

UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT



MQ-9A, T/N 05-000102

**645TH AERONAUTICAL SYSTEMS GROUP
AERONAUTICAL SYSTEMS CENTER
WRIGHT-PATTERSON AIR FORCE BASE, OHIO**



LOCATION: VICTORIA, REPUBLIC OF SEYCHELLES

DATE OF ACCIDENT: 4 April 2012

BOARD PRESIDENT: COL KENNETH L. ECHTERNACHT, Jr.

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION MQ-9A, T/N 05-000102 VICTORIA, REPUBLIC OF SEYCHELLES 4 April 2012

On 4 April 2012, at 0929 Zulu time (Z), an MQ-9A Reaper Remotely Piloted Aircraft (RPA), tail number (T/N) 05-000102, crashed into the Indian Ocean following a commanded engine shutdown and attempted forced landing that occurred 4 minutes and 15 seconds after takeoff from Seychelles International Airport (FSIA), Victoria, Republic of Seychelles. The RPA, Multi-Spectral Targeting System (MTS), MTS Electronics Unit, and Special Operations Forces (SOF) pod were destroyed, a loss value exceeding \$8,931,000. There were no fatalities, injuries, or damage to other property.

The Mishap Remotely Piloted Aircraft (MRPA) was an asset of the 645th Aeronautical Systems Group, Wright-Patterson Air Force Base, Ohio. The MRPA was forward-operated by the 409th Air Expeditionary Group, Detachment 1 at FSIA, Victoria, Republic of Seychelles. The mishap crew consisted of a contractor-furnished Mishap Operator (MO) and Mishap Sensor Operator (MSO). Maintenance support was provided by a contractor-furnished maintenance team that consisted of a maintenance lead, mechanics, and avionics technicians.

The accident investigation board (AIB) president found by clear, convincing evidence that the causes of the mishap were 1) the MO commanded the engine off by moving the Condition Lever to a position that closed the fuel shut off valve, shutting off fuel to the engine and 2) the MO and MSO failed to complete the landing gear extension sequence to include confirming that the landing gear was extended. Additionally, the AIB president found by a preponderance of evidence that MO's limited recent experience in launch procedures substantially contributed to the mishap.

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.

SUMMARY OF FACTS AND STATEMENT OF OPINION

**AIRCRAFT ACCIDENT INVESTIGATION
MQ-9A, T/N 05-000102
VICTORIA, REPUBLIC OF SEYCHELLES
4 APRIL 2012**

TABLE OF CONTENTS

COMMONLY USED ACRONYMS AND ABBREVIATIONS iii

SUMMARY OF FACTS 1

1. AUTHORITY and PURPOSE 1

 a. Authority 1

 b. Purpose 1

2. ACCIDENT SUMMARY 1

3. BACKGROUND 1

 a. Air Force Materiel Command (AFMC) 2

 b. Aeronautical Systems Center (ASC) 2

 c. 645th Aeronautical Systems Group (645 AESG) 2

 d. 409th Air Expeditionary Group (409 AEG) 2

 e. Merlin RAMCo Inc. (MRI) 2

 f. MQ-9A Reaper Remotely Piloted Aircraft (RPA) 3

4. SEQUENCE OF EVENTS 3

 a. Mission 3

 b. Planning 3

 c. Preflight 4

 d. Summary of Accident 5

 e. Impact 8

 f. Egress and Aircrew Flight Equipment 9

 g. Search and Rescue 9

 h. Recovery of Remains 9

5. MAINTENANCE 9

 a. Forms Documentation 9

 b. Inspections 9

 c. Maintenance Procedures 10

 d. Maintenance Personnel and Supervision 10

 e. Fuel and Oil Inspection Analyses 10

 f. Unscheduled Maintenance 10

6. AIRCRAFT AND AIRFRAME SYSTEMS 10

 a. Structures and Systems Analysis 10

 b. Engineering Evaluations and Analysis 11

7. WEATHER 12

 a. Forecast Weather 12

 b. Observed Weather 12

 c. Space Environment 12

 d. Operations 12

8. CREW QUALIFICATIONS.....	12
a. Mishap Pilot Operator (MO).....	12
(1) Training.....	12
(2) Experience.....	13
b. Mishap Sensor Operator (MSO).....	13
(1) Training.....	13
(2) Experience.....	13
9. MEDICAL.....	14
a. Qualifications.....	14
b. Health.....	14
c. Pathology.....	14
d. Toxicology.....	15
e. Lifestyle.....	15
f. Crew Rest and Crew Duty Time.....	15
10. OPERATIONS AND SUPERVISION.....	15
a. Operations.....	15
b. Supervision.....	15
(1) 409 AEG/ Det 1.....	15
(2) Merlin RAMCo Inc.....	16
11. HUMAN FACTORS.....	16
a. Overview.....	16
b. Causal.....	16
(1) AE 103 Procedural Error.....	16
c. Contributory.....	18
(1) PC506 Expectancy.....	18
(2) PC102 Channelized Attention.....	18
(3) PP102 Cross Monitoring Performance.....	19
(4) SP003 Limited Recent Experience.....	19
(5) SP005 Proficiency.....	20
d. Non-Contributory.....	20
(1) AE102 Checklist Error.....	20
(2) PC308 Circadian Rhythm Desynchrony.....	21
12. GOVERNING DIRECTIVES AND PUBLICATIONS.....	21
a. Directives and Publications not available on AF Departmental Website.....	21
b. Directives and Publications available on AF Departmental Website.....	21
c. Known or Suspected Deviations from Directives or Publications.....	22
13. ADDITIONAL AREAS OF CONCERN.....	22
STATEMENT OF OPINION.....	23
1. OPINION SUMMARY.....	23
2. DISCUSSION OF OPINION.....	23
a. Cause: MO commanded the engine off.....	23
b. Cause: MC failed to complete landing gear extension.....	24
c. Substantially Contributing Factor: MO's limited recent experience.....	25
3. Conclusion.....	25

COMMONLY USED ACRONYMS AND ABBREVIATIONS

ACC	Air Combat Command	fpm, ft/min	feet per minute
ACC/A8Q	ACC/RPA Requirements Directorate	FSR	Field Service Representative
AEG	Air Expeditionary Group	FSIA	Seychelles International Airport (ICAO)
AESG	Aeronautical Systems Group	FSOV	Fuel Shutoff Valve
AF	Air Force	ft.	feet, foot
AFB	Air Force Base	FUEL1	Fuels Technician 1
AFE	Aircrew Flight Equipment	FUEL2	Fuels Technician 2
AFI	Air Force Instruction	GA	General Atomics
AFMC	Air Force Materiel Command	GA-ASI	General Atomics Aeronautical Systems, Inc.
AFRICOM	U.S. Africa Command	GCS	Ground Control Station
AFSAS	Air Force Safety Automated System	GDT	Ground Data Terminal
AFTO	Air Force Technical Order	GFR	Government Flight Representative
AGL	Above Ground Level	GGR	Government Ground Representative
AIB	Aircraft Investigation Board	GLS	GPS Landing System
AF IMT	Air Force Information Management Tool	GOCO	Government Owned, Contractor Operated
AOA	Angle of Attack	GPS	Global Positioning System
AOR	Area of Responsibility	HDD	Head-Down Display
ASC	Aeronautical Systems Center	HQ	Headquarters
ASC/WI	ASC/PEO ISR/SOF	HUD	Head-Up Display
ASC/WII Det 3	ASC/PEO MQ-1/9 Det 3	IAW	in accordance with
AT	Avionics Technician	ICAO	International Civil Aviation Organization
ATC	Air Traffic Control	IETMS	Interactive Electronic Technical Manual System
ATIS	Automated Terminal Information System	in	inch(es)
ATP	Airline Transport Pilot	in Hg	inches Mercury
BLOS	Beyond Line of Sight	IMDS	Integrated Maintenance Data System
C	Celsius	IP	Instructor Pilot
CAP	Critical Action Procedures	ISB	Interim Safety Board
CC	Commander	ISB IO	Interim Safety Board Investigating Officer
C2	Command and Control	ISO	Instructor Sensor Operator
Capt	Captain	ISR	Intelligence, Surveillance, and Reconnaissance
Col	Colonel	IAS	knots indicated airspeed
CONOPS	Concept of Operations	kts	nautical miles per hour
CRM	Crew Resource Management	L	Local time
DEEC	Digital Engine Electronic Controller	LA	Legal Advisor
deg, °	degree(s)	LOS	Line of Sight
Det, DET	Detachment	LP	Lead Pilot
DET 1 CC/GFR	Detachment 1 CC/GFR	LR	Launch and Recovery
DL	downlink/datalink	LRE	Launch and Recovery Element
DNIF	Duty Not Including Flying	LRT	Launch and Recovery Training
DoD	Department of Defense	Lt Col	Lieutenant Colonel
DoD-HFACS	DoD Human Factors Analysis and Classification System	LSO	Lead Sensor Operator
DV	Distinguished Visitor	Maj	Major
DVR	Digital Video Recorder	MAJCOM	Major Command
EGT	Exhaust Gas Temperature	MC	Mishap Crew (MO and MSO)
EP	Emergency Procedure	MCE	Mission Control Element
EQUIP SPEC1	Equipment Specialist 1	MDS	Mission Design Series
EQUIP SPEC2	Equipment Specialist 2	m	meter(s)
ESM	Engine Start Module	MO	Mishap Operator
FAA	Federal Aviation Administration	MP	Mishap Pilot
FAE	Functional Area Expert		
F	Fahrenheit		

MRI	Merlin RAMCo Inc.	RPM	Revolutions per Minute
MRPA	Mishap Remotely Piloted Aircraft	RTB	Return to Base
MSL	above Mean Sea Level	RWY	Runway
MSO	Mishap Sensor Operator	SAR	Search and Rescue
MSOV	Mechanical Fuel Shutoff Valve	SCAA	Seychelles Civil Aviation Authority
MTS	Multi-Spectral Targeting System	SEGT	SRL Exhaust Gas Temperature
MX	Maintenance	SIB	Safety Investigation Board
MX1	Maintenance Technician 1	S/N	Serial Number
MX2	Maintenance Technician 2	SO	Sensor Operator
MX3	Maintenance Technician 3	SOCOM	U.S. Special Operations Command
nm	nautical mile(s)	SOF	Special Operations Forces
NOTAMS	Notices to Airmen	SOP	Standard Operating Procedure
OCONUS	Outside the Contiguous United States	SFO	Simulated Flame Out
OCO	Overseas Contingency Operations	SRL	Single Red-Line
ORF	Operational Read File	SSgt	Staff Sergeant
ORM	Operational Risk Management	TCTO	Time Compliance Technical Order
OT&E	Operational Test and Evaluation	T/N	Tail Number
PEO	Program Executive Office(r)	T.O./TO	Technical Order
PHA	Physical Health Assessment	TOD	Technical Order Data
PMATS	Predator Mission Aircrew	TV	Television
	Training Simulator	UAS	Unmanned Aircraft System
POL	Petroleum, Oil, & Lubricants	UAV	Unmanned Aerial Vehicle
PPSL	Predator Primary Satellite Link	U.S./US	United States
PSO1	Left Pilot/Sensor Operator Station	USAF	United States Air Force
PSO2	Right Pilot/Sensor Operator Station	USN	United States Navy
RCM	Redundant Control Module	VVI	Vertical Velocity Indicated
RPA	Remotely Piloted Aircraft	Z	Zulu time/Greenwich Mean Time

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 18 May 2012, the Vice Commander, Air Force Materiel Command (AFMC), appointed Colonel Kenneth L. Echternacht, Jr. to conduct a Remotely Piloted Aircraft (RPA) accident investigation of the 4 April 2012 crash of an MQ-9A Reaper RPA, tail number (T/N) 05-000102, in Victoria, Republic of Seychelles. The investigation occurred at Eglin Air Force Base (AFB), Florida from 2 July through 31 July 2012. The following board members were also appointed: Pilot Member, Legal Advisor, Medical Member, Maintenance Member, and Recorder (Tab Y-1-Y-9).

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the RPA 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.

2. ACCIDENT SUMMARY

On 4 April 2012, at 0929 Zulu time (Z), an MQ-9A Reaper RPA, T/N 05-000102, crashed into the Indian Ocean following a commanded engine shutdown and attempted forced landing that occurred 4 minutes and 15 seconds after takeoff from Seychelles International Airport (FSIA), Victoria, Republic of Seychelles (Tabs DD-4, EE-3, EE-16). The RPA, Multi-Spectral Targeting System (MTS), MTS Electronics Unit, and Special Operations Forces (SOF) pod were destroyed, a loss value exceeding \$8,931,000.00 (Tabs D-139, K-12, P-3, V-9.10, DD-21). There were no fatalities, injuries or damage to other property.

3. BACKGROUND

The Mishap Remotely Piloted Aircraft (MRPA) was assigned to the 645th Aeronautical Systems Group (645 AESG), Wright-Patterson AFB, Ohio (Tab V-1.6, V-2.5 - V-2.6). At the time of the mishap, the 409th Air Expeditionary Group (409 AEG)/Detachment 1 (Det 1) forward-operated the MRPA from FSIA (Tabs K-10, V-2.5). The site was supported by contractor-furnished operations and maintenance personnel qualified in the MQ-9A Unmanned Aircraft System (UAS), managed under a 645 AESG contract with Merlin RAMCo Inc. (MRI) (Tab V-1.7, V-2.7).

a. Air Force Materiel Command (AFMC)

AFMC delivers war-winning expeditionary capabilities to the warfighter through development and transition of technology, professional acquisition management, exacting test and evaluation, and world-class sustainment of all United States Air Force (USAF) weapon systems. AFMC provides the work force and infrastructure necessary to ensure the United States (U.S.) remains the world’s most respected air and space force. AFMC fulfills its mission of equipping the USAF with the best weapon systems through the Air Force Research Laboratory and several unique centers, which are responsible for the total oversight for aircraft, electronic systems, and missiles and munitions (Tab CC-3).



b. Aeronautical Systems Center (ASC)

ASC is the largest of three USAF product centers within AFMC. The center designs, develops, and delivers dominant aerospace weapon systems and capabilities for U.S. military and coalition warfighters. ASC focuses on speed and innovation in acquisition management, and rapid transition of technology into aerospace systems (Tab CC-7).



c. 645th Aeronautical Systems Group (645 AESG)

645 AESG, commonly referred to as Big Safari, is a USAF program office that provides management, direction, and control of acquisition, modification, and logistics for special purpose weapons systems. It oversees the testing and fielding of new weapons systems, sensors, and platforms. 645 AESG reports to ASC/WI, the Program Executive Office for Intelligence, Surveillance, and Reconnaissance (ISR) and Special Operations Forces (Tab CC-9).



d. 409th Air Expeditionary Group (409 AEG)

409 AEG supports the USAF ISR mission across the entire U.S. Africa Command (AFRICOM) area of responsibility from multiple locations. The objective is to promote regional security and stability, dissuade conflict, and protect U.S. and coalition interests. 409 AEG was activated 1 January 2011 in support of Overseas Contingency Operations (OCO) in AFRICOM (Tab CC-10). 409 AEG/Det 1 was forward-deployed to FSIA (Tab V-1.4).



e. Merlin RAMCo Inc. (MRI)

Merlin RAMCo Inc. (MRI) employs qualified personnel to aid the Armed Forces in meeting their challenging demands. Their ISR professionals support a variety of manned and unmanned platforms across many disciplines. MRI employees are deployed across the globe performing engineering services, operational training, flight operations, ISR maintenance, security support, technical manual services, and logistics support. MRI has more than 80 employees at 14 locations across the U.S. and in five other countries, and services multiple customer support sites around the world (Tab CC-11).



f. MQ-9A Reaper Remotely Piloted Aircraft (RPA)

The MQ-9A Reaper is a medium-to-high altitude, long endurance RPA system employed primarily in a hunter/killer role against dynamic execution targets and secondarily as an ISR asset. The MQ-9A is manufactured by General Atomics Aeronautical Systems, Inc. (GA-ASI) in Poway, California. A fully operational MQ-9A UAS consists of several sensor/weapon-equipped RPAs, a Ground Control Station (GCS), a Predator Primary Satellite Link and spare equipment, along with operations and maintenance crews for deployed 24-hour operations (Tab CC-12).

The basic crew consists of an Operator to control the RPA and command the mission, a Sensor Operator (SO) to operate the payloads, and a Mission Coordinator, when required. To meet combatant commander requirements, the MQ-9A delivers tailored capabilities using mission kits containing various weapons and sensor payload combinations (Tab CC-12).

The MQ-9A baseline system carries a Multi-Spectral Targeting System (MTS), which has a robust suite of sensors for targeting. The MTS integrates an infrared sensor, a color/monochrome daylight TV camera, an image-intensified TV camera, a laser designator and a laser illuminator into a single package (Tab CC-12).

The USAF proposed the MQ-9A UAS in response to Department of Defense (DoD) direction to support OCO. It is larger and more powerful than the MQ-1B Predator UAS and is designed to destroy or disable time-sensitive targets with persistence and precision. "MQ-9A" is the DoD designation for its multi-role ("M") RPA series ("Q"), ninth model, version A ("-9A") aircraft (Tab CC-13).

4. SEQUENCE OF EVENTS

a. Mission

On 4 April 2012, the MRPA was tasked to perform both the launch and recovery, and mission control element phases of a mission from the Republic of Seychelles (Tab V-2.16, V-2.25, V-9.26, V-11.6). The mission was authorized by the 409 AEG, Detachment 1 Government Flight Representative (GFR) and involved a Government Owned Contractor Operated (GOCO) unit that was manned by Merlin RAMCo Inc (MRI) contractors in accordance with a 645 AESG contract (Tabs V-1.6, V-7.12, EE-6).

b. Planning

On 4 April 2012, the Mishap Operator (MO) and Mishap Sensor Operator (MSO) showed at approximately 0700Z, 11:00 am local, to start their flight duty period (Tabs K-8, V-11.22). The MO collected mission materials to include current Notices to Airmen (NOTAMS), a weather report, and inflight guide in preparation for the mission (Tab V-7.12). At approximately 0800Z, the MO, MSO, Site Lead, and GFR1 attended a mandatory flight briefing (Tabs R-10, V-3.10, V-7.12, V-11.22). The flight briefing was conducted by the MO and followed the Detachment 1

MQ-9A, T/N 05-000102, 4 April 2012

In-Flight Guide Mission Briefing Guide and included an Operational Risk Management (ORM) assessment, AF IMT 4327a Flight Authorization review, NOTAMS, weather, and crew emergency expectations in accordance with AFI 11-2FT, Volume 3, *Flight Test Operations Procedures*, 16 November 2011 and AFI 11-202, Volume 3, Air Force Materiel Command Supplement, *General Flight Rules*, 25 August 2011 mission briefing requirements (Tabs V-7.15, V-9.23, EE-6, EE-7).

The total ORM level for the mishap mission was assessed as “Green”, but the human factors element of “CREW PROFICIENCY (30 DAYS)” was assessed as “Yellow” (Tabs K-11, V-10.21). Other individual ORM elements including “DUTY DAY”, “LANDING”, “NIGHT (FLT OR SHOW TIME)”, and “LANDING X-WIND COMP[ONENT]” were assessed as either “Yellow” or “Red” (Tab K-11). Once the flight brief was complete, the MO and MSO stepped to the GCS to start the preflight (Tab V-11.22).

c. Preflight

During the preflight, individuals present inside the GCS included the MO, MSO, MO2, Sr Avionics Tech, and United States Navy Distinguished Visitor (USN DV) (Tabs R-7, R-14, V-1.15, V-2.4, V-2.23, V-3.13, V-9.25, V-11.23). The Sr Avionics Tech left the GCS before the MRPA started taxiing and was not present in the GCS during the takeoff (Tabs R-11, V-3.11, V-3.13, V-3.15). The USN DV received a separate safety brief on the GCS from MO2 prior to entry and MO2 coordinated with and received permission to enter from the MO (Tabs R-14, V-10.23 - 10.24).

The MRPA and GCS were configured with a standard operational flight program software package in compliance with the fielding guidance at the time of the mishap (Tab EE-5). The MRPA had a 3,750 lb fuel load and a SOF Pod on Station 7 for a startup weight of 8,737 lbs (Tabs D-139, K-12, V-2.20, V-5.7, V-9.10).

The preflight included a review of the AFTO 781 maintenance forms for both the MRPA and GCS, a walk around inspection of the MRPA, and execution of multiple checklists to configure the GCS Pilot and Sensor Operator Stations, establish the line of sight link between the MRPA and GCS, check control systems, start the engine, and taxi the aircraft for takeoff (Tab V-3.7, V-3.10, V-11.25). The preflight procedures were slow but considered uneventful (Tabs R-11, R-12, R-15, V-11.24).

The planned departure was from FSIA Runway 31 (Tabs R-7, V-9.27). The Detachment 1 / Seychelles Civil Aviation Authority standard operating departure procedure was to fly to reporting point CORAL, southeast of the airfield, before heading north to reporting point STARFISH (Tab EE-7). The common practice at Detachment 1 was to deviate from this procedure and request direct STARFISH when departing from Runway 31 (Tab V-7.33).

Because the FSIA runway elevation is 10' Mean Sea Level (MSL), the aircrew at Detachment 1 interchange MSL and Above Ground Level (AGL) due to the closeness in their values (Tabs AA-3, EE-9).

d. Summary of Accident

On 4 April 2012, at approximately 0922Z the MRPA taxied onto FSIA Runway 31 (Tabs N-2, R-7, V-9.27, V-11.27). The MC completed the pre-takeoff checks and initiated the takeoff checks (Tab V-11.27). Prior to takeoff, the flaps were in the extended position in accordance with the pre-takeoff checks (Tabs V-6.21, V-7.32, DD-4, EE-7). Air Traffic Control (ATC) checked with the crew to see if they were ready for takeoff at 09:23:59Z (Tab N-2). At 09:24:21Z the MO received the last engine instrument indication that confirmed the MRPA systems were ready for takeoff and he proceeded to advance his throttle to full power for takeoff (Tabs EE-3, N-2, R-9). The MRPA took off at 09:25:00Z, five minutes before the scheduled takeoff time of 0930Z (Tabs K-10, N-2, R-8, V-10.26, EE-3).

At 09:25:15Z, while passing 270' MSL the MO raised the landing gear (Tabs R-9, V-11.28, EE-3). The MSO moved the landing gear handle on the right Pilot/Sensor Operator station (PSO2) to match the MO's PSO configuration (Tab V-7.33, V-11.28). The MSO began to swing the MTS towards the right wing, but failed to complete the visual sweep of the MRPA; thereby failing to visually confirm that the gear retracted in accordance with flight manual procedures (Tab EE-8). The gear retraction took 25 seconds (Tab DD-5). Additionally, the MO did not raise the flaps in accordance with the Takeoff checklist (Tabs R-17, BB-7, BB-8, DD-11, EE-7).

At 09:25:22Z, while the gear was retracting and MRPA was passing 460' MSL, the MO notified ATC that he was passing 500' AGL (Tabs N-2, EE-3). Five seconds later, ATC notified the MO that he took off without a clearance (Tabs N-3, R-9, R-15, V-11.27, EE-3). At 09:25:41Z, the MO requested to proceed direct to STARFISH (Tabs N-3, EE-3). Three seconds later ATC provided a clearance. At the same time, the landing gear reached the fully retracted position (Tabs N-3, R-9, EE-4).

At 09:26:12Z, the MO initiated a four-degree right hand check turn towards STARFISH (Tab EE-4). At 09:26:24Z, while passing 1,770 ft MSL, the MO turned "On" the Airspeed Hold, which is the fourth step on the Climb, Level Off, Cruise checklist (Tabs N-3, BB-8, BB-9, EE-4). However, turning the Airspeed Hold to the "On" mode does not occur on the Climb, Level Off, Cruise checklist until after the landing gear has been confirmed up and the flaps have been set to the neutral position (Tab BB-8, BB-9). The MO did not raise the flaps in accordance with the Climb, Level Off, Cruise checklist (Tabs R-17, BB-7, BB-8, DD-11, EE-7).

Additionally, the Climb, Level Off, Cruise checklist should not be started until the aircraft climbs past 2,000 ft AGL and only after the Pilot directs the Sensor Operator to read the steps from the checklist (Tabs V-6.25, V-7.35, V-11.30, BB-8). The MO did not prompt the MSO to start the Climb, Level Off, Cruise checklist at the time that he turned the Airspeed Hold "On" (Tab V-11.30).

At 09:26:26Z, two seconds after the Airspeed Hold was turned on, an audible warning is heard in the GCS, a red message appears on both the MO and MSO's HUDs that reads "WARN[ING]" (Tabs R-8, V-6.24, EE-4, EE-6). Simultaneously, a "Flaps Override" message is displayed in the warning and caution area of both the MO and MSO's Head-Down Displays (HDD) (Tabs R-8, V-6.24, EE-6). At 09:26:30Z, the MSO called out the Flaps Override message to the MO who

acknowledged the call one second later (Tabs N-3, R-8, R-9, V-11.28, EE-4). To extinguish the warning, the MO needed to move the Flap Lever to the neutral position (Tab V-6.25, V-7.34 - V-7.36, V-11.29). The Flap Lever was not moved from the takeoff position at any point (Tabs R-17, V-3.20, V-10.34, V-11.29, DD-11).

At 09:26:34Z the MO pulled the Condition Lever aft to the “Stop” position (Tabs V-3.23, V-11.29, BB-4, BB-6, DD-4, DD-5). This action caused the mechanical fuel shutoff valve (MSOV) to close and resulted in a commanded engine shutdown (Tabs BB-4, BB-6, DD-4, DD-5, EE-6). An engine out indication was displayed on both PSO1 and PSO2 (Tabs DD-4, DD-5, EE-6).

The Condition Lever has three positions: Run, Stop, and Stop and Feather (Tabs V-6.25, V-7.37, BB-4, BB-6, EE-7, EE-8). The full forward detent “Run” position is required for the engine to continue operating (Tabs V-3.20, V-6.25, V-7.37, BB-4, BB-6, EE-7). The middle detent “Stop” position closes the MSOV in order to shutoff fuel to the engine (Tabs V-6.25, V-7.37, BB-4, BB-6, EE-7). The full aft “Stop and Feather” position closes the MSOV and feathers the propeller to reduce drag on the aircraft in order to extend glideback range (Tabs V-6.25, V-7.37, BB-4, BB-6, BB-12, DD-5, EE-8). The system computers will close the MSOV when the Condition Lever setting is moved approximately 1/3 of the range of motion aft from the full forward position; there is a detent at this position (Tab BB-6). The commands from the Condition Lever are unique to that control mechanism. Condition Lever commands cannot be replicated via other interfaces nor can an erroneous signal be sustained without moving the Condition Lever to a matching position (Tab V-3.19).

At 09:26:42Z, the MSO alerted the MO to the engine out indication and two seconds later the MO acknowledged the call (Tabs N-3, R-6, R-8, R-9, R-15, V-11.29, EE-4). Simultaneous to the MSO declaration, the MO initiated a right hand turn back towards FSIA (Tab EE-4).

At 09:26:49Z, the MO turned off all hold modes by pressing the Landing Configuration Button on the Control Stick and pulled the Control Stick Trigger (Tabs R-9, EE-4).

At 09:26:53Z, the MO declared an emergency with ATC and notified them that the MRPA’s engine was out and that he intended to land on Runway 31 (Tabs N-3, R-9, V-11.32, EE-4). In actuality, the MO executed the forced landing attempt to Runway 13; the opposite direction from Runway 31 (Tabs R-6, R-7, V-11.32, V-10.26). The time it took from the initial emergency declaration until the MO concluded dialogue with ATC was 20 seconds (Tabs N-3, EE-4).

At 09:27:17Z, the MSO initiated the Engine Failure checklist challenge and response procedures (Tabs N-3, EE-4). The first three steps of this checklist are critical action procedures and are required to be executed from memory (Tabs V-6.27, V-7.42, BB-11, BB-12). The boldface steps associated with this checklist are: 1) **GLIDE – ESTABLISH**, 2) **LANDING SITE – SELECT**, 3) **CONDITION LEVER – AFT AS REQUIRED** (Tabs V-6.27, BB-11, BB-12). When the MSO initiated the first challenge item of this checklist, the MO gave the response items for both the first and second steps of procedure (Tabs N-3, EE-4).

While the MO analyzed where to set the Condition Lever, MO2 moved into the center seat position of the GCS in order to assist the Mishap Crew (MC) in the emergency (Tab V-3.15, V-10.27). The USN DV moved to the back of the GCS (Tabs R-7, V-3.15).

At 09:27:24Z, MO2 suggested the MO lower the landing gear (Tabs N-3, R-6, R-9, V-11.33, V-10.28). At 09:27:30, the MO lowered the Landing Gear Handle, and the “Ready to Lower Landing Gear” message was displayed on the MO’s HUD (Tabs R16, DD-12). The MSO lowered the PSO2 Landing Gear Handle to match the PSO1 position (Tab V-11.33). The MO did not pull the trigger to complete the gear extension sequence (Tabs V-3.16, DD-4, DD-5, EE-8). The MSO failed to use the MTS to confirm visually the landing gear had been extended properly (Tabs V-11.34, EE-8). The flight manual directs the SO to confirm landing gear is down using the AN/DAS-1 MTS sensor before descending below 500 feet AGL (Tabs BB-10, EE-8). Both PSO1 and PSO2 HUDs continued to provide a gear up indication via graphic symbology in the bottom left corner of the display throughout the remainder of the flight (Tab EE-6, EE-8). The “Ready To Lower Landing Gear” displayed in the top center of PSO1 remained present throughout the remainder of the flight (Tab EE-6). The “Ready To Lower Landing Gear” message was observed by the Sr Avionics Tech when he walked into the GCS. However, at that point it was too late to get the landing gear down since the MRPA was on short final (Tab V-3.15).

At 09:27:34Z, the MO completed the Engine Failure critical action procedure by pulling the Condition Lever aft (Tabs N-3, DD-13, EE-4). The aft Condition Lever position the MO opted to use was the full aft position (Tabs N-3, R-6, R-9, V-10.30, DD-6, EE-4). The engine stopped rotating as the propeller feathered and the MRPA accelerated from 102 KIAS to a peak speed of 137 KIAS (Tabs R-6, EE-4, EE-5).

MO2 provided energy state information to the MO from this point until the MRPA was in a position to land (Tabs R-15, V-10.30). MO2 assessed the MRPA was high and needed to descend based on altitude and Ground Data Terminal (GDT) data available on the PSO1 HUD (Tab V-3.17, V-10.30).

At 09:27:41Z the MO acknowledged MO2’s recommendation to descend (Tabs N-3, EE-4). MO2 recommended slipping the aircraft (Tabs N-3, R-6, R-9, R-16, V-10.30, EE-5). In order to dissipate excess energy, a pilot can either slip the aircraft or execute S-turns (Tabs V-7.45, EE-9). At 09:27:50Z the MO acknowledged MO2’s recommendation to slip the aircraft as he initiated the maneuver (Tabs N-3, V-10.30, V-11.35, DD-12, EE-5). The MSO used the MTS to monitor the MRPA’s alignment with the runway (Tab V-11.34).

At 09:28:09Z the MRPA passed 490’ MSL and the MSO called out “500 ft” to the MO (Tabs N-4, EE-5). MRPA airspeed was 127 KIAS and the heading was pointing 24 degrees to the right of the runway heading as the MRPA continued to track towards the runway centerline (Tab EE-5).

At 09:28:16Z the MRPA passed 240’ MSL and the MSO called out “250 ft” to the MO (Tabs N-4, EE-5). MRPA airspeed was 133 KIAS and the heading was pointing 19 degrees to the right of the runway heading (Tab EE-5). The MSO told the MO “you’re fast, 134 [KIAS]” (Tabs N-4, EE-5).

At 09:28:23Z the MRPA crossed the threshold of Runway 13 at 20' MSL on the PSO1 HUD and with 137 KIAS (Tab EE-5). MSO called out "50 ft" to the MO (Tabs N-4, EE-5). The MRPA was pointing 10 degrees to the right of the runway heading (Tab EE-5).

At 09:28:25Z the MSO directed the MO to "Straighten out" (Tabs N-4, EE-5). The MRPA was positioned half way between the runway centerline and the right edge of the runway (Tab EE-5). Over the following 10 seconds, the MO maneuvered the aircraft with multiple banks and two pitch oscillations in order to put the MRPA into a landing attitude (Tabs R-16, DD-9, EE-5).

At 09:28:35Z the MRPA stabilized in a landing attitude approximately 1/3 the distance (2,500 ft) down the runway (Tabs DD-9, DD-13, EE-5). The MRPA was still half way between the centerline and right edge of the runway with 127 KIAS and a heading of 134 (4 degrees to the right on the runway heading) (Tab EE-5). MSO directed the MO to land the MRPA (Tabs N-4, EE-5). The MO declared he had "one shot on the brakes" (Tabs N-4, EE-5).

At 09:28:37Z the MRPA impacted the runway and bounced back into the air (Tab EE-5). The MRPA's landing gear was still in the stowed position during the impact and the propeller was not rotating (Tabs R-10, R-12, V-4.14, V-5.21, V-9.29, DD-5). Two seconds later, the MRPA settled back onto the runway and started skidding (Tab EE-5). The MTS video was lost when the sensor impacted the runway (Tabs V-3.19, V-11.37, DD-9). At 09:28:43Z the MRPA was at 118 KIAS and 126 knots ground speed (KGS) when the MO stated that he was "coming on the brakes" (Tabs N-4, R-6, R-9, R-16, V-10.31, EE-5). The brakes will not function unless the landing gear is in the extended position (Tab EE-10).

At 09:28:46Z, with 113 KIAS, the MRPA started to gradually climb into the air where it reached a maximum altitude of approximately 40 ft MSL (Tabs R-6, R-7, R-8, R-9, R-16, V-10.31, EE-5). At 09:28:52Z there was only 2,000 ft remaining of useable runway (Tab EE-5). The MSO had shifted his crosscheck to the PSO1 HUD and suggested the MO ditch the MRPA into the Indian Ocean (Tabs N-4, R-8, V-3.20). At 09:29:12Z the MO commanded a slight right hand turn and nose up position. In response, the MRPA slowed to 83 KIAS and approached the water (Tabs R-6, R-7, R-9, R-16, EE-5).

The MRPA GPS and navigation systems were operating as expected and there was no significant weather impact from takeoff through final impact (Tabs R-10, V-2.19, V-3.21, V-9.23, V-9.24, V-1.15, V-11.22, DD-4).

e. Impact

MQ-9 Reaper T/N 05-000102 crashed into the Indian Ocean at approximately 09:29:15Z on 4 April 2012 approximately 500' beyond and 400' right of Runway 13 departure end (Tabs H-2, R-6, R-10, V-1.13, DD-4). There was no environmental impact to the marine habitat or beach (Tab P-3). The MRPA was destroyed on impact (Tabs V-1.15, V-4.15, V-5.20, V-9.29, DD-4). The total cost of the MRPA, MTS, MTS Electronic Unit, and SOF pod was in excess of \$8,931,000 (Tab P-2). There were no fatalities, injuries, or damage to other property (Tabs P-3, EE-11).

MQ-9A, T/N 05-000102, 4 April 2012

f. Egress and Aircrew Flight Equipment (AFE)

Not applicable.

g. Search and Rescue (SAR)

Not applicable.

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

The Air Force Technical Order (AFTO) 781 series forms for the MRPA were documented in accordance with (IAW) applicable maintenance guidance and indicated no outstanding maintenance issues that would have prevented the MRPA from flying on 4 April 2012 (Tab D-8 - D-13). Further, per the AFTO Form 781K, there were no delayed discrepancies that would have required the aircraft to be grounded on 4 April 2012 (Tab D-119, D-120). The Maintenance Lead, the individual who approves an aircraft for flight, reviewed all applicable maintenance forms and data for the MRPA noting that nothing was out of the ordinary prior to the mishap mission (Tab D-10 - D-13). The Maintenance Lead then certified the aircraft as available for flight (Tab D-8).

A 30-day pre-mishap history check of the Integrated Maintenance Data System (IMDS) and AFTO 781 series forms, revealed no maintenance issues in the previous ten days leading up to the mishap (Tab D-8 - D-113).

b. Inspections

All required inspections were accomplished on the MRPA and documented IAW applicable maintenance guidance. There were no overdue Aircraft Time Compliance Technical Orders (TCTO) directing modifications of the aircraft or the performance of any inspection of the MRPA (Tabs D-119-D-120, EE13 - EE-14).

On 2 April 2012, maintenance personnel completed a scheduled 100 flight hour airframe inspection in which no discrepancies were noted (Tabs D-17 - D-26, V-5.17).

On 4 April 2012, maintenance personnel performed a basic post flight/pre-flight inspection and serviced fuel. No discrepancies were noted during this inspection (Tabs D-8 - D-13, V-4.12).

All required inspections of the Ground Control Station (GCS) had been accomplished and the GCS was functioning properly (Tab V-3.8, V-3.18).

c. Maintenance Procedures

Maintenance procedures on the MRPA and GCS were not a factor in the mishap. All maintenance procedures were accomplished IAW applicable technical orders and AFIs.

d. Maintenance Personnel and Supervision

The MRPA was maintained by Merlin RAMCo Inc, under contract with the 645th AESG to provide deployed maintenance support on the MQ-9A UAS (Tab EE-14). A review of the training and qualification records of contract maintenance personnel who performed maintenance on the MRPA indicated that all personnel were trained and qualified to perform the tasks executed on the MRPA (Tab EE-15). There was no evidence to indicate that maintenance personnel training and qualifications were a factor in this mishap.

e. Fuel, Hydraulic and Oil Inspection Analyses

No fuel, engine oil, or hydraulic fluid analysis was completed and there is no evidence to support that any fluids were a factor in the mishap warranting further investigation (Tab EE-15). Maintenance personnel properly serviced fuel tanks and oil reservoirs IAW applicable technical data. The servicing certification on the AFTO Form 781H reflected full oil levels and adequate fuel levels (Tab D-9).

f. Unscheduled Maintenance

Independent of maintenance schedules, all necessary repairs or replacements were properly made and were not relevant to the mishap (Tab EE-14, EE-15).

6. AIRCRAFT AND AIRFRAME SYSTEMS

a. Structures and Systems.

The MRPA was recovered from the Indian Ocean approximately 500' beyond and 400' right of Runway 13 (Tab H-2). The right wing, fuselage, engine, and right ruddervator were recovered intact. The left wing was separated at the wing root and the forward fuselage separated just forward of main wing spar. The left ruddervator also separated from the aircraft during impact. The MRPA reflected underside impacts consistent with abrasions and paint transfer observed on the runway. Two of the three propeller blades had aft curled tips and were bent aft at the blade mid-span and the propeller spinner cone also sustained significant damage. The vertical stabilizer with rudder, and pieces of the MTS, antenna and lower engine bay were discovered on Runway 13 (Tab H-3, H-4).

The Ground Control Station (GCS) was secured immediately following the mishap and data logs and head-up display (HUD) data were downloaded for evaluation (Tab V-3.22).

b. Engineering Evaluations and Analyses.

General Atomics Aerospace Systems Inc (GA-ASI) received and analyzed data from the GCS data logs and the MO and MSO HUDs from the mishap flight (Tab DD-4, DD-25). This data reflected settings of the GCS and flight parameters of the MRPA as they were throughout the mishap mission (Tab DD-4). GA-ASI verified the flight parameters by comparing them against the real time data observed in the HUD to produce their technical analysis (Tab DD-4 - DD-14).

GA-ASI's technical analysis determined the MRPA's engine was performing normally, producing good thrust and did not indicate any signs of malfunction (Tab DD-11). The GCS data logs indicated the MRPA was responding correctly to commands from the GCS such as roll, pitch, throttle, flaps, and landing gear (Tab DD-4). The engine out condition resulted when the MO moved the Condition Lever to a position that caused the MSOV to close and shut off fuel to the engine (Tab DD-4, DD-5, DD-14). The data logs did not indicate an engine restart was attempted during the duration of the flight (Tab DD-12). Further, the data logs showed the landing gear was never commanded down (Tab DD-5, DD-12).

GA-ASI requested testing of the GCS with emphasis placed on the Condition Lever to verify its functionality (Tab DD-25). Based upon the GCS Throttle Quadrant Test, the Condition Lever indicated smooth and continuous movement. No erratic feather commands were observed in the data logs and no testing anomalies were reported. Further, a review of the data logs did not indicate any erratic or anomalous GCS commands that may have been causal in the engine shutdown (Tab DD-25).

The AIB reconstructed the mishap utilizing highly qualified MQ-9A Launch and Recovery crew in a Predator Mission Aircrew Training Simulator (PMATS) using variables identical to the MRPA. These variables included MRPA gross weight, winds, density altitude, and MO actions up through engine shutdown (Tab EE-5). Leaving all variables unchanged, the simulation confirmed if the Airspeed Hold mode is turned "On" prior to retracting the flaps a "Flaps Override" warning is displayed on both HDDs, "WARN" is displayed on both HUDs, and an audible tone is produced. The simulation then confirmed if the Condition Lever is moved aft from the "Run" position to the "Stop" position the engine will shut down and an "Engine Out Detected" warning will be displayed on both HDDs, "WARN" is displayed on both HUDs and an audible tone is produced (Tab EE-6).

Additionally, the simulation confirmed if the Pilot's landing gear handle is lowered but the Control Stick Trigger is not depressed, the landing gear will not extend, a "Ready to Lower Landing Gear" message will be displayed on the Pilot's HUD, and landing gear up symbology will remain on both HUDs (Tab EE-6).

Finally, simulation further confirmed that if the MO had extended the landing gear, and factoring in the MRPA's impact location, airspeed, orientation, and impact acceleration, the MRPA recovery could have resulted in a successful landing (Tab EE-6).

7. WEATHER

a. Forecast Weather

The forecasted FSIA weather at 0930Z on 4 April 2012 was: 1) winds 340 degrees at 9 knots with variable direction between 320 degrees and 040 degrees, 2) temperature of 90 degrees Fahrenheit, 3) no icing, turbulence, or windshear, 4) unlimited visibility, 5) a few clouds at 2,000 ft, and 6) isolated thunderstorms outside of 25 NM and along the mission route (Tab F-3).

b. Observed Weather

Weather was as briefed (Tab F-2). Actual winds during the takeoff and mishap were variable in direction between 360 degrees and 010 degrees at 5-6 knots (Tab F-2).

c. Space Environment

The mishap mission was conducted using a Line of Sight (LOS) command and control link and did not utilize the Beyond Line of Sight (BLOS) satellite datalink (Tabs V-3.14, EE-7). There is no evidence of any adverse conditions in the space environment that may have been a factor in the mishap (Tab F-16, F-17).

d. Operations

Maximum crosswind for the mishap was 5 knots and the maximum tailwind for the landing was 4 knots (Tab EE-10). Weather at the time of the mishap was within the MRPA's operational limits (Tab EE-10). Weather was determined not to be contributory to this mishap.

8. CREW QUALIFICATIONS

a. Mishap Pilot Operator (MO)

(1) Training

Prior to his separation from the United States Air Force (USAF), the MO was qualified to fly both the mission phase and the launch/recovery phase of MQ-9A operations (Tabs G-2, T-4). The MO's last mission phase military checkride was on 7 January 2011, but did not include a launch and recovery qualification (Tab G-2, G-3). The MO's last military checkride prior to separation that did include a launch and recovery qualification in the MQ-9A was on 26 April 2010 (Tab T-4). IAW AFI 11-2MQ-9, Volume 1, *MQ-9—Crew Training*, 23 Jun 10, paragraphs 2.2.2, 4.7.4, and 6.5.1, the MO was required to complete an approved Launch and Recovery Course. The MO took the Initial Qualification Course in order to regain his Launch and Recovery (LR) qualification. The MO completed the required training from MRI on 4 December 2011 (Tab G-6).

(2) Experience

The MO was a current and qualified pilot with 3549.3 total hours (Tabs T-3, V-2.24, EE-10). These hours included 1512.1 hours in the KC-10, 736.5 hours in the MQ-1B, and 931.9 hours in the MQ-9A (Tabs T-3, EE-10). The MQ-9A was the MO's third assigned aircraft after the KC-10 and MQ-1B (Tabs T-3, V-2.24). The MO flight time during the 90 days prior to the mishap was as follows:

	Hours	Sorties
30 days	4.6	4
60 days	42.0	13
90 days	96.0	26

(Tab EE-10)

The MO's qualifications were not contributory to this mishap.

Additional launch procedure, simulated flame out (SFO), and landing proficiency data for the 90 days prior to the mishap were as follows:

	Launch Procedures	Landings	SFO
30 days	1	6	2
60 days	1	15	2
90 days	5	21	3

(Tab EE-10)

The MO's proficiency was not causal or a substantial contributory factor to this mishap. However, the MO training demonstrates he had limited recent experience in launch procedures.

b. Mishap Sensor Operator (MSO)

(1) Training

The MSO was qualified in the MQ-9A since 13 July 2007 (Tab T-6). His qualifications included Instructor Sensor Operator (Tabs G-18, G-36, G-37, V-6.8). The MSO's last military checkride was on 24 April 2011 (Tab G-17). The MSO completed the requisite LR Conversion Training course from MRI on 26 August 2011 (Tab G-22).

(2) Experience

The MSO was current and qualified on 4 April 2012 and had a total flight time of 2910.0 hours, with 891.1 hours in the MQ-1B and 2018.9 hours in the MQ-9A (Tabs T-7, V-2.24, EE-10). The MSO maintained dual qualifications in both the MQ-1B and MQ-9A while on active duty (Tab T-6). The MSO flight time during the 90 days prior to the mishap was as follows:

MQ-9A, T/N 05-000102, 4 April 2012

	Hours	Sorties
30 days	7.3	7
60 days	66.3	18
90 days	109.9	29

(Tab EE-10)

The MSO's qualifications were not contributory to this mishap.

Additional launch procedure and landing proficiency data for the 90 days prior to the mishap were as follows:

	Launch Procedures	Landings
30 days	4	7
60 days	14	8
90 days	23	12

(Tab EE-10)

The MSO's proficiency was not contributory to this mishap.

9. MEDICAL

a. Qualifications

The MO and MSO had current Federal Aviation Administration (FAA) medical certificates and were medically qualified for flight duty without restrictions at the time of the mishap (Tab EE-12).

b. Health

The AIB medical member reviewed the available medical records for the MO and MSO as well as a written history provided by the MSO documenting his nutrition, medications, hydration, sleep patterns, fatigue and exertion for the 72-hour and 14-day time periods prior to the mishap. A written history was not available for the MO, but a non-privileged MO statement and testimony from multiple witnesses provided sufficient evidence of the MO's habits and health during the time period leading up to the mishap (Tabs R-9, V-11.42, V-7.64, V-7.65, V-10.13). There is no evidence any prescription or over-the-counter medications were a factor in this mishap. There is no evidence the health or any medical conditions of the MO or MSO were factors in this mishap (Tab EE-13).

c. Pathology

There were no fatalities or injuries as a result of this mishap (Tab EE-12).

d. Toxicology

On 4 April 2012, immediately after the mishap, a USAF medical provider collected blood and urine samples from the MO and MSO. The samples were sent to the Armed Forces Medical Examiner System, Dover AFB, Delaware, for analysis. The toxicology testing resulted in negative findings for the presence of ethanol or drugs of abuse for the MO and MSO (Tab EE-12).

e. Lifestyle

No lifestyle factors were found to be relevant to the mishap (Tab EE-13).

f. Crew Rest and Crew Duty Time

As required by AFI 11-202, Volume 3, *Flying Operations-General Flight Rules*, AFMC Supplement 1, Chapter 9, 25 August 2011, aircrew are required to have a minimum 12-hour non-duty period before the flight duty period begins. This includes the opportunity for at least 8 hours of uninterrupted rest during the 12 hours immediately prior to the beginning of the flight duty period. No crew rest or crew duty time requirements were violated or found to be a factor in the mishap (Tab EE-13).

10. OPERATIONS AND SUPERVISION

a. Operations

There was nothing unusual about the 409 AEG/Detachment 1, MRI mission crew and maintenance crew, or the site's operations tempo or workload during the timeframe relevant to the mishap (Tab V-1.8, V-2.6, V-2.28, V-7.50, V-8.5, V-9.5). The mishap crew's experience level was appropriate for the mission (Tabs V-2.13, V-2.24, V-2.26, V-7.65, V-7.66, V-10.11, EE-10).

b. Supervision

(1) 409 AEG/Detachment 1

The leadership of 409 AEG/Detachment 1 provided appropriate supervision. Through the Detachment 1 Government Ground Representative (GGR) and Government Flight Representatives (GFR1 and GFR2), they provided appropriate oversight of the ground and flight operations conducted by MRI. Oversight by Detachment 1's GFR ensured contractor flights were approved (Tab K-10), mission crews were current and qualified, and mission ORM assessments (Tab K-11) were conducted in accordance with the MRI, Contractor's Procedures for GOCO Operations (Tab EE-6) and Procedures for ORM Threshold Assessment (Tab EE-6). There is no evidence to suggest 409 AEG/Detachment 1 supervision was a factor in the mishap.

(2) Merlin RAMCo Inc

The leadership of MRI provided appropriate supervision. Through their onsite Maintenance Lead and Lead Pilot, they provided supervision of the ground and flight operations conducted by MRI. The Lead Pilot ensured each member of the MC was current and qualified, and assembled the MC based on qualification, skill level, and need to maintain currency in all phases of flight operations (Tabs K-8, V-10.14). A preplanned shift to the mission flying schedule occurred on 4 April 2012 and as a result, the MC shifted from aircraft mission control and landing phases to aircraft takeoff and mission control phases (Tabs K-8, V-10.9, V-11.20 - V-11.21). The Total ORM assessment level for this mission was “GREEN” with the MO checking his “CREW PROFICIENCY (30DAYS)” as “<10 HRS or <4 SORTIES”, representing a “YELLOW” factor assessment (Tab K-11). The Lead Pilot (LP) also administered written MQ-9 BOLDFACE/ Critical Action Procedure (CAP) tests prior to a shift in the mission flying schedule (Tab V-10.18, V-11.12). Specific to the April 2012 MQ-9 BOLDFACE/CAPS test, the MSO incorrectly answered one question regarding the ENGINE FIRE / ENGINE RPM DECAY ON THE GROUND critical action procedure, and the LP failed to notice that the MSO missed this question (Tabs K-2, EE-7, EE-8).

11. HUMAN FACTORS

a. Overview

A DoD taxonomy was developed to identify hazards and risks, called DoD Human Factors Analysis and Classification System (DoD-HFACS), referenced in Attachment 5 of AFI 91-204, *Safety Investigations and Reports*, 24 September 2008. All human factors enumerated in Attachment 5 to AFI 91-204 were carefully analyzed for possible contribution to the mishap sequence. The relevant human factors are discussed below. DoD-HFACS describes four main tiers of human factors as: 1) Acts, 2) Preconditions, 3) Supervision, and 4) Organizational Influences (AFI 91-204, attach 5). The DoD-HFACS taxonomy nanocodes which associate each human factor with a particular tier are also included for reference (AFI 91-204, attach 5).

b. Causal

(1) AE103 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 (AFI 91-204, attach 5). The MO committed two separate procedural errors during the mishap sequence: 1) the MO moved the Condition Lever aft to the “Stop” position while intending to move the Flap Lever and 2) the MO and MSO failed to complete the necessary sequence to extend and confirm the position of the landing gear (Tabs DD-4, DD-5, and EE-4 - EE-10).

(A)The Condition Lever was moved aft to the “Stop” position

At 09:26:30Z the MSO called “Flaps Override” which the MO acknowledged (Tab N-3, N-6). According to testimony by the MSO, the MO then made a movement to change the position of one of the control levers on PSO1; however, the MSO did not see which lever was moved (Tab V-11.29). Based on a review of the technical data, the Condition Lever was commanded aft from the full forward “Run” position to the middle “Stop” position (Tabs V-3.23, DD-4, DD-5, EE-6, EE-7). This closed the MSOV, causing the engine to shutdown, and an engine out was detected (Tabs V-3.23, DD-4). On the MO’s HUD video the engine torque rolled back and an audible lever actuation is heard coincident with the engine shutdown (Tab EE-4). At 09:26:41Z, 11 seconds after the “Flaps Override” call, the MSO called “Engine Out Detected” (Tab N-3, N-6). According to a review of the parametric data, the engine was performing as expected up to this point in the mishap sequence (Tab DD-4, DD-11). Throughout the mishap mission, the flaps moved automatically three times in response to other MRPA inputs, but were never commanded to the neutral position by the Flap Lever (Tab DD-5, DD-11). The MSO observed that the “Flaps Override” warning did not extinguish when the “Engine Out Detected” warning came on (Tab V-11.29). After the MRPA crashed in the Indian Ocean, the MO noted to the MO2 to look at the Flap Lever, which the MO2 recognized was still in the takeoff setting (Tabs R-17, V-10.33).

(B)The MO & MSO failed to extend and confirm the position of the landing gear

Following the engine out the MO began a right hand turn. At 09:26:53Z the MO contacted ATC, declared an emergency, and stated his intent to land on Runway 31 (Tab N-3, N-6). The MSO then began the Engine Failure checklist at 09:27:15Z and the MO responded with confirmation of the first two steps of the boldface portion of this checklist (Tab N-3, N-6). At 09:27:24Z the MO2 said something off headset which was not captured in the transcripts to which the MO responded “...gear coming down” (Tab N-3, N-6). According to MO2’s testimony, he recommended the MO bring the landing gear down. MO2 then made the determination to focus on the energy state of the MRPA and distance from Runway 31 (Tabs R-6, R-15, V-10.29).

After the MO declared “...gear coming down” there is no confirmation of the MRPA’s landing gear position by the MC, nor is there any mention of the landing gear for the remainder of the mission (Tab N-3 - N-4, N-6 - N-7). There are three steps required to extend the landing gear 1) gear handle down, 2) read advisory message on the HUD “Ready To Lower Landing Gear”, and 3) pull the Control Stick Trigger (Tabs BB-5, EE-8 - EE-9).

After the MO called “...gear coming down” the advisory message “Ready To Lower Landing Gear” was displayed on the MO’s HUD and stayed displayed for the remainder of the mission (Tabs V-3.15, V-3.16, DD-4, DD-13). This message indicates the Landing Gear Handle was commanded down, but the necessary trigger pull was not executed or not executed correctly (Tab DD-4). There were no maintenance issues with the GCS or the Control Stick Trigger, nor were there any indications of maintenance issues after the mishap (Tab V-3.8, V-3.18, V-3.19, V-9.26, EE-13). All MRPA and GCS flight controls were operating normally during pre-flight inspections. The landing gear operated normally when retracted after takeoff (Tabs V-3.8, V-3.13, V-9.25, DD-4, DD-5, DD-25, EE-13).

Once the landing gear was retracted, it did not change state for the remainder of the mishap mission (Tab DD-5, DD-12). According to standard procedure, the MSO should have used the MTS to confirm visually the landing gear was properly extended (Tabs V-6.30, V-11.35, BB-10). This step in the landing gear extension procedure was never accomplished (Tabs V-11.34, V-11.35, EE-4 to EE-5, EE-8). Multiple witnesses asserted the landing gear was stowed as the MRPA came in to land (Tabs V-3.16, V-4.14, V-9.29, DD-6). Photographs as well as MO2 testimony reinforced that the gear was still retracted after the MRPA was recovered (Tabs R-17, S-2, V-10.34, DD-6, DD-21).

c. Contributory

(1) PC506 Expectancy

Expectancy is a factor when the individual expects to perceive a certain reality and those expectations are strong enough to create a false perception of the expectation (AFI 91-204, attach 5). This directly ties into the procedural error that led to the failure to extend and confirm the position of the landing gear. The MO called "...gear coming down" at 09:27:28Z after being told by MO2 to lower the landing gear (Tabs N-3, N-6, R-6, R-16, V-11.33). The MSO observed the MO bring the Landing Gear Handle down and lowered his Landing Gear Handle to match control settings (Tab V-11.31, V-11.33). MO2 stated he heard the MO call "...gear coming down" and observed the MO move the Landing Gear Handle, therefore MO2 believed the MRPA landing gear was down at the time of the impact (Tabs R-6, R-16, V-10.30). At 09:28:43Z, after the MRPA impacted the runway, the MO stated "coming on the brakes" (Tab N-4). MO2 further stated no one understood why the MRPA became airborne after the brakes were applied, nor did any crewmembers realize the gear was still retracted until the wreckage was later recovered (Tabs R-17, V-10.30).

(2) PC102 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 can be described as an overly tight focus of attention leading to the exclusion of comprehensive situational awareness (AFI 91-204, attach 5). Channelized attention directly ties into the procedural error that led to the failure to extend and confirm the position of the landing gear.

Based on a review of the audio transcripts from both the MO and the MSO, lowering the landing gear is mentioned only once at 09:27:28Z (Tab N-3, N-6). All further communication between the MO, MSO and MO2 is related to energy state and distance from the runway (Tabs N-3 - N-4, N-6 - N-7, V-11.29). In the testimony from MO2, he stated that he was utilizing the MO's HUD, but his focus was solely on three factors: altitude, airspeed, and GDT range (Tabs R-15, V-10.29). The "Ready To Lower Landing Gear" advisory message was displayed on the MO's HUD from the time he lowered the Landing Gear Handle until the MRPA crashed into the Indian Ocean (Tabs V-3.15 - V-3.16, EE-4 - EE-5, EE-8). The landing gear position symbology on the lower left corner of the MC HUDs showed the gear was still in the retracted position (Tab EE-8).

MQ-9A, T/N 05-000102, 4 April 2012

There was no acknowledgement by the MC or MO2 of the advisory message or the landing gear position symbology (Tabs N-3 - N-4, N-6 - N-7, V-11.33). At 09:28:43Z the MO stated “coming on the brakes” which had no effect because the landing gear was still in the stowed position (Tab N-4). The MC was not aware that the gear was in the stowed position until the wreckage was later recovered (Tabs R-17, V-10.28, V-10.34).

(3) PP102 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 (AFI 91-204, attach 5). This directly ties to the procedural error that led into the failure to extend and confirm the position of the landing gear. RPA Crew Resource Management (CRM) dictates a SO should read off checklist steps while the crew accomplishes and verbally verifies their completion; a process known as challenge and response (Tab V-6.13, V-7.33, V-11.18). The Site IP noted when the MO first arrived at the deployed location, he had CRM “issues.” Additionally, the Site IP noted the MSO had to overcome a tendency to be “quiet” (Tab V-7.55, V-7.56). The MSO stated he observed and was told the MO had a hard time trusting his SO (Tab V-11.16). During the mishap, the MSO did not verbally confirm with the MO the landing gear was extended although he did lower the Landing Gear Handle on PSO2, to match the PSO1 configuration (Tab N-3 - N-4, N-6 - N-7). In addition, standard procedure dictates the SO visually confirm the landing gear position with the MTS (Tabs V-7.45, V-11.35, BB-10). This step was never accomplished; the MSO kept the MTS fixed on the runway as the MRPA was coming back to land (Tabs V-11.34, V-11.35, EE-4 - EE-5, EE-8). The MSO and MO2 both testified they did not check the HUD landing gear position symbology to confirm the landing gear extension at any point (Tabs R-15, V-10.28, V-11.33).

(4) SP003 Limited Recent Experience

Limited Recent Experience is a factor when the supervisor selects an individual whose experience for a specific maneuver, event, or scenario is not sufficiently current to permit safe mission execution (AFI 91-204, attach 5). This factor is directly tied to the procedural error that led to the incorrect movement of the Condition Lever. The MO completed LRE training 4 December 2011, just prior to deploying (Tab G-6). The MSO stated he was told the MO had low experience and seemed uncomfortable and unfamiliar with checklists (Tab V-11.16, V-11.19). A separate mishap occurred on 13 December 2011 that resulted in a grounding of the site’s one remaining RPA for 30+ days (Tab V-7.6, V-7.52). When the MO resumed flying operations after the first down period, the Site IP stated the MO seemed to have “issues” and was not proficient. The Site IP considered using the MO for only the MCE phase. However, the MO’s performance improved right before a second down period (Tab V-7.55, V-7.56). A lightning strike occurred on 14 February 2012 resulting in a second down period lasting 33 days (Tab V-7.6, V-7.27, V-7.52). During this down period, the site aircrew gathered once per week to conduct emergency procedure ground training (Tab V-7.53). During part of this down period, the MO was in leave status, which involved travel to another island in the Seychelles and to England (Tab V-7.60). Site leadership asked the MO to return from his trip early in order to fill the flying schedule rotation (Tab V-7.60). On the day of the mishap, the MSO stated the MO seemed “rusty” (Tab V-11.26). According to the 30-, 60-, 90-day look back, the MO had only

MQ-9A, T/N 05-000102, 4 April 2012

performed one launch in the prior 60-day period (Tab EE-10). In the MO's non-privileged post mishap witness statement, he noted it was his "first takeoff without IP supervision in a few months (the second takeoff within as many months)" (Tab R-9).

(5) SP005 Proficiency

Proficiency is a factor when an individual is not proficient in a task, mission or event (AFI 91-204, attach 5). This factor is directly tied to the procedural error that led to the incorrect movement of the Condition Lever. The MO completed LR training on 4 December 2011, just prior to deploying (Tab G-6). The GFR noted in his interview, the MO had low overall experience with LR procedures (Tab V-2.25). According to the 30-, 60-, 90-day look back, the MO had only performed one launch in the prior 60-day period (Tab EE-10). On 4 April 2012, the human factors element of "CREW PROFICIENCY (30 DAYS)" was assessed as "Yellow" on the ORM worksheet, indicating that in the last 30 days the MO had less than 10 flight hours or 4 missions (Tab K-11). The MSO description of the MO as "rusty" on the mishap day is substantiated by: 1) the MSO reminding the MO to obtain ATC clearance before starting the MRPA engine and then again before taxiing, 2) the MSO observing the MO accomplish checklist steps early and/or out of order, 3) the MO conducting a non-standard departure brief, and 4) the MO taking off without an ATC clearance (Tabs N-3, N-6, V-11.23, V-11.24, V-11.26, V-11.27). In the MO's non-privileged post mishap witness statement, he incorrectly identified the "Flaps Override" as a "Flaps Overspeed" (Tab R-9). In addition, the MO had only recently re-qualified on 4 December 2011 for LR operations, and subsequently faced two extended down periods where no flying was accomplished (Tab V-7.6, V-7.52). These down periods interrupted the MO's proficiency/experience progress as substantiated by: 1) the Site IP who stated the MO had "issues" after the first down period and 2) the MSO noting the MO seemed "rusty" on the day of the mishap (Tab V-7.55, V-7.56, V-11.26).

d. Non-Contributory

(1) AE102 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 (AFI 91-204, attach 5). While not directly contributory, this human factor error reinforces the MO's limited recent experience and the lack of proficiency. The MO made several checklist errors during the Takeoff and Climb, Level Off, Cruise checklists, to include doing checklist steps out of order or too early (Tabs V-11.23, BB-7 - BB-9, EE-3 - EE-5, EE-7). It was noted more than once during the MO's LR training, that his checklist discipline and pace could be improved (Tab G-12, G-15, G-16). The MO's Site IP noted the MO seemed to prefer to fly with the checklists in his lap, which placed him in a head-down position (Tab V-7.55, V-7.56, V-11.19). Prior to the initiation of the mishap sequence, the MO turned the Airspeed Hold "On" before he raised the flaps, which is out of sequence IAW the Climb, Level Off, Cruise checklist and caused the "Flaps Override" warning (Tabs R-19, BB-7 - BB-9, EE-4). The MSO also noted that although the "Engine Failure" boldface steps were performed by the MO, they were performed in a non-standard way (Tab V-11.32).

(2) PC308 Circadian Rhythm Desynchrony

Circadian Rhythm Desynchrony is a factor when the individual's normal, 24-hour rhythmic biological cycle (circadian rhythm) is disturbed and it degrades task performance. This is caused typically by night work or rapid movement (such as one time zone per hour) across several time zones; referred to as "shift lag" and "jet lag." Time in the new time zone will lead to adaptation and recovery; the amount of time depends on the number of time zones crossed and the direction of travel. Recovery from shift lag may never occur (AFI 91-204, attach 5). This factor cannot be tied directly to the mishap sequence but neither can it be completely discounted as an influence on the MO's performance. The MO spent approximately one week in England prior to the mishap and returned approximately one week before the mishap occurred (Tab V-7.60). The time zone difference between England and Seychelles is +4 hrs. Additionally, the day prior to the mishap, a preplanned shift change occurred that pushed the MO's schedule forward 6 hours in one day (Tabs K-8, V-10.14, V-11.20, V-11.21). MO stated in his testimony he received only 5 hours of sleep due to the schedule change (Tab R-9). Although crew rest requirements were met IAW AFI 11-202, Volume 3, *Flying Operations-General Flight Rules*, Chapter 9, 22 October 2010, the 8 hours rest that is recommended was available but not achieved.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Directives and Publications Relevant to the Mishap not available on the AF Publishing website

- (1) TO 1Q-9(M)A-1, *Flight Manual, USAF Series MQ-9A Aircraft*, 4 July 2010
- (2) AFTTP 3-3 MQ-9, *Air Force Tactics, Techniques, and Procedures 3-3.MQ-9*, 15 September 2010
- (3) Operational Read File GOCO-1, *Contractor's Procedures for GOCO Operations*, 9 January 2012
- (4) Operational Read File GOCO-4, *Procedures for ORM Threshold Assessment*, 28 October 2011
- (5) Seychelles Civil Aviation Authority, Air Navigation Services Division, *Standard Operating Procedure*, 15 October 2009
- (6) TO 00-5-15, *Air Force Time Compliance Technical Order Process*, 1 January 2010
- (7) TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, 15 June 2011

b. Directives and Publications Relevant to the Mishap available on the AF Publishing website

- (1) AFI 11-2MQ-9, Volume 1, *MQ-9—Crew Training*, 23 June 2010
- (2) AFI 11-202, Volume 1, *Aircrew Training*, 22 November 2010
- (3) AFI 11-202, Volume 1, Air Force Materiel Command Supplement, *Aircrew Training*, 25 July 2011
- (4) AFI 11-2FT, Volume 1, *Flight Test Aircrew Training*, 20 September 2011
- (5) AFI 11-2MQ-9, Volume 3, *MQ-9—Operations Procedures*, 28 November 2008
- (6) AFI 11-202, Volume 3, *General Flight Rules*, 22 October 2010

MQ-9A, T/N 05-000102, 4 April 2012

- (7) AFI 11-202, Volume 3, Air Force Materiel Command Supplement, *General Flight Rules*, 25 August 2011
- (8) AFI 11-202, Volume 3, Air Combat Command Supplement, *General Flight Rules*, 9 March 2012
- (9) AFI 11-2FT, Volume 3, *Flight Test Operations Procedures*, 16 November 2011
- (10) AFI 21-101, *Aircraft and Equipment Maintenance Management*, 26 July 2010
- (11) AFI 51-503, *Aerospace Accident Investigations*, 26 May 2010
- (12) AFI 91-204, *Safety Investigations and Reports*, 24 September 2008

NOTICE: The AFIs listed in paragraph 12.b 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

Deviations to TO 1Q-9(M)A-1, *Flight Manual, USAF Series MQ-9A Aircraft*, 4 July 2010 Takeoff and Climb, Level Off, Cruise checklists and landing gear extension procedures are identified in sections four and eleven of the above referenced Flight Manual and the pilot memorandum (Tab EE-7 - EE-10). The MC's deviations from the landing gear extension procedures were found to be causal to the mishap.

The MO also failed to initial section 16 of the AF IMT 4327a in accordance with Operational Read File GOCO-1 (Tab K-10). This signature is required to certify the launch pilot completed a go/no-go assessment of the crew currencies and qualifications. This deviation was not found to be causal or contributory.

13. ADDITIONAL AREAS OF CONCERN

None.

31 July 2012

KENNETH L. ECHTERNACHT, JR., Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

AIRCRAFT ACCIDENT INVESTIGATION MQ-9A, T/N 05-000102 VICTORIA, REPUBLIC OF SEYCHELLES 4 APRIL 2012

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 4 April 2012, at 0929 Zulu time (Z), an MQ-9A Reaper Remotely Piloted Aircraft (RPA), tail number (T/N) 05-000102, crashed into the Indian Ocean following a commanded engine shutdown and attempted forced landing that occurred 4 minutes and 15 seconds after takeoff from Seychelles International Airport (FSIA), Victoria, Republic of Seychelles. The RPA, Multi-Spectral Targeting System (MTS), MTS Electronics Unit, and Special Operations Forces (SOF) pod were destroyed, a loss value exceeding \$8,931,000. There were no fatalities, injuries, or damage to other property.

I find by clear, convincing evidence that the causes of the mishap were 1) the Mishap Operator (MO) commanded the engine off by moving the Condition Lever to a position that closed the fuel shut off valve, shutting off fuel to the engine and 2) the MO and Mishap Sensor Operator (MSO) failed to complete the landing gear extension sequence to include confirming that the landing gear was extended. Additionally, I find by a preponderance of evidence the MO's limited recent experience in launch procedures substantially contributed to the mishap.

2. DISCUSSION OF OPINION

a. Cause: the MO commanded the engine off by moving the Condition Lever to a position that closed the fuel shut off valve

The mishap crew (MC) completed mission planning and preflight duties at FSIA without incident. After completing start-up, taxi and pre-takeoff checks, which included the MO setting the Mishap Remotely Piloted Aircraft (MRPA) flaps to the standard takeoff position and the Condition Lever position to the forward "Run" position, the MRPA took off at 09:25:00Z, prior to receiving Air Traffic Control (ATC) clearance.

Approximately 25 seconds after takeoff, the MC raised the landing gear. The MO then failed to adjust the MRPA's flaps to the appropriate position in accordance with the Takeoff checklist.

Prior to reaching 2000 feet and approximately 1 minute and 25 seconds after takeoff, the MO selected the Airspeed Hold mode. By selecting the Airspeed Hold mode prior to adjusting the

MRPA's flaps, the MO's actions triggered a "Flaps Override" warning that the MSO called out to the MO. The MO acknowledged the warning verbally. Approximately 1 minute and 34 seconds following takeoff and in response to the "Flaps Override" warning, the MO inadvertently moved the Condition Lever aft from the forward "Run" position to the middle "Stop" position. This action shut off fuel to the MRPA's engine and resulted in an additional "Engine Out Detected" warning that the MSO called out to the MO.

The AIB also reconstructed the mishap accident in a MQ-9A simulator using variables identical to the MRPA, including aircraft gross weight, winds, density altitude, and MO actions up through the point the engine shut down occurred. Based on the simulation results, the AIB confirmed the MO's actions led to an "Engine Out Detected" warning and an engine shutdown.

Had the MO left the Condition Lever in the appropriate position and instead adjusted the Flap Lever in response to the "Flaps Override" warning, the mishap would not have occurred.

b. Cause: the MO and MSO failed to complete the landing gear extension sequence to include confirming that the landing gear was extended

Following the engine shut down, the MO turned the MRPA back towards FSIA. Approximately 1 minute and 53 seconds after takeoff, the MO declared an emergency with ATC and stated his intent to land on Runway 31. Approximately 2 minutes and 17 seconds after takeoff, the MC initiated the Engine Failure checklist and successfully established a glide path back to FSIA. However, the MO questioned himself on proper placement of the Condition Lever. Approximately 2 minutes and 24 seconds after takeoff, MO2 recommended the MO lower the landing gear. In response, the MO lowered his landing gear handle, but failed to pull the trigger on the Control Stick. Because the MO did not complete all the necessary actions required to extend the landing gear, the landing gear remained stowed. The MSO lowered his landing gear handle to match the MO action, but failed to confirm the landing gear was down with the MRPA's MTS. Additionally, both the MO and MSO failed to confirm the landing gear was down using their respective Head-Up Displays (HUD). From approximately 2 minutes and 30 seconds after takeoff through the remainder of the flight, the MO's HUD displayed a "Ready to Lower Landing Gear" message. The MO's and MSO's HUDs also provided a landing gear up indication. Approximately 3 minutes and 35 seconds after takeoff, the MRPA impacted within the first third of the runway and with a high rate of airspeed.

Based on information from simulations conducted using variables identical to the MRPA, the AIB confirmed the MO's actions resulted in a "Ready to Lower Landing Gear" message in the MO's HUD and landing gear up indications in the MO's and MSO's HUDs.

Although the MC did a remarkable job positioning the MRPA for an emergency landing, the landing gear was never lowered. Based on the MRPA's impact location, airspeed, orientation, and impact acceleration, the AIB determined through simulation that the MRPA could have been recovered with minimal or no damage if the landing gear had been down.

c. Substantially Contributing Factor: the MO's limited recent experience in launch procedures

Just prior to deploying to the Seychelles, the MO completed MQ-9 launch and recovery qualification training on 4 December 2011. During the 4 months leading up to the 4 April 2012 mishap, the site experienced two separate down periods with no aircraft available for flight activities. Both of these periods were in excess of 30 days and prevented the MO from conducting flying activities. As a result, the MO performed only one aircraft launch during the 60 days prior to the 4 April 2012 mishap. Although qualified and current for the 4 April 2012 mission, the AIB found the MO to have limited recent experience with MQ-9 launch procedures. This lack of recent experience manifested itself when the MO conducted a non-standard departure brief, took off without proper ATC clearance, failed to adjust the flaps following take off, performed checklist items out of order, mistook a "Flap Override" warning for a "Flap Overspeed" warning, and moved the Condition Lever to a position that shut off fuel to the engine. As such, the MO's limited recent experience in launch procedures substantially contributed to the mishap.

3. CONCLUSION

I developed my opinion by examining witness testimony; consulting subject matter experts in MQ-9A operations and maintenance; reviewing digital images of the MRPA wreckage, crash site, and ground control station; physically inspecting the MRPA wreckage; and reviewing applicable directives and guidance. I further developed my opinion by extensively reviewing the audio/video recording of the MO's and MSO's HUDs, technical analysis of the ground control station (GCS) data logs, and multiple simulations performed in a Predator Mission Aircrew Training Simulator (PMATS) by highly qualified MQ-9A Launch and Recovery pilots using the MRPA's flight profile.

31 July 2012

KENNETH L. ECHTERNACHT, JR., Colonel, USAF
President, Accident Investigation Board

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, 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