This manual contains active content, you must "trust" this document or select "play" to view the active content.
If you can read this warning, you may not have yet activated this document.

CHAPTER 12

AIRCREW SURVIVAL EQUIPMENT

Emergency conditions arise quickly and leave little or no time for preparation. You must know what survival equipment is available and how to use it before the need arises.

You can receive aircrew survival training in a number of places. The first place is the aviator's equipment shop, commonly called the "parachute loft" or just the "paraloft." There you will meet the personnel that rig, pack, inspect, and maintain all Navy survival equipment. These personnel are members of the Aircrew Survival Equipmentman rating and are commonly called "parachute riggers." In the parachute loft, you can get first-hand information on the different items that are covered in this chapter.

The next place is in flight physiology. There you will find the medical people who are responsible for survival training. You may have an opportunity to see or even take a ride in the pressure chamber. The pressure chamber allows you to use oxygen equipment under the atmospheric pressure conditions encountered at high altitudes and to see how your body reacts to those changes.

The multiplace egress device is used in many areas. This device is used to simulate the problems involved in ditching an aircraft at sea, day or night. This training teaches you how to escape from a sinking aircraft and how to use inflatable life rafts and life preservers.

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to do the following:

1. State the types, characteristics, and uses of flight clothing.
2. Explain the history, components, and types of parachute assemblies.
3. Describe the different types of life preservers.
4. Identify types of life rafts and their uses.
5. List survival items and rescue equipment.

FLIGHT CLOTHING

Naval aircrew protective equipment is designed to meet the extreme stresses of a combat environment. It also provides fire protection and camouflage, and has design features for escape and evasion. The wide range of environmental conditions in which aircraft must operate requires a compromise between comfort and the high level of protection needed. Protection is the first priority. Postcrash fire and cold water exposure are two critical areas where the survival requirements are more important than maintaining the best cockpit flying conditions. Flight clothing is designed to minimize injury from these hazards.

Aircrew personal protective equipment, such as flight clothing, plays an important role in the safety and survival of pilots and aircrewmen. It protects personnel from the elements and provides adequate comfort for efficient mission performance. The primary purpose of flight clothing and equipment is to protect you from a variety of hazards. No single item of clothing or equipment can cover all the potential requirements. The Navy uses both general flight gear and specialized protective equipment for protection and comfort in cold and hot climates. General flight gear consists of flight coveralls, boots, gloves, etc.; specialized protective equipment consists of Anti-gravity (anti-g) protection coveralls and anti-exposure equipment.

Summer Flyer's Coverall CWU-27/P and Blue Flyer's Coverall CWU-73/P

The CWU-27/P summer flyer's coverall and the CWU-73/P blue flyer's coverall (*Figure 12-1*) are designed to be worn as an outer garment in warm-temperature zones, and they provide protection in the event of an aircraft fire. They are designated for use by all aircrew members.

Figure 12-1 — Summer flyer's coverall.

Configuration

The coveralls are one-piece, unlined garments that are made of aramid cloth, which is a high-temperature-resistant, inherently flame-retardant synthetic fabric with no hot-melt point or drip characteristics (*Figure 12-1*). This lightweight fabric does not support combustion, but begins to char at 700 to 800 °F. The fabric has abrasion resistance similar to nylon, and like nylon, aramid is nonabsorbent. Because of this characteristic, cotton underwear should be worn under the coverall for optimum comfort. The colors of the CWU-27/P are sage green and Khaki, and the CWU-73/P is blue.

The CWU-27/P and CWU-73/P have a slide fastener (zipper) front closure, side pass-through, biswing back, and hook and pile fastener size adjustments at the end of each arm. Also included are two breast patch pockets, one combination cigarette and multiple pencil compartments on the upper front left sleeve, and two thigh pockets. The CWU-73/P has epaulets to allow attachment of shoulder boards. Except for the knife pocket on the left thigh and the multiple pencil compartment pocket on the right lower leg, all pockets and pass-throughs have butted, beaded, and covered slide fasteners. If a hook blade knife (shroud cutter) is carried, it should be tied to the pocket cord and stowed in the knife pocket with the hook blade open for emergency use.

Fitting

The coveralls are fitted to the aircrew member, and their size normally corresponds to men's regular suit sizes. The coveralls are used with standard Navy personal equipment and may be worn under the anti-g garment. The coverall sleeves should always be worn down and closed at the wrist to ensure maximum fire protection.

Maintenance

The aircrew member's responsibility for maintaining the coverall is limited to cleaning. The coveralls are inspected for general condition at intervals not to exceed 360 days. Repairs performed at the organizational level are restricted to repairing open seams and small holes or tears, replacing hook and pile fastener tape, and replacing slide fasteners.

Only high-temperature-resistant aramid cloth (MIL-C-81280) and high-temperature-resistant nylon thread (MIL-T-83193) should be used for repairs.

A new coverall should be laundered before use to soften the fabric and eliminate any possible skin irritation that might occur due to original fabric harshness. After tumble drying or during drip drying, the coverall should be hung on a wooden hanger. The fabric is a drip-dry type that requires no special handling, and it may be washed as frequently as needed. The coverall may be laundered by the aircrew member at home or in a commercial-type washer and dryer. Laundering in water up to 140 °F and tumble drying up to 180 °F does not damage or shrink the coveralls.

Using a commercial fabric softener in the rinse cycle removes body oils during the laundering process. The fabric softeners also stop static cling. Ironing or pressing is permissible. However, it is difficult to remove wrinkles or creases due to the high-temperature-resistant qualities of the material. Coveralls that are heavily soiled and/or stained with oil or grease may be cleaned with solvents normally used in commercial dry cleaning establishments. Dry cleaning or laundering does not compromise the flame-retardant properties, and no renewable flame-retardant treatment is required.

EZ-P Optional Zipper Alteration

The CWU-27/P is altered with the horizontal relief zipper in lieu of the standard CWU-27/P configuration.

The optional zipper alteration is a continuous zipper that was added just below the waist adjustment tabs. The zipper starts at the right front waist area and extends to the left front waist area. To protect the skin from the zipper, an internal section of fabric was added. To provide snag resistance and conceal the zipper, an external flap of fabric extends the length of the horizontal zipper.

⚠ CAUTION ⚠

Altered garments are not authorized to be worn with the Chemical Biological Radiation(CBR) Ensemble (A/P22P-14(V) with CMU-34/P and CMU-35/P Chemical Protective underclothes). If the command has a CBR posture, at least one normal (unaltered) flight suit must be available to be worn with the CBR Ensemble.

NOTE

Testing revealed that flight suit fit is critical for effective use of this alteration. There should be no less than 4 inches of ease in the hip of the flight suit that is sent to the manufacturer for alteration. Therefore, ordering a flight suit that is larger than the standard issue suit may be required.

The alteration must only be accomplished by Creative Apparel Associates; Aircrew Survival Equipmentmen are not authorized to install the alteration.

Flight Coveralls (Cold Weather)

The cold weather flight coverall is a one-piece lined coverall similar to the summer-weight flight suit. The outer layer is a fire-resistant aramid twill with an inner layer of aramid microfiber thermal insulation. The coverall is sized and belted, has a concealed hood in the collar, has ample pocket space, and is wash and wear. The coverall has adjustable sleeve cuffs. A front closure and leg

zippers make it easy to get into and provide a snug fit. The coverall is available in 24 sizes and may be worn instead of the summer flight suit when conditions warrant.

Flyer's Boot/Bellville/Air Safety Boot

The impact-resistant approved flyer's boots (*Figure 12-2*) are designed to protect the aircrew member's feet against high-impact forces. The boot is water-resistant.

Figure 12-2 — Flyer's air safety boot.

Configuration

The upper boot is black in color and constructed of high-quality calfskin. The inner liner is made with soft, full-grain, glove leather. The boot is 8 inches high when fully laced and is available in sizes 4 narrow through 14½ extra wide. The traction treads outsoles and heels are made of nonslip, nonmarking, jet-fuel-resistant rubber. The steel box toe is constructed of cold-rolled carbon steel to provide a safety margin through greater compression resistance. The boot is designed for use by all aircrew members.

Fitting

The boot is fitted to the aircrew member and normally corresponds to the individual's shoe size.

Maintenance

The aircrew member is responsible for maintenance of the boot. Maintenance is limited to cleaning and polishing. Polish used for everyday care of shoes is acceptable. Repairs are not authorized, as the sole and heel should outwear the upper boot. Broken or worn laces may be replaced.

Fire-Resistant Flyer's Gloves, GS/FRP-2

The fire-resistant flyer's glove (MIL-G-81188) is designated for use in warm-to-moderate temperature zones and provides protection in the event of aircraft fire. They are used by all aircrew members (*Figure 12-3*).

Figure 12-3 — Fire-resistant flyer's gloves.

Configuration

The gloves are snug fitting and designed to provide maximum dexterity and sense of touch. If properly fitted, they should not interfere with the operation of the aircraft and use of survival equipment. The gloves are available in sizes 4 through 12. Because the fabric is stretchable, the sizes will accommodate any size hand. The gloves are constructed of soft cabretta gray leather (palm and front portion of fingers) and a stretchable, sage green/khaki, lightweight knit aramid fabric (entire back of hand). The

cloth portion of the gloves will not melt or drip, and it does not support combustion. The fabric does begin to char at 700 to 800 °F.

Fitting

The fire-resistant flyer's glove normally corresponds to the aircrew member's glove size. Determine the proper size glove on a trial fit basis. The glove must fit snugly.

Maintenance

It is the aircrew member's responsibility to clean the gloves. Repairs or other maintenance actions are performed at the organizational level or above and are limited to restitching seams.

Helmets

Wearing protective helmets while flying in Navy aircraft depends upon the designation of the aircraft. You will find that aircraft such as fighters, attack planes, and helicopters usually require aircrew members to wear a protective helmet during takeoff, in flight, and during landing. Other aircraft may require that the helmet be worn only during takeoff and landing.

The Navy headgear for an aircrew member is considered to be a pilot's protective equipment. Maintenance and upkeep is the responsibility of the Aircrew Survival Equipmentman.

There are a number of different types of headgear. Each has its own specific function. As you work with the different types, you will find that with very little effort, you can change their basic configuration to meet requirements for all fixed-wing aircraft.

General Aircrew Helmet Assemblies

The basic HGU-68/P helmet assembly seen in *Figure 12-4* features a lightweight helmet shell constructed of a multi-layer mixed composite of graphite fabric and ballistic nylon fabric with the helmet edge trimmed for optimal peripheral vision. The helmets are available in four sizes (medium, large, extra-large, and extra-large wide). An integrated chin/nape strap and a thermoplastic comfort liner provide stability and comfort. The HGU-68/P is compatible for use with the AN/AVS-9(R) Night Vision Image Intensifier Set (NVIIS), the A/P22P-14(V) CBR protective mask, and the MBU-17(V)2/P oxygen mask. The helmets also house the communications components: H-87B/U earphones, radio frequency (communications) cable assembly, and a boom swivel mount for installation of the M-87/AIC or M26542/2 series boom microphones. The visor assemblies authorized for use with the HGU-68/P helmet assembly are the neutral, clear, gradient, amber, and laser eye protective or neodymium. The visor assemblies can be easily attached or removed via snap fasteners.

Figure 12-4 — HGU-68/P helmet assembly.

Configuration

The basic HGU-84/P (*Figure 12-5)* helmet does not come equipped with the communications components and NVIIS interface accessories, which must be procured separately and installed on the helmet to build up the configurations.

Helmet Shell Assembly

The helmet shell assembly seen in *Figure 12-5* is designed to provide impact protection. This assembly consists of a helmet shell that is constructed of pressure-molded, laminated graphite and ballistic nylon and a polystyrene energy-absorbing liner that absorbs and reduces impact forces. The helmet assembly also includes a lens pad that buffers the visor from the shell, snap fasteners that the visors are attached to, a boom swivel assembly that supports the microphone assembly, and a helmet block for mounting an NVIIS or a Helmet Sight Assembly (HSA) (HGU-67/P). The helmet shell is equipped with pile fasteners that are attached to the inside to facilitate positioning and retention of earcups. The edge of the helmet shell is covered with a foam edgeroll encased in a black leather cover.

Figure 12-5 — Helmet Shell Assembly.

Flyer's Helmet Bag (MIL-B-43290J)

The flyer's helmet bag (*Figure 12-6*) is a nylon fabricated bag used for holding the aircrew member's helmet and auxiliary equipment.

Figure 12-6 — Flyer's helmet bag (MIL-B-43290J).

Anti-Exposure Assemblies

Anti-exposure assemblies consist of several garments that protect the aircrew member in the event of immersion. Constant wear assemblies provide additional protection from cold weather. The constant wear assemblies consist of a waterproof outer garment worn over a ventilation liner and/or cold weather underwear.

The quick-donning anti-exposure suit is carried in the aircraft and donned only in case of emergency. It consists of a waterproof outer garment equipped with permanently attached boots and wrist and neck seals. An inflatable hood and anti-exposure mittens are stowed in the pockets. In case of emergency, the assembly is donned over the regular flight clothing.

Either continuous-wear or quick-donning anti-exposure suits are provided as appropriate for flight personnel and passengers when there is a significant risk of crashing in the water, or when any of the following conditions prevail:

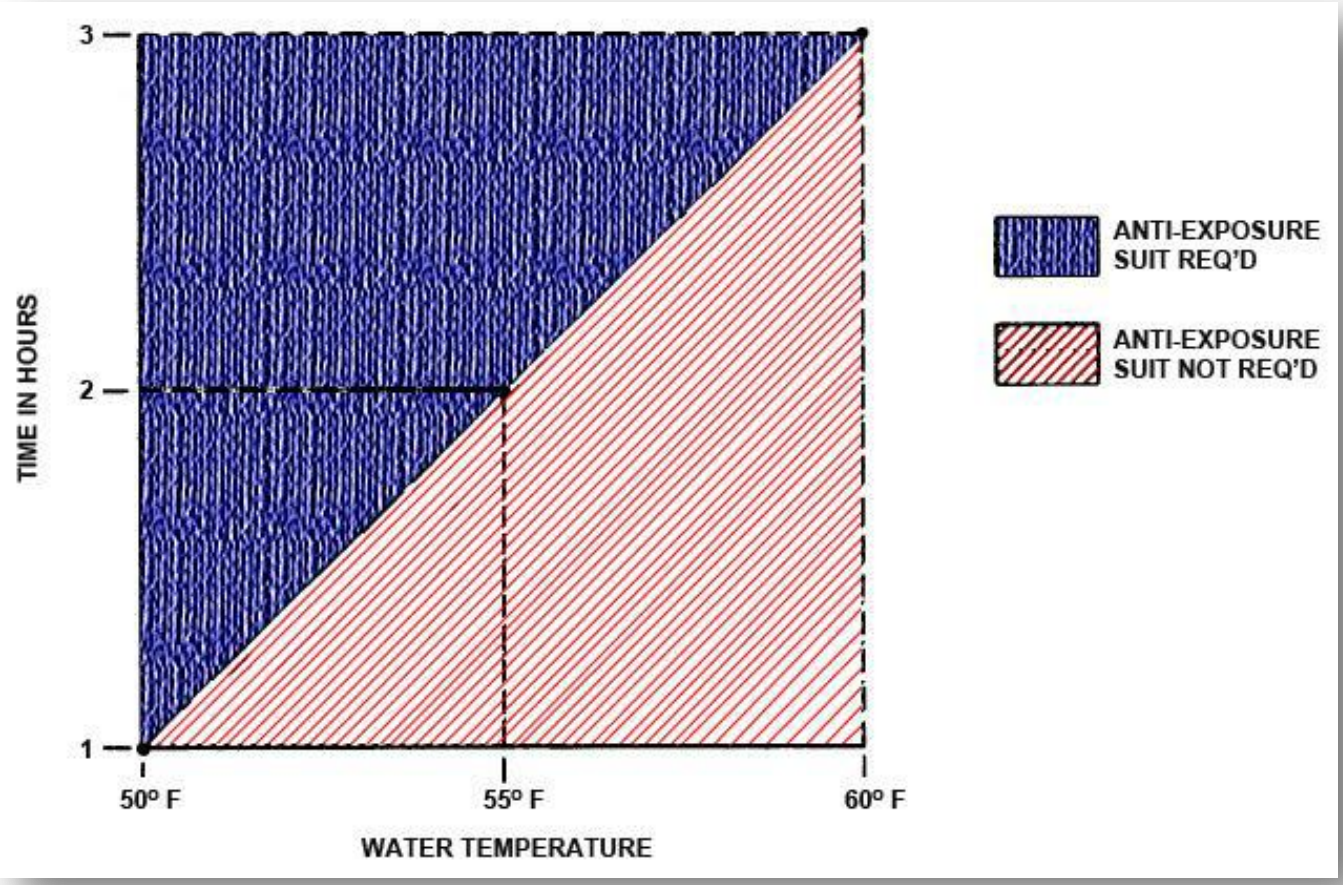
1. The water temperature is 50 °F or below
2. The outside air temperature (OAT) is 32 °F (wind chill factor corrected) or below

If the water temperature is between 50 and 60 °F, the commanding officer of the unit concerned considers the following search and rescue (SAR) factors:

1. The maximum probable rescue time. This should be a function of mission distance, SAR equipment, and SAR location.
2. The lowest temperatures that will occur in the mission area during the time period of the flight.

Then by using (*Table 12-1*), the commanding officer determines whether anti-exposure suits are required.

Table 12-1— Anti-exposure suit temperature chart



When water temperature is below 60 °F and anti-exposure suits are not required, the flight equipment includes anti-exposure, high-temperature-resistant undergarments. Wearing double layers of these

undergarments can significantly improve anti-exposure protection. Please refer to OPNAVINST 3710.7U (pages 169 through172) for water temperature charts.

A/P22P-6(V)2 and A/P22P-6A(V)2 Anti-Exposure Assemblies

The A/P22P-6(V)2 and the A/P22P-6A(V)2 anti-exposure assemblies (*Figure 12-7*) are continuous wear assemblies designed to keep the wearer dry. The complete assemblies provide protection from the thermal effects of cold water immersion in the event of emergency overwater bailout. The assemblies differ only in the type of liner that is worn. The A/P22P-6(V)2 assembly uses the CWU-23/P liner, and the A/P22P-6A(V)2 assembly uses the CWU-72/P liner.

The A/P22P-6(V)2 and the A/P22P-6A(V)2 anti-exposure assemblies are intended to provide the aircrew member with a lightweight coverall assembly that allows for the performance of all required flight operations without restricting any body movements. The coveralls are moisture/vapor permeable to prevent excessive buildup of body heat. In the event of immersion in water, the suit fabrics will not allow water to enter, keeping the wearer dry. All components of the assembly must be worn to achieve the greatest level of exposure protection.

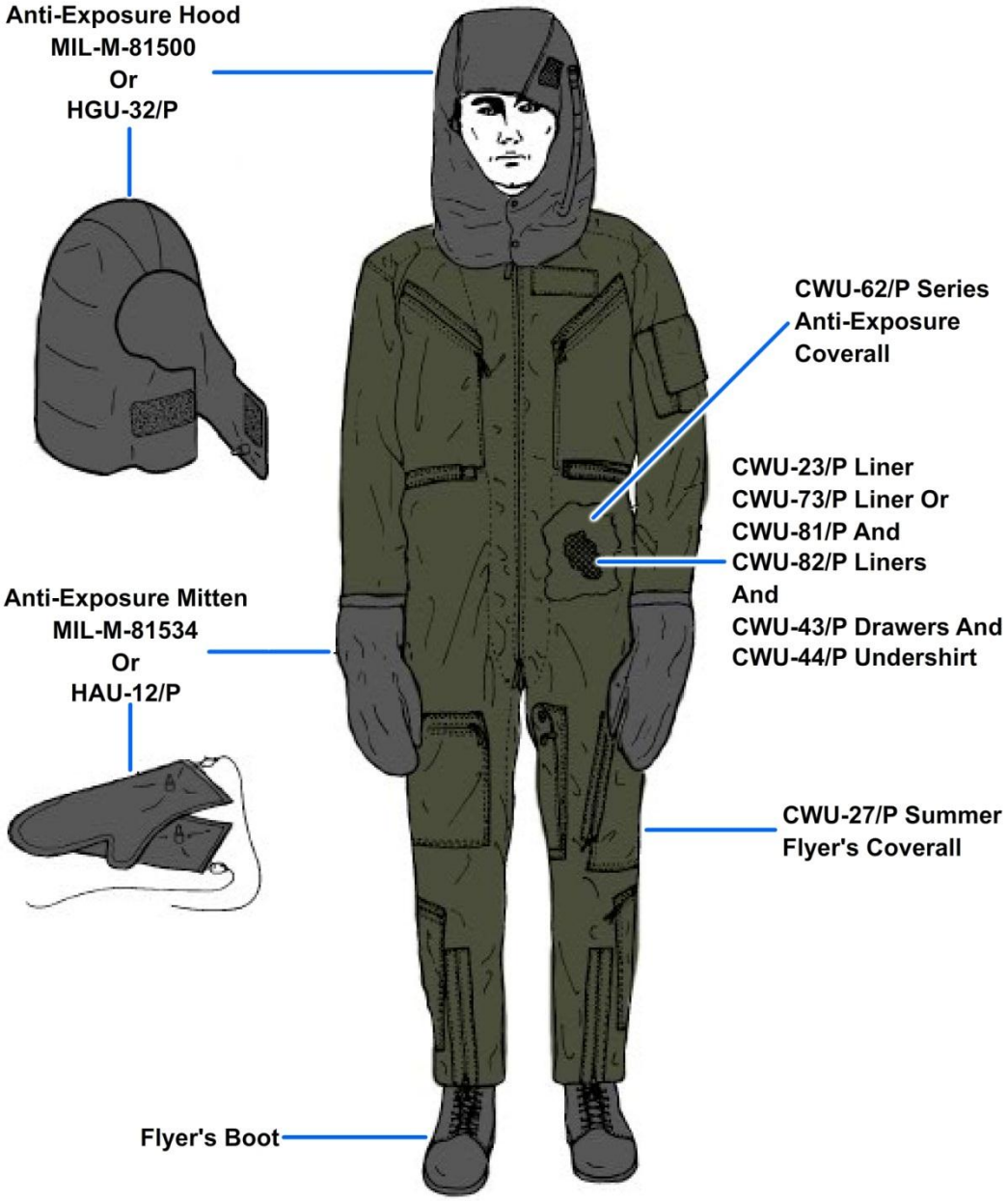


Figure 12-7 — Anti-exposure assemblies.

The A/P22P-6(V)2 and the A/P22P-6A(V)2 anti-exposure assemblies should be properly sized to the aircrew member based on His or her height, weight, and chest measurements. You determine the chest circumference by taking a tape measurement at nipple height with the aircrew member wearing one cold weather undershirt.

The CWU-23/P liner (*Figure 12-8*) is a one-piece garment that is supplied in 12 sizes. The liner is worn directly under the CWU-62/P anti-exposure coverall and over the recommended underclothing. The liner provides an inner layer of 100 percent cotton and an outer layer of polypropylene netting.

Each sleeve ending has a coated stretch fabric insert to permit easy insertion of the hands and to reduce bulk. The leg endings are short enough to clear the tops of the flight boots, again to reduce bulk. They are notched at the front to allow standard wool or cotton socks to be pulled up over the liner legs and to hold the liner legs in place when the CWU-62/P coverall is donned.

The CWU-72/P liner (*Figure 12-9*) is a one-piece garment and is supplied in nine sizes. The liner is worn directly under the CWU-62/P coverall and over the recommended underclothing. The liner provides a layer of thermal protection and is made of 100 percent olefin microfiber thermal insulation sandwiched between two layers of high-temperature-resistant aramid fabric.

Figure 12-8 — CWU-23/P liner.

Figure 12-9 — CWU-72/P liner.

CWU-62/P Series Anti-Exposure Coverall

The CWU-62/P anti-exposure coverall (*Figure 12-10*) is a one-piece garment and is supplied in 12 sizes. The coverall should not be worn in direct contact with the skin. It is a lightweight coverall that prevents water from entering but permits bodily produced moisture vapor to pass out, thus minimizing heat and moisture buildup. Proper maintenance is essential to the life and safety of this coverall, as well as proper sizing and fitting. The neck seal and wrist seals are manufactured from rubber and are sealed with a water- and pressure-sealing slide fastener.

To fit the CWU-62/P coverall, the neck and wrist seals may be trimmed at the initial fitting, but the seals tend to adjust to the aircrew member after a short period of time. If no excessive seal restriction exists, and if the seal fit is acceptable to the aircrew member, the seals should be left as they are. Neck seals need to fit snugly and remain in direct contact with the neck through all normal head movements. Wrist seals must fit tightly enough to prevent water entry but not be so tight as to restrict blood flow.

Figure 12-10 — Anti-exposure coverall.

Multi-Climate Protection System

Multi-Climate Protection System (MCPS) is composed of 12 pieces that can be mixed and matched to form 6 different individual layers. The MCPS is a modular garment system that can be worn in conjunction with current flight suits and aviation flight equipment in a broad range of climate conditions by adding or removing layers that provide flame resistance, moisture management, thermal wind, and water protection. Four different state-of-the-art, flame-resistant textiles were developed exclusively for use in the MCPS garments.

Configuration

1. The silkweight garment set seen in *Figure 12-11* is a lightweight layer for times when a warmer layer is not needed or for layering under a thicker layer. The fabric is an aramid rashel knit that provides breathability, insulation, and flame resistance. The shirt has a thumbhole in the cuff to allow the sleeve to be held in place when other layers are donned overtop. It can also be used to keep the hand partially covered with the cuff for warmth. The shirt has an aramid mesh fabric on the bottom to reduce bulk when tucking it in. The drawer has a front fly and elastic waist. The elastic stirrup on the bottom of the leg is to aid in donning layers overtop and can be cut off by aircrew members who do not like this feature.

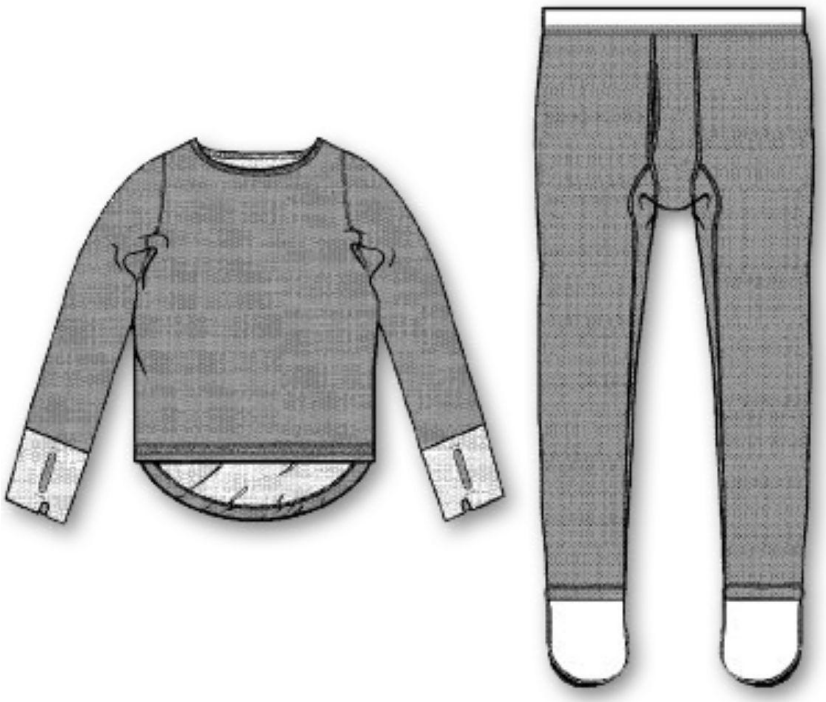


Figure 12-11 — Gammon-type sample fittings view.

2. The midweight garment set seen in *Figure 12-12* is a medium-weight layer for use alone or for layering over and under other layers of the MCPS. The set is constructed of an aramid fleece engineered to provide flame protection in a garment that wicks and provides a comfortable fit. The aramid fleece is worn on the inside next to the skin, and a polyester Lycra blend is worn on the outside to provide a closer fit. The shirt has an aramid mesh cloth on the bottom to reduce bulk when tucked in. The drawer has a front fly and elastic waist. The elastic stirrup on the bottom of the leg is to aid in donning layers overtop and can be cut off by aircrew members who do not like this feature.

Figure 12-12 — Midweight shirt and drawer.

3. The heavyweight garment set seen in *Figure 12-13* will provide the level of protection required for in-water immersion when used with the anti-exposure coverall. The zip neck shirt is made of an aramid double velour, which is modeled after the 200-weight polyester double velour available commercially. This layer can be worn alone or with the silkweight and/or midweight layers under a flight suit or an anti-exposure suit. Due to the knit structure of the fabric and its compressibility, it increases comfort and mobility when compared to currently fielded garments. The shirt has a Nomex mesh on the bottom to reduce bulk when tucked in. The liner pant has a front fly and elastic waist.

Figure 12-13 — Heavyweight shirt and drawer.

4. The overall seen in *Figure 12-14* was developed to be worn over the flight suit and underneath the shell pant to provide insulation to aircrew on helicopters or in the back of patrol and cargo fixed-wing aircraft who work in an environment with very little, if any, capability to provide heat. The design enables the overall to be put on while boots are worn and has a suspender that adjusts with Velcro in order to avoid hardware that could press into the body and create a hot spot. Aircrews that wear a torso harness will not use this item. The overall is made from the same double-weight velour as the heavyweight garments.

Figure 12-14 — Overall.

5. The fleece jacket shown in *Figure 12-15* and vest shown in *Figure 12-16* are designed to be worn over the silkweight, midweight, and/or heavyweight garments, alone or under the shell outer jacket on cold/wet days. The garments provide warmth without weight and block 95 percent of the wind while still providing outstanding breathability. The garments are water-repellent, shed rain and snow, and dry quickly. The vest provides warmth to the body core on moderately cold days while still providing freedom of movement. The garments are constructed of an aramid 300-weight double fleece engineered to provide flame protection in a garment that wicks and provides comfort.

Figure 12-15 — Fleece jacket.

Figure 12-16 — Fleece vest.

6. The outershell jacket and trousers seen in *Figure 12-17* are made of a waterproof, windproof, and breathable flame-resistant Gortex Best Defense fabric, developed and manufactured for the MCPS. The outershell jacket can be used alone or over the other MCPS garments as layered protection. The jacket is designed to stay on the hip, has waterproof zippers, a mapll pocket on the upper left chest, hand warmer pockets behind the large front patch pockets, and survival hood that can be snapped onto the collar. The shell pant is made of the same fabric as the shell jacket. The pant can be put on while boots are worn and comes with suspenders to help keep them in place. The outershell trousers can be used alone or over the other MCPS components as layered protection.

Figure 12-17 — Outershell jacket and trousers.

7. The face mask shown in *Figure 12-18* is a unisex pullover-style garment designed for use in rotary wing aircraft only. The face mask is a semi-form fit, soft, warm, wind-resistant, fire-resistant garment with minimum bulk. The face mask can be worn under the helmet or as a stand-alone cold weather garment. The face mask is constructed of aramid fleece, with a black stretch, velour panel insert at the back to help facilitate donning and doffing. The ear inserts are made of a mesh knit that provides a layer of protection while still allowing unimpeded hearing through the aircrew member's helmet/cranial/headset without removing the face mask. The left front has a slit in the fleece to facilitate the use of a boom microphone. The face mask comes in two sizes (medium/large and extra-large) and can be worn up, covering the face, nose, mouth, chin, ears, and neck, or in the down position, covering the neck only. The face mask was designed to be tucked under a shirt or jacket for full neck protection.

Figure 12-18 — Face mask.

Application

MCPS is designed to provide aircrew with the ability to select the garments they require based upon mission, aircraft, and environment.

Anti-G Garments

Although there is no limit to the speed a human can endure in straight and level flight in an aircraft, changing speed or direction can produce inertia to which the body has a sharply limited tolerance. In the case of extreme stresses exerted by forces of the type met in seat ejection, ditching, or parachute opening shock, the short duration of the force restricts its effects. However, changing the direction of flight often produces stress forces equal to several times the normal value of gravity for periods longer than a second. These forces can have dangerous effects.

At 5 g's (five times the force of gravity), the pilot's body is exposed to a force that increases its weight and that of its components five times. This increased weight has many effects. The pilot is pushed down into his seat. His arms and legs feel like lead, and manipulation of the controls becomes more difficult. In addition, the extra weight of the internal organs causes abdominal and chest discomfort. Most important, however, is the effect on the circulatory system.

At 5 g's, the pressure exerted by the column of blood between the head and the heart becomes just about equal to the blood pressure in the arteries. As a result, the pressure supplied by the heart is not great enough to pump an adequate supply of blood to the head.

To counteract these effects, the pressure in the arteries must be increased above the heart level. At the same time, distended vessels and tissue and fluid spaces in the regions below the heart must be restored to normal. This is accomplished by the anti-g garment.

With the anti-g system, compressed air is metered to the garment in proportion to the gravitational force being exerted. The bladders of the garment inflate, compressing the legs and abdomen of the wearer by an amount also proportional to the gravitational force. Thus, the garment prevents blood from collecting in the abdomen and lower extremities and forces blood from the lower to the upper part of the body. This effect increases blood flow to the heart and increases resistance to the shifting of blood to the lower limbs. In addition, it raises the diaphragm, decreasing the distance between the heart, the eyes, and the brain. Altogether, it increases the tolerance of the pilot an average of about 2 g's.

Anti-g Garments Description

The anti-g garments are designed to provide protection against the effects of high g-forces experienced by aircrew personnel assigned to high-performance aircraft.

Configuration

The anti-g garments consists of a bladder system that is encased in a fire-resistant outer shell. As gravitational forces increase, the system automatically inflates at predetermined pressures. To lessen the effect of a blackout, the anti-g garment applies pressure on the body to restrict the flow of blood to the aircrew member's waist and feet.

The following garments fit from the waist down and are worn over the standard flight suit:

- CSU-15/P
- CSU-13B/P
- CSU-20/P

The CSU-21/P counter pressure vest, also discussed in this chapter, is worn on the upper torso over the standard flight suit.

CSU-15/P, CSU-13B/P, and CSU-15A/P Anti-G Garments

The CSU-15/P anti-g garment and the CSU-13B/P anti-g garment seen in *Figure 12-19* provide protection against the effects of g-forces experienced in high-performance aircraft. The CSU-15A/P anti-g garment is identical to the current CSU-13B/P in form, fit, and function and will be used as an alternative to the CSU-13B/P anti-g garment for Navy/Marine Corps only.

Configuration

The anti-g garments, seen in *Figure 12-20*, are made of a fire-resistant aramid cloth outer shell that houses a bladder. The garments are cut away at the buttock, groin, and knee area for comfort and flexibility. The outer shell has waist and leg entrance fasteners, adjustment lacing areas with lacing covers, and leg pockets with slide fastener

Figure 12-19 — CSU-13B/P anti-g garment.

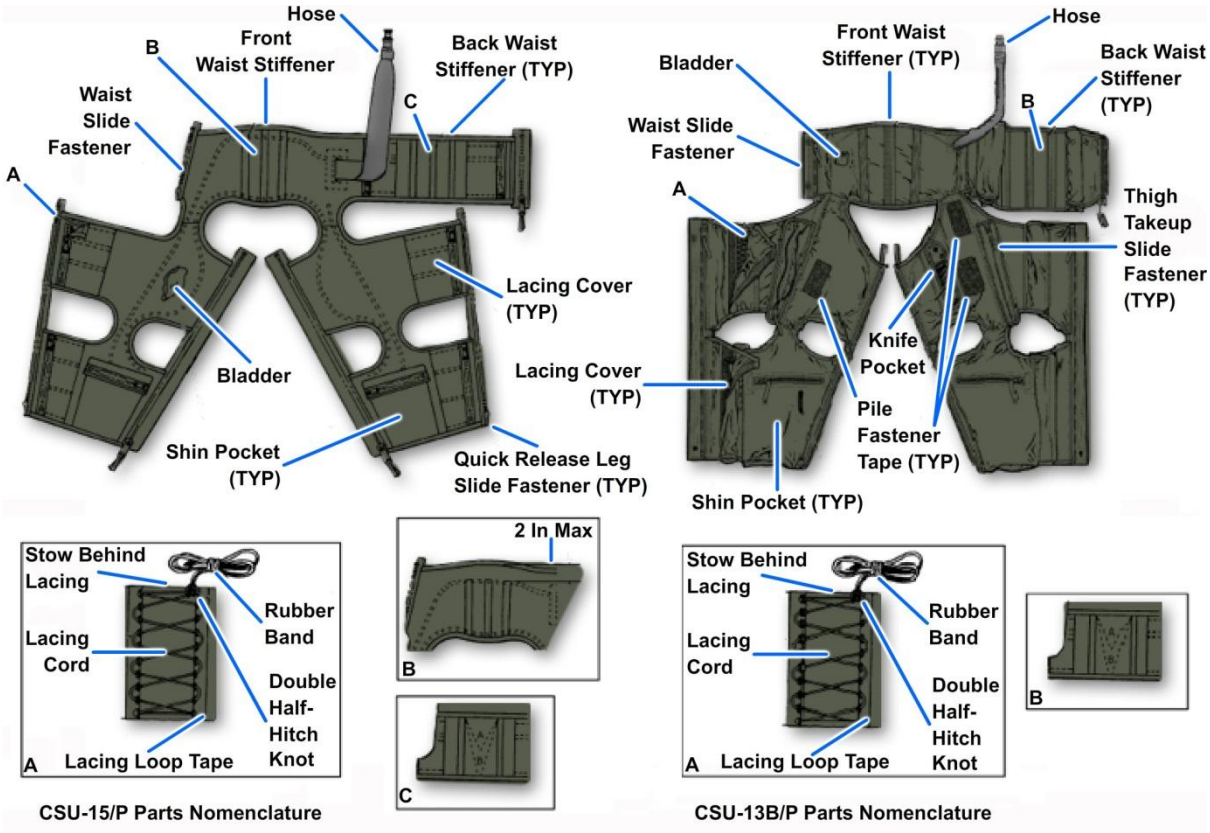


Figure 12-20 — CSU-13B/P and CSU-15/P parts nomenclature.

closures for refined adjustments and storage. The bladder is made of a polyurethane-coated nylon cloth that covers the abdomen, thighs, and calves. The bladder of the anti-g garment is fitted with a hose that is connected directly to the aircraft's anti-g system.

Application

The CSU-15A/P and CSU-13B/P anti-g garments are used in conjunction with standard Navy personal equipment. The CSU-15A/P anti-g garment is identical to the current CSU-13B/P and can be used as an alternative for Navy/Marine Corps only.

PARACHUTE FAMILIARIZATION

The word parachute is, in the modern sense, derived from the French word para, meaning to prepare for or to protect against, and the French word chute, meaning a fall or quick descent—literally, to protect from a fall. As early as the year 1300, Chinese experimenters are reported to have jumped off the Great Wall with devices resembling umbrellas. In the year 1495, the great genius, artist, and inventor Leonardo da Vinci sketched a parachute design to be made of caulked linen that would permit a gentle descent to earth. About a century later, Fausto Veranzio described and sketched a parachute design consisting of a four-poled square frame covered with fabric, which he claimed could be used to escape from tall, burning buildings. Since man, not yet airborne, had no use for a lifesaving device of this nature at that time, parachutes were considered novelties or items of amusement, and interest in them gradually lessened. It was not until the invention of the first aerial balloon that interest in the parachute was renewed. As a result of the balloon, the parachute became less of a toy and more a means of escape.

History

In the late 1700s, the Montgolfier brothers had invented a balloon that would stay aloft. This balloon was kept in the air by burning bundles of straw beneath the bag to furnish the necessary supply of hot air. If the fabric caught fire, the flight was abruptly ended. This meant that those who went up on such flights had to have a means of escape. Those early days of ballooning saw excursions of curiosity into the use of parachutes by early balloonists such as the Montgolfiers, Blanchard, Martyn, Arnold, Appleby, and Hampton. Some parachute drops, using animals as passengers, were successfully made. The first human parachute descent was accomplished by the famous French balloonist Andre-Jacques Garnerin, on 22 October 1798. This historic event took place over Monceau Park, near Paris, when Garnerin released himself and his semi-rigid parachute from the balloon at an altitude of 6,000 feet.

On 14 July 1808, a famous Polish balloonist, Jodaki Kuparento, was the first man to have his life saved from a flaming bag of hot air when, over Warsaw, remnants of his burning balloon blew into the balloon's net structure and blossomed into a parachute, lowering him to the ground safely. However, the need for a foolproof parachute—whose main role at that time was its use as an added thrill to balloon ascensions—was not strong enough to stimulate a great deal of inventive effort until nearly 100 years later. Hence, with the coming of the air age in 1903, when the Wright brothers made their spectacular flight at Kitty Hawk, North Carolina, there came also an era of experimentation with parachutes designed for this new type of flying machine.

Albert Berry is credited with being the first person to jump successfully from an aircraft using a parachute. This jump was made on 1 March 1912, from a Benoist Pusher biplane, at Jefferson Barracks, not far from Kinloch Park Aerodrome, St. Louis, Missouri. The parachute was an unbleached muslin cotton parachute, 36 feet in diameter. Its suspension lines terminated into a trapeze bar and strap arrangement. The parachute assembly was packed into a cone attached under the airplane. It was retained within the metal cone by a series of break cords. The weight of Berry's falling body pulled the canopy and lines from the container. Many others, using makeshift or

experimental parachutes, made descents before World War I, but parachutes still were not considered essential equipment for military aviators. As World War I progressed, the resultant mortality rate among pilots was very high. However, the lives of over 800 balloonist observers and artillery fire directors were saved by parachutes, demonstrating a desperate need for a foolproof and practical lifesaving device for aviators. The next step was to improve parachute reliability and make them mandatory for military flyers.

Parachute lore tells us that in 1917 a French pilot attacked a German Fokker and riddled it with bullets. The plane exploded in flames and began to plunge to earth. As the Frenchman circled his kill, he was surprised to see the enemy pilot jump, immediately followed by a ribbon of white swinging out behind him as he fell through the clouds. Still amazed, he watched as a great billowing canopy fluttered and opened. The plummeting body slowed with a jerk and began swaying gently beneath the air-filled blossom. The adversary waved at the stunned victor and proceeded to swing into no man's land, where the reception was far from friendly. Twenty-seven rifle and machine gun bullets were pumped into the German's legs. He survived and gained the honor of being the first person to save his life by an emergency escape from an airplane.

Official documentation reveals that regular emergency bailouts were made during the late months of 1918 by German aviators. Captured equipment showed the parachute to be a unique one designed by Heineke. Gradually, German fighter pilots began to equip themselves with parachutes. Soon, whole squadrons were doing the same. At the end of the war, it was reported that all flyers in the entire German Air Force were in the process of wearing parachutes in flight.

All parachutes, however clever in design, were still dependent upon a static line attached to the aircraft to deploy the parachute, and they were far from perfect. Thus, some emergency escape attempts continued to take lives. Towards the end of 1918, with the war coming to a close, demands by the flying public and Congress finally resulted in the formation of a U.S. Air Service Parachute Board at McCook Field in Dayton, Ohio. Floyd Smith, with a reputation for his ideas in parachute design, was put in charge of this new unit of the engineering division. He surrounded himself with Guy M. Ball, James M. Russel, James J. Higgins, and Sgt. Ralph W. Bottreil. At the beginning of 1919, energetic Major E. L. Hoffman was chosen as military head of this parachute development team.

The crash program produced results. Parachutes from all over the world, all attached (static-line actuated) types, were tested and found to be unsafe, weak, or otherwise unsuitable for use in emergency jumps from airplanes. Initial testing on a new parachute design devised by Floyd Smith showed potential. This concept involved the use of a parachute canopy and lines packed into a container worn on a body harness, and a manually operated ripcord yanked while falling freely through the air with no attachment to the aircraft was used to open the parachute. Floyd Smith, with Guy Ball closely at his side, worked to perfect this new revolutionary parachute.

This parachute ultimately became the U.S. Air Service Airplane Parachute, type A. It had a 28-foot diameter silk canopy with silk suspension lines. The canopy was formed of 40 gores, with a novel shock-reducing vent design, and it was packed into a backpack container worn on the body of the flyer through the use of a webbing harness. A small pilot-chute was used to deploy the packed canopy and lines into the air when a pull on the ripcord opened the flaps on the back container worn on the body. Not having to be attached to the aircraft allowed the aviator to leave his disabled aircraft regardless of its position. It was capable of withstanding an opening shock delivered by 200 pounds falling at a speed of 400 miles per hour.

When Major Hoffman felt that it was time for the Model A parachute to be live-jumped, he chose a young, enthusiastic parachutist and designer named Leslie L. Irvin because of his vast experience as a parachute jumper. Irvin had previously responded to the government's call for a suitable parachute and had submitted a static-line operated parachute assembly with a cotton canopy. He was apprised that the submitted parachute was unsuitable because by that time the use of a silk canopy, as well as the ripcord concept, was considered preferable. Irvin continued to cooperate with the board by

supplying parachute items. On 28 April 1919, flying in a USD-9 airplane piloted by Floyd Smith at an altitude of 1,500 feet and airspeed of 80 miles per hour, Irvin jumped from the turret cockpit wearing a prototype Model A chute. He pulled the ripcord, the parachute opened in 1.4 seconds, and he became the first man to make a free-fall parachute jump from an aircraft.

The new parachute was the first step on the way to all modern personnel parachutes—emergency, military, and sporting. From this basic design came the seat pack, chest or reserve chutes, backpacks, and any other parachute that can be attached to a harness.
In October 1922, Lieutenant Harold Harris, U.S. Army, was saved from death using a manually operated parachute when his aircraft failed. By March 1924, it became mandatory for all Army and Navy aircrew to wear the standard back-type parachute while in flight. A sign in one of the parachute lofts read, “Don’t forget your parachute. If you need it and you haven’t got it, you’ll never need it again.”

With the requirement for all Navy aviators to wear parachutes came the necessity for trained personnel to pack and maintain these parachutes. In June 1922, the Bureau of Aeronautics requested volunteers from among the petty officers attached to the various naval air stations to take a course of instruction in parachutes at the Army School at Chanute Field, Rantoul, Illinois. Thirteen Chief Petty Officers were selected from throughout the Navy. They completed the course of instruction and returned to their duty stations. Three of them were selected for further training at McCook Field, Dayton, Ohio, at that time known as the Army Equipment Experimental Depot. The three chief petty officers received advanced training in parachutes. In August 1923, Chief Alva Starr and Chief Lyman Ford—two of the three—were ordered to Lakehurst, New Jersey, to set up a training course on parachutes. Although the course was established, the PR rate was not established until 1942. In September 1924, class No. 1 was convened at the Parachute Material School at Lakehurst to teach parachute rigging.

Although his name is now lost to history, one of the farsighted founders of the PR school decided on a novel means to help combat the airmen’s reluctance to “hit the silk.” He reasoned that if the men who packed and repaired the parachutes had enough confidence in their ability and equipment to make a deliberate, premeditated jump, aviators might be more willing to trust his parachute over his crashing airplane. In the beginning, graduate trainees jumped from the outer wing tips of a biplane flying high above the naval air station at Lakehurst. Later, the students let go from short rope ladders suspended from the sides of the old gondola airships (blimps) and eventually from training and patrol-type lighter-than-air ships. Since the beginning of the PR school in 1924, there have been over 72,000 parachute jumps made at Lakehurst, New Jersey.

With the coming of the jet age, the emergency use of parachutes has become a highly technical sequence. Today’s emergency sequence for ejecting from a disabled aircraft starts with the aircrewman making a decision to leave the aircraft. After that decision is made, everything is done automatically, as you will see in the ejection sequence for the A-6 aircraft, shown in *Figure 12-21*.

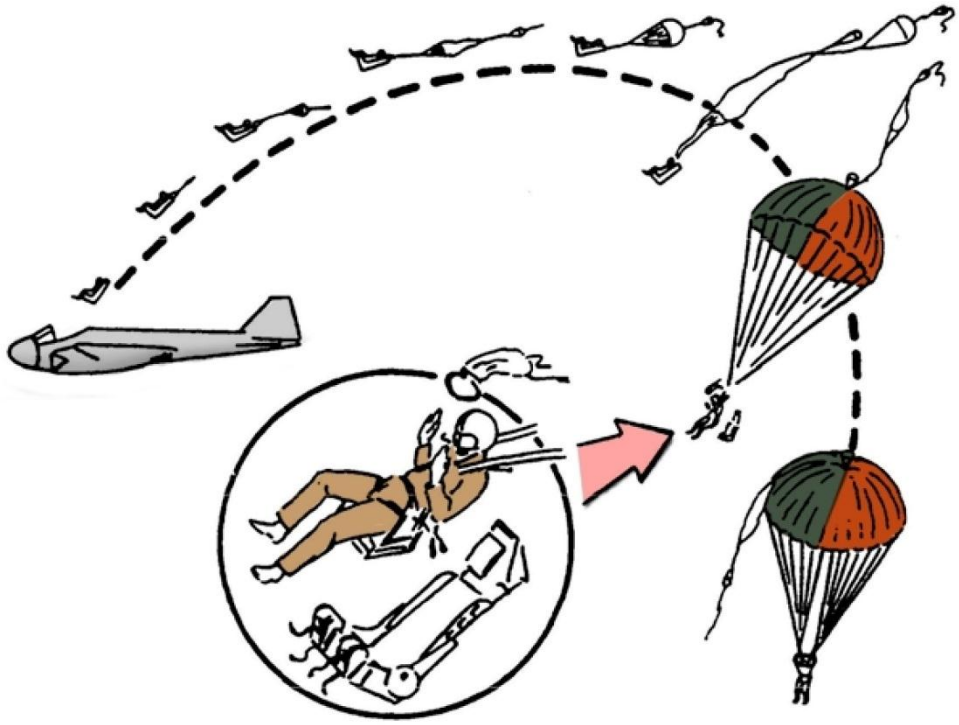


Figure 12-21 — Ejection sequence.

This is only one of several types of ejection systems used in modern naval aircraft.

For example, the ejection sequence of the MK GRU-7 is as follows:

1. Initial ejection.
2. Drogue gun fires.
3. Controller drogue deploys.
4. Stabilizer drogue deploys.
5. Main parachute deploys, and a normal parachute descent is made.

The parachute has evolved from the experimental devices of the early Chinese through the seat ejection systems of today. Considering parachute evolution in light of continuing innovations in shuttle flight and other advanced aircraft, it appears that development to this point is just the beginning.

A parachute appears somewhat similar to a giant umbrella. By offering a large air-resisting or drag surface, the parachute, when opened, provides the deceleration necessary to allow for the safe descent of an aircrewman. In each parachute jump a sequence of events takes place as shown in *Figure 12-22*. The parachutist clears the aircraft and then pulls the ripcord. The ripcord pins are removed from the locking cones, permitting the grommets to separate from the locking cones. The container spring opening bands pull the side and end flaps apart, allowing the pilot chute to spring beyond the negative pressure area immediately above the falling body. This results in its getting a better —bite‖ on the surrounding air, thus speeding the opening of the canopy.

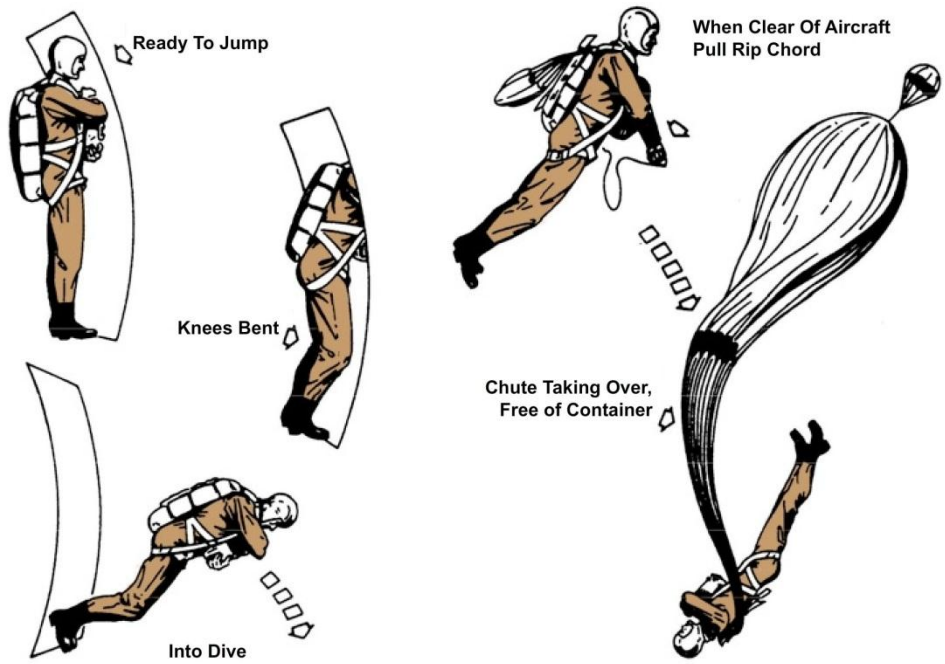


Figure 12-22 — Aircraft egress, pilot chute deployed, and main canopy.

The aircrewman falling away from the pilot chute causes the main canopy to be pulled from the container assembly, followed by the suspension lines. The canopy begins to fill with air during this operation.

The ties on the risers break as the load is applied. The lift webs are then pulled from the container while the canopy fully opens; at this point the parachutist receives the opening shock as the parachute fills with air. The aircrewman then hangs or sits suspended in the harness during the descent.

Many different types of parachutes are used in today's naval aircraft. To really understand the operating principles of a parachute, you should first know the basic design and construction of a parachute and its components.

Components of Parachutes

The design and construction of a parachute and its components are based on the idea that a chain is only as strong as its weakest link. Every component or link from the jumper to the canopy must carry its share of the maximum load that is applied during the opening shock.

The five major parts of a standard service parachute, starting at the top and working down, are the pilot chute, main canopy, suspension lines, harness, and pack. These five major parts are shown in *Figure 12-23*.

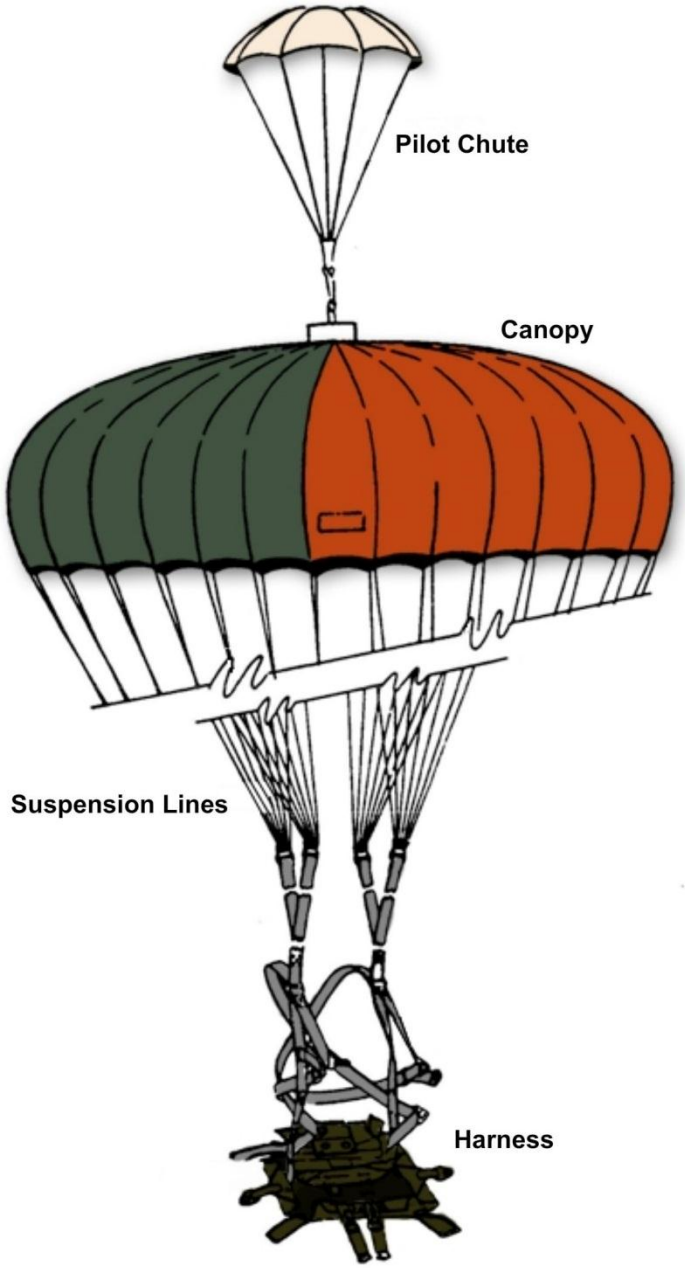


Figure 12-23 — The five major parts of a parachute.

Pilot Chute

The pilot chute has the job of anchoring itself in the airstream in order to pull the remaining packed components out of the parachute pack. The order of deployment for most parachute assemblies is the pilot chute, the canopy, the suspension lines, and the risers. A typical pilot chute is shown in *Figure 12-24*.

Figure 12-24 — Pilot chute.

Canopies

Six sizes of canopies are used in naval aviation. They are the 35-foot, 28-foot, 26-foot, 24-foot, 21-foot, and 17-foot sizes. The 28-foot canopy is the size dealt with in this chapter and is most commonly

described as a polygon having 28 sides and a diameter of 28 feet ±1 inch. The 28-foot canopy contains approximately 796 square feet of nylon cloth plus 2,400 yards of nylon thread. The sewing on a parachute varies from 8 to 10 stitches per inch. The cloth that is used in the construction of a parachute canopy is high-tensile strength, 1.1 ounce ripstop nylon. Ripstop nylon cloth must meet the following minimum requirements: tensile strength (T/S) of 42 pounds per square inch, tear strength of 5 pounds, and air permeability of 80 to 100 cubic feet per minute. T/S is the greatest stress cloth can withstand along its length without rupturing, expressed as the number of pounds per square inch. Tear strength is the average force, expressed in pounds, required to continue a tear across either the filling or the warp of the cloth. Air permeability is the measured amount, in cubic feet, of the flow of air through a square foot of cloth in 1 minute under a specific pressure.

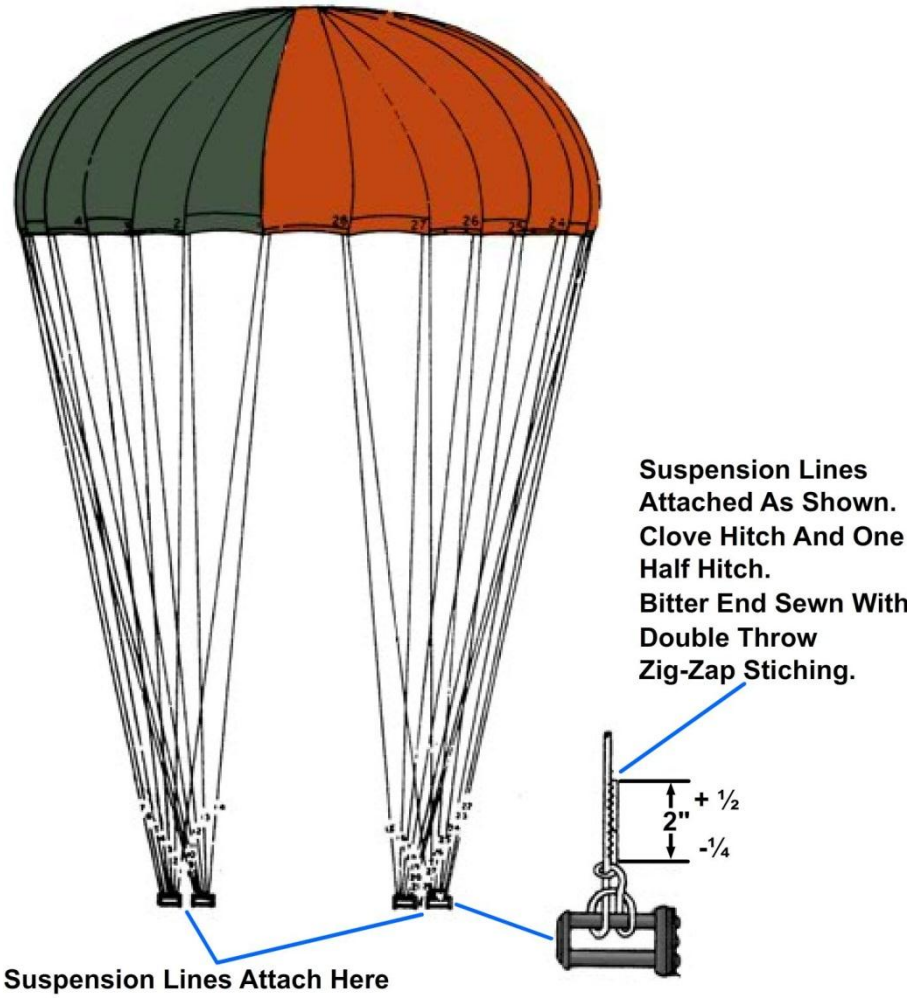


Figure 12-25 — Suspension lines on a 28-foot canopy.

The suspension lines are sewn into the canopy. These lines run continuously from the connector link on one side, through the canopy, and to the connector link on the other side (*Figure 12-25*). The material between any two suspension lines is called a gore (*Figure 12-26*).

Suspension Lines

The suspension lines form a net or skeleton for the canopy and absorb much of the shock load. Therefore, when being assembled, they must be placed under a 20-pound tension, marked, and cut as a group to

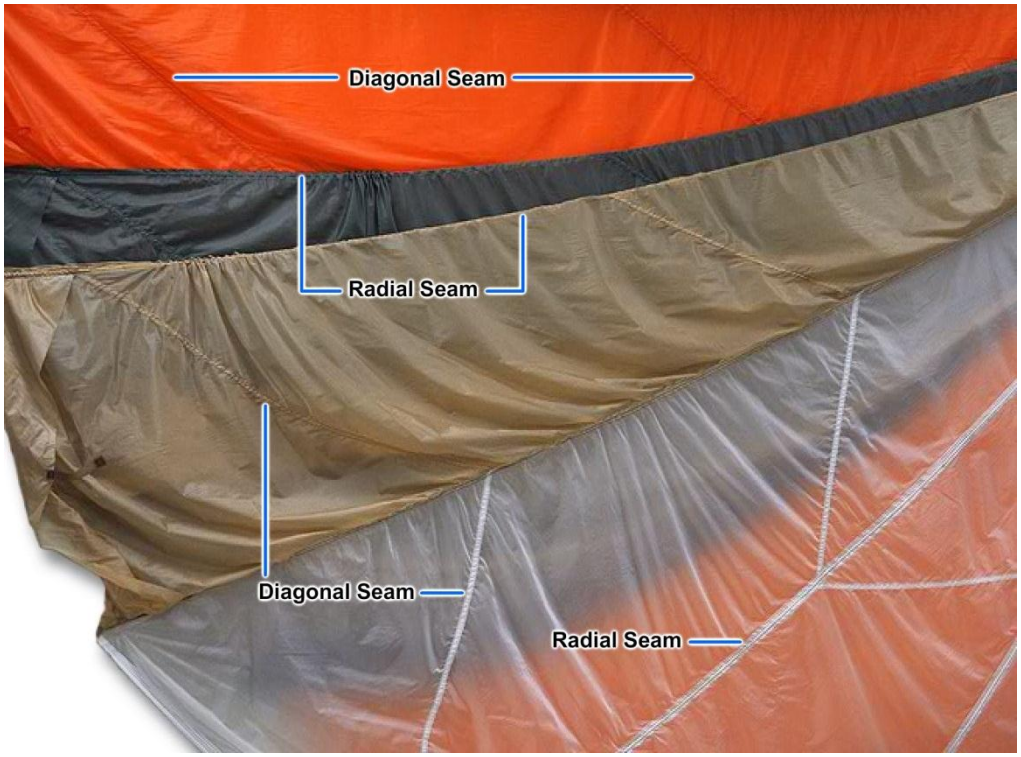


Figure 12-26 — Close-up view of a gore.

assure equal distribution of the shock load. The 28 suspension lines counted at the links are actually 14 lines that are 75 feet 4 inches in length. These lines run continuously from link to link; that is, each line is secured to a connector link on one side of the canopy and runs up and over the canopy and down to a link on the opposite side.

Type III nylon suspension line (with a minimum T/S of 550 pounds) is used on all main canopies and vane-type pilot chutes. This line consists of a loosely woven outer covering called a sleeve and several strong inner cords called the core. This core provides the greater portion of the strength of the suspension line.

The suspension lines are attached to the connector links by tying a clove hitch, then a half-hitch, and completing the attachment with 2 (+½ or -¼) inches of zigzag stitching. These lines are attached to the lift webs with removable connector links. One of the four removable connector links is shown in *Figure 12-27*.

To prevent the canopy on the 28-foot parachute from slipping along the suspension lines, each line is anchored by zigzag stitching at several points to the radial seams through which it passes. One-half inch of slack is allowed in the vicinity of the skirt between the zigzag sewing points to relieve the strain during opening shock.

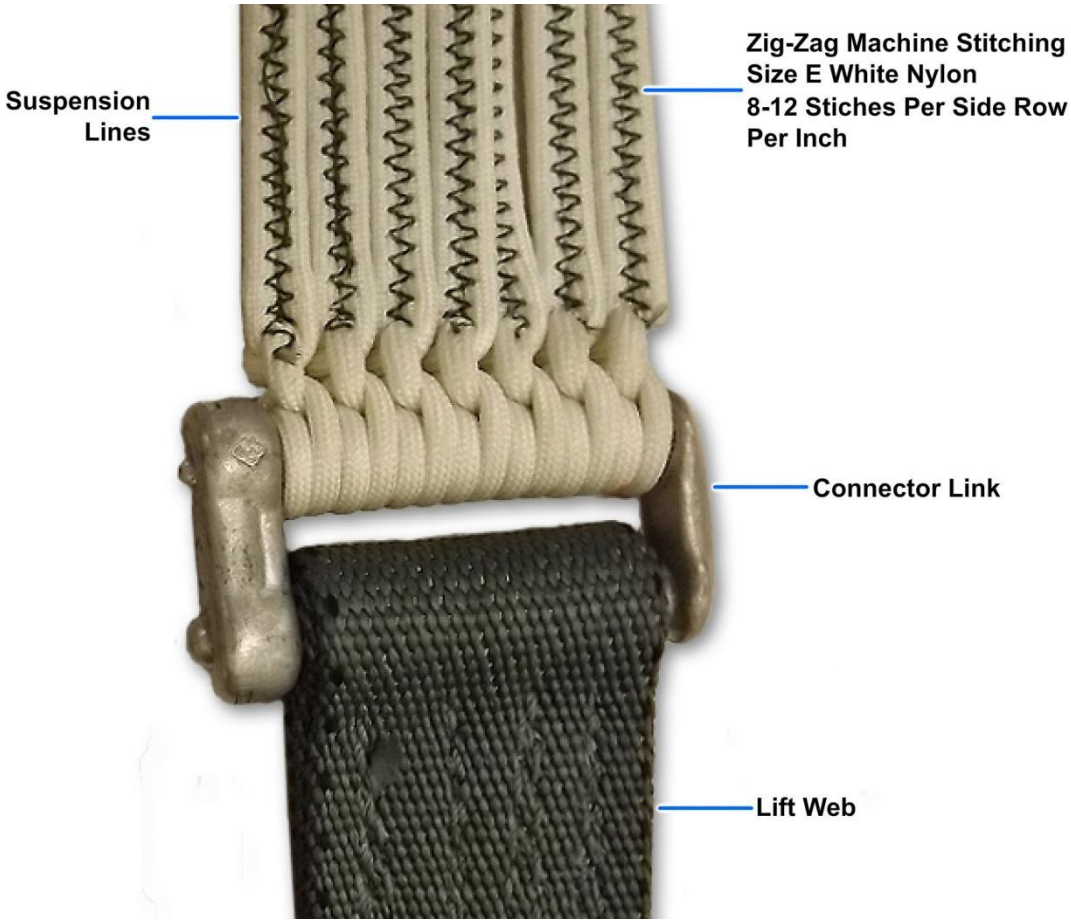


Figure 12-27 — Method of attaching suspension lines at the link.

Parachute Containers

The parachute container is designed to house and protect the pilot chute, main canopy, and suspension lines. There are as many different styles of containers as there are parachutes. They all have the same basic opening procedures. There are four flaps: top, bottom, left, and right. These flaps are held closed by two or four ripcord pins inserted through locking cones. To open the parachute container, the ripcord pins must be removed either manually or automatically. This allows the flaps to open and the pilot chute to spring from the pack. The pilot chute then pulls the canopy out.

Parachute Harness

The harness is the part of the parachute that holds the parachute to the wearer. It is designed to absorb the largest part of the opening shock and has chest, leg, and back straps added to prevent the

jumper from falling free from the chute on the way down. Personnel parachute harnesses are made of 1¾-inch-wide nylon webbing that has a T/S from 6,000 to 8,700 pounds.

The Navy uses two types of harnesses. The first is the quick-fit harness. It is made in three configurations: seat-type, back-type, and chest-type. The other type of harness is the integrated torso harness. It combines the harness, lap belt, and shoulder harness into one integrated garment. This harness improves the individual's comfort and mobility; it is more secure and easier to put on and take off. It also reduces the number of exposed straps and overall bulk and weight.

Ripcord

The ripcord is a manual releasing device used to allow the container to open. It consists of locking pins attached to a length of 3/32-inch diameter corrosion-resistant steel cable. The ripcord handles are made of steel tubing in the shape of a cloverleaf or a trapezoid, and they are attached by passing the cable through a small hole drilled in the grip and then swaging a retaining ball or clamping a small sleeve onto the loose end of the cable. The pins are swaged in place and tested to withstand a pull of 300 pounds.

Harness Hardware

Parachute harness fittings (hardware) are small metal devices usually made of cadmium or chrome-plated steel. They are designed to join the parachute and harness and to afford easy and rapid adjustment of the harness to the wearer.

The many types of parachute harness fittings include adapters, snaps, D-rings, V-rings, connector links, and Koch release adapters. Some of the more common types of these fittings and their T/S's are illustrated in *Figure 12-28*.

Adapters

Two types of adapters are used with a regular quick-fit type harness. They are the regular harness adapter and the friction adapter. The harness adjuster adapter is used to adjust the harness to the wearer, and the friction quick-fit adapter has a grip slide bar that allows the wearer to make quick adjustments to the harness.

Figure 12-28 — Harness hardware.

Interaction Available

Snaps

There are several types of snaps used with parachutes. They are the plain harness snap, the quick-fit snap, and the quick-connector snap. The harness snap is a plain hook-shaped, spring-actuated guard that snaps over a V-ring to secure two parts of the harness together. The quick-fit snap is similar except that it has a grip slide bar. The quick-connector snap is similar to the harness snap and is used as a means to quickly attach the Navy chest-type parachute to the two D-rings on the Navy chest-type harness.

Connector Links

Connector links are fittings designed to join the parachute to the harness. The suspension lines are attached to the connector link on one side, and on the other side of the connector link the harness is attached.

Koch Release Adapters

Integrated torso suit harnesses are equipped with four Koch release adapters that attach to the fittings on the lap belts and risers of the integrated parachute assembly. Release fitting adapters are manufactured in two parts: male and female.

The male portion of the adapter is attached to the torso suit harness, and the female portion is attached to the riser assembly of the parachute. *Figure 12-29* shows the Koch parachute release adapters.

Parachute Systems

The modern high-performance aircraft used by the Navy make extreme demands of emergency escape devices. The most critical time for ejection from an aircraft is at low altitudes, especially during takeoffs and landings. The ultimate goal that engineers have been trying to achieve in seat performance is to safely eject the occupant at zero airspeed and at zero altitude, at low altitudes under a high speed, or under other adverse altitude conditions. The system discussed in this chapter gives the aircrewman that zero airspeed and zero altitude ejection.

A/P28S-32 Emergency Parachute

A/P28S-32 emergency parachutes are integral to the SJU-17 series of Aircrew Automated Ejection Seat Escape Systems.

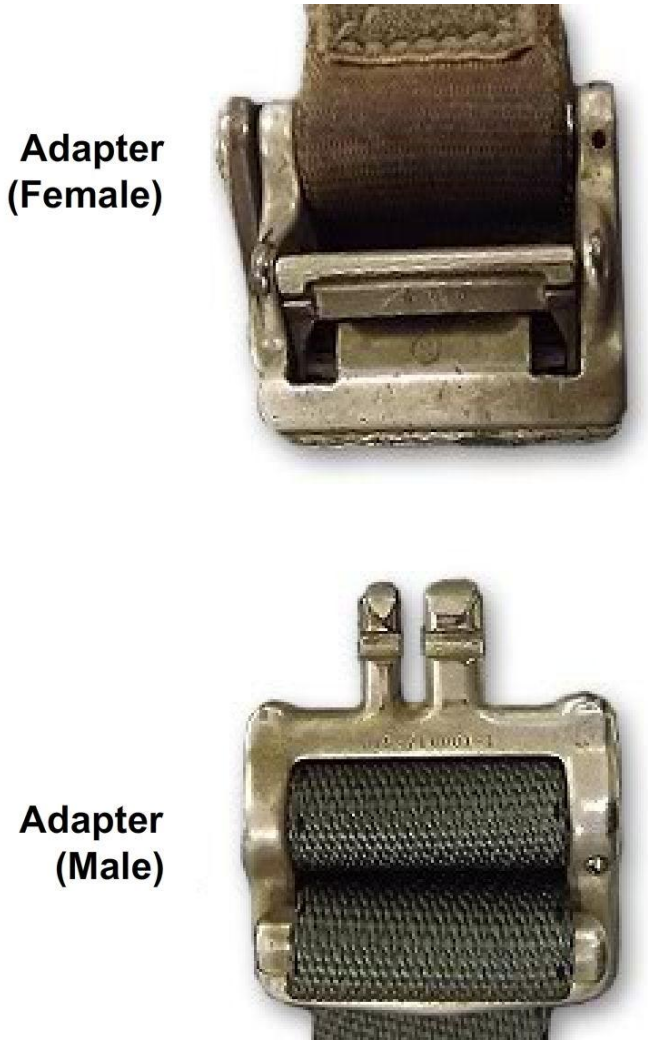


Figure 12-29 — Koch release adapter.

Description

The A/P28S-32 emergency parachute assembly (*Figure 12-30*) is composed of an aero-conical canopy, withdrawal line, deployment sleeve, suspension line stowage tray, and forward and aft risers. These items are packed into a metal rigid container closed by a lid assembly.

The multicolored (white, international orange, olive green, and sand shade) nylon canopy inflates to a 21-foot diameter and consists of 20 gores (*Figure 12-31*). The canopy is stowed in a deployment sleeve, which is attached to a withdrawal line. The withdrawal line is connected to the parachute deployment rocket motor when the assembly is installed on the seat.

The canopy has two Le-Moigne slots that control direction and forward velocity. The Le-Moigne slots are located 180 degrees apart in gores 6 and 16, and they are locked in the closed position to ensure the parachute descends vertically upon initial opening. Pulling down the two handles between the risers unlocks a toggle securing the Le-Moigne slots in the closed position. Once tension is released from the steering lines, the Le-Moigne slots open and provide forward drive to the canopy. To turn the canopy, the aircrewman pulls down on the appropriate steering line handle. Pulling down the left hand (LH) steering line handle will close the LH slot, turning the canopy left and vice versa. Pulling down both steering line handles simultaneously will close both slots, decreasing the forward velocity of the canopy.

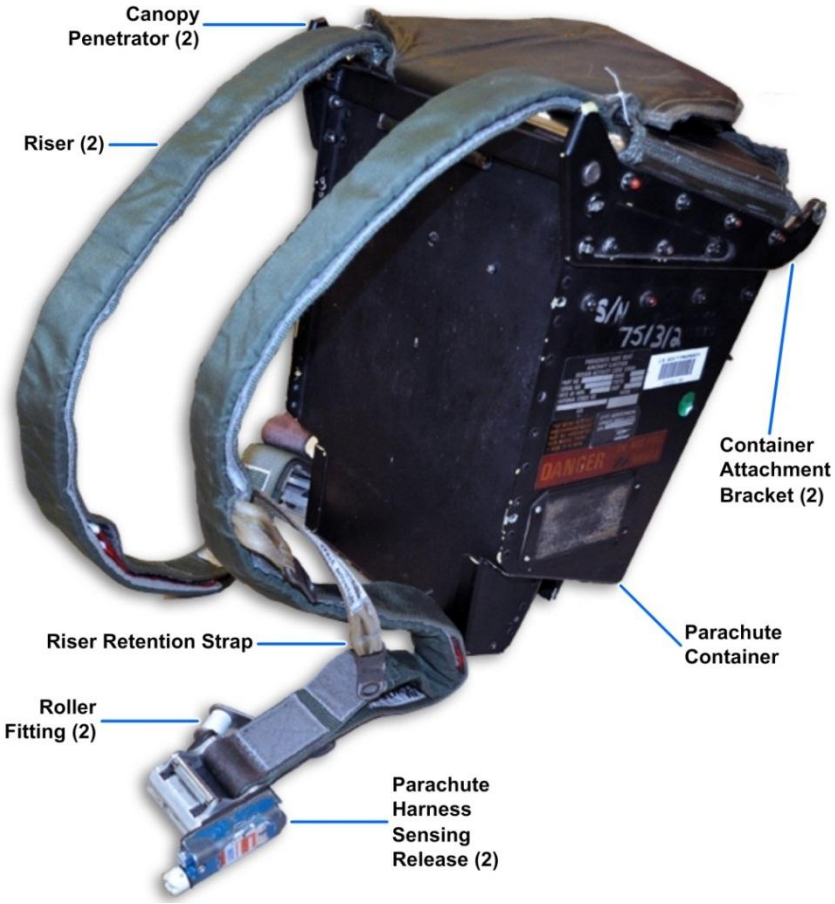


Figure 12-30 — A/P28S-32 emergency parachute assembly.

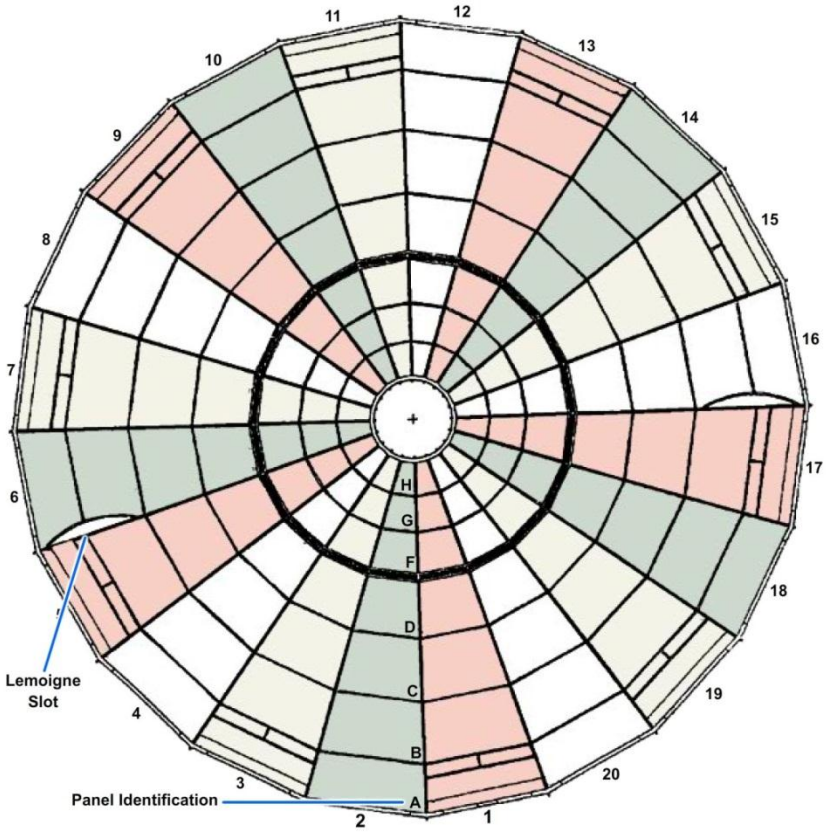


Figure 12-31 — A/P28S-32 multicolored emergency parachute assembly.

Connector links are used to attach the suspension lines to the risers. The other end of the riser assemblies connect to canopy release fittings that connect with the male fitting of the aircrewman's parachute restraint harness.

The canopy is packed into the deployment sleeve assembly, which is then packed into the rigid container. The

rigid container attaches to the ejection seat and serves as a headrest for the aircrewman. When seated in the ejection seat, the aircrew connects the canopy release fittings on the risers to the fittings on the parachute restraint harness assembly.

MT-2XX/SL Ram Air Parachute Description

The MT-2XX/SL is a Ram Air Parachute Assembly with a seven-cell, 370-square-foot canopy used as both a main and reserve. The main parachute assembly is convertible to either free fall or static line configuration (*Figure 12-32*).

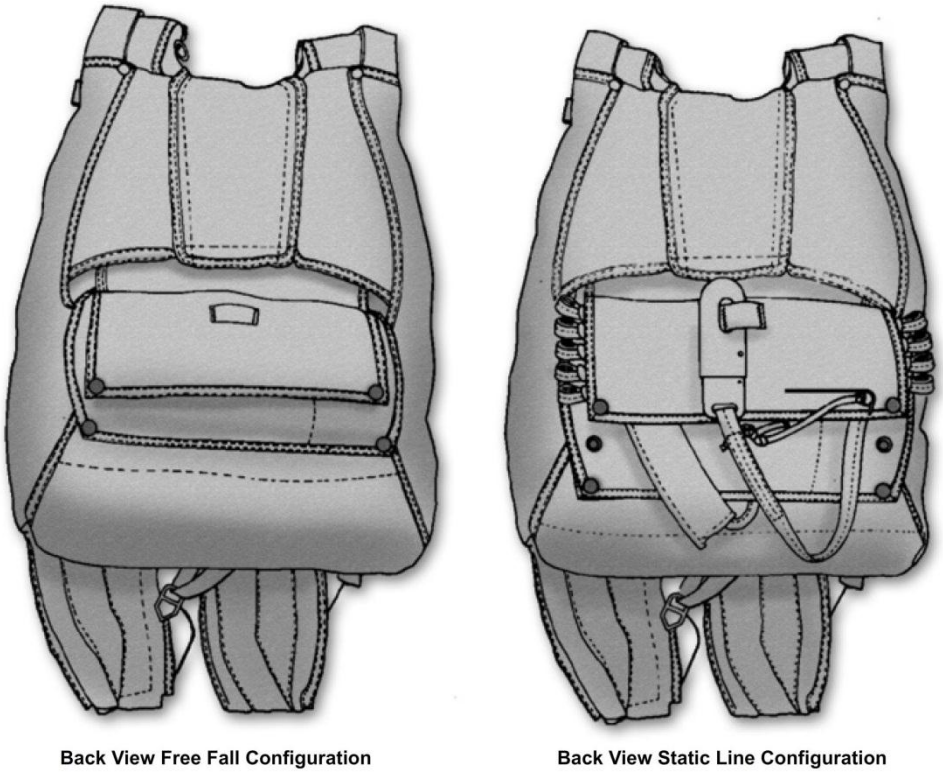


Figure 12-32 — MT-2XX/SL ram air parachute assembly.

Main Deployment System (Free Fall Configuration)

The main parachute assembly consists of a pilot parachute connected by a bridle to the seven-cell ram air canopy. A free fall deployment bag is used to house the canopy and suspension lines (*Figure 12-33*). The free fall deployment bag is packed in the main parachute compartment of the pack/harness assembly with the riser assembly attached to the pack/harness assembly using a three-ring release system. A cutaway handle can be used to actuate the three-ring release system, disengaging the riser assembly from the pack/harness assembly. There are two ways to actuate the main parachute assembly:

- Manually by using the main ripcord
- Automatically by the automatic ripcord release

The main pilot parachute has a 6¾-inch diameter crown, a 32-inch spiral spring, and is covered with a combination of nylon fabric and nylon mesh fabric. A 1-inch loop at the bottom of the main pilot

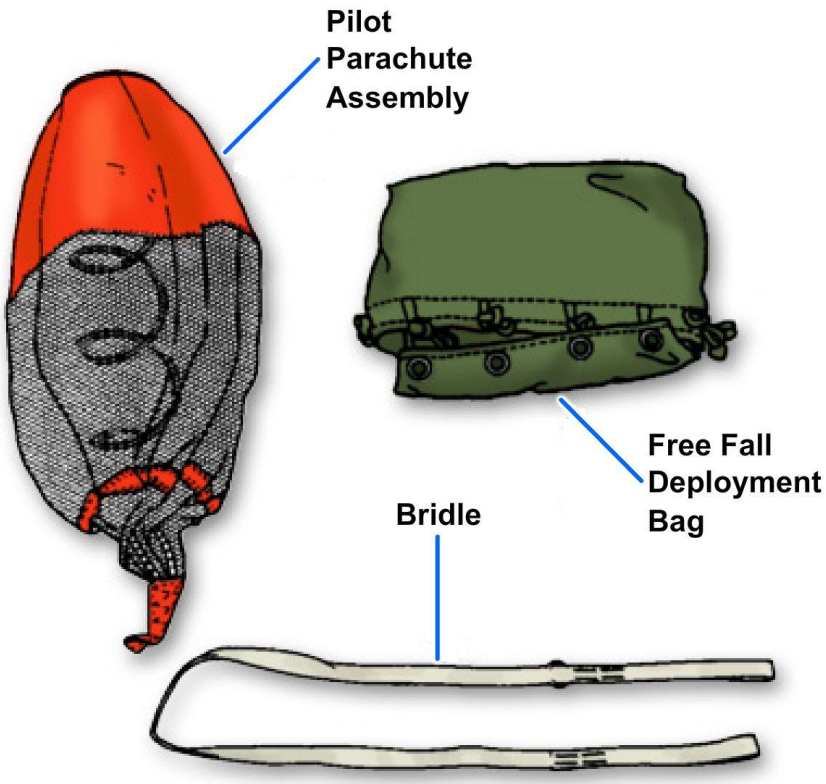


Figure 12-33 — Main deployment system (free fall configuration).

parachute is used to connect a 62-inch bridle to the main canopy assembly. The free fall deployment bag measures 17 inches by 9¾ inches and is constructed of nylon cloth. A grommet in the top of the free fall deployment bag allows the bridle to pass through the bag and attach to the canopy. The free fall deployment bag has attachment points for elastic stowage bands, which are used to lock the bag closed and stow suspension lines.

Main Deployment System (Static Line Configuration)

The main parachute assembly consists of a drogue/slider control line that runs through grommets installed in the center of the canopy and attaches to the slider on one end and to the drogue parachute on the top end (*Figure 12-34*). The inner deployment bag is used to house the canopy and drogue/slider control line. The outer deployment bag is used to house the inner deployment bag and suspension lines. A 14-foot 8-inch static line and outer deployment bag is used for deployment from the aircraft. The outer deployment bag is packed in the main parachute compartment of the pack/harness assembly with the riser assembly attached to the pack/harness assembly using a three-ring release system. A cutaway handle can be used to actuate the three-ring release system, disengaging the riser assembly from the pack/harness assembly. The main parachute may be deployed by static line only.

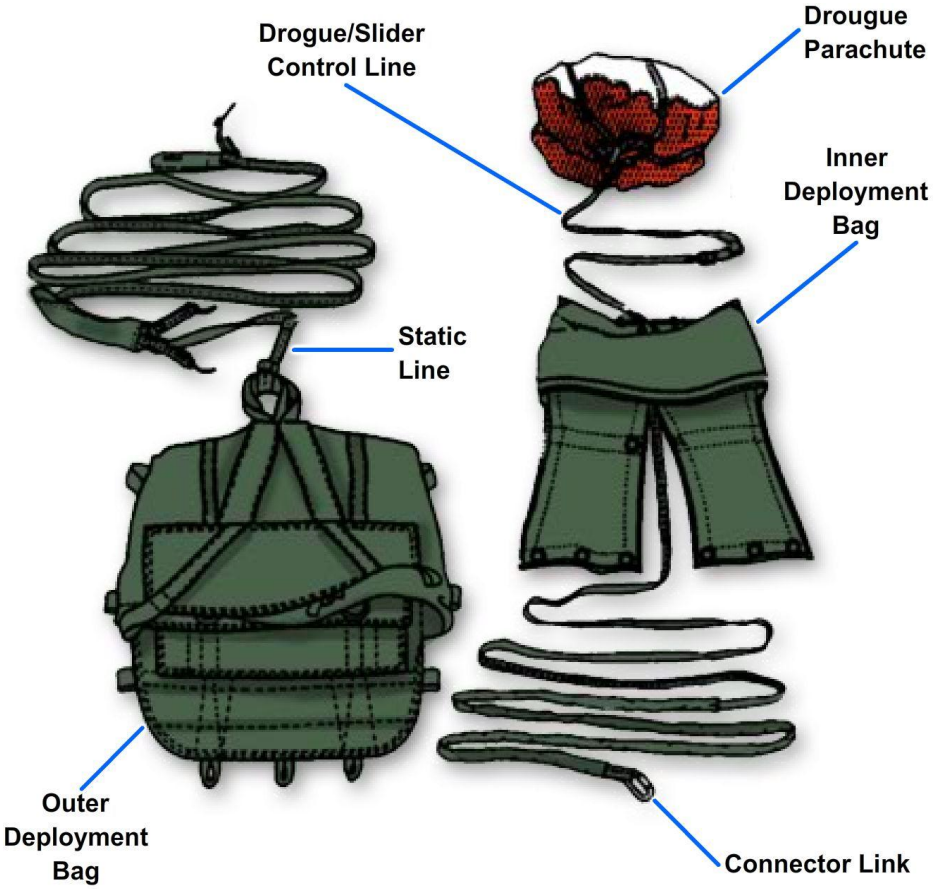


Figure 12-34 — Main deployment system (static line configuration).

The main parachute assembly is deployed by a static line anchored to the aircraft.

The outer deployment bag measures 16¾ by 10 inches and is constructed of nylon cloth. A grommet on the top of the outer deployment bag allows the drogue parachute to be secured to the static line. The outer deployment bag has attachment points for elastic stowage bands, which are used to lock the bag closed and stow suspension lines. A 1-inch loop at the bottom of the drogue parachute is used to connect the drogue/slider control line. The inner deployment bag measures 17 by 10 inches and is constructed of cotton cloth. A grommet on the top of the inner deployment bag allows the drogue/slider control line to pass through the inner deployment bag, pass through the center cell grommets and inner and outer buffer tubes on the canopy, and attach to the slider loop with a No. 6 connector link. The inner deployment bag has attachment points for 2-inch elastic stowage bands, which are used to lock the inner deployment bag closed and stow the drogue/slider control line.

Main Canopy Assembly

The main canopy assembly consists of a rectangular canopy constructed of nylon fabric with heat-set, stabilized, braided polyester suspension and steering lines; a slider for reefing; and four barrel nut-style connector links (rapide links) for connection to the main risers.

The ram air canopy is a wing. It has upper and lower surface panels connected by a series of ribs. This construction forms a rectangular-shaped canopy with seven dual openings at the leading edge known as cells. Each cell is identified numerically, 1 through 7, as shown in *Figure 12-35*. The cells allow ram air pressure between the upper and lower control surfaces, giving the canopy its shape and glide characteristics. All inner ribs have three crossports cut into them to allow spanwise air flow (the center rib has only two crossports). The outer ribs and alternating ribs through the canopy (eight in all) have load-distributing tapes and attachment loops for suspension line attachment.

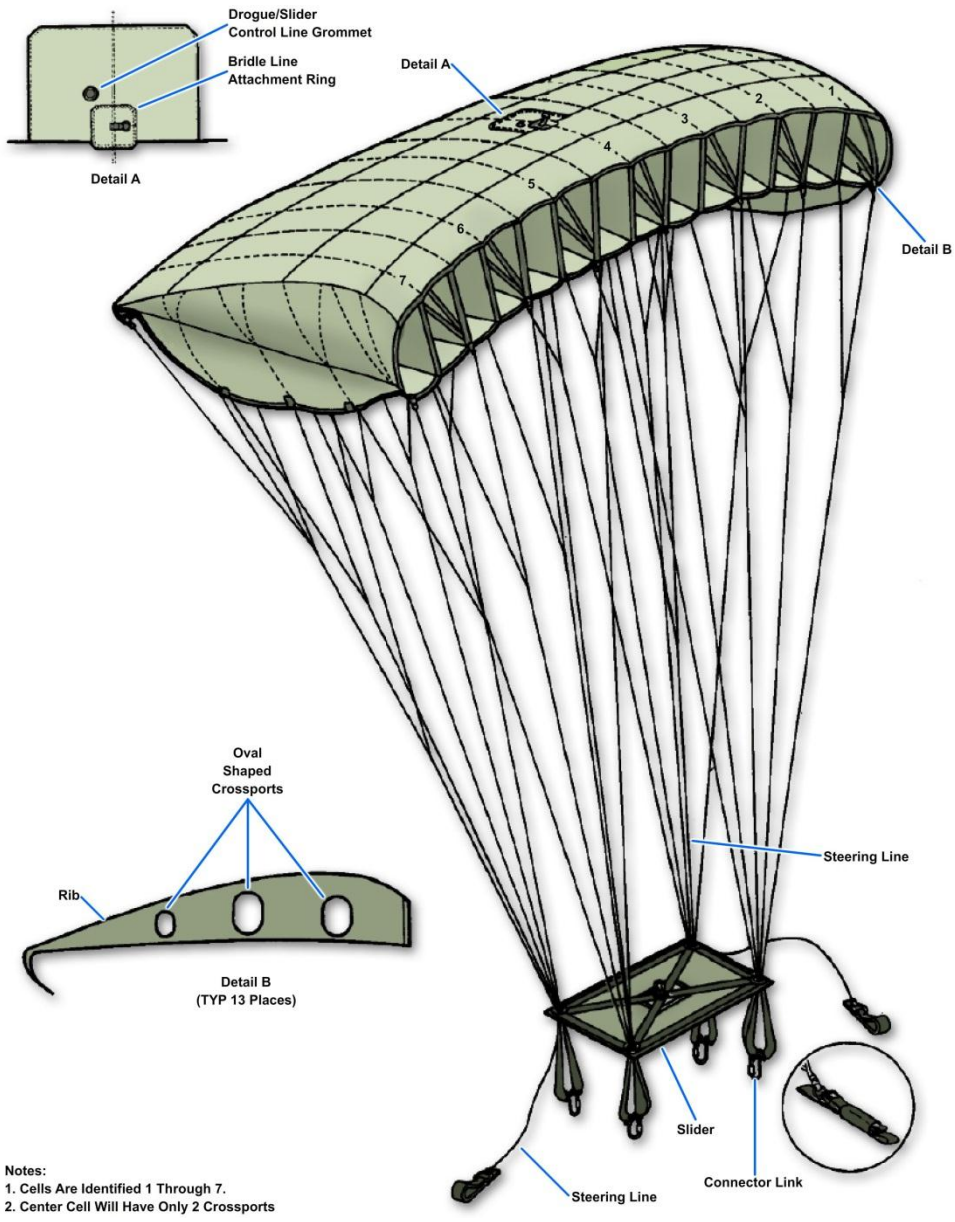


Figure 12-35 — Main and reserve canopy assembly.

The suspension lines are connected to alternate ribs at four chordwise attachment points on each rib. The lines attached to the leading edge are identified as the A lines. The lines attached just aft of the A lines are the B lines, and so on to the D lines. The lines attached to the trailing edge are the steering lines. Each set of lines along each rib (A, B, C, and D) is identified numerically 1 through 8, as shown in *Figure 12-36*; e.g., 1A, 1B, 1C, and 1D.

The center A and B lines are continuous (lines 4A, 4B, 5A, and 5B). They run directly from the fourth A line attachment point down to and around the front left connector link and up to the B line attachment point. The fifth A and B lines run from the fifth A line attachment point down to and around the front right connector link and up to the fifth B line attachment point.

The remaining A lines are attached directly to one of the front two connector links. The B lines are cascaded to the associated A lines. The C lines run directly to one of the two rear connector links, and the D lines are cascaded to associated C lines. This method of construction reduces weight, volume, and aerodynamic drag.

Two steering lines attached at the risers by guide rings are used to maneuver the canopy. Each steering line is formed by attaching five cascaded lines from the trailing edge of the canopy into one main steering line. Each steering line then runs directly to the back of the rear riser.

A stabilizer panel is attached to each outboard side of the canopy, and the first and eighth line sets descend from those stabilizer panels rather than directly from the canopy lower surface.

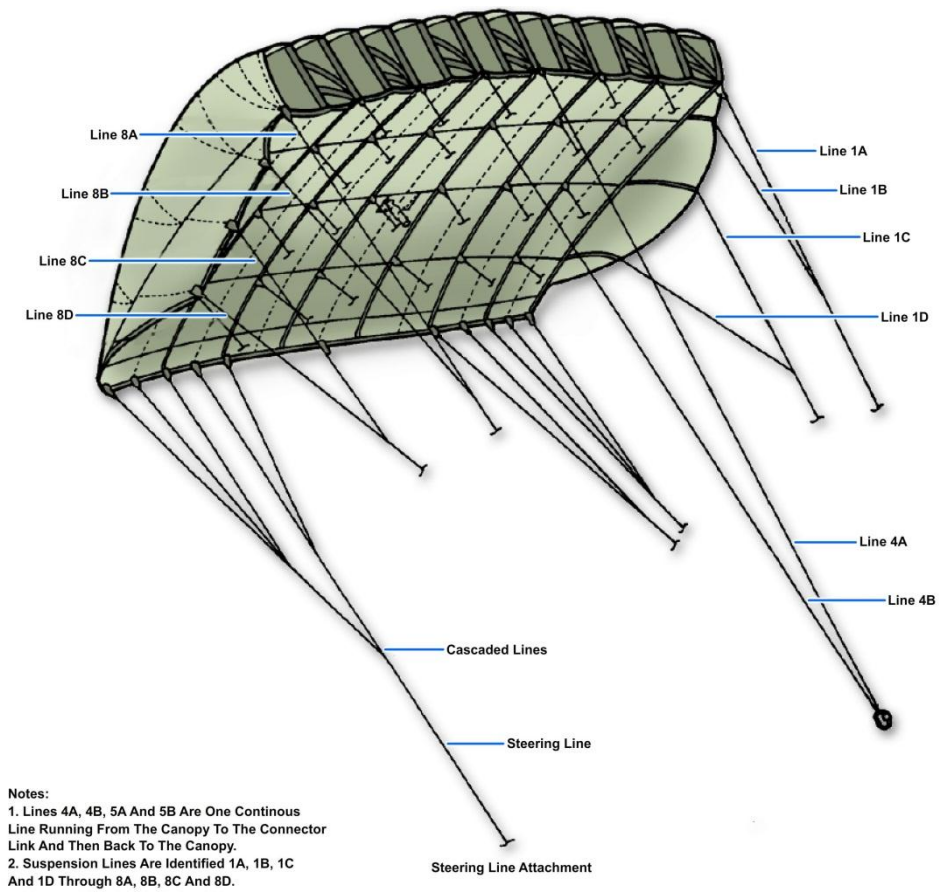


Figure 12-36 — Main and reserve canopy assembly (lines).

Slider

The slider shown in *Figure 12-36* is used for reefing; it is made of nylon fabric and measures 27 by 28 inches. All sides are reinforced with webbing. Four number eight grommets are installed at each corner. The slider has a loop attached to the center used as an attachment point for the drogue/slider control line.

Connector Link

Four number six, barrel nut-style connector links (rapide links) are used to connect the suspension lines to the risers. Each connector link has a rated tensile strength of 7,150 pounds.

Pack/Harness Assembly

The pack and harness assemblies (*Figures 12-37 and 12-38*) are integral parts of each other. The pack is divided into two compartments for the main and reserve parachute assemblies, while the harness provides attachment points for the main and reserve ripcords, main risers, cutaway handle, and accessory attachment rings.

The pack, constructed of parapack cloth, provides an upper (reserve) and lower (main) compartment for stowing parachute assemblies. Protective covers are

Figure 12-37 — Pack/harness assembly (back).

provided for the main risers, an automatic ripcord release pocket is located on the right side of the container, and the dual-purpose CYPRES Spandex pouch is located inside the reserve container.

The harness is constructed of nylon webbing and is an integral part of the pack. The harness includes eight adjustment points, two leg straps with quick-ejector snap hooks, an adjustable chest strap, an adjustable belly band, two diagonal straps, and two main slings. Two accessory attaching rings, one on each upper main sling, are used to accommodate the rucksacks, containers, and weapons. The reserve parachute assembly attaches to the reserve risers. The risers include guide rings and steering line keepers for the

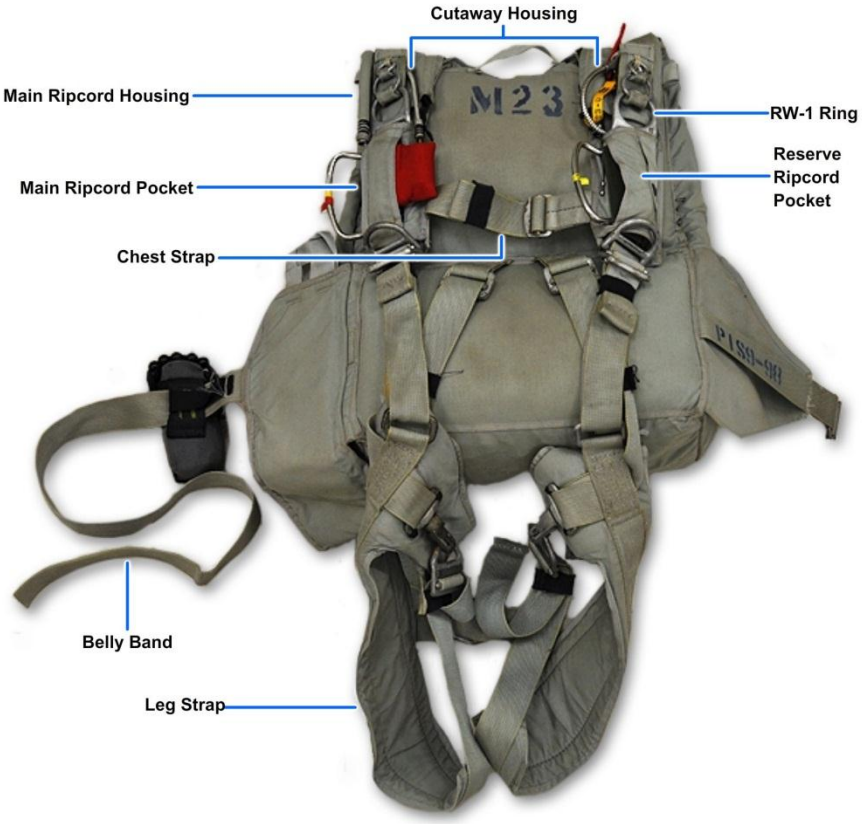


Figure 12-38 — Pack/harness assembly (front).

stowage of excess steering line. The right and left main slings serve as attachment locations for the main and reserve ripcord pockets and the cutaway handle. Also located on the main sling are the RW-1 rings, used for attaching the main riser assembly to the pack/harness assembly.

The main ripcord assembly consists of a stainless steel braided cable with two locking pins. The cable is secured to a curved ripcord handle with two swaged balls.

The reserve ripcord assembly consists of a stainless steel braided cable with two locking pins. The cable is secured to a curved ripcord handle with two swaged balls.

The cutaway handle consists of a nylon-covered cushion grip, and two plastic-coated cables. A 4½-inch length of hook and pile fastener is sewn to the cushion grip to secure the grip to the main ripcord grip pocket.

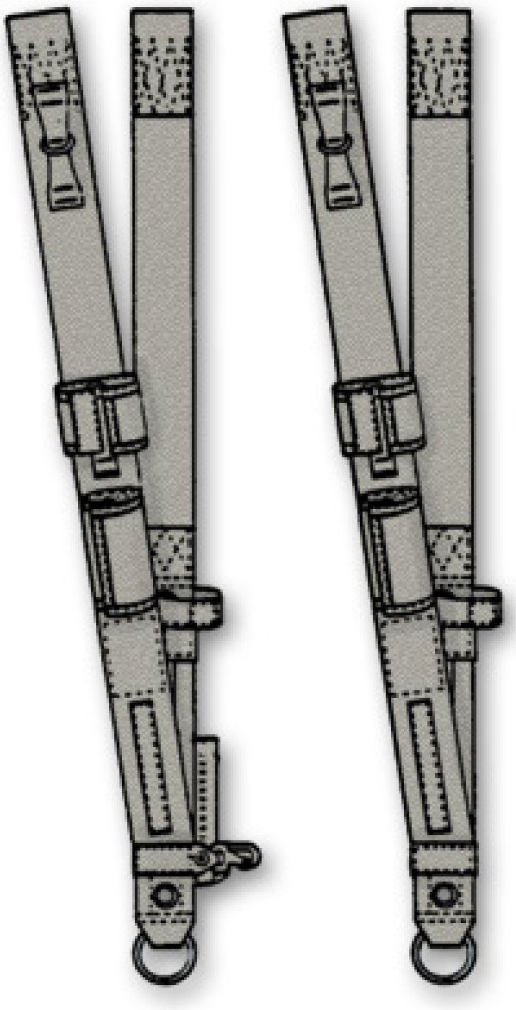


Figure 12-39 — Riser assembly.

Main Riser Assembly

The main riser assembly (*Figure 12-39*) is constructed of nylon webbing. Each riser strap is 36 inches in length. The bottom end of each riser incorporates two rings, a grommet, and a locking loop. A fluted channel is sewn to the back of the rear riser strap for stowing the cutaway cable. The back of the rear riser also incorporates steering line keepers for stowing excess steering line as well as steering line toggle keepers for stowage of steering line toggles.

Reserve Parachute Assembly

The reserve parachute assembly consists of a seven-cell ram air canopy, identical to the main canopy. The canopy is attached to the reserve risers and is packed in the upper compartment of the pack/harness assembly (*Figure 12-36)*. The reserve parachute assembly can be actuated by three methods:

- Manually by using the reserve ripcord
- Automatically by the reserve static line upon release of the main parachute after pulling the cutaway handle
- Automatically by the Military CYPRES (2) Automatic Activation Device

Figure 12-40 — Reserve deployment system.

Reserve Deployment System

The reserve pilot parachute (*Figure 12-40*) consists of a 5¾-inch diameter crown and a 19-inch spiral spring and is covered with a combination of nylon fabric and large-hole nylon mesh fabric. A 2-inch-wide by 18-foot bridle is attached to the reserve pilot parachute with a Lark's head knot, and the opposite end is sewn to the reserve deployment bag. Bridle assistor pockets are sewn on bridle. The reserve deployment bag, constructed of nylon fabric, measures 12 by 16 inches. The mouth of the bag has a guide channel, safety stow loop, and grommets for locking the bag closed. The suspension lines are stowed in the suspension line stowage pocket.

MC-6 Static Line Parachute System

Description

The MC-6 Static-Line Parachute System is a two-part parachute system that composed both the MC-6 main parachute and the T-11 reserve parachute. The MC-6 parachute system weighs 42 pounds and is capable of supporting 400 pounds. In a typical mission, aircrew can drop from as low as 500 feet above ground level (AGL), and at aircraft speeds between 130 to 150 knots indicated airspeed (KIAS). The MC-6 system includes a main canopy assembly, a reserve canopy assembly, pack trays, a harness assembly, risers, a deployment bag, and a universal static line.

MC-6 Main Parachute

The MC-6 main parachute (*Figure 12-41*) is located on the back of the parachutist. Depending on the jumper's total weight and drop altitude, its rate

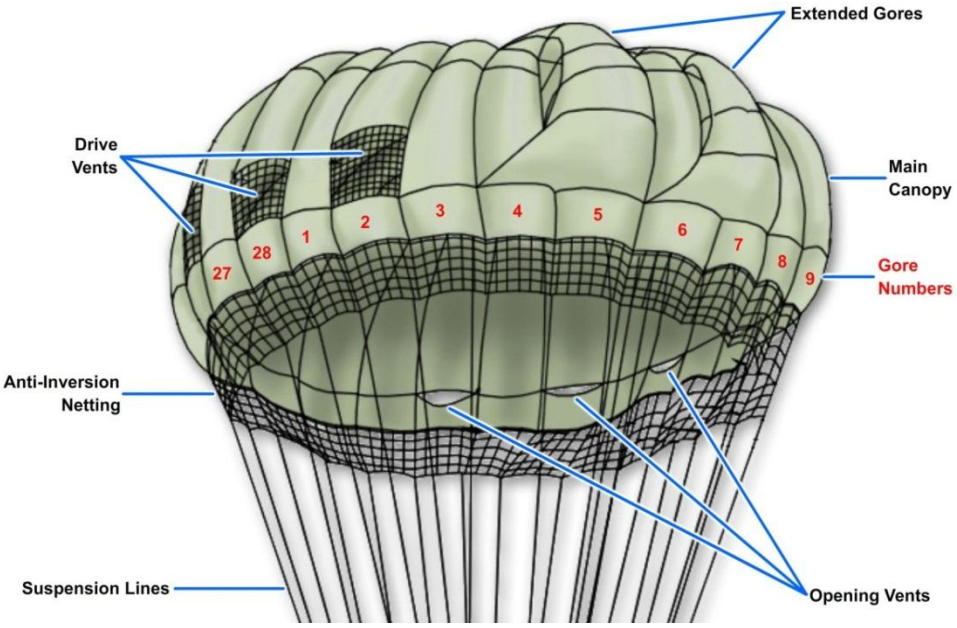


Figure 12-41 — MC-6 main parachute.

of decent is between 14.5 to 18.5 feet per second. The main parachute has a forward speed of 10 knots and can complete a 360-degree turn in 5 seconds.

Main Canopy

The MC-6 main canopy has a 32-foot nominal diameter and is constructed of low-permeability nylon parachute cloth. The canopy consists of 28 gores consisting of four panels per gore with the exception of the four extended gores, which consist of seven horizontal and two vertical panels. The four extended gores are located on gores 4-5, 6-7, 21-22, and 23-24. When the jumper pulls either the left or right control line toggle, it closes the extended gores, which redirects the airflow through the opposite extended gores to provide turning capability.

Six opening vents located on the front canopy gores 9,11,13,15,17, and 19 prevent the front of the canopy from collapsing, improving the forward drive and stability of the canopy. Three drive vents located on rear of the canopy with mesh netting sewn into gores 2, 26, and 28 allow for positive airflow through the canopy, which provides the canopy with its forward drive.

There are 28 suspension lines that are 21 feet in length, made with nylon cord, and connected to the connector links from the suspension line attaching loops on the anti-inversion netting.

Figure 12-42 — Pack tray assembly.

Figure 12-43 — Harness assembly.

Pack Tray Assembly

The pack tray assembly (20 x 14 x 14 inches) (*Figure 12-42*) is constructed of duck textured nylon fabric and uses four pack closing flaps with each flap containing one grommet.

Harness Assembly

The harness assembly (*Figure 12-43*) is made of nylon webbing and consists of right and left upper main lift web assemblies and the lower saddle assembly.

Riser Assembly

The MC-6 uses two riser assemblies (*Figure 12-44*) with a

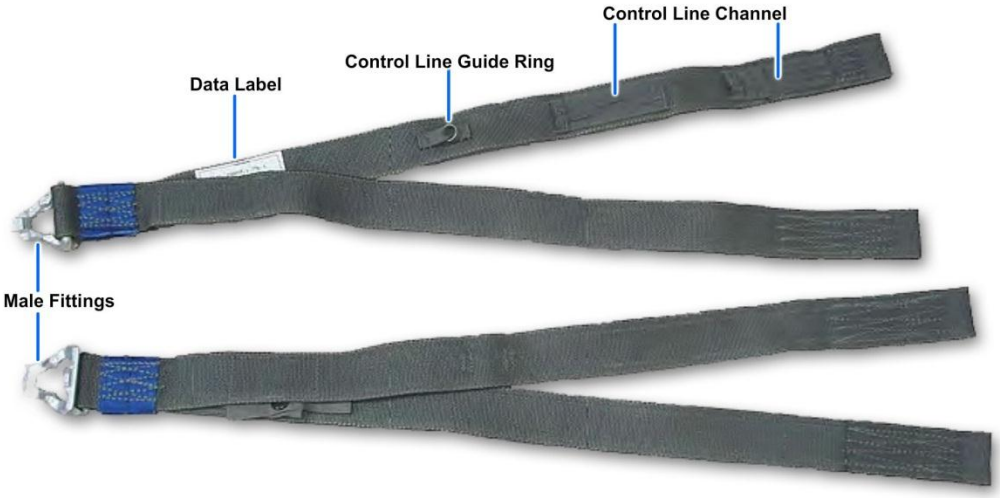


Figure 12-44 — Riser assembly.

finished length of 30 inches and a tensile strength of 5,500 pounds. The male fitting is permanently attached to the riser assembly. When attached to the canopy, the riser assemblies provide four individual risers.

Deployment Bag

The MC-6 main parachute is packed in a deployment bag (*Figure 12-45*). The deployment bag is constructed of 8.2-ounce sateen cloth.

Figure 12-45 — Deployment bag.

Universal Static Line (USL)

The main static line (*Figure 12-46*) is a modified 15-foot universal static line (USL) that contains a curved pin inside a protective cover. The USL extension is 5 feet long. The USL snap hook is attached to either the universal static line modified (with curved pin) or the USL extension. The static line protective sleeve keeps the static line from getting damaged during deployment.

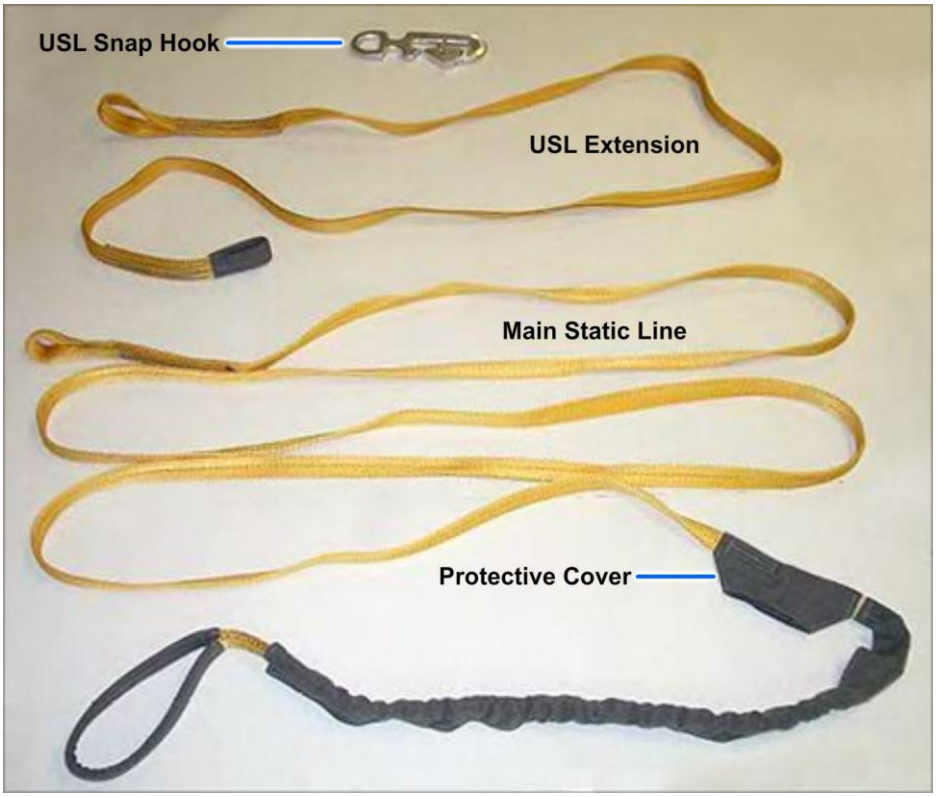


Figure 12-46 — Universal static line.

T-11 Reserve Parachute

The T-11 reserve parachute (*Figure 12-47*) has been adapted for use with the MC-6 Static-line Parachute System. The T-11 shape is designed to resist malfunctions and to open rapidly, providing the benefit of minimum altitude loss.

The T-11 reserve parachute is a chest-mounted ripcord center-pull reserve parachute. In an emergency situation, the T-11 reserve parachute may be deployed with either hand.

The T-11 reserve parachute provides a rate of decent of 14 to 18 feet per second. Because the T-11 reserve deploys with its lower lateral band even with the hem of the main parachute, the risk of air stealing by a malfunctioned main parachute is reduced. Tests have proven to be highly successful with the reserve controlling the descent, even with a fully inflated main parachute.

The T-11 reserve parachute has a lightweight construction that allows the reserve to align with the airflow at low speeds. In the case of a low-speed malfunction, such as some main canopy damage, the reserve will rise and inflate faster.

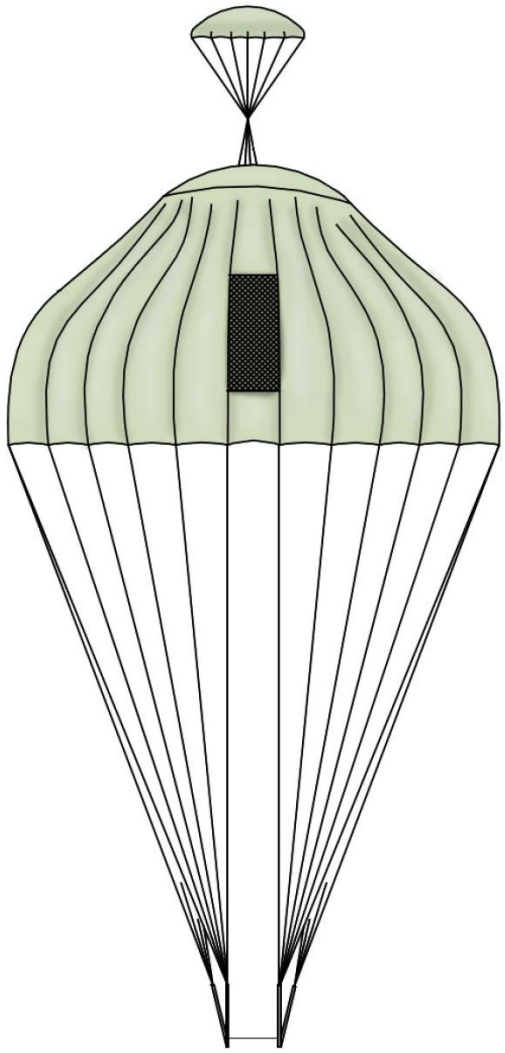


Figure 12-47 — T-11 reserve parachute.

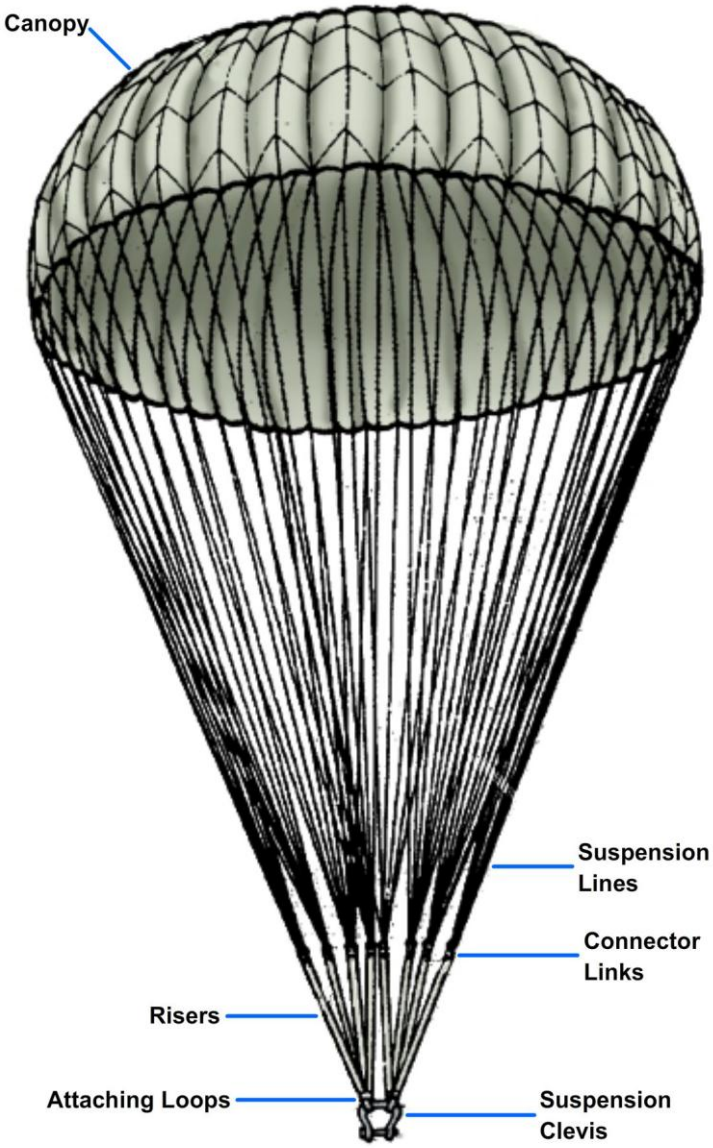


Figure 12-48 — Parachute canopy assembly.

G-12 Cargo Parachute

Description

The G-12 cargo parachute is a heavy-capacity parachute designed for the delivery of bulk-type platform loads. The G-12 cargo parachute assembly weights 128 pounds and is capable of supporting 2,200 pounds. The G-12 cargo parachute was designed for deceleration and stabilization of bulky-type platform loads and can be used for delivering fragile items.

The canopy (*Figure 12-48*) consists of a 64-foot diameter flat-circular nylon canopy. It consists of 64 gores with 8 sections per gore and 64 suspension lines. The gores and suspension lines are numbered clockwise when viewed from the canopy vent (*Figure 12-49*).

Two riser assemblies, each composed of four suspension risers, terminate in two riser attaching loops connected to a suspension clevis. Each of the eight suspension risers is connected to eight suspension lines by connector links.

The deployment bag is of the locking-closure type. It measures 24 inches wide by 36 inches deep by 10 inches high and is used for packing the G-12 parachute.

The G-12 parachute uses a 15-foot-long static line, a 68-inch diameter nylon pilot chute, and a 111-inch-long deployment line.

LIFE PRESERVERS

Life preservers are worn by aircrew members on overwater flights. Their function is to keep survivors afloat until a raft can be reached or a rescue team arrives. Proper inspection, maintenance, and handling of life preservers are necessary to prevent any possible malfunction that could result in the loss of life.

WARNING

Never wear a life preserver under any garment. Always wear a life preserver as the outermost garment when flying. Wearing a life preserver under any item of clothing or equipment may cause serious injury or death.

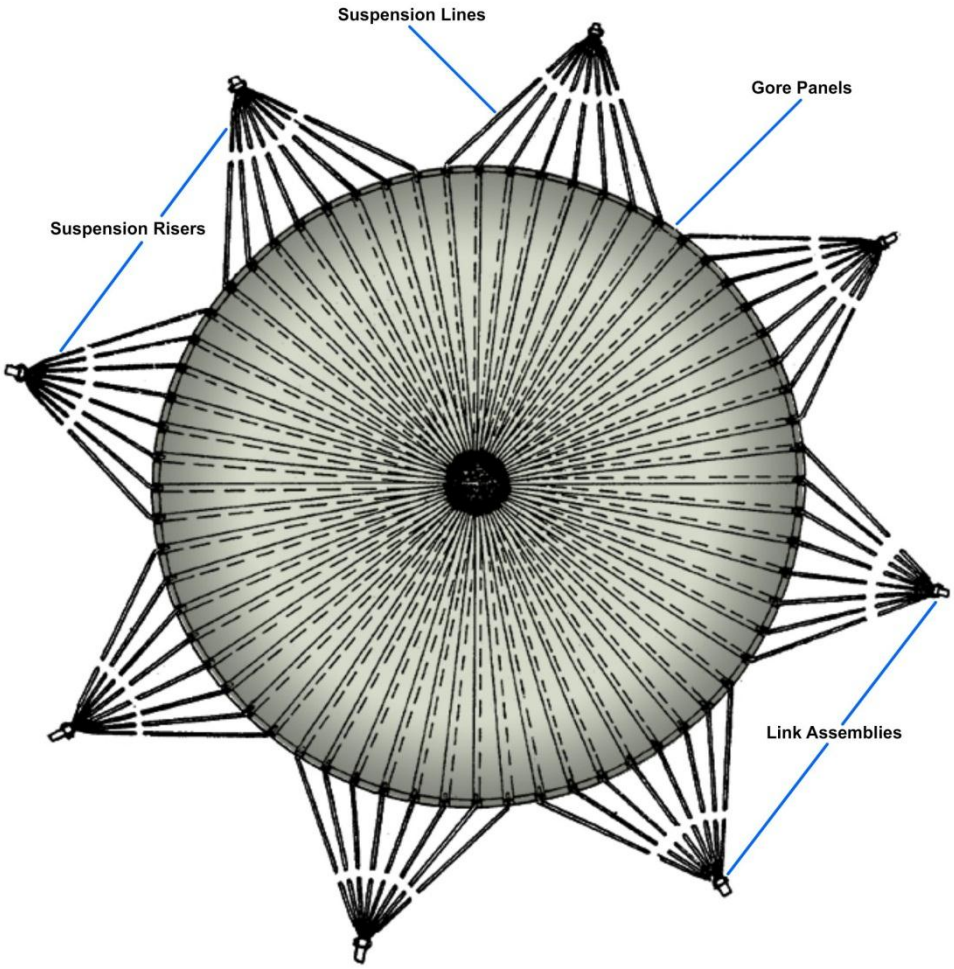


Figure 12-49 — Suspension line and gore arrangement and numbering.

LPU-32/P Life Preserver Assembly

> **WARNING**
>
> The LPU-32/P life preserver is not suitable for use by small children in Naval aircraft.

Description

The LPU-32/P life preserver assembly (*Figure 12-50*) is authorized for use by passengers and troops in helicopter or transport-type aircraft for sea survival situations. It is designed such that one size fits all.

The LPU-32/P life preserver assembly consists of a life preserver yoke assembly and additional survival items, each of which must be ordered separately to make up the complete system. The LPU-32/P life preserver Assembly weighs approximately 4 pounds and provides a minimum of 40 pounds of buoyancy. It consists of flotation assembly, two inflators, and a casing cover assembly, which includes the belt assembly and the survival items pouch. Donning or doffing does not require removing personal effects, such as helmets or eyeglasses.

The dual-cell, yoke-type flotation assembly is constructed of a heat-sealed, polyurethane-coated nylon cloth. A fire-retardant, aramid cloth casing protects the bladder. It is equipped with an oral inflation tube, a check valve, and a manifold stem assembly.

The waist belt assembly consists of an adjustable belt made of nylon webbing, a nylon slide (loop-loc), a tri-glide, and side release. A 12-inch locally manufactured extension belt is authorized for use with winter garments, battle-dressed troops, or larger passengers.

The LPU-32/P life preserver inflation assembly consists of two Type II 16 gram CO_2 cylinders and inflators. Each inflator is connected and secured to the valve stem on the flotation assembly with a cap nut; gaskets prevent leaking between valve stem, inflator, CO_2 cylinder, and cap nut. The manifold stem is equipped with a check valve to prevent leakage.

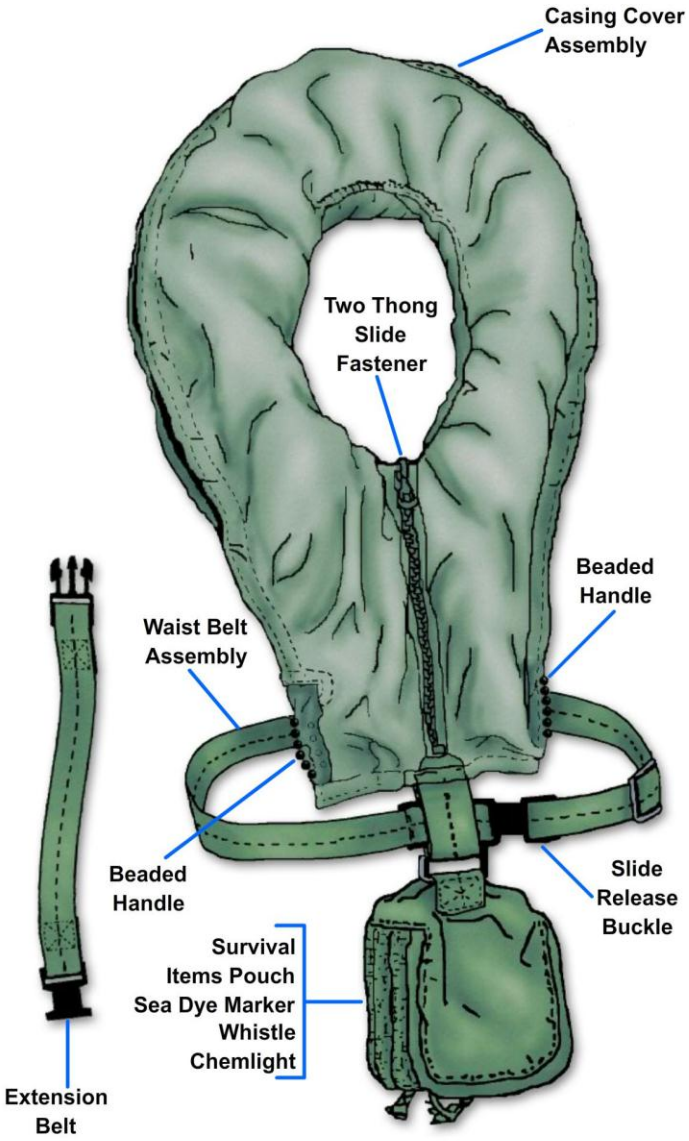


Figure 12-50 — LPU-32/P life preserver assembly.

The survival items pouch consists of fire-retardant aramid cloth (same as the casing), two pull slide fasteners, and two grommets for securing survival items. The survival items include a sea-dye marker, a whistle, and a chemical light with attached lanyard.

The LPU-32/P is the preferred passenger life preserver on Naval fixed-wing and rotary-wing aircraft.

The LPU-32/P is manually inflated by pulling both of the beaded handles down. Survival items shall only be used as required by an emergency. In an emergency situation, the oral inflation tube should be used to top-off an inflated preserver, maintain inflation of a leaky preserver, or inflate a preserver when the CO_2-actuated inflator malfunctions or fails. The oral inflation tube is also used to inflate a preserver with air during an inspection test, to deflate a preserver in preparation for packing, or to relieve excess pressure.

To don the LPU-32/P life preserver, proceed as follows:

1. Unfasten LPU-32/P all the way and place over head.
2. Fasten buckle and adjust belt. Passengers in winter garments, battle-dressed troops, or larger passengers may require the use of a locally manufactured extension belt.
3. For passengers issued the LPU-32/P incorporated with a vertical adjustment strap for use with outer tactical vest (OTV) or modular tactical vest (MTV), adjust the vertical waist belt strap so the waist belt is below the OTV or MTV. For passengers not wearing the OTV or MTV, the vertical adjustment strap should be adjusted so the waist belt sits at the waist.
4. Fasten all the way up.
5. Inflate the preserver by pulling both beaded handles down or by using oral inflation valves.

NOTE

Donning does not require removing helmet or other personal effects. The LPU-32/P is designed to be worn either way; there is no front or back.

NOTE

Either slide fastener on survival items pouch may be used to remove survival items, as required.

LPU-34/P Low-Profile Flotation Collar

Description

The LPU-34/P low-profile flotation collar (LPFC) life preserver, shown in *Figure 12-51*, is equipped with two manually operated inflation devices. The LPU-34/P is designed as a constant wear item for use with compatible flight clothing and other crew equipment. It weighs 3¼ pounds and provides a minimum of 65 pounds of buoyancy.

The LPU-34/P consists of an exterior cover assembly, inflation shell assembly, and a flotation assembly. The flotation assembly consists of two independent inflatable bladders, each of which is equipped with a manual inflation device and an oral inflation valve. The bladders are packed in a black cloth inflation shell assembly. Four straps on the inflation shell assembly pass through grommets on the exterior cover assembly to attach the LPU-34/P to the survival vest. A beaded handle that connects to an inflation device by lanyard is mounted on each side of the exterior

Figure 12-51 — LPU-34/P life preserver assembly.

cover to initiate inflation of the life preserver. Two additional straps adjust a plastic buckle, which snaps across the wearer's chest to help keep the LPU-34/P in position when worn.

The black cloth inflation shell assembly contains the two inflatable bladders. The design of the shell assembly provides the shape for the flotation collar. The inflation valve stem and oral inflation tube of each bladder extend through openings in the shell assembly. A manual inflation device is secured to each valve stem by a cap nut, which also serves as a cap for the valve stem. When installed, each inflation device and its CO_2 cylinder are wrapped in a protective cover. The oral inflation valve tubes, which are provided as backup to CO_2 cylinder inflation, are retained by inserting the top of each tube in retainer loops attached to the inflation shell assembly.

The LPU-34/P LPFC is designated for use by aircrew personnel operating aircraft that are not equipped with ejection seat systems. It is designed for constant wear with compatible flight clothing and equipment. The LPU-34/P is inflated by pulling the beaded handles in a natural downward motion. Each beaded handle is connected by a lanyard to the actuating lever of an inflation device. Pulling the handles initiates slide fastener separation on the exterior cover and causes the $CO2$ cylinder to be punctured, inflating the bladders. The slide fastener on the exterior cover continues to separate as the bladders inflate to provide head-out-of-water buoyancy.

NOTE

The exterior cover must be manually opened prior to attempting to inflate the bladders with the oral inflation tubes.

WARNING

The LPU-36/P life preserver contains an automatic inflation device and is configured for use only in aircraft with ejection seat systems.

In an emergency situation, the oral inflation tubes may be used to top off the inflated bladders, maintain inflation in a leaky bladder, or inflate a bladder if an inflation device malfunctions. The oral inflation tube may also be used to inflate the bladders during an inspection test or to evacuate air to perform packing.

LPU-36/P Low-Profile Flotation Collar Life Preserver

Description

The LPU-36/P low profile flotation Collar (LPFC) life preserver, shown in *Figure 12-52*, is designed as a constant wear item for use with survival vests and other aircrew equipment. The LPU-36/P weighs 3¼ pounds and provides a minimum of 65 pounds of buoyancy. There are no survival items attached to the life preserver, and it does not interfere with removal of a non-integrated parachute harness.

The LPU-36/P consists of multiple components compactly packed into an exterior cover assembly. The flotation

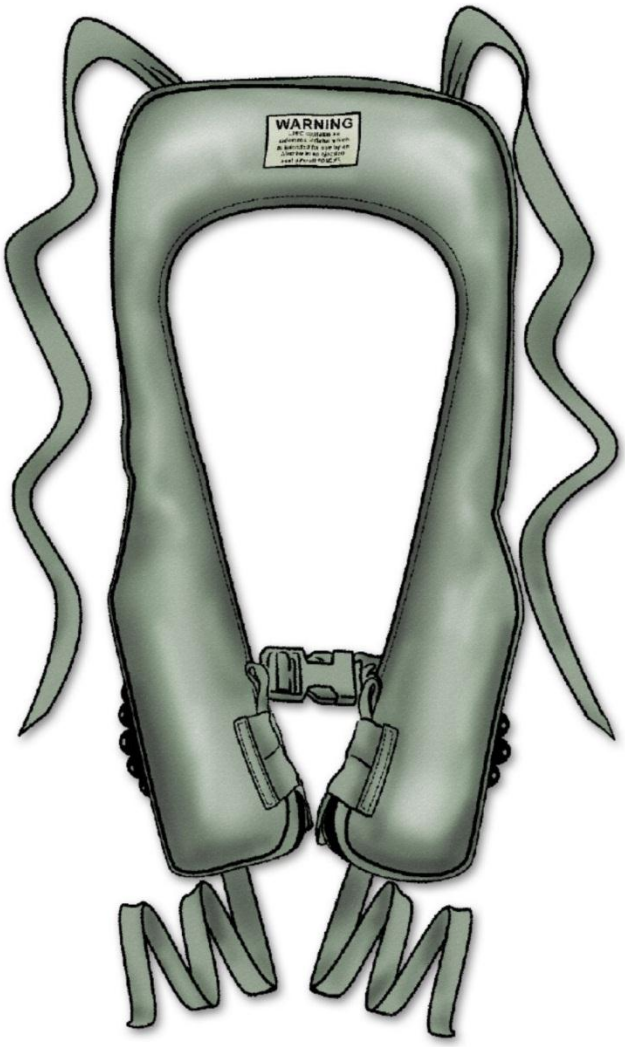


Figure 12-52 — LPU-36/P life preserver assembly.

assembly consists of two independent inflatable bladders, each with an FLU-8 (series) automatic/manual inflator and an oral inflation valve. The bladders are packed inside a black cloth inflation shell assembly. Four straps on the inflation shell assembly pass through grommets on the exterior cover assembly to attach the LPU-36/P to the modified torso harness or survival vest. Two additional straps adjust a plastic buckle that snaps across the wearer's chest to keep the LPU-36/P in position when worn.

The primary method of initiating inflation is the manual mode, pulling both beaded handles in a natural downward motion. Each beaded handle is connected by a lanyard to the actuating lever of the inflator. Pulling the handles initiates slide fastener separation on the exterior cover and causes the CO2 cylinders to be punctured, inflating the bladders. The slide fastener securing the exterior cover continues to separate as the bladders inflate.

LIFE RAFTS

Naval aircraft that make operational flights over water are required to carry enough life rafts to carry all the assigned crew plus passengers. Life rafts are manufactured in various sizes and configurations to meet the demands of all types of aircraft.

Pneumatic life rafts are compact assemblies that can be stowed in a small area. They should be stowed so they are easy to get to, preferably near an emergency exit. Never stow a life raft under other equipment or cargo or near batteries. Protect them from sources of heat, such as heaters, engines, auxiliary power units, and electronic tubes.

If the aircraft flight manual designates a storage place for rafts, this space should be used. Whenever possible, stow rafts in the same places in all aircraft of the same model. This allows new crewmen to know the location of the rafts and thus avoid confusion in the event of a ditching situation.

One-Man Life Rafts

One-man life rafts are used with various soft and hard types of survival kits. They are intended for use by aircrew members forced down at sea. They can also be used when forced down over land for crossing rivers and streams, or as a shelter.

LRU-23/P Life Raft Assembly

The LRU-23/P life raft assembly (*Figure 12-53*) is intended for use by aircrew personnel and is

Figure 12-53 — LRU-23/P life raft assembly.

stowed in individual seat survival kits. The LRU-23/P is designed to accommodate one person and provides insulation against low air and water temperatures. The LRU-23/P is manufactured by RFD Ltd. and is supplied by Martin-Baker Ltd.

The three main components of the life raft are the flotation chamber, the double-layer floor, and the double-layer canopy. The components are constructed of dark blue, single-ply, polyurethane-coated nylon fabric and assembled using radio frequency welding techniques. This type of fabric and construction reduces the weight and bulk of the life raft, enhancing its adaptability for use in seat survival kits.

LRU-29/P22P-20 Sealed Life Raft Assembly

The LRU-29/P22P-20 sealed life raft assembly (*Figure 12-54*) is a vacuum packaged LRU-16/P one-person life raft. The LRU-16/P raft is re-designated after vacuum packaging by the manufacturer of the A/P22P-20 crew backpack assembly. The life raft is constructed of blue-colored, polyurethane-coated nylon fabric that is assembled using radio frequency welding techniques. The life raft comes with an inflatable floor and weather shield for insulation from the elements. A FLU-10 zero-leak inflator is included.

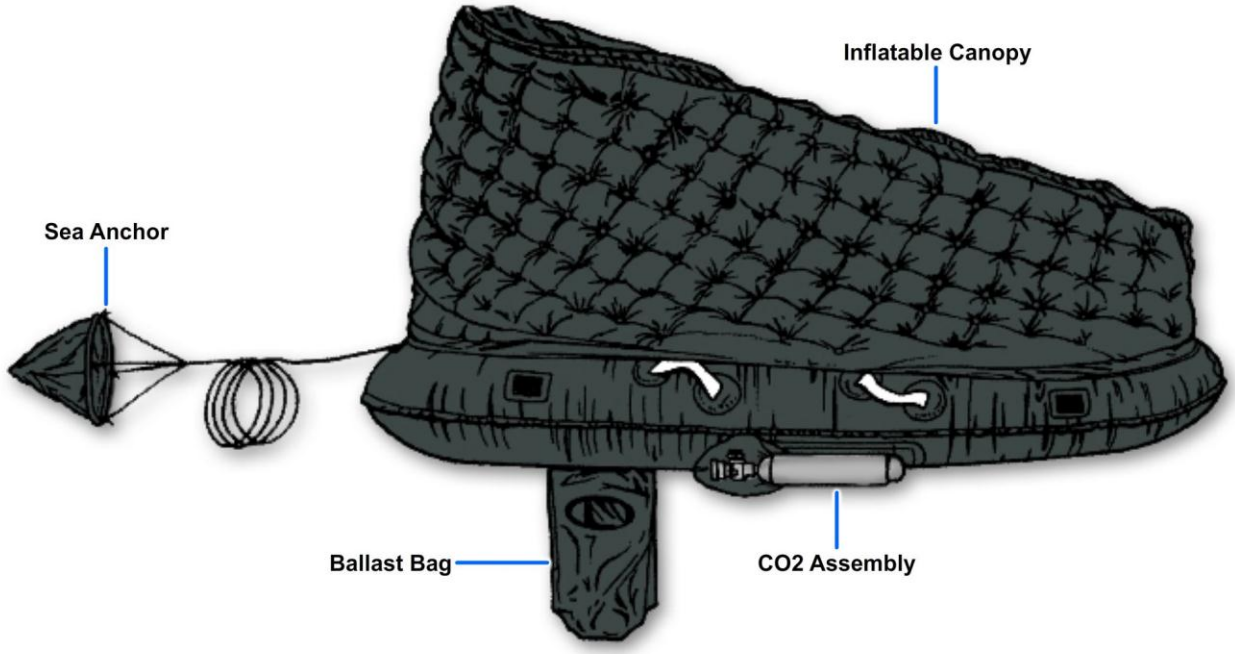


Figure 12-54 — LRU-29/P22P sealed life raft assembly.

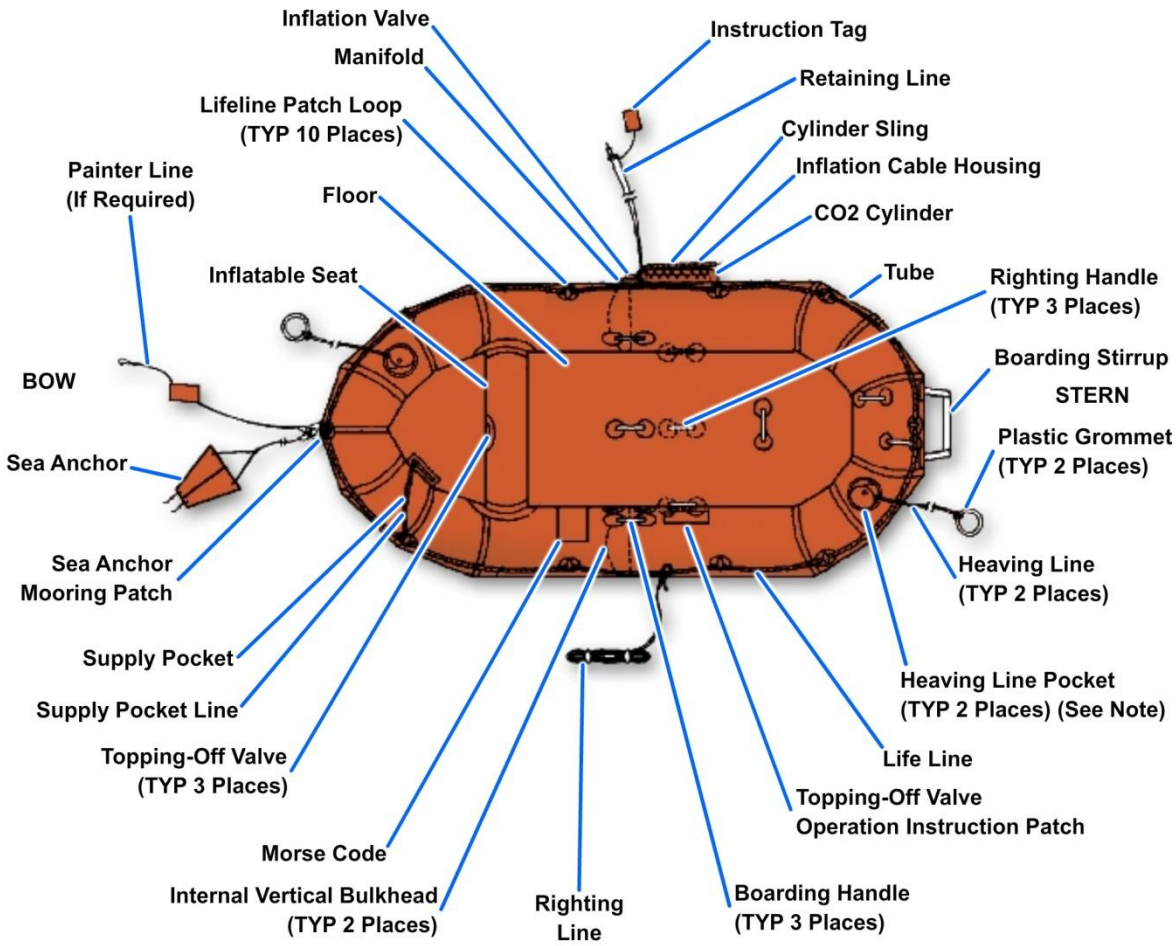
Multiplace Rafts

Multiplace life rafts vary in size and in the quantity of equipment they carry.

The Chief of Naval Operations (CNO) has established survival equipment lists as standards to be used by all concerned. These lists provide the equipment necessary for effective 24-hour survival capability.

LRU-12/A Life Raft Assembly

The LRU-12/A life raft assembly (*Figure 12-55*) consists of an inflation assembly (carbon dioxide cylinder and inflation valve) and a four-man raft. Two types of carbon dioxide cylinders and four types of inflation valves are approved for service use. The life raft is made up of a two-compartment main tube; an inflatable seat attached to the main tube; a non-inflatable floor attached to the bottom of the main tube and inflatable seat; and a sea anchor, which is used to retard drifting. A lifeline, a righting line, a supply pocket, and a combination supply pocket and bailer are attached to the main tube.



NOTE: Newly Procured LRU12/A Liferaft Assemblies Will Be Configured With Heaving Line Assemblies.
Earlier Configurations Without Heaving Lines Will Be Considered Serviceable.

Figure 12-55 — LRU-12/A life raft assembly.

Boarding and righting handles are attached to the main tube and the floor. Emergency survival equipment and raft accessories, stowed in accessory containers, are provided for the safety and survival of the aircrewmen. The lifeline also provides a means for securing the accessory containers to the life raft. Topping-off valves are located on the main tube and inflatable seat.

The LRU-12/A life raft assembly is inflated by pulling the inflation assembly actuating handle, located under the carrying case end flap. The LRU-12/A life raft assembly (raft compartment installation) is automatically inflated and ejected after the raft compartment door has been released. After boarding, the inflatable seat should be inflated through the topping-off valves with the hand pump provided in the accessory container.

The LRU-12/A life raft assembly can either be dropped to survivors or used by aircrewmen in the event of an aircraft ditching emergency. The raft is stowed in a readily accessible area inside the aircraft fuselage on applicable aircraft.

Survival items are intended to provide a means for sustaining life, for aiding escape and evasion, and for suitable detection capability. Survival items may be packed in life rafts, droppable kits, and kits intended to be carried or worn by the aircrewmen, or they may be individually carried.

With a few minor exceptions, the equipment and survival items carried in the LRU-12/A life raft assembly differ from those carried in other rafts mainly in the quantity carried.

Multiplace Life Rafts (MPLRs), LRU-30A/A (8-Man), LRU-31A/A (12-Man), AND LRU-32A/A (20-Man)

Description

The mulitplace life rafts (MPLRs) are intended for use by aircrewmembers and passengers forced down at sea (*Figure 12-56*).

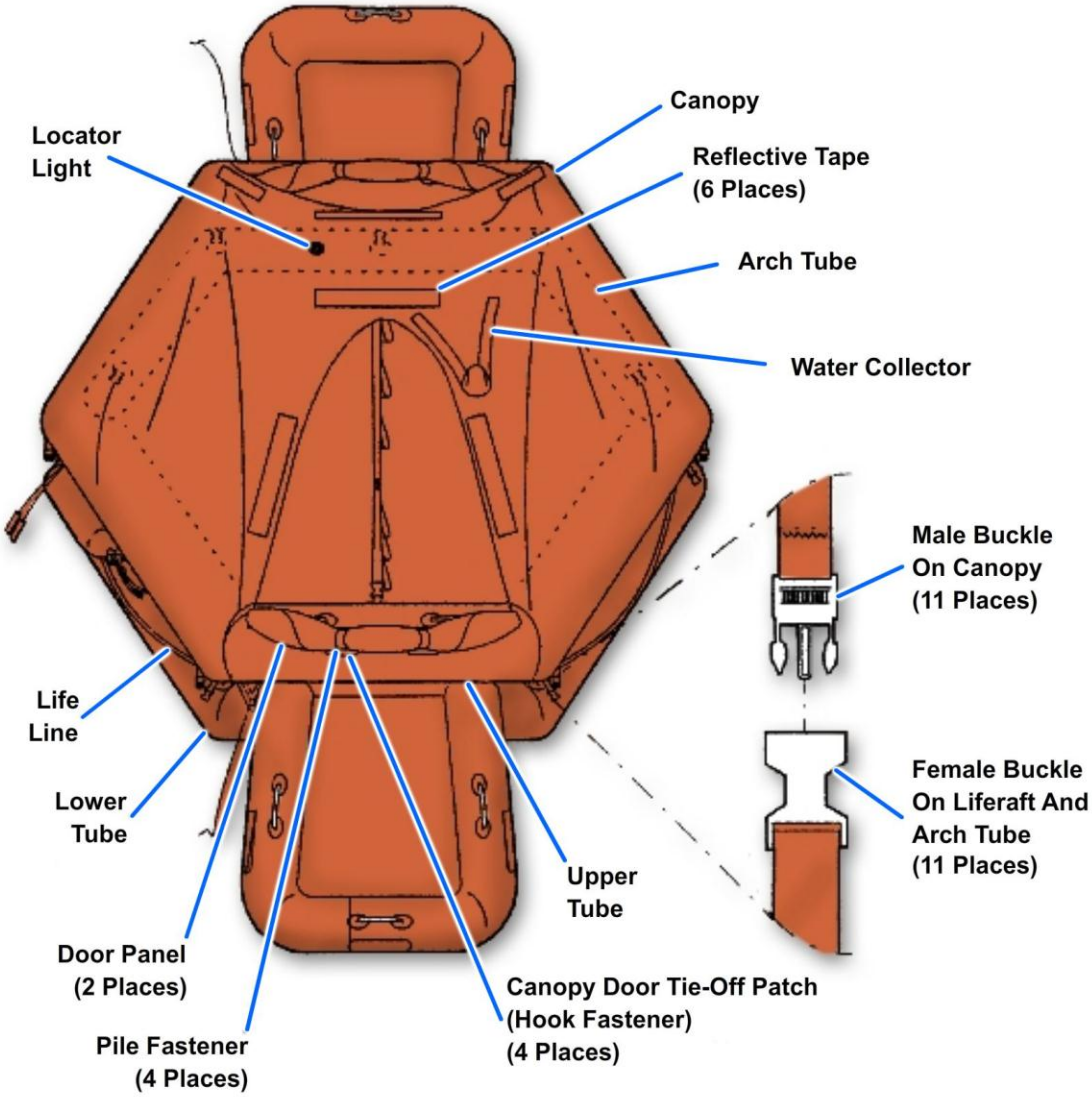


Figure 12-56 — Multiplace life raft.

The newly configured MPLR LRU-30A/A (8-man), LRU-31A/A (12-man), and LRU-32A/A (20-man) consist of the life raft in a polymer tub with a cover, and webbing straps with frangible links. The tub cover has a clear window for verifying the CO_2 bottle charge. The frangible links are designed to break at 180 pounds of force as the life raft expands when actuated. The tub assembly is stowed in a container that incorporates protective skids on the bottom for horizontal storage and at the end opposite the inflation pull handle for vertical stowage. The container is custom fitted to the tub, streamlining the overall package. This new configuration functions exactly as the old vacuum-bagged version. Only the packaging of the life raft and container has changed; the life rafts themselves are unchanged.

Multiplace life rafts are authorized for all rotary and fixed-wing transport aircraft. Selection shall be based on mission, available storage space, and total number of crew and passengers carried. Additional consideration shall be made for the life raft inspection cycle.

The LRU-30A/A, LRU-31A/A, and LRU-32A/A are inflated by pulling the inflation pull handle attached to the actuation/mooring line. The actuation/mooring line has a snap-hook attached to the bitter end for attachment to the aircraft or the person(s) launching the life raft. The newly configured MPLR has a shortened stroke to actuate the life raft. Pulling the inflation pull handle will fully inflate the life raft, boarding ramps, and canopy. The survival equipment container is tethered to the life raft and should be retrieved after entering the life raft.

⚠ CAUTION ⚠

The LRU-30A/A, LRU-31A/A, and LRU-32A/A are not designed to be air dropped. The search and rescue model manager will develop procedures for dropping the MPLR in emergency situations. These procedures will be published in NATOPS when completed.

Demonstrating the Use of Rafts

Many ditching and water crashes occur in a rough sea or at night. Only complete familiarization with the use of survival equipment will give the aircrewman a chance of surviving under such adverse conditions. Therefore, intensive drills in the use of rafts and their associated equipment are essential for safety.

The survival officer must be concerned with survival techniques and should see that a survival training program is set up in the parachute loft. In most cases, the chief in charge of the loft has the responsibility of setting up this training. As a PR, you will have many occasions to participate in this training and, in many instances, may be completely responsible for the carrying out of the program. Regardless of who is in charge and must shoulder the complete responsibility, it is the duty of every PR to be completely familiar with all phases of survival training and to be able to demonstrate the use of survival equipment.

The multiplace egress trainer is a very effective system of training in water survival techniques. It is used to simulate an actual aircraft ditching and to teach the best escape procedure with full equipment.

Although such complete courses of training cannot be conducted in certain localities because of the lack of specialized equipment, the PR should make every attempt to give aircrewmen frequent practice in the actual use of the equipment. Discussions, demonstrations, and shop lectures are all helpful, but working with the actual raft equipment is the only way to acquire the knowledge essential to survival.

In demonstrating the rafts use, the most important thing to stress is that the retainer lanyard snap must be firmly attached to the ring on the life vest before the raft is inflated. Inflate the raft as soon as possible so that personnel can get out of the water. The raft is inflated by pulling on the short-length cable attached to the CO_2 cylinder valve. After several hours, the CO_2 cylinder may be removed from the side of the raft. It tends to chafe the side of the compartment and acts as an anchor, causing the raft to orbit around it. Sometimes it is possible to back off the coupling between the cylinder and the manifold so that the cylinder releases from the mount. Once the cylinder has been removed, it is no longer useful in any way and should be thrown over the side. This, of course, is under actual emergency conditions; in a training demonstration, the cylinder should be saved and recharged for further use on the training equipment.

In demonstrating their use, also give instructions on manual inflation of rafts. If nothing happens after the CO_2 cable has been pulled, the carrying case should be pulled off and the raft unfolded so that the hand pump will be accessible. After the pump is removed, the first compartment to be inflated should be the seat. This will help keep the raft afloat so that the remaining compartment can be inflated with the pump. In attaching the pump, you must take care not to screw the pump too tightly into the valve. If it is too tight, it may freeze and become impossible to loosen without some type of wrench or pliers.

assembly consists of two independent inflatable bladders, each with an FLU-8 (series) automatic/manual inflator and an oral inflation valve. The bladders are packed inside a black cloth inflation shell assembly. Four straps on the inflation shell assembly pass through grommets on the exterior cover assembly to attach the LPU-36/P to the modified torso harness or survival vest. Two additional straps adjust a plastic buckle that snaps across the wearer's chest to keep the LPU-36/P in position when worn.

The primary method of initiating inflation is the manual mode, pulling both beaded handles in a natural downward motion. Each beaded handle is connected by a lanyard to the actuating lever of the inflator. Pulling the handles initiates slide fastener separation on the exterior cover and causes the CO2 cylinders to be punctured, inflating the bladders. The slide fastener securing the exterior cover continues to separate as the bladders inflate.

LIFE RAFTS

Naval aircraft that make operational flights over water are required to carry enough life rafts to carry all the assigned crew plus passengers. Life rafts are manufactured in various sizes and configurations to meet the demands of all types of aircraft.

Pneumatic life rafts are compact assemblies that can be stowed in a small area. They should be stowed so they are easy to get to, preferably near an emergency exit. Never stow a life raft under other equipment or cargo or near batteries. Protect them from sources of heat, such as heaters, engines, auxiliary power units, and electronic tubes.

If the aircraft flight manual designates a storage place for rafts, this space should be used. Whenever possible, stow rafts in the same places in all aircraft of the same model. This allows new crewmen to know the location of the rafts and thus avoid confusion in the event of a ditching situation.

One-Man Life Rafts

One-man life rafts are used with various soft and hard types of survival kits. They are intended for use by aircrew members forced down at sea. They can also be used when forced down over land for crossing rivers and streams, or as a shelter.

LRU-23/P Life Raft Assembly

The LRU-23/P life raft assembly (*Figure 12-53*) is intended for use by aircrew personnel and is

Figure 12-53 — LRU-23/P life raft assembly.

Ground/Air Emergency Code Card

The ground/air (GND/AIR) emergency code card (*Figure 12-59*) contains aircraft distress signals, aircraft acknowledgments, display signals, and body signals. Use these signals if communications equipment is not operable, no communication equipment is available, or if radio silence is required.

RESCUE AND SURVIVAL EQUIPMENT

When an aircrewman has to leave his or her aircraft in a hostile environment, survival items provide a means of sustaining life, attracting the attention of rescuers, and evading the enemy. Survival items may be packed in life rafts, droppable kits, and kits intended to be carried or worn by the aircrewman.

Many of the items that are frequently carried by the aircrewman are discussed in the following text.

Signaling Equipment and Devices

The following items are used to attract the attention of a rescue team. With the proper knowledge, ability, and caution, these items can provide invaluable assistance in a survival situation.

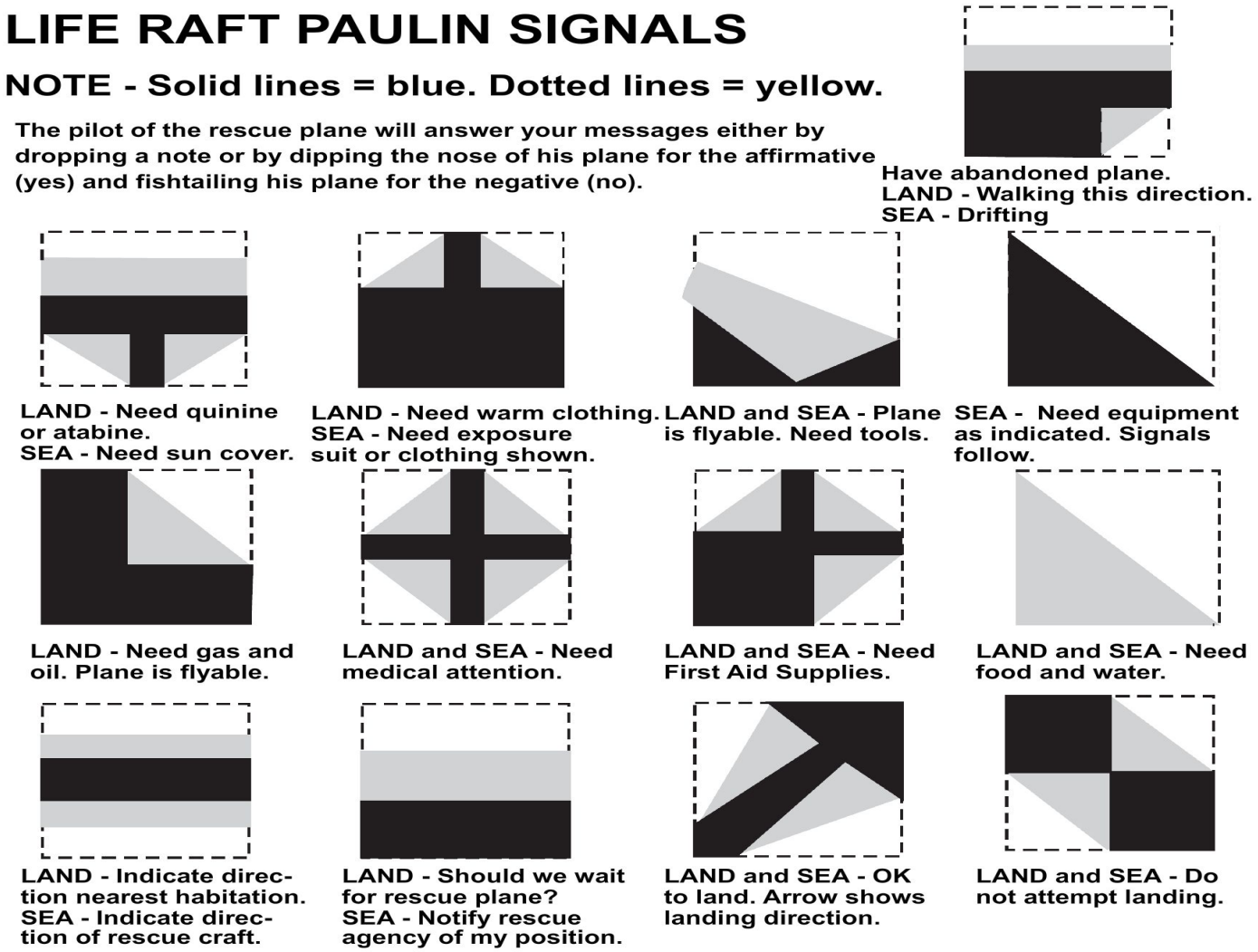


Figure 12-59 — GND/Air emergency code card.

Interaction Available

Dye Marker

The dye marker shown in *Figure 12-60* is an aniline dye powder in a sealed container. When placed in the water, it produces a bright fluorescent green color. It is used to attract the attention of rescue aircraft. The dye is exhausted from the package in 20 to 30 minutes and ceases to be a good target after 1 hour. The dye-exposed water area is visible at an approximate distance of 10 miles from an altitude of 3,000 feet. If rapid dispersion of the dye is desired, agitate the packet of dye vigorously in the water.

Figure 12-60 — Dye marker.

Signaling Mirror

The emergency signaling mirror is approximately 3 by 5 inches and consists of an aluminized reflecting mirror and a sighting device (*Figure 12-61*). It is used by personnel in rafts or on land to attract the attention of passing aircraft or ships by reflection, either in sunlight or in hazy weather. The reflections of this shatterproof mirror can be seen at a distance 3 to 5 times as great as those from which a raft can be sighted at sea. On a clear sunny day, the mirror reflects the equivalent of 8 million candlepower. Flashes from the mirror have been seen from a distance of 40 miles. A smaller mirror, measuring 2 by 3 inches, is also used in some kits.

Past experience indicates that personnel may have difficulty using the mirror in a bobbing raft at sea. Signaling practice with the mirror should be encouraged as part of the training program for flight crews. Such practice reduces the difficulty in case of emergencies. Before using the mirror, read the instructions printed on its back (*Figure 12-61)*.

Figure 12-61 — Signaling mirror.

Interaction Available

Mk 79, Mod 0 Illumination Signal Kit

The Mk 79 signal kit is supplied with one pencil-type launcher (Mk 31), seven Mk 80 screw-in cartridges, and a bandolier for storing the flares until use. Protective caps should be used over the primers of the cartridges when the bandolier is not in use.

Each cartridge flare has a minimum duration of 4½ seconds and can be propelled upward to a height of 250 to 650 feet. When the launcher is stored in the survival vest, it should be in the COCKED position and empty (*Figure 12-62)*.

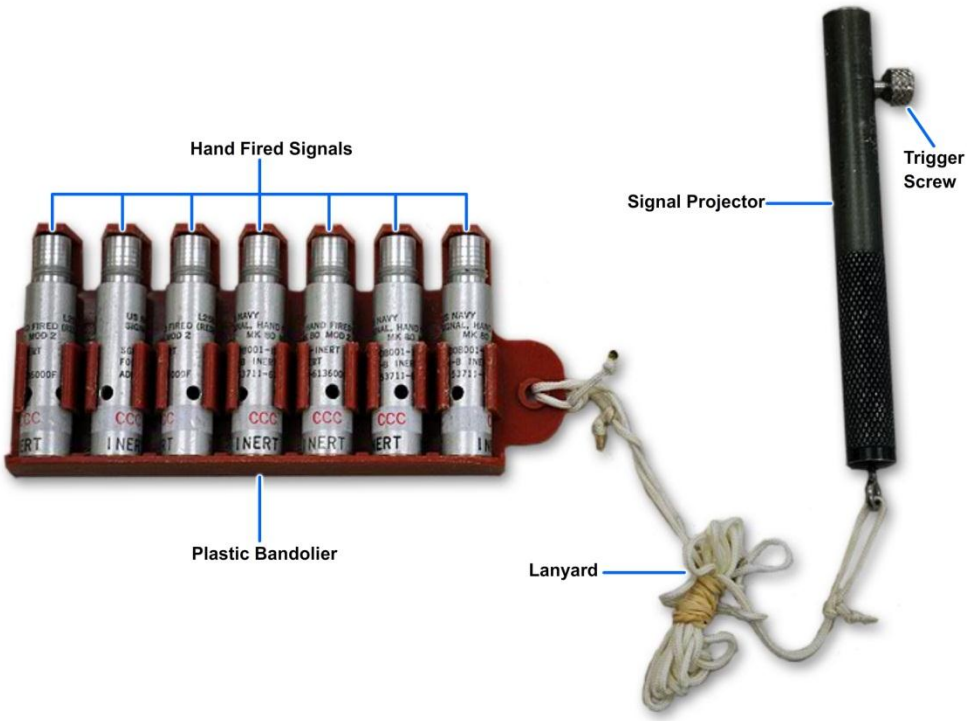


Figure 12-62 — MK 79, Mod 0 illumination signal kit.

Mk 124, Mod 0 Signal Flare

The Mk 124, Mod 0 signal flare is intended to attract the attention of SAR aircraft and give them drift direction. To avoid being burned by sparks, the user must ignite the Mk 124, Mod 0 signal at arm's length and no more than shoulder high. If the Mk 124, Mod 0 signal is being used at sea, hold it over the side of the life raft to prevent damage to the life raft from hot residue. The Mk 124, Mod 0 signal may be put out by dousing in water or snuffing in sand. Refer to NAVAIR 11-15-7 for precautions, handling, and storage procedures.

The Mk 124, Mod 0 consists of an aluminum cylinder approximately 5 inches long and 1½ inches in diameter (*Figure 12-63)*.

Figure 12-63 — MK 124, Mod 0 marine smoke and illumination signal.

SDU-39/N Distress Light

The SDU-39/N light equips aircrew members and shipboard personnel with a high-intensity visual distress signal. The infrared filter and blue flash guard are used in conjunction with the SDU-39/N light for signaling purposes in combat areas (*Figure 12-64)*.

The SDU-39/N is commonly called a strobe light. It emits a high-intensity flashing light. This light is visible for great distances at night.

The aircrewman should perform a daily inspection to ensure that the light is operative. The calendar inspection consists of activating the light for 2 minutes. If the light does not operate at 50 flashes per minute (±10 flashes) for the 2-minute duration, replace the battery. Repeat the procedure; if the light still does not operate, remove the light from service.

Figure 12-64 — SDU-39/N distress light.

You must perform this test both in total darkness and also in a lighted area.

You should store the batteries for the SDU-39/N light in a cold area or refrigerator to prolong service life and dependability.

To avoid accidental activation causing possible night blindness to the crewman, install the SDU-39/N light in the survival vest with the dome down and a protective cap installed over the switch.

General Purpose Medical First Aid Kits

Description

Medical first aid kits provide first aid treatment of common injuries and illnesses encountered in an aviation survival environment. They are intended for emergency use only and not to supplant usual sources of routine medical care. Medical first aid kits are intended for use when medical assistance is required as a result of injury or infection.

There are two types of medical first aid kits (*Figure 12-65)*:

- General purpose: aircraft panel mounted
- Rigid case: for life rafts

Figure 12-65 — Medical first aid kits.

Individual First Aid Kit (IFAK)

The individual first aid kit (IFAK) provides first aid treatment of common injuries and has the capability to treat major injuries encountered in an aviation emergency survival environment. The IFAK is used for emergency use only and does not replace usual sources of routine medical care.

> **WARNING**
>
> Aircrew personnel shall be trained on the use of the IFAK trauma components by qualified medical personnel, and training will be documented in NATOPS. Training for Marine Corps aircrew personnel shall be in accordance with USMC Training and Education Command (TECOM).

The IFAK is used to supplement the current panel-mounted first aid kit, it is not a replacement. It shall be mounted to the aircraft in accordance with applicable technical directives. The IFAK has two inserts:

1. A minor first aid kit (*Figure 12-66)* is a Ziploc-type bag containing: 10 each bandage, adhesive; 1 each dressing, burn; 1 each providone-iodine solution; 1 bottle water purification tablets; 2 each bandage, gauze triangular; 5 each bandage adhesive (2x4).

Figure 12-66 — IFAK minor first aid kit.

2. A trauma insert is a vacuumed sealed pouch containing: 2 each bandage elastic (vacuumed sealed); 2 rolls bandage gauze (vacuumed sealed); 1 each tourniquet, one-handed; 2 each combat gauze (rolled or Z-folded).
3. The inserts are contained in a single tan-colored pouch (NIIN 01-539-2734) (*Figure 12-67)*.

Figure 12-67 — IFAK pouch.

Individual Aircrewman's Survival Kit (SRU-31/P)

The complete SRU-31/P kit consists of two parts. The first packet contains medical items that an aircrewman might need in an emergency situation. The local medical department has responsibility for the medical items that are contained in packet number one.

Packet number two contains general survival items. They are also intended to be used only in an emergency situation.

Packet one and packet two are contained in a carrying bag. Each packet can be replaced individually. Each item within a packet is packed in a transparent bag that is hermetically sealed and retained in place by means of hook-and-pile tape. Additional adhesive-backed discs of hook-and-pile tape are contained in the spare pocket of each container.

Medical Packet

The following items are contained in the medical packet of the SRU-31/P kit:

- Soap—non-perfumed, intended to avoid detection
- Instruction card—provides general condensed instructions on use of survival items
- Anti-diarrhea tablets—dosage rates listed on instruction card (expiration date of 4 years)
- Pain killer (aspirin)—expiration date listed on foil packet; replace as required; dosage rate listed on instruction card
- Surgical tape—ensure the package is intact and its sterile seal not damaged
- Eye ointment—expiration date of 2 years
- Water purification tablets—manufacturer's date and applicable instructions listed on bottle
- Bandage (elastic)—ensure package is intact and its sterile seal not damaged
- Bandages (adhesive)
- Insect repellent

General Packet

The following items are contained in the general packet of the SRU kit:

- Metal matches—may cause spontaneous ignition through oxidation; should remain in its original sealed container (foil wrapped) until ready for use; all metal matches in polyethylene and open packets must be removed from service and discarded in a fireproof container
- Mirror—signaling mirror described at the beginning of this chapter
- Water bag—1-quart capacity (belt loops provided for convenient carrying)
- Signal panel—silver/orange paulin, imprinted with the ground-to-air emergency code (may also be used as a blanket for protection against unfavorable weather)
- Mosquito headnet and mittens— provided for protection against insect bites
- Chiclets—multi-flavored gum, designed to relieve tension
- Multi-flavored candy—service shelf life is indefinite

The packet also contains surgical tape, a water receptacle, wrist compass, razor knife, tweezers, and pins.

Rations

The rations carried by aircrew personnel are not intended for subsistence but as a source of quick energy when no other food is available.

The food packet contains two packets of candy and gum, twine, and an instruction sheet.

When you inspect any item that contains these rations, you should remove and replace any food packet that is older than 6½ years (*Figure 12-68)*.

Figure 12-68 — Rations.

Bagged Drinking Water

Bagged drinking water, shown in *Figure 12-69*, is intended for use in emergencies when no other clean water is available. One bag of water supports a survivor for about 1 day.

Bagged drinking water contains 4 ounces of drinking water and may be carried in this ready-to-use state.

Bagged drinking water should be inspected upon issue and at intervals to coincide with the inspection schedule of the kit or assembly.

Helicopter Rescue Devices

The helicopter's ability to land and take off in a small area and to hover over a spot lends itself very effectively to rescue work.

A helicopter may make a rescue by employing one of three methods. The first is by hovering, the second by landing, and the third by making a low, slow pass with the rescue device hanging near ground level. The last is used mainly in hostile areas when the helicopter pilot does not wish to present the aircraft or the survivor as a stationary target for enemy gunners. The most common helicopter pickup by far is made by hovering.

Figure 12-69 — Bagged drinking water.

> ⚠ **CAUTION** ⚠
>
> A static charge of electricity is built up in the helicopter and must be dissipated by grounding. Do NOT touch the rescue device until after it has contacted the ground or water to permit the discharge of static electricity and prevent electrical shock.

Research, development, testing, and evaluation of air rescue devices have been continuous since the helicopter became the primary rescue vehicle. The various types of rescue devices, their functions, and associated maintenance procedures are discussed in the sections that follow.

All helicopter rescue devices must be scheduled into periodic maintenance under the direction and control of the maintenance/material control officer to which the equipment is assigned. Maintenance must be thorough at all times. No instance of careless treatment or willful neglect of aircrew personal protective equipment will be tolerated. The vital function of the equipment must be uppermost in the minds of all personnel concerned.

Individual paralofts normally store and maintain all helicopter rescue devices, and checkout is on an individual basis. Because of the lack of individual identification of the rescue devices, it is impossible to match the Aviation Crew Systems History Card to the rescue device. All rescue devices should be locally serialized by individual paralofts to ensure positive control of inspection cycles performed on helicopter rescue devices.

Rescue Strop

The rescue strop (also known as the" horse collar" and rescue sling) is used to assist personnel performing rescue work from a helicopter over water or land. It is constructed with an international orange nylon casing, a retaining strap, stainless steel hardware, and closed-cell foam (*Figure 12-70)*.

The rescue sling is lowered on a hoist cable from a helicopter to the rescue swimmer and survivor. The sling is designed to accommodate one survivor at a time.

Rescue Seat

The rescue seat is a buoyant aluminum device consisting of a hollow flotation chamber and a three-pronged seat with prongs 120 degrees apart (*Figure 12-71)*.

Figure 12-70 — Rescue strop.

Figure 12-71 — Helicopter rescue seat.

Lead is inserted in the base of the assembly to minimize roll and to provide the proper degree of submergence of the seat in the water. A safety strap is provided to assist the survivor in remaining in the seat during hoisting to the helicopter. The flotation chamber and hoist bracket of the seat are bright orange. The lower seat assembly is yellow for high visibility.

The helicopter rescue seat is intended for use in retrieving survivors and assisting the rescue swimmer in performing rescue operations when it is difficult to make a helicopter landing over land or water.

During a rescue, the helicopter rescue seat is lowered on a hoist cable from a helicopter to the rescue swimmer and survivor. The rescue seat is designed to accommodate one person at a time.

WARNING

The sea anchor must not be used when personnel are hoisted out of the water.

Rescue Net

The rescue net looks like a conically shaped birdcage with an opening on one side. The net weighs approximately 20 pounds and is bright orange for high visibility. To stabilize the net during use, a sea anchor is provided. A 10-foot sea anchor retaining line with two single snap hooks is also provided. One halyard snap hook permits complete removal of the sea anchor from the net, while the other snap hook permits shortening of the sea anchor to 5 feet to be used in moderate seas. During high seas, the 10-foot retainer line is used. The rescue net has a snap lock lower frame and three upper support ribs with sliding sleeves that form a rigid cage when the net is fully extended. Foam plastic floats are provided on the rigid upper frame of the net (*Figure 12-72)*.

Figure 12-72 — Rescue net.

Figure 12-73 — TRISTAR harness assembly.

The rescue net is used to assist the rescue swimmer performing rescue work from a helicopter over water or land. The rescue net may also be used to ferry or pick up cargo.

TRISAR Harness Assembly

The TRISAR harness, shown in *Figure 12-73,* provides a slightly reclined seated position for rescuers that allow them total

use of their hands. The flotation vest provides a minimum of 35 pounds of buoyancy. The flotation vest accommodates all required survival items and is available in five sizes.

Rescue Hook

The rescue hook consists of one large hook, an adjacent small hook, and a ring located at the bottom of both hooks. A bearing assembly is attached to the upper section, allowing the hook to rotate freely about its axis. The large hook supports 3,000 pound and is used to hoist personnel. The smaller hook supports 1,000 pounds and is used to hoist equipment. The ring at the bottom supports 1,500 pounds and is also used to hoist miscellaneous equipment. Both hooks have a spring-loaded latch to prevent inadvertent release of personnel or equipment (*Figure 12-74)*.

The rescue hook is attached to the hoist cable and is used to assist rescue personnel in performing rescue operations from a helicopter. The rescue hook can hoist personnel and/or equipment during both sea and land helicopter rescues.

Figure 12-74 — Rescue hook.

Hoist Quick-Splice Plate

The hoist quick-splice plate is made of ¼-inch aluminum, 6⅝ inches in length, and 3 inches wide with the corners rounded off. The holes are grooved in places where the hoist cable rests and are beveled to prevent cable kink under load. A stainless steel clip, 1/32 inch thick, is attached to the plate with two 5/32-inch steel rivets. A rescue hook is attached to the plate with thimbles, swaging sleeve, and a length of hoist cable. The distance between the rescue hook and the plate is 6 inches (*Figure 12-75)*.

The hoist quick-splice plate is used when the hoist cable is cut or broken during a rescue operation. It is used when time is a factor and no other means are available for rescue.

Cable Grip

The cable grip (that opens and closes on the cable) and a shackle enable the cable grip to be attached to the crewman‘s safety belt to take the weight off the hoist assembly during a hoist failure. The cable grip is capable of supporting 1,000 pounds (*Figure 12-76)*.

The cable grip is an emergency condition device used by personnel performing rescue operations from a helicopter when the rescue hoist has a malfunction that renders the hoist inoperable. The cable grip is used for quick, temporary attachment to the hoist cable.

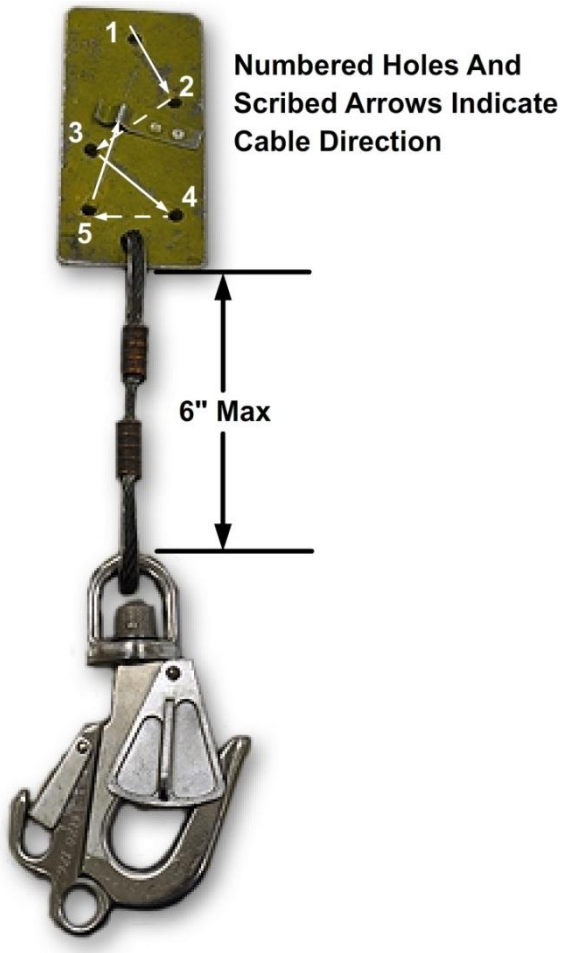


Figure 12-75 — Hoist quick-splice plate.

Pneumatic Rescue Hand Tool

The pneumatic rescue hand tool is a cartridge-operated device. A chamber within the handle secures a 3,000 psi nitrogen gas cylinder that provides a very powerful force against the cutting blade.

The case is made of nylon webbing, 12½ inches long and 5¾ inches wide at the top, tapering to 3¼ inches wide at the bottom. A 46-inch lanyard and baby swivel hook attached to the upper grommet are designed to attach to the pneumatic rescue hand tool (*Figure 12-77)*.

The pneumatic rescue hand tool is designed for the helicopter rescue crewman to use during air/sea rescue operations.

The pneumatic rescue hand tool gives the crewman a readily available cable cutter and parachute harness webbing cutter. The tool can cut single strands of stainless steel cable up to 7/32 inch in diameter, as well as harness webbing of thickness up to and including ¼ inch and widths up to 1¾ inch, in single cuts. The pneumatic rescue hand tool, complete with case, should be readily available to the rescue crewman during rescue operations.

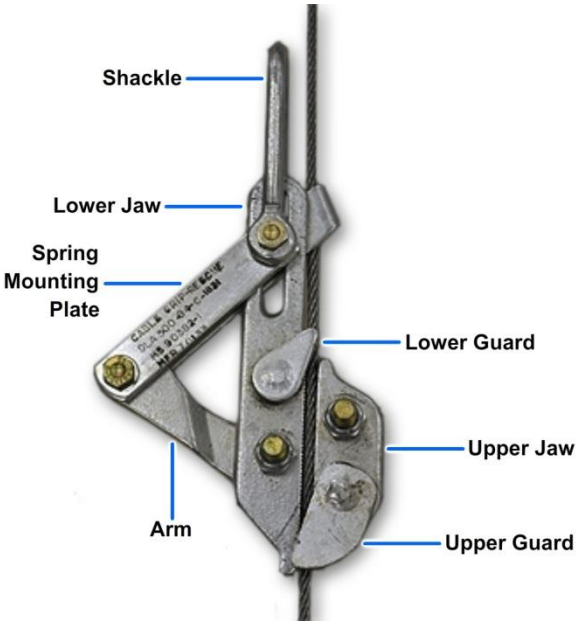


Figure 12-76 — Cable grip.

Helicopter Rescue Equipment Bag

The helicopter rescue equipment bag (P/Ns 261 and 1682AS100-1), also referred to as SAR bag or SAR curtain (*Figure 12-78*), is made of heavy -duty lightweight international orange denier nylon with labeled pockets for storage of rescue equipment. It can be folded or hung vertically with the equipment installed.

When the rescue equipment is stowed in the SAR bag, it is used to assist the SAR crewman in the performance of his or her duties during the SAR mission. Each item of rescue equipment is stowed in a designated pocket of the SAR bag for easy access.

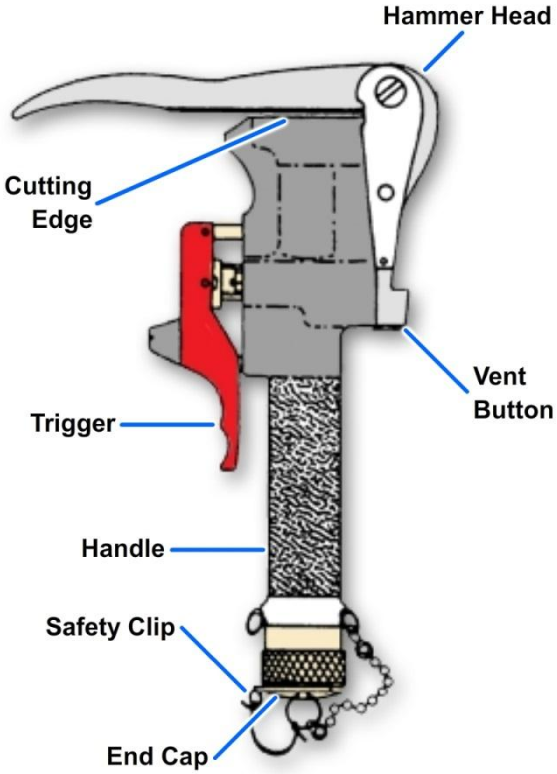


Figure 12-77 — Pneumatic rescue hand tool.

Figure 12-78 — Helicopter rescue equipment bag.

End of Chapter 12

Aircrew Survival Equipment

Review Questions

12-1. Flyer's boots come in which of the following size ranges?

A. 4 narrow through 14½ extra wide
B. 5½ wide through 13 regular
C. 5½ narrow through 15½ narrow
D. 6 regular through 16 wide

12-2. The CWU-62/P anti-exposure coverall is supplied in how many sizes?

A. 9
B. 10
C. 11
D. 12

12-3. What type of garment provides protection from the effects of high g-forces experienced by aircrew assigned to high-performance aircraft?

A. Anti-exposure
B. Anti-g
C. Survival vest
D. Torso harness

12-4. Who was the first person credited for successfully jumping from an aircraft using a parachute?

A. Jodaki Kuparento
B. Albert Berry
C. Arnold Appleby
D. Andre-Jacques Garnerin

12-5. When did it become mandatory for all Army and Navy aircrew to wear the standard back-type parachute while in flight?

A. 1918
B. 1919
C. 1922
D. 1924

12-6. How much does the LPU-34/P series life preserver weigh, in pounds?

A. 3
B. 3¼
C. 4
D. 4½

12-7. The LPU-34/P series life preserver has how many inflatable bladders?

A. One
B. Two
C. Three
D. Four

12-8. What is the buoyancy rating, in pounds, of a properly inflated LPU-32/P life preserver?

A. 32
B. 40
C. 50
D. 65

12-9. After how long does a dye marker cease to be a good target?

A. 1 hour
B. 10 to 15 minutes
C. 20 to 30 minutes
D. 30 to 50 minutes

12-10. How far, in miles, can the dye marker be seen from an altitude of 3,000 feet?

A. 5
B. 8
C. 3
D. 10

12-11. What amount of candlepower is equivalent to the light a signaling mirror can produce?

A. 6 million
B. 8 million
C. 10 million
D. 11 million

12-12. How many Mk 80 cartridges are in an Mk 79, Mod 0 signal kit?

A. 7
B. 8
C. 10
D. 12

12-13. How many feet can the Mk 80 signal flare travel when propelled upward?

A. 100 to 350
B. 150 to 400
C. 250 to 650
D. 350 to 750

12-14. Each cartridge flare has a minimum duration of how many seconds?

A. 2½
B. 4½
C. 5¼
D. 6¼

12-15. For each 2-minute duration, how many times per minute is the SDU-39/N required to flash?

A. 20 ±5
B. 30 ±10
C. 40 ±5
D. 50 ±10

RATE TRAINING MANUAL – USER UPDATE

CNATT makes every effort to keep their manuals up-to-date and free of technical errors. We appreciate your help in this process. If you have an idea for improving this manual, or if you find an error, a typographical mistake, or an inaccuracy in CNATT manuals, please write or e-mail us, using this form or a photocopy. Be sure to include the exact chapter number, topic, detailed description, and correction, if applicable. Your input will be brought to the attention of the Technical Review Committee. Thank you for your assistance.

Write: CNATT Rate Training Manager
230 Chevalier Field Avenue
Pensacola, FL 32508
COMM: (850) 452-9700 Ext. 3190 for the N73 Director
DSN: 922-9700 Ext. 3190 for the N73 Director

E-mail: Refer to any of the Aviation Rating pages under CNATT on the NKO Web page for current contact information.

Rate____ Course Name_____

Revision Date_____ Chapter Number____ Page Number(s)_____

Description

_____

_____

_____

(Optional) Correction

_____

_____

_____

(Optional) Your Name and Address

_____

_____

_____