

**UNITED STATES AIR FORCE**  
**AIRCRAFT ACCIDENT INVESTIGATION**  
**BOARD REPORT**



**F-35A, T/N 14-5103**

**56TH AIRCRAFT MAINTENANCE SQUADRON**  
**56TH FIGHTER WING**  
**LUKE AIR FORCE BASE, ARIZONA**



**LOCATION: LUKE AIR FORCE BASE, ARIZONA**

**DATE OF ACCIDENT: 15 MARCH 2023**

**BOARD PRESIDENT: COLONEL SEAN S. BRAMMER-HOGAN**

**Conducted IAW Air Force Instruction 51-307**

**EXECUTIVE SUMMARY  
UNITED STATES AIR FORCE  
AIRCRAFT ACCIDENT INVESTIGATION**

**F-35A, T/N 14-5103  
LUKE AIR FORCE BASE, ARIZONA  
15 MARCH 2023**

On 15 March 2023 at 2138 Local (L), the mishap aircraft (MA), an F-35A aircraft tail number (T/N) 14-5103, experienced foreign object damage (FOD) during a maintenance ground run. The MA's maintenance was conducted by the 62d Aircraft Maintenance Unit, 56th Aircraft Maintenance Squadron, 56th Maintenance Group, assigned to the 56th Fighter Wing. No one was injured during the mishap. The foreign object, a handheld flashlight, damaged the \$14,000,000 engine beyond local repair.

The mishap team (MT) arrived for the maintenance swing shift at 1430L. Each member of the MT was current and qualified to accomplish all the tasks they were assigned that day. The weather on 15 March 2023 created maintenance operations delays. In addition to high winds and rain, thunderstorms and lightning within five nautical miles from the airfield suspended maintenance operations for approximately one hour. Following the delay, the MT was tasked to complete a Time Compliance Technical Directive (TCTD) on the MA.

To complete the TCTD, the MT removed a panel and inserted a metering plug into an engine fuel line. They prepared the aircraft for an engine run to test the installed metering plug for fuel leaks. The engine run was completed with no visual indications or health reporting codes that would indicate an abnormal engine run. Once the engine was shut down, the MT reported hearing a noise from the decelerating engine. A post-engine run inspection was completed by mishap member 1. The inspection noted significant damage to the engine.

The Board President found by a preponderance of evidence that a handheld flashlight caused the damage to the aircraft. An incomplete tool kit inventory and failure to comply with Joint-Service Technical Data guidance, prior to engine start, resulted in the FOD. The Board President found that F-35 Autonomic Logistics Information System checklist complacency and a disconnect between Department of the Air Force Instruction 21-101 tool inventory guidance and unofficial local procedures were contributing factors 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 by the United States or by any person referred to in those conclusions or statements.”

**SUMMARY OF FACTS AND STATEMENT OF OPINION  
F-35A, T/N 14-5103  
LUKE AIR FORCE BASE, ARIZONA  
15 MARCH 2023**

**TABLE OF CONTENTS**

ACRONYMS AND ABBREVIATIONS .....	iii
SUMMARY OF FACTS.....	2
1. AUTHORITY AND PURPOSE .....	2
a. Authority.....	2
b. Purpose.....	2
2. ACCIDENT SUMMARY .....	2
3. BACKGROUND.....	2
a. Air Education and Training Command (AETC) .....	3
b. 56th Fighter Wing (56 FW).....	3
c. 56th Aircraft Maintenance Squadron (56 AMXS) .....	3
d. F-35A .....	3
4. SEQUENCE OF EVENTS.....	4
a. Mission .....	4
b. Planning.....	4
c. Preflight .....	4
d. Summary of Accident.....	5
e. Impact.....	5
f. Egress and Aircrew Flight Equipment (AFE).....	5
g. Search and Rescue (SAR) .....	5
h. Recovery of Remains .....	5
5. MAINTENANCE.....	5
a. Forms Documentation .....	5
b. Inspections.....	5
c. Maintenance Procedures.....	6
d. Maintenance Personnel and Supervision.....	6
e. Fuel, Hydraulic, Oil, and Oxygen Inspection Analyses .....	6
f. Unscheduled Maintenance .....	6
6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS.....	6
a. Structures and Systems.....	6
(1) Engine .....	6
b. Evaluation and Analysis.....	7
(1) Engine.....	7
7. WEATHER .....	8
a. Forecast Weather.....	8
b. Observed Weather.....	8
c. Space Environment.....	8
d. Operations .....	8
8. CREW QUALIFICATIONS .....	8
a. Mishap Maintenance Member.....	8

9. MEDICAL.....	8
a. Qualifications.....	8
b. Health.....	8
c. Pathology.....	9
d. Lifestyle.....	9
e. Crew Rest and Crew Duty Time .....	9
10. OPERATIONS AND SUPERVISION .....	9
a. Operations.....	9
b. Supervision.....	9
11. HUMAN FACTORS analysis.....	9
12. GOVERNING DIRECTIVES AND PUBLICATIONS .....	10
c. Publicly Available Directives and Publications Relevant to the Mishap.....	10
d. Other Directives and Publications Relevant to the Mishap.....	10
e. Known or Suspected Deviations from Directives or Publications .....	10
STATEMENT OF OPINION.....	11
1. Opinion Summary .....	11
2. Cause.....	11
3. Substantially Contributing Factor .....	11
a. Substantially Contributing Factor: Procedure or Checklist Not Followed Correctly .....	11
4. Conclusion.....	13
INDEX OF TABS .....	14

## ACRONYMS AND ABBREVIATIONS

56 FW	56th Fighter Wing
62 AMU	62d Aircraft Maintenance Unit
56 AMXS	56th Aircraft Maintenance Squadron
AETC	Air Education Training Command
AFB	Air Force Base
AFE	Air Flight Equipment
AFI	Air Force Instruction
AGL	Above Ground Level
AIB	Accident Investigation Board
ALIS	Autonomic Logistics Information System
AZ	Arizona
BOS	Before Operations Servicing
CTK	Composite Tool Kit
CTOL	Conventional Takeoff and Landing
DoD	Department of Defense
FIVV	Fan Inlet Variable Vane
FOD	Foreign Object Damage
FRC	Fault Reporting Codes
HPC	High Pressure Compressor
HPT	High Pressure Turbine
HRC	Health Reporting Codes
IAW	In Accordance With
IPP	Integrated Power Package
JTD	Joint Technical Data
L	Local Time
MA	Mishap Aircraft
MAJCOM	Major Command
MM	Mishap Member
MOC	Maintenance Operations Center
MT	Mishap Team
PAIR	Production Aircraft Inspection Requirements
PMA	Portable Maintenance Aids
SAR	Search and Rescue
SUP	Supplement
TCTD	Time Compliance Technical Directive
T/N	Tail Number
Z	Zulu Time

## SUMMARY OF FACTS

### 1. AUTHORITY AND PURPOSE

#### a. Authority

On 6 June 2023, Lieutenant General Brian S. Robinson, the Commander of Air Education and Training Command, appointed Colonel Sean Brammer-Hogan to conduct an Accident Investigation Board (AIB) for a mishap that occurred on 15 March 2023, involving an F-35A aircraft, Tail Number (T/N) 14-5103 at Luke Air Force Base (AFB), Arizona (AZ). (Tabs A-5 to A-7, Y-3 to Y-6, CC-22, and CC-24). The investigation was conducted at Luke AFB, AZ from 13 June 2023 through 07 July 2023. Additionally, the following members were appointed to support the accident investigation: A legal advisor (Major), a recorder (Master Sergeant), and a maintenance advisor (Technical Sergeant). (Tab Y-5 to Y-6).

#### b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this Accident Investigation Board conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force aerospace accident, prepare a publicly releasable report, and obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action.

### 2. ACCIDENT SUMMARY

On the evening of 15 March 2023, the Mishap Aircraft (MA), an F-35A, T/N 14-5103, operated by the 56th Fighter Wing, Luke AFB, AZ, experienced engine damage during a maintenance ground run. (Tabs D-18, D-19, CC-22, CC-24, and CC-25). The mishap occurred on the F-35A ramp, parking location 19-6. (Tab D-18). The mishap team (MT) consisted of three maintainers. (Tab V-1.1 and V-3.1). Two of the mishap members (MM1/MM2) that conducted the maintenance on the MA were assigned to the 62d Aircraft Maintenance Unit (62 AMU). (Tabs D-18, V-1.2, and V-2.1). The third mishap member (MM3) was assigned to the 187th Aircraft Maintenance Squadron but was on an extended training tour with the 62 AMU. (Tab V-3.1). At 2138L, the MA ingested a flashlight (foreign object) during a maintenance ground run. (Tabs R-40, V-1.3, and V-4.4 to V-4.5). No individuals were injured during the mishap. The estimated engine damage is \$3,933,106. (Tab DD-3).

### 3. BACKGROUND

#### a. Air Education and Training Command (AETC)



AETC's primary mission is to recruit, train and educate exceptional Airmen. With headquarters at Joint Base San Antonio-Randolph, Texas, AETC was established and activated in January 1942, making it the oldest major command in the Air Force. AETC's training mission makes it the first command to touch the lives of nearly every Air Force member. AETC includes Air Force Recruiting Service, two numbered air forces and the Air University. The command operates 12 major installations and supports tenant units on numerous bases across the globe. There are also 16 active-duty and seven Reserve wings. (Tab CC-3 to CC-19).

#### b. 56th Fighter Wing (56 FW)



The 56 FW's primary mission is to train the world's greatest fighter pilots and combat-ready Airmen. The 56th Fighter Wing, headquartered at Luke Air Force Base, Phoenix, Arizona, is the largest fighter wing in the U.S. Air Force. The wing is part of Air Education and Training Command. The wing also oversees the Gila Bend Air Force Auxiliary Field and is steward of the 1.7 million acre Barry M. Goldwater Military Training Range. (Tab CC-22).

#### c. 56th Aircraft Maintenance Squadron (56 AMXS)



The 56 AMXS's primary mission is to ensure mission-ready aircraft are maintained to support basic F-16 and F-35 pilot training. 56 AMXS provides intermediate and flight line maintenance for 25 F-16C/D and 70 F-35A aircraft valued at \$9 billion. Manned with over 650 active duty, civilians, contractors and 100+ Republic of Singapore Air Force (RSAF) maintainers, the squadron is divided into five Aircraft Maintenance Units supporting their associated fighter squadrons. The Aircraft Maintenance Units are the 21st Aircraft Maintenance Unit "Gamblers," the 61st Aircraft Maintenance Unit "Top Dogs," 62d Aircraft Maintenance Unit "Spikes," 63d Aircraft Maintenance Unit "Panthers," and 425th Aircraft Maintenance Unit "Black Widows." (Tab CC-23).

#### e. F-35A



The F-35A is the U.S. Air Force's latest fifth-generation fighter. It will replace the U.S. Air Force's aging fleet of F-16 Fighting Falcons and A-10 Thunderbolt II's, which have been the primary fighter aircraft for more than 20 years, and bring with it an enhanced capability to survive in the advanced threat environment in which it was designed to operate. With its aerodynamic performance and advanced integrated avionics, the F-35A will provide next-generation stealth, enhanced situational awareness, and reduced

vulnerability for the United States and allied nations. The conventional takeoff and landing (CTOL) F-35A gives the U.S. Air Force and its allies the power to dominate the skies – anytime, anywhere. The F-35A is an agile, versatile, high-performance, 9g capable multirole fighter that combines stealth, sensor fusion and unprecedented situational awareness. (Tab CC-24 to CC-25).

#### **f. Time Compliance Technical Directive (TCTD)**

Time compliance technical directives are issued to provide instructions to Air Force activities for accomplishing one-time changes, modifications, or inspections of equipment, or installation of new equipment. (Tab V-7.5). The purpose of the TCTD referenced in this report was to add a metering plug between the Augmenter Throttle Valve Pressure Tube assembly (CP12) and the Main Fuel Throttle Valve. (Tab V-8.4). On 15 December 2022, a CP12 tube assembly rupture resulted in a F-35B mishap and significant damage to the aircraft. (Tab V-7.5). This TCTD mitigates the risk of a CP12 tube assembly rupture. (Tab V-7.5). The Joint Program Office issued this directive to resolve the CP12 tube assembly discrepancy for the F-35 fleet. (Tab V-7.5)

### **4. SEQUENCE OF EVENTS**

#### **a. Mission**

On Wednesday, 15 March 2023, the 62 AMU production superintendent scheduled a Time Compliance Technical Directive (TCTD) maintenance action to be conducted on F-35A, T/N 14-5103. (Tab V-1.4, V-2.12, V-3.9, and V-7.7). The TCTD was directed to the swing shift expediter, who assigned the task to the MT. (Tab V-1.2, V-2.13, and V-9.9). The technical directive was to install a metering plug into an engine fuel line and conduct a leak check on the new metering plug while the engine was running. (Tabs V-2.7, V-4.6, and BB-15 to BB-18).

#### **b. Planning**

As of 15 March 2023, the 62 AMU had completed the TCTD for the majority of the F-35A fleet and T/N 14-5103 was one of the last aircraft that needed to be completed. (Tab V-7.5 and V-10.6). The swing shift expediter assigned this task to MM1, a qualified engine run crew chief, and the rest of the MT. (Tab V-4.5 and V-9.4). MM1 was the only member of the MT qualified to perform engine runs on 15 March 2023. (Tab V-1.2 and V-4.5).

#### **c. Preflight**

MM2 and MM3 completed an aircraft exterior safe for maintenance inspection prior to starting the TCTD. No issues were noted. (Tab V-2.6). Once the fuel metering valve was installed, MM2 and MM3 conducted a tool inventory and completed the rest of the pre-engine operation technical order requirements. (Tabs V-1.2, V-2.8, and BB-24). MM1 completed the Engine Before Operations Servicing (BOS) Inspection checklist and conducted the inlet inspection. (Tabs V-1.2 and BB-20).



#### **d. Summary of Accident**

At 2131L, MM1 began the Engine Operation – Idle procedure. (Tabs DD-4, V-2.10 and R-40). The aircraft was started with no abnormal indications. (Tabs V-1.3 and DD-4). At 2138L, the aircraft’s inlet and exhaust debris sensors recorded debris. (Tab DD-4 to DD-6). Following the metering plug installation, the engine must be run at idle for at least 5 minutes to conduct a fuel leak check (Tabs V-2.8 and BB-18). During the engine run, MM1 did not receive a notification of foreign object ingestion from the mishap aircraft. (Tab V-2.8). At 2144L, MM1 initiated shutdown of the aircraft following the engine run with no cockpit indications of a foreign object damage to the engine. (Tabs V-2.11 and DD-4). During the shutdown, the MT reported hearing abnormal noises as the engine was spinning down. (Tab V-1.3, V-2.11, and V-3.12). Following the shutdown, MM1 completed the post operations servicing inspection and identified damage to the blades of the engine. (Tab V-1.3 to V-1.4). MM1 reported the engine damage to the maintenance expeditor and stated, “I believe I just ingested a flashlight.” (Tabs R-40 and V-10.7).

#### **e. Impact**

Not applicable.

#### **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**

Upon review of the MA’s ALIS maintenance forms, no overdue TCTDs were noted that would have prohibited the maintenance procedures. (Tab U-3). Two TCTDs were open, and maintenance was actively working on one of the tasks when the mishap occurred. (Tab U-3). The secondary open TCTD did not contribute to the MA incident. (Tab U-3). The MA had no repeat or recurring maintenance issues and all required maintenance actions were completed. (Tab U-3).

#### **b. Inspections**

Two Production Aircraft Inspection Requirements (PAIR) were due prior to the mishap. Neither of the overdue PAIR contributed to the mishap. (Tab U-3). All other scheduled aircraft and engine inspections required for the MA were satisfactorily completed and documented properly. (Tab U-3). No AFE was in use during the mishap.

### **c. Maintenance Procedures**

Upon completion of the TCTD, maintenance personnel proceeded to perform an engine run as a follow-on maintenance procedure. (Tabs V-7.11 and BB-18). MM2 performed a tool inventory prior to MM1 performing all the prerequisites to perform an engine run. (Tab V-1.2 and V-2.9). MM1 performed the Engine BOS-Inspection, which required a flashlight due to lack of illumination within the MA inlet. (Tab V-3.5 and V-4.5). When MM1 exited the intake, MM1 set the flashlight on the lip of the intake. (Tab V-1.2). After the engine run and during the Engine Post Operations Servicing Inspection, MM1 discovered damage to the engine blades. (Tab V-9.6). A concurrent tool inventory inspection performed by MM2 noted a missing flashlight. (Tab V-2.11). All other applicable maintenance documentation, procedures, practices and performance were in compliance with the governing maintenance directives. (Tab U-3).

### **d. Maintenance Personnel and Supervision**

Training records validated that all 62 AMU maintenance personnel who performed maintenance procedures on the MA were fully trained and qualified on all required procedures, including the TCTD. (Tab U-3). MM1 was trained and qualified to perform the Engine Before Operations Servicing-Inspection, the Engine Operation (Idle) procedure, and the Post Operations Servicing-Inspection. (Tab G-3). In interviews, maintenance personnel and leadership stated that swing shift had experienced maintenance personnel, and ample supervision available on shift during the mishap. (Tab V-5.7, V-7.6, and V-8.5). Prior to assigning a maintenance task, expeditors and production superintendents review training records to ensure maintenance personnel are qualified and assign tasks accordingly. (Tab V-4.12 and V-11.6).

### **e. Fuel, Hydraulic, Oil, and Oxygen Inspection Analyses**

Pre and post mishap fuel and hydraulic oil analyses were normal and no discrepancies were noted. (Tab D-3 to D-4).

### **f. Unscheduled Maintenance**

None of the unscheduled maintenance contributed to the mishap. (Tab U-3).

## **6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS**

### **a. Structures and Systems**

#### **(1) Engine**

The MA engine sustained damage to the 2d stage rotor, 3d stage rotor, 5th stage rotor, 6th stage rotor, fuel nozzle, bypass duct, high pressure compressor (HPC), high pressure turbine (HPT), and fan inlet variable vane (FIVV). (Tab U-3).

## **b. Evaluation and Analysis**

### **(1) Engine**

Analysis of the mishap aircraft was executed by the 62 AMU after post-incident. (Tabs U-6 and U-7) Data files from the aircraft memory device and portable memory device were analyzed and revealed spikes (indications) in the aircraft debris system monitors during the engine run. (Tab DD-4). These indications are consistent with foreign object ingestion into the engine. (Tab DD-4). These indications were not visible to MM1 inside the aircraft cockpit and are only viewable post engine run operations. Additionally, a fuel sample analysis indicated that there were no detectable volatile contaminants and fuel contamination was not a factor in this mishap. (Tab D-3 to D-4).

### **(2) Integrated Power Package**

A separate analysis of the Integrated Power Package (IPP) was performed and found no damage related to the mishap event. (Tab DD-7). Following the inspection, it was recommended to return the IPP to service. (Tab DD-7).

## **7. WEATHER**

### **a. Forecast Weather**

The 56th Operation Support Squadron weather forecasters provided the weather forecast at 1300L on 15 March 2023. (Tab F-3). The forecasted weather was southwest winds at 10 knots with gusts to 20 knots, light rain, a ceiling of 3,500 ft. above ground level (AGL) and thunderstorms in the areas. (Tab F-3). In addition, the weather forecast included a temporary weather condition for thunderstorms and increased winds of up to 30 knots. (Tab F-3).

### **b. Observed Weather**

The observed weather at Luke AFB at the time of the mishap was 10 knot southerly winds, a broken ceiling at 11,000 AGL, and a weather advisory for lightning within 25 nautical miles. (Tabs F-3 and W-3). Prior to the mishap, maintenance members took shelter for 50 minutes in response to a weather warning for lightning within five miles of Luke AFB as thunderstorms and rain moved through the area. (Tab F-3). The lightning warning was downgraded at 2038L. (Tab F-3). There were no significant changes to the weather following the mishap. (Tab W-3).

### **c. Space Environment**

Not applicable.

### **d. Operations**

No evidence suggests that weather played a role in this mishap. The weather warning created a maintenance delay, but witnesses stated there was enough time to complete the TCTD following the termination of the weather warning. (Tab V-2.6 and V-4.7).

## **8. CREW QUALIFICATIONS**

### **a. Mishap Maintenance Member**

MM1 was current and qualified to complete the engine run on the MA. (Tab G-3).

## **9. MEDICAL**

### **a. Qualifications**

MM1, MM2, and MM3 were medically capable of performing their assigned duties on 15 March 2023. (Tab T-3).

### **b. Health**

A review of the medical records for MM1, MM2, and MM3 revealed no conditions relevant to the mishap. (Tab T-3).

### **c. Pathology**

The Defense Health Agency performed a Forensic Toxicology Examination on the blood and urine of MM1, MM2, and MM3 for the presence of drugs of abuse, ethanol, methanol, isopropanol, and acetone. (Tab T-3). All test results were negative. (Tab T-3).

### **d. Lifestyle**

There is no evidence to suggest lifestyle factors were a factor in the mishap. (Tab T-3).

### **e. Crew Rest and Crew Duty Time**

The AETC supplement to AFI 21-101, *Aircraft and Equipment Maintenance Management*, states that personnel will not be scheduled for more than 12 hours of continuous duty time. (Tab BB-12). The MT was scheduled for swing shift, an 8-hour shift from 1430 to 2230. (Tab V-2.1). MM2 indicated that turnover after the shift could take up to an hour and that based on the type of maintenance performed, crew members could end up leaving work between 2300 and 2330, resulting in a 9-hour total shift. (Tab V-2.1).

## **10. OPERATIONS AND SUPERVISION**

### **a. Operations**

At the time of the mishap, the MT members did not feel rushed or pressured to complete the TCTD maintenance action before the end of their shift. (Tab V-1.4, V-2.14 and V-3.10).

### **b. Supervision**

During the engine run the swing shift expediter, located inside a vehicle and facing the MA, was watching the engine run take place, but did not observe anything out of the ordinary during the engine run. (Tab V-4.7).

## **11. HUMAN FACTORS ANALYSIS**

The Department of Defense Human Factors Analysis and Classification System 8.0 lists potential human factors that can play a role in aircraft mishaps and identifies potential areas of assessment during an accident investigation. (Tab BB-9). One human factor was identified as relevant to the mishap: Procedure or Checklist Not Followed Correctly. (Tab BB-9).

## 12. GOVERNING DIRECTIVES AND PUBLICATIONS

### a. Publicly Available Directives and Publications Relevant to the Mishap

- (1) DAFI 21-101, *Aircraft and Equipment Maintenance Management*, 10 August 2020
- (2) *Department of Defense Human Factors Analysis and Classification System*, Version 8.0

**NOTICE:** All directives and publications listed above are available digitally on the Air Force Departmental Publishing Office website at: <https://www.epublishing.af.mil> and <https://www.safety.af.mil/>

### b. Other Directives and Publications Relevant to the Mishap

- (1) JTD, Engine Before Operations Servicing (BOS) - Inspection
- (2) JTD, Engine – Operation (Idle)

### c. Known Deviations from Directives or Publications

JTD, Engine Before Operations Servicing (BOS) - Inspection: Make sure engine inlet and exhaust areas are clear of foreign objects and no loose items can be ingested in the aircraft.

JTD, Engine Before Operations Servicing (BOS) - Inspection: Personnel must remove all loose items from their pockets/person and perform hardware, tool, and equipment inventories before and after entry/exit of inlet/exhaust. Failure to comply can result in damage to aircraft.

JTD, Engine – Operation (Idle): FOD can be ingested into engine. Intake area must be clear of objects. Failure to comply can result in damage to aircraft.

DAFI 21-101, para. 8.5.4. Users will perform a visual inventory of all dispatchable/decentralized CTKs when issued for use, at the completion of each job or tasks, and when returned to the tool storage facility.

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SEAN S. BRAMMER-HOGAN, Colonel, USAF  
President, Accident Investigation Board

## STATEMENT OF OPINION

### F-35A, T/N 14-5103 LUKE AIR FORCE BASE, ARIZONA 15 MARCH 2023

*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 the evening of 15 March 2023, the MA, an F-35A, T/N 14-5103, operated by the 56th Fighter Wing, Luke AFB, AZ, experienced engine damage during a maintenance ground run. At 2138L, the MA ingested a flashlight (foreign object) during a maintenance ground run. During an inlet inspection prior to the engine run, MM1 used a flashlight that was left inside the engine inlet, which ultimately led to the foreign object damage. Following the shutdown, MM1 completed the post operations servicing - inspection and identified damage to the blades of the engine. No individuals were injured during the mishap, but the estimated engine damage is \$3,933,106.

#### **2. CAUSE**

I find, by a preponderance of the evidence, that the mishap was caused by a deviation from JTD and DAFI 21-101 guidance. MM1 did not accomplish the required checklist items prior to the engine run, nor did MM1 adhere to cautions listed in the JTD. In addition, MM1 did not accomplish a tool inventory check following completion of the Engine Before Operations Servicing-Inspection per DAFI 21-101. MM1 failed to follow the steps to ensure that the inlet was clear of foreign objects and did not ensure a tool inventory check was completed following the aircraft inlet inspection. These deviations led to MM1's failure to realize that a flashlight was left in the inlet, resulting in the ingestion of the flashlight and foreign object damage to the MA engine.

#### **3. SUBSTANTIALLY CONTRIBUTING FACTORS**

I find, by a preponderance of evidence, that each of the following factors substantially contributed to the mishap.

##### **a. F-35 Autonomic Logistics Information System (ALIS) checklist complacency**

The F-35 ALIS and portable maintenance aids (PMA) are not optimized to conduct flightline maintenance. The ALIS was designed as a single aircraft information system to integrate operations, maintenance, prognostics, supply chain, customer support services, training and

technical data. This integrated system should reduce maintenance downtimes, provide real-time updates, track parts through the global supply chain and allow commanders in operational fleet management. For flightline maintenance, ALIS is intended to quickly diagnosis maintenance issues, locate needed parts, access technical data customer support, and provide a consolidated portable maintenance task checklist and updated aircraft maintenance documentation or records on the maintenance member's PMA. Due to lack of real-time network connectivity on the flightline, maintenance members cannot maintain the most up-to-date status of the aircraft and must manually sync their PMA prior to each shift. However, because this sync does not always work properly, maintenance members have potentially outdated downloads of aircraft records on their PMAs. Maintenance members end up travelling to the aircraft with insufficient aircraft maintenance data, and no way to update the PMA data or maintenance forms in real-time. Instead, maintenance members begin and complete PMA checklist items on the flightline, before having an opportunity to enter the discrepancies in the aircraft forms. The forms must be manually updated on local computers once the members return from the flightline. These disconnects between maintenance actions and documentation generate complacency when members are conducting JTD checklists, as they may incorrectly assume required steps or maintenance has already been performed. The JTD checklist design also requires users to reference multiple different checklists within and outside of the primary checklist for the task they are executing. For example, to complete the Engine - Operation (Idle) procedure, a member must reference and complete at least fifteen other checklists, each of which has its own list of required tasks and procedures. Based on the task they are trying to perform, users may also be required to scroll through irrelevant checklists unrelated to their current task in order to get to the checklists they must perform, potentially missing important cautions or warnings. The substantial number of checklists and difficulty in accessing the correct ones causes complacency when users reference the required maintenance procedures.

**b. Disconnect between DAFI 21-101 tool inventory guidance and local procedures**

DAFI 21-101 directs the "user" to perform a visual inventory of the tool kit after each task. However, the DAFI defines "user" as the individual that signed out the tool kit, not necessarily the person performing the maintenance task. This conflicts with local unofficial training and guidance. During witness interviews, 62 AMU maintenance members stated the "best practice" is that the individual who is performing the engine run must accomplish the inlet inspection and personally conduct a tool kit inventory once the inlet inspection is completed. Instead of MM1 conducting a tool inspection after they inspected the inlet, it was MM2 who accomplished a tool inspection in accordance with DAFI 21-101. This led to a situation where both MM1 and MM2 believed that the flashlight had been properly accounted for, resulting in an incomplete tool kit inventory prior to the engine run.



#### 4. CONCLUSION

I find, by a preponderance of evidence, that the mishap was caused by MM1 not executing a complete inlet inspection and failing to conduct a tool kit inventory prior to engine run operations. MM1 failed to clear the inlet of foreign objects after completing the required inspections for an engine run after they exited the aircraft inlet. Failure to complete checklist tasks resulted in a flashlight being left inside the inlet. The flashlight was ingested into the engine during the engine run and caused the damage to the engine.

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SEAN S. BRAMMER-HOGAN, Colonel, USAF  
President, Accident Investigation Board

**INDEX OF TABS**

SAFETY INVESTIGATOR INFORMATION..... A

NOT USED .....B

NOT USED .....C

MAINTENANCE REPORT, RECORDS, AND DATA .....D

NOT USED .....E

WEATHER DATA ..... F

PERSONNEL RECORDS ..... G

NOT USED ..... H

NOT USED ..... I

NOT USED .....J

MISSION RECORDS AND DATA ..... K

NOT USED ..... L

NON-DISCLOSURE AGREEMENTS .....M

NOT USED ..... N

NOT USED ..... O

DAMAGE SUMMARY ..... P

AIB TRANSFER DOCUMENTS..... Q

RELEASABLE WITNESS TESTIMONY .....R

RELEASABLE PHOTOGRAPHS ..... S

PERSONNEL RECORDS NOT INCLUDED IN TAB G..... T

MAINTENANCE REPORT, RECORDS, AND DATA NOT INCLUDED IN TAB D .....U

WITNESS TESTIMONY AND STATEMENTS .....V

WEATHER RECORDS NOT INCLUDED IN TAB F.....	W
NOT USED .....	X
LEGAL BOARD APPOINTMENT DOCUMENTS.....	Y
NOT USED .....	Z
NOT USED .....	AA
APPLICABLE REGULATIONS, DIRECTIVES, AND OTHER GOVERNMENT DOCUMENTS .....	BB
FACT SHEETS.....	CC
ENGINE FOD ANALYSIS .....	DD