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18 Jan 24

From: [REDACTED] (b)(6), (b)(7)c USMC  
To: Commanding General, 2d Marine Aircraft Wing, FMF

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

Ref: (a) JAGINST 5800.7G W/CH 2 (JAGMAN)  
(b) DoD FLIP IFR Supplement  
(c) USGS Elevation Point Query Service  
(d) NGS Coordinate Conversion and Transformation Tool  
(e) SOP for USMC F-35 Flight Operations  
(f) F-35B-FM-001 (F-35B Flight Manual)  
(g) CNAFINST 4790.2D CH-1 (NAMP)  
(h) VMFAT-501 SqdBul 3710.1 (SOP)

Encl: (1) Appointment Letter  
(2) Extension Request Approvals  
(3) OPREP-3 Serious Incident Report  
(4) MP Personnel Casualty Report  
(5) MP NATOPS Qualification and Designation Record  
(6) VMFAT-501 Qualification and Designation Matrix  
(7) MP DIFOP Orders  
(8) MP Aircrew Training Jacket Summary  
(9) MP Aviation Background Review Summary  
(10) FRS Completion Letter  
(11) MP FRS Crew Performance Summary  
(12) MP NATOPS Audit  
(13) MP Physiology and Survival Training Record  
(14) MP NATOPS and Instrument Check Record  
(15) MP Flight Hours Logbook  
(16) Operational Risk Management Worksheet  
(17) Summary of Interview with [REDACTED] (b)(6), (b)(7)c (MP)  
(18) Summary of Interview with [REDACTED] (b)(6), (b)(7)c Pilot)  
(19) Summary of Interview with [REDACTED] (b)(6), (b)(7)c  
(20) MP Medical Recommendation for Flying (Up Chit)  
(21) MP Report of Medical History and Medical Examination  
(22) Summary of email with [REDACTED] (b)(6), (b)(7)c (DOSS)  
(23) Aviation Training Form for MP flight on 22 August 2023  
(24) MA ALIS Screenshot of Hotseat Part A (A-Sheet)  
(25) Lockheed Martin Engineering Investigation Report  
(26) Summary of MA Maintenance History  
(27) MA ALIS Screenshots of Pilot Display MAFs  
(28) MA ALIS Screenshots of Nacelle Fan MAFs  
(29) MA ALIS Screenshot of the Daily Inspection Record  
(30) MA ALIS Screenshot of AV Status Page  
(31) MA ALIS Screenshot of the Turnaround Inspection Record  
(32) 15 September Aviation Maintenance Supply Readiness Report

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

- (33) MA ALIS Screenshot of Ordnance Loadout Configuration
- (34) VMFAT-501 CCX/DFT Flight Schedules (15-17 September)
- (35) VMFAT-501 Corrected Flight Schedule for 15 September
- (36) JB Charleston Terminal Area Forecast for 17 September
- (37) JB Charleston Radar Snapshots for 17 September
- (38) CHS Air Traffic Mandatory Occurrence Report for Swede 11
- (39) JB Charleston Weather Observations for 17 September
- (40) Summary of email with (b)(6), (b)(7)c
- (41) Summary of email with (b)(6), (b)(7)c
- (42) MCAS Beaufort Emergency Operations Center Log
- (43) JB Charleston Emergency Operations Center Log
- (44) NAVAIR Mishap Investigation Support Team (MIST) Report
- (45) MP Discharge Summary from MUSC Hospital
- (46) MP 24 October Dermatology Outpatient Note
- (47) MCAS Beaufort Special Situation Reports (SITREPs)
- (48) Summary of email with (b)(6), (b)(7)c (Navy Region Southeast)
- (49) National Defense Area Declaration and Termination Letters
- (50) Acronyms

### Executive Summary

1. On the afternoon of 17 September 2023, the F-35B piloted by (b)(6), (b)(7)c USMC, experienced an electrical malfunction resulting in the loss of primary pilot displays and communications while operating under instrument flight rules in instrument meteorological conditions (IMC).

2. At 13:32:46 Eastern Daylight Time, (b)(6), (b)(7)c ejected from his aircraft while attempting to execute missed approach procedures off the Instrument Landing System (ILS) approach to Runway 15 into Joint Base Charleston, SC. The subsequent crash site was approximately 64 nautical miles to the northeast of the airfield.

3. Lockheed Martin flight safety engineers determined:

a. That during final approach, the mishap pilot lowered the landing gear and depressed the HOOK/STOVL button commanding the aircraft to change from conventional takeoff and landing mode (Mode 1 CTOL) to short takeoff and vertical landing mode (Mode 4 STOVL). The Mode 4 (STOVL) conversion was completed at 13:31:02.

b. Approximately one minute later, the Crash Survivable Memory Unit (CSMU) data recorded an (b)(3) (b)(3) which caused malfunctions of some displays, as well as navigation and communication capability; however, the standby flight display and backup communications remained basically functional.

c. Twenty seconds after this transient electrical event, CSMU data indicates the pilot raised the landing gear at 13:32:26. (b)(3) (b)(3) later, the pilot initiated a conversion back from Mode 4 (STOVL) to Mode 1 (CTOL). During this second conversion, ejection was

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

initiated at 13:32:46. (b)(3) after ejection, the aircraft completed conversion to Mode 1 (CTOL).

d. After ejection, systems necessary for flight remained operational allowing the aircraft to complete its conversion to Mode 1 (CTOL). With the aircraft in a nominally trimmed condition, the aircraft continued flying unmanned for 11 minutes and 21 seconds before impacting in a rural area approximately 64 miles to the northeast.

4. From his perspective in the cockpit, (b)(6), (b)(7)c recounts the following:

a. After intercepting the ILS, he slowed the flight to 200 knots and lowered the landing gear. Approaching the final approach fix, he converted the flight to Mode 4 (STOVL). After converting, (b)(6), (b)(7)c helmet Mounted Display (HMD) flickered out.

b. While considering missed approach options, his HMD came back accompanied by a multitude of cautions and advisories. Based on his exposure to similar emergencies, (b)(6), (b)(7)c decided to continue the approach.

c. A short time later, his HMD went out again. After twice experiencing loss of his HMD, (b)(6), (b)(7)c determined that a runway landing was not feasible; and he made the decision to convert out of Mode 4 (STOVL), back to a Mode 1 (CTOL), and execute missed approach procedures.

d. Upon climb-out, (b)(6), (b)(7)c discovered that he had lost communication with Charleston Tower and his wingman. Seconds later, his HMD returned accompanied by additional cautions and advisories. Additionally, he perceived the aircraft was not responding to pilot commands to convert out of Mode 4 (STOVL).

e. (b)(6), (b)(7)c then lost his HMD a third time at a last recalled altitude of 1,900 feet above ground level (AGL). With no visible reference to the horizon or ground, and unsure of which flight instruments he could trust, he perceived that the aircraft was still not responding to his commands to convert - and therefore was out-of-controlled flight (OCF). (b)(6), (b)(7)c elected to eject in accordance with the F-35B Flight Manual OCF emergency procedures.

5. The JAGMAN investigation concludes that the mishap occurred as a result of pilot error, in that (b)(6), (b)(7)c incorrectly diagnosed an OCF flight emergency and ejected from a flyable aircraft - albeit under extremely challenging cognitive and flight conditions. Furthermore, the investigation finds that the mishap was not due to dereliction of duty on behalf of the mishap pilot or anyone involved. The following facts and opinions support this conclusion:

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

a. (b)(6), (b)(7)c was qualified and current to conduct the scheduled flight and was of sound mind and body leading up to and during the mishap flight.

b. The electrical malfunction that contributed to the mishap was not related to any maintenance activities. All preventative, scheduled, and unscheduled maintenance conducted on the aircraft was done correctly and in keeping with established standards.

c. The flight was scheduled, planned, briefed, and conducted in an orderly and highly professional manner, in accordance with all applicable orders and directives. All supervisory, support, and controlling personnel performed their duties as expected.

d. (b)(6), (b)(7)c applied OCF emergency actions to a perceived loss of aircraft control below 6,000 feet AGL. To further complicate circumstances, this incident occurred while in IMC and was accompanied by a loss of primary communications and flight instrumentation.

e. Commanded flight inputs were in-progress at the time of ejection; standby flight instrumentation was providing accurate data; and the backup radio was partially operational.

6. Additionally, the JAGMAN investigation reaches the following conclusions pertaining to post-ejection events:

a. The mishap aircraft's extended follow-on flight was due to a nominally trimmed condition provided by the F-35's advanced automatic flight control systems. The loss of positive radar contact with the aircraft resulted from a failed Mode 3 transponder caused by the electrical malfunction and the aircraft's eventual descent below the Air Traffic Control radar horizon.

b. All safety and escape equipment were present, serviceable, and worked as expected. Some survival items, to include the survival radio, sustained damage upon impact with the ground. Pilot rescue and aircraft search operations were efficient and effective.

c. The recommendation is for (b)(6), (b)(7)c injuries to be deemed to have occurred while in the line of duty and not due to his own misconduct. No other individuals suffered injuries as a result of this mishap.

d. The government's environmental clean-up efforts were sufficient and in keeping with established procedures and directives.

#### Preliminary Statement

1. This report completes an investigation conducted in accordance with reference (a) and enclosure (1), to determine the circumstances surrounding the F-35B mishap of Marine Aircraft Group 31 (MAG-31), Marine Fighter Attack Training Squadron 501 (VMFAT-501) on 17

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

September 2023 resulting in the total loss of the aircraft and damage to private land in the vicinity of Hemmingway, South Carolina (SC) located 64 miles northeast of Joint Base (JB) Charleston, SC. The aircraft was piloted by (b)(6), (b)(7)c USMC.

2. The mishap resulted in no ground-related injuries, but it did result in property damage in the form of lost forested land and crops. Specific details and information regarding affected property owners are maintained by (b)(6), (b)(7)c and (b)(6), (b)(7)c at the office of the On-Scene Coordinator at Navy Region Southeast; they can be reached at (b)(6), (b)(7)c@us.navy.mil and (b)(6), (b)(7)c@us.navy.mil.

3. From this point forward, (b)(6), (b)(7)c may be referred to as the Mishap Pilot (MP) or Mishap Flight Lead (MFL).

4. F-35B Bureau Number (BUNO) 169591 (side number BF-66) may be referenced as the mishap aircraft (MA).

5. Together, the MP and MA may be referred to by the Air Traffic Control (ATC) callsign of Swede 11.

6. (b)(6), (b)(7)c USMC, VMFAT-501 Instructor Pilot was the Mishap Wingman (MW) and may be referred to as Swede 12.

7. When operating as a combined element, Swede 11 and Swede 12 may be referred to collectively by the MFL's callsign of Swede 11.

8. JB Charleston and Marine Corps Air Station (MCAS) Beaufort, SC may be referred to as Charleston or Beaufort, respectively.

9. Unless otherwise noted, the following conventions apply:

a. All times in this report are based on the 24-hour clock in Eastern Daylight Time. Very precise times, such those recorded by the Crash Survivable Memory Unit (CSMU), are reflected in the hours, minutes, and seconds (HH:MM:SS) format. Less precise times, such as those derived from logbook entries, are reflected as hours and minutes (HHMM).

b. All aircraft altitudes reflect feet above Mean Sea Level (MSL). All weather forecasts and observations reflect feet Above Ground Level (AGL). Note that for the purposes of this report, the difference between MSL and AGL is insignificant in most circumstances. The field elevation at JB Charleston is 46 feet MSL. The elevation of the crash site is 35 feet MSL. These elevations were derived from Department of Defense (DoD) Flight Information Publication (FLIP) Instrument Flight Rules (IFR) Supplement and the United States Geological Survey: Elevation Point Query Service (<https://apps.nationalmap.gov/epqs/>). [Ref (b) and (c)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

- c. All airspeeds reflect Knots Calibrated Airspeed (KCAS).
  - d. All compass references are presented in degrees magnetic.
  - e. Latitude and Longitude are referenced in degrees, minutes, and seconds (DDD° MM' SS.S" N / DDD° MM' SS.S" W). Coordinates were converted using the National Geodetic Survey (NGS): Coordinate Conversion and Transformation Tool (<https://www.ngs.noaa.gov/NCAT/>). [Ref (d)]
10. On 19 October 2023, an extension was granted by the Convening Authority (CA) to 19 November 2023. [Encl (2)]
  11. Additionally, on 8 November 2023, an extension to 19 December 2023 was granted by the CA. [Encl (2)]
  12. Finally, on 19 December, an extension to 18 January 2024 was granted by the CA. [Encl (2)]
  13. All reasonably available and relevant evidence was collected and analyzed. Due to the governmental and public interest surrounding the loss of this aircraft, every effort was made to keep this report unclassified to permit the widest dissemination.
  14. The Investigating Officer (IO) is very familiar with Marine aviation, having served three tours and four deployments with operational squadrons (including one as the Commanding Officer) and an additional tour as an Instructor Pilot. The IO is currently serving as (b)(6), (b)(7)c and has logged more than 2,460 hours in military aircraft.
  15. Acronyms and definitions are listed in Enclosure (50).
  16. There are no classified enclosures associated with this report.
  17. On 10 and 11 October 2023, the IO consulted (b)(6), (b)(7)c (b)(6), (b)(7)c Staff Judge Advocate, Office of the Staff Judge Advocate, 2d Marine Aircraft Wing regarding this investigation.
  18. Prior to questioning, the IO advised witnesses of the purpose of the JAGMAN investigation and reasons for apparent duplication of effort with the Aviation Mishap Board. All personnel cooperated fully with this investigation. Since none of the personnel interviewed were suspected of an offense under the Uniform Code of Military Justice, warnings pursuant to Article 31(b) were not necessary.

### Structure and Organization

1. Findings of fact flow logically through the investigation in the following order:
  - a. Pilot Information

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

- i. Identity and Military Status
- ii. Summary of Training and Qualifications
- iii. Flight Time Summary
- iv. Aeromedical Clearance and Post-Mishap Screening
- v. Human Factors and Personal Stressors
- b. Aircraft Information
  - i. General Information and Flight History
  - ii. Maintenance History
- c. Pre-Flight Planning
  - i. Authorization and Scheduling
  - ii. Mission Planning and Briefing
- d. Flight Execution
  - i. Key Events
  - ii. Lockheed Martin Engineering Investigation Key Points
- e. Pilot Recovery
  - i. Ejection Actions
  - ii. Recovery of MP, Ejection Seat and Survival Gear
  - iii. Aircraft Survivability Equipment Performance
  - iv. Record of Pilot Injuries
- f. Aircraft Search Operations
  - i. Overview of Flight Path
  - ii. Ejection through Last Radar Contact
  - iii. Last Radar Contact through Crash Site Discovery
- g. Crash Site Information
  - i. Aircraft and Environmental Damages
  - ii. Crash Containment Actions and Aircraft Reclamation



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

iii. Environmental Restoration Actions

2. Opinions address the following:

- a. Evaluation of Pilot
- b. Evaluation of Aircraft and Maintenance
- c. Evaluation of Scheduling and Planning
- d. Most Probable Cause of Mishap
- e. Evaluation of Pilot Recovery Efforts
- f. Most Probable Cause of Loss of Contact with Aircraft
- g. Evaluation of Aircraft Search Operations
- h. Evaluation of Containment, Reclamation, and Restoration

3. Based upon findings of fact and developed opinions, specific recommendations conclude this report.

**Findings of Fact**

**Pilot Information**

Identity and Military Status

1. (b)(6), (b)(7)c USMC was the mishap pilot of F-35B BUNO 169591 on 17 September 2023. [Encl (3), (4)]
2. MP was (b)(6), (b)(7)c instructor with VMFAT-501 aboard MCAS Beaufort. [Encl (5), (6)]
3. MP was assigned to (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (7)]
4. MP was on active duty (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (7)]

Summary of Training and Qualifications

5. (b)(6), (b)(7)c completed Primary Flight Training (b)(6), (b)(7)c (b)(6), (b)(7)c at Training Squadron 8 (VT-8), aboard Vance Air Force Base, Oklahoma. [Encl (8)]
6. MP completed Advanced Flight Training on (b)(6), (b)(7)c at VT-21 aboard Naval Air Station Kingsville, Texas. [Encl (8)]



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

7. MP completed Primary and Advanced Flight Training with well-above average performance. [Encl (9)]

8. MP was designated a Naval Aviator at Training Wing 2 on (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (5)]

9. MP was designated a Weapons and Tactics Instructor on (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (5)]

10. MP completed the Category C F-35 Fleet Replacement Squadron (FRS) syllabus at VMFAT-501 on (b)(6), (b)(7)c 2023 with above average performance. [Encl (10), (11)]

11. MP was designated a Section Lead on (b)(6), (b)(7)c 2023. [Encl (5)]

12. MP was designated an F-35B FRS Instructor Pilot on (b)(6), (b)(7)c 2023. [Encl (5)]

13. MP's ejection seat refresher brief and egress drill were completed on (b)(6), (b)(7)c 2023 and are current through (b)(6), (b)(7)c 2024. [Encl (5), (12)]

14. MP completed aviation physiology and water survival refresher training for ejection seat aircraft on (b)(6), (b)(7)c 2022. Training is valid until (b)(6), (b)(7)c 2026. [Encl (13)]

15. MP's last Naval Aviation Training and Operating Procedures Standardization (NATOPS) instrument evaluation was on (b)(6), (b)(7)c 2023 and is valid for one year. [Encl (10), (14)]

16. MP's last F-35B NATOPS flight evaluation was on (b)(6), (b)(7)c 2023 and is valid for one year. [Encl (10), (14)]

#### Flight Time Summary

17. Prior to the mishap, MP accumulated 2,822.1 hours of total flight time and 32.4 hours of F-35B flight time. [Encl (15)]

18. MP's flight time in the last 30/60/90 days was 6.4/6.4/9.1 hours respectively. [Encl (15)]

19. MP's flight time was below average, and his flight on Friday 15 September 2023 was assessed to be medium risk. [Encl (16)]

20. According to the Standard Operating Procedures (SOP) for USMC F-35B Flight Operations, flight crew must have flown once within 15 days to fly without limitations or completion of additional pre-flight requirements. [Ref (e)]

21. MP's last flight before the mishap was on 16 September 2023. [Encl (15), (17), (18), (19)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

### Aeromedical Clearance and Post-Mishap Screening

22. MP's last flight physical and clearance for flight duty was dated (b)(6), (b)(7)c 2023 with an expiration date of (b)(6), (b)(7)c 2024. [Encl (20)]

23. Post mishap drug and alcohol screening showed no detection of illicit substances in the MP's system. [Encl (21)]

24. MP denied any abnormal physiologic symptoms immediately preceding the mishap. [Encl (21)]

25. MP was pending a (b)(6), (b)(7)c appointment for (b)(6), (b)(7)c (b)(6), (b)(7)c. [Encl (21)]

26. MP had been seeing (b)(6), (b)(7)c

(b)(6), (b)(7)c

(b)(6), (b)(7)c

[Encl (21)]

### Human Factors and Personal Stressors

27. There were no known personal stressors inhibiting MP's ability to perform safely in the flight. [Encl (17), (18), (19), (22)]

28. MP's last evaluated flight was on 22 August 2023. [Encl (23)]

29. MP appeared highly coherent and well-rested prior to the flight according to (b)(6), (b)(7)c and (b)(6), (b)(7)c USMC, VMFAT-501 Instructor Pilot. [Encl (17), (18), (19)]

### Aircraft Information

#### General Information and Flight History

30. The mishap aircraft was an F-35B Lightning II, Aircraft BF-66, BUNO 169591, assigned to VMFAT-501. [Encl (24), (25)]

31. The F-35B short takeoff and vertical landing (STOVL) aircraft is a single-engine, single-seat, low-observable, all-weather tactical strike-fighter. [Ref (f)]

32. The F-35B has a cockpit display system that provides data to the pilot and takes pilot input through touch screen features. The system includes three displays for flight information. [Ref (f)]

33. The Helmet Mounted Display (HMD) provides a presentation on the helmet visor. The HMD replaces the head-up display (HUD) found in legacy aircraft and provides the same type of flight reference, landing aid, navigation, and weapon employment symbology found on a typical HUD, with separate declutter options for on-axis versus off-

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

axis viewing. Head orientation and position are provided as an output to mission systems for slaving other sensors and weapons. [Ref (f)]

34. The Panoramic Cockpit Display (PCD) provides a head-down display and uses a portal window concept to support multiple formats on a single display surface, such as electronic flight instruments (EFI), aircraft subsystem, tactical, and prognostics and health management formats. A touchscreen interface provides pilot input. [Ref (f)]

35. The Standby Flight Display (SFD) is a stand-alone unit used to provide back-up EFI data in the event of primary flight display failure and/or navigation solution error. In a failure scenario where primary attitude data cannot be displayed, the SFD provides the independent secondary source of attitude data as well as magnetic heading, barometric altimeter setting, airspeed, altitude, vertical velocity indication, and angle-of-attack data. The SFD is located just beneath the PCD. [Ref (f)]

36. The Integrated Caution, Advisory and Warning (ICAW) system notifies the pilot of system faults. The ICAW system uses visual indications on the HMD, EFI, and PCD. The pilot is provided with aural indications via the intercom. System fault order of importance are provided as a color-coded Warning, Caution, or Advisory. [Ref (f)]

37. The MA had 1,267.1 flight hours on the airframe prior to the mishap flight. This is near the average amount of flight hours for aircraft assigned to VMFAT-501. [Encl (26)]

38. The MA flew 18.4 hours in the preceding 30 days, with no pilot display discrepancies noted. [Encl (26), (27)]

39. The MP hot-seated the MA from (b)(6), (b)(7)c (b)(6), (b)(7)cc on Friday 15 September 2023 (two days before the mishap), whereby the outgoing pilot exited the cockpit, and the incoming pilot assumed the pilot position. [Encl (17), (24)]

40. The MA was last flown on Friday 15 September 2023 and Saturday 16 September 2023 by the MP with no display discrepancies noted. [Encl (17), (18), (19)]

#### Maintenance History

41. The last maintenance performed in the nacelle fan area was from 9 to 23 March 2023. During this period, nacelle fan serial number 0606 was removed and reinstalled to facilitate troubleshooting of the component. [Encl (28)]

42. In the process of the above maintenance actions, multiple nutplate fasteners were discovered disbonded from the (b)(3) area and subsequently repaired. [Encl (28)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

43. A review of previous maintenance actions in this area revealed other instances of disbanded nutplate repairs on 30 December 2022. [Encl (28)]

44. The mishap aircraft was in a Non-Mission Capable or "down" status from 10 July 2023 to 11 September 2023 for multiple maintenance requirements, including a high-time Integrated Power Package (IPP), damaged IPP drop link bushings, ladder door latches, and the incorporation of (b)(3) [Encl (26)]

45. The MA Daily inspection was signed off at 0408 on 15 September 2023 by (b)(6), (b)(7)c USMC, VMFAT-501 Powerline Division. [Encl (29), (30)]

46. A Daily inspection is good for 72 hours or until the aircraft is flown. After takeoff, a Daily inspection expires in 24 hours; however, when operating away from home base, a Commanding Officer may authorize a NATOPS pilot inspection in lieu of a Daily for the remainder of 72 hours. [Ref (g)]

47. Under this construct, the MA's Daily inspection would have expired at the completion of any flight launched before 0408 on 18 September 2023. [Encl (24), (30), Ref (g)]

48. The MA Turnaround Inspection was signed off at 0408 on 15 September 2023 by (b)(6), (b)(7)c USMC, VMFAT-501 Powerline Division. [Encl (24), (30), (31)]

49. A Turnaround Inspection is good for 24 hours or until the aircraft is flown. When operating away from home base, a Commanding Officer may authorize a NATOPS pilot inspection in lieu of a Turnaround. [Ref (g)]

50. Hotseat crew changes do not affect the status of Daily or Turnaround inspections. [Ref (g)]

51. All maintenance personnel who inspected the MA since the previous flight reported the aircraft as ready for flight within their respective areas of responsibilities. [Encl (24), (29), (30), (31)]

52. At the time of release, the MA was in a Partial Mission Capable status, due to degraded Distributed Aperture System (DAS) and Electronic Warfare (EW) systems. [Encl (32)]

53. (b)(6), (b)(7)c signed off the MA as Safe-For-Flight on 15 September 2023, following the hotseat to the MP. The outgoing pilot did not report any display malfunctions. [Encl (24)]

54. The MA was not carrying ordnance at the time of the mishap. [Encl (25), (33)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

### Pre-Flight Planning

#### Authorization and Scheduling

55. At the time of the mishap, VMFAT-501 was executing a Cross Country / Detachment for Training (CCX/DFT), departing from MCAS Beaufort to JB Charleston on Friday 15 September 2023 and returning on Sunday 17 September 2023. [Encl (17), (18), (19), (34)]

56. The flight schedule for each day authorized either a division (three or four-plane formation) or two sections (two-plane formations) for (b)(6), (b)(7)c and (b)(6), (b)(7)c [Encl (34)]

57. The flight schedule for Friday, 15 September 2023 authorized a division funeral flyover with a recovery into Charleston. [Encl (17), (18), (19), (34)]

58. On Saturday, 16 September 2023, the schedule called for division Strike Coordination and Reconnaissance, followed by coordinated sections conducting Tactical Intercepts (TI) and Red Air (simulated threat aircraft) missions. [Encl (34)]

59. Sunday's flight schedule called for coordinated sections conducting TI and Red Air, followed by independent sections conducting Familiarization maneuvers with a recovery back to Beaufort. [Encl (34)]

60. On Friday, only three of the planned four aircraft were available due to a maintenance cancellation; so, (b)(6), (b)(7)c hot-seated his aircraft to (b)(6), (b)(7)c and did not participate in the CCX/DFT, in accordance with the briefed aircraft degradation plan. [Encl (17), (18), (19), (35)]

61. On Saturday, 16 September 2023, (b)(6), (b)(7)c and (b)(6), (b)(7)c (b)(6), (b)(7)c were scheduled to conduct TI in coordination with (b)(6), (b)(7)c (b)(6), (b)(7)c and (b)(6), (b)(7)c acting as Red Air. The flight schedule for Sunday, 17 September 2023 called for the roles to be reversed. [Encl (34)]

62. With (b)(6), (b)(7)c no longer participating in the DFT/CCX, (b)(6), (b)(7)c (as the section lead and in consultation with the detachment's Operations representative, (b)(6), (b)(7)c adjusted the order of training to capture the TI code for himself on Saturday and (b)(6), (b)(7)c on Sunday. [Encl (18)]

63. This change was authorized per the squadron SOP, as it did not change the Operational Risk Management assessment or prerequisites. [Ref (h)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

Mission Planning and Briefing

64. On the day of the mishap (b)(6), (b)(7)c and (b)(6), (b)(7)c initially briefed a tactical intercept flight. [Encl (17), (18), (19)]

65. At planned launch time, the members of the flight delayed until after lunch due to poor weather. [Encl (17), (18), (19)]

66. (b)(6), (b)(7)c (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (17), (18), (19)]

67. (b)(6), (b)(7)c chose not to fly on Sunday, to avoid the risk of having to divert to Savannah due to the potential for lightning in the vicinity of Charleston during the recovery window. [Encl (17), (18), (19)]

68. (b)(6), (b)(7)c and (b)(6), (b)(7)c elected to conduct Basic Fighter Maneuvering (BFM) for currency. [Encl (17), (18), (19)]

69. The squadron SOP states that instructors may brief BFM as an alternate mission. It also states that Air Combat Maneuvering Instructors (ACMIs) may conduct BFM with a student that has completed the BFM syllabus. [Ref (h)]

70. MP was not an FRS student. [Encl (10)]

71. Although not required, MW was an ACMI and was qualified to instruct BFM as an alternate mission. [Encl (6), (18)]

72. The squadron SOP explicitly states, "BFM alternate mission 1vl TI for weather does not require approval" for a schedule change. [Ref (h)]

73. The MP and MW executed a new brief for BFM and waited for the weather to improve. [Encl (17), (18), (19)]

74. The MP administratively briefed and led the mission as the MFL. [Encl (17), (18), (19)]

75. During the mishap flight's mission planning, the weather at Charleston was forecasted to be no worse than four statute miles of visibility, showers and rain with a broken layer of clouds at 3,000 feet during their time of flight. [Encl (36)]

76. Radar snapshots on the day of the mishap indicate large thunderstorm activity to the west of Charleston. [Encl (37)]

77. The mishap flight briefed an Instrument Landing System (ILS) recovery to Runway 15 at JB Charleston. [Encl (17), (19)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

## Flight Execution

### Key Events

78. The Mishap Flight's callsign was Swede 11 and consisted of the MFL (Swede 11) and the MW (Swede 12). [Encl (34), (38)]

79. Swede 11 departed at about 1245 from JB Charleston, SC. [Encl (17), (18), (19), (25)]

80. At departure, observed weather at Charleston was overcast 5,000 feet, and broken layers at 1,400 feet and 3,400 feet. The winds were 310 degrees true at 14 knots. Visibility was one and three quarters miles with heavy rain and mist. [Encl (25), (39)]

81. Swede 11 executed an uneventful BFM training sortie and began recovery to Charleston at approximately 1325. [Encl (17), (18), (19), (25), (38)]

82. After training, the MFL rejoined the flight and received Charleston airport information via Automated Terminal Information System (ATIS). The MFL passed the following ATIS information to the MW: Winds 160 at 11 knots, four miles visibility, and a scattered layer at 1,900 feet. [Encl (17), (18), (19), (39)]

83. Swede 11 contacted Charleston Radar East Approach, who advised them of heavy rain in the area and began to vector them around to intercept the final course for the ILS 15 Approach. [Encl (17), (38)]

84. The MFL put the MW into a one-mile trail formation to penetrate weather during the instrument recovery. This position allows the trail aircraft to track the position of the lead aircraft on radar while in Instrument Meteorological Conditions (IMC). [Encl (17), (19), (39)]

85. Charleston Radar directed Swede 11 on an initial heading of 330 to form a left-hand box around the field and descended the section from 10,000 feet to 5,000 feet to 3,000 feet during the vectors. [Encl (17)]

86. Swede 11 entered IMC while being vectored over land north of the airfield. [Encl (19)]

87. The MP could see weather buildups in his radar, and the air traffic controller seemed to be vectoring them around the heavy buildups. [Encl (17)]

88. At 13:27:46, Charleston Radar East gave Swede 11 a left hand turn to a heading of 180 and cleared them for the ILS 15 approach. [Encl (17), (38)]



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

89. The MP noted the conditions were still IMC with light to moderate precipitation. Based on ATIS, he was expecting to break out around 2,000 feet with four miles visibility. [Encl (17)]

90. At 13:29:27, Charleston Radar East handed Swede 11 off to Charleston Tower. [Encl (38)]

91. After intercepting the ILS, the MFL slowed the flight to 200 knots, lowered the landing gear. [Encl (17)]

92. At 13:29:39, [REDACTED] (b)(3), (b)(4)  
[REDACTED] (b)(3), (b)(4)  
[REDACTED] (b)(3), (b)(4) [Encl (25)]

93. At 13:30:10, Charleston Tower cleared Swede 11 to land on Runway 15. [Encl (38)]

94. The MP recalled the Tower controller announcing that traffic ahead of him had broken out at 900 feet and that it was the first time the MP recalled being told that ceilings were less than 2,000 feet. [Encl (17)]

95. Approaching the final approach fix, the MFL made the radio call to convert the flight to Mode 4 (STOVL) and slow the flight to 150 knots in preparation for the 100-knot slow landing. This was the last radio call Swede 12 heard from Swede 11. [Encl (17), (19)]

96. [REDACTED] (b)(3), (b)(4)  
[REDACTED] (b)(3), (b)(4) [Encl (25)]

97. Approximately one half of the way down the ILS 15 approach, Swede 12 noticed that Swede 11 fell out of the flight data link. [Encl (19)]

98. MP reported his HMD flickered shortly after converting. Near simultaneously, a momentary caution displayed in his HMD that he perceived to be engine-related and then the HMD flickered out. While MP considered missed approach options, the HMD came back. [Encl (17)]

99. After the HMD returned, the MP continued the approach, but began experiencing multiple cautions and advisories. He remembered or perceived the cautions to be related to flight controls, avionics and flight control actuator cooling, air data source degrades, and the inertial navigation system. [Encl (17)]

100. [REDACTED] (b)(3), (b)(4)  
[REDACTED] (b)(3), (b)(4)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

(b)(3), (b)(4)

(b)(3), (b)(4)

[Encl (25),

Ref (f)]

101.

(b)(3), (b)(4)

(b)(3), (b)(4)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

102. Based on his exposures to similar emergencies in the simulator, the MP felt the best course of action was to continue the approach. [Encl (17)]

103. A short time later, the MP lost his HMD a second time, and he transitioned to his SFD to execute the missed approach procedure. MP recalled that his PCD was not operational each time he lost his HMD. [Encl (17)]

104. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25), Ref (f)]

105. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25)]

106. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25)]

107. Swede 12 observed Swede 11's radar track move to the 10 o'clock high position, which lead him to believe Swede 11 was executing a missed approach. [Encl (19)]

108. Upon climb out and acceleration past 150 knots, the MP realized that he had lost communications with Tower and his wingman. [Encl (17)]

109. While executing his missed approach, the MP reported his HMD had returned at some point, and he began to see more cautions and advisories post. [Encl (17)]

110. [REDACTED] (b)(3), (b)(4) [Encl (25)]

111. At 13:32:24, [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25), Ref (f)]

112. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25)]

113. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[Encl (25)]

114. While transitioning his reference back to the HMD from the SFD, the MP perceived that the aircraft was not converting as commanded, and then he lost his HMD again. [Encl (17)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

115. Having lost his HMD and PCD attitude references a third time, and unsure of which instruments he could trust, the MP perceived he had entered out of controlled flight (OCF). [Encl (17)]

116. The F-35B Flight Manual states, "The aircraft is considered to be in out of controlled flight (OCF) when it fails to respond properly to pilot inputs." [Ref (f)]

117. The MP's last recalled altitude was 1,800 - 1,900 feet. Due to his proximity to the terrain, the MP elected to eject in accordance with the F-35B Flight Manual Emergency Procedures OCF minimum recovery altitude. [Encl (17)]

118. The F-35B Flight Manual, EMR/ICAW Rule #11 states, "If out of control below 6000 feet AGL, eject." [Ref (f)]

119. The F-35B Flight Manual, OCF Emergency Procedure (EP) Step \*5A (memory item) is: "If out of control below 6000 feet AGL: EJECT." [Ref (f)]

120. At 13:32:46, CSMU data recorded ejection. [Encl (25)]

121. At 13:32:51, Mode 1 (CTOL) conversion completed. [Encl (25)]

122. At 13:33:09, Charleston Tower Controller observed that Swede 11 appeared to be executing a missed approach and advised Swede 11 of climb-out instructions. Swede 11 did not acknowledge. [Encl (38)]

123. At 13:33:38, Swede 12 reported "on deck" to Charleston Tower after breaking out at approximately 500 feet with one-half mile visibility. Tower responded by asking the status of Swede 11. Swede 12 replied that he presumed Swede 11 was executing a missed approach. [Encl (19), (25)]

124. After exiting the runway, Tower notified Swede 12 that Swede 11 was tracked 25 miles north of the airfield heading towards Shaw Air Force Base's airspace. [Encl (19)]

125. Approximately 10 minutes later, Charleston Tower advised Swede 12 that Swede 11 had ejected. [Encl (19)]

Lockheed Martin Engineering Investigation Key Points

126. [REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4)

[REDACTED] (b)(3), (b)(4) [Encl (25)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

128. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

129. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

130. (b)(3), (b)(4) [Encl (25), (40)]

131. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25), Ref (f)]

132. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

133. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

134. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

135. (b)(3), (b)(4) [Encl (25)]

136. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

137. (b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

138. (b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25), Ref (f)]

139. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

140. (b)(3), (b)(4)  
(b)(3), (b)(4)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

141. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

142. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

143. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

144. (b)(3), (b)(4) [Encl (25)]

145. (b)(3), (b)(4)  
(b)(3), (b)(4)  
[Encl (25)]

146. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

147. (b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

148. (b)(3) [Encl (25)]

149. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

150. (b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

**Pilot Recovery**

Ejection Actions

151. During ejection, the MP's helmet and mask were ripped off. After violent motion stopped and his chute had opened, he noted that he was still in IMC. [Encl (17)]

152. Upon breaking out of the clouds and observing that he was over a residential area, the MP released his seat pan and raft to avoid

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

getting tangled in power lines. He then attempted to use the steering toggles to descend to a safe area. Upon landing, he discovered he was in a backyard of a home. [Encl (17)]

153. After landing, the MP was able to manipulate the quick-release from his harness, identified himself to the home occupants as a military pilot, and asked the resident to dial 911. [Encl (17)]

Recovery of MP, Ejection Seat and Survival Gear

154. About 1335, MP landed at or near (b)(6), (b)(7)c in Midland Park, Charleston, SC. [Encl (41), (42)]

155. MP identified himself as a military pilot to the residents and asked them to dial 911. [Encl (17)]

156. At about 1340, MP called (b)(6), (b)(7)c cell phone and informed (b)(6), (b)(7)c that he had ejected. [Encl (18)]

157. (b)(6), (b)(7)c informed the VMFAT-501 Commanding Officer and Operations Officer of the mishap. [Encl (18)]

158. MP was taken by ambulance to the Medical University of South Carolina Emergency Department (MUSC ED). [Encl (17)]

159. At 1421, JB Charleston activated their Emergency Operations Center (EOC). [Encl (43)]

160. At 1437, MCAS Beaufort activated their EOC. [Encl (42)]

161. At approximately 1445, the USAF 437 Airlift Wing Chief of Safety and JB Charleston Fire Chief arrived at the ejection landing site and discussed the situation with local police. [Encl (41)]

162. By the time Safety Personnel had arrived, local law enforcement was already recovering the personal effects of the pilot. [Encl (41)]

163. Local law enforcement turned over the parachute, seat kit, and a few other effects to the JB Charleston Fire Chief. [Encl (41)]

164. By 1500, the Charleston EOC and Beaufort EOC were coordinating. [Encl (43)]

165. About 1700, a Marine detachment arrived at Charleston from Beaufort. [Encl (42), (43)]

166. From 1730-1930, Air Force Security Forces searched the areas in the vicinity of Ashley Phosphate Plant, Midland Park, Interstate Highway 26 and Stahl Road for aircraft debris and survival gear, with negative findings. [Encl (43)]



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

167. At 2009, Charleston Base Operations informed the Charleston EOC that metal components, possibly from the ejection seat, were being held at Building 169. [Encl (43)]

168. At 0837, on 18 September 2023, a Naval Air Systems Command (NAVAIR) Mishap Investigation Support Team (MIST) was enroute to search area for ejection seat. [Encl (42)]

169. At 0848, Beaufort EOC received confirmation that Charleston Security Forces had possession of MP Survival Equipment. [Encl (42)]

170. About 0900, MIST Commander was on-scene at Charleston searching for the ejection seat. [Encl (43)]

171. At 1010, the Pilot seat was found on the flight line, and a cordon was established out to 50 feet with the MIST Team on site. [Encl (42), (43)]

172. At 1054, the grid location of the ejection seat was recorded as [REDACTED] (b)(6), (b)(7)c [Encl (42)]

173. At 1124, the ejection seat was transported to Charleston Security Forces headquarters. [Encl (42)]

174. At 1610, the Marine Detachment searched the wood-line north of Charleston for additional aircraft parts and survival equipment. [Encl (43)]

175. At 1418, on 20 September 2023, Marine Explosive Ordnance Disposal (EOD) personnel returned to Beaufort with the ejection seat. Ejection seat was stored in the southern third of Hangar 414. Energetic components were stored in the EOD Magazine. [Encl (42)]

176. At some point between 1930 on 22 September 2023 and 0800 on 23 September 2023, [REDACTED] (b)(6), (b)(7)c USMC, VMFAT-501 Executive Officer recovered the MP's parachute from Charleston and transferred custody of the item to responsible parties in Hangar 414 aboard MCAS Beaufort. [Encl (42)]

#### Aircraft Survivability Equipment Performance

177. [REDACTED] (b)(3), (b)(4) [Encl (25)]

178. [REDACTED] (b)(3), (b)(4)  
[REDACTED] (b)(3), (b)(4) [Encl (25)]

179. Preliminary field investigation revealed no anomalies with the ejection seat. [Encl (44)]

180. MP initiated the ejection. [Encl (17), (44)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

181. From the MP's reported perspective, all safety and emergency equipment seemed to work correctly to include: the ejection handle and seat; arm and leg restraints; parachute and steering controls; seat pan release; and harness quick releases. [Encl (17)]

182. Adverse effects noted by the MP include (b)(6), (b)(7)c  
(b)(6), (b)(7)c  
(b)(6), (b)(7)c  
(b)(6), (b)(7)c The MP felt he was wearing his helmet and mask correctly. [Encl (17)]

183. Additionally, MP reported (b)(6), (b)(7)c  
(b)(6), (b)(7)c  
(b)(6), (b)(7)c [Encl (17), (21)]

184. Restraint system functioned as designed. [Encl (44)]

185. Parachute functioned as designed; during post ejection canopy inspection no damage was noted. [Encl (44)]

186. Based on ground elevation, wind-speed, gear and aircrew weights the descent velocity was calculated to have been 18.9 feet per second. [Encl (44)]

187. During the inspection it was noted the Signal Whistle and Compass were not attached. [Encl (44)]

188. All four four-ounce bagged water packets were burst. [Encl (44)]

189. The survival radio sustained significant ground impact damage. [Encl (44)]

#### Record of Pilot Injuries

190. MP reported (b)(6), (b)(7)c  
(b)(6), (b)(7)c  
(b)(6), (b)(7)c [Encl (21)]

191. MP reported (b)(6), (b)(7)c after ejection while descending beneath the parachute canopy. [Encl (21)]

192. Upon landing, MP executed an uneventful Parachute Landing Fall without additional injuries. [Encl (17), (21)]

193. After landing, MP continued (b)(6), (b)(7)c was able to walk to the door of the nearby home. [Encl (17)]

194. He was given paper towels by the residents for (b)(6), (b)(7)c  
(b)(6), (b)(7)c as a result of the ejection. [Encl (17)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

195. After the paramedics arrived and conducted their initial assessments, MP walked to the ambulance, and they placed him on the gurney and drove him to the MUSC ED. [Encl (17)]

196. Upon arrival, MP was given a thorough examination to include x-rays and Computed Tomography (CT) scans. MP's chief complaint was

(b)(6), (b)(7)c [Encl (17), (45)]

197. While at MUSC, MP met with the VMFAT-501 Commanding Officer, Safety Officer, and Flight Surgeon (b)(6), (b)(7)c USN (b)(6), (b)(7)c (b)(6), (b)(7)c conducted a post mishap medical examination per DOD Forms 2807-1 and 2808. [Encl (17), (21), (45)]

198. MP remained overnight for observation, and after some additional x-rays, he was released the following morning. [Encl (17), (45)]

199. No medical procedures were conducted; (b)(6), (b)(7)c

(b)(6), (b)(7)c

[Encl (45)]

200. MP's Discharge Diagnosis included the following active problems:

(b)(6), (b)(7)c

(b)(6), (b)(7)c

[Encl (17), (45)]

201. Additionally, MP reported (b)(6), (b)(7)c and (b)(6), (b)(7)c

(b)(6), (b)(7)c

canopy during ejection. [Encl (17), (45)]

202. (b)(6), (b)(7)c

(b)(6), (b)(7)c

[Encl (21)]

203. MP consulted (b)(6), (b)(7)c

(b)(6), (b)(7)c

(b)(6), (b)(7)c

resulting from MP's ejection. [Encl (46)]

### Aircraft Search Operations

#### Overview of Flight Path

204. After ejection, the MA flew in a nominally trimmed condition, for 11 minutes and 21 seconds before last recorded data. [Encl (25)]

205. The MA continued flying unmanned at approximately 10 degrees nose up, making a shallow left turn to a northerly direction and climbing to a peak altitude of 9,329 feet. [Encl (25)]

206. Approximately 11 minutes after ejection, the MA reversed its bank to a shallow right descending turn and began clipping the top of a densely forested area. [Encl (25)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

207. The MA plowed through dense forest approximately 64 miles northeast of JB Charleston in a rural area. [Encl (25)]

208. The crash site was not located until the following day, at 1645 on 18 September 2023. [Encl (42), (47)]

#### Ejection through Last Radar Contact

209. At the time of ejection (13:32:46) (b)(3), (b)(4) (b)(3), (b)(4) at 1,746 feet and 243 knots. [Encl (25)]

210. Moments later, Charleston Tower observed a "primary-only" target approximately 3.5 nautical miles east of the airport heading northeast bound and advised Charleston Radar East that the target may be Swede 11. [Encl (38)]

211. Charleston Departure tracked the MA as it continued northeast bound until contact was lost at 13:38:26 on the 012 radial, at 23.87 nautical miles from the Charleston VORTAC Navigational Aid. [Encl (38)]

#### Last Radar Contact through Crash Site Discovery

212. Charleston Radar personnel contacted the 437 Airlift Wing Chief of Safety about the last pings they received from the F-35. From their scope, they lost contact with the aircraft near Lake Moultrie outside the town of Bonneau, SC, approximately 25 nautical miles North from the airfield. [Encl (43)]

213. At 1700 on 17 September 2023, Charleston EOC called the Beaufort EOC to inform them that Incident Command (IC) had been established in Bonneau Beach Fire Department, SC. Beaufort EOD was notified of the mishap. [Encl (41), (42), (43)]

214. At 1707, Beaufort EOC was informed that South Carolina Department of Natural Resources (DNR) watercraft and the Berkley County Sherriff's Department were searching for the MA on and around Lake Moultrie. [Encl (41), (42)]

215. At 1759, (b)(6), (b)(7)c Navy Region Southeast, called to inform the Beaufort EOC that the recovery and clean up team was activated and enroute to JB Charleston and Lake Moultrie. [Encl (42)]

216. At 1821, Charleston EOC contacted the South Carolina Emergency Management Division (SCEMD), informing them that the Clarendon County Sherriff's Department was searching nearby Lake Marion. [Encl (43)]

217. At 2007, (b)(6), (b)(7)c Beaufort County Sherriff's Office, informs the Beaufort EOC that the search area had been moved to the border of Williamsburg and Florence Counties, along with aviation assets from the Civil Air Patrol, South Carolina State Law Enforcement

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

Division (SLED), and DNR based on radar information from Shaw Air Force Base. [Encl (41), (42)]

218. At 2040, SCEMD contacted Charleston EOC, informing them that the search area was being moved to near the town of Leo, SC. [Encl (43)]

219. At 2115, Charleston EOC contacted (b)(6), (b)(7)c Navy Region Southeast, for confirmation of a report of 1,000 gallons of JP8 jet fuel being onboard MA. [Encl (43)]

220. At 2129, Charleston EOC confirmed that (per the Florence County Emergency Management Division) the search had been moved to the area of lower Florence County and upper Williamsburg County, with the staging area located in Lake City, SC. [Encl (41), (42)]

221. At 2235, (b)(6), (b)(7)c USMC, VMFAT-501 Safety Officer, called Beaufort EOC to provide coordinates of last radar contact tracked by the Eastern Air Defense Sector as (33° 45' 16.8" N / 079° 36' 21.0" W). [Encl (42)]

222. At 0020 on 18 September 2023, (b)(6), (b)(7)c called to inform that Jacksonville Center had last contact with MA located at (33° 18' 07.8" N / 079° 56' 09.6" W). MA speed decreased to 160 Knots Groundspeed (KGS) then rapidly accelerated to 400 KGS before losing contact. [Encl (42)]

223. By 1000 that morning, the following aircraft were assisting in the search: Florence County Sherriff Helicopter; USMC UC-12; SLED Helicopter; and three Civil Air Patrol Cessnas. [Encl (41)]

224. At approximately 1230, the Civil Aircraft Patrol Forensics team provided a chart of radar pings with a potential flight path. The new corridor placed the potential crash site near Hemmingway, SC. [Encl (41)]

225. At 1445, (b)(6), (b)(7)c USMC, MCAS Beaufort Provost Marshal, relayed a new lead on MA's location. A resident at (b)(6), (b)(7)c (b)(6), (b)(7)c Hemmingway, SC reportedly heard a loud "thump" that did not sound like thunder at about 1345 on 17 September 2023. [Encl (41), (42)]

226. At approximately 1645, the JB Charleston Fire Chief reported he had talked to a property owner in Hemmingway, SC who had seen a flash of light and heard a loud bang outside of his house at about the time in question. [Encl (41), (43)]

227. After obtaining permission to walk the property, the JB Charleston Fire Chief noticed scorched trees overhead and started walking into a wooded area. As he approached, he noticed a fuel smell and small aircraft parts. As he entered the woods, he noticed aircraft wreckage overhead and radioed in the crash site. [Encl (41)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

228. (b)(6), (b)(7)c Deputy Director, USAF 628th Mission Support Group, reported establishment of a National Defense Area (NDA). [Encl (43)]

229. At 1645, (b)(6), (b)(7)c received photographs of possible MA parts near Boggy Swamp, located about four miles west of Hemmingway, SC (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (41), (42)]

### Crash Site Information

#### Aircraft and Environmental Damages

230. The crash site was a non-populated area in the coastal plain region of South Carolina with a variety of habitats, to include agricultural crops, upland wooded forest area, and lowland area with a small freshwater stream running through it. [Encl (48)]

231. The debris field was found amid dense forest, cotton, and soybean fields, and it was oblong in shape, stretching approximately 1,800 feet long by approximately 300 feet at its widest point. [Encl (25)]

232. The MA impacted through the trees in a southeasterly direction in the northwest corner of the field. From overhead, all that could be seen was where the aircraft entered the trees. The only visible aircraft part from the air was a large chunk of the engine. [Encl (41)]

233. The MA crash site indicated a low angle, high speed trajectory, leaving the MA wreckage shredded into mostly small pieces, with the largest pieces ranging from three to five feet. [Encl (25)]

234. The total loss of the aircraft resulted in Class A mishap, at approximate \$100 million. [Encl (3)]

235. (b)(3), (b)(4)  
(b)(3), (b)(4)  
(b)(3), (b)(4) [Encl (25)]

236. (b)(3)  
(b)(3) [Encl (25)]

#### Crash Containment Actions and Aircraft Reclamation

237. About 1700 on 18 September 2023, a staging area was set up in a homeowner's front yard (b)(6), (b)(7)c in Hemmingway, SC. The crash site could be entered from (b)(6), (b)(7)c Marines established security and controlled access to the crash site. [Encl (41)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

238. Crash site location was (b)(6), (b)(7)c  
(b)(6), (b)(7)c  
(b)(6), (b)(7)c all crash debris was to the north. [Encl (41)]

239. At 1750, an NDA was declared by (b)(6), (b)(7)c USMC, MCAS Beaufort Commanding Officer. [Encl (47), (49)]

240. The JB Charleston Fire Chief and his team entered the crash site and started placing marking flags to help identify parts and debris. [Encl (41)]

241. At 2030, (b)(6), (b)(7)c established a Temporary Flight Restriction (TFR) encompassing a one-mile radius up to 1,000 feet. [Encl (42)]

242. At 2039, (b)(6), (b)(7)c reported setting up a Command Post with (b)(6), (b)(7)c (b)(6), (b)(7)c [Encl (41), (42)]

243. At 2055, Beaufort Aircraft Rescue and Fire Fighting arrived on-scene. [Encl (42)]

244. At 2135, (b)(6), (b)(7)c assumes IC. [Encl (42), (43), (47)]

245. At 2150, Charleston EOC conducted handoff to Beaufort EOC via phone. [Encl (43), (47)]

246. At 2234, (b)(6), (b)(7)c informed the Beaufort EOC that he would need (b)(2) personnel for security to man the ECP and perimeter security. [Encl (42)]

247. (b)(6), (b)(7)c stated that V-22 aircraft should not land near the crash site, due to ground conditions and fire hazards; however, he noted the Lake City Municipal airport was approximately 20 miles away. [Encl (42)]

248. (b)(6), (b)(7)c noted that reliability of cell phone service varied by provider, and Iridium phones were requested along with life support items such as food, water, portable toilets, and fuel. [Encl (42)]

249. At 0050 on 19 September 2023, (b)(6), (b)(7)c relayed that he was establishing a mobile command center and meeting tents with tables, chairs, whiteboards, generators, and lights. Additionally, heavy equipment along with trailers and transportation were on site. [Encl (42)]

250. At 0116, (b)(6), (b)(7)c relayed that high-speed internet and encrypted radios were operational. [Encl (42)]



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

251. At the 0830 Charleston EOC briefing, potential drone activity over the crash site was highlighted as a concern. [Encl (43)]

252. At 0845, the EOD and Safety Teams conducted an initial sweep of the crash site. [Encl (42)]

253. At 1105, EOD completed their sweep of the crash site, finding no explosive material. [Encl (42)]

254. At 1145, Charleston EOC contacted (b)(6), (b)(7)c to request any radiation samples and/or monitor data. [Encl (43)]

255. At 1208, the crash site location was refined. The center of the wreckage created an impact crater approximately 15 feet wide by 30 feet long at (b)(6), (b)(7)c that had filled with water by the time the investigation team arrived at the site. [Encl (25), (42)]

256. At 1210, the IC reported one incident of Unmanned Aerial System (UAS) activity in the area. They worked with local law enforcement to remove the UAS. [Encl (42)]

257. At 1212, an eyewitness arrived on scene and reported having witnessed the crash. [Encl (42)]

258. At 1213, (b)(6), (b)(7)c reported to the Charleston EOC that USMC EOD recorded radiation exposure of 22 microrem over two hours on their personal detectors. [Encl (43)]

259. At 1600, the TFR changed to a three-mile radius from the surface to 10,000 feet. [Encl (42), (47)]

260. At 1756, Aircraft Rescue and Firefighting Marines located both flight data recording boxes. [Encl (42)]

261. At 1000 on 20 September 2023 (b)(6), (b)(7)c requested soil and water samples for Alpha and Beta contamination. [Encl (42)]

262. At 1236, Starlink was established at the mishap site. [Encl (42)]

263. At 1256, (b)(6), (b)(7)c MCAS Beaufort Director of Operations, approved Charleston EOC's request for bio-environmental support for radiation monitoring and soil and water sampling. [Encl (42)]

264. At 0830 on 21 September 2023, a Federal Bureau of Investigation (FBI) (b)(7)e arrived at the mishap site. [Encl (42), (47)]

265. At 1800 on 26 September 2023, the FBI (b)(7)e departed the mishap site. [Encl (42), (47)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

266. At 0830 on 28 September 2023, the first of two convoys of aircraft debris departed the mishap site for MCAS Beaufort, SC. At 1240, first convoy offloaded debris at Hangar 414. [Encl (42), (47)]

267. At 1220, IC contacts reported that a helicopter flew over the mishap site at approximately 1,500 feet AGL. Beaufort EOC contacted Myrtle Beach Approach Control and reported the incursion. [Encl (42)]

268. At 1233 on 29 September 2023, a second convoy of aircraft debris arrived at MCAS Beaufort. [Encl (42), (47)]

269. By 1600 on 3 October 2023, 15 of 22 truckloads of excavated dirt were removed from the mishap site. [Encl (42)]

270. By 1100 on 4 October 2023, all dirt removal was complete. [Encl (42), (47)]

271. By 0915 on 5 October 2023, all personnel, equipment and debris had departed the mishap site, and the NDA and TFR were cancelled. [Encl (42)]

272. By 1410, the final convoy arrived at MCAS Beaufort, and recovery and restoration operations were declared complete. [Encl (42)]

#### Environmental Restoration Actions

273. Aircraft debris field was scattered across an area of approximately 40 acres of varying rural terrain. [Encl (48)]

274. The initial response, recovery, remediation, and restoration process took 17 days and cost approximately \$2.14 million. This was led by the Navy Federal On-Scene Coordinator. Final site restoration is pending tree planting. [Encl (48)]

275. A site assessment and delineation began immediately upon arrival to scene. Clearing and excavation of impacted soil began within three days, and within 10 days the aircraft debris was removed and returned to the installation. [Encl (48)]

276. Site restoration is pending completion and scheduled to occur in January-February 2024. It will consist of planting trees to the large areas cleared during the response. This will be done in coordination with a local forester and input from property owners. One property owner declined to have trees planted adjacent to his agricultural cropland. This area will naturally revegetate with local native plants. [Encl (48)]

277. 2,145.24 tons of contaminated soil plus debris (trees, etc.) was disposed. [Encl (48)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

278. Some surrounding soy and cotton crops near the impact site were cut for the purposes of ensuring contaminant removal and to provide access to the site. [Encl (48)]

279. Site access was controlled to 1.5 square miles temporarily for the time of the response, in order to protect classified and sensitive information and maintain safety controls of the response area. [Encl (48)]

280. The removal of regulated contaminants from the environment was accomplished within 17 days. [Encl (48)]

281. Samples were taken throughout the debris field, and analytical results confirmed remediation was accomplished in accordance with federal and state policies. [Encl (48)]

### Opinion

#### Evaluation of Mishap Pilot

1. MP is a highly experienced fighter/attack pilot who was qualified and current to conduct the scheduled flight on 17 September 2023. [FF 2, 4-18, 20-22]
2. Despite his extensive experience in AV-8B, MP is a relative novice in the F-35B. [FF 10, 12, 17]
3. Although his flight on Friday, 15 September 2023 was assessed to be medium risk per the squadron's Operational Risk Management worksheet, MP's flight on Sunday, 17 September 2023 would have been low risk due to his recent flights over the weekend. [FF 19, 40]
4. MP was rested and focused on the day of the mishap, and the conduct of the entire evolutions leading up to the mishap was not unusual for the conditions. [FF 23, 24, 27-29, 69, 72]
5. Throughout the weekend and during the mishap flight, there were no indications of impending avionics malfunctions for the MP to assess. [FF 40, 53]
6. MP was recovered and treated for injuries in a timely manner. He received a thorough medical examination, and the results were appropriately documented. [FF 195-203]
7. MP suffered injuries in the line of duty, which were not due to his own misconduct. [FF 191, 193, 194, 200-203]
8. MP's (b)(6), (b)(7)c predated the mishap and therefore is not attributable to the mishap; nor was it a contributing factor to the mishap. [FF 25]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

9. MP's (b)(6), (b)(7)c predated the mishap. Ample evidence exists that (b)(6), (b)(7)c experienced by the MP post-mishap is a direct result of the ejection. (b)(6), (b)(7)c (b)(6), (b)(7)c did not contribute to the mishap. [FF 26, 191, 193, 200]

#### Evaluation of Aircraft and Maintenance

10. The electrical malfunction that contributed to the mishap was not related to any maintenance activities. [FF 38, 41]

11. The number of times disbonded nutplates were addressed in the maintenance actions associated with (b)(3) (b)(3) represent a potential Foreign Object Debris (FOD) hazard. [FF 42, 43]

12. There is no indication of maintenance malpractice by the mishap squadron, nor were there any known aircraft discrepancies that would have indicated an impending failure. [FF 38, 40, 41, 44-53]

13. The MA was properly configured and inspected prior to flight. [FF 52, 54]

14. The MA was properly scheduled, screened, and released for flight in accordance with reference (g). [FF 45-54]

#### Evaluation of Scheduling and Planning

15. All supervisory, support, and controlling personnel (to include Operations, Safety, Standardization, NATOPS, and Command Leadership) performed their duties as expected. [FF 2, 4, 12-16, 19-22, 27, 29, 45-60]

16. The flight was scheduled, planned, briefed, and conducted in an orderly and highly professional manner in accordance with all applicable orders and directives. [FF 55-77, 80-97]

17. Schedule changes were prudent, authorized, and in no way contributed to the mishap. [FF 60, 62, 63, 65, 67-73]

#### Most Probable Cause of Mishap

18. The mishap occurred as a result of pilot error, in that the MP incorrectly diagnosed an OCF flight emergency and ejected from a flyable aircraft - albeit under extremely challenging cognitive and flight conditions. [FF 114, 115, 117, 120, 121, 144, 145, 147-150, 204]

19. Primary factors contributing to the mishap can be traced back to (b)(3) event that occurred at 13:32:05. This event induced failures of both primary radios, (b)(3) the TACAN, and the ILS. [FF 100, 101, 126-129]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

20. Additionally, it is probable that the HMD and PCDs were not operational for at least three distinct periods. [FF 98, 103, 104, 106, 114, 132-136, 141]

21. The MP likely became disoriented due to the high cockpit workload coupled with the following factors:

a. Lack of external visual cues due to IMC operations. [FF 82, 84, 86, 87, 89, 94]

b. Intermittent and recurring display failures. [FF 98, 103, 104, 106, 114, 132-136, 141]

c. Head movements associated with switching between displays. [FF 106]

d. Breakdown of flight instrument scan due to changing displays. [FF 98, 103, 104, 106, 114, 132-136, 141]

e. Rapid assertions of Cautions and Advisories along with associated aural cues. [FF 99-101, 104, 109, 111, 128, 139]

f. Loss of primary communications. [FF 95, 97, 100, 101, 108, 129]

g. Possible vestibular illusions while transitioning from STOVL to CTOL. [FF 103-109, 112-115]

22. Per the definition of OCF in the F-35B Flight Manual, the MP applied an appropriate emergency procedure in response to a *perceived* loss of aircraft control below 6,000 feet AGL. [FF: 116-119]

23. The F-35B Flight Manual definition for OCF is too broad and contributed to this mishap. [FF 114-116]

24. MP's decision to eject was ultimately inappropriate, because commanded flight inputs were in-progress at the time of ejection, standby flight instrumentation was providing accurate data, and the MA's backup radio was, at least partially, functional. Furthermore, the aircraft continued to fly for an extended period after ejection. [FF 113, 121, 131, 137, 204]

#### Evaluation of Pilot Recovery Efforts

25. All safety and escape equipment was present, in serviceable condition, and generally worked as expected. [FF 151-153, 177-185, 190]

26. JB Charleston and civil authorities were responsive and effective at locating and recovering the MP, the ejection seat, and survival gear. [FF 155, 158, 159, 161-163, 166-174]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

27. JB Charleston and MCAS Beaufort EOCs coordinated effectively and provided mutual support for search and recovery of the MP, ejection seat, and survival gear. [FF 160, 164, 165, 169, 174-176]

28. Although not a factor in this mishap, failure to properly secure survival equipment within the flight vest could have resulted in loss of critical survival gear and delayed recovery. [FF 187]

29. The durability of the survival radio is suspect. [FF 189]

30. The durability and/or placement of the water packets in the flight vest may not be sufficient for parachute landings. [FF 188, 189]

#### Most Probable Cause of Loss of Contact with Aircraft

31. The loss of positive contact with the MA can be partially attributed to the F-35B's low-observable technology, the (b)(3) failure resulting in the loss of the Mode 3 transponder, and the aircraft's eventual descent below the Air Traffic Control radar horizon. [FF 31, 130, 210, 211, 222]

32. The failure of the MA to transmit discrete Mode 3 information to ATC is credited to the (b)(3) event that occurred at 13:32:05, resulting in the (b)(3) [FF 100, 101, 126, 129, 130]

33. Not having a discrete Mode 3 signal made it difficult to positively follow and pass the MA track between adjacent controlling agencies. [FF 210, 211]

34. The MA's extended follow-on flight was due to a nominally trimmed condition provided by the F-35's advanced automatic flight control systems. [FF 204]

35. While relatively stable, the MA was not coupled to specific flight parameters. Instead, aircraft flight attitude slowly drifted, resulting in changes to altitude, airspeed, and heading until flight was no longer sustainable. [FF 146, 205, 206]

#### Evaluation of Aircraft Search Operations

36. JB Charleston and MCAS Beaufort EOCs coordinated effectively with each other and Federal, State, and Local authorities. [FF 212-221, 223, 224, 226]

37. The MA was difficult to locate for the following reasons:

a. MP was unable to communicate intent prior to ejection. [FF 95, 97, 100, 101, 108, 129]

b. Positive radar contact was not maintained. [FF 31, 130, 210, 211, 222]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

- c. Extended flight created an expansive search area. [FF 204]
- d. The crash site was in a densely forested area. [FF 227, 230-232]
- e. High speed, low angle impact left only small pieces of wreckage. [FF 222, 227, 232, 233, 235]
- f. There was little to no fire upon impact. [FF 236]
- g. The crash site was hardly noticeable from the air. [FF 232]

Evaluation of Containment, Reclamation, and Restoration

- 38. Air Force, Marine Corps, and Civilian authorities worked effectively together in securing the mishap site, locating debris, and establishing accountability, communications, logistics, and life support for extended operations. [FF 225-229, 237, 239-272]
- 39. IC transfer and EOC handoff was seamless and timely. [FF 244, 245]
- 40. Navy Region Southeast was a critical enabler in the rapid mobilization of resources. [FF 215, 219, 242, 249, 250, 254, 258, 261]
- 41. Counter-UAS resources were not requested in a timely manner. [FF 251, 256, 264, 265]
- 42. The Government's environmental clean-up efforts were sufficient and in keeping with established procedures. [FF 266, 268-281]

Recommendations

1. No further investigation is needed, and no punitive actions are recommended.

2. [REDACTED] (b)(5)  
[REDACTED] (b)(5)

3. Topic: Disbonded nutplates on [REDACTED] (b)(3)

a. Discussion: Opinion #11 highlights the potential FOD hazard associated with disbonded nutplates on [REDACTED] (b)(3) but more information is needed to determine if this a Fleet-wide problem.

b. Recommendation: VMFAT-501 should review other aircraft MAFs associated with [REDACTED] (b)(3) to determine if the instances of disbonded nutplates were isolated to the MA. Additionally, they should inspect

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

this panel on a percentage of squadron planes. Fleet input may be helpful in this research. If warranted, VMFAT-501 should initiate an Engineering Investigation to determine the cause and corrective / preventive actions.

4. Topic: Reliability of the F-35B Communication Knobs and Voice Activated Communication Control System

a. Discussion: MP experienced a failure of COM-A and COM-B. The Backup Radio was still functional; however, with a PCD failure, MP would have been unable to change frequencies via the PCD. The F-35B has radio knobs as an alternative; however, they are notoriously unreliable. Most pilots resort solely to changing frequencies via the PCD. This increases pilot workload and decreases situational awareness because pilots must access this feature via a drop-down menu which covers half of one portal. Changing frequencies this way is especially difficult in high workload situations such as when flying formation and/or in instrument meteorological conditions. The F-35 is also equipped with a voice activated communication control system that has not functioned since 30P05 software was installed.

b. [REDACTED] (b)(5)  
[REDACTED] (b)(5)

5. Topic: Proficiency with Standby Flight Display and Backup Radio

a. Discussion: In FF 115, MP stated he was unsure of which instruments he could trust and perceived that he was out-of-controlled flight. This was likely due to disorientation resulting from factors listed in Opinion #21.

b. Recommendation: VMFAT-501 should examine the F-35 FRS syllabus to determine whether additional education or training on the SFD is warranted, as well as use of the backup radio.

6. Topic: OCF Definition

a. Discussion: The F-35B Flight Manual states, "The aircraft is considered to be in out of controlled flight (OCF) when it fails to respond properly to pilot inputs." The OCF RECOVERY Emergency Procedure generally focuses on unresponsiveness to pitch, roll, and yaw inputs and does not address unresponsiveness to commanded changes in the thrust vector. This phenomenon is addressed in other procedures, such as the CONV HALT Caution and Advisory as well as the CONV STUCK EP.

b. Recommendation: VMFAT-501 should submit a NATOPS change modifying the definition of OCF to read, "The aircraft is considered to be in out of controlled flight (OCF) when it fails to respond properly to pilot pitch, roll, or yaw inputs."



Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

7. Topic: Recorded Mishap Data Sources

a. Discussion: Unlike advanced F-16 CSMUs, the F-35 CSMU does not have the ability to record audio. CSMU audio could prove essential to the efficacy of future mishap investigations.

b. [REDACTED] (b)(5)  
[REDACTED] (b)(5)

8. Topic: Durability of Aircrew Survival Items

a. Discussion: The MP's survival radio and water packets were damaged or destroyed upon MP's impact with the ground following his parachute descent.

b. [REDACTED] (b)(5)  
[REDACTED] (b)(5)

9. Topic: UAS and Counter-UAS

a. Discussion: At 0830 on 19 September 2023, the Charleston EOC identified the potential for drone activity, and later that day an incident was observed at 1210. It was not until 21 September 2023 that an FBI [REDACTED] (b)(7)e arrived at the mishap site, and there was no reported UAS activity through their departure on 26 September 2023. It is also noteworthy that there were no other UAS incursions after the TFR boundaries were expanded out to three nautical miles and 10,000 feet AGL at 1600 on 19 September 2023.

b. [REDACTED] (b)(5)  
[REDACTED] (b)(5)

[REDACTED] (b)(6), (b)(7)c



UNITED STATES MARINE CORPS  
2D MARINE AIRCRAFT WING  
II MARINE EXPEDITIONARY FORCE  
FLEET MARINE FORCES  
POSTAL SERVICE CENTER BOX 8050  
CHERRY POINT, NC 28533-0050

IN REPLY REFER TO:  
5800  
SJA  
SEP 20 2023

From: Commanding General, 2d Marine Aircraft Wing, FMF  
To: (b)(6), (b)(7)c USMC

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

Ref: (a) JAGINST 5800.7G CH-1 (JAGMAN)

1. This appoints you, per reference (a), to inquire into the facts and circumstances surrounding the aircraft mishap that occurred in the vicinity of Charleston, South Carolina on 17 September 2023. This Command Investigation is convened to investigate the circumstances surrounding a Class A aviation mishap in compliance with 10 U.S.C. § 2255.

2. You will investigate the nature of the mishap and address the circumstances that caused and contributed to the mishap. At a minimum, you will address the following:

a. The pilot's identity, background, history, training, experience and military status. Include any sociological, psychological, and human factors related to the accident, including potential stress factors, fatigue, use of medication, or intoxication.

b. The type, model, series, and bureau number of the aircraft, whether the aircraft had any known or suspected mechanical problems, and the extent to which any problems were resolved before the mission.

c. The identity of any individuals who were injured or suffered property damage as a result of the mishap, including name, age, address, telephone number, occupation, and a complete description of how their injuries occurred.

d. The type, duration, and purpose of the flight, briefing of the pilot, and other pertinent information regarding the particular flight, including the use of night vision goggles or other mission-specific factors relevant to the aircraft or performance.

e. Weather conditions throughout the flight.

f. Description of the flight path and maneuvers of the aircraft during flight, including manner or descent and impact.

g. Positions of external control surfaces, landing gear, canopy, and other relevant parts of the aircraft, during the flight.

h. Presence, condition, and use of safety, communication, escape,

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE  
F-35 MISHAP OF MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023

and survival equipment.

i. Post-mishap assessment of the aircraft and detailed description of all damage to the aircraft, including wreckage diagrams, disassembly and inspection reports, wreckage photographs, and data on the engine, fuselage, and control surfaces.

j. Assessment of the scene of the mishap including its precise location, a description of the terrain, and a complete listing and cost of damaged or destroyed Government and non-Government property.

k. Description of rescue operations employed, their effectiveness, and any difficulties encountered.

l. Instructions in effect at the time of the accident concerning procedures relating to the particular flight, including applicable local and regional flight rules governing the flight and copies of air charts in effect and in use.

m. Performance data on the aircraft in question under prevailing wind, weather, and temperature.

n. Cause, nature, and extent of any injuries suffered as a result of the mishap as substantiated by medical records, including line of duty / misconduct determinations for injuries to Naval personnel, if required.

o. Roles of supervisory, support, and controlling personnel.

p. When the evidence concerning the mishap is sufficient to do so, an opinion or opinions as to the cause or causes of the mishap.

q. When the evidence is not sufficient to form an opinion or opinions as to the cause or cause of the mishap, a description of those factors, if any, which, in the opinion of the investigator, substantially contributed to the mishap.

3. Report all findings of fact, opinions, and recommendations in a written report by 19 October 2023, unless an extension is granted. Any extension request will be approved by me.

4. If you have not previously done so, read Chapter II of the reference (a) in its entirety before beginning your investigation. You are directed to seek assistance of the Office of the Staff Judge Advocate before beginning your investigation. Additionally, you are directed to consult with a member of the armed forces or an officer or employee of the DoD who possesses knowledge and expertise relevant to aviation mishap investigations. The point-of-contact is (b)(6), (b)(7)c (b)(6), (b)(7)c who can be reached at 252 466-8164 or via e-mail at (b)(6), (b)(7)c @usmc.mil.

(b)(6), (b)(7)c

S. F. BENEDICT



UNITED STATES MARINE CORPS  
2D MARINE AIRCRAFT WING  
II MARINE EXPEDITIONARY FORCE  
FLEET MARINE FORCES  
POSTAL SERVICE CENTER BOX 8050  
CHERRY POINT, NC 28533-0050

IN REPLY REFER TO:  
5800  
SJA  
19 Oct 23

FIRST ENDORSEMENT on (b)(6), (b)(7)c ltr 5800 CO of 19 Oct 23

From: Commanding General, 2d Marine Aircraft Wing, FMF

To: (b)(6), (b)(7)c USMC

Subj: EXTENSION REQUEST FOR COMMAND INVESTIGATION INTO THE  
CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF MAG-31, VMFAT-501  
ON 17 SEPTEMBER 2023

1. Your request for an extension to complete the subject command investigation is approved. The report is now due by 19 November 2023.

2. The point of contact for this matter is (b)(6), (b)(7)c  
(b)(6), (b)(7)c 2d Marine Aircraft Wing Staff Judge Advocate, who can be reached at (b)(6), (b)(7)c @usmc.mil or 252-466-8163.

(b)(6), (b)(7)c

By Direction



UNITED STATES MARINE CORPS  
2D MARINE AIRCRAFT WING  
II MARINE EXPEDITIONARY FORCE  
FLEET MARINE FORCES  
POSTAL SERVICE CENTER BOX 8050  
CHERRY POINT, NC 28533-0050

IN REPLY REFER TO:  
5800  
SJA  
9 Nov 23

FIRST ENDORSEMENT on (b)(6), (b)(7)c ltr 5800 CO of 8 Nov 23

From: Commanding General, 2d Marine Aircraft Wing, FMF

To: (b)(6), (b)(7)c USMC

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(b)(6), (b)(7)c

By Direction

## SIR MESSAGE FORMAT

(CLASSIFICATION DETERMINED BY INFORMATION IN THE REPORT)

FROM: VMFAT 501

TO: CMC WASHINGTON DC PPO

INFO: CG II MEF

CG 2ND MAW

MAG THREE ONE

SUBJ/OPREP-3 SIR/VMFAT-501/001A/SEP/AMP/

REF/A/DOC/CMC/08062007/MCO 3504.2//

REF/B/TEL/CDO HQMC/182201ZSEP2023

NARR/REF A IS MCO ON OPREP-3SIR: SERIOUS INCIDENT REPORTS. REF B IS VOICE REPORT SUBMITTED TO THE USMC COMMAND CENTER.//

POC/ (b)(6), (b)(7)c VMFAT-501 OPERATIONS OFFICER/-/TEL (b)(6), (b)(7)c

(b)(6), (b)(7)c (b)(6), (b)(7)c @USMC.MIL//

GENTEXT/REMARKS/1. WHILE ON A ROUTINE TRAINING FLIGHT OUT OF CHARLESTON INTERNATIONAL AIRPORT, THE MISHAP PILOT WAS EXECUTING AN INSTRUMENT APPROACH INTO CHARLESTON INTERNATIONAL AIRPORT FOR RUNWAY 15. COMMUNICATIONS WERE LOST WITH MISHAP PILOT ON SHORT FINAL. THE PILOT EJECTED AND LANDED SAFELY IN THE BACKYARD OF A HOME IN A NEIGHBORHOOD APPROXIMATELY 1 MILE NORTH OF THE AIRPORT. THE PILOT IS STABLE AND WAS ABLE TO SPEAK ON THE PHONE. THE PILOT IS AT MEDICAL UNIVERSITY OF SOUTH CAROLINA (MUSC) HOSPITAL. THE LOCATION OF THE AIRCRAFT IS CURRENTLY UNKNOWN. THE AIRCRAFT IS ASSUMED TO BE A TOTAL LOSS RESULTING IN A CLASS A MISHAP AT APPROXIMATELY \$100 MILLION. ALCOHOL WAS NOT INVOLVED. THE PILOT HAD THE APPROPRIATE QUALIFICATIONS, CURRENCY, CREW DAY, AND DID NOT RECENTLY RETURN FROM A DEPLOYMENT.

UPDATE 1: THE PILOT WAS DISCHARGED FROM THE HOSPITAL ON 18SEP2023 AT ABOUT 2000Z. THE AIRCRAFT AND DEBRIS FIELD WAS FOUND TODAY, 18SEP2023 AT 2100Z (b)(6), (b)(7)c BY A SOUTH CAROLINA LAW ENFORCEMENT DIVISION HELICOPTER. THE EMERGENCY RECLAMATION TEAM (ERT), COMPRISED OF VMFAT-501 PERSONNEL LOCATED ON THE GROUND, CONFIRMED THE DEBRIS WAS AN F-35B AIRCRAFT. LOCAL LAW ENFORCEMENT AND THE ERT HAVE SECURED AND CORDONED OFF THE AREA. THE AIRCRAFT DEBRIS IS LOCATED IN A FIELD AND WOODED AREA ADJOINING THE FIELD. NO CIVILIAN INJURIES OR DAMAGE HAVE BEEN REPORTED AT THIS TIME. THE VMFAT-501 AIRCRAFT MISHAP BOARD (AMB) AND THE ERT ARE LIAISING WITH THE NATIONAL ON-SCENE-COMMANDER (NOSC) AND ARE ENROUTE TO THE CRASH SITE.

2. 171335 SEP 23 (171735Z SEP 23)

3. PERSONNEL INVOLVED:

A. PILOT

(1)

(2)

(b)(6), (b)(7)c

(3) [REDACTED] (b)(6), (b)(7)c

(4) VMFAT-501, MAG-31, MCAS BEAUFORT, SC

(5) [REDACTED] (b)(6), (b)(7)c

(6) STABLE, MUSC HOSPITAL.

4. VMFAT-501, POC [REDACTED] (b)(6), (b)(7)c

5. HIGH MEDIA INTEREST IS PRESENT AT THIS TIME. MCAS BEAUFORT PAO HAS BEEN NOTIFIED OF THIS INCIDENT.

6. VMFAT-501 SECURITY OFFICER HAS BEEN NOTIFIED.

7. THE NOSC, ERT, AND AMB WILL DETERMINE STEPS FOR THE RECOVERY OF THE AIRCRAFT AS MORE INFORMATION BECOMES AVAILABLE.///



~~FOR OFFICIAL USE ONLY~~

THIS E-MAIL CONTAINS FOR OFFICIAL USE ONLY (FOUO) INFORMATION WHICH MUST BE PROTECTED UNDER THE PRIVACY ACT, DOD 5400.11-R. TREAT ANY ATTACHMENTS AS FOUO.

\*\*\*\*\*

DO NOT CHANGE ANYTHING BELOW THIS LINE.  
TO CHANGE THIS CASUALTY REPORT, DISCARD THIS EMAIL, RETURN TO DCIPS-FORWARD, MAKE YOUR CHANGES AND GENERATE THE EMAIL AGAIN.  
\*\*\*\*\*

\*\*\*\*\*

\*\*\*\*\* CASUALTY REPORT \*\*\*\*\*  
\*\*\*\*\*

Report Type: INIT

Casualty Type: Nonhostile

Casualty Status: NSI ILL/INJURY

Casualty Category: Pending

Report Number: 1TV00123

Personnel Type: Regular

Personnel Affiliation: Active Duty

Personnel Category: Obligated/Voluntary Service

Last Name: (b)(6), (b)(7)c

First Name: (b)(6), (b)(7)c

Service: United States Marine Corps

Military Rank: (b)(6), (b)(7)c

Military Unit of Assignment: (b)(6), (b)(7)c

Date/Time of Incident (New/Old): 20230917/1330

Incident City: CHARLESTON

Incident State: SC

Incident Country: United States

Circumstance: ON 230917 AT 1330, (b)(6), (b)(7)c WAS ON AN INSTRUMENT APPROACH TO LAND AT CHARLESTON INTERNATIONAL AIRPORT IN WEATHER. PILOT EJECTED FROM AN F-35B AFTER EXPERIENCING AN UNKNOWN FAILURE OF THE AIRCRAFT. PILOT LANDED IN THEIR PARACHUTE NORTH OF THE AIRPORT IN THE BACKYARD OF A HOME. (b)(6), (b)(7)c WAS THEN TRANSPORTED TO MEMORIAL UNIVERSITY SOUTH CAROLINA HOSPITAL FOR FURTHER OBSERVATION WHERE HE REMAINS IN STABLE CONDITION. (b)(6), (b)(7)c HAS DETERMINED SNM'S CASUALTY STATUS TO BE NSI.

Diagnosis Info: (b)(6), (b)(7)c  
(b)(6), (b)(7)c

Progress Report: Report Date: 202309181123 Hospital: Medical University of South Carolina City: Charleston State: SC Country: US Medical Progress: Making Normal Improvement (Agate)Remarks: Anticipate discharge from hospital today 9/18, injuries are non surgical and require outpatient follow up care (b)(6), (b)(7)c

Remarks: (b)(6), (b)(7)c HAS DETERMINED SNO TO BE NOT SERIOUSLY INJURED (NSI). POINT OF CONTACT OFFICER (b)(6), (b)(7)c USMC, VMFAT-501 MCAS BEAUFORT, SC (b)(6), (b)(7)c PCR VERIFIED BY (b)(6), (b)(7)c XO), USMC, VMFAT-501 MCAS BEAUFORT, SC (b)(6), (b)(7)c THIS IS THE FINAL REPORT.

Software Version: DCIPS Forward - Version 8.0 Build: 70 Release Date: 01 May 2014

~~FOR OFFICIAL USE ONLY~~

**SUBJ: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF  
MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023**

The following enclosures have been withheld in their entirety under FOIA Exemptions (b)(6) and (b)(7)C.

The foreseeable harm in releasing 5 U.S.C. § 552(b)(6) information contained in personnel, medical, or similar files to a requestor, other than the actual person in which the information is pertaining to, would constitute a clearly unwarranted invasion of their privacy. Similarly, 5 U.S.C. § 552(b)(7)C provides protection for law enforcement information the disclosure of which "could reasonably be expected to constitute an unwarranted invasion of personal privacy."

Enclosure (5) MP NATOPS Qualification and Designation Record, pages 49-51

Enclosure (6) VMFAT-501 Qualification and Designation Matrix, page 52

Enclosure (7) MP DIFOP Orders, page 53

Enclosure (8) MP Aircrew Training Jacket Summary, pages 54-56

Enclosure (9) MP Aviation Background Review Summary, page 57

Enclosure (10) FRS Completion Letter, page 58

Enclosure (11) MP FRS Crew Performance Summary, pages 59-91

Enclosure (12) MP NATOPS Audit, page 92

Enclosure (13) MP Physiology and Survival Training Record, pages 93-109

Enclosure (14) MP NATOPS and instrument Check Record, pages 110-111

Enclosure (15) MP Flight Hours Logbook, pages 112-227

VMFAT-501 ORM WORKSHEET - 15 SEPTEMBER 2023

| EVENT | AIRCREW         | T&R  | DAYS SINCE LAST FLIGHT | LAST FLIGHT | 30 DAY HOURS | LAST NIGHT | LAST PCO | EP SIM | PREREQUISITES                                       | RISK ASSESSMENT CATEGORIES |                        |                  |                  |             | LMH | LMH   | SPECIFIC RISKS AND CONTROL MEASURE FOR ANY RISK >L | RISK ASSESSMENT CATEGORIES |                        |                   |                  |              | ASSESSED HAZARDS AND MITIGATION | FLT LT INITIALS      | RISK LEVEL |                         |
|-------|-----------------|------|------------------------|-------------|--------------|------------|----------|--------|---|----------------------------|------------------------|------------------|------------------|-------------|-----|-------|--|----------------------------|------------------------|-------------------|------------------|--------------|---------------------------------|----------------------|------------|-------------------------|
|       |                 |      |                        |             |              |            |          |        |   | 1                          | 2                      | 3                | 4                | LMH         |     |       |  | 1                          | 2                      | 3                 | 4                | 5            |                                 |                      |            |                         |
|       |                 |      |                        |             |              |            |          |        |   | HUMAN FACTORS              | CURRENCY / PROFICIENCY | MISSION SPECIFIC | SCHEDULING / DSS | OTHER RISKS |     |       |  | INITIAL 30HR RISK LEVEL    | CURRENCY / PROFICIENCY | MISSION SPECIFIC  | SCHEDULING / DSS | OTHER RISKS  |                                 |                      |            | UPDATE / WX ENVIRONMENT |
| 1     | (b)(6), (b)(7)c | 1102 | 4                      | 9/11        | 1.0          | #          | #        | 8/22   | 0120 - SCHED 9/14                                   | M                          |                        |                  |                  |             | L   | 5 HRS |  |                            |                        |                   |                  | BRIEF, DECON |                                 | M                    |            |                         |
|       |                 | 3    | 9/12                   | 4.8         | 9/12         | #          | #        | 8/25   | FAM IP  | M                          |                        |                  |                  |             |     | L     | 5 HRS  |                            |                        |                   |                  |              | ↓                               | M                    |            |                         |
| 2     |                 | 1102 | 4                      | 9/11        | 1.0          | #          | #        | 8/22   | 0120 - SCHED 9/14                                   | M                          |                        |                  |                  |             |     | L     | 5 HRS  |                            |                        |                   |                  |              | WX/DOWNWIND                     |                      | M          |                         |
|       |                 | 24   | 8/22                   | 1.7         | 8/29         | #          | #        | 7/31   | FAM IP  | L/M                        |                        |                  |                  |             |     |       | L  | 5 HRS, 24 DAYS             |                        |                   |                  |              | UNFAMILIAR RFD, W/ DOWNWIND W/  |                      | M          |                         |
| 3     |                 | 23   | 8/23                   | 2.9         | 8/23         | #          | #        | 7/28   | TI IP   | M                          |                        |                  |                  |             |     |       | L  | 5 HRS FLOW YESTERDAY       |                        |                   |                  |              | W/ DOWNWIND W/                  |                      | M          |                         |
| 4     |                 | 1319 | 2                      | 9/13        | 3.2          | #          | #        | 9/6    | 0319 - SCHED 9/14, 1318 - 9/13                      | M                          |                        |                  |                  |             |     |       | L  | 5 HRS                      |                        |                   |                  |              | VIA TRS, BRIEF                  |                      | M          |                         |
|       |                 | 3    | 9/12                   | 2.5         | 7/18         | #          | #        | 9/1    | TI IP   | M                          |                        |                  |                  |             |     |       |  | L                          | 5 HRS                  |                   |                  |              |                                 | Completion Preparing |            | M                       |
| 5     |                 | 1319 | 2                      | 9/13        | 8.9          | #          | #        | 9/5    | 0319 - SCHED 9/14, 1318 - 9/13                      | L                          |                        |                  |                  |             |     |       |  | L                          |                        |                   |                  |              |                                 |                      |            | M                       |
|       |                 | 1103 | 4                      | 9/11        | 1.0          | #          | #        | 8/22   | 1102 - SCHED 9/15                                   | M                          |                        | L                |                  |             |     |       |  | L                          | 5 HRS, 2ND FLIGHT      |                   |                  |              |                                 |                      |            | M                       |
|       |                 | 24   | 8/22                   | 1.7         | 8/29         | #          | #        | 7/31   | FAM IP  | M                          |                        | L                |                  |             |     |       |  |                            | L                      | 5 HRS, 2ND FLIGHT |                  |              |                                 |                      |            | M                       |
| 6     |                 | 2103 | 2                      | 9/13        | 8.7          | 9/13       | #        | 9/13   | FLY OVER  | L                          |                        | L                |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |
|       |                 | 2103 | 21                     | 8/25        | 2.5          | 6/6        | #        | 8/22   | FLY OVER  | M/L                        |                        | L                |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |
|       |                 | 2103 | 22                     | 8/24        | 0.7          | 6/8        | #        | 8/25   | FLY OVER  | M/L                        |                        | L                |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |
|       |                 | 2103 | 2                      | 9/13        | 5.4          | 6/13       | #        | 9/11   | FLY OVER  | L                          |                        | L                |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |
| 7     |                 | 1100 | N/A                    | N/A         | 0.0          | #          | #        | #      | PRE-TAXI CHECKLIST-97<br>2101 SCHED 9/13 NOT LOGGED | L                          |                        |                  |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |
| 8     |                 | 1100 | N/A                    | N/A         | 0.0          | #          | #        | 9/8    | PRE-TAXI CHECKLIST-97                               | L                          |                        |                  |                  |             |     |       |  |                            |                        |                   |                  |              |                                 |                      |            | M                       |

L - NO ADDITIONAL APPROVAL REQUIRED

M - REQUIRES CO APPROVAL

H - REQUIRES MAG CO APPROVAL

5 "LOWS" CONSTITUTE AN OVERALL "MEDIUM"  
3 "MEDIUMS" CONSTITUTE AN OVERALL "HIGH"

|                   |                                  |   |
|-------------------|----------------------------------|---|
| HUMAN FACTORS     | <15 Days from PCS/Terminal Leave | M |
|                   | Final Flight                     | M |
|                   | Crew Rest <12 Hrs                | M |
|                   | Crew Day >12 Hrs (Day)           | M |
|                   | Crew Day >10 Hrs (Night)         | M |
|                   | Student Refly                    | L |
| 2nd Flight of Day | L                                |   |
| 0                 | M                                |   |

|                             |                              |   |
|-----------------------------|------------------------------|---|
| CURRENCY / PROFICIENCY      | Prerequisites Not Met        | M |
|                             | >30 Days Since Last Flight   | M |
|                             | 16-30 Days Since Last Flight | L |
|                             | <5 Hrs Within 30 Days        | M |
|                             | <10 Hrs Within 30 Days       | L |
|                             | Last AAR >180 Days           | L |
| Last Night Flight >60 Days  | L                            |   |
| Last Night Flight >180 Days | M                            |   |

|                                  |                                     |   |
|----------------------------------|-------------------------------------|---|
| MISSION SPECIFIC                 | Non-Syllabus Event                  | L |
|                                  | XC / Out Of Local Area (Non Divert) | L |
|                                  | Ordnance Delivery                   | L |
|                                  | Airshow Demo                        | M |
|                                  | LFE                                 | L |
|                                  | DACT                                | L |
| Night AAR/FORM LLL               | L                                   |   |
| FAM-1101 Verify NATOPS Paperwork | H                                   |   |

|  |                                      |   |
|--|--------------------------------------|---|
| OPERATIONAL LOADS                          | Visiting Aircrew                     | L |
|  | Flight Brief <2 Hrs From Sim Event   | L |
|  | Flight Brief <3.5 Hrs From Land Time | L |
|  | Single Runway Ops                    | L |
| UPDATE / ENVIRONMENT                       | BASH Moderate                        | L |
|  | Anti-Exposure Suit                   | L |
|  | Outside Temperature >90o F           | L |
|  | Weather <500/1                       | L |
| Aircrew/Mission Change <2 Hrs Before Brief | M                                    |   |

## MEMORANDUM FOR THE RECORD

Subj: SUMMARY OF THE 12 OCTOBER INTERVIEW WITH (b)(6), (b)(7)c

1. This memorandum for the record serves as a summary of an interview the investigating officer (IO) conducted on 12 October 2023 with (b)(6), (b)(7)c. (b)(6), (b)(7)c was a member of the Marine Fighter Attack Training Squadron 501 (VMFAT-501) Cross-Country (CCX) Detachment for Training (DFT) during the weekend of 17 September 2023 and the mishap pilot (MP).
2. (b)(6), (b)(7)c contact information is (b)(6), (b)(7)c.
3. The interview focused on the facts and circumstances surrounding the VMFAT-501 CCX/DFT beginning with the departure flights on Friday 15 September and ending with the post-ejection pilot recovery actions on 17 September. The following information was provided by (b)(6), (b)(7)c during the interview:
  - a. (b)(6), (b)(7)c reported to work (Pilot Training Center / Simulator Building) at 0700 on Friday for an Air-to-Air Refueling warmup simulator flight. The event was scheduled from 0800-0940.
  - b. At approximately 1015, he reported to VMFAT-501 for his flight brief.
  - c. The original plan was a four plane CCX/DFT to Joint Base Charleston, SC (KCHS) departing from MCAS Beaufort (KNBC) on Friday 15 September and returning on Sunday 17 September.
  - d. Friday tasking was a four-plane funeral flyover launching from KNBC and recovering to KCHS. (b)(3), (b)(6), (b)(7)c was to be -2 in the flight. The other flight members were (b)(6), (b)(7)c, (b)(6), (b)(7)c and (b)(6), (b)(7)c.
  - e. While taxiing as a flight to the runway, (b)(6), (b)(7)c experienced a problem with his Standby Flight Display (SFD) and returned to the line for troubleshooting.
  - f. (b)(6), (b)(7)c was unable to get the malfunction to clear and was forced to cancel his launch due to maintenance.
  - g. The rest of the flight departed and executed the flyover with three aircraft.
  - h. Post-flyover, (b)(6), (b)(7)c returned to KNBC, went through the fuel pits, and hotseated his aircraft to (b)(6), (b)(7)c as briefed for the contingency plan.
  - i. After the hotseat, (b)(6), (b)(7)c departed KNBC for the ranges, executed FAM flight maneuvers; a practice Instrument Landing System (ILS) approach into KCHS; followed by an overhead break recovery and landing. He then joined (b)(6), (b)(7)c and (b)(6), (b)(7)c who were already on deck in KCHS.
  - j. (b)(6), (b)(7)c noted that post-flight, he had no concerns with the plans for the rest of the weekend or the condition of his aircraft.



k. On Saturday, (b)(6), (b)(7)c briefed and lead Division Armed Reconnaissance in the vicinity of MCAS Cherry Point as an Instructor Under Training. The mission was conducted in two sorties separated by hot gas at Cherry Point. Following training, all three aircraft recovered to KCHS on Saturday afternoon around 1500 without incident.

l. After the flight, (b)(6), (b)(7)c noted two concerns shared by the flight members. Weather forecasts made flight operations questionable on Sunday; and due to a foreign delegation scheduled to visit Charleston Air Force Base, arrangements needed to be made to hangar the aircraft in the event they were forced to remain overnight on Sunday.

m. Pilots returned to the hotel for debrief by 1600. After the debrief, each pilot executed independent dinner plans.

n. (b)(6), (b)(7)c departed the hotel around 1730 to meet a friend for appetizers. He returned around 2100 and had dinner at the hotel restaurant until about 2140.

o. Following dinner, (b)(6), (b)(7)c returned to his room, called (b)(6), (b)(7)c and went to bed around 2215.

p. On Sunday morning, (b)(6), (b)(7)c rose around 0715, got ready, checked work email, and check out of his room prior to meeting for breakfast at 0845. Following breakfast, the pilots departed the hotel around 0930.

q. Pilots briefed at KCHS Base Operations from 1000 until about 1040. The original plan called for a 2v2 tactical intercept; but with only three aircraft, the plan was re-briefed as a 2v1 with (b)(3), (b)(6), (b)(7)c and (b)(6), (b)(7)c flying together against (b)(6), (b)(7)c as "red air." The flight planned and briefed an ILS recovery for both practice and forecast cloud layers. At launch time, weather was unsuitable, so they delayed the first sortie, and the crews went to eat lunch.

r. Following lunch, weather had improved, but there was potential for cumulonimbus in portions of the working area. (b)(6), (b)(7)c (b)(3), (b)(4) (b)(3), (b)(4) (b)(6), (b)(7)c and (b)(6), (b)(7)c re-briefed the flight as a 1v1 with the same ILS recovery.

s. After confirming weather minimums for training and agreeing to maintain enough fuel for an approach to Charleston and a divert field of Savannah, (b)(6), (b)(7)c and (b)(6), (b)(7)c launched at around 1245 with (b)(6), (b)(7)c administratively leading the section.

t. The section passed through a cloud layer and precipitation on the way to the range. Following check-in with Sea Lord (range control), the section was assigned a range space, conducted their g-warmups, environmental assessment, and FENCED in.

u. (b)(6), (b)(7)c first demonstrated the radius defense maneuver to (b)(6), (b)(7)c with (b)(6), (b)(7)c (b)(6), (b)(7)c in the offensive position. Next the pilots reversed roles with (b)(6), (b)(7)c in the offensive position and (b)(6), (b)(7)c executing the radius defense maneuver. After (b)(6), (b)(7)c executed the radius defense maneuver a second time, they rejoined the flight, conducted battle damage assessments, and got airfield information via the Automated Terminal Information System (ATIS) for KCHS.

v. After checking out with Sea Lord, the flight contacted Charleston Approach who advised them of heavy rain in the area and began to vector them around to intercept the final course for the ILS 15 approach.

w. (b)(6), (b)(7)c put the flight into a one-mile trail formation for the vectors and approach. The flight was descended from 10,000 feet to 5,000 feet to 3,000 feet on an initial 330 heading to form a left-hand box around the field.

x. (b)(6), (b)(7)c could see weather buildups in his radar and the air traffic controller seemed to be vectoring them around the heavy buildups. He noted the ride was smooth and he was careful to check for icing on the wings due to the precipitation.

y. On an approximately 20-mile base leg, the flight was given a left hand turn to heading of 180 for a dog leg to final and was cleared for the approach. He noted the conditions were still Instrument Meteorological Conditions (IMC) with light to moderate precipitation. Based on ATIS, he was expecting to break out around 2,000 feet with 4 miles visibility.

z. After intercepting the ILS, he slowed the flight to 200 knots, lowered the gear, and approaching the final approach fix he converted the flight to Mode IV/ Short Takeoff and Vertical Landing (STOVL) and slowed to 150 knots in preparation for the briefed 100 knot slow landing.

aa. After switching frequencies to Charleston Tower, (b)(6), (b)(7)c recalls the controller announcing that traffic ahead of him had broken out at 900 feet. This was the first time that he had any indication that ceilings were less than 2,000 feet.

ab. After converting and established on the approach (b)(6), (b)(7)c Helmet-Mounted Display (HMD) flickered, and he got a momentary caution in his HMD that he perceived to be engine-related and then the HMD flickered out. While considering missed approach options, the HMD came back.

ac. After the HMD returned, (b)(6), (b)(7)c continued the approach, but began experiencing cascading cautions. He remembered or perceived the cautions to be related to flight controls, avionics and flight control actuator cooling, air data source degrades, and the inertial navigation system.

ad. Based on his exposures to similar emergencies in the simulator, (b)(6), (b)(7)c felt the best course of action was to continue the approach.

ae. A short time later, he lost his HMD a second time and he transitioned to the SFD to execute the missed approach procedure. Upon climb out and acceleration past 150 knots, he realized that he had lost communications with Tower and (b)(6), (b)(7)c

af. While executing his missed approach, at some point (b)(6), (b)(7)c noticed his HMD had returned and he began to see more failures post.

ag. While transitioning his reference back to the HMD from the SFD, he attempted to continue his conversion out of Mode IV/STOVL back to Mode I/CTOL (Conventional Takeoff and Landing). He perceived that the aircraft was not converting as commanded and then he lost his HMD again.

ah. Having lost his primary attitude reference a third time and unsure of which instruments he could trust, (b)(6), (b)(7)c perceived he had entered out-of-control flight.

ai. His last recalled altitude was 1,800 - 1,900 feet and due to his proximity to the terrain, (b)(6), (b)(7)c (b)(6), (b)(7)c elected to eject in accordance with the F-35B Flight Manual Emergency Procedures minimum ejection altitudes.

aj. When asked about the configuration of the aircraft prior to ejection, (b)(6), (b)(7)c believed the landing gear was still down because this would have assisted with the avionics cooling failures. He also believed the aircraft was still in Mode IV/STOVL because he perceived the aircraft was unresponsive after pressing the convert button.

ak. (b)(6), (b)(7)c did not feel that the HMD failure was in conjunction with any changes to flight regimes.

al. During ejection, (b)(6), (b)(7)c helmet and mask were ripped off. After violent motion stopped and his chute had opened, he noted that he was still in IMC.

am. Upon breaking out of the clouds and observing that he was over a residential area, (b)(6), (b)(7)c (b)(6), (b)(7)c released his seat pan and raft to avoid getting tangled in power lines. He then attempted to use the steering toggles to descend to a safe area. Upon landing, he executed a Parachute Landing Fall and discovered he was in a backyard of a home.

an. After landing he noted (b)(6), (b)(7)c but was able to manipulate the quick-release from his harness and walk to the door of the home. He identified himself as a military pilot and asked the resident to dial 911.

ao. The residents invited him inside and had him sit down. He was given paper towels for the (b)(6), (b)(7)c After the residents had called 911, he was given the phone and he spoke to the operator. At some point, he spoke to (b)(6), (b)(7)c letting him know he had ejected.

ap. After the paramedics arrived and conducted their initial assessments, he walked to the ambulance, and they placed him on the gurney and drove him to the Medical University of South Carolina Emergency Room where he was met by the trauma team.

aq. Upon arrival (b)(6), (b)(7)c was given a thorough examination to include x-rays and Computed Tomography (CT) scans. (b)(6), (b)(7)c (b)(6), (b)(7)c

ar. After further x-rays and CT scans, the doctors determined he did not need surgery. (b)(6), (b)(7)c (b)(6), (b)(7)c then met with the squadron Flight Surgeon, Commanding Officer, and the Safety Officer. He remained overnight for observation and after some additional x-rays, he was released the following morning.

as. All safety and emergency equipment seemed to work correctly to include: the ejection handle and seat; arm and leg restraints; parachute and steering controls; seat pan release; and harness quick releases. (b)(6), (b)(7)c (b)(6), (b)(7)c (b)(6), (b)(7)c he was wearing his helmet and mask correctly.

at. Beyond the previously mentioned injuries, (b)(6), (b)(7)c had (b)(6), (b)(7)c (b)(6), (b)(7)c



au. (b)(6), (b)(7)c was not aware of any sociological, psychological, or human factors that may have contributed to the incident to include stress, fatigue, use of medications, or intoxication.

4. On 11 December, the IO emailed (b)(6), (b)(7)c follow-up questions regarding the setup of his Panoramic Cockpit Displays (PCDs) in the terminal phase of flight. The following information was provided in response:

a. (b)(6), (b)(7)c displays were set up in Nav Master Mode with the following portals:

i. Portal 1: 5x5 Electronic Flight Instrument – Horizontal Situation Indicator (HSI) (No ADI) with Distributed Aperture System (DAS) and Fuel page below in the 2x2.5 secondary windows.

ii. Portal 2: 5x7 vHUD

iii. Portal 3: 5x7 Weather Radar (ASR – Weather) with Flight Controls System (FCS) and Comm/Nav/Identification (CNI) in Secondary Tabs

iv. Portal 4: 5x7 TSD HSI - Map with Prognostics and Health Management (PHM) and SRCH page in Secondary Tabs

b. This setup was based on the FAM FSG for instrument flying with two slight deviations:

i. DAS and Fuel were placed in the secondary windows of portal 1 for pattern work. The DAS page provides position over the VL pad. The Fuel page provides Gross Weight for Slow/Vertical landings.

ii. The Weather Radar page was left on Portal 3 due to weather in the area. (b)(6), (b)(7)c stated he would pull up the full FCS page in portal 3 from the Secondary Tab when in the pattern and clear of weather. FCS on one full portal is also in FSG recommended setup for FAM/pattern work.

c. To his recollection, when (b)(6), (b)(7)c lost his HMD, his PCDs were not operational.

5. The point of contact for this matter is (b)(6), (b)(7)c at (b)(6), (b)(7)c or (b)(6), (b)(7)c

(b)(6), (b)(7)c

(b)(6), (b)(7)c

## MEMORANDUM FOR THE RECORD

Subj: SUMMARY OF THE 11 OCTOBER INTERVIEW WITH (b)(6), (b)(7)c

1. This memorandum for the record serves as a summary of an interview the investigating officer (IO) conducted on 11 October 2023 with (b)(6), (b)(7)c Marine Fighter Attack Training Squadron 501 (VMFAT-501). (b)(6), (b)(7)c was the senior instructor pilot and overall flight lead on the VMFAT-501 Cross-Country (CCX) Detachment for Training (DFT) during the weekend of 17 September 2023.
2. (b)(6), (b)(7)c contact information is: (b)(6), (b)(7)c and (b)(6), (b)(7)c.
3. The interview focused on the facts and circumstances surrounding the VMFAT-501 CCX/DFT beginning with the departure flights on Friday 15 September and ending with the post-ejection pilot recovery actions on 17 September. The following information was provided by (b)(6), (b)(7)c during the interview:
  - a. The original plan was a four plane CCX/DFT to Joint Base Charleston, SC (KCHS) departing from MCAS Beaufort (KNBC) on Friday 15 September and returning on Sunday 17 September.
  - b. Friday tasking was a four-plane funeral flyover launching from KNBC and recovering to KCHS.
  - c. Flight order was as follows: (b)(6), (b)(7)c and (b)(6), (b)(7)c
  - d. Prior to departure (b)(6), (b)(7)c experienced a malfunctioning Standby Flight Display and returned to the line for troubleshooting culminating in a maintenance abort for that aircraft.
  - e. The rest of the flight departed and executed the flyover with three aircraft.
  - f. Because he was (b)(6), (b)(7)c flight hours for (b)(3), (b)(6), (b)(7)c were a mission priority for the weekend. Therefore, post-flyover, (b)(3), (b)(6), (b)(7)c returned to KNBC to hotseat his aircraft to (b)(6), (b)(7)c
  - g. After the hotseat, (b)(6), (b)(7)c departed and rejoined (b)(6), (b)(7)c and (b)(6), (b)(7)c who were already on deck in KCHS.
  - h. On Saturday, scheduled training was adjusted due to cancellation of tanker support. (b)(6), (b)(7)c requested and was approved to conduct Armed Reconnaissance training in the vicinity of MCAS Cherry Point. All three aircraft conducted approved training without incident and recovered to KCHS Saturday afternoon.
  - i. Saturday evening, each pilot executed independent dinner plans and agreed to meet on Sunday morning between 0830 and 0900.
  - j. On Sunday morning, all pilots appeared highly coherent and well-rested prior to the flight.
  - k. Having completed the desired training codes for (b)(6), (b)(7)c on Saturday, (b)(6), (b)(7)c elected to conduct Air Combat Maneuvering (ACM) currency flights on Sunday.

l. (b)(6), (b)(7)c (b)(3), (b)(4)  
(b)(3), (b)(4)

m. Due to convective activity in the area, (b)(6), (b)(7)c delayed the flight to reassess the weather and ultimately decided against flying his aircraft.

n. (b)(6), (b)(7)c approved (b)(6), (b)(7)c and (b)(6), (b)(7)c to continue with the planned ACM flight without him, provided they held enough reserve fuel to divert to Savannah.

o. (b)(3), (b)(6), (b)(7)c and (b)(3), (b)(6), (b)(7)c launched at about 1240 local. Weather at the field was Visual Meteorological Conditions with isolated thunderstorms in the area.

p. (b)(6), (b)(7)c (b)(3)  
(b)(3)

q. (b)(6), (b)(7)c monitored the weather from Base Operations while (b)(6), (b)(7)c and (b)(6), (b)(7)c (b)(6), (b)(7)c flew. Twenty to thirty minutes after their departure, weather started to build south of the KCHS.

r. About 1315 (b)(6), (b)(7)c asked Base Operations personnel to pass to the flight that lightning was within 10 nm of the airfield.

s. About 1325, heavy rains and lightning had reached the field. Base Operations personnel indicated to (b)(6), (b)(7)c that the flight was beginning their recovery to KCHS.

t. About 1337, (b)(6), (b)(7)c received a call on his cell phone from (b)(6), (b)(7)c stating that he had just ejected and was in someone's backyard. (b)(6), (b)(7)c confirmed (b)(6), (b)(7)c was okay and advised him to call 911.

u. After ending the call (b)(6), (b)(7)c notified his Commanding Officer, the Squadron Operations Officer, and KCHS Base Operations.

v. Next, (b)(6), (b)(7)c confirmed the location of (b)(6), (b)(7)c who by this time was safe on deck at KCHS.

w. After locating (b)(6), (b)(7)c exchanged multiple calls with (b)(6), (b)(7)c Squadron personnel, and Base Operations coordinating the mishap response and the location of the mishap aircraft.

x. (b)(6), (b)(7)c was not aware of any sociological, psychological, or human factors that may have contributed to the incident to include stress, fatigue, use of medications, or intoxication.

4. The point of contact for this matter is (b)(6), (b)(7)c at (b)(6), (b)(7)c or (b)(6), (b)(7)c

(b)(6), (b)(7)c

## MEMORANDUM FOR THE RECORD

Subj: SUMMARY OF THE 11 OCTOBER INTERVIEW WITH (b)(6), (b)(7)c

1. This memorandum for the record serves as a summary of an interview the investigating officer (IO) conducted on 11 October 2023 with (b)(6), (b)(7)c Instructor Pilot, Marine Fighter Attack Training Squadron 501 (VMFAT-501). (b)(6), (b)(7)c was a member of the VMFAT-501 Cross-Country (CCX) Detachment for Training (DFT) during the weekend of 17 September 2023 and the mishap wingman.

2. (b)(6), (b)(7)c contact information is: (b)(6), (b)(7)c  
(b)(6), (b)(7)c

3. The interview focused on the facts and circumstances surrounding the VMFAT-501 CCX/DFT beginning with the departure flights on Friday 15 September and ending with the post-ejection pilot recovery actions on 17 September. The following information was provided by (b)(6), (b)(7)c during the interview:

a. The original plan was a four plane CCX/DFT to Joint Base Charleston, SC (KCHS) departing from MCAS Beaufort (KNBC) on Friday 15 September and returning on Sunday 17 September.

b. Friday tasking was a four-plane funeral flyover launching from KNBC and recovering to KCHS.

c. Upon taxi as a flight to the runway, (b)(6), (b)(7)c experienced a maintenance issue and returned to the line for troubleshooting.

d. (b)(6), (b)(7)c was unable to get the malfunction to clear and was forced to cancel his launch due to maintenance.

e. The rest of the flight departed and executed the flyover with three aircraft.

f. Because he was (b)(6), (b)(7)c, flight hours for (b)(6), (b)(7)c were a mission priority for the weekend. Therefore, post-flyover, (b)(6), (b)(7)c (b)(6), (b)(7)c returned to KNBC to hotseat his aircraft to (b)(6), (b)(7)c

g. After the hotseat, (b)(6), (b)(7)c departed and rejoined (b)(6), (b)(7)c and (b)(6), (b)(7)c who were already on deck in KCHS.

h. On Saturday, (b)(6), (b)(7)c briefed and lead Division Armed Reconnaissance in the vicinity of MCAS Cherry Point as an Instructor Under Training. The mission was conducted in two sorties separated by hot gas at Cherry Point. Following training, all three aircraft recovered to KCHS on Saturday afternoon without incident.

i. After the flight, (b)(6), (b)(7)c noted that the flight members were aware of the forecasted thunderstorms on Sunday and were watching the weather closely.

j. Saturday evening, each pilot executed independent dinner plans and agreed to meet on Sunday morning at 0830.

k. On Sunday morning, all pilots appeared highly coherent and well-rested prior to the flight. The flight brief was delayed to 1000 due to unsupportable weather. At brief time, the ability to conduct training was still in question so crews delayed launch until after lunch. Crews shifted the training area from W-122 to W-137 due to transit times and divert fuel considerations.

l. The original plan called for (b)(6), (b)(7)c to act as Red Air against (b)(6), (b)(7)c and (b)(6), (b)(7)c (b)(6), (b)(7)c however (b)(6), (b)(7)c as unable to fly due to a maintenance restriction on his aircraft. After confirming weather minimums for training, (b)(6), (b)(7)c and (b)(6), (b)(7)c launched at around 1245 with (b)(6), (b)(7)c administratively leading the section.

m. The section departed runway 15 and maintained runway heading to the training area. (b)(6), (b)(7)c (b)(6), (b)(7)c lected to lead the section at 250 knots to mitigate the effects of intermittent precipitation enroute. The flight exited the cloud layers at 9,000 feet and weather became virtually clear over the water.

n. (b)(6), (b)(7)c described the transit to the working area as “the bumpiest I have felt in this aircraft.”

o. The section executed three sets of Basic Fighter Maneuvering before returning to KCHS early with plenty of gas.

p. (b)(6), (b)(7)c passed the following local weather observation to (b)(6), (b)(7)c Winds 160 at 11 knots, 4 miles visibility, and a scattered layer at 1,900 feet.

q. (b)(6), (b)(7)c put the section in a one-mile trail formation due to the potential to penetrate weather during their recovery. This position allows the trail aircraft to track the position of the lead aircraft on radar while in Instrument Meteorological Conditions (IMC).

r. The flight maneuvered under radar vectors from Air Traffic Control (ATC) during their recovery. They entered IMC while being vectored over land north of the airfield. (b)(6), (b)(7)c remained in IMC until breaking out at 500 feet at the completion of the approach.

s. ATC established the flight at 3,000 feet on a left “dog leg” for the Instrument Landing System (ILS) 15 approach. (b)(6), (b)(7)c made the radio call to (b)(6), (b)(7)c to convert their aircraft to Mode 4 / Short Takeoff and Vertical Landing (STOVL) configuration for a slower approach. This was the last radio call (b)(6), (b)(7)c heard from (b)(6), (b)(7)c for the remainder of the approach.

t. Approximately one half of the way down the ILS 15 approach (b)(6), (b)(7)c noticed that (b)(6), (b)(7)c (b)(6), (b)(7)c aircraft fell out of their data link. Additionally, (b)(3), (b)(6), (b)(7)c watched (b)(6), (b)(7)c radar track move to the 10 o'clock high position which he lead him to believe (b)(6), (b)(7)c was executing a missed approach.

u. After breaking out at approximately 500 feet with one-half mile visibility, (b)(6), (b)(7)c reported “safe on deck” to (b)(6), (b)(7)c and asked if he was executing a missed approach. After hearing no response, (b)(6), (b)(7)c reported the same to ATC and asked about the status of (b)(6), (b)(7)c ATC responded asking the same of (b)(6), (b)(7)c

v. After exiting the runway, ATC notified (b)(6), (b)(7)c that (b)(6), (b)(7)c aircraft was tracked 25 miles north of the airfield heading towards Shaw’s airspace. Approximately 10 minutes later, ATC advised (b)(6), (b)(7)c that (b)(6), (b)(7)c had ejected.

w. Within approximately one hour after landing, KCHS Base Operations had stood up an Emergency Operations Center (EOC) to determine the location of the missing aircraft. (b)(6), (b)(7)c assisted the EOC by acting as an F-35B Subject Matter Expert.

x. (b)(6), (b)(7)c was not aware of any sociological, psychological, or human factors that may have contributed to the incident to include stress, fatigue, use of medications, or intoxication.

4. The point of contact for this matter is (b)(6), (b)(7)c at (b)(6), (b)(7)c or (b)(6), (b)(7)c

(b)(6), (b)(7)c

**SUBJ: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF  
MAG-31, VMFAT-501 ON 17 SEPTEMBER 2023**

The following enclosure has been withheld in its entirety under FOIA Exemption (b)(6).

The foreseeable harm in releasing 5 U.S.C. § 552(b)(6) information contained in personnel, medical, or similar files to a requestor, other than the actual person in which the information is pertaining to, would constitute a clearly unwarranted invasion of their privacy.

Enclosure (20) MP Medical Recommendation for Flying (Up Chit), page 239

Enclosure (21) MP Report of Medical History and Medical Examination, pages 240-249

MEMORANDUM FOR THE RECORD

Subj: SUMMARY OF EMAIL WITH (b)(6), (b)(7)c

1. This memorandum for the record serves as a summary of an email between (b)(6), (b)(7)c (b)(6), (b)(7)c VMFAT-501) and (b)(6), (b)(7)c (b)(6), (b)(7)c VMFAT-501) on 4 December 2023 (b)(6), (b)(7)c coordinates the Human Factors Councils for VMFAT-501.

2. (b)(6), (b)(7)c contact information is: (b)(6), (b)(7)c and (b)(6), (b)(7)c

3. The exchange focused on human factors for (b)(6), (b)(7)c that might have contributed to the mishap on 17 September 2023. The following information was provided by (b)(6), (b)(7)c

a. Although no notes were taken during the Human Factors Council (b)(6), (b)(7)c did not recall anything pertaining to (b)(3), (b)(6), (b)(7)c hat would have contributed to the mishap.

2. The point of contact for this matter is (b)(6), (b)(7)c at (b)(6), (b)(7)c or (b)(6), (b)(7)c

(b)(6), (b)(7)c



**SUBJ: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE F-35 MISHAP OF  
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Enclosure (23) Aviation Training Form for MP flight on 22 August 2023, pages 251-252

# (24) MA ALIS Screenshot of Hotseat Part A (A-Sheet)

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Back

| Qualification | Name            | Date/Time     | Disclaimer   |
|---------------|-----------------|---------------|--|
| Plane Captain | (b)(6), (b)(7)c | 15SEP23 04:08 | I have personally inspected this aircraft IAW applicable JTD DMCs/checklists. Any discrepancies noted have been entered on the POS, BOS, IOS, or have a work order initiated against the air vehicle.  |
| Release       | (b)(6), (b)(7)c | 15SEP23 18:27 | I UNDERSTAND MY RESPONSIBILITY AS SET FORTH HEREIN: WHEN PERFORMING INSPECTIONS, I AM CONSIDERED TO BE THE DIRECT REPRESENTATIVE OF THE COMMANDING OFFICER FOR ENSURING SAFETY OF FLIGHT OF THE ITEM CONCERNED. I WILL NOT PERMIT FACTORS, SUCH AS OPERATIONAL DESIRES, MAINTENANCE CONSIDERATION, PERSONAL RELATIONS OR THE APPROACH OF LIBERTY TO MODIFY MY JUDGMENT. BY SIGNING AN INSPECTION REPORT, I AM CERTIFYING UPON MY OWN INDIVIDUAL RESPONSIBILITY THAT THE WORK INVOLVED HAS BEEN PERSONALLY INSPECTED BY ME; THAT IT HAS BEEN PROPERLY COMPLETED AND IS IN ACCORDANCE WITH CURRENT INSTRUCTIONS AND DIRECTIVES; THAT IT IS SATISFACTORY; THAT ANY RELATED PARTS OR COMPONENTS WHICH MAY HAVE BEEN REMOVED BY THE WORK ARE PROPERLY REPLACED AND ALL PARTS ARE SECURE, AND THAT THE WORK HAS BEEN PERFORMED IN SUCH A MANNER THAT THE ITEM IS COMPLETELY SAFE FOR FLIGHT OR USE." THIS IS CERTIFICATION OF SAFE FOR FLIGHT CONDITION BY PERSONNEL AUTHORIZED BY THE COMMANDING OFFICER TO RELEASE AIRCRAFT SAFE FOR FLIGHT. |

**Pilot Flight Equipment**

|     | Part Number | Serial Number | CAGE Code |
|-----|-------------|---------------|-----------|
| HMD |             |               |           |
| PIC |             |               |           |

**PMD**

Select the serial number for the PMD the pilot is carrying:

Serial Number:

| Qualification | Name            | Date/Time     | Disclaimer   |
|---------------|-----------------|---------------|--|
| Accept        | (b)(6), (b)(7)c | 15SEP23 17:22 | I have reviewed the discrepancy reports of the 10 previous flights, insured proper filing of weight and balance data, and accept this aircraft for flight. I also affirm that I performed a pre-flight inspection on my aircrew PPE and shall perform a post flight inspection my return IAW OPNAVINST 3710-7U and all applicable JTD modules. Additionally, I shall verify all applicable emergency radio pre and post flight inspections are complied with IAW NAVY NAVAIR 16-30PRQ7-1 table 4-2, NAVAIR 16-30PRC149-1 manuals. I understand my oxygen mask life preserver retainer shall be secured upon my person during flight operations. I have checked out LEP as required for mission requirements. |

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**LOCKHEED MARTIN (LM) AERONAUTICS COMPANY**  
**ENGINEERING INVESTIGATION REPORT OF F-35B BUNO 169591 (BF-66)**  
**CLASS A FLIGHT MISHAP, 17 September 2023, AFSAS (b)(4)**

**Date: 13 October 2023**  
**Document Type: Engineering Investigation Report**



***Reviewed by:***

(b)(6), (b)(7)c

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 Lockheed Martin Aeronautics Company

(b)(6), (b)(7)c

***Approved by:***

(b)(6), (b)(7)c

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(b)(6), (b)(7)c

***Prepared by:***

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Flight Safety Engineer, Senior Staff  
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(b)(6), (b)(7)c

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## TABLE OF CONTENTS

|   |            |
|---|------------|
| <b>TABLE OF CONTENTS .....</b>                              | <b>2</b>   |
| <b>EXECUTIVE SUMMARY .....</b>                              | <b>3</b>   |
| <b>INVESTIGATION SCOPE .....</b>                            | <b>4</b>   |
| <b>AIRCRAFT CONFIGURATION.....</b>                          | <b>5</b>   |
| <b>CRASH SITE AND AIRCRAFT OBSERVATIONS.....</b>            | <b>7</b>   |
| <b>RECORDED DATA EXTRACTION PROCESS.....</b>                | <b>13</b>  |
| <b>RECORDING SYSTEMS.....</b>                               | <b>20</b>  |
| <b>POWER AND THERMAL MANAGEMENT SYSTEM (PTMS).....</b>      | <b>36</b>  |
| <b>AIR DATA SYSTEM (ADS).....</b>                           | <b>39</b>  |
| <b>ELECTRICAL POWER SYSTEM (EPS) .....</b>                  | <b>43</b>  |
| <b>MISSION SYSTEMS (MS).....</b>                            | <b>49</b>  |
| DMC LEFT (DMCL) AND DMC RIGHT (DMCR) .....                  | 49         |
| INTEGRATED CAUTION AND WARNING SYSTEM (ICAWS) DATA .....    | 50         |
| DMC - HELMET (DMCH) AND HMD .....                           | 51         |
| DATA COMPARISON TO OTHER FLIGHTS.....                       | 51         |
| STANDBY FLIGHT DISPLAY (SFD).....                           | 53         |
| INTEGRATED CORE PROCESSOR (ICP) .....                       | 54         |
| <b>FLIGHT CONTROL LAW APPLICATION (CLAW) .....</b>          | <b>55</b>  |
| <b>PROPULSION SYSTEM.....</b>                               | <b>80</b>  |
| <b>COM, NAV, AND IDENTIFICATION (CNI) SYSTEM.....</b>       | <b>83</b>  |
| <b>FLIGHT CONTROLS SYSTEM (FCS).....</b>                    | <b>87</b>  |
| <b>FUEL MANAGEMENT SYSTEM (FMS) .....</b>                   | <b>96</b>  |
| <b>HYDRAULICS AND UTILITIES ACTUATION (HUA) SYSTEM.....</b> | <b>102</b> |
| <b>CREW SYSTEMS .....</b>                                   | <b>109</b> |
| EJECTION SEAT.....  | 109        |
| LIFE SUPPORT SYSTEM (LSS) .....                             | 111        |
| PILOT FLIGHT EQUIPMENT (PFE).....                           | 115        |
| TRANSPARENCY REMOVAL SYSTEM (TRS).....                      | 116        |
| HELMET MOUNTED DISPLAY (HMD) SYSTEM .....                   | 118        |
| <b>CONCLUSION SUMMARY .....</b>                             | <b>120</b> |
| <b>RECOMMENDATION SUMMARY.....</b>                          | <b>122</b> |
| <b>GLOSSARY.....</b>  | <b>123</b> |
| <b>ATTACHMENTS .....</b>                                    | <b>127</b> |





**MISHAP AIRCRAFT:** F-35B BUNO 169591 (BF-66)  
 MCAS Beaufort, SC (at Joint Base Charleston)

**MISHAP DATE:** 17 September 2023

**INVESTIGATORS:** (b)(6), (b)(7)c  
 LM Aeronautics Lead Investigator  
 (b)(6), (b)(7)c  
 LM Aeronautics Investigator  
 (b)(6), (b)(7)c

**EXECUTIVE SUMMARY**

At approximately 16:42:42 Zulu (Z) on 17 September 2023, the mishap aircraft (MA) F-35B with bureau number (BUNO) 169591 (BF-66) based at Marine Corps Air Station (MCAS) Beaufort, SC took off from Joint Base Charleston, SC on a training sortie in a two-ship formation. After successful completion of the, the formation recovered to Joint Base Charleston for an approach to Runway 15. Observed weather at Joint Base Charleston during the time of the mishap was overcast at 5,000 feet, and broken layers at 1,400 and 3,200 feet. Winds were 310 degrees (magnetic) at 14 knots and visibility was 1¾ miles with heavy rain and mist.

The crash survivable memory unit (CSMU) data recorded that during final approach, the landing gear lowered and the Lift Fan Engaged to change from conventional takeoff and landing (Mode 1 CTOL) to short takeoff and vertical landing (Mode 4 STOVL) mode. The Mode 4 (STOVL) conversion was completed at aircraft (AC) time 4688.31 seconds (s) (17:31:02.8Z). Approximately one minute later, the CSMU data recorded an inverter converter controller #1 (ICC1) voltage drop at AC time 4750.65s (17:32:05.2Z) lasting approximately 0.24 seconds. During this transient electrical event, the electrical distribution unit (EDU) battery (BATT) Bus 1 received fill-in power (b)(3), (b)(4) and remained powered on nominal battery potential until the ICC1 voltage returned to a steady state. The utility (UTIL) Bus 1 and BATT Bus 1 received fill-in power (b)(3), (b)(4) and remained powered on nominal battery potential until the ICC1 voltage returned to a steady state plus an additional eight seconds (b)(3), (b)(4) (b)(3), (b)(4)

Twenty seconds after this transient electrical event, the CSMU data recorded the landing gear was raised at AC time 4771.61s (17:32:26.1Z) and a second conversion was initiated from Mode 4 (STOVL) to Mode 1 (CTOL) at AC time 4783.12s (17:32:37.6Z). During this second conversion, ejection was initiated at AC time 4791.78s (17:32:46.3Z) with the MA in a five-degree climb, 1,746 feet mean sea level (MSL), and 243 knots calibrated airspeed (KCAS). Five seconds after ejection, the MA completed conversion to Mode 1 (CTOL) at AC time 4796.72s (17:32:51.2Z).

With the MA in an initial five-degree climb and in a nominally trimmed condition, the MA continued flying unmanned for approximately 11 minutes and 21 seconds before impacting in a rural area approximately 64 miles northeast of Joint Base Charleston. The MA impacted approximately 11 degrees nose low and 23 degrees of right bank at a max speed of 552 KCAS on





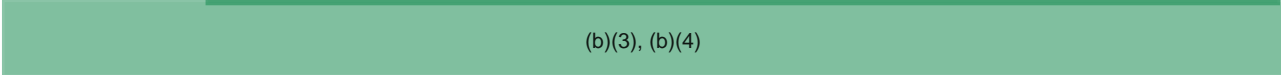
a southeasterly heading. There was no post-impact fire, but the MA experienced significant structural breakup.

Report Conclusion. While in STOVL (b)(3), (b)(4) mode, the CSMU recorded the EDU (b)(3), (b)(4) (b)(3), (b)(4) contactor output to the nacelle fan was tripped at AC Time 4750.65s (17:32:05.165Z) lasting approximately 0.24 seconds. This partial power loss may have caused a momentary reduced functionality of some displays, navigation, and communication capability but standby flight display (SFD) information remained unaffected. The helmet pitch data during the last 24 seconds before ejection at AC time 4791.78s (17:32:46.3Z) recorded several instances of downward helmet pitch (b)(3), (b)(4) (b)(3), (b)(4) after ejection, aircraft systems necessary for flight remained operational allowing the MA to complete its conversion to Mode 1 (CTOL) mode at AC time 4796.72s (17:32:51.2Z). The Automatic Ground Collision Avoidance (AGCAS) was not available due to a Flight Control System (FCS) interlock that transitions AGCAS to a failed state when an FCS VEL DEGD Integrated Caution Advisory or Warning (ICAW) is asserted. The FCS VEL DEGD asserted due to a momentary loss of Inertial Navigation System (INS) and Global Positioning System (GPS) aiding to the Tactical Navigation System (TNS) at AC time 4764.789s (17:32:19.303Z). The FCS VEL DEGD had no impact on aircraft flying qualities

**INVESTIGATION SCOPE**

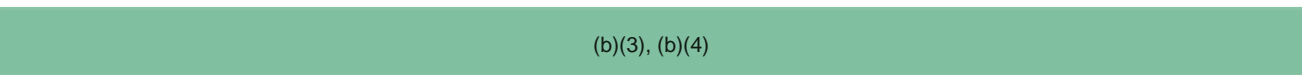
This is an Engineering Investigation Report (EIR) for the United States Marine Corps Aircraft Mishap Board (AMB) prepared by LM Aeronautics Flight Safety and F-35 Integrated Product Team (IPT) engineers. (b)(3), (b)(4)

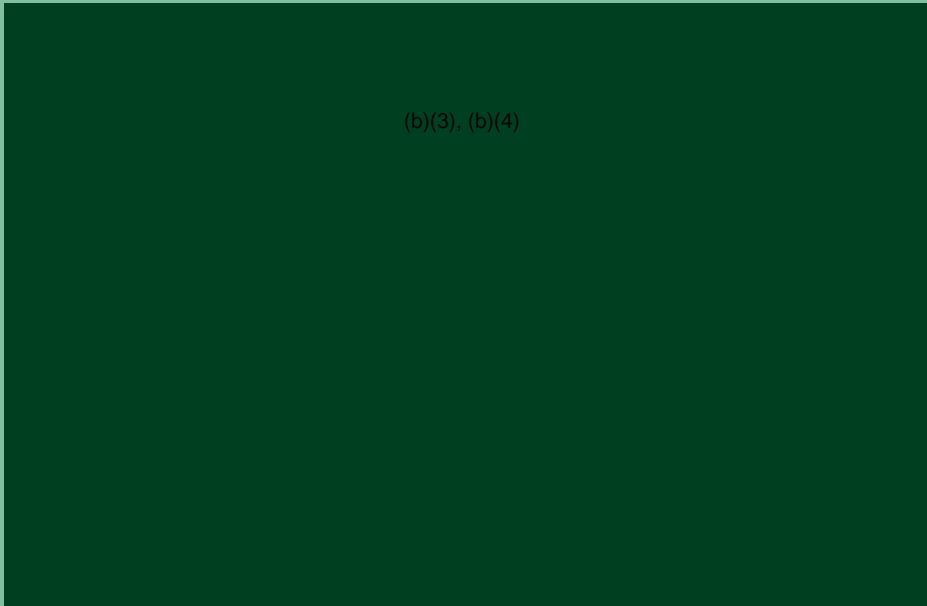
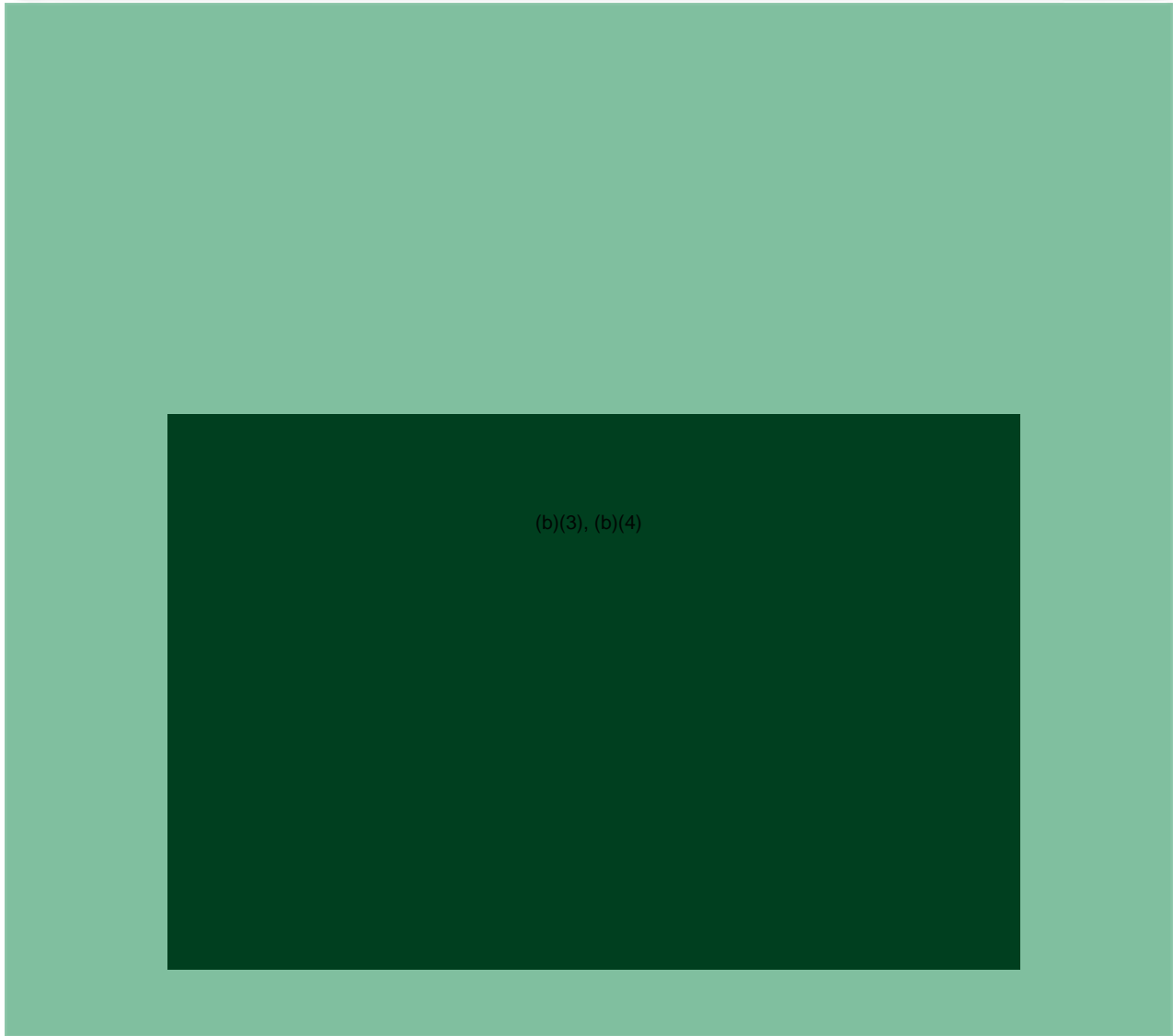
The CSMU records data at the design required rates for various parameters. When data is not recorded, a “gap” in the data record is created in the data collections. This “raw” recorded data is often referred to as “unfilled” data. Unless otherwise annotated, the charts provided in this report use filled data. (b)(3), (b)(4)



CSMU times are referenced throughout this report as “AC time.” This time is used when available and represents a more precise time. AC times were converted to a common universal time coordinated (UTC), commonly referred to as Zulu or “Z” time to establish a common reference timeline. The data conversion from AC time (seconds) to UTC (seconds) is to add 58374.513650 seconds to the AC time. At the time of the mishap, local time was four hours behind UTC time.

Where able, acronyms are typically spelled out when they first occur in this report, but a glossary of acronyms is also provided toward the end of this report beginning on page 123.

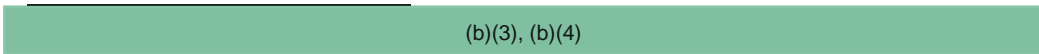




(b)(3), (b)(4)

OBSERVATION: The MA was not configured with any internal or external stores.

- Station 1: Empty
- Station 2: Empty
- Station 3: Empty
- Station 4: Empty
- Station 5: Empty
- Station 6: Empty
- Station 7: Empty
- Station 8: Empty
- Station 9: Empty
- Station 10: Empty
- Station 11: Empty



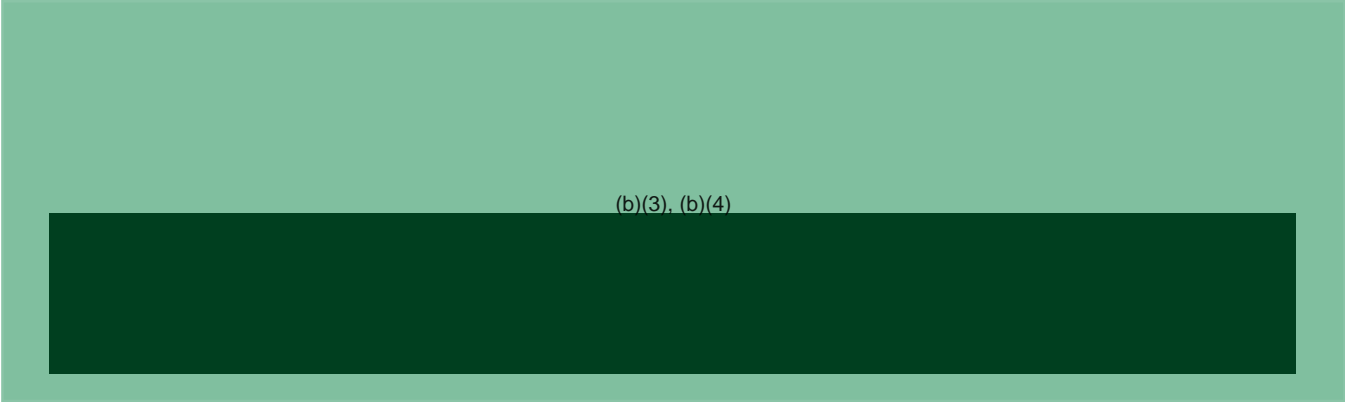
(b)(3), (b)(4)







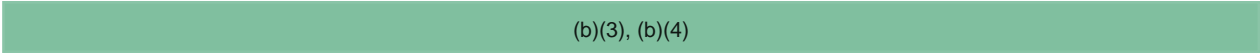
ANALYSIS: After a successful extraction of the CSMU data, the recorded fuel just before the MA impact at AC time 5473.3s (17:44:07.8Z) was approximately 2,800 pounds, an aircraft gross weight of (b)(3), (b)(4) resulting in an aircraft center of gravity (CG) of (b)(3), (b)(4) mean aerodynamic chord (MAC) just before the MA impact with trees.



(b)(3), (b)(4)

CONCLUSION: The configured MA (b)(3), (b)(4) CG was within the defined (Landing Gear UP) aircraft limitations.

RECOMMENDATION: None.



(b)(3), (b)(4)

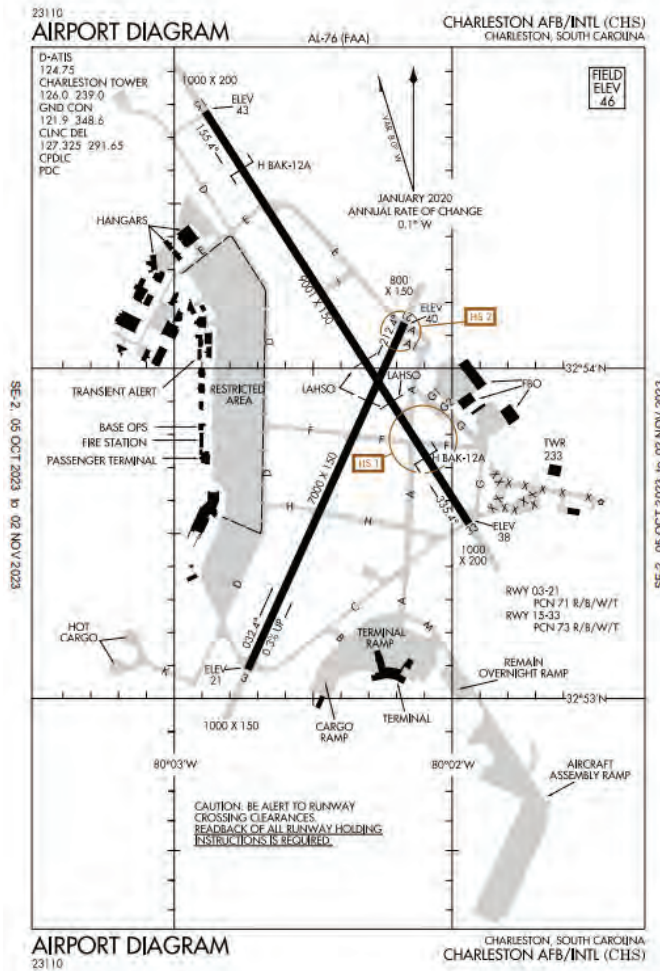






**CRASH SITE AND AIRCRAFT OBSERVATIONS**

**OBSERVATION:** Runway 15 at Joint Base Charleston is 9,001 feet long by 150 feet wide and lays on a heading of 147 degrees True with BAK-12A arresting systems at each end of the runway displaced approximately 1,260 feet from Runway 15 approach end and 1,460 feet from Runway 33 approach end. The overrun at both ends of the runway is 1,000 feet long by 200 feet wide. The airport diagram is provided in Figure 2 below.



**Figure 2. Joint Base Charleston Airport Diagram**

The MA crash site involved two locations. Ejection was initiated during the approach to Runway 15 at Joint Base Charleston. CSMU data recorded ejection was initiated at AC time 4791.8s (17:32:46.3Z) at 32.919399N, 080.050836W. At the time of ejection, the MA was on a 149 true heading (T), at 1,746 feet MSL and 243 KCAS. The MA ejection seat was recovered just inside the Joint Base Charleston airfield perimeter fence.

After the ejection sequence completed, the MA continued flying unmanned at approximately 10 degrees nose up making a shallow left turn to a northerly direction and climbing to a peak altitude of 9,329 feet mean sea level (MSL). Approximately 11 minutes after ejection, the MA



reversed its bank to a shallow right descending turn and began clipping the top of a densely forested area. The MA plowed through dense forest approximately 64 miles northeast of Joint Base Charleston in a rural area creating the second crash site (see Figure 3 below).



Figure 3. MA Ground Track

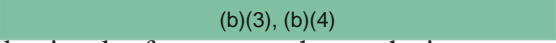
The center of the wreckage created an impact crater approximately 15 feet wide by 30 feet long at 33.74918N, 079.58021W that had filled with water by the time the investigation team arrived at the site. The debris field was found amid dense forest, cotton, and soybean fields and was oblong in shape, stretching approximately 1,800 feet long by approximately 300 feet at its widest point. The MA crash site (see Figure 4 below) indicated a low angle/high speed trajectory leaving the MA wreckage shredded into mostly small pieces, with the largest pieces ranging from three to five feet. There was no evidence of a post-impact fire at the site, but fuel vapors were present in the crash site foliage.



Figure 4. Crash Site Overview





The CSMU, aircraft memory device (AMD), and portable memory device (PMD) were located in close proximity with each other  Photograph 1 through Photograph 4 below provide visual references to the crash site.



**Photograph 1. Entry into forest (looking Northwest)**



**Photograph 2. Nose Landing Gear (NLG) Strut embedded approximately eight feet up tree trunk**





Photograph 3. CSMU



Photograph 4. Lift fan remnants

**ANALYSIS:** The mishap flight was recovering to Joint Base Charleston with heavy rain in the area. Figure 5 below is a translation of the observed weather at 1742Z and Chart 1 provides a weather history at the airfield during the time of ejection.





KCHS 171742Z 31014KT 1 3/4SM R15/1600V4000FT +RA BR BKN014 BKN034 OVC050 23/22 A2990 RMK AO2 P0058 T02330217

**Translate METAR**

**KCHS IFR 5:42 PM UTC**

**Heavy Rain, Mist**  
**Overcast 5,000'** VIZ **1.75sm** PRES **29.90"Hg**  
**Broken 3,400'** TEMP **73°F** WIND **310° 14kts**  
**Broken 1,400'** DEW **72°F**

RVR RVR: Rwy 15, 1600 to 4000 Feet

RMK AO2 P0058 T02330217

Figure 5. METeorological Aerodrome Report (METAR) Translation - courtesy of iflightplanner.com

### Daily Observations

| Time     | Temperature | Dew Point | Humidity | Wind | Wind Speed | Wind Gust | Pressure | Precip. | Condition     |
|----------|-------------|-----------|----------|------|------------|-----------|----------|---------|---------------|
| 10:56 AM | 83 °F       | 71 °F     | 67 %     | SE   | 12 mph     | 0 mph     | 29.89 in | 0.0 in  | Mostly Cloudy |
| 11:56 AM | 80 °F       | 73 °F     | 79 %     | SSE  | 8 mph      | 0 mph     | 29.87 in | 0.1 in  | Mostly Cloudy |
| 12:56 PM | 77 °F       | 72 °F     | 84 %     | SSE  | 13 mph     | 0 mph     | 29.86 in | 0.0 in  | Heavy Rain    |
| 1:42 PM  | 74 °F       | 71 °F     | 91 %     | NW   | 16 mph     | 0 mph     | 29.85 in | 0.6 in  | Heavy Rain    |
| 1:49 PM  | 74 °F       | 71 °F     | 91 %     | NW   | 10 mph     | 0 mph     | 29.87 in | 1.1 in  | Heavy Rain    |
| 1:56 PM  | 74 °F       | 72 °F     | 93 %     | NNW  | 3 mph      | 0 mph     | 29.86 in | 1.5 in  | Heavy Rain    |
| 2:06 PM  | 75 °F       | 74 °F     | 96 %     | CALM | 0 mph      | 0 mph     | 29.86 in | 0.1 in  | Light Rain    |
| 2:22 PM  | 76 °F       | 73 °F     | 91 %     | SE   | 5 mph      | 0 mph     | 29.85 in | 0.1 in  | Cloudy        |
| 2:56 PM  | 79 °F       | 74 °F     | 84 %     | S    | 8 mph      | 0 mph     | 29.83 in | 0.1 in  | Mostly Cloudy |

Red dash line approximate ejection at 13:32L

Chart 1. Joint Base Charleston Weather History (courtesy of wunderground.com/history)

Photographs were taken of the damaged trees at the impact site. On-site analysis using Theodolite 7.0 surveying software and lining up the tops of the damaged trees indicated a descent path of approximately 10 degrees on an approximate bearing of 120 degrees True. CSMU data confirmed the aircraft attitude at impact was approximately 11 degrees nose low and 23 degrees of right bank at a max speed of 551.59 KCAS on a southeasterly heading.

CONCLUSION: The ejection sequence was initiated on short final while in heavy rain conditions and the MA continued flying unmanned before coming to a rest in a low angle/high speed trajectory approximately 64 miles northeast of Joint Base Charleston.

RECOMMENDATION: None.





## RECORDED DATA EXTRACTION PROCESS

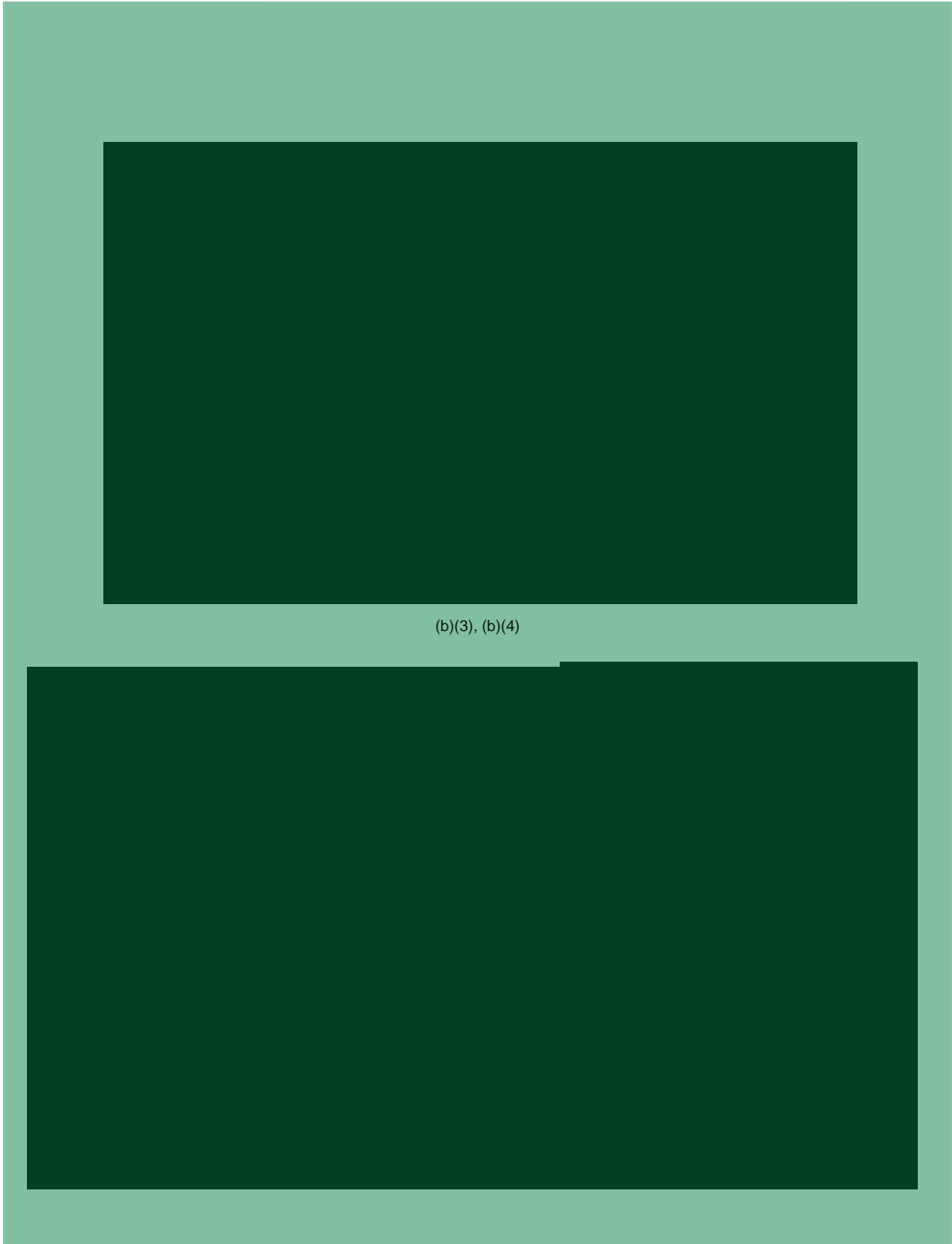
The aircraft memory device (AMD) and portable memory device (PMD) were both found at the crash site. Both sustained significant damage and data recovery was not possible, however, the CSMU was found and was hand-carried (b)(7)f to LM Aeronautics Fort Worth, TX on 20 September 2023. The CSMU arrived at the LM Aeronautics (b)(3), (b)(4) (b)(3), (b)(4) for extraction at approximately 1600L.

Incoming inspection showed the CSMU was very badly damaged (see Photograph 5 below). The electronic control module housing was broken, and all circuit cards were missing likely due to excessive impact during the crash. The crash protected memory (CPM) module was disassembled at the LM Aeronautics Design Development Lab (DDL) the next day to extract mishap data (b)(3), (b)(4)



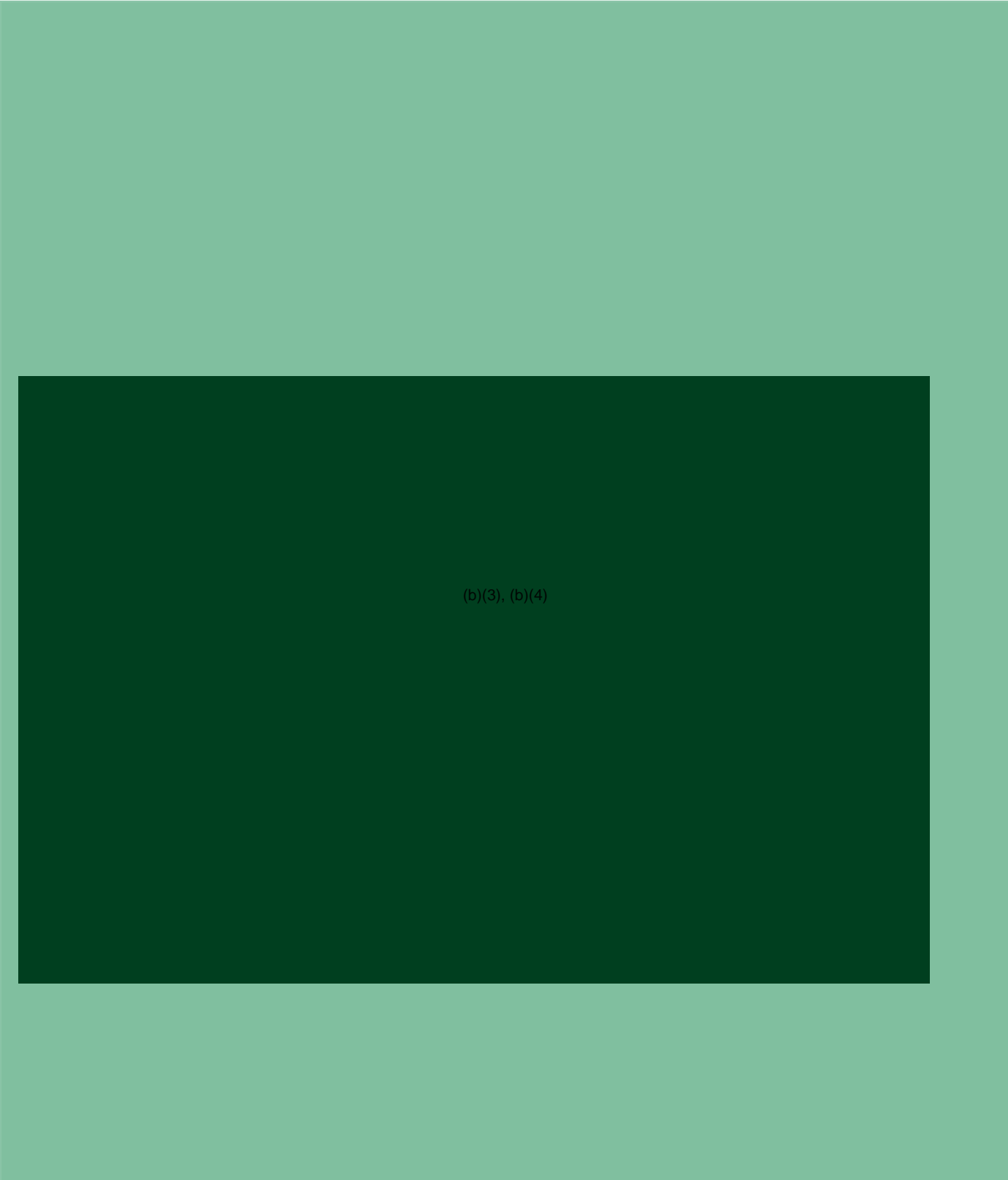
**Photograph 5. CSMU - Received Condition**

(b)(3), (b)(4)



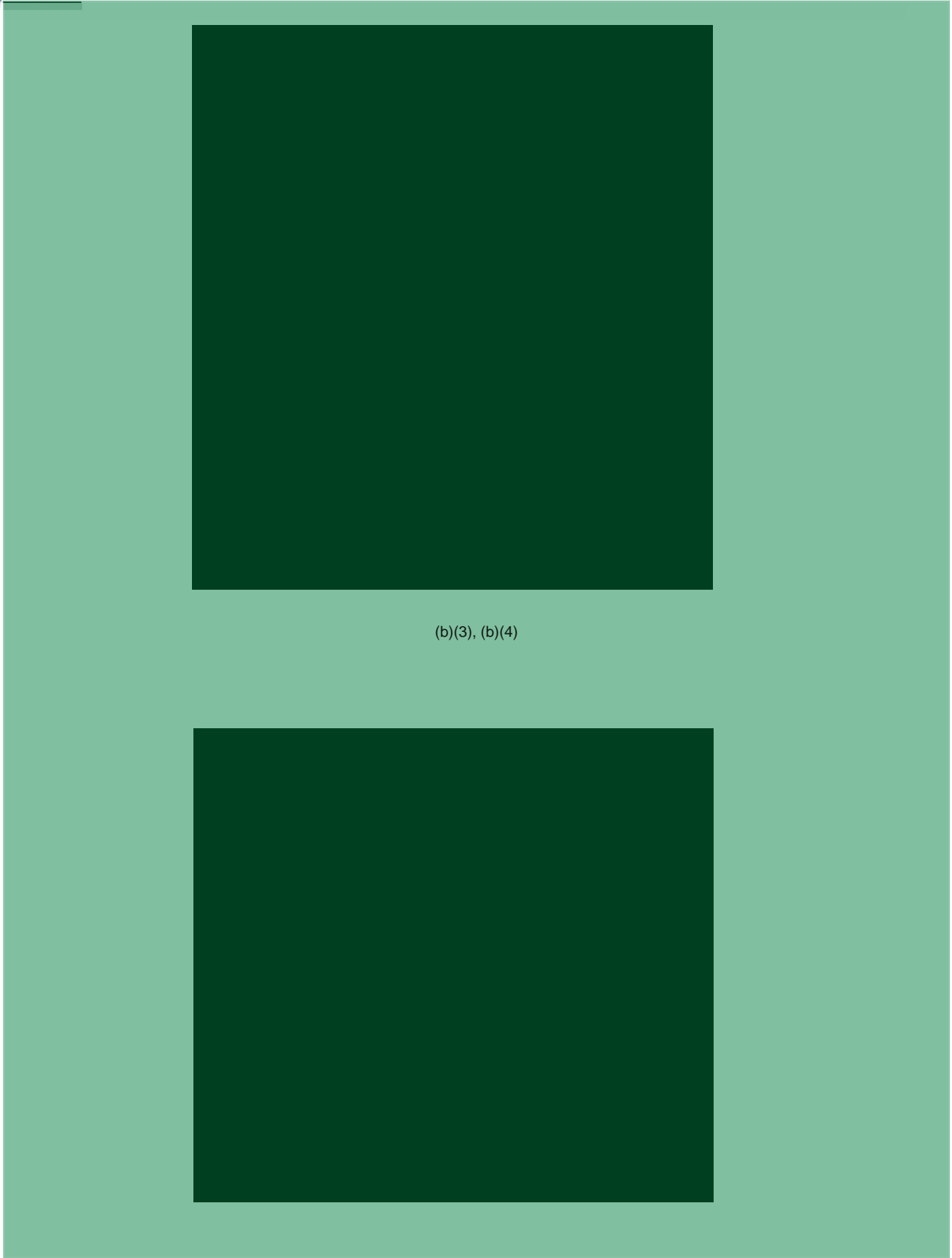
(b)(3), (b)(4)



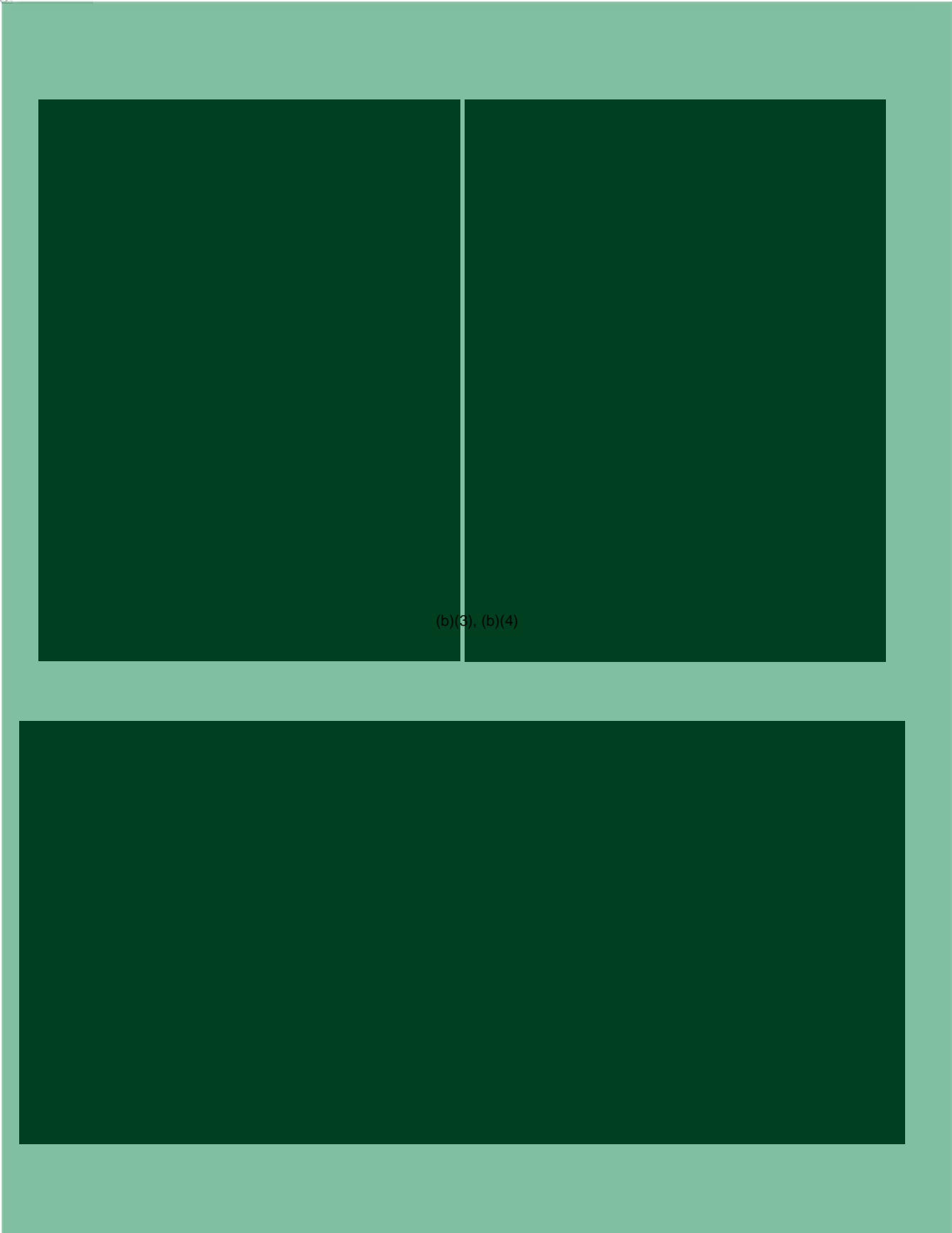


(b)(3), (b)(4)

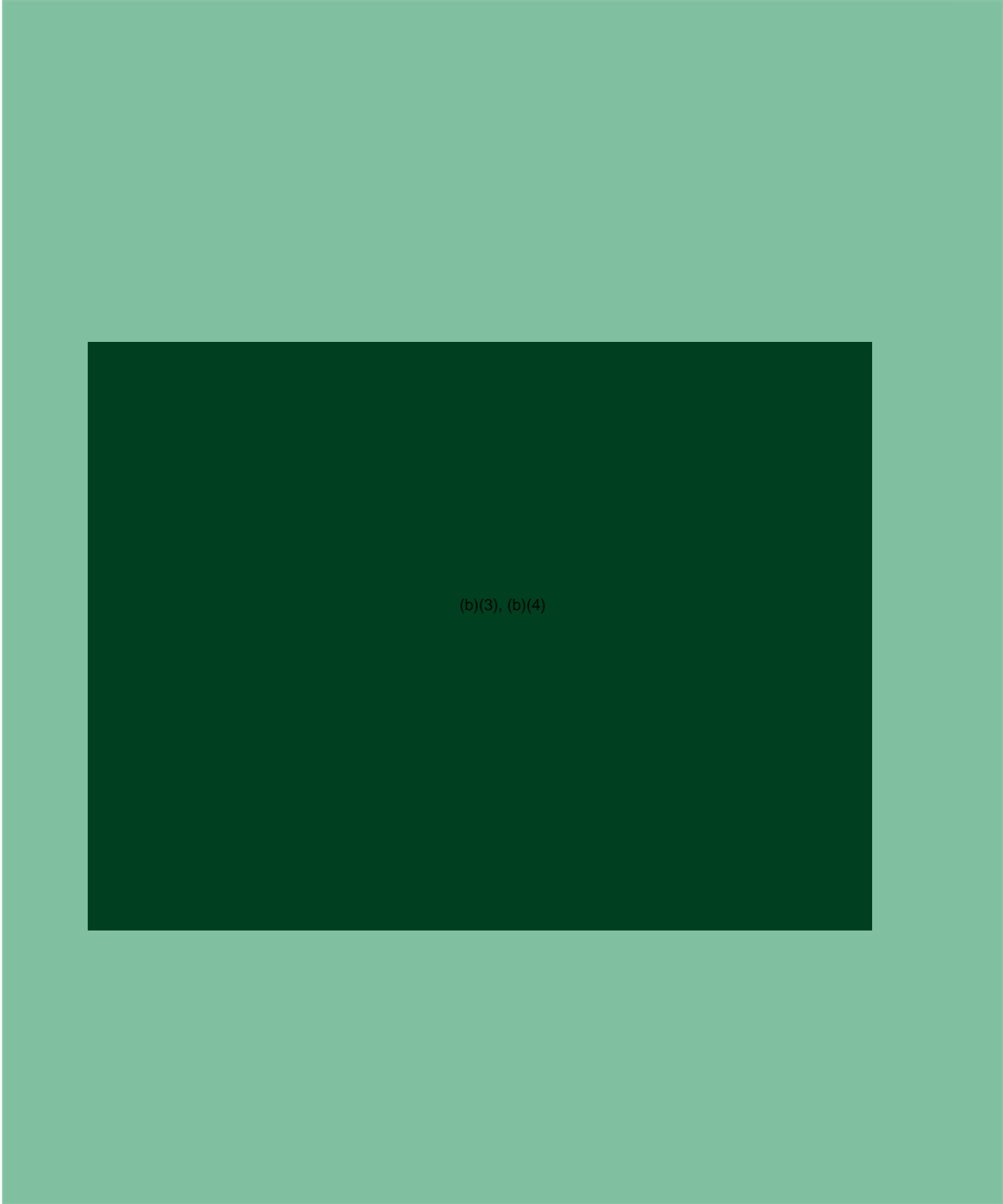




(b)(3), (b)(4)

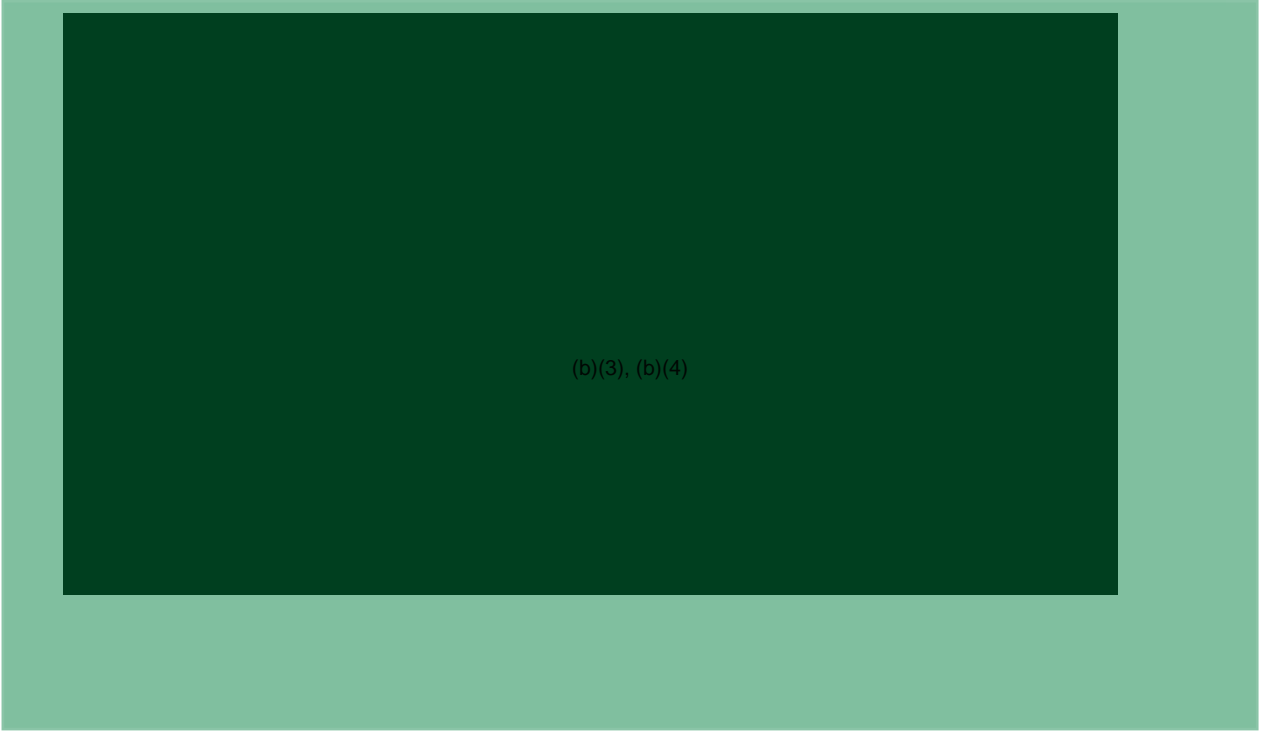


(b)(3), (b)(4)



(b)(3), (b)(4)





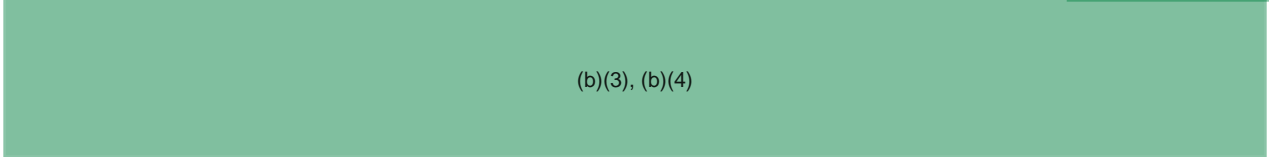
(b)(3), (b)(4)





## RECORDING SYSTEMS

DESCRIPTION: The aircraft memory system's (AMS) primary function is to provide a nonvolatile solid-state mass storage capability for the aircraft avionics subsystems (b)(3), (b)(4)



(b)(3), (b)(4)

The aircraft contains two AMS subsystems. The AMD remains with the aircraft and is accessed by the maintainer. It is located in the aft left console panel and is the primary repository for OFP files and backup recorder for Prognostics and Health Management (PHM) data. The PMD is accessed on the right-side console and is the primary repository for mission data and the primary recorder for PHM data.

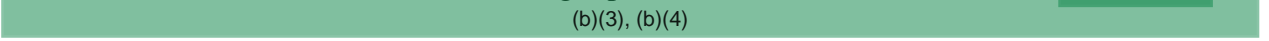
*AMD.* The AMD primary purpose is mass storage for aircraft avionics subsystems. Stored data includes prognostics health management, theater data, and the current version of avionics subsystems OFPs. During initial power-on sequence, the display management computer (DMC) and other avionics subsystems query the AMD to make sure systems are executing the latest version of their OFPs. The AMD (b)(3), (b)(4)



(b)(3), (b)(4)

is located in the aft left console panel.

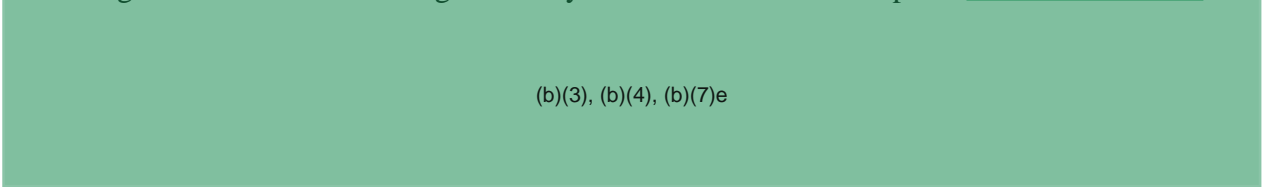
*PMD.* The PMD is the pilot's primary repository for data for the current mission and the primary recorder for PHM data. Current mission flight plan and other related mission data (b)(3), (b)(4)



(b)(3), (b)(4)

are loaded by the pilot prior to installing the EDTC into the enhanced data transfer cartridge receptacle (EDTCR). During mission execution, the PMD records all mission related audio and selected video and predetermined parametric data. At the conclusion of the mission, the PMD is removed, and the recorded mission and PHM data is uploaded for post-mission debrief. The AMD can be removed from the aircraft via maintenance action if the PHM data cannot be retrieved from the PMD (b)(3), (b)(4)

*Crash survivable memory unit (CSMU).* The flight data recorder manager (FDRM) initializes the recording capability of the CSMU and manages mishap data collection to send to the CSMU for recording. The FDRM also manages activity to erase recorded mishap data (b)(3), (b)(4)



(b)(3), (b)(4), (b)(7)e



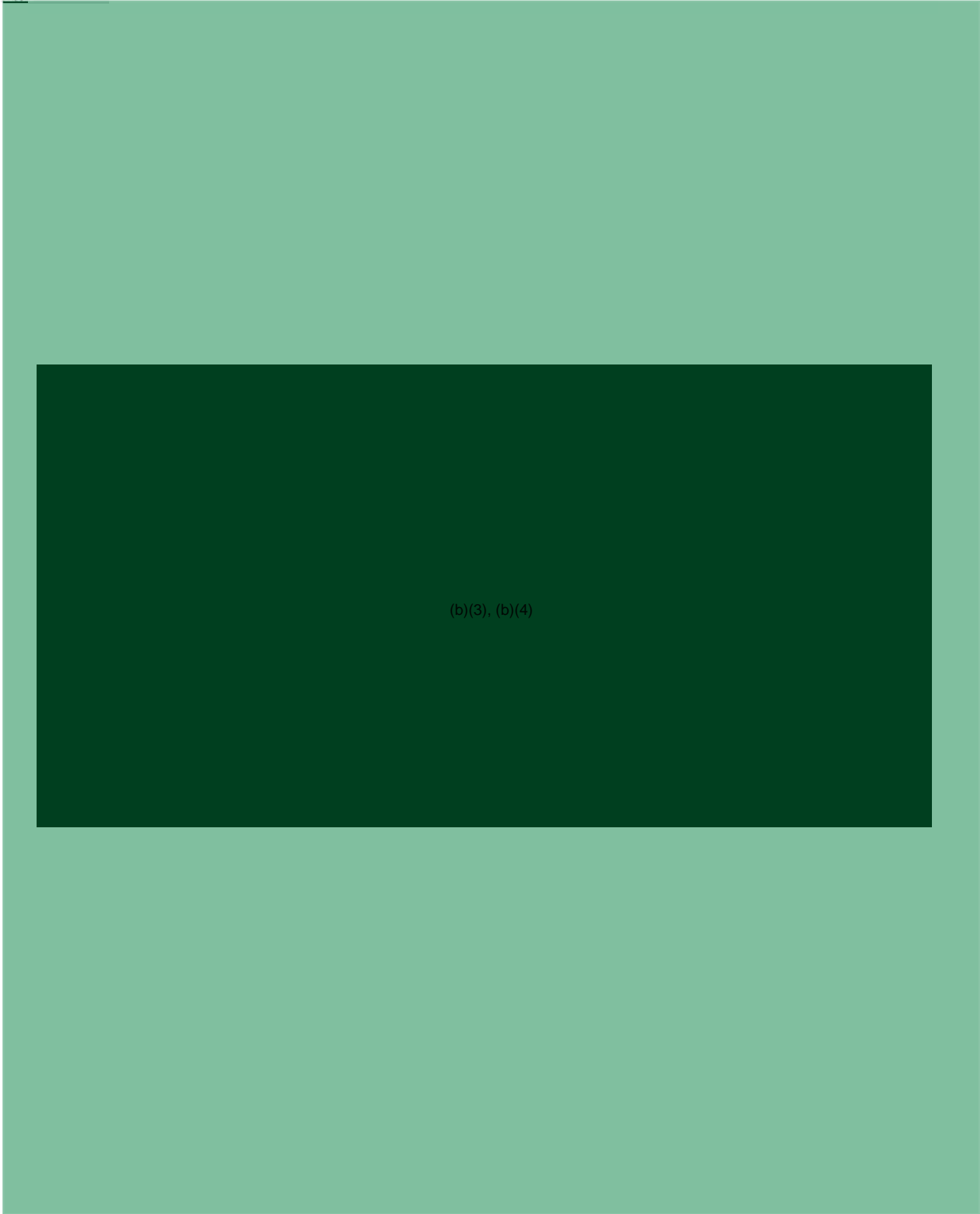
(b)(3), (b)(4)





(b)(3), (b)(4)

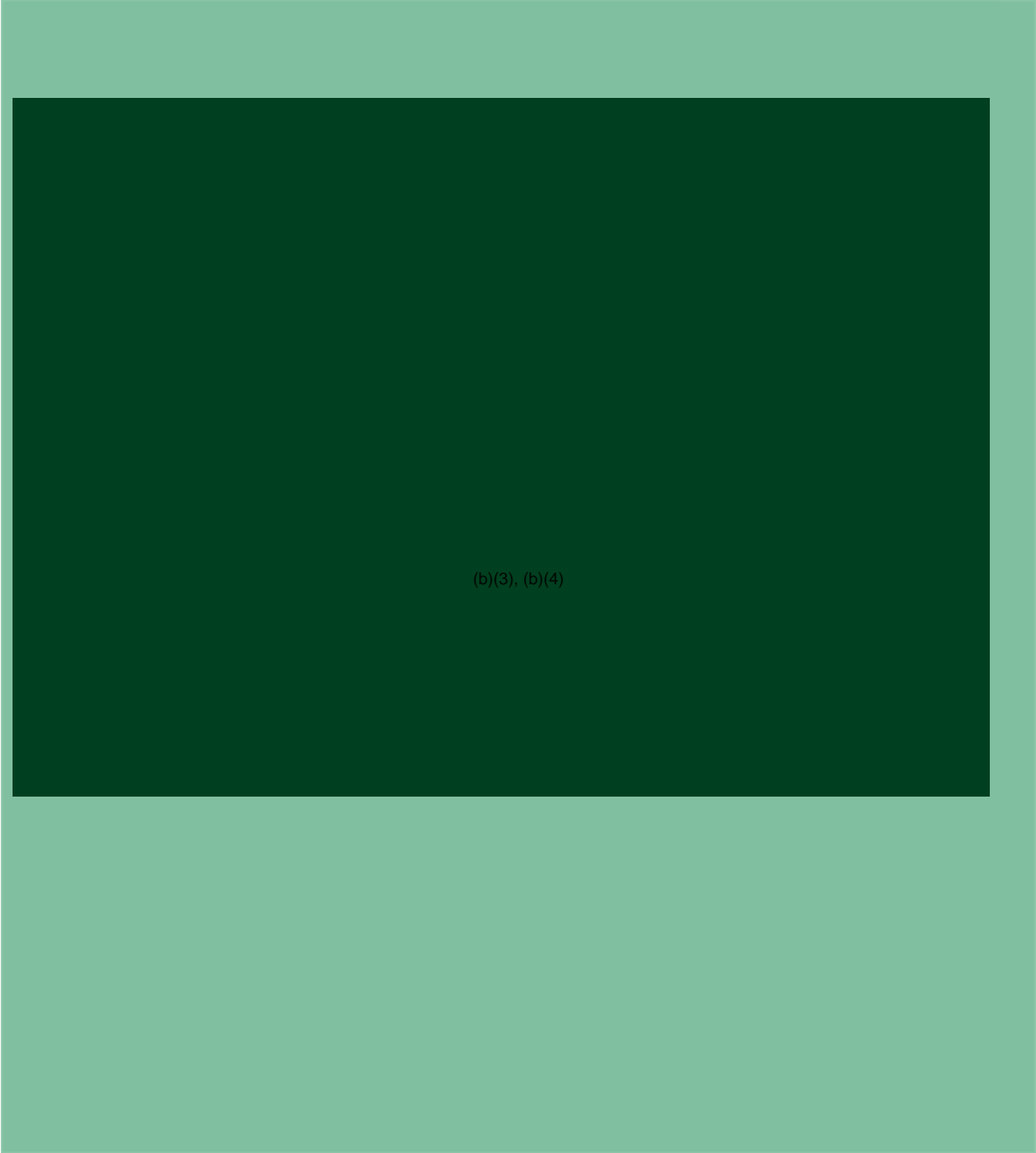




(b)(3), (b)(4)







(b)(3), (b)(4)





(b)(3), (b)(4)

Once the MA CSMU data was extracted and processed, select CSMU information was used to build the event summary in Table 3 below. CSMU AC times and Zulu times are provided for each event.

Table 3. MA Event Summary

| CSMU AC Time (s) | Zulu Time h:mm:ss.fs | Event                             | Comment   |
|------------------|----------------------|-----------------------------------|---|
| 1800.42          | 16:42:54.9           | Takeoff                           | Based on recorded L/N/R weight-off-wheels (WOW) events    |
| 4194.97          | 17:22:49.5           | Recovery to Joint Base Charleston | Based on northwesterly heading, level at 5,000 feet MSL   |
| 4605.13          | 17:29:39.6           | Landing Gear (LG) DOWN            | LG Down = 1   |
| 4605.14          | 17:29:39.6           | LG Handle DOWN                    | LG Handle Posn = 1  |
| 4673.81          | 17:30:48.3           | Conversion button pressed         | Lift Fan Engaged = 1                                      |
| 4688.31          | 17:31:02.8           | FCS Conversion Mode 4             | Remains in Jetborne Mode 4 (STOVL) until AC time 4783.29s |
| 4750.65          | 17:32:05.2           | ICC1 Voltage drop #1              | First ICC1 voltage drop                                   |
| 4750.85          | 17:32:05.4           | ICC1 Voltage drop #2              | 28V battery also begins discharging                       |
| 4750.89          | 17:32:05.4           | ICC1 Voltage recovers             | Transient voltage drop lasted 0.24 seconds                |
| 4761.06          | 17:32:15.6           | 28V battery not discharging       |   |
| 4771.59          | 17:32:26.1           | Landing Gear UP                   | LG Down = 0   |
| 4771.61          | 17:32:26.1           | LG Handle UP                      | LG Handle Posn = 0  |
| 4783.12          | 17:32:37.6           | Conversion button pressed         | Lift Fan Engaged = 1                                      |
| 4791.78          | 17:32:46.2           | Ejection                          | Seat Occupied = 0   |
| 4796.72          | 17:32:51.2           | FCS Conversion Mode 1             | Converts to Wingborne Mode 1 (CTOL)                       |
| 5473.32          | 17:44:07.8           | Last Recorded Data                | MA flew 11 min 21 secs after ejection                     |

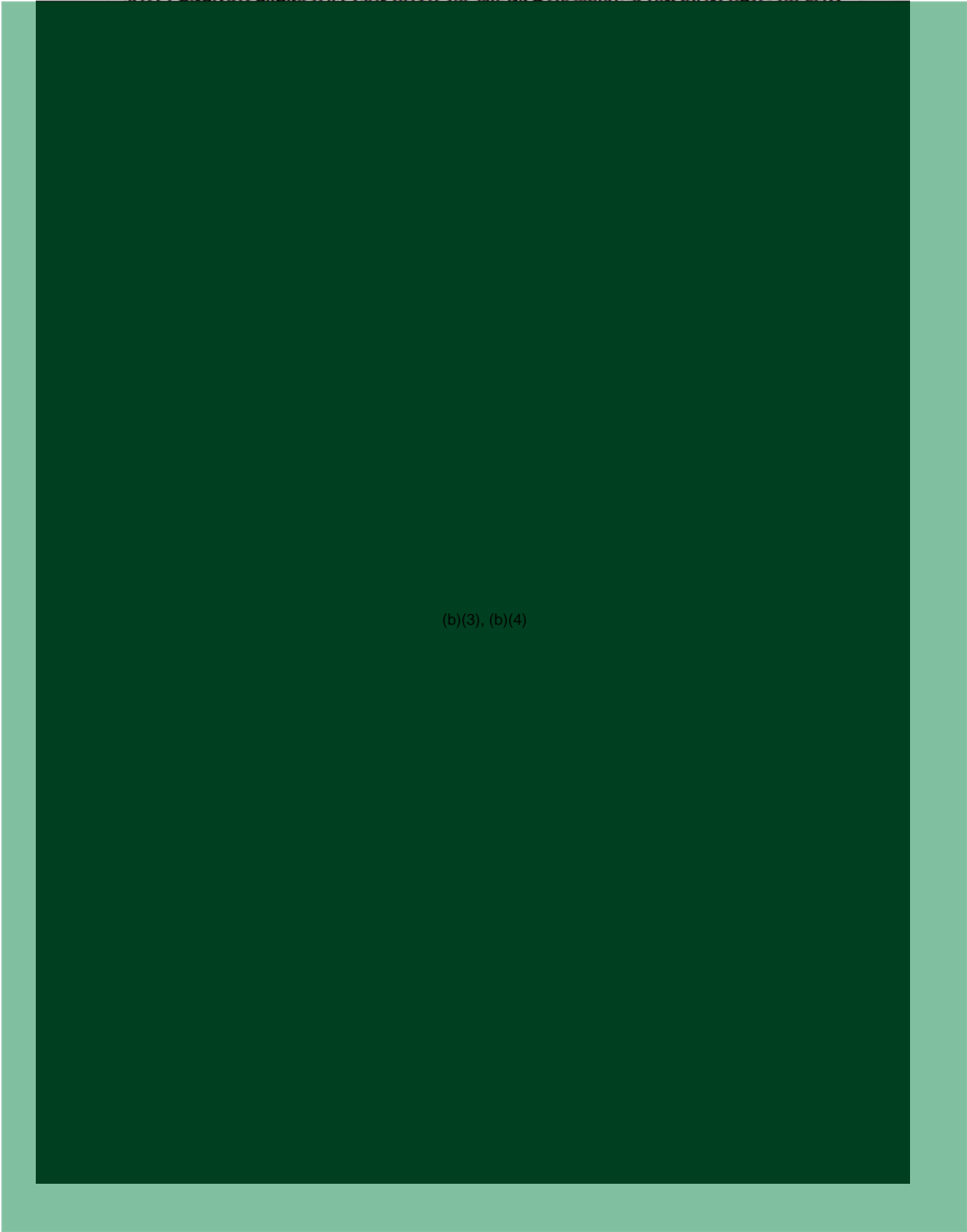


(b)(3), (b)(4)



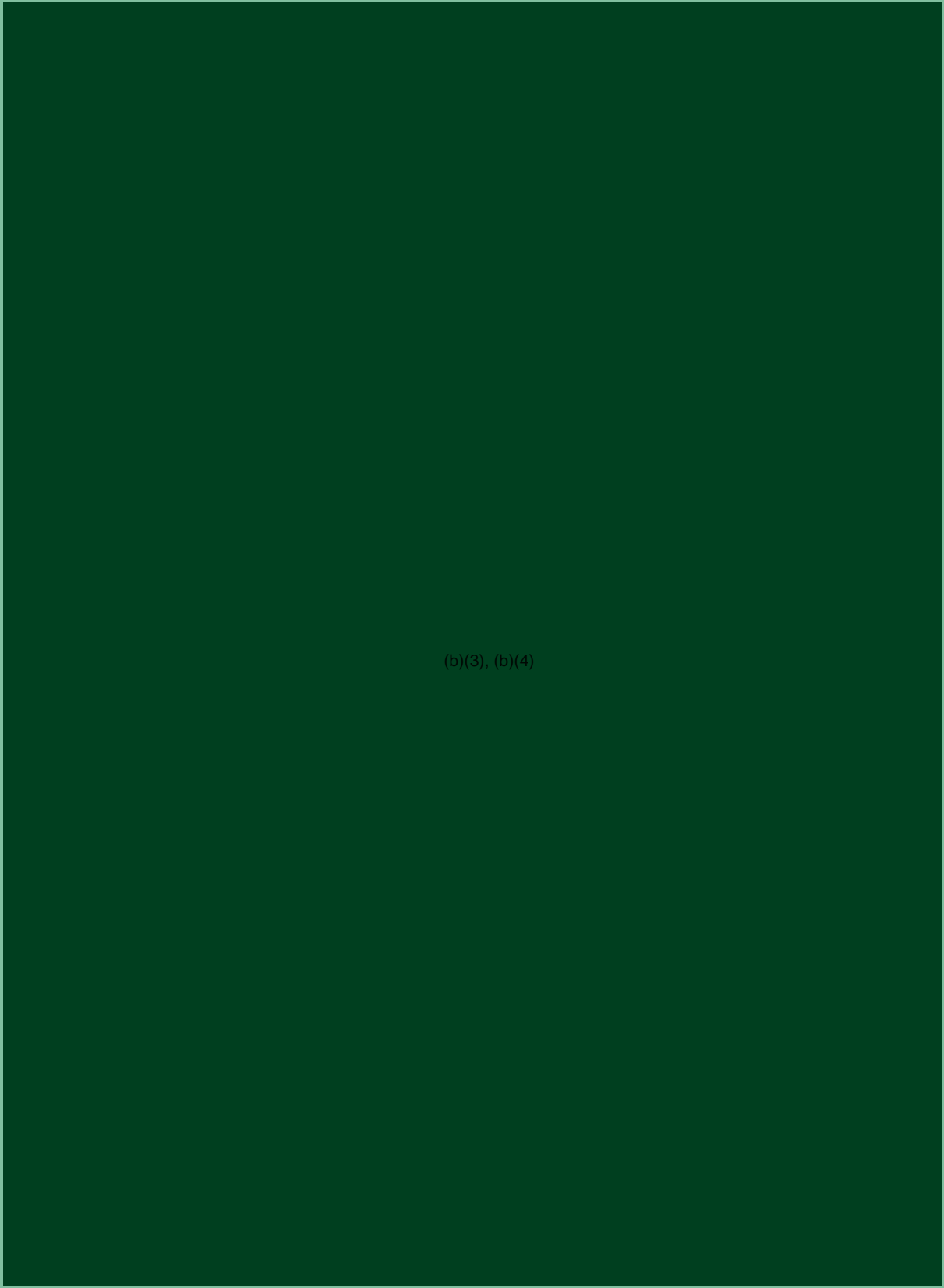


SELECT ANALOG PARAMETERS (S/N 169591 (BF-66) MCAS Beaufort SC) INCIDENT DATE: 20230917



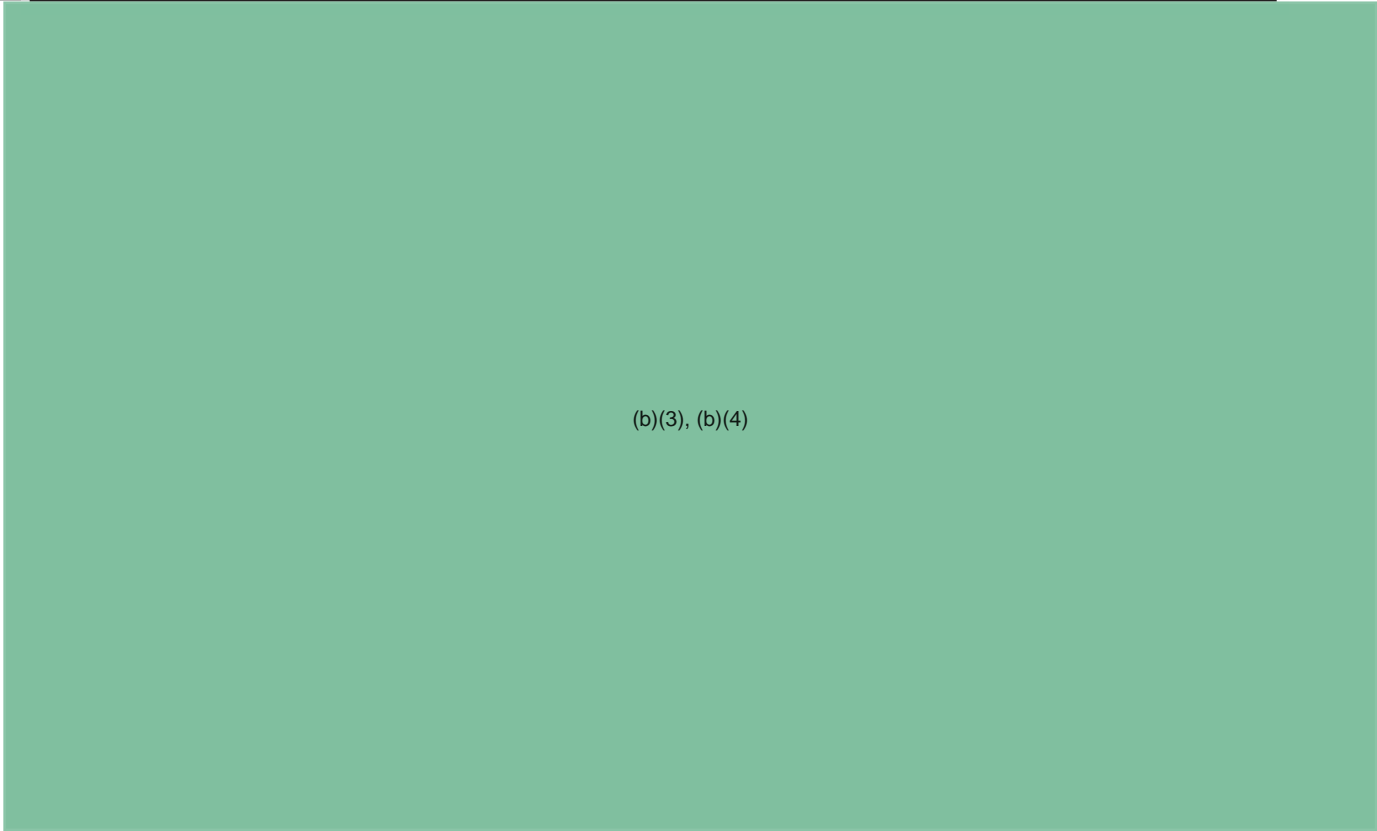
(b)(3), (b)(4)





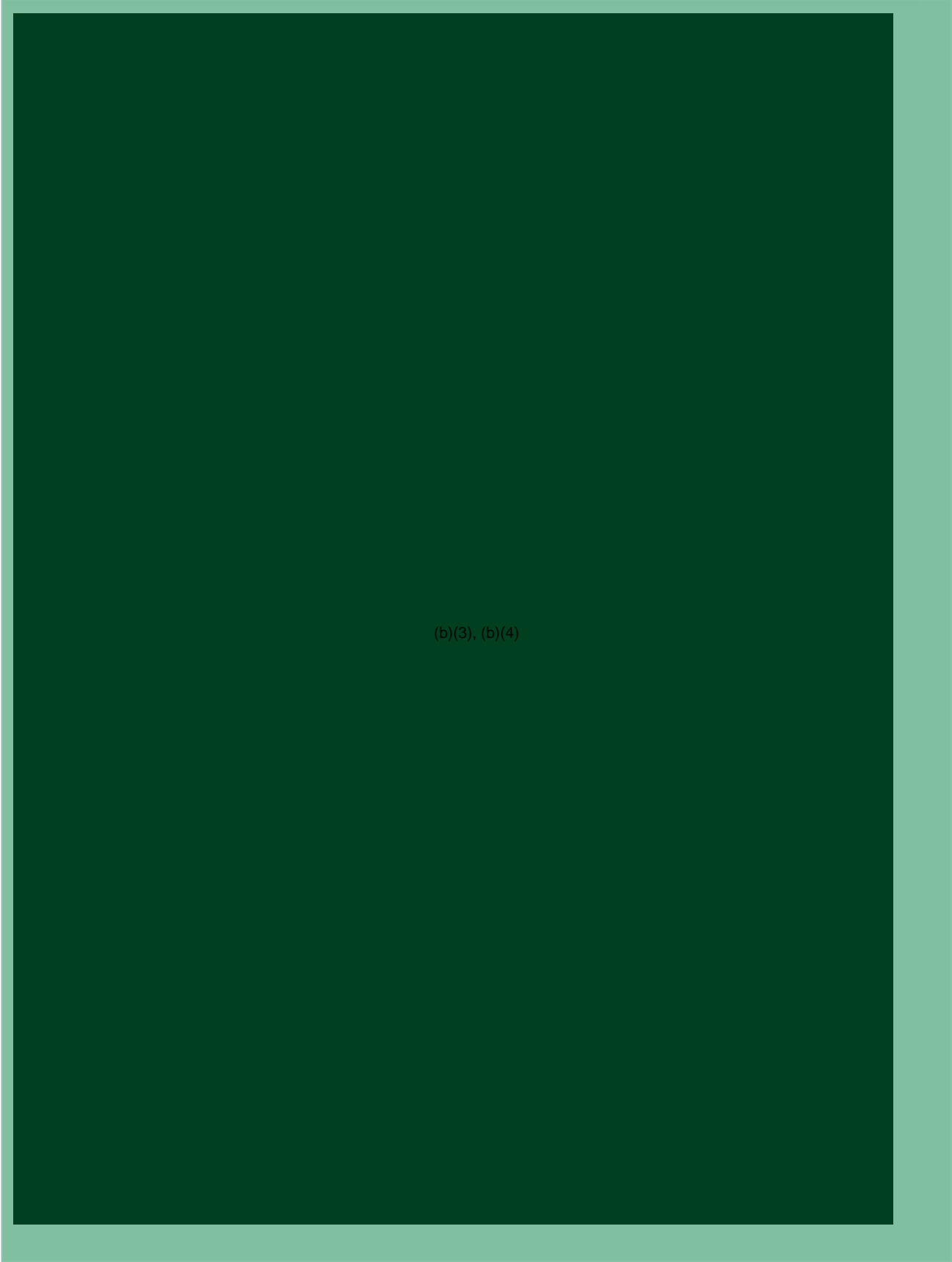
(b)(3), (b)(4)





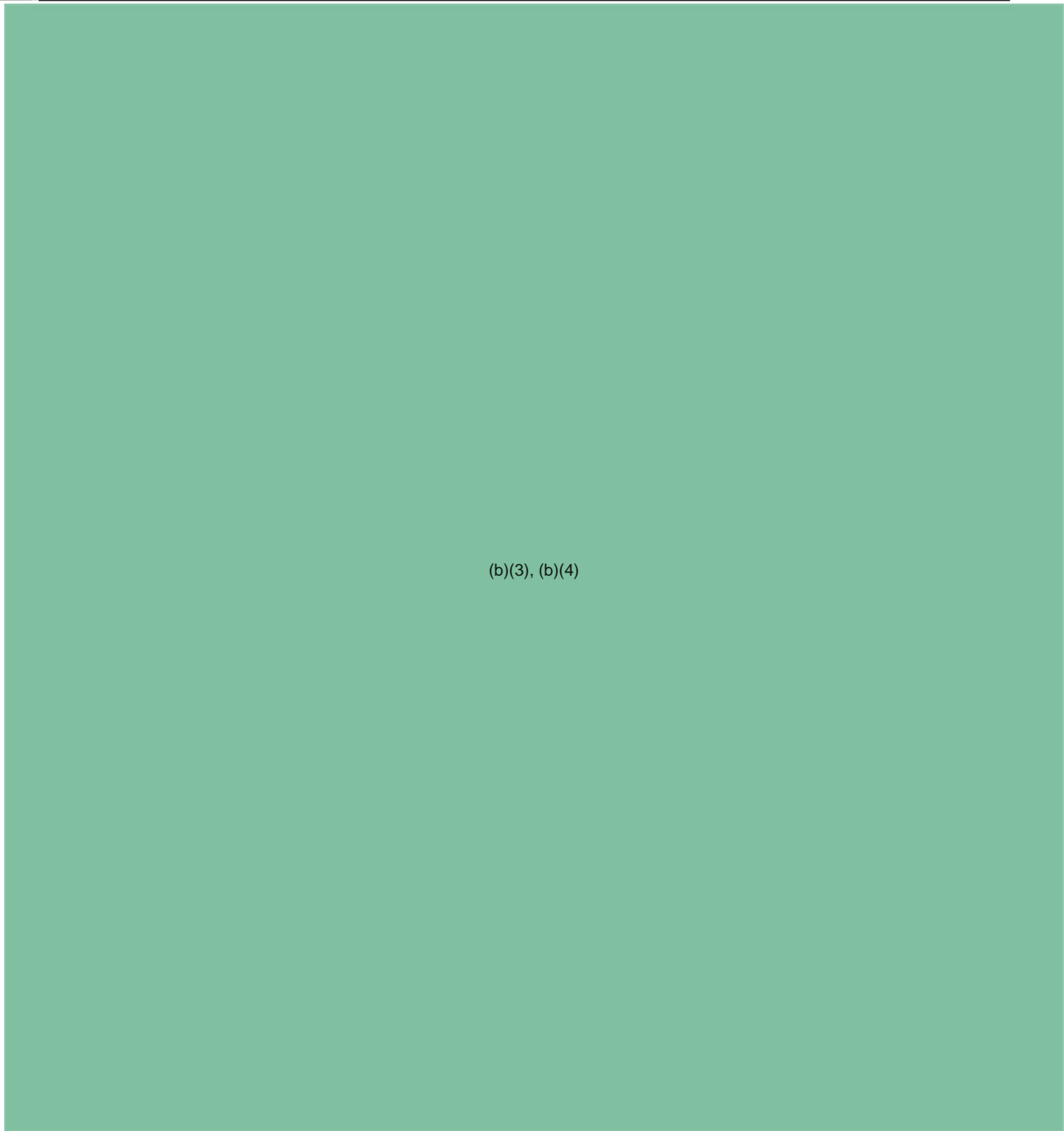
(b)(3), (b)(4)





(b)(3), (b)(4)

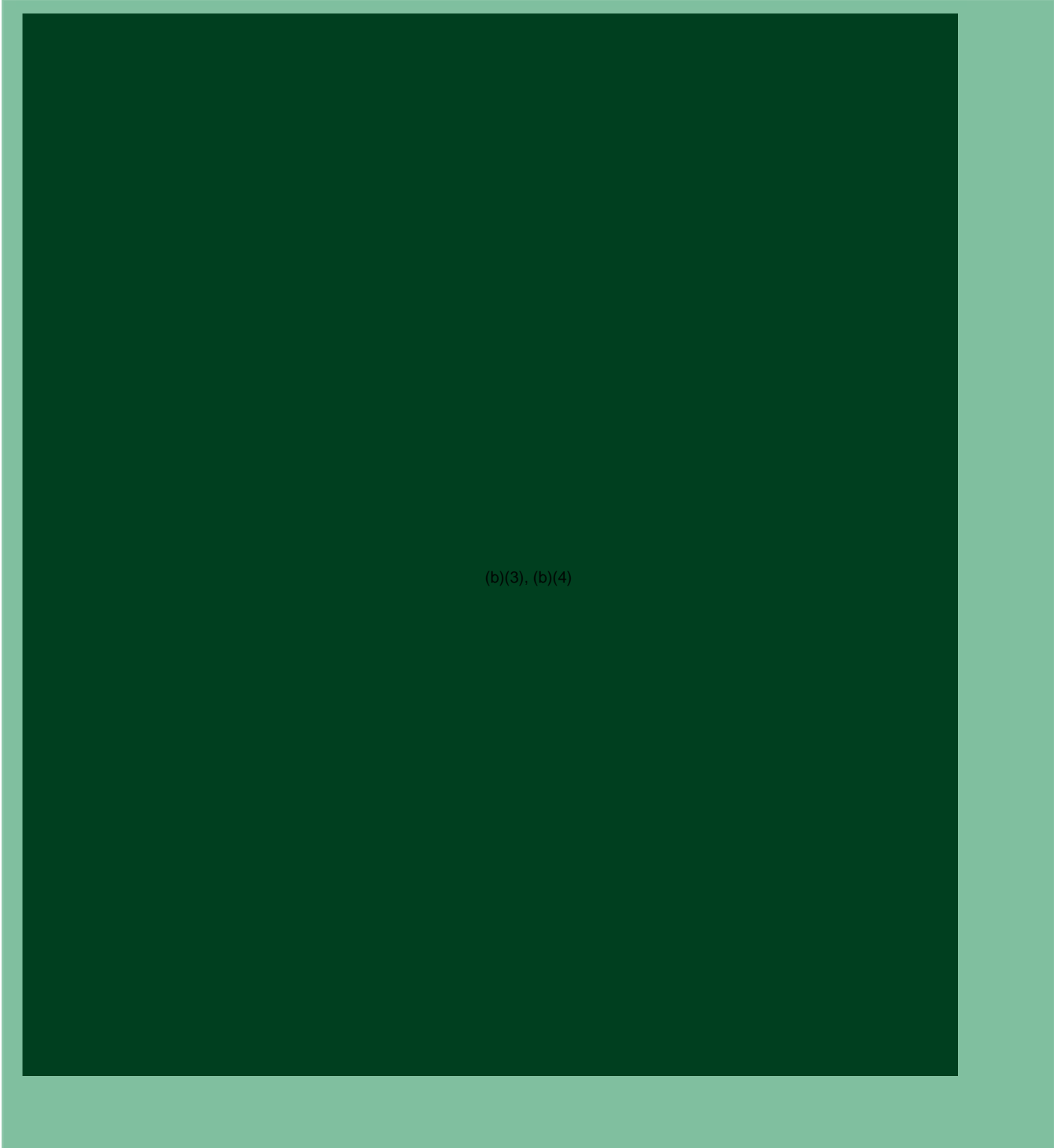




(b)(3), (b)(4)

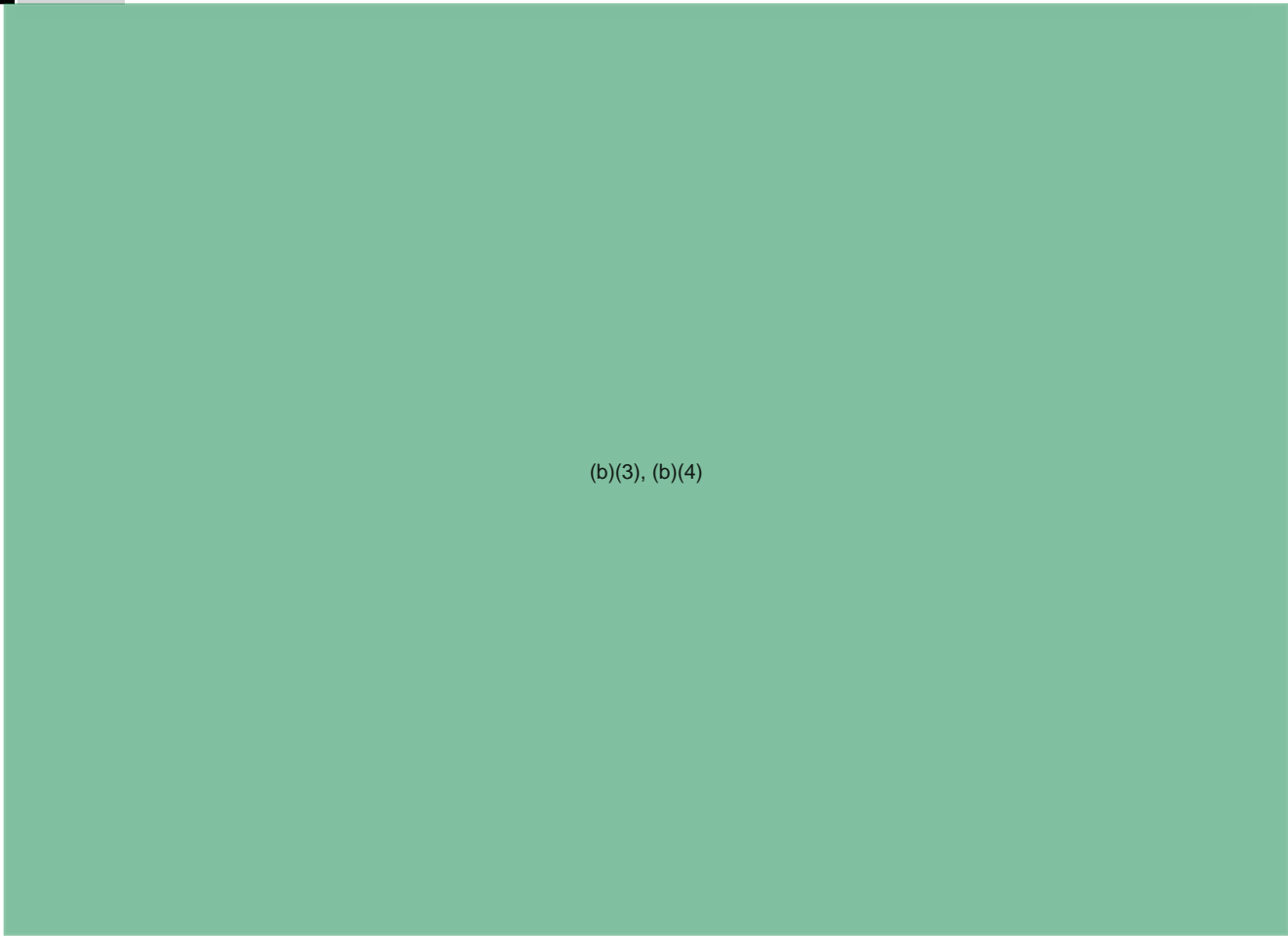






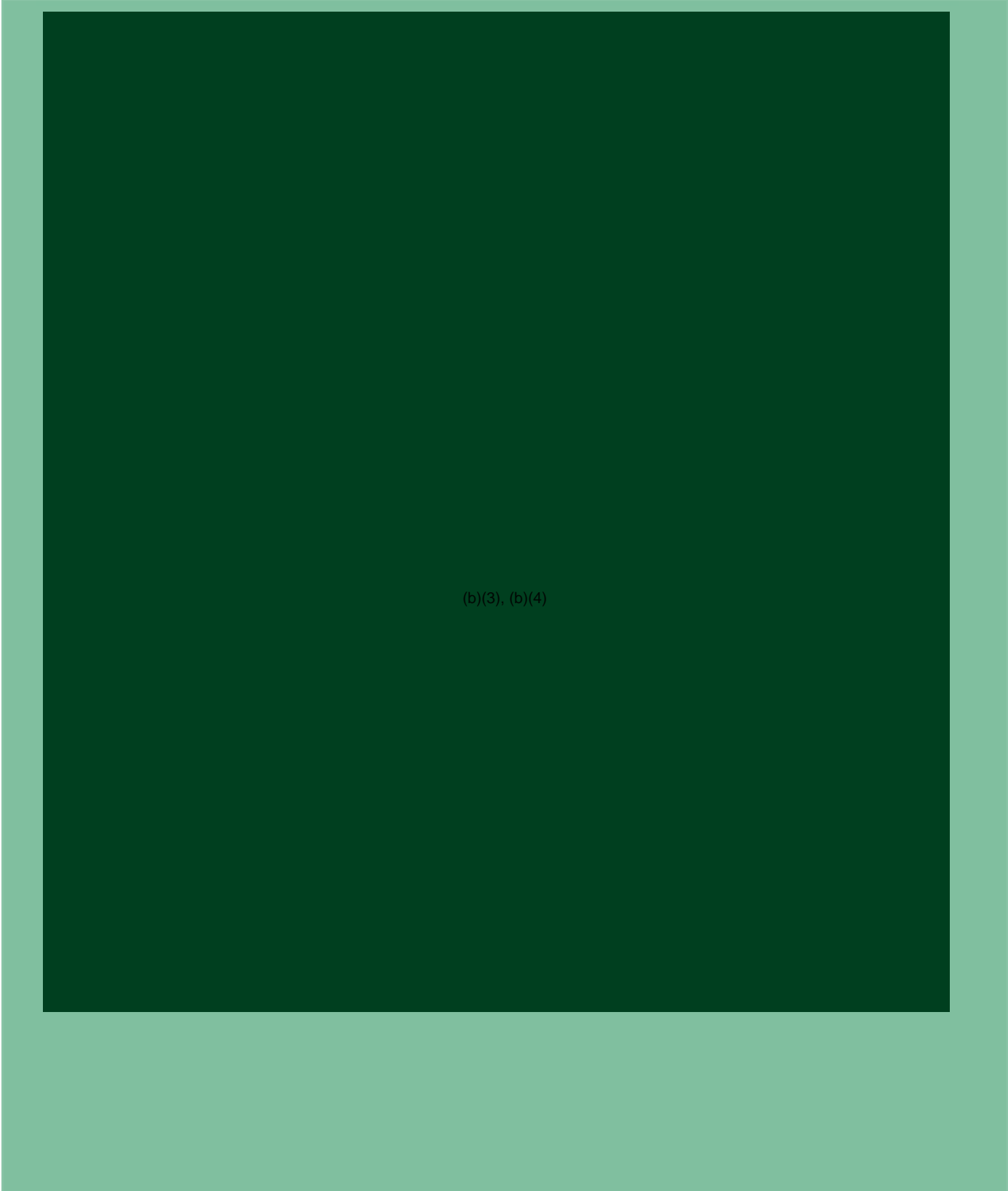
(b)(3), (b)(4)





(b)(3), (b)(4)





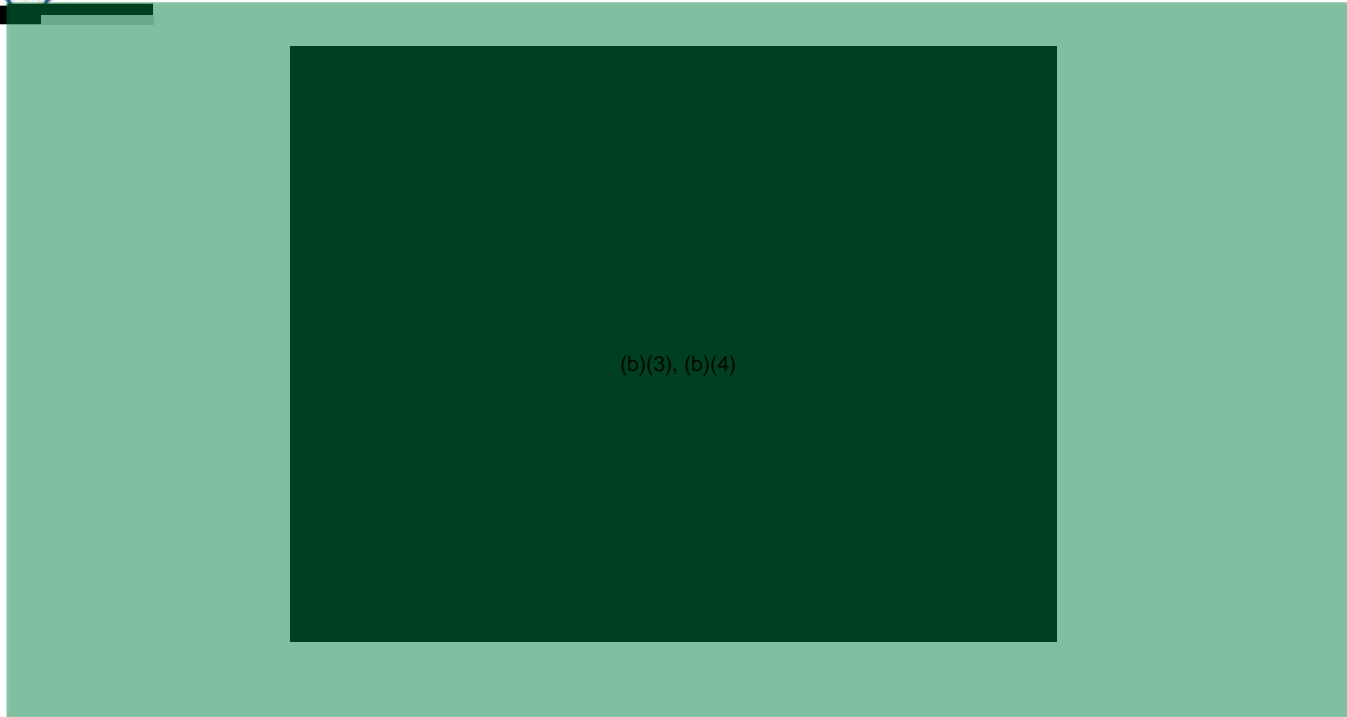
(b)(3), (b)(4)





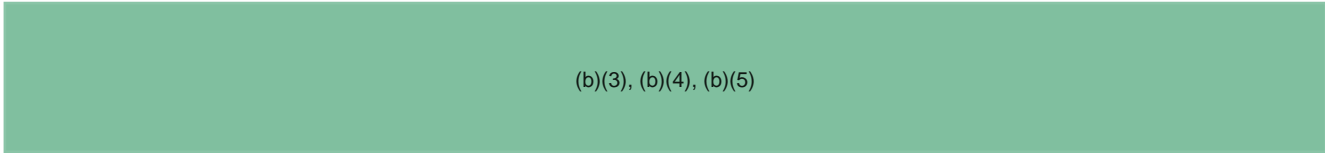
(b)(3), (b)(4)





(b)(3), (b)(4)

CONCLUSION: The MA CSMU was functioning and operating normally.



(b)(3), (b)(4), (b)(5)





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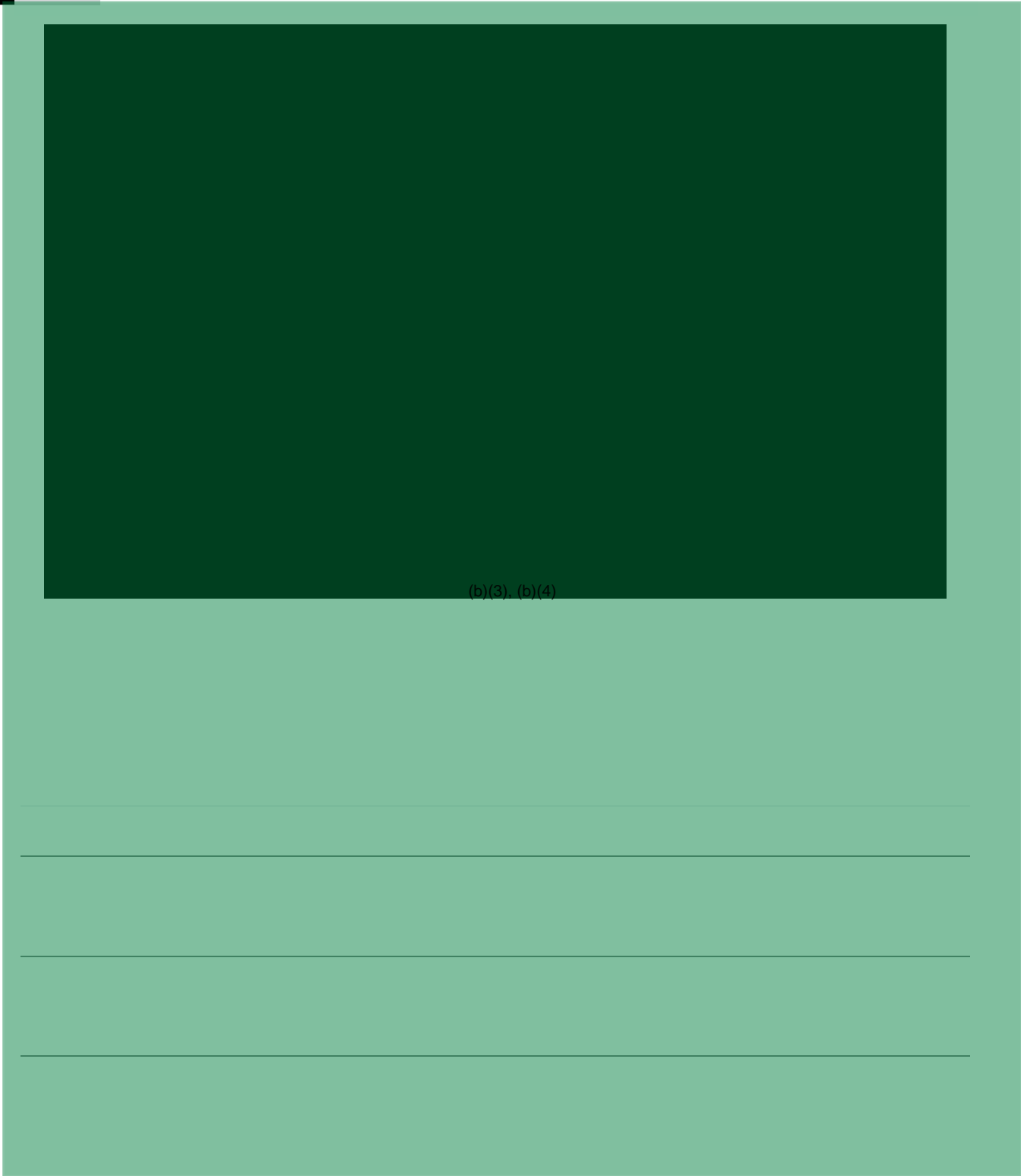
## **POWER AND THERMAL MANAGEMENT SYSTEM (PTMS)**

**DESCRIPTION:** The PTMS (in part) provides cooling and electrical power to the aircraft. It functions as an environmental control system (ECS) and auxiliary power unit (APU)/emergency power unit (EPU). The PTMS provides primary electrical power for ground maintenance and engine start through the IPP and engine starter/generator (ES/G). The IPP combines the conventional APU and EPU in a single mechanical power system. The APU function is accomplished by the electrical power management system, which delivers the required electrical power to start the main engine by converting shaft power generated by the power section of the IPP to electrical power.



(b)(3), (b)(4)





(b)(3), (b)(4)

ANALYSIS: The only faults noted in the MA CSMU data related to PTMS were all related to the nacelle fan. (b)(3), (b)(4) a stuck off fault for the nacelle fan (b)(3), (b)(4) was detected by PTMS and would have been annunciated to the MP (b)(3), (b)(4) The timing of the stuck off fault and corresponding indication to the MP (by COOL FAIL ENG ICAW) were as expected based on

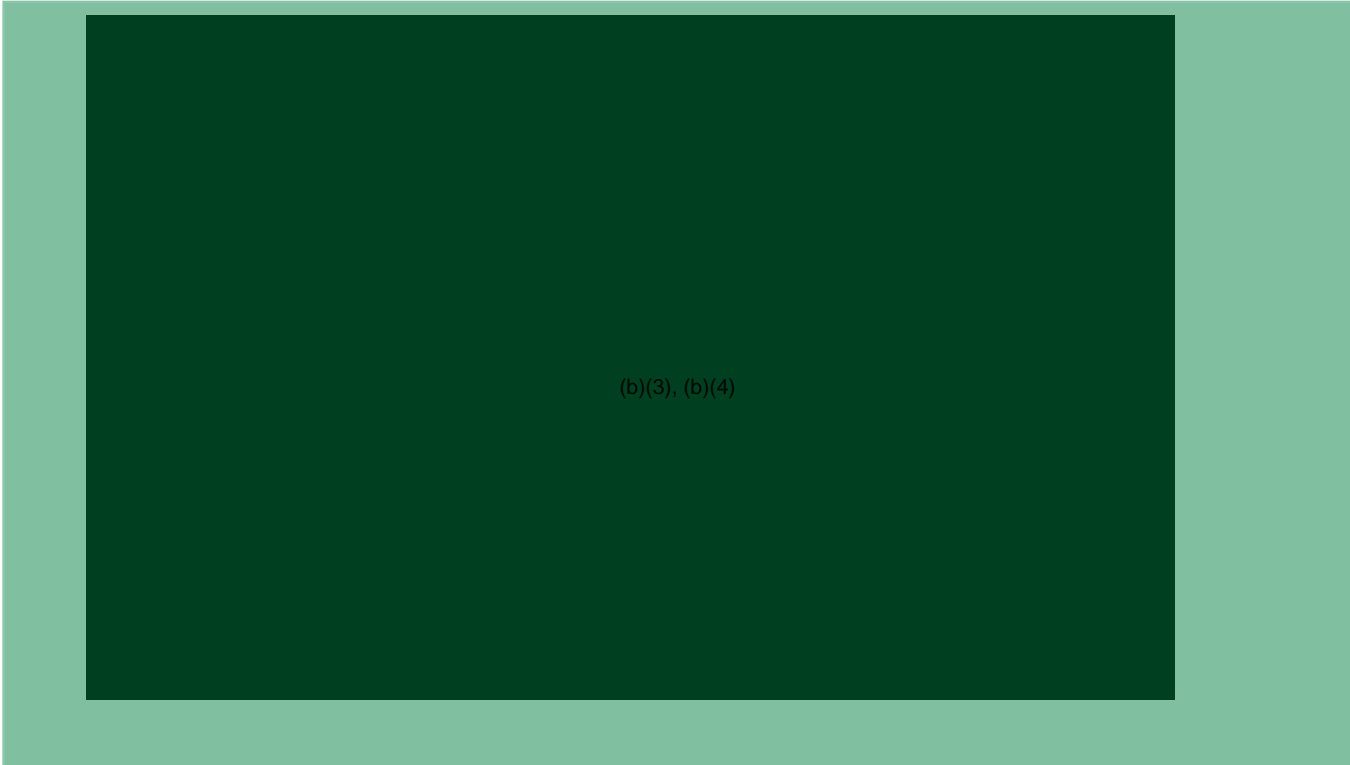




the persistence times used for these indications (b)(3), (b)(4)

(b)(3), (b)(4) the root cause of the stuck off fault was due to an electrical trip on its contactor (b)(3), (b)(4)

(b)(3), (b)(4). This is indicative of an electrical short likely occurring within the nacelle fan electronics (b)(3), (b)(4)  
(b)(3), (b)(4)



During the voltage drop as the electrical power system isolated the short from the rest of the system, there was also a temporary loss of the hot liquid PAO loop. This is an expected condition  
(b)(3), (b)(4)

CONCLUSION: The nacelle fan tripped its electrical power contactor. The electrical fault drove a power transient to half of the non-battery backed buses until the fault was isolated by the tripped contactor. PTMS performed in accordance with its design for the given nacelle fan fault condition.

RECOMMENDATION: None.







**AIR DATA SYSTEM (ADS)**

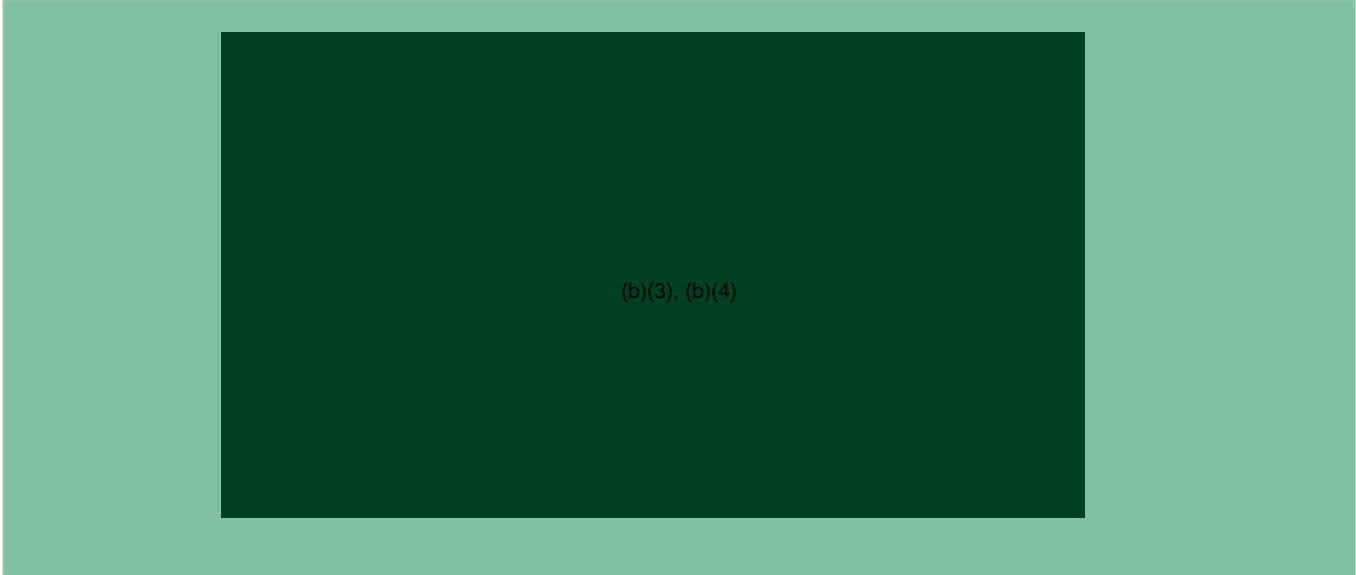
**DESCRIPTION:** The F-35 ADS consists of four line replaceable units (LRUs) - one left hand and one right hand multi-function probe (MFP), and one left hand and one right hand flush port module (b)(3), (b)(4). The left-hand side LRUs are mirror images of the right-hand side LRUs. The left-hand side and right-hand side line replaceable components (LRCs) are otherwise functionality identical.

The fully dual-redundant MFPs sense, measure, and transmit local air data parameters to the aircraft's air data application (ADA) software hosted within the VMC (b)(3), (b)(4). (b)(3), (b)(4) The MFPs also sense and control redundant (b)(3), (b)(4) electrical power for regulation of the pitot-static probe de-icing and anti-icing heaters. Integration of each MFP's pitot-static probe, pressure sensors, and associated electronics into a single chassis precludes the need for interconnecting pneumatic lines typical of legacy aircraft.

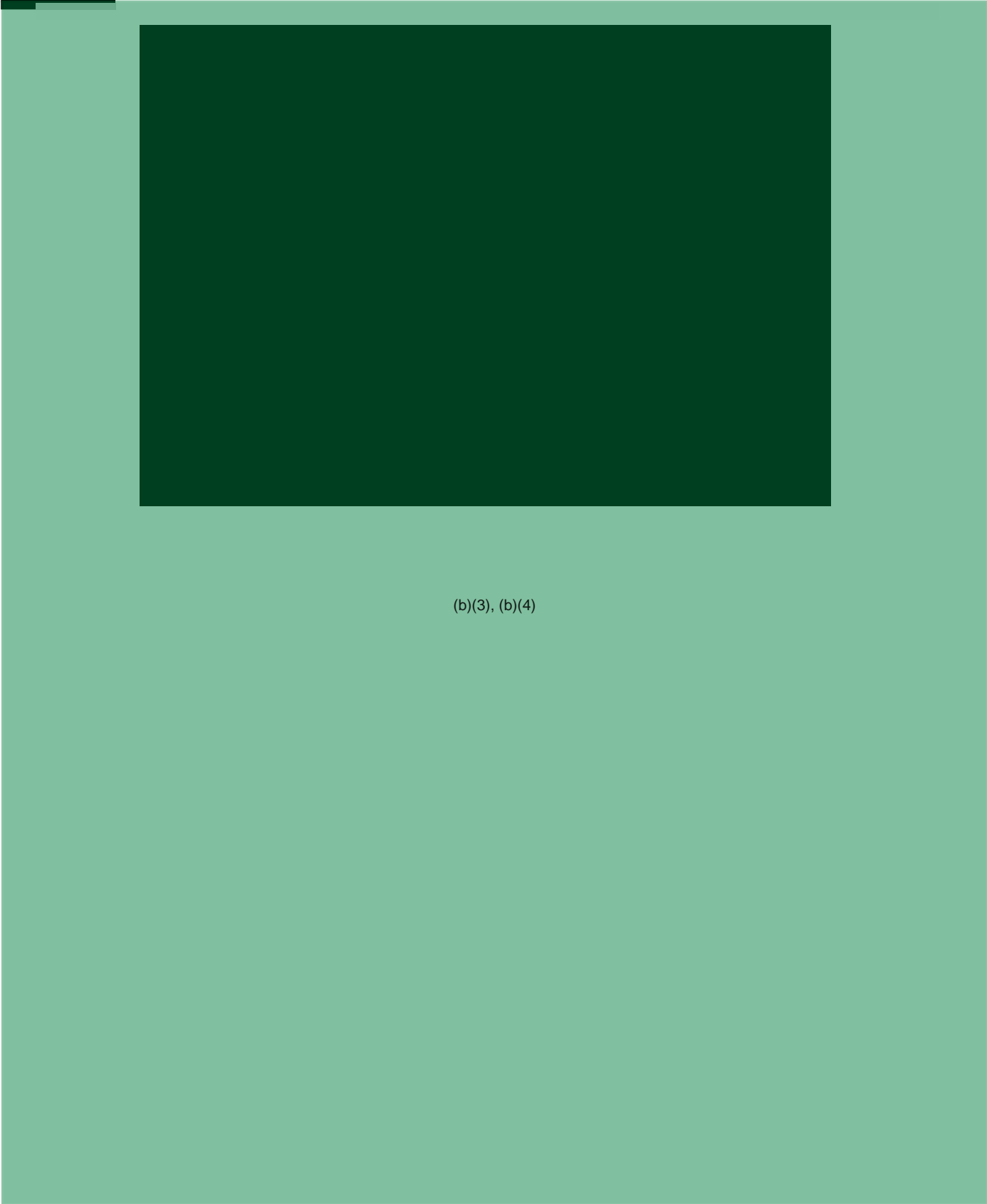
The fully dual-redundant flush port modules (FPMs) sense, measure, and transmit local static pressure to the ADA (b)(3), (b)(4). The FPMs also sense and control (b)(3), (b)(4) electrical power for regulation of the static ports de-icing and anti-icing heaters. Integration of each FPM's sensing ports, pressure sensors, and associated electronics into a single chassis precludes the need for interconnecting pneumatic lines typical of legacy aircraft.

The ADA utilizes information provided by the ADS to compute aircraft pressure altitude, calibrated airspeed, true airspeed, Mach number, angle of attack (AOA), and angle of sideslip (AOS). The ADA also provides air data parameters to pilot displays and other appropriate subsystems.

Fault monitoring, fault reporting, and redundancy management of the aircraft's air data function is performed at both the LRC level by hardware/software resident within the individual MFPs and FPMs as well as at the system level by the flight control system integrity monitor software resident within the VMCs.



(b)(3), (b)(4)



(b)(3), (b)(4)





(b)(3), (b)(4)





(b)(3), (b)(4)

CONCLUSION: Based on a review of the CSMU data, the ADS performed as designed.

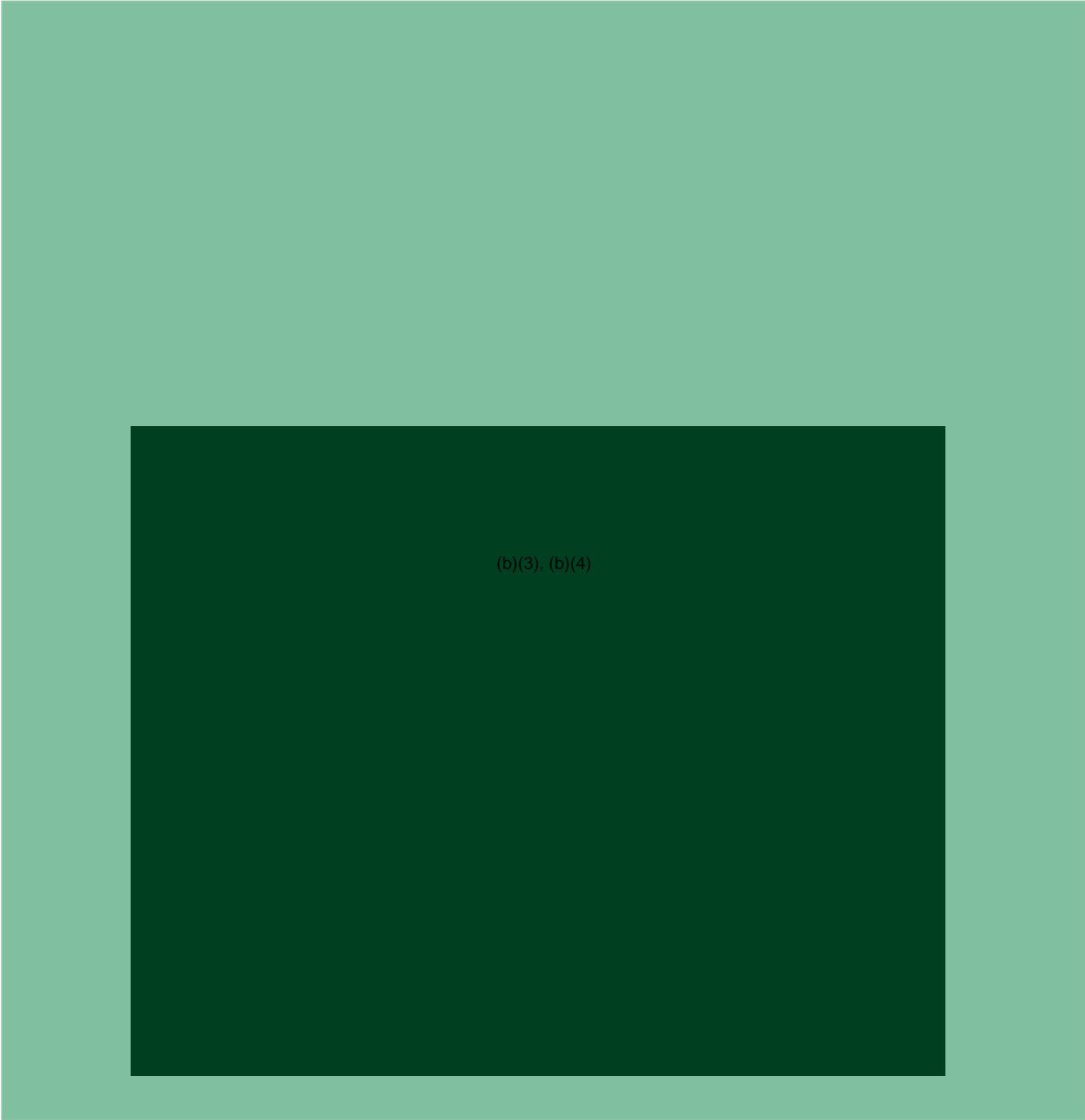
RECOMMENDATION: None





**ELECTRICAL POWER SYSTEM (EPS)**

DESCRIPTION: The EPS (b)(3), (b)(4) generates and distributes 270V power from (b)(3), (b)(4) two inverter converter controllers (ICC) which receive an isolated unregulated power input from the engine starter generator (ESG). With the engine running at ground idle or higher, each ICC is capable of providing (b)(3), (b)(4) while regulating output voltage at 270V that is distributed by an electrical distribution unit (EDU).

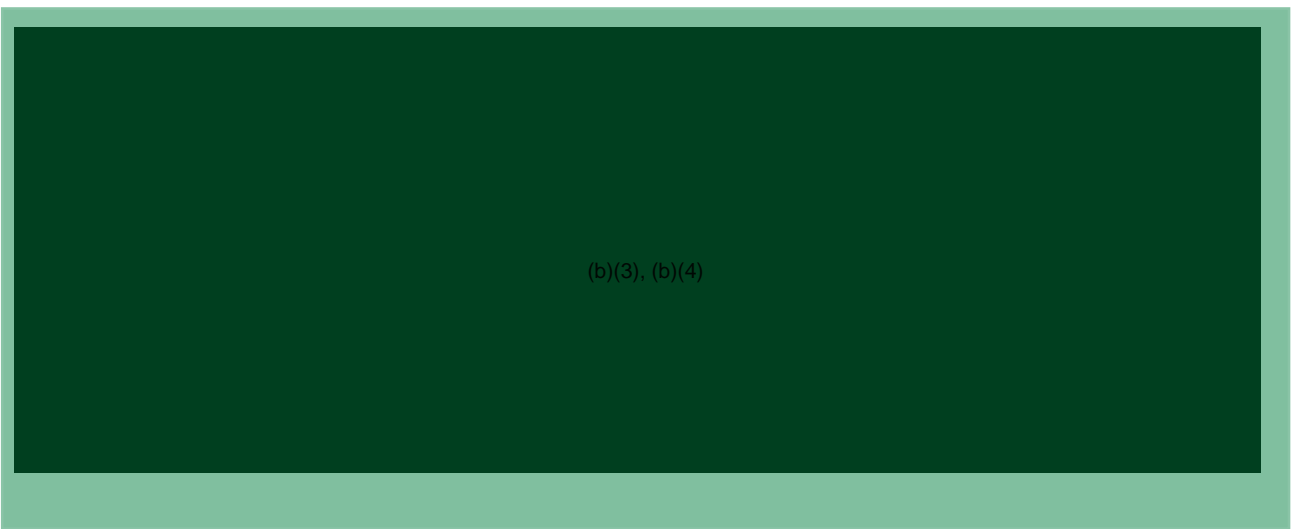




(b)(3), (b)(4)

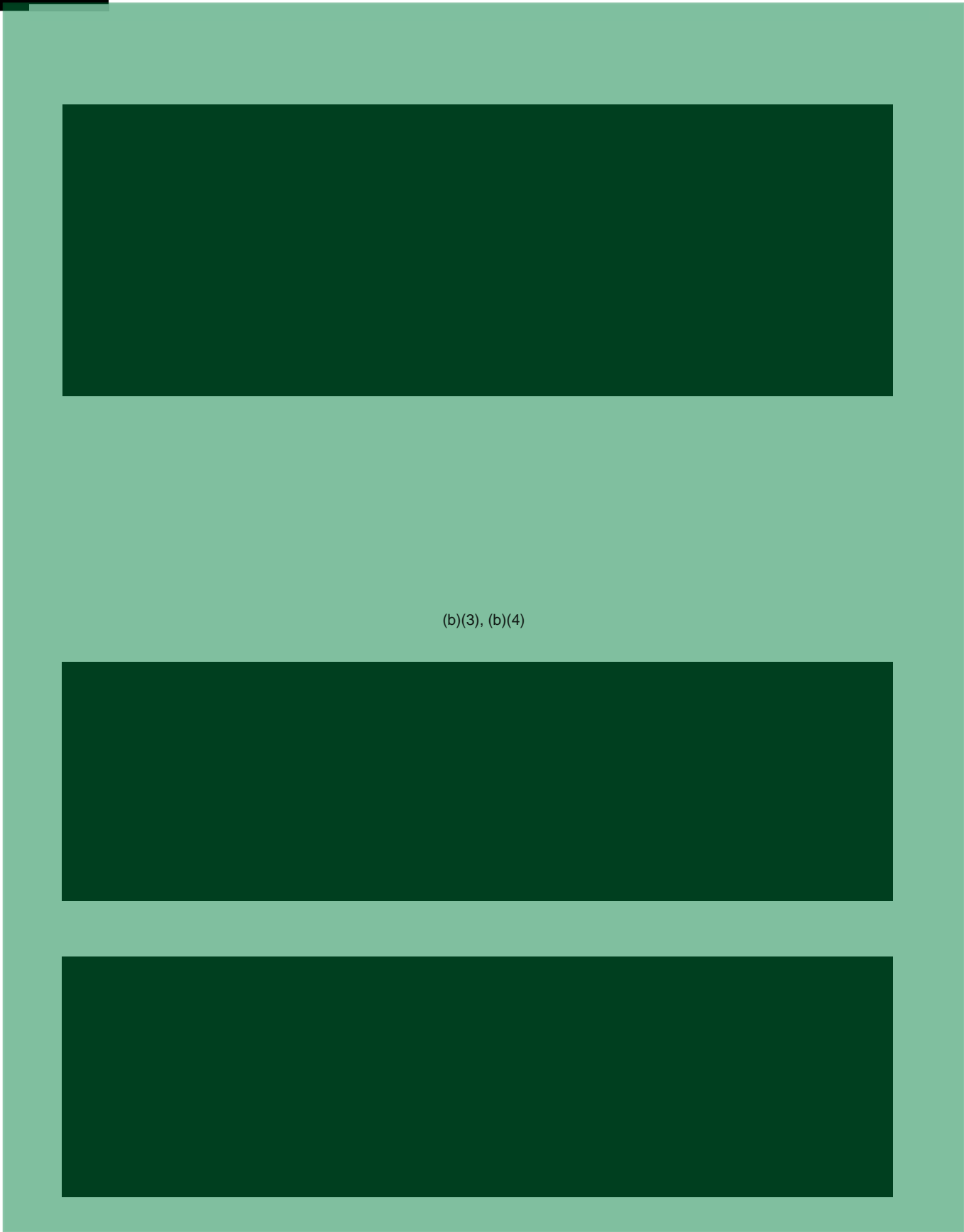
ANALYSIS: The MA CSMU data from AC time 4500s (17:27:54.5Z) to end was analyzed. During the flight, the EDU (b)(3), (b)(4) contactor output to the Nacelle Fan tripped while the aircraft was in Dual ICC/Hover mode. A momentary voltage drop was also observed on the ICC1 voltage output around the time the trip occurred. The voltage drop event was transient and did not persist long enough to set any EPS Bus Fail ICAWs. The (b)(3), (b)(4) batteries provided fill-in power to the battery-backed buses per design requirements during the voltage drop event. No EPS ICAWs or other anomalies were observed. (b)(3), (b)(4)

(b)(3), (b)(4) EPS Power State was in Dual ICC and did not change. At AC time 4673.85s (17:30:48.4Z), EPS Power Mode transitioned from Normal to Hover. At AC time 4796.65s (17:32:51.2Z), EPS Power Mode transitioned from Hover back to Normal and did not change for the remainder of the flight.



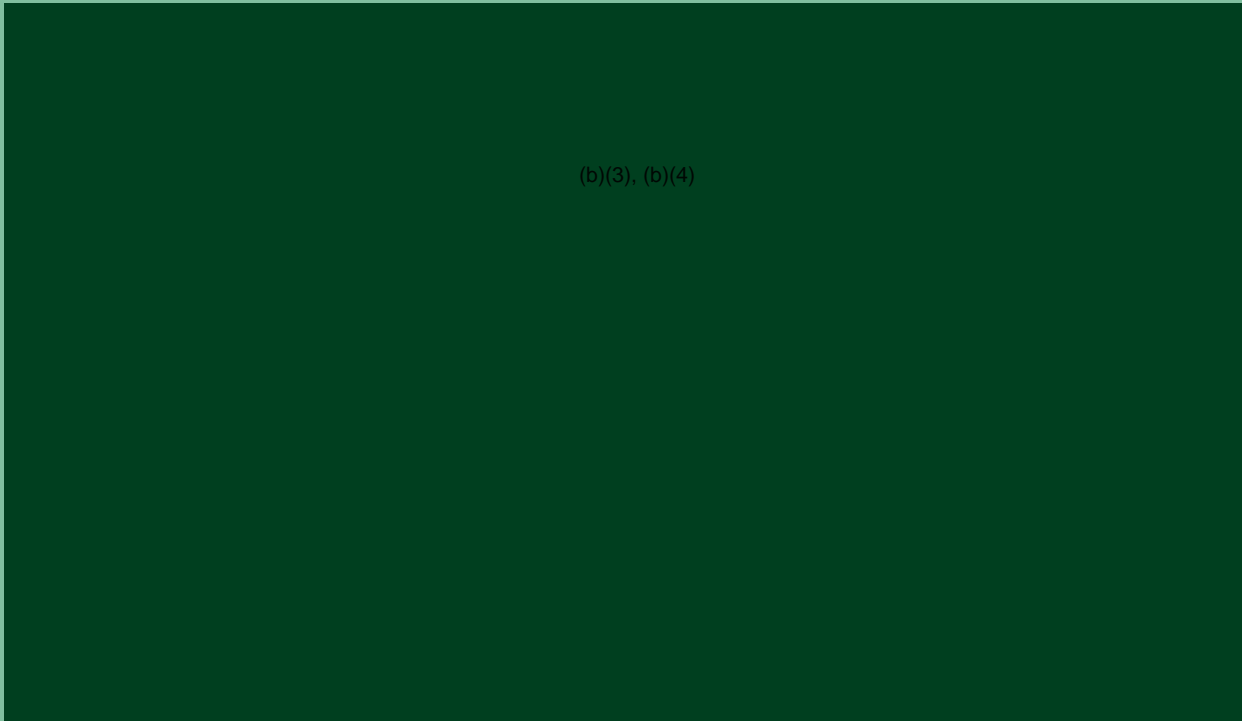
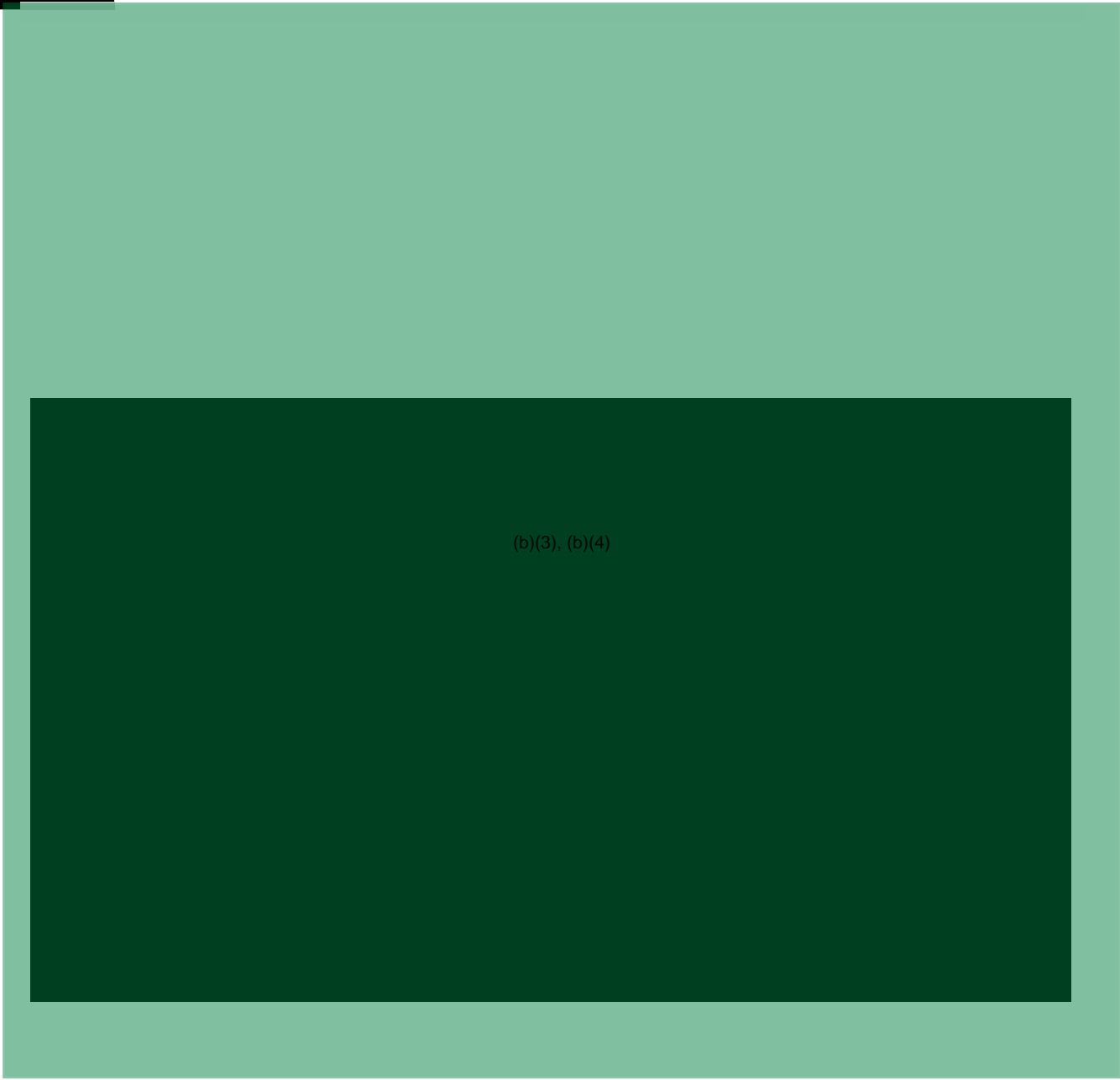
(b)(3), (b)(4)





(b)(3), (b)(4)





(b)(3), (b)(4)





(b)(3), (b)(4)





The MA CSMU data analysis of the electrical power system indicated the system performed as expected during the EDU(b)(3), (b)(4) overcurrent event. No further EPS anomalies were observed for the remainder of the flight.

CONCLUSION: The EDU(b)(3), (b)(4) contactor output to the Nacelle Fan tripped at AC time 4751.01s (17:32:05.5Z) due to an overcurrent event causing a transient voltage drop on the ICC1 voltage output.

RECOMMENDATION: None.

