left due to MB1's FCS inputs (Tab CC-10).

At approximately 16:52:46 (4.7 seconds after disconnect), MA2 fell aft as part of the BREAKAWAY action, but was still bound to the ARB nozzle (Tab CC-10). Both the elevator and rudder control surfaces reached maximum deflection (Tab CC-10). MB1 maintained full telescope retract command and boom fly up command on the FCS and TCS respectively, with moderate boom fly right command (Tab CC-10). At this time, the vertical and axial nozzle forces reached their maximum values during the incident (Tab CC-10).

At approximately 16:52:46 (4.8 seconds after disconnect), the ARB boom nozzle separated from the MA2's receptacle, resulting in a decrease in nozzle forces in all three directions (Tabs CC-10-11). The boom flew up and right at high rates due to the orientation of the elevator and rudder control surfaces (Tab CC-11). The high rates resulted in a BOOM INOP status in which the flight control surfaces no longer respond to boom operator or boom control systems commands (Tab CC-11).

At approximately 16:52:47 (5.3 seconds after disconnect and 0.5 seconds after the ARB nozzle physically cleared MA2's receptacle), the boom impacted MA1's empennage (Tab CC-11). Because the hoist cable rewind rate exceeded a software monitoring threshold, a hoist warning annunciated and the hoist drum locked in place (Tab CC-11). The impact with MA1 damaged the tail cone, the APU exhaust duct, and the boom (Tab CC-11). MFP1 was able to maneuver MA2 to the right of MA1 (Tab R-77). The MC described the impact as "as loud noise, violent action" causing MA1 to "kind of bow wave several times" before the boom began to oscillate and ultimately separate from MA1 (Tab R-148).

MP1 called a Knock-It-Off call over the air refueling primary frequency to terminate the emergency separation and assess the damages to MA1 (Tab R-149). Due to damage sustained to the ARB during the impact and separation of the ARB from MA1, MA1 received a hydraulic caution annunciation due to major hydraulic line leakage (Tab CC-11). Following the separation of the ARB from MA1, MP1 requested a battle damage assessment (BDA) from MFIP, in which MFIP flew around MA1 to assess and report any damage he was able to see (Tab R-149). Upon completion of the BDA, MFIP confirmed the ARB did in fact detach from MA1, falling into the ocean, while also noting fuel venting from the remaining portion of the ARB, as well as a cable hanging out of the end of the ARB, which was later determined to be the telescoping chain (Tab R-78).

MC1 was already flying west, so the decision was made to divert to JBLE and MA1 officially declared an In-Flight Emergency (Tab R-177). MC1 ran an emergency checklist isolating the left hydraulic system due to quantity loss. Several other checklists were accomplished and MC1 determined that there was no immediate rush to divert to JBLE (Tab R-149).

A second BDA was requested after descending to 10,000 ft to better gauge the damage to the boom (Tab R-156). MFIP performed this BDA and reported that fuel had stopped spraying from the broken portion of the boom and that there was a cable hanging from the boom (Tab R-156). MP2 had concerns with diverting to JBLE due to the possibility of FODing the runway with the boom in trail causing the F-22s to divert (Tab R-206).

The decision was then made to recover the aircraft at Seymour Johnson AFB due to having KC-46A maintenance support, as well as only being 20 minutes away at that point in time (Tab R-156, Tab R-206). MC1 ran several other checklists, notably depressurizing the aircraft at a safe altitude due to suspected fuselage damage, avoiding any additional structural damage (Tab R-206).

Seymour Johnson AFB personnel were notified and prepped the runway in anticipation of the aircraft landing boom in trail (Tab R-156). What was left of the boom was raised prior to landing with no latch verified and MB1 and MB2 visually monitored the boom upon landing verifying it didn't fall and contact the ground. The aircraft was cleared to taxi to a parking spot once cleared by emergency services upon landing (Tab R-178).

e. Impact

At the conclusion of the mishap, MA1 remained in level flight at approximately 24,000 ft approximately 100 miles off the coast of Virginia (Tab M-14). After impact, the aft portion of the boom along with the U-Tail and Telescoping tube fell to the ocean. The section of the boom still attached to the aircraft remained hanging by the hoist cable (Tab S-5). The left hydraulic system quantity depleted due to the boom separation (Tab R-149, Tab-156).

f. Egress and Aircrew Flight Equipment (AFE)

After impact, MA1 crew initially headed for JBLE, Virginia; however, the crew grew concerned that landing at JBLE would FOD out the single runway and prevent the F-22s in flight at the time from landing at JBLE. Additionally, MA1 considered the availability of KC-46A maintenance at Seymour Johnson AFB. MA1 then diverted to Seymour Johnson AFB, landed, and egressed from the aircraft without incident (Tab R-15, Tab R-156).

MA2 landed at JBLE and egressed normally, without the use of emergency egress equipment (Tab R-83, Tab R-106).

g. Search and Rescue (SAR)

Not Applicable.

h. Recovery of Remains

Not Applicable.

5. MAINTENANCE

a. Forms Documentation

The AFTO 781 series of forms collectively provides maintenance, inspection, service, configuration, status, and flight record of the aerospace vehicle for which they are maintained. The AFTO 781 forms, in conjunction with the Maintenance Information System or Field Maintenance Command & Control (FMxC2, also referred to as G081), provide a comprehensive database used to track and record maintenance actions and inspection histories on individual aircraft (Tab U-4-5).

A review of the active and archived AFTO 781 series forms, and G081 historical records for MA1 up to 60 days prior to the mishap revealed one recurring discrepancy stating the Aerial Refueling Boom roll position is inaccurate or lagging (Tab U-5, Tab U-7). There was an inconsistency with the documentation for an In-Flight Operational Check (IFOC) for the maintenance performed to correct the boom lag discrepancy (Tab U-19). Maintenance entered a discrepancy documenting the initial IFOC on 13 June 2025 with no corrective action by aircrew (Tab U-18, Tab U-19). Two other IFOC entries after the initial IFOC discrepancy were closed correctly (Tab U-25, Tab U-26). The initial IFOC was still open at the time of the mishap (Tab D-13).

The only Time Compliance Technical Order (TCTO) pertaining to the boom system still open at the time of the mishap was 1C-46(K)A-725, which is a Depot Level Routine TCTO for a modification to the RVS (Tab D-28). All other TCTOs for the boom system were completed before the date of the mishap. There were six open TCTOs noted for modifications to the aerial refueling manifolds at the time of the mishap (Tab D-28, Tab D-29).

b. Inspections

MA1 adheres to the Aerospace Vehicle Manufacturer Inspection Concept, utilizing A-Check and C-Check inspections. C-Checks are major depot level inspections scheduled every 24 months, and A-Checks are minor home station level inspections scheduled every six months (Tab U-28). Both inspection types involve specific maintenance procedures outlined in the Weapons Systems -6 Technical Order (TO). MA1 was current on both A-Check and C-Check inspections at the time of the mishap. It was noted that the next A-Check was due on 30 July 2025 (Tab U-29).

c. Maintenance Procedures

The KC-46 utilizes five before and after flight inspections that each incorporate different criteria ensuring the aircraft and systems are functional and safe for flight (Tab U-32). They are listed as follows:

The Pre-Flight Inspection (PR) is a flight preparedness inspection done in accordance with the Mission Data System (MDS) specific -6 TO. The inspection includes visually examining the aerospace vehicle and operationally checking certain systems and components to ensure there are no serious defects or malfunctions (Tab U-32).

A Pre-Launch Inspection (PLI), including General Visual Inspections (GVI) for specific items and areas, is completed by qualified maintenance personnel within four hours prior to each flight (Tab U-32).

The Basic Post-Flight (BPO) is a more thorough check than the PR inspection and is accomplished in accordance with the MDS specific -6 TO or maintenance manual for the aerospace vehicle. The BPO will consist of checking the aerospace vehicle condition by performing visual examination or operational checks of certain components, areas or systems to assure that no defects exist that would be detrimental to flight. Maintenance personnel will perform a BPO after the last flight of a specified flying period (Tab U-33).

A Combined Pre-Flight/Basic Post-Flight (PR/BPO) consolidates the PR and BPO inspections and may be accomplished instead of a BPO when a BPO is due and a continuation flight is scheduled (Tab U-33).

The Thru-Flight Inspection (TH) is a between flights inspection and will be accomplished after each flight, when a turnaround sortie or a continuation flight is scheduled and a BPO inspection is not required. The TH consists of checking the aerospace vehicle for flight continuance suitability by performing visual examination and/or operational checks of certain components, areas or systems, according to established TOs to ensure no defects exist which would be detrimental to further flight (Tab U-32).

The applicable procedural inspections for MA1 were accomplished in their entirety and documented on the AFTO Form 781H in their respective intervals and prior to the mishap flight (Tab D-3).

d. Maintenance Personnel and Supervision

Maintenance personnel assigned to the 22d Aircraft Maintenance Squadron were responsible for all required inspections, documentation, and servicing for MA1 prior to flight (Tab D-3, Tab D-4). No supervisory shortfalls or hinderances affecting the maintenance quality on MA1 were identified. Personnel involved with MA1's preparation for flight had proper and adequate training, experience, certification, and supervision to perform their assigned tasks (Tab U-35-44). There is no evidence to suggest that the training, qualifications, and maintenance personnel supervision were a factor in this mishap.

e. Fuel, Hydraulic, Oil, and Oxygen Inspection Analyses

Not applicable.

f. Unscheduled Maintenance

Unscheduled maintenance is reactive repair work triggered by unexpected problems, such as component malfunctions, Pilot-Reported Discrepancies (PRD), or damage, and is performed to address the immediate problem.

MA1's 60-day maintenance history reveals recurring instances of Boom Roll Position Lagging (U-7). This discrepancy, first documented on 12 June 2025, was reported as a PRD seven times in June 2025 (Tab U-7-13). Three instances were documented for IFOCs. The first, entered on 13 June 2025, never received corrective action from aircrew, despite subsequent flights (Tab U-19). The second IFOC, entered on 17 June 2025, was signed off as "Ops Check Failed" on 18 June 2025. The final IFOC, entered on 19 June 2025, was signed off as "Ops check passed" on 23 June 2025 (Tab U-25, Tab U-26). The roll position lag discrepancy was again documented on 25 June 2025 and remained unresolved at the time of the mishap. On 30 June 2025, maintenance members replaced the Roll Position Sensor referencing the IFOC from 13 June 2025 (Tab U-45).

The board reviewed this discrepancy and concluded that there was no evidence to indicate that boom roll position lagging was relevant to the mishap.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

(1) Aerial Refueling Boom

The KC-46A aerial refueling boom has two aerodynamically faired tubes that attach to the airplane fuselage at the boom fuselage interface (Tab U-48). One internal tube telescopes aft from the outer fixed tube during refueling operations (Tab U-48). On the top of the outer tube of the boom is an attached U-Tail flight control system (Tab U-48). The U-Tail and its flight control surfaces are attached to the outer fixed tube of the boom (Tab U-49). The U-Tail flight control surface has a set of rudders with hydraulic actuators, an elevator, and an actuator (Tab U-49). The outer tube of the boom has an A-frame with a rudder and elevator for U-Tail flight control (Tab U-49). An Aerial Refueling Operator (ARO), commonly referred to as the boom operator, controls the U-Tail flight control system from the Aerial Refueling Operator Station (AROS) (Tab U-49). An ARO uses the U-Tail to control the boom and to engage its nozzle with the receiver aircraft receptacle (Tab U-49).

(2) Aerial Refueling Operator Station

The AROS is the primary interface between the ARO and the following aerial refueling systems: Aerial Refueling Boom (ARB), centerline drogue system, and wing aerial refueling pod (Tab U-52). The console consists of structural members to support mission equipment, controls, and visual displays required to see the aerial refueling systems and the receiver aircraft and to control other elements of the AR system including the drogue/jettison control panel, lighting control panels, etc. (Tab U-52).

(3) Automatic Load Alleviation System

The aerial refueling boom has an integrated Automatic Load Alleviation System (ALAS) incorporated into the boom flight control system (Tab U-54). Automatic load alleviation prevents binding of the boom nozzle in the aerial refueling receptacle when attempting a disconnect and ensures the boom, elevators and rudders are in trim upon disconnect from the receiver, which minimizes the transient motion of the telescoping boom upon disconnect (Tab U-54). The Nozzle Load Sensor Assembly measures the bending, radial and torsion loads applied to the boom nozzle joint by the receiver when in contact (Tab U-54). The load measurements transmit back to the Actuation Control Unit (ACU), which computes a solution and controls the boom elevators and rudders to relieve the stresses induced by receiver movements thus reducing boom bending loads and nozzle binding (Tab U-54). If boom nozzle loads exceed a prescribed amount, the HI-LOAD text is shown (BB-20). If the HI-LOAD indication is shown following the disconnect the boom may be pinned in the receiver receptacle and retraction of the telescoping tube may be needed to clear the receptacle. The boom operator should neutralize flight control stick inputs in this condition (BB-20).

(4) KC46A Deficiency Reports

During the Air Force acquisition process, a subprocess, known as Deficiency Reporting, Investigation, and Resolution (DRI&R) exists to provide the Air Force with a means of identifying deficiencies, resolving those deficiencies within the bounds of contractual requirements, program resources and the appropriate acceptance of risk for those deficiencies that cannot be resolved in a timely manner (BB-62). Incorporated into the DRI&R process, TO-35D-54, *USAF Deficiency Reporting, Investigation, and Resolution,* defines the most important deficiencies as:

Category (CAT) I – "Deficiencies which may cause death, severe injury, or severe occupational illness; may cause loss or major damage to weapon system; critically restricts the combat readiness capabilities of the using organization: or result in a production line stoppage" (BB-63).

The KC-46A has one CAT I DR that is applicable to this accident investigation for the boom telescope being too stiff while in contact with a receiver aircraft (Tab EE-4). This report states that axial breakout forces are too stiff causing unsuitable interactions of the boom with receivers. This stiffness causes receiver aircraft to inadvertently carry an excess amount of thrust which following a disconnect can cause the receiver aircraft to rapidly accelerate toward the tanker aircraft (Tab EE-5). The stiff boom also requires receiver aircraft to make large power corrections when attempting to make fore and aft position adjustments (Tab EE-6). During test of the stiff boom, once the breakout forces were overcome, an excessive telescope rate would build if the forces were not immediately corrected by the receiver pilot (Tab EE-6). When a normal disconnect is made with the receiver pushing on the boom, the receiver aircraft may rapidly accelerate toward the tanker aircraft, greatly increasing the probability of a boom strike on the tanker or receiver aircraft (Tab EE-6).

b. Damages

The evidence indicates both MA1 and MA2 sustained damage while the boom was still in the contact position, and MA1 sustained additional damage after it was struck by the boom. (Tab R-77).

(1) Boom Structure

During the mishap the two structural tubes of the boom were stressed immensely causing them to crack and then separate slightly forward of the U-Tail assembly, causing the Aft end of the boom along with the U-Tail and telescoping tube to detach and plummet into the ocean (Tab S-5). The detached portion of the boom was never recovered. It is unclear whether the structure was cracked while in contact with MA2 due to stress. The impact of the boom striking the fuselage caused the latch hook-eye to shear off leaving a hole directly between the remaining hoist cable and shock absorber (Tab S-5). The shock absorber also ruptured upon the impact, deflating it completely (Tab S-14).

Remaining portion of boom (Tab S-5).

Missing latch hook eye (Tab S-14).

(2) Boom Internals

The separation tore all the wiring, hydraulic tubing, and the telescoping chains and cables leaving only a small portion of the chain intact and hanging freely from the outer tube (Tab Z-3).

Break point of boom (Tab Z-3).

(3) Hoist Cable

The boom hoist cable remained attached to the hoist motor and the structure of the boom but was noticeably stressed beyond limits and fraying significantly (Tab S-22).

Hoist cable (Tab S-22).

(4) Aircraft

Due to the impact of the boom to the fuselage, MA1 sustained damage to the APU access doors, the APU exhaust, the APU exhaust deflector, and the aircraft tail section (Tab S-6).

Tail-cone of MA1 (Tab S-6).

c. Evaluation and Analysis

Analysis of MA1's Air Refueling Control Computer (ARCC) data was conducted by the Board President, Boom Member, and Maintenance Member. The AIB conducted this review in conjunction with data analysis and animation provided by Boeing and in consultation with a Boeing employee (Tab J-21, Tab CC-9, Tab V-1.1). The AIB also reviewed an animation based on the ARCC data created by the Air Force Safety Center (AFSEC) (Tab S-23-29). Finally, the AIB obtained appointment of a Subject Matter Expert from the Aerial Refueling Certification Agency (ARCA) who provided further analysis based on the ARCC data (Tab CC-3-8). Each stage of analysis yielded a detailed sequence of events focused on the air refueling contact and emergency breakaway procedures between MA1 and MA2. Specifically, the AIB was able to plot the position of the ARB (elevation and telescope), the radial force placed on the ARB nozzle, and the position of the AROI FCS and TCS controls to illustrate the multiple forces which interacted throughout the period in question.

7. WEATHER

a. Forecast Weather

The forecast for the Air Refueling track 636 on 8 July 2025 was winds from the southwest at 30 knots with scattered clouds between 15,000-25,000MSL and visibility of 3-5 nautical miles in-cloud and seven nautical miles out-of-cloud (Tab F-8). Isolated thunderstorms were forecasted east of the track (Tab F-8). No icing or turbulence was forecasted for the track (Tab F-8).

b. Observed Weather

No members of the MC reported mission impacting weather or weather hazards (Turbulence, icing, and thunderstorms) (Tabs R-147, R-177, R-182).

c. Space Environment

Not Applicable.

d. Operations

All forecasted weather was within operating limits on the day of the mishap (Tab BB-22-23).

8. CREW QUALIFICATIONS

a. Mishap Pilot 1 (MP1)

MP1 was a qualified KC-46A Instructor Pilot with 1,690 combined flight hours in the T-1A and KC-46A (Tab T-3). MP1 was initially qualified in the T-1A on 5 April 2019 and qualified in the KC-46A on 28 June 2022 and was current for air refueling operations on the day of the mishap (Tab T-5, Tab G-179). MP1's recent flight time is as follows (Tab T-7):

	Hours
30 days	17.2
60 days	43.2
90 days	54.6

b. Mishap Pilot 2 (MP2)

MP2 was a KC-46A Co-Pilot with 59.3 hours in the KC-46A (Tab T-3). MP2 was initially qualified in the KC-46A on 25 February 2025 and was current for air refueling operations on the day of the mishap (Tab T-5, Tab G-209). MP2's recent flight time is as follows (Tab T-3-7):

	Hours
30 days	12.5
60 days	12.5
90 days	12.5

c. Mishap Pilot 3 (MP3)

MP3 was a qualified KC-46A Mission Pilot with 3,012 combined flight hours in the T-6A, KC-135 and KC-46A (Tab T-3). MP3 was initially qualified in the KC-135 on 14 March 2011 and in the KC-46A on 22 October 2022 (Tab G-215). MP3 was overdue on Tanker Air-to-Air Refueling

(AAR) Autopilot Off but was under direct supervision from an Instructor Pilot on the day of the mishap (Tab T-5). MP3's recent flight time is as follows (Tab T-7):

	Hours
30 days	3
60 days	6
90 days	18

d. Mishap Boom Operator 1 (MB1)

MB1 was a qualified KC-46A Instructor Boom Operator with 1,012 total flight hours in the KC-135 and KC-46A (Tab T-3). MB1 was initially qualified as a KC-135 Boom Operator on 9 October 2019 and in the KC-46A on 31 August 2021 and was current for air refueling operations on the day of the mishap (Tab G-154, Tab T-5). MB1's recent flight time is as follows (Tab T-7):

	Hours
30 days	9.8
60 days	13.5
90 days	41.6

e. Mishap Boom Operator 2 (MB2)

MB2 was a qualified KC-46A Boom Operator with 454 total flight hours in the KC-46A (Tab T-3). MB1 was initially qualified as a KC-46A Boom Operator on 24 May 2023 (Tab G-165). MB2 was overdue for Fighter Contacts but was under direct supervision from an Instructor Boom Operator on the day of the mishap (Tab T-5). MP2's recent flight time is as follows (Tab T-7):

	Hours
30 days	6.8
60 days	20.3
90 days	20.3

f. Mishap Fighter Instructor Pilot (MFIP)

MFIP was a qualified F-22A Instructor Pilot with 1,032 total flight hours in the F-22A (Tab T-37). MFIP was initially qualified in the F-22A on 1 June 2018 and was current for air refueling operations on the day of the mishap (Tab T-9, Tab T-39). MFIP's recent flight time is as follows (Tab T-41):

	Hours
7 days	0
30 days	4.1
90 days	14.3

g. Mishap Fighter Pilot 1 (MFP1)

MFP1 was a student pilot in the F-22A with 13 total flight hours in the F-22A (Tab T-43, Tab G-6). MFP1 was under the direct supervision of MFIP for air refueling operations on the day of the mishap (K-29). MFP1's recent flight time is as follows (Tab T-41):

	Hours
7 days	1.8
30 days	10.9
90 days	12.5

9. MEDICAL

a. Qualifications

All members of the MC, as well as MFP1, were medically qualified for all flight duties at the time of the mishap (Tab X-3, Tab X-6).

b. Health

All members of the MC, as well as MFP1, underwent medical examination immediately following the mishap. No recent medications or other health conditions that could have played a role in the mishap were identified (Tab X-3, Tab X-6).

c. Pathology

Toxicology screening for all members of the MC, as well as MFP1, was performed by the Armed Forces Medical Examiner System (AFMES). Results of the screening did not show any abnormal findings (Tab G-239, Tab G-240, Tab G-242, Tab G-244-246).

d. Lifestyle

There is no evidence to suggest lifestyle factors were a factor in the mishap.

e. Crew Rest and Crew Duty Time

Prior to performing flight duties, aircrew members must have proper crew rest, defined as at least a 12-hour, non-duty and rest opportunity prior to beginning the flight duty period. Crew rest is free time and includes time for meals, transportation, and an opportunity for at least 8 hours of uninterrupted sleep (Tab BB-25). Upon review of the post-mishap statements, there is no evidence to indicate that crew rest was a factor in this mishap. The MC, as well as MFP1, filled out 72-hour and 7-day history reports, none of which presented any lack of opportunity for adequate rest (Tab R-18-30, Tab R-57-69, Tab R-108-120, Tab R-162-174, Tab R-190-202, Tab R-217-229).

10. OPERATIONS AND SUPERVISION

a. Operations

There is no evidence to suggest operations were a factor in this mishap.

In consideration of issues with the lagging boom, the MC discussed whether to continue with AR as planned (Tab R-33, Tab R-211). MBI informed MP3 that he was comfortable attempting AR and would reassess if there were any issues (Tab R-211). MB1 indicated that he did not feel any external or internal pressure, despite the laggy boom, to conduct the air refueling mission on the day of the mishap (Tab R-40).

b. Supervision

The 344 ARS ensured all flight crew members were appropriately qualified for the mission (Tab AA-3). No supervision issues were noted.

11. HUMAN FACTORS ANALYSIS

a. Introduction

The Department of Defense Human Factors Analysis and Classification System 8.0 (DoD HFACS 8.0) lists potential human factors that can play a role in aircraft mishaps and identifies potential areas of assessment during an accident investigation (Tab BB-27). Six human factors were identified as relevant to the mishap.

b. AE101: Unintended Activation or Deactivation

This is a factor when an individual's movements inadvertently activated or deactivated equipment, controls, switches, weapons systems, etc., when there is no intent to do so and resulted in the near-miss or mishap (Tab BB-32).

c. AE104: Over-Controlled/Under-Controlled Aircraft

This is a factor when the mishap individual(s) inappropriately reacted to conditions by either over- or under-controlling the aircraft/vehicle/vessel/system, which resulted in the near-miss or mishap. (Examples include: applying too much or too little pressure, oversteering/understeering, improper braking, etc.) (Tab BB-32).

d. PE202: Instrumentation and Warning System Issues

This is a factor when workspace/cockpit instrument or warning system elements (design, reliability, lighting/backlighting, audible cues, location, symbology, size, display, etc.) negatively affected performance, resulting in a hazardous condition or unsafe act (Tab BB-42).

e. PE204: Controls and/or Switches

This is a factor when the location, shape, size, design, reliability, or other aspect of controls and/or switches negatively affected performance and resulted in a hazardous condition or unsafe act (Tab BB-42).

f. OR004: Purchasing or Providing Poorly Designed or Unsuitable Equipment

This is a factor when there are inadequacies in the acquisition and/or fielding of warfighting or commercial materiel, resulting in hazardous conditions or fallible decisions throughout subordinate units or the field/fleet (Tab BB-53).

g. OR008: Failure to Provide Adequate Information Resources

This is a factor when weather, intelligence, operational planning material or other information necessary for safe operations planning are too complex, too vague, incorrect or not available throughout the organization, resulting in hazardous conditions or unsafe acts throughout subordinate units or the field/fleet (Tab BB-54).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

- AFI 51-307, *Aerospace and Ground Accident Investigations*, 18 March 2019
- AFMAN 11-202v3, *Flight Operations*, 10 January 2022
- AFMAN 11-2KC-46v3, *KC-46 Operations Procedures*, 2 May 2024
- AFMAN 11-2F-22Av3, *F-22A – Operations Procedures*, 11 April 2022
- DAFI 21-101_AMCSUP, *Aircraft and Equipment Maintenance Management*, 30 July 2025
- DAFMAN 48-123, *Medical Examinations and Standards*, 8 December 2020

NOTICE: All directives and publications listed above are available digitally on the Air Force Departmental Publishing Office website at: https://www.e-publishing.af.mil.

b. Other Directives and Publications Relevant to the Mishap

- AFTTP 3-3.KC-46, *Combat Fundamentals KC-46*, 8 March 2024
- AFTTP 3-3.F-22A, *Combat Fundamentals F-22A,* 22 Sept 2023
- AMCI 90-903, *Aviation Operational Resource Management (AVORM) Program,* 4 August 2022
- ATP-3.3.4.2. NATO Standard Air-to-Air Refueling, Edition D Version 1, April 2019
- ATP-3.3.4.2, US Standards Related Document (SRD), 1 August 2025
- HQ AMC/A3V FCIF 25-09-15, *KC-46A Telescope Envelope Restriction*
- HQ AMC/A3V FCIF 25-09-14, *Continued Emphasis: Proactive Boom Operator Communications and Receiver Stability*
- Technical Order (TO) TO 00-20-1-AMC-WA-1, *Aerospace Maintenance Inspection, Documentation, Policy, and Procedures*, 24 June 2024
- TO 1-1-300, *Maintenance Operational Checks and Check Flights*, 15 December 2023
- TO 1C-46(K)A-1, *Flight Manual – Flight Crew Operations Manual*, Revision 23, 31 October 2025
- TO 1C-46(K)A-1CL-1, *Flight Manual – Quick Reference Handbook, Pilot Handheld Checklist*, Revision 23, 31 October 2025
- TO 1C-46(K)A-2-WA-1, *Maintenance Manuals - KC-46A Aircraft Interactive Electronic Technical Manual (IETM)*, 17 October 2025

c. Known or Suspected Deviations from Directives or Publications

No known or suspected deviations that were a factor in the mishap were discovered during the investigation.

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20 May 2026

KEVIN E. WHITE, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

KC-46, T/N 17-6033
SEYMOUR JOHNSON AIR FORCE BASE, NORTH CAROLINA
8 JULY 2025

Under 10 U.S.C. § 2254(d) the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.

1. OPINION SUMMARY

On 8 July 2025, a United States Air Force KC-46A Pegasus, tail number 17-6033, Mishap Aircraft 1 (MA1), assigned to the 22d Air Refueling Wing, McConnell Air Force Base (AFB), Kansas, operated by a crew assigned to the 22d Air Refueling Wing, departed McConnell AFB on a training mission to air refuel four flights of two F-22As assigned to the 1st Fighter Wing, Joint Base Langley-Eustis (JBLE), Virginia. The scheduled flight profile was a single-ship departure from McConnell AFB to air refueling track 636 off the coast of Virginia, air refueling F-22As for approximately one hour before returning to McConnell AFB. At approximately 1652 Zulu (Z) / 1242 local time (L), while refueling with the fifth F-22A, Mishap Aircraft 2 (MA2), piloted by an F-22A student pilot (Mishap Fighter Pilot 1 [MFP1]), MA1 experienced nozzle binding of the boom in MA2's air refueling receptacle. Upon release of the nozzle from MA2, the air refueling boom rapidly flew upwards and struck the bottom aft portion of MA1's fuselage resulting in a critical failure of the refueling boom structure just forward of the flight controls and the aft section of the boom departed the aircraft in flight. There were no fatalities, injuries, or damage to civilian property. MA2 landed safely at JBLE and MA1 emergency diverted and safely landed at Seymour Johnson AFB, North Carolina. The estimated damage to MA1 was $9,979,567.

I find, by a preponderance of the evidence, one cause for this mishap. The mishap boom operator's (MB1) manual control inputs to the air refueling flight control stick (FCS), resulting in an excessively out of trim air refueling boom (ARB) that produced a radial force to the boom nozzle which then caused it to become bound inside of the receiver's air refueling receptacle. This subsequently produced an unrecoverable boom fly-up rate upon release of receptacle, striking MA1 and driving a critical failure of the boom structure which then departed in flight. Additionally, I find, by the preponderance of the evidence, one additional factor substantially contributed to the mishap: failure of MFP1 to account for the KC-46A stiff boom characteristics, causing an excessive closure rate.

2. CAUSE

Following a thorough review and analysis of the system data captured by the Air Refueling Control Computer (ARCC) on 8 July 2025, the Accident Investigation Board (AIB) identified a high radial nozzle force as the primary factor causing the boom nozzle to become bound in MA2's air refueling receptacle. In the absence of this high radial nozzle force, I believe the ARB telescope would have retracted under the Telescope Control Stick (TCS) command from MB1.

The data illustrated that MB1 input TCS retraction and FCS fly-up commands nearly simultaneously upon disconnect and maintained a near maximum fly-up command of the ARB throughout the emergency breakaway until its release from the air refueling receptacle. While it is unlikely that MB1 was aware of his flight control inputs due to limited system feedback, the procedural execution was misaligned with the US Standards Related Document (SRD) caution which states:

> "Binding of the boom nozzle in the receiver's receptacle is possible, even with a disconnect signal … If nozzle binding occurs or is suspected, neutralize boom flight control inputs before retraction. Avoid abrupt boom flight control inputs."

This improper control input caused the ARB to bind within MA2's air refueling receptacle, creating a significant ARB fly up command that impacted the MA1's fuselage approximately half a second after release from MA2.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

a. Failure of MFP1 to account for the KC-46A Stiff Boom characteristics, causing an excessive closure rate

The KC-46A has several documented deficiencies that complicate its ability to accomplish its aerial refueling mission. One such deficiency is for the boom telescope being too stiff while in contact with a receiver aircraft, causing receiver aircraft to inadvertently carry an excess amount of thrust which, following a disconnect, can cause the receiver aircraft to rapidly accelerate toward the tanker aircraft. Receiver pilots are required to make large power corrections when attempting to make fore and aft position adjustments to mitigate the "stiff boom" deficiency. The deficiency also contends that "once the breakout forces were overcome an excessive telescope rate would build if the receiver pilot did not apply an immediate power correction to arrest or slow the forward or aft motion."

In this case, all data throughout the investigation show that MA1 provided a stable air refueling platform throughout the mission, refueling multiple receiver aircraft, including MA2. MFP1, a student pilot, seemingly had a difficult time air refueling, causing three emergency breakaways during the air refueling timeframe.

During the mishap air refueling contact, MA2 moved forward in the air refueling envelope approximately 7 feet in 10 seconds, approaching the inner telescope limit when MB1 triggered a disconnect. MA2 continued its inward movement an additional 2 feet causing MB1 to direct an emergency breakaway.

Following MB1's emergency breakaway command, MFP1 followed the appropriate procedures and reversed the forward movement. However, prior to the breakaway procedure application, MFP1 did not account for the excessive power setting used to overcome the breakout forces and did not stop her closure rate in an acceptable manner. As a result, MA2 moved forward relative to MA1 while the aircraft were still physically connected, contributing to the nozzle binding and the resulting mishap.

4. CONCLUSION

I find, by a preponderance of the evidence, one cause for this mishap. MB1 made manual control inputs to the ARB during the separation, causing a radial force to be applied to the ARB nozzle, resulting in it becoming bound within the receiver's air refueling receptacle. As a result, the bound forces exceeded structural and programmed limitations of the ARB that, upon release of the receptacle, led to a rapid upward movement that struck the aft portion of the MA1 fuselage and further caused a critical failure of the boom shaft and departure from the aircraft.

Additionally, I find, by a preponderance of the evidence, one factor which substantially contributed to the mishap. MFP1 failed to account for the KC-46 stiff boom characteristics, causing an excessive closure rate. MFP1 did not appropriately account for the excessive power setting used to overcome the stiff boom and did not reduce power appropriately once they reached breakout forces.

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KEVIN E. WHITE, Colonel, USAF
President, Accident Investigation Board

INDEX OF TABS