UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

C-130J-30 Super Hercules, T/N 04-3144

41st Airlift Squadron
19th Airlift Wing
Little Rock Air Force Base, Arkansas

LOCATION: Forward Operating Base Shank, Afghanistan

DATE OF ACCIDENT: 19 May 2013

BOARD PRESIDENT: Colonel Michael P. Zick

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION
C-130J-30, T/N 04-3144
Forward Operating Base Shank, Afghanistan
19 May 2013

On 19 May 2013, at approximately 0950 Zulu (1420 local), a C-130J, tail number (T/N) 04-3144, assigned to the 41st Airlift Squadron, 19th Airlift Wing, Little Rock Air Force Base (AFB), Arkansas, ran off the end of a runway at Forward Operating Base (FOB) Shank, Northeast, Afghanistan, struck a ditch which collapsed the nose gear and eventually ripped the right main landing gear from the fuselage. The right outboard engine struck the ground, pressurized fuel and oil lines were broken, fluid was sprayed over the cracked engine casing, and the right wing caught fire. The mishap aircraft (MA) came to a full stop at approximately 544 feet (ft) off the end of the paved runway surface. The mishap crew (MC), Aeromedical Evacuation (AE) crew and two ambulatory patients safely evacuated the aircraft through the top flight-deck emergency escape hatch meeting 600 ft off the nose of the aircraft. There were no fatalities, significant injuries or damage to civilian property. The total estimated loss is $73,990,265.

The MA was on an AE mission and included five active duty C-130J crewmembers from the 772nd Expeditionary Airlift Squadron (19th Airlift Wing deployed), Kandahar Air Base (AB), Afghanistan. Additionally, the MA had aboard six reserve AE crewmembers from the 651st Expeditionary Aeromedical Evacuation Squadron (349th Air Mobility Wing and 433rd Airlift Wing deployed), Kandahar AB, Afghanistan. The mishap sortie happened on the third of five planned legs that day to an airfield that was at 6,809 ft Mean Sea Level (MSL) and experiencing winds varying from 200 to 250 degrees gusting from 6 to 28 knots. On the second attempted landing, the MA touched down approximately 1,500 ft down the runway but was 27 knots indicated airspeed (KIAS) faster than computed touchdown landing speed leading to the aircraft going off the end of the runway at approximately 49 KIAS.

The Accident Investigation Board (AIB) president found, by clear and convincing evidence, that the causes of the accident were poor Crew Resource Management (CRM) and mishap pilot one's (MP1) late power reduction causing a 27 KIAS fast touchdown at a high altitude airfield (6,809 ft MSL). Additionally, the AIB President found by the preponderance of evidence that each of the following factors substantially contributed to the mishap: 1) Channelized Attention; 2) Risk Assessment; 3) Delayed Necessary Action; 4) Response Set; 5) Procedural Error.

SUMMARY OF FACTS AND STATEMENT OF OPINION
C-130J-30, T/N 04-3144
19 May 2013

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

16L	16 Left
AW	Airlift Wing
34R	34 Right
AB	Air Base
AC	Alternating Current
ACAWS	Advisory, Caution, and Warning System
ADO	Assistant Director of Operations
AE	Aero-Medical Evacuation
AEF	Air Expeditionary Force
AEW	Air Expeditionary Wing
AF	Air Force
AFE	Aircrew Flight Equipment
AFB	Air Force Base
AFE	Air Flight Equipment
AFI	Air Force Instruction
AFIP	Air Force Institute of Pathology
AFPAM	Air Force Pamphlet
AFPD	Air Force Policy Directive
AFPET	Air Force Petroleum Agency
AFTO	Air Force Technical Order
AGL	Above Ground Level
AIB	Accident Investigation Board
AMC	Air Mobility Command
AMD	Air Mobility Division
AMXS	Aircraft Maintenance Squadron
AOR	Area of Responsibility
AR	Arkansas
AS	Airlift Squadron
ATC	Air Traffic Control
ATO	Air Tasking Order
BARO	Barometer
C2	Command and Control
Capt	Captain
CC	Commander
CDDAR	Crash Damaged/Disabled Aircraft Recovery
CDM	Climb Dive Marker
CNIMU	Communication Navigation Information Management Unit
Col	Colonel
CRM	Cockpit/Crew Risk Management
CSAR	Combat Search and Rescue
CVR	Cockpit Voice Recorder
DO	Director of Operations
DoD	Department of Defense
DFDR	Digital Flight Data Recorder
DTADS	Data Transfer and Diagnostic System
EAS	Expeditionary Airlift Squadron
EAMXS	Expeditionary Maintenance Squadron
EAW	Expeditionary Airlift Wing
E-Go	Early Go
EMS	Equipment Maintenance Squadron
EOG	Expeditionary Operations Group
Est.	estimated
FAE	Functional Area Expert
FAST	Fatigue Avoidance Scheduling Tool
FCIF	Flight Crew Information File
FDP	Flight Duty Period
FF	Fuel Flow
FLT	Flight
FLT IDLE	Flight Idle
FOB	Forward Operating Base
FPM	Feet per Minute
FRAG	Fragmentary Order
ft	Feet
ft/sec	Feet per Second
g	Gravitational Force
GMT	Greenwich Mean Time
GND IDLE	Ground Idle
GPS	Global Positioning System
HARAD	High Altitude Ramp And Door
HDD	Heads-Down Display
HUD	Heads-Up Display
IAW	In Accordance With
IFR	Instrument Flight Rules
IMDS	Integrated Maintenance Data System
inHg	Inches of Mercury
INTEL	Intelligence
K	Thousand
KCAS	Knots Calibrated Airspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed
kts	Knots
L	Local Time
LIMFAC	Limiting Factor
LMC	Lockheed Martin Aeronautics Company
LRAFB	Little Rock Air Force Base
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
MAF	Mobility Air Force
MAJCOM	Major Command
MC	Mishap Crew
MCD	Medical Crew Director
METAR	Meteorological Aerodrome Report
MLM	Mishap Loadmaster
MMS	Maintenance Management System
MP	Mishap Pilot
MS	Mishap Sortie
MSL	Mean Sea Level
NAF	Numbered Air Force
NATO	North Atlantic Treaty Organization
NCO	Non-commissioned Officer
NM	Nautical Miles
NOTAMs	Notices to Airmen
NVGs	Night Vision Goggles

OAKN	Kandahar Air Base
OASH	Forward Operating Base Shank
OASL	Forward Operating Base Salerno
OAZI	Camp Bastian
Obs	Observation
OAT	Outside Air Temperature
OG	Operations Group
Ops	Operations
ORM	Operational Risk Management
OST	Off Station Trainer
PA	Public Affairs
Para.	Paragraph
PHA	Periodic Health Assessment
PLF	Parachute Landing Fall
PR	Pre Flight
Prop	Propeller
PIC	Pilot In Command
PSI	Pounds Per Square Inch
QA	Quality Assurance
RPA	Remotely Piloted Aircraft
RTB	Return-To-Base
RW	Runway
SAR	Search and Rescue
SII	Special Interest Item
SOF	Supervisor of Flying
Sq	Squadron
TACC	Tanker Airlift Control Center
TAC	Tactics
TAS	True Air Speed
TBA	Training Business Area
TCO	Testing Control Office
TCTO	Time Compliance Technical Order
T.O.	Technical Order
T/N	Tail Number
TOD	Tech Order Data
TOLD	Takeoff and Landing Data
U.S.	United States
USAF	United States Air Force
USAFCENT	United States Air Forces Central
USCENTCOM	United States Central Command
VFR	Visual Flight Rules
VVI	Vertical Velocity Indication
WOW	Weight on Wheels
WST	Weapon Systems Trainer
Z	Zulu

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 31 May 2013, Lieutenant General Robert R. Allardice, Vice Commander, Headquarters Air Mobility Command (AMC) appointed Colonel Michael P. Zick to conduct an aircraft accident investigation on the 19 May 2013 crash of an C-130J, tail number (T/N) 04-3144, at Forward Operating Base (FOB) Shank, Afghanistan (Tabs Q-8 and Y-3). The investigation was based at Little Rock AFB from 9 July 2013 through 21 August 2013 and included temporary duty traveling to Afghanistan to interview witnesses and inspect the accident site (Tab Y-4). In addition to Col Zick, the following board members were also appointed to aid in the investigation: a Lieutenant Colonel Medical Member, a Captain Legal Advisor, a Captain Pilot Member, a Senior Master Sergeant Maintenance Member, a Master Sergeant Recorder, and a Staff Sergeant Loadmaster Member (Tab Y-3 and Y-5). Three Functional Area Experts (FAE) were also appointed, whose skills centered around C-130J landing gears, C-130J anti-skid brakes, C-130J propellers, and C-130J Digital Flight Data Recorders (Tab Y-7 thru Y-9).

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft accident, to prepare a publicly-releasable report, and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes (Tab BB-61 thru BB-63).

2. ACCIDENT SUMMARY

On 19 May 2013, at approximately 0950 Zulu (1420 local), a C-130J, T/N 04-3144, assigned to the 41st Airlift Squadron, 19th Airlift Wing, Little Rock AFB, Arkansas, ran off the end of a runway at FOB Shank, Northeast, Afghanistan, struck a ditch which collapsed the nose gear and eventually ripped the right main landing gear from the fuselage (Tabs N-24, Q-7, Q-8, Y-3 and DD-9). The right outboard engine struck the ground, pressurized fuel and oil lines were broken, fluid was sprayed over the cracked engine casing, and the right wing caught fire (Tab V8.1). The mishap aircraft (MA) came to full stop approximately 544 feet (ft) off the end of the paved runway surface (Tab DD-8, DD-9 and DD-13).

The MA was on an AE mission and included five active duty C-130J crewmembers from the 772d Expeditionary Airlift Squadron (19th Airlift Wing deployed), Kandahar AB, Afghanistan (Tab K-11 and K-23). Additionally, the MA had aboard six AE crewmembers from the 651st Expeditionary Aeromedical Evacuation Squadron (349th Aeromedical Evacuation Squadron), Kandahar AB, Afghanistan (Tabs K-13 and V4.2). There were no fatalities, significant injuries or damage to civilian property. The total estimated loss is $73,990,265 (Tab P-5, P-7 and P-9).

3. BACKGROUND

The 19th Airlift Wing (19 AW), located at Little Rock AFB, Arkansas, owned the MA (Tabs Q-8 and CC-9). The MA was operated by deployed members of the 41st Airlift Squadron (41 AS) (Tab K-23). The 41 AS falls under the 19 AW (Tabs G-6 and CC-11). The 19 AW and its subordinate units report to 18th Air Force (18 AF), which is the numbered air force (NAF) within Air Mobility Command (AMC) (Tab CC-3 and CC-5).

While deployed at Kandahar AB, Afghanistan, the 41 AS crewmembers are assigned to the 772nd Expeditionary Airlift Squadron (772 EAS) and fall under the 451st Expeditionary Operations Group (451 EOG), which reports to the 451st Air Expeditionary Wing (451 AEW) (Tab CC-19 and CC-23). The 451 AEW and its subordinate units report to United States Air Forces Central Command (USAFCENT), a component within United States Central Command (USCENTCOM) (Tab CC-15 and CC-17).

a. Home Units and Organizations

(1) AMC

AMC's mission is "To provide global air mobility ... right effects, right place, right time." AMC, headquartered at Scott AFB, Illinois, is a major command of the United States Air Force (USAF). AMC provides worldwide cargo and passenger delivery, air refueling and aeromedical evacuation. The command also transports humanitarian supplies to hurricane, flood and earthquake victims both at home and around the world. AMC has one NAF, 17 Wings, two airlift groups and smaller specialized units (Tab CC-3).

(2) 18 AF

18 AF's mission is "Tasking and executing all air mobility missions." 18 AF, headquartered at Scott AFB, Illinois, is the only NAF assigned to AMC (Tab CC-3). Units reporting to 18 AF include 11 airlift, air mobility and air refueling wings, one airlift group, and the Tanker Airlift Control Center (TACC) (Tab CC-3 and CC-5).

(3) 19 AW

The 19 AW mission is "Mission ready Airmen delivering premiere C-130 airlift and installation excellence." The 19 AW, at Little Rock AFB, Arkansas, is part of AMC and provides the Department of Defense (DoD) the largest C-130 fleet in the world. As part of AMC's Global Reach capability, the wing's responsibilities range from supplying humanitarian airlift relief to victims of disasters, to airdropping supplies and troops into the heart of contingency operations in hostile areas (Tab CC-7).

(4) 19 OG

The 19 OG "Plans, trains, and executes air and space power for operational levels of war." Equipped with the largest C-130 Hercules fleet in the world, the 19 OG provides part of AMC's Global Reach capability Tab (CC-23). Tasking requirements range from supplying humanitarian airlift relief to victims of disasters, to airdropping supplies and troops into the heart of contingency operations in hostile areas (Tab CC-7).

(5) 41 AS

The 41 AS mission is "To provide the best tactical airlift to the fight today and to be ready for any conflict tomorrow" (Tab CC-9). The 41 AS is part of the 19 AW at Little Rock AFB, Arkansas, and operates the C-130J aircraft (Tab CC-9 and CC-21). The 41 AS executes a three part mission, supporting the combat mission in Operation Enduring Freedom, executing AMC's worldwide mobility needs, and maintaining readiness to execute tactical airlift and airdrop missions anytime, anywhere (Tab CC-9).

b. Deployed Units and Organizations

(1) USCENTCOM

United States Central Command's mission is "With national and international partners, USCENTCOM promotes cooperation among nations, responds to crises, and deters or defeats state and non-state aggression, and supports development and, when necessary, reconstruction in order to establish the conditions for regional security, stability, and prosperity" (Tab CC-11). USCENTCOM is one of nine combatant commands in the United States (U.S.) military and its Area of Responsibility (AOR) covers the central area of the globe and consists of 20 countries (Tab CC-13).

(2) USAFCENT

United States Air Forces Central Command's mission is "To project decisive air and space power for United States Central Command (USCENTCOM) and America" (Tab CC-14). USAFCENT is the air component of USCENTCOM, a regional unified command. USAFCENT is responsible for air operations (either unilaterally or in concert) with coalition partners and developing contingency plans in support of national objectives for USCENTCOM's 20-nation area of responsibility in Southwest Asia. Additionally, USAFCENT manages an extensive supply and equipment prepositioning program at several AOR sites (Tab CC-13).

(3) 451 AEW

The 451 AEW "Provides a persistent and powerful airpower presence in the Afghanistan area of operations." The 451 AEW is located at Kandahar airfield, Kandahar International Airport, which is located 10 miles South-East of Kandahar City in Afghanistan. Kandahar Airfield is home to a large North Atlantic Treaty Organization (NATO) contingent with more than 40 countries represented on the base (Tab CC-17). The 451 AEW provides world-class tactical airlift, close air support, intelligence, surveillance and reconnaissance, command and control, airborne datalink, casualty evacuation and AE capabilities whenever and wherever needed (Tab CC-15).

(4) 451 EOG

The 451 EOG is responsible for conducting flying and AE operations for the 451 AEW. The group oversees the day-to-day operations of one A-10 Thunderbolt II squadron, one C-130 airlift squadron, an HH-60 Pave Hawk combat search and rescue squadron, an airborne datalink capability, a MQ-1 squadron, a MQ-9 squadron and control-reporting center. The 451 EOG also has command of rescue and airlift detachments at Camp Bastion. Additionally, the operations group oversees a range of support functions such as airfield management and operations, intelligence, and weather (Tab CC-17).

(5) 772 EAS

The 772 EAS operates the C-130J aircraft. The 772 EAS mission includes airland, AE, and airdrop missions (Tab CC-21). The unit transports troops, prisoners, Afghan National Army allies, distinguished visitors to or from austere locations throughout the AOR (Tab CC-23). The 772 EAS also works closely with the 451st Expeditionary Aeromedical Evacuation Squadron to provide time-critical, lifesaving support to the war fighter (Tab CC-21).

c. C-130J-30 Super Hercules

The C-130J-30 Super Hercules is a four-engine turboprop transport aircraft (Tab CC-25 and CC-26). The C-130J's basic crew includes two pilots and one loadmaster (Tab CC-27). The C-130J 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 (Tab CC-25).

The C-130J includes an advanced two-pilot flight station with fully integrated digital avionics to include color multifunctional liquid crystal and head-up displays (HUD) and state-of-the-art navigation. The aircraft also features fully integrated defensive systems, low-power color radar, digital moving map display and a digital auto-pilot. The C-130J also includes an improved fuel management, environmental, and enhanced cargo handling systems over previous models (Tab CC-25 and CC-26).

d. FOB Shank

FOB Shank (OASH) is located approximately 40 miles South of Kabul, Afghanistan (Tab DD-55). Runway 34 Right/16 Left is primary and is 6,827 ft long by 90 ft wide (Tab DD-59). Field elevation is 6,809 ft (Tab DD-66). When landing Runway 34 Right, there is a 1.5 degree down slope coupled with a "W" gradient effect consisting of two pronounced "hills." Due to the mountainous terrain and the potential for visual illusions while on final and on the ground, AMC declared (USAFCENT adopted) this a special Pilot in Command (PIC) airfield. This requires one pilot on the crew to have operated to or from the airfield in the past 12 calendar months (Tab V3.1 and DD-68).

4. SEQUENCE OF EVENTS

a. Mission

The MC was alerted for a routine Afghanistan AE mission to transport patients from Kandahar AB, to Camp Bastion, to FOB Salerno, to FOB Shank, deliver them to Bagram AB and return to Kandahar AB upon mission completion (Tabs K-13, K-25, V4.3 and V4.4). The mission was tasked by the theater's Air Mobility Division (AMD) and authenticated by the 772nd Expeditionary Airlift Squadron Assistant Director of Operations (772 EAS/ADO) on 18 May 2013 (Tabs K-11 and DD-67).

The MC consisted of Mishap Pilot 1 (MP1), Mishap Pilot 2 (MP2), Mishap Pilot 3 (MP3), Mishap Loadmaster 1 (MLM1) and Mishap Loadmaster 2 (MLM2) (Tab K-11). MP1 was the aircraft commander all day and was seated in the left pilot seat on the flight deck (if standing at the tail of the aircraft and looking forward at the nose, the left seat is on the left) (Tabs K-11 and V21.3). The aircraft commander is the one responsible for the safe accomplishment of the tasked mission (Tab V21.2). MP2 was the copilot and was seated in the right seat on the flight deck (Tab V24.3). MP3 was an extra pilot and occupied the seat located between MP1 and MP2, immediately aft of the center flight deck console (Tab V25.2). MLM1 was seated at the right paratroop door in the aft section of the cargo compartment (Tab V17.3). MLM2 was seated at the left paratroop door in the aft cargo compartment (Tab V19.2).

Figure 1. Photo of a C-130J cockpit and 3 pilot stations

The C-130J has a combat crew composition of two pilots and two loadmasters (Tab V2.2). The usual four-person hard crew, which included MP1, MP3, MLM1 and MLM2, had an additional pilot on 19 May 2013 (Tabs K-11 and V2.1). MP2 was the additional pilot (Tab V2.1). At the time of the mishap, MP2 was working in the 772 EAS Tactics shop and did not regularly fly missions (Tab V2.1 and V25.3). In order to keep MP2 current in the aircraft and familiar with procedures found within the AOR, it was normal practice to assign staff members as guest help on routine missions (Tab V21.3 and V25.3). This particular mission was assigned to MP2 by the 772 EAS/DO and he felt there were no Operational Risk Management (ORM) concerns (Tab V2.1).

b. Planning

Mission planning was normal (Tab V25.22). Planning for this tasking began on 18 May 2013 for a mission on 19 May 2013 (Tab V2.1 and V2.2). As with most missions within the AOR, the squadron Tactics shop for the MC accomplished much of the planning. This planning included assembling the crew's mission binder that holds all current flight products (e.g. weather reports, airfield notices, and intelligence reports) (Tab V3.1). After the binder is assembled, it is the duty of the Tactics and Intel shop to brief the particulars of each mission to the crews following their show-time (Tab V2.2 and V3.1). On the day of the mishap, the MC "showed" at the 772 EAS at 0430Z (2+30 hours prior to planned departure of 0700Z) and signed out aircrew flight equipment consisting of night vision goggles (NVGs), survival equipment and other personal professional gear. Then all crewmembers attended the mission brief and acknowledged they had received all the current material by initialing the Flight Crew Information Files (FCIFs), special instructions (SPINS), read files and a monthly emergency procedures test (Boldface) (Tab K-17). During the mission brief, the MC took note that gusty winds would be a factor of concern for the mission (Tab V24.20 and V24.21).

c. Preflight

Preflight was normal (Tab V21.4). Following the MC's mission brief, the MLM1 and MLM2 stepped to the aircraft to begin preflight checks (Tab V17.14). While the two loadmasters were

at the aircraft, the three pilots completed airfield study (Tab V17.13 and V17.14). MP1 received a final brief from the DO, which included an ORM review and possible mission concerns (Tab V2.1, V21.21 and V21.23).

The Air Force ORM program is a logic based, common sense approach to making calculated decisions on human, material, and environmental factors before, during and after all operations (Tab BB-12). The MC's risk assessment was signed off by the 772 EAS/DO due to them scoring in the "Medium Risk" category (risk score of 73) (Tabs K-19 and V21.23). The elevated risk was due to the experience levels of MP1, MP2 and MLM2, as well as mission and environmental factors (Tabs K-19 and V21.24). The 451 EOG ORM worksheet implements the program by categorizing and identifying mission, environmental, weather, and airfield factors that could increase risk to mission accomplishment (Tab K-19).

Following the DO brief, MP1 stepped to the aircraft (Tab V21.21). As normal for AE missions, the MC and AE crewmembers met for a coordination brief at the aircraft prior to takeoff (Tab V4.4 and V21.4). They discussed mission specifics relating to the safe transportation of expected medical patients (Tab V5.1 and V24.21). No concerns were noted from the aircraft forms, the aircraft walk-around, preflight checks or engine start (Tab V21.21 and V21.22).

d. Summary of Accident

The scheduled take-off time at Kandahar AB (OAKN) was 0700Z, but the crew received permission for a 30 minute early departure and took off at 0630Z without incident. Prior to FOB Shank (OASH), the MC stopped at Camp Bastion (OAZI) and FOB Salerno (OASL) picking up one ambulatory patient from each location (Tab K-25). At Camp Bastion, MP2 accomplished the landing with MP1 performing pilot-monitoring duties (Tab V24.5). The MA departed Camp Bastion for FOB Salerno at 0739Z. The MA arrived at FOB Salerno at 0900Z (Tab K-23). MP1 accomplished that landing with MP2 performing pilot-monitoring duties (Tab V24.5). The flights from Kandahar AB, to Camp Bastion, to FOB Salerno were normal (Tab V21.4).

At approximately 0925Z, the MA departed FOB Salerno for FOB Shank (Tab K-23). At 0942Z, the reported weather conditions at FOB Shank were 5,000 meters of visibility with dust and haze, temperature 29 degrees Celsius, altimeter setting at 30.04, with winds 240 degrees at 18 knots gusting to 26 knots (Tab N-13). Originally, MP1 had planned for MP2 to fly the approach and complete the landing, but due to high crosswinds reported by Air Traffic Control (tower), MP1 decided to accomplish the landing instead (Tab V24.6).

During the first attempt at landing, MP1 briefed a 100% flap Maximum Effort Landing (Tab N-15 and N-17). A Maximum Effort Landing is a 100% flap landing flown at slower speeds than a normal 100% flap landing and results in shorter landing distances (Tab V21.6). After executing an approach to runway 34R, the MC determined they were too high and too fast, so a go-around was initiated at 0946:58Z (Tabs N-18, N-19, and V24.8). A go-around is an approach to landing that is aborted before or after touchdown (Tab V16.1). Following the go-around, the MC requested and was approved a right overhead (right traffic pattern) in order to reattempt the landing (Tabs N-19 and V21.7).

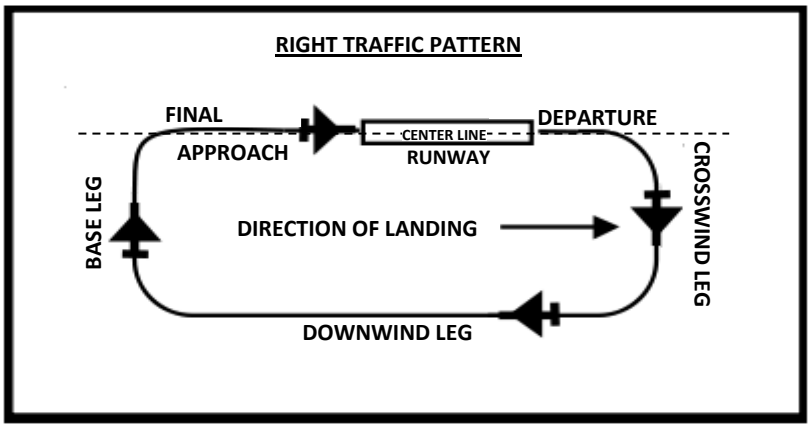

Figure 2. Photo of Right Traffic Pattern

At 9:48:35Z, while the MA was on a 160 degree heading (downwind leg), tower reported winds 250 degrees at 23 gusting to 28 knots, a straight crosswind (Tab N-20 and N-21). MP2 later testifies that the HUD indicated a quartering tailwind for final, but does not verbalize the indication (Tab V24.10 and V24-12). Shortly thereafter, prior to turning right (base leg), MP1 decided to fly a 50% flap approach due to the high crosswinds (Tabs N-21, N-22 and V21.7). Although 100% flap approaches are the normal landing configuration for a C-130J, 50% flap approaches improve roll control in high crosswind conditions. Landing with flaps set at 50% is carried out in a similar fashion to a 100% flap landing, however longer landing distances are required (Tab BB-41). Just after the MA turns base leg, tower broadcasts new winds to another aircraft within the air traffic control area. Those winds were reported as 230 degrees at 19 gusting to 28 knots (Tab N-22). This created a tailwind component of approximately 10 knots, but there is no evidence that the crew took note of the reported wind shift (Tabs N-22 thru N-24 and DD-63). Additionally, the aircraft's flight data recorder showed the MA experienced an approximate 17-knot tailwind component at touchdown (Tab DD-9 and DD-10).

As the MA turned for landing, MP1 overshot the extended centerline of the runway and had to correct back in order to line-up with the runway (final approach). When the MA was established on final approach, the aircraft was approximately .5 miles from the runway (Tab V24.10).

Once established on final, MP2 testified everything looked good except the MA was not slowing and was approximately 20 KIAS too fast (Tab V24.10). Note, KIAS is airspeed as reported to the pilots on the primary airspeed indication system (Tab V16.1). Just prior to touchdown MP2 stated, "100 ft, you're fast." No reference to how fast was verbalized (Tab N-24). At 0950:31Z, the MA speed was 148 KIAS (169 knots true airspeed and 187 knots ground speed) and made initial touchdown with the aft main landing gear only, 27 KIAS faster than the computed touchdown speed of 121 KIAS (Tabs V24.13, V24.14, Z-13 and DD-10). Touchdown was light, approximately 1,500 ft past the approach end of the runway, slightly long, with 5,500 ft of runway remaining (Tabs V11.2, V21.10, DD-9 and DD-12).

Figure 3. Recreation photo of CNIMU displaying 50% flap approach speeds

With crew-entered winds of 250 degrees at 23 gusting to 28 knots, the computed landing distance for a 50% flap landing, was 5,147 ft (Tabs J-15 and Z-15). The crew-entered runway distance available, was 6,827 ft (Tab J-15). The MC concluded that they had enough available runway distance to land (Tabs N-21, V21.7 and V24.11).

Figure 4. Recreation photo of CNIMU displaying 50% flap landing distance

After the main landing gear touched down, MP1 held the nose wheel up for approximately four seconds and delayed maximum antiskid braking for approximately eight seconds after the nose wheel came down (Tabs V16.4, V24.14, DD-9 and DD-10).

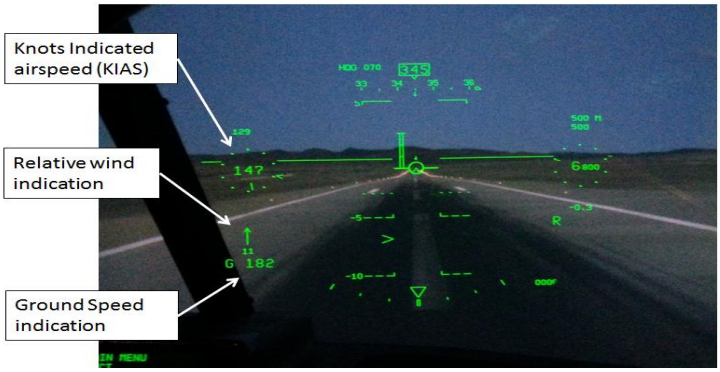

Figure 5. Recreation of the C-130J HUD showing a fast touchdown with tailwind

At 0950:35Z MP2 stated "four board," indicating that the aircraft was about to pass the marker that designates 4,000 ft to go before the end of the runway (Tabs V24.14 and DD-10). The aircraft's nose tire was on the ground at this time (Tab V24.14).

At 0950:41Z an Advisory Caution and Warning System (ACAWS) alert for Anti-Skid Fail occurs (Tab DD-9 and DD-53). The MC did not notice the caution (Tabs N-24 and V21.16).

At 0950:43Z, the MA was traveling at 140 KIAS, 160 KTAS, with a ground speed of 169 knots. MP1 stated, "alright, brakes" and began applying full anti-skid braking and power reversing (Tab DD-10). At that point, the MA had approximately 2,200 ft to go to the end of the paved runway surface (including the 300 ft overrun) (Tab DD-7, DD-9, DD-10 and DD-12). Almost immediately after braking and moving the power levers into full reverse, the MA experienced a directional control problem abruptly veering to the left side of the runway coming close to the edge (Tabs V9.1, V21.12, V26.4, DD-9 and DD-10). MP1 uses differential braking (full right brakes) with minor nose wheel steering to regain control of the aircraft and stop it from diverging even more (Tab V22.2). The MA started to correct back towards the runway centerline with approximately 1000 ft of paved runway surface remaining and was traveling 97 KIAS, 111 KTAS, and 131 knots ground speed (Tabs V7.2, DD-9 and DD-12). At that time, MP1 began to use maximum brake pedal deflection in order to stop the MA before it departed the paved runway surface (Tab V21.15). Note, MP1 stated that the brakes did not feel normal and did not slow the aircraft as expected (Tab V21.1 and V21.27). At 0950:52Z, MP1 states "going off… everybody hold on" to the crew (Tab N-24).

e. Impact

At 0950:55Z, the MA departed the paved runway surface traveling at approximately 49 KIAS, and 69 knots ground speed (DD-9 and DD-12). It traveled approximately 440 ft before it struck a ditch, which collapsed the nose gear and ripped the right main landing gear from the fuselage (Tabs V20.6, DD-7, DD-9, DD-10 and DD-12). The right outboard engine struck the ground, and pressurized fuel and oil lines broke, fluid sprayed over the cracked engine casing and the right wing caught fire (Tab V9.1). The aircraft came to a complete stop approximately 544 ft past the end of the paved runway surface (Tab DD-8, DD-9, DD-12 and DD-13).

Figure 6. Photo of the MA at the crash site.

Figure 7. Photo of the MA at the crash site.

f. Egress and Aircrew Flight Equipment (AFE)

After the MA came to a complete stop, the MC, AE crew and two ambulatory patients quickly egressed the aircraft through the flight deck overhead escape hatch (Tab V18.4, V18.5 and V21.17). Evacuation through the flight deck hatch was necessitated by the fire on the right wing, extensive damage, loss of electric power, and spinning propellers on the left wing (Tab V18.4, V21.17, V21.18 and V24.18). MP3 was the first out of the aircraft in order to help individuals down from the fuselage (Tab V25.12). MLM2 was the last out of the aircraft and ensured 100% accountability (Tab V17.10 and V19.7). Upon exit, all individuals rallied 600 ft off the nose of the aircraft to take another head count and to get everyone to a safe distance due to the aircraft being equipped with hazardous flares on board (Tab V17.11, V21.18 and V25.12).

g. Search and Rescue (SAR)

Immediately following the accident, the airfield control tower contacted Crash-Fire-Rescue, the Task Force Battle Captain, and base Command Post (Tabs R-5 and DD-18). Crash-Fire-Rescue arrived on the scene within minutes and the crew was reported safe and accounted for (Tab R-9 and R-17). By 1001Z (1431L), Personnel Recovery, Safety Office, the Flight Surgeon and Chaplain were notified (Tab DD-17 and DD-18). There were no fatalities or significant injuries reported (Tab DD-17).

h. Recovery of Remains

Not applicable.

Airspeed Upon Landing				
Location	KIAS	KTAS	GS (kts)	(ft)Distance Remaining
A	148	169.8	187	5493
B	144.5	165.5	180	4257
C	143	168.3	174.5	3061
D	138.5	158.7	171.5	2479
E	139.5	159.7	168.5	1850
F	139.5	159.7	168.5	1794
G	130.5	149.4	165	1626
H	116.5	133.3	148	1100
I	97	110.9	130.5	632
J	65	75	93.5	-124
K	49.5	56.2	69	-532/232*
L	40.5	--	62.5	-642/342*
M	35.5	--	54.5	-740/440*

*distance past edge of paved surface
- distance past marked end of runway

Figure 8. Airspeed Landing Roll Chart

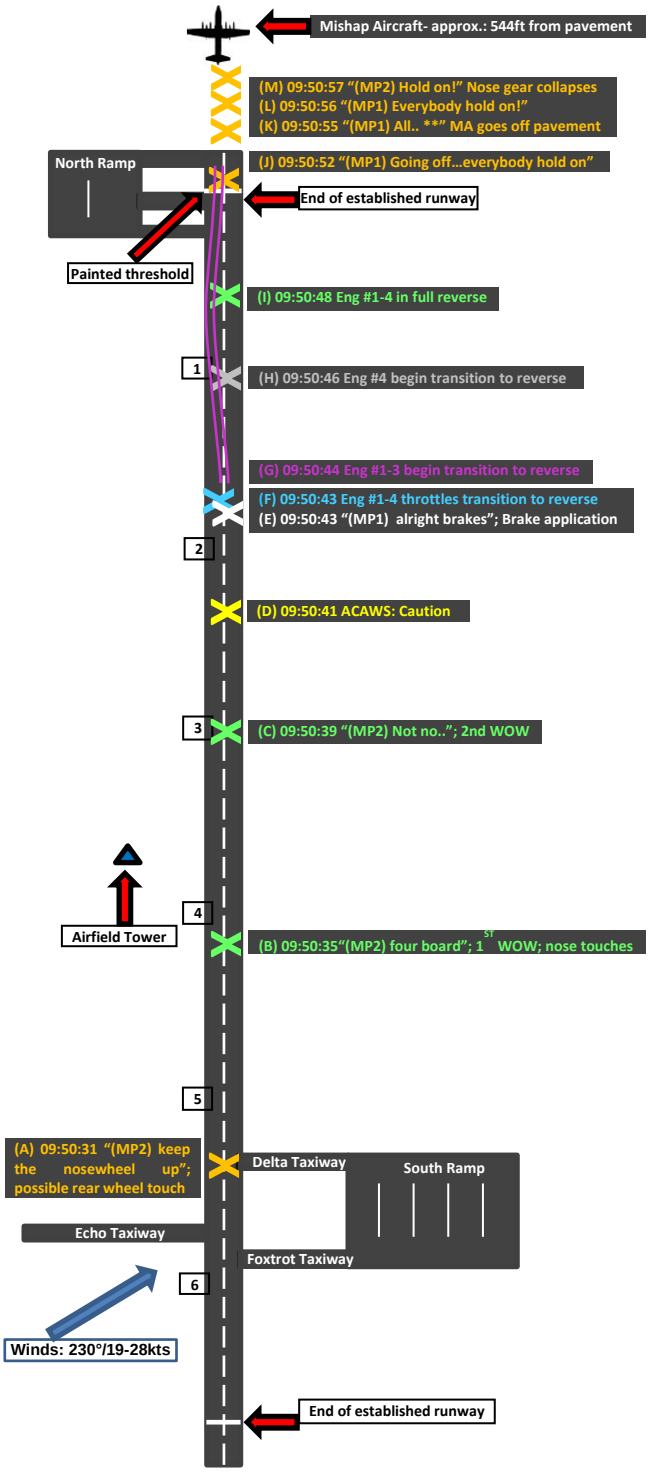

Figure 9. FOB Shank Events Diagram

5. MAINTENANCE

Maintenance was not seen as a factor in this mishap.

a. Forms Documentation

The 19th Aircraft Maintenance Squadron (19 AMXS), Little Rock AFB, Arkansas, and the 379th Expeditionary Aircraft Maintenance Squadron (379 EAMXS), Kandahar AB, Afghanistan, maintain the aircraft forms for the MA. Maintenance technicians document specific tasks performed on the MA using Air Force Form 781H and 781A in accordance with T.O. 00-20-1. The data is then entered into an electronic database in accordance with T.O. 00-20-2 (Tab DD-31). Maintenance utilizes two different databases to store aircraft records, the Integrated Maintenance Data System (IMDS) and the Data Transfer and Diagnostic System (DTADS). IMDS is a core-automated database used for tracking aircraft discrepancies, repair events, and aircraft flight history (Tab BB-66). 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-46). A comprehensive review of the IMDS history and 781H and 781A forms from June 2011 to May 2013 as well as all available DTADS history showed no evidence to suggest any maintenance correlation to the mishap. However, the 781A form did contain one error that bears mentioning. On 13 May 2013, the right forward brake was replaced and the technician neglected to document a brake operational check. However, there was no evidence to show that this discrepancy was relevant to the mishap (Tabs U-16, U-17, DD-31 and DD-32).

b. Time Compliance Technical Orders

TCTOs are the authorized method of directing and providing instructions for modifying military systems and end items or performing one-time inspections. TCTOs are categorized as Immediate Action, Urgent Action, Routine Action, Routine Safety Action and Record. The category determines the compliance period (Tab BB-22). Historical records showed that all required TCTOs had been accomplished on the MA in accordance with applicable guidance (Tab DD-31).

c. Inspections

The C-130J undergoes aerospace vehicle manufacturer inspections in intervals that are prescribed by TO 1C-130J-6, *USAF Series C-130J Aircraft*, 01 July 2011 (Tab BB-54). These include various "Letter" Checks, A – D (Tab BB-13 thru BB-15). A and B checks are considered minor inspections, while C and D are considered major inspections (Tab BB-18). Inspections are conducted on 270-day intervals (Tab BB-52). A review of the historical and active records revealed that on 28 February 2013 the aircraft weight and balance record was recertified (Tab U-3). 19 AMXS conducted an "A" Check (isochronal inspection) on the MA (Tabs U-5, BB-52 and BB-54). On 15 January 2013, the 19th Equipment Maintenance Squadron (EMS) completed a "C" Check (Tabs U-6, U-7, BB-52 and BB-54). Between 13 and 18 May 2013, the 400-hour propeller inspections were completed (Tabs U-8 thru U-15 and Tab BB-55). A Combined Basic Post-Flight/Pre-Flight inspection was accomplished on 17 May 2013 and a Thru-Flight inspection was completed on 18 May 2013 (Tabs D-5, BB-15, BB-16 and BB-54).

The Production Superintendent cleared the MA for flight and signed the exceptional release prior to flight (Tab D-5). "Exceptional Release" is a forms inspection performed by a qualified Senior NCO or other designated personnel. An exceptional release is required before flight and serves as a certification that the authorized individual reviewed the active forms to ensure the aircraft is safe for flight (Tab BB-19). The MA's inspections were current and in accordance with T.O. 1C-130J-6 and did not contribute to the mishap. Only one issue was identified. No one in the squadron is documented as qualified to complete an "A" check in the Training Business Area (TBA) (Tab DD-31). TBA is an electronic data base located within IMDS where all maintenance training records are maintained (Tabs BB-68 and DD-31). Further research revealed that during reorganization of work centers and task groups the "A" Check task was lost from all personnel records. Leadership and the immediate supervisor of the individual who completed the inspection stated that the technician was qualified and this was a documentation error (Tabs U-5 and DD-31).

d. Maintenance Procedures

A complete review of the maintenance records for the MA showed all maintenance actions and documentation were accomplished in accordance with standard maintenance practices and applicable T.O.'s with the exception of one minor documentation error. This is addressed in paragraph 5a above (Tab DD-32).

e. Maintenance Personnel and Supervision

The 19 AMXS, EMS, active duty, civilian and contract personnel along with the 379 EAMXS performed scheduled and unscheduled maintenance. Training records for all available personnel who completed maintenance actions on the MA were reviewed. All maintenance was performed by qualified personnel. The review discovered only one minor documentation error dealing with TBA. This is addressed in paragraph 5c above (Tab DD-31).

f. Fuel, Hydraulic, and Oil Inspection Analyses

The Air Force Petroleum Agency (AFPET) at Wright-Patterson AFB, Ohio, analyzed the fuel, hydraulic and oil of the MA. AFPET determined that the fuel, hydraulic fluid, and oil samples met material test requirements (Tab D-53 thru D-63). These items did not contribute to the mishap. Note, the left outboard and left inboard engines (number one and two respectively) were inaccessible and therefore not tested. The right outboard engine (number four) had extensive fire damage and did not have a fuel sample taken (Tabs V7.1, V7.2, V9.1 and DD-32).

g. Unscheduled Maintenance

A comprehensive review of the IMDS history and available 781A forms for the prior 12-months disclosed the following unscheduled maintenance: the right forward brake was replaced on 13 May 2013 (Tab U-16 and U-17). The landing gear control panel was replaced on 18 May 2013 (Tab U-18 thru U-24). There was one minor documentation error; this is addressed in paragraph 5a above.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

Airframe, Missile, or Space Vehicle Systems were not seen as a factor in this mishap.

a. Condition of the Structures and Systems

Because of the MA's impact with the ditch and subsequent fire, many parts were badly damaged or unrecoverable (Tab DD-29). None of the parts recovered and tested showed any indication of a malfunction (Tabs J-3, J-4 and V15.1). There was no indication that the pre-crash condition of any of the aircraft systems and structures was a factor in the mishap (Tab DD-32 thru DD-33 and DD-54).

b. Technical Reports and Engineering Evaluation

1. Anti-Skid Control Unit

Crane Aerospace & Electronics (Crane) conducted analysis on the anti-skid control unit. The test showed several test points out of calibration limits (Tab J-3). This would not have affected brake control and did not cause a fault when tested at crane. Tests concluded that the anti-skid system was functional and would have provided anti-skid protection (Tabs J-3, J-4 and V15.1).

2. Wheel Speed Transducers

Crane Aerospace & Electronics conducted analysis on the wheel speed transducers. All transducers passed a functional test. The right forward transducer failed the torque test and may have caused an "Anti-Skid Fail" caution. All systems tested at Crain were fully functional and would have functioned as designed (Tabs J-4 and J-9 and V15.1).

3. Brakes

MP1 stated that the brakes did not feel normal and did not slow the aircraft as expected (Tab V21.13). The brakes were examined and were found to be in serviceable condition (Tab V7.1). There was an anti-skid fail caution on the DTADS download at 0950:40Z (Tab DD-53). The anti-skid components were tested and found to be serviceable. This is addressed in paragraphs b1 and b2. A couple of factors could be the reason for what the MC experienced. If you put too much energy into the brakes and the brakes heat up, several things can occur. You could have brake fires. You could melt fuse plugs. Also, brake performance degrades as the brakes get hotter – this is called brake fade. There is not always visible indications of brake fade or clear signs that the brakes were over temped (over heated). (Tab V14.1 and V14.2).

4. Digital Flight Data Recorder (DFDR)

The Chief of C-130 Avionics Section, Robins AFB, Georgia, analyzed the DFDR and assisted the maintenance member in reading the data (Tab V12.1).

c. Testing and Analysis

1. CNIMU - Crew Input TOLD

Lockheed Martin analyzed the Communication Navigation Information Management Unit (CNIMU) from the MA and was able to recover crew input weight and wind information that helped determine calculated landing distances (Tabs J-13 thru J-16). Information of fuel status was missing on the recovered CNIMU but was stored on the MA's DFDR (Tabs V12.1 and DD-61). Based on that fuel weight (approximately 15,800 lbs), the AIB was able to recreate what the CNIMU showed for approach speeds (Tabs Z-13 and DD-61). An APP (approach) speed of 139 KIAS, and a TD (touchdown) speed, of 121 KIAS was computed (Tab Z-13). Note, the speeds shown take into account a 5-knot wind gust increment off crew-entered winds of 250 degrees at 23 knots, gusting to 28 knots (J-15). As a result, the CNIMU raised the touchdown speed by 5 knots due to the gust in accordance with T.O. 1 C-130(C)J-1-1 (Tabs Z6 and BB-27).

2. C-130J Weapon System Trainer Simulator

a. Test Explanation

On 21 July 2013 and 23 July 2013, the AIB Pilot Member flew approximately 30 approaches and landings in a C-130J-30 Weapon Systems Trainer (WST) simulator at Little Rock AFB, Arkansas. The simulator's software was designed to replicate FOB Shank runway 34R and the flight characteristics of a C-130J-30 aircraft. During the tests, the AIB Pilot Member flew different landing scenarios to recreate and to help identify causal and contributing factors relevant to the 19 May 2013 mishap. These factors included: 1) a landing touchdown speed 27 KIAS faster than intended; 2) a delay of 12 seconds from touchdown to actuating brakes; 3) a unreported tailwind component of 14 knots; 4) asymmetric reversing of engines causing a directional control problem that results in the aircraft veering left (Tab DD-3 thru DD-5).

b. Landing Scenarios

The following scenarios were utilized during the approach and landing (aircraft gross weight 109,800 lbs) (Tab DD-3 thru DD-5):

1. Scenario 1

Landing 50% flap approach into 34R, at 148 KIAS, with tailwind of 14 knots and delaying 12 seconds from touchdown to brake application with asymmetric engine reversing (Tab DD-3 thru DD-5).

2. Scenario 2

Landing 50% flap approach into 34R, at 148 KIAS, with tailwind of 14 knots and delaying 12 seconds from touchdown to brake application with symmetric engine reversing (Tab DD-3 thru DD-5).

3. Scenario 3

Landing 50% flap approach into 34R, at 148 KIAS, with no tailwind and delaying 12 seconds from touchdown to brake application with symmetric engine reversing(Tab DD-3 thru DD-5).

4. Scenario 4

Landing 50% flap approach into 34R at 148 KIAS with no tailwind and actuating brakes after 4 second nose wheel touch down delay (approximately 4,000 ft of runway remaining,) with symmetric engine reversing once below 145 KTAS (Tab DD-3 thru DD-5).

c. Results

Under all the above landing scenarios, when touching down 27 KIAS fast, the aircraft went off the end of the runway (Tab DD-3 thru DD-5).

Additionally, in recreation of the exact mishap scenario, a safe go-around could have been executed all the way up to the point where MP1 initiated breaks and reverse (approximately 2000 ft remaining). The MA was at 139 KIAS (168 knots ground speed, 160 KTAS) at that point. In simulation, a go-around was able to pass over the end of the runway at 150 ft (Tab DD-4 and DD-5).

7. WEATHER

Weather was a factor in this mishap, but not substantially.

a. Forecast Weather

The FOB Shank forecasted weather at the time of the mishap: Winds from 230 degrees at 12 knots gusting to 18 knots, visibility 8,000 meters with blowing dust, cloud cover scattered at 12,000 ft above ground level and altimeter setting 30.01 inches of Mercury (inHg) (Tab F-4). Additionally, weather advisory was in effect for winds gusting 25 to 35 knots (Tab F-3).

b. Observed Weather

In the 15 minutes preceding the mishap, winds ranged from 200 to 250 degrees gusting from 6 to 28 knots (Tab N-8 thru N-24). At the time of the mishap, the weather reported to the MC from FOB Shank Air Traffic Control tower was winds from 250 degrees at 23 knots gusting to 28 knots, visibility was 5000 meters with dust and haze (Tab N-21). Additionally, prior to touchdown, at 0949:08, the weather reported to another aircraft was a wind from 230 degrees at 19 knots gusting to 28 knots (Tab N-22). A special weather observation issued just after the mishap (roughly three minutes later) reported winds from 220 degrees at 8 knots gusting to 24 knots, temperature 29 degrees Celsius (Tab F-5).

c. Space Environment

Not applicable.

d. Operations

The mission was operating within acceptable weather standards. Nothing was noted for the day of the mission other than the weather shift with gusty winds (Tab V2.2.). Wind never exceeded a crosswind component of 28 kts, which is within the MA's crosswind landing limitation (Tabs N-8 thru N-24 and V16.2).

8. CREW QUALIFICATIONS

Crew Qualifications were not seen as a factor in this mishap.

a. Mishap Pilot 1 (Left Flight Deck Seat)

MP1 was a current and qualified Aircraft Commander in the C-130J-30. MP1 had 904.4 total hours in the C-130J-30, 416.3 primary hours, 278.7 secondary hours, and 209.4 other hours. Of the 904.4 total hours flown, 188.5 hours were as an Aircraft Commander, 477.7 flying hours were combat hours and 23.5 were combat support hours (Tab G-6). In accordance with AMC restrictions designating FOB Shank as a special Pilot in Command (PIC) airfield, MP1 had flown into the airfield in the last 12 months (Tabs V2.2 and DD-58).

MP1's flight time for the 90 days before the mishap was as follows (Tab G-7):

	Hours	Sorties
Last 30 Days	56.6	48
Last 60 Days	105.3	106
Last 90 Days	151.0	134

b. Mishap Pilot 2 (Right Flight Deck Seat)

MP2 was a current and qualified Pilot in the C-130J-30. MP2 had 252.1 total hours in the C-130J-30, 110.8 primary hours, 49.6 secondary hours and 91.7 other hours. 38.4 flying hours were combat hours and 6.0 were combat support hours (Tab G-26). In accordance with AMC restrictions designating FOB Shank as a special PIC airfield, MP2 had flown into the airfield in the last 12 months (Tabs V24.3, V24.4 and DD-58).

MP2's flight time for the 90 days before the mishap is as follows (Tab G-27):

	Hours	Sorties
Last 30 Days	18.3	19
Last 60 Days	29.7	29
Last 90 Days	64.9	41

c. Mishap Pilot 3 (Center Flight Deck Seat)

MP3 was a current and qualified Pilot in the C-130J-30. MP3 had 611.1 total hours in the C-130J-30, 349.6 primary hours, 149.5 secondary hours and 112.0 other hours. 305.9 flying hours were combat hours and 4.8 were combat support hours (Tab G-44). In accordance with

AMC restrictions designating FOB Shank as a special PIC airfield, MP3 had flown into the airfield in the last 12 months (Tabs V2.2 and DD-58).

MP3's flight time for the 90 days before the mishap is as follows (Tab G-45):

	Hours	Sorties
Last 30 Days	56.6	48
Last 60 Days	105.3	106
Last 90 Days	151.0	134

d. Mishap Loadmaster 1 (Right Aft Paratroop Door)

MLM1 was a current and qualified Loadmaster in the C-130J-30. MLM1 had 767.6 total hours in the C-130J-30, 727.8 primary hours and 39.8 other hours. 396.1 flying hours were combat hours and 4.8 were combat support hours (Tab G-76).

MLM1's flight time for the 90 days before the mishap is as follows (Tab G-77):

	Hours	Sorties
Last 30 Days	56.6	48
Last 60 Days	105.3	106
Last 90 Days	151.0	134

e. Mishap Loadmaster 2 (Left Aft Paratroop Door)

MLM2 was a current and qualified Loadmaster in the C-130J-30. MLM2 had 236.4 total hours in the C-130J-30, 208.2 primary hours and 28.2 other hours. 137.1 flying hours were combat hours and 4.8 were combat support hours (Tab G-62).

MLM2's flight time for the 90 days before the mishap is as follows (Tab G-63):

	Hours	Sorties
Last 30 Days	56.6	48
Last 60 Days	105.3	106
Last 90 Days	151.0	134

9. MEDICAL

Medical was not seen as a factor in this mishap.

a. Qualifications

All Mishap Crewmembers were physically qualified without restrictions for the crew duties they were performing at the time of the mishap (Tab X-4). Only one member of the crew, MLM2, possessed an aeromedical waiver. It was deemed not to be a factor in the mishap (Tab X-4).

b. Health

At the time of the mishap, all crewmembers were in good health and denied acute medical illness or injury (Tab X-4). During egress from the mishap aircraft, MP1 and MLM1 received minor injuries to their hands and MP3 received superficial injuries to his lower legs. MP2 and MLM2 received no injuries during the mishap (Tab X-4).

c. Pathology

Blood and urine samples were collected from all five crewmembers. The samples were submitted to the Armed Forces Institute of Pathology for toxicological analysis. All blood samples tested negative for elevated carbon monoxide levels or ethanol. The urine drug screening tests were negative for amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, opiates and phencyclidine. The urine of MP3 tested positive for a medication that was prescribed to him as part of the overall fatigue management and mitigation program and a metabolite of that medication. Use of this medication was not a factor in this mishap (Tab X-4 and X-5).

d. Lifestyle

No lifestyle factors were found to be relevant to the mishap. Witness testimony and medical record reviews for the mishap crew did not reveal any significant or unusual habits, behaviors, or stressors (Tab X-5).

e. Crew Rest and Crew Duty Time

According to AFI 11-202, Volume 3, *General Flight Rules*, 22 October 2010, paragraphs 9.4.6 and 9.7.2, the Flight Duty Period (FDP) begins when an aircrew member reports for a mission, briefing, or other official duty and ends when engines are shut down at the end of the mission, mission leg, or a series of missions. The maximum FDP for tanker/transport such as the C-130J is 16 hours (Tab BB-59). At the time of the mishap, the mishap crew had been 8 hours 20 minutes into their FDP (Tabs K-17 and Q-7). The Mishap Crew's FDP was not a factor in this mishap.

AFI 11-202, Volume 3, Paragraph 9.8, states that aircrew require at least 10 continuous hours of restful activities (including an opportunity for at least 8 hours of uninterrupted sleep) during the 12 hours immediately prior to the FDP (Tab BB-59). All members of the mishap crew had appropriate crew rest and had not exceeded their crew duty day at the time of the mishap (Tabs K-17, Q-7 and X-5). Crew rest was not a factor in this mishap.

Additionally, MP1's data from the preceding six days prior to the mishap was entered into the Fatigue Avoidance Scheduling Tool (FAST). FAST is a commercially available tool developed in conjunction with the USAF to predict times of fatigue and assist schedulers in not scheduling critical tasks during times of maximum fatigue. At the time of the mishap, FAST predicted that MP1 was still in the "good" range for fatigue and alertness (Tab X-5).

10. OPERATIONS AND SUPERVISION

Operations and Supervision were not seen as a factor in this mishap.

a. Operations

The 41 AS arrived in Kandahar, Afghanistan in March 2013 (Tab V2.22). The first mission flown by the MC was on 13 March 2013 (Tab G-13). In the months leading up to the mishap, the 772 EAS experienced an average operations tempo where crews were flying every-other-day with an FDP ranging from 10 to 14 hours (Tab X-5). On the day of the mishap (19 May 2013), the MC showed to the 772 EAS at 0430Z and was scheduled to make a final return to Kandahar at 1430Z, a FDP of 10 hours (Tab K-17 and K-25).

b. Supervision

The 41 AS preparation for this deployment started eight to nine months prior to departing Little Rock AFB (Tab V2.2). The preparation began with building crews based on experience levels, qualifications, personalities and availability. The MC was average in experience when compared with other 41 AS crews tasked on this deployment (Tab V2.1). The 41 AS developed a pre-deployment preparation program consisting of ground training and two Off Station Trainer (OST) missions to Reno, Nevada (Tab V2.2). The particular location of the OST was selected to replicate the high-pressure altitudes that crews would encounter in Afghanistan and was conducted between 10 to 14 January 2013 and 24 to 28 January 2013 (Tab V2.2, V2.22 and V2.28 thru V2.30). The ground training objectives focused on heavy weight operations, airland and airdrop vertical profile planning, austere base ground operations, combat crew resource management, and the complications of deployed Air Traffic Control (ATC) communications (Tab V2.2 and V2.26). The training included formation flying, airdrops, simulated hostile engagements and simulated aircraft emergencies. Additionally, as part of their ground training, crews received instruction on high-pressure altitude operations, and mountain flying. The MC participated in all segments of this pre-deployment training (Tab V2.1, V2.20, V2.25, V2.5, and V2.7).

11. HUMAN FACTORS

Human Factors substantially contributed to this mishap.

a. Introduction

AFI 91-204, *Safety Investigations and Reports,* Attachment 5, contains the Department of Defense Human Factors Analysis and Classification System, which lists potential human factors that can play a role in mishaps. It is designed for use by members of an investigation board in order to accurately capture the complex layers of human error in context with the individual and mishap or event (Tab BB-3 and BB-4). The analysis below lists the human factors directly involved in this mishap with their definitions.

b. Applicable Factors

(1) 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. Channelized attention may be described as a tight focus of attention that leads to the exclusion of comprehensive situational information (Tab BB-7).

The mishap crew, particularly MP1, was consumed with landing the aircraft under difficult conditions including high crosswinds which led to the crew not perceiving the dangers of a tailwind, high landing speed or distance from the end of the runway on initial touchdown (Tabs N-23, V21.10, V21.12, V22.7, BB-38 and DD-3).

T.O. 1C-130J-1 states "due to rapid engine response and the lift generated by the propeller wash over the wings, a four engine go-around can be safely executed at any time during the approach and even after touchdown, if necessary" (Tab BB-32). After the initial touchdown MP1 became fixated on concern for nose wheel limiting speed and power lever transition speed. Both fixations drew the MC's attention away from the approaching end of the runway and consideration of alternative actions such as a go-around (Tabs V21.11, BB-26 and BB-30).

(2) Risk Assessment – During Operation

Risk assessment during operations is a factor when the individual fails to adequately evaluate the risks associated with a particular course of action and this faulty evaluation leads to inappropriate decision and subsequent unsafe situation. This failure occurs in real-time when formal risk-assessment procedures are not possible (Tab BB-6).

T.O. 1C-130J-1 states that special high speed landing procedures are required if the temperature is greater than +15 degrees Celsius and the landing field elevation is greater than 2,000 ft MSL. Under these conditions, the crew should determine the maximum indicated airspeed for transition from FLT IDLE to high speed GND IDLE. Additionally, they should reference the Maximum Landing Weight Permitted by Power Lever Transition Limits chart (Tab BB-33). The rush to land the aircraft on the second attempt lead to a truncated Before Landing brief and did not allow the MC to properly reference these high speed-landing concerns (Tab N-21 thru N-24). Therefore, risk associated with landing the MA increased without proper consideration.

The MC failed to assess or appreciate the risks associated with a 50% flap landing at a high altitude airfield (Tabs V2.2, V2.3, V21.24 and BB-41). A 50% flap landing dictates higher landing speeds which result in longer landing distances and less time to safely stop the aircraft (Tab BB-41). Landing at a higher altitude airfield with a higher temperature compounds the landing solution further by necessitating even higher landing speeds and longer landing distances (Tabs V21.8 and BB-41).

One of the core curricula of Cockpit/Crew Resource Management (CRM) found in AFI 11-290 is Risk Management (RM). RM includes risk assessment, the risk management processes/tools,

breakdowns in judgment and flight discipline, problem-solving, evaluation of hazards, and control measures (Tab BB-70). The MC missed several opportunities where CRM could have help advert this accident. Examples of those opportunities include: When MP1 asked if FOB Shank was "landing Runway 34R" and tower took it as a request for 34R (Tab N-13 and R-16). This strengthened the MC's idea that Runway 34R was the preferred runway when in fact it may not have been (Tab V24.9). It continued with poor coordination of the go-around when MP1 moved the flaps on his own (Tab N-19) and MP1's quick retort to MP2's challenge of the aircraft's low altitude on downwind (Tab N-20). Furthermore, MP2's lack of verbalization of the expected tailwind on final and the distraction with animals on short final did not help with situational awareness of the crew (Tabs V24.12 and N-22). The late notice to change to a 50% flap landing led to a truncated Before Landing Brief by MP1 and left no time for the MC to check critical/required information (Tab N-21 thru N-24, and Tab BB-33). This was evident when MP3 relayed the total runway length instead of the required landing distance upon MP1's query (Tab N-21 and V-25.20). The fact that no one challenged that "68" was the same distance as the runway itself (Tabs DD-59, N-15 and N-21) shows how risk assessment had fallen off the MC's scope. It further progressed with the poor verbiage used by MP3 and MP2 to help guide the aircraft around the final turn causing it to overshoot final (Tab N-23), or the lack of inputting a computer aided turning radius called a "white line" into the navigation system to help MP1 navigate around the turn himself (Tab V24.12). Additionally, MP2's "Fast" call on short final without the 20 KIAS deviation included did not alarm the crew to a potential problem (Tab V24.12). This could have informed the MC that they were traveling much faster than normal and may have alerted them to the need to go-around or immediately start using full braking when on the ground. The lack of a go-around call coupled with the delayed braking shows the crew was truly not aware of the risk they had placed the aircraft and themselves in.

(3) Necessary Action – Delayed

Necessary action delayed is a factor when the individual selects a course of action but elects to delay execution of the actions and the delay leads to an unsafe situation (Tab BB-6).

MP1 and MP2 recognized the need to slow the aircraft down but due to increased ground speed chose to delay braking action due to concerns over nose wheel limiting speed and going to GND IDLE at too high of a true airspeed due to concern over propeller over speed (Tab V21.11, V21.14, V22.14, V24.13 and V24.14). Four seconds after initial touchdown MP1 put the nose wheel down and yet still waited another 8 seconds before instituting full anti-skid breaking (Tabs V16.3, V16.4, V24.14, BB-25 and DD-9).

(4) Response Set

Response set is a factor when the individual has a cognitive or mental framework of expectations that predispose them to a certain *course of action* regardless of other cues (Tab BB-8 and BB-9).

The MC (with the exclusion of MP2) were recently involved in a landing that led to a loss of a tire. Due to this recent event and concern for negative feedback, MP1 may have been motivated to delay breaking early in the landing sequence (Tab V22.5).

MP1's experience with normal landing speeds at lower altitudes may have led MP1 to believe that 2,000 ft of remaining runway was plenty of space to stop the aircraft (Tabs V2.2, V22.7 and DD-9). However, MP1 did not account for the higher airfield altitude and the additional

increased touchdown speed at the time that MA had 2,000 ft of runway remaining (Tabs V22.4, V22.7, BB-38, BB-41, DD-3, DD-9 and DD-12).

(5) 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-5).

The main landing gear tires have a limiting speed of 174 knots ground speed (Tab V16.1). The nose wheel has a limiting speed of 139 knots ground speed (Tab BB-34). The aircraft flight data recorder shows the aircraft main landing gear touching down at 187 knots ground speed, and the nose gear touching down at 180 knots ground speed (Tabs V16.3, V16.4, DD-9 and DD-12). Both speeds exceed the T.O. C-130J-1 limitations for main landing gear and nose wheel landing gear.

In order to validate TOLD calculations, aircrews must follow certain assumptions. These assumptions include: a) A one-second allowance for distance traveled during transition from touchdown to taxi attitude; b) Maximum anti-skid breaking (brakes at ambient temperature) and power selection achieved upon reaching taxi attitude. Taxi attitude is when all wheels are on the ground (Tab BB-25 and BB-31). Following main landing gear touchdown, MP1 held the nose wheel off the ground for approximately four seconds in order to attempt to slow below the nose wheel limiting speed. After nose wheel touchdown, MP1 delayed going to maximum anti-skid braking for another eight seconds (Tabs V16.4, DD-9, DD-10 and DD-12). In total, there was a delay of 12 seconds from initial touchdown to full anti-skid braking (Tabs V16.4, DD-3 and DD-9). Delays in lowering the nose and initiating full anti-skid braking invalidated the computed landing data for the MA (Tabs BB-25, BB-38 and DD-4).

T.O. 1C-130J-1 states that the safe condition to move power levers below FLT IDLE is when the weight of the aircraft is on all three gear and the KTAS is below 145 (Tab BB-31). The MA landed at 170 KTAS and recognized they could not immediately select reverse power due to this limitation (Tabs V24.17 and DD-10). However, data from the aircraft flight data recorder shows MP1 selected reverse power while the aircraft was still traveling at 160 KTAS, well above the 145 limitation (Tab DD-9, DD-10 and DD-12). Furthermore, the data recording shows that the power levers went straight from FLT IDLE to full reverse, with no pause at GND IDLE (Tab DD-9 and DD-10). The T.O. 1C-130J-1 directs pilots to pause momentarily with power levers in GND IDLE to check for symmetric power. If symmetric power is confirmed by BETA indications, the pilot can then use reverse. Failure to identify an asymmetric problem before max reversing could result in directional control difficulties (Tab BB-31 and BB-32). As cautioned, the MA experienced a directional control problem following reversing the power without first checking for BETA indications at GND IDLE (Tab V21.14 and V24.14). The right outboard propeller (number four) delayed going into reverse for approximately two seconds (Tab DD-9, DD-10 and DD-12). At this time the MA abruptly veered to the left of the runway coming close to the edge of the paved surface (Tab DD-9 and DD-10).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 51-503, *Aerospace Accident Investigations,* 26 May 2010
(2) AFI 11-2C-130J, Volume 3, *Flying Operations C-130J Operations Procedures*, 8 December 2009
(3) AFI 11-290, *Cockpit/Crew Resource Management Program*, 15 October 2012
(4) AFI 91-204, *Safety Investigations and Reports,* 24 September 2008
(5) AFI 11-202, Volume 3, *Flying Operations, General Flight Rules,* 22 October 2010
(6) TO 00-5-1, *AF Technical Order System,* 15 January 2013
(7) TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, 15 June 2013
(8) TO 00-20-2, *Maintenance Data Documentation,* 1 November 2012
(9) AFI 36-2232, *Maintenance Training*, 22 February 2006

NOTICE: All Air Force Instructions 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 not Publicly Available

(1) TO 1C-130(C)J-1-1, *Flight Manual, USAF Series C-130J (Long) Aircraft,* 1 July 2011
(2) TO 1C-130J-1, *Flight Manual, USAF Series C-130J Aircraft,* 1 July 2011
(3) TO 1C-130J-2-45GS-001, *Transfer and Diagnostic System*, 1 January 2011
(4) TO 1C-130J-2-31GS-002, *Indicating and Recording Advisory, Caution, and Warning System (ACAWS)*, 1 July 2009
(5) TO 1C-130J-6WC-14, *A/B/C1/C2 Check Inspection*, 1 July 2011
(6) TO 1C-130J-6, *Aircraft Scheduling Inspection and Maintenance Requirements*, 1 January 2012
(7) TO 1C-130J-2-42GS-00-1, *Data Transfer and Diagnostic System, USAF Series C-130J Aircraft,* 1 January 2011
(8) 1C-130J-31GS-00-2, *Indicating and Recording , Advisory, Caution and Warning System (ACAWS), USAF Series C-130J Aircraft,* 1 July 2009
(9) 1C-130J-6WC-14, *Work Cards, A/B/C1/C2 Check Inspection, USAF Series C-130J Aircraft,* 1 July 2011
(10) TO 1C-130J-6, *Aircraft Scheduled Inspection and Maintenance Requirements, USAF Series C-130J Aircraft,* 1 January 2012

13. ADDITIONAL AREAS OF CONCERN

None.

17 SEPTEMBER 2013

MICHAEL P. ZICK, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

AIRCRAFT ACCIDENT INVESTIGATION
C-130J-30, T/N 04-3144
Forward Operating Base Shank, Afghanistan
19 May 2013

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 19 May 2013, at approximately 0950 Zulu (1420 local), a C-130J, tail number (T/N) 04-3144, assigned to the 41st Airlift Squadron, 19th Airlift Wing, Little Rock Air Force Base (AFB), Arkansas, ran off the end of a runway at Forward Operating Base (FOB) Shank, Northeast, Afghanistan, struck a ditch, which collapsed the nose gear and eventually ripped the right main landing gear from the fuselage. The right outboard engine struck the ground, pressurized fuel and oil lines were broken, fluid was sprayed over the cracked engine casing, and the right wing caught fire. The mishap aircraft (MA) came to a full stop at approximately 544 feet (ft) off the end of the paved runway surface. The mishap crew (MC), Aeromedical Evacuation (AE) crew and two ambulatory patients safely evacuated the aircraft through the top flight-deck emergency escape hatch meeting 600 ft off the nose of the aircraft. There were no fatalities, significant injuries or damage to civilian property. The total estimated loss is $73,990,265.

The MA was on an AE mission and included five active duty C-130J crewmembers from the 772nd Expeditionary Airlift Squadron (19th Airlift Wing deployed), Kandahar Air Base (AB), Afghanistan. Additionally, the MA had aboard six reserve AE crewmembers from the 651st Expeditionary Aeromedical Evacuation Squadron (349th Air Mobility Wing and 433rd Airlift Wing deployed), Kandahar AB, Afghanistan. The mishap sortie happened on the third of five planned legs that day to an airfield that was at 6,809 ft Mean Sea Level (MSL) and experiencing winds varying from 200 to 250 degrees gusting from 6 to 28 knots. On the second attempted landing, the MA touched down approximately 1,500 ft down the runway but was 27 knots indicated airspeed (KIAS) faster than computed touchdown landing speed leading to the aircraft going off the end of the runway at approximately 49 KIAS.

I found, by clear and convincing evidence, that the causes of the accident were poor Crew Resource Management (CRM) and mishap pilot one's (MP1) late power reduction causing a 27 KIAS fast touchdown at a high altitude airfield (6,809 ft MSL). Additionally, I found by the preponderance of evidence that each of the following factors substantially contributed to the mishap: 1) Channelized Attention; 2) Risk Assessment; 3) Delayed Necessary Action; 4) Response Set; 5) Procedural Error.

I developed my opinion by analyzing factual data from historical records, Air Force directives and guidance, engineering analysis, witness testimony and information provided by technical experts. Additionally, I used the MA's Digital Flight Data Recorder (DFDR) and Cockpit Voice Recorder (CVR) to determine the mishap sequence of events. I then used the C-130J-30 Weapon Systems Trainer (WST) simulator to recreate the mishap as well as run multiple excursions for further analysis.

2. CAUSE

On the second landing attempt at a high altitude airfield (6,809 ft MSL), poor CRM coupled with a late power reduction by MP1 caused the MA to touchdown 27 KIAS faster than computed touchdown landing speed leading to the aircraft going off the end of the runway at approximately 49 KIAS. Because of unique aircraft performance characteristics when operating into and out of high altitude airfields, there was no way that the MA could perform a 50% flap landing (in accordance with T.O. 1C-130(C)J-1-1 landing assumptions, nose wheel landing gear speed restrictions and power level transition speed restrictions) at FOB Shank and land 27 KIAS fast. The MA's actual landing speed simply overtasked the aircrafts capability to stop within the runway available.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

Several factors substantially contributed to this mishap, including:

a. Channelized Attention

The MC, particularly MP1, was consumed with landing the aircraft under difficult conditions. These conditions included high gusting crosswinds, a tailwind, high outside air temperature and high-pressure altitude. On two occasion, MP1 verbalized difficulty with crosswinds. Unfortunately, due to channelized attention on crosswinds, MP1 failed to acknowledge/heed the "fast" call of MP2 on short final thus leading to a touchdown that was 27 KIAS faster than computed touchdown landing speed. Additionally, MP1 did not recognize that the winds had shifted to include a 17 knot tailwind. This tailwind increased the aircraft's ground speed on touchdown further complicating the MA's landing solution.

Both the high ground speed and true airspeed drove the MC to fixate on technical-order limitations with the nose landing gear and power-lever transition, which delayed their braking, and power reversing, thus invalidating the aircrafts computed landing performance. Furthermore, this fixation drew their attention away from the approaching end of the runway and considerations of alternative actions such as performing a go-around. In fact, just before MP1 chose to begin braking and reversing, the aircraft was traveling at 139 KIAS (168 GS) with approximately 2,000 ft remaining. At that moment, the MA was at a safe speed to execute a go-around for another attempt.

b. Risk Assessment – During Operation

On downwind following the first landing attempt, MP1 changed the planned landing from a 100% flap Max-Effort landing to a 50% flap landing. This abrupt change was driven by concern over crosswinds on landing. Although the aircraft had the performance to do so, T.O. 1C-130J-1 states that special high speed landing procedures are required if the temperature is greater than +15 degrees Celsius and the landing field elevation is greater than 2,000 ft MSL. Under these conditions, the crew should determine the maximum indicated airspeed for transition from FLT IDLE to high speed GND IDLE. Additionally, they should reference the Maximum Landing Weight Permitted by Power Lever Transition. The rush to land the aircraft on the second attempt lead to a truncated Before Landing brief and did not allow the MC to properly reference these high speed-landing concerns. Furthermore, poor CRM amongst the MC did not help them identify and manage threats to safe and effective mission operations. Therefore, risk associated with landing the MA increased without proper consideration or backup.

c. Delayed Necessary Action

MP1 and MP2 recognized the need to slow the aircraft down, but due to competing interests, they delayed doing so. Because of the increased ground speed on touchdown, MP1 kept the nose wheel up due to technical-order limitations. This delayed the MC's ability to apply brakes early on in their ground roll. Additionally, because of the high true airspeed on touchdown, MP1 delayed bringing the aircraft throttles into GND IDLE and full reverse due to concern of a propeller over speed. The fact that MP1 delayed putting the nose wheel down for approximately four seconds and full anti-skid braking for another eight seconds only ensured that the MA would depart the paved runway surface at a high speed. When the MC experienced a directional control problem upon reversing the power at a high true airspeed, it necessitated the crew to use differential braking in order to keep the aircraft on the runway, which further reduced their ability to reach full anti-skid braking in time to stop the aircraft before the end of the paved surface.

d. Response Set

Even after the MA reached a three point taxi attitude (nose wheel and main landing gear on the ground), MP1 failed to apply full anti-skid braking on the aircraft until approximately 2,000 ft remaining on the runway. This contradicts the basic landing distance assumptions of T.O. 1C-130(C)J-1-1 that are predicated on a one second allowance for distance traveled during transition from touchdown to taxi attitude and maximum anti-skid braking with power achieved upon reaching that three point attitude. The fact that MP1 delayed anti-skid braking and only partially used braking early in the landing sequence suggests he was not aware of his high speed and perhaps motivated to delay braking because of a recent experience of losing a tire on landing.

Additionally, the MC's experience with landing lightweight aircraft on airfields at approximately sea level (0 ft MSL) would have led them to believe that 2,000 ft of remaining runway would have given them plenty of time and space to stop the aircraft. Unfortunately, a lightweight landing at 27 KIAS faster than computed touchdown speed on a high altitude airfield (6,809 ft) with a 17 KIAS tailwind far exceeded the capability of the aircraft to stop in the remaining paved

surface. In both cases, it would appear that MP1 was predisposed to the actions taken due to prior experience.

e. Procedural Error

Recognizing that the aircraft was traveling too fast to touch down the main landing gear should have alerted the MC for the need to perform a go-around instead of landing. The need to delay placing the nose landing gear down or delay selecting reverse power because the speed was too great should have alerted the crew for the need to perform a go-around. Finally, the fact that their actions totally invalidated their computed TOLD should have alerted them to the need for a go-around. As it was, there was only one valid procedural option for the MC once they touched down 27 KIAS fast, that was to execute a go-around. Procedural error clearly contributed to the destruction of the MA.

4. CONCLUSION

By clear and convincing evidence, I find the causes of the mishap was poor CRM and MP1's late power reduction on his second landing attempt causing the MA to touchdown 27 KIAS faster than computed touchdown landing speed leading to the aircraft going off the end of the runway at approximately 49 KIAS. I find by preponderance of the evidence that the MC's channelized attention, risk assessment, delayed necessary action, response set, and procedural error all substantially contributed to the mishap.

17 SEPTEMBER 2013

MICHAEL P. ZICK, Colonel, USAF
President, Accident Investigation Board