DEPARTMENT OF THE NAVY
COMMANDER NAVAL AIR FORCE, PACIFIC
BOX 357051
SAN DIEGO, CALIFORNIA 92135-7051

5830
Ser N01J/3754
6 Dec 11

THIRD ENDORSEMENT on CDR (b)(3), (b)(6) USN, ltr of 26 Apr 11

From: Commander, Naval Air Force, Pacific
To: File

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING A VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 6 APRIL 2011

Ref: (c) COMNAVAIRPAC ltr 5830 Ser N01J/3728 of 1 Dec 11
(d) COMSTRKFIGHTWINGPAC/LANT INST 3700.2

1. This constitutes final action in this matter. The following is a brief summary of relevant facts:

a. On 6 April 2011, LT Lowe and LT Williams performed a Tactical Demonstration Flight of an F/A-18F Aircraft. During the execution of a maneuver called the "Loaded Roll" control of the aircraft was lost. Despite the aircrew's attempts to recover, the aircraft impacted the ground before the crew could safely eject and both officers perished.

2. After careful review of the subject investigation, the findings of fact, opinions, and recommendations of the investigating officer, as endorsed, are approved.

3. Per reference (c), it has been previously determined that LT Lowe's and LT William's deaths were in the line of duty and not due to their own misconduct.

4. The mishap was caused by the aircrew's failure to execute the maneuver in accordance with the prescribed airspeed and AOA parameters, their failure to promptly execute recovery procedures, and by systemic failures in the F/A-18 TACDEMO program. Demonstration aircrews were not referencing the TACDEMO instruction for specific requirements of the maneuvers. Additionally, the TACDEMO instruction's minimum requirement of four simulator practice flights was well short of the number

required for aircrew proficiency. The demonstration aircrew lacked understanding of the F/A-18E/F pirouette logic and the specific flight parameters that would have enhanced the safety margin of the Loaded Roll maneuver. Moreover, I am especially concerned that the mishap crew improperly performed the Loaded Roll Maneuver during three previous practice demonstration flights. Subsequent debriefs did not use replay devices, such as CVRS 8mm tapes and MFOQA data, which showed excessive AOA, and a vital opportunity to prevent the accident was lost.

5. The investigation pointedly demonstrates that leaders in the aviation community at all levels must stress vigilance and operational risk management in our daily operations. To that end, the administrative measures recommended by the investigating officer shall be expeditiously implemented to prevent a similar incident. I have ordered the removal of the "Loaded Roll" from future demonstration flights. The maneuver was developed for use by experienced test pilots and requires the focused training of skills not normally employed by or available to our TACDEMO pilots.

6. After discussion with CNAL leadership, the joint CSFWP/CSFWL TACDEMO instruction, reference (d), shall incorporate the recommendations of this investigation to provide for better oversight of the TACDEMO operations across the Naval Air Force. This instruction will be further modified to include the requirement that each TACDEMO Commanding Officer must certify that flight crews are ready to begin practice flights after completion of simulator training. The instruction must also provide for the vigorous periodic examination of the TACDEMO program by the establishment of an annual flight safety audit program for the F/A-18 TACDEMO program to be conducted by VX-9. This program will:

a. Review all CSFWP/CSFWL approved instructions, handouts, and in-flight reference material for safety of flight parameters and clarity; and

b. Report recommended program changes to CSFWP/CSFWL with copy to CNAF N45 and TACDEMO/Legacy PM (N3A2).

7. For consistency, Commanding Officer, Strike Fighter Squadron ONE TWO TWO, letter 5800 Ser 00/282 dated 20 May 2011 is hereby

numbered as page 26. Additionally, Commander, Strike Fighter Wing, Pacific Fleet, letter 5800 Ser N00/285 dated 21 June 2011 is hereby numbered as page 27.

8. By copy of this report, Commander, Naval Safety Center, is invited to consider utilization of this report's contents for Operational Risk Management (Human Factors) Case Study, Analysis and Recreational Mishap classroom instruction.

9. My point of contact is LCDR (b)(3), (b)(6) JAGC, USN, who can be reached by phone at (b)(6) or by E-mail at (b)(3), (b)(6) @navy.mil.

A. G. MYERS

Copy to:
COMNAVPERSCOM
COMNAVSAFECEN
COMSTRKFIGHTWINGPAC
VFA-122
CDR (b)(3), (b)(6)

DEPARTMENT OF THE NAVY
COMMANDER STRIKE FIGHTER WING
U.S. PACIFIC FLEET
001 K ST BLDG 1 RM 121
NAS LEMOORE CA 93245-5022

IN REPLY REFER TO
5800
Ser N00/285
21 Jun 11

SECOND ENDORSEMENT on CDR (b)(3), (b)(6) , USN, ltr of
26 Apr 2011

From: Commander, Strike Fighter Wing, U.S. Pacific Fleet
To: Commander, Naval Air Forces

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING A VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 6 APRIL 2011

1. Forwarded, concur with the recommendations of Commanding Officer, Strike Fighter Squadron 122

(b)(3), (b)(6)

Copy to:
VFA-122

DEPARTMENT OF THE NAVY
STRIKE FIGHTER SQUADRON ONE TWO
NAVAL AIR STATION
LEMOORE, CALIFORNIA 93246-5122

5800
Ser 00/282
20 May 11

FIRST ENDORSEMENT on CDR (b)(3), (b)(6) USN, ltr of
26 Apr 2011

From: Commanding Officer, Strike Fighter Squadron 122
To: Commander, Naval Air Forces
Via: Commander, Strike Fighter Wing U.S. Pacific Fleet

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING A VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

1. Readdressed and Forwarded.

2. Concur with the opinion that the deaths of LT Matthew Ira Lowe and LT Nathan Hollingsworth Williams were in the line of duty and not as a result of their misconduct.

3. Concur with the basic proceedings, findings of fact, opinions, and recommendations of the investigating officer.

4. The F/A-18 Tactical Demonstration is currently suspended.

5. Strike Fighter Squadron 122, in conjunction with Strike Fighter Wings, U.S. Pacific and U.S. Atlantic Fleet, Strike Fighter Squadron 106, and experts from NAVAIR, the U.S. Air Force Tactical Demo Team and the U.S. Navy Blue Angels have conducted a thorough review of the F/A-18 Tactical Demo Air Show as outlined in recommendation (2). Recommended changes have been forwarded to Commander, Naval Air Forces for review. Strike Fighter Squadron 122 will resume the F/A-18 Tactical Demo Air Show when authorized by Commander, Naval Air Forces.

(b)(3), (b)(6)

26 Apr 11

From: CDR (b)(3), (b)(6) , USN
To: Commanding Officer Strike Fighter Squadron 122

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING A VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

Ref: (a) JAGMAN
(b) OPNAVINST 3710.T

Encl: (1) Strike Fighter Squadron 122 Flight Schedules 21DEC10-06APR11
(2) Cost of Data for Aircraft, Onboard Equipment and Flight Gear
(3) Aviation Safety Officer's Course Diploma for Investigation Officer
(4) Flight Log Book entries for LT Matthew I. Lowe
(5) Flight Log Book entries for LT Nathan H. Williams
(6) NATOPS Folder Qualifications for LT Matthew I. Lowe
(7) NATOPS Folder Qualifications for LT Nathan H. Williams
(8) Preliminary Autopsy Report for LT Nathan H. Williams, Autopsy Number: ME11-0199/A11-20
(9) Preliminary Autopsy Report for LT Matthew I. Lowe, Autopsy Number: ME11-200/A11-21
(10) NAVAIR MIST Egress System Assessment, BUNO 165877
(11) VFA-122 E/F High Demonstration Kneeboard Card
(12) VFA-122 SHARP Currency spreadsheet
(13) Copy of Weapon System Officer Kneeboard Card for VFA-122 F/A-18F Flight Demonstration
(14) Copy of VFA-122 Flight Demonstration High Show Maneuver Training Card
(15) Copy of VFA-122 Flight Demonstration Currency Tracker
(16) COMSTRKFIGHTWINGPAC INSTRUCTION 3700.2H Change 1
(17) COMSTRKFIGHTWINGPAC INSTRUCTION 3700.2H
(18) COMSTRKFIGHTWINGPAC INSTRUCTION 3700.2E-G
(19) STRIKE FIGHTER SQUADRON ONE TWO TWO INSTRUCTION 3710.1E
(20) NATOPS FLIGHT MANUAL F/A-18F AIRCRAFT A1-F18EA-NFM 000
(21) Initial Mishap Data Report VFA-122 06APR11
(22) Amateur Mobile Phone Video of Mishap 06APR11

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING AN VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

(23) Copy of Aircraft Discrepancy Book (ADB) with last 10 Flight's Maintenance Action Forms (MAFs), Daily, Turnaround and Post Flight Maintenance Forms
(24) Mishap crash site GPS coordinates
(25) Medical record review for mishap crew by Flight Surgeon CDR (b)(3), (b)(6)
(26) 72 Hour History for Mishap crew
(27) Biographies of mishap crew
(28) Photographs of Mishap Site
(29) Aerial Photographs of Mishap Site
(30) Weather Observations for NAS Lemoore for time period 04APR11-11APR11
(31) Flight demonstration list of Training Flights and Simulators for LT Matthew I. Lowe and LT Nathan H. Williams
(32) Statement from (b)(6), Boeing Chief Test Pilot
(33) NAVAIR reports and emails regarding BUNO 165877 Flight Control System during Mishap Flight
(34) NAVAIR Simulations from BUNO 165877
(35) Deployable Flight Incident Recorder Set (DFIRS) Data from BUNO 165877
(36) Extract from Boeing STL-99A0070 Rev A Report on High AOA F/A-18E/F
(37) Statement of CDR (b)(3), (b)(6), USN, VFA-122
(38) Statement of CAPT (b)(3), (b)(6), USN, CSFWP/CSFWL
(39) Statement of LT (b)(3), (b)(6), USN, VFA-122
(40) Statement of LT (b)(3), (b)(6), USN, VFA-122
(41) Statement of LT (b)(3), (b)(6) USN, VFA-122
(42) Statement of LT (b)(3), (b)(6) USN, VFA-122
(43) Statement of LT (b)(3), (b)(6) USN, CVW-9
(44) Statement of LT (b)(3), (b)(6) USN, VFA-122
(45) Statement from CDR (b)(3), (b)(6), USN, Eglin AFB
(46) Commanding Officer Strike Fighter Squadron One Two Two ltr 5830 Ser N00/182 of 12 Apr 11
(47) Extension Request of 25 Apr 11
(48) Extension Approval of 26 Apr 11
(49) Boeing St. Louis Demonstration Flight Preparation Plan dtd 16 July 2009
(50) Military Flight Operational Quality Assurance

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING AN VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

(MFOQA) data from LT Matthew I. Lowe FRS TACDEMO flight practices

(51) Statement from Assistant Fire Chief (b)(6), NASL Fire

(52) Statement from (b)(6), NASL Emergency Management Officer

(53) Statement from (b)(6), NAVFAC SW Environmental

Preliminary Statement

1. Pursuant to enclosure (46) and in accordance with reference (a), a command investigation was conducted to inquire into the circumstances surrounding a Class Alpha mishap involving the loss of an F/A-18F aircraft BUNO 165877 in the vicinity of NAS Lemoore on 06 April 2011.

2. In accordance with Title 10 USC 2255 and section 0241c(2) of reference (a), the Investigating Officer, a graduate of the Naval Aviation Safety Course, is qualified to conduct the inquiry into the facts surrounding the mishap.

3. Per enclosures (47) and (48), a 7-day extension for submission of this report was requested and granted. Extensions were necessary to ensure receipt and analysis of critical enclosures, primarily Engineering Investigation (EI) results of the CVRS cockpit tape and the final toxicology results.

4. Statements were obtained from the three observers who witnessed the mishap, CAPT (b)(3), (b)(6) CDR (b)(3), (b)(6) and LT (b)(3), (b)(6).

5. The investigating officer was able to observe a replay of the mishap flight from the Deployable Flight Incident Recorder Set (DFIRS) data that was recovered from BUNO 165877 at the crash site.

6. The NAVAIR analysis of the DFIRS data recovered from BUNO 165877 noted no system failures in the Flight Control System or Air Data Sensors during the mishap flight.

7. All reasonable available and relevant evidence was collected. There were no difficulties encountered during the conduct of this investigation.

8. The Aviation Mishap Board will maintain all original evidence.

9. LT (b)(3), (b)(6) , JAGC, USN, Staff Judge Advocate, NAS Lemoore assisted the Investigating Officer with legal advice during the course of this investigation.

FINDINGS OF FACT

1. F/A-18F Aircraft BUNO 165877 (EXPERT 51) was involved in a Class ALPHA Flight Mishap on 06 April 2011. The crewmembers perished from multiple blunt force injuries. [Enclosures (1), (2), (8), (9)]

2. Autopsies for the mishap aircrew showed that death was instant due to blunt force trauma. [Enclosures (8), (9)]

3. No other persons were killed or injured due to this mishap. [Enclosures (1), (37 - 39)]

4. The crash site is located on land owned by (b)(6) from Lemoore CA. The cleanup of the site is still in progress. [Enclosure (24)]

5. The crash site occurred on private property that was used for agriculture. [Enclosures (28)]

6. The mishap aircraft impacted the ground at N 36 19.449 W 119 58.229. The mishap aircraft was heading approximately 176 degrees magnetic at impact. Wreckage was distributed to the south of the impact point to a maximum of N 36 19.383 W 119 58.236. [Enclosures (24), (28), (29)]

7. The crash and subsequent emergency response caused damage to the irrigation system and the farm fields of (b)(6) . The

precise amount of the damage is unknown at this time. [Enclosures (51 - 53)]

8. The crash site was exposed to various environmental contaminants from the crash of BUNO 165877. [Enclosures (51 - 53)]

9. Environmental remediation is ongoing at this time. [Enclosure (53)]

10. LT Matthew I. Lowe and LT Nathan H. Williams were on board Expert 51, BUNO 165877, when the mishap occurred. All crewmembers were active duty US Navy assigned to VFA-122, Naval Air Station Lemoore, CA, during the mishap. [Enclosures (1), (2), (8), (9), (23), (28)]

11. LT Matthew I. Lowe, Pilot in Command, reported to VFA-125 on 20 July 2009. He was born on 20 November 1977. [Enclosures (9), (27)]

12. LT Matthew I. Lowe was a second tour Naval Aviator who was a designated F/A-18A-F Pilot in Command, F/A-18A-D Functional Check Flight (FCF) Instructor Pilot, and Instrument Rated Pilot with a total of 1492.6 flight hours and 117.9 in model (F/A-18E/F). He was current in all of his qualifications including, NATOPS Check, Instrument Check, Egress Training, Swim and Physiology, Aircrew Coordination Training, had current flight gear and a Medical up chit. [Enclosures (4), (6), (12)]

13. LT Matthew I. Lowe last flew a flight demonstration practice on 05 April 2011 logging 0.5 total hours. [Enclosures (1), (4)]

14. LT Matthew I. Lowe was considered a competent pilot. [Enclosures (37 - 39)]

15. LT Matthew I. Lowe's medical record contained no remarkable entries. [Enclosure (25)]

16. LT Matthew I. Lowe's Toxicology indicated no drugs or alcohol in his system. [Enclosure (25)]

17. LT Nathan H. Williams, Weapon System Officer, reported to VFA-122 on 25 January 2010. He was born on 11 June 1982. [Enclosures (8), (27)]

18. LT Nathan H. Williams was a second tour Naval Aviator who was designated an F/A-18F Weapon System Officer, F/A-18E/F NATOPS Qualified Instructor and Instrument Rated Weapon Systems Officer with a total of 1318.4 flight hours and 1118.2 hours in model. He was current in all of his qualifications including, NATOPS Check, Instrument Check, Egress Training, Swim and Physiology, Aircrew Coordination Training, had current flight gear and a Medical up chit. [Enclosures (5), (7), (12)]

19. LT Nathan H. Williams last flew a flight demonstration practice on 05 April 2011 logging 0.5 total hours. [Enclosure (1), (5)]

20. LT Nathan H. Williams was considered a competent Weapon System Officer. [Enclosures (37 - 39)]

21. LT Nathan H. Williams' medical record contained no remarkable entries. [Enclosure (25)]

22. LT Nathan H. Williams' Toxicology indicated no drugs or alcohol in his system. [Enclosure (25)]

23. F/A-18F Aircrew is defined as both the Pilot in Command and Weapon System Officer. [Enclosure (20)]

24. Mishap aircrew began their training for the FRS F/A-18F Demonstration on 21 Dec 2010. [Enclosures (1), (31)]

25. CSFWP/CSFWL FRS TACDEMO Instruction 3700.2H requires a minimum of 3 Demonstration practice flights and 4 simulator practices before the TACDEMO check ride flight for all potential FRS TACDEMO aircrew. [Enclosures (16), (17)]

26. Boeing Flight Demonstration Preparation Plan requires 22 simulators and 17 practice flights prior to any air show flight demonstration qualification for a 500 feet AGL minimum altitude. [Enclosure (47)]

27. LT Matthew I. Lowe completed 18 Flight Demonstration simulators during his training for the FRS TACDEMO qualification. [Enclosures (1), (31)]

28. LT Nathan H. Williams completed 16 Flight Demonstration simulators during his training for the FRS TACDEMO qualification. [Enclosures (1), (31)]

29. LT Matthew I. Lowe flew 4 Flight Demonstration practices in the F/A-18F including the mishap flight. [Enclosures (1), (4), (31)]

30. LT Nathan H. Williams flew 2 Flight Demonstration practices in the F/A-18F including the mishap flight. [Enclosures (1), (5), (31)]

31. VFA-122 FRS TACDEMO currency tracker only requires TACDEMO Weapon System Officers complete 2 practice flights prior to qualification. [Enclosure (15)]

32. Mishap flight was scheduled, briefed and flown as a DEMO-004. DEMO-004 is intended to be the Standard Demonstration Check Ride using normal MINALTs. The mishap flight would have been the final TCADEMO practice training flight before the aircrew were FRS TACDEMO qualified. [Enclosures (1), (4), (5), (16), (17)]

33. Mishap crew briefed the mishap flight in accordance with VFA-122 Standard Operating Procedures and CSFWP/CSFWL FRS TACDEMO Instructions. Mishap aircrew met and briefed in the VFA-122 Ready Room for their crew brief. TACDEMO observer met with mishap crew for final guidance prior to crew walk. [Enclosures (17), (19), (39)]

34. Naval Air Station Lemoore weather prior and during the mishap flight was reported as 70 degrees Fahrenheit, winds out of the North at 14 knots gusting to 21 knots, visibility 10 nautical miles with the sky clear with no clouds or obstructions. [Enclosures (30)]

35. The last flight prior to the mishap flight was a day practice TACDEMO flown by the mishap aircrew on 05 April 2011. The Pilot in Command was LT Matthew I. Lowe and the Weapon Systems Officer was LT Nathan H. Williams. The aircraft was flown for 0.5 flight hours with no major discrepancies. [Enclosures (1), (4), (5), (23)]

36. A turnaround inspection was completed at 0534 06 April 2011 on aircraft 122, BUNO 165877, by CIV (b)(6) [Enclosure (23)]

37. A daily inspection was completed at 0534 06 April 2011 on aircraft 122, BUNO 165877, by CIV (b)(6) . [Enclosure (23)]

38. The acceptance sheet was signed by LT Matthew I. Lowe at 1100 06 April 2011. [Enclosure (23)]

39. Aircraft 122, BUNO 165877, was a Partial Mission Capable Aircraft. The aircraft was not delivered with MTU Mount and MTU (Magnetic Tape Unit) and the Dry Bay Fire Suppression System failed during the 28-Day for MSP 823. [Enclosure (23)]

40. Mishap aircrew completed their preflight at approximately 1115 with no discrepancies noted. [Enclosures (1), (23), (39)]

41. Mishap flight was scheduled for an 1145L takeoff and 1215L land time. [Enclosure (1)]

42. At approximately 1155L aircraft 122, BUNO 165877, started its takeoff roll for the beginning of the FRS TACDEMO. [Enclosures (34), (35)]

43. Mishap aircraft flight planned to execute the F/A-18F FRS TACDEMO. The F/A-18F FRS TACDEMO consists of 11 different maneuvers. The mishap occurred during the 8th maneuver named as the Loaded Roll. [Enclosures (1), (16), (17), (37 - 39)]

44. The FRS TACDEMO Loaded Roll Maneuver is preceded by the Square Loop Maneuver. [Enclosures (16), (17)]

45. Witness statements watching the mishap flight, stated they noticed no anomalous flight characteristics or maneuvers during the flight until the Loaded Roll Maneuver portion of the FRS TACDEMO. [Enclosures (37 - 39)]

46. Deployable Flight Incident Recorder Set (DFIRS) Data from BUNO 165877 showed no anomalous flight characteristics during the mishap flight. [Enclosures (33 - 35)]

47. NAVAIR Flight Dynamics Engineers from the Aeromechanics Safety Investigation Support Team state that there was no sign

of any Flight Control System (FCS) failures or problems during the mishap flight. [Enclosure (33)]

48. The Military Flight Operational Quality Assurance (MFOQA) data from the mishap aircraft, BUNO 165877, was reviewed for several flights prior to the mishap flight. No significant anomalies were seen. [Enclosure (33)]

49. A comprehensive review of the entire available past history of the mishap aircraft, BUNO 165877, was reviewed using automated tools to look for Angle of Attack (AOA) sensor issues. The comprehensive review found no indications of any problems with the AOA sensors. [Enclosure (33)]

50. NAVAIR Aeromechanics analysis concluded there were no system failures in the Flight Control System (FCS) or air data sensors during the mishap flight. [Enclosure (33)]

51. Review of DFIRS data using Boeing's simulation tool showed no significant issues with any of the mishap aircraft, BUNO 165877, systems. [Enclosures (34), (35)]

52. Review of the Aircraft Discrepancy Book (ADB) for the last ten flights showed 4 Maintenance Action Forms (MAFs). MAFs were written to document; Radar troubleshooting for a MSP 044, Heads Up Display (HUD) desiccant white, Starboard Main Mount was replaced for threads showing and removal of aft ARI. [Enclosure (23)]

53. At 12:06:02.80L the mishap aircraft, BUNO 165877, took a 5G 60 degree left hand turn cut away from NAS Lemoore runway 32L (show center).

a. At 12:06:07.550L and approximately 85 degrees Angle of Bank (AOB) Mishap Pilot inputted stick and rudder commands to start the loaded roll at 289 KCAS, 880 Feet Above Ground Level (AGL) and 15 degrees AOA. The Mishap Pilot selected Max Afterburner (AB), full right rudder and approximately full aft and half lateral right stick.

b. At 12:06:08.75L the mishap aircraft was wings level, 25 degrees nose up, 264 KCAS, 920' AGL, 5.1 G and 20.9

degrees AOA, and 6920 fpm Vertical Speed Indicator (VSI) with the same flight control inputs.

c. At 12:06:09.68L, the mishap aircraft was approximately 90 degrees right wing down, 35 degrees nose up, 247 KCAS, 1160' AGL and 21.6 degrees AOA and 7680 fpm VSI with the same flight control inputs.

d. At 12:06:10.75L, mishap aircraft was approximately 150 degrees right wing down, 15 degrees nose down, 228 KCAS, 1220' AGL, 4G, 30 degrees AOA and 2980 fpm VSI with the same flight control inputs.

e. At 12:06:11.85L, mishap aircraft was approximately 180 degrees right wing down or inverted, 61 degrees nose down, 210 KCAS, 1300' AGL, 3.2G, 39.1 degrees AOA and -4510 VSI fpm with approximately the same flight control inputs.

f. At 12:06:12.83L, the mishap aircraft was approximately 90 degrees left wing down, 63 degrees nose down, 178 KCAS, 1300' AGL and 42.5 degrees AOA and -9630 fpm VSI with the same flight control inputs.

g. At 12:06:13.56L, the mishap aircraft was approximately 60 degrees left wing down, 45 degrees nose down, 178 KCAS, 1220' AGL and 46.7 degrees AOA and -10970 fpm VSI with the Mishap Pilot neutralizing the right rudder and maintaining aft and half lateral right stick inputs.

h. At 12:06:15.95L, the mishap aircraft was approximately 25 degrees left wing down, 7 degrees nose down, 175 KCAS, 362' AGL and 46.2 degrees AOA and -9590 fpm VSI with all of the flight control inputs beginning to neutralize.

i. At approximately 12:06:16.20L the mishap aircraft impacted the ground. Mishap aircraft struck the ground at approximately 10 degrees left wing down and 5 degrees nose down. [Enclosures (34), (35), (38)]

54. Ejection was initiated at approximately 328-330 feet AGL. Based on the mishap flight parameters, the escape system would have had to be initiated at 350 feet AGL to safely recover the aft crewmember. The escape system would have to be initiated at 410 ft AGL to safely recover both aircrew assuming dual sequenced ejections via the inter seat sequencing system. [Enclosure (10)]

55. The mishap aircraft aft seat initiated the ejection sequence per the DFIRS data. The DFIRS data shows that the pilot was giving inputs to both the stick and throttle as the DFIRS was being jettisoned from the aircraft. Since the pilot had both hands on the controls at the time of DFIRS jettison, the mishap WSO had to initiate the ejection sequence. [Enclosure (10)]

56. The mishap aircraft aft ejection seat appeared to have functioned normally. The known and estimated aircraft airspeed and altitude indicates ejection seat should operate under Mode 1. The aft seat catapult fully stroked, indicating seat was clear of the aircraft prior to ground impact. [Enclosure (10)]

57. The Mishap WSO and remains of the aft ejection seat were located approximately 300 feet south of the aircraft impact crater. At approximately 150 feet south of the aircraft impact point, the aft crewmember ejection seat impacted the ground and continued to its final resting spot 300 feet from aircraft initial impact. Mishap aircraft was heading approximately 178 degrees magnetic at time of impact. [Enclosure (10)]

58. The Mishap Pilot ejection sequence began but was interrupted by the disintegrating cockpit from ground impact. The known and estimated aircraft airspeed and altitude indicates ejection seat should operate under Mode 1. The inertia reel straps were found fully retracted indicating start of ejection sequence prior to ground impact. [Enclosure (10)]

59. Preliminary findings indicate that the aft crewmembers parachute deployment was interrupted by ground impact just prior to seat-man separation stage. Parachute restraint systems functioned as designed. [Enclosure (10)]

60. Mishap Pilot parachute deployment was started after ejection seat exposure to aircraft impact. Seat harness broke due to overload during ground impact. [Enclosure (10)]

61. No anomalies were noted or discovered with any of the Cartridges and Propellant Actuated Devices (CADPAD) located in the aft cockpit egress system. [Enclosure (10)]

62. The Mishap Pilot's left and right hand seat initiators, harness reel, 0.7 second delay and catapult primary initiator worked as designed. The explosive sequence was interrupted by ground impact prior to ejection seat movement. The PDRM was deflagrated by ground fire and was not recovered. The under seat rocket motor was destroyed by ground impact. All unexpended devices appeared normal and would have likely functioned as designed had the explosive sequence not been interrupted by ground impact. [Enclosure (10)]

63. Ejection seats were operating as designed prior to ground impact. Ejection initiation occurred outside of the designed ejection envelope. [Enclosure (10)].

64. CSFWP/CSFWL FRS TACDEMO Instruction describes the procedures for the execution of the Loaded Roll portion of the demonstration. [Enclosures (16), (17)]

65. CSFWP/CSFWL FRS TACDEMO 3700.2H states "At show center take a smooth 60 degree cut away (2-3G) and then reverse turn into a loaded roll in the opposite direction (targeting approximately 260 KCAS). The loaded roll is executed with AOA smoothly increasing to 25-30 AOA until the inverted portion where it is eased to 15-20 AOA, then increased again as the aircraft returns upright." [Enclosures (16), (17)]

66. Mishap aircraft began to input controls for the beginning of the Loaded Roll at 289 KCAS vice the CSFWP/CSFWL FRS TACDEMO Instruction specified "approximately 260 KCAS". [Enclosures (16), (17)]

67. Mishap aircraft reached a maximum of 21.5 degrees AOA while initially upright and through the first 180 degrees of roll. Upon completion of the inverted portion of the Loaded Roll, the mishap aircraft reaches a maximum of 48.6 degrees AOA while

sustaining over 42.5 degrees AOA till mishap aircraft ground impact. [Enclosures (34), (35)]

68. CSFWP/CSFWL FRS TACDEMO Instruction specifies the pilot should target 25-30 AOA while upright. [Enclosures (16), (17)]

69. Mishap aircraft reached a maximum of 42.4 degrees AOA during 180 degrees of roll while inverted during the Loaded Roll maneuver. The mishap aircraft AOA starts at 21.5 degrees AOA when 90 degrees right wing down and continues to build to 42.4 degrees AOA when the mishap aircraft is 90 degrees left wing down. [Enclosures (34), (35)]

70. CSFWP/CSFWL FRS TACDEMO Instruction specifies the pilot should ease the AOA to 15-20 degrees AOA until upright again. [Enclosures (16), (17)]

71. All of the interviewed current and former FRS TACDEMO aircrew stated that they do not ease or reduce the AOA to 15-20 degrees while inverted when performing the Loaded Roll maneuver. All stated they target 30 degrees AOA for the complete 360 degrees of roll. [Enclosures (39 - 43)]

72. FRS TACDEMO aircrew trained to the TACDEMO maneuvers using an 8.5 x 11 training card (gouge) labeled High Show Maneuvers. This training card references 25-30 degrees AOA for the Loaded Roll. It does not mention the reduction of the AOA to 15-20 while inverted. [Enclosures (14), (39 - 44)]

73. VFA-122 FRS TACDEMO Weapons System Officers flew and trained to an 8.5 x 11 kneeboard card that described the FRS TACDEMO maneuvers as well as inter-cockpit calls made during the air show for the demonstration aircrew. The card describes the Loaded Roll parameters as 1000 feet, 230 KCAS and 25-34 degrees AOA. [Enclosures (13), (39), (40)]

74. Most of the current and past FRS TACDEMO aircrew never referenced the CSFWP/CSFWL FRS TACDEMO Instruction for maneuver parameters. [Enclosures (40), (42), (43)]

75. NAVAIR Flight Dynamics states that as AOA increases above 40 degrees for the F/A-18E/F, roll performance of the aircraft (with or without pirouette enhancement) is adversely affected by

loss of control surface aerodynamic effectiveness. Performance is also limited by the Flight Control System (FCS) for departure resistance improvement at high AOAs. The control laws are designed to reduce sideslip buildup, particularly at higher AOAs, where excessive sideslip can lead to departure from controlled flight. [Enclosure (33)]

76. The Mishap Pilot's control inputs during the Loaded Roll portion of the FRS TACDEMO commanded the F/A-18F FCS to invoke pirouette logic or enhancement. It is unknown on whether that was the Mishap Pilots intention. During portions of the mishap maneuver, the pirouette enhancement was either inactive or ineffective. [Enclosures (20), (33), (34), (35), (36)]

77. Pirouette logic is a variable roll-command enhancement feature in the control law which provides improved roll performance for certain portions of the flight envelope. In general, the pirouette logic was designed to improve roll performance for moderate to high AOA, low speed conditions. Pirouette command is faded in from 13 degrees to 25 degrees AOA, above 25 degrees AOA the full pirouette command is available. The pilot pirouette command is generated by summing lateral stick with scaled rudder pedal input to generate a 'composite roll command', and the composite roll command in excess of full lateral stick equivalent (+/- 3 inches) is treated as an input command to the pirouette logic (called "excess roll command"). Under the right AOA and airspeed conditions, the pirouette enhancement is obtained by applying coordinated lateral stick and pedal. Pirouette enhancement is faded to zero at airspeeds above about 208 KCAS, and is only fully available at airspeeds below 121 KCAS. For airspeeds above 208 KCAS, there is no pirouette enhancement available. At these higher airspeeds, at AOA's above 25 degrees, the rudder pedal is still summed with lateral stick to generate a composite roll command, however this command is limited to full lateral stick equivalent - there is no enhancement available. [Enclosures (33), (36)]

78. Mishap aircraft airspeed during the Loaded Roll first decreased below 208 KCAS at approximately 60 degrees nose down and inverted. As the mishap aircraft's airspeed decreased below 208 KCAS its AOA increased above 40 degrees AOA. The mishap aircraft FCS would have commanded the pirouette enhancement as

the aircraft began to lose control surface aerodynamic effectiveness due to the excessive AOA. [Enclosures (33 - 36)]

79. Mishap Pilot neutralized the full right rudder at 12:06:13.56L. The mishap aircraft was approximately 60 degrees left wing down, 45 degrees nose down, 178 KCAS, 1220' AGL and 46.7 degrees AOA and -10970 fpm VSI when the Mishap Pilot neutralized the right rudder. The Mishap Pilot still had aft and right lateral stick inputted at this time. By removing the right rudder, the mishap aircraft FCS removed the pirouette enhancement and initiated a cancellation command that generated opposite sideslip in order to stop the nose from tracking. [Enclosures (33 - 36)]

80. By removing the right rudder at 46.7 degrees AOA and 178 KCAS, roll authority is virtually eliminated when only lateral stick inputs are attempting to command roll. With both lateral stick and rudder commanded in the same direction, roll authority and sideslip would have been increased and the mishap aircraft's nose position would have continued in a nose up attitude. [Enclosure (36)]

81. The fate of the mishap aircraft had the Mishap Pilot left in the full right rudder control inputs was unable to be determined during NAVAIR simulations. Since the Mishap Pilot was applying near full aft longitudinal stick, with the horizontal stabilators near the full nose-up command deflection limit, and AOA was near the maximum for the last few seconds of data, the extreme rate of descent in the final few seconds (no less than 10000 ft/min, i.e. 167 ft/sec) would have probably prevented any successful recovery or avoidance of ground impact. [Enclosures (33 - 36)]

82. Boeing's Chief Test Pilot developed an F/A-18 E/F Flight Demonstration for the purpose of demonstrating the capabilities of the F/A-18E/F for Foreign Military Sales. The Flight Demonstration was developed by an F/A-18 Test Pilot with over 4000 hours in the F/A-18. The Boeing Flight Demonstration contains a maneuver also named the Loaded Roll. The Loaded Roll, as described by a Boeing Test Pilot, was designed to utilize the pirouette enhancement allowing the aircraft improved roll performance during the maneuver. [Enclosure (32)]

83. In 2004 the current FRS TACDEMO crew met with a Boeing Flight Demonstration Pilot and discussed the desires to gain information regarding the Boeing demonstration in order to modify the current F/A-18 C-F FRS TACDEMO. The FRS aircrew received documents regarding the Boeing Flight Demonstration as well as Safety and Operational Risk Management issues regarding the Boeing Flight Demonstration. [Enclosure (45)]

84. In 2004 the VFA-122 FRS TACDEMO team consisted of two F/A-18F crews. [Enclosure (45)]

85. The 2004, the FRS TACDEMO aircrew practiced a demonstration they developed in the simulator. The demonstration included a maneuver called the Loaded Roll. The 2004 FRS TACDEMO pilot stated that knowledge of or discussion of the pirouette enhancement or logic during the maneuver was never discussed or captured in the CSFWP/CSFWL instruction. [Enclosure (45)]

86. The 2004 FRS TACDEMO aircrew met with the then CSFWP Commander and presented briefs, graphics and descriptions describing the summary they developed. [Enclosure (45)]

87. The 2004 FRS TACDEMO was verbally approved in early March 2004 and subsequently flown at the first air show at NAS Lemoore March 19 2004. [Enclosure 45]

88. A 2004 FRS TACDEMO for the F/A-18F was first incorporated in the CSFWP/CSFWL FRS TACDEMO 3700.2F dated 08 April 2005. The new FRS TACDEMO instruction included the Loaded Roll maneuver. [Enclosure (18)]

89. The Boeing Flight Demonstration technique for executing the Loaded Roll is to rely on pirouette enhancement to aid in the roll. Visually, when viewed from behind, the loaded roll should appear to be a very dynamic and almost a flat-plate roll maneuver. To accomplish the roll the pilot starts the maneuver without a rate of descent near or slightly above the pirouette logic speed (225 to 208 KCAS) and in an AOA range that is the best for generating good roll rates throughout the maneuver (25-30 degrees AOA). The notion of Low Altitude Training (LAT) Rules enters into this maneuver in the second half of the roll where the AOA needs to be reduced and the pull on the stick relaxed so that the movement of the velocity vector is

constrained to be less than the amount that it moved upward in the first half of the roll. A turn is initiated to the left or right and the aircraft is then loaded with G and AOA before commencing a rolling maneuver opposite to the bank angle of the turn. This will cause the first 180 degrees of roll to be above the horizon. The intent of the first 180 degrees of roll is to achieve a climbing attitude and upward velocity vector trajectory before proceeding into the second half of the roll that occurs with 180 degrees of roll with the lift vector below the horizon. The second half of the roll will result in a downward movement of the velocity vector. Based on LAT concepts the net result would be that the velocity vector would remain at or near the horizon by the completion of the maneuver. The pilot should reduce the AOA (15-20 degrees) and relax the aft stick pressure as the aircraft rolls inverted. The first half of the roll should target no more than 30 degrees AOA to ensure that there is a large margin between the rolling AOA and the region where control effectiveness starts to drop off above 35 degrees AOA and especially above 40 degrees AOA. By reducing the AOA while inverted the aircraft rolls at a quicker rate. This insures that the time spent with the velocity vector pointed in a downward direction is less than the time spent above the horizon in the first half of the roll. The combination of the higher roll rate and less AOA (and G) is in keeping with the concepts of LAT. The end result of this sequence of control inputs is that the loaded roll maneuver should be completed no lower than the altitude from which the maneuver was initiated. [Enclosure (32)]

90. CSFWP/CSFWL FRS TACDEMO 3700.2H defined entry airspeed for the Loaded Roll is approximately 50 KCAS higher than the Boeing Flight Demonstration Loaded Roll and 50 KCAS higher than F/A-18F pirouette enhancement "fade in" availability. [Enclosures (16), (17), (32), (36)]

91. CSFWP/CSFWL FRS TACDEMO 3700.2H does not describe or define when the pilot should reach or target 25-30 degrees AOA other than to target the AOA range while upright. [Enclosures (16), (17)]

92. CSFWP/CSFWL FRS TACDEMO 3700.2F dated 08 April 2005 describes the entry to the Loaded Roll as follows; At show

center, with 260 KCAS, roll the aircraft 30 to 45 degrees away from the crowd and pull to 25-30 AOA. Maintain 25-30 AOA and conduct a loaded roll in the opposite direction from entry. [Enclosure (18)]

93. Current CSFWP/CSFWL FRS TACDEMO 3700.2H instruction does not specify the pilot to pull to 25-30 AOA before beginning the Loaded Roll. [Enclosures (16), (17)]

94. CSFWP/CSFWL FRS TACDEMO 3700.2H does not describe specific cockpit flight control positions (Stick, Rudder, Throttles) required in order to complete the Loaded Roll portion of the FRS TACDEMO. [Enclosures (16), (17)]

95. Interviewed FRS TACDEMO pilots demonstrated multiple ways to execute the Loaded Roll. All use full rudder in direction of the loaded roll. 50% of the pilots use lateral stick while others position the stick in the neutral lateral position while only using longitudinal stick for AOA control. Review of MFOQA data for all of the prior practice demonstration flights showed pilots using various techniques to complete the Loaded Roll. [Enclosures (39 - 44)]

96. CSFWP/CSFWL FRS TACDEMO 3700.2H instruction does not mention nor reference the pirouette enhancement or logic for the Loaded Roll portion of the F/A-18F FRS TACDEMO. [Enclosures (16), (17)]

97. None of the current and past FRS TACDEMO aircrew understood that the pirouette logic enhancement might be enabled during the Loaded Roll maneuver. 50% of the interviewed FRS TACDEMO pilots control inputs during the Loaded Roll would have commanded FCS pirouette logic. [Enclosures (39 - 44)]

98. The current FRS TACDEMO instruction requires 4 simulator practices (one being emergency procedures) prior to a FRS TACDEMO flight practice. The Mishap Pilot completed 19 simulators prior to the first flight. The Mishap WSO completed 14 simulators prior to the first flight. [Enclosure (31)]

99. Interviewed FRS TACDEMO aircrew stated that all required 15-20 simulators before feeling comfortable with the first practice flight. All stated that the 4 required simulators per the

current FRS TACDEMO instruction were insufficient. [Enclosures (39 - 44)]

100. Aircrew flying in VFA-122 are required to carry and use CVRS 8mm tapes for all flights. [Enclosure (19)]

101. Interviewed FRS TACDEMO aircrew stated that 8mm tapes are always taken and used to record all flight practices. [Enclosures (39 - 44)]

102. Interviewed FRS TACDEMO aircrew stated debriefs post flight included the observer. The observer would point out any parameters they noticed for each maneuver during the flight demonstration practice. [Enclosures (39 - 43)]

103. FRS TACDEMO observers are located approximately 1 nautical mile away from the center of the demonstration box. [Enclosures (39 - 43)]

104. FRS TACDEMO practices never included a CVRS 8mm or MFOQA electronic replay debrief. FRS TACDEMO aircrew stated that CVRS 8mm tape debriefs had never been done before. [Enclosures (39 - 44)]

105. The Mishap Pilot's 3 prior FRS TACDEMO practices were recorded using MFOQA. Mishap Pilot used similar longitudinal and lateral stick inputs on all of the FRS TACDEMO practices. The full application of longitudinal stick during all 3 prior flights resulted in excessive AOA increasing above 40 degrees AOA. [Enclosure (45)]

OPINIONS

1. The mishap aircrew died in the line of duty and not due to their misconduct. [FF (1), (15), (16), (21), (25)]

2. The mishap aircrew were fully qualified, per all known and current instructions, to perform the duties they were assigned on the VFA-122 flight schedule dated 06 April 2011. [FF (1), (10), (12), (18)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING AN VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

3. The mishap aircrew were in compliance with the crew rest and currency requirements. [FF (13), (19), (24), (25), (27), (28), (32)]

4. Aircraft 122, BUNO 165877, was properly authorized and scheduled. [FF (33), (34), (36 - 40)]

5. There were no unusual human factors related to the flight and mishap. Neither LT Matthew I. Lowe nor LT Nathan H. Williams exhibited any of the classic human factors issues known to cause additional stress for the accomplishment of their duties. [FF (12), (14), (18), (20)]

6. Neither intoxication nor use of medication was a factor in the incident. [FF (15), (16), (21), (22)]

7. Aircraft 122, BUNO 165877, was mechanically sound with no problems that would have influenced the mishap flight. [FF (40), (45), (47 - 52)]

8. The mishap crew was in full control of aircraft 122, BUNO 165877, until ejection and subsequent mishap aircraft ground impact. [FF (47), (51), (53 - 55)]

9. Weather during the mishap flight was not a factor. [FF (34)]

10. Private property, owned by (b)(6) of Lemoore CA, was damaged by this mishap. [FF (4 - 9)]

11. (b)(5)

12. (b)(5)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING AN VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

(b)(5)

13. (b)(5)

14. (b)(5)

15. (b)(5)

16. (b)(5)

17. (b)(5)

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(b)(5)

18. (b)(5)

19. (b)(5)

20. (b)(5)

21. (b)(5)

22. (b)(5)

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(b)(5)

23. (b)(5)

24. (b)(5)

25. (b)(5)

26. (b)(5)

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RECOMMENDATIONS

(b)(5)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING A CLASS ALPHA MISHAP INVOLVING AN VFA-122 F/A-18F AIRCRAFT, BUNO 165877, WHICH OCCURRED AT N 36 19.449 W 119 58.229, RESULTING IN THE DEATHS OF LT MATTHEW IRA LOWE AND LT NATHAN H. WILLIAMS ON 06 APRIL 2011.

(b)(5)

(b)(3), (b)(6)