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AIR EDUCATION AND TRAINING COMMAND HANDBOOK 11-211

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FLYING OPERATIONS

ROAD TO WINGS REMOTELY PILOTED AIRCRAFT

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This publication implements Air Force Policy Directive (AFPD) 11-2, *Aircrew Operations* and AFPD 91-2, *Safety Programs*. It provides flight training activities with a source of lessons learned from over 10 years of aircraft accidents in the MQ-9A aircraft. This publication applies to Air National Guard and Air Force Reserve Command units. Ensure that all records created as a result of processes prescribed in this publication are maintained IAW Air Force Instruction (AFI) 33-322, *Records Management and Information Governance Program*, and disposed of IAW Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. This publication may not be supplemented or further implemented/extended.

FOREWORD

The "Road to Wings" series is a journey in Air Force Remotely Piloted Aircraft (RPA) mishaps since 2009…how they happened, why they happened, and most importantly, the lessons learned from those mishaps. Whether you are a student attending training or an experienced 3,000+ hour aviator, "Road to Wings" offers all of us the opportunity to learn from past mistakes and improve our airmanship.

This handbook includes Class A mishaps for the MQ-9 aircraft. The majority of mishaps contained herein occurred during combat operations and/or during the Launch/Recovery phase of flight. Students are encouraged to discuss these scenarios with their instructors and with fellow students. What steps would you have taken to break the mishap chain? How would you have reacted if it was you in the scenario?

The information in this handbook is not directive in nature. The vast majority of the information contained in "Road to Wings" was derived from non-privileged sources and has been further "sanitized" so as to not include any references to date or location. For example, the "Mishap" and "Investigation" sections contain information derived from mishap reports and the "Lessons Learned" section was written by a long line of aviators discussing the mishaps and applying their experience. The "Action Taken" section discusses the strides that were made to prevent the mishap from occurring in the future. Because much of the information in this handbook is historical, it may contain references to documents that have changed drastically or are now obsolete.

From your "dollar ride" to your "fini flight," you will be challenged on every sortie you fly. Stay sharp and stay engaged. Your airmanship and sound decision making is critical to breaking the mishap chain.

"You've got to expect things are going to go wrong. And we always need to prepare ourselves for handling the unexpected. – Neil Armstrong

1. Engine Failure on Climbout.

1.1. Mishap:

1.1.1. The mishap sortie (MS) was launched in support of an operational mission. Prior to takeoff, the mishap aircraft (MA) received "line up and wait" instructions from Tower. The MA entered the runway and shortly after received a "confirm ready" call from Tower. The mishap pilot (MP) did not acknowledge Tower and, upon seeing the desired engine parameters, applied full throttle and took off without having received clearance from Tower. Passing 1,900 feet above ground level (AGL) the mishap sensor operator (MSO) announced "Flaps Override" warning. The MP moved the condition lever to the fuel cutoff position (center detent) and an engine out indication was displayed on both pilot and sensor operator stations. The MSO announced "Engine Out Detected" and the MP began a right turn, commanded landing configuration, and transmitted the loss of the engine to air traffic control (ATC). After completing the turn back to base, the MP executed the ENGINE FAILURE boldface leaving the condition lever in the fuel cutoff position (center detent), allowing the propeller to windmill. The MP then lowered the landing gear control switch. The blue advisory text "Ready to lower landing gear" displayed on the MP's head-up display (HUD) and remained on through the remainder of the flight. The condition lever was moved a second time and placed in the full aft position. The MA impacted the runway 2,000 feet beyond the threshold. Initial impact damaged the payload and the MSO lost video. The MA became airborne two more times before impacting the water.

1.2. Investigations:

1.2.1. Operator Factor. The flap retract step in both the TAKEOFF and CLIMB, LEVEL OFF, CRUISE checklists was not accomplished.

1.2.2. Operator Factor. The MP inadvertently moved the condition lever vs. the flap lever when presented with the “Flaps Override” warning. The MA lost power due to fuel starvation caused by the fuel shutoff valve being commanded closed.

1.2.3. Operator Factor. The MP failed to command the landing gear down. The mishap crew (MC) did not confirm the gear were down/locked and reference the BEFORE LANDING checklist during the recovery.

1.2.4. Operator Factor. The flap lever was set to command 16 degrees the entire flight. On landing (with gear not extended) the MA decelerated and accelerated upon touchdown, commanding different flap configurations. This changed the MA’s aerodynamics and ultimately led to the multiple touchdowns.

1.3. Lesson Learned:

1.3.1. Had the MP 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.

1.3.2. It was likely that if the MP would have moved the condition lever to the run position at any time during the approach prior to starting the flare, the engine would have restarted.

1.3.3. AFTTP 3-3.MQ-9 provides a common technique, during time-sensitive emergencies, to perform a LAGS check. Links, Autopilot/Altimeter, Gear, and Speed/Start Point. If time does not permit the full completion of a checklist, crew members need to remember the basics of getting the aircraft into a safe configuration prior to landing.

1.3.4. When the MP failed to obtain takeoff clearance, it created the first link in the chain of events. It is our responsibility to take our thoughts captive and rely on the things that will get us back on track (i.e. increased crew resource management (CRM), checklists, operations checks, etc).

1.4. Action Taken:

1.4.1. The warning now appears in the HUD when the condition lever is moved out of the full forward position.

Figure 1. Engine Failure on Climbout.

2. Pilot Induced Oscillation.

2.1. Mishap (**Figure 1**). During an operational sortie the MA returned to base early due to Multispectral Targeting System (MTS) issues. The mission control element (MCE) handed back the MA to the launch and recovery element (LRE) and the MP established a descent profile. On final, the MP had -2.8 degrees (nose down) trim applied throughout the approach. The aircraft weight at touchdown was at the maximum landing weight for normal conditions (considered a heavyweight landing). As a result of Pilot Induced Oscillation (PIO), seven bounces (up to a 5G impact) occurred and go-around calls were made. On the seventh contact the nose gear strut failed and the left main gear sheared. The MA then entered a skid down the runway and departed the prepared surface off the left side of the runway. The MA traveled approximately 3900 feet from initial touchdown to the final resting position; there were no injuries.

2.2. Investigation:

2.2.1. Logistics Factor. The acceleration of the MQ-9 program led to multiple oversights in acquisition and training programs. The MQ-9 was pressed into operational service without the acquisition of a simulator suitable for training aircrew in the launch and recovery (LR) phase of flight.

2.2.2. Operator Factor. The MP was not proficient in landing a heavy weight MQ-9 in the flight conditions encountered in the MS. Numerous publications make reference to the need to not relax back stick pressure until it is assured the main landing gear are in contact with the runway.

2.2.3. Logistics Factor. The instrumentation, ergonomics, and auditory cues from the ground control station (GCS) are inadequate and provide little additional situational awareness to the operator. The lack of a radar altimeter to display AGL altitude to the pilot during and approach makes the flare and landing phase difficult. The lack of audible cues and a cluttered HUD instrument presentation also increase the confusion of the operator while performing a normal instrument cross check.

2.2.4. Operator Factor. The crew misapplied the landing procedure, failed to recognize a PIO early enough, and once directed to "go around" the pilot failed to properly apply go around and Landing PIO Recovery boldface procedures.

2.3. Lesson Learned:

2.3.1. While the MP had good intentions, it was less than ideal to perform a heavyweight landing for the first time with a crosswind.

2.3.2. While inadequate auditory cues are available on the MQ-9, this does not eliminate the need for a proper cross-check of instrumentation on final and round out to the flare.

2.3.3. Adherence to PIO boldface and honoring the go-around call could have avoided this mishap.

2.4. Action Taken:

2.4.1. MQ-9 aircraft are now equipped with three laser altimeters. The laser altimeters provide precision altitude readout any time the aircraft is at or below 100 feet AGL.

2.4.2. A pitch command carat on a fixed pitch ladder was added to the HUD.

2.4.3. All operational squadrons now have a certified simulator.

Figure 2. Pilot Induced Oscillation.

3. Area Stall.

3.1. Mishap. The mishap occurred during a transit portion of the sortie, where the MC planned to gain the MA from the LRE crew and fly it to the working area. The MC conducted initial checks and took control of the MA at an assigned altitude of 8,500 feet mean sea level (MSL) with Altitude and Airspeed Hold modes engaged. When the MP updated the initial lost link heading (also applied all of the preset settings to the MA) the aircraft began climbing to attain the preset 9,000 minimum altitude MSL. When the MA continued climbing through 8,500 MSL, the MP acknowledged the climb and commanded Landing Configuration. Commanding Landing Configuration turned off all autopilot functions, including stall protection. The MA was automatically trimmed 9 degrees nose high to correspond with the current aircraft pitch. Power decreased from the autopilot commanded torque setting to the actual throttle position of approximately 30%. The MP made multiple attempts to level off but failed to trim in the correct pitch. The MP also retarded the throttle to idle resulting in airspeed dropping below stall. After the MC acknowledged the stall condition the MP increased the throttle full forward, the MA began a spin, and went lost link. The MA impacted the ground and was destroyed.

3.2. Investigation:

3.2.1. Operator Factor. The MP stalled the MA while attempting to recover from a nose high unusual attitude due to poor task management. The MP did not correct the minimum altitude preset value of 9,000 feet prior to taking control of the MA at a lower altitude, which resulted in an unexpected climb. The MP commanded Landing Configuration, while in a nose high attitude, and then focused attention on resolving the incorrect minimum altitude preset and other checklist steps rather than maintaining control of the MA. The MP failed to provide adequate control inputs to correct the nose high condition.

3.2.2. Operator Factor. According to AFI 11-2MQ-1&9 Volume 3, "the sensor operator will inform the pilot of all head-down display (HDD) caution and warning messages during non- critical phases of flight." The MSO failed to communicate a stall warning, in a timely manner, to the MP and the MP failed to respond to the stall warning. The fact that the stall warning tone cannot be silenced should have alerted both the MP and MSO that a critical situation was developing.

3.3. Lesson Learned:

3.3.1. Pilots should be intimately familiar with the differences between auto-pilot on and auto- pilot off flight. Case in point, when Landing Configuration is commanded, the pitch is latched onto the current pitch attitude and requires trim (or holding the stick in position) to make corrections.

3.3.2. As auditory cues are minimal in the MQ-9, aircrew need to make control inputs and verify the aircraft is performing accordingly.

3.3.3. Maintain aircraft control, analyze the situation, and then take proper action. Performing these steps out of order is poor task management and will often times lead to the loss of aircraft.

3.4. Action Taken:

3.4.1. The videos and animation from this mishap were added to the MQ-9 academics in order to increase understanding of stall characteristics and considerations.

Figure 3. Area Stall.

4. Short Landing.

4.1. Mishap. The MS was scheduled as an Intelligence Surveillance and Reconnaissance (ISR) mission in support of a contingency operation. The MP planned to perform a simulated flameout (SFO) for currency purposes. After the MA hit low key and turned to final, the MP struggled to identify the runway environment (the nose infrared (IR) camera was selected). The throttle was at idle and airspeed was below approach speed and slightly above stall speed. When reaching approximately 100 ft AGL, the MP advanced the throttle full forward in conjunction with the go-around callout. The MA impacted the perimeter fence and ground 900' short of the runway. The MA was destroyed on impact.

4.2. Investigation:

4.2.1. Operator Factor. The MP stalled the MA while attempting to go around from a low approach at the termination of an SFO maneuver. The MP allowed the MA to get low and slow due to improperly executed procedures and lack of situational awareness because of being fixated on searching for the runway. The MSO did not make appropriate low airspeed and altitude calls and the MC did not adhere to AFI guidance when a go around was required.

4.3. Lesson Learned:

4.3.1. At High Key the MP set the commanded torque between 0 and 2% instead of the suggested 4-6% which is used to simulate a feathered propeller. The lower torque setting set by the MP caused an increased descent rate beyond the expectation of the MP.

4.3.2. Due to the excessive negative vertical speed indicator (VSI) and inadequate adjustments to Low and Base Key, the MC rolled out on final at a lower altitude below the desired glide path and with a steeper descent rate. Due to being low and not aligned with the runway the MP had trouble finding the runway.

4.3.3. When the go around was initiated the MA's engine, working as designed, did not have enough time to overcome the sink rate. The MP’s verbiage to the MSO dictated a go around at 100 ft AGL. Neither one of these go around calls were adhered to due to fixation on finding the runway. The MSO is required to back up the MP by communicating critical information during the SFO regarding altitude, VSI, airspeed, and runway location.

4.4. Action Taken:

4.4.1. Training and T.O. guidance for use of the MQ-9A Gen2IR nose camera was added.

Figure 4. Short Landing 2.0.

5. Short Landing 2.0

5.1. Mishap:

5.1.1. The mishap sortie was launched as a training mission. The MA then entered the pattern and the MP requested high key to execute a SFO pattern to a low approach. The MP retarded the power, pitched and trimmed for a -5 degree pitch and began a 25 degree bank to the right in accordance with SFO procedures. Abruptly the MA airspeed decelerated from 98 knots indicated airspeed (KIAS) to 87 KIAS. Five seconds after retarding the power and three seconds after the torque had stabilized at 2%, the "BETA" indicator illuminated above the torque gauge. As the MP continued the SFO, the MSO inquired about the aircraft's altitude and directed a go-around. The MP initiated the go around by pulling the nose up and adding full throttle. Three seconds later, the MA struck power lines, went lost link, and impacted the ground.

5.2. Investigation:

5.2.1. Logistics Factor. The aircraft going into beta mode caused the MA to have significantly greater descent rates than is normally expected.

5.2.2. Operator Factor. When the MP increased the descent rate to attain the desired approach speed and the speed did not accelerate, the MP fixated on the airspeed and let the altitude and VSI drop out of his cross check.

5.2.3. Operator Factor. The MP was using a camera which provided essentially no visual cues for the altitude state, winds were significantly pushing the MA away from the airfield, and was performing the approach to a runway to which he had never done an SFO.

5.2.4. Operator Factor. The MC went 480 feet below their planned roll out altitude on final without being established on final or having the runway in sight before calling for a go around.

5.3. Lesson Learned:

5.3.1. Had the MC crosschecked their VSI after high key, they would have realized they would not make the necessary low key altitude based on the VSI they were experiencing.

5.3.2. If the MC had forced themselves to get to approach speed, they may have realized that the pitch down and VSI required was too high to continue the pattern.

5.3.3. Remember the importance of your crosscheck. Fixation during "dumb, different, and/or dangerous" situations can pull your attention away from the basic things that keep you airborne.

5.3.4. The low contrast and detail available in the IR nose camera video feed made it difficult for the MP to judge his altitude above the ground.

5.4. Action Taken:

5.4.1. Improved thermal crossover in simulators to provide more accurate conditions when using the IR nose camera.

5.4.2. Added verbiage to AFI 11-2MQ-1&9 Volume 3 requiring crewmembers to terminate the maneuver if not in a position to land and to make an intra-cockpit base key/one mile final (straight-in approach) call on SFOs.

5.4.3. CRM training included a case study of this mishap.

Figure 5. Short Landing.

6. Weather Stall.

6.1. Mishap. The MS was scheduled as an MQ-9A operational contingency sortie. The briefed forecast weather for the MC was scattered clouds with haze on departure and decaying thunderstorms in the vicinity. After handoff, the MSO identified a potential cloud layer in their flight path and the MC ran and completed the Airframe Icing Checklist. The MSO began to scan with the MTS and verbally identified the edge of a thunderstorm directly in front of them. After the MA entered the weather (including severe turbulence) Landing Configuration was commanded by the MP. The MA automatically trimmed to 14 degrees nose-high to correspond with current mishap ground control station (MGCS) commanded pitch trim. Airspeed decreased from 116 KIAS to 92 KIAS and angle of attack (AOA) increased to 23 degrees. The MA began to stall and depart controlled flight. Return Link (RL) and Command Link (CL) were lost and subsequently regained returning pitch trim and power to the previous settings. The MA's attitude returned to a high positive pitch and low airspeed resulting in a second stall. The MA did not recover and impacted the water.

6.2. Investigation:

6.2.1. Operator Factor. The MC failed to recognize deteriorating weather, did not execute a weather avoidance maneuver in a timely manner, and inadvertently flew into hazardous weather.

6.2.2. Operator Factor. The MP commanded landing configuration while in a nose high attitude which set an unusually high pitch trim, and failed to recognize an unusual attitude and failed to perform a recovery maneuver due to an inadequate crosscheck. Without sufficient control stick inputs, compounded by poor CRM, the MA's unusual attitude quickly progressed to a stall and then a spin. The departure from controlled flight caused the MA to lose RL and CL. When the MA regained links, the MP again failed to recognize the MA's nose high attitude due to an insufficient crosscheck, and allowed a secondary stall to develop without any corrective action.

6.3. Lesson Learned:

6.3.1. The MP exhibited an insufficient crosscheck of aircraft instruments due to task saturation. The MP should have been able to maintain accurate awareness of aircraft performance and applied corrections if an appropriate crosscheck technique had been used.

6.3.2. AFMAN 11-217 outlines the recovery procedure of recognize, confirm, recover. Furthermore, it states the recommended procedure to recover an aircraft with extreme pitch attitudes (above 10 degrees) is to bank the aircraft in the shorter direction towards the nearest 30 degrees bank index and allow the aircraft to fall toward the horizon, using power as necessary throughout the recovery.

6.3.3. Throughout the mishap sequence, there were instances of poor CRM between the MP and MSO. Air Force Tactics, Techniques, & Procedures (AFTTP) 3-3.MQ-9, addresses the importance of effective communication between crew members from the beginning of the mission planning through the end of the debrief. The lack of coordination for someone to be heads-up at all times contributed to the MC's inability to identify deteriorating weather in a timely manner.

6.3.4. Prior to the first stall, the MC had multiple indications of an impending stall but were never acknowledged by the MC.

6.4. Action Taken:

6.4.1. Implemented a deliberate Operational Risk Management (ORM) process that limits inexperienced crew members from flying on the same crew to the maximum extent possible and ensures risk is accepted at the appropriate level.

Figure 6. Weather Stall.

7. Lightning Strike.

7.1. Mishap:

7.1.1. During an operational mission, the MA entered a storm system, the MTS was obscured, and the MA began to encounter turbulence. The HUD displayed "Aileron Tip Stall Override", "Stall Protect Override" and the AOA displayed 9.0 degrees. Ten seconds later the MP disabled the Preprogrammed Mode at the same time the "AV Not Close to Assigned Altitude" alert appeared, indicating the MA was off altitude by at least 200 feet; the alert was repeated for the next ten seconds. Multiple bright flashes were observed on the HUD and the MP called for the Loss of Control Prevent critical action procedure (CAP). Turbulence continued and precipitation/ice was observed on the camera lens. The MA experienced un-commanded roll (in both directions) along with a multitude of HUD and HDD warnings. The MP was able to regain control after the MA had lost 8,200 ft in altitude and reached a speed of 165 KIAS. The MP began running controllability checks once clear of the storm system and then made a climb to FL260 for the 600 mile return to base (RTB). During the transit the MC contacted the LRE to discuss the controllability issues they were having. After options were deliberated with the LRE and Higher Headquarters, the decision was made to ditch the MA. The MA was destroyed on impact.

7.2. Investigation:

7.2.1. Operator Factor. The MC saw weather at the 12 O'clock position and maneuvered around it, but failed to perform a 360 degree weather sweep once abeam to ensure this would not affect their target area.

7.2.2. Operator Factor. The MC was unable to assess the weather cell’s size/movement because both MP and MSO had the same video source selected on their HUD and were looking in the target area.

7.2.3. Operator Factor. The MC failed to appropriately identify the weather as a thunderstorm. Therefore, the crew did not apply the guidance (current at the time) of maintaining 25 nautical miles (NM) away from known thunderstorm activity.

7.3. Lesson Learned:

7.3.1. The big takeaway here is to ask for a weather update and submit a pilot report (PIREP) **<u>when weather differs from the forecast</u>**.

7.3.2. Had the MP recognized the turbulence conditions sooner and commanded a greater (more aggressive) bank angle this would have turned the MA out of the weather sooner and potentially resulted in less damage.

7.4. Action Taken:

7.5. Weather sweep guidance was added to the AFTTP 3-3.MQ-9.

8. Long Landing.

8.1. Mishap:

8.1.1. The MS was supporting an operational mission. On takeoff and at approximately 2500ft AGL, the engine failed and the "Engine out detected" illuminated with the associated warning tone. The MP immediately cross-checked the engine instruments and verified the engine out condition. The MP then made a right turn away to set up for an approach to land on the opposite direction runway. The MC completed the CAPs and continued with the ENGINE FAILURE checklist. Simultaneously, the MP declared an emergency with the tower controller and requested firefighting support and a straight-in approach. The MA touched down approximately half way down the runway, with 5,000ft remaining, at 132 KIAS. The MA continued off the runway and impacted a rock breakwater and came to rest in the ocean.

8.2. Investigation:

8.2.1. Operator Factor. The MC continued the approach after completing the ENGINE FAILURE checklist despite excess energy and an incorrect pattern entry point. The MP thought it was possible to trade the excess altitude for increased airspeed in the remaining distance to the runway and still land the MA.

8.2.2. Operator Factor. The excess speed in the round out and flare caused the MA to float significantly down the runway before touching down. There was no reverse thrust capability with the engine inoperative. The wheel brakes were the MP's only tool to stop the MA, but were not sufficient to stop within the distance remaining.

8.2.3. Logistics Factor. The engine failed due to fuel starvation caused by an electrical short which forced electrical closure of the fuel shut-off valve.

8.3. Lesson Learned:

8.3.1. The MC had an opportunity to intercept the overhead forced landing pattern near low key. Doing so would have provided the MC more time to accomplish applicable checklists, achieve proper airspeed, and manage energy through S-turns and slips in an effort to normalize the approach.

8.3.2. While the wind was variable at 5 knots in this mishap, opposite direction landings often result in faster approaches due to a tailwind. A tail wind can affect the expected touchdown point and increase the landing roll.

8.3.3. The MC unnecessarily rushed and mis-prioritized the landing task by dropping energy management and pattern procedure out of the crosscheck during the RTB and approach.

8.3.4. The MSO made an error by not accomplishing advisory or directive calls to the MP concerning altitude deviations.

8.3.5. Based on engineering analysis and the information from a previous incident, there was adequate wheel braking distance to stop the aircraft should the MP have landed in the normal landing zone.

8.3.6. The MP's last SFO was 4 months prior to the mishap. In these situations, consideration should be given to providing oversight via a current/qualified squadron supervisor while conducting LR duties.

8.4. Action Taken:

8.4.1. A Time Compliance Technical Order (TCTO) requiring the replacement of the Engine Start Module (ESM) was expanded and reissued.

8.4.2. The unit operating the aircraft added SFO and other emergency procedures training and currency to the local training program. Additionally, members are required to perform SFO landing patterns before flying operational sorties.

Figure 7. Long Landing.

9. High Pressure Takeoff.

9.1. Mishap:

9.1.1. The MA was scheduled to launch on an ISR mission sortie. During taxi, the MP noted unusual torque jumps during power applications. While taxiing the oil pressure exceeded both the caution and warning limits and this was noticed by the MC minutes later. After lift-off the MSO noted the oil pressure was high and called for an abort. The MP acknowledged the abort, but stated the MA was already airborne and decided they couldn't land again on the runway remaining. The MP elected to continue the climb out and declared an emergency requesting a closed pattern. At approximately 500ft AGL, the engine torque and engine speed decreased and the automatic engine restart activated. Torque and engine speed increased and the automatic engine restart ceased. Seconds later, the engine failed. The MP applied the CAPs for engine failure and moved the condition lever aft. The MA crash landed and was destroyed.

9.2. Investigation:

9.2.1. Operator Factor. The MP fixated on power shortcomings during taxi procedures and failed to recognize several instrument indications that identified high oil pressure which should have forced an abort while on the ground.

9.2.2. Operator Factor. Shortly before takeoff a check of the engine instruments was verbalized. The crew failed to notice the visual indicator of high oil pressure and consequently failed to abort prior to takeoff.

9.2.3. Logistics Factor. The MA suffered mechanical failure of a compressor bearing which resulted in an un-commanded engine shutdown.

9.3. Lesson Learned:

9.3.1. The MP assumed that the MA was operating “normally” during taxi based on the aircraft’s reputation. If an aircraft has been signed off by maintenance and is not functioning properly, make the conservative call—taxi back and ask for maintenance to take a look.

9.3.2. Prior to takeoff, perform an adequate systems check and cover abort decision points with associated distances. Being a crew aircraft, brief this information and adhere to crew resource management IAW AFI 11-290, *Cockpit/Crew Resource Management*.

9.4. Action Taken:

9.4.1. Additional maintenance practices were incorporated to minimize oil system anomalies.

Figure 8. High Pressure Takeoff.

10. Controlled Flight Into Terrain.

10.1. Mishap:

10.1.1. This sortie was generated to support a Launch and Recovery syllabus event. After conducting multiple SFOs, the MC came off the perch with negative VSI up to -2366 feet per minute (fpm). The MA experienced degraded links just prior to impacting mountainous terrain.

10.2. Investigation:

10.2.1. Logistics Factor. The MA was known to have abnormal descent rates (or slow speed based on pitch) when pulling the power to flight idle.

10.2.2. Operator Factor. The mishap instructor pilot (MIP) directed the mishap student pilot (MSP) to reduce power to 0 percent torque.

10.2.3. Operator Factor. The MIP directed the MSP to increase the descent rate when a descent had already been established.

10.2.4. Operator Factor. During the pattern downwind the MIP failed to recognize an abnormal descent rate of the MA with an excessive negative VSI. As a result of excessive VSI, the MA was well below pattern altitude when turning to an extended final approach.

10.2.5. Operator Factor. Continuing the abnormal descent rate, the MC experienced a degraded downlink signal (impairing their video) due to high terrain obstruction.

10.3. Lesson Learned:

10.3.1. When initiating the turn to final, reducing power to idle could result in unexpected descent rates. Crews should use the AFTTP 3-3.MQ-9 technique of 4 to 6 percent torque.

10.3.2. The MC channelized their attention on teaching the student proper airspeed control vs. an effective MA crosscheck. Instruction should never take priority over the basics of airmanship— Aviate, Navigate, Communicate.

10.4. Action Taken:

10.4.1. Local guidance was implemented to ensure awareness of terrain and procedures for avoidance.

10.4.2. A caution was added to the Technical Order (TO) 1Q-9(M)A-1 describing aircraft performance when pulling power to flight idle.

Figure 9. Controlled Flight Into Terrain.

Parting Thoughts

After reading through a number of the mishaps described within this handbook, it is clear that no one is exempt from making a mistake. I challenge each of you to take some time during your busy schedules to discuss these mishaps with your peers, students, and instructors. Focus not only on "what" happened, but more importantly "why" it happened. While a good number of these mishaps occurred long ago and under different guidance, there is a common theme in all of them – Airmanship. Airmanship is a skill that you are never finished developing. Each of you play a vital role by equipping others with the tools you have used through your learning experiences. Flying is a dangerous job and learning from each other is how we mitigate risks to an acceptable level. If we fail to maintain that cross flow of information, the next generation may end up repeating history.

"*The proactive approach to a mistake is to acknowledge it instantly, correct and learn from it.*"

- Stephen Covey

JASON A. POWELL, Lt Col, USAF
Acting Director of Safety

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 11-290, *Cockpit/Crew Resource Management*, 27 May 2020

AFI 11-2MQ-1&9V3, *Flying Operations*, 01 November 2012

AFI 33-322, *Records Management and Information Governance Program*, 23 March 2020

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AFTTP 3-3.MQ-9, *Combat Aircraft Fundamentals*

TO 1Q-9(M)A-1, *Flight Manual for MQ-9A Aircraft*

Abbreviations and Acronyms

ATC—Air Traffic Control

AGL—Above Ground Level

AOA—Angle of Attack

CAP—Critical Action Procedure

CL—Command Link

CRM—Cockpit/Crew Resource Management

FPM—Feet Per Minute

GCS—Ground Control Station

HDD—Head-down Display

HUD—Head-up Display

IR—Infrared

ISR—Intelligence, Surveillance and Reconnaissance

KIAS—Knots Indicated Airspeed

LR—Launch and Recovery

LRE—Launch and Recovery Element

MA—Mishap Aircraft

MC—Mishap Crew

MCE—Mission Control Element

MGCS—Mishap Ground Control Station

MIP—Mishap Instructor Pilot

MP—Mishap Pilot

MSL—Mean Sea Level

MSO—Mishap Sensor Operator

MSP—Mishap Student Pilot

MTS—Multi-Spectral Targeting System

NM—Nautical Mile

ORM—Operational Risk Management

PIO—Pilot Induced Oscillation

PIREP—Pilot Report

RL—Return Link

RTB—Return to Base

RPM—Revolutions Per Minute

SFO—Simulated Flame Out

TCTO—Time Compliance Technical Order

TO—Technical Order

VSI—Vertical Speed Indicator