UNITED STATES AIR FORCE AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

C-130J, T/N 08-3174

774TH EXPEDITIONARY AIRLIFT SQUADRON
455TH AIR EXPEDITIONARY WING
BAGRAM AIRFIELD, AFGHANISTAN

LOCATION: JALALABAD AIRFIELD, AFGHANISTAN

DATE OF ACCIDENT: 2 OCTOBER 2015

BOARD PRESIDENT: BRIG GEN PATRICK X. MORDENTE

Conducted IAW Air Force Instruction 51-503

ACTION OF THE CONVENING AUTHORITY

The report of the accident investigation board, conducted under the provisions of AFI 51-503, that investigated the 2 October 2015 mishap that occurred at Jalalabad Airfield, Afghanistan, involving C-130J, T/N 08-3174, assigned to the 317th Airlift Group, Dyess Air Force Base, Texas, and operationally deployed to the 455th Air Expeditionary Wing, Bagram Airfield, Afghanistan, complies with applicable regulatory and statutory guidance and on that basis is approved.

2/14/2016

X

Signed by: SCHATZ.ROWAYNE.A.JR.1177943386

ROWAYNE A. SCHATZ, JR.
Major General, USAF
Vice Commander

United States Air Force Accident Investigation Board Report

C-130J, Jalalabad Airfield, Afghanistan

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

C-130J, T/N 08-3174
JALALABAD AIRFIELD, AFGHANISTAN
2 OCTOBER 2015

On 2 October 2015, at approximately 0016 hours local time (L), a C-130J, Tail Number (T/N) 08-3174, crashed after takeoff from Runway 31, Jalalabad Airfield (JAF), on the second scheduled leg of a contingency airlift mission. The mishap aircraft (MA) was assigned to the 455th Air Expeditionary Wing at Bagram Airfield, Afghanistan. The mishap crew (MC) was from the 774th Expeditionary Airlift Squadron. The MC consisted of the mishap pilot (MP), the mishap copilot (MCP), and two mishap loadmasters. Also onboard were two fly-away security team (FAST) members and five contractors travelling as passengers. Upon impact, all eleven individuals onboard the aircraft died instantly. The aircraft struck a guard tower manned by three Afghan Special Reaction Force (ASRF) members, whom also died. The MA and cargo load were destroyed, and a perimeter wall and guard tower were damaged. The MA and cargo were valued at $58,363,044.

On 1 October 2015, at approximately 2313L, the MA landed at JAF following the first scheduled leg of a contingency airlift mission. While on the ground, the MP placed a hard-shell night vision goggle (NVG) case forward of the yoke during Engine Running Onload/Offload (ERO) operations to maintain the MA elevator in an up position to accommodate loading operations of tall cargo. In the 50 minutes that followed prior to take-off at 0015L, neither the MP nor the MCP removed the case. During the takeoff roll, with the MCP at the controls, the MA rotated early and lifted off the ground approximately three knots below the anticipated takeoff speed. The MA's pitch angle continued to increase due to the hard-shell NVG case blocking the flight controls, thus preventing the MCP from pushing the yoke forward to decrease the pitch angle. The MCP misidentified the ensuing flight control problem as a trim malfunction resulting in improper recovery techniques being applied by both mishap pilots. The rapid increase in pitch angle resulted in a stall that the mishap pilots were unable to recover. The MA impacted approximately 28 seconds after liftoff, right of the runway, within the confines of JAF.

The Accident Investigation Board (AIB) president found by a preponderance of the evidence that the causes of the mishap were the MP's placement of the hard-shell NVG case in front of the yoke blocking forward movement of the flight controls, the distractions experienced by the MP and MCP during the course of the ERO, and the misidentification of the malfunction once airborne. The AIB president also found by a preponderance of the evidence that environmental conditions, inaccurate expectations, and fixation substantially contributed to the mishap.

United States Air Force Accident Investigation Board Report

C-130J, Jalalabad Airfield, Afghanistan

SUMMARY OF FACTS AND STATEMENT OF OPINION
C-130J, T/N 08-3174
2 OCTOBER 2015

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

18 AF	18th Air Force
1Lt	First Lieutenant
39 AS	39th Airlift Squadron
317 AG	317th Airlift Group
317 AMXS	317th Aircraft Maintenance Squadron
455 AEW	455th Air Expeditionary Wing
609 AOC	609th Air Operations Center
774 EAS	744th Expeditionary Airlift Squadron
774 EAMXS	774th Expeditionary Aircraft Maintenance Squadron
A1C	Airman First Class
A/C	Aircraft
AC	Aircraft Commander
ACAWS	Advisory, Caution, and Warning System
ADO	Assistant Director of Operations
AEW	Air Expeditionary Wing
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFIP	Air Force Institute of Pathology
AFLCMC	Air Force Life Cycle Management Center
AFMAN	Air Force Manual
AFMES	Armed Forces Medical Examiner System
AFTO	Air Force Technical Order
AG	Airlift Group
AGL	Above Ground Level
AIB	Accident Investigation Board
AIB/LA	Accident Investigation Board Legal Advisor
AIB/LM	Accident Investigation Board Loadmaster
AIB/MX	Accident Investigation Board Maintenance Member
AIB/PM	Accident Investigation Board Pilot Member
AIB/PSME	Accident Investigation Board Pilot Subject Matter Expert
AIB/R	Accident Investigation Board Recorder
ALC	Air Logistics Center
AMAX	Adjusted Maximum Effort
AMC	Air Mobility Command
AMD	Air Mobility Division
AMFLMETO	Adjusted Minimum Field Length for Maximum Effort Takeoff
AMU	Aircraft Maintenance Unit
AMXS	Aircraft Maintenance Squadron
ANG	Air National Guard
AOA	Angle of Attack
AOR	Area of Responsibility
APU	Auxiliary Power Unit
ARFF	Aircraft Rescue and Firefighting
ARMS	Aviation Resource Management System
AS	Airlift Squadron
ASRF	Afghan Special Reaction Force
ATLAS	Aircraft Trim, Linearization, and Simulation
BAF	Bagram Airfield
BAU	Bus Adapter Unit
BPO	Basic Post Flight
Brig Gen	Brigadier General
CAC	Common Access Card
CAOC	Combined Air Operations Center
Capt	Captain
CC	Commander
CENTCOM	Central Command
CFL	Critical Field Length
CG	Center of Gravity
CGO	Company Grade Officer
CMDU	Color Multifunction Display Unit
CNI-MU	Communications/Navigation/Identification Management Unit
CO	Carbon Monoxide
Col	Colonel
COMSEC	Communications Security
CV	Vice Commander
CVR	Cockpit Voice Recorder
DADS	Digital Air Data System
DC	Direct Current
DIM	Death, Injury, and Missing
DME	Distance Measuring Equipment
DNIF	Duty Not Including Flying
DO	Director of Operations
DoD	Department of Defense
DFDR	Digital Flight Data Recorder
DSN	Defense Switched Network
DTADS	Data Transfer and Diagnostic System
EAS	Expeditionary Airlift Squadron
EAMXS	Expeditionary Aircraft Maintenance Squadron
ECP	Entry Control Point
EGO	Early Go
ELRS	Expeditionary Logistics Readiness Squadron
ELT	Emergency Locator Transmitter
EOG	Expeditionary Operations Group
ER	Exceptional Release
ERO	Engine Running Onload/Offload
EWS	Emergency Water Supply
FACC	Fire Alarm Communication Center
FAST	Fly Away Security Team
FCIF	Flight Crew Information File

FDP	Flight Duty Period
FOB	Forward Operating Base
FOV	Field of View
FP	First Pilot
ft	Feet
FUSS	Flaps Up Safety Speed
g	Gravitational Force
GPS	Global Positioning System
GS	Government Service
HDD	Head Down Display
HFACS	Human Factors Analysis and Classification System
Hg	Mercury
HQ	Headquarters
HUD	Head Up Display
HSC	Home Station Check
IAW	In Accordance With
IC	Incident Command
ICAO	International Civil Aviation Organization
ICS	Intercommunication System
IDLH	Immediately Dangerous to Life and Health
IMC	Instrument Meteorological Conditions
IMDS	Integrated Maintenance Data System
in	Inches
IP	Instructor Pilot
IR	Infrared
ISB	Interim Safety Board
ISB/I	Interim Safety Board Investigator
ISO	Isochronal
JA	Judge Advocate
JAF	Jalalabad Airfield
JAG	Judge Advocate General
JI	Joint Inspector
JSTARS	Joint Surveillance Target Attack Radar System
JTAC	Joint Terminal Attack Controller
K	Thousand
KCAS	Knots Calibrated Airspeed
KTAS	Knots True Airspeed
L	Local Time
lbs	pounds
LM-Aero	Lockheed Martin Aeronautics Company
Lt Col	Lieutenant Colonel
Lt Gen	Lieutenant General
LZ	Landing Zone
MA	Mishap Aircraft
MAC	Mean Aerodynamic Chord
Maj	Major
MAJCOM	Major Command
MAX	Maximum
MC	Mishap Crew
MCP	Mishap Copilot
MCT	Movement Control Team
MEFL	Multi-Element Flight Lead
MFAST	Mishap Fly-Away Security Team
MHE	Material Handling Equipment
MK	Mishap Contractor
ML	Mishap Loadmaster
ML1	Mishap Loadmaster 1
ML2	Mishap Loadmaster 2
MMS	Maintenance Management System
MOB	Main Operating Base
MP	Mishap Pilot
MS	Mishap Sortie
MSgt	Master Sergeant
MSL	Mean Sea Level
NAF	Numbered Air Force
NATO	North Atlantic Treaty Organization
NCOIC	Noncommissioned Officer In Charge
NCP	North Compound Personnel
ND	Nose Down
NIU	Nacelle Interface Unit
NM	Nautical Miles
NOTAM	Notices to Airmen
NVG	Night Vision Goggle
OAJL	Jalalabad Airfield
OG	Operations Group
OAIX	Bagram Airfield
Ops Tempo	Operations Tempo
ORM	Operational Risk Management
OSS	Operation Support Squadron
OST	Off Station Trainer
PA	Pressure Altitude
PAR	Personnel Accountability Report
PAX	Passenger
PDM	Programmed Depot Maintenance
PE	Professional Equipment
PFD	Primary Flight Display
PGB	Propeller Gear Box
PL	Positive Launch
PLA	Power Lever Angle
PLCU	Pallet Lock Control Unit
PLT	Power Lever Transition
PR	Preflight Inspection
Rad Alt	Radar Altimeter
RM	Risk Management
SAR	Search and Rescue
SCBA	Self-Contained Breathing Apparatus
SIB	Safety Investigation Board
SKL	Secure Key Loader
SME	Subject Matter Expert
SPINS	Special Instructions
SPS	Stick Pusher System
SrA	Senior Airman
SSgt	Staff Sergeant
TCTO	Time Compliance Technical Order
TH	Thruflight
T/N	Tail Number

TO	Technical Order
TOC	Tactical Operations Center
TOLD	Takeoff and Landing Data
TSgt	Technical Sergeant
TTPs	Tactics, Techniques, and Procedures
UAS	Un-manned Aircraft System
UCMJ	Uniform Code of Military Justice
US	United States
USAF	United States Air Force
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOSIP	Voice Over Secure Internet Protocol
W	Witness
WEZ	Weapons Engagement Zone
WIC	Weapons Instructor Course
Z	Zulu Time

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 2 October 2015, Major General Rowayne A. Schatz Jr., Vice Commander, Air Mobility Command (AMC) appointed Brigadier General Patrick X. Mordente to conduct an aircraft investigation of the 2 October 2015 crash of a C-130J aircraft, Tail Number (T/N) 08-3174 at Jalalabad Airfield (JAF), Afghanistan (Tab Y-3 to Y-4). The investigation occurred at Scott Air Force Base (AFB), Illinois, from 12 November 2015 through 10 February 2016. The following board members were appointed: Legal Advisor (Lieutenant Colonel), Medical Member (Captain), Pilot Member (Captain), Maintenance Member (Lieutenant Colonel), Loadmaster Member (Master Sergeant), and Recorder (Staff Sergeant) (Tab Y-3, Y-5, and Y-7). A C-130J Test Pilot (Lieutenant Colonel), an Aerospace Physiologist (Captain), a C-130J Propulsion Engineer (Government Service (GS)-13), and a C-130 Equipment Specialist (GS-11) were also appointed as Subject Matter Experts (SME) (Tab Y-6, Y-8 and Y-9).

b. Purpose

In accordance with Air Force Instruction (AFI) 51-503, *Aerospace and Ground Accident Investigations*, 14 April 2015, this Accident Investigation Board (AIB) conducted a legal investigation to inquire into all the facts and circumstances surrounding this United States 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 2 October 2015, the mishap aircraft (MA), a C-130J, T/N 08-3174, departed JAF on the second scheduled leg of a contingency airlift mission at 0015 hours local time (L) (Tabs K-4, N-17, CC-55, and CC-57). The mishap crew (MC) from the 774th Expeditionary Airlift Squadron (EAS) at Bagram Airfield (BAF), Afghanistan, consisted of the mishap pilot (MP), the mishap copilot (MCP), and two mishap loadmasters (MLs) (hereinafter Mishap Loadmaster 1 (ML1) and Mishap Loadmaster 2 (ML2)) (Tab K-2). Additionally, two Fly-Away Security Team (FAST) members, five contractors travelling as passengers, and 39,386 pounds of cargo were aboard the aircraft (Tabs K-2, K-25, K-32, and X-15 to X-23). The MCP performed an adjusted maximum effort (AMAX) takeoff reaching a maximum nose-up pitch attitude of 42 degrees while climbing to approximately 700 feet above ground level (AGL) (Tabs L-3, L-4, and N-12 to N-13). Approximately 12 seconds after takeoff, the MA entered a stall due to the high pitch angle (Tabs J-18, CC-55, and CC-57). The MP and MCP were unable to recover from the stall (Tab J-18). At approximately 0016L, the MA impacted the ground 14 degrees nose-low in 28 degrees of right bank at an airspeed of 111.5 knots and was destroyed (Tabs J-18, J-21 to J-22, and S-2). All eleven personnel onboard died upon impact (Tab CC-15). Additionally, three

Afghan Special Reaction Force (ASRF) members on the ground were killed (Tab EE-5 and EE-12). Total Department of Defense (DoD) damage cost was $58,363,044, which includes the loss of the MA worth $51,606,131 and cargo worth $6,756,913 (Tab P-2). Additionally, a JAF guard tower and perimeter wall were damaged (Tab S-2 to S-3).

3. BACKGROUND

The 317th Airlift Group (317 AG), located at Dyess AFB, Texas, was assigned the MA and the 39th Airlift Squadron (39 AS) operated the MA (Tabs K-4, CC-53, DD-9, and DD-11). The 39 AS falls directly under the 317 AG, which falls under the operational control of 18th Air Force (18 AF) (Tab DD-5 and DD-9). Eighteenth Air Force is a Numbered Air Force (NAF) within AMC, both of which are headquartered at Scott AFB, Illinois (Tab DD-3 and DD-5).

While operating at the deployed location, the MA and MC were assigned to the 455th Air Expeditionary Wing (455 AEW) and operated under the 774 EAS, located at BAF (Tabs K-4, CC-53, DD-13, and DD-15). The Air Mobility Division Chief of the 609th Air Operations Center (609 AOC) authorized the mission (Tabs DD-12 and EE-10).

a. Air Mobility Command (AMC)

AMC is a major command headquartered at Scott AFB, Illinois. AMC provides America's Global Reach. This rapid, flexible, and responsive air mobility promotes stability in regions by keeping America's capability and character highly visible. AMC's mission is to provide global air mobility – right effects, right place, right time. Nearly 136,000 active-duty, Air National Guard (ANG), Air Force Reserve and DoD civilians make AMC's rapid global mobility operations possible (Tab DD-3 to DD-4).

b. 18th Air Force (18 AF)

Eighteenth Air Force, headquartered at Scott AFB, Illinois, was first activated to execute Tactical Air Command's troop carrier responsibilities. 18 AF's mission is Airmen delivering innovative Rapid Global Mobility solutions through operational expertise and capabilities. 18 AF presents air mobility forces to combatant commanders. It is charged with carrying out AMC's operational role as Air Forces Transportation, the air component of United States (US) Transportation Command. 18 AF has an assigned Active, Reserve, Guard and civilian workforce of more than 37,000 people (Tab DD-5).

c. 317th Airlift Group (317 AG)

The 317 AG is comprised of the 39th and 40th Airlift Squadrons, the 317th Aircraft Maintenance Squadron, the 317th Maintenance Squadron, and the 317th Operations Support Squadron. For over 65 years, the 317 AG has championed the cause for tactical airlift, bringing the compassion and resolve of America and her allies (Tab DD-9).

d. 39th Airlift Squadron (39 AS)

The 39 AS maintains quality aircrew and aircraft to mobilize, deploy, and provide intra-theater airlift worldwide for DoD customers. The men and women of the 39 AS support theater commanders' requirements with combat-delivery capability through tactical airland and airdrop operations as well as humanitarian efforts and aeromedical evacuation (Tab DD-11).

e. 609th Air Operations Center (609 AOC)

The 609 AOC was first established as the 609th Air Operations Group, and activated on 1 January 1994. It was then redesignated as the 609th Air and Space Operations Center on 1 March 2008, and on 1 December 2014, it became known as the 609 AOC. The 609 AOC is presently located at Al Udeid Airbase, Qatar (Tab DD-12).

f. 455th Air Expeditionary Wing (455 AEW)

The 455 AEW is comprised of more than 1,600 Airmen located at Bagram, Jalalabad, and Kandahar airfields. The wing consists of five groups: 455th Expeditionary Operations Group, 455th Expeditionary Mission Support Group, 455th Expeditionary Maintenance Group, 455th Expeditionary Medical Group, and the 451st Air Expeditionary Group. The wing has four priorities: (1) provide decisive airpower in support of the 2015 fighting season and execution of North Atlantic Treaty Organization's (NATO) Resolute Support mission; (2) empower Airmen to defend themselves where they live and where they work; (3) flawlessly execute medical care and aeromedical evacuation responsibilities in Afghanistan; and, (4) deliver relentless care for our Airmen (Tab DD-13).

g. 774th Expeditionary Airlift Squadron (774 EAS)

The 774 EAS provides premier C-130 combat airlift, airdrop, and aeromedical evacuation to the warfighter in Afghanistan and the entire US Central Command Area of Operations. The C-130s are the backbone of intra-theater resupply, sustainment, and troop movement throughout Afghanistan (Tab DD-15).

h. C-130J – Hercules

The C-130 Hercules primarily performs the tactical portion of the airlift mission. The aircraft is capable of operating from rough, dirt strips and is the prime transport for airdropping troops and equipment into hostile areas. The C-130 operates throughout the US Air Force, serving with Air Mobility Command, Air Force Special Operations Command, Air Combat Command, US Air Forces in Europe, Pacific Air Forces, Air National Guard, and the Air Force Reserve Command, fulfilling a wide range of operational missions in both peace and war situations. Basic and specialized versions of the aircraft perform a diverse number of roles, including airlift support, Antarctic ice resupply, aeromedical missions, weather reconnaissance, aerial spray missions, firefighting duties for the US Forest Service, and natural disaster relief missions (Tab DD-17).

The C-130J is the latest addition to the C-130 fleet. The C-130J incorporates state-of-the-art technology, which reduces manpower requirements, lowers operating and support costs, and provides life-cycle cost savings over earlier C-130 models. Compared to older C-130s, the J model climbs faster and higher, flies farther at a higher cruise speed, and takes off and lands in a shorter distance. The C-130J-30 is a stretch version—adding 15 feet to the fuselage and increasing usable space in the cargo compartment. The MA was a C-130J-30 (Tab DD-17).

Major system improvements include an advanced two-pilot flight station with fully integrated digital avionics, color multifunctional liquid crystal and head-up displays (HUD), and state-of-the-art navigation that includes a dual inertial navigation system and global positioning system (GPS). The aircraft also features fully integrated defensive systems, low-power color radar, digital moving map display, new turboprop engines with six-bladed all-composite propellers, and a digital auto pilot. The C-130J and C-130J-30 also includes improved fuel efficiency, environmental and ice-protection, and an enhanced cargo-handling system (Tab DD-17 to DD-18).

4. SEQUENCE OF EVENTS

a. Mission

The planned mission consisted of two round-trip transport flights from BAF (airport designator OAIX) to JAF (airport designator OAJL), followed by a flight to Kabul, a flight to Kandahar Airfield, and a final return to BAF for mission termination (Tabs K-4 and CC-53). The mishap sortie (MS) was the second scheduled leg of this mission, taking off from JAF for return to BAF (Tab K-4). The Air Mobility Division Chief at the 609 AOC authorized the MS (Tab EE-10).

(1) Crew Composition

The MP was the aircraft commander (Tab K-2). He was in the left seat during the MS and was the pilot monitoring the controls during the takeoff roll (Tabs N-17 and CC-53). The MCP was the pilot flying during the takeoff roll and was in the right seat (Tabs N-17 and CC-53). ML1 and ML2 were posted in the cargo compartment (Tabs N-16 and CC-53 to CC-54).

(2) Airspace Considerations

The MS was flown in airspace controlled by US contractors from the Jalalabad Air Traffic Control Tower (hereinafter "Tower") (Tab R-3 to R-4). The MC maintained radio contact with the Tower throughout the flight (Tab N-17 to N-19). The Tower was able to keep the MA in view during the takeoff roll through liftoff before losing sight of the MA at the departure end of the runway due to the night flying environment. Other aircraft were not in Tower's airspace during the MS (Tab V-13.3 to V-13.4).

b. Planning

The mission was planned by the 774 EAS in conjunction with the 609 AOC (Tabs K-4, V-7.3, and EE-10). It was planned and briefed as a nighttime, contingency mission involving one C-130J aircraft from the 455 AEW, call sign "Torque 62" (also referred to as "TORQE 62") (Tabs K-4 and V-10.2 to V-10.4). The crew followed the standard planning process, which included reviewing the calculated fuel log, applicable Notices to Airmen (NOTAMs), cargo load plan, airfield analysis, and weather analysis (Tabs F-2 to F-7, K-4, K-7 to K-8, K-14 to K-16, K-18, K-22, V-10.3, and EE-11). The crew briefing was led by the Night Tactics Chief using the standard 774 EAS classified briefing (Tabs V-10.2 to V-10.3 and EE-11). Nothing unusual was noted during the brief (Tab V-10.4). No other squadron supervisory personnel were present for the briefing, nor were any required to be present (Tab V-14.2).

c. Preflight

On 1 October 2015 at 1930L, the MC arrived at the 774 EAS operations building and used Risk Management (RM) (commonly referred to as Operational Risk Management (ORM), and hereinafter referred to as ORM) to evaluate mission risk (Tabs K-6, V-7.3, BB-57, and CC-54). ORM is a decision-making process to systematically evaluate possible courses of action, identify risks and benefits, and determine the best course of action for any given situation (Tab BB-57). The MC and squadron leadership categorized the mission as low risk based on mission, aircrew, and environmental factors (Tabs K-5 and CC-54). All crewmembers determined they were safe and prepared to fly the planned mission (Tabs K-5 to K-6 and CC-54).

The MC received the local intelligence and tactics briefing shortly after show time (Tab V-10.3 and V-14.2). The duty tactician did not note anything unusual with the MC's demeanor during the briefing. After the initial portion of the briefing, the MLs were released to prepare the MA for flight. The MP and MCP remained in the operations building to review the airfields they would be operating at throughout the night. This was a 10-15 minute discussion of mission specifics to include weather and NOTAMs (Tab V-10.3 to V-10.4). The Assistant Director of Operations

(ADO) was on duty and discussed destination weather concerns at Kabul prior to releasing the MP and MCP for flight (Tab V-7.3). The MP and MCP left the operations building at approximately 2020L (Tab V-10.3). The MP and MCP also went to Aircrew Flight Equipment (AFE) to arm their weapons, check out Night Vision Goggles (NVGs), and collect their professional gear before proceeding to the MA. An AFE craftsman was on duty and oversaw the AFE sign-out process. He did not note anything out of the ordinary with the MC and saw no cause for concern prior to the flight (Tab V-11.3). The MC checked out five sets of NVGs issued in hard-shell black cases (Tabs V-11.3, Z-16, and EE-9). The NVGs used in the MS were binocular-style, helmet mounted, image intensification devices that amplify visible and near-infrared (IR) energy (Tab BB-25). After completing the sign-out process, the MP and MCP proceeded to the aircraft to continue pre-flight duties (Tab V-7.3).

d. Summary of Accident

(1) Bird-Strike Sortie

The first sortie flown by the MC on 1 October 2015 was a planned flight from BAF to JAF. The MA took off as scheduled at 2136L (Tabs K-4 and CC-53). After takeoff, the MA experienced a bird strike and returned to BAF to allow maintenance personnel to inspect the MA before continuing the mission (Tabs K-4 and V-5.6). The MC landed at 2155L, taxied to park, and returned the MA to maintenance for inspection (Tabs K-4 and V-5.6). At this time, the MP and MCP returned to the operations building. They informed the ADO of the bird strike and their plans to continue the mission (Tab V-7.4). The MP and MCP did not seem concerned by the event; once cleared by maintenance, they returned to the MA to continue the mission as planned (Tab V-5.6 and V-7.4).

(2) Flight to Jalalabad Airfield (JAF)

The MC took off for JAF at approximately 2253L (Tab K-4). The sortie was uneventful and the MA landed safely at JAF at approximately 2313L (Tabs J-11, N-3 to N-4, and CC-55). The MP and MCP noted fireworks during the approach into JAF, but did not consider it enemy action and did not execute evasive maneuvers (Tab N-2 to N-4). The MCP relayed this information back to unit leadership (Tab N-6).

(3) Loading & Ground Operations

The MP taxied to Alpha Ramp to begin Engine Running Onload/Offload (ERO) procedures at 2316L (Tabs N-2 and CC-55). The AIB determined the local times referenced throughout the remainder of the sequence of events based on matching a known cockpit voice recorder (CVR) time stamp with a digital flight data recorder (DFDR) time stamp (Tab CC-55 and CC-57 to CC-58). The AIB then extrapolated the DFDR time stamps and applied them to the CVR, thus providing a consistent time reference throughout the report (Tab CC-55 and CC-57 to CC-58). The MC followed the ERO checklist in accordance with the planned mission (Tabs K-4, N-2, and V-12.5). The FAST members took their position outside the MA prior to the cargo offload (Tab N-3). During the cargo offload sequence, ML1 requested that the MP raise the elevator on the MA to provide more clearance for offloading the high-profile (tall) cargo (Tabs N-4 and CC-54).

Raising the elevator lifts the control surface above horizontal and is accomplished by pulling the yoke aft (toward the pilot) (Tab CC-54). This request was not considered an unusual request by the MP who complied at 23:19:49L (DFDR time 4710) (Tabs J-11 to J-12, N-4, and CC-54 to CC-55). For the next six minutes, there were changes in the elevator deflection, indicating that the MP was holding the yoke back to maintain between positive 6 and positive 13 degrees of elevator deflection. At 23:26:06L (DFDR time 5087) the elevator position increased to positive 20 degrees deflection momentarily before settling to a position between six to eight degrees positive deflection (Tabs J-11 to J-12 and CC-55). This occurred immediately before the MP told the MCP, "My NVG case is holding…the elevator" as demonstrated in Figures 4-1 and 4-2 (Tabs J-11 to J-12, N-5, Z-3, and Z-19).

Figure 4-1 (Tab Z-3)
Case Forward of Yoke (Daytime)

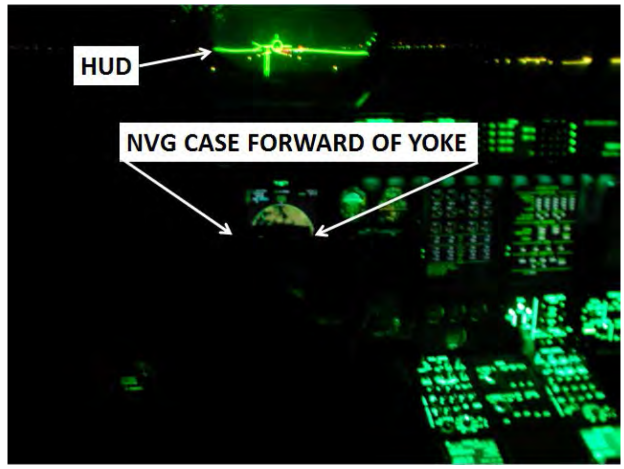

Figure 4-2 (Tab Z-19)
Case Forward of Yoke (Nighttime)

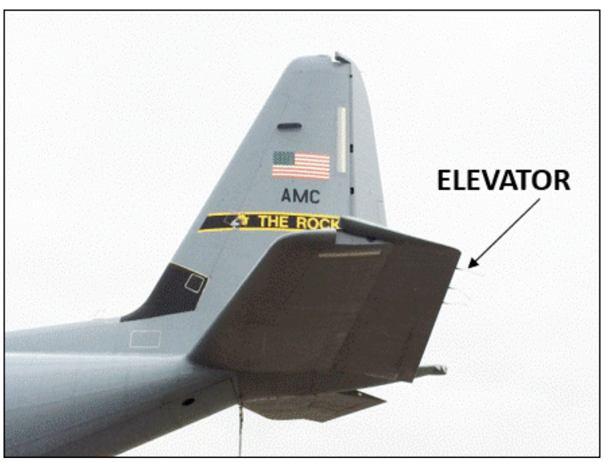

Figure 4-3 (Tab Z-20)
Elevator Without Case Forward of Yoke

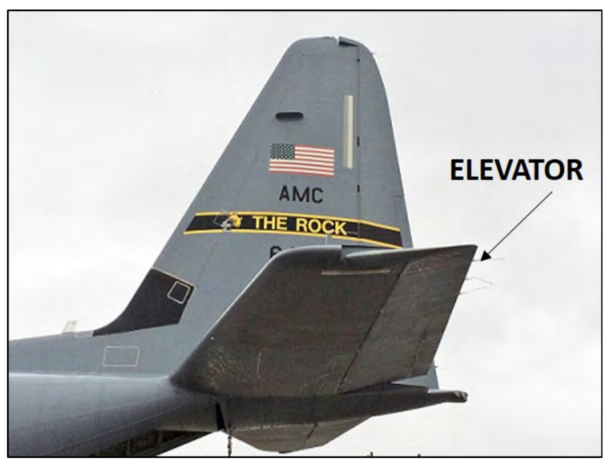

Figure 4-4 (Tab Z-4)
Elevator With Case Forward of Yoke

The natural resting state of the elevator during ground loading operations is approximately negative 15 degrees deflection, as demonstrated in Figure 4-3 (Tab J-11 to J-12). On the MA, the elevator position remained between six to eight degrees positive deflection while loading operations continued, as demonstrated in Figure 4-4 (Tab J-11). This positive elevator deflection was collaborated by video evidence of the MA loading operations, depicted in Figures 4-5 and 4-6 (Tab CC-3). Approximately ten minutes after the hard-shell NVG case was placed forward of the yoke, the MCP got out of the right seat to assist with loading operations in the back of the MA (Tabs N-7 and CC-55).

Figure 4-5 (Tab Z-5)
Elevator Down Position

Figure 4-6 (Tab Z-6)
Elevator Up Position

The MLs were tasked with onloading five pallets utilizing ERO procedures (Tab K-32). The onload also included five passengers not included in the original load plan, prompting a decision by the MLs to move the forward-most pallet aft to pallet position three rather than pallet position two (Tabs K-25, K-32, and R-14 to R-15). This decision was in accordance with (IAW) AFI 11-2C-130J Volume 3, *C-130J Operations Procedures*, 8 December 2009 (Tab BB-17). This load change shifted the center of gravity (CG) to 28.6% of Mean Aerodynamic Chord (MAC) for takeoff (Tab N-8). The total load weight was 40,300 pounds (including the passengers) and the calculated aircraft gross weight for takeoff was 153,200 pounds (Tabs J-12, N-8, and CC-23). The cargo weight and CG computed based on the new load plan was within flight limits and met all requirements for safe flight (Tab CC-23).

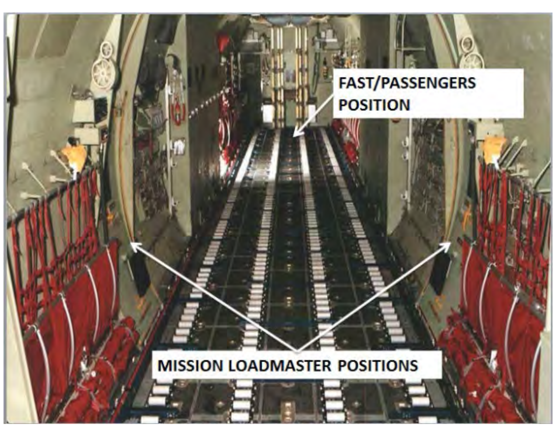

Figure 4-7 (Tab Z-7)
C-130J Cargo Area

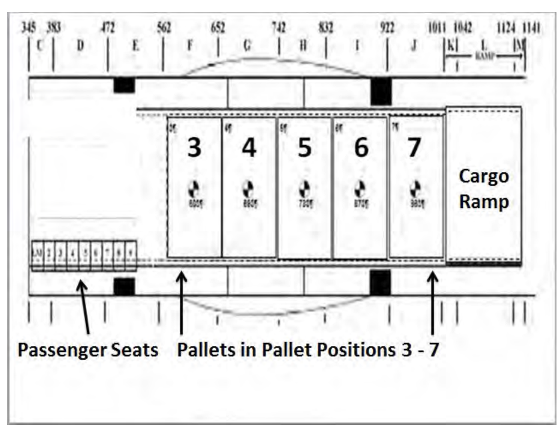

Figure 4-8 (Tab Z-15)
Top-Down View of MA as Loaded

The cargo consisted of five Tri-Con shipping containers placed on 463L pallets and restrained with MB-1 tie-down chains and devices as demonstrated in Figures 4-9 and 4-10 (Tabs K-32, N-8, R-18 to R-19, and V-4.3). All cargo was restrained and tied-down with devices and chains sufficient for flight IAW Technical Order (TO) 1C-130J-9, *Cargo Loading Manual; C-130J Aircraft*, 1 January 2015 (Tab BB-68 to BB-76). A United States Air Force (USAF) Joint Inspector (JI) visually inspected all cargo during pallet build operations. Additionally, the JI ensured the Tri-Cons were braced and packed to prevent an inflight CG shift. All pallets were weighed and marked for flight (Tab V-4.3 to V-4.5).

Figure 4-9 (Tab Z-8)
463L Pallet w/ Tri-Con

Figure 4-10 (Tab Z-9)
463L Pallet Chain Restraints

During cargo loading operations, the MP was in the left pilot seat determining if the MA's performance would be sufficient to takeoff from JAF (Tab N-8 to N-9). The MP initially expected the MC would need to perform an AMAX takeoff instead of a normal takeoff, which would allow the MA to takeoff in a shorter runway distance and at a lower takeoff speed (Tabs N-8, BB-14 to BB-16, and CC-55 to CC-56).

The MP then verified that the load weight was 40,300 pounds (Tab N-8). After running the Takeoff and Landing Data (TOLD) calculations, the MP acknowledged that they had 750 feet of runway available beyond what was required for takeoff (Tabs N-8 to N-9, BB-14 to BB-16, and CC-10). AIB calculations show this matches the distance required to perform a normal takeoff (Tabs BB-14 and CC-10). The MCP returned to the right seat at approximately 0002L and the MP confirmed that they would perform an AMAX takeoff, with an expected liftoff speed of 111 knots (Tabs N-11 and CC-55). The AIB calculated the normal takeoff speed for the MA would have been 122 knots (Tab CC-10).

Throughout the remainder of the ground operations, the mishap pilots did not discuss the hard-shell NVG case holding the elevator in a raised position; video and DFDR data confirmed that the elevator remained in its raised position until the takeoff roll (Tabs J-11 to J-12 and N-12 to N-18). The blocking of flight controls during loading operations was a nonstandard procedure and there was no regulatory guidance to accompany the proper placement and removal of an object blocking the controls (Tabs V-7.5 to V-7.6, V-9.4, and CC-54). The ERO checklist did not include a step requiring the pilots to check the flight controls prior to departure; therefore, it was incumbent on the MP and the MCP to remember to remove the hard-shell NVG case (Tabs BB-63 to BB-65 and CC-54). To check the flight control, the MP or MCP would move the yoke forward and aft to confirm full range of motion (Tab CC-54). When accomplished, all flight control checks occur solely within the flight deck; no external check would have been accomplished that may have alerted the MP or MCP to the raised elevator position (Tab CC-54). The AIB could not determine whether a flight control check would have alerted the MP or MCP to the hard-shell NVG case forward of the yoke (Tab CC-54).

(4) Mishap Sortie (MS)

After the completion of the ERO, the MC taxied to the active runway and back-taxied for takeoff on Runway 31 (Tabs N-19 and CC-3). The MP and MCP were wearing NVGs for the takeoff (Tab N-13). Tower called the winds at three knots from 220 degrees (Tab N-19). There was no elevator movement up to this point, indicating that the MP and MCP had not removed the hard-shell NVG case from forward of the MP's control yoke (Tab J-12 to J-13).

The MCP conducted the takeoff from the right seat and began the takeoff roll at 00:15:24L (Tabs N-17, CC-55, and CC-57). Normally during a takeoff roll, the pilot keeps the elevator deflected down until the aircraft reaches rotation speed, at which point the pilot pulls the yoke aft, which raises the elevator, and the aircraft becomes airborne (Tab CC-54). During the MA's takeoff roll, the elevator deflection decreased from positive six to eight degrees to positive three to five degrees (Tab J-13). This slight change is consistent with aerodynamic forces across the elevator surface (Tab CC-21). The MA passed the briefed acceleration time check and the MP called rotate at 00:15:50L (Tabs N-17, CC-55, and CC-57). The MA became airborne at 00:15:50L at an indicated airspeed of 107.5 knots (Tabs J-13 to J-14, L-3, N-17, CC-55, and CC-57).

After the MP called "Rotate" at 00:15:50L (Figure 4-11), the MCP responded that the MA was "going off on its own" at 00:15:54L. The MCP became aware of a problem at 00:15:56L when he stated, "Ahh," and verbalized a trim failure two seconds later (00:15:58L) as the MA reached its top airspeed of 117 knots (Tabs J-13 and J-16, L-3, N-17, Z-14, CC-29 to C-32, CC-55, and CC-57). The MCP applied full nose-down trim in an attempt to help move the yoke forward at 00:15:57L (Tabs L-6, CC-55, and CC-57). The trim reached full negative deflection in three seconds, indicating that the trim system was operating normally (Tab L-6). The MA continued to pitch up as the mishap pilots attempted to remedy the perceived trim malfunction (Tabs L-4 and CC-32 to CC-35). Three seconds after the MCP verbalized a trim malfunction, the first stall warning occurred at 00:16:01L (Figure 4-11) (Tabs N-17, Z-14, CC-55, and CC-57). The MA was at greater than 20 degrees nose-up pitch, wings level, and an airspeed of 115 knots (Tabs J-16, L-3 to L-4, and CC-34).

At approximately 00:16:02L, when the MA was at 25 degrees of positive pitch, the MP, already in control of the MA, applied right aileron, and began rolling the MA to the right (Tabs L-4, L-6, J-16, N-17 to N-18, CC-35 to CC-36, and CC-55 to CC-57). This input is consistent with the MP attempting to maintain controlled flight (Tab CC-56). At 00:16:02L, the MA entered a stall and, except for a brief period just prior to impact, remained stalled throughout the remainder of the MS (Tabs J-18, CC-55, and CC-57). At 00:16:03L, the MA issued a second stall warning as the MA's pitch continued to increase through 35 degrees nose-up (Figure 4-11) (Tabs L-4, N-17, Z-14, CC-37, CC-55, and CC-57).

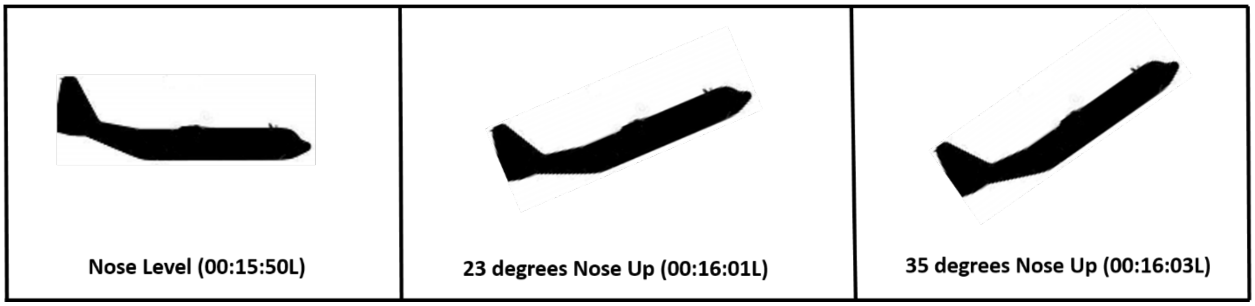

Figure 4-11 (Tab Z-14)
Pitch Angles of MA w/ Time Stamps

The stick pusher, a device that applies approximately 49 to 71 pounds of forward column force to the yoke to reduce the angle of attack (AOA), activated just prior to the second stall warning (Tabs J-18 to J-20, BB-36 to BB-38, CC-55 and CC-57). During AIB simulations with the hard-shell NVG case behind the yoke, the stick pusher activated but was ineffective because of the blocked controls (Tabs BB-38 and CC-10). At 00:16:05L, the MP confirmed he had control of the MA and directed the MCP to select emergency trim, an alternate to the normal trim system (Tabs N-18, CC-55, and CC-57). At 00:16:06L, the MCP confirmed he had selected emergency trim; however, the DFDR shows the trim system functioned properly in the normal position and the MCP switching to emergency trim had no additional effect (Tabs L-4, L-6, N-18, CC-55, and CC-58). The pitch and roll continued to increase until the MA reached a maximum positive pitch of 42 degrees at 00:16:07L (Figure 4-12) (Tabs J-20 to J-21, L-4, Z-14, CC-38 to CC-40, CC-55 and CC-58). The MA issued a third stall warning at 00:16:07L (Tabs N-18, CC-55, and CC-58). The roll continued to increase through the stall and the MA's nose dropped (Tabs J-20, L-4, Z-14, and CC-41 to CC-49). The MP input left aileron to correct the roll but due to the stalled condition, the right roll continued to increase (Tabs J-18, J-20, L-4, and L-6, and CC-41 to CC-49). The MA reached a maximum right bank of 75 degrees at 00:16:12L (Tabs L-4 and CC-47).

At approximately 00:16:13L, the MA began to roll to the left (Tabs L-4, CC-49, CC-55, and CC-58). The MA's nose continued to drop, eventually reaching negative 28 degrees pitch at 00:16:15L (Figure 4-12) (Tabs J-21, L-4, CC-50, CC-55, and CC-58). At 00:16:15L, the MP stated, "We're going down," a statement he repeated three consecutive times (Tabs N-18, CC-55, and CC-58). At 00:16:15L, the nose-down pitch angle was arrested as the MA nose started to rise (Tabs J-21, L-4, CC-51 to CC-52, CC-55, and CC-58).

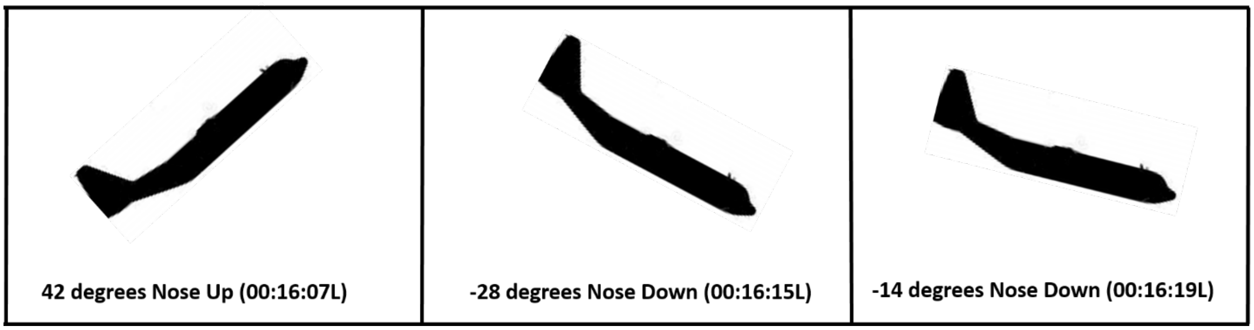

Figure 4-12 (Tab Z-14)
Pitch Angles of MA w/ Time Stamps

e. Impact

With a descent rate in excess of 8,000 feet per minute, the MA impacted the terrain, a perimeter wall to the right of the runway, and a guard tower at a force from 40g to more than 97g (Tabs J-8 to J-9, EE-5, and S-2 to S-3). The MA impacted at 14 degrees nose-down, 28 degrees of right bank, airspeed of 111.5 knots, and approximately 50% flaps at 00:16:18L, 28 seconds after becoming airborne (Figure 4-12) (Tabs J-21 to J-22, L-3 to L-4, L-7, CC-55, CC-57 to CC-58, and EE-5). The MA exploded upon impact and was destroyed (Tabs J-9 and CC-3 to CC-4).

f. Egress and Aircrew Flight Equipment (AFE)

All life support equipment on board the MA was inspected prior to takeoff and deemed serviceable (Tab EE-7 to EE-8). Due to the destruction of the MA upon impact and the immediate death of the 11 personnel onboard, there was no opportunity to use survival gear or life support equipment (Tabs J-9 and CC-15). The emergency locator transmitter (beacon) was functional and operational (Tab N-19).

g. Search and Rescue (SAR)

The time of the crash was 00:16:18L (Tabs N-18, CC-55, and CC-58). The MP transmitted a distress call to Tower seconds before impact, stating, "We're going down" (Tab N-18 to N-19). The contractor providing fire and emergency services at JAF received a call from Tower at 00:16:24L (Tab EE-4). Crews were dispatched with two fire trucks (Crash-5 and Crash-13), two tanker trucks (Tanker-8 and Tanker-9), and one rescue vehicle (Rescue-3) at 00:17:17L (Tab EE-4). Immediately after impact, ground personnel who witnessed the accident identified one injured ASRF member and one ASRF casualty located within the guard tower (Tab EE-5 and EE-12). Both the ASRF injured member and casualty were transported to the base medical facility, but the injured member later died due to his injuries (Tab EE-5 and EE-12). A third ASRF casualty was located in the tower after an accountability check by the ASRF command and a further search of the guard tower (Tab EE-5 and EE-12). It took the response crews approximately 38 minutes to arrive at the crash site due to miscommunication as to whether the MA impacted within the confines of JAF or outside of the JAF perimeter, heavy congestion, and narrow access gates. Upon arrival, the MA was completely engulfed in flames (Tab EE-4 to EE-5). Once the fire on the MA was extinguished, a team of USAF Pararescuemen and fire crews conducted the search and recovery effort and all 11 personnel onboard the aircraft were found. There were no survivors (Tab EE-5 to EE-6).

h. Recovery of Remains

The crews from the contractor providing fire and emergency response services and USAF Pararescuemen performed recovery efforts (Tab EE-6). Remains of the 11 personnel onboard the MA were recovered on 2 October 2015 and later transferred to the Office of the Armed Forces Medical Examiner, Dover AFB, Delaware (Tabs CC-15 and EE-6). A local Afghan official took control of the remains of the three ASRF members (Tabs CC-15 and EE-5 to EE-6).

5. MAINTENANCE

a. Forms Documentation

The 317th Aircraft Maintenance Squadron (317 AMXS), Dyess AFB, maintained the MA's forms while in the US, and the 774th Expeditionary Aircraft Maintenance Squadron (774 EAMXS), BAF, Afghanistan, maintained the MA's forms while deployed (Tab V-5.3 and CC-59). Maintenance utilizes two different databases to store aircraft records: the Integrated Maintenance Data System (IMDS) and the Data Transfer and Diagnostic System (DTADS) (Tab CC-59). IMDS tracks aircraft history, scheduling, and aircrew debriefing processes and provides a common interface for entering base-level maintenance data into other standard logistics management systems (Tab BB-30). DTADS is the Maintenance Management System (MMS) designed to support on-aircraft diagnostics, software loading functions, and post-flight data retrieval and processing (Tab BB-42). The purpose of Air Force Technical Order (AFTO) 781 series forms is to document maintenance discrepancies (Tab BB-28). The active AFTO 781 series forms were on the MA and destroyed in the crash (Tabs V-5.4 and BB-28). A comprehensive review of the MA's IMDS history, the archived 781H and 781A forms, Time Compliance Technical Orders (TCTOs), and all available DTADS history was accomplished (Tabs D-2 to D-21, and CC-13). There is no evidence of non-compliance with maintenance actions, TCTOs, or forms documentation (Tab CC-13). Review of the MA's documentation indicated a recurring write-up on the #4 engine oil cooling system; however, there is no evidence to suggest this recurring write-up was a factor in this mishap (Tab CC-14).

b. Inspections

The Plans, Scheduling, and Documentation section of the 317 AMXS and 774 EAMXS tracked the MA's inspections (Tabs V-5.3, BB-27, BB-33, BB-79, BB-82, and CC-59). TCTOs are AF, MAJCOM or NAF directed modifications and inspections that provide units with instructions for doing a one-time change, modification, or inspection of equipment (Tab BB-79). The Plans, Scheduling, and Documentation section is responsible for building, coordinating, publishing, and distributing annual, quarterly, monthly and weekly schedules to support maintenance and operational requirements (Tab BB-80). The preflight inspection (PR) is a flight preparedness inspection and is accomplished prior to the first flight of the specified flying period (Tab BB-50). A PR is valid for 72 hours (Tab BB-50). The next inspection is the thruflight (TH), accomplished between flights when scheduled ground time exceeds six hours, but does not exceed the 72-hour preflight validity period (Tab BB-51). At the end of the flying day, a Basic Post Flight (BPO) inspection is accomplished (Tab BB-51). The C-130J undergoes progressive inspections in intervals to ensure the airworthiness of the aircraft to include various checks conducted on 270-day intervals (Tab BB-53). The A Check, or Home Station Check (HSC) equivalent, is a minor inspection (Tab BB-27 and BB-53). The B and C Checks are major isochronal (ISO) inspections (Tab BB-53). Lastly, Programmed Depot Maintenance (PDM) is a programmed in-depth inspection requiring skills, equipment, and/or facilities not normally present at operating locations (Tab BB-27).

For T/N 08-3174, the most recent PR was performed on 30 September 2015 at 0230L hours. The most recent TH was performed on 30 September 2015 at 2130L hours (Tab U-13).

The most recent HSC was completed on 24 April 2015. The next HSC was due on 19 January 2016. The most recent ISO was completed on 27 April 2015. The next ISO was due on 2 October 2016. The most recent PDM was completed on 21 January 2011. The next PDM was due on 21 January 2023 (Tab D-10).

TCTOs are inspections or maintenance procedures required before specific dates or flight (Tab BB-82). No TCTOs restricted the MA from flying. Historical records showed all TCTOs were accomplished IAW applicable guidance (Tabs D-20 and CC-13).

c. Maintenance Procedures

Minor maintenance actions were performed on the aircraft prior to the mishap (Tab D-5 to D-8). The night of the mishap, the MA took off on time from BAF and experienced a bird strike, which required a return to base for an inspection (Tabs K-4 and V-5.6). Maintenance conducted for the bird strike included a thorough inspection of the left side of the MA's nose as well as all four engines (Tab V-5.6). The maintenance crew noted no damage or evidence of bird ingestion into the engines (Tab V-5.6). The MA then flew an uneventful mission to JAF (Tab K-4). There was no evidence found to indicate maintenance procedures were a factor in this mishap (Tab CC-13 to CC-14).

d. Maintenance Personnel and Supervision

All pre-mission activities were normal and a thorough review of maintenance training records for the 317 AMXS and 774 EAMXS AF Form 623s and AF Form 797s) revealed all involved personnel were properly trained and qualified (Tab CC-14).

e. Fuel, Hydraulic, and Oil Inspection Analyses

Fuel samples from the truck that refueled the MA were tested (Tab U-3). All fuel samples were within limits and free of contamination (Tab U-3). No viable engine oil and hydraulic fluid samples were obtained from the MA post-impact (Tab CC-14).

f. Unscheduled Maintenance

A comprehensive review of the IMDS history and archived 781A forms revealed the following unscheduled maintenance since the last scheduled inspection: The right forward main landing gear wheel was replaced on 9 July 2015 (Tab U-5); the #4 oil cooler flap actuator was removed and replaced on 31 July 2015 and again on 21 September 2015 (Tab U-7 and U-9 to U-10); and the #4 Nacelle Interface Unit (NIU) was replaced on 24 September 2015 (Tabs D-8 and U-11). There is no evidence to suggest unscheduled maintenance was a factor in this mishap (Tab CC-14).

6. AIRFRAME

a. Structures and Systems

The MA was a total loss, therefore limited aircraft systems were recovered post-impact (Tabs J-9 and S-2). The tail section was largely intact to include the tail section flight control surfaces (Tab J-9 and S-2 to S-3). The elevator boost pack assembly was removed and shipped to Ogden Air Logistics Center (ALC) for a functionality bench check (Tab J-5). The analysis report is discussed below. A thorough review of the live video feed, cockpit voice recorder (CVR), and DFDR shows all systems performed normally up to the time of impact (Tabs J-10, J-25, L-6 to L-10, N-17 to N-18, and CC-3). This was further verified by the Air Force Life Cycle Management Center SME (Tab CC-19 to CC-21).

b. Evaluation and Analysis

(1) Engine Performance

Four AE2100D3 turboprop engines powered the MA (Tabs D-2 and BB-48). A complete engine consists of a gas turbine power unit connected by a torquemeter shaft and supporting structure to a propeller gearbox (PGB) (Tab BB-48). Each engine, with accessories, was installed in a nacelle structure attached to the wing (Tab BB-48). The engines supplied power to the PGBs to operate the propellers (Tab BB-48). Each PGB drove a hydraulic pump and an electric generator to power the aircraft (Tab BB-48). The engines also supplied high-pressure bleed air for the bleed air systems (Tab BB-48).

According to DFDR data, all four engines were operating normally throughout the MS (Tab L-8 to L-10). The MCP set and maintained takeoff power until approximately seven seconds after takeoff, when the power briefly reduced (Tabs L-8 and Tab N-17). Following this brief reduction in power, all engines returned to takeoff (full) power (Tab L-8). All engine parameters indicate normal engine performance throughout the MS (Tab L-8 to L-10).

Prior to the MS, the MA's total aircraft time was 2,551.7 hours (Tab D-2 and D-9). Table 6-1 depicts engine operating time and cycles for all four engines as of 30 September 2015 (Tab D-2 and D-9).

Engine Data - Aircraft T/N 08-3174				
Installed Position	1	2	3	4
Engine Model and Series	AE2100D3	AE2100D3	AE2100D3	AE2100D3
Engine Operating Time (hours)	4775.3	2211.9	2551.7	2551.7
Engine Operating Cycles	2087.0	1722.0	1645.0	1645.0

Table 6-1. Engine Data (Tab D-2 and D-9)

Throughout the ground operations and takeoff sequence, the IR video showed the #4 engine apparently running hot, as indicated by the white color in Figure 6-1 (Tabs CC-14 and Z-10). Upon investigation into the maintenance history of the #4 engine, there was evidence of the #4 engine experiencing high oil temperatures and a sticking oil cooler flap (Tab U-7 and U-9 to U-10). Maintenance replaced the NIU for the sticking oil cooler flap and the oil temperatures were determined to be within limits (Tab U-11). The DFDR confirmed all four engines were operating normally throughout the MS (Tab L-8 to L-10).

Figure 6-1 (Tab Z-10)
IR Image of MA ERO (The numbers denote the specific engine)

(2) Hydraulic Systems Performance

The MA used three independent hydraulic systems (Tab BB-40). A utility hydraulic system, a booster hydraulic system, and an auxiliary hydraulic system powered all the hydraulic components on the MA (Tab BB-40). Each system provided input to the mission computer for the display of status and Advisory, Caution, and Warning System (ACAWS) messages (Tab BB-40). The utility and booster hydraulic systems distributed hydraulic power to various systems throughout the MA (Tab BB-40). Four engine-driven pumps supplied pressure to the utility and booster systems (Tab BB-40). Hydraulic system operations were tracked and recorded on the DFDR and no hydraulic ACAWS notifications occurred (Tabs J-25 and CC-59).

(3) Flight Control System Performance

The flight control systems of the MA included the primary flight controls, trim systems, the flaps, and portions of the stall warning system (Tab BB-35). The primary flight controls included the ailerons, rudder, and elevators (Tab BB-35). The secondary flight controls included the aileron trim, rudder trim, elevator trim, and flap control systems (Tab BB-35). Flight controls maintained the attitude and directional control of the MA (Tab BB-35). Each pilot had a complete set of controls (Tab BB-35). Flight control inputs were transmitted to the booster assemblies through mechanical rods and cables (Tab BB-35). Elevators were controlled by fore and aft movement of the control yoke columns (Tab BB-35). The rudder was controlled by pushing the rudder pedals (Tab BB-35).

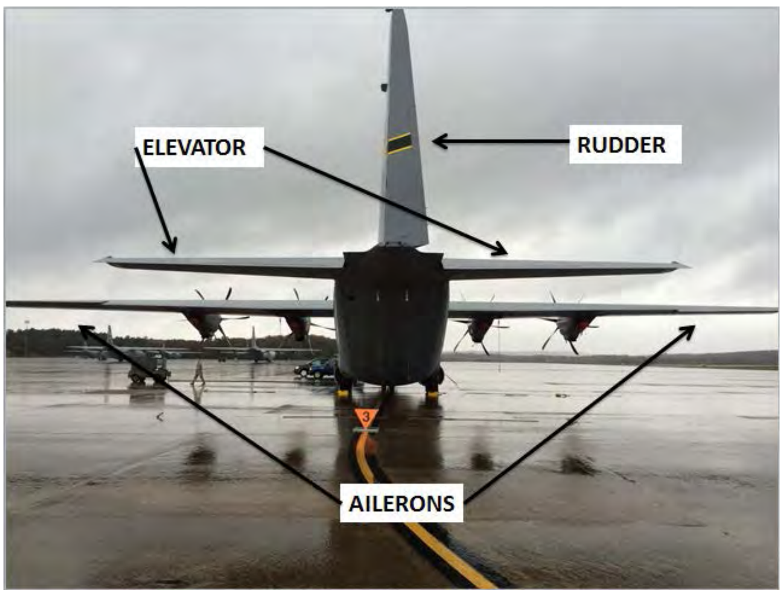

Figure 6-2 (Tab Z-11)
Primary Flight Controls

Roll motion (lateral control) of the MA was controlled by two ailerons (Tab BB-35). One aileron was mounted near the outboard end of each wing, forming part of the trailing edge (Tab BB-35). Ailerons were controlled by turning the control wheels (Tab BB-35). Movement of the control wheels is transmitted through dual cable systems to a common input quadrant assembly mounted on the rear beam of the center wing. (Tab BB-35). Pushrods and links transmit motion from the input quadrant to the booster assembly (Tab BB-35). The aileron control surfaces are in turn deflected by movement of the booster output lever and aileron pushrods and links (Tab BB-35).

The yaw (directional control) of the MA was controlled by the rudder control system (Tab BB-35 to BB-36). The rudder was hinged to the rear beam of the vertical stabilizer (Tab BB-35). The rudder was normally actuated by a hydraulically powered booster assembly (Tab BB-35). The booster assembly was controlled by MP and MCP rudder pedals (Tab BB-35). Depressing one pedal at a time moved the rudder through its full travel range in both directions from the neutral position (Tab BB-35 to BB-36). Deflection of the rudder into the airstream caused the MA to change direction (Tabs L-7 and BB-36).

Pitch attitude (longitudinal control) of the MA was controlled by the elevator control system (Tab BB-36). The two elevators were connected together and were mounted along the trailing edge of the horizontal stabilizer (Tab BB-36). The travel range of the elevators was from 40 degrees above to 15 degrees below the faired position (Tab J-11 to J-12). Upward elevator movement into the airstream exerted pressure to pitch the MA up (Tabs BB-36 and CC-54). Downward movement caused the opposite effect (Tabs BB-36 and CC-54). The stall warning system provided three stall alert warnings and the stick pusher attempted to correct for an impending MA stall by applying 49 to 71 pounds of force to push the control columns forward (Tabs N-17 to N-18 and BB-36 to BB-38). A trim tab formed part of the trailing edge of each elevator (Tab CC-25).

The tail section of the MA was largely intact and the tail section flight control surfaces were recovered (Tabs J-8 to J-9 and S-2 to S-3). The rudder had separated from the vertical tail, but it was otherwise intact (Tabs J-8 to J-9 and S-2 to S-3). Both horizontal tails were still connected (Tab S-2 to S-3). The left horizontal tail was intact (Tab S-2 to S-3). The outboard tip of the right horizontal tail had broken off and the elevator had become detached and was lying on top of the tail (Tabs J-8 to J-9 and S-2 to S-3). The elevator boost pack was shipped to Ogden ALC, 309th Commodities Maintenance Group, for a functionality bench check (Tab J-5). The report confirmed that the elevator boost pack from the MA mechanically functioned as designed, even after exposure to the extreme temperatures during the post-impact fire (Tab J-6). There was no indication of binding along the entire length of travel (Tab J-6). The elevator boost pack was functioning as designed during the MS (Tab J-5 to J-6). There was no indication of structural or mechanical failure in any areas reviewed (Tab CC-14).

One anomaly noted by analysis of the DFDR was that the elevator position transducer became questionable during flight, indicated by the reading of negative 64 degrees at intermittent periods (Tab J-4). The elevator position transducer sends information to the DFDR to record the deflection of the elevator (Tab J-2 to J-4). Because the elevator transducer from the MA was tested and shown to produce accurate signals, this failure was indicative of an intermittent ground connection (Tab J-4). The Air Force Life Cycle Management Center report suggests that the failure was caused by normal airframe deflection from flight loads while the MA was airborne (Tab J-3 to J-4). As the MA took flight, the structure moved and caused the ground wire to lose connectivity (Tab J-3 to J-4). This can be attributed to damaged wiring, poor ground bond maintenance, or loose hardware, none of which would be detected during normal maintenance inspections (Tab J-3 to J-4). The root cause of the loss of connectivity, however, cannot be determined due to extensive fire damage upon impact (Tab J-4). While the elevator transducer output cannot be considered reliable in flight, there were no indications that the elevator had any kind of mechanical failures (Tab CC-21). This was supported by the data from the flight from BAF to JAF, which showed similar readings with no indication of a malfunctioning elevator (Tabs J-2 to J-4, and CC-21). Neither the MP nor the MCP would have been aware of this anomaly as there is no display in the C-130J flight deck that indicates the elevator position (Tab CC-56).

The DFDR, video footage, SME analysis, as well as functionality tests conducted by Ogden ALC indicated that all flight control systems were operating properly throughout the mishap flight (Tabs J-2 to J-5, J-10 to J-12, J-16, J-18 to J-21, L-4, L-6 to L-7, CC-3 to CC-4, and CC-19 to CC-21).

(4) Stall Protection System: Stall Warning System

The purpose of the stall warning system was to provide adequate pre-stall warning to allow the pilots time to recover from a high AOA condition without stalling the MA (Tab BB-36). A wing stalls when it exceeds the critical AOA based on the aircraft configuration (flap setting and power setting) (Tab BB-36). The mission computer processed AOA sensor information and initiated stall warnings (Tabs N-17 to N-18 and BB-36). The stall warnings consisted of a voice message on the intercommunication system (ICS) and a visual presentation on the HUD and Head Down Display (HDD) (Tabs N-17 to N-18 and Tab BB-36). A stick pusher control actuator was used to provide elevator deflection in an attempt to correct an impending stall (Tabs J-20 and BB-36 to BB-37).

When the mission computer detected an imminent stall, the stick pusher actuator provided elevator-down control input to the elevator booster, which was designed to affect the control columns and elevator (Tabs J-20 and BB-38). The control-column-down push force is 49 to 71 pounds, depending on elevator position (Tab BB-38). The stick pusher can be overcome by the MP or MCP (Tab BB-38). An aural stall warning precedes activation of the stick pusher (Tabs N-17, J-20, BB-38, CC-55 and CC-57).

During the takeoff sequence, the MA's AOA triggered the stick pusher (Tab J-19 to J-20). The DFDR showed little to no nose-down movement and the stick pusher had little to no effect on the MA's flight path (Tabs J-19 and L-4). The MA's lack of response to the system input is consistent with a blocked flight control (Tab CC-10). All data indicated that the aircraft stall warning system was operating normally throughout the mishap sequence (Tabs J-19 to J-21 and N-17 to N-18).

(5) System Integration and Display

System integration and display provided central data processing for the digital avionics suite, and allowed the crew to selectively access, control, and display a volume of airplane data (Tab BB-44). The display system included the HDD and the HUD (Tab BB-44). The HDD provided the MC with a relatively simple way to access a large amount of information (Tab BB-45). The system consisted of four color-multifunction-display units capable of displaying a variety of information (Tab BB-45).

The HUD was a dual electronic and optical system that generated airplane attitude, flight path, and tactical symbology as primary references for flight and displayed information in MP's and MCP's field of view (Tab BB-46). Airplane instruments and sensors provided data for display information during takeoff, go-around, cruise, approach and landing phases of airplane operation (Tab BB-46).

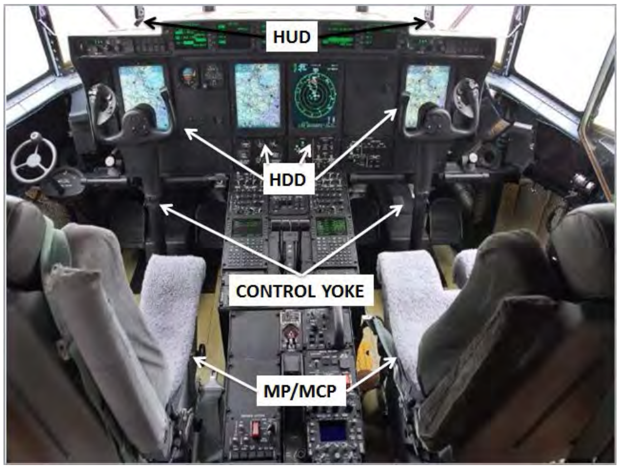

Figure 6-4 (Tab Z-12)
Flight Deck HDDs and HUD

Figure 6-5 (Tab Z-13)
HUD

7. WEATHER

a. Forecast Weather

JAF is a Visual Flight Rules (VFR) only airfield; wherein pilots are allowed to self-navigate to the landing runway unless given a specific vector and altitude by the air traffic controllers (Tabs V-9.3, BB-88, and CC-54). The forecast weather for the MS predicted few clouds at 10,000 feet mean sea level and 9,000 meters visibility with haze, variable winds at 6 knots, temperature of 20 degrees Celsius, and an altimeter setting of 30.05 inches mercury (in Hg) (Tab F-2). The term "few" means cloud coverage greater than 0 percent but less than 25 percent (Tab BB-21). The predicted lunar illumination at takeoff was approximately 81 percent (Tab W-3).

b. Observed Weather

Observed weather prior to the MS was Visual Meteorological Conditions (VMC) and within operational limits (Tabs R-4, V-9.2 to V-9.3, and CC-54 to CC-55). During VMC flights, pilots do not require the use of aircraft instruments to determine aircraft attitude relative to the earth (Tab CC-54). Tower transcripts indicated landing weather at 2304L was as follows: altimeter setting 30.01 in Hg, temperature 22 degrees Celsius, winds 290 degrees at 3 knots (Tabs N-19 and CC-55). At approximately 0015L, the crew was cleared for takeoff and given winds 220 degrees at 3 knots with no other weather updates (Tabs N-17, CC-55, and CC-57).

c. Space Environment

Not applicable.

d. Operations

Based on the forecast and actual observations, the weather was within operational limits for the MS (Tabs F-2, N-17, N-19, V-9.2 to V-9.3, and CC-54 to CC-55).

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

The MP was a current and qualified aircraft commander with 943.0 total C-130J hours, including 235.9 combat hours, and 164.8 NVG hours (Tab G-4). He was certified as an aircraft commander on 9 October 2014 and completed his most recent flight evaluation on 29 July 2015 (Tab G-4, G-37, and G-39 to G-40). Squadron leadership considered the MP a top Aircraft Commander and he was projected to attend Instructor Pilot school (Tab V-8.3 and V-12.3).

The MP's flight time during the 90 days before the mishap was as follows:

	Hours
Last 30 Days	53.3
Last 60 Days	60.8
Last 90 Days	90.9

(Tab G-4)

b. Mishap Copilot (MCP)

The MCP was a current and qualified first pilot with 338.4 total C-130J hours, including 31.5 combat hours, and 47.6 NVG hours (Tab G-13). He was initially qualified on 16 November 2013 and completed his most recent flight evaluation on 3 April 2015 (Tab G-51 and G-55). Additionally, the MCP was previously qualified as a senior surveillance manager on the E-8C, where he accumulated an additional 2,164.2 flight hours (Tab G-13 and G-57 to G-58). MCP had a great reputation and was on track for upgrade to Aircraft Commander (Tab V-8.4 and V-12.4).

The MCP's flight time during the 90 days before the mishap was as follows:

	Hours
Last 30 Days	53.3
Last 60 Days	60.8
Last 90 Days	69.2

(Tab G-13)

c. Mishap Loadmaster 1 (ML1)

The ML1 was a current and qualified loadmaster in the C-130J (Tab G-71). He had a total of 524.5 C-130J hours, including 31.5 combat hours and 32.5 NVG hours (Tab G-22). He was initially qualified on 24 January 2014 and completed his most recent flight evaluation on 18 May 2015 (Tab G-71). ML1 had been identified by his leadership as an Instructor Loadmaster candidate (Tab V-6.3).

The ML1's flight time during the 90 days before the mishap was as follows:

	Hours
Last 30 Days	53.3
Last 60 Days	66.0
Last 90 Days	86.9

(Tab G-22)

d. Mishap Loadmaster 2 (ML2)

The ML2 was a current and qualified loadmaster in the C-130J (Tab G-76). He had a total of 596.7 C-130J hours, including 31.5 combat hours and 39.7 NVG hours (Tab G-29). He was initially qualified on 18 April 2014 and completed his most recent flight evaluation on 23 July 2015 (Tab G-76). ML2 had been identified by his leadership as an Instructor Loadmaster candidate (Tab V-6.4)

The ML2's flight time during the 90 days before the mishap was as follows:

	Hours
Last 30 Days	53.3
Last 60 Days	62.1
Last 90 Days	126.8

(Tab G-29)

9. MEDICAL

a. Qualifications

At the time of the mishap, all members of the MC had current annual physical flight examinations and were medically qualified for worldwide flight duty without restrictions (Tab CC-15). The MCP and ML1 had current and valid medical waivers (Tab CC-15).

b. Health

Interviews were conducted with the 774 EAS commander, director of operations, first sergeant, superintendent, and several fellow aircrew members in an attempt to determine the MC's 72-hour and 7-day medical history (Tab R-21). Due to the deployment setting and flight crew schedules, interactions amongst aircrews were very inconsistent (Tab R-21). Additionally, the MC operated as a "hard crew", which meant the MC had flown together for each sortie since the deployment began, further limiting interactions with other individuals (Tabs R-21, V-8.3, and CC-55). Based on these factors, sufficient information could not be collected to determine the MC's 72-hour and 7-day medical history (Tabs R-21 and CC-16). However, the MC's medical records indicated each individual was in good health and had no recent performance-limiting illnesses (Tabs R-21 and CC-16).

c. Pathology

The remains of all eleven personnel onboard the MA were recovered and positively identified, and transferred from JAF to the Armed Forces Medical Examiner System (AFMES), Dover AFB, Delaware for autopsy examination(Tabs X-3 to X-23, CC-15, and EE-14 to EE-15). Injuries sustained by each were consistent with the nature of the mishap (Tab X-3 to X-23). All eleven individuals died instantly upon impact prior to the post-crash fire (Tabs J-9, J-22, and CC-15). The three Afghans who were in the guard tower remained within the care and custody of local Afghanistan officials (Tab CC-15).

Post-mortem toxicology testing was performed on the MC. Samples were submitted to the AFMES for analysis. All specimens were examined for carbon monoxide (CO), cyanide, volatiles (including alcohol) and drugs. All results were negative with the exception of the MCP, who had ethanol present in his system (Tab CC-15). However, the AFMES medical examiner attributed the ethanol presence to decomposition (Tab CC-15 to CC-16).

d. Lifestyle

Due to the lack of 72-hour/7-day histories, lifestyle factors were not analyzed (Tabs R-21 and CC-16).

e. Crew Rest and Crew Duty Time

The Flight Duty Period (FDP) began when an aircrew member reports for a mission, briefing, or other official duty and ended at final engine shutdown after the final flight of the completed mission (Tab BB-19). The maximum FDP for the C-130J was 16 hours (Tab BB-12). However, all mission related tactical events should be accomplished within the first 12 hours (Tab BB-12). At the time of the mishap, the MC was 4 hours and 46 minutes into their FDP (Tabs K-4, K-6, N-17, CC-3 to CC-4, CC-55, and CC-57 to CC-58).

AFI 11-202, Volume 3, *General Flight Rules*, 7 November 2014, required aircrew members have proper "crew rest" prior to performing flight duties. The AFI further defined normal crew rest as a minimum of 12 non-duty hours before the designated flight duty period began. During this time, an aircrew member may have participated in meals, transportation, and rest, as long as they had the opportunity for at least eight hours of uninterrupted sleep. Crew rest periods could not begin until after the completion of official duties (Tab BB-19).

Due to the deployment setting and the MC's death from the mishap, a 72-hour history, including sleep hygiene, was unreliable (Tab R-21 and CC-16). A Fatigue Avoidance Scheduling Tool would normally be calculated to establish individual fatigue levels (Tab CC-16). However, the data was not available for calculation (Tab R-21 and CC-16). According to the MC's ORM worksheet, the MCP annotated a "medium" (one point) individual risk factor, which was warranted if the individual had acceptable rest, minor health, finance, family stress, work stress, personal problems, or other distractions. An individual could have up to 10 points without requiring aircraft commander consultation (Tab K-5 to K-6). The AIB was unable to determine specifically why the MCP annotated one point on the pre-flight ORM worksheet (Tabs R-21 and CC-16).

10. OPERATIONS AND SUPERVISION

a. Operations

The 774 EAS operated on a stable schedule with expected aircrew alert times that were relatively constant from day to day. The MC was flying every other day to allow for sufficient crew rest and recovery. Overall, the squadron leadership believed the operations tempo was low-to-moderate (Tab V-12.3).

b. Supervision

Members of the squadron leadership team were involved in the planning process and in assessing the ORM for each aircrew (Tab V-12.3). The squadron received the first draft of the expected schedule approximately two days prior to execution and the Director of Operations assigned crews to each mission (Tab V-12.7). The mission start times were scheduled in "buckets" that allowed supervision to ensure that aircrews did not experience significant shifts in their work/rest cycle from day to day (Tab V-12.3 and V-12.7). Additionally, the nature of the living quarters at BAF allowed squadron leadership to see aircrews on a semi-regular basis to assess their mental state and overall comfort level with the missions flown (Tab V-12.7). Squadron leadership had not noticed any issues with any member of the MC (Tab V-12.6 to V-12.7).

11. HUMAN FACTORS ANALYSIS

a. Introduction

The DoD Human Factors Analysis and Classification System (HFACS) version 7.0 lists potential human factors that can play a role in mishaps (Tab BB-6 to BB-10). It is designed for use by an investigation board in order to accurately record all aspects of human performance associated with an individual and the mishap event (Tab BB-6). DoD HFACS helps investigators perform a more complete investigation, classify particular actions (or inactions) that sustained the mishap sequence, and contribute to a safety database as a repository for detecting mishap trends and preventing future mishaps (Tab BB-6). The DoD HFACS classification taxonomy divides the failures into active failures and latent failures (Tab BB-6). Active failures, or "Acts," are the actions or inactions of individuals that most immediately lead to a mishap (Tab BB-6). Latent failures may remain undetected for some period of time prior to their manifestation as an influence on an individual's actions during a mishap (Tab BB-6). Latent failures and conditions are divided into *Preconditions, Supervision, and Organizational Influences* (Tab BB-6). The discussion below lists the human factors directly involved in this mishap. Each of the following factors fall under the categories of Acts or Preconditions (Tab BB-8 to BB-10).

b. Inadequate Real-Time Risk Assessment

Inadequate Real-Time Assessment is a factor when an individual fails to adequately evaluate the risks associated with a particular course of action, and this faulty evaluation leads to inappropriate decision-making and subsequent unsafe situations (Tab BB-8).

The MP placed a hard-shell NVG case forward of the left seat control yoke during the ERO (Tabs CC-5 to CC-6, N-2, N-5). The ERO continued for approximately 50 minutes after the elevator was blocked (Tabs J-11 to J-12, N-5 to N-17). The blocking of flight controls during loading operations was a nonstandard procedure and there was no regulatory guidance to accompany the proper placement and removal of an object blocking the controls (Tabs V-7.5 to V-7.6, V-9.4, and CC-54). The ERO checklist did not include a step requiring the pilots to check the flight controls prior to departure and therefore, it was incumbent on the MP and the MCP to remember to remove the hard-shell NVG case (Tabs BB-63 to BB-65 and CC-54). The MP did not adequately evaluate the risk associated with blocking the elevator controls with the hard-shell NVG case (Tabs J-11 to J-12, N-2, N-5 to N-17, V-7.5 to V-7.6, V-9.4, BB-8, BB-63 to BB-65, CC-5 to CC-6, and CC-54).

c. Distraction

Distraction is a factor when the individual has an interruption of attention and/or inappropriate redirection of attention by an environmental cue or mental process (Tab BB-10).

The MC landed at JAF at 2313L and began the ERO at 2316L (Tabs J-11 and N-4, CC-3, and CC-55). During the cargo offload, ML1 requested that the MP raise the elevator to provide more clearance for the high-profile cargo during ERO operations (Tabs N-3 to N-4, BB-63 to BB-65, CC-3, and CC-55). For the next six minutes, there were changes in the elevator deflection between the range of positive 6 and positive 13 degrees of deflection (Tabs J-11 to J-12, CC-3, and CC-55). At 23:26:06L (DFDR time 5087) the elevator position increased to positive 20 degrees deflection momentarily before settling to a position between six to eight degrees positive deflection (Tabs J-11 to J-12 and CC-55). This occurred immediately before the MP told the MCP that the "NVG case is holding…the elevator" (Tabs J-11 to J-12, N-5, and CC-55). The elevator position remained steady between six to eight degrees positive deflection until the takeoff roll (Tabs J-11 to J-12, and L-6.

During the 50 minutes after the MP placed the case forward of the yoke, the MP's and MCP's attention was redirected towards discussing loading operations, aircraft gross weight, climb-out procedures, and TOLD (Tabs J-11 to J-12, N-5 to N-17). Neither the MP nor the MCP referenced the case again (Tab N-5 to N-17).

d. Wrong Choice of Action During an Operation

Wrong choice of action during an operation is a factor when the individual, through faulty logic or erroneous expectations, selects the wrong course of action (Tab BB-8).

During the takeoff sequence, the MA lifted off the ground greater than three knots below the calculated AMAX takeoff speed (Tabs L-3, N-12, and N-17). The MCP, who was performing the takeoff, recognized a control problem identified on the CVR at 00:15:56L (Tabs L-4, N-17, CC-55, and CC-57). Two seconds later, the MCP incorrectly identified the flight control malfunction by stating "Trim failure" (Tab N-17). The first stall warning indication occurred three seconds after the verbal misidentification of a trim malfunction (Tab N-17). Due to the rapid progression of the nose-up pitch attitude, the mishap pilots had eleven seconds from MA liftoff until the first stall warning indication to identify and correct the malfunction (Tabs J-16 and N-17).

e. Environmental Conditions Affecting Vision

Environmental Conditions Affecting Vision is a factor that includes obscured windows; weather, fog, haze, darkness; smoke, etc.; brownout/whiteout (dust, snow, water, ash or other particulates); or when exposure to windblast affects the individual's ability to perform required duties (Tab BB-9).

Three inter-related environmental conditions affecting vision were factors in this mishap: nighttime operations, use of NVGs, and reliance on the HUD in conjunction with the ACAWS notifications.

The MA landed at JAF at 2313L (Tabs J-11 and CC-55). The weather was VMC with 9,000 meters visibility (Tabs F-2 and CC-55). The predicted lunar illumination at takeoff was approximately 81 percent (Tabs N-17 and W-3). Due to the operations occurring at night, the MC wore NVGs (Tab N-13 and N-17). It was standard operating procedure for aircrews operating on NVGs to dim the cockpit lights and increase the brightness of the HUD (Tab CC-7).

NVGs permit aircrews to operate more effectively in low-illumination environments (Tabs BB-23 and CC-7). The field of view (FOV) the NVGs provide is less than the eye's natural FOV, particularly in peripheral vision (Tab BB-23 to BB-24). Therefore, a person must constantly process two input components to his visual system (Tab BB-23). The two components are focal vision, which is primarily responsible for object recognition, and ambient vision, which is responsible for spatial orientation (Tab BB-23). This reliance on focal vision increases the aviator's workload and ultimately decreases the recognition of peripheral cues (Tab BB-23 to BB-24).

The information provided by the HUD, combined with the ACAWS, allowed aircrews to maintain their visual scan external to the aircraft with only occasional crosschecks of the HDD to monitor aircraft systems (Tab CC-55). Due to the HDD design, internal crosschecks of aircraft systems were normally done without the aid of NVGs (Tab CC-7). Prior to the takeoff roll, the MCP and MP checked the horsepower setting (Tab N-17). After this, all information required to perform the takeoff was available in the HUD (Tab CC-7).

Figure 11-1 (Tab Z-17)
View of HDDs w/ Light

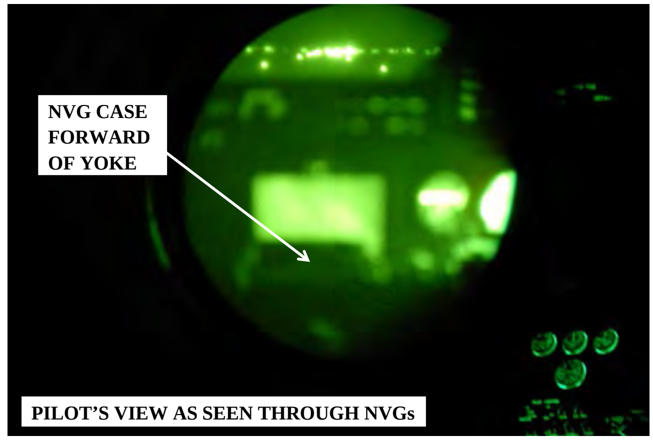

Figure 11-2 (Tab Z-18)
View of HDDs through NVGs

During the AIB's simulations at Little Rock Air Force Base, the AIB Pilot Member (AIB/PM) dimmed flight deck lighting to replicate nighttime operations (Tabs Z-19, CC-9, and CC-56). The hard-shell NVG case placed forward of the yoke became inconspicuous to all three AIB pilots during the course of multiple takeoff sequences (Tab CC-9).

f. Inaccurate Expectation

Inaccurate Expectation is a factor when the individual expects to perceive a certain reality and those expectations are strong enough to create a false perception of the expectation (Tab BB-10).

The MP initially expected the MC would need to perform an AMAX takeoff instead of a normal takeoff (Tab N-8). The MP then verified that the load weight was 40,300 pounds (Tab N-8). After running the TOLD calculations, the MP acknowledged that they had 750 feet of runway available beyond what was required for takeoff (Tab N-8 to N-9, N-12). AIB calculations showed this matched the distance required to perform a normal takeoff (Tab CC-10). When later asked by the MCP, the MP confirmed that they would perform an AMAX takeoff (Tab N-11).

The decision to perform an AMAX takeoff resulted in a planned rotation speed of 111 knots instead of 122 knots associated with a normal takeoff (Tabs N-11 to N-12 and CC-10). During the MS, the MA lifted off at 107.5 knots, only a few knots below the planned rotation speed (Tabs L-3, N-12, and N-17). For a normal takeoff, had the MA lifted off at 107.5 knots instead of 122 knots, it may have provided a more pronounced alert of the problem to the mishap pilots, allowing them to abort the takeoff (Tab CC-10). The MP's inaccurate expectation that an AMAX takeoff was required led to an unnecessary AMAX takeoff (Tabs L-3, N-8, N-11 to N-12, and N-17).

g. Fixation

Fixation is a factor when the individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others (Tab BB-10).

At liftoff, the MP reported "You're a little early;" the MCP replied "It's going off on its own" (Tab N-17). Six seconds after liftoff, the MCP became aware of a problem with the MA (Tab N-17). He then misidentified the problem as trim failure and the MP instructed him to "Go emergency" (Tab N-17). During the five seconds from when the MCP first realized something was wrong (00:15:56L) to the first ACAWS stall warning (00:16:01L), both MP and MCP focused their attention on a trim failure problem (Tab N-17). The mishap pilots neither verbalized a different flight control problem nor attempted to reduce power to control the increasing aircraft pitch (Tabs L-8 and N-17 to N-18).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 51-503, *Aerospace and Ground Accident Investigations*, 14 April 2015
(2) AFI 91-204, *Safety Investigation and Reports*, 12 February 2014, Corrective Actions Applied on 10 April 2014 (Updated per AFI 91-204_GM2015-01, 14 April 2015)
(3) AFI 11-202, Volume 3, *General Flight Rules*, 7 November 2014 (Updated per AFI 202V3_AFGM2015-01, 13 April 2015)
(4) AFI 11-2C-130J Volume 3, *C-130J Operations Procedures,* 8 December 2009 (Updated per AFI11-2C-130JV3_AFGM4, 6 March 2015)
(5) AFI 21-101, *Aircraft and Equipment Maintenance Management*, 21 May 2015
(6) AFI 90-802, *Risk Management*, 11 February 2013
(7) AF Handbook 11-203, Volume 1, *Weather for Aircrews,* 12 January 2012
(8) AF Manual 11-217, Volume 3, *Supplemental Flight Information*, 23 February 2009 (certified current 9 April 2012)

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

b. Other Directives and Publications Relevant to the Mishap

(1) TO 00-20-1, *Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, 30 October 2015 (Merged with AMC Supplement 1, 5 May 2014)
(2) TO 00-20-2, *Technical Manual Maintenance Data Documentation*, 1 November 2012
(3) TO 00-5-1, *Air Force Technical Order System*, 1 October 2014
(4) TO 00-5-15, *Air Force Time Compliance Technical Order Process*, 22 September 2014
(5) TO 1C-130J-2-27GS-00-1, *Technical Manual General System Flight Control Systems USAF C-130J Series Aircraft*, 15 January 2014 (Incorporating change 9, 1 July 2015)
(6) TO 1C-130J-2-29GS-00-1, *Technical Manual General System Hydraulic Systems USAF C-130J Series Aircraft*, 15 January 2004 (Incorporating change 6, 1 July 2013)
(7) TO 1C-130J-2-45GS-00-1, *Technical Manual General System Data Transfer and*

Diagnostic System USAF C-130J Series Aircraft, 1 January 2011 (Incorporating change 3, 1 January 2015)

(8) TO 1C-130J-2-46GS-00-1, *Technical Manual General System Integration and Display USAF C-130J Series Aircraft*, 15 January 2014 (Incorporating change 17, 1 July 2015)

(9) TO 1C-130J-2-70GS-00-1, *Technical Manual General System Power Plan USAF C-130J Series Aircraft*, 15 January 2004 (Incorporating change 12, 1 July 2015)

(10) TO 1C-130J-6WC-10, *Work Cards Preflight/Thruflight/Postflight/Combined Pre/Postflight Inspection USAF Series C-130J Aircraft*, 1 July 2011 (Incorporating change 7, 1 July 2015)

(11) TO 1C-130J-6WC-14, *Work Cards A/B/C1/C2 Check Inspection USAF Series C- 130J Aircraft*, 1 July 2011 (Incorporating change 8, 1 July 2015)

(12) TO 1C-130J-1, *USAF Series C-130J Aircraft*, 1 July 2011 (Incorporating change 7, 1 January 2015)

(13) TO 1C-130J-9, *Technical Manual Cargo Loading Manual All USAF Series C-130J Aircraft*, 1 July 2011 (Incorporating change 6, 1 January 2015)

c. Known or Suspected Deviations from Directives or Publications

(1) AFI 11-2C-130JV3, *C-130J Operations Procedures*, 8 December 2009, paragraph 5.4.3

The MP directed the MCP to perform an AMAX takeoff (Tab N-12). Current guidance only allows a copilot to perform a maximum effort takeoff from the right seat under the supervision of a qualified instructor pilot (IP) in the left seat (Tab BB-17). The MP was not a qualified IP (Tab G-36).

\\signed\\

10 February 2016

PATRICK X. MORDENTE
Brigadier General
President, Accident Investigation Board

STATEMENT OF OPINION

C-130J, T/N 08-3174
JALALABAD AIRFIELD, AFGHANISTAN
2 OCTOBER 2015

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 1 October 2015, at approximately 2313 hours local time (L), a C-130J, Tail Number (T/N) 08-3174, landed at Jalalabad Airfield (JAF) following the first scheduled leg of a contingency airlift mission. The mishap crew (MC) conducted an Engine Running Onload/Offload (ERO). The ERO began at approximately 2316L. During the ERO, at approximately 2320L, the mishap loadmaster 1 (ML1) requested that the mishap pilot (MP) raise the elevator to facilitate off-loading high-profile (tall) cargo. Six minutes after this request, at approximately 2326L, the MP placed a hard-shell night vision goggle (NVG) case forward of the pilot's yoke. The MC continued to perform duties associated with their respective crew positions for the remaining 50 minutes of ground operations. Prior to takeoff, the MP confirmed with the mishap co-pilot (MCP) that they would perform an adjusted maximum effort (AMAX) takeoff.

On 2 October 2015, at approximately 0015L, the mishap aircraft (MA) began its departure from Runway 31, JAF, with the MCP at the controls. The MA began to rotate prematurely and lifted off the ground at approximately 107.5 knots, below the calculated AMAX takeoff speed of 111 knots. The MA's pitch angle continued to increase without control input due to the aft yoke position forced by the hard-shell NVG case. The MCP misidentified the blocked flight controls as a trim malfunction, and applied full nose down trim with no apparent change to the increasing pitch angle. Following the trim input, the first of three Advisory Caution and Warning System (ACAWS) aural stall warnings sounded, alerting the mishap pilots to an impending aircraft stall. The stall protection system—specifically, the stick-pusher—continued to operate throughout the remainder of the mishap but was ineffective due to the hard-shell NVG case forward of the yoke. At approximately 25 degrees of positive pitch, the MP applied right aileron resulting in the MA entering a right bank angle. The MA pitch angle continued to increase, ultimately reaching a maximum of 42 degrees positive pitch just prior to reaching a right bank of 75 degrees. By this point, the MA was fully stalled and unrecoverable. As the MA stalled, the nose dropped to approximately 28 degrees down. Throughout the stall, the mishap pilots continued to apply control inputs in an attempt to recover the aircraft. These inputs resulted in the aircraft roll angle reducing towards a wings-level attitude and the MA's nose beginning to rise. However, due to the high descent rate and low altitude, the MA impacted the ground at approximately 0016L, with 14 degrees nose-down pitch, at a descent rate in excess of 8,000 feet per minute, and a force from 40g to greater than 97g.

The MA impacted right of Runway 31, within the JAF perimeter, striking a barrier wall and guard tower. The MA and cargo were destroyed on impact and in the ensuing fire. All eleven personnel onboard and three individuals on the ground died.

By a preponderance of the evidence, I find that the cause of the mishap was pilot error due to the combination of the MP's placement of a hard-shell NVG case in front of the yoke blocking forward movement of the flight controls, the distractions experienced by the MP and MCP during the course of the ERO, and the misidentification of the malfunction once airborne. I also find, by a preponderance of the evidence, environmental conditions, fixation, and inaccurate expectations substantially contributed to the mishap.

I developed my opinion and determined the mishap sequence of events by analyzing factual data from real-time video, video animation, the Cockpit Voice Recorder (CVR), the Digital Flight Data Recorder (DFDR), engineering analysis, witness testimony, simulation of the mishap sequence, information provided by technical experts, and Air Force directives and guidance.

2. DISCUSSION OF OPINION

a. Causes

(1) Inadequate Real-Time Risk Assessment (Hard-Shell NVG Case Placement)

The MP placed a hard-shell NVG case forward of the yoke during the ERO. This placement of the case braced the yoke in a position that raised the elevator to facilitate off-loading high-profile (tall) cargo. The blocking of the flight controls during loading operations is a non-standard procedure; as such, there is no regulatory guidance to prohibit the act, or to address the proper placement and removal of the object blocking the controls. The ERO checklist did not require the pilots to perform a flight control check prior to departure. It was therefore incumbent on MP and MCP to remember to remove the hard-shell NVG case without a checklist item as backup.

During the course of the investigation, the Accident Investigation Board (AIB) conducted takeoff simulations in a flight simulator to recreate flight conditions experienced during the mishap sortie (MS). Placement of a similar hard-shell NVG case forward of the yoke closely replicated the mishap sequence of events. Failure to assess the risk of blocking the flight controls during an ERO was causal to this accident.

(2) Distraction

The MC landed at JAF at 2313L on a mission in support of contingency operations in Afghanistan. They began the ERO procedure at 2316L and continued loading operations for the next 60 minutes until they started their takeoff roll. During the 60 minute ERO, the MC had to address issues concerning the cargo and passenger loading, aircraft gross weight, climb out procedures, and Takeoff and Landing Data (TOLD). Performing a nighttime ERO during contingency operations is a complex procedure requiring the full attention of the aircrew to maintain safe parameters. At 23:26:06L, the MP told the MCP, "My NVG case is holding…the elevator." After this initial comment, neither the MP nor the MCP referenced the NVG case again. The lack of additional reference to the NVG case placement, coupled with the stable elevator position after the placement of the NVG case forward of the yoke, indicate that the mishap pilots became distracted and failed to remove the NVG case prior to takeoff. This distraction was causal to the accident.

(3) Wrong Choice of Action During an Operation (Misidentification of Malfunction)

During the takeoff sequence, the MA lifted off the ground greater than three knots below the calculated AMAX takeoff speed. The MCP, who was performing the takeoff, recognized a control problem approximately six seconds after liftoff. Two seconds later, the MCP incorrectly identified the flight control malfunction by stating, "Trim failure." The first stall warning indication occurred three seconds after the verbal misidentification of a trim malfunction. The mishap pilots had eleven seconds from MA liftoff until the first stall warning indication. The mishap pilots lost valuable time by incorrectly identifying, and then applying, procedures for a trim malfunction instead of identifying the actual issue and subsequently removing the hard-shell NVG case. The wrong choice of action during the takeoff sequence was causal in this accident.

b. Substantially Contributing Factors

The following factors substantially contributed to this mishap:

(1) Environmental Conditions Affecting Vision

Three related environmental conditions substantially contributed to the mishap: nighttime operations, use of NVGs, and reliance on the Head Up Display (HUD) and ACAWS.

The nighttime mission required the use of NVGs and the CVR indicates that the MP and the MCP were utilizing this equipment. While the AIB does not have direct evidence of how the MC operated flight deck lighting, standard operating procedures for nighttime operations with NVGs is to dim the flight deck lights and increase the HUD brightness in order to enhance nighttime vision. Additionally, aircrews experience a reduced field of view (FOV) when using NVGs, and as a result, lack visual cues in the periphery of their vision. Focal vision during NVG use is a conscious process requiring more time and effort to maintain spatial orientation. Coupled with a reduced FOV, this increases the aviator's workload and decreases the recognition of peripheral cues.

The extensive information provided by the HUD, coupled with the ACAWS, allows aircrew to maintain their visual scan external to the aircraft with only occasional crosschecks of the Head Down Display (HDD) to monitor aircraft systems. Internal crosschecks of aircraft systems are done without the aid of NVGs due to the NVGs being sighted for distant vision. This limited the use of NVGs internal to the aircraft for scanning purposes and reduced the MP's and MCP's ability to see the hard-shell NVG case placed forward of the yoke.

During AIB simulations in a flight simulator, the flight deck lighting was dimmed to replicate nighttime operations. It was observed by the AIB that the hard-shell NVG case placed forward of the yoke became inconspicuous to all three pilot members during the course of these simulations.

The preponderance of evidence drawn from the CVR, standard operating procedures, and flight simulation shows that nighttime operations, coupled with the use of NVGs and reliance on the HUD and ACAWS by the mishap pilots, substantially contributed to their failure to maintain awareness of the hard-shell NVG case placed forward of the MP's yoke.

(2) Inaccurate Expectation

Prior to calculating TOLD, the MP anticipated the need to perform an AMAX takeoff due to the expected total weight of the aircraft. After TOLD calculations, the MP acknowledged that the total load weight was 40,300 pounds and they had 750 feet of runway beyond what was required to perform the takeoff. According to AIB calculations, the runway was 750 feet longer than required for a normal takeoff and the mishap pilots did not need to do an AMAX takeoff. However, when later asked by the MCP, the MP confirmed they would perform an AMAX takeoff.

The MP incorrectly assumed an AMAX takeoff was required due to the weight of the load. The MP's TOLD calculation of 750 feet of excess runway is associated with critical field length (CFL) and a normal takeoff. However, at some point, he incorrectly associated the 750 feet of excess runway to Adjusted Minimum Field Length for Maximum Effort Takeoff (AMFLMETO), which drove the decision to perform an AMAX takeoff.

The decision to perform an AMAX takeoff resulted in a planned rotation speed of 111 knots instead of 122 knots associated with a normal takeoff. During the mishap sortie, the MA lifted off at 107.5 knots, only a few knots below the planned rotation speed. For a normal takeoff, had the MA lifted off at 107.5 knots instead of 122 knots, it may have provided a more pronounced alert of the problem to the mishap pilots, allowing them to abort the takeoff. The MP's inaccurate expectation that an AMAX takeoff was required caused an unnecessary AMAX takeoff. This decision substantially contributed to the sequence of events that resulted in the mishap.

(3) Fixation

The MCP misidentified the flight control problem as trim failure during the takeoff sequence. The mishap pilots then fixated on a non-existent trim malfunction for at least five seconds instead of considering a flight control problem and performing corrective action to decrease the pitch. This failure to consider alternative causes for the MA's increased pitch angle and subsequent stall substantially contributed to the accident.

3. CONCLUSION

I find by the preponderance of the evidence that the cause of the mishap was pilot error due to the combination of the MP's decision to place the hard-shell NVG case forward of the yoke blocking the flight controls, the distractions experienced by the MP and MCP during the course of the ERO, and the misidentification of the malfunction once airborne resulting in the destruction of the aircraft and cargo and the loss of fourteen lives. I also find, by a preponderance of the evidence, environmental conditions, inaccurate expectations, and fixation substantially contributed to the mishap.

\\signed\\

10 February 2016

PATRICK X. MORDENTE
Brigadier General, USAF
President, Accident Investigation Board