Military Free-Fall Parachuting
Tactics, Techniques, and Procedures
Foreword

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Tactics, Techniques, and Procedures

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Preface

This field manual (FM) presents a series of concise, proven techniques and guidelines that are essential to safe, successful military free-fall (MFF) operations. The techniques and guidelines prescribed herein are generic in nature.

The procedures contained in this FM apply to MFF-capable organizations of all sizes for all MFF operations. These techniques represent the safest and most effective methodologies available for executing MFF operations. MFF personnel use these techniques in joint as well as combined operations. In events involving multinational forces, U.S. forces personnel should govern their actions by common sense, guided by the contents of this FM.

This FM incorporates the lessons learned from years of testing and from several actual instances of combat application. It applies during training as well as during actual operations.

When conducting joint MFF operations, Service components will follow this manual. When conducting Service-pure MFF operations, Services will use their applicable regulations and standing operating procedures (SOPs). This manual provides the safest methodologies for MFF operations. Commanders can request waivers from their Service to meet Service-specific operational requirements when these methodologies impede mission accomplishment.

The proponent and preparing agency of this publication is the U.S. Army John F. Kennedy Special Warfare Center and School (USAJKSWCS). Reviewers and users of this publication should submit comments and recommended changes on Department of the Army Form 2028 to Commander, USAJKSWCS, ATTN: AOJK-DT-SFA, Fort Bragg, NC 28307-5000.

This FM implements Standardization Agreement (STANAG) 3570, Drop Zones and Extraction Zones—Criteria and Markings, 26 March 1986.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.
Chapter 1

Military Free-Fall Parachute Operations

Special operations missions require rapid and clandestine infiltrations into operational areas or objectives across the operational continuum. MFF parachuting enables the commander to infiltrate detachments or individuals into areas under conditions that restrict static-line parachute operations.

CHARACTERISTICS

MFF parachute operations are flights over or next to the objective area from altitudes not normally associated with conventional parachute operations. MFF infiltrations normally take place during darkness or twilight to reduce the chance of enemy observation. Ram-air parachutes permit detachment members to deploy their parachutes at a designated altitude. They can then assemble in the air and land together in the objective area to execute their mission. MFF operations take place under varying weather conditions.

ADVANTAGES

MFF parachuting allows all special operations forces (SOF) personnel to open at a predesignated altitude. It also allows them to land safely together as a tactical unit ready to execute its mission. Although free-fall parachuting can produce highly accurate landings, it is primarily a means of entering a designated impact area within the objective area. This type of drop can be made except under the most adverse weather conditions. The advantages of MFF parachuting are as follows:

- As a means to infiltrate hostile areas when low-altitude penetration is not practical because of enemy ground fire.
- When there is a need or desire for precision landings on small drop zones (DZs).
- When immediate assembly of the operational detachment is necessary.
- When the desired or available aircraft cannot be used for static-line parachute operations.
- Where parachute operations using aircraft at low altitudes are prohibited, unsafe, or otherwise impractical, such as in mountainous terrain.
- When infiltration is to occur with other operations involving aircraft, or formations of aircraft, flying at high altitude.
- When navigational aids are not available to assure the required accuracy of drops at low altitude (for example, deserts and jungles).
- When there is a need for near simultaneous landings at multiple points on an objective (for example, attack or seizure of key installations).
- When standoff operations increase supporting aircraft survivability.
- When low-signature infiltrations are necessary to mission success.
APPLICATIONS

MFF parachute operations are ideally suited for, but not limited to, the infiltration of operational elements, pilot teams, assets, and personnel replacements conducting various missions across the operational continuum. Pathfinder or special tactics teams (STTs) can also infiltrate to provide terminal guidance for future airborne operations.

MFF parachute operations do not take place only at high altitude. In training, the MFF parachutist can exit an aircraft as low as 5,000 feet above ground level (AGL), immediately deploying his parachute. The combat minimum exit altitude is 2,000 feet AGL. It is the minimum altitude for deploying the main canopy during in-flight emergency exit procedures. The free-fall tactical element can exit an aircraft in a fraction of the time required for a comparable static-line operation. Such quick exits also reduce dispersion even without considering the ram-air parachute’s increased maneuverability.

CONSIDERATIONS

When planning MFF operations, commanders coordinate with the required agencies and services to obtain jamming for the supporting air service. This coordination also includes planning for the disruption of detection systems when operations are to take place in hostile areas protected by radar and other detection systems. Other considerations include—

- Availability of aircrews working under arduous conditions in depressurized aircraft at high altitudes.
- Specialized training of personnel and special equipment required.
- Currency and proficiency levels of training of the parachutist.
- Delivery altitudes requiring the use of oxygen and special environmental protective clothing.
- Limitations on jumping with extremely bulky or heavy equipment. The total combined weight of the parachutist, parachute, and equipment cannot exceed 360 pounds (lbs).
- Accurate weather data. This information is essential. The lack of accurate meteorological data, such as winds aloft, jet stream direction and velocity, seasonal variances, or topographical effects on turbulence, can severely affect the infiltration’s success or the mission’s combat effectiveness.
- High altitude high opening (HAHO) standoff operations. Wind, cold, and high altitude openings increase the probability of physiological stress and injury, parachute damage, and opening shock injuries.
- Minimum and maximum exit and opening altitudes for training (Figure 1-1, page 1-3).
EXIT ALTITUDE (IN FEET) | OPENING ALTITUDE (IN FEET)
---|---
Minimum | Maximum | Minimum | Maximum
5,000 AGL | 35,000 MSL | 3,500 AGL | 25,000 MSL

**NOTE:** Openings above 25,000 feet MSL exceed the MC-4 and MC-5 parachute design specifications. The U.S. Navy (USN) MTI-XS/SL maximum deployment altitude is 18,000 feet MSL.

Figure 1-1. Minimum and maximum exit and opening altitudes.

### WARNING

Personnel will not fly as passengers for 2 hours after a no-decompression dive; 12 hours after a decompression or repetitive dive; or 72 hours after an exceptional exposure or saturation dive. Flying after these times is limited to 8,000 feet mean sea level (MSL) cabin pressure, which is the maximum recommended for commercial passenger aircraft. If aircraft cabin pressure is below 2,300 feet MSL then flying may be done immediately after an air dive. There is no waiting period for flying after an oxygen dive.

Personnel, after surfacing from a dive, should wait for the following intervals (in hours) before conducting MFF operations (Figure 1-2):

| SURFACE INTERVAL AFTER DIVING BEFORE MFF OPERATIONS |
|---|---|---|---|---|
| Exit Altitude (maximum) | Oxygen | No-D ** | Decompression or Repetitive** | Exceptional Exposure** | Saturation ** |
| <13,000 feet MSL | no wait | 24 | 24 | 72 | 96 |
| <18,000 feet MSL | no wait | 24 | 36 | 96 | 96 |
| <25,000 feet MSL | no wait | 24 | 48 | 96 | 120 |
| <35,000 feet MSL | no wait | 36 | 48 | 120 | 120 |

**Diving definitions in the table are based on the U.S. Navy Diving Manual. Listed times include all breathing mixtures.

For MFF HAHO operations with opening altitudes above 13,000 feet MSL, add 12 hours to the listed times.

For MFF HAHO operations with opening altitudes above 18,000 feet MSL, add 24 hours to the listed times.

Figure 1-2. Surface interval after diving before MFF operations.
PHYSICAL EXAMINATION AND TRAINING REQUIREMENTS

Before participating in MFF operations and regardless of altitude or aircraft used, each MFF parachutist must meet certain minimum requirements. To attend the MFF course the MFF student must have a current Physiological Training Card (Air Force Form 1274) and a high altitude low opening (HALO) physical examination in accordance with (IAW) the USAJFKSWCS standard.

To conduct MFF operations, all personnel must be a graduate of a USAJFKSWCS-recognized MFF parachutist course and must have a current HALO physical IAW their Service regulations. The MFF parachutist must also have a current Physiological Training Card (Air Force Form 1274) by undergoing physiological training every 3 years, to include oxygen procedural training and a high altitude chamber flight.

EQUIPMENT

The MFF parachutist jumps with the proper table of organization and equipment and table of allowance clothing and equipment for the climatic conditions facing him, as well as food and survival items. Additional equipment required includes the free-fall parachutist helmet, goggles, and altimeter. The detachment members jump with and carry all operational equipment and supplies as individual loads except when using accompanying free-fall bundles.

NOTE: All DOD standard Ram-Air Parachute Systems (RAPS) main canopies are designed with the same load-bearing and gliding capability. MFF jumpmaster must check technical specifications for all nonstandard canopies. They may be jumped on the same pass and combined in the same airborne operation. The only jumpmaster planning consideration is to make sure he plots the high altitude release point (HARP) for the smallest (least gliding capable) canopy, usually the reserve for some sister Service RAPS. (See Appendix A for information on computing the HARP.)

If dropping selected items as accompanying supplies, the parachutist packs them in proper aerial delivery containers. During a drop, the detachment members locate the bundles and follow them to the ground under canopy to lessen the chance of losing the equipment. Techniques used to free-fall equipment include—

• An automatic ripcord release (ARR) and a ripcord-activated parachute.
• Power-actuated reefing line cutters and items of issue available to airborne units when shorter delays are necessary.
• A ram-air free-fall bundle system.
• A high altitude airdrop resupply system for delivery of loads up to 2,000 lbs rigged in A-22 containers.
• A drogue-stabilized, tandem parachute system.

OXYGEN

For altitudes above 10,000 feet MSL, the use of oxygen is mandatory for aircrew members (see Figure 5-1, page 5-3). Special equipment needed in addition to the goggles and helmets are oxygen masks and several main oxygen sources. These oxygen sources include—

• An oxygen console to support an entire operational element for long flights.
• The delivery aircraft’s oxygen supply to support the aircrew.
• Walk-around oxygen bottles for jumpmasters, aircrew, oxygen safeties, or Air Force physiological technicians.

• Portable/bailout oxygen system with oxygen mask for the parachutist after he has disconnected from the onboard console and left the aircraft.

**PROCEDURES**

When employed correctly, SOF can make MFF infiltrations. However, since the number of personnel normally dropped in this manner is small, they take only absolutely essential equipment and supplies. The MFF parachutist normally attaches the combat pack (all-purpose, lightweight, individual, carrying equipment) below his main parachute (Figure 1-3, page 1-6). However, he also may attach the equipment to his front like the static-line parachutist does (Figure 1-4, page 1-6). Chapter 4 addresses other rucksack systems authorized by sister Services.

**Briefing**

The briefing includes a review of en route plans and actions at specified points along the route in case of an abort or enemy action. It explains all the techniques of the jump, to include oxygen procedures, when to arm the ARR, and actions at time warnings. It indicates that a minimum of two extra parachute systems and altimeters will be available in case of a premature firing of the ARR, a failure of an altimeter, or the accidental opening of a container.

**Station Procedures**

Under tactical conditions, the operational element completely rigs itself and the jumpmasters make a jumpmaster personnel inspection (JMPI) before the point of no return. This procedure ensures the personnel will exit the aircraft with all their equipment in case of a bailout over enemy territory. All detachment members calibrate their altimeters so that the instruments read distance above the ground at the DZ.

**In-Flight Procedures**

En route, the aircraft commander keeps the jumpmaster informed of the aircraft’s position. In turn, the jumpmaster keeps the parachutist informed. This information is essential. The parachutist must know his relative position along the route so that he can apply the required actions in case of an abort or enemy action. While in flight, the aircraft commander keeps the MFF jumpmaster informed of changes to the altimeter reading should it be necessary to abort and make an emergency exit. All actions at time warnings will be IAW pre-mission briefings and this manual. The pilot will signal the jumpmaster upon arriving at the HARP. The parachutist exits the aircraft on the jumpmaster’s command.

**Free-Fall Procedures**

Upon exiting the aircraft, the parachutist orients himself on a preselected heading or groups on a prebriefed or designated parachutist until manually activating his parachute at the predesignated altitude. This technique keeps the parachutist’s dispersion relatively constant during free-fall. Visual sighting of terrain features will not always be a reliable means of determining heading, for example, in night operations, flat jungle areas, or desert terrain. One way the parachutist maintains heading is to orient himself to the aircraft’s direction of flight upon exiting. An alternate method is the use of a wrist-mounted compass. If terrain permits, the
HALO team orients on a specific terrain feature and begins navigating toward it during free-fall.

NOTE: Commanders must make sure that MFF training operations conducted outside military-controlled airspace comply with Federal Aviation Administration or host nation agreements or regulations.

![Figure 1-3. Parachutist with rear-mounted combat pack.](image)

![Figure 1-4. Parachutist with front-mounted combat pack.](image)
Chapter 2

The Military Free-Fall Ram-Air Parachute Systems

The evolution of the parachute used in MFF has been considerable over the years. This chapter identifies MC-4 RAPS components (Figures 2-1 through 2-14, pages 2-1 through 2-14). There are two RAPS used in DOD that have similar employment and flight characteristics to the MC-4. These are the USN MT11XS/SL and the United States Marine Corps (USMC) MC-5, both of which have a static-line capability, though the MT1-XS/SL has a smaller reserve canopy.

NOTE: Questions regarding employment of RAPS in the static-line configuration should be addressed to the Airborne School, Fort Benning, GA. Technical manual (TM) 10-1670-287-23&P contains information on repairing and maintaining the MC-4. USMC TM 09770A-12&P/1A contains information for the MC-5, and NAVAIR 13-1-21 for the MT1-XS/SL.

Figure 2-1. The MC-4 RAPS components.
Figure 2-1. The MC-4 RAPS components (continued).
Figure 2-1. The MC-4 RAPS components (continued).
Figure 2-2. The MC-4 RAPS harness and container assembly components.
Figure 2-3. The MC-4 RAPS assembly components.
Figure 2-4. Location of the three-ring canopy release assembly.

NOTE: Proper locking sequence of the three-ring canopy release assembly.
Figure 2-5. Location of the main ripcord handle and cutaway handle (front view).
Figure 2-6. Location of the chest strap, reserve ripcord handle, large equipment attachment ring, and reserve ripcord cable housing (front view).
Figure 2-7. Location of the oxygen fitting block and equipment lowering line attachment V-ring (front view).

Figure 2-8. Location of the main and reserve parachutes in the container.
Figure 2-9. Location of straps (front view).

Figure 2-10. Location of the equipment tie-down loop and main risers (side view).
Figure 2-11. Location of main and reserve components.
Figure 2-12. FF-2 assembly components.
MFF PARACHUTIST HELMET ASSEMBLY

MFF parachutists use the following helmets: the Gentex HGU-55/P helmet, the Gentex Light Weight Parachutist helmet, the MC-3 helmet (a semirigid, padded leather helmet), the Protec helmet with free-fall liner, and the Bell motorcyclist helmet (full-face helmet not authorized for MFF). To conduct MFF with oxygen, personnel must wear helmets with bayonet receptacles attached. The jumpmaster should have internal earphones and a microphone for communication.

WARNING

The parachutist makes sure that bayonet receivers on his helmet are compatible with the oxygen mask and the mask fits properly.
MFF parachutists must use eye protection. Commercial (Kroop) goggles provide a wide field of vision and come in two sizes, regular and a larger box design that fits over standard military eyeglasses. Military-issue Sun, Wind, and Dust Goggles are authorized but not recommended because they restrict the parachutist’s field of vision. Both of these are authorized for parachuting with or without an oxygen mask. The clear full-face shield issued with the Gentex helmet is only authorized for use with an oxygen mask. All lenses used should be clear and relatively free of scratches that might obstruct vision.

MA2-30/A AND THE PA-200 FREE-FALL ALTIMETERS

The parachutist wears the MA2-30/A or the PA-200 altimeter on his left wrist (Figure 2-14). The altimeter shows his altitude above the ground during free-fall. It permits him to determine when he has reached the proper altitude for deploying the main parachute. The altimeter must be transported and stored with care. It must be chamber tested for accuracy IAW TM 10-1670-264-13&P. It must be rechecked after an unusually hard landing and after accidentally dropping it. An altimeter that was submerged in water must be replaced.

![Figure 2-14. MA2-30/A and PA-200 free-fall altimeters.](image)

ALTIMETER SETTING COMPUTATION

1. Find the difference in elevation between the departure airfield (DAF) and the DZ.
2. If the DAF is lower than the DZ, set the altimeter back, (-), or to the left.
3. If the DAF is higher than the DZ, set the altimeter forward, (+), or to the right.

4. If the DAF and DZ elevation are the same, no adjustment to the altimeter is necessary except to place the altitude indicator arrow on zero.

**CAUTION**

Special consideration will be given to any OBSTACLES (for example, ridgelines, mountains, towers, and other such items and their elevations) that may be located within 3 nautical miles or 5.5 kilometers of your release point (RP) and/or desired impact point (DIP). These obstacles may force you to consider alternatives to HALO.

**OTHER RECOMMENDED ITEMS**

Boots (without speed lacing hooks) are not RAPS components; however, they are considered mandatory safety equipment. Different types of gloves, boots, and jumpsuits may be necessary depending upon the degree of environmental protection required.
Chapter 3

Donning and Recovering the MC-4 Ram-Air Parachute System

The method of donning and adjusting the MC-4 RAPS provides an additional safety check and prevents unnecessary delays during the JMPI. It also makes sure there is minimum discomfort to the parachutists aboard the aircraft (or from the opening shock during parachute deployment). The buddy system, or the pairing of parachutists, within each operational element provides the most efficient and accurate way for parachutists to adjust and check each others’ parachutes.

PREPARING THE AVIATOR’S KIT BAG AND THE MC-4 KIT BAG

The parachutist determines how he will wear the kit bags. He prepares them as follows:

**Aviator’s Kit Bag.** He closes its slide fastener and secures all its snap fasteners. He then folds the kit bag in two folds from the bottom leaving the handles centered (Figure 3-1) when front-mounting this kit bag. For rear mounting, he folds each end of the kit bag with one fold toward the center leaving the handles exposed at one end (Figure 3-1).

**MC-4 Kit Bag.** He wears it like the rucksack under the MC-4 RAPS. He prepares the MC-4 kit bag by closing its slide fastener. If it is front-mounted, he rolls it from bottom to top with shoulder straps exposed and places retainer bands on each end (Figure 3-1).

![Figure 3-1. Folded aviator’s kit bag for front or rear mounting and the MC-4 kit bag.](image)
DONNING THE RAM-AIR PARACHUTE SYSTEM

See Figure 3-2, page 3-4, for procedures on donning the MC-4 RAPS. The parachutist first checks the parachute assembly for visible defects. He then lets out all harness adjustments for ease of donning (Figure 3-2A) and lays the assembly out with the pack tray face down.

To don the parachute, the parachutist (No. 1) assumes a modified high jumper position. The second parachutist (No. 2) holds the harness container by the main lift webs at the canopy release assemblies and places it on No. 1’s back (Figure 3-2B).

No. 1 remains bent forward at the waist and No. 2 pushes the container high on No. 1’s back. As No. 1 threads and fastens the chest strap (Figure 3-2C), No. 2 prepares the leg straps.

No. 2 calls out “Left leg strap” and passes it to No. 1.

No. 1 repeats “Left leg strap” and grasps the leg strap with one hand. With his other hand, he starts from the saddle and feels the length of the leg strap, removing any twists and turns. He inserts the leg strap through one aviator’s kit bag handle (if the kit bag is front mounted) and fastens the leg strap (Figure 3-2D). He repeats the procedure for the remaining leg strap. He performs the same steps for the MC-4 kit bag by inserting the leg straps through the shoulder straps.

No. 1 stands erect and checks to make sure the canopy release assemblies are in the hollows of his shoulders by adjusting the main lift webs (Figure 3-2E).

No. 1 locates the free running ends of the horizontal adjustment straps and tightens the harness so it fits snugly and comfortably (Figure 3-2F).

No. 2 then threads the long running end of the waistband through both kit bag handles (if the kit bag is rear mounted) and No. 1 fastens the waistband to the waistband extension (Figure 3-2G and H).

After final adjustment, No. 1 folds all excess webbing inward, except for the main lift webs that are folded outward, and secures them using the elastic keepers (Figure 3-2I). No. 1 should be able to stand erect without straining.

When properly donned, the system should feel snug but not so tight as to restrict movement. The jumper should be able to properly “Arch,” “Look,” “Reach,” and “Pull” the ripcord on the ground before the actual jump.

No. 1 and No. 2 then change positions and repeat the procedure.

When both parachutists have donned their parachute assemblies and adjusted their harnesses, they face each other, make a visual inspection of each other, and correct any deficiencies before the JMPI.

RECOVERING THE RAM-AIR PARACHUTE SYSTEM

If jumping oxygen, the parachutist locks the ON/OFF switch in the OFF position. He removes the bailout bottles and pouch from the waistband.

NOTE: The parachutist does not place the oxygen mask on the ground unprotected during parachute recovery. Moisture from breathing and condensation due to
temperature changes will cause dirt and debris to adhere to the mask, interfering with sealing and increasing risk of injury.

The parachutist removes the harness and container and daisy chains the lines. He removes the aviator’s kit bag and opens it. He then replaces the arming pin in the FF-2 or moves the Jump/Off switch to Off on the AR2. Next, he replaces the ripcord in the ripcord cable housing and replaces the ripcord handle in the stow pocket.

The parachutist places the pilot chute next to the kit bag. He places the canopy, deployment bag, suspension lines, and risers in the kit bag. He then removes the quick-release snap hooks and lowering line quick-ejector snap from the equipment rings on the parachute harness. Next, he places the harness and container in the kit bag with the backpad facing up to protect the ARR. Finally, the parachutist places the pilot chute in the kit bag and snaps or zips the fasteners.
Figure 3-2. Donning the MC-4 RAPS.

A. Let out all straps.
B. Don the harness container.
C. Push container up and thread chest strap.
D. Position kit bag and fasten leg strap.
E. Adjust the main lift webs.
F. Adjust horizontal adjustment straps.
G. Thread waistband.
H. Secure and snug waistband.
I. Slow all excess webbing.
Chapter 4

The Automatic Ripcord Release

The ARR is a safety device designed to activate the main or reserve parachute of the RAPS should the parachutist fail to do so. The ARR functions at a predetermined altitude AGL by sensing changes in barometric pressure. The jumpmaster calculates the proper millibar setting and inspects the ARR for the proper setting. The current ARRs are the AR2, the FF-2 Hite Finder, and the MK 2100 (see TM 10-1670-264-13&P, TM 10-1670-305-13&P, and TM 10-1670-300-20&P).

**WARNING**

The ARR is a mechanical safety device. It is a secondary means to activate the main or reserve parachute. Its use is mandatory for all MFF operations.

ARR ACTIVATION SETTING AND OPERATION

The ARRs are set to activate at 500 feet or more below the briefed main parachute manual activation altitude, however, they are not under any circumstances set to activate below the ARR’s prescribed activation altitude. The activation altitudes are 2,000 feet AGL for the AR2, 2,500 feet AGL for the FF-2, and 1,500 feet AGL for the MK 2100. The ARRs sense the altitude 1,000 feet above the MSL activation altitude. The ARR fires after the timer’s activation, withdrawing the ripcord pin from the main or the reserve parachute closing loop depending on the ARR model. The process cannot be stopped once the timer is activated.

ARR MILLIBAR SETTING CALCULATION

The jumpmaster obtains the forecasted aircraft “altimeter setting” for the DZ. If flying a mission with limited weather information, the aircrew can provide the altimeter setting en route to the drop area. The altimeter (pressure) setting will be given in inches of mercury (Hg). The jumpmaster obtains the setting to the nearest one-hundredth of an inch.

Using the Irvin FF-2 Calculator (Figure 4-1, page 4-2), the jumpmaster determines the ARR millibar setting by first placing the black line over the altimeter setting on the outer scale (example 30.00). Next, the jumpmaster adds the given ARR activation altitude (example 2,500 feet AGL) to the given DZ elevation expressed in feet (example 4,700 feet) to determine the MSL activation altitude (example 7,200 feet). He then places the red line over the MSL activation altitude (example 7,200 feet) on the inner scale of the calculator and reads the millibar under the red line on the center scale (example 778 millibars).

FF-2 ARMING AND DISARMING

On the jumpmaster’s command, the parachutist removes the arming pin to arm the FF-2. The safe arming altitude for the FF-2 is 2,500 feet above the MSL activation altitude. If the aircraft must descend below the safe arming altitude, the parachutist reinserts the
arming pin to disarm the FF-2. He must disarm the FF-2 not lower than 2,500 feet above
the MSL activation altitude to prevent an inadvertent firing.

Figure 4-1. Calculating the ARR millibar setting using the Irvin FF-2 Calculator.

EXAMPLE

Altimeter setting = 30.0
ADD:
ARR activation altitude = 2,500 feet AGL
DZ altitude = +4,700 feet MSL

7,200 feet MSL = millibar setting of 778
FF-2 AUTOMATIC RIPCORD RELEASE ASSEMBLY

The FF-2 ARR assembly (Figure 4-2, page 4-4), commonly called the Hite Finder, automatically opens a free-fall parachutist’s parachute at a safe altitude should he fail to pull the manual ripcord. The FF-2’s response depends on presetting the instrument for the barometric pressure at the desired activation altitude, computed in millibars, above the intended DZ. The FF-2 is in an alloy case, at the bottom of which is a cylindrical housing that contains the main spring, a plunger, and a barrel cap. On one side of the FF-2’s case is a millibar dial knob used to set the activation altitude. On the opposite side is an access hole, covered by a threaded plug, used to reset the time-delay mechanism. The arming pin assembly used to manually activate the FF-2’s time-delay mechanism is located on the top. Also located and fitted on top of the release case is the power cable and housing assembly that pulls the parachute ripcord pins in the instrument’s operational sequence.

The parachutist can check the reset operation using the “RESET INDICATOR” window (Figure 4-2) located immediately below the FF-2 case’s rounded face. He visually checks the window and observes the location of the two white marks. If the FF-2’s time-delay mechanism has been reset, the two marks will be aligned. If the lower, movable mark is offset more than one-half the width of the indicator, the time-delay mechanism may not have been reset properly. The parachutist replaces an FF-2 that has not been reset with another that has been reset, or he has the support rigger reset the time-delay mechanism as required.

In most cases the FF-2 ARR has been installed when the parachute is issued. The FF-2 ARR fits into a stowage pocket specifically designed to contain it. Should the parachutist have to install the release, he follows the procedures in Figure 4-3, page 4-5.

WARNING
Due to the exposed mounting location of the FF-2 ARR, take extreme care when handling, storing, and transporting an MC-4 steerable parachute.

Should the parachutist have to remove the FF-2 ARR from the parachute, he removes the withdrawal hook by unscrewing the knurled locking nut and removing it from the retainer slot. He rotates the withdrawal hook off the locking pin. He reinstall the open end of the withdrawal hook in the hook retainer slot and secures it to the retainer by screwing the knurled locking nut back across the retainer.

AR2 AUTOMATIC RIPCORD RELEASE, M451

The AR2 automatically deploys a parachute at a predetermined altitude. It is designed to open the reserve parachute but can be used with the main parachute. It may also be used with cargo parachutes. It senses rate of fall and altitude above MSL (not AGL). AR2 actuates when it falls through a preselected altitude at a fall rate of 80 feet per second (ft/sec) or greater. Altitude settings vary as follows:

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Incremental Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 foot to 3,000 feet</td>
<td>1,000-foot increments</td>
</tr>
<tr>
<td>3,000 feet to 10,000 feet</td>
<td>500-foot increments</td>
</tr>
<tr>
<td>10,000 feet to 25,000 feet</td>
<td>1,000-foot increments</td>
</tr>
</tbody>
</table>
Figure 4-2. FF-2 ARR assembly.

Major Components

Automatic Ripcord Release, AR2 (Figure 4-4, page 4-6). The AR2 basically consists of an aneroid with associated mechanism, rate-of-fall sensing chamber, and a spring-loaded power cable. All components, except the power cable and its flexible housing, are contained in a housing. The housing provides all required chambers, passages, and mounting pads for each component. An altitude setting dial and JUMP/OFF switch are
mounted on the housing. The power cable supplied for use with the reserve parachute has a fixed eye that connects to the reserve parachute ripcord pin.

Figure 4-3. Installing the FF-2 ARR.
Principles of Operation of the AR2, Model 451

The AR2 senses the rate of fall and altitude above MSL (not AGL). When the AR2 falls through the altitude set on the altitude dial at a rate of fall of over 0.0368 pounds per square inch (psi/sec) (which equates to 80 ft/sec at an altitude above MSL of 5,500 feet), the power cable will retract 2 inches (minimum) and at an initial force of 70 lbs. If the rate of fall is at a slower speed such as 70 ft/sec measured at 5,500 feet, the AR2 will not actuate. When the AR2 is used on the reserve parachute, the main parachute must fully open 1,500 feet above the setting on the altitude dial. If the main parachute opens a few hundred feet above the setting on the altitude dial while in free-fall, the rate mechanism may not have enough time to equalize the pressure and to deactivate. NOTE: Brief jumpers on the importance of pulling at the correct altitude. If the free-fall is initiated below the altitude set on the altitude dial, the AR2 will definitely actuate, generally within +/- 500 feet MSL of the AR2’s preset altitude. This distance of free-fall before actuation will depend on the rate of fall and altitude. High altitude and slow rate of fall will tend to delay actuation of the AR2.

Operation Under Usual Conditions

1. Verify that the JUMP/OFF switch is in the OFF position and that the AR2 has been cocked at installation.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>If there is any indication of a leak in the aneroid, remove the AR2 from service. A leaking aneroid may cause a malfunction resulting in DEATH of the parachutist.</td>
</tr>
</tbody>
</table>
WARNING
The altitude dial indicates thousands of feet MSL (not AGL). If altitude dial is incorrectly set, two parachutes may deploy and become entangled, resulting in the DEATH of the parachutist.

2. Check the AR2 for aneroid leakage at ground level before every jump. To conduct the aneroid leakage test, set the altitude dial to an altitude at least 3,000 feet AGL (Figure 4-5, page 4-8). The yellow indicator should indicate the local ground altitude. Example: If local ground elevation is 500 feet above MSL, and the altitude dial is set at 3,500 feet or above, the yellow indicator should be approximately halfway between the MSL mark and the 1,000-foot mark. If there is a leak in the aneroid, the yellow indicator will show some altitude above 500 feet, such as 2,000 or 3,000 feet or higher. After conducting the aneroid leakage test, reset the altitude dial to the correct activation altitude for the intended DZ.

3. Compute AR2 settings for reserve mounting:
   a. Determine the desired activation altitude AGL (minimum 2,000 feet AGL).
   b. Determine the elevation of the intended DZ above MSL.
   c. Add the desired activation altitude AGL to the DZ elevation MSL to obtain your setting for the AR2 in MSL.
   d. Notify jumpers of setting.

   NOTE: The manual activation altitude of the main parachute must be at least 2,000 feet above the AR2 activation altitude. The lowest setting currently authorized for the AR2 is 2,000 feet (AGL).

4. Before jumping, verify that altitude dial is set at desired setting.

WARNING
Do not move JUMP/OFF switch to the JUMP position unless the aircraft is at least 1,500 feet above the altitude set on the dial. It is imperative that the AR2 remain well above the altitude set on the dial at all times after the JUMP/OFF switch has been moved to JUMP. If altitude dial is incorrectly set, two parachutes may deploy and become entangled, resulting in DEATH of parachutist.

5. Move JUMP/OFF switch to JUMP and verify that the switch is all the way over to the detent position.

6. After completing the jump, move the JUMP/OFF switch to OFF.

7. With the JUMP/OFF switch in OFF position, prepare the AR2 for the next jump by repeating steps 1 through 5.
WARNING

Moving the JUMP/OFF switch to OFF repositions the mechanism for the next jump. If the switch is left in the JUMP position, the next jump will cause the AR2 to activate prematurely, causing deployment of two parachutes, which may become entangled, resulting in DEATH of parachutist.

Figure 4-5. Aneroid leak indicator.

SENTINEL MK 2100

The Sentinel MK 2100 automatic emergency parachute release system (Figure 4-6, page 4-9) is precision engineered and manufactured to provide automatic emergency opening of the parachute pack assembly. Basically the Sentinel MK 2100 consists of four main operating elements:

- Altitude sensing mechanism including calibration means.
- Automatic rate of descent sensing “ON-OFF” capability for controlling the altitude actuation output signal.
- Self-test indicating system for battery and actuator cartridge condition checks.
- Power ripcord actuating mechanism.

Properly calibrated, the Sentinel MK 2100 can accurately sense the preset actuation altitude of 1,000 feet to 20,000 feet. Altitude and rate of descent sensing capability combine with reliable solid-state electronic circuitry to provide completely automatic operation while in the air. The electronic circuitry supplies the power to the explosive detonating cartridge. When the explosive cartridge fires, powerful expanding gases drive the actuating piston within the power actuating cylinder with ample force and movement to extract the pins from the locking cones on the reserve parachute.

The batteries are self-contained and are the nicad type that exhibit good low temperature characteristics. These AA size cells are automatically checked by a built-in test circuit that operates every time the unit is calibrated. This circuit checks both the battery capacity to operate the unit, plus the electrical integrity of the actuating cartridge. A
solid-state electronic indicating light is used to provide “GO/NO-GO” system functioning checks.

Figure 4-6. Sentinel MK 2100.

Components

- **The Sensing Unit**: It contains altitude sensing means, rate of descent sensing means, self-testing means, calibrating means, and the batteries.
- **Power Ripcord**: It converts explosive energy into mechanical motion to activate the reserve ripcord.
- **Cartridge**: Electrically detonated gas pressure provides energy to operate the power ripcord.

Theory of Operation

After exit from the aircraft, the rate of descent sensing element automatically turns “on” when the vertical falling rate reaches approximately 50 percent of terminal velocity. Automatic disarming occurs when the rate of descent falls below this level. Reserve activation only occurs when the preset firing altitude is reached with a velocity greater than 50 percent of terminal falling speed. Therefore, descent through the preset altitude under a normally inflated canopy would not cause activation of the reserve assembly.

Should the parachutist’s rate of descent for any reason increase after a normal opening due to canopy damage or destruction, the Sentinel MK 2100 will again automatically “Re-Arm” itself as it senses the increased vertical velocity above 50 percent of terminal velocity. The Sentinel MK 2100 also has a unique operating characteristic that provides for automatic release actuation within 1 to 4 seconds after a cutaway release is made from a partially malfunctioned canopy below the preset altitude, if manual operation does not occur sooner.

Manual activation override of the system is inherently provided at all times due to the integrated design of the power ripcord assembly and manual ripcord.

As a safety feature, the Sentinel MK 2100 is only able to fire when the preset firing altitude is approached from a 1,500 feet or higher altitude and only for 60 seconds or so after passing the preset altitude on the way down. After 60 seconds, a built-in timer disables the circuit until the unit is taken above the preset altitude again and the cycle is
repeated. An arming pin is provided to completely disable the sensing unit and must be removed prior to exit to enable proper operation.

Safety

An operational cartridge light only indicates that the electrical output and wiring circuitry, up to and including the cartridge, is operational. It **DOES NOT** ensure that the explosive charge is good.

A visual inspection of the charge before use is the only way to verify whether the charge has been fired. (On occasion it is possible for a fired cartridge to still light the cartridge light.) This visual check should be considered mandatory due to critical use of the Sentinel MK 2100 as lifesaving equipment.

If anything appears abnormal or out of the ordinary when calibrating and/or using the MK 2100, discontinue its use and return it for repairs immediately.

If the jump is aborted for any reason, the arming pin **MUST** be reinserted. This is done to avoid any possibility of the unit firing in a rapidly descending aircraft.

Do not operate the Sentinel MK 2100 unnecessarily. It is an emergency system and should be treated as such.

During cold weather jumping, the battery’s condition should be checked prior to exit to determine if the lower temperature at jump altitude has degraded the battery’s capacity to activate the cartridge.
Chapter 5

Oxygen Equipment

MFF parachuting is physically demanding. It exposes the parachutist to extremes of temperature, rapid pressure changes, and long exposures at altitudes requiring supplemental oxygen. To prepare for this environment, the MFF parachutist must be thoroughly familiar with the use of oxygen and the handling of oxygen supplies. All personnel participating in MFF operations must meet the physical requirements outlined in Chapter 1, regardless of altitude and type of aircraft used.

OXYGEN FORMS

The parachutist uses gaseous oxygen or liquid oxygen (LOX). A discussion follows on these forms of aviator’s breathing oxygen and their containers.

Gaseous Oxygen

Gaseous aviator’s breathing oxygen is designated Grade A, Type I, Military Specification MIL-0-27210E. No other manufactured oxygen is acceptable. The difference between aviator’s and medical or technical (welder’s) oxygen is the absence of water vapor. The purity requirement for aviator’s oxygen is 99.5 percent by volume. It may not contain more than 0.005 milligram of water vapor per liter at 760 millimeters (mm) of mercury and 68 degrees Fahrenheit. It must be odorless and free from contaminants, including drying agents. The other types of oxygen may be adequate for breathing, but they usually contain excessive water vapor that, with the temperature drop encountered at altitude, could freeze and restrict the flow of oxygen through the oxygen system the parachutist uses.

Gaseous-Low Pressure. Low-pressure aviator’s breathing oxygen is stored in yellow, lightweight, shatterproof cylinders. These cylinders are filled to a maximum pressure of 450 psi; however, they are normally filled in the range of 400 to 450 psi. They are considered empty when they reach 100 psi. If a cylinder is stored at a pressure less than 50 psi for more than 2 hours, it must be purged because of the water condensation that forms.

Gaseous-High Pressure. High-pressure aviator’s breathing oxygen is stored in lime green, heavyweight, shatterproof bottles stenciled with AVIATOR’S BREATHING OXYGEN. These bottles can be filled to a maximum pressure of 2,200 psi; however, they are normally filled in the range of 1,800 to 2,200 psi.

Liquid Oxygen

Liquid aviator’s breathing oxygen is designated Grade B, Type II, Military Specification MIL-0-27210E. LOX’s most common usage is in storage facilities and for aircraft oxygen supplies because a large quantity can be carried in a small space.
OXYGEN HANDLING AND SAFETY

Due to limited contact with oxygen and its handling, personnel may not fully appreciate the danger involved. Improper use and handling can result in property damage, serious injury, and death. Personnel handling oxygen must—

- Keep oil and grease away from oxygen. They must not handle oxygen equipment with greasy hands or clothing. They do not let fittings, hoses, or any other oxygen equipment get smeared with oil, grease, hydraulic fluid, or dirt. A drop of oil in the wrong place can cause an explosion.

- Keep oxygen away from fires. Small fires rapidly become large fires in the presence of oxygen supplies. Personnel handling oxygen must never permit smoking near oxygen equipment, while handling oxygen supplies, or when using oxygen life-support equipment.

- Handle cylinders and valves carefully. Before opening cylinder valves, they make sure the cylinder is firmly supported. They never let a cylinder drop or tip over. Dropping a cylinder can damage or break the valve, allowing the gas to escape and to propel the cylinder a great distance, an obvious hazard. These personnel open and close the valves only by hand. If they cannot open and close them by hand, they must return the cylinder to the depot for repair.

OXYGEN REQUIREMENTS

The lower density of oxygen at high altitude causes many physiological problems. For this reason, MFF parachutists and aircrews need additional oxygen. Figure 5-1, page 5-3 contains United States Air Force (USAF)-established requirements for supplemental oxygen for the MFF parachutist during unpressurized flight. Air Force Instruction (AFI) 11-409, High Altitude Airdrop Mission Support Program, outlines these requirements. The following paragraphs briefly describe the requirements.

All personnel will prebreathe 100 percent oxygen at or below 10,000 feet MSL pressure or cabin altitude below 10,000 feet MSL pressure on any mission scheduled for a drop at or above 18,000 feet MSL.

The required prebreathing time will be completed before the 20-minute warning and before the cabin altitude ascends through 10,000 feet MSL.

A break in prebreathing requires restarting the prebreathing period or removing the individual(s) whose prebreathing was interrupted from the mission.

Prebreathing requires the presence of an Air Force physiological technician onboard the aircraft.

All personnel onboard during unpressurized operations above 10,000 feet MSL and higher will use oxygen. (Exception: Parachutists may operate without supplemental oxygen during unpressurized flights up to 13,000 feet MSL provided the time above 10,000 feet MSL does not exceed 30 minutes each sortie.) See Figure 5-1.
## DEPLOYMENT ALTITUDE

<table>
<thead>
<tr>
<th>Deployment Altitude</th>
<th>Onboard Oxygen</th>
<th>HALO Operations</th>
<th>HAHO Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 10,000 feet MSL</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Above 10,000 feet MSL Below 13,000 feet MSL</td>
<td>Supplemental oxygen at normal when unpressurized flight exceeds 30 minutes.</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>See Note 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 13,000 feet MSL Below 18,000 feet MSL</td>
<td>Supplemental oxygen at normal before ascending through 10,000 feet MSL or cabin altitude.</td>
<td>Supplemental oxygen at normal from 1-minute warning until canopy deployment below 10,000 feet MSL.</td>
<td>Supplemental oxygen at normal until descent below 10,000 feet MSL.</td>
</tr>
<tr>
<td>See Notes 1 and 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 18,000 feet MSL Below 25,000 feet MSL</td>
<td>Prebreathe the supplemental oxygen at 100% for 30 minutes.</td>
<td>Supplemental oxygen at normal from 1-minute warning until canopy deployment below 10,000 feet MSL.</td>
<td>Supplemental oxygen at normal from 1-minute warning until descent below 10,000 feet MSL.</td>
</tr>
<tr>
<td>See Notes 1 and 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 25,000 feet MSL Below 30,000 feet MSL</td>
<td>Prebreathe supplemental oxygen at 100% for 30 minutes HALO and 45 minutes HAHO.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See Notes 1 and 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 30,000 feet MSL Below 35,000 feet MSL</td>
<td>Prebreathe supplemental oxygen at 100% for 60 minutes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>See Notes 1 and 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Supplemental oxygen means each parachutist will have his own oxygen mask and regulator.
2. All prebreathing will be conducted at or below 10,000 feet MSL or 10,000 feet MSL cabin altitude.

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**Figure 5-1. Supplemental oxygen requirements for parachutists.**

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**OXYGEN LIFE-SUPPORT EQUIPMENT**

Life-support equipment consists of the oxygen mask, the portable/bailout oxygen system with the AIROX VIII assembly, and the six-man prebreather portable oxygen system. This equipment is discussed in the paragraphs below.

**Oxygen Mask**

The oxygen mask is designed to be worn with parachutist helmets that have receivers for the bayonet lugs of the mask’s harness assembly. Oxygen enters the facepiece through the valve located at the front of the mask. Exhaled air passes out through the same valve. The construction of the valve’s exhalation port allows a pressure of only 1 mm of mercury greater than the pressure of the oxygen being supplied by the regulator to force open the valve and allow exhaled air to pass to the atmosphere. A 17.5-inch long convoluted silicone hose with a 3/4-inch internal diameter attaches to the mask. Inside the hose is an antistretch cord that prevents extreme stretching and hose separation in the
windblast during free-fall. The mask has an integral microphone that adapts to the aircraft’s communication system.

**Types of Oxygen Masks.** There are several types of oxygen masks currently in use. The most common of these masks are described in the paragraphs below.

The MBU-5/P pressure-demand oxygen mask has been a military standard for over 15 years (Figure 5-2, page 5-5). It has a soft, pliable silicone rubber facepiece with a separate plastic outer shell. Four facepiece sizes are available to fit the personnel.

The MBU-12/P pressure-demand oxygen mask is a replacement for the MBU-5/P mask (Figure 5-3, page 5-6). It has a soft, supple silicone rubber facepiece integrally bonded to a plastic hard shell. It seals firmly during pressure breathing. It comes in four sizes to provide proper fit and superior comfort during extended wear. The lower profile design and four-point suspension are more stable during free-fall. Antiroll webs at the nose seal prevent downward roll off. The integral facepiece and hard shell design permit good downward vision and increased head mobility.

**Fitting the Oxygen Mask.** Trained personnel must supervise mask fitting (Figure 5-4, page 5-7). When the mask fits properly, it should create a leak-tight seal around the sealing flange throughout the range of pressure breathing forces administered by regulators. The mask has a four-point suspension harness with offset bayonet connectors that the parachutist attaches to the receivers mounted on his helmet to fit the mask. For safety and to make sure of proper fit, the MFF parachutist should be issued the same mask and helmet for each operation. To fit the oxygen mask the parachutist—

- Loosens the adjustment screws on the receivers on his helmet (depending on the type of helmet and bayonet receivers).
- Masks and inserts each bayonet lug into its bayonet receiver to the second locking position (Figure 5-4A).
- Adjusts the mask straps until the mask is comfortable and snug but not so snug that the mask influences his vision (Figure 5-4B). He secures any excess strap.
- Tests for seal by pulling the two pins of the antisuffocation valve toward the chrome ring closing the antisuffocation valve and inhaling (Figure 5-4C). If the mask leaks around the face portion, he readjusts the four straps and once again checks for seal. (If any other portion of the mask leaks, the mask must be replaced.) If a seal cannot be made at the face portion, he exchanges the mask for the next size and repeats the fitting process.
- Tightens the receiver adjustment screws and secures the excess straps if a seal is achieved (depending on the type of helmet and bayonet receivers).

**Cleaning the Oxygen Mask.** The parachutist cleans his oxygen mask after each use IAW TM 55-1660-247-12. He carefully wipes all surfaces with gauze pads or a similar lint-free material dampened with 70 percent isopropyl alcohol (rubbing alcohol). If isopropyl alcohol is not available, he uses a solution of warm water and a mild liquid dishwashing detergent, such as Ivory, Joy, or Lux. To rinse, he carefully wipes the masks with swabs soaked in clean water. He must take care not to wet the electronic parts. He must allow the mask to air dry. The masks must be stored in a dust-free environment, away from
heat and sunlight. If the mask needs more extensive cleaning, the unit turns it in to the supporting life-support facility.

Figure 5-2. MBU-5/P pressure-demand oxygen mask.
**Figure 5-3. MBU-12/P pressure-demand oxygen mask.**
The 106-Cubic-Inch Portable/Bailout Oxygen System with the AIROX VIII Assembly

The portable/bailout oxygen system with the AIROX VIII assembly is a constant-flow oxygen metering system. This system consists of a pressure reducer and an oxygen and air controller with an integrated prebreather adapter. These components increase oxygen duration and permit comfortable exhalation with standard military pressure-demand masks and associated connectors (Figure 5-5, page 5-8). This system—

- Has been approved for use from 0 to 35,000 feet MSL.
- Has an 8.2 liters per minute nominal oxygen flow.
• Requires minimum maintenance.
• Has an oxygen reducer.
• Interfaces with the MBU-5/P and MBU-12/P masks.
• Has an oxygen and air controller that mates with the CRU-60/P or MC-3A connectors.
• Has a charging valve.
• Has a 20-micron oxygen/60 mesh air inlet filter.
• Contains two 2.6-inch siphon tubes that protect the oxygen reducer from foreign matter in the cylinders.
• Has a toggle-type ON/OFF control.
• Has an oxygen relief valve.
• Reduces exhalation difficulty associated with constant-flow oxygen systems.
• Uses two 53-cubic-inch high-pressure cylinders.
• Weighs approximately 10.5 lbs.

Figure 5-5. The 106-cubic-inch portable/bailout oxygen system with the AIROX VIII assembly.

AIROX VIII Assembly

The AIROX VIII assembly provides the MFF parachutist with a standoff parachuting capability up to 35,000 feet MSL (Figure 5-6, page 5-9). It extends the duration of two 53-cubic-inch oxygen cylinders and permits the use of any pressure-demand mask and associated oxygen connectors. It eliminates the backpressure associated with constant-flow oxygen systems and has virtually no maintenance.
The parachutist cannot overbreathe the system. When inhaling more volume than the unit delivers, an ambient air valve opens up negating the breathing starvation sensation felt with other constant-flow systems as cylinder pressure decreases.

The AIROX VIII assembly has a special prebreather adapter that allows simultaneous hookup of the prebreather unit and the bailout system to the AIROX unit. The parachutist makes only one disconnection upon standing up. The connection from the prebreather connects to the ambient air port on the AIROX unit, thus preventing any ambient air from entering the parachutist’s system while prebreathing. When preparing to exit the aircraft, the parachutist stands up, turns on the bailout system, disconnects from the prebreather, and jumps.

Figure 5-6. AIROX VIII assembly.
Figure 5-7. Rigging the portable/bailout oxygen system with the AIROX VIII assembly to the RAPS.

- Place the oxygen cylinder into the detachable pouch with the ON/OFF valve to front. Secure the hook-pile straps. Thread the waistband through the detachable pouch keepers.
- Fasten the waistband.
- Secure right wing flap over the oxygen bottles.
- Route the oxygen hose behind right main lift web.
- Route the oxygen hose behind the waistband.
- Secure the dovetail fitting to the oxygen fitting block.
To rig the AIROX VIII assembly with the portable/bailout oxygen system to the RAPS (see Figure 5-7, pages 5-10 and 5-11), the parachutist—

- Places the oxygen cylinders into the detachable pouch with the ON/OFF valve to his front. He secures it with the hook-pile straps. He threads the waistband through the center keepers on the detachable pouch. (Figure 5-7A).
- Fastens the waistband (Figure 5-7B).
- Tightens the right wing flap over the oxygen bottles (Figure 5-7C).
- Routes the oxygen hose between his body and the right main lift web and under the waistband on his right side (Figure 5-7D and E).
- Routes the oxygen hose over the waistband and secures the dovetailed fitting in the oxygen fitting block (Figure 5-7).
- Tightens the waistband.

**Six-Man Prebreather Portable Oxygen System**

The six-man prebreather portable oxygen system was designed as a self-contained, easy to operate, small, lightweight, and virtually maintenance-free oxygen system (Figure 5-8, page 5-13). Oxygen duration is based on altitude and individual consumption.
requirements. Therefore, the same volume of oxygen based on a given time at sea level will last longer at altitude, based on expansion of the gas.

The system’s size was based on placing it completely under the troop seats on a C-141B Stuルifter aircraft and securing it with the existing 10,000-lb floor fittings. On the C-130 aircraft, use the 5,000-lb tie-downs. Its outer housing is of 4130 aircraft sheet steel, and recesses or steel guards protect the critical components. Color coding identifies certain parts, such as hoses and their mating parts, to prevent their misconnection.

The system has 100 percent oxygen capability for 1 hour for six parachutists while ascending to 35,000 feet MSL.

NOTE: With the CRU-79/P regulator, the system has an operational ceiling of 50,000 feet MSL.

Other system features are listed below:

- Weighs 106 lbs when filled.
- Measures 27.3 inches wide, 13.37 inches deep, and 10.99 inches high.
- Can provide oxygen for one to six parachutists.
- Has modular components.
- Is constructed to survive an 8G forward crash load.
- Has a recessed refilling point.
- Has an easily gripped and guarded ON/OFF knob.
- Has color-coded and -indexed oxygen connectors to make sure of proper hose connections, including optional hose lengths to fit parachutist seating requirements.
- Has a steel guard around oxygen hose connectors.
- Interfaces with any pressure-demand mask and associated connectors.
- Can be refilled while being used.

MA-1 Portable Oxygen Assembly

The MA-1 portable oxygen assembly is a low-pressure system capable of supplying the parachutist with breathing oxygen for normal or emergency use. It is commonly called the walk-around bottle. The MA-1 is filled from the aircraft’s oxygen supply. Pressure is indicated on the cylinder pressure gauge. The cylinder is considered full at 300 psi and empty at 100 psi. The MA-1 is operated by placing the selector knob at one of the four settings (NORM, 30M, 42M, and EMER) and breathing directly through the CRU (connector regulator unit) connector receiver port or an attached oxygen mask (Figure 5-9, page 5-14).

THE “PRICE” CHECK

Each letter of the acronym PRICE represents an area of or a specific item of oxygen equipment that the parachutist must check. The PRICE check makes no provision for inspecting the mask or protective helmet. The parachutist checks—
• **P** - Pressure. He checks for full pressure on the particular system in use.

• **R** - Regulator. He checks everything on the particular regulator in use. He checks for dents, cracks, broken gauges, grease or oil, and movement of dials and levers. He checks the entire oxygen delivery system for leaks.

• **I** - Indicator. He checks to make sure the flow indicator shows that gas is flowing through the regulator from the storage system.

• **C** - Connections. He checks all hose connections.

• **E** - Emergency equipment. He does a complete PRICE check on any emergency oxygen equipment and the complete bailout system.

Figure 5-8. Six-man prebreather portable oxygen system.
Figure 5-9. MA-1 portable oxygen assembly.

OXYGEN SAFETY PERSONNEL

Oxygen safety personnel must be onboard each aircraft during MFF operations using supplemental oxygen. They must have received physiological training and unit-level technical training on the oxygen system(s) being used. For jumps from 18,000 feet or above, an Air Force physiological technician will be requested with the aircraft and will be onboard for the jump. The oxygen safety personnel or the Air Force physiological technician will—

- Plan for all oxygen equipment required for the mission. They provide one additional mask of each size and one additional complete bailout system per six parachutists. They plan for one additional open oxygen station per every six parachutists in the event of a hose or regulator failure.
- Conduct preflight inspection and preflight operational checks of all oxygen equipment (Figures 5-10 through 5-11, pages 5-15 through 5-18).
- Supervise the transportation and installation onboard the aircraft of prebreathers and oxygen cylinders.
• Issue oxygen supply hoses to each parachutist and supervise hose connection.
• Make sure the parachutists mask properly, fully open shutoff valves on the prebreathers, and receive oxygen after the aircraft procedure signal “mask” is given.
• Periodically check oxygen pressure and equipment function during use (every 10 minutes).
• Monitor each parachutist for signs of hypoxia, bends, or chokes.
• Assist the parachutist with the activation of the bailout systems and inspect all bailout systems to make sure they were activated.
• Check the parachutist’s hose connections on the AIROX VIII. If the parachutist still indicates a problem, activate the bailout system, move the parachutist to an open station, and deactivate the bailout system.

**PREFLIGHT INSPECTION OF THE 106-CUBIC-INCH PORTABLE/BAILOUT OXYGEN SYSTEM**

Check to ensure that—
- Cylinders are lime green and stenciled in white with the words AVIATOR’S BREATHING OXYGEN.
- No cracks, dents, or gouges are in the cylinders.
- Cylinder clamp and roller are on the bottom one-third of the cylinders and secure.
- Cylinders are tight into the pressure reducer body.
- Reducer body is not cracked or damaged.
- Filler valve, pressure gauge, and relief valve are tight into the pressure reducer body.
- Cap on the filler valve is secure and the filler cap lanyard is secured to both the cylinder and filler valve.
- Pressure gauge face is not damaged and the dial indicator is not sticking.
- ON/OFF control valve is secured to the pressure reducer body with four “Allen” screws.
- Guide rails of the ON/OFF control valve are undamaged. Operating lever operates properly and the detent will hold the valve in the ON and OFF position.
- Union elbow is secured tightly to the top of the pressure reducer and the elbow directs the hose over the pressure gauge.
- Hose assembly is not frayed or crushed, and the cloth covering is not worn and is free of oil or other contaminants.
- Hose assembly is securely attached to the union elbow and flow indicator.
- There is no obvious damage to the flow indicator body, the arrow points toward the AIROX, and the flow indicator is securely attached to the AIROX.
- View glass is clear indicating a no-flow condition and the white sleeve, yellow sleeve, and spring are present.
- Blue tamper-proof dot is present directly below the ambient air port.

*Figure 5-10. Portable/bailout oxygen system preflight inspection and operational checklist.*
| Equalization port is free of foreign objects or debris. |
| Brass set screw and brown tamper-proof dot are present. |
| Body of the AIROX is not damaged or cracked. |
| Ambient air port is securely attached to the AIROX and not damaged and the safety lock wire and screw are intact. |
| Chrome ring is present and rotates freely. |
| Gasket is present, clean, and free of nicks or tears. |
| Inlet orifice is free of foreign objects or debris and the screen is present and not damaged. |
| Cover of the outlet orifice is spring loaded and seats properly. |
| No foreign objects or debris is in the outlet orifice and the screen is present and not damaged. |
| Dovetail mounting plate is securely attached to the bracket. |
| There is no damage to the dovetail mounting plate. |
| Locking lever is spring loaded and functions properly. |

**PREFLIGHT OPERATIONAL FUNCTION CHECK**

- Ensure the system is fully charged at 70 degrees Fahrenheit (F).
- Connect a mask to the outlet orifice and ensure that it is secure and that excessive force is not required to connect and disconnect.
- Turn the system on and seal the mask to the face.
- Inhale—yellow sleeve (on flow indicator) rises.
- Exhale—yellow sleeve falls. Inhalation shall be normal with undue exertion.
- Ensure there is no oxygen flow from the relief valve.
- Turn the system off, reseal the mask to the face, and ensure you can breathe through the ambient air port.
- Connect a hose and regulator assembly to the ambient air port, ensure that it is secure and that excessive force is not required to connect and disconnect.

**PREFLIGHT INSPECTION OF 6-MAN PREBREATHER**

- Unit has no obvious damage.
- Gauge faces are not broken.
- Dial indicators are not sticking.
- All screws are present and not coming loose.
- Handles are not separating from unit.
- Filler cap is present and tied down to unit.
- All female disconnect plugs are present and tied down to disconnect.
- Female disconnects are not distorted and the pins of the male connectors of hose assemblies will engage with the collar of the female disconnect.

---

**Figure 5-10. Portable/bailout oxygen system preflight inspection and operational checklist (continued).**

**Figure 5-11. Sample prebreather preflight inspection and operational function check.**
Female disconnects are safety-wired to the adjacent female disconnect.
The connector manifold guard does not interfere with the operation of the female disconnects or male
connectors of the hose and regulator assembly.
Both sets of screws in the on-off knob are present and not backing out.
On-off valve stem is not bent.
The container is not cut, damaged severely, or corroded.
Unit is fully charged to 1,800 psi at 70 degrees F.

PREFLIGHT INSPECTION OF THE HOSE AND REGULATOR ASSEMBLY
Check to ensure that—
Each male connector has the proper amount of pins (red - 2 pins; yellow - 3 pins; gray - 4 pins) and the
mating probe is not distorted.
Male connector is tight into hose assembly.
Wire wrapping is not frayed and hose is not crushed.
Cloth covering is free of oil or other contaminants.
Red male connector is connected to 72-inch hose; yellow connector to 90-inch hose; and gray connector to
98-inch hose.
Hose is tightly connected to regulator.
Regulator is not cut or cracked.
No foreign object or debris is in equalization port.
Hose and check-valve assembly is clamped to regulator and clamp is safety wired.
Cover is spring loaded and seats evenly over check valve.
Check valve is spring loaded.

PREFLIGHT OPERATIONAL FUNCTION CHECK
Turn the shutoff valve counterclockwise to the fully opened position (about 5 1/2 turns) (Figure 5-12, page
5-19).
Ensure the reducer pressure gauge indicates 40-60 psi (Figure 5-12).
Remove each disconnect plug, depress the “poppet” of each disconnect (Figure 5-13A, page 5-19), and
ensure oxygen flows from each disconnect.
Close shutoff valve and ensure reducer pressure remains steady (40-60 psi).
Bleed off the pressure through the disconnect manifold.
Install all hose and regulator assemblies to their appropriate disconnect (Figure 5-13B). (Be sure to bleed
manifold pressure before attaching hose and regulator assemblies.)
Connect an MBU-12/P mask to each hose and regulator assembly.
Open shutoff valve (about 5 1/2 turns).

CAUTION
Failure to properly connect the hose and regulator assemblies to the prebreather using
the above procedures could possibly damage the diaphragm of the CRU-79/P regulator
and render the equipment inoperative.

Figure 5-11. Sample prebreather preflight inspection and operational function check
(continued).
Listen for and feel the oxygen flow from each mask. (Disconnect all but one mask and note the reducer pressure for a 3 to 5 second interval. The reducer pressure should not drop below 40 psi.)

Hold the mask to the face and inhale. Inhalation shall be normal with no undue exertion to breathe oxygen. Remove mask from hose and regulator assembly and ensure check valve closes and there is no flow from the hose and regulator assembly. Repeat the above step for each hose and regulator assembly.

Close shutoff valve and bleed manifold pressure through one or more check valves until reducer pressure indicates zero.

Monitor reducer pressure for 15 minutes. (Ensure gauge indicator remains at zero.)

Figure 5-11. Sample prebreather preflight inspection and operational function check (continued).

**WARNING**

NEVER partially close the shutoff valve during oxygen use; it will result in a restriction of oxygen flow to the parachutist.

**PREBREATHER ATTACHMENT**

The prebreather oxygen assembly is normally located under the troop seats, and the oxygen supply hoses are routed up and behind the seats. The prebreather may also be positioned centerline in the aircraft using 10,000-lb tie-down fittings (C-141B), 5,000-lb tie-down fittings (C-130), or securing straps.

When using 10,000-lb tie-down fittings, the parachutist places the two large holes in the base plate of the prebreather over existing 10,000-lb tie-down fitting holes in the floor of the aircraft. Through the openings in the side of the prebreather, he places two 10,000-lb fittings (one through each end) into the mating receptacle now visible through the prebreather’s baseplate. He then locks the fittings in place. These fittings will provide all the security necessary to hold the prebreather in place.

When using the oxygen console tie-down assembly, the parachutist places the two large holes in the prebreather’s baseplate over the attached 5,000-lb ringed tie-down fittings. Next, he places securing adapters over the exposed rings and pushes the pins through the holes in the adapters until they lock. These fittings will provide all the security necessary to hold the prebreather in place (Figure 5-14, page 5-20).

Cargo straps are not necessary for added security when using the 10,000-lb tie-down fittings or oxygen console tie-down assembly. If the parachutist uses cargo straps in place of the tie-down fittings, he places the straps through the securing access holes at each end of the prebreather and cinches tight to existing fittings.

*NOTE: The prebreather carrying handles are not stressed for use as securing points.*
Figure 5-12. Pressure gauge and manual shutoff valve.

Figure 5-13. Removing end plugs and depressing poppets.
PHYSIOLOGICAL EFFECTS OF HIGH ALTITUDE MFF OPERATIONS

Most physiological effects of high altitude MFF operations fall into the category of pressure change hazards. These hazards usually include various physiological symptoms. Based on Class C Physiological mishaps since 1984, the most common types have been sinus blocks, ear blocks, hyperventilation, hypoxia, and decompression sickness.

Individuals flying and parachuting with a head cold or some other type of upper respiratory illness usually are at risk for sinus blocks and ear blocks. Sinus blocks and ear blocks usually occur during free-fall descent or during aircraft pressurization.
Performing a Valsalva maneuver as you feel your ears getting “full” can clear most ear blocks. A Valsalva maneuver may clear a sinus block but may require additional medical attention. Use of nasal sprays may serve as a “get-me-down” procedure for both sinus and ear blocks.

Hyperventilation is a condition characterized by abnormal shallow and rapid breathing. Fear, anxiety, stress, intense concentration, or pain normally causes hyperventilation. Symptoms are similar to hypoxia and include lightheadedness, visual impairment, dizziness, numbness and tingling of the extremities, and loss of coordination and judgment. Corrective action is as follows: calm the parachutist and have him talk, which will make him reduce his rate and depth of breathing. The goal is to achieve a breathing rate of 12 to 16 breaths per minute. Because of the similarity to hypoxia, continue or place him on 100 percent oxygen. Inform the aircraft commander. Reevaluate the parachutist’s conscious state. If he is not responsive, treat as an in-flight emergency and evacuate the parachutist to the nearest medical facility.

Hypoxia is a condition caused by lack of oxygen. A reduction in the partial pressure of oxygen in the atmosphere occurs as the parachutist ascends. When the parachutist inhales, he receives fewer oxygen molecules. The reduction of the partial pressure inhibits the body's ability to transfer oxygen to the tissues. The most common symptoms of hypoxia are blurred or tunnel vision, color blindness, dizziness, headache, nausea, numbness, tingling, euphoria, belligerence, loss of coordination, and lack of good judgment. Corrective action for a parachutist who becomes hypoxic is to place him on 100 percent oxygen and inform the aircraft commander. In extreme cases, it may be necessary to descend the aircraft and evacuate the parachutist to the nearest medical facility. If hypoxia goes unrecognized and uncorrected, it can result in seizures, unconsciousness, or even death.

Decompression sickness is a condition caused by the release of nitrogen from body tissues. There are four types of decompression sickness symptoms: the bends, chokes, neurological (central nervous system) hits, and skin manifestations. Decompression sickness usually occurs during unpressurized flight above 18,000 feet MSL but can occur at lower altitudes.

- The bends is the most common type of decompression sickness. The most common symptoms are a deep, dull, and penetrating pain in major movable joints that can increase to agonizing intensity. This pain may be significant enough to feel as if the parachutist cannot move the joint. The affected parachutist might also go into shock. Corrective action for a parachutist who experiences the bends is to place him on 100 percent oxygen, inform the aircraft commander, descend the aircraft or pressurize the cabin to as close to sea level as possible, and evacuate to the nearest medical facility with a recompression chamber. A flight surgeon or aeromedical examiner will determine if compression therapy is required.

- The chokes is the rarest type of decompression sickness, yet it is potentially life threatening. It is similar to the bends, but it occurs in the smaller blood vessels of the lungs, resulting in poor gas exchange and oxygenation of the blood. The most common symptoms are a deep, sharp pain near the breastbone, a dry nonproductive cough, an inability to take a normal breath, feeling of suffocation and apprehension, and possible shock symptoms such as sweating, fainting, and
cyanosis. Corrective action for a parachutist who experiences the chokes is to place him on 100 percent oxygen, inform the aircraft commander, descend the aircraft or pressurize the cabin to as close to sea level as possible, and evacuate to the nearest medical facility with a recompression chamber. A flight surgeon or aeromedical examiner will determine if compression therapy is required.

- In extreme cases of decompression sickness, the central nervous system may also become affected. If so, the affected parachutist may experience vision disturbances, headaches, partial paralysis, loss of orientation, delirium, and vertigo. Corrective action for a parachutist who experiences a central nervous system hit is to place him on 100 percent oxygen, inform the aircraft commander, descend the aircraft or pressurize the cabin to as close to sea level as possible, and evacuate to the nearest medical facility with a recompression chamber. A flight surgeon or aeromedical examiner will determine if compression therapy is required.

- Skin manifestations or paraesthesia is caused by nitrogen bubbles forming at the subcutaneous layer of the skin. The most common symptoms are itching, hot and cold flashes, a creepy feeling or gritty sensation, mottled reddish or purplish rash, and a tingling feeling of the affected area(s). Corrective action for a parachutist who experiences any of these symptoms is to place him on 100 percent oxygen, keep him from scratching or exercising the affected area(s), and inform the aircraft commander. Normally the condition will dissipate upon descent. However, if the parachutist is incapacitated due to the condition, descend the aircraft, pressurize the cabin to as close to sea level as possible, and evacuate to a medical facility with a recompression chamber. A flight surgeon or aeromedical examiner will determine if compression therapy is required.

Many factors contribute to altitude-related illnesses. Facial hair such as beards and mustaches can cause an insufficient seal of the oxygen mask to the parachutist’s face. Facial hair can reduce the effectiveness of the oxygen equipment and render prebreathing ineffective. Poor physical conditioning and fatigue will make the individual more susceptible to decompression sickness. Alcohol use dehydrates the body, constricting the capillaries that decrease the efficiency of the cardiovascular system. Nicotine from tobacco use hardens arteries and restricts blood flow to the capillaries, reducing the efficiency of the cardiovascular system. Smoking reduces the efficiency of the lungs.

CORRECTIVE MEASURES FOR PHYSIOLOGICAL AND OXYGEN-EQUIPMENT-RELATED EMERGENCIES

For in-flight emergencies, make sure the jumpmaster, oxygen safety, and aircraft commander (also USAF physiological technician if flight is above 18,000 feet MSL) are made aware of the problem. Ensure that the parachutist is receiving 100 percent oxygen from the console, the walk-around bottle, or an onboard aircraft regulator. Attempt to establish communications with the parachutist. Identify the problem and take corrective actions to include immobilizing the affected areas if possible. If the problem becomes progressive or severe, inform the aircraft commander of the nature of the problem and declare an in-flight emergency. Descend the aircraft, pressurize the cabin to as close to sea level as possible, and evacuate to a medical facility with a recompression chamber. A flight surgeon or aeromedical examiner will determine if compression therapy is required.
Parachutists should be aware of the symptoms of decompression sickness and monitor themselves on return to the ground. Some parachutists may have symptoms of decompression sickness during flight that they do not notice due to discomfort from the parachute and equipment worn or that they do not report. Although these symptoms usually resolve themselves upon returning to ground, some personnel may continue to have symptoms. These personnel require prompt medical evaluation since their illness is more severe.
Chapter 6

Equipment and Weapons

Free-fall parachutists will normally operate with individual equipment that includes clothing and equipment in keeping with the climatic conditions, food, and survival items. In addition, each parachutist will have a weapon, free-fall parachutist’s jump helmet, goggles, and altimeter. They jump and carry all detachment equipment and supplies as individual loads. If selected items must be dropped as accompanying supplies, they pack these supplies in appropriate aerial delivery containers.

EQUIPMENT AND WEAPONS PACKING

The parachutist can attach or wear his individual equipment and weapon in several configurations (for example, exposed, placed in containers, or a mix of the two). Unit SOPs specify ways to pack equipment that are consistent with safety requirements. As a rule, units pack hard, bulky, or irregularly shaped (nonaerodynamic) items in containers. Parachutists can use rucksack rigging systems approved by their Service Test Board.

The parachutist packs his individual equipment in containers, kit bags, or the medium or large combat pack. He then attaches it to the equipment rings on the parachute’s main lift web. He may front or rear mount the combat pack using the improved equipment attaching sling or the H-harness (modified). He may attach both a front and rear mounted rucksack or equipment as long as he is under the 360 lbs suspended weight limit. He should lower combat packs or any equipment that weighs more than 35 lbs.

The parachutist pads fragile items (like weapon sights). He does not place crushable items (like the protective mask) directly under the attaching harnesses. Exposed weapons or equipment, snap hooks, and projections are potential safety hazards that the parachutist tapes.

PARACHUTIST AND PARACHUTE LOAD LIMITATIONS

Commanders: Do not overload the parachutist with equipment! The variety (and weight) of equipment and weapons that you can attach to a parachutist (Figures 6-1 to 6-4) may exceed the safe design limits of the MC-4 RAPS. Overloading can result in parachute damage, unsafe descent rates, and injury to the parachutist. Also, the parachutist’s actions (and the time available) to release the tie-down straps and to lower the equipment may interfere with his control of the parachute close to the ground.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MAXIMUM CONTAINER LOAD (LBS)</th>
<th>MAXIMUM RIGGED WEIGHT (LBS)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Combat Pack</td>
<td>50</td>
<td>55.56</td>
</tr>
<tr>
<td>Large Combat Pack</td>
<td>70</td>
<td>75.96</td>
</tr>
</tbody>
</table>

*Weight of H-harness attaching sling.

Figure 6-1. Container weight limits.
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>WEIGHT (LBS)</th>
<th>REFERENCE</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Load-Bearing Capacity of MC-4 RAPS on Deployment</td>
<td>360</td>
<td>Natick Research and Development Command</td>
<td>Increased weight will reduce canopy service life or destroy canopy (for example, blown cells).</td>
</tr>
<tr>
<td>Air Movement Planning Weight of Combat-Equipped Free-Fall Parachutist</td>
<td>305</td>
<td></td>
<td>Parachutist with one equipment container and weapon.</td>
</tr>
</tbody>
</table>

**Figure 6-2. Parachute load limits.**

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Container Maximum Internal Weight</th>
<th>Weight of Container</th>
<th>Suspended Weight of MC-4 RAPS With Oxygen</th>
<th>Fatigue Uniform, Helmet, Mask, and Boots</th>
<th>Soldier Weight</th>
<th>M16A2 Rifle</th>
<th>Total Suspended Weight*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kit Bag</td>
<td>50</td>
<td>3</td>
<td>43.15</td>
<td>15</td>
<td>205</td>
<td>7.6</td>
<td>323.75</td>
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<tr>
<td>Medium Combat Pack</td>
<td>50</td>
<td>5.56</td>
<td>43.15</td>
<td>15</td>
<td>205</td>
<td>7.6</td>
<td>326.31</td>
</tr>
<tr>
<td>Large Combat Pack</td>
<td>70</td>
<td>5.96</td>
<td>43.15</td>
<td>15</td>
<td>205</td>
<td>7.6</td>
<td>346.71</td>
</tr>
</tbody>
</table>

*Weight of parachutist in lbs.

**Figure 6-3. Weight of parachutist with two equipment loads.**

<table>
<thead>
<tr>
<th>Weapon Load Type</th>
<th>Weapon Load With Ammunition(1)</th>
<th>Weight of Large Combat Pack</th>
<th>Soldier Weight</th>
<th>Fatigue Uniform, Helmet, Mask, and Boots(2)</th>
<th>Load-Bearing Equipment With Two Canteens (Water)</th>
<th>Suspended Weight of MC-4 RAPS With Oxygen</th>
<th>Remaining Weight of MC-4 RAPS With Oxygen</th>
<th>Total Suspended Weight*</th>
</tr>
</thead>
<tbody>
<tr>
<td>M16 Rifleman</td>
<td>31</td>
<td>5.96</td>
<td>205</td>
<td>15</td>
<td>11.5</td>
<td>43.15</td>
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<td>40</td>
<td>5.96</td>
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<td>11.5</td>
<td>43.15</td>
<td>39.39</td>
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<tr>
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<td>5.96</td>
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<td>15</td>
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<td>43.15</td>
<td>7.79</td>
<td>360</td>
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<tr>
<td>M60 Machine Gunner</td>
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<td>5.96</td>
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<td>11.5</td>
<td>43.15</td>
<td>24.99</td>
<td>360</td>
</tr>
</tbody>
</table>

*Weight of parachutist in lbs.  (1) Includes basic load of ammunition, grenades, Claymore, bayonet, and cleaning kit.  (2) Weight of uniform does not include winter gear (for example, parka, liners, underwear).

**Figure 6-4. Weight of parachutist with two equipment loads and basic load.**
LIFE PREServers

Parachutists must wear military approved flotation devices (B-7, LPU-10/P, UDT) whenever the planned flight path is over open bodies of water large enough to be unavoidable with a maneuverable chute for one third or more of the distance under canopy. They also wear them when an open body of water is within 1,000 meters of the planned impact point.

B-7 Life Preserver

The parachutist wears the B-7 over his uniform or jumpsuit and under his parachute harness (Figure 6-5). He fits the B-7 by placing one flotation packet under each arm, making sure the packet flaps are to the outside and the toggle cords are down and to the front. He routes the shoulder strap from front to rear over his left shoulder, under the back strap, then from rear to front over his right shoulder and attaches it to the ring on the right flotation packet.

Figure 6-5. B-7 and LPU-10/P life preservers.
He adjusts the shoulder strap so that the flotation packets fit snugly against his armpits. Before donning the parachute, he attaches the chest strap to the attachment ring on the left flotation packet, forming a quick release.

If there is a water emergency, he inflates the B-7 by pulling the toggle cords located on each flotation packet. He can also manually inflate it by blowing into the rubber hose located on each flotation packet. He uses manual inflation only if the carbon dioxide (CO2) inflation system fails to operate.

**WARNING**
The parachutist makes sure he does not wear the B-7 life preserver with the flotation packets between the parachute harness and his body. Serious injury may result if inflated when worn incorrectly.

**LPU-10/P Life Preserver**

The LPU-10/P is a standard USAF carbon-dioxide cartridge-activated life preserver assembly worn during flights over water or during airdrops when water obstacles are near or on the intended DZ. It has an adjustable harness and underarm inflation bladders. The LPU-10/P is designed to keep the wearer’s head above water at weights up to 250 lbs for up to 10 minutes. It is compatible with the USAF C-9, T-10, and MC-4 parachute harness assemblies. It must be maintained IAW USAF TO 14S-1-102.

The LPU-10/P is worn under the parachute harness. The harness is worn so that the inflatable packets are under the parachutist’s arms. The manual inflating valves should be completely closed when donning the life vest. The shoulder and waist straps are then adjusted to ensure the inflation packet is one hand width beneath the armpit and not constrained by the parachute harness.

**WARNING**
The inflation packets must be one hand width beneath the jumper’s armpit and clear of the harness straps. If the inflation packets are too snug under the armpit, or if they are between the harness and the jumper’s body, the jumper can experience severe pain or crushed ribs during inflation.

The parachutist inflates the flotation bladders by pulling two toggle cords (at the bottom of the vest) that activate CO2 cartridges that fill the flotation bladders with gas. An alternate way to inflate the vest is by blowing into the manual inflation valve rubber hoses located on the bottom side of the wings. Manual inflation should only be used if the CO2 inflation valves fail to operate.

**Underwater Demolition Team (UDT) Life Vest**

The UDT vest is put on over the uniform before donning the parachute. The UDT vest is worn around the neck, with the straps passing under the arms and fastened to the vest. The straps should be snug so the vest does not move in free-fall and interfere with the cutaway handle or the reserve ripcord. The parachute chest strap passes between the UDT vest and the parachutist (Figure 6-6, page 6-5). It must be worn secured with a lightweight rubber band around the middle to prevent interfering with the cutaway handle and reserve ripcord handle. The oral inflation tube is routed through its retainer
loop. The oral inflation tube knurled nut is screwed down in the open position to allow inflating it.

**WARNING**

The parachutist must not wear the UDT life vest with the flotation chamber worn between the parachute chest strap and his body. Serious injury may result if inflated when worn incorrectly. Parachutists must protect the activation lanyard of the UDT vest. Accidental inflation by the CO₂ cartridges may result in obstruction of the reserve ripcord and cutaway handles.

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**HOOK-PILE TAPE (HPT) (VELCRO) LOWERING LINE ASSEMBLY**

Figure 6-7, page 6-6, shows the steps (A through E) for stowing an HPT lowering line assembly. The current HPT lowering line assembly (NSN 1670-01-067-6838) consists of—

- An 8- or 15-foot lowering line (the 8-foot lowering line is recommended for most equipment) made of 1-inch-wide tubular nylon.
- A 9- by 7-inch nylon duck retainer (stow pocket) sewn to the upper end. The flaps have HPT sewn to the edges.
- A metal (parachute harness) ejector snap with a yellow safety release.

**NOTE:** The yellow release lanyard should be taped to the lowering line with one single wrap of masking tape the length of the lanyard, leaving one to two inches exposed at the top of the lanyard.
NOTE: To help prevent the inadvertent, premature deployment of the lowering line, the parachutist places a double looped retainer band around the middle of the stowed lowering line retainer pocket before attaching it to the combat pack (Figure 6-8, page 6-7).

Figure 6-7. Stowing the HPT lowering line assembly.

WEAPONS PREPARATION

A parachutist can jump with his individual weapon either exposed or inside a weapon or other equipment container. If the commander decides to jump with weapons exposed, he must consider the increased risk of injury to the parachutist(s) that may further hinder the mission’s success.

Exposed Weapons

A buddy helps the parachutist attach an exposed weapon to his left shoulder. The muzzle always faces down and the pistol grip to the rear to reduce the chance of entanglement during parachute deployment. Hazards the parachutist faces when jumping with exposed weapons include—

- The weapon becoming entangled with the parachute upon deployment.
- The weapon becoming entangled with another parachutist’s parachute should a midair entanglement occur.
- Damage to the weapon upon landing or when dragged on the ground.
Figure 6-8. Stowed lowering line with retainer band emplaced.

M16A1/A2 and M4/A1 Rifle

The parachutist prepares the rifle by extending the sling all the way and tapes the keeper in place. He secures padding over the side-mounted bolt assist and the operating handle. He pads and tapes the muzzle and sights to avoid possible entanglement with the parachute’s suspension lines or dirt clogging the weapon upon landing. He inserts the magazine and tapes it to the receiver, including the ejector port cover, to prevent loss of the magazine as well as debris from entering the bolt area. He tapes the handguards to prevent their loss at landing impact. To aid the removal of the padding and tape, he folds and presses together a portion of the adhesive side of the running end of the tape to form a quick-release pull tab. Figure 6-9, page 6-8 shows how the M16A1/A2 or M4/A1 rifle are rigged for jumping.

Tie-Downs. The parachutist uses a 12- to 18-inch tie-down of 1/4-inch cotton webbing to secure the weapon. He attaches the tie-down to the weapon sling, about 6 inches below the buttstock sling swivel, with a girth hitch.

Positioning. With the help of a buddy, the parachutist slings his weapon over his left shoulder with the muzzle down and rotates the pistol grip to his rear (Figure 6-10, page 6-9). He places the sling from the lower keeper (buttstock) on the outside of the stock.
and over his left shoulder. He then runs the sling under the main lift web and routes the chest strap through the sling. He secures the tie-down to the weapon tie-down loop on the parachute system. He positions the waistband through the carrying handle. He tightens the waistband securely so that the weapon lies snugly against his side. He then assumes the basic free-fall position to test the fit of the weapon.

Figure 6-9. The M16A1/A2 and M4/A1 rigged for jumping.

M203 Grenade Launcher

The parachutist prepares the grenade launcher the same as he does the M16A1/A2 and M4/A1. He tapes the handguard and grenade launcher barrel together with the barrel latch covered. He removes the quadrant sight. He tapes down the leaf sight. Figure 6-11, page 6-9, shows the M203 rigged for jumping.

Tie-Downs. He uses the same procedures as for the M16A1/A2 and M4/A1.

Positioning. He uses the same procedures as for the M16A1/A2 and M4/A1.
Figure 6-10. Positioning the weapon on the parachutist.

Figure 6-11. The M203 rigged for jumping.
M14, G3, and FN FAL Rifles

The parachutist prepares each of the weapons by removing the sling from the weapon and the slingkeeper from the sling. He forms a loop by running the sling through the slinghook. He replaces the sling by placing the loop around the small of the stock. He replaces the slingkeeper and secures the sling to the barrel, just below the front sight, with a half hitch. He tapes the butt plate closed. He pads and tapes the flash suppressor, front sight, and bayonet lug. He removes the optical sight and packs it in his equipment container. Figure 6-12 shows the M14 rigged for jumping.

*Tie-Downs.* He prepares a 12- to 18-inch tie-down as for the M16A1/A2 and M4/A1.

*Positioning.* With the help of a buddy, he slings the weapon over his left shoulder, muzzle down, and rotates the operating handle away from his body. He secures the weapon in the same manner as the M16A1/A2 and M4/A1.

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Submachine Guns, Caliber .45, MP5, MP5A3, and MP5K

The parachutist prepares each of these weapons by removing the sling from the upper swivel as well as all the slack. He folds the end of the sling and runs the fold through the upper sling swivel. He passes the tip of the sling through the fold and fastens the snap. He closes the cover and removes the magazine. He collapses the stock. He tapes one magazine to the left of the receiver or carries it elsewhere. He covers and tapes the muzzle. Figure 6-13, page 6-11, shows the MP5 rigged for jumping.

*Tie-Downs.* He prepares a 12- to 18-inch tie-down as for the M16A1/A2 and the M4/A1.

*Positioning.* With the help of a buddy, he slings the weapon over his left shoulder, muzzle down, pistol grip forward, and secures it in the same manner as the M16A1/A2 and M4/A1.

Pistols

The parachutist can jump with a pistol in a shoulder holster or packed in an equipment container. He wears the shoulder holster under his jumpsuit or other protective clothing. He secures the pistol in the holster by taping the holster closed or by using a lanyard.
M60 Machine Gun, M224 60-mm Mortar

The parachutist does not jump with these weapons exposed during MFF operations. He breaks them down and packs them in a front-mounted equipment container or kit bag.

Other Weapons

The parachutist can rig other weapons using the methods previously described. User unit SOPs should specify ways to pack or rig similar type weapons consistent with safety requirements. Units requiring technical help should contact B Company, 2d Battalion, 1st Special Warfare Training Group, USAJFKSWCS, Yuma, Arizona; DSN 899-3626/3639.

COMBAT PACKS AND OTHER EQUIPMENT CONTAINERS

This paragraph discusses the use of harnesses, equipment attachment slings, and lowering lines in preparing and rigging kit bags and different packs.

H-Harness (Modified)

The modified H-harness consists of two 84-inch nylon straps held together by two 11-inch straps (Figure 6-14, page 6-12). One end of each strap has two friction adapters attached 3 inches apart. Two 24-inch or 36-inch equipment attachment straps with adjustable lugs and two quick-release ejector snap hooks are part of the assembly. The H-harness is used to rig the kit bag and combat packs to the parachute harness.

Aviator’s Kit Bag/MC-4 Kit Bag

The parachutist uses the canvas aviator’s kit bag or the MC-4 kit bag to jump individual equipment such as the load-carrying equipment or properly padded machine gun groups.

Preparing the Bag. The parachutist packs the equipment IAW unit SOP. He carefully places sharp-edged objects in the bag so that they are not against his body when he

Figure 6-13. The MP5 rigged for jumping.
attaches the bag to the parachute harness. He unfastens the snaps, undoes the slide fastener, and folds down the top of the kit bag (about one-half its filled bulk) to pack the equipment. When packed, he zips the bag and fastens the snaps. He gathers up the excess bag material and folds it on top so as to expose the handles.

![Image](https://example.com/image.png)

**Figure 6-14. H-harness with attaching straps.**

**Attaching the H-Harness to the Kit Bag.** The parachutist takes the two end web adapters and lays out the harness (with the adapters nearest the body and the second two adapters on top). He connects the equipment attachment straps as follows: With the adjustable lug nearest the body, he threads the attachment strap’s end under the attaching bar of the second friction adapter and back over the top of the bar. He tightens the strap leaving about 3 inches between the nap and the bar. He repeats this step for the remaining strap. He places one quick-release snap hook on each adjustable lug. He lays out the H-harness with the attachment straps down and the snap hook openings up. He attaches the H-harness to the kit bag by centering the bag on the harness 6 inches from the snap hooks. He places the H-harness straps around the kit bag and threads them through the friction adapters to form a quick release. He threads the snap hooks on the attaching straps through the handles of the kit bag. He rolls and tapes any excess strap (Figure 6-15, page 6-13).

**Attaching the Kit Bag to the Parachutist.** When completely rigged, the parachutist attaches the H-harness to himself. He runs the attachment straps through the handles of the kit bag and then attaches them to the equipment attachment rings on the parachute harness. If wearing a front-mounted aviator’s kit bag and a rear-mounted combat pack, he hooks up the kit bag quick-release snap hooks to the equipment attachment rings first. He then hooks up the combat pack quick-release snap hooks to the outside of the kit bag’s snap hooks.

**Combat Packs, Medium and Large**

The parachutist attaches the medium and large combat packs to himself using the modified H-harness or the improved equipment attachment sling. He can attach the combat pack either to his front or rear.
Packing the Combat Pack. The parachutist inserts equipment in the combat pack and places padding between the load and the front portion of the pack. He fills the outside pockets with nonfragile items as the full pockets help to position the H-harness and attachment sling. He closes the combat pack by engaging the drawstrings and tie-down straps. He routes the running ends of the waist straps behind the frame and secures them by tying or taping.

Rigging the Medium Combat Pack Without the Pack Frame. The parachutist turns the pack upside down. He places the H-harness on his pack so that the cross straps are in front of the pack and the friction adapters are touching the bottom of the pack. He runs the harness straps over the top of the pack and crosses the straps at the center of the back of the pack. He runs the straps through the friction adapters. He threads the equipment attaching straps through the intermediate friction adapters. He attaches the quick-release snap hooks to the adjustable lugs.

Rigging the Medium and Large Combat Packs with the Pack Frame, Modified H-Harness, and Lowering Line. The parachutist—

- Positions the modified H-harness on floor or ground with the friction adapters down. Places the pack, frame up, over the harness making sure that the cross straps are to the top of the pack and the friction adapters are touching (or near) the bottom of the frame (Figure 6-16, page 6-14).
- Runs the harness straps over the top of the pack and then under the top portion of the frame.
- Runs the harness straps under the horizontal bar of the frame and crosses them at the center of the back of the pack. Continues to run the straps under the frame and secures them to the friction adapters.
- Routes the loop end of the lowering line under the crossed diagonal straps. He passes the running end of the lowering line through its own loop and tightens it, making sure he centers the lowering line at the intersection of the straps.
- Secures the lowering line stow pocket to the pack frame with retainer bands. He leaves the portion with the quick-ejector snap free for attachment to the parachute harness.
Threads the equipment attaching straps through the intermediate friction adapters, attaches a quick-release snap hook to each adjustable lug, and rolls and tapes any excess straps.

**Figure 6-16. The combat pack and frame rigged with the modified H-harness.**

**Improved Equipment Attachment Sling**

The improved equipment attachment sling was a component of the MC-3 military free-fall system (Figure 6-17, page 6-15). The parachutist modifies this sling by removing the leg straps with HPT closures or folds and tapes the leg straps so that he cannot use them. This sling is used to rig combat packs to the parachute harness.

**Rigging the Large Combat Pack with the Improved Equipment Attachment Sling (Spider Harness) and Lowering Line.** The parachutist—

- Tightens and secures all straps on the pack and positions the pack with the frame up (Figure 6-18A, page 6-16). He positions the harness on the frame with the friction adapters on the diagonal locking straps at the bottom of the frame and the running ends at the top of the frame. He routes the friction adapters of the diagonal locking straps under the pack frame’s base. He routes the anchor straps (parachute harness attaching straps with adjustable quick-release lugs) and lateral locking straps under the shoulder straps and over the pack frame.

- Turns the pack over. He routes the running ends of the diagonal locking straps around the long axis of the pack, across the straps at the center of the back, and secures them to their respective friction adapters that protrude beneath the bottom of the pack frame (Figure 6-18B).
• Tightens the lateral locking straps and secures them around the pack and to their respective friction adapters (Figure 6-18C).

**NOTE:** If the pack is small, the parachutist crosses and tightens the lateral locking straps and secures them around the pack and to their opposite friction adapters.

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**Figure 6-17. Improved equipment attachment sling and lowering line.**

- Folds and secures the running ends of all straps to themselves with tape or ties them with 1/4-inch cotton webbing.
- Places the combat pack in an upright position.
- Attaches a quick-release snap hook to each adjustable lug so that the latch handles face away from his body when attaching the combat pack to the equipment rings (Figure 6-18D).

**WARNING**

The parachutist tapes all combat pack shoulder strap quick-ejector releases to preclude inadvertent release in free-fall causing instability.

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**Attaching the Lowering Line.** The parachutist routes the loop end of the lowering line under the crossed diagonal straps between the diagonal straps and the loop on the backside of the diagonal straps. He passes the running end of the lowering line through its own loop and tightens it (Figure 6-19, page 6-17). The parachutist makes S-folds with the remainder of the lowering line. He places the S-folds into the retainer pocket. He then secures this pocket to the appropriate side of the pack frame (right side for front mount, left side for rear mount) with retainer bands. He uses three retainer bands: two on the frame and one double wrapped around the center of the lowering line. He tapes the yellow release lanyard to the lowering line with one single wrap of masking tape the length of the lanyard, leaving one to two inches exposed at the top of the lanyard. He then attaches the lowering line quick-ejector snap to the right side lowering line attachment V-ring.
Figure 6-18. The combat pack and frame rigged with the improved equipment attachment sling.

**Attaching the Combat Pack.** The parachutist attaches the combat pack with frame to himself in the same manner as the combat pack without frame.

**Attaching the Rear-Mounted Combat Pack.** The parachutist loosens the shoulder straps. He steps through the shoulder straps, one leg through each strap (Figure 6-20A, page 6-18). He attaches the lowering line to the right side lowering line attachment V-ring on the parachute harness (Figure 6-20B and Figure 6-21, page 6-19). He attaches the quick-release snap hooks to the equipment rings on the main lift webs, has No. 2 lift up on the pack, and he pulls the slack out (Figure 6-20C and D). In this last step, the parachutist could pull out the slack by himself by squatting and sitting on the pack.

**Attaching the Front-Mounted Combat Pack.** The parachutist loosens the shoulder straps. He faces the combat pack (as in Figure 6-22A, page 6-20) and steps through the shoulder straps, one leg through each strap (as in Figure 6-22B). He attaches the lowering line to the right side lowering line attachment V-ring on the parachute harness.
(Figure 6-21 and Figure 6-22B), ensuring it is routed between the rucksack or combat pack shoulder strap and his body. He attaches the quick-release snap hooks to the equipment attachment rings on the main lift webs (Figure 6-22C).

![Diagram showing attaching the lowering line to the combat pack.](image)

**Figure 6-19. Attaching the lowering line to the combat pack.**

*Releasing the Combat Pack.* After his canopy deploys and when he is clear of other parachutists and has canopy control, the parachutist loosens the combat pack’s shoulder straps and pulls them clear of the kit bag. At the same time he detaches the combat pack’s right side quick-ejector so that the pack falls cleanly when released. When on his final approach and 500 feet above the ground, he ensures the ejector snap is still connected, then releases the second quick-release snap hook (the parachutist may hang the rucksack from his feet). He ensures the combat pack is fully lowered by 200 feet AGL. To jettison the combat pack, he releases the lowering line’s quick-ejector snap, allowing the pack to fall free.

**WARNING**

The parachutist lowers all rear-mounted combat packs with frames to avoid injury upon landing.

*NOTE:* If the combat pack is lowered before 200 feet or the final approach and you have to make turns, the combat pack will start to swing and you may impact the ground the same time as the pack.
Figure 6-20. Attaching the rear-mounted combat pack.
The USMC Single Action Release Personal Equipment Lowering System (SARPELS)

The SARPELS is a complete lowering system authorized for use by the USMC for both static-line and MFF parachute operations. The SARPELS was designed to provide a single-point release capability for personal equipment carried by military parachutists. Refer to USMC TM 10121A-12&P.

The system consists of the SARPELS cargo carrier, two D-ring attaching straps, two leg strap cable retainers with buckle and grommet, the single-point release handle, a 15-foot static-line lowering line, and an 8-foot military free-fall lowering line. The complete system weighs 9.5 lbs empty. The SARPELS cargo carrier weighs 6 lbs empty and measures 22Lx18Wx24H inches. The 8-foot military free-fall lowering line is made of 1-inch tubular nylon with a maximum capacity of 1,000 lbs.
Figure 6-22. Attaching the front-mounted combat pack.

**Loading the SARPELS Cargo Carrier.** The parachutist—

- Loads personal supplies and equipment in the SARPELS cargo container in such a manner as to maintain the general shape of the cargo container (Figure 6-23, page 6-21). Does not load more than 110 lbs into the cargo container.
Standing from the top of the SARPELS, folds over the left side flap and then the right side flap (Figure 6-24).

**WARNING**

Do not overload the SARPELS cargo carrier. Personal injury may occur. Maximum safe load is 110 lbs.
• Stows the unused webbing straps into the small side pockets on either side of SARPELS cargo carrier (Figure 6-25).

• Folds the outer side flaps in half and over the side pockets and straps (Figure 6-26, page 6-23).

• Still standing at the top, folds the left top flap and then the right flap (Figure 6-27, page 6-23).

• Folds over the large top flap (Figure 6-27).

• Inserts the horizontal straps through the webbing and buckles (Figure 6-28, page 6-24). On the SARPELS model with three horizontal straps, the top strap is optional, depending on the size of the cargo.

• Roll-folds the excess webbing of the horizontal straps and secures them with the elastic retainer band.

• Inserts the vertical straps through the webbing and buckles (Figure 6-29, page 6-24).

• Roll-folds the excess webbing of the vertical straps and secures them with the elastic retainer band.

Figure 6-25. Stowage pockets.
Rigging the SARPELS Cargo Carrier. The parachutist—

- Feeds the white webbing of the SARPELS cargo carrier through the parachute harness link of the D-ring attaching straps (Figure 6-30, page 6-25). Ensures that the opening to the snap hooks of the D-ring attaching straps are facing down toward him.
- Pulls the green 550 cord through the white webbing (Figure 6-31, page 6-25).
- Pulls the red 550 cord through the green 550 cord (Figure 6-32, page 6-26).
- Pulls the red 550 cord through the grommet of the leg strap (Figure 6-33, page 6-26).
Runs the wire rope of the single-action release handle between the webbing handles (Figure 6-34, page 6-27). Then he runs the wire rope through the red 550 cord and into the retaining pouch of the leg strap cable retainers with buckle and grommet. **NOTE:** *The dotted line represents the wire rope hidden within the retainer pouch.*

Secures the single-point release strap with the Velcro within webbing handles (Figure 6-35, page 6-27).
Figure 6-30. Inserting the white webbing through the parachute harness link.

Figure 6-31. Inserting the green 550 cord through the white webbing.

Installing the Eight-Foot Military Free-Fall Lowering Line. The parachutist—

- Uses the eight-foot-long lowering line for MFF operations using a ram-air parachute system (MC-5).
- Attaches the lowering line through the sewn webbing loop on the back side of the SARPELS carrier at the top of the stowage pocket (Figure 6-36, page 6-28).
Feeds the sewn loop of the lowering line through the sewn loop on the cargo carrier. Inserts the quick ejector snap through the sewn loop of the lowering line (Figure 6-37, page 6-28). Pulls the entire lowering line through the loop and cinches it down. S-folds the excess lowering line and secures it with an elastic retainer band and places it in the stowage pocket. Closes the stowage pocket with the Velcro.

Figure 6-32. Inserting the red 550 cord through the green 550 cord.

Mounting the SARPELS Cargo Container. The parachutist—

- Mounts the SARPELS cargo container to the parachute harness’ large equipment attachment rings using the snap hook of the D-ring attaching straps (Figure 6-38, page 6-29).
- Attaches the quick ejector snap of the lowering line to the large equipment attachment rings on the parachute harness.
- Ensures the SARPELS cargo carrier is securely in place and is attached by the appropriate lowering line. Personal injury may occur if the wrong lowering line is used.
- Once under canopy, and in accordance with unit SOP, pulls the white webbing of the single-action release handle to lower the equipment load (Figure 6-39, page 6-29).

Figure 6-34. Leg strap cable retainer with buckle and grommet.

Figure 6-35. SARPELS release assembly.

WARNING
Release the SARPELS cargo carrier before landing to avoid personal injury.

Harness, Single-Point Release
The harness, single-point release (HSPR) (Figure 6-40, page 6-31) is an H-type design authorized for use by USMC MFF parachutists. It is made of nylon webbing, has friction adapters to secure it around the load, and has two adjustable D-ring attaching straps. To
stabilize the pack to the parachutist during movement in the aircraft, exit, free-fall, and parachute deployment, two adjustable leg straps secure the pack to the parachutist’s right and left legs. The leg straps are equipped with the male portion of the leg strap release assembly. The harness has a single-point release assembly that simultaneously releases the load and leg straps from the parachutist and parachute harness.

Figure 6-36. Stowage pocket with 8-foot lowering line.

Figure 6-37. Securing the 8-foot lowering line to the cargo carrier.

Rigging the All-Purpose, Lightweight, Individual, Carrying Equipment (ALICE) Pack with the HSPR

Before attaching the HSPR to the pack, the release handle and adjustable D-ring attaching straps are attached to the HSPR (Figure 6-41A, page 6-32).
Figure 6-38. Mounted SARPELS.

Figure 6-39. The single-action release handle.
• Route the two release handle cables between the two plies of the release handle cross strap. Attach the pile tape of the release handle to the hook tape attaching tab located between the plies of the release handle cross strap. Ensure that the release handle lanyard is not misrouted. Place the triangle links of the adjustable D-ring attaching straps on top of the white attaching loops. Route the white attaching loop up through the triangle link. Route the green attaching loop up through the white attaching loop. Route the red attaching loop up through the green attaching loop. Route the red attaching loop through the grommet on the female portion of the leg strap release assembly. Ensure that the cable loop retainer on the female portion of the leg strap release assembly is facing up. Route the release handle cable through the red attaching loop and then through the cable loop retainer. Repeat the process for the other strap.

• Turn the harness over so that the adjustable D-ring attaching straps are on the bottom. Place the ALICE pack on top of the harness so that the middle outer cargo pocket is placed between the release handle cross strap and the adjustable cross strap. Ensure the top of the pack is facing the equipment retainer straps (Figure 6-41B, page 6-32). Route the equipment retainer straps underneath the top of the frame, cross them on the back of the pack to form an X, then route them underneath the frame and the backrest of the pack.

• Route the equipment retainer straps through their appropriate friction adapters (a two- or three-finger quick release is optional; if used, the quick release loop is secured to the harness with tape or a retainer band). S-roll the excess webbing and secure it with retainer bands or tape (separate from the quick-release loop if used). Attach the HPT lowering line in the same way as with the modified H-harness for a front-mounted combat pack (Figure 6-41C). The 8-foot HPT lowering line is normally used for MFF operations. Next tighten the shoulder straps (Figure 6-41D).

• Route the adjustable leg straps around the pack and attach the male portion of the leg strap release assembly to the female portion of the leg strap release assembly, leaving it connected until it is time to attach the combat pack to the parachutist (Figure 6-41E).

**Attaching HSPR and ALICE Pack to Parachutist**

Use the buddy system to attach the HSPR to the parachutist. The parachutist stands facing the HSPR-rigged ALICE pack and attaches the ejector snap on the HPT lowering line to the right-side lowering line attachment V-ring on the parachute harness. The buddy routes the lowering line between the combat pack’s shoulder straps and the parachutist’s body. The parachutist then grasps the harness by the two adjustable D-ring attaching straps and secures the snap hooks to the large equipment attachment rings on the main lift webs (Figure 6-42, page 6-33). The buddy routes the adjustable leg straps around the parachutist’s legs and attaches the male portion to the female portion of the leg strap release assembly. The parachutist then pulls on the free-running ends of the adjustable D-ring attaching straps and snugs the pack up to the large equipment attachment rings. After this, the parachutist folds the excess webbing and secures it in the webbing retainer (Figure 6-43, page 6-33).
Figure 6-40. HSPR (NSN 1670-01-227-7992).
Figure 6-41. Rigging the HSPR.
Figure 6-42. Attaching the HSPR-rigged combat pack.

Figure 6-43. Parachutist with HSPR-rigged combat pack.
Chapter 7

Aircraft Procedure Signals and Jump Commands

Aircraft noise, the MFF parachutist helmet, and the oxygen mask make verbal communication extremely difficult. Therefore, the parachutist receives aircraft procedure signals and jump commands (Figure 7-1) by arm-and-hand signals. The MFF parachutist must be thoroughly familiar with all signals and commands and the required actions for each one. Standardization of procedural signals and jump commands permits interoperability of all MFF-capable units. Safety significantly increases when the parachutist understands the jumpmaster’s intent and the jumpmaster understands the parachutist’s desired response.

<table>
<thead>
<tr>
<th>AIRCRAFT PROCEDURE SIGNALS</th>
<th>JUMPMASTER ACTIONS</th>
<th>PARACHUTIST ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DON HELMETS</td>
<td>Gives command before takeoff or landing.</td>
<td>Dons helmet, fastens chin strap, and fastens seat belt.</td>
</tr>
<tr>
<td></td>
<td>*CAUTION If the helmet is removed after the JMPI, the jumpmaster ensures there is no twist in the oxygen delivery hose.</td>
<td></td>
</tr>
<tr>
<td>UNFASTEN SEAT BELTS</td>
<td>Normally gives command on reaching an altitude of 1,000 feet AGL or when notified by the flight crew that it is safe to do so.</td>
<td>Disconnects seat belt and stows it to the left and right for easy retrieval.</td>
</tr>
<tr>
<td>*MASK</td>
<td>*Turns on own console and masks.</td>
<td>*Turns on console. Secures mask to face and assures proper attachment and seal. Checks delivery of oxygen.</td>
</tr>
<tr>
<td>*CHECK OXYGEN</td>
<td>*Gives signal immediately following the command “mask” and then periodically. *Gives signal after the 20- and 10-minute warnings.</td>
<td>*Checks own oxygen and returns the thumbs up signal to the jumpmaster. In the event of an oxygen problem, extends arm straight forward, palm down.</td>
</tr>
<tr>
<td>*NOTE: Mask and oxygen checks will be determined by flight plan and mission profile when given. *NOTE: Oxygen Safety checks gauges.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME WARNING 20-Minute Warning</td>
<td>*All parachutists must be awake. First pass attaches combat equipment.</td>
<td></td>
</tr>
<tr>
<td>*CHECK OXYGEN</td>
<td>*Checks own oxygen and returns the thumbs up signal to the jumpmaster. In the event of an oxygen problem, extends arm straight forward, palm down.</td>
<td></td>
</tr>
<tr>
<td>TIME WARNING 10-Minute Warning</td>
<td>Ensures RED jump/caution light is on.</td>
<td>Second pass attaches combat equipment.</td>
</tr>
<tr>
<td>WIND SPEED</td>
<td>Normally gives signal immediately after the 10-minute warning, if known, and updates to remain current with the DZ party’s information.</td>
<td></td>
</tr>
<tr>
<td>*These signals, commands, and actions are used only during oxygen jumps with prebreather.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7-1. Aircraft procedure signals and jump commands (oxygen and nonoxygen jumps).
<table>
<thead>
<tr>
<th>JUMP COMMANDS</th>
<th>JUMPMASTER ACTIONS</th>
<th>PARACHUTIST ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM ARR</td>
<td>On ascent gives ARM ARR command at 5,000 feet AGL (or 2,500 feet above activation altitude set on the ARR, whichever is higher). Arms own ARR first and is checked by another parachutist while seated. Normally gives signal immediately after the 10-minute warning and wind speed.</td>
<td>Ensures his parachute is against the seat or fuselage. Arms ARR, counts to six, receives a check, and passes the thumbs up signal from the last parachutist in the front of the aircraft to the rear, and then to the jumpmaster.</td>
</tr>
<tr>
<td>STAND UP</td>
<td>Gives command about 2 minutes before time over target (TOT). (O₂ or equipment jumps may require additional time for this command only, all other commands remain the same.)</td>
<td>Stands, faces the rear, and checks own equipment. Checks the pins *and oxygen pressure gauge of the man in front and taps him to indicate he is OK. The last two parachutists check each other. *NOTE: During an oxygen jump, the right hand should be on the ON/OFF switch of the oxygen bailout bottle and the left hand on the disconnect for the console hose.</td>
</tr>
<tr>
<td>MOVE TO THE REAR</td>
<td>Gives command about 1 minute before TOT.</td>
<td>Tightens shoulder straps of rucksack and puts goggles down. *Turns on oxygen bailout bottle and disconnects from the console. Moves to within 1 meter of the jump door or to the hinge of the ramp.</td>
</tr>
<tr>
<td>STAND BY</td>
<td>Gives command about 15 seconds before TOT.</td>
<td>Returns thumbs up signal and moves to 1 foot of edge of ramp or door. Focusses attention on jumpmaster.</td>
</tr>
<tr>
<td>GO</td>
<td>Ensures GREEN jump/caution light is on. Ensures aircraft is over release point.</td>
<td>Exits the aircraft.</td>
</tr>
<tr>
<td>ABORT</td>
<td>Gives command anytime an unsafe condition exists inside the aircraft, outside the aircraft, or on the DZ. Gives command when the RED jump/caution light is on. *Reconnects own console and turns off own oxygen bailout bottle.</td>
<td>Returns to seat. *Reconnects to console and turns off oxygen bailout bottle.</td>
</tr>
<tr>
<td>*CHECK OXYGEN</td>
<td>*Checks own oxygen and returns the thumbs up signal to the jumpmaster. In the event of an oxygen problem, extends arm straight forward, palm down.</td>
<td></td>
</tr>
<tr>
<td>DISARM ARR</td>
<td>Gives command when jump is aborted and doors have been closed. Gives command before the aircraft descends below 5,000 feet AGL (or 2,500 feet above activation altitude set on the ARR, whichever is higher).</td>
<td>Disarms ARR. Gives the thumbs up to the jumpmaster.</td>
</tr>
</tbody>
</table>

*These signals, commands, and actions are used only during oxygen jumps with prebreather.

Figure 7-1. Aircraft procedure signals and jump commands (oxygen and nonoxygen jumps) (continued).

AIRCRAFT PROCEDURE SIGNALS

Signals used between aircraft boarding and the jump command “stand up” are procedure signals. The aircraft procedure signals discussed in the following paragraphs begin before takeoff. The jumpmaster gives these signals.
Don Helmets

The jumpmaster gives the signal “**don helmets**” before takeoff. He may also give it during the flight. Upon receiving this signal (Figure 7-2), the parachutist dons his helmet, fastens his chin strap, and fastens his seat belt.

![Figure 7-2. Don helmets.](image)

Unfasten Seat Belts

The jumpmaster normally gives the signal “**unfasten seat belts**” upon reaching an altitude of 1,000 feet AGL or when the flight crew chief indicates that it is safe to do so (Figure 7-3). If the aircraft descends back through 1,000 feet AGL later in the flight, the parachutist refastens his seat belt upon receiving the command to “**don helmets**.”

![Figure 7-3. Unfasten seat belts.](image)
Emergency Bailout

The jumpmaster gives the “emergency bailout” signal for an emergency exit during flight. Jump commands may be given if time permits. If there is no time for the full jump command sequence, he gives abbreviated signals immediately after the bailout signal (Figure 7-4).

- Extend one arm straight up, with the index finger extended, and move in a circular motion.

- Place the clenched left fist by the reserve ripcord handle and thrust out to the side (above 1,000 feet).

- Place the clenched right fist by the main ripcord handle and thrust out to the side (above 2,000 feet).

Figure 7-4. Emergency bailout.
For exits from 1,000 to 2,000 feet AGL, the jumpmaster signals to “immediately exit, clear, and pull the reserve ripcord handle.”

For exits at 2,000 feet AGL and above, the jumpmaster signals to “immediately exit, clear, and pull the main ripcord handle.”

**Mask**

The jumpmaster signals “mask” when the parachutist must begin using supplemental oxygen. Upon receiving this signal, the parachutist masks and checks to make sure the oxygen system is functioning properly (Figure 7-5).

![Figure 7-5. Mask.](image)

Place your right thumb on your right cheek and rotate the palm and fingers of your right hand across your nose and mouth.

**Check Oxygen**

The jumpmaster signals “check oxygen” immediately after the signal to mask and periodically after that. At a minimum he gives it following the 20- and 10-minute time warnings. Upon receiving this signal, the parachutist returns the signal if everything is functioning correctly. If there is a problem, the parachutist extends an arm in front of his body with his hand open, palm down (Figure 7-6, page 7-6).

**Time Warnings**

The jumpmaster receives time warnings from the flight crew. The jumpmaster signals the “time warnings” to the parachutist to allow him adequate time to prepare for the jump. The parachutist receives the time warnings normally 20 minutes and 10 minutes before TOT (Figure 7-7, page 7-7).

**Wind Speed**

The jumpmaster signals “wind speed” after the 10-minute time warning (Figure 7-8, page 7-8). In gusting wind conditions, the jumpmaster gives the wind speed signal first to
indicate the lower wind speed. He follows with the “gusting winds” signal to indicate the higher wind speed (Figure 7-9, page 7-8).

Figure 7-6. Check oxygen.

Arm ARR

The jumpmaster normally signals “arm ARR” after the 10-minute time warning. He can also give this signal any time the aircraft reaches 5,000 feet AGL (or 2,500 feet above the activation altitude set on the ARR, whichever is higher). Upon receipt of this signal, the parachutist ensures his parachute is against the seat or fuselage, arms his ARR, counts to six, gets a check from another parachutist, and passes the thumbs up from the front of the aircraft to the rear of the aircraft to the jumpmaster (Figure 7-10, page 7-9).

JUMP COMMANDS

The jump commands discussed in the following paragraphs begin as early as 2 minutes before the actual jump is made. The jumpmaster gives these commands.

NOTE: The 2 min, 1 min, 15 sec, and “go” command can be given with either hand, depending upon which side of the A/C the MFF jumpmaster is on.

Stand Up

The jumpmaster commands “stand up” about 2 minutes before TOT (Figure 7-11, page 7-9) (O₂ or equipment jumps may require additional time for this command only, all other commands remain the same). Upon receiving this command, the parachutist stands up, faces the jumpmaster, and checks his equipment. If jumping oxygen, the parachutist also places his right hand on the ON/OFF valve of the bailout bottles and grasps the console hose at the AIROX VIII with his left hand.
Move to the Rear

The jumpmaster commands “move to the rear” about 1 minute before TOT (Figure 7-12, page 7-10). Upon receiving this command, the parachutist tightens the combat pack’s shoulder straps around his legs, adjusts his goggles, and moves to within 1 meter of the jump door or to the hinge of the cargo ramp. If jumping oxygen, the parachutist must activate the bailout oxygen system, check the flow indicator of the AIROX VIII, and disconnect from the oxygen console before moving to the rear of the aircraft.

**NOTE:** If jumping with combat pack, the parachutist dons it after the 20-minute warning.
Extend your right arm in front of your body at waist level, palm up, forearm parallel to ground, and elbow locked at your side.

Next, turn your upper body at the waist from right to left to right.

Return to center.

Then, extend one or both arms to your side at about head level, hands open, palms forward, with the correct number of fingers held up to indicate knots of wind speed.

Move your right arm out and down in a diagonal slash across your body from left to right. Then, display the appropriate number of fingers to indicate the higher wind speed.

**Figure 7-8. Wind speed.**

**Figure 7-9. Gusting winds.**
Stand By

The jumpmaster commands “stand by” about 15 seconds before the exit (Figure 7-13, page 7-10). Upon receiving this signal, the parachutist signifies readiness by returning the jumpmaster’s signal and then moves to the jump door or the cargo ramp.

Go

The jumpmaster commands “go” when the aircraft is over the release point and the green jump light is on (Figure 7-14, page 7-11).
Abort

The jumpmaster commands “**abort**” anytime an unsafe condition exists inside or outside the aircraft (red jump light comes on) or on the DZ (Figure 7-15, page 7-12). Upon receiving this command, the parachutist returns to his seat and sits down. If jumping oxygen, the parachutist reconnects to the oxygen console, turns off the bailout system, and then sits down.
Disarm ARR

The jumpmaster gives the signal “disarm ARR” (reinsert arming pin) by reversing the arm ARR signal. The safety or the assistant jumpmaster checks the ARR arming pin and the pins of the main and reserve parachute. The parachutist on the right side of another parachutist can more easily reinsert the arming pin.
Figure 7-15. Abort.

Slowly turn away from the exit and face the front of the aircraft. Then lower your head and shake it from side to side while walking toward the front of the aircraft.

**CAUTION**

If the jumpmaster has cocked his arm to give the command "go," he must NOT move it when he gives the abort signal. The parachutists may exit if the jumpmaster moves his cocked arm.
Chapter 8

Body Stabilization

The MFF parachutist must be able to exit an aircraft with his combat equipment, fall on a designated heading, and manually deploy his main parachute without losing stability. Body stabilization skills allow the parachutist to group in free-fall, cover small lateral distances with a rucksack, move off a lower parachutist’s back in free-fall, and turn to keep the DZ or group leader in sight. The MFF parachutist maintains these skills through regular MFF jumps and periodic refresher training. This chapter addresses the body stabilization skills needed to make a night, tactical MFF jump with combat equipment from oxygen altitudes. Appendixes B and C provide recommendations for an MFF proficiency training program and suggested sustained airborne training.

TABLETOP BODY STABILIZATION TRAINING

Any stable tabletop or flat surface can be used for body stabilization training. The parachutist lies on his stomach on the tabletop. At the command “go,” he lifts his arms and legs from the tabletop, assumes the poised or diving exit position, then moves to the stable free-fall position (Figures 8-1 through 8-3, pages 8-1 through 8-2). Controlled movement positions during free-fall include turns, gliding, altimeter check, and main ripcord pull (Figures 8-4 through 8-7, pages 8-3 through 8-5).

Upon exiting the aircraft, face in the direction of flight and extend body with your back arched. Position legs comfortably apart and knees slightly bent. Hold head back and extend arms to the rear and away from your body at a 45-degree angle.

Figure 8-1. Poised exit position.
Upon exiting the aircraft, face opposite the direction of flight and extend your body with your back arched. Stretch your arms straight out ahead of you, arms comfortably apart. Hold your head back. Bend your legs back from the knees with your feet close to your buttocks.

**Figure 8-2. Diving exit position.**

In the stable free-fall position, arch your back and hold your head up and back. Extend your arms horizontally, elbows bent at 90-degree angles. Hold your hands at eye level, palms down and slightly cupped, fingers spread. Hold your legs about shoulder width apart, with your knees bent at a 45-degree angle. Your knees should be slightly higher than your thighs.

**Figure 8-3. Stable free-fall position.**
To execute right or left turn, arch, look in direction of turn while rotating your upper body (shoulder) in direction of turn to start the turn. Before reaching desired heading, counter and stop turn on desired heading. Resume the stable free-fall position.

**Figure 8-4. Body turn.**

The glide is a controlled lateral movement. It allows you to maintain relative position with a designated group leader or bundle. To glide, bring your arms back with your elbows held near your sides and your forearms at about a 90-degree angle to your body. Rotate your shoulders up and forward to cup your upper body. Then straighten your legs from the knees. The straighter you hold your legs, the faster the glide will be. To stop the glide, return to the stable free-fall position.

**Figure 8-5. Gliding.**
RECOVERY FROM INSTABILITY

Instability creates a hazard to the parachutist and to other parachutists in the air. Instability is the primary cause of MFF malfunctions. There are a variety of reasons for instability. In most cases it is caused by a parachutist who does not present a symmetrical body position to the relative wind, either on exit or in free-fall. A contributing factor to instability in free-fall is the inadvertent shift or release of combat equipment. A flat spinning or tumbling body motion characterizes instability. It is dangerous not only to the parachutist experiencing it but often to other parachutists in free-fall with him. It prevents tactical grouping.

NOTE: If you encounter any or all of these situations, maintain altitude awareness and pull at the prescribed pull altitude.

Recovery from a Flat (Horizontal) Spin

If the parachutist is spinning or falling on his back, he must first return to a face-to-earth free-fall attitude by arching his body. Depending upon the speed of his spin, sometimes this movement alone is enough to slow or stop a flat spin. If he is still spinning after facing the earth, he must counter the direction of the spin. He does this movement by looking in the opposite direction of the spin (for example, if spinning clockwise, he looks counterclockwise) and making a hard body turn in that direction. He holds this body position until the spin slows and stops. Depending on the amount of momentum he developed before he started countering the spin, he may have to hold this body position for several revolutions. Once the spin has stopped, he checks his body position, makes an altimeter check, and continues with the mission.

If a shift of the combat pack causes a flat spin, the parachutist may have to adjust his body position to obtain stability or maintain a heading. The severity of the shift (versus an inadvertent release) determines how much adjustment of the knees, the angle of the

Figure 8-6. Altimeter check.
lower leg, hand and arm placement, or cocking of the hips he must make to counter the effect of a combat pack that is now not symmetrical or square to the relative wind.

Figure 8-7. Main ripcord pull.
Recovery from Tumbling

A bump during a group exit or breaking the arched body position normally causes tumbling. If tumbling, the parachutist assumes the hard arch body position until he faces the earth. Once he faces the earth, he relaxes the hard arch to a stable free-fall body position. How long it takes him to return to a face-to-earth position will vary with the severity of the tumble, his body area surface, and his combat equipment’s configuration. Presenting a symmetrical body position to the relative wind on exit from the aircraft is the most significant factor in preventing tumbling.

Altitude Awareness

A parachutist who is unstable must remain altitude aware. The stress created by instability can cause a normal human phenomenon of temporal (time) distortion. The resultant effect varies from individual to individual. It can appear to be either time compression or a slowing down of perceived time passage. He must not get so caught up in his attempts to recover stability that he loses altitude awareness and forgets to manually activate his parachute. **He must never sacrifice the pull altitude for stability or the continued attempts to obtain stability before the pull.** An unstable parachutist **must** remember that as he is falling, an area of low pressure is created above him. Any altimeter reading while in this low-pressure area will not reflect the correct altitude AGL. An example is a parachutist falling back to earth who looks at his altimeter while holding it in front of his face. Due to the low-pressure zone in which the altimeter is located, the parachutist will read a higher altitude than where he actually is in feet AGL. Remember that this pressure differential can cause the altimeter to be off as much as 1,000 feet.
Chapter 9

Military Free-Fall Jump Training

This chapter describes the RAPS canopy and its components. Also covered are the ram-air parachute deployment sequence, its theory of flight, and its flight characteristics. Finally, canopy control procedures are explained.

RAM-AIR PARACHUTE CHARACTERISTICS

The ram-air parachute canopy’s design is similar to an aircraft’s wings, with curved upper surfaces (top skin) and flat lower surfaces (bottom skin). Support ribs maintain the airfoil shape of the canopy (Figure 9-1).

![Figure 9-1. Shape of the ram-air parachute canopy.](image1)

Reinforced, load-bearing support ribs serve as attaching points for the suspension lines, and non-load-bearing ribs separate a cell into two compartments. Cross-port vent holes in the support ribs equalize the internal air pressure in a canopy (Figure 9-2).

![Figure 9-2. Structure of the ram-air parachute canopy.](image2)
Nose, tail, chord, and span are terms of reference applied to ram-air parachutes. The open portion at the front is called the nose, with the rear being the tail. The distance from left to right is the span, and from nose to tail is the chord (Figure 9-3).

The stabilizers are single-layered extensions of the canopy on the left and right sides of the parachute. They channel the airflow across the chord and help to maintain straight and stable flight.

The military ram-air canopy has four suspension line groups. They are identified from nose to tail as A, B, C, and D. A continuous line group is a line attached to the parachute’s bottom skin that runs directly to the connector link without having another line attached to it. The suspension lines distribute a suspended load under the canopy without distorting the canopy’s airfoil shape (Figure 9-4, page 9-3).

Upper control lines converge from points of attachment on the left and right trailing edges of the tail, respectively, to common connection points with the lower control lines. The lower control lines are attached to the upper control lines and have a soft steering toggle secured to the lower end. Deployment brake loops sewn into the lower control lines set the canopy brakes for deployment.

The sail slider is a rectangular piece of reinforced fabric with a large grommet in each corner. The sail slider is a deployment device that retards the opening of a ram-air parachute (Figure 9-5, page 9-4).

Plastic disks called slider stops are sewn to the stabilizers at suspension line attachment points. These slider stops limit the upward travel of the sail slider.

The suspension lines are attached to a connector link on each riser (Figure 9-5).
Figure 9-4. Location of components of the ram-air parachute.

Trim tabs on the main parachute’s front risers shorten the risers to create an artificial decrease in the canopy’s angle of attack into the wind.

Guide rings sewn to the rear risers function as anchor points for the deployment brakes and guides for the lower control lines (Figure 9-5).

RAM-AIR PARACHUTE DEPLOYMENT SEQUENCE

At the prescribed parachute deployment altitude, the parachutist manually activates his parachute. He grabs and unseats the main ripcord handle in his right hand and fully extends his arm (Figure 9-7, page 9-6).

When the main ripcord pin clears the closing loop, the main pilot chute opens the closing flaps, launches from the main parachute container, and extends the pilot chute bridle. The bridle extracts the deployment bag from the main container, and the suspension lines unstow from their retainer bands. When the lines are fully extended, they pull the main parachute from the deployment bag, and the canopy begins to inflate (Figure 9-6, page 9-5). The sail slider retards the canopy’s deployment. As the canopy inflates, it forces the sail slider down toward the risers as the suspension lines spread apart. After complete
canopy deployment, the parachutist pulls the steering toggles from the deployment brake loops to release the control lines from the deployment brakes setting to the full flight setting.

Figure 9-5. Detailed lower portion of the ram-air parachute.
Should the parachutist encounter an uncontrollable situation requiring the initiation of emergency procedures, he discards the main ripcord handle. He then looks at and secures the cutaway handle with his right hand and the reserve ripcord handle with his left hand and then arches vigorously. He pulls the cutaway handle to full arm extension. He then immediately pulls the reserve ripcord handle to full arm extension. Then he discards both these handles. This action allows the cutaway cables to clear the release loops threaded through the small rings of the canopy release assembly. The three-ring system activates the right side a moment before the left side to prevent an entanglement.

As the left riser set is jettisoned, it pulls the reserve static line, usually deploying the reserve before manual activation of the reserve ripcord (Figure 9-7, page 9-6).

**WARNING**

The parachutist must first pull the cutaway handle AND THEN the reserve ripcord handle to full arm extension and discard them to make sure complete emergency procedures are followed.

As the reserve ripcord pins clear the closing loops, the pilot chute opens the closing flaps. The pilot chute deploys from the reserve parachute container and, as it catches air, extends the 2-inch-wide high-drag bridle. Upon extraction of the reserve free bag from the container, the free-stowed suspension lines deploy from a pocket on the free bag and
extract the reserve parachute from the free bag. The free bag then completely separates from the reserve parachute. As the canopy deploys, it forces the sail slider down the suspension lines. When the parachutist releases the toggles from the deployment brake loops, he releases the control lines from the deployment brake setting to the full flight setting.

**Figure 9-7. Cutaway sequence and deployment of the reserve.**

**RAM-AIR PARACHUTE THEORY OF FLIGHT**

The ram-air parachute is an inflated and pressurized fabric airfoil that generates lift by moving forward through the air. The relative lengths of the suspension lines maintain the airfoil’s angle of attack. In flight, the parachutist keeps the wing’s leading edge at a slightly lower angle than the trailing edge. Thus this angle forces the canopy’s airfoil-shaped surface to glide or plane through the air, very much like a glider in descending flight. The wing-shaped ram-air parachute generates lift caused by the reduced pressure of the airflow over the curved upper surface.

The ram-air parachute’s leading edge is open or physically missing, forming intakes that allow the cells to be ram-air inflated. Internal air pressure pushes a small amount of stagnant air ahead of the airfoil, forming an artificial leading edge. The focal point of this stagnant air acts as a true leading edge, deflecting the relative air above and below. Drag...
is the only force that retards the wing’s forward motion through the air. It is created by the friction of air passing over the canopy fabric, the suspension lines, and the parachutist and his equipment. Gravity, plus the resultant sum of these aerodynamic forces on the upper surface, acts to pull the ram-air parachute through the air and contributes to the flat glide angle of the canopy (Figure 9-8).

Figure 9-8. Ram-air parachute theory of flight.

Applying brakes on the ram-air parachute causes the trailing edge to deflect downward, creating additional drag (Figure 9-9, page 9-8). This drag produces a proportionate loss of airspeed but generates lift for a short time. Prolonged application of brakes results in a loss of airspeed and generated lift and a steeper approach angle. As full brakes are reached, the wing ceases to generate dynamic lift, resulting in an increased rate of descent at an almost vertical descent angle. Depressing the toggles beyond full brakes causes the parachute to cease flying and enter a stall.

Differential application of brakes (one side only, or one side more than the other) produces an unbalanced drag force at the trailing edge. This drag results in a yaw-type turn toward the side with the highest drag.

Because the slow side generates less lift, it tends to drop slightly in a shallow banking motion, much like an airplane. This bank angle increases as differential toggle displacement increases.
RAM-AIR PARACHUTE FLIGHT CHARACTERISTICS

The parachutist must remember that the ram-air parachute is a high-performance gliding system. In the hands of an inexperienced parachutist, or one ignorant of proper handling techniques, it is, because of its high performance, potentially dangerous. The parachutist must possess a working knowledge of its flight capabilities and limitations and fully understand the canopy control techniques.

The ram-air parachute is not overly complicated. It is basically a fabric wing section. The parachutist must have a very basic knowledge of aerodynamics to better understand its flight and handling characteristics.

The ram-air parachute planes or glides through the air at about 20 to 30 miles per hour (mph). It always flies at this speed regardless of wind conditions, except when the parachutist applies brakes.

The flying speed is called AIRSPEED and remains constant regardless of whether the parachute is headed upwind, downwind, or crosswind. The only variation in flying upwind or downwind is a change in GROUND SPEED that is often mistaken for a change in airspeed.

Wind affects ground speed only and has no effect on airspeed. Brakes applied with conventional control lines and toggles control the ram-air parachute’s airspeed. The parachutist must remember that 50 percent of toggle travel on a ram-air parachute will cause a speed reduction of close to 12 mph.

There is almost no surge on deployment, and there is no wind noise at all until after releasing the brakes. A parachutist who has not been previously exposed to the ram-air
parachute’s flight characteristics can use the wind noise created by forward speed as a rough airspeed indicator. A reduction in the wind noise level can provide a stall warning.

After the parachutist becomes accustomed to the canopy, he will not notice the wind noise. By this time he will have learned to fly the canopy by feel, and he will have ample stall warning. A parachutist will feel the canopy shudder as it loses lift and begins to stall.

The parachutist must remember that in controlling the canopy’s flight, how fast he moves the toggles from one position to another is as critical as the relative position of the toggles. As a rule, rapid and generous (more than 30 percent) application of both toggles will cause a rapid decrease in airspeed, decelerating into the stall range at about 0 to 3 mph. (Depending on the wind speed, the ground speed could still be very high.)

Due to the penetrating ability of the ram-air parachute, it is often difficult to determine wind direction without the aid of a windsock, streamer, or smoke on the ground. All landings should be made facing into the wind.

The ram-air parachute has a constant airspeed of 20 to 30 mph. If the parachutist points the ram-air parachute downwind with a 10-mph wind, the ground speed will be 30 to 40 mph. If he turns the ram-air parachute into the wind and the winds are 10 mph, the airspeed remains the same but the ground speed reduces by 10 mph. If the ram-air parachute faces into 20-mph winds, the ground speed will be 0 mph (Figure 9-10, page 9-10).

**CANOPY CONTROL**

The overall objective of MFF parachuting is to land personnel and equipment intact to accomplish the assigned mission. The free-fall parachutist must know and employ the principles of canopy control as they relate to the use of the ram-air parachute.

Wind action, direction of canopy flight, and manipulation of the control toggles primarily control the movement of the ram-air parachute. Upon canopy deployment, the parachutist grabs the control toggles and performs a controllability check of the parachute. The purpose of this check is to determine if the jumper's canopy is capable of landing him safely. Refer to Figure 9-11, page 9-10 for canopy controllability check.

The parachutist must first know wind direction and approximate speed since the direction of his canopy’s flight, as determined by his toggle manipulation, is in relation to wind action. The canopy’s shape, design, span, and chord generate the ram-air parachute’s 20- to 30-mph glide. The flow of air over and under the canopy’s wing shape provides the lift and forward flight of the parachute. By specific manipulation of the toggles, the parachutist may distort the trailing edge and cause the canopy to turn, to vary forward speed, and to increase the rate of descent.

Canopy control involves the coordination of wind direction and speed, canopy flight and penetration, and the parachutist’s own selective manipulation and distortion of the canopy. Maneuvering the parachute requires more than simply turning the canopy. A properly executed parachute maneuver requires correct canopy manipulation to combine the wind’s force and the canopy’s flight to move the parachute in a given direction. The parachutist may have to hold into the wind, run with the wind, or crab to the left or right while holding or running. Figure 9-11 contains a condensed guide to good canopy control.
Figure 9-10. Controlling ground speed.

- Check canopy and ground position after opening.
- Keep a sharp lookout for other parachutists.
- Check your altitude and your first ground reference point.
- Pick out intermediate ground references between you and the target.
- Determine wind direction (on the ground and at altitude).
- Check the holding pattern and penetration of your canopy.
- Use the upwind toggle to turn your canopy.
- Locate the wind line and determine the direction in which you want to move.
- Always maneuver toward the wind line.
- Check your progress at halfway and three-quarter-way points and make necessary adjustments.
- Turn into the wind at a minimum altitude of 500 feet.
- Control your canopy all the way to the ground.
- Always land facing into the wind.

Figure 9-11. Guide to good canopy control.
**Holding Maneuver.** Pointing the canopy into the wind, or “holding,” aims the canopy flight directly into the wind (Figure 9-12). This maneuver increases lift, has the same effect as reduced wind speed, and slows the canopy’s forward movement. The parachutist manipulates the toggles to maintain the position. To crab to either direction while holding, he turns the canopy slightly in the direction in which he wants to move. Turning the canopy too far may cause it to become windcocket and move with the wind. As the parachutist’s canopy begins to move in the desired direction, he manipulates the toggles to keep it in position until he completes the maneuver.

**Running Maneuver.** If the parachutist points the canopy with the wind, the combined glide speed and the wind speed produce an increased canopy movement speed called “running” (Figure 9-13). He manipulates the toggles to maintain the canopy in position. To crab while running, he turns the canopy slightly in the desired direction and maintains the position until he completes the maneuver.

**Crabbing Maneuver.** The parachutist performs a “crabbing” movement by pointing the canopy at any given angle to the wind direction (Figure 9-14). The force of the wind from one direction and the flight of the canopy at an angle to it moves the canopy at an angle to the direction of flight. The direction of flight varies with the wind speed and the angle at which the parachutist points the canopy. A canopy pointed at a downwind angle makes a sharper angle than one pointed upwind.

The effective canopy range and the wind line determine the course (direction of movement) the parachutist follows in maneuvering toward the target area. The effective canopy range is the maximum distance from which the parachutist can maneuver the canopy into the target area from a given altitude. It is greater at high altitudes and decreases proportionately at lower altitudes, forming a cone- or funnel-shaped area.
(Figure 9-15). Changes in wind direction and conditions may cause this range to shift in any direction.

A wind line is an imaginary line extending upwind from the target area to the opening point and can be marked by ground references. Accurate reference points are essential to effective parachute maneuver.

The parachutist checks his movement in relation to the ground. Winds at altitude may be from different directions than those at the DIP.

The parachutist picks a ground reference point on the wind line, halfway between the opening point and the target area. This point is the first checkpoint that he can reach in half the opening altitude with correct canopy manipulation. The second checkpoint is a reference point halfway between the first checkpoint and the target area that he should reach in half the remaining altitude.

The parachutist always tries to maintain the “upwind advantage.” This advantage is a margin in his canopy range where he will not be blown behind his target area from which he cannot recover and land with his group.

The ram-air parachute is a highly maneuverable canopy capable of 360-degree turns in 3 to 5 seconds under normal conditions. Its maneuverability comes from the parachutist’s
use of its capabilities to vary forward speed, rate of descent, turn, and crosswind movement.

Under normal conditions, the parachutist varies his forward speed and rate of descent by using the canopy’s toggles. Immediately upon canopy deployment, he clears the toggles from the deployment brakes setting and performs a controllability check. His toggle position at the stall point will be at a different position as wind speed increases and when carrying heavy equipment loads.

**WARNING**

Before attempting any maneuvers or turns, the parachutist must be alert to prevent collisions with other parachutists. This maneuver is especially critical below 500 feet AGL.

*Full Flight (No Brakes).* The maximum canopy flight and penetration for maneuvering are obtained using full flight. The toggles are in the up position behind the rear risers (Figure 9-16).

![Figure 9-16. Full flight.](image)

*Half Brakes.* The parachutist grasps the toggles and pulls them down to about shoulder or chest level for the half brakes position (Figure 9-17, page 9-14). The canopy speed will decrease to about a 9- to 12-mph flight, and the rate of descent will increase.
Full Brakes. The parachutist pulls the toggles to about waist level for full brakes (Figure 9-18). The canopy stops moving forward and the rate of descent increases. In the full brakes position, the canopy is actually on the verge of a stall.

Figure 9-17. Half brakes.

Figure 9-18. Full brakes.
**Stall.** A stall occurs when the parachutist pulls the toggles below the full brakes position (Figure 9-19). The angle of attack of the parachute’s nose and wing change produce a very great amount of lift for a short time. As the parachute loses forward airspeed and because the parachutist pulled the tail down lower than the nose, the canopy will attempt to fly backward and the rate of descent will increase to a hazardous degree. To regain forward airspeed and flight, the parachutist slowly raises the toggles to the half brakes position to raise the tail.

**Figure 9-19. Stall.**

**WARNING**

The parachutist does not move the toggles quickly from the stall to the full flight position, as the canopy will surge forward with an increased rate of descent. The parachutist must avoid stalling the ram-air parachute below 500 feet AGL.

The parachutist can make turns from the full flight, half brakes, and full brakes positions. Turns from full flight are very responsive, but due to the high forward speed, the turns will cover a wide arc. The parachutist makes these turns by depressing either toggle, leaving the other one at the guide ring. In this type of turn, the parachute will bank and actually dive, causing the parachute to lose altitude quickly. The further the parachutist depresses the toggle, the steeper the bank angle becomes.

Spiral turns are basically turns from full flight but maintained for more than 360 degrees of rotation. The parachute will begin diving in a spiral. The first turn will be fairly slow, with shallow bank angles, but the turn speed and bank angle will increase rapidly while
the parachutist maintains the spiral. The parachutist should use trim tabs located on the front risers to lose altitude, if required.

**WARNING**

Spiral turns are NOT recommended. They will cause excessively fast diving speed with a rapid loss of canopy control. If the parachutist makes a spiral turn, he should be aware of other parachutists and wind direction. He must NEVER make a spiral turn below 500 feet AGL.

Turns from the half brakes position result in almost flat turns. These turns are desirable when flying the target approach legs.

Turns from full brakes are extremely fast, and heading changes are quick and flat. To prevent the canopy from stalling, the parachutist makes these turns by raising the opposite toggle.

The parachutist makes flared landings into the wind. He starts them at an altitude of 10 to 15 feet, with room ahead for the actual touchdown. At 200 feet, he eases both toggles to the full flight position, allowing airspeed to build. At about 10 feet above the ground (depending on wind conditions), he slowly pulls both toggles downward, timing the movement to coincide with the full brakes position at touchdown. The flared landing, when properly executed, practically eliminates forward and vertical speed for a short period. If the parachutist slows down the ram-air parachute before the flare point, depressing the toggles will result in a “sink.” On high wind days, the parachutist must be aware that the canopy will react quicker during the flare; therefore the flare should be conducted slightly lower to the ground. On low or no wind days, the parachutist must be aware that the canopy will react slower during the flare; therefore the flare should be conducted slightly higher from the ground. If the flare is conducted too low on a low or no wind day, the parachutist may not have slowed the canopy down enough to perform a safe landing.

**WARNING**

On a misjudged flare attempt, if the parachute enters a stall, the parachutist initiates recovery procedures by slowly raising the toggles about 6 inches. He must be prepared to perform a parachute landing fall (PLF).

**NOTE:** In turbulent wind conditions, the parachutist maintains about 25 percent to half brakes to help keep the ram-air parachute inflated and stable.

**NOTE:** The parachutist can safely land the ram-air parachute in the half brakes position. This procedure is especially useful during night or limited visibility operations when he cannot see the ground or if recovering from a stall. He must be prepared to perform a PLF upon ground contact.

The ram-air parachute landing approach is similar to standard aircraft practice consisting of a downwind leg, a base leg, and a final approach upwind into the target (Figure 9-20, page 9-17). The parachutist uses his altimeter to assist his visual altitude determination.
**Downwind Leg.** The parachutist flies the downwind leg along the wind line, passing the target area at an altitude between 1,500 and 1,000 feet (depending on winds), about 300 feet to the side of the target. He continues the downwind leg about 300 to 400 feet downwind of the target (again, depending on winds).

**Base Leg.** When 300 to 400 feet past the target, the parachutist begins a gentle 90-degree turn to fly the base (crosswind) leg across the wind line. He usually flies this leg at 30 to 60 percent brakes, depending on the wind conditions. He may either shorten or extend the base leg to reach the turning altitude. Under low wind conditions, he flies the base leg to a turning point about 500 feet directly downwind of the target and at an altitude of 500 feet.

![Figure 9-20. Landing approaches.](image-url)
**Final Approach.** Under light wind conditions (0 to 5 knots) and 500 feet directly downwind of the target, the parachutist makes a braked turn to turn toward the target. He completes the final turn at approximately 500 feet and no lower than 200 feet. On the final approach, braking techniques control descent and flight. The parachutist performs any major control corrections immediately while there is enough altitude and distance to the target. He lowers his equipment at 200 feet.

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The parachutist avoids the turbulent air directly behind and above a ram-air parachute by flying offset to a parachute to his front or a minimum of 25 meters to the rear and above. He does not make sharp or hook turns on the final approach or attempt a 360-degree turn.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing while facing in a direction other than into the wind results in higher lateral movement and increased rate of descent, increasing the probability of injury on impact.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The parachutist maintains a sharp lookout for fellow parachutists at 500 feet and below to avoid canopy collisions and entanglements. The lower parachutist has the right-of-way.</td>
</tr>
</tbody>
</table>

**TURBULENCE**

Turbulence is the result of an air mass (wind) flowing over obstructions on the earth’s surface. Common obstructions are irregular terrain (bluffs, hills, mountains), man-made features (buildings, elevated roadways, overpasses), or natural ones such as tree lines. A disturbance of the normal horizontal wind flow causes turbulence. As the air mass moves around and over the obstruction, it transforms into a complicated pattern of eddies and other irregular air movements. Turbulence generally affects the flight of the parachute at the most critical time for the parachutist—the last 200 feet of canopy flight.

In general, with ground wind speeds less than 10 knots, both the windward and leeward sides of an obstruction cause small eddies 10 to 50 feet in depth. When wind speeds are between 10 and 20 knots, obstructions can cause currents that are several hundred feet in depth. Additionally, there will still be eddies on the windward and leeward side near the obstruction. At wind speeds greater than 20 knots, currents formed on the leeward side are carried considerable distances beyond the object that created them. Only minor eddies and currents form over smooth water surfaces. Turbulence is worse over choppy swells closer to the surface of the water due to the wind flow over a constantly changing surface configuration. Over mountains, even light winds (moving air masses) pushed up mountain sides or redirected down valleys can form major eddies and air currents that have violent, abrupt characteristics. Additionally, in HAHO operations in mountains or
around hilly terrain, unstable air masses form currents that continue to grow in size and complexity. The resultant turbulence can extend up to thousands of feet AGL.

An example of turbulence is the vortex created by aircraft taking off or landing. The turbulence created by these aircraft can invert smaller aircraft landing too closely behind them. Another example is the turbulence behind another parachutist’s canopy. The parachutist who finds himself behind this canopy will feel the turbulence it creates. Turbulence can exist around any cloud mass. Individual clouds probably will not create turbulence. Clouds that mark the leading edge of an air mass probably will contain strong downdrafts. Cloud decks capping mountain ridges will contain very strong downdrafts and abrupt turbulence. Those type cloud formations will contain rapid pressure differentials. Altimeter readings should be suspect because the parachutist could be 1,000 feet lower than the indicated altitude on the altimeter.

The parachutist should avoid at all costs clouds that contain thunderhead activity due to the violent turbulence associated with those formations.

**LAND AND SEA BREEZES**

The thermal differences of air masses associated with the interface along shorelines causes land and sea breezes. In the daytime, coastal landmasses warm up faster than water. The air above the land rises, causing a lower air density than over the water. The air flows from the water over the land to replace the lower air density there. This phenomenon creates an “onshore” breeze known as a “sea breeze.” It is most evident on clear, summer days in lower latitudes. The same phenomenon occurs in reverse in the evening due to the more rapid cooling of the land mass. The reversed process creates a “land breeze.” The airflow over obstacles near shoreline DZs creates turbulence; when farther away from the coast, turbulence might not exist.

**VALLEY AND MOUNTAIN BREEZES**

Winds generally flow upslope on warm days in mountainous terrain. They flow downslope in the evening as the air masses cool. During the day, the winds create “valley breezes;” at night, the reverse process creates “mountain breezes.” These breezes, coupled with the airflow over obstacles, can cause strong and unpredictable turbulence.
Chapter 10

MC-4 Ram-Air Parachute Emergency Procedures

Military free-fall airborne operations are inherently dangerous. Emergencies may occur before or during takeoff, during flight, while in free-fall, or during canopy descent. Safety considerations require that each parachutist be able to recognize an emergency situation and react accordingly.

REFRESHER TRAINING

The conditioned response executed as the correct procedure for a particular emergency is a highly perishable skill. Refresher training must include performance-oriented training with special emphasis on emergency procedures and the actions required to respond successfully to any situation. This training must take place before each MFF airborne operation. The duration of the training should be commensurate with the time between airborne operations and, at the very least, until each parachutist is confident in his emergency procedure skills.

ESTABLISHED PROCEDURES

The procedures established by this publication in response to emergency situations have proven to be the most successful in both the MFF training and tactical environments. Any departure from these procedures may interfere with the parachutist’s conditioned response. This action can lead to a delay at a critical time with the potential of causing injury or death. This publication strongly recommends that all parachutists follow these established procedures. Figures 10-1 through 10-12, pages 10-1 through 10-9, depict the emergency procedures that may be used with the RAPS during emergency situations.

- Learn the location of emergency exits and how to open them.
- Secure all loose items.
- Wear helmet.
- Fasten seat belt securely.

Figure 10-1. Emergency preparations before takeoff.
<table>
<thead>
<tr>
<th>SITUATION</th>
<th>SIGNAL</th>
<th>ACTION IN FIXED-WING AIRCRAFT</th>
<th>ACTION IN ROTARY-WING AIRCRAFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash Landing During Takeoff</td>
<td>- Continuous ringing of alarm bell or verbal warning by aircrew.</td>
<td>- Remain seated until aircraft stops, then exit.</td>
<td>- Follow aircrew instructions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Pull legs inside aircraft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Remain in position.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Cover head with arms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Clear the aircraft as soon as it stops and move well away from</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>it.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Jumpmaster ensures all personnel are away from the wreckage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>NOTE:</strong> Coordinate opening the aircraft exits with the aircrew.</td>
<td></td>
</tr>
<tr>
<td>During Flight</td>
<td>- Six short rings of alarm bell or verbal warning by aircrew.</td>
<td>- If time and altitude permit, jump.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- One long ring of alarm bell.</td>
<td>- If not, secure seat belt.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Brace for impact.</td>
<td></td>
</tr>
<tr>
<td>Below 1,000 Feet AGL (400 feet</td>
<td>- Six short rings of alarm or verbal warning by aircrew.</td>
<td>- Take aircraft seats and fasten seat belts.</td>
<td>- Take aircraft seats and fasten seat belts.</td>
</tr>
<tr>
<td>minimum for static line)</td>
<td>- One long ring.</td>
<td>- Prepare for crash landing.</td>
<td>- Prepare for crash landing.</td>
</tr>
<tr>
<td>Emergency Bailout</td>
<td>- Three short rings of alarm bell or verbal warning by aircrew.</td>
<td>- Prepare for exit.</td>
<td>- Exit at the jumpmaster’s command.</td>
</tr>
<tr>
<td>1,000 to 2,000 Feet AGL</td>
<td>- Green light.</td>
<td>- Exit at the jumpmaster’s command.</td>
<td>- Deploy the reserve parachute immediately.</td>
</tr>
<tr>
<td></td>
<td>- One long sustained ring.</td>
<td>- Deploy the reserve parachute immediately.</td>
<td>- Attempt to land with the other jumpers.</td>
</tr>
<tr>
<td>Above 2,000 Feet AGL</td>
<td>- Three short rings of alarm bell or verbal warning by aircrew.</td>
<td>- Prepare for exit.</td>
<td>- Exit at the jumpmaster’s command.</td>
</tr>
<tr>
<td></td>
<td>- Green light.</td>
<td>- Exit at the jumpmaster’s command.</td>
<td>- Deploy the main parachute after a maximum 5-second delay.</td>
</tr>
<tr>
<td></td>
<td>- One long sustained ring.</td>
<td>- Deploy the main parachute after a maximum 5-second delay.</td>
<td>- Attempt to land with the other jumpers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Attempt to land with the other jumpers.</td>
<td></td>
</tr>
<tr>
<td>Ditching Over Water With Insufficient Drop Altitude</td>
<td>- Six short rings of alarm bell.</td>
<td>- Remain seated.</td>
<td>- Pull legs inside aircraft.</td>
</tr>
<tr>
<td></td>
<td>- Verbal warning by aircrew.</td>
<td>- Secure seat belt.</td>
<td>- Remain in position.</td>
</tr>
<tr>
<td></td>
<td>- One long ring.</td>
<td></td>
<td>- Cover head with arms.</td>
</tr>
<tr>
<td>Figure 10-2. In-flight emergency procedures.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Order to Lighten Load  
- Verbal warning by aircrew.  
Designated parachutist may help jumpmaster or loadmaster jettison cargo.  
As directed by pilot.

Fire in Flight  
- Verbal warning by aircrew.  
- Remove parachutists from vicinity of fire.  
- Extinguish the fire.  
As directed by pilot.

Figure 10-2. In-flight emergency procedures (continued).

<table>
<thead>
<tr>
<th>JUMPMASTER RESPONSIBILITY</th>
<th>PARACHUTIST RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Shout “PILOT CHUTE” and try to contain the pilot chute and canopy in the aircraft.</td>
<td>- Shout “PILOT CHUTE” and try to contain the pilot chute and canopy in the aircraft.</td>
</tr>
<tr>
<td>- In UH-1H or UH-60, close the opposite door.</td>
<td>- If possible, move away from the open exits to a safe area forward in the aircraft.</td>
</tr>
<tr>
<td>- Unhook the reserve static line from the riser.</td>
<td>- If the canopy or pilot chute is pulled outside the aircraft, exit immediately.</td>
</tr>
<tr>
<td>- Cut away main canopy and remove from container and secure.</td>
<td></td>
</tr>
<tr>
<td>- Secure parachutist with seat belt and continue with the operation (jumpmaster’s discretion).</td>
<td></td>
</tr>
<tr>
<td>- If extracted, another parachutist may exit and deploy his canopy and follow and land with the extracted parachutist.</td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

If you are standing in the vicinity of an open door or ramp and you experience a premature deployment, try to contain it; if any portion of the parachute goes out of the aircraft, exit immediately to minimize or avoid serious injury.

Figure 10-3. Procedures for inadvertent pilot chute deployment inside the aircraft.

1. Pull  
2. Pull at designated altitude.  
3. Pull stable at the designated altitude.  
4. Never sacrifice altitude for stability.

Figure 10-4. The four priorities during free-fall.
<table>
<thead>
<tr>
<th>EMERGENCY</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision on exit</td>
<td>• Maintain your arch, gently push off the parachutist, regain your</td>
</tr>
<tr>
<td></td>
<td>stability, check your altimeter, check the ripcords, and continue</td>
</tr>
<tr>
<td></td>
<td>the MFF as planned.</td>
</tr>
<tr>
<td>Instability in free-fall</td>
<td>• Arch, check your hands and feet, counter, and maintain altitude</td>
</tr>
<tr>
<td>Spinning</td>
<td>awareness.</td>
</tr>
<tr>
<td>Tumbling</td>
<td>• Arch, keep your head up, check your hands and feet, and maintain</td>
</tr>
<tr>
<td>Entering a cloud or loss of visibility</td>
<td>altitude awareness.</td>
</tr>
<tr>
<td></td>
<td>• Stop all movement and return to a stable, relaxed arch. Maintain</td>
</tr>
<tr>
<td></td>
<td>altitude awareness. Pull at the prescribed altitude even if you are</td>
</tr>
<tr>
<td></td>
<td>still in the cloud.</td>
</tr>
<tr>
<td>Rucksack shifts</td>
<td>• Counter any turns by turning in the opposite direction.</td>
</tr>
<tr>
<td></td>
<td>If the rucksack strap moves below your knee, make one attempt to</td>
</tr>
<tr>
<td></td>
<td>replace it while maintaining stability. If unsuccessful, relax and</td>
</tr>
<tr>
<td></td>
<td>continue. Counter any turns by turning in the opposite direction.</td>
</tr>
<tr>
<td>Accidental opening</td>
<td>• Conduct post-opening procedures.</td>
</tr>
<tr>
<td>Main parachute</td>
<td>• Cut away main canopy, do a penetration check, and continue to fly the</td>
</tr>
<tr>
<td>Reserve parachute</td>
<td>canopy for a landing on the intended DZ.</td>
</tr>
<tr>
<td>(Check the risers; also no trailing pilot chute)</td>
<td>• Cut away main canopy, do a penetration check, and continue to fly the</td>
</tr>
<tr>
<td>Main and reserve parachutes deploy</td>
<td>canopy for a landing on the intended DZ.</td>
</tr>
<tr>
<td>Main deploys and reserve opens</td>
<td>• Slow the main parachute to prevent the reserve from inflating. Try to</td>
</tr>
<tr>
<td>partially but does not fully inflate</td>
<td>pull in the reserve deployment bag and hold it between your legs. Be</td>
</tr>
<tr>
<td></td>
<td>ready to cut away the main parachute.</td>
</tr>
<tr>
<td>Maneuvers in free-fall</td>
<td>Use turning and sliding techniques to avoid other parachutists. Always</td>
</tr>
<tr>
<td>Collision avoidance</td>
<td>look in the direction of the turn before you begin the turn. Never</td>
</tr>
<tr>
<td></td>
<td>free-fall over another parachutant’s back.</td>
</tr>
<tr>
<td>Lost equipment</td>
<td>• Maintain your arch. Reach up with both hands (keeping elbows high),</td>
</tr>
<tr>
<td>Lost goggles</td>
<td>find and replace the goggles. Maintain altitude awareness.</td>
</tr>
<tr>
<td></td>
<td>**NOTE: If the goggles will not remain in place or they separate from</td>
</tr>
<tr>
<td></td>
<td>you, squint your eyes to see.</td>
</tr>
<tr>
<td></td>
<td>• Observe other parachutists in free-fall.</td>
</tr>
<tr>
<td></td>
<td>• Activate main parachute with other parachutists at the prescribed</td>
</tr>
<tr>
<td></td>
<td>activation altitude.</td>
</tr>
<tr>
<td></td>
<td>• If unable to observe other parachutists, immediately clear air space,</td>
</tr>
<tr>
<td></td>
<td>wave off, and pull the main ripcord.</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE: This procedure is the same for both day and night operations.</strong></td>
</tr>
</tbody>
</table>

Figure 10-5. Emergencies in free-fall.
MALFUNCTION | CUTAWAY PROCEDURES
---|---
Total Malfunction  | • Throw away the main ripcord.
  *NOTE*: A total malfunction occurs when the canopy remains in the container assembly after the ripcord has been pulled.*
Partial Malfunction  | • Look at and grab the cutaway handle.
  *NOTE*: A partial malfunction occurs when the container assembly opens but the canopy does not fully or properly deploy.
  • Look at and grab the reserve ripcord.
  • Pull cutaway handle.
  • Pull reserve ripcord (throw both handles away).
  • Arch and ensure reserve pilot chute has deployed.
  • Perform post-opening procedures.

Figure 10-6. Cutaway procedures.

- Use the rear risers to avoid other parachutists as required. Turn right to avoid a collision.
- Release the brakes and gain control of the canopy.
- Check the canopy.
- Resolve post-opening malfunctions as required.
- If controllability of the canopy is questionable, perform a controllability check (see Figure 10-9, page 10-7).
- If a malfunction cannot be resolved, and if the canopy is uncontrollable, the decision to cut away must be made by 2,000 feet AGL.
- Orient yourself to the drop zone.
- Locate the other parachutists and achieve separation.
- Activate the strobe light or canopy lighting system as required.
- Maintain altitude awareness.
- Check rate of descent with other jumpers.

*NOTE: Procedures should be done immediately after the parachute deploys.*

Figure 10-7. Post-opening procedures.
### MALFUNCTION PROCEDURE

<table>
<thead>
<tr>
<th>MALFUNCTION</th>
<th>PROCEDURE</th>
</tr>
</thead>
</table>
| Pilot Chute Over the Nose of the Canopy | - Perform post-opening procedures.  
                                    | - Perform a dynamic stall.  
                                    | - Execute a controllability check. |

**WARNING**

Activation of the main or reserve parachute above the prescribed opening altitude may cause serious injury or death to other parachutists in free-fall.

<table>
<thead>
<tr>
<th>MALFUNCTION</th>
<th>PROCEDURE</th>
</tr>
</thead>
</table>
| Floating Ripcord | - Locate the ripcord housing with the right hand.  
                                    | - Locate the ripcord cable that should protrude from the housing.  
                                    | - Pull the cable.  
                                    | - If unsuccessful, perform cutaway procedures. |

**WARNING**

Make no more than two attempts to locate the ripcord (the initial attempt is the first attempt).

<table>
<thead>
<tr>
<th>MALFUNCTION</th>
<th>PROCEDURE</th>
</tr>
</thead>
</table>
| Hard Pull        | - If the pull is unsuccessful, come across with the left hand in a punching motion and push the right hand and ripcord out.  
                                    | - If still unsuccessful, perform cutaway procedures. |
| Pack Closure     | - Check over your shoulder again.  
                                    | - If main parachute does not deploy, perform cutaway procedures. |
| Pilot Chute Hesitation | - Check over your shoulder again.  
                                    | - If main parachute does not deploy, perform cutaway procedures. |
| Horseshoe        | - Perform cutaway procedures immediately. |
| Bag Lock         | - Pull down twice on the rear risers.  
                                    | - If the main parachute does not deploy, perform cutaway procedures. |
| Dual Main and Reserve Deployment | - If both the main and reserve parachutes deploy completely (ensure good reserve deployment and canopy separation before cutaway), cut away the main parachute.  
                                    | - If only the reserve pilot chute and bridle are deployed, try to contain them.  
                                    | - If the reserve parachute deploys and will not fully inflate, slow the main parachute and be prepared to cut away should the reserve parachute fully inflate. |
| Closed End Cells/Hung Slider       | - Bring both toggles to the full brake position for 3 to 4 seconds and slowly let up on the toggles to the 50-percent brake position (this procedure may be performed a maximum of two times).  
                                    | - If unsuccessful, continue with the post-opening procedures (controllability check). |

*Figure 10-8. Malfunction procedures.*
MALFUNCTION PROCEDURE

Premature Brake Release
• Immediately release the opposite brake.
• Perform post-opening procedures.

Broken Control Lines
• Release the brakes and steer with the remaining control line.
• Continue the post-opening procedures.
• Determine the stall point at a safe altitude using the rear risers.
• Use the rear risers for landing.

NOTE: The rear risers may also be used for control; however, overuse may fatigue the arms.

Broken Lines
• Perform post-opening procedures.

Line Twists
• Reach up and separate the risers and use a kicking motion to untwist the suspension lines.

NOTE: Do not release the brakes until the twists are cleared.

Rips and/or Tears
• Perform post-opening procedures.

Tension Knots
• Perform post-opening procedures.

Figure 10-8. Malfunction procedures (continued).

PARACHUTE COLLISION AVOIDANCE
• Lower parachutist has the right-of-way.
• All parachutists maintain a safe vertical and horizontal separation.
• Look right, clear, turn right.

COLLISION IMMINENT
• Steer to avoid; look right, clear, turn right.
• If unable to avoid collision, spread arms and legs in an attempt to bounce off the canopy or lines.

NOTE: A 25-meter vertical and 25-meter horizontal separation is recommended for normal operations.

Figure 10-10. Recommended parachute separation.
<table>
<thead>
<tr>
<th>SITUATION</th>
<th>HIGHER PARACHUTIST</th>
<th>LOWER PARACHUTIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower parachutist is entangled with higher parachutist, and higher parachutist has a good canopy. Above 2,000 feet AGL</td>
<td>• Attempt to clear off the lower canopy.</td>
<td>• If canopy cannot be cleared, check the altitude. • Above 2,000 feet AGL, perform cutaway procedures.</td>
</tr>
</tbody>
</table>

*NOTE: If lower canopy is cleared, it should reinflate in 150 to 200 feet.*

| 1,000 to 2,000 feet AGL | • Make every effort to control lower canopy. • Be prepared to do a PLF. | • Perform cutaway procedures. **OR** • Jettison equipment. • Land with higher parachutist. • Be prepared to do a PLF. |

| Below 1,000 feet AGL | • Make every effort to maintain control of lower canopy. • Be prepared to do a PLF. | • Jettison equipment. • Land with higher parachutist. • Be prepared to do a PLF. |

*NOTE: The higher parachutist should fly the final approach and land with half brakes.*

| Both parachutists are entangled, and neither has a good canopy. At any altitude | • Get clear of entangled lines and cut away (altitude permitting). | • Cut away after the higher parachutist (altitude permitting). |

**WARNING**

The higher parachutist may be fatally engulfed in the canopies if the lower parachutist performs a cutaway first.

If still unsuccessful, both should deploy reserve parachutes in an attempt to slow the descent.

If only one reserve parachute deploys, the parachutist with the good reserve must bring the other parachutist to the ground.

If both reserves deploy, cut away from the entanglement.

*NOTE: Communication between the parachutists and altitude awareness are critical in successful disengagement.*

Figure 10-11. Canopy entanglement procedures.
**TREES**
- Do not lower equipment; jettison if it was lowered.
- Turn canopy into wind.
- Brake as needed (50 percent braking position) to achieve vertical descent through the trees.
- Prepare for a PLF.
- Use forearms to protect face while passing through trees.
- If suspended, signal for assistance.

**NOTE:** Goggles and oxygen mask provide additional face and eye protection.

**WIRES**
- Throw away ripcord.
- Turn off oxygen.
- Slow canopy down.
- Avoid wires at all costs, even if a downwind landing is required.
- Streamline body while passing through the wires.
- If entangled, remain motionless until power is disconnected.
- Prepare to do a PLF after passing through the wires.
- If the parachute is entangled in the wires and contact with the ground is made, cut away from the main chute immediately and move away.

**NOTE:** If time and altitude permit, unhook the reserve static line and jettison equipment.

**WATER**
- Jettison oxygen mask and equipment.
- Unhook reserve static line.
- Unfasten chest strap and waist strap.
- Inflate flotation device if available.
- Turn canopy into the wind.
- Use brakes to slow airspeed.
- After entering water, release leg straps (as feet contact the water) and swim free of the harness.
- If being dragged in the water, cut away the main canopy.
- If trapped under the canopy, follow a seam to the edge.
- Signal for assistance using emergency devices.

**NOTE:** On entering water, be prepared for a normal landing or a PLF.

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**Figure 10-12. Emergency landing procedures.**
Chapter 11

High Altitude High Opening (HAHO) Stand-Off Parachuting

Stand-off delivery techniques offer the commander a unique method for infiltrating trained operational elements. The RAPS gives the commander a tactical capability to infiltrate these elements by parachute without requiring the aircraft to overfly the intended DZ. These elements can be released at an offset release point and cover long distances under canopy. The flight characteristics of the RAPS’ reserve parachutes are identical to the main parachute’s. This fact increases the chance of a successful infiltration should a cutaway from the main parachute take place because of a malfunction.

NOTE: For parachute systems that have a smaller reserve canopy than the main canopy, the mission commander planning the operation must plan for contingencies that address the reduced glide capability should a cutaway from the main parachute take place. Canopy openings at 6,000 feet AGL or above are considered HAHO jumps.

TECHNIQUES AND REQUIREMENTS

The parachutist uses a combination of delayed free-fall and HAHO techniques if making exits at an altitude above 25,000 feet MSL. He can also deploy his parachute at intermediate altitudes to minimize the chance of parachute damage or injury to himself upon canopy deployment, while using the glide advantage of the RAPS.

WARNING
The maximum deployment altitude of the RAPS is 25,000 feet MSL.

The maximum altitude for routine training should be 17,500 feet MSL. Conducting training at this altitude eliminates the need for oxygen prebreathing and minimizes the chance of parachute damage and injury to the parachutist due to opening forces. The parachutist is also less likely to encounter physiological problems and cold weather injuries.

HAHO stand-off parachuting requires extensive airspace clearance. Additionally, this training must take place in areas having alternate DZs should the parachutist (or element) not be able to reach the primary DZ.

Accurate weather data is essential. Wind directions and speeds are critical for route planning. Air temperatures are important for preparing against exposure injuries.

WARNING
Icing conditions may occur at high altitude or during adverse weather conditions. Ice formation on the parachute canopy adversely affects its flight characteristics by increasing the rate of descent and decreasing its responsiveness.
SPECIAL EQUIPMENT

Special precautions must be taken to prevent exposure injuries to the parachutist at high altitude. Gloves are necessary to protect the hands. The gloves, however, must not interfere with the manual activation of the main parachute or the performance of emergency procedures.

The parachutist can use toggle extensions. They permit the parachutist to keep his hands at waist level during extended flights. They also allow for improved blood circulation to the hands and arms and lessen fatigue. Other techniques are to leave the brakes stowed and simply steer the parachute using the risers to make needed corrections.

WARNING

Do not use the toggle extensions for flaring.

Each parachutist needs a compass to determine direction should he separate from the group or during limited visibility, such as when passing through cloud layers. A marine-type, oil-dampened compass that pressure changes or cold weather does not affect is recommended. The compass must show direction regardless of its mounted attitude on the parachutist. The parachutist takes care when mounting the compass to avoid erroneous readings that interference from radios or other electronic navigation aids might cause. He adjusts the declination of his compass while wearing all his accompanying equipment. This action will account for all magnetic variances that accompanying metal objects cause.

The parachutist mounts the electronic navigation or guidance devices so that they do not interfere with the manual activation of the main parachute or the performance of emergency procedures. The use of such devices may also increase the likelihood of detection during infiltration.

The parachutist can use radios for air-to-air or air-to-ground communications. He mounts the radio so that it also does not interfere with the manual activation of the main parachute or the performance of emergency procedures. The use of radios may increase the likelihood of detection during infiltration.

FREE-FALL DELAYS

As an aircraft increases altitude, the aircraft’s true airspeed (TAS) must increase to maintain a constant indicated airspeed due to decreased air density. TAS is the actual speed of the aircraft through the air mass. When TAS exceeds terminal velocity, the parachutist must allow for longer delays to decelerate to a safe speed for parachute deployment (Figure 11-1, page 11-3).

WARNING

Failure to take the minimum recommended delay can result in serious injury to the parachutist and parachute damage.
EXIT ALTITUDE (IN FEET) | DELAY (IN SECONDS)  
---|---
10,000 to 12,500 | 5 to 7  
12,500 to 20,000 | 7 to 9  
20,000 to 25,000 | 6 to 10  
Above 25,000 | Free-fall below 25,000 feet

Figure 11-1. Recommended free-fall delays.

PARACHUTE JUMP PHASES

The HAHO stand-off parachute jump has four phases. These phases include exit, delay, and deployment; assembly under canopy; flight in formation; and final approach and landing.

Exit, Delay, and Deployment

On the command “go,” the group leader exits the aircraft. The remainder of the element exits the aircraft at designated intervals using the same exit technique as the group leader. Each parachutist free-falls for the required delay. Exit interval will be established to assure canopy separation between parachutists at opening. **The exit interval will be based on type of aircraft, its speed, and the mission requirements.**

A parachutist experiencing a malfunction must immediately start emergency procedures to minimize loss of altitude.

Upon deployment, the group leader checks with the element for malfunctions, then assumes the initial flight heading.

Should a member of the element be beneath the group, the element must execute the rehearsed tactical plan (lose altitude to reform the group or follow the low parachutist).

Assembly Under Canopy

The opening altitude should be a minimum of 1,000 feet above any cloud layer to allow enough altitude for the element to assemble under canopy. Each parachutist flies his canopy to his rehearsed position within the formation. Each parachutist assumes the group leader’s heading.

Flight In Formation

The “wedge” and the “trail” formations are the easiest to control and to maintain in flight (Figure 11-2, page 11-4). The group leader (low parachutist) has the primary responsibility for navigation. He jumps with the navigation aids.

Element members in the formation maintain relative airspeed and position with the group leader. They do this maneuver by trimming their canopies using the trim tabs on the front risers and by braking.

Under limited visibility conditions, such as when passing through a cloud layer, each parachutist goes to half brakes and maintains the compass heading until he regains visual contact with the formation or as stated in unit SOP. Each parachutist must maintain altitude awareness and keep a sharp lookout for other parachutists.
Final Approach and Landing

The group leader initiates the landing pattern at about 1,000 feet AGL in the landing area. Each parachutist removes any trim tab settings to prevent injury on landing from the increased forward speed.

The landings are staggered to avoid the turbulence directly above and to the rear of the other ram-air canopies. Each parachutist prepares to do a PLF should visibility prevent him from seeing the ground.

\textit{NOTE: Use a wedge formation on a HAHO mission at night only when total positive communications have been established. Echelon turns must be executed when flying the wedge formation at night.}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{wedge_formation.png}
\caption{Assembly flight formations.}
\end{figure}
Chapter 12
Limited Visibility Operations

MFF infiltrations during periods of limited visibility (adverse weather or darkness) have a higher chance of success than strictly daylight operations. Limited visibility infiltrations offer surprise and increased security due to reduced enemy observation capability. Limited visibility operations require a high degree of skill and individual discipline. A well-rehearsed tactical plan executed by personnel proficient in MFF skills is critical to success.

ADVERSE WEATHER

Foggy, overcast, or mostly cloudy conditions effectively prevent observation from the ground. However, adverse weather conditions present special problems for the MFF parachutist. High winds and precipitation can degrade canopy performance and make control difficult. Entering clouds may cause disorientation and lead to detachment separation under canopy, free-fall collisions, or canopy entanglements. The loss of depth perception due to ground fog, smoke, or haze may prevent the parachutist from executing a proper landing.

In free-fall, the parachutist stops all maneuvering upon entering a cloud. He activates the main parachute at the designated altitude, even if he has not passed through the cloud layer. In clouds under canopy, he flies the canopy at the half brake position to give himself the greatest range of canopy response.

NIGHT OPERATIONS

Night MFF parachuting offers the same advantages as parachuting during adverse weather, especially during the first quarter, new moon, and last quarter moon phases. Night free-fall parachuting is the most psychologically demanding of parachute operations. Extensive training must take place at night. During this training, the parachutist develops confidence in the equipment and his abilities.

Commanders must weigh the tactical situation when placing lighting devices on the parachutist and on the parachute canopy for safety and control during free-fall and canopy flight. At a minimum, use lighting devices for altimeters and other instruments.

The use of oxygen dramatically improves night vision. Wearing the oxygen mask until the landing is a recommended procedure. The commander may consider using oxygen for all night free-fall operations, even if the jumping altitude does not require it.

The jumpmaster can use night vision devices to help him while spotting from the aircraft. The parachutist can also use them during canopy flight as an aid to navigation and formation flying. He must have extensive experience flying and landing with night vision goggles to overcome the loss of depth perception. An additional factor to consider is that the night vision goggles will seriously impair his night vision after using them for extended periods.
WARNING
Night vision goggles should not be worn during free-fall because they restrict the parachutist’s ability to locate the ripcord handle and the cutaway handle.

The lack of depth perception at night may prevent the parachutist from executing a proper landing. The parachutist flies the parachute at the half brake position and performs a PLF on contact with the ground. Various night lighting techniques exist to identify parachutists, group leaders, or subunit elements while under canopy. Some techniques involve attaching the devices in the aircraft and some must be activated and placed on the canopy before packing the parachute. Some of these techniques are rheostatic electroluminescent riser lights; chemical lights on the parachutist’s body and on the risers; and other electrical systems placed in pockets on the canopy’s top skin.
Chapter 13
Military Free-Fall Drop Zone Operations

The airborne and airlift commanders make joint recommendations concerning drop altitudes and DZs. The airborne force commander recommends the final selection of DZs. He bases his recommendations on the suitability and size of the DZs, their geographic relationship to the initial objectives, and the natural or man-made obstacles and the rough surfaces that could cause an unacceptable number of injuries or excessive equipment damage. After considering the airborne force commander’s preference, the routes to the DZs, the terrain obstructions, the ease of DZ identification, and enemy defenses, the mission commander recommends approach headings and selects initial and timing points. The AMC/Air Force Special Operations Command mission commander ensures delivery of troops, equipment, and supplies to the selected DZs at the times established in the air movement plan.

DROP ZONE CATEGORIES

United States Army (USA) and USAF DZs consist of terrain or water masses that have been approved jointly by the USA and USAF for the conduct of joint airborne operations involving personnel and equipment delivered from USAF troop carrier aircraft. A USA DZ consists of terrain or water masses that have been approved by the Army for the conduct of airborne operations involving personnel and equipment delivered from aircraft other than USAF troop carrier aircraft.

DROP ZONE SELECTION CRITERIA

The ground unit commander selects the general area of the DZ where it will best support the ground tactical plan. The joint force commander gives guidance on DZ size in operation plans and operation orders.

Size

There is no minimum size for MFF DZs (STANAG 3570, AFI 13-217, and United States Army Special Operations Command [USASOC] Regulation 350-2). During training, the experience level of the parachutists must be considered when selecting DZs. An area 50 meters by 100 meters (for example, a football field) is the recommended minimum size DZ for training.

Other Considerations

In a peacetime environment, designated personnel survey and mark DZs before dropping personnel and equipment from an aircraft. Control personnel must also be on the DZ before and during the drop. The drop zone safety officer (DZSO) or drop zone support team leader (DZSTL) must inspect the DZ before use when conducting joint operations. The DZSO or DZSTL must record the obstacles on the DZ and in the immediate surrounding area for use in the jumpmaster personnel briefing.
The maneuverability of the RAPS allows for greater flexibility in the selection of DZs; however, DZs are selected only after a detailed analysis of the following:

- Mission.
- Proximity to the objective area.
- Enemy threat and air defense capability.
- Adequate approach and departure routes.
- Method of insertion (HALO or HAHO).
- Elevation and drop altitude.
- Physical characteristics of available DZs and surrounding areas.
- Relative number of obstacles in the area.
- Number of parachutists to infiltrate.

DROP ZONE PERSONNEL QUALIFICATIONS AND RESPONSIBILITIES

The airborne commander designates key personnel for each airborne operation. These key personnel are the primary jumpmaster, assistant jumpmasters, oxygen safety personnel (when required), departure airfield control officer, DZSTL or DZSO, and malfunction officer (MO). See FM 57-220/MCWP 3-1.5.7/TO 14D1-1-1-121 for further discussion of responsibilities during airborne operations.

DZSO (Officer or NCO)

The DZSO must be an officer, warrant officer, or noncommissioned officer (NCO). The commander makes sure the DZSO is a qualified and current static-line or MFF jumpmaster, has performed the duties of assistant DZSO in support of an airborne operation involving personnel or heavy equipment at least once, and is familiar with MFF operations IAW this manual. The MFF jumpmaster briefs the DZSO on the DZ markings, communications, and operating procedures that will be used.

The DZSO has overall operational responsibility for the DZ. He conducts a ground or aerial recon of the DZ before the drop to make sure there are no safety hazards. Other responsibilities include—

- Establishing personal liaison with the USAF drop zone control officer (DZCO) and STT and discussing drop procedures (USAF troop carrier aircraft).
- Clearing the DZ of unauthorized personnel and vehicles.
- Briefing and posting road guards (if required).
- Making sure medical personnel are in position.
- Opening the DZ to provide adequate lead-time.
- If using an STT, collocating with the STT about 10 minutes before the drop time and remaining with them until the completion of the jump (USAF troop carrier aircraft).
Maintaining constant check of ground winds. Peacetime ground wind training limits will not exceed 18 knots. There are no winds aloft restrictions. Winds aloft, either in free-fall or under canopy, are computed in the wind drift (D=KAV) calculation.

After the pilot notifies the DZSO that the aircraft is 2 minutes from drop time, reporting back to the pilot the ground winds and a clear or negative drop. The aircraft pilot reports to the DZSO the number of parachutists that exited the aircraft.

Relaying strike report to the aircraft pilot (Army aircraft or USAF troop carrier aircraft).

During night drops, making sure that all lights on or next to the DZ (except for DZ markings) are turned off 5 minutes before drop time and remain off during the jump.

Directing recovery crew to assist parachutists and to retrieve equipment in trees.

Assisting in medical evacuation of injured personnel from the DZ.

Immediately after the completion of the jump, requesting the STT to ask the pilot (USAF troop carrier aircraft) or asking the pilot (Army aircraft) if any personnel or equipment did not drop and then relaying this information to the airborne commander on the DZ.

If a malfunction occurred, preventing the handling of the equipment until parachute malfunction personnel have examined the equipment. If a malfunction officer or an NCO is not physically located on the DZ, the DZSO secures the equipment and allows no one to examine it until he can turn it over to an appropriate parachute maintenance facility.

Recording the necessary information for the parachute operation report.

Closing the DZ.

**DZSTL**

The DZSTL must be an officer, warrant officer, or NCO. The DZSTL must have been certified as a DZSTL by having attended one of the following since 1988:

- United States Army Infantry School (USAIS) Pathfinder Course.
- USAIS Jumpmaster Course.
- USAIS DZSTL MTT.
- 82d Airborne Division Advanced Airborne School DZSTL Course.
- Special Forces Qualification Course (SFQC).
- USASOC Jumpmaster Course.

The commander ensures the DZSTL is a qualified and current jumpmaster, has performed the duties of assistant DZSTL in support of airborne operations involving personnel or heavy equipment at least once, is current as a DZSTL, and is familiar with MFF operations IAW this manual. The DZSTL must have completed a DZSTL refresher
course or performed the duties of DZSTL or assistant DZSTL within the preceding 180 days to be current. The MFF jumpmaster briefs the DZSTL on the DZ markings, communications, and operating procedures that will be used.

In operations in which the STT is not present, the Army DZSTL has overall responsibility for the conduct of operations on the DZ (IAW FM 57-220). He represents both the airborne and airlift commanders. The DZSTL assumes the responsibilities normally associated with the USAF STT and Army DZSO.

Malfunction Officer

The investigation of personnel, parachutes, and equipment malfunctions receives the highest priority and is secondary in priority only to medical aid for the injured. It supersedes all other aspects of the operation to include ground tactical play. Prompt and accurate investigations and reporting could save lives and equipment. The report provides data to determine if a system or procedural training change is necessary to prevent future occurrences. The MO is subordinate to the DZSO/DZSTL and is a member of the drop zone support team. Any assistance required by the MO must pass through the DZSO/DZSTL, who controls the DZ.

The MO must be a commissioned officer, warrant officer, or NCO (minimum grade of E-5). The MO must be a trained parachute rigger (92R, 921A, 92D) who is familiar with airdrop, parachute recovery, and aircraft personnel parachute escape systems (IAW AR 59-4). Exception: For Air Force unilateral training loads, the DZ MO will be a minimum grade of E-4.

The organization that provides the air items will provide the MO. He will be present on the DZ during all personnel and equipment drops and will be familiar with requirements. The MO must have the following minimum equipment in his possession during duty performance:

- A communication capability with the DZ control party.
- A good quality camera to take photos of malfunctions or incidents (video camera preferred). Photographic equipment is essential for the proper performance of malfunction officer duties. Pictures of malfunctions greatly assist in investigations.
- The forms and clerical supplies necessary to tag equipment and initiate reports.
- Binoculars or night vision devices.
- Transportation to move around the DZ.

If a malfunction occurs, the MO immediately conducts an on-site investigation of the cause(s) of the malfunction. The MO photographs the malfunctioned equipment, or the malfunction as it happens, and the malfunction site that shows possible cause(s) of the malfunction. The MO secures, identifies, tags, and numbers airdrop equipment involved in the malfunction incident. The MO then prepares and submits DD Form 1748-2 to report all airdrop malfunctions (see AR 59-4), as well as any other required reports.

NOTE: It is important to prepare complete and accurate MFF accident reports. The fielding of new MFF equipment and the introduction of new MFF procedures depends on the feedback of the reporting process to detect accident patterns. There are several
forms used by the Services in addition to DD Form 1748-2. Appendix G contains an example of the amount of detail that should be included in an accident report.

USAF DZCO

The USAF DZCO represents the airlift commander. He supervises all USAF personnel on the DZ. He also observes drop operations. Other responsibilities include—

- Evaluating all factors that might adversely affect safety.
- If conditions make drop operations unsafe, directing the STT to relay that information to the appropriate USAF commander as soon as possible and to display the established NO DROP signal on the DZ.
- Directing the use of STT equipment.
- Canceling drops when requested to do so by the Army DZSO.
- Keeping the Army DZSO advised on ground wind speed on the DZ.
- Preparing the necessary log and reports for submission to the airlift control element or the appropriate USAF commander.

STT

The STT marks the DZs with proper navigational and identification aids. The STT establishes ground-to-air communications at DZs as well as communications with designated control agencies. Other responsibilities include—

- Providing the USA DZSO with surface weather and low-level (up to 1,500 feet) wind-aloft observations.
- Exercising air traffic control over aircraft in the vicinity of specific DZ (as directed).

MILITARY FREE-FALL DROP ZONE MARKINGS

MFF infiltrations usually take place on blind DZs due to the general ineffectiveness of visual markings when viewed from high altitudes (HALO) and extended distances (HAHO). DZ identification is normally by location in relation to major terrain features. DZ markings are sometimes used when the tactical situation permits and it is desirable to indicate wind direction to the descending parachutists (Figure 13-1, page 13-6). TC 31-24, FM 57-38, and Air Force Instruction 13-217 outline marking techniques.

HIGH ALTITUDE RELEASE POINT AND MFF DROP ZONE DETECTION

Location in relation to major terrain features identifies the HARP. Appendix A contains methods of computing the HARP. The HARP may be marked, if known, when the tactical situation permits. In heavily vegetated, mountainous, or urban terrain and during conditions of restricted visibility, DZs and HARPs may be difficult to detect. Electronic beacons or radar transponders and appropriate tracking devices help aircraft personnel and parachutists locate DZs or HARPs. Expedient methods such as balloons and pyrotechnics may also help aircraft personnel and parachutists locate DZs or HARPs. In situations where secrecy is important, aircraft and parachutists equipped with automatic direction finding equipment may conduct drops using only the radio homing beacon.
Parachutists may also use the NAVSTAR Global Positioning System with portable terminals.

**Figure 13-1. Military free-fall drop zone markings.**

**HAHO AIRCRAFT OR TEAM IDENTIFICATION**

In air-to-ground identification, the aircraft or team (HAHO) identifies itself to the reception committee by arriving in the objective area within the specified time limit. It also identifies itself by approaching at the designated drop altitude and track (aircraft).

In ground-to-air identification, the reception committee identifies itself to the aircraft or team by displaying the correct marking pattern within the specified time limit and using the proper authentication code signal.
AUTHENTICATION SYSTEM

There is no standard authentication system for unconventional warfare reception operations. During mission planning, the commanders concerned agree on the authentication system they will use. Signal operation instructions prescribe the authentication procedures.

Authentication may take the form of a coded light source, panel signal, radio contact, homing beacon, or combinations thereof. Authentication may be employed individually or with the marking pattern. When using a homing beacon or radar transponder for authentication, the commanders concerned will jointly agree upon positioning and turn on and turn off times during mission planning.
Chapter 14

Intentional Water MFF Operations

This chapter provides guidance and requirements when conducting intentional MFF parachute operations into a water DZ. This chapter outlines procedures that are different from standard procedures outlined throughout the remainder of this manual. These procedures are only for intentional water MFF operations, they do not change the procedures for unintentional water landings as outlined in the emergency landing procedures. Service regulations for conducting parachute operations into water DZs provide additional restrictions and guidance.

ADDITIONAL SUPPORT REQUIRED FOR WATER DROPS

All basic parachute support operations outlined in Chapter 13 must be used when conducting deliberate water parachute operations. Listed below is the additional support needed for parachute operations using a water DZ. Refer to individual Service regulations for additional restrictions.

Parachutist Recovery Boats. A minimum of one power-driven boat is required for every five parachutists being dropped on the same pass. The boat coxswain cannot act as the DZSTL, safety swimmer, or medic. Parachutist recovery boats must have an inflatable boat or ladder rigged alongside if they have a freeboard of more than three feet and/or the boats do not provide an easy platform for recovery of personnel. Boats assigned as personnel recovery platforms may only be used to assist in the recovery of equipment after all parachutists have been recovered.

Equipment Recovery Boats. A minimum of one power-driven boat is required for every two equipment platforms dropped on the same pass. Equipment recovery boats are to be used in the recovery of equipment parachutes and platforms. Recovery boats assigned to recover personnel do not meet this requirement when parachutists and equipment are on the same pass. Equipment recovery boats must be large enough to recover cargo parachutes and platforms. The boat coxswain cannot act as the DZSTL, safety swimmer, or medic.

Safety Swimmers. A minimum of one safety swimmer is required to be onboard each recovery boat. The safety swimmer must have fins, facemask, knife, flare, and an inflatable life preserver. For night drops, safety swimmers should also have a light visible for 1 mile (for example, chemlite) and an emergency light visible for 3 miles (for example, strobe). The safety swimmer will be used to recover personnel and equipment and assist parachutists as needed. The safety swimmer cannot be additionally assigned as the DZSTL, boat coxswain, or medic.

Support for Multiple Passes. Boats that have been dropped may be used as recovery boats for additional passes provided they have the proper personnel assigned, they are completely de-rigged, and they are on station ready for the next pass.
JUMPER REQUIREMENTS

**Jumper Swimmer Qualification.** Parachutists must be qualified swimmers IAW their Service regulations before making a water parachute drop.

**First Water Jump.** Personnel must be current parachutists to conduct their first water jump. Their first jump must be made during the day and without combat equipment.

**Jumper Currency.** Personnel who are not current can use a water jump for refresher providing it is done during the day and without combat equipment.

EQUIPMENT REQUIREMENTS

**Minimum Equipment.** Each parachutist must have the following minimum equipment for a water jump:

- Life preserver.
- Long-sleeved top.
- Booties, coral shoes, jungle boots (or equivalent).
- Fins.
- Helmet (waiverable by commander for cold water operations).
- Knife and flare.

**Equipment Waivers.** Helmets can be waived by the commanding officer based on operational requirements and a risk assessment (for example, wet suit hoods or cold weather hoods).

**Flotation.** Parachutists must ensure they wear enough flotation to enable them to be positively buoyant in the water. If an injury occurs to the jumper, he must be able to float without swimming.

**Life Jacket.** When using a UDT life preserver, do not route the parachute harness chest strap over the life preserver, allowing the life preserver to inflate in an emergency without releasing the chest strap.

**Altimeters.** Altimeters are required for every jump except water jumps with delays less than 10 seconds.

**Automatic Ripcord Release.** ARRs are required for all MFF parachute operations. There are no waterproof ARRs currently available. Units should coordinate for waivers when conducting intentional water MFF parachute operations without an ARR IAW their Service regulations.

**Safety Lanyards.** Only 80-lb cotton tape is authorized as the safety lanyard for swim fins. The safety lanyards must be short enough not to catch or snag on anything during exit.

**Placement of Fins.** During an exit for a water parachute drop, the jumper may wear his fins as described in one of the two methods listed below. From either configuration the jumper must be able to put the fins on either under canopy or in the water.
• Worn on feet as normal with 80-lb safety lanyards. This method may be used if the jumper does not have to walk far to exit. Short fins are recommended if the jumper must walk in the aircraft to exit.

• Taped vertically to shins with foot through strap and 80-lb safety line. Holding the fin vertical with the strap down, place the foot through the fin strap. Tape the top of the fin to the front of the parachutist’s leg, folding the end of the tape over to make a quick-release tab. Secure the fin to the parachutist’s ankle with a short piece of 80-lb cotton tape. Whenever possible the jumper should wear his fins on exit. If the jumper does not have his fins on during exit then he should wait to put them on until AFTER entering the water. This step will allow the jumper to concentrate on canopy grouping at low altitudes. Aircraft configuration and SOP will determine the proper location.

**DZ REQUIREMENTS AND MARKINGS**

**Establishment of the DZ.** The DZ must be established not less than 30 minutes (60 minutes recommended) before the TOT to allow time for the DZSO to monitor DZ conditions.

**Surface Winds.** Surface winds shall not exceed 18 knots.

**Sea State.** Sea state shall not exceed a three-foot chop or a four-foot swell.

**Water Depth.** The depth of the water must be at least ten feet deep.

**Water Temperature.** Minimum safe water temperature for personnel drops is 50 degrees F (10 degrees Celsius) unless an appropriate exposure suit is worn. Partial or full exposure suits should be considered whenever water temperatures are below 72 degrees F.

**Air-to-Ground Communications.** Personnel must establish a positive visual or electronic signal for DZ identification before the drop for water parachute operations. Only a positive visual or electronic signal for DZ identification is required; however, radio communications are highly recommended to assist in verifying the DZ (USASOC units require radio communications). Use positive night visual signals (for example, beacons, strobes) for night drops to avoid confusion and aid in positive identification.

**Drop Zone Communication.** All DZ safety craft must be equipped with boat-to-boat radio communications.

**Drop Zone Configuration.** As per Service regulations.

**JUMPER PROCEDURES FOR WATER JUMP**

**MC-4 Water Jump Procedures.** Procedures for a premeditated water parachute jump after a standard aircraft exit using the MC-4 are described below.

• Check parachute and locate other parachutists. Turn canopy toward the DZ.

• Disconnect reserve static line (RSL) and release waistband.

• Continue to steer and group with other parachutists to the target.
• At no lower than 200 feet above the water turn into the wind and release the chest strap (500 feet recommended with combat equipment).
• Confirm leg strap snap hook locations.
• Flare canopy to land (land with half brakes for night jumps).
• After entering the water, release leg straps and crawl out of the harness.
• Put fins on if required.
• Swim to the center of trailing edge (tail).
• Hand the center of the trailing edge (tail) and harness to recovery boat.

**Reserve Static Line.** When making an MFF water jump with the MC-4, parachutists must ensure they disconnect the RSL once under a good canopy. This action will prevent the reserve from being activated if the main is cut away while in the water.

**Using the Life Preserver.** If the parachutist is unable to stay above the water, he must either add air using the oral inflation tube or inflate his life preserver with the CO₂.

**High Winds.** If a jumper is being dragged in high winds, he must roll over on his back and attempt to collapse the canopy by pulling in on one steering toggle. If this is not possible, he then performs a cutaway on the MC-4 RAPS. If jumping the MC-4 RAPS, ensure the reserve static-line system is disconnected before the main’s cutaway.

**No Wind Landings.** In a no wind landing condition, the canopy may possibly land on the jumper. If this occurs, the jumper must first remain calm and avoid getting tangled in the suspension lines. If the canopy is completely over the jumper, he then creates an air pocket by splashing the water and lifting the canopy above the water. The procedure to get out is to follow a seam to the edge of the canopy, pulling the canopy over you as you go.

**Equipment Flotation.** The reserve parachute will float for a short time; however, if the parachute starts to sink, make no attempt to hang on or recover it.

**DZ PROCEDURES FOR PICKUP OF PARACHUTISTS AND EQUIPMENT**

**Recovery Boat Assignments.** Recovery boats must have assigned duties by the DZSTL so as to minimize confusion during the recovery procedure. These assignments must be briefed by the DZSTL/DZSO before setting up the DZ.

**Recovery Priority.** Recovery boats will first pick up any jumper who signals he is in trouble or has deployed his reserve parachute. Parachutists always have priority for pickup over cargo chutes or equipment.

**Approaching Parachutists in the Water.** Boat coxswains must approach the parachutist perpendicular to the wind to avoid drifting or being blown over the jumper or the parachute. Caution must always be taken not to operate the propeller (screws) while the jumper is alongside in the water. The engine should be placed in neutral. If the parachute gets entangled in the propeller (screws), turn the motor off while the safety swimmer frees it.
Recovery of the MC-4 RAPS. The jumper must hand the center of the trailing edge (tail), then the harness to the boat crewman. The suspension lines should be daisy chained starting from the harness end. After the lines are daisy chained, the canopy will be pulled in from the trailing edge (tail) first to allow the water to drain out the leading edge (nose).

Nonrecovery of Parachutes and Platforms. Recovery of equipment after a water parachute jump is only administrative. Combat conditions will call for the sinking of parachutes and platforms. All swimmers except one should be in the combat rubber raiding craft (CRRC) or move away from it before sinking the platform. Parachutes and platforms may be intentionally sunk on training jumps as long as procedures are used to prevent the equipment from resurfacing and becoming a navigation hazard.

NIGHT WATER PARACHUTE OPERATIONS

For night water MFF parachute training, parachutists are required to be equipped with a light visible for 1 mile (for example, a chemlite), an emergency light visible for 3 miles (strobe), and with a flare for emergencies in the water. During free-fall and under canopy, parachutists display a light (for example, a chemlite) visible for 1 mile as a safety measure to prevent mid-air collisions or entanglements. Parachutists are not required to be marked for combat situations.

WATER JUMPS WITH COMBAT EQUIPMENT

Combat Equipment Limitations. Jumping with combat equipment is authorized for water parachute jumps. Parachutists should always minimize the amount of equipment they jump with in the water for safety reasons. Parachutists are not authorized to jump with rifles rigged on the jumper. They must place rifles and other weapons in weapons bags. Rifles rigged on the jumper may easily entangle with suspension lines in the water. Whenever possible, place as much equipment as possible in the CRRC load except for individual survival gear.

Jumper Currency. Parachutists conducting water parachute operations with combat equipment must be current and have made at least one previous noncombat equipment water parachute jump.

Equipment Rigging. Equipment packs jumped on the individual must be rigged to be positively buoyant in water. Equipment should be dip-tested for buoyancy before the jump. The equipment is rigged and attached as described in Chapter 4.

Parachutist Procedures. When jumping equipment, it is recommended to make the turn on final approach at 500 feet but no lower than 200 feet to allow additional time to unfasten the chest strap and lower the equipment. After the parachutist enters the water, he must disconnect the equipment after getting out of the harness.
Chapter 15
Jumpmaster Responsibilities and Currency Qualifications

This chapter establishes the procedures and techniques that jumpmasters use in MFF parachute operations. It delineates duties and responsibilities, regardless of unit, location, and mission. Units may have to supplement this guidance with SOPs to perform certain missions. See FM 57-220/MCWP 3-1.5.7/TO 14D1-1-1-121 for further discussion of responsibilities during airborne operations.

RESPONSIBILITIES

The airborne commander designates the key personnel for each airborne operation. These key personnel are the primary jumpmaster, assistant jumpmasters, oxygen safety personnel (when required), departure airfield control officer, DZSTL, DZSO, and MO. Each aircraft has a designated primary jumpmaster, an assistant jumpmaster, and oxygen safety personnel (when required). The airborne commander gives the designated primary jumpmaster command authority over, and responsibility for, all airborne personnel and their associated equipment onboard a jump aircraft. The primary jumpmaster assigns tasks to the assistant jumpmasters and oxygen safety personnel (when required) appointed to help him. The primary jumpmaster can delegate authority but cannot delegate responsibility. Figure 15-1 lists his responsibilities.

<table>
<thead>
<tr>
<th>AT THE UNIT AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Receives the operations officer’s briefing.</td>
</tr>
<tr>
<td>• Receives weather decision or mission abort criteria from airborne troop commander.</td>
</tr>
<tr>
<td>• Checks the manifest (DA Form 1306).</td>
</tr>
<tr>
<td>• Organizes the planeload.</td>
</tr>
<tr>
<td>• Appoints assistant(s) and/or safety personnel.</td>
</tr>
<tr>
<td>• Briefs the personnel.</td>
</tr>
<tr>
<td>• Inspects the personnel and equipment.</td>
</tr>
<tr>
<td>• Conducts prejump training.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AT THE DEPARTURE AIRFIELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Coordinates with the departure airfield commander.</td>
</tr>
<tr>
<td>• Makes weather decision.</td>
</tr>
<tr>
<td>• Issues the parachutes.</td>
</tr>
<tr>
<td>• Inspects the personnel (see Appendix E).</td>
</tr>
</tbody>
</table>

Figure 15-1. Jumpmaster responsibilities.
Figure 15-1. Jumpmaster responsibilities (continued).

QUALIFICATIONS

For appointment by the airborne commander as either a jumpmaster or assistant jumpmaster for an airborne operation, the individual must be a graduate of the MFF Jumpmaster Course. (See note below.) He must have performed jumpmaster duties within the previous 6 months or attended MFF jumpmaster refresher training. An assistant jumpmaster must have performed assistant jumpmaster duties at least twice before being designated as a jumpmaster.

NOTE: The Commandant, United States Army John F. Kennedy Special Warfare Center and School, is the proponent for the conduct of MFF courses of instruction. Only graduates of a USAJFKSWCS-recognized MFF jumpmaster course may perform duties as an MFF jumpmaster. The only recognized Navy MFF jumpmasters are those who hold a Navy MFF jumpmaster graduation certificate dated before 16 June 1989 or those who have graduated from the USAJFKSWCS MFF Jumpmaster Course. The only recognized Air Force MFF jumpmasters are those who have graduated from the USAJFKSWCS MFF Jumpmaster Course and those previously qualified Air Force free-fall jumpmasters who have undergone an MFF jumpmaster upgrade certification using USAJFKSWCS criteria.
CARDINAL RULES
General rules stress that the jumpmaster must—

- **Never** sacrifice safety for any reason.
- Rehearse jumpmaster procedures on the ground.
- Arm his ARR before opening the jump door(s) or the ramp.
- Face the open jump door when in flight.
- Maintain a firm handhold on the aircraft when working in or close to an open jump door or ramp.
- **Never** allow anyone in or near an open jump door or ramp who is not wearing a helmet and safety harness or parachute. The helmet requirement may be waived for intentional water jumps.

CURRENCY AND REQUALIFICATION REQUIREMENTS
An MFF jumpmaster must be USAJFKSWCS-trained or have formally undergone transitional training in a proponent-recognized school environment from the MC-3 system to the RAPS. He must have performed primary or assistant jumpmaster duties within the last 6 months where parachutists actually exited the aircraft while using a jumpmaster-directed release.

Previously qualified MFF jumpmasters who do not meet proficiency and currency requirements will meet the following requalification requirements:

- Undergo MFF parachutist refresher training outlined in Appendix B.
- Receive jumpmaster personnel inspection training for the primary MFF parachute system used in his parent unit.
- Receive refresher training in wind drift (HARP) calculation for MFF mission profiles.
- Receive oxygen equipment refresher training.
- Perform assistant jumpmaster duties for one MFF jump.
- Execute under canopy navigation techniques specific to the navigation aids unique to the parent unit.

An MFF jumpmaster who meets the currency criteria will conduct the requalification and refresher training.

*NOTE: Whenever possible, use a jumpmaster-directed release to enhance MFF jumpmaster skills.*
By Order of the Secretary of the Army:

ERIC K. SHINSEKI
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the Secretary of the Army

DISTRIBUTION:

Active Army, Army National Guard, and U.S. Army Reserve: To be distributed in accordance with initial distribution number 111110, requirements for FM 31-19.
Appendix A

High Altitude Release Point Calculation

The effects of variable wind directions and speed must be accounted for when determining the HARP for each MFF mission. Accurate wind data is essential to calculate the HARP precisely. Commanders are cautioned against planning pinpoint landings on targets when wind data is questionable due to the source, timeliness of reporting, or other dynamic meteorological conditions (for example, thunderstorms or changing fronts). Wind will affect the parachutist during free-fall and canopy performance after deployment.

OBTAINING WIND DATA

Military airfields, civilian airports or weather services, artillery meteorological sections, or pilot teams in the operational areas can provide wind data. Aircrew personnel can also determine wind data during flight as the aircraft passes through different flight levels. (It is not advisable to use this technique for actual infiltrations, as the data obtained en route to the objective area may not reflect conditions at the objective area.)

RECORDING WIND DATA

The jumpmaster records the reported wind data according to altitude in feet, direction in degrees, and speed (velocity) in knots. He records the wind data for every 2,000 feet of altitude during free-fall and every 1,000 feet of altitude under canopy.

CALCULATING AND PLOTTING THE HARP

The jumpmaster calculates and plots the HARP’s location in reverse sequence (Figure A-1, page A-2). First, he calculates the distance and direction from the DIP to the parachute opening point. Second, he calculates the distance and direction from the parachute opening point to the preliminary release point (PRP). Third, he calculates the distance and direction from the PRP (to compensate for forward throw) to the HARP.

Calculation of the HARP during HAHO operations may or may not require calculation of free-fall drift, depending upon the length of free-fall required. For HAHO missions requiring less than 2,000 feet of free-fall, the jumpmaster disregards free-fall drift.

When plotting the HARP on a map, the jumpmaster converts the wind direction from True North to a grid azimuth using the declination diagram.

USING THE WIND DRIFT FORMULA AND CONSTANTS

The jumpmaster uses the wind drift formula $D = K \times A \times V$.

- $D$ = distance in meters.
- $K$ = constant (drift in meters per 1,000-foot loss of altitude in a 1-knot wind).
- $A$ = altitude in thousands of feet.
- $V$ = average wind speed (velocity).
The jumpmaster also uses the following wind drift constants (K factors):

- \( K = 3 \) (parachutist in free-fall).
- \( K = 25 \) (MC-3 parachute system and RAPS [HALO]).
- \( K = 48 \) (RAPS [HAHO]).

**NOTE:** The jumpmaster calculating the HAHO wind drift uses the constant of the least performing canopy; for example, the U.S. Navy MT1-X-S uses the S-type reserve that has a K factor of 60. Therefore, if a parachutist has to activate his reserve parachute, he will still be able to glide to the DZ.

Figure A-1. Plotting the HARP, free-fall, and canopy drift for a HALO mission profile.
CALCULATING HALO FREE-FALL DRIFT AND DIRECTION

To determine the parachutist’s drift in free-fall, the jumpmaster calculates the average wind speed (velocity) and average wind direction from the exit to the opening altitude. Opening altitude (4,000 feet in this example) is not included since that is where the free-fall stops. The wind data from 4,000 feet to 1,000 feet is calculated using the canopy drift constant.

**EXAMPLE:**

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Velocity</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000</td>
<td>85</td>
<td>160</td>
</tr>
<tr>
<td>18,000</td>
<td>75</td>
<td>160</td>
</tr>
<tr>
<td>16,000</td>
<td>75</td>
<td>165</td>
</tr>
<tr>
<td>14,000</td>
<td>65</td>
<td>165</td>
</tr>
<tr>
<td>12,000</td>
<td>50</td>
<td>155</td>
</tr>
<tr>
<td>10,000</td>
<td>45</td>
<td>150</td>
</tr>
<tr>
<td>8,000</td>
<td>20</td>
<td>185</td>
</tr>
<tr>
<td>6,000</td>
<td>20</td>
<td>190</td>
</tr>
</tbody>
</table>

| 435 knots | 1330 degrees |

The jumpmaster determines the averages by—

- Determining the total free-fall distance from the exit (20,000) to the opening (4,000). \( A = 20,000 - 4,000 = 16,000 \), or \( A = 16 \).
- Dividing the sum of the wind velocities (435) by the number of velocities (8). \( V = \frac{435}{8} = 54.375 \), or \( V = 54 \) (rounded to nearest whole number) knots average wind speed (velocity).
- Dividing the sum of the wind directions (1330) by the number of directions (8). Direction = \( \frac{1330}{8} = 166.25 \), or Direction = 166 degrees (round to nearest whole number) average wind direction.

The jumpmaster substitutes the numerical values for the letters of the \( D = K A V \) formula.

- \( D = (3) (16) (54) \)
- \( D = 2,592 \) meters at 166 degrees (True North).

*NOTE:* If using wind directions from 315 degrees to 045 degrees to calculate the average wind direction, incompatible averages may result. To compensate, the jumpmaster adds 360 degrees to directions of 001 to 045 degrees.

**EXAMPLE:**

<table>
<thead>
<tr>
<th>Direction</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>345</td>
<td>345</td>
</tr>
<tr>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>345</td>
<td>345</td>
</tr>
<tr>
<td>010</td>
<td>010(+360) = 370</td>
</tr>
<tr>
<td>015</td>
<td>015(+360) = 375</td>
</tr>
</tbody>
</table>
CALCULATING CANOPY DRIFT

To determine the parachutist’s drift under canopy, the jumpmaster calculates the average wind speed (velocity) and direction from 1,000 feet to the opening altitude.

Example:

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Velocity</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000</td>
<td>15</td>
<td>190</td>
</tr>
<tr>
<td>3,000</td>
<td>14</td>
<td>220</td>
</tr>
<tr>
<td>2,000</td>
<td>11</td>
<td>205</td>
</tr>
<tr>
<td>1,000</td>
<td>9</td>
<td>220</td>
</tr>
</tbody>
</table>

(Disregard Surface Winds)

The jumpmaster determines the averages by—

- Dividing the sum of the velocities (49) by the number of velocities (4). \( V = \frac{49}{4} = 12.25 \) or \( V = 12 \) (rounded to nearest whole number) average wind speed (velocity).
- Dividing the sum of the wind directions (835) by the number of directions (4). Direction = \( \frac{835}{4} = 208.75 \) degrees, or 209 degrees (rounded to the nearest whole number) average wind direction.

The jumpmaster substitutes the numerical values for the letters of the \( D = KAV \) formula.

- \( D = (25) (4) (12) \)
- \( D = 1,200 \) meters at 209 degrees (True North).

CALCULATING FORWARD THROW

Compensation must be made for the distance a parachutist’s body initially travels into the direction of flight due to forward speed (velocity). The average forward throw, at normal high-performance aircraft exit speeds, is 300 meters.

CALCULATING DOGLEGs

Two consecutive changes in wind direction of 90 degrees or more are known as doglegs. Doglegs require separate calculations from the altitude where the wind direction changes.

**NOTE:** A single 90-degree or greater change in wind direction is treated as Erroneous Winds and will not be included in calculations.

CALCULATING THE HAHO HIGH ALTITUDE RELEASE POINT

To calculate the HAHO HARP, the jumpmaster uses the modified \( D = KAV \) formula, as the intention is to maximize the linear distance traveled using the RAPS’ gliding
capability. For doglegs with less than 6,000 feet of vertical descent, use the standard \( D = K A V \) formula.

The jumpmaster uses the following HAHO gliding distance formula:

- \( D = (A - SF) (V + 20.8) \)
- \( D = \) gliding distance in nautical miles (NM).
- \( A = \) altitude in thousands of feet.
- \( SF = \) safety factor in thousands of feet.
- \( V = \) average wind speed (velocity) in knots.
- \( 20.8 = \) canopy speed constant.
- \( K = 48 \) (canopy drift constant).

The jumpmaster calculates the safety factor. It provides a buffer area after exit to permit the parachutists to assemble under canopy and to establish the landing pattern over the DZ. For example, the element commander desires 1,000 feet for canopy assembly after exit and 2,000 feet to establish the landing pattern. The safety factor is 3,000 feet. Therefore, \( SF = 3 \).

The jumpmaster calculates the total gliding distance in NM. To convert NM to kilometers (km), multiply by 1.85.

When an element exits the aircraft in stick formation, the jumpmaster compensates for dispersion between the parachutists. He obtains this figure by dividing the total number of parachutists by 2 and then multiplying the result obtained by 50 meters. He plots the calculated distance back into the aircraft’s line of flight. This procedure places the middle of the stick on the desired opening point.

The jumpmaster plots 300 meters back into the aircraft’s line of flight to compensate for forward throw.

The following are examples of HAHO HARP calculations:

**EXAMPLE 1: HAHO HARP CALCULATION.**

**Situation.** The exit altitude is 14,000 feet. Twelve parachutists will exit the aircraft in stick formation. The element commander desires 1,000 feet for canopy assembly and a 1,000-foot arrival altitude over the DZ. Wind speed and direction at altitude are—

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Velocity</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,000</td>
<td>25</td>
<td>090</td>
</tr>
<tr>
<td>12,000</td>
<td>22</td>
<td>080</td>
</tr>
<tr>
<td>10,000</td>
<td>21</td>
<td>090</td>
</tr>
<tr>
<td>9,000</td>
<td>21</td>
<td>090</td>
</tr>
<tr>
<td>8,000</td>
<td>20</td>
<td>085</td>
</tr>
<tr>
<td>7,000</td>
<td>18</td>
<td>080</td>
</tr>
</tbody>
</table>
Jumpmaster Calculations.

The jumpmaster—

1. Determines the average wind speed. $V = \frac{210}{12} = 17.50$, or $V = 18$ (rounded to nearest whole number) average wind speed.

2. Determines the average wind direction. $D = \frac{995}{12} = 82.91$, or $D = 83$ (rounded to nearest whole number) degrees (True North) average wind direction.

3. Determines the safety factor is 2 (minimum).

4. Substitutes the numerical values for the letters of the formula.

   $$D = (12 - 2) \left( \frac{20.8 + 18}{48} \right)$$

   $$D = (10) \left( \frac{38.8}{48} \right)$$

   $$D = 388.0 \div 48.$$

   $$D = 8.0 \text{ NM at 83 degrees (True North)}.$$

5. Determines the gliding distance. $8.0 \text{ NM} \times 1.85 = 14.80 \text{ km}$.

6. Determines dispersion $= (12 \div 2) \times 50 = 300$ meters.

7. Determines forward throw. 300 meters.

8. Converts the average wind direction to a grid azimuth and plots it on the map to determine the opening point.

9. Plots the dispersion and forward throw from the PRP to determine the HARP (there is no free-fall drift in a HAHO so the PRP is the opening point.)

10. Determines the grid azimuth from the opening point to the DIP. Converts the grid azimuth to a magnetic azimuth. The magnetic azimuth is the compass heading followed to the DZ.

**EXAMPLE 2: HAHO HARP CALCULATION WITH A DOGLEG.**

Situation. Exit altitude is 15,000 feet. Twelve parachutists exit the aircraft in stick formation. The element commander desires 1,000 feet for canopy assembly and a 2,000-foot arrival altitude over the DZ. A change of wind direction creates a dogleg at 9,000 feet AGL. Wind speed and direction at altitude are—

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Velocity</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,000</td>
<td>33</td>
<td>210</td>
</tr>
</tbody>
</table>
Jumpmaster Calculations (Below the Dogleg from 9,000 to 1,000 feet).

The jumpmaster calculates the gliding distance and direction from the DIP to the dogleg at 9,000 feet. He—

1. Determines that the average wind speed (velocity) from 1,000 feet to 9,000 feet is 17.11 or \( V = 17 \) (rounded to the nearest whole number) knots average wind speed.

2. Determines that the average wind direction from 1,000 feet to 9,000 feet is 84.44 or 84 (rounded to the nearest whole number) degrees (True North).

3. Determines that the safety factor is 3. He must remember that in a formula for a HAHO dogleg, the safety factor is 2 on the base leg and 1 on the dogleg to equal a total safety factor of 3.

4. Establishes that altitude = 9,000 feet or \( A = 9 \).

5. Substitutes the numerical value for the letters of the formula.

\[
D = (9 - 2) (20.8 + 17) \div 48.
\]

\[
D = (7) (37.8) \div 48.
\]

\[
D = 264.6 \div 48 = 5.5 \text{ NM} \times 1.85 = 10.1 \text{ km} \text{ gliding distance at 84 degrees (True North).}
\]
Calculating the HAHO HARP

Jumpmaster Calculation (Above the Dogleg from 10,000 to 14,000 feet).

The jumpmaster calculates the gliding distance and direction from 10,000 feet to the exit altitude. He—

1. Determines that the average wind speed (velocity) from 10,000 feet to 15,000 feet is 30.66 or 31 (rounded to the nearest whole number) knots.
2. Determines that the average wind direction from 10,000 feet to 15,000 feet is 200 degrees (True North).
3. Determines that the safety factor is 1.
4. Establishes that altitude = 5,000 feet or A = 5.
5. Substitutes the numerical value for the letters of the formula.

\[
D = (5 - 1) (20.8 + 31) \div 48.
\]

\[
D = (4) (51.8) \div 48.
\]

\[
D = 207.2 \div 48 = 4.3 \text{ NM} \times 1.85 = 7.9 \text{ or } 8 \text{ km} \text{ (rounded to the nearest whole number) gliding distance at 200 degrees (True North).}
\]

The jumpmaster converts the True North azimuths to grid azimuths. He plots the glide path from the DIP to the dogleg. He plots the glide path from the dogleg to the opening point. He calculates the dispersion for 12 parachutists (300 meters). He plots the PRP from the opening point. He compensates for forward throw and plots the HARP.

The jumpmaster determines the grid azimuth from the opening point to the DIP. He converts the grid azimuth to a magnetic azimuth. The magnetic azimuth is the compass heading followed to the DZ. By holding a single compass heading, the parachutist will maintain direction and follow a curving path from the opening point to the DZ, rather than a path with distinct turns.

**NOTE:** The safety factor above the dogleg and below the dogleg, when combined, mathematically incorporates the desired effect over the complete group.
MFF parachuting skills are highly perishable. MFF personnel maintain these skills through regularly scheduled training periods to develop the necessary degree of proficiency. Otherwise, mission capability and parachutist safety will suffer.

**PROFICIENCY**

Commanders conduct oxygen training jumps below 18,000 feet MSL to eliminate the need for prebreathing. They conduct proficiency jumps as a part of other training operations, such as field training exercises or Army Training and Evaluation Programs, to take advantage of available training assets. They follow a minimum program consisting of eight parachute jumps per quarter (Figure B-1). They do not plan more than four proficiency jumps for any one day. Figure B-2, page B-2, depicts a suggested 30-day predeployment training program.

<table>
<thead>
<tr>
<th>JUMP NUMBER</th>
<th>TYPE OF JUMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HALO/administrative-nontactical</td>
</tr>
<tr>
<td>2</td>
<td>HALO/combat equipment/oxygen</td>
</tr>
<tr>
<td>3</td>
<td>HALO/combat equipment/night</td>
</tr>
<tr>
<td>4</td>
<td>HALO/combat equipment/night/oxygen</td>
</tr>
<tr>
<td>5</td>
<td>HAHO/administrative-nontactical</td>
</tr>
<tr>
<td>6</td>
<td>HAHO/combat equipment/oxygen</td>
</tr>
<tr>
<td>7</td>
<td>HAHO/combat equipment/night</td>
</tr>
<tr>
<td>8</td>
<td>HAHO/combat equipment/night/oxygen</td>
</tr>
</tbody>
</table>

Figure B-1. Minimum quarterly training guide.
NOTE: Commanders, remember that for safety and parachutist confidence, parachutists require a jump refresher before executing night combat equipment jumps after prolonged periods of nonjumping. You may not be able to include the eight jumps depicted in Figure B-1 in the quarterly training plan; however, follow the intent of the progression where possible. For example, after a 3-month layoff, an element should make a daylight jump before a night combat equipment jump.

NOTE: Units can fulfill oxygen training requirements at altitudes below 18,000 feet MSL. A mission profile that is consistent with prebreathing requirements can be flown without requiring the coordination with or the presence of USAF physiological technicians. Training missions using full oxygen equipment can be flown at altitudes below 13,000 feet MSL. Flights at these altitudes would be consistent with any altitude’s oxygen use requirements. These training mission profiles might occur in areas where airspace restrictions are in force or when there are not enough aircrew personnel.

CURRENCY

Currency does not equate to proficiency. Do not consider MFF airborne operations to meet pay requirements as proficiency jumps unless the mission profile follows a tactical insertion profile. MFF jumpmaster currency standards are outlined in Chapter 15.

<table>
<thead>
<tr>
<th>DAY</th>
<th>SUBJECT</th>
<th>SCOPE</th>
<th>CLASSROOM HOURS</th>
<th>PRACTICAL HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Familiarization With Free-Fall and HAHO Equipment</td>
<td>Review</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emergency Procedures</td>
<td>Review of emergency procedures, cutaway procedures, malfunction types, and emergency landings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ram-Air Canopy Control and Characteristics</td>
<td>Review</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Airborne Operations</td>
<td>12,500 H/A-NT poised exit door 12,500 H/A-NT poised exit ramp 12,500 H/A-NT</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Airborne Operations</td>
<td>12,500 H/CE 12,500 H/CE</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Oxygen Review and Procedures Airborne Operations Night Operations</td>
<td>Review 17,500 H/O 17,500 H/CE/O Review night airborne operations</td>
<td>1 1</td>
<td>1 8</td>
</tr>
</tbody>
</table>

Figure B-2. Suggested 30-day predeployment training program.
<table>
<thead>
<tr>
<th>DAY</th>
<th>SUBJECT</th>
<th>SCOPE</th>
<th>CLASSROOM HOURS</th>
<th>PRACTICAL HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Airborne Operations</td>
<td>17,500 H/CE/O 12,500 H/A-NT/N</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 8   | HAHO                   | Planning and organizing, formations, communications, canopy control, group leaders, emergency procedures, use of compass
|     | HAHO Computations      | HAHO formula, spotting techniques, control, NAVAIDs, DZ marking day and night, and support equipment | 2               | 4               |
| 9   | Airborne Operations HAHO | 12,500 S/A-NT 12,500 S/A-NT 12,500 S/CE        |                 | 8               |
| 10  | Airborne Operations HAHO | 12,500 S/CE 12,500 S/CE/N 12,500 S/CE/N        |                 | 8               |
| 11  | Airborne Operations HAHO | 12,500 S/CE/O 12,500 S/CE/O 12,500 S/CE/N      |                 | 8               |
| 12  | Airborne Operations HAHO | 12,500 S/CE/N/O 12,500 S/CE/N/O                |                 | 8               |
| 13  | Commander’s Time       | Weather day as needed                          |                 |                 |
| 14  | Commander’s Time       | Weather day as needed                          |                 |                 |
| 15  | Airborne Operations HAHO | 17,500 S/CE/O 17,500 S/CE/O                   |                 | 8               |
| 16  | Airborne Operations HAHO | 17,500 S/CE/N/O 17,500 S/CE/N/O                |                 | 8               |

Figure B-2. Suggested 30-day predeployment training program (continued).
<table>
<thead>
<tr>
<th>DAY</th>
<th>SUBJECT</th>
<th>SCOPE</th>
<th>CLASSROOM HOURS</th>
<th>PRACTICAL HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Airborne Operations HAHO</td>
<td>17,500 S/O/N&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Airborne Operations HAHO</td>
<td>12,500 S/CE&lt;br&gt;12,500 S/CE&lt;br&gt;12,500 H/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Airborne Operations HAHO</td>
<td>17,500 S/CE/N/O&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Airborne Operations HAHO</td>
<td>17,500 S/CE/O/N&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Airborne Operations HAHO</td>
<td>12,500 S/CE&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Airborne Operations HAHO</td>
<td>17,500 S/CE/O/N&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Airborne Operations HAHO</td>
<td>12,500 S/CE&lt;br&gt;12,500 S/CE&lt;br&gt;12,500 H/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Airborne Operations HAHO</td>
<td>17,500 S/CE/O/N&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Commander’s Time</td>
<td>Weather day as needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Airborne Operations HAHO</td>
<td>12,500 S/CE&lt;br&gt;12,500 S/CE</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Airborne Operations HAHO Review</td>
<td>17,500 S/CE/O/N&lt;br&gt;Course review of all instruction</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

*Figure B-2. Suggested 30-day predeployment training program (continued).*
Minimum MFF currency standards are:

- A current flight physical (per Service requirements).
- A current record of USAF physiological training (AF Form 702 or AF Form 1274).
- Parachutist must have conducted an MFF jump within the last 180 days.

**MFF PARACHUTE REQUALIFICATION AND REFRESHER TRAINING**

Previously qualified MFF parachutists who, after meeting medical and USAF chamber currency requirements, do not meet the proficiency and currency requirements listed above, will undergo the following training to become requalified:

- Attend emergency procedures class and suspended harness drills.
- Attend combat equipment rigging (combat pack and weapon) class.
- Attend canopy control and grouping under canopy class.
- Perform one daylight jump without combat equipment stressing a stable exit, maintaining heading, and pulling the ripcord at the prescribed pull altitude while maintaining heading (plus or minus 500 feet).
- Perform one daylight jump with rifle and combat equipment, executing a stable exit, making a left and right turn, stopping on heading, and pulling the ripcord at the prescribed pull altitude (plus or minus 500 feet) while maintaining heading and landing within 50 meters of the group leader.
- Perform one night jump with rifle, combat pack (rucksack), and complete oxygen system, executing a manual parachute activation at the prescribed pull altitude (plus or minus 500 feet) and landing within 50 meters of the group leader.

**MFF HAHO PARACHUTISTS REQUALIFICATION/REFRESHER TRAINING**

Previously qualified MFF parachutists who do not meet proficiency and currency requirements will, after becoming current as an MFF parachutist, undergo the training outlined below. The intent of the following recommendations is to build upon the training progression listed in the previous paragraphs. In addition, the intent is to provide
safe training and increase parachutist skills, ability, and confidence, culminating in a HAHO night combat equipment oxygen jump.

The parachutist makes one MFF ram-air parachute jump with combat equipment from not higher than 13,000 feet AGL with opening not lower than 10,000 feet AGL. He must land within 100 meters of the group leader.

The parachutist makes one MFF ram-air parachute jump with combat equipment and complete oxygen system with opening not higher than 18,000 nor lower than 16,000 feet AGL. He must land within 100 meters of the group leader.

Training progression continues with a daylight combat equipment jump at altitudes above 18,000 feet MSL, depending upon the availability of USAF physiology technicians. For familiarization purposes, prebreathing can still take place below 18,000 feet MSL.
Appendix C

Suggested Military Free-Fall Sustained Airborne Training

Sustained airborne training must be conducted within the 24-hour period before station time of any MFF parachute operation. At a minimum, MFF sustained airborne training must consist of the jumpmaster troop briefing, a mock aircraft rehearsal, action procedures in free-fall and canopy flight, emergency procedures, canopy entanglement procedures, and landing procedures. Figures C-1 through C-6, pages C-1 through C-5, provide outlines of the material to be covered during sustained training.

In-Flight Rigging Procedures
Actions at the Time Warnings
Oxygen Procedures
Aircraft Procedure Signals and Jump Commands
Bundle Ejection Control
Aircraft Exit Procedure
Automatic Ripcord Release Arming and Disarming
In-Flight Emergency Procedures

*NOTE: The jumpmaster uses field-expedient mock aircraft to conduct the rehearsal. The rehearsal is performance-oriented and conducted exactly as the actual mission will occur.*

Figure C-1. Mock aircraft rehearsal.

Group Procedures
• In free-fall
• Under canopy

Communications (Air-to-Air, Air-to-Ground, Ground-to-Air)
• Call signs
• Frequencies
• Time windows
• Transponder codes
• Drop zone ground marking patterns
• Visual authentication codes
• Abort signals

Figure C-2. Action in free-fall and canopy flight.
## MANIFEST CALL
- Identification Cards
- Identification Tags
- Uniform
- Rigged Equipment and Bundle Inspection

## WARNING
Do not conduct MFF operations for a period of 24 hours or longer after diving.

Refer to Figure 1-2 on page 1-3.

## INTRODUCE ASSISTANTS AND OXYGEN SAFETY PERSONNEL
- Spare Parachute Systems
- Spare Altimeters

## BRIEF OVERVIEW OF THE TACTICAL PLAN

### CRITICAL TIMES
- Weather Decision
- Load Time
- Station Time
- Prebreathing Time
- Takeoff Time
- Time Over Target

### MARSHALING PLAN
- Location of Sustained Airborne Training
- Movement to the Departure Airfield
- Aircraft Parking Location
- Parachute Issue Location and Time
- Jumpmaster Personnel Inspection Location and Time
- Joint Mission Briefing Location and Time
- Rigging of Oxygen Consoles and Equipment

## OPERATIONAL INFORMATION
- Type Aircraft
- Type Airdrop (HALO or HAHO)
- Type Release (Jumpmaster-Directed Release)
- Type Exit (Door or Ramp)
- Number of Parachutists and Exit Sequence
- Automatic Ripcord Release Millibar Setting
- Equipment Bundles
- In-Flight Rigging

Aircraft Flight Information
- Flight route and checkpoints
- Duration of flight
- Drop heading, exit altitude, and airspeed
- High altitude release point

---

Figure C-3. Sample jumpmaster troop briefing.
Canopy Flight Information
- Wind speed at opening altitude
- Forecasted altitude winds (direction and speed)
- Cloud layers and temperatures aloft
- Opening altitude and HAHO delay
- Heading(s) under canopy and checkpoints
- Other NAVAIDS
- Radio frequencies

Drop Zone Information
- Name and location (primary and alternates)
- Drop zone dimensions
- Drop zone markings (if used)
- Obstacles on or near the drop zone
- Forecasted ground winds (direction and speed)
- Cloud ceiling or other obscurants

Assembly Plan
- Assembly area location
- Assembly aids (if used)
- Disposition of air items
- MEDEVAC procedures

Special Instructions
- Life preservers
- Off the drop zone procedures

Figure C-3. Sample jumpmaster troop briefing (continued).

**PROBLEMS/MALFUNCTIONS IN FREE-FALL**
- Collision on Exit
- Instability in Free-Fall
- Rucksack Shifts
- Accidental Opening
- Altimeter Failure or Loss
- Lost Goggles
- Clouds
- Floating Ripcord
- Hard Pull
- Pack Closure
- Pilot Chute Hesitation
- Horseshoe
- Bag Lock
- Hung Slider

Figure C-4. Emergency procedures.
Riser Separation
Closed End Cells
Premature Brake Release
Broken Control Lines
Broken Lines
Line Twists
Rips and/or Tears
Tension Knots
Pilot Chute Over the Nose of Canopy
Combinations
Dual Main and Reserve Deployments

**CUTAWAY PROCEDURES**
Total Malfunction
Partial Malfunction

**POST-OPENING PROCEDURES**
Controllability Check
Penetration and Rate of Descent

*Figure C-4. Emergency procedures (continued).*

**COLLISION AVOIDANCE**

**ENTANGLEMENT HAS OCCURRED**
Lower Parachutist Entangled, Higher has a Good Canopy
- Above 2,000 feet AGL
- Between 1,000 and 2,000 feet AGL
- Below 1,000 feet AGL
Neither Parachutist Has a Good Canopy
- Cutaway priority
- Reserve deployments

*Figure C-5. Canopy entanglement procedures.*

**LOWERING EQUIPMENT**

**RAM-AIR PARACHUTE LANDING TECHNIQUE**

**EMERGENCY LANDINGS**
- Trees
- Wires
- Water

*Figure C-6. Landing procedures.*
LOW WIND LANDING PROCEDURE
HIGH WIND LANDING PROCEDURE
RECOVERY OF EQUIPMENT
ALTERNATE DZ LANDING

Figure C-6. Landing procedures (continued).
Appendix D

Sample Accident Report

This appendix provides a sample accident report at Figure D-1, pages D-2 and D-3. It provides an example of the amount of information that elements should provide in such reports.
Figure D-1. Sample Accident Report.
Figure D-2. Sample Accident Report (Reverse Side).
Appendix E

Jumpmaster Personnel Inspection

Before each MFF parachute operation, the jumpmaster conducts a systematic inspection of each parachutist’s parachute and combat equipment for proper wear, fit, and attachment. All equipment being airdropped will receive a JMPI. The jumpmaster must never sacrifice safety for speed.

**WARNING**

Improper or incomplete jumpmaster personnel inspections may result in death, serious injury, or equipment loss and damage.

**JMPI OF THE MC-4 HARNESS AND CONTAINER SYSTEM**

The jumpmaster uses the following sequence to detect and identify deficiencies. With hands and eyes working together, he starts at the front of the parachutist and moves to the rear, from top to bottom, right side to left side (Figure E-1, page E-2).

**IF MAKING AN OXYGEN JUMP, FIRST PERFORM THE OXYGEN INSPECTION SEQUENCE ON PAGE E-8.** Then continue with the following:

**IF JUMPING IN THE VICINITY OF A WATER HAZARD, FOLLOW THE INSPECTION SEQUENCE FOR FLOTATION DEVICES ON PAGE E-11.** Then continue with the following:

1. Harness. Check for proper fit before continuing the JMPI.

2. Helmet and Goggles.
   a. Use correct helmet: MC-3, Gentex HGU-55/P, Gentex Light Weight Parachutist helmet, Bell helmet, or Protec helmet with free-fall liner.
   b. Make sure it fits properly and is serviceable.
   c. Use approved goggles (Kroop, military-issue Sun, Wind, and Dust goggles, or Gentex only).
   d. Make sure the lenses are clear and not cracked or scratched.
   e. Make sure the goggle strap is secured if worn outside of helmet.
   f. Check that bayonet receivers are present and securely attached.
   g. Make sure the two adjustment screws are present on the receiver covers.
   h. Check chin strap for proper attachment and serviceability, with excess stowed.
Figure E-1. JMPI without oxygen, weapon, or rucksack.
3. **Right Riser.** Make sure no twists are present in front or rear riser from riser cover to 3-ring release assembly.

4. **Right 3-Ring Release Assembly.**
   a. Check for correct assembly: small ring, medium ring, base ring (elongated snowman effect).
   b. Give small and medium ring a 1/4 turn to check for free movement.

5. **Right Main Canopy Release Cable and Cable Housing.**
   a. Inspect for tacking and proper routing.
   b. Make sure the 3-ring locking loop is through the small ring and the grommet on the riser and the eye on the cable housing (without any twists or frays).
   c. Rotate riser toward parachutist’s neck, ensuring the release cable is routed through the locking loop and the running end is stowed in the stowage flute.

6. **Main Ripcord Assembly.**
   a. Make sure the housing is tacked properly.
   b. Make sure there are no broken strands on main ripcord cable.
   c. Make sure the two swage balls are present on the end of the ripcord cable.
   d. Check that the main ripcord handle is properly seated in the elastic pocket.

7. **Cutaway Handle (Main Canopy Release Ripcord).**
   a. Make sure that the cutaway cables are not twisted more than 180 degrees.
   b. Check that the handle is seated in its pocket and the Velcro is properly mated.

8. **Chest Strap.**
   a. Make sure there are no twists and it is properly routed (to include the chest strap extension).
   b. Make sure the excess is rolled under and stowed in the slack retainer.
   c. Make sure it is properly routed through the friction adapter.

**IF JUMPING WITH A WEAPON, FOLLOW THE INSPECTION SEQUENCE ON PAGE E-12.** Then continue with the following:

9. **Reserve Ripcord.**
   a. Make sure it is properly seated in the elastic pocket.
   b. Check that the 2 swage balls are present on end of the reserve ripcord cable.
   c. Make sure there are no broken strands.
   d. Make sure the cable is properly routed to the cable housing.
e. Make sure the cable housing is tacked.

10. Left riser. Make sure there are no twists in the front or rear riser from the riser cover to the 3-ring release assembly.

11. Left 3-Ring Release Assembly.
   a. Check for correct assembly—small ring, medium ring, base ring (elongated snowman effect).
   b. Give the small and medium rings a 1/4 turn to check for free movement.

12. Left Main Canopy Release Cable and Cable Housing.
   a. Inspect for tacking and proper routing.
   b. Make sure the 3-ring locking loop is through the small ring and the grommet on the riser and the eye on the cable housing (without any twists or frays).
   c. Rotate riser toward parachutist’s neck, making sure the release cable is routed through the locking loop and the running end is stowed in the stowage flute.

13. Reserve Static Line.
   a. Make sure the reserve static-line quick-release lanyard is attached and snapped.
   b. Make sure the reserve static-line loop is attached to the release shackle and routed correctly.

   a. Check that the large equipment attachment ring and V-ring are present.
   b. Make sure the running end of the adjustment strap is rolled and stowed in the slack retainer.
   c. Make sure there are no twists.

IF JUMPING WITH A RUCKSACK, FOLLOW THE INSPECTION SEQUENCE ON PAGE E-12. Then continue with the following:

15. Right Main Lift Web.
   a. Check that the large equipment attachment ring and V-ring are present.
   b. Make sure the running end of the adjustment strap is rolled and stowed in the slack retainer.
   c. Make sure there are no twists.
   d. Check free-floating strap and oxygen fitting block for proper attachment, make sure the four screws are present on the back of the fitting block.

   a. Make sure the right wing flap is secured to the waistband.
b. Check that there are no twists from its attachment point on the right side of container to the left wing flap.

c. Make sure the excess is rolled under and stowed in the slack retainer.

d. Check for proper routing through the waistband extension friction adapter.

e. Check the waistband extension is routed through the kit bag handles (rear-mounted).

f. Check the kit bag is positioned between the jumper’s back and the main pack tray.

17. Right Leg Strap, Kit Bag Handle (front-mounted).

a. Make sure the snap hook gate closes and has proper spring tension.

b. Make sure the excess is rolled under and stowed in the slack retainer.

c. Check for correct routing, with no twist in leg strap or saddle.

d. Ensure the leg strap is routed through one kit bag carrying handle (front-mounted).

18. Left Leg Strap, Kit Bag Handle (front-mounted).

a. Make sure the snap hook gate closes and has proper spring tension.

b. Make sure the excess is rolled under and stowed in the slack retainer.

c. Check for correct routing, with no twist in leg strap or saddle.

d. Ensure the leg strap is routed through one kit bag carrying handle (front-mounted).


a. Make sure it is located on parachutist’s left wrist, that it fits snugly, and it is properly attached (with 0 to the top).

b. Check for proper free-fall altimeter setting.

c. Tell the parachutist to turn and continue the JMPI.

20. Reserve Container.

a. Peel open the reserve ripcord protective flap.

b. Make sure the reserve ripcord cable housing is tacked down.

c. Check that the reserve static line is routed correctly and that the reserve ripcord cable runs through the reserve static-line ring and fixed guide ring.

21. Reserve Ripcord Cable.

a. Check that the reserve ripcord cable has no broken strands.

b. Make sure it is routed on the left side of the grommets.
c. Make sure the top pin is inserted at a 45-degree angle.
d. Make sure the closing loops are not frayed.
e. Make sure both pins are not seated past their shoulders.
f. Tell the parachutist to bend.

22. Main Container.
   a. Open both protective flaps.
   b. Make sure the closing flaps are closed in the proper sequence (bottom, left, right, top).
   c. Make sure the main ripcord cable housing is tacked.
   d. Check that main ripcord cable and ARR power cable are not twisted around each other.
   e. Make sure the 2-inch cable extension with swage ball is at the 12 o’clock position (top).
   f. Make sure the closing loop is not frayed.
   g. Make sure the main pin is not seated past its shoulder.

23. Inspect the FF-2.
   a. Make sure the withdrawal hook is routed around the main ripcord pin and to the right of the closing loop.
   b. Make sure the withdrawal hook is not seated in the grommet.
   c. Make sure the knurled nut is finger tight and at least three threads are showing.
   d. Make sure the rubber bumper is present.
   e. Move the rubber bumper to check that the FF-2 power cable has no broken strands.
   f. Make sure the locking key is properly seated and locked in the stiffener plate.
   g. Tell the parachutist to stand erect.
   h. Follow the power cable housing forward to the knurled nut on the body of the FF-2. Make sure the knurled nut is finger tight.
   i. Check that the arming pin is properly seated and locked in place.
   j. Check that the FF-2 is properly placed in its stow pocket and the snap fasteners are secured.
   k. Check for correct millibar setting.
   l. Check reset indicator for proper alignment (no more than 50 percent off).
m. Tap parachutist to indicate completion of JMPI.

OR

23. Inspect the AR2. Do the normal JMPI sequence through the inspection of the parachutist’s altimeter. After the altimeter inspection, the following will apply.

a. Locate the AR2 on the left wing flap and make sure the lower protector flap is snapped and secured.

b. Open the top protector flap of the AR2 and inspect the altitude dial for proper setting. Close the top protector flap.

c. Make sure the power cable housing retainer is tight.

d. Visually inspect to make sure the swage ball is not visible. Make sure that the plastic seal retainer is present.

e. Inspect the remainder of the power cable housing for visible damage.

f. Visually inspect the ambient air port to make sure it is free of debris.

g. Visually inspect the aneroid leak indicator window for proper ambient altitude according to the DZ MSL elevation.

h. Move JUMP/OFF switch to the JUMP position, making sure that the activation lever has spring tension.

i. Move the JUMP/OFF switch to the OFF position.

j. Instruct the parachutist to turn and face to the rear.

k. Inspect the AR2 power cable housing to make sure it exits the upper right portion of the reserve.

l. Inspect the AR2 power cable housing to make sure it enters between the reserve protector flap and the top closing flap of the reserve.

m. Peel open the reserve ripcord protector flap.

n. Make sure the mounting bracket screws are present and tight.

o. Follow the AR2 power cable from the mounting bracket to the eyelet checking for broken strands.

p. Make sure the proper routing of the top locking pin is through the power cable eyelet.

q. Make sure the power cable eyelet is not in the grommet and the beveled edge of the eyelet is facing up.

r. Pick up the inspection as the reserve ripcord cable routes through the reserve static-line guide ring and fixed guide ring. Continue the normal JMPI sequence from this point through completion, excluding any FF2-related item.
23. Inspect the MK 2100. Do the normal JMPI sequence through the inspection of the parachutist’s altimeter. After the altimeter inspection, the following will apply.

   a. Go to the parachutist's left side.
   b. Make sure the arming pin is seated into the altitude sensing device and the lanyard is tied in a half-hitch around the top restraining strap of the MK 2100 pocket.

   **WARNING**
   Make sure the lanyard is not tied in a half hitch around the MK 2100 cable.

   c. Make sure the cable from the altitude sensing unit is connected and secured to the cable protruding from the left side of the container.
   d. Make sure the nuts on both cables are hand tight and serviceable.
   e. Push the button on the top of the altitude-sensing unit and make sure the red circuitry light is lit.

   *NOTE: Once the aircraft has taken off, the red light will not work.*

   f. Open the reserve protective flap.
   g. Make sure the ripcord housing is tacked.
   h. Pick up the inspection as the reserve ripcord cable routes through the reserve static-line guide ring and fixed guide ring.
   i. Make sure the reserve ripcord cable moves freely in the cable housing.
   j. Make sure the reserve cable is routed to the left of the top grommet.
   k. Make sure the top ripcord pin is at a 45-degree angle inserted through the withdrawal cable eyelet.
   l. Make sure both ripcord pins are fully seated.
   m. Continue the normal JMPI sequence from this point through completion excluding any FF2-related item.

**JMPI FOR THE MC-4 RAPS WITH THE 106 CUBIC INCH PORTABLE/BAILOUT OXYGEN SYSTEM**

The jumpmaster inspects the entire oxygen system before inspecting the harness/container system. The recommended inspection sequence for the MC-4 parachute assembly with the oxygen system follows (Figure E-2, page E-9).
Figure E-2. JMPI with oxygen and life preserver.
1. Inspect the inside of the mask making sure there is no debris, the four self-sealing screws are present, the combination valve retainer is present, and the portion that matches with the parachutist’s face is not torn or damaged in any way that would cause the parachutist to have an improper seal or fit.

2. Attach the mask to the left side bayonet receiver.

3. Check for proper fit and seal. Make sure there is no damage to the hard shell or soft shell portion of the mask. Make sure the four capped tee nuts secure the four attaching straps to the hard shell portion of the mask, and the excess is either taped or tacked. Check that the combination valve is of the correct type (green exhalation port flaps only), the delivery tube clamp is present and attached properly, and there is no damage to the delivery tube at its attachment point to the combination valve.

4. Detach the oxygen mask from the left side bayonet receiver. Inspect the oxygen mask delivery tube to make sure there is no damage (check for holes, discoloration, or deterioration). Make sure the delivery tube retainer is present and attached correctly. Check that the elastic slack retainer is around the chest strap and the Velcro is mated around the delivery tube.

5. Move to the quick disconnect assembly. Inspect the delivery tube clamp to make sure that it is present and attached properly. Make sure there is no damage to the delivery tube at its attachment point to the quick disconnect. Disconnect the delivery tube from the AIROX VIII. Inspect the quick disconnect to make sure that there is no debris inside the quick disconnect and that the anti-suffocation valve moves freely, has correct spring tension, and returns to the closed position. Inspect the gasket (O-ring) to make sure it is present and the beveled lip portion is up (not reversed).

6. Inspect the AIROX VIII. Disconnect the oxygen mask delivery tube. Make sure the dust cover is present and serviceable. Check that the debris screen is present and is not damaged or corroded. Check that there is no debris inside the AIROX VIII. Reconnect the oxygen mask delivery tube making sure the quick disconnect assembly is fully seated.

7. Grasp the AIROX VIII and move the entire assembly gently up and down to check that the dovetail mounting plate is correctly mated with the oxygen fitting block. Inspect the oxygen fitting block to make sure it is assembled correctly and the four attachment screws are present and secure on the back of the oxygen fitting block.

8. Check the ambient air port of the AIROX VIII. Visually inspect the inside of the ambient air port to make sure the debris screen is present and is not damaged or corroded. Check that there is no debris inside the ambient air port. Inspect the anti-suffocation valve to make sure it has correct spring tension and returns to the closed position. Inspect the gasket (O-ring) to make sure it is present and that the beveled lip portion is up (not reversed).

9. Inspect the blue anti-tamper seal (blue dot of paint). Make sure it is present and aligned.

10. Grasp the “B” nut giving it a slight turn to make sure it is tight. (The “B” nut attaches the delivery hose [medium pressure] to the AIROX VIII.)
11. Follow the delivery hose (medium pressure) from its point of connection on the AIROX VIII and check for proper routing. Make sure the delivery hose is routed from the AIROX VIII over the outside of the waistband. Check that the delivery hose then makes a 180-degree bend and runs under the waistband and between the parachutist’s body and his right main lift web. Check that it then runs to the union elbow.

12. Check the “B” nut at its point of attachment to the union elbow for tightness by giving it a slight twist. Then give the union elbow a slight twist checking for proper tightness to the reducer manifold.

13. Push up on the bottom of the oxygen bottle pocket with the left hand while the right hand is on the manifold and pulls the bottles away from the parachutist’s body. Move to the overpressure relief valve making sure it is seated by pushing in on the cap. While in this position with the oxygen bottles away from the parachutist’s body, inspect the waistband from its point of attachment on the container to the right wing flap friction adapter. Make sure the waistband is not twisted and the waistband is routed through both of the center loops on the oxygen bottle pocket. Check that the oxygen system is between the waistband and right wing flap.

14. Tell the parachutist to bend. Inspect the filler port cap making sure it is present and finger tight. Check that the oxygen pressure gauge indicates adequate pressure. The needle on the oxygen pressure gauge must be on the number 1 of 1800 psi or higher to be correct.

15. Tell the parachutist to stand erect. Turn the ON/OFF control valve on and listen for a flow of oxygen out of the oxygen mask. Make sure the ON/OFF control valve can be locked in the ON position. Turn the ON/OFF control valve off making sure it can be locked in the OFF position.

**NOTE:** The jumpmaster calculating the HAHO wind drift uses the constant of the least performing canopy; for example, the U.S. Navy MT1-X-S uses the S-type reserve that has a K factor of 60. Therefore, if a parachutist has to activate his reserve parachute, he will still be able to glide to the DZ.

This sequence completes the JMPI of the 106-Cubic-Inch Portable/Bailout Oxygen System. Return to the normal JMPI sequence for the MC-4 Ram-Air Parachute System.

**JMPI FOR THE MC-4 RAPS WITH FLOTATION DEVICES**

The recommended sequence for the MC-4 with flotation devices follows (Figure E-2, page E-9).

1. B-7 and LPU-10/P Life Preservers.
   a. Check that the life preserver straps are over the uniform and under the parachute harness (B-7 chest strap fastened with a quick release).
   b. Ensure flotation packets fit under the armpits, with the flaps to the outside, and the toggles down and to the front. Make sure no part of the flotation packet is under the parachute harness.

2. UDT Life Vest.
a. Make sure the life vest is worn around the neck with all straps under the parachute harness, including the parachute harness chest strap. The vest is secured with a rubber band to prevent interference with the cutaway handle and the reserve ripcord.

b. Make sure the inflatable portion of the vest does not go under the chest strap.

Unscrew the CO₂ cartridge to make sure it has not been fired. Reinsert the cartridge into its fitting and ensure it is finger tight. Make sure the protective flap does not cover the toggle.

Return to the normal JMPI sequence for the MC-4 Ram-Air Parachute System.

**JMPI FOR THE MC-4 RAPS WITH WEAPON (M16A1/A2 AND M4/A1)**

The recommended inspection sequence for the MC-4 with individual weapon attached to the parachute system follows (Figure E-3, page E-13). Follow the normal JMPI sequence until you encounter the weapon sling over the chest strap extension.

1. Make sure the sling is routed over the chest strap extension and under the left main lift web.

2. Make sure the sling is routed over the parachutist’s shoulder.

3. Check that the weapon tie-down is secured around the weapon sling about 6 inches from the swivel on the stock of the weapon.

4. Make sure the sling is routed to the outside of the weapon butt stock and weapon magazine is to the parachutist’s rear.

5. Check that the weapon is placed between the left wing flap and the parachutist with the waistband extension routed through the weapon carrying handle.

Go to the reserve ripcord handle and continue the normal JMPI.

**JMPI FOR THE MC-4 RAPS WITH REAR- OR FRONT-MOUNTED COMBAT PACK (RUCKSACK)**

The recommended inspection sequence for the MC-4 parachute assembly with the combat pack (rucksack) follows (Figures E-3, page E-13, front-mounted and E-4, page E-14, rear-mounted). Follow the normal JMPI sequence until you arrive at the equipment attachment ring on the left main lift web.

1. Make sure the left quick-release snap hook has proper spring tension and that the gate is closed. Make sure the quick release is seated. Follow the left attachment strap around to the improved equipment attachment sling, making sure it is not routed under any portion of the MC-4 harness or rucksack frame.

2. Make sure the right quick-release snap hook has proper spring tension and that the gate is closed. Make sure the quick release is seated. Follow the right attachment strap around to the improved equipment attachment sling, making sure it is not routed under any portion of the MC-4 harness or rucksack frame.
3. Inspect the HPT lowering line assembly at its point of attachment on the right V-ring. Make sure the gate on the quick ejector release is closed and the locking arm is locked. Check the routing of the tubular nylon to the nylon duck container (stow pocket) making sure it is routed free of any portion of the MC-4 parachute system or the rucksack frame and is located between the parachutist’s leg and the shoulder strap of the rucksack.
4. Check the running end of the HPT lowering line for proper attachment. Make sure it is attached between the lateral locking straps where the diagonal straps cross. Check that the running end of the lowering line passes through its own loop and is tightened down.

5. Grasp both shoulder straps and pull to the outside of the parachutist’s legs to make sure they are attached correctly and that the parachutist has a leg through each shoulder strap.

Return to the JMPI inspection sequence at the left main lift web large equipment ring.
Appendix F

Jumpmaster Aircrew Briefing Checklist

The jumpmaster briefs the aircrew as a part of his duties at the departure airfield. He uses the checklist at Figure F-1 to brief the aircrew.

Free-Fall Operation Concept
Aircrew Troop Safety Briefing (Time, Location)
Marshaling Plan
Drop Zone
  • Designation and Location
  • Desired Impact Point
  • Proposed HARP Location
  • Elevation
  • Major Obstacles
  • Marking/Identification
  • Strike Reports
Flight Route/Checkpoint Warnings/Altitudes
Drop Heading
Racetrack (Turnoff Direction, Turnaround Time)
Drop Altitude AGL and MSL
Number of Passes
Drop Speed
Formation or Interval (Multiple Aircraft)
Number of Parachutists/Safety/Static Personnel
Command of Personnel Remaining Onboard the Aircraft
Time Warnings; Relayed from Crew to Jumpmaster
Jump Caution Lights; When Turned On and Off
Confirmation of Load/Station/TOT Times
Aircraft Inspection
Aircraft Configuration
Call Signs and Frequencies

Figure F-1. Sample jumpmaster aircrew briefing checklist.
| Intercom |
| Cabin Lighting |
| Opening/Closing of Troop Doors/Ramp |
| Aircraft Emergencies |
| • Load Jettison |
| • Fuselage Fire |
| • Abandon Aircraft |
| • Emergency Bailout |
| • Crash Landings |
| • Ditching |
| • Rapid Depressurization |
| Movement in the Aircraft |
| Smoking Restrictions |
| Airsickness |
| Latrine Facilities |
| Forecasted Weather Conditions |
| In-Flight Rigging |
| Oxygen Procedures |
| • Pressurized/Depressurized Flight |
| • Prebreathing Requirement |
| • Oxygen Emergencies |
| Automatic Ripcord Release |
| • Arming/Disarming Altitude |
| • Activation Altitude |
| Free-Fall Bundles |
| • Location and Movement |
| • Ejection Procedures |
| Visual Jumpmaster Release |
| • Spotting Procedure |
| • Increments of Correction |
| • Hand-and-Arm Signals |
| Manifest |

Figure F-1. Sample jumpmaster aircrew briefing checklist (continued).
Appendix G

Sample Aircraft Inspection Checklist

Special Forces operational detachments primarily use USAF troop carrier aircraft when conducting MFF operations and proficiency training. The preparation of the aircraft for parachute operations is an aircrew responsibility. The jumpmaster, accompanied by the aircraft loadmaster, inspects the aircraft and coordinates any activities particular to the airborne operation (loading and placement of oxygen consoles for example). At a minimum, the jumpmaster checks the exterior and interior areas of the aircraft directly related to the airborne operation. FM 57-220 contains the specific items that must be inspected and the peculiarities of certain aircraft. Figure G-1 contains a sample aircraft inspection checklist.

<table>
<thead>
<tr>
<th>AIRCRAFT EXTERIOR (Vicinity of the Jump Doors or Ramp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projections</td>
</tr>
<tr>
<td>Sharp Edges</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AIRCRAFT INTERIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seats and Safety Belts</td>
</tr>
<tr>
<td>Jump Caution Lights</td>
</tr>
<tr>
<td>Cabin Lighting (if required)</td>
</tr>
<tr>
<td>Jump Doors</td>
</tr>
<tr>
<td>• Sharp or protruding edges</td>
</tr>
<tr>
<td>• Door latches</td>
</tr>
<tr>
<td>• Jump platforms</td>
</tr>
<tr>
<td>• Air deflectors</td>
</tr>
<tr>
<td>Floors</td>
</tr>
<tr>
<td>• Clean</td>
</tr>
<tr>
<td>• Excess equipment secured</td>
</tr>
<tr>
<td>• Roller system removed or reversed</td>
</tr>
<tr>
<td>Oxygen Equipment</td>
</tr>
<tr>
<td>• Secured</td>
</tr>
<tr>
<td>• Operational</td>
</tr>
<tr>
<td>• Jumpmaster and spare console stations</td>
</tr>
<tr>
<td>• Walk-around bottle filler stations operational</td>
</tr>
<tr>
<td>Safety Equipment</td>
</tr>
<tr>
<td>• Alarm bells</td>
</tr>
<tr>
<td>• Intercom system</td>
</tr>
<tr>
<td>• Fire extinguishers</td>
</tr>
</tbody>
</table>

Figure G-1. Sample aircraft inspection checklist.
<table>
<thead>
<tr>
<th>Troop Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Emergency exits</td>
</tr>
<tr>
<td>• First aid kits</td>
</tr>
<tr>
<td>• Overwater flight equipment</td>
</tr>
<tr>
<td>Troop Facilities</td>
</tr>
<tr>
<td>• Airsickness bags</td>
</tr>
<tr>
<td>• Latrine/head</td>
</tr>
</tbody>
</table>

**Figure G-1. Sample aircraft inspection checklist (continued).**
## Glossary

### Part I. Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFI</td>
<td>Air Force Instruction</td>
</tr>
<tr>
<td>AGL</td>
<td>above ground level</td>
</tr>
<tr>
<td>ALICE</td>
<td>all-purpose, lightweight, individual, carrying equipment</td>
</tr>
<tr>
<td>A/NT</td>
<td>administration nontactical</td>
</tr>
<tr>
<td>AMC</td>
<td>Air Mobility Command</td>
</tr>
<tr>
<td>ARR</td>
<td>automatic ripcord release</td>
</tr>
<tr>
<td>CO₂</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>CRRC</td>
<td>combat rubber raiding craft</td>
</tr>
<tr>
<td>CRU</td>
<td>connector regulator unit</td>
</tr>
<tr>
<td>DAF</td>
<td>departure airfield</td>
</tr>
<tr>
<td>DIP</td>
<td>desired impact point</td>
</tr>
<tr>
<td>DZ</td>
<td>drop zone</td>
</tr>
<tr>
<td>DZCO</td>
<td>drop zone control officer</td>
</tr>
<tr>
<td>DZSO</td>
<td>drop zone safety officer</td>
</tr>
<tr>
<td>DZSTL</td>
<td>drop zone support team leader</td>
</tr>
<tr>
<td>F</td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>FM</td>
<td>field manual</td>
</tr>
<tr>
<td>ft/sec</td>
<td>feet per second</td>
</tr>
<tr>
<td>HAHO</td>
<td>high altitude high opening</td>
</tr>
<tr>
<td>HALO</td>
<td>high altitude low opening</td>
</tr>
<tr>
<td>HARP</td>
<td>high altitude release point</td>
</tr>
<tr>
<td>HPT</td>
<td>hook-pile tape</td>
</tr>
<tr>
<td>HSPR</td>
<td>harness, single-point release</td>
</tr>
<tr>
<td>IAW</td>
<td>in accordance with</td>
</tr>
<tr>
<td>JMPI</td>
<td>jumpmaster personnel inspection</td>
</tr>
<tr>
<td>km</td>
<td>kilometer</td>
</tr>
<tr>
<td>lbs</td>
<td>pounds</td>
</tr>
<tr>
<td>LOX</td>
<td>liquid oxygen</td>
</tr>
<tr>
<td>LPU</td>
<td>life preserver unit</td>
</tr>
<tr>
<td>MFF</td>
<td>military free-fall</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>MO</td>
<td>malfunction officer</td>
</tr>
<tr>
<td>mph</td>
<td>miles per hour</td>
</tr>
<tr>
<td>MSL</td>
<td>mean sea level</td>
</tr>
</tbody>
</table>
Part II. Definitions

*abort* - To terminate a mission for any reason other than enemy action. It may occur at any point after the beginning of the mission and prior to its conclusion. (JP 1-02)

*above ground level (AGL)* - The actual distance of the aircraft above the ground, normally expressed in feet.
alignment - The heading in relation to the release point.

altimeter - A device to determine altitude.

automatic ripcord release (ARR) - A mechanical device designed to automatically extract the ripcord pin(s) at a predesignated altitude.

automatic ripcord release calculator - A circular slide rule type of instrument used by the jumpmaster to calculate the setting on the FF-2 ARR.

body stabilization - A movement made in free-fall to attain and maintain a stable body position during free-fall.

body turn - A movement made in free-fall to effect a turn by moving the upper torso either to the right or left.

control lines - The lines that connect the toggles and turn slots and by which the parachutist may control the action of his canopy.

crabbing - A movement made in free-fall to maneuver the canopy at an angle to the direction of the wind.

cutaway - A term used for jettisoning the main canopy in the event of a malfunction.

departure airfield - The actual location where parachutists are loaded on the aircraft and from which the aircraft departs for the DZ.

desired impact point (DIP) - A desired spot for parachute landings on the DZ.

dogleg - A term used to describe calculations when the directional difference in winds is 90 degrees or more at two consecutive altitudes.

drop time - The actual time parachutists exit the aircraft.

drop zone (DZ) - A terrain feature used as a landing area for parachutists.

drop zone safety officer (DZSO) - The officer responsible for the conduct of operations on the DZ.

glide - A position used to permit forward movement to prevent collision with other parachutists. Parachutists bring the hands toward the shoulders. They do not break the arch in their back. They extend their legs slightly.

grouping - A technique used to enable parachutists to fall together in the air, remain together under canopy, and land as a compact tactical unit.

guide ring - A ring attached to the rear risers through which the control lines pass.

heading - The direction of flight.

holding - A term used when the canopy is pointed directly into the wind (as opposed to crabbing or running).

hypoxia - A lack of oxygen.

impact point - A point on the ground where the parachutist should land.
**jump commands** - The commands given by the jumpmaster to the parachutists on his sortie to control the parachutists’ actions between the 2-minute warning and exit.

**jumpmaster** - The assigned airborne qualified individual who controls parachutists from the time they enter the aircraft until they exit.

**jumpmaster personnel inspection** - An inspection by the military free-fall jumpmaster similar to that of static-line jumpmaster to ensure all safety requirements have been met.

**loadmaster** - The Air Force representative who is responsible for securing all loads on the aircraft.

**lowering line** - A cord designed to allow a parachutist to lower a rucksack or a piece of equipment to the ground prior to his own impact.

**malfunction** - A discrepancy in the deployment or inflation of the parachute that can create any faulty, irregular, or abnormal condition increasing the parachutist’s rate of descent, or a condition in which the canopy is uncontrollable.

**millibars** - A unit of measurement of barometric pressure used when setting the FF-2 ARR.

**nonoxygen jump** - A parachute jump, normally below 10,000 feet, that does not require the use of oxygen equipment.

**nonoxygen procedures** - The signals given by the jumpmaster to control the action of the parachutists between take-off and the 2-minute time warning when oxygen is not used.

**opening point** - The point on the ground over which the parachutist deploys his canopy.

**oxygen check** - A visual check made by the jumpmaster to see that each parachutist is receiving oxygen.

**oxygen jump** - A free-fall parachute jump requiring the use of oxygen, normally at any altitude above 10,000 feet.

**oxygen mask** - A face mask that may be connected to an oxygen supply, allowing parachutists to operate above nonoxygen altitudes.

**oxygen procedures** - The procedures used by parachutists and the jumpmaster when they jump using oxygen equipment.

**partial malfunction** - A situation in which the canopy does not fully deploy.

**physiological training** - The training conducted by the Air Force to enable parachutists to identify oxygen equipment and systems and explain the effects of high altitude physiology, cabin pressurization, and hazardous noise and stress.

**pilot briefing** - A briefing the jumpmaster gives the pilot to clarify any points related to the airborne operation, such as drop signal, time, or alternate DZ.

**power cable** - A cable through which power is transmitted from the FF-2 ARR to the pins, securing the parachute opening.
**prebreathing time** - The time spent prior to a high altitude drop when the parachutists and jumpmaster breathe 100 percent oxygen.

**preliminary release point** - The point above the ground at which the initial vector stops and the free-fall drift factor begins.

**release point** - The point over which parachutists exit the aircraft.

**reset indicator** - A window on the FF-2 ARR through which the release time-delay mechanism is checked.

**running** - A technique used for pointing the canopy in the direction of the wind.

**safe-to-arm altitude** - An altitude 5,000 feet AGL or 2,500 feet above the ARR activation altitude, whichever is higher.

**special tactics teams** - Teams consisting of combat control, combat weather, and pararescue personnel.

**spotting** - A technique used by the jumpmaster to visually align the aircraft and release the parachutists at the proper release point.

**terminal velocity** - The velocity at which a falling object attains its maximum, constant speed, normally about 125 miles per hour for a free-fall parachutist.

**time warnings** - The warnings given by the jumpmaster, in minutes, to alert the parachutist to the time remaining before exiting the aircraft.

**toggles** - The nylon loops attached to lines that control the forward speed of the canopy and left and right maneuvering, mounted on the front side of the front risers.

**total malfunction** - A type of malfunction in which the parachute remains in the packtray.

**walk-around bottle** - A large, low-pressure oxygen cylinder that may be used by either the jumpmaster or safety personnel not connected to the oxygen console or the aircraft oxygen system.

**wind drift formula** - A formula used to locate the proper release point.

**wind line** - An imaginary line extending upwind from the target area to the opening point.
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