

# REDACTION CITATIONS

The red letters and numbers refer to specific exemptions of the Freedom of Information Act (Title 5 U.S.C § 552) that protect the redacted (blacked out) information.

(b) (1) denotes a redaction to protect information that is properly and currently classified in the interest of national defense, as specifically authorized under the criteria established by Executive Order and implemented by regulations, such as DOD 5200.1-R (Reference (G)). Information is withheld because it contains information concerning military operations and vulnerabilities or capabilities of plans and release of this information would impede the defense of national security.

(b) (2) (High) denotes a redaction to protect personnel, operating procedures, and national security. Information is withheld because release of this information would clearly or could be expected to impede the conduct of the mission, allow circumvention of previously unknown tactics, and place personnel at increased risk for injury or death.

(b) (3) specifically 10 USC §130b denotes a redaction to protect personnel. Information is withheld because release of this information would clearly constitute or could be expected to constitute placing personnel in overseas, sensitive, or routinely deployable units and their family members at increased risk for injury, harm, or death.

(b) (5) denotes a redaction to protect attorney work product or attorney client privilege. Information is withheld because release of this information would constitute or could be expected to be a violation of attorney client privilege and a failure to protect attorney work product.

(b) (6) denotes a redaction to protect personal privacy. Names and identities of personnel as well as other personal identifying information are withheld because release of this information would clearly constitute or could be expected to constitute an unwarranted invasion of the personal privacy of the individuals.



DEPARTMENT OF THE NAVY  
NAVAL SPECIAL WARFARE COMMAND  
2000 TRIDENT WAY  
SAN DIEGO, CALIFORNIA 92155-5599

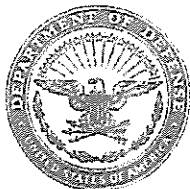
5830  
Ser 004/L114  
1 Aug 08

From: Commander, Naval Special Warfare Command  
To: Commander, Naval Special Warfare Development Group  
Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
THE DEATH OF SOC LANCE VACCARO, USN, ON OR ABOUT 6 MAR 08  
IN MARANA, ARIZONA

1. Pursuant to reference (a), the subject investigation has been reviewed and will be retained by the Force Judge Advocate, Naval Special Warfare Command, with a copy of this final review attached.
2. I concur with the Investigating Officer and first endorser that SOC Lance Vaccaro was killed as a result of an accident during (b)(2)High parachute training. I also concur that the primary causative factors were a failure to follow emergency procedures due to loss of altitude and changing circumstances in the air and equipment malfunction due to extreme gravitational forces exerted on both him and his (b)(2)High
3. Although training and equipment were adequate, I concur with the prior endorser's order to carry out the Investigating Officer's recommendations on curriculum, equipment and training to reduce the risk during future (b)(2)High parachute operations. These recommendations are logical and will further improve the (b)(2)High course of instruction while also ensuring the safety of jumpers.
4. The proceedings, findings of fact, opinions, and recommendations of the investigating officer are approved.

  
G. J. BONELLI

Copy to:  
(b)(3),(b)(6)



DEPARTMENT OF THE NAVY  
NAVAL SPECIAL WARFARE DEVELOPMENT GROUP  
1636 REGULUS AVE.  
VIRGINIA BEACH, VA 23461-2299

IN REPLY REFER TO:  
5800  
Ser N00/320  
28 Jul 08

FIRST ENDORSEMENT on (b)(3), (b)(6) USN, ltr of  
30 June 08

From: Commander, Naval Special Warfare Development Group  
To: Commander, Naval Special Warfare Command

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
THE DEATH OF SOC LANCE VACCARO, USN, ON OR ABOUT  
6 MARCH 08 IN MARANA, ARIZONA

1. I have reviewed the above referenced, redacted Command Investigation. I concur with the findings, opinions, and recommendations, which are unchanged from the original report.
2. I concur with the investigating officer that SOC Lance Vaccaro was killed as a result of an accident during high-risk (b)(2)High parachute training. I hereby direct the Chief Staff Officer to ensure that the Investigating Officer's recommendations on curriculum, equipment and training are carried out so that Naval Special Warfare Development Group may learn from this accident and reduce the risk during future parachute operations.
3. The investigation is returned to the Legal Office for retention and forwarding to COMNAVSPECWARCOM.

A handwritten signature in cursive script, reading "Scott P. Moore", is positioned above the printed name.

SCOTT P. MOORE

30 Jun 2008

From: (b)(3), (b)(6) USN  
To: Commander, Naval Special Warfare Development Group  
Via: (1) Group Judge Advocate, Naval Special Warfare  
Development Group  
(2) Chief Staff Officer, Naval Special Warfare  
Development Group  
  
Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
THE DEATH OF SOC LANCE VACCARO, USN, ON OR ABOUT  
6 MARCH 08 IN MARANA, ARIZONA  
  
Encl: (1) NSWDCG ltr 5800 N00J 13 May 08  
(2)  
(3)  
(4) The enclosures listed originated with another government agency  
(5)

The documents described in this paragraph originated with state/local agencies

- (7) Pictures of SOC Lance Vaccaro's Military Freefall  
(b)(2)High at the impact  
site/DZ
- (8) NAVSPECWAR 3000.3B Chapter 4 Military Freefall  
Parachuting; 4-15 Canopy Control, 4-16 Cutaway  
Procedures, 4-17 Freefall Parachute Malfunctions  
(copy)
- (9) Natick equipment analysis and out-brief (PowerPoint  
brief) (copy)
- (10) Natick "preliminary" (b)(2)High fatality equipment  
conclusion update and way ahead meeting report  
(20 May 08) (copy)
- (11) DZ/Impact site, (b)(2)High photo CD (copy)
- (12) SOC Lance Vaccaro's (b)(2)High video CD (copy)
- (13) COMNAVSPECWARCOMINST 3000.3B, Appendix B; Freefall  
Jump Master brief.
- (14) NSWDCG Jump Manifests
- (15) Malfunction Report completed by (b)(3), (b)(6)  
USN

#### Preliminary Statement

1. At approximately 0800L on 06 MARCH 2008, while participating  
in a (b)(2)High parachute training

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course at Pinal Air Base, Arizona, SOC Lance M. Vaccaro was fatally injured. During a routine training jump, SOC Vaccaro exited the aircraft at 12,500 feet Above Ground Level (AGL) with no apparent problem. He started a right turn upon opening his main canopy at 5,500 feet AGL. He then released his breaks and attempted to release (b)(2)High in an attempt to correct the spin. He was unsuccessful and the turn/spin accelerated. While struggling with the (b)(2)High SOC Vaccaro lost altitude awareness and failed to follow emergency procedures before dropping below his critical altitude for cutting away his main and deploying his reserve. In an attempt to slow his descent, he deployed his reserve parachute somewhere between 2,000 - 500 feet AGL without cutting away his main canopy. The reserve parachute never gained sufficient airflow to fully extract and open. SOC Vaccaro suffered severe internal injuries upon impacting the ground (b)(2)High and was provided initial emergency medical treatment on site. He died while being transported via an Air Life Flight to University Medical Center, Tucson, AZ.

2. The circumstances and events that took place between main parachute deployment at 5,500 feet AGL to approximately 3,000 feet AGL are unknown and cannot be recreated. The fact that SOC Vaccaro was in a severe spin and down plane is clear. But the exact cause of that spin and down plane cannot be determined. This investigation does detail emergency procedures to be performed under the circumstances and those actions SOC Vaccaro is known to have taken in an attempt to free himself (b)(2)High (b)(2)High

3. In the investigation of events surrounding the accident on 06 March 2008, all reasonably available evidence was collected and reviewed. The investigating officer was informed of his duties and responsibilities on 13 May 2008. An extension was requested and granted for 26 May 2008. (b)(3), (b)(6)  
USN, was consulted throughout the investigation for procedural issues and administrative support.

4. The U.S. Naval Criminal Investigation Service (NCIS) investigation field report and Pima County autopsy report were made available to the investigating officer. In addition to an independent review of the available information, the investigating officer conducted an in-depth investigation into details regarding the incident. The investigating officer also used statements, photographs, and information included in the NCIS investigation, as well as information from SOC Vaccaro's

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jump video, impact site photos, and equipment provided by Natick  
Research Laboratories (NATICK).

5. The NATICK testing facility is currently conducting further  
testing on SOC Vaccaro's (b)(2)High to ascertain information  
on improving (b)(2)High and its components. The point of  
contact for that effort is (b)(6) 757-893-2970, Naval  
Special Warfare Development Group, Air Operations Manager.

### Findings of Fact

1. The information in this paragraph is based on documents that originated with another government agency  
raph is based on documents that originated with another government agency
2. The information in this paragraph is based on documents that originated with another government agency [Encl (2)]
3. Date of this jump: 6 March 2008. [Encl (15)]
4. Number of tandem jumps (b)(2)High and personnel: (b)(2)High  
12.- Personnel. [Encl (14)]
5. Date of last tandem jump (b)(2)High or personnel): 05 March  
2008. SOC Vaccaro conducted a total of 12 successful personnel  
jumps the week prior to the accident. [Encl (14)]
6. The information in this paragraph is based on documents that originated with another government agency [Encl (2)]
7. Exit altitude was 12,500 feet AGL. [Encl (14)]
8. The aircraft's speed was 110 knots. [Encl (15)]
9. The type of jump was (b)(2)High [Encls (15)]
10. Type of harness/container system: (b)(2)High  
[Encl (15)]
11. Type of main parachute: (b)(2)High [Encl (15)]
12. The information in this paragraph is based on documents that originated with another government agency  
ation in this paragraph is based on documents that originated with another government agency [Encl (2)]
13. The information in this paragraph is based on documents that originated with another government agency  
s paragraph is based on documents that originated with another government agency [Encl (13)]
14. The weather was briefed and all parameters were within  
standards for the training. [Encl (13)]
15. The information in this paragraph is based on documents that originated with another government agency  
ph is based on documents that originated with another government agency

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16. The information in this paragraph is based on documents that originated with another government agency [Encl (2)]

17. The Sky Van aircraft took off and flew to 12,500 feet AGL. [Encl (15)]

18. The information in this paragraph is based on documents that originated with another government agency [Encls (3)]

19. The information in this paragraph is based on documents that originated with another government agency [Encls (4), (12)]

20. The information in this paragraph is based on documents that originated with another government agency  
graph is based on documents that originated with another government agency

21. The information in this paragraph is based on documents that originated with another government agency  
graph is based on documents that originated with another government agency  
[Encl (5)]

22. Emergency procedures to counter the right turn event are to attempt two (b)(2)High cutaway tries, then execute cutaway procedures to release the main parachute and get out the reserve parachute. This requires a decision to cutaway by 3,500 feet AGL, execute main canopy cutaway, and initiate reserve deployment by 3,000 feet AGL. [Encls (8), (13)]

23. The information in this paragraph is based on documents that originated with another government agency  
ph is based on documents that originated with another government agency  
[Encls (5), (7)]

24. Emergency procedures include cutting away the main parachute before deploying the reserve. [Encls (8), (13)]

25. SOC Vaccaro does not appear to have attempted to cut away his main parachute at any time. [Encl (7)]

26. The information in this paragraph is based on documents that originated with another government agency  
s based on documents that originated with another government agency  
[Encls (5), (7) (14:4-15, 4-16)]

27. The information in this paragraph is based on documents that originated with another government agency  
is based on documents that originated with another government agency

28. The information in this paragraph is based on documents that originated with another government agency  
paragraph is based on documents that originated with another government agency, (4)]

29. The information in this paragraph is based on documents that originated with another government agency  
s paragraph is based on documents that originated with another government agency, (5), (7), (11)]

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
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30. The information in this paragraph is based on documents that originated with another government agency  
; paragraph is based on documents that originated with another government agency, (4), (5)]

31. The information in this paragraph is based on documents that originated with another government agency  
aph is based on documents that originated with another government agency ]

32. The information in this paragraph is based on documents that originated with another government agency  
information in this paragraph is based on documents that originated with another government agency ]

33. The information in this paragraph is based on documents that originated with another government agency  
information in this paragraph is based on documents that originated with another government agency ]

34. The information in this paragraph is based on documents that originated with another government agency  
on in this paragraph is based on documents that originated with another government agency ]

35. The information in this paragraph is based on documents that originated with state/local agencies.  
The information in this paragraph is based on documents that originated with state/local agencies. [Encls (6)]

36. All of SOC Vaccaro's parachute equipment and personal  
safety equipment met the safety standards for the jumps that  
were being conducted. [Encls (9)]

37. The information in this paragraph is based on documents that originated with another government agency  
The information in this paragraph is based on documents that originated with another government agency [Encl (2)]

38. The information in this paragraph is based on documents that originated with state/local agencies.  
mation in this paragraph is based on documents that originated with state/local agencies ]

39. The information in this paragraph is based on documents that originated with state/local agencies.  
graph is based on documents that originated with state/local agencies.  
[Encls (4), (6)]

40. The information in this paragraph is based on documents that originated with another government agency.  
on in this paragraph is based on documents that originated with another government agency.  
[Encls (5), (8)]

41. (b)(2)High [Encl (7)]

42. The information in this paragraph is based on documents that originated with another government agency.  
used on documents that originated with another government agency.  
[Encls (5), (7), (10-pg 11)]

43. To date, Naval Special Warfare Development Group has not  
received a copy of the Death certificate.

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
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### OPINIONS

1. The primary causes of this accident appear to have been equipment, changing circumstances in the air (right turn upon opening, (b)(2)High, a failure to follow emergency procedures, and inexperience (b)(2)High [FF (4), (5), (19), (20), (21), (22), (23), (24), (25), (26)]
2. SOC Vaccaro was fully qualified to perform this jump. He was mentally and physically prepared for the (b)(2)High course of instruction. SOC Vaccaro was a confident and capable parachutist with over 300 jumps. [FF (1), (2), (4), (5), (38)]
3. On 06 March 2008, The (b)(2)High students followed all military free fall jump & (b)(2)High procedures listed in the COMNAVSPECWARINST 3000.3B. [FF (1), (13), (15), (16)]
4. The jump brief was given at 0515 and was done in accordance with NAVSPECWARCOMINST 3000.3B, covering the days training events. This brief covered all pertinent information recorded for the jumpers and, more importantly, it covered emergency procedures. SOC Vaccaro was trained in emergency procedures and understood the importance of altitude awareness. [FF (1), (2), (4), (5), (13), (14), (22), (24), (39)]
5. SOC Vaccaro exited, fell stable, and deployed his main parachute as briefed. [FF (7), (13), (17), (18), (19)]
6. The exit video showed no signs of distress, nor does it provide any evidence as to the cause of the incident. It showed a standard exit, with a good main parachute deployment at 5,500 feet AGL. [FF (19)]
7. Once SOC Vaccaro's main parachute opened, he went into a slight right hand turn that appeared to accelerate with time and the loss of altitude. He failed to perform emergency main chute cutaway/reserve chute deployment procedures at the appropriate altitude (b)(2)High and not tracking his altitude. [FF (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (36), (39), (40), (41), (42)]
8. (b)(2)High (b)(2)High SOC Vaccaro should have been cutting away his main parachute and getting out his reserve by 3,000 feet AGL. Instead, SOC Vaccaro deployed his reserve somewhere

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between 2,000 - 500 feet AGL. [FF (20), (21), (22), (23), (24),  
(25), (26)]

9. (b)(6) watched the pilot chute come out but not inflate  
or fill with enough air to fully deploy the reserve and reach  
full line stretch. This failure to inflate was likely due to  
the slower rate of descent that SOC Vaccaro was experiencing.  
The pilot chute is designed for high speed descent deployment,  
not deployment at slower speeds. It appears that there was not  
sufficient airflow over SOC Vaccaro's back during his downward  
spiral to facilitate a complete reserve deployment once  
initiated. [FF (20), (21), (23), (26), (36), (42)]

10. (b)(2)High [FF (20),  
(b)(2)High (27), (30), (40), (41)]

11. The parachute and (b)(2)High were properly  
manufactured. [FF (10), (11), (15), (36), (40), (41), (42)]

12. The safety systems were thoroughly tested and found to be  
in proper working order. [FF (10), (11), (15), (36), (40), (41),  
(42)]

13. The course of instruction and curriculum have proven over  
time to be unmatched. Although the recommendations below make  
suggestions to improve training, the evidence demonstrates that  
SOC Vaccaro was sufficiently trained in emergency procedures to  
handle this event. [FF (1), (2), (4), (5), (29)]

14. (b)(2)High he was a  
very experienced jumper and met all requirements for this course  
of instruction. [FF (1), (2), (4), (5), (9), (13), (29)]

15. SOC Vaccaro received prompt medical care. His injuries  
were too severe for emergency care to save his life. [FF (27),  
(28), (29), (30), (31), (32), (33), (34), (35), (38)]

#### RECOMENDATIONS

1. Training should be amended to include additional ground time  
for practicing clearing of malfunctions, recognizing and  
correcting for hazardous conditions (b)(2)High and  
appropriate time for progressions from one corrective measure to  
the next (b)(2)High

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2.

(b)(2)High

(b)(2)High This makes it difficult to check the altimeter. Also, if a jumper becomes fixated on pulling, then they may forget to check their altimeter. An audible or "bright flashing light" alarm may help to remind the jumper when they are approaching the 3500 feet decision point.

3. The Air Operations division should continue to work with Performance Design and the NATICK Testing Facility on equipment design and (b)(2)High procedures to alleviate any future incidents of this nature. Further testing, reports, and recommendations will be forthcoming.

3. Videotape all student final approaches and landings to increase training value and support any future accidents/injury investigations. Videos of instructors demonstrating (b)(2)High cutaways and correction procedure progressions could also become part of the curriculum.

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

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NAVAL SPECIAL WARFARE DEVELOPMENT GROUP  
1636 REGULUS AVE.  
VIRGINIA BEACH, VA 23461-2299

IN REPLY REFER TO:

5800  
N00J  
13 MAY 08

From: Commander, Naval Special Warfare Development Group  
To: (b)(3), (b)(6)

Subj: COMMAND INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING  
THE DEATH OF SOC LANCE VACCARO, USN, ON OR ABOUT  
6 MARCH 08 IN MARANA, ARIZONA

Ref: (a) JAG Manual, Chapter II

1. Per reference (a), specifically Part F, you are hereby appointed to investigate the facts and circumstances surrounding the death of SOC Lance Vaccaro, USN, that occurred on or about 6 March 2008 in Marana, Arizona.
2. The purpose of this inquiry is to determine what happened to cause this incident and why. An investigation has already been completed that was intended to answer the question whether or not SOC Vaccaro was in the line of duty at the time of the accident. To complete this investigation, you will need to review the reports from the previous investigations, ensure a complete inspection of the rigging by a qualified jumpmaster, and take any other steps necessary to form a complete and comprehensive analysis of the circumstances and cause of this incident.
3. If you have not already done so, you should also read Chapter II, Parts A, B, C and F of reference (a) in their entirety before beginning your preliminary inquiry.
4. You may seek legal advice from (b)(3), (b)(6) USN, during the course of your preliminary inquiry. You should also coordinate your investigation with (b)(6) of NCIS (b)(6)
5. By copy of this appointing letter, the Legal Office is directed to furnish the necessary clerical assistance in preparing the results of your preliminary inquiry

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

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ENCLOSURE (1)



NAVAL SPECIAL WARFARE COMMAND

DELETED PAGE INFORMATION SHEET

Page(s) 12 - 18  
Enclosures (a) - (5)

Withheld entirely at this location. One or more of the following explain this decision:

Deleted under exemption(s) \_\_\_\_\_

Documents originated with other government agency(ies). Referred for review and direct response to you.

Pages contain information furnished by other government agency(ies). We will advise you of releasability of information following consultation with agency(ies).

Comments: NAVAL CRIMINAL INVESTIGATIVE  
SERVICE (NCIS)

NAVAL SPECIAL WARFARE COMMAND

DELETED PAGE INFORMATION SHEET

Page(s) 19 - 34  
ENCLOSURE (6)

Withheld entirely at this location. One or more of the following explain this decision:

Deleted under exemption(s) \_\_\_\_\_

Documents originated with state/local agency(ies). They must be contacted directly to obtain this information.

Pages contain information furnished by other government agency(ies). We will advise you of releasability of information following consultation with agency(ies).

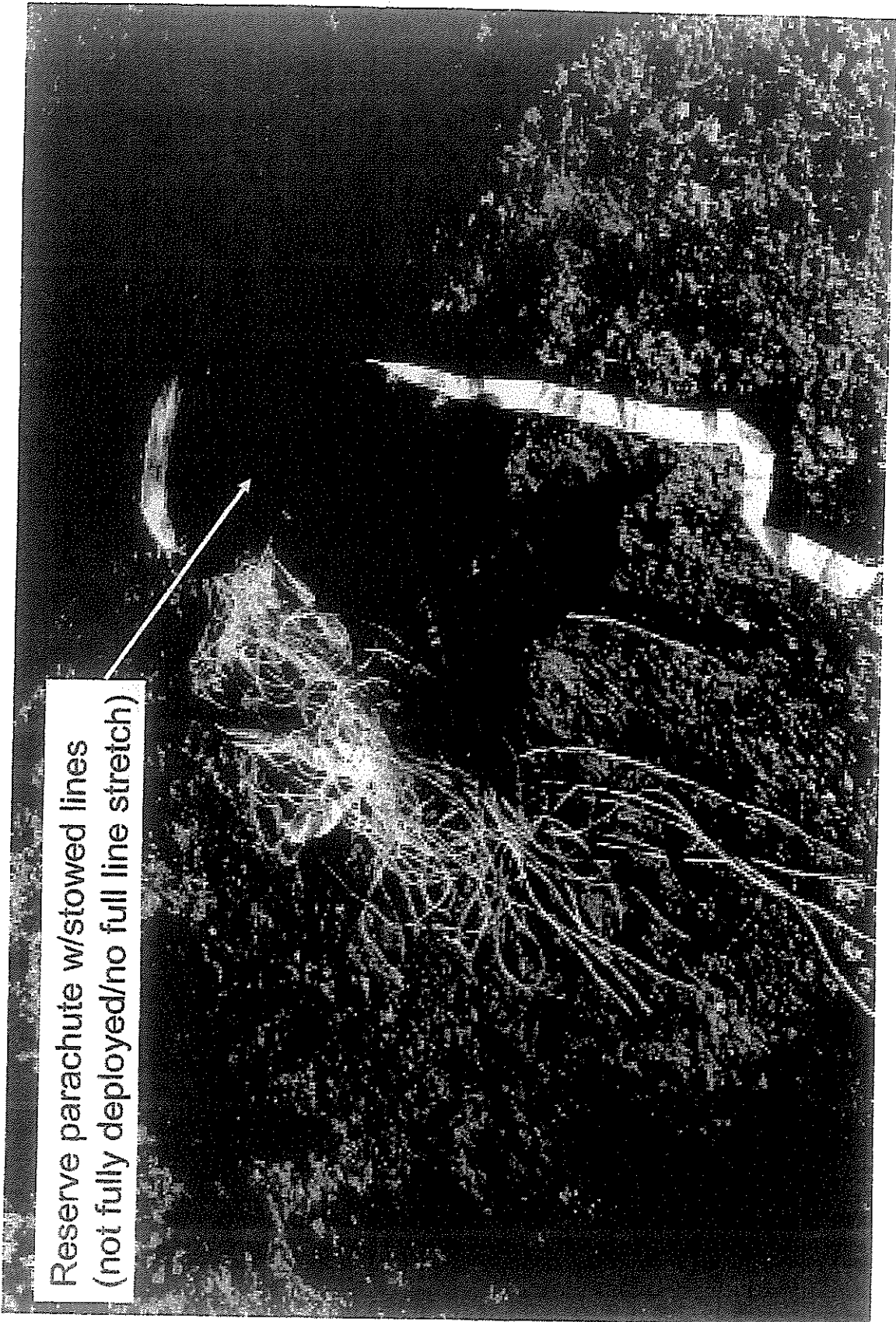
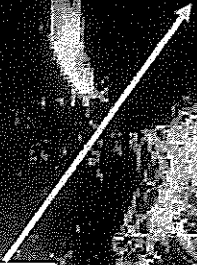
Comments: DOCUMENTS FROM PIMA COUNTY  
MEDICAL EXAMINER'S OFFICE

(b)(2)High

ENCLOSURE ( 2 )

35

Reserve parachute w/stowed lines  
(not fully deployed/no full line stretch)



36

(b)(2)High

ENCLOSURE ( 7 )

( 37 )

(b)(2)High

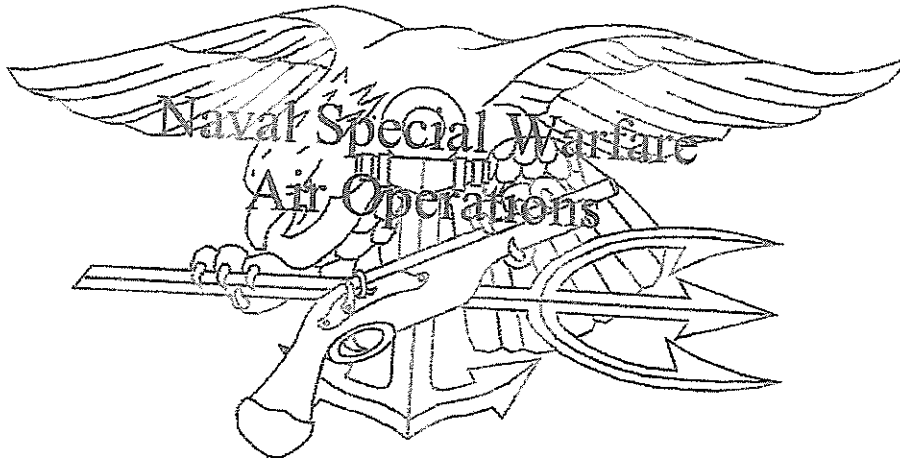
ENCLOSURE (7)

38

(b)(2)High

ENCLOSURE ( > )

39



# CHAPTER 4

## Free-Fall Parachuting

This chapter provides guidance for conducting NSW FF operations. NAVSEA SS400-AG-MMO-010, Special Forces Military FF Operations (published by the U.S. Army and commonly referred to as FM 3-05.211), provides greater detail for some procedures. Rules and procedures in this manual may deviate slightly from FM 3-05.211 to meet NSW unique mission requirements. FF water parachute jumps are discussed in this chapter but are covered in greater detail in Chapter 5.

**4-1. High-Altitude High-Opening/High-Altitude Low-Opening Freefall**

**Freefall Methods**

The two military FF parachuting methods are HAHO and HALO. Jumps using either FF method count toward FF qualification and hazardous duty incentive pay.

**High-Altitude High-Opening**

HAHO FF jumps are jumps made with parachute deployment at or above 10,000 feet AGL. The NSW LTG for HAHO, NSW LTG for Tactical DZs, and FM 3-05.211 outline HAHO procedures.

**High-Altitude Low-Opening**

HALO jumps are FF jumps with parachute deployment below 10,000 feet AGL.

**Freefall Advantages**

FF may offer the following advantages over S/L as an insertion method:

- Precision landing on small DZs (e.g., rooftops, ships, oil platforms)
- Parachute insertions when low altitude drops are impractical
- Standoff that may decrease aircraft detectability by threat (radar, etc.)
- Use of aircraft not authorized/configured for S/L parachute operations (e.g., P3).

**4-2. Personnel Required for Freefall Parachute Operations**

With the exception of jumps requiring supplemental oxygen, FF support personnel requirements are the same as those for S/L (Section 3-1). For oxygen jumps an Oxygen Safety Technician is required. Oxygen safety requirements are described in Section 4-21.

**4-3. Freefall Training**

**Training Considerations**

Training recommended to maintain combat jumper proficiency in land FF HALO and HAHO is a minimum of six FF jumps per quarter as follows:

- One day HALO, combat equipment
- One night HALO, combat equipment
- One day or night HAHO, no equipment
- One day or night HAHO, combat equipment
- One day or night HALO, combat equipment with supplemental oxygen.

Training recommended to maintain MCADS jumper proficiency is a minimum of six FF jumps per quarter that include:

- One day water jump, no equipment
- One night water jump, no equipment
- One day MCADS water jump.

**4-4. Freefall Equipment**

**Nonstandard Parachutes**

Nonstandard FF parachute systems are described in Section 2-10.

**MC Series Parachute Systems**

The ram-air MC-4 system, used primarily by the US Army, is a non-S/L capable 370-square-foot parachute. The MC-5, used primarily by the USMC, is similar to the MC-4 system, but is S/L capable. Both system's maximum suspended weight is 360 pounds with a maximum opening altitude of 25,000 above MSL.

Other MC series parachutes, the MC1-1 and MC-6, are round S/L parachutes discussed in Section 3-2.

Note: A detailed description of FF parachuting equipment can be found in FM 3-05.211 and NAVAIR 13-1-21.

## MT-Series Parachute Systems

The MT-series parachute systems are both S/L and FF capable and are described in Section 3-2.

### Altimeters and Automatic Activation Devices

An approved altimeter and AAD (see AAD in Section 4-5) are required for each FF jumper except when conducting a water jump intended to involve less than 10 seconds of freefall prior to opening canopy. A parachute altimeter must be available in the aircraft for the JM for all jumps. When the airport altitude is different from the DZ altitude, ensure that the altimeter is adjusted for DZ altitude.

### Reserve Static Line

When using the MT-series parachutes, the Reserve S/L (RS/L) system must be hooked up. The RS/L normally will remain connected except on water jumps or when there is high wind on the drop zone, in which case the RS/L can be disconnected after the jumper is under a good main canopy.

### Parachute Packing

Ram-air main parachutes can be packed by either a qualified SO PR or the jumper of that canopy. Parachute packing regulations are provided in Chapter 2, Section 2-10.

### Donning Equipment

It is recommended that jumpers use the buddy system when donning the FF parachute assembly. This is especially important when jumping with equipment or oxygen. Refer to the parachute's manual or the NSW LTG for proper donning procedures (manuals and LTGs are listed in Appendix S).

## 4-5. Automatic Activation Devices

### Automatic Activation Device Types

The only AADs currently authorized for general military use are the FF-2 Hitefinder, the Cypres, and the AR2 (see ANU List). The AR2 is not authorized for NSW use and not discussed in this manual. Information on the AR2 can be found in FM 3-05.211.

### FF-2 Hitefinder Parachute Release Mechanism

The FF-2 Hitefinder is a main parachute-mounted AAD. It is mechanical (no batteries) and fires every time the preset altitude is reached. The FF-2 is ready to be set when the reset indicator is aligned, the arming pin is in place, and the cable is cocked.

FF-2 activation occurs at the activation altitude plus or minus 500 feet; therefore it should be set to activate a minimum of 500 feet below the planned parachute opening altitude, but never below 2,500 feet AGL.

At the JM's direction, the FF-2 is armed (pin pulled) by the jumper at 2,500 feet above the activation setting, which makes the minimum exit altitude 5,000 feet AGL (2,500 feet minimum setting plus 2,500 feet arming).

Safety Note: JMs must know if they are working with barometric pressure or the aircraft altimeter setting to set the FF-2 correctly.

### FF-2 Millibar Setting Calculation

The FF-2 setting is in millibars. The JM may derive the millibar setting for activation altitude from either the barometric pressure or the aircraft altimeter.

To calculate the millibar setting using barometric pressure, the JM must first obtain the current or forecast barometric pressure for the DZ. This reading will be given in inches of mercury (Hg) and must be to the nearest one-hundredth of an inch.

Using the Irvin FF-2 Calculator (whiz wheel), the JM determines the millibar setting by first placing the black line over the barometric pressure on the outer scale (29.00 for example). Next, he places the red line over the FF-2 activation altitude (2,500 feet AGL, for example) on the inner scale of the calculator and reads the millibar setting under the red line on the center scale (896 millibars in this case).

If the DZ is at a different altitude from the area where the barometric pressure reading is taken, the JM must add or subtract the altitude difference between the reading location and DZ location. For example, if the weather station where the readings are taken is at 1,000 feet above MSL and the DZ is at 1,500 feet above MSL, the JM must add 500 feet to the activation altitude before using the whiz wheel. (e.g., 2,500 feet + 500 feet = 3,000 feet activation altitude).

To calculate the millibar setting by using the aircraft altimeter setting, the JM obtains the current or forecast aircraft altimeter setting for the DZ. The altimeter setting will be given in inches of Hg and must be to the nearest one-hundredth of an inch. If a mission is being flown with limited weather information, the aircrew can provide the altimeter setting en route to the DZ.

Using the whiz wheel, the JM determines the FF-2 millibar setting by first placing the black line over the altimeter setting on the outer scale (30.61, for example). Next, he adds the FF-2 activation altitude (2,500 feet AGL, for example) to the given DZ elevation expressed in feet (1,500 feet, for example) to determine the corrected activation altitude (4,000 feet in this case). He then places the red line over the corrected activation altitude (4,000 feet) on the inner scale of the calculator and reads the millibar setting under the red line on the center scale (896 millibars in this case).

### Cypres

The Cypres (name derived from "Cybernetic Parachute Release System") comes in two versions, the Military Cypres used with standard parachutes and the Expert Cypres used with nonstandard parachutes.

The Cypres is an electronic, reserve-mounted AAD. It is designed to cut the loop rather than pull the pin on the reserve. It is installed inside the reserve container by qualified SO PRs.

The jumper will turn on the Cypres at the JM's direction. The JM will check to ensure proper operation during the JMPL.

### 4-6. Freefall Altitudes and Exit Parameters

#### Above Ground Level and Mean Sea Level

Altitudes can be expressed in feet AGL or feet above MSL. The JM must brief jumpers, DZSOs, and pilots on which unit will be used. Pilots most often work in feet above MSL.

#### Minimum Exit Altitudes

Figure 4-1 illustrates the minimum exit altitudes for a FF jump made with and without AADs.

#### Maximum Exit Altitudes

The maximum exit altitude is 35,000 feet above MSL.

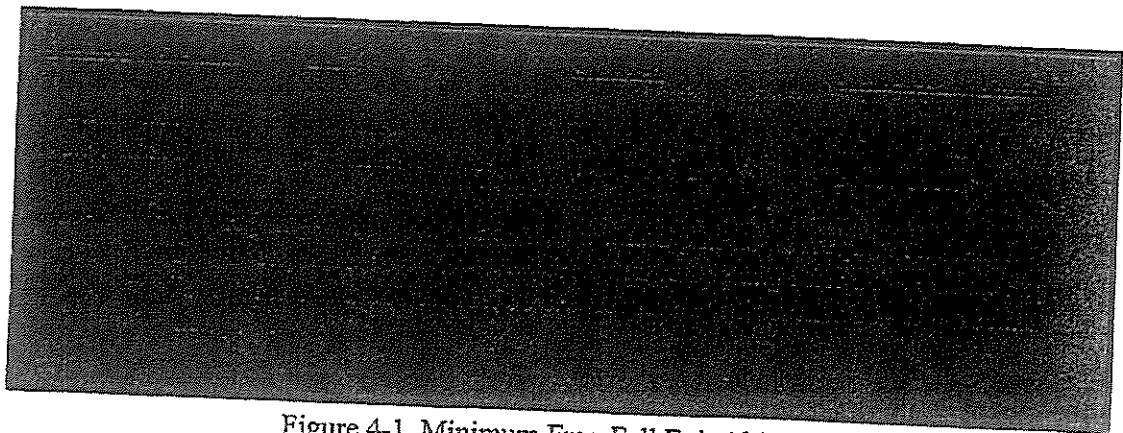


Figure 4-1. Minimum Free-Fall Exit Altitudes

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### Opening Altitudes

Minimum opening altitude for HALO and HAHO jumps is 3,500 feet AGL for military parachute systems (e.g., MT-series) and 2,000 feet AGL for nonstandard parachutes. An over-water FF exit below 3,500 feet with a military parachute requires that the jumper perform a "clear and pull."

Maximum opening altitude is 25,000 feet above MSL for all canopies except the MT-1X, which has an 18,000 feet maximum opening height.

For group exits, the opening altitudes should be staggered. Groups exiting first deploy at the lowest altitude and subsequent groups deploy at higher altitudes. Staggered opening altitudes and sufficient time between jumper exits will help to prevent collisions during deployment.

### 4-7. Weather and Terrain Restrictions

Ceiling and visibility restrictions for FF training jumps:

- The cloud ceiling over the PI must be a minimum of 1,000 feet AGL.
- At drop altitude, there will be a 1,000-foot cloud-free zone immediately below the aircraft.
- For JMD operations, the JM must be able to see the DZ from the aircraft at exit altitude.

Procedures for thunderstorms, wind, flights over water, and high-altitude drop zones are the same for FF and S/L and are provided in Section 3-5.

### 4-8. Communication Requirements

#### Free-Fall Communication Requirements

With the exception of night HAHO operations, communications requirements for FF are the same as those for S/L jumps (see Section 3-6).

#### Night High-Altitude/High-Opening Communications

When performing night HAHO operations, radios are required for each jumper. The DZSO will be equipped with a radio for communication between the jumpers and

ground. Radios are recommended for use by jumpers for night HALO operations.

### 4-9. Drop Zones

#### Drop Zone Markings and Surveys

DZ markings, blind DZs, and DZ surveys are covered in Sections 4-8 to 4-10.

#### Free-Fall Drop Zone Size Requirements

There is no minimum size for FF DZs. An area 50 by 100 yards and free of major obstacles is the recommended minimum for training jumps. Consider the experience level of the parachutists when selecting a DZ for training evolutions.

#### Secondary Drop Zone

A secondary DZ should be planned when conducting HAHO FF operations, or for operations involving small primary DZs. Depending on the terrain and opening altitude, JMs should consider designating secondary DZs both upwind and downwind of the primary DZ.

### 4-10. Airdrop Release Methods

#### Jumpmaster Directed Release, Computed Air Release Point, and Verbally Initiated Release

JMD release, CARP, and VIRS information is provided in Section 3-7.

#### High-Altitude Release Point Calculation

JMs using the JMD release method for high altitudes will compute the exit point using the HARP calculations. Procedures for using HARP are provided in FM 3-05.211.

### 4-11. Prejump Requirements

#### Personnel Assignments, Notice to Airmen

Personnel assignments and NOTAM requirements are covered in Section 3-11. For FF jumps at 18,000 feet above MSL or higher, verify that a USAF physiological technician has been scheduled.

## Aircraft Inspection, Jumpmaster Personnel Inspection

Requirements for JM aircraft inspection and JMPIs are discussed in Section 3-13.

### Briefing

Briefing requirements for jumpers, DZSO, and pilot are covered in Section 3-12.

When conducting an oxygen jump, the NSW Oxygen Safety Technician must ensure that jumpers are briefed on the safe use of oxygen. See Section 4-21 for oxygen requirements and Appendix C for the oxygen safety brief format.

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## 4-12. In-Flight Emergencies

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### Emergency Exits

With the exception of inadvertent pilot-chute deployment (discussed in the following paragraph) in-flight emergency actions are described in Section 3-15. FF jumpers making an emergency exit perform a "clear and pull" regardless of altitude.

### Inadvertent Pilot-Chute Deployment

If a jumper's parachute is activated inside the aircraft accidentally, the parachute should immediately be contained and the jumper moved forward in the aircraft. If the canopy deploys out of the aircraft, the jumper should quickly exit the aircraft with the parachute.

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## 4-13. Aircraft Procedures and Freefall Jump Commands

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### Conduct in the Aircraft

Conduct while in flight is discussed in Section 3-14.

### Jump Commands

The JM will issue the following minimum commands to FF jumpers prior to the drop. Some of the commands may be modified to suit the type of aircraft used.

- Don helmets and seatbelts (before takeoff).
- Unfasten seatbelts (above 1,000 feet AGL).

- Time warning (20 minutes).
- Arm FF-2 and check pins (5,000 feet AGL).
- 10-minute warning.
- DZ ground winds.
- Stand up (2 minutes out).
- Move to rear (1 minute out).
- Stand by.
- Go.

### Free-Fall Jump Visual Signals

FF jump command visual signals can be found diagrammed in FM 3-05.211. Ensure that the standby signal is given clearly and not confused with the "Go" signal.

### Arming the FF-2

When using the FF-2, allow a minimum of 6 seconds after the AAD is armed prior to checking the pins. This will allow time for a malfunctioning or incorrectly set FF-2 to activate. After the minimum 6 second wait, the JM or Assistant JM must visually check the FF-2 to ensure that it is armed and did not fire prematurely.

### Checking Equipment

After the stand-up signal has been given, each jumper will check the equipment of the jumper in front of him. This includes ensuring the main and reserve ripcord pins are at least three-quarter stowed.

### Hold Signal

Anyone at anytime can give the "Hold" signal (clenched fist) if they believe there is an unsafe condition. The "Hold" signal must be passed to JM. When a hold signal is given, jumpers will stop and await instructions from the JM.

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## 4-14. Exits and Canopy Deployment

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### Exiting Aircraft

When ordered by the JM, the jumper will perform a poised or dive-out exit. Dive-out exits require a minimum delay of 4 seconds prior to canopy deployment.

When conducting CARP, HARP, or AWADS jumps, the JM will brief whether the jumpers will exit on the green light or JM signal.

### Accidental Exits

If a jumper exits or falls out of the aircraft early, he must deploy his parachute and get a bearing on the DZ, or identify an alternate landing area. No one may exit after the jumper that fell out. No other jumpers will exit the aircraft until the DZSO has been notified and the status of the jumper is known. The JM must immediately notify the pilot that a jumper is under canopy.

### Short Delay Exits

Immediate canopy deployment from a fast-moving aircraft can damage the parachute system and cause severe opening shock. When the aircraft is flying faster than 110 knots, there must be a delay between the time the jumper exits the aircraft and the time he pulls his ripcord. This will allow time for the jumper to clear the aircraft's horizontal throw and transition to a slower vertical FF. The faster the airspeed, the more delay needed. The minimum delay when conducting a clear-and-pull (also called delayed exits) for an aircraft at over 110 knots is 4 seconds.

In the thinner air at higher altitudes, aircraft fly faster. Clear and pulls from higher altitudes must have a longer delay to compensate for the speed of the aircraft.

### Body Stabilization and Control

If a jumper becomes unstable, the jumper responds by performing a hard arch with arms and legs extended, and head back. Information on body positions and control are in the Body Stabilization NSW LTG and in FM 3-05.211.

### Freefall above Other Jumpers

At no time will a parachutist position himself above another parachutist in FF, regardless of altitude. Injury from collision would occur if there were an accidental deployment of the lower jumper's parachute. Due to his limited vision, the low man always has the right of way.

**Safety Note:** Being over top of another jumper during FF could lead to serious injury in the event of an accidental or early deployment of the low jumper's canopy.

### Altimeter Failure

If a jumper has a failed altimeter during FF, he will watch the other jumpers and deploy when they deploy. If it is a night jump or no other jumper can be seen, he must perform a "Wave Off" (see below) and deploy his canopy immediately.

### Free-Fall through Clouds

Jumpers going through clouds during FF must avoid forward or lateral movement and deploy their canopy at the assigned altitude.

See Section 3-5 for procedures while under canopy in clouds.

### Wave Off and Pull

At a thousand feet above the assigned pull altitude, each jumper will perform a "Wave Off," using both arms to signal any jumpers above that he is preparing to deploy his canopy. If he spots a person directly above him, and the altitude permits, he will track out from under the higher jumper for 500 feet of descent (3 seconds) and then deploy his canopy. Note that at terminal velocity a jumper falls at 120 miles per hour, or 176 feet per second. The jumper will perform the following steps to pull:

- Arch – ensure stability
- Look – identify the main ripcord handle
- Reach – keep body symmetrical
- Pull – full extension with both arms
- Check – over the right shoulder to clear burble.

### Post-Deployment Procedures

Immediately after deployment, the jumper places hands on risers and locates other jumpers to reduce potential for a canopy collision. If the area is clear, the jumper should release the brakes and continue with post-deployment procedures as follows:

- Check canopy and perform canopy controllability check (Section 4-15).
- Check altitude and ground references.
- Locate target and check wind.
- Monitor other jumpers' positions.
- Steer canopy to the target.
- Face into the wind and land.

#### 4-15. Canopy Control and Canopy Controllability Check

##### Parachute Aerodynamics

A ram-air parachute is a high-performance gliding system. The parachutist must have a basic knowledge of the aerodynamics to understand flight characteristics, capabilities, limitations, and canopy control techniques. For detailed information on parachute aerodynamics, refer to the NSW LTG "Canopy Control" or FM 3-05.211.

##### Turbulence

Wind obstructions (e.g., trees, hills, buildings, etc.), unstable air masses aloft, or flying close behind another canopy can cause turbulence that affects ram-air canopy performance. Turbulence will cause the canopy to rock and buffet slightly. In turbulent wind conditions, use 25 to 50 percent brakes to smooth out the canopy ride.

##### Canopy Controllability Check

If canopy performance is questionable after deployment, a jumper should perform the following controllability check:

- Release brakes.
- Check straight flight path.
- Look left and turn left 90 degrees.
- Look right and turn right 90 degrees.
- Determine stall point.

If the canopy requires more than 50 percent toggle to fly straight, stalls prior to 50 percent brakes, or is unstable during turns, it is uncontrollable and should be cut away.

##### Separation from Other Canopies

The recommended separation while under canopy is 50 feet behind and 50 feet above other parachutists.

Note: Further information on HAHO parachuting techniques is provided in the NSW HAHO LTG and FM 3-05.211.

#### 4-16. Free-Fall Cutaway Procedures

##### Use of Reserve Parachute

The reserve parachute is used when the main parachute fails or the parachutist determines that the main parachute will not provide a safe rate of descent for landing. When deployed together, ram-air main and reserve parachutes are usually incompatible and likely will malfunction.

##### Cutaway Technique

Before the reserve parachute can be deployed, the main parachute must be cut away. The technique for performing a cutaway and reserve deployment of the MT series parachute system is as follows:

- Throw away the main ripcord.
- Maintain arch if still in FF.
- Look at and grab the cutaway handle with your right hand.
- Look at and grab the reserve ripcord with your left hand.
- Pull the cutaway handle to full extension and throw it away.
- Pull the reserve ripcord to full extension and throw it away.
- Look and clear over your right shoulder to ensure that the reserve pilot chute has deployed.
- Perform post-opening procedures and canopy controllability check.

##### Decision Altitude and Cutaway Altitude

The most critical element in any malfunction is altitude awareness. The decision to cut away should be made by 2,500 feet AGL and cutaway should be performed by 2,000 feet AGL. A cutaway may be performed below 2,000 feet AGL, but jumpers must use caution due to altitude required for reserve deployment.

#### 4-17. Freefall Parachute Malfunctions

##### Total Malfunctions

A total malfunction is defined as the jumper falling at terminal velocity with no canopy. Following are possible ram-air canopy total malfunctions and proper jumper reactions:

FLOATING RIPCORD (caused by the ripcord not being stowed properly)

- Attempt to locate ripcord housing and trace to ripcord.
- If not found, cut away main and deploy reserve.

HARD PULL (caused from tight pack, bent pins, or AAD misrouted)

- Use both hands to pull.
- If not successful, cut away main and deploy reserve.

BAG LOCK

- Perform cutaway and deploy reserve.

PACK CLOSURE (caused by wedged pilot chute)

- Make quick look (time is critical).
- Elbow the pack.
- If not successful, cut away main and deploy reserve.

PILOT CHUTE HESITATION/BURBLE (caused by not checking over shoulder)

- Make a quick look (time is critical).
- Elbow the pack.
- If not successful, cut away main and deploy reserve.

HORSESHOE (caused by poor body position)

- Cut away and deploy reserve.

RISER SEPARATION (caused by worn or old equipment)

- Cut away main canopy and deploy reserve.

#### Partial Malfunction

Partial malfunctions will slow the rate of descent of the jumper, but not enough to land safely. Some partial malfunctions can be cleared, while others require the main to be cut away and the reserve deployed.

Altitude awareness is critical. Jumpers should not get engrossed in fixing a partial malfunction and lose track of time and altitude. The

following are possible ram-air canopy partial malfunctions and jumper reactions:

STREAMERS/SNIVELS (caused by poor packing, poor body position, or damaged equipment)

- Pull down rear risers twice vigorously.
- If not successful, cut away main canopy and deploy reserve.

CLOSED END CELLS/HUNG SLIDER (caused by a slow opening)

- Pull down steering toggles twice to waist level, hold for 3 to 4 seconds.
- Perform a canopy controllability check.
- If not controllable, cut away main canopy and deploy reserve.

TENSION KNOTS (caused by old or worn equipment and/or a hard opening)

- Pull down riser with affected line, let snap free. If not cleared repeat once more.
- Perform a canopy controllability check.
- If not controllable, cut away main canopy and deploy reserve.

RIPS/TEARS/HOLES (caused by worn equipment, hard opening, and poor packing)

- If hole is bigger than 10 inches or you can see the sky through the hole, cut away main and deploy reserve.
- If hole is smaller than 10 inches, compare rate of descent with other jumpers.
- Perform canopy controllability check.
- If uncontrollable or if descent rate too fast, cut away main canopy and deploy reserve.

PREMATURE BRAKE RELEASE (caused by poor packing)

- Pull down affected riser to counter turn.
- Release opposite brake.
- Perform a canopy controllability check (look for broken steering line).
- If not controllable, cut away main canopy and deploy reserve.

### BROKEN STEERING LINE/BROKEN LINES (caused by old or worn equipment and/or a hard opening)

- Perform a canopy controllability check.
- Use both rear risers for landing (CAUTION: The canopy reacts and stalls much quicker using rear risers).
- If not controllable, cut away main canopy and deploy reserve.
- Prepare for PLF.

### LINE TWIST (caused by bad body position or poor packing)

- Reach above and spread risers apart.
- Bicycle out.
- Do not release brakes.
- If unable to correct by 2,500 feet AGL, cut away and deploy reserve canopy.

### MAIN AND RESERVE CANOPIES DEPLOY (caused by ripcord handles snagging or AAD firing)

- If the reserve deploys while under a main canopy, try to contain between legs and steer to DZ.
- If both canopies are inflated, grasp the cutaway pillow with the right hand. Separate canopies by pushing or pulling the left rear riser. It does not matter which canopy, main or reserve, is at the left rear; the objective is to separate the two canopies. Once canopies have separated as much as possible, initiate cutaway procedures. See note below.

Note: Main and reserve canopies may fly together and possibly could be landed safely. However, when in doubt and altitude permits, perform emergency cutaway procedures.

### PILOT CHUTE OVER NOSE (caused by bad opening or flying canopy backwards [deep stall])

- Perform a canopy controllability check.
- If not controllable, cut away main canopy and deploy reserve.

## 4-18. Canopy Collision Procedures

### Avoiding a Collision

After opening and checking for a good canopy, the jumper's first concern should be to avoid a canopy collision. Actions to help prevent a canopy collision include:

- Stay alert to prevent collisions from happening.
- Avoid target fixation.
- Turn right to avoid a head-on collision.
- Remember that the low man has the right of way.

### Collision Procedures

If a canopy collision occurs, the jumper must perform the following actions. Appendix B, Figure B-1, provides more detail on canopy entanglement procedures.

- Take a modified spread eagle position with left hand protecting handles; try to bounce off lines and steer clear.
- If entangled, communicate with each other and attempt to clear at altitude.
- Maintain altitude awareness.
- When using FF parachutes, the top jumper has priority on cutaway in an entanglement. This is due to the fact that the top jumper normally has a good canopy and the possibility of being further entangled by the bottom jumper's parachute if the bottom jumper cuts away first.
- If necessary, the top jumper can land the bottom jumper; to do so he must flare higher.
- Do not cut away from entanglement below 1,000 feet AGL. If the collision occurs close to the ground, attempt to deploy the reserve to slow the rate of descent.

## 4-19. Canopy Landing Procedures

### Disconnecting the Reserve Static Line

If under good canopy, the RS/L system may be disconnected prior to landing. This is required for water and high-wind landings to prevent reserve deployment if the main is cut away.

## Landing Technique

Good landings come with practice and experience, and will be affected by winds, DZ altitude, and temperature. Procedures for performing a normal "flare" landing:

- Use flat S-turns to descend.
- Turn and face into the wind at approximately 500 feet.
- Use brakes to avoid overshooting the target.
- At 200 feet, let up brakes to full flight.
- Depending upon the wind conditions, start flare at 10 to 20 feet above the ground.
- Have toggles at full flare position when feet touch the ground.

Note: The best landings can be achieved from full flight. This will plane the canopy out smoothly instead of dropping the canopy straight down.

## Drop Zone Approach Path

The JM must brief a predetermined approach path into the DZ. Jumpers follow this approach path to avoid canopy collisions.

When the planned approach path cannot be followed, the low jumper will establish the approach path into the DZ. Canopy control and approach are discussed in detail in the NSW LTG, Canopy Control, and FM 3-05.211.

## No-Wind Landings

For landings in a no-wind situation, land according to the DZ marking. This will prevent a situation where jumpers landing from different directions might collide. No-wind landings will require the jumper to execute a full flare from forward flight to achieve a smooth landing.

## Night Landings

Night landings are difficult and should not be attempted by jumpers having problems with day landings. The procedures for performing a night landing are as follows:

- If there is enough illumination, use a "flare" landing.
- If there is doubt about when to flare, land the canopy with 50 to 75 percent brakes.
- Prepare to perform a PLF.

## Jumper Accountability

After executing a proper landing, all jumpers muster with the stick leader who will report the muster to the DZSO. For operations, a predetermined rally point should be established.

## Standing Up After Landing

After landing, all jumpers will stand up immediately to make it evident to the DZ medical support that they are not injured.

## 4-20. Emergency Landing Procedures

### Obstacles, High-Tension Wires, Trees

Emergency landings near obstacles, high-tension wires, and trees are described in Section 3-21.

### Unintentional Water Landing

An unintentional water landing is defined as any landing in a body of water by a jumper rigged for a land jump. Jumpers are required to wear personal flotation if a body of water is located within 1,000 meters of the DZ (see flotation in Section 3-2).

Procedures for an unintentional water landing are as follows:

- Jettison equipment and unhook reserve static-line (RS/L) system.
- Continue to steer canopy.
- Release waist strap.
- Face into the wind at 150 feet.
- Release the chest strap at 100 feet.
- Flare for landing.
- Release the leg strap connectors as your feet enter the water. Prepare for a PLF.
- Roll out of the harness and swim free.
- Inflate flotation device if needed.
- Do not attempt to save any equipment or parachute gear at the risk of your life.

### High-Wind Landing

A high-wind landing can escalate into a life-threatening situation if not acted on immediately. High-wind landing procedures are as follows:

- Disconnect the RS/L system.
- Face into the wind.
- In high winds, a full flare may not be required to land.
- To deflate canopy, run to downwind side.
- If being dragged, turn onto one side and apply full brake on the upper side of the body to collapse the canopy.
- Cut away as a last resort. Be aware that, unless it has been disconnected, the RS/L will deploy the reserve when the main is cut away.

### Rough Terrain Landing

If an emergency exit is required or a drop is made into a blind DZ, rough terrain might be encountered. Rough terrain procedures are:

- Look for clear, level ground.
- Look for indications of ground wind direction.
- Fly the canopy at 50 to 75 percent brake on landing approach if not sure of terrain.
- Prepare to do a PLF.

## 4-21. Free-Fall Oxygen Regulations

### Oxygen Requirements

All FF jumps conducted at 13,000 feet above MSL or greater require the use of supplemental oxygen. Oxygen is required at 10,000 feet above MSL if jumper exposure to altitude exceeds 30 minutes. Appendix G details oxygen requirements for HALO and HAHO jumps at various altitudes. Supplemental oxygen means that each jumper will have his own oxygen mask and regulator.

### Oxygen Safety Technician

For oxygen jumps, one Oxygen Safety Technician from any service is required for every 16 jumpers. The Oxygen Safety Technician will assist the JM during the jump operation.

The Assistant JM can carry out the duties of the Oxygen Safety Technician provided he does not jump and is qualified for both positions. An Oxygen Safety Technician may participate as a jumper if another Oxygen Safety Technician (any service) remains aboard the aircraft.

### U.S. Air Force Physiological Technician

Jumps at 18,000 feet or higher above MSL, require a USAF Physiological Technician in addition to the Oxygen Safety Technician.

The USAF Physiological Technician will be requested at the same time as the aircraft. He will be responsible for adherence to USAF regulations governing the use of oxygen by both aircrew and parachutists.

### Hyperbaric Chamber

Prior to conducting a jump from 18,000 feet altitude or greater, the JM or physiological technician must identify the location of the nearest hyperbaric chamber.

### Oxygen Safety Brief

The Oxygen Safety Technician must give a safety brief to the jumpers no more than 24 hours prior to the operation. The safety brief will include oxygen hookup procedures, oxygen hand signals, and emergency medical procedures. The oxygen safety brief is outlined in Appendix C.

### Airspace Clearance

High-altitude jumps may require special clearances. The JM must ensure that the local airspace controlling authority is contacted at least 48 hours prior to confirm high-altitude airspace clearance.

### Decompression Sickness

The aircraft will descend and land if an individual begins showing signs of decompression sickness (see Chapter 2 for information on flying after diving). Parachutists showing signs of decompression sickness will remain on 100 percent oxygen until seen by a flight surgeon.

## Oxygen Equipment

The oxygen life support equipment used for HAHO and HALO FF jumps consists of oxygen mask with helmet, oxygen pre-breather system, and the portable bailout system with an Airox VIII valve. Information on these items is available in FM 3-05.211 and NSW LTGs (see Appendix S).

Oxygen equipment and tools must always be kept away from oil and grease to prevent fire or explosion.

### Aviator's Breathing Oxygen

Only gaseous aviator's breathing oxygen is used for parachute operations.

### Oxygen Jumping Restrictions

High altitudes expose the body to extreme temperature and pressure changes, and require use of supplemental oxygen. Because of these factors, parachutists must keep the following rules in mind:

- Do not conduct jump operations over 13,000 feet above MSL within 24 hours after SCUBA diving activity.
- Do not make more than two jumps between 13,000 and 18,000 feet above MSL in any 24-hour period. Do not make more than one oxygen jump higher than 18,000 feet above MSL in any 24-hour period.
- Dark goggles are not permitted on oxygen jumps. The JM, Oxygen Safety Technician, and Physiological Technician must be able to see the eyes of the jumpers.

## 4-22. Freefall Oxygen Procedures

### Donning of Oxygen Equipment

Jumpers must ensure that all oxygen equipment is secure and that it will not come loose during FF. An oxygen mask must fit a jumper's face with no leaks. Because the equipment is worn for a long period of time, all equipment must be fitted comfortably to the jumper. See FM 3-05.211 and the NSW Oxygen LTG for proper donning of oxygen equipment.

## Oxygen Jump Hand Signals

The hand signals and time checks given when using oxygen are outlined in FM 3-05.211.

### Procedures in the Aircraft

Aircraft procedures for jumps using supplemental oxygen are as follows:

- Jumpers must be loaded in reverse-stick order and located within hose length of the assigned prebreather console. The Oxygen Safety Technician connects the prebreather console hoses to each jumper and turns the console on. Each jumper shall check the oxygen mask and gas flow.
- Jumpers don the oxygen mask and commence prebreathing when the JM gives the "Mask" signal. The Oxygen Safety Technician checks each person for proper oxygen mask fit.
- The Oxygen Safety Technician will note start of prebreathing when the last jumper is on console and breathing. If at any time during the prebreathing a jumper goes off mask, the prebreathing time must be restarted. Prebreathing will always be conducted at an air pressure equivalent to 10,000 feet above MSL or lower altitude (cabin can be pressurized).
- The Oxygen Safety Technician must continuously monitor personnel and gas pressure. Jumpers must wear clear goggles so that their eyes are visible at all times.
- The signal "Check Oxygen" (thumbs up) is given immediately following the "Don Mask" signal and periodically thereafter. Jumpers will return this signal if everything is functioning correctly. The arm extended with hand open and palm down will be given if there is a problem.
- The "Stand Up" command, normally 2 minutes out from RP should be given at 6 minutes for high-altitude operations. This will ensure that jumpers have sufficient time to stand up, turn on the oxygen bailout bottle, be disconnected from the console, check equipment, and perform pin check.
- The Oxygen Safety Technician shall visually check O<sub>2</sub> bottle gauges at this time and switch out empty bottles if necessary.
- The "Move to Rear," "Stand By," and "Go" signals will then be given by the JM.

## Abort Command

If the "Abort" command is given, all personnel will return to their seats, reconnect to the console, and shut off the bailout systems. This will keep jumpers from using the limited amount of oxygen available in the bailout bottles.

## Removing Mask Below 10,000 Feet

To save oxygen, jumpers have the option of shutting off bailout bottles and removing masks if below 10,000 feet above MSL while under canopy. It must be remembered that a hanging mask makes it difficult to look 90 degrees to the right or left. Additionally, oxygen improves the jumper's night vision during night FF jumps.

## 4-23. Free-Fall Combat Equipment Jumps

### Rigging of Combat Equipment

The principal considerations for equipment during FF are:

- Do not lose objects during FF.
- Avoid entangling the parachute in exposed objects during deployment.

Rigging for FF combat equipment jumps is done in accordance with FM 3-05.211 or NSW LTG, Combat Equipment Rigging for Military FF. To avoid injury to jumper or damage to equipment, jumpers are not authorized to modify procedures in FM 3-05.211. Basic rigging guidance is provided below.

### Load-Bearing Equipment

Parachute assemblies are worn in the normal manner for combat equipment jumps. LBE should be placed inside the jumpers pack whenever possible. LBE may be placed outside the pack if unit SOPs dictate.

### Weight Considerations

Caution must be taken not to overload parachutists with equipment. The total combined suspended weight of the jumper, parachute, weapon, and equipment cannot exceed the maximum rated weight for the smallest canopy in the parachute system. Refer

to Section 4-4 for maximum suspended weights for ram-air parachutes.

### Fragile Items

Fragile items must be padded. Exposed projections (e.g., weapons, equipment, or snap hooks) are potential safety hazards and must be taped.

### Equipment Packs

The equipment pack may be attached to the front or the rear of the jumper. The JM should brief position of the packs prior to the jump.

Equipment packs are rigged using the H-harness or the improved equipment-attachment sling (spider harness). In addition to equipment harnesses, there are commercially available equipment kit bags which contain a built-in harness system.

Refer to FM 3-05.211 or NSW LTGs for description and rigging procedure of harnesses and equipment packs.

### The Hook Pile Tape Lowering Line

The 8-foot HPT lowering line (NSN 1670-01-067-6838) is used to lower equipment prior to landing. When using the HPT lowering line, verify that the length is 8 feet and not the 15 foot line used for S/L rigging. Lowering lines longer than 8 feet can cause dangerous jumper oscillation prior to landing.

**Safety Note:** JMs must ensure that the 15-foot lowering line is not mistakenly used instead of the required 8-foot lowering line.

The HPT will be attached to the jumper's harness on the right front equipment D-ring. When attaching to the front D-ring, ensure that the HPT snap hook is closed fully and attached outside of the equipment pack snap hook.

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## Rigging Weapons

Weapons rigging is addressed in Section 3-22, in FM 3-05.211, and in NSW LTGs.

## Lowering of Equipment under Canopy

The jumper will ensure that the lowering line is still attached prior to releasing equipment. Before entering the downwind leg of the landing, the jumper will release the equipment straps and maintain control of equipment with his feet. Equipment can then be lowered at approximately 200 feet AGL.

After equipment is lowered, avoid any radical turns, which could cause the canopy to oscillate, and ensure that the landing area is free of obstacles. Light and small equipment packs (less than 35 pounds) may be landed without releasing.

## 4-24. Combat Equipment Emergency Situations

### Emergency in Free-Fall

Combat equipment that partially releases during FF can present serious body stabilization problems, the most common being spinning. If possible, the equipment should be jettisoned prior to canopy deployment to reduce the chance of entanglement.

If the equipment cannot be released prior to the pull altitude, the jumper can attempt to grab and secure the equipment with his left hand and deploy his main with his right hand; however, do not waste time and altitude trying to grab the equipment.

### Emergency under Canopy

Landing near trees, high-tension electrical wires, in high wind, unintentional water landings, and emergency landings with combat equipment are addressed in Chapter 3, Section 3-21.

## 4-25. Night Freefall Operations

### Jumper Light (Signal) Requirements

Jumper light requirements are described in Section 3-23.

### Altimeter Lighting

Jumpers must either use an altimeter equipped with a light or rig an alternative light source to see the altimeter. Only a small amount of light is required to light the altimeter adequately. Jumpers tend to over-light their altimeters blinding themselves during FF.

If using a chemlite, all but a small window of the chemlite must be taped to avoid overlighting. It is recommended that the jumper have a backup light source available for the altimeter.

### Communications and Signaling Devices

Night radio requirements for HAHO jumpers are covered in Section 4-8. All jumpers must have an emergency signaling device (e.g., strobe or flare) when performing night jumps.

### Jumpmaster Night Briefs

JMs must thoroughly brief jumpers on procedures for DZ identification and landing. The jumper must be prepared to perform a PLF in case of hard landing (see Section 4-19 for night FF landing procedures).

## 4-26. Nonstandard Aircraft

Appendix N lists four nonstandard aircraft that have been used for NSW paradrop operations. Rigging and airdrop procedures for these aircraft can be found in FM 3-05.210, Appendix F, and FM 3-21.220, Chapter 19. For aircraft with no written procedures, refer to manufacturer's manuals and conduct an operational risk management assessment prior to conducting air operations.

#### 4-27. Exceptions for Combat Operations

Training procedures may be waived for combat operations. Waiver authority is discussed in Section 2-12. Waivers should be based on sound military judgment and an operational risk management assessment. Ensure that any changes are necessary, well briefed, and rehearsed.

In addition to the exceptions listed in Section 3-25, the following procedures may be used in combat, but, for safety reasons, would not be used in peacetime.

- Exit and opening altitude will be based on tactical situation.
- The 1000-foot minimum cloud ceiling over the DZ can be lowered to 500 feet.
- AAD is optional.

(b)(2)High

(b)(2)High

ENCLOSURE ( 1 )

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# Jumper's Video

- Jumper appears stable through descent with jumper making corrections, as needed to compensate [REDACTED] b)(2)High
- Jumper waves off and releases [REDACTED] b)(2)High to deploy main
- Jumper's body turns right during elongation approx 230 degrees and body returns to center
- Jumper goes vertical with harness /risers offset. Left side high

## Jumper's Video

- Cameraman/instructor falls away from jumper prior to full inflation of jumpers' main
- Main parachute appears to be sniveling and slow to inflate Canopy also appears to have 1/2 right turn induced by earlier jumper body motion.
- Original right turn on jumper appears to be induced by [redacted] swinging to jumper's right rear just prior to [redacted]

(b)(2)High

(b)(2)High

# Personnel Parachute Observations

- Parachute Packing
  - Method of packing not clear
  - Video indicates "sniveling" of main
  - Trim measurements questionable
  - No inspection standard for trim
  - Equipment in good condition
  - No porosity issues
  - Appears to meet construction specs, Warp/Fill of canopy appears symmetrical
  - Does not reflect any jumps on system from this training. Last repack Feb 08 No course repacks recorded
- Parachute Log Record

# Canopy Inspection

- **Cross Ports**
  - Evaluated and checked all cross ports on the canopy; all were present and port sizes were evaluated per TM 10443C-OI and TMAN-007-August 2005-REV0.
- **Air Permeability**
  - Air Permeability machine used Textest FX 3300
  - 36 readings were taken on bottom skin of canopy
    - Mean- 0.08307 cfm
    - Max- 0.11 cfm
  - 36 readings were taken on top skin of canopy
    - Mean-0.08139 cfm
    - Max- 0.101 cfm

(b)(2)High

## Trim Requirements

- After surmising that this canopy was "out of trim" PD sent a representative to this location to assist in determining the status of this canopy.
- (b)(6) (PD) departed after inspecting and providing confirmation that we were inspecting correctly.
- (b)(6) two observations were:
  - The canopy on video appeared to have a significantly delayed inflation and it appeared to not be typical
  - And
  - The outer trim measured within tolerance but the inner (mid/rear) concerned him as they appeared to be borderline on affecting canopy performance. More analysis was required to determine any affect on an open canopy's performance.

(b)(2)High

## Trim Requirements

- Per PD “ Trim measurements included in the manual are only representative of those measurements that the canopy was manufactured to. After one jump those measurements are no longer a valid tool for determining the actual trim of a specific canopy.
- There does not appear to be any standard / “tool” for determining whether a canopy is in or out of trim

# TRIM Measurements

	A-B	Required	A-C	Required	A-D	Required
A10	3 1/9	3	9	9 7/8	16 1/6	17 7/8
A9	2 5/6	3	9 2/5	11	20 1/4	22 3/8
A8	3 1/2	3 1/8	11 1/5	11 7/8	23 1/6	24 1/2
A7	3 1/2	3 1/4	12	12 1/4	24 3/5	25 1/4
A6	3 2/3	3 3/8	12 2/3	12 3/8	25 1/3	25 5/8
A5	3 2/5	3 3/8	12 5/8	12 3/8	22 1/2	25 5/8
A4	3 1/2	3 1/4	13	12 3/4	25 2/7	25 1/4
A3	3	3 1/8	10 1/2	11 7/8	22 7/8	24 1/2
A2	3	3	10	11	20 7/9	22 3/8
A1	3 1/8	3	10	9 7/8	17	17 7/8



# Line Lengths

	Right	Required	Left	Required
A5	216 7/8	217 7/8	217 1/8	217 7/8
A4	216 7/8	217 1/2	217 3/8	217 1/2
A3	215 3/8	217 1/4	215	217 1/4
A2	215 1/8	216 7/8	215 1/8	216 7/8
A1	215 1/8	216 7/8	same as rt	216 7/8

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# Personnel Parachute observations

- Reserve
    - Cutaway pillow-64 lbs pull
    - Ripcord pillow-42 lbs pull
  - Packtray
    - Pack tray binding tape seams in reserve stowage area
- Within repack cycle
  - Prcht. log record book correctly annotated with recent in-cycle repack.
  - Parachute activated with extended and cut reserve pilot chute bridle.
  - Reserve canopy still in free bag with both locking stows intact
  - Locking stows on free bag approx 3-3 1/2 in long
  - Suspension lines spilled from stowage pocket

# Reserve Parachute on DZ



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▪ No TDP supplied/Drawing (provided multiple copies- had no consistency on drawing)

(b)(2)High

(b)(2)High

(b)(2)High

components are fielded-Confusion on what is authorized to jump

(b)(2)High

Unknown-test to support fielding components

(b)(2)High

▪ X-rayed cable housings to insure no foreign matter present prior to re-inserting cables

(b)(2)High

(b)(2)High

ENCLOSURE

7p