CHAPTER 5

AIR-LAI'D MINES AND TORPEDOES

Since World War II, the U.S. Navy has developed sophisticated air-launched torpedoes and air-laid mines. These weapons incorporate components so sensitive that their operation is classified information.

Therefore, the information in this training manual on air-launched torpedoes and air-laid mines is limited. For more detail information consult the specific weapon assembly manual noted throughout the chapter.

LEARNING OBJECTIVES

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

1. Identify the purpose of the Mark (Mk) 46 and Mk 54 torpedoes.
2. Recognize torpedo configurations to include warshot, exercise, and aircraft-launched.
3. Identify the characteristics of Otto Fuel II and the symptoms of the human body that may occur when exposed to the fuel.
4. Identify aircraft-laid mines.
5. Recognize the classifications of aircraft-laid mines.
6. Describe aircraft-laid mine components.
7. Identify operational aircraft mines.
8. Recognize the safety precautions for handling mines.
9. Recognize the safety precautions for handling torpedoes.

Mk 46 TORPEDO CONFIGURATIONS

The Mk 46 Modifications (Mods) torpedo can be configured as a warshot torpedo, an exercise torpedo, and a recoverable exercise torpedo (REXTORP). REXTORPs provide additional exercise firing opportunities to increase the proficiency level of operational unit personnel in the handling, loading, preparation, and delivery (placement) of warshot torpedoes. The Mk 46 torpedo can be launched from surface ships or from rotary- and fixed-wing aircraft against potential underwater threats.

Mk 46 Warshot Configuration

The Mk 46 Mods torpedo warshot configuration (Figure 5-1) is a tactical configuration that consists of a nose section, a warhead, a control group, a long fuel tank, and an after body. A tactical warhead (containing explosives) is used in the warshot configuration.
Mk 46 Exercise Configuration

The Mk 46 exercise torpedo (Figure 5-2) includes an exercise head with a buoyancy subsystem and a short fuel tank. The buoyancy subsystem replaces what would be the warhead on a warshot and occupies the space directly aft of the array nose assembly. Its purpose is to provide positive buoyancy to the torpedo upon termination of the exercise run. The buoyancy section contains lead dropped weights, which separate at the end of run and provides positive buoyancy to the exercise torpedo to bring it to the surface.

Figure 5-1 — Mk 46 warshot torpedo.

Figure 5-2 — Mk 46 exercise torpedo.
**Mk 46 REXTORP Configuration**

The Mk 46 REXTORP is an inert, non-running, presettable exercise torpedo shape. The Mk 46 REXTORP matches the warshot torpedo’s external physical characteristics (e.g., length, center of gravity, and hookups). The Mk 46 REXTORP can be launched ballasted (*Figure 5-3*) to simulate the warshot weight but requires 180 pounds of lead ballast to be released in order to be recovered. The Mk 46 REXTORP can be launched unballasted as well (surface vessel torpedo tube (SVTT) or rotary wing only).

![Ballasted REXTORP](image1)

**Unballasted REXTORP** *(SVTT or Rotary Wing Only)*

*Figure 5-3 — Mk 46 REXTORP configurations.*

**Mk 54 Torpedo Configurations**

The Mk 54 torpedo is the next-generation lightweight, variable-speed, anti-submarine torpedo that combines the Mk 50 torpedo search and homing system with the propulsion system of the Mk 46 torpedo for optimized performance in shallow water. The Mk 54 torpedo can be configured as a warshot torpedo, an exercise torpedo, and a REXTORP. The Mk 54 torpedo looks similar to the Mk 46 torpedo because it repurposes many of the Mk 46 torpedo parts. However, the Mk 54 torpedo...
utilizes an enhanced sonar system. Because it is suitable for both deep water and littoral environments, the Mk 54 torpedo can be launched from surface ships or from rotary- and fixed-wing aircraft against potential underwater threats.

**Mk 54 Warshot Configuration**

The Mk 54 warshot torpedo (Figure 5-4) is a tactical configuration that consists of a nose section, a warhead, a control group, a long fuel tank, and an after body. A tactical warhead (containing explosives) is used in the warshot configuration.

![Figure 5-4 — Mk 54 warshot torpedo.](image)

**Mk 54 Exercise Configuration**

The Mk 54 exercise torpedo (Figure 5-5) includes an exercise head with a buoyancy subsystem and a short fuel tank. The buoyancy subsystem replaces the warhead on a warshot and occupies the space directly aft of the array nose assembly. Its purpose is to provide positive buoyancy to the torpedo upon termination of the exercise run. The buoyancy section contains a gas generator propellant that produces CO₂ to fill a buoyancy bag and provide positive buoyancy to the exercise torpedo to bring it to the surface.

![Figure 5-5 — Mk 54 exercise torpedo.](image)
Mk 54 REXTORP Configuration

The Mk 54 REXTORP (Figure 5-6) is an inert, non-running, presettable exercise torpedo shape. It matches the warshot torpedo’s external physical characteristics (e.g., length, center of gravity, and hookups). However, it does not represent the warshot weight and does not have ballast. The Mk 54 REXTORP is approximately 220 pounds lighter than the warshot in order to be positively buoyant for retrieval.

AIRCRAFT-LAUNCHED TORPEDO CONFIGURATIONS

To air-launch torpedoes, launch accessory equipment is used. The accessory equipment includes suspension bands to attach the torpedo to the aircraft and torpedo air stabilizers to ensure a predictable air trajectory and water entry. Torpedoes are configured and issued to the fleet depending on tactical or training requirements. An aviation ordnanceman (AO) is not responsible for the assembly of the torpedo at the organizational level. However, the AO is responsible for the installation of launch accessory equipment. The physical characteristics, such as weight, length, etc., of the Mk 46 Mods and Mk 54 Mods torpedo vary. These characteristics depend on the configuration of the torpedo itself (warshot or exercise) and the configuration of the attached launch accessories. The Mk 46 and Mk 54 torpedo are configured with aircraft-launch accessories for either helicopter or fixed-wing aircraft launching.

The basic items of accessory equipment used in launching torpedoes from fixed-wing aircraft and helicopters are the torpedo air stabilizer and suspension band assembly. The torpedo air stabilizer ensures a predictable air trajectory and water entry without structural damage to the torpedo. The air stabilizer reduces the descent speed of the torpedo relative to the speed of the launching aircraft. A static line or release lanyard deploys the parachute when the torpedo is dropped from the aircraft. The deployed parachute stabilizes the torpedo during descent to the water, slows the descent speed to an acceptable velocity for water entry, and assures the proper water entry angle.

For detailed information concerning aircraft launch accessories, refer to the U.S. Navy Aircraft Torpedoes Accessories and Trajectory Data and Quality Assurance Test and Inspection Plan for Installation of Torpedo Mk 46 Launch Accessories, NAVSEA SW512-AO-ASY-010.
Torpedo Air Stabilizers

Air stabilizers are used to arrest the launch speed of the torpedo as well as to orient the torpedo such that it enters the water at its specified water-entry angle. Water-entry angle is important to make sure no damage is done to the torpedo as it enters the water. The stabilizers are different for fixed-wing and helicopter launches, but their functionality is the same.

The Mk 28 Mod 3 air stabilizer (Figure 5-7) is used for air-launching from a fixed-wing aircraft. The Mk 28 Mod 3 air stabilizer is usable for Mk 46 torpedoes, Mk 46 REXTORPs, Mk 54 torpedoes, and Mk 54 REXTORPs.

The Mk 31 Mod 1 (Figure 5-8) air stabilizer is used for air-launching from rotary-wing aircraft. The Mk 31 Mod 1 air stabilizer is usable for Mk 46 torpedoes, Mk 46 REXTORPs, Mk 54 torpedoes, and Mk 54 REXTORPs.

Torpedo Suspension Bands

Suspension bands (Figure 5-9) are used in pairs to suspend the torpedo from the bomb racks or shackles of the launching aircraft. The bands wrap around the torpedo and are secured by tension bolts. After the bands are installed, the torpedo is loaded aboard by engaging the suspension band lugs in the bomb racks or on the bomb shackles of the aircraft.

The torpedo is loaded internally into a weapons bay for fixed-wing aircraft launch and loaded externally for helicopter launch. When the bomb rack/shackle hooks are released, the torpedo drops away (or in the case of patrol (P)-8 aircraft, the torpedo is pneumatically ejected from the weapons bay). Release wires unlash the suspension bands, allowing them to break away from the torpedo as it is launched from the aircraft.
The Mk 78 Mod 1 (Figure 5-9) suspension band assembly is used for air-launching from both fixed-wing aircraft and helicopters. The Mk 78 Mod 1 is only usable for Mk 46 torpedoes and Mk 46 REXTORPs.

The Mk 89 Mod 1 (Figure 5-9) suspension band assembly is used for air-launching from both fixed-wing aircraft and helicopters. The Mk 89 Mod 1 is usable for Mk 46 torpedoes, Mk 46 REXTORPs, Mk 54 torpedoes, and Mk 54 REXTORPs. Only Mk 89 Mod 1 suspension bands can be used for the Mk 54 torpedo due to the increased weight.

For detailed information concerning aircraft launch accessories, you should refer to the Description, Operation, Installation, Removal, and Trajectory Data for Mk 46/Mk 54 Torpedo Flight Accessories, NAVSEA SW512-AO-ASY-010.

**Torpedo Propeller Baffles**

Propeller baffles (Figure 5-10) lock the propellers and attach to the front plate of the Mk 28 air stabilizer for fixed-wing aircraft. Their function is to keep the propellers from windmilling in air and turning the engine, which could destroy the engine due to lack of engine oil. The metal baffle can be used on either the Mk 46 or Mk 54 torpedo, but must be used for the Mk 54 torpedo on the P-8 aircraft. The plastic baffle can also be used on either torpedo but can only be used on the P-3 aircraft due to speed restrictions.
Torpedo Nose Caps

Nose caps (Figure 5-11) serve two functions:

- To protect the torpedo, by use of a conductive coating, from electromagnetic energy entering the weapon through the transducer array.
- To absorb shock loads experienced during water entry by fracturing upon impact.

![MK 14 Fixed-Wing Nose Cap](image1)  ![MK 13 Helicopter Nose Cap](image2)

Figure 5-11 — Fixed-wing and helicopter nose cap.

The Mk 14 nose cap is used for fixed-wing launches, and the Mk 13 nose cap is used for rotary-wing launches. The Mk 13 nose cap has ribs added to ensure proper breakup of the nose cap upon water entry when dropped from a hovering helicopter. Nose caps are required on warshot and exercise torpedoes, and are not used on REXTORPs.

OTTO FUEL II

Otto Fuel II is the propellant for the propulsion system of the Mk 46 Mods and Mk 54 Mods torpedo. Otto Fuel II is first sprayed under pressure into a combustion chamber where it is ignited. The exhaust gases from the burning fuel are used to drive the torpedo engine. The major advantage of this system is the short turnaround time required for exercise weapons.

Otto Fuel II is a stable, liquid monopropellant composed of a nitrate ester in solution with a desensitizing agent and a stabilizer. It is a bright red, free-flowing, oily liquid that is heavier than water.

NOTE

When in a thin layer, such as a spill, stain, or leak, Otto Fuel II is a yellow-orange color.

Otto Fuel II is noncorrosive. It has an extremely low vapor pressure, minimizing explosive and toxic hazards. Otto Fuel II can detonate, but the conditions and stimulus required are so extreme that it is considered a nonexplosive. The propellant has a high flash point and other safety characteristics. It is classified as a low fire hazard material.

The ingredient of medical concern in Otto Fuel II is the nitrated ester. Nitrated esters are known for their acute effects on the human body. Symptoms of exposure to Otto Fuel II include the following:

- Headache
- Dizziness
- Drop in blood pressure
- Nasal congestion
A stowage space is specifically designated for each type of torpedo stowed aboard a combat ship. When handling Otto Fuel II, at least two crewmembers should handle the fuel. All personnel must know the general characteristics of Otto Fuel II, the safety precautions for handling the fuel, and protective equipment required. As an AO, handling Otto Fuel II is limited to emergency situations and not a daily task.

To avoid hazardous situations when handling Otto Fuel II, personnel should be well trained and supervised. For further information concerning Otto Fuel II, refer to Otto Fuel II Safety, Storage, and Handling Instructions, NAVSEA S6340-AA-MMA-010.

AIRCRAFT-LAID MINES

Naval mines are used in offensive or defensive mining operations. The primary objective is to effectively defend or control vital straits, port approaches, convoy anchorages, and seaward coastal barriers.

Aircraft mine delivery is the principal method of making large-scale mining attacks on enemy coastal and port areas. Aircraft-laid mines are usually carried and dropped in the same way as bombs, but they have different ballistic flight paths. Air-laid mines usually require parachutes that are released from the mine on water entry.

Classifications

Mines are classified by intended use, method of delivery, position assumed when laid, method of actuation, or weight. Mines classified by their intended use are further classified as service, exercise (recoverable), and training mines. Service mines are fully explosive-loaded mines assembled with service components for use in wartime. Exercise and training mines are inert loaded to service weight.

They have many uses, such as assembly and laying in fleet exercises. After exercise completion, they are recovered, analyzed, and overhauled for reuse. When assembled, exercise and/or training mines may contain minor explosive components.

Mines classified by method of delivery are submarine-laid, surface-laid, or air-laid. The classification depends on the laying vehicle.

Mines classified by the position they take in the water after being laid are moored or bottom mines. Moored mines are buoyant mines. They are connected by cable to an anchor resting on the bottom of the sea (*Figure 5-12*). There are two important considerations in laying moored mines—stability and moored depth. An anchor achieves mine stability with sufficient negative buoyancy to retain the mine in its position (without moving) on the bottom of the sea.

Bottom mines rest on the bottom of the sea. Their effective depth is controlled by the amount of charge they contain relative to the depth of the area in which they are planted. Their design includes sufficient negative buoyancy to provide good stability on the bottom of the sea.

NOTE

Depending upon the sensitivity of the individual, a temporary symptom-free tolerance may develop during the remainder of the working period. After exposure to a vapor-free environment, the first contact with Otto Fuel II vapors often causes the above symptoms to recur.
Mines are also classified by the methods used to activate them. Methods of activation are contact and influence, or a combination of both methods. Influence-actuated mines are the only mines used tactically in an air-laid operation. Influence-actuated mines are further classified as magnetic, acoustic, or pressure mines.

These classifications are generally combined to describe a given mine; for example, an air-laid, pressure-fired, bottom mine or an air-laid, magnetic-fired, moored mine. Table 5-1 provides a list of the air-laid mines currently in use by the U.S. Navy.

Table 5-1 — Air-Laid Mines Currently in Use

<table>
<thead>
<tr>
<th>MINE DESIGNATION</th>
<th>WEIGHT CLASS</th>
<th>TYPES OF ACTUATION</th>
<th>POSITION IN WATER</th>
<th>RETARDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mk 62</td>
<td>500 pound</td>
<td>Influence</td>
<td>Bottom</td>
<td>Fin</td>
</tr>
<tr>
<td>Mk 63</td>
<td>1,000 pound</td>
<td>Influence</td>
<td>Bottom</td>
<td>Parachute</td>
</tr>
<tr>
<td>Mk 65</td>
<td>2,000 pound</td>
<td>Influence</td>
<td>Bottom</td>
<td>Parachute</td>
</tr>
</tbody>
</table>

Mine Components

The components used in a mine vary, depending on the type of mine and its specific use. In addition to the mine case and explosive system, mine components provide mine arming, target sensing, actuation, laying control, countermeasure resistance, firing power, and sterilization. Exercise components are used in exercise (recoverable) mines.

Mine Case

The mine case is the main element of the mine. It contains or carries all other components. The mine case is normally made of sheet steel, but aluminum, spun glass, or various plastics are used in some types of mine cases. The case is watertight and strong to resist water pressure. Mine case openings are carefully sealed with suitable gaskets.
Explosive Components

The explosive system of a mine includes the main charge, the booster, the initiating system, and auxiliary explosive devices.

Main Charge

The main charge is the mine's payload. It is a high explosive cast directly into the mine case, or into an explosive section attached to the mine case when the mine is assembled. The amount of explosives used in air-laid mines ranges from 160 to 1,300 pounds. Types of explosives used include composition B, trinitrotoluene (TNT), composition H6, or high-blast explosive (HBX) mixtures. The HBX mixtures are most commonly used explosives.

Booster

The booster varies from a few ounces to several pounds of explosive. Generally, the smaller boosters contain tetryl, and the larger boosters contain granular grade A TNT. The intermediate size booster contains composition B. In some cases, the booster consists of a subbooster. The booster is housed in a brass, terneplate, plastic, or fiber container. When assembled in the mine case, the booster is in intimate contact with the main charge explosive.

Initiating System

An electric primer in an explosive fitting is used to set off a flash detonator. The flash detonator initiates the leads to the booster or subbooster, causing the mine to detonate. Explosive fittings may contain a primer or a detonator, depending on their design function.

Auxiliary Explosive Devices

Auxiliary devices are usually small explosives that blow or open a hole in the mine case to sink it. A small explosive device, such as the explosive driver, is used during the mine planting or operating sequence. For example, it is used to close or open electrical switches, unlock mechanical linkages, open gas bottles, and jam cables from further pay out. Other types of auxiliary explosive devices are used to cut cables and to release pyrotechnic signals from exercise and training mines.

Arming Components

An arming device is a combination of a hydrostatic switch piston and an explosive aligning piston. They are internally mounted in a single assembly. The hydrostatic piston acts to open and close electrical switches. The explosive piston aligns the explosive train when the hydrostatic piston and the explosive piston are forced in by water pressure after the mine is laid. These pistons are held in the retracted or safe position by safety pins during ground handling.

The safety pins are replaced by arming wire assemblies after the mines are loaded aboard the aircraft.

After planting, a clock-delay mechanism prevents firing until the mine has been submerged for a predetermined period of time. A switch in the detonator circuit of the mine controls the firing mechanism. The switch remains open until the clock-delay device has run its predetermined time. The time could vary from 8 minutes to 10 days, depending upon the type of clock installed. Sometimes another clock is also used to sterilize the mine after a preselected period of armed life.
Firing Components

Firing components include elements that detect the target, analyze target information, and act to fire the mine. In simple systems, a single device does these functions. However, in most systems, these functions are performed by two or more components.

The types of firing mechanisms used in mines vary widely in appearance and configuration. In older mines, the firing mechanism might be a circuit arrangement. In newer mines, the firing mechanism might be a color-coded rectangular box.

Since influence-actuated mechanisms are the only type of firing mechanisms currently used in aircraft mines, they are discussed in the following paragraphs. Influence-actuated firing mechanisms may be subdivided into three general categories—acoustic, pressure, and magnetic.

Acoustic

An acoustic mine is fired by the initiation of an enclosed microphone. The microphone picks up the sound waves generated by a nearby ship’s rotating screws or other operating machinery. These mines are equipped with an anticountermine device that prevents detonation of the mine from explosions set off during minesweeping operations.

Pressure

The pressure mine firing mechanism is actuated by a decrease in water pressure immediately surrounding the mine. Normally, the increase of pressure occurs only when a large ship passes over it. The pressure mine firing mechanism is used in conjunction with a magnetic-influence mechanism. The combination of these two mechanisms makes effective minesweeping operations nearly impossible.

Magnetic

Magnetic mines are induction mines actuated by changes in the earth's magnetic field. Their actuation depends primarily on the rate at which the field changes rather than the amount of change. A change in the magnetic field induces an electromagnetic field in the winding of a coil. This electromagnetic field and the resulting current are proportional to the rate of change of the magnetic field. When the magnetic field increases to a predetermined level, a relay actuates and closes the firing circuit.

Parachute Packs

Some mines laid from aircraft use parachutes to prevent them from building up too much speed before entering the water. The parachute reduces the impact velocity and protects the mine components from damage. The use of parachute packs permits the mines to be released from an aircraft at high altitudes, which may be required when ports or sea passages are heavily armed.

The parachute pack currently used is the delayed-opening type. In this type of parachute pack, a control mechanism is used to open the parachute at some point in the air trajectory of the mine. A typical delayed-opening parachute pack contains a drogue type parachute, release gear, and a control device. The parachute release gear consists of a metal ring that attaches the parachute to the mine during air travel. It is released from the mine upon water impact by inertia weights, wipe-off plates, or hydrostatic mechanisms. The control device opens the parachute during the mines descent. An adjustable fixed-delay device usually controls the opening of the parachute. Since firing an explosive fitting deploys the parachute, parachute pack control devices contain explosive components.
OPERATIONAL AIRCRAFT MINES

Air-laid mines currently in operational use are discussed briefly in the following paragraphs.

Mk 62 and Mk 63 Mines

The Mk 62 (Figure 5-13) and Mk 63 (Figure 5-14) mines are 500- and 1,000-pound, aircraft-laid, all modular, influence-actuated bottom mine for use against submarines and surface targets. The detection system responds to either magnetic or magnetic and seismic target influences.

The Mk 62 mine consists of bomb body Mk 82 or bomb live unit (BLU)-111 and the Mk 63 mine consists of bomb body Mk 83 or BLU-110. The bomb/mine conversion kit Mk 130 Mod 1 contains the Mk 32 arming device, Mk 59 booster, and the Mk 57 target detecting device (TDD), which requires a Mk 130 battery to be installed. The bomb/mine conversion kit also has the necessary hardware (less battery and fin assembly) to convert a general-purpose (GP) bomb to an air-laid mine.

Figure 5-13 — Mk 62 mine.
Mk 65 Mine

The Mk 65 Mods mine (Figure 5-15) is a 2,000 pound, air-laid, all modular, influence-actuated, bottom mine used against submarines and surface targets.
PBXN-103 is used as the explosive payload. Through use of specific components, the Mk 65 Mod 0, Mod 1, and Mod 3 mine can each be assembled in two operational assemblies (OAs). The Mk 65 mine consists of a mine case, a Mk 45 safety device arming group with a Mk 2 arming device, a Mk 57 TDD, and a Mk 7 tail assembly.

SAFETY PRECAUTIONS

Handling torpedoes and mines is a specialized job. If the handler isn’t qualified, the torpedo, mine, or their components should not be disassembled. You should follow the same safety precautions for torpedoes and mines as you do when handling bombs.

- The torpedo suspension bands, part of the air launch accessories, are under tension; the bands present an impact and laceration hazard to personnel if a band is accidently released or a band strap breaks; personnel should avoid the band area of the torpedo unless performing specific maintenance actions involving the bands.
- Safety bolts must be installed in the suspension band lugs after receipt of the torpedo at the landing area.
- All Otto Fuel II spills and leaks shall be kept to a minimum and shall be cleaned up at once; the use of solvents to cleanse Otto Fuel II from the skin is prohibited (solvents tend to speed up the absorption of the fuel into the skin and magnify the effects of the exposure).
- An Otto Fuel II spill kit must be readily available in the immediate area of the torpedo magazine; refer to NAVSEA S6340-AA-MMA-010 for proper clean-up, firefighting, and emergency procedures.
- To conform to safety and ammunition stowage requirements, mines are normally received aboard ship in assembly configurations C or D; AOs are not required to assemble mines, but they are required to be qualified and certified in mine handling and aircraft loading procedures.
- A Mobile Mine Assembly Unit (MOMAU), composed of personnel from the mineman rate, is responsible for the proper assembly of all mines; it is the responsibility of the mine planting activity to notify the MOMAUs of scheduled mine operations and the exact dates their assistance will be required.
- When a mine is jettisoned safe, the wires remain in the clock starter and booster extender, preventing the operation of the mine after submerging; however, when the mine strikes the water, the arming wires may pull free; hydrostatic pressure or countermining shock can cause the wires to shear; also, after a mine is submerged for a long period, the wires can corrode and break.
- No mine is jettisoned safe in water that is less than 800 feet (243.8 meters) deep with positive assurance that it is not a hazard; depths greater than 800 feet will crush or flood the mine case, making the mine inoperative.
- Open the vent located on the Mk 130 Mod 1 battery container prior to opening the container itself; if caustic odor is present, do not open the container; vacate and secure the area and notify the hazardous material response team immediately.
- Do not bend the fin release band latch during handling as it may cause fin to malfunction.
- When handling mines during preflight operations, the same general handling techniques used for bombs or torpedoes should be followed.
End of Chapter 5
Air-Laid Mines and Torpedoes

Review Questions

5-1. What primary weapon is used in antisubmarine warfare?

A. Depth bomb  
B. General-purpose bomb  
C. Torpedo  
D. Underwater bomb

5-2. The Mark 46 Modifications torpedo can be assembled into what number of recoverable exercise configurations?

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

5-3. The Mark 54 modifications torpedo can be assembled into what number of configurations?

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

5-4. What Naval Sea systems Command publication contains component location information for a Mark 46 Modifications torpedo?

A. SW010-AF-ORD-010  
B. SW050-AB-MMA-010  
C. SW512-AO-ASY-010  
D. TW010-AC-ORD-010

5-5. What means is used to ensure a predictable air trajectory and water entry without causing structural damage to a torpedo?

A. Air stabilizer  
B. Flat nose section  
C. Floatation  
D. Suspension

5-6. Which of the following suspension band configurations are used to suspend torpedoes from the bomb racks or shackles of the launching aircraft?

A. One Mark 78 Modification 10  
B. One Mark 87 Modification 11  
C. Two Mark 78 Modification 1  
D. Two Mark 87 Modification 1
5-7. Propeller baffles prevent the propellers from engaging in what type of movement?
   A. Sliding
   B. Slipping
   C. Vibrating
   D. Windmilling

5-8. Using Otto Fuel II in torpedoes has what major advantage?
   A. Fast burning and non-toxic
   B. Requires a short turnaround time for exercise weapons
   C. Safe to handle onboard ship
   D. Slow burning to allow sufficient drop time

5-9. What Naval Sea Systems Command publication contains Otto Fuel II safety, storage, and handling instructions?
   A. OP 2173
   B. OP 5
   C. S6340-AA-MMA-010
   D. SG420-AP-MMA-010

5-10. What symptom could occur when a person is initially exposed to Otto Fuel II vapors?
   A. An increase in blood pressure
   B. Headache
   C. Improved vision
   D. Sneezing

5-11. Aircraft-laid mines are used in which of the following types of operations?
   A. Defensive only
   B. Offensive only
   C. Nonservice
   D. Offensive or defensive

5-12. Which of the following general classifications are magnetic, acoustic, and pressure mines grouped into?
   A. Influence only
   B. Contact only
   C. Influence and contact
   D. Pressure and magnetic

5-13. Depending on the type of mine, the explosive system may contain which of the following components?
   A. Main charge only
   B. Initiating system only
   C. Booster only
   D. Booster, a main charge, and an initiating system
5-14. Air-laid mines contain which of the following types of explosives?

A. Composition B, TNT, H6, or RDX
B. Composition B, TNT, RDX, or tritonal
C. HBX, composition B, H6, or TNT
D. TNT, H6, or tritonal

5-15. The arming device in an air-laid mine consists of what type of switch piston?

A. Acoustic
B. Electrical
C. Explosive
D. Hydrostatic

5-16. A Mark 63 service mine is classified as what type of mine?

A. Bottom
B. Floating
C. Moored
D. Surface

5-17. What safety device is used in a Mark 65 mine?

A. Mk 31
B. Mk 45
C. Mk 57
D. Mk 79

5-18. At what depth of water, in feet, must mines be jettisoned?

A. 400
B. 600
C. 800
D. 1,000
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