UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

C-17A, T/N 60002

16th AIRLIFT SQUADRON
437th AIRLIFT WING
CHARLESTON AIR FORCE BASE, SOUTH CAROLINA

LOCATION: BAGRAM AIR BASE, AFGHANISTAN

DATE OF ACCIDENT: 30 JANUARY 2009

BOARD PRESIDENT: COLONEL RICHARD D. ANDERSON

Conducted IAW Air Force Instruction 51-503

Volume One of Two

ACTION OF THE CONVENING AUTHORITY

The report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 30 January 2009 mishap at Bagram Air Base, Afghanistan, involving C-17A, T/N 60002, assigned to the 437th Airlift Wing, Charleston Air Force Base, South Carolina, complies with applicable regulatory and statutory guidance, and on that basis is approved.

Signed this 5 day of May, 2009.

VERN M. FINDLEY II
Lieutenant General, USAF
Vice Commander, Air Mobility Command

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION

C-17A, T/N 60002
BAGRAM AIR BASE, AFGHANISTAN
30 JANUARY 2009

On 30 January 2009, at 2215 local time (L), a C-17A aircraft, tail number 60002, landed at Bagram Air Base (AB), Afghanistan, with the landing gear retracted. The mishap aircraft (MA) was operated from Al Udeid AB, Qatar, in support of Operation ENDURING FREEDOM, Operation IRAQI FREEDOM, and Joint Task Force HORN of AFRICA operations. The MA is assigned to the 437th Airlift Wing, Charleston Air Force Base (AFB), South Carolina (SC). The mishap crew (MC) consisted of the mishap aircraft commander (MP), mishap copilots (MCP1 and MCP2), and mishap loadmasters (ML1 and ML2). MCP1 controlled the MA during descent and most of the approach. MP took control of the MA during the final stages of the approach and landing. MCP2 observed from the left additional crewmember seat on the flight deck. ML1 was at the forward loadmaster station in the cargo compartment, and ML2 sat in a sidewall seat. All were members of the 16th Airlift Squadron, Charleston AFB, SC, deployed to the 816th Expeditionary Airlift Squadron, Al Udeid AB, Qatar. The MA suffered an estimated $18.9M in damage to include the main landing gear assemblies and pods, fuselage underbelly, and left troop door air deflector.

During the second of three scheduled sorties of a combat airlift mission, MP and MCP1 used slats and flaps to add drag to the aircraft for descent and slowdown for a visual straight in approach to Bagram AB while avoiding terrain, scanning for threats, and clearing air traffic with the aid of night vision goggles (NVGs). They performed required checklists with the exception of the "Before Landing Checklist." MCP1 flew the MA from cruise until 28 seconds prior to landing (short final) under direct supervision of MP, a certified instructor pilot. MP took control of the MA on short final to improve landing position. MP landed on runway centerline approximately 2,800 feet past the beginning of the runway with the landing gear retracted and slid 4,528 feet before coming to rest on the runway to the right of centerline. Crash, fire, and rescue response was immediate, and there were no fatalities, injuries, or damage to other property.

The accident investigation board president found clear and convincing evidence that MP's and MCP1's failure to lower the landing gear and confirm proper aircraft landing configuration in accordance with the "Before Landing Checklist" caused the mishap.

The accident investigation board president also found sufficient evidence that aircrew distractions, task saturation, reduced cockpit visual cues, failure to cross-monitor each other's performance, Tower's failure to transmit a required reminder, and the MC's inadvertent disabling of the Ground Proximity Warning System alerts were substantially contributing factors.

SUMMARY OF FACTS AND STATEMENT OF OPINION
C-17A, T/N 60002
30 JANUARY 2009

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COMMONLY USED ACRONYMS AND ABBREVIATIONS

§	Section
11-2C-17V3	AFI 11-2C-17 Volume 3
16 AS	16th Airlift Squadron
437 AW	437th Airlift Wing
816 EAS	816th Expeditionary Airlift Squadron
AB	Air Base
AC	Aircraft Commander
ACIQ	Aircraft Commander Initial Qualification
ACM	Additional Crew Member
ACO	Airspace Control Order
ADO	Assistant Director of Operations
AEG	Air Expeditionary Group
AERO-I	Aeronautical Intermediate
AEW	Air Expeditionary Wing
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFTO	Air Force Technical Order
AGL	Above Ground Level
AIB	Aircraft Investigation Board
amb	ambulance
AMC	Air Mobility Command
ANVIS	Aviator's Night Vision Imaging System
AOR	Area of Responsibility
API	Approach Path Indicator
AR	Air Refueling
AS	Airlift Squadron
ASMC	Area Support Medical Company
ASR	Airport Surveillance Radar
ASRR	Airfield Suitability and Restriction Report
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Air Tasking Order
ATOC	Air Terminal Operations Center
ATT	Pitch Attitude Command/Attitude Hold Mode
AW	Airlift Wing
BDHI	Bearing, Distance, Heading Indicator
BPO	Basic Post or Pre-Flight Inspection
CASS	Computer Aided Scheduling System
CD	Deputy Commander
CFR	Crash, Fire, Rescue
CRM	Crew Resource Management
DNIF	Duty Not Involving Flying
DLC	Direct Lift Control
DME	Distance Measuring Equipment
DO	Director of Operations
DoT	Department of Transportation
DS	Defensive System or Director of Staff
DTS	Defense Travel System
DVD	Digital Video Device
EAS	Expeditionary Airlift Squadron
ECP	Entry Control Point
EFS	Expeditionary Fighter Squadron
EMSG	Expeditionary Mission Support Group
ERO	Engine Running On/Off-load
evac	evacuation
FAF	Final Approach Fix
FAIP	First Assignment Instructor Pilot
FCIF	Flight Crew Information File
FEF	Flying Evaluation Folder
freq	frequency
FP	First Pilot
GDSS	Global Decision Support System
GPWS	Ground Proximity Warning System
HSC	Home Station Check
HUD	Heads Up Display
HQ	Headquarters
IAW	In Accordance With
IFM	Integrate Flight Manager
IMC	Instrument Meteorological Condition
IP	Instructor Pilot
IR	Infra-Red
IRU	Inertial Reference Unit
iso	isolate
L	Local Time
LACM	Left Additional Crew Member
LMR	Land Mobile Radio
LRC	Learning Resource Center
Lt Col	Lieutenant Colonel
M	million
MA	Mishap Aircraft
max	maximum
MAJCOM	Major Command
MC	Mishap Crew
MCD	Mission Computer Display
MCP1	Mishap Copilot 1
MCP2	Mishap Copilot 2
MFD	Multi Function Display
MFR	Memorandum For Record
min	minimum
ML1	Mishap Loadmaster 1
ML2	Mishap Loadmaster 2
MLG	Main Landing Gear
MP	Mishap Aircraft Commander
MRP	Mission Ready Program
MSL	Mean Sea Level
NCO	Non-Commissioned Officer
NM	Nautical Mile
NOGs	(slang) Night Vision Goggles
NOTAMS	Notices to Airmen
NVGs	Night Vision Goggles
OCONUS	Outside Continental United States

OG	Operations Group
OPR	Officer Performance Report
Ops	Operations
ORM	Operational Risk Management
OSS	Operations Support Squadron
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PAX	Passenger
PIFR	Procedural Instrument Flight Rule
qual	qualification
R & R	Rest & Relaxation
RACM	Right Additional Crew Member
RAF	Royal Air Force
RPG	Rocket Propelled Grenade
rolex'd	delayed
RWY	Runway
SA	Situational Awareness
SARM	Squadron Aviation Resource Management
SC	South Carolina
SIB	Safety Investigation Board
SOE	Schedule of Events
SOF	Supervisor of Flying
Sortie	Flight
SPRO	Semi Prepared Runway Operations
TACC	Tanker Airlift Control Center
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Alert and Collision Avoidance System
TCI	Time Change Item
TCTO	Time Compliance Technical Order
TDD	Theater Direct Delivery
TDY	Temporary Duty
TERP	Terminal Instrument Procedures
TMS	Training Management System
T/N	Tail Number
TO	Technical Order
Tower	Bagram AB Air Traffic Control Tower
TRT	triple tandem
TSgt	Technical Sergeant
TV	Television
US	United States
USAF	United States Air Force
VBO	Velocity Brake Onset
VFR	Visual Flight Rules
WAP	Warning and Caution Annunciator Panel
WSO	Weapons System Officer
Z	Zulu or Greenwich Mean 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, PURPOSE, AND CIRCUMSTANCES

a. Authority

On 9 February 2009, Lieutenant General Vern M. Findley, II, Vice Commander, Air Mobility Command (AMC), appointed Colonel Richard D. Anderson, to conduct an aircraft accident investigation of a mishap that occurred on 30 January 2009, involving a C-17A aircraft at Bagram Air Base (AB), Afghanistan (Tab Y-3 through Y-4). The investigation was conducted at Al Udeid AB, Qatar, on 18-19 and 21-22 February 2009; at Bagram AB, Afghanistan, on 20 February 2009; and at Charleston Air Force Base (AFB), South Carolina (SC), from 4-19 March 2009. Board members were Lieutenant Colonel Rawson Wood (Medical), Captain Travis Elliott (Pilot), Captain Duane Richardson (Maintenance), Captain Kathy Malowney (Legal), Master Sergeant Bryan Cawvey (Court Reporter), and Technical Sergeant James Watson (Recorder) (Tab Y-3 through Y-5).

b. Purpose

The purpose of this investigation is to provide a publicly-releasable report of the facts and circumstances surrounding the accident, to include a statement of opinion on the cause or causes of the accident; to gather and preserve evidence for claims, litigation, disciplinary, and adverse administrative actions; and for other purposes.

c. Circumstances

The accident board was convened to investigate the Class A accident involving a C-17A Globemaster III aircraft, tail number (T/N) 60002, operated from Al Udeid AB, Qatar, which occurred during a combat mission in support of Operation ENDURING FREEDOM on 30 January 2009 (Tab B-3).

2. BACKGROUND

a. Organizations and Personnel

The mishap aircraft (MA) is assigned to the 437th Airlift Wing (437 AW), Charleston AFB, SC, and it was operated from Al Udeid AB, Qatar, in combat support of the Global War on Terrorism in Operation ENDURING FREEDOM, Operation IRAQI FREEDOM, and Joint Task Force HORN of AFRICA operations (Tabs B-3, V-3.2, CC-4). The 437 AW provides a large part of AMC's Global Reach airlift capability. The mission of the 437 AW is to command assigned airlift and support units; provide for the airlift of troops and passengers, military equipment, cargo and aeromedical airlift; and to participate in operations involving the airland or airdrop of troops, equipment, and supplies when required (Tab CC-8). The mishap crew (MC) consisted of Captain Anthony J. Mione, mishap aircraft commander (MP); First Lieutenant Chad M. Dugie, mishap copilot (MCP1); First Lieutenant James A. Linnehan, mishap copilot (MCP2); Staff Sergeant Matthew J. Conn, mishap loadmaster (ML1); and Airman First Class Kylor R. Eutsler, mishap loadmaster (ML2). All were members of the 16th Airlift Squadron (16 AS), Charleston

AFB, SC, deployed to the 816th Expeditionary Airlift Squadron (816 EAS), Al Udeid AB, Qatar, at the time of the mishap (Tabs B-3, V-1.2 through V-1.3, V-2.2, V-3.1, V-4.1, V-5.1).

b. C-17A Globemaster III

Fifty-three C-17A Globemaster III aircraft are assigned to Charleston AFB, SC. The cost per aircraft is approximately $202.3M. Minimum crew for a C-17A is a pilot, copilot, and loadmaster. The C-17A has a cruise speed of approximately 450 miles per hour at 28,000 feet (Mach .76). With in-flight refueling, it can fly nonstop to anywhere in the world. Its maximum cargo load is about 169,000 pounds, and it can carry three helicopters, two large buses, one of the Army's newest tanks, or other outsized cargo. In addition, it features heads-up displays, can airdrop both cargo and 102 paratroopers, and is able to land on small, austere runways as short as 3,500 feet (Tabs CC-8, CC-11 through CC-12).

3. ACCIDENT SUMMARY

At 2215 local time (L)/1745 Zulu (Z, or Greenwich Mean Time), on 30 January 2009, the MA touched down on Runway (RWY) 03 at Bagram AB, Afghanistan, with the landing gear retracted (Tab B-3). MP was seated in the left pilot seat, with MCP1 seated in the right copilot seat. At the discretion of MP, MCP2 was positioned behind MP in the left additional crewmember (ACM) seat, and the one duty passenger was positioned behind MCP1 in the right additional crewmember seat (in compliance with Air Force Instruction 11-2C-17, Volume 3 (AFI 11-2C-17V3), *C-17 Operations Procedures*). ML1 was seated downstairs at the forward loadmaster station, and ML2 was seated downstairs in a sidewall seat (Tab V-1.6 through V-1.7, V-5.2). After the mishap, the MC and passenger exited the MA safely (Tabs V-1.17, V-15.3). The MA sustained damage including the main landing gear assemblies and pods, fuselage underbelly, and left troop door air deflector (Tab S-6 through S-18). Repair costs are estimated at $18.9M (Tab CC-25). There were no civilian injuries, and there was no other property damage.

4. SEQUENCE OF EVENTS

a. Mission

This mission was conducted in support of Operation ENDURING FREEDOM and consisted of three sorties. The first sortie was conducted from Al Udeid AB, Qatar, to Kuwait City International, Kuwait, and was uneventful. The MC's second (or mishap) sortie included carrying one active duty Air Force passenger and 21,000 pounds of cargo from Kuwait City, Kuwait, to Bagram AB, Afghanistan (Tab K-25 through K-29). This AMC mission was authorized by Eighteenth Air Force and tasked by the Tanker Airlift Control Center (TACC), Scott AFB, Illinois. The MC was authorized to conduct the mission by the 816 EAS leadership (Tab V-9.22 through V-9.23). Prior to the mishap sortie, MP and MCP1 had completed 34 sorties together since deploying to the 816 EAS (Tabs G-107 through G-130, V-8.15, V-9.22 through V-9.23).

b. Planning

Mission planning was conducted by the TACC Integrated Flight Manager (IFM) section at Scott AFB. Printouts of the products for the mission to Bagram AB were provided to the MC prior to departure from Kuwait City through electronic transmission (Tab K-7 through K-23). Airfield specific threat and intelligence briefings were conducted by an 816 EAS tactician prior to initial departure from Al Udeid AB. No squadron supervisory personnel attended the briefings, which was standard (Tabs K-6, V-11.3 through V-11.6). Pre-mission preparation was conducted in accordance with (IAW) AFI 11-202 Volume 3, *General Flight Rules* and AFI 11-2C-17V3.

c. Preflight

The MC's preflight inspection of the MA was accomplished IAW applicable technical order procedures. MCP2 also tested the Terrain Awareness and Warning System (TAWS) and Ground Proximity Warning System (GPWS) (Tabs V-2.4, V-3.2 through V-3.3). No significant delays or aircraft system deficiencies were noted.

d. Summary of Accident

The MA departed on schedule (approximately 1430Z) from Kuwait City, Kuwait (Tabs K-3, V-3.8). No significant events were noted during takeoff or cruise phases of flight. MCP1 controlled the MA during descent and most of the approach. MP controlled the MA during final stages of the approach and landing. MCP2 observed from the left additional crewmember seat on the flight deck (Tab V-1.6 through V-1.7).

Upon initial radio contact with Bagram radar approach control, the MC was notified that the approach radar was out of service. Subsequently, they cancelled Instrument Flight Rules (IFR) and proceeded under Visual Flight Rules (VFR) (Tabs V-1.9, V-8.8). They had to report their position to Bagram Air Traffic Control Tower (Tower) to provide aircraft sequencing and separation, approaching 20 miles, 18 miles, 7 miles, and twice on short final (Tab N-9 through N-14). During initial descent into Bagram AB, MP, MCP1, and MCP2 donned night vision goggles (NVGs) to help with terrain avoidance, aircraft traffic de-confliction, and airfield acquisition. MP, MCP1, and ML1 completed a "Descent Checklist" and "Approach Checklist" IAW procedures during the initial descent phase (Tab V-1.8). At 10 miles and 230 knots, the MA configuration was "slats extended, flaps one-half," to produce drag and increase the descent rate (Tab V-1.8). At that point, radio traffic consisted of a departing C-130 and a helicopter nearing RWY 03 that was cleared to land (Tab N-10 through N-12). Approximately 4 miles from landing, the MA's TAWS, which provides aural and visual warnings of potential danger associated with proximity to the ground or obstacles, alerted "TERRAIN AHEAD, TERRAIN AHEAD." There is a known TAWS database anomaly at Bagram AB, approaching RWY 03, which generates erroneous terrain warnings. It has become common for aircrews to disregard these alerts to complete tasked airlift missions, rather than execute a maximum power climb IAW AFI 11-2C-17V3. MP stated, "We're visual, turning it [TAWS] off," and proceeded to land (Tabs N-13, V-1.18 through V-18.19, V-8.9, V-8.14, V-9.8 through V-9.9).

Approximately 3 miles (45 seconds) out, MP and MCP1 removed their NVGs and then MP reported "short final" to prompt Tower for landing clearance. In response to MP's direction,

"Alright, slow and get configured," MCP1 called for MP to lower flaps to three-quarters. Tower directed the MC to "continue." Next, MCP1 called for a full flap final landing configuration and MP lowered the flaps to full. With 28 seconds until landing, MP took control from MCP1 and again reported, "short final," to prompt Tower for landing clearance (N-13 through N-14). Tower immediately cleared the MA to land without transmitting the required "check wheels down" reminder IAW Joint Order 7110.65S (Tabs N-21, T-10).

At 300 feet above ground level (AGL), MCP1 failed to announce the required "300 feet" call (Tab V-1.13, CC-22). Here, MP and MCP1 were procedurally required to execute a go-around if more than 10 knots faster than calculated approach speed of 119 knots. Despite an actual airspeed of 157 knots (38 knots fast), they did not execute a go-around (Tabs L-25, L-35, CC-22).

Additionally, GPWS, which provides aural and visual warnings of aircraft configuration and flight parameter deviations, did not alert the crew of any problems. MP and MCP1 testified to hearing "SINK RATE," a GPWS-generated warning, which would seem to indicate that GPWS was operating normally (Tabs V-1.4, V-1.19, V-2.14). However, neither MCP2 nor the Air Force duty passenger (seated behind MP and MCP1) remembered hearing any such warnings (Tabs V-3.5, V-6.8 through V-6.9). More importantly, while aural warnings generated by other systems were clearly recorded on the cockpit voice recorder and Survivable Flight Data Recorder (SFDR), there were no GPWS warnings. Boeing flight tests and SFDR data confirmed that GPWS should have issued both "SINK RATE" and "TOO LOW GEAR" warnings on short final, but did not (Tabs L-12 through L-27, N-3 through N-15, O-6 through O-40, CC-20 through CC-21).

Furthermore, there were no cockpit indications of a failed GPWS. Had GPWS failed, the MC would have received an aural alert and a master caution light, calling their attention to a yellow "GPWS FAIL" message on the warning and caution annunciator panel (WAP). None were heard on the cockpit voice recorder, and MP testified that no such indication was received (Tabs N-3 through N-15, V-1.4, V-1.12). There was no evidence from MP's or MCP1's testimony that GPWS failed (Tabs V-1.4, V-1.19, V-2.14).

As a Boeing systems expert confirmed, it is probable that the MC inadvertently disabled GPWS warnings during approach (Tab CC-26). This would result in a green "GPWS WARNING OFF" message on the WAP. If present during cruise or initial descent, it would have been noticed by MP during the "Approach Checklist" (Tabs N-8, CC-20 through CC-21). The MC probably disabled GPWS warnings later in the approach, but the resultant message went unnoticed due to its subtle nature. This explains the absence of expected GPWS warnings. Unfortunately, annunciations on the WAP are not captured by any aircraft recorder, so it is impossible to determine precisely when GPWS warnings were disabled (Tab L-35, CC-20).

MP and MCP1 never lowered the landing gear, nor did they conduct a "Before Landing Checklist" (Tab V-1.13).

e. Impact

At touchdown, the MA's configuration was slats extended, flaps full, and landing gear retracted at a speed of 138 knots (19 knots fast) (Tabs L-26, L-35, V-1.10 through V-1.11). The MA impacted runway centerline approximately 2,800 feet past the beginning of RWY 03 at approximately 2215L and slid 4,528 feet before coming to rest slightly right of runway centerline (Tabs B-3, S-3 through S-8).

f. Life Support Equipment, Egress and Survival

All life support equipment used by the MC was inspected and serviceable. The NVGs used by the MC during the descent phase and prior to landing were pre-flighted correctly and worked appropriately. The MC and passenger egressed the MA safely. No survival equipment was used or required during flight or egress (Tabs V-1.8, V-3.8).

g. Crash, Fire, and Rescue (CFR)

Tower immediately notified CFR units, which quickly responded (Tabs N-22, V-1.14). Appropriate rescue assets arrived at the incident within minutes and extinguished the fire on the left aft portion of the aircraft (Tab S-16 through S-17).

5. MAINTENANCE

a. Forms Documentation

The 8th Expeditionary Air Mobility Squadron, Al Udeid AB, Qatar, maintained the aircraft forms for the MA (Tab CC-23). Maintenance is documented on Air Force Technical Order (AFTO) 781 series forms (781A, C, D, H, J, and K) and in the G081 core automated maintenance system for mobility database. AFTO 781 series forms are hard copy forms used to document daily maintenance actions. They are retained in a binder specifically assigned to each aircraft. G081 is a database of aircraft discrepancies, repair actions, and flying history. Aircraft AFTO 781 series forms, a 180-day maintenance history from G081, a listing of Time Compliance Technical Orders (TCTO) and a list of Time Change Items (TCI) were reviewed to determine air worthiness up to the point of the mishap. There were no relevant maintenance discrepancies found, and no repeat or recurring maintenance problems. There were open TCTOs and upcoming TCIs; however, none of these were overdue at the time of the mishap and none were relevant to the mishap. There were several minor documentation errors found between the active AFTO 781 forms and G081 (Tabs D-5, U-5). There is no evidence to suggest these minor documentation errors were factors in the mishap.

b. Inspections

The only inspection due at the time of the mishap was a 15-day clear-water rinse. This item is not considered overdue until the next scheduled major inspection, which would have been a Home Station Check (HSC) #2, due on 23 April 2009. The last maintenance inspection accomplished was a combined Basic Post-flight/Pre-flight inspection which was signed off with no discrepancies at 1400Z on 29 January 2009 (Tab D-5).

c. Maintenance Procedures

Aircraft AFTO 781 series forms and G081 revealed all required maintenance actions were in compliance with standard operating procedures (Tab D-5).

d. Maintenance Personnel and Supervision

Maintenance personnel from the 437 AW deployed to Al Udeid AB serviced and performed maintenance on the MA prior to the mishap. The training records for applicable 437 AW maintenance personnel were reviewed and revealed no discrepancies. All had adequate training and experience (Tab U-6).

e. Fuel, Hydraulic and Oil Inspection Analysis

Analysis of the engine oil and hydraulic fluid samples indicated only trace contaminants were present (Tab D-4). A fuel sample was taken, but not tested (Tab U-8). There is no evidence to indicate these fluids were factors in the mishap.

f. Unscheduled Maintenance

There were no unscheduled maintenance actions performed since the last scheduled inspection, a combined Basic Post-flight/Pre-flight inspection accomplished on 29 January 2009. Prior to that, the most recent unscheduled maintenance action was a #3 engine generator change and a reseating of the intercom control system panel connector (Tab D-5). Both tasks were accomplished by qualified maintenance personnel at Al Udeid AB (Tab U-5 through U-6). There is no evidence to suggest that these were factors in the mishap. Additionally, MCP1 testified that there was a "phase shift problem" with the copilot's heads-up display (Tab V-2.4). However, there were no discrepancies written in the AFTO 781 forms or in the G081 history (Tabs D-5, U-6). There is no evidence to suggest that this was a factor in the mishap.

6. AIRCRAFT AND AIRFRAME

a. Condition of Systems

The MA was moved from the runway to the parking ramp requiring removal of many parts including eight of twelve main landing gear tires and multiple landing gear doors (Tab U-7). Flight deck switches, controls, and circuit breakers were photographed immediately following the mishap (Tabs S-8, Z-3). The damaged or destroyed condition of various structures and components prohibited testing of each aircraft system. The removal team lifted the aircraft to install jacks and lowered the gear using freefall procedures (Tab U-4). No components were sent for tear-down analysis. There was no evidence to suggest that any pre-existing defects were a factor in the mishap.

b. Testing

Not applicable.

7. WEATHER

a. Forecast Weather

The weather forecast for Bagram AB, on 30 January 2009, at 1815Z, was provided by the TACC weather division and was included in the IFM printout. Winds were expected to be variable at 3 knots with a temperature of 5 degrees Celsius. Anticipated visibility was 5 statute miles with mist and clear skies (Tab F-5).

b. Observed Weather

Observed weather for Bagram AB, on 30 January 2009, at 1755Z, was reported by Bagram AB Automatic Terminal Information Service. Winds were calm with a temperature of 4 degrees Celsius. Visibility was unrestricted with clear skies (Tab F-12).

c. Space Environment

Not applicable.

d. Conclusion

Based on forecast and observed data, there is no evidence to suggest that weather was a factor.

8. CREW QUALIFICATIONS

a. Mishap Aircraft Commander (MP)

MP was a current and qualified Instructor Pilot (IP) with a total of 826 hours in the C-17, including 142 IP hours. Prior experience included 751 hours in the C-21A and an IP rating. Grand total flight time for MP was 1,879 hours (Tab G-5). No deficiencies were noted in Training Management System (TMS) or flight evaluation records except for one debrief item for ground operations on his initial IP evaluation (Tab G-4). Administrative errors were discovered in the individual training summary due to changes in tracked currency items. The changes occurred after the 16 AS deployed and had no effect on mission readiness or qualification (Tabs G-10 through G-13).

IAW AFI 11-202V3, there are maximum 7, 30, and 90-day flight times, and all of MP's flight times were below maximum allowable levels as shown below (Tabs G-7, G-107 through G-111):

	Actual	Maximum
Last 7 Days	20.2	56
Last 30 Days	63.7	125
Last 90 Days	145.3	330

b. Mishap Copilot 1 (MCP1)

MCP1 was a current and qualified First Pilot with a total of 149 hours in the C-17. MCP1 had no other military aircraft experience since pilot training. Grand total flight time was 402 hours

(Tab G-43). No deficiencies were noted in flight evaluation records. TMS records as documented by MP four days prior to the mishap, state, "His struggle comes when he is on final at about 10 NM [nautical miles] out and inbound to landing. His pacing on when to get configured and how to plan out his descent was really challenging at first. He tended to be very high with the API [Approach Path Indicator] line past the runway and was late to realize the situation he was in" (Tab G-46). Administrative errors were discovered in the individual training summary due to changes in tracked currency items. The changes occurred after the 16 AS deployed and had no effect on mission readiness or qualification (Tabs G-37 through G-42).

MCP1's 7, 30, and 90-day flight times were below maximum allowable. See below (Tabs G-43, G-107 through G-111):

	Actual	Maximum
Last 7 Days	20.2	56
Last 30 Days	63.7	125
Last 90 Days	96.1	330

c. Mishap Copilot 2 (MCP2)

MCP2 was a current and qualified First Pilot with a total of 248 hours in the C-17. MCP2 had no other military aircraft experience since pilot training. Grand total flight time was 496 hours (Tab G-61). No deficiencies were noted in flight evaluation records. MCP2 achieved an "Excellent" rating on the most recent flight evaluation. TMS records indicate "Great" aircraft general knowledge and checklist discipline, as well as, safety checks (Tabs G-66 through G-67). Administrative errors were discovered in the individual training summary due to changes in tracked currency items. The changes occurred after the 16 AS deployed and had no effect on mission readiness or qualification (Tabs G-55 through G-60).

MCP2's 7, 30, and 90-day flight times were below maximum allowable. See below (Tabs G-61, G-107 through G-111):

	Actual	Maximum
Last 7 Days	20.2	56
Last 30 Days	50.6	125
Last 90 Days	119.8	330

d. Mishap Loadmaster 1 (ML1)

ML1 was a current and qualified Loadmaster in the C-17 with a total of 659 hours. Prior experience included 1,328 hours as Loadmaster in the C-5A and B models. Grand total flight time was 1,987 hours (Tab G-80). No deficiencies were noted in TMS or flight evaluation records. ML1 achieved an "Excellent" rating on the most recent evaluation (Tab G-71). Administrative errors were discovered in the individual training summary due to changes in

tracked currency items. The changes occurred after the 16 AS deployed and had no effect on mission readiness or qualification (Tabs G-77 through G-79).

ML1's 7, 30, and 90-day flight times were below maximum allowable. See below (Tabs G-80, G-107 through G-111):

	Actual	Maximum
Last 7 Days	20.2	56
Last 30 Days	63.7	125
Last 90 Days	67.6	330

e. Mishap Loadmaster 2 (ML2)

ML2 was a current and qualified Loadmaster with a total of 354 hours in the C-17. ML2 had no prior loadmaster experience. Grand total flight time was 354 hours (Tab G-94). No deficiencies were noted in TMS or flight evaluation records. Administrative errors were discovered in the individual training summary due to changes in tracked currency items. The changes occurred after the 16 AS deployed and had no effect on mission readiness or qualification (Tabs G-91 through G-93).

ML2's 7, 30, and 90-day flight times were below maximum allowable. See below (Tabs G-88, G-107 through G-111):

	Actual	Maximum
Last 7 Days	20.2	56
Last 30 Days	63.7	125
Last 90 Days	87.2	330

9. MEDICAL

a. Qualifications

Medical records of the MC were reviewed and no discrepancies were identified. The MC was medically qualified to fly (Tabs X-3 through X-4).

b. Health

No discrepancies were identified. There was no evidence to suggest that the health of the MC was a factor (Tabs V-1.15, V-2.13, X-3 through X-4).

c. Pathology

Post-mishap toxicology reports were reviewed and no discrepancies were identified. There was no evidence to suggest that the MC was under the influence of any substance (Tabs X-3 through X-4).

d. Lifestyle

There was no evidence that unusual habits, behavior, or stress on the part of the MC contributed to the accident (Tabs V-1.15, V-2.13, V-8.6).

e. Crew Rest and Crew Duty Time

Crew rest facilities were adequate. There was no evidence to suggest crew rest was a factor (Tabs V-1.5, V-2.3, V-3.2, V-4.2, V-5.1).

10. OPERATIONS AND SUPERVISION

a. Operations

The 16 AS was deployed for approximately one month to the United States Central Command area of responsibility as the 816 EAS (Tabs V-1.2 through V-1.3, V-2.2). Deployed operations tempo for the squadron was significantly higher than home station, but consistent with previously deployed squadrons. Surge operations were not in effect, and the mission was routine for the MC (Tab V-8.5). There was no evidence to suggest that flying operations tempo was a factor.

b. Supervision

The leadership of the 816 EAS provided appropriate supervision. They ensured each member of the MC was current, qualified, and assembled IAW current command-wide operational practices regarding qualification and skill level (Tabs T-3, V-9.4). Operational Risk Management assessment for this mission scored in the "High" category, because the MC's flight duty day was scheduled for 95 percent of maximum allowable flight duty day IAW AFI 11-2C-17V3. The mission and risk was accepted by the appropriate level of supervision. Furthermore, the 816 EAS leadership consistently mitigated risk by providing an additional pilot (Tabs T-3, V-9.3 through V-9.4, V-9.6, V-9.9 through V-9.10). There was no evidence to suggest squadron supervision was a factor.

11. HUMAN FACTORS

The Department of Defense Human Factors Analysis and Classification System Guide includes a list of potential human factors that may contribute to a mishap. Chain of events models encourage notions of linear causality and do not account for the indirect, non-linear, and feedback relationships common for accidents in complex systems. When the mishap is investigated as an interdependent system, any person whose actions or inactions impacted the outcome of the mishap should be investigated as a mishap person. All factors in the guide were assessed for relevancy to the mishap (Tabs BB-3 through BB-37).

a. Checklist Error

Checklist Error is a factor when the individual, either through an act of commission or omission makes a checklist error or fails to run an appropriate checklist and this failure results in an unsafe situation (Tab BB-16). The "Before Landing Checklist" is required to confirm proper aircraft landing configuration (Tab CC-22). MP and MCP1 never lowered the landing gear and did not

call for nor complete this checklist during the mishap approach and landing sequence (Tabs N-3 through N-15, V-1.13, V-2.12, V-3.4).

b. Necessary Action - Rushed

Necessary Action - Rushed is a factor when individuals take necessary actions as dictated by the situation, but perform these actions too quickly and the rush leads to an unsafe situation (Tab BB-17). MCP1 was rushed and not able to keep up with the time-constrained demands of flying the MA in the airport environment. In response to excessive speed and altitude one minute before landing, MP directed MCP1 to use speed brakes, indicating they were flying too fast for the approach. Finally, MP took control of the MA in an attempt to salvage the landing (Tabs N-3 through N-15, V-1.19, V-1.22, V-2.17).

c. Instrumentation and Sensory Feedback Systems

Instrumentation and Sensory Feedback Systems is a factor when instrument factors such as design, reliability, lighting, location, symbology, or size are inadequate and create an unsafe situation. This includes inadequacies in auditory or tactile situational awareness or warning systems such as aural voice warnings or stick shakers (Tab BB-20). If the gear handle is up and locked, and GPWS is off or not working, no warning systems exist to indicate an unsafe landing configuration; even the "red light" in the gear handle will not illuminate unless the landing gear position disagrees with the landing gear handle position. Furthermore, the design of the configuration page on the multi-function display does not warn aircrews that the gear is not down and locked (Tabs N-3 through N-15, V-1.12, V-2.11).

Additionally, Air Force Manual 11-217, Volume 1, *Instrument Flight Procedures*, states, "The image provided by NVGs places limitations on critical aspects of human visual performance, (i.e. visual acuity, field-of-view, contrast sensitivity, and motion/depth perception). These limitations combine to create a degraded visual environment, increase cognitive workload, and contribute to spatial disorientation … Both the instrument crosscheck and an effective scanning technique require concentration … NVG operations are inherently more demanding than comparable day missions and aircrew must fully understand the limitations on human physiology and aircraft systems." MP testified to NVGs being a "SA [situational awareness] drainer," stating, "I know I have to concentrate harder when I've got NVGs on" (Tab V-1.26). Cockpit lighting is also reduced during NVG operations to increase their effectiveness and it is not possible to scan the interior through NVGs (Tabs CC-18 through CC-20). MP, MCP1, and MCP2 were wearing NVGs for descent and approach (Tabs N-12 through N-13, V-3.5). This could explain their failure to recognize that the gear handle was in the up position.

As discussed in the Sequence of Events, it is apparent that the MC inadvertently disabled GPWS warnings during the approach. The resultant green "GPWS WARNING OFF" message on the WAP would easily go unnoticed by MP, MCP1, and MCP2 due to its subtle nature, especially while wearing NVGs (Tabs V-1.4, CC-20 through CC-21).

d. Controls and Switches

Controls and Switches is a factor when the location, shape, size, design, reliability, lighting or other aspect of a control or switch is inadequate and this leads to an unsafe situation (Tab BB-21). The GPWS and TAWS warning off buttons are located directly across from each other on the C-17A mission computer GPWS/TAWS control page. While silencing the TAWS aural warnings, MP may have inadvertently disabled GPWS warnings due to the close proximity and similarity of the two systems' control buttons (Tabs L-13 through L-27, V-1.21, CC-20).

e. Procedural Error

Procedural Error is a factor when a procedure is accomplished in the wrong sequence or using the wrong technique or when the wrong control or switch is used. This also captures errors in navigation, calculation, or operation of automated systems (Tab BB-16). According to AFI 11-2C-17V3, the GPWS is to be set commensurate with the aircraft phase of flight. There were no GPWS warnings found on any aircraft recorders, despite the known gear-up configuration below 250 feet AGL (Tab CC-20 through CC-21). The lack of GPWS warnings was apparently due to the MC inadvertently disabling them, which was a procedural error (Tabs V-1.4, V-1.19, CC-20).

f. Channelized Attention

Channelized Attention is a factor when the individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others of a subjectively equal or higher or more immediate priority, leading to an unsafe situation. It may be described as a tight focus of attention that leads to the exclusion of comprehensive situational information (Tab BB-21). The MC focused on approach radar outage, radios, aircraft traffic, system-generated terrain warnings, and student instruction when they should have been configuring the MA for landing and performing the "Before Landing Checklist." Channelized attention was a factor (Tabs N-3 through N-15, V-1.13, V-2.18).

g. Cross-Monitoring Performance

Cross-monitoring performance is a factor when crew or team members fail to monitor, assist or back-up each other's actions and decisions (Tab BB-29). MCP1 failed to lower the landing gear and call for the "Before Landing Checklist" while flying the MA. MP failed to notice and correct the deviation. MCP2 was focused on outside scanning IAW AFI 11-2C-17V3 and also did not notice or intervene. ML1 was busy coordinating parking and cargo download details with the Air Terminal Operations Center (ATOC) and ML2 was not on headset (Tabs V-4.4, V-5.2). Regulatory guidance only directs C-17 crewmembers occupying ACM seats during flight to assist in clearing anytime the aircraft is below 10,000 feet. The "Before Landing Checklist" is a pilot only checklist and should have been run by MP and MCP1. AFI 11-2C-17V3 states, "Any crewmember seeing a deviation of 200 feet altitude or 10 knots in airspeed, or a potential terrain or obstruction problem, will immediately notify the PF (pilot flying). Deviations from prescribed procedures for the approach being flown will also be announced." However, nowhere is it specified that additional crewmembers or loadmasters have a responsibility to back-up the pilots operating the aircraft by monitoring certain instruments, checklists, or other aircraft systems. Alternatively, crew resource management (CRM), as defined in AFI 11-290,

Cockpit/Crew Resource Management, is the "effective use of all available resources -- people, weapon systems, facilities, and equipment, and environment -- by individuals or crews to safely and efficiently accomplish an assigned mission or task." Crews are directed, by AFI 11-2C-17V3 Charleston AFB Supplement 1, to appoint a CRM monitor (Tab BB-39). There is no evidence suggesting that anyone on the MC was filling this role. Regardless, any crewmember is empowered to intervene when they detect a deviation or identify a CRM breakdown. IAW AFI 11-2C-17V3, "Time-out" is the officially-sanctioned word used to break the developing chain of events that is potentially leading to a mishap; although "Go-around" is immediately effective on short final. Had anyone detected that the gear was not lowered or that the "Before Landing Checklist" had not been accomplished, they would have intervened and this mishap would not have occurred. Therefore, cross-monitoring performance was a factor (Tabs N-3 through N-15, V-2.20, V-4.1).

h. Supervision - Defacto Policy

Supervision - Defacto Policy is a factor when unwritten or "unofficial" policy perceived and followed by the individual, which has not been formally established by the properly constituted authority, leads to an unsafe situation (Tab BB-34). IAW AFI 11-2C-17V3, when encountering a TAWS warning at night, aircrews are directed to advance power to maximum and initiate a climb until the warnings cease and they are clear of terrain. Recognizing that compliance with this procedure would often result in mission failure at Bagram AB, it was ignored without formally established policy. Disregarding TAWS warnings at locations with known database anomalies, such as Bagram AB, has become an acceptable solution to complete tasked airlift missions (Tabs V-7.5, V-8.9). A witness testified, "That [erroneous TAWS warnings] has been a historical issue going into Bagram for years. And it's something that needs to be fixed ASAP … But it is a known issue across the entire C-17 fleet" (Tab V-9.8). During approach, the MC received a "TERRAIN AHEAD, TERRAIN AHEAD" alert. They responded by turning off TAWS alerts and continued the approach (Tabs N-3 through N-15, V-2.10, V-8.14).

i. Air Traffic Control Resources

Air Traffic Control Resources is a factor when inadequate monitoring of airspace, enroute navigational-aids or language barriers in air traffic controllers causes an unsafe situation (Tab BB-35). According to Joint Order 7110.65S, "Tower shall issue the wheels down check at the appropriate place in the pattern," with intent solely to remind the pilot, but not to place responsibility on the controller. Tower personnel did not direct the MC to confirm that the landing gear was down indicating presence of this factor (Tabs N-17 through N-23, V-1.12, V-2.12).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications

1. AFI 11-2C-17, Volume 2, *C-17 Aircrew Evaluation Criteria*, dated 19 April 2005
2. AFI 11-2C-17, Volume 3, *C-17 Operations Procedures*, dated 15 December 2005
3. AFI 11-2C-17, Volume 3, Charleston AFB Supplement 1, *C-17 Operations Procedures*, dated 1 September 2003

4. AFI 11-202 Volume 3, *General Flight Rules*, dated 5 April 2006
5. AFI 11-290, *Cockpit/Crew Resource Management Training Program*, dated 11 April 2001
6. Air Force Manual 11-217, Volume. 2, *Instrument Flight Procedures*, dated 8 August 1998
7. Joint Order 7110.65S, *Air Traffic Control*, 14 February 2008
8. TO 1C-17A-1, *FLIGHT MANUAL USAF Series C-17A Aircraft*, dated 15 March 2005, Change 9 dated 1 May 2008

b. Maintenance Directives and Publications

1. AFI 21-101, *Aerospace Equipment Maintenance Management*, dated 29 June 2006

NOTICE: The AFIs listed above are available digitally on the AF Departmental Publishing Office internet site at: **http://www.e-publishing.af.mil.**

c. Known or Suspected Deviations from Directives or Publications

Except as described above, there were no known or suspected deviations.

13. NEWS MEDIA INVOLVEMENT

The Air Force Print News and the Air Force Times printed articles regarding the accident, response, and removal of the MA (Tab CC-13 through C-16).

1 May 2009

RICHARD D. ANDERSON
Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

C-17A, T/N 60002 ACCIDENT
30 JANUARY 2009

Under 10 U.S.C. 2254(d) any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft 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:

The mishap crew (MC) consisted of the mishap aircraft commander (MP), mishap copilots (MCP1 and MCP2), and mishap loadmasters (ML1 and ML2). MCP1 controlled the mishap aircraft (MA) during descent and most of the approach. MP controlled the MA during final stages of the approach and landing. MCP2 observed from the left additional crewmember seat on the flight deck. ML1 was at the forward loadmaster station in the cargo compartment, and ML2 sat downstairs in a sidewall seat.

I found by clear and convincing evidence that MP's and MCP1's failure to lower the landing gear and confirm proper aircraft landing configuration in accordance with the "Before Landing Checklist" caused the mishap. Additionally, I found sufficient evidence that aircrew distractions, task saturation, reduced cockpit visual cues, failure to cross-monitor each other's performance, Bagram Air Traffic Control Tower's (Tower) failure to transmit a required reminder, and the apparent disabling of the Ground Proximity Warning System (GPWS) alerts by the MC were substantially contributing factors.

2. CAUSE:

MC testimony, cockpit voice recordings, photographic evidence, and eyewitness testimonies clearly established that the cause of the mishap was MP's and MCP1's failure to lower the landing gear and confirm proper aircraft landing configuration in accordance with the "Before Landing Checklist." Had they lowered the gear, the mishap would not have occurred. Similarly, had MP and MCP1 conducted the "Before Landing Checklist," they would have properly configured the MA for landing.

3. SUBSTANTIALLY CONTRIBUTING FACTORS:

Aircrew Distractions

The MC was distracted by the approach radar outage, radios, aircraft traffic, and system-generated terrain warnings. During descent and approach, Bagram radar approach control was temporarily out of service resulting in Tower's reduced capability to determine aircraft position.

In order to maintain situational awareness for sequencing, Tower requested aircraft radio position reports which channelized MP's and MCP1's attention. The MC was further distracted by other radio transmissions from multiple helicopters, a departing C-130, the Air Terminal Operations Center (ATOC), and Tower. Knowing they were responsible for collision avoidance, the MP, MCP1, and MCP2 focused on clearing for potentially hazardous air traffic. They were aware of aircraft in the vicinity of the approach path and runway. This channelized their attention as they attempted to visually acquire the known traffic. Fixation on this task resulted in increased concentration outside the cockpit distracting them from interior duties. Finally, MP and MCP1 were distracted by the Terrain Awareness and Warning System (TAWS) on final approach. This system provides aural and visual warnings of proximity to the ground or obstacles. When confronted with a TAWS warning at night, aircrews are required to establish a maximum power climb until the warning has ceased and terrain clearance is verified. Witness testimonies established that erroneous airfield data often results in nuisance alerts. It has become common for aircrews to disregard known erroneous terrain warnings approaching Bagram AB in order to complete tasked airlift missions. MP and MCP1 visually confirmed and announced terrain clearance, disregarded alerts, disabled TAWS warnings, and continued the approach.

Task Saturation

Task saturation was evident during MCP1's approach and MP's attempt to acquire normal approach parameters. MP is a new instructor pilot. His focus on preparing MCP1 for the next level of responsibility resulted in his intent to allow the less experienced crewmember to control the MA during approach and landing under direct supervision. Testimony and documentation regarding MCP1's training indicate normal flight skill progression. However, his training records specifically indicate difficulty with descending, slowing, and configuring in time for a stable approach to landing. He required instruction and significant monitoring during all of his "pilot flying" duties, which include calling for checklists. MP recognized excess altitude and airspeed and took control of the MA with only 28 seconds before landing. The approach to landing was steeper and faster than normal. MP became focused on maneuvering the MA into a position for landing. MCP1 did not transition to proactive "pilot not flying" duties as evidenced by his failure to make the mandatory "300 feet" announcement. The MA was 38 knots above approach speed at 300 feet above ground level (AGL). This is 28 knots faster than regulatory guidance for a stabilized approach and authorization to continue. Had a go-around been accomplished as required when not stable at 300 feet AGL, the mishap would have been avoided. These deviations indicate MP's and MCP1's significant task saturation.

Reduced Cockpit Visual Cues

The MC was current and qualified to operate the C-17 using night vision goggles (NVGs). MP's, MCP1's, and MCP2's use of NVGs during the descent and approach phase increased their ability to visually clear terrain, obstacles, and other aircraft. However, because it is not possible to scan the interior through NVGs, it was more difficult for them to view other items in the cockpit. They had to look below the NVGs to read checklists, scan warning systems, and operate switches and controls. Cockpit lighting was also reduced to increase NVG effectiveness. These factors increased the likelihood of missed cockpit cues. MP's and MCP1's attention was concentrated outside at the expense of a more aggressive internal visual scan, and they failed to notice that the gear handle was in the up position.

Failed Cross-Monitoring Performance

The MC failed to monitor, assist or back-up each other's actions. When MCP1 failed to lower the landing gear and call for the "Before Landing Checklist," MP failed to notice and correct the deviation. MCP2 was focused on outside scanning, ML1 was busy coordinating with the Air Terminal Operations Center (ATOC), and ML2 was not on headset. Although crew members are required to notify the pilot flying if they see a deviation from prescribed flight parameters or approach procedures, guidance does not direct specific in-flight responsibilities for crewmembers to back-up the pilots flying, except clearing for air traffic. However, crew resource management (CRM) requires the effective use of all crewmembers to safely accomplish the mission. Any crewmember is empowered to intervene when they detect a deviation or identify a CRM breakdown. "Time-out" is the officially-sanctioned word used to break the developing chain of events leading to a potential mishap; although "Go-around" is immediately effective on short final. 816th Expeditionary Airlift Squadron crews regularly fly with an additional pilot to mitigate risk. This implies a responsibility to monitor the rest of the crew and correct deficiencies. Had crewmembers adequately monitored each other, they probably would have detected that MP and MCP1 had not lowered the gear or accomplished the "Before Landing Checklist." This would have prevented the mishap.

"Check Wheels Down" Reminder

Regulatory guidance required Tower to issue a "check wheels down" call to the MC before landing. The intent is solely to remind the pilot to lower the wheels, not to place responsibility on the controller. This reminder was never transmitted to the MC. Had the MC been issued the "check wheels down" reminder prior to landing, they probably would have noticed that their landing gear was retracted and prevented the mishap.

Ground Proximity Warning System (GPWS)

The MC never received a GPWS warning indicating they were about to land with the gear retracted. Flight testing with the landing gear retracted did not produce any situations where the aircraft failed to announce "TOO LOW GEAR" except when the system was intentionally disabled. MP and MCP1 testified to hearing "SINK RATE," a GPWS-generated warning. This would seem to indicate that GPWS was operating normally. However, neither MCP2 nor the Air Force duty passenger (seated behind MP and MCP1) remembered hearing any GPWS warnings. More importantly, while aural warnings generated by other systems were clearly recorded on the cockpit voice recorder and the Survivable Flight Data Recorder (SFDR), there were no GPWS warnings. This includes "TOO LOW GEAR" and "SINK RATE," which should have been generated. Therefore, GPWS either malfunctioned or was disabled.

MCP1 and MCP2 both testified the GPWS was tested during preflight duties. Had the GPWS later malfunctioned, there would have been an aural warning tone and master caution light. This would call attention to the overhead panel where "GPWS FAIL" would have been clearly annunciated in yellow, cautioning the MC of their GPWS status. However, if GPWS warnings were inadvertently disabled, there would not be an aural warning tone or master caution light. The system would assume that GPWS warnings were turned off intentionally, and the only indication would be a green "GPWS WARNING OFF" advisory annunciation light on the

overhead warning panel. This would not be noticeable on NVGs without a deliberate scan of this panel. There is no evidence of an aural warning tone or master caution light associated with "GPWS FAIL," and MP presumably scanned the overhead warning panel during the "Approach Checklist" with no mention of a "GPWS WARNING OFF" annunciation. Therefore, it is apparent that the MC (possibly MP when he disabled the TAWS warnings) inadvertently disabled the GPWS warnings, preventing the "TOO LOW GEAR" aural warning. The MC was not warned of their gear position.

4. SUMMARY

I determined by clear and convincing evidence that MP's and MCP1's failure to lower the landing gear and confirm aircraft landing configuration in accordance with the "Before Landing Checklist" caused the mishap. Additionally, I found sufficient evidence of six substantially contributing factors. They were distracted by the approach radar outage, radios, concern with other aircraft traffic, and aircraft system-generated terrain warnings. Additionally, MP's decision to instruct while MCP1 flew the MA culminated in an unstable approach and failure to recognize required landing parameters indicating significant task saturation. Due to the reduced interior visual cues during NVG operations, they did not notice the gear handle position. Similarly, the individual crewmembers failed to cross-monitor each other's performance to detect procedural deviations and breakdown in CRM. Had Tower transmitted "check wheels down," this mandatory reminder should have drawn their attention to the landing gear panel where they probably would have noticed the improper position of the gear handle. Finally, the MC apparently disabled GPWS warnings inadvertently, preventing "TOO LOW GEAR" from disrupting the sequence of events and spurring corrective action.

1 May 2009

RICHARD D. ANDERSON
Colonel, USAF
President, Accident Investigation Board