

STANDARDIZED FALL PROTECTION EQUIPMENT IMPROVES SAFETY ON NAVY VESSELS

Many tasks onboard Navy surface ships and submarines involve accessing areas that can't be reached from the deck or from built-in work platforms. Sailors on submarines perform various tasks topside and from the sail (the tower-like structure found on the surface of submarines), in port and at sea. Aboard surface ships, crew members climb ladders, work aloft on king posts, masts, and antennas, paint while over the side, and enter confined spaces, tanks, and voids to perform maintenance. Working in these areas can be hazardous because of the risk of falling to a deck, pier, or into the water. A fall of just a few feet could result in serious injury, even death. For this reason, Navy policies and procedures require the use of full body safety harnesses and safety lanyards when working from heights.



Manning the bridge wearing fall protection equipment on the USS Dolphin (AGSS 555).

Safety harnesses and lanyards are designed to arrest free falls, evenly distribute the forces incurred upon the body during a fall, and reduce the overall impact of the sudden stop. The shock absorber (i.e., decelerating device) incorporated into the lanyard slows a person down during the fall in a gradual, smooth motion that reduces the abrupt stop, which could cause injury when the bottom of the rope is reached. Working lanyards do not have shock absorbers and are not intended to be used to arrest a free fall. Working lanyards when used with the side D-rings of a harness, allow the user to connect in a given location and work hands free, without having to continually use one or two hands to hold on safely.

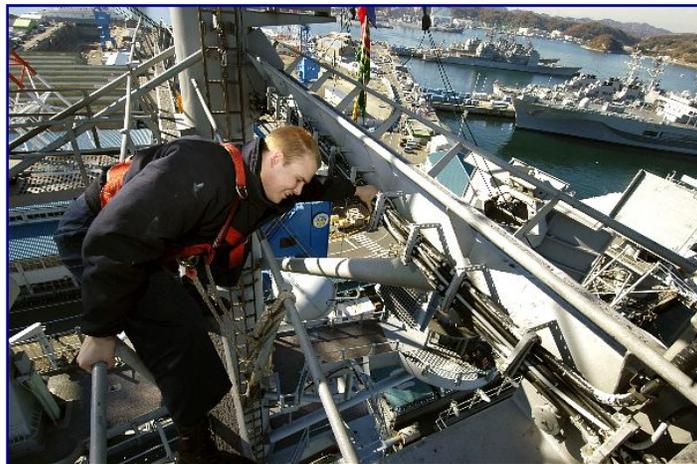
For 40 years, the Navy used a parachute-type safety harness and safety lanyard for shipboard applications where fall protection is required.

Disadvantages Parachute-type Harness

- Difficult to don and properly adjust.
- Incorporates a removable safety belt.
- Female sailors must wear and adjust this harness differently than males.
- Becomes uncomfortable after a short period of use.
- Frontal D-ring positioned below body's center of gravity, causing user to pull lower torso away from ladder when descending to disengage the spring loaded pawl of the safety sleeve.
- Heavy when compared to modern commercial equivalents.
- No longer meets DoD and national industry standards.

Over the years, the Department of Defense (DoD) and Industry standards to which these

components were originally designed were either cancelled without replacement by the DoD or withdrawn by the American National Standards Institute (ANSI). The manufacture of the parachute-type safety harness and braking lanyard originally specified by MIL-H-24460 for use aboard Navy vessels was no longer controlled by recognized



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procurement standards or by nationally recognized industry standards. Consequently, the parachute-type safety harnesses and braking lanyards entering the supply system to be used by Sailors began to deviate from the original established requirements. These harnesses and lanyards had not been evaluated for the specific submarine and shipboard processes where fall protection was necessary.

The naval shipyards were among the first Navy commands to implement state-of-the-art fall protection equipment. In an effort to reduce confusion and eliminate retraining, the naval shipyards began standardizing equipment used in the shipyard environment. Shipyard Occupational Safety and Health and Environment Offices modernized fall

protection programs, established standardized fall protection policy, and selected standardized styles of safety harnesses and lanyards. Today, the Navy's shipyards have switched to the use of a *crossover style* safety harness almost exclusively. More than twelve thousand naval shipyard workers have been trained on and employ the *crossover-style* safety harnesses to control fall hazards during ship repair and dismantlement.

The Naval Sea Systems Command (NAVSEA) also recognized the benefits of standardizing fall protection equipment onboard Navy vessels. In the past, if ships wished to use the shipyard equipment when ashore, ship's force personnel were trained by shipyard personnel to utilize the standardized shipyard fall protection equipment during ship availabilities. However, providing this fall protection equipment and training by the naval shipyards only extended to the end of the repair period. Until recently, the ships would revert to the use of the NAVSEA authorized parachute-style equipment upon return to sea.

In 2003, NAVSEA initiated an effort to identify a suitable standardized replacement for the shipboard parachute harnesses and braking lanyards. Standardization was necessary to simplify the supply system, reduce the need for retraining as sailors transfer commands, and eliminate safety risks from equipment unsuited for specialized needs aboard ships and submarines. Drawing upon expertise gained at the naval shipyards, NAVSEA joined forces with members of the Navy's Fall Protection Advisory Council and Naval Safety Center personnel to identify



U.S. Naval Academy midshipmen relax on USS Constitution's main fighting top nearly 70 feet above the spar deck. About 50 midshipmen visited "Old Ironsides" for a morning of mast climbing, while wearing crossover-style safety harnesses and twin-leg safety lanyards.

a suitable replacement harness and lanyard. After extensive review, two manufacturers' crossover-style safety harnesses and twin-leg safety lanyards were selected for evaluation aboard surface ships and submarines. The equipment selected for evaluation met ANSI Z359.1, Safety Requirements for Personal Fall Arrest Systems, Subsystems & Components.

Surface ship and submarine evaluations of the fall protection harnesses and lanyards were conducted using an established Navy process. The technical

expertise for the evaluations and shipboard training were provided by NAVSEA. The evaluations were conducted aboard ten ships - USS McFaul (DDG 47), USS Ronald Reagan (CVN 76), USS Dolphin (AGSS 555), USS Newport News (SSN 759), USS Key West (SSN 722), USS Asheville (SSN 758), USS Kentucky (SSBN 737), USS Hampton (SSN 767), USS Jimmy Carter (SSN 723), and USS Constitution (IX-21). The evaluation results confirmed that crossover-style safety harnesses and twin-leg safety lanyards utilized by the naval shipyards are suitable for surface ship use.



USS Constitution was one of ten ships used to test fall protection harnesses and lanyards.

The crossover-style safety harness uses a similar approach to the parachute-type safety harness with shoulder straps crossing in the back where the Dorsal D-ring is attached. The dorsal D-ring straps run to the sub-pelvic strap and integral thigh straps. The shoulder straps continue down the frontal region until the straps cross at the chest area, where



Crossover-style safety harness

the frontal D-ring is located, and then continue downward to attach to the sub-pelvic strap and thigh straps. The crossover design eliminates the need for a horizontal chest strap to hold the shoulder straps in place. This design also eliminates the need for an integral waist belt required by the parachute-type safety harness. It allows greater freedom of motion and provides a greater level of protection in the event of an arrested free

fall. Side D-rings are provided for use in fall restraint and for the Spin-Around Lanyard used on decks of submarines (see below).

Advantages of the Crossover-style Harness

- Gender neutral. [May be put on, removed, adjusted, and worn in the same manner by both sexes.]
- Provides the four necessary D-ring locations with a minimum of straps, buckles, or additional belts.
- Allows a greater fit range of individual sizes.
- Incorporates sub-pelvic strap across buttocks to transfer forces to sub-pelvic region during arrested free-fall/subsequent suspension period.
- Frontal D-ring positioned at or above the body's center of mass, maintaining user upright.
- Meets current industry standard and DoD procurement standard, ANSI Z359.1.

Disadvantages of the Crossover-style Harness

There is a single disadvantage to the crossover-style harness. Due to shoulder straps crossing at the Dorsal D-ring and Frontal-D ring, the shoulder straps are positioned closer to the neck than other styles of harnesses. Individuals with muscular necks may feel discomfort due to rubbing around the base of the neck by the shoulder straps. These users may find it necessary to wear collared shirts or use optional shoulder pads designed to be installed by the user.

The safety lanyard chosen for evaluation and approved for use by surface vessels is the twin-leg safety lanyard with tie-back (at right). The lanyard consists of two six-foot lanyard legs attached to a decelerating device (shock absorber). The free end of each lanyard leg is fitted with a self-locking snap hook as is the decelerating device. Adjustable tie-back D-rings are fitted along the length of each lanyard, which allow lanyards to be attached to structural members too large for connecting the snap hook directly.



Advantages of the Twin-leg Tie-back Safety Lanyard

- Allows the user to move from one area to another while remaining connected at all times, supporting a “tie-off at all times” policy.
- Adjustable tie-back D-rings allow user to pass lanyard around an object and connect back to the D-ring without concern of “forced roll-out.”
- Meets the current industry standard and DoD procurement standard, ANSI Z359.1.

Disadvantages of the Twin-leg Tie-back Safety Lanyard

- Twin-leg feature of this lanyard increases strapping.
- Extra lanyard can create a tripping or fouling hazard.
- Shock absorber can be defeated and length of the lanyard inappropriately extended by connecting a lanyard leg snap hook to the dorsal D-ring and not utilizing the snap hook located at the shock absorber.

While the crossover-style safety harnesses were judged suitable for submarine use, the twin-leg safety lanyards were not. The twin-legged lanyard is not suitable for submariners since the lanyard creates additional hazards when used on the bridge. Submariners use the Dyna-Brake ® lanyard with a [Spin-Around knotted working lanyard](#) to assist in self rescue and to keep from being dragged through the water.

The twin-leg lanyard incorporated with the Spin-Around Lanyard features works well on the decks of submarines. However, the features of the twin-leg lanyard only increase the equipment and complexity of the watch standers connecting their lanyards in the sail. NAVSEA is currently developing a safety lanyard meeting ANSI Z359.1 that can be utilized on the deck with a Spin-



Naval Academy midshipmen wear crossover-style safety harnesses and twin-leg safety lanyards while training aboard USS Constitution.

Around Feature and function in the sail without the Spin-Around feature.



Crewmembers wearing fall protection on USS Greenville (SSN 772).

NAVSEA has authorized the use of [two cross-over style harnesses](#) aboard surface ships and submarines. The authorizing naval messages along with the National Stock Numbers (NSNs) for the cross-over harness, twin-leg lanyards, and sizing charts are posted on the NAVSEA Damage Control, Fire Protection, and CBR-D website at:

<http://www.dcfpnavymil.org/dcc/equip/harness.htm>.

The information at this site can be accessed by clicking on “Equipment & Systems,” and scrolling down to “Safety Harnesses and Lanyards,” under “Personnel Protective Equipment.”

Although the parachute-type full body harness (NSN 4240-01-421-0859) is no longer available, there are literally thousands of these harnesses still in use throughout the fleet. If these harnesses continue to pass Maintenance Requirement Card No. A6 3TRT N, the harness may be used. The switch to the crossover style harness will be accomplished through attrition as the harnesses are replaced.

Identifying the harnesses and lanyards that meet shipboard needs is just a small part of the Navy’s overall fall protection effort. The Navy’s focus is not only to ensure we remain current on state-of-the-art fall protection systems and meet standards for this equipment, but to continually improve the total fall protection program. To best continue this approach, the Navy’s designated Fall Protection Engineer is a member of the ANSI Committee on Standards for Fall Protection and a member of the International Society of Fall Protection. Significant changes were issued with the ANSI Z359 standards in 2007. The ANSI Committee widened its scope beyond fall arrest equipment by developing standards that address managed fall protection programs, work positioning and work restraint systems, and the rescue aspect of protecting personnel exposed to fall hazards in both the Navy and the nation’s industrial workplaces. The committee originally established by the Chief of Naval Operations to develop fall protection policy for ashore commands found in OPNAVINST 5100.23 Series, continues to meet as a *Task Action Team* with membership comprising a broad spectrum of Navy commands.

For more than forty years, the Navy's equipment and procedures to protect personnel working aloft and over the side were static, without significant improvements. Through a joint effort by the naval shipyards, NAVSEA, Chief of Naval Operations Fall Protection Advisory Council, the Naval Safety Center and industry experts, Navy surface ships and submarines now have standardized fall protection equipment and a recognized set of specifications controlling their manufacture. The industry and the Navy will continue working to develop program and technical improvements that protect our most valued resource - our people - from the hazards associated with falls, both afloat and ashore.

