CHAPTER 5

AIRCRAFT FIREFIGHTING (CVN/LHD/LHA)

On carrier, fixed wing aircraft, nuclear (CVN), Amphibious Assault Ship, Multipurpose (LHD), and General Purpose Amphibious Assault Ship (LHA) class ships, hazards to firefighters are associated with a broad spectrum of substances that range from fire-accelerating materials to non-combustibles. Included within the spectrum are highly volatile aircraft fuels and ordnance explosives and propellants that produce fire and violent explosions; less volatile lubricants and hydraulic substances that produce dense smoke and toxic vapors; deicing fluids that burn with little flame; electrical wiring and equipment that can create smoke and fire when faults or equipment breakdowns occur; aircraft interior materials that can sustain combustion; radiation hazards; and non-flammable metals, composites, and compounds materials that are poisonous and carcinogenic. It is essential that firefighters possess a detailed knowledge of the hazards that can affect the success of their firefighting efforts, as well as those that can affect their long-term personal wellbeing. This chapter addresses many hazards found in today’s inventory of naval aircraft.

LEARNING OBJECTIVES

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

1. Identify the different elements of a fire.
2. Identify the different classes of fires.
3. Recognize the various extinguishing agents used aboard aircraft carriers.
4. Identify flight deck and hangar deck firefighting equipment.
5. Identify the air department aircraft firefighting organization.
6. Identify aircraft firefighting procedures.

Fire Chemistry

For many years, fire was considered to be the product of a combination of three elements: fuel, an oxidizing agent, and temperature. Research in the past 30 years has indicated the presence of a fourth critical element. The fourth element is the chemical chain reaction that takes place in a fire and allows the fire to both sustain itself and grow. For example, in a fuel fire, as the fire burns, fuel molecules are reduced within the flame to simpler molecules. As the combustion process continues, the increase in temperature causes additional oxygen to be drawn into the flame area. Then, more fuel molecules will break down, enter into the chain reaction, reach their ignition point, begin to burn, cause a temperature increase, draw additional oxygen, and continue the chain reaction. As long as there are fuel and oxygen and as long as the temperature is sustained, the chain reaction will cause the fire to grow. Figure 5-1 gives an example of the chemical chain reaction with the fourth element, the fire tetrahedron, and how fire is constructed.

The most common method of controlling or extinguishing a fire is to eliminate one or more of the sides of the tetrahedron. This can be accomplished by the following methods.

- Smothering—removing the oxygen
- Cooling—removing the heat
- Starving—removing the fuel or combustible matter

5-1
Classification of Fires

Class A Fires
Class A fires (burning wood and wood products, cloth, textiles and fibrous materials, paper and paper products) are extinguished with water in straight or fog pattern. If fire is deep seated, aqueous film forming foam (AFFF) can be used as wetting agent.

Class B Fires
Class B fires, (petroleum-based products: gasoline, jet fuels, oil, and other flammable/combustible liquids) are extinguished with AFFF, halon 1211, Purple-K-Powder (PKP), and carbon dioxide (CO$_2$).

Class C Fires
Class C fire involves energized electrical equipment. Extinguishment tactics are:

- De-energize and treat as a class A, B, or D fire.
- Attack with application of non-conductive agents (CO$_2$, halon 1211, PKP); or attack with application of fresh or salt water in fog patterns maintaining nozzle at least 4 feet from the energized object.

Class D Fires
Class D fires (combustible metals such as magnesium and titanium) are extinguished with water in large quantities applied in a narrow angle fog. When water is applied to burning class D material, there may be small explosions. The firefighter should apply water from a safe distance or from behind shelter.

Fire Accelerating Materials
Fire accelerating materials carried on aircraft are of major concern to aircraft rescue and firefighting crews. They are of greatest importance during fire suppression. Every effort should be made to isolate their potential and neutralize their effects on aircrew, passengers, and rescue personnel until rescue operations are completed. Common fire-accelerating materials include the following substances:

1. Gasoline—aviation gasoline (AVGAS), motor gasoline (MOGAS)
2. Jet fuel
3. Oils
4. Oxygen
5. Hydraulic fluid
6. Anti-icing fluid
7. Class A combustibles
8. Ordnance
Aircraft Systems Hazards

Firefighters require a basic knowledge of the component systems that exist within an aircraft because of the hazards associated with them. Significant systems within most aircraft include the fuel system, an installed fire extinguishing system, hydraulic systems, an oxygen system, and anti-icing and deicing systems. When preparing an aircraft mishap response, the effects of all potential system hazards should be reviewed and carefully considered. Many of the fluids that are routed throughout an aircraft within piping and tubing are hazardous. Recognizing the color schemes of the various identification labels used on piping, tubing, and conduits will enable Firefighters to be more aware of the hazards present. The most common color-coded identification tapes used to mark aircraft piping and tubing.

Jet Fuels/Aviation Gasoline

The temperature produced by the burning of vaporized aircraft fuel and air is intense (approximately 1,500 °F). Heavier oils may have greater heat retention properties, but are much more difficult to ignite than aircraft fuels. When heavier lubricating oil is combined with gasoline, as frequently occurs in aircraft fires, the aircraft fuel serves to provide ignition. It raises the temperature of the oil to the flash point, producing additional flammable vapors.

Aircraft Fuel Vapors

AVGAS and jet fuels (JPs) constitute the principal problems in aircraft firefighting. There are various types of jet fuels/aviation gasoline.

Avgas

The flashpoint (by closed cup method at sea level) of AVGAS is –50 °F (–46 °C). The rate of flame spread has been calculated to be between 700 and 800 feet per minute.

JP-4

JP-4 jet fuel is a blend of gasoline and kerosene and has a flashpoint from –10 °F (–23 °C). The rate of flame spread has also been calculated to be between 700 and 800 feet per minute.

JP-5

JP-5 fuel is a kerosene grade with a flashpoint of 140 °F (60 °C). The rate of flame spread has been calculated to be in the order of 100 feet per minute. The lowest flashpoint considered safe for use aboard naval vessels is 140 °F (60 °C).
JP-8

JP-8 is a kerosene grade with a flashpoint of 100 °F (38 °C). The rate of flame spread is in the order of 100 feet per minute.

Biofuels

A biofuel is a type of fuel whose energy is derived from biological carbon fixation (fermentation of carbohydrates). Biofuels include fuels derived from biomass conversion, as well as solid biomass, liquid fuels and various biogases.

Fuel-Air Mixtures

Although there are differences in the properties of the different fuels now in use, it must be emphasized that under aircraft crash impact conditions where fuel mists (fuel-air mixture) are created, all of the fuels are easily and readily ignitable.

Severity After Ignition

There is so little difference in the heat of combustion between the various aircraft hydrocarbon fuels that the severity after ignition would be of no significance from the fire safety point of view. The firefighting and control measures are the same for the entire group of aviation hydrocarbon fuels.

Alternative Fuels (Biofuels) Flashpoint

Alternative fuels, i.e., biofuels, will meet all the specification properties as current petroleum based fuels.
Fuel Tanks
The exact location of a fuel tank on a particular aircraft can be found in the NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual, NAVAIR 00-80R-14-1.

Tanks
Fuel loads can vary from 30 gallons in small aircraft to approximately 50,000 gallons in large jet aircraft. Fuel tanks are installed in a variety of places between aircraft structural framework or as a built-in part of the wing. Fuel tanks are often carried under the floor area in the fuselage of helicopter. Upon severe impact, these tanks generally rupture, which results a fire. Many naval aircraft are provided with external auxiliary fuel tanks located under the wings and fuselages.

External Fuel Tank Fire Tests
Aircraft external fuel tanks (EFTs) exposed to an enveloping fire will rupture given enough exposure time, and release fuel into the existing fire. For this reason all EFTs are tested prior to acquisition to ensure compliance with requirements. Test requirements are outlined in Military Specification, Tanks, Fuel, Aircraft, Auxiliary External, Design and Installation of, MIL-T-18847(series AS).

Fuel Tank Fire with ESF Installed
ESF is a flexible polyether and polyester polyurethane foam installed in certain aircraft fuel cells to provide explosive protection from projectile penetration in a hostile environment. If ignited, when exposed to an enveloping fuel fire, it may melt, producing flammable liquids.

Rocket Engines (JATO)
JATO stands for “jet-assisted takeoff.” If this type of rocket engine is surrounded by fire, extreme care shall be used in approaching the area. No attempt should be made to extinguish the rocket engine if it ignites. These engines burn very intensely for a short period of time.

Hydrazine
Hydrazine is a clear, oily, water like liquid with an odor similar to that of ammonia. Hydrazine will readily ignite when exposed to heat, flame, or oxidizing agents. The flashpoint is 126 °F (52 °C). Hydrazine vapors are much more sensitive than the liquid form to electrical sparks, embers, flame, etc.

Hydrazine fuel (H-70) is a blend of 70-percent hydrazine and 30-percent water and is used to power the emergency power unit (EPU) on F-16 series aircraft. EPU operation results in noise similar to the rapid firing of a rifle. Exhaust gases exiting from the EPU turbine are approximately 1600 °F (871 °C) and basically consist of 40 percent ammonia, 17 percent nitrogen, 15 percent hydrogen, and 28 percent water.
Emergency limits for exposure to hydrazine vapors are in concentrations of 30 parts per million (ppm) for 10 minutes, 20 ppm for 30 minutes, and 10 ppm for 60 minutes. Irreversible health effects occur at 80 parts per million for 30 minutes. Such high concentrations are only attainable in enclosed areas such as a hangar and cannot be achieved in open air.

**Hydrazine Fire Hazards and Extinguishment**

Hydrazine is a strong reducing agent. It becomes hypergolic with oxidizers such as nitrogen tetroxide and metal oxides of iron, copper, lead, etc. Spontaneous ignition may occur if it is absorbed in rags, cotton waste, etc. Hydrazine will ignite when exposed to heat, flame or oxidizing agents. Since hydrazine will become hypergolic with exposure to oxidizers, its fires can best be handled by diluting with large amounts of water.
Lubrication and Hydraulic Systems

Although less volatile and flammable than aircraft fuels, oils and lubricants can still cause significant problems for firefighters. Because of their proximity to hot engines and exhaust surfaces, ignition of lubricants is always a possibility. When flammable hydraulic fluids are used to raise and lower landing gear, the probability of brake and tire fires is increased. The heat and dense smoke created by these fires can damage the aircraft, obscure vision, and create toxic fumes.

Oxygen Systems

Oxygen systems on aircraft can present hazardous conditions to firefighters during an emergency. Liquid oxygen is a light blue liquid that flows like water and is extremely cold. It boils into gaseous oxygen at –297 °F (–183 °C) and has an expansion rate of approximately 860 to 1. Liquid oxygen is a strong oxidizer and, though in itself it is nonflammable, it vigorously supports combustion.

Materials in Combination with Liquid Oxygen

Liquid oxygen forms combustible and explosive mixtures when it comes in contact with flammable or combustible materials such as wood, cloth, paper, oil, or kerosene. Procedures for fighting fires involving liquid oxygen include cutting off the flow of oxygen or fuel. Blanketing and smothering agents are ineffective. If flammables or combustibles are present, use large amounts of water at the seat of the fire, continue through to the source of the liquid oxygen (LOX) leak, and apply water until the leak is sealed.

An effective method of stopping an oxygen leak (when the oxygen is not already mixed with flammable or combustible materials) is to spray the leak with water fog. The water is rapidly converted to ice by super-cold oxygen and the ice buildup forms a seal, stopping the oxygen flow.

NOTE
If water is not readily available, and no fire is present, isolate the aircraft if possible. The oxygen compartment should be opened and natural venting allowed to occur until the oxygen container contents are depleted to a point permitting safe removal.

Anti-Icing Fluids

Anti-icing fluids are usually a mixture of about 85 percent alcohol and 15 percent glycerin. While not as great as other aircraft hazards, it should be remembered that the alcohol used in aircraft anti-icing systems burns with an almost invisible flame. The best method of control is by dilution with water.

Class A Combustibles

Class A combustibles in aircraft fires are best extinguished with AFFF. When aircraft cockpit and interior finish materials are burned or charred, they produce toxic gases. These gases include carbon monoxide, hydrogen chloride, and hydrogen cyanide. It is therefore necessary that firefighting and
rescue personnel who enter an aircraft during a fire sequence be equipped with a self-contained breathing apparatus.

Grade JP-4 jet fuel is a blend of gasoline and kerosene and has a flashpoint beginning at low as 10 °F. The rate of flame spread is calculated to be between 700 to 800 feet per minute. JP-4, because of the range of its vapor pressure (2 to 3 psi at 100 °F), requires additional precautions in handling. JP-4 forms explosive vapors from -10 °F to 80 °F, which are normal storage and handling temperatures. This means that the space above the liquid almost always contains an explosive mixture.

**Explosive Suppressant Foam**

When aircraft fuel cells equipped with ESF burn they produce potentially toxic gases. These gases include carbon dioxide, carbon monoxide, cyanides, and nitrous oxides. It is therefore necessary that firefighting and rescue personnel in the immediate vicinity or downwind of burning ESF be equipped with a self-contained breathing apparatus. Burning produces toxic gases, intense heat, and dense smoke.

**Electrical Systems**

Electrical systems within the aircraft are always potential fire hazards. Aircraft wiring faults and electrical malfunctions can create sufficient heat to cause insulation material to catch on fire and create smoke and toxic gases as byproducts of combustion.

**Non-Lithium Batteries**

Alkaline or nickel-cadmium batteries may experience an overheated condition resulting from internal shorting or thermal runaway. The overheated battery presents a hazardous condition to both aircraft and personnel, including the release of combustible gases and violent rupture. When an overheated or damaged battery is detected, aircraft rescue and firefighting (ARFF) personnel should open the battery compartment, check for the following conditions, and take the action indicated:

1. If flame is present, use available extinguishing agent, halon 1211, PKP, AFFF, or CO₂. Agent should be used in large quantities to extinguish any fire, to cool the battery, and to dilute and flush combustible gases or fluids from the compartment.

2. If no flame or fire is present, but smoke, fumes, or electrolyte is being emitted from the battery or vent, ensure the battery switch in the cockpit is in the OFF position. Remove the quick disconnect from the battery and, if possible, move the battery clear of the aircraft. Use large quantities of AFFF applied in a narrow fog to lower the battery temperature. CO₂ shall not be directed into a battery compartment to effect cooling or displace explosive gases.

3. Prior to removing the quick disconnect from the battery, ensure the battery switch in the cockpit is in the OFF position. When approaching a battery that is in a thermal runaway condition, ARFF personnel shall work in teams of two. They shall be attired in proximity firefighting protective ensemble (PFFPE) with extinguishing agent available for instant use.
Lithium Batteries

Lithium batteries are used in many military systems such as sonobuoys, weapons, communication equipment and aircraft. Lithium battery designs vary significantly in chemistry, core design, and safety features. Common chemistries include but are not limited to: lithium/thionyl chloride, lithium/sulfur dioxide, lithium/vanadium oxide, lithium/carbon monofluoride, lithium ion/cobalt oxide, and lithium/manganese dioxide. A cell is a single independent container and a battery is one or more cells combined to provide power to a designated application. These batteries can rupture or vent due to improper or over-charging, physical damage, or exposure to fire. Case rupture or venting may include evolution of large amounts of gas, particulate matter, and fire. Gases released during venting are highly flammable and noxious and can be lethal. A small single cell which is integral to larger equipment or weapons systems poses only a minor hazard if it ruptures or vents. However, much larger lithium batteries consisting of many cells are now being used in weapons and aircraft. Cook-off of these larger lithium batteries can pose a serious hazard to personnel and to the ship.

A typical lithium battery rupture will discharge its stored electrical energy, and as each cell fails it can forcefully eject lethal fragments and a pressurized mist of combustible or flammable electrolyte which can ignite as a large fireball and trigger the cascading rupture of remaining cells over a period of several seconds to several minutes.

WARNING
Failure to conduct this procedure may result in an electrical arc, which could initiate a fire or explosion if battery gases are present.

During venting of a large lithium cell or battery, the resulting fireball and dense, acidic, and toxic smoke can be immediately dangerous to life and health (IDLH) for unprotected personnel. Depending on the battery chemistry, gaseous and liquid by-products can be caustic to eyes, skin, and respiratory track.

Personnel should approach from up wind and avoid exposure to smoke and gas clouds. If very high acid gas concentrations form, they can pose a hazard to protected personnel by skin absorption and damage to protective breathing equipment.

Application of a narrow-angle fog of water or AFFF is the preferred method to cool the battery, suppress fireballs as they occur, and reduce the likelihood of reaction of remaining cells. Maintain an adequate distance for personnel safety from exposure to fireballs and from projected fragments. Utilize personnel wearing PFFPE and self-contained breathing apparatus (SCBA) as soon as they are available.
Continue to cool the battery for several minutes after the last cell reaction. Follow-on cell reaction may occur without warning while the battery is hot. Do not approach until there is confidence that all reactions have stopped.

The discharge products from lithium batteries vary with the different chemistries. Typical products can include acid gases, oxidizers, and other toxic and irritating materials. Personal protective equipment is needed for post-casually clean-up. Firefighting agent run-off may be caustic.

Large quantities of AFFF or water should be used to dilute chemicals and wash down of the deck and exposed equipment. Activation of the flight deck sprinkling system should be considered to assist in dilution and wash down if multiple large batteries are involved.

A thermal imaging camera (TIC) can be used to assess whether a disconnected battery temperature is rising over time. A rising temperature over time would indicate a thermal runaway situation.

**Ordnance-Related Hazards**

Hazards to firefighters presented by ordnance come in several different forms. In addition to the hazards posed by cook-off of the warhead itself, firefighters are confronted with cook-off of the propulsion systems of missiles, rockets, torpedoes, small arms ammunition, and some mines. Hypergolic fuels, including hydrazine, used as propellants in missiles and rockets, and otto fuel and lithium used in torpedoes and mines demand special considerations. Radioactive components in weapons also demand special consideration and precautions when encountered by crash and rescue team members.

**Ordnance Cook-Off Times**

Naval aircraft carry a wide variety of ordnance in support of their assigned missions. The Naval Air Warfare Center Weapons Division (NAWCWPNDIV) China Lake publishes *Insensitive Munitions Characteristics Of Air-Launched In-Service Weapons*. This volume provides a single-source reference for cook-off characteristics and summarizes the current available data for in-service air-launched weapons. Summarized are weapons descriptions, explosive type, cook-off time, reaction, typical fast cook-off results, hazards, and cook-off test data. Summary cook-off times for these ordnance items are contained in *Figure 5-2, frames 1-4*. This volume shall become a part of the ready reference library of crash and rescue crews ashore and afloat.

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**NOTE**

- Dry chemical, carbon dioxide and Class D extinguishers, including LITH-X, have been found to be generally ineffective and are not recommended for lithium battery fires.
- There is little free lithium in Navy-approved lithium batteries, so there is no hazard of significant volumes of hydrogen formation due to water reaction with free lithium or risk of a violent lithium-water reaction or fire.
Ordnance Cook-Off Time Summary

**Figure 5-2 — Ordnance cook-off time summary.**
NOTE

- Ordnance cooling hose team leaders shall ensure minimum manning of hose team personnel immediately upon lock on for weapons cooling. Once the team is in place, personnel shall maintain proper positioning to lower the team’s physical silhouette should a deflagration or explosion occur.

- Ordnance cooling teams may lock in place hose control devices for extended cooling and personnel safety. The teams shall then evacuate the scene leaving one Firefighter to tend the nozzle.

- At the discretion of the air boatswain incident commander, a TIC may be employed to assess the surface temperature of the weapon in order to expedite the down load and disposition of the weapon.

- The actual time for the cooling of weapons shall be determined by the air boatswain incident commander based upon the degree of actual exposure of the weapon to the fire. Historically weapons have been cooled for a minimum of 15 minutes or until deemed safe by EOD personnel. However, post-assessment cooling for minimal exposures may be less than 15 minutes. Severe exposures may require cooling in excess of 15 minutes.

WARNING

Should a mishap occur while transporting ordnance to or from the maintenance depot, storage/assembly areas, or along transportation routes, HERO emission control (EMCON) shall be set.

WARNING

In the event of an ordnance mishap, all ordnance containing electrically initiated devices (EIDs), even those normally classified hazards of electromagnetic radiation to ordnance (HERO) SAFE ORDNANCE, shall be considered HERO UNSAFE/UNRELIABLE ORDNANCE. This is because possible changes in the ordnance configuration may result in loss or reduction of radio frequency-protective features.
**WARNING**

- All air-launch weapons exposed to a fire can cook off either during or after the fire is extinguished. The fire duration and the type/location of the weapons will determine the reaction severity that may occur.

- Burning ordnance, in or out of a fire, may transition to detonation at any time. Personnel safety and fire exposure time of weapons must be considered when expediting post-fire evolutions to satisfy operational commitments.

- Extreme caution should be exercised if air-ground cluster bombs are involved in mishap. Canisters will likely fail on impact, scattering submunitions over a wide area. These submunitions will likely arm and/or detonate if moved, stepped on, or run over by vehicles approaching the scene. Because of their size, these devices may be submerged in AFFF, thereby hampering identification.

- Ordnance cooling should be accomplished using a dispersed agent pattern that will provide coverage of agent over the weapon. Care must be taken to prevent a narrow stream pattern from dislodging hung ordnance or pushing or rolling ordnance lying on the deck. Many general purpose bombs may be equipped with rotary vane fuses, fore and/or aft. If rotated by agent application, arming and/or detonation may occur.

**NOTE**

Reactions shown in Figures 5-1, frames 1-4 reflect those observed during actual tests. During firefighting, anticipate the most violent indicated reaction. Nonthermally protected ordnance will not normally be used aboard combatants, whereas it is used ashore in lieu of thermally protected ordnance. Minimum fast cook-off times for nonthermally protected items can be expected.

**Hydrazine Mixture**

In the past the Navy has used hydrazine mixtures for propulsion in rocket motors and ballistic missiles; now the only mixture currently in use by the Navy is used to propel the AQM-37 Target Drone. The misuse of a hydrazine can be very hazardous due to its toxicity and compatibility issues. Hydrazine fuels will ignite on contact with certain chemical oxidizers, and do not require a source of ignition.

Hydrazine derivative hydrazine mixtures (such as mono-methyl hydrazine) that generally use a nitrogen tetroxide oxidizer (also known as MON-3), are currently being used in ballistic weapons by the Army and the Air Force.
Pyrotechnics and Countermeasures (Decoy Flares)

There is a wide array of countermeasures, flares, and markers deployed throughout the Navy using a variety of decoy emissions, including high intensity heat and light, infrared and high energy radio frequency, impulse charge and aircraft parachute flares/marine locator markers. Many contain different pyrotechnic and pyrophoric metal fuels, impulse charges, lithium-ion batteries, and thermal batteries. Each device has its unique combustion and health hazards including heat up to 4000 °F, fumes with inhalation and skin exposure toxicity, electromagnetic radiation, and extreme light. Therefore, fire teams responding to incidents involving these devices shall wear protective equipment (PFFPE with SCBA) when in close proximity. Pyrotechnic and pyrophoric compositions contain their own oxidants and combustible metals, therefore they do not depend on atmospheric oxygen for combustion, so the use of most agents such as PKP, AFFF and CO₂ may be of little to no help in extinguishing most flares. General fire protection includes:

1. Jettisoning or moving to a safe location initiated devices that have not ignited.

2. Application of large amounts of water or AFFF on devices that have ignited. Although water will not extinguish most pyrotechnic devices, the water will cool the deck and reduce heat exposure to surrounding aircraft, weapons, equipment, and personnel. Application should continue until the device has burned itself out.

To the extent possible, fire departments and ship firefighting teams shall be familiar with the hazards and specific emergency handling procedures for the devices typically used on their airfield or ship and consult with explosive ordnance disposal (EOD) or weapons officer as soon as possible. If specific hazards are not known or specific devices cannot be immediately identified, general fire protection procedures shall be followed.
**WARNING**

Ignited flares produce intense bright light that may be damaging to vision. Personnel in close proximity should avoid direct eye contact, using peripheral vision when possible.

**CAUTION**

Some decoys are explosively separated and can travel up to 150 feet so personnel shall remain clear of their trajectory path.

**NOTE**

- It is recommended that water in flooding quantities be used to cool the surrounding area to prevent the spread of the fire while the flare burns itself out. If time does not exist for the flare to burn itself out, it is recommended that it be picked up by a fully outfitted hotsuitman from the cold end, and jettisoned over the side or removed to a clear area.
- Some aircraft parachute flares and infrared decoys may be quenched or contained by inhibiting airflow with water, AFFF, CO₂, or sand.
- Some decoys may be deactivated by the saturation of water, but if left to dry they may reignite. If the decoy is kept saturated with water long enough it will deactivate the material. EOD must render safe.

**Marine Locator Markers (Pyrotechnics)**

MK 25 MODS 2, 3 and 4/MK 58 MOD 0 contain red phosphorus and activate when their sea water battery is exposed to salt water. Most red phosphorous will burn underwater and produces residue and particles of white phosphorous. Both red and white particles can spontaneously reignite and are very toxic. Fire teams responding to fires involving these devices shall wear protective equipment (PFFPE with SCBA) when in close proximity. If an incident should happen, cool the surrounding area with water in flooding quantities. After flare is out the surrounding area and objects that may have been contaminated by phosphorous chemicals should be handled as a possible fire threat until decontaminated.

**Infrared (IR) Decoy Flares and Decoy Devices (Pyrophoric Metals)**

The combustion products in infrared decoys and devises are highly toxic and burn at very high temperatures. For instance, a decoy flare with magnesium, teflon and viton payload produces a six-foot-diameter fire ball that burns at 4000 °F; a reacting decoy containing a pyrophoric metal payload device burns at 1100 °F. If an incident should happen, a pyrophoric metal reaction can be controlled by inhibiting airflow to the pyrophoric metal using water, AFFF, or CO₂.
Aircraft Parachute Flares (Pyrotechnics)

MK 45 parachute flares are ejected using an explosive charge. ARFF personnel shall be aware of the possible trajectory path of the flare and remain clear.

LUU 2A/2B/19 flares all utilize a simple mechanical dial timer and spring assembly that falls off to deploy the parachute. If the parachute opens and pulls on the ignition lanyard it will initiate the primer and light the candle.


Otto Fuel

Otto fuel II is a stable liquid mono-propellant used in the propulsion of the MK 46 torpedo. Both the MK 46 torpedo and the MK 60 Captor Mine contain otto fuel II. Otto fuel II is composed of a nitrate ester in a solution with a desensitizing agent and a stabilizer. It is a bright red, free flowing, oily liquid that is heavier than water. It is insoluble in water. Detailed safety and handling instructions for otto fuel are contained in Otto II Fuel Safety, Storage and Handling, NAVSEA S6340-AA-MMA-010.

The nitrate esters in the otto fuel are known for their acute effects, including nasal turgidity, blood pressure changes, headaches, and dyspnea (difficult breathing).

Because otto fuel is a monopropellant and contains its own oxidizer, combustion cannot be smothered. The most efficient method of extinguishing an otto fuel II fire is to cool the propellant below 250 °F. This is best accomplished by the use of a finely dispersed water fog (neat or AFFF). Water and AFFF are both less dense than otto fuel II and will form a layer on the surface of the monopropellant and absorb the heat given off by the fire. For very small otto fuel fires, flames may be swept off the surface and extinguished with carbon dioxide fire extinguishers.
Otto fuel concentrations of less than 1.0 ppm, but greater than 0.4 ppm, produce a complete nasal blockage in some individuals. A headache lasting for several hours after exposure is the chief symptom of vapor inhalation, although nausea may develop after prolonged exposure. Skin absorption of otto fuel may also cause headaches.

In the event of overexposure to otto fuel II, the affected personnel shall immediately be removed from the contaminated area and receive medical attention as soon as possible. Contaminated clothing shall be removed immediately and contaminated skin areas washed with soap and warm water. If eyes are splashed, they shall be flushed immediately with large quantities of water for at least 15 minutes and prompt medical attention obtained.

If otto fuel is ingested, do not induce vomiting. Seek prompt medical attention. All items shall be discarded or thoroughly cleaned using detergent and warm water prior to storing and reuse.

Exercise care when removing and handling contaminated clothing and equipment so that personnel will not be exposed to the fuel.

The smoke from burning otto fuel must be considered as hazardous and toxic as otto fuel fumes. All warnings and procedures apply.

For information on protective clothing and cleanup procedures of Otto fuel, refer to NAVSEA OP 4522, Appendix A.

Special Weapons

Special weapons resemble conventional weapons in that they are enclosed in a shell or casing. The weapon or warhead casings are of varying thicknesses and may break up, depending on impact. Most weapons contain a conventional type of explosive that may detonate upon impact or when subjected to fire. The amount of high explosive involved in a detonation may vary from a small amount to several hundred pounds and constitutes a major hazard. If the casing ruptures, the exposed pieces of high explosive can ignite and burn. Radiological hazards may exist, regardless of the particular type of special weapon. The firefighting techniques and precautions for combating fires involving special weapons are found in the General Firefighting Guidance Technical Manual, Special Weapons Ordnance Publication, (SWOP) 20-11.
Other Combustible Material Hazards

Lithium

Lithium, the propulsion agent for the conventional warhead MK 50 torpedo, may be present at the site of nuclear weapons mishaps. The MK 50 can be launched from ships (FFG-7, DD-963) and aircraft (helicopters, S3 fixed-wing), and thus is a potential hazard at shore airfields and as a fly-on hazard for most air-capable/aviation ships.

The MK 50 torpedo’s internal propulsion system is fueled by 16 pounds of lithium. Lithium is a highly reactive combustible metal (class D fire). Under normal circumstances, lithium remains in a solid state contained in a stainless steel boiler inside the torpedo. Even when the boiler is activated in the propulsion mode, all lithium combustion remains within the boiler enclosure. The lithium will present a firefighting problem only if the boiler is breached because of physical damage to the torpedo. Rupture of the boiler could result in the release of molten lithium because of activation of the internal start charge or heat from an exposure fire. When molten lithium is exposed to the air, burning will result on the surface of the lithium mass. Though considerable heat and light are released when lithium burns, flame height is very low (similar to burning lava or charcoal briquettes). Burning lithium cannot be extinguished using conventional firefighting agents. Additionally, burning lithium reacts with water (or AFFF) to produce hydrogen gas. If confined, such as in a closed magazine, hydrogen can ignite with explosive force capable of rupturing doors and bulkheads.

Burning lithium emits a toxic and caustic particulate cloud. Do not breathe or expose yourself to the particulate cloud. Breathing of the particulate may cause damage to the respiratory system. Exposure to the particulate cloud may cause burning and damage to the eyes. Molten lithium will cause chemical burns to the skin. The white light emitted by burning lithium can cause eye burns. Avoid looking directly at the lithium.

Burning lithium in direct contact with an aluminum deck can melt through the deck. A 3/8-inch aluminum plate burns through in less than 3 1/2 minutes. Burning lithium on a steel deck may cause warping or cracking of a light-weight deck which is not being cooled with water. A fire watch should be placed in the area immediately below the burning lithium. To forestall damage to the deck, apply water to the underside of a hot deck immediately beneath the lithium. The application of water or AFFF on a lithium fire results in a decomposition of water into hydrogen and oxygen. Liberated hydrogen may violently ignite if confined and allowed to reach its lower explosive limit. This hydrogen ignition may produce a pressure wave of burning lithium that can be scattered a distance of approximately 50 feet.

⚠️ WARNING ⚠️

Application of halon 1211, PKP, or CO₂ is not effective against burning lithium and will result in a flare-up or explosion. Direct application of halon 1211, PKP, or CO₂ to burning lithium should be avoided.

⚠️ WARNING ⚠️

PFFPE, structural ensembles, or standard Navy shipboard firefighting ensembles with gloves, flash hoods, and SCBA shall be worn when attacking a lithium fire and during investigation/cleanup operations.

The primary concern in any MK 50 fire scenario is spread to adjacent pieces of ordnance and, in the worst case, cook-off of exposed warheads. Sympathetic chain ignition of multiple pieces of
ordnance/torpedoes and eventual mass detonation of warheads could destroy the ship; hence, rapid cooling is essential. If a torpedo’s boiler is breached, it is likely that the same torpedo’s warhead or adjacent warheads may be threatened by burning lithium. In spite of the potential for hydrogen generation, cooling with water or AFFF must be initiated as soon as possible to protect against potential warhead cook-off or other adverse reactions.

Flight deck firefighting tests involving the MK 50 and AFFF applied from hose lines and flush deck nozzles have shown that in open air the hydrogen combustion reaction, if any, is not hazardous to firefighters at an upwind standoff distance of 50 feet. If possible, attempt to jettison burning lithium (and preferably the torpedo) over the side. Burning chunks of lithium on the deck may be scooped up with a shovel once the warhead is no longer exposed. A straight stream of water may also be successful in washing burning lithium overboard, or to a safer area on shore installations.

**Polyethylene Packaging Material**

Polyethylene packaging material (bubble packs and so forth) present a hazard in that they cannot be extinguished by water only. AFFF must be used on these materials to preclude a continued reflash.

**Fluoroelastomer (Viton)**

Fluoroelastomer (Viton) is a vulcanizing compound that may be found in small quantities throughout the aircraft. In small quantities, it poses no significant threat to firefighting or salvage personnel. However, aircraft such as the F/A-18s do contain substantial amounts of viton.

This rubber-like compound is applied to the aircraft engine exterior and various other areas throughout the aircraft. Highly toxic products of combustion, including hydrogen fluoride, carbonyl fluoride, carbon monoxide, and low-molecular-weight fluorocarbon fragments, can be generated in a fire involving viton. Personnel fighting such a fire should wear a positive-pressure self-contained breathing apparatus.

**Protective Clothing**

Anyone exposed to fumes from the fire should be moved to fresh air at once and checked by a physician.

NOTE

Viton is halogen based and will self-extinguish if ignition source is removed.

Personnel handling residues of viton that have been involved in fire shall wear neoprene gloves to avoid skin contact with these possibly highly corrosive residues that likely include hydrogen fluoride.

Cleanup procedures for small pieces of Viton shall include wrapping and packaging for transportation to an authorized hazardous material disposal site. Entire engine sections shall be processed in accordance with current directives.

CAUTION

Do not attempt to wash away pieces of viton with water or AFFF as it could increase danger of corrosive residues.

**Plastics**

When involved in a fire, all plastics present varying degrees of toxic hazards because of the gases, fumes, and/or minute particles produced. Any fire involving plastics should be approached on the
assumption that toxic fumes and particles are present. This includes all fires involving special weapons.

**Composite Materials Reinforced with Carbon/Graphite Fibers**

Composite materials that are reinforced with carbon/graphite fibers provide superior stiffness, high strength-to-weight ratio, and ease of fabrication. As a result, this material is being used in advanced aircraft to replace heavier metal components. See *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1 for aircraft containing composite material. Unfortunately, carbon/graphite fibers can be released into the atmosphere if their epoxy binder burns. Once free, these small lightweight fibers can be transported up to several miles by air currents and, because of their high electrical conductivity, can damage unprotected electrical/electronic equipment. Approximately 752 °F (400 °C) will cause epoxy binder to ignite or decompose. Similarly, mechanical agitation, especially an explosion, can fragment the fibers and cause them to become airborne. Until such time as more is known, aircraft crash and firefighting units must endeavor to extinguish fires involving carbon fiber reinforced composites as quickly as possible and provide maximum containment of the aircraft debris. The containment and cleanup function is extremely important and must be treated as a special hazard prevention measure. Accordingly, the practices for extinguishment, containment, post-fire, and cleanup as contained in the *U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14 page 6-14 should be observed in the event of an aircraft crash/fire incident involving any of the aircraft containing carbon fiber composites. Any aircraft incident involving fire on these types of aircraft must be considered to have potential contamination hazards until positively identified to the contrary.

**Composite Materials Reinforced with Boron/Tungsten Fibers**

Composite materials that are reinforced with boron fibers provide superior stiffness, high strength-to-weight ratio, and ease of fabrication. As a result, this material is being used in advanced aircraft to replace heavier metal components. See *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual*, NAVAIR 00-80R-14-1 for aircraft containing composite material. Unfortunately, boron fibers can be released if their epoxy binder burns. Boron fibers pose less of a problem to unprotected electrical equipment than carbon/graphite fibers because boron fibers are much heavier and thus are less likely to become airborne, and also because boron fibers are much less electrically conductive. However, loose boron fibers are stiff and sharp and pose handling problems. The extinguishment, containment, post-fire, and cleanup practices for boron fibers are the same as those outlined for carbon/graphite fibers in paragraph above.

---

**WARNING**

Inhalation of composite fibers resulting from aircraft fires and/or aircraft material damage may be harmful to personnel. Respiratory protection should be worn when exposed to these potential hazards.

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**NOTE**

The nature of shipboard aircraft mishaps and the nonavailability of such protection may prevent all shipboard firefighting personnel from complying with the above warning.
Non-Combustible Material Hazards

Radiological
Radioactive sources may be present on or within an aircraft. Those sources do not represent a significant hazard to personnel during normal operations, but in an aircraft mishap or fire this material may mist, exposing firefighting personnel and requiring protective measures be taken during firefighting, salvage, or cleanup operations. Inhalation of alpha and/or beta particles is considered the most significant radiological hazard associated with a mishap involving radioactive material. Beta radiation sources may also cause burns to unprotected skin/eyes after prolonged exposure. In all cases, self-contained breathing apparatus and standard firefighting clothing will protect personnel against levels of radiation expected at a mishap site. Refer to the *Special Weapons Ordnance Publication*, SWOP 20-11 for mishaps involving special weapons.

AMERICIUM 241 (AM-241)
AM-241 is a product of plutonium and has many of the same associated hazards. AM-241 emits potentially hazardous amounts of alpha and gamma radiation. Alpha emittance is approximately 5 MeV; gamma emittance is approximately 60 KeV.

AM-241 is found in the laser optical module of the laser transceiver carried in the forward-looking infrared (FLIR) pod on the F/A-18A/B/C/D aircraft. The FLIR pod is a self-contained system designed to mount on the fuselage over weapons station No. 4. The pod is 13"x 72" and weighs approximately 358 pounds.

The possibility of free AM-241 escaping its container is remote, short of catastrophic destruction of the unit. Recovery of the AM-241 should be left to the accident investigation board, as protective clothing and instrumentation may be needed for its detection.

```
WARNING
Procedures and safety precautions for handling and disposal of the optical module include wearing gloves and a properly fitted protective mask while double sealing it in plastic bags, and shipping it to the licensed repair facility for repair or disposal.
```

Nonradiological Metals/Compounds
The following materials are often associated with nuclear weapon mishaps and may present the following health hazards:

1. Beryllium
   - Beryllium is a light, gray-white, nonradioactive, hard, and brittle metal that resembles magnesium and may be found on some aircraft. Because beryllium oxidizes easily, any fire or explosion involving beryllium will release toxic fumes and smoke. Positive-pressure SCBA is required whenever beryllium fumes or smoke are present.

2. Lead
   - Pure lead and most of its compounds are toxic. Lead enters the body through inhalation, ingestion, or skin absorption. Inhalation of lead compounds presents a very serious hazard. Skin absorption is usually negligible. Positive-pressure SCBA and firefighter clothing are required to protect personnel from lead compounds.
ARFF Ready References

The following references shall be available to ARFF personnel as companion documents to this NATOPS Manual:

- *Shipboard Firefighting Naval Ships’ Technical Manual (NSTM)*, Chapter 555. Contains detailed information, including sketches and diagrams, extinguishing agents and systems, and portable equipment. Shore-based fire departments, and supporting ships or aviation units shall each maintain a copy in their ready reference libraries.


- *Aircraft Signals NATOPS Manual, NAVAIR 00-80T-113* Contains the standard hand, wand, and light signals used by aircraft handling, aircrews, aircraft firefighting, and other aircraft support personnel.

Firefighting Agents and Equipment

**AFFF**

AFFF liquid concentrates consist primarily of synthetic fluorocarbon surfactant materials that are noncorrosive and have an unlimited shelf life when stored in a protected area where the temperatures may range from 32 °F (0 °C) to 120 °F (48 °C).

NOTE
Failure to follow manufacturer storage procedures may cause AFFF to break down and separate, degrading its ability to form a vapor seal.

These concentrates must meet current military specification standards (MIL-F-24385). Three-percent and six-percent AFFF concentrate is approved for naval use. Optimum performance for a 3-percent concentrate is realized when proportioned at 3 parts concentrate to 97 parts water. For a 6-percent concentrate, optimum performance is achieved when proportioned at 6 parts concentrate to 94 parts water. Current shipboard equipment requires 6-percent concentrate. AFFF concentrate is noncorrosive. When mixed with water, corrosive effects occur because of the corrosive properties of water (particularly saltwater) and the AFFF-induced low-surface tension of the mixture promoting seepage through small cracks, etc. Either fresh water or salt water may be used for proportioning systems. For premixing, only fresh water should be used to reduce corrosion activity. The *Commander Naval Air Forces (COMNAVAIRFORINST)* 4790.2(series) outlines the mandatory procedures that must be followed whenever an aircraft is sprayed with AFFF solution.

NOTE
The foaming of runways shall not be accomplished or attempted in any manner.

Firefighting Efficiency

The unique extinguishing and securing action of AFFF on flammable liquid fires results from a combination of rapid foam blanketing and vapor sealing when applied properly. During fire extinguishment, the AFFF foam blanket rapidly yields a very thin layer of AFFF solution that extinguishes the fire and forms a vapor seal, restricting further emission of flammable vapors.
Application of AFFF

AFFF fire extinguishing efficiency is not critically dependent on foam expansion as is the case with protein-type foam concentrates. AFFF can be applied with either approved non-air-aspirating nozzles or air-aspirating foam nozzles. However, the variable stream fog nozzle type is preferred because of the rapid stream adjustability afforded the firefighter. Additionally, these nozzles produce more fluid foam, resulting in faster control and extinguishment.

| NOTE |
| AFFF is compatible with halon 1211 and PKP dry chemical firefighting agents. |

| WARNING |
| Periodic reapplication of AFFF is essential to avoid reflash when working in and around crashed aircraft. |

Navy Shipboard Vari-Nozzles

The navy nozzle (Figure 5-3, frame 1-2) used on both saltwater and AFFF hose lines on ships is referred to as the vari-nozzle. The vari-nozzle is available in three sizes: a 95 gallon per minute (GPM) with a 1-1/2″ national pipe straight hose (NPSH) threaded inlet, a 125 gpm with a 1-1/2″ NPSH inlet, and a 250 gpm with a 2-1/2″ national hose (NH) threaded inlet. All gpm ratings are nominal assuming a nozzle inlet pressure of 100 pounds per square inch (psi). The spray pattern from this nozzle can be varied from straight stream through a range up to at least a 90° fog stream pattern. Some nozzles may adjust up to approximately 110° depending on the manufacturer. Stream patterns are changed by rotating the black shroud which surrounds the last 4 to 5 inches of the tip end of the nozzle. Markings are provided to indicate position settings for straight stream, narrow fog (30°), and wide fog (90-110°). The gpm flow rate remains constant throughout the pattern range. The vari-nozzle produces an acceptable fog pattern down to 60 psi. Below 60 psi the fog pattern is not full and radiant heat protection is degraded.

Fire Extinguishing Agent Supply Requirements

Each ARFF organization shall maintain a minimum ready stock of one vehicle/equipment load of AFFF, PKP, and halon 1211 (total tank capacity) for each manned ARFF vehicle assigned. The minimum ready stock shall exclude the initial load of agent in the tank and agent necessary to satisfy firefighting training requirement.

Supply departments for air activities should maintain an equal amount of agent.

Water

Water is not generally considered to be a suitable agent for use in combating large aircraft fuel fires without the addition of either foam agents or surfactants. This is particularly true when the fire involved is in deep pools or pits.

Many procedures for applying water in aircraft firefighting have been explored. The most successful applications have been obtained by using fog and spray streams. It is generally recognized that, within certain limits, the higher the nozzle pressure, the smaller the water particles become and the more effective the spray stream becomes. The successful use of water may be attributed to correct methods of application, the ability of a water stream to move the burning fuel to an area sufficiently remote from the aircraft, or its ability, when properly applied, to cool the aircraft fuselage and provide a heat shield for personnel.
Water is also an effective agent for cooling ordnance or batteries and for extinguishing class A fires incidental to an aircraft fire.

**WARNING**

Extreme caution shall be exercised to preclude disruption of an AFFF blanket with water. Reignition or spread of the fire can result.

**Figure 5-3 — 1-1/2 and 2-1/2 inch Navy vari-nozzle.**
**CVN, LHD, and LHA Organization and Operations**

**Air Department Repair Teams**
Within the CVN, LHD, and LHA damage control organization are three repair teams in the air department:

1. Aviation fuel repair team
2. Crash, salvage, and rescue team
3. Hangar deck firefighting and rescue team

**Air Officer (Air Boss)**
The air boss is responsible for aircraft firefighting, salvage, jettison, and personnel rescue. Other responsibilities include overseeing aviation fuel repairs occurring on the flight/hangar decks and coordinating activities with damage control central.

**Aircraft Handling Officer (ACHO)**
The ACHO is responsible for coordination of all aircraft movement on the flight/hangar decks during aircraft crash and fire evolutions and ensures communication between the scene leader and primary flight control (PRIFLY).

**Aircraft Crash, Salvage, and Rescue Officer (Air Boatswain)**
The air boatswain is responsible for organizing, supervising, and training the crash, salvage, and rescue team (both flight and hangar deck) and maintaining and operating assigned equipment on the flight deck.

**Integrity Watch Officer (IWO)**
The IWO assumes the duties of the ACHO when aircraft integrity watch is set. The IWO's duties apply to initial emergency response only and do not include authority to set flight quarters or have aircraft moved in other than emergency conditions.

**Aviation Fuel Officer**
The aviation fuel officer is responsible for the organization, training, and operation of the aviation fuel repair team.

**Ordnance Handling Officer (OHO), CVN Only**
The ordnance handling officer shall keep the ACHO/air boatswain continually updated as to type/quantity of ordnance being used, staged, or transported on the flight or hangar deck.

**Air Gunner**
The air gunner shall keep the ACHO/air boatswain continually updated as to type/quantity of ordnance being used, staged, or transported on the flight or hangar deck.

**CVN Crash, Salvage, and Rescue Team**
The crash, salvage, and rescue team (also referred to as crash and salvage) is the flight deck repair team. From its station in the island structure it serves to effect rescue of personnel from damaged aircraft on the flight deck, clear away wreckage, fight fires on the flight deck, and make minor emergency repairs to the flight deck and associated equipment.
Crash and Salvage Team Organization During Normal Flight Operations

Table 5-1 is a guideline only and should be adapted to meet CVN local requirements. Crash and salvage personnel should be trained and qualified to perform the functions of every other member of the team.

### Table 5-1 — CVN Crash and Salvage Team Organization During Normal Flight Operations

<table>
<thead>
<tr>
<th>NAME</th>
<th>RATE***</th>
<th>FUEL SPILL</th>
<th>A/C FIRE</th>
<th>A/C CRASH (SALVAGE)</th>
<th>A/C IN CATWALK</th>
<th>A/C JETTISON</th>
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<td>SCN LDR</td>
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<tr>
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<td>EQUIP</td>
<td>EQUIP</td>
<td>NETS**</td>
<td>AS RQD</td>
</tr>
</tbody>
</table>

**Notes:**
* Normally one MFFV will respond to fuel spill while the other mobile firefighting vehicles (MFFV) cover flight ops.
** Applicable to jettison stations with portable coaming and safety nets with lowering capability.
*** Or qualified personnel.

After providing required equipment, all personnel perform duties as directed by the supervisor.

### Duties and Procedure Requirements

The aircraft firefighting team organization and duties are essential to meet the training and procedure requirements contained herein:

### Scene Leader

The scene leader is a trained individual in the vicinity of an incident who understands the requirements of the emergency and accepts responsibility for directing all available firefighting assets at the scene.
MFFV Driver and Operator
The driver, turret operator, and one handline operator for the P-25 provide immediate response and initial firefighting actions. MFFV driver should be equipped with a flight deck wire free communications system headset.

Hose Team Leader
The hose team leader is positioned directly beside the nozzle man and is responsible under the direction of the scene leader for the hose team.

**NOTE**
The hose team leader shall only provide direction to the hose team and not operate the hose.

Hose Team/Deployment
AFFF hoses shall be deployed to the scene using maximum personnel participation. When in place, a hose team shall consist of one AFFF hose with a minimum of 5 persons (maximum 7) on each 2 1/2-inch hose and a minimum of 3 persons (maximum 5) on each 1 1/2-inch hose or 1 3/4-inch hose.

**NOTE**
- Minimum manning requirements should be enforced for hose teams involved at the fire scene to minimize exposure to ordnance hazards.
- All personnel on the hose team should be positioned on the outside of the hose in relation to the aircraft to aid in mobility, communication, and decrease interference between hose team members when able.
- All personnel shall wear leather gloves.

Messengers
Messengers are responsible for relaying information from the scene leader to flight deck/hangar deck control.

Rescue Personnel
Rescue personnel shall be available for immediate response and properly attired in PFFPE and SCBA while performing firefighting duties. Rescue personnel should always work in pairs as directed by the scene leader.

**NOTE**
In each hangar bay, PFFPEs shall be available for a minimum of two SCBA-equipped hotsuitmen.

AFFF Hose Station Operator (Plug Man)
The plug man operates the station at the direction of the hose team leader, and maintains direct communication on the sound-powered phone X50J with the AFFF proportioning station operator.
Background Assistance Leader
This person organizes and dispatches background assistance personnel in support of the scene leader.

### NOTE
All flight deck, hangar deck and embarked squadron personnel not actively engaged at the fire scene, or involved in other critical duties, shall muster with the background assistance leader. The background assistance leader will provide further support as required.

Medical Personnel
Medical personnel shall report to the background assistance leader for assignments.

EOD/Weapons Personnel
During all fixed and rotary wing operations involving ordnance, or whenever ordnance is on the flight deck, properly equipped EOD personnel shall be stationed in flight deck control or at the discretion of the ACHO. They shall be dispatched to the scene by the ACHO to provide technical assistance and weapons cooling temperature checks and weapons disposal as required by the scene leader. The OHO shall maintain a status board that confirms type, quantity, and location of all weapons on the flight/hangar deck and/or aircraft. This information shall be provided to the scene leader and ACHO.

Aviation Fuels Repair Personnel
These personnel shall respond to the background assistance detail and be available to provide technical assistance and systems repair. Additional V-4 personnel shall be dispatched to isolate affected stations/quadrants of the JP-5 system and notify flight deck control when affected systems are isolated.

⚠️ WARNING ⚠️
If fire occurs in an enclosed fuel station, personnel shall not enter the fuel station without an SCBA.

Aviation Squadrons
Aircraft squadrons are to provide a senior maintenance representative for technical assistance to be included in the background assistance leader’s detail. Additionally, all air wing personnel shall provide immediate assistance in all firefighting or training evolutions.

### NOTE
Emergency lighting shall be checked daily. Emergency lighting is provided at each hose reel station; controls are located in PRIFLY and on the navigation bridge.

Equipment

SCBA
The SCBA shall be made available to all firefighters/salvage personnel required in the immediate vicinity of an aircraft mishap. An SCBA is a device worn by firefighters, rescue, and others to provide
breathable air in an IDLH environment. An SCBA has a full-face mask, regulator, pressure reducer, air cylinder, cylinder pressure gauge, associated hoses, and a harness with adjustable shoulder straps and waist belt which lets it be worn on the back. The air cylinder is usually of a 30-minute, 45-minute or 60-minute rated duration. This cylinder however does not usually last the full rated duration, depending on the exertion and fitness of the wearer.

**AFFF Hose Outlets CVN**

Hangar bay AFFF hose reel outlets (Figure 5-4) are located port and starboard within each bay. A pushbutton control is located adjacent to each AFFF hose station.

Flight deck AFFF hose reel outlets are located in catwalks and in the vicinity of the island. The station consists of one 1 1/2-inch hose reel and one 2 1/2-inch hose outlet with hose and nozzle preconnected. A pushbutton control is located adjacent to each AFFF hose station.

**Hose Outlets**

Hoses shall be of sufficient length to permit reaching all areas on the flight deck, adjacent weather decks, and the hangar deck from at least two outlets.

**Equipment for Saltwater and AFFF Hose Outlets (Hangar and Flight Decks)**

1. Hose outlet valves
2. Hoses
3. Vari-nozzles
4. Spanner wrenches (2) (hangar deck only)
5. One CO₂ and one PKP extinguisher (AFFF outlets only)

**Vari-Nozzles and In-Line Eductors**

Vari-nozzles are used on all AFFF and saltwater hose lines. Flow rates are 250 gpm for all 2 1/2-inch hose lines. Nozzles on 1 1/2-inch AFFF hoses on flight and hangar decks are the 125 gpm units. Nozzles on 11/2-inch and 1 3/4-inch saltwater lines and those used with AFFF in-line eductors are 95 gpm models. All nozzle gpm flow ratings are based on 100 psi pressure at the nozzle inlet. The portable in-line eductors are stowed in repair lockers and are used to mix saltwater and AFFF concentrate from 5-gallon containers to produce AFFF solution for combatting fires. This in-line eductor may be placed anywhere in the hose line but is recommended to be near or on the saltwater outlets, as a minimum of 100 psi at the inlet is optimum for proper proportioning. Hose downstream of the eductor is typically limited to 150 feet on the same deck or one deck above the saltwater outlet. Locating the eductor at the outlet allows the plug man to handle transferring the pickup tube between AFFF containers and moves this activity off to the side.
Hose control devices shall be attached to AFFF hose outlets near large concentrations of weapons (i.e., forward and aft of the bomb farm). Alternate stations should be designated for firefighting coverage.

PFFPE

Aircraft firefighting/rescue protective clothing is a prime safety consideration for personnel engaged in firefighting and rescue work. The PFFPE offers a means of providing protection to firefighters because of its high percentage of reflectivity to radiant heat. PFFPE fabrics have been adopted for use in the Navy mishap/rescue program. Firefighters assigned ARFF duties, both shipboard and shorebased, shall be provided with a complete PFFPE. The recognized PFFPE is comprised of the following elements: coat, trousers, helmet (proximity) which includes an attached helmet shroud (proximity) and helmet cover (proximity — separate or as part of the helmet shroud), footwear (proximity boots), gloves (proximity), hood (anti-flash or firefighting), and summer aviator gloves (for shipboard application only, under the proximity gloves).

Hood Requirements

The hood specified as an element of the PFFPE, worn under the proximity helmet/shroud/cover combination, shall be either the standard Navy anti-flash hood (NSN 4210-01-493-4694) or any “firefighting protective hood” meeting the requirements of National Fire Protection Association (NFPA) 1971 that bears a label indicating conformance to such. Note that there are no unique NFPA proximity requirements for hoods at this time. As such, the requirements in the structural portions of NFPA 1971 are the only available requirements applicable for hoods. Therefore, a unique “proximity hood” is not manufactured or available. The hood is the only element of the PFFPE that is acceptable to be in accordance with the structural NFPA standards.

General Requirements for the PFFPE

Procurements of the coat, trousers, helmet (also including the attached shroud), footwear, and proximity gloves specified as elements of the PFFPE shall meet the requirements of NFPA 1971, as applicable to proximity ensembles. Current PFFPE meeting the requirements of the former NFPA 1976, 2000 edition can continue to be utilized until the garments are no longer serviceable. Each of these elements shall bear one of the following two labels as evidence of conformance to such:

1. “This (element name will be inserted here) meets the (element name will be inserted here) requirements of NFPA 1976, standard on protective ensemble for proximity firefighting, 2000 edition. Do not remove this label.”
2. “This proximity firefighting protective (element name will be inserted here) meets the (element name will be inserted here) requirements of NFPA 1971, 2007 edition. Do not remove this label.”

All future procurements of these PFFPE elements shall be in accordance with the proximity portions of NFPA 1971, 2007 edition.

NOTE

ARFF personnel shall wear head protection while performing duties that require the individual to be on the exterior and above ground level on all aircraft firefighting and rescue vehicles.
Special Requirements for the PFFPE Helmet

PFFPE coats and trousers are designed as a set to ensure that the elements have a proper interface with one another to afford and maintain protection to the wearer during anticipated activities and movements. As such, only coats and trousers manufactured by the same manufacturer of the same model shall be worn together by the user whenever the use of a PFFPE is required. In addition, coats and trousers shall be properly sized for the wearer to ensure that the PFFPE coat and PFFPE trousers have at least a 2-inch overlap of all layers so there is no gaping of the total thermal and radiant heat protection when the protective garments are worn. The minimum overlap shall be determined by measuring the garments on the wearer, without SCBA, in both of the following positions:

1. Position A. Standing, hands together reaching overhead as high as possible.
2. Position B. Standing, hands together reaching overhead, with body bent forward at a 90-degree angle, to the side (either left or right), and to the back.

NOTE

- NFPA 1971, 2007 edition includes requirements for both proximity and structural firefighting protective ensembles. For elements manufactured in accordance NFPA 1971, 2007 edition, only those meeting the specific proximity requirements are acceptable for use in proximity applications with the exception of the hood. All acceptable elements, with the exception of the hood, will bear the label above that includes the word “proximity” in its verbiage. Elements, with the exception of the hood, that only list “structural” on the NFPA conformance label are not acceptable for use in proximity applications.

- Some elements of the PFFPE are comprised of multiple detachable components, such as the shells and liners of the coats and trousers. These elements will bear the following on its product label: “For compliance with the proximity firefighting (element name will be inserted here) requirements of NFPA 1971 (or NFPA 1976), the following protective items must be worn in conjunction with (element name will be inserted here) here): (additional components will be listed here) do not remove this label.”

NOTE

All components/elements listed on the label described above shall be employed/worn by the user whenever the use of a PFFPE is required in order to afford proper protection to the wearer.
Requirements for Summer Aviator Gloves

There are no NFPA standards associated with aviator gloves. Acceptable aviator gloves are available through the stock system under the following national stock numbers (NSNs): 8415-01-504-5173 (size: M); 8415-01-504-5562 (size: L); and 8415-01-504-3063 (size: XL).

Care and Maintenance of PFFPE

The PFFPE shall be maintained in accordance with NFPA 1851. The heat reflective ability of PFFPE clothing items is reduced when they are stained or otherwise soiled. It is imperative that careful attention be given to the following care, cleaning, and maintenance instructions.

1. Clean and store in accordance with manufacturers’ specifications. Storage should be on hangers with suitable hanging space to prevent metalized fabrics from creasing or cracking. If folded, the folds should be loose. Do not sit on a folded garment.

   NOTE
   Garments shall be dry prior to storage.

2. Dirt and soot should be sponged off with mild soap and water, and the aluminum surface dried with a clean cloth. Rub gently to avoid removal of the aluminum.

   NOTE
   Brushes shall not be used on the aluminum surface.

   a. Cleaning solution shall be in accordance with manufacturer’s instructions. When instructions are not available, mix at a ratio of one ounce of soap to one gallon of water. Up to three ounces of soap may be used; increasing solution concentration does not mean better cleaning.

   b. Rinse off all soap mixtures with clean water.

3. Grease stains shall not be removed by the use of dry cleaning solvents (isopropanol or perchlorethylene react with the aluminum surface and may etch the metal). Clean the clothing with water and wipe dry. Allow the garment to hang in a ventilated location at room temperature.

4. AFFF may be removed by sponging clean with mild soap and water. Allow the garment to hang to dry in the open or in a place with good circulation. During firefighting operations, it is not always possible to prevent agents from getting onto protective clothing. However, PFFPE clothing that has been covered or spotted with agent will have less heat reflection than the suit normally provides.

5. Corrosive chemicals will react with the aluminum surface and may etch the metal. Clean the clothing with soap and water solution and wipe dry. Allow clothing to hang in ventilated location at room temperature.

   CAUTION
   PKP will react to aluminum surface if left to dry; after using PKP follow cleaning instructions in detail.

6. Outer shell and other radiant reflective components of PFFPE and ensemble elements shall not be cleaned with a brush or other abrasive cleaning devices.
7. Outer shell and other radiant reflective components of PFFPE and ensemble elements shall not be machine washed and not machine dried.

![CAUTION]

If liner system is laundered in the shipboard laundry, Wash Formula III (100 °F with detergent) shall be used.

8. Removal of composite fibers from PFFPE shall be accomplished with the use of a high-efficiency vacuum cleaner (with a .3 micron high-efficiency particulate air (HEPA) filter).

9. Inspection criteria for garments shall be:
   - Replace aluminized shell components when metal wears off or fabric cracks/tears.
   - Liner shall be replaced or repaired if torn or inner batting becomes visible due to wear. Repairs shall be made only by repair facility which is authorized by the original garment manufacturer.

![WARNING]

Spraying worn clothing with aluminum paint serves no useful purpose and is a dangerous practice.

Care of PFFPE Helmet Face Shield

The gold-coated face shield is a reflective heat shield. The face shield is not a sun shield. This item should be kept in excellent condition to maintain the radiated heat-reflective efficiency. In particular, when the face shield’s gold surface becomes worn, scratched, or marred, 90 percent of the heat protection is lost and the face shield should be replaced immediately.

1. For adequate protection, replace worn gold coated face shield. Ensure the gold surface is on the outside as marked on the edge.
2. Avoid touching or wiping gold surface as much as possible.
3. Clean face shield without removing it from the helmet using a clean soft cloth with mild soapy water; rinse and pat dry.

![NOTE]

For shipboard crews, one spare gold reflective face shield shall be maintained for each PFFPE helmet. Spare face shields shall be from the same manufacturer, and same model, as the helmet. The gold face shield is optional for Navy shore-based airfield firefighting.

Damage Control/Firefighter (DC/FF) Helmet

The DC/FF helmet is designed to protect the head, neck and face from short duration flame (flash) exposure, heat and falling objects. The helmet shell is made from a special woven heat-resistant fiberglass design. This heat and flash protection is enhanced by wearing a firefighter’s hood beneath the helmet. The helmet has a wide brim that extends at the back to protect the firefighter’s neck and collar from hot objects or water and falling debris. It has a fold down plastic shield to protect the eyes from heat flash and direct bursts of straight stream water in firefighting evolutions.
The helmets are colored bright red with reflective markings. The helmets have a chin strap and an adjustable “ratchet-type” suspension. Some have a metal or plastic bracket attachment on the side brim for helmet lights and others have a light that fits on the helmet. The firefighter’s helmet is certified to meet NFPA 1972-1992 Standard for Structural Fire Helmets. The firefighter’s helmet may be procured through the supply system (MILSTRIP requisition, NSN 4210-01-493-7428).

NOTE
The DC/FF Helmet is NOT the same helmet as the PFFPE Helmet discussed previously. The DC/FF is NOT to be used as a replacement or substitute for the PFFPE Helmet as it is not designed to specifically interface with the required aluminized reflective shroud/cover nor is it equipped with the reflective proximity face shield.

Thermal Imaging Camera

The TIC provides firefighters and rescue personnel with the ability to detect surface temperatures on areas exposed to fire in order to determine where additional firefighting effort needs to be concentrated or to determine if internal aircraft components continue to burn during overhaul and salvage operations.

The TIC can also be used to assess the surface temperature of weapons exposed to fire and help to estimate the time needed for additional cooling. The TIC can also be used to locate down personnel in smoke-filled or low visibility areas, and can be used to visualize fluid levels in enclosed containers, such as fuel tanks and AFFF tanks/drums.

Powered Extrication Tool

The powered extrication tool is also referred to as “Jaws of Life,” Portable Hydraulic Actuated Rescue System (PHARS), or Portable Electric Actuated Rescue System (PEARS). Due to the reduced maintenance requirements, the removal of the need for combustible fuel storage and the increased reliability over the PHARS, the PEARS is the type most recommended for shipboard use. The PEARS uses a battery or battery pack to power the power head for use during an aircraft rescue operation or to aid in a specific portion of a salvage evolution. Ships currently using PHARS should replace them with a PEARS through natural attrition.

Cordless Drill/Driver

The current manual method of opening the canopy of an F/A-18 or F-35 during an emergency can be improved with the use of a cordless drill and 1/4-inch hex drive to 3/8-inch drive adaptor. Improvements include much faster opening times, less exertion required by rescuers, and less stress to the aircraft. The following shall apply to ensure proper use of the drill for this application:

CAUTION
Lowering the canopy with the use of power tools could over torque the canopy manual drive mechanism and cause damage to the canopy.
Use of the drill shall be an option available at the discretion of the air boatswain on each ship and shall not be considered as a one-for-one replacement for the speed wrench.

Any drill used for this purpose shall be a dedicated tool and only used as an emergency tool to ensure its availability and operability during all flight operations. Additionally, it shall be capable of reverse operation.

Two batteries shall be available during flight operations (one on the tool, and one in a charger).

Cordless tool batteries must be used regularly in order for them to maintain a full charge and to maximize the chargeability of the battery. Batteries used for this tool should be rotated regularly with batteries for other tools that get regular day-to-day usage.

The speed wrench shall continue to be available in the tool roll and shall be available at the scene as a backup in case of mechanical failure of the drill/battery.

Portable drills purchased for this use must be 18-volt or higher rating and must have a two-speed motor to ensure the low speed/high torque setting is available. The minimum torque rating must be 400 inch pounds. The chuck size must be 3/8 or 1/2 inch.

Do not operate drill/driver in “hammer” or “impact” setting. Damage to the aircraft will occur.

A 1/4-inch hex drive to 3/8-inch drive adaptor must also be acquired and firmly installed in the drill chuck.

Once acquired, portable drills should be tested to assure they are capable of opening the F-18F canopy and to check the drill chuck torque setting to see if a non-drill torque setting is available that will open the canopy. This will provide a greater measure of safety for the operator when the canopy tops out fully open.

Portable drills used for flight operations shall be checked daily prior to flight operations:
   a. Ensure two fully charged batteries, one on the drill and one in the charger.
   b. Check drill positioned in the low setting.
   c. Ensure 1/4-inch hex drive to 3/8-inch drive adaptor is installed
   d. Check the drill chuck to assure proper torque setting.

NOTE
The use of power tools to open the canopy shall only be considered in case of an emergency and shall not become a standard practice if manual opening of the canopy is required. Power tools shall not be used to close the canopy.

NOTE
Drill must operate in reverse while opening the canopy.

WARNING
Once the canopy of an F-18 reaches the full open position the drill operator will experience a sudden stop, which could cause injury due to the drill twisting force.
Air Bag Rescue and Lifting System

Normally utilized ashore, an air bag rescue and lifting system shall consist of bags sufficient in size and quantity to lift normally supported aircraft. This system shall be supplied with accompanying pressure regulators, hoses, valves, and air supply. The system is to be used for expeditious rescue of pinned victims, lifting heavy debris, and other various needs if entry at the immediate mishap scene is inaccessible to heavy equipment (cranes or mechanical lifting devices). Complete operating instructions shall be provided with and accompany each system.

Respiratory Protection Program

Each activity shall establish and maintain a respiratory protection program, per Office of the Chief of Naval Operations, OPNAVINST 5100.19/5100.23(series).

Extension Wands Aboard Ship

On all ships with embarked helicopters having engine inlets unreachable by standard CO₂ horns, 5- or 7-foot insulated extension pipes are required to be fitted on 15-pound portable CO₂ extinguishers. Ships certified for V-22 operations shall maintain V-22 extension wands. All extension pipes and wands shall be mounted securely with appropriate hardware.

NOTE

The V-22 extension wand is specifically required for all V-22 operations aboard ship. This wand may also be used and substituted for the extension pipes required for all other rotary-wing aircraft.

Filter Breathing Masks

Provisions should be made to ensure a sufficient number of filter-type breathing masks are available as prescribed for composite materials that are likely to be encountered at the crash site. All personnel involved in mop-up, salvage, or standby operations at the crash site shall be required to wear this mask or a higher level of protection.

Fire Hoses

Fire hoses shall be inspected, maintained, and tested in accordance with NFPA 1962 or Naval Sea Systems Command (NAVSEA) PMS as applicable.

Flight Deck Tool Inventory

Crash and salvage tool inventories containing the firefighting/rescue tools and equipment listed in Table 5-2 shall be maintained for use in emergencies. All equipment shall be inspected daily prior to commencement of flight operations. Requirements for salvage equipment can be found in NATOPS Aircraft Salvage Manual, NAVAIR 00-80R-19(afloat).
## Table 5-2 — Crash and Salvage Tool Inventory

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
<th>National Stock Number (NSN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter, 1/4-inch hex drive to 3/8-inch drive drill</td>
<td>1</td>
<td>5120-00-227-8095</td>
</tr>
<tr>
<td>Adapter, 3/8-inch drive step down to 1/4-inch drive</td>
<td>4</td>
<td>5110-00-293-2336</td>
</tr>
<tr>
<td>Axe, crash/fire</td>
<td>2</td>
<td>5120-00-221-7958</td>
</tr>
<tr>
<td>Bar, 1/2-inch drive breaker</td>
<td>1</td>
<td>5120-00-242-0762</td>
</tr>
<tr>
<td>Bar, 60-inch pry</td>
<td>1</td>
<td>5120-00-224-1390</td>
</tr>
<tr>
<td>Bar, crow (26-inch)</td>
<td>1</td>
<td>5120-00-224-1372</td>
</tr>
<tr>
<td>Cutters, bolt (36-inch)</td>
<td>1</td>
<td>5110-00-188-2524</td>
</tr>
<tr>
<td>Cutters, cable (14-inch)</td>
<td>1</td>
<td>5110-00-224-7053</td>
</tr>
<tr>
<td>Drill-driver, electric, portable</td>
<td>1</td>
<td>5130-01-444-4662</td>
</tr>
<tr>
<td>Extension, 3/8-inch drive, 12-inch</td>
<td>1</td>
<td>5120-00-243-1691</td>
</tr>
<tr>
<td>Extension, ½-inch drive, 6-inch</td>
<td>2</td>
<td>5120-00-243-7326</td>
</tr>
<tr>
<td>Extinguisher, Halon 1211</td>
<td>13</td>
<td>4210-00-203-0217</td>
</tr>
<tr>
<td>Extinguisher, CO₂</td>
<td>2</td>
<td>4210-00-953-1656</td>
</tr>
<tr>
<td>Extinguisher, PKP</td>
<td>2</td>
<td>4210-00-953-1656</td>
</tr>
<tr>
<td>Extinguisher, fresh water</td>
<td>3</td>
<td>4210-00-720-1815</td>
</tr>
<tr>
<td>Ground locks for each type aircraft assigned (AVCAL items)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Halligan tool</td>
<td>1</td>
<td>5120-00-009-5044</td>
</tr>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>2</td>
<td>5120-00-061-8545</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>7</td>
<td>5120-00-237-4969</td>
</tr>
<tr>
<td>Harness, safety, lanyard</td>
<td>6</td>
<td>4240-00-022-2518</td>
</tr>
<tr>
<td>Harness, safety</td>
<td>6</td>
<td>4240-00-022-2522</td>
</tr>
<tr>
<td>Hook, 4-pound, grapnel trailed with 12-foot chain</td>
<td>1</td>
<td>2040-00-287-9644</td>
</tr>
<tr>
<td>Hose control devices, 2 ½-inch</td>
<td>4</td>
<td>CONTACT COMNAVAIRFOR N73 FOR PROCUREMENT</td>
</tr>
<tr>
<td>Hose control devices, 1 ½-inch</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Hoses, spare (collapsible)</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>1 ½-inch, or</td>
<td></td>
<td>4210-01-131-0249</td>
</tr>
<tr>
<td>1 ⅞-inch</td>
<td></td>
<td>4210-01-143-1404</td>
</tr>
<tr>
<td>Hoses, spare (2 ½-inch)</td>
<td>12</td>
<td>4210-01-131-0247</td>
</tr>
<tr>
<td>HTS-3 tip</td>
<td>4</td>
<td>5120-00-863-4944</td>
</tr>
<tr>
<td>Jack kit, 10 ton port-a-power</td>
<td>1</td>
<td>5120-00-595-8388</td>
</tr>
<tr>
<td>Ladder with a minimum straight length capability of 15 feet. Ladder</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>shall meet the requirements of NFPA 1931 or have at least an</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSHA duty rating of Type 1A, Industrial Extra Heavy Duty, with a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>minimum working load of 300 pounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Megaphone, battery-powered (public address set)</td>
<td>1</td>
<td>5830-00-412-9206</td>
</tr>
<tr>
<td>Nozzles, 1 1/2-inch, 125 gpm spare</td>
<td>4</td>
<td>4210-00-601-0986</td>
</tr>
<tr>
<td>Nozzles, 2 1/2-inch, spare</td>
<td>4</td>
<td>4210-00-465-1904</td>
</tr>
</tbody>
</table>

### NOTE

- Use Allowance Equipment List (AEL) CVN/LHA/LHD/LPD/ACS AIRCRAFT CRASH AND SALVAGE TOOL INVENTORY, 2-830024010 to purchase tool inventory items.
- Crash and Salvage shall establish a written, monitored tool control program.
### Table 5-2 — Crash and Salvage Tool Inventory (Continued)

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pliers, 8 ½-inch locking (vise grip)</td>
<td>2</td>
<td>5120-00-277-4244</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>2</td>
<td>5120-00-239-8251</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>1</td>
<td>5120-00-278-0352</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>2</td>
<td>5110-00-224-1532</td>
</tr>
<tr>
<td>Pliers, 6-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-223-7396</td>
</tr>
<tr>
<td>Pliers, 10-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-233-7398</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>2</td>
<td>5120-00-247-5177</td>
</tr>
<tr>
<td>Plugs, tapered, rubber</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Plugs, tapered, wooden</td>
<td>3</td>
<td>5510-00-260-8958</td>
</tr>
<tr>
<td>SCBA, 45-minute positive-pressure (which includes bottles)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>SCBA, spare 45-minute air bottles</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>PFFPE</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>PFFPE, spare</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Powered extrication tool</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>2</td>
<td>5120-00-293-0448</td>
</tr>
<tr>
<td>Ratchet, 1/2-inch drive</td>
<td>2</td>
<td>5120-00-230-6385</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>2</td>
<td>6230-00-299-3035</td>
</tr>
<tr>
<td>Saw, gasoline portable forcible entry</td>
<td>2</td>
<td>5130-00-134-1207</td>
</tr>
<tr>
<td>Saw, gas portable forcible entry blades (10 spare blades per frame)</td>
<td>2</td>
<td>5110-00-289-9657</td>
</tr>
<tr>
<td>Saw, hack, frame</td>
<td>12</td>
<td>5110-00-277-4589</td>
</tr>
<tr>
<td>Saw, hack, spare blades (12 spare blades per frame)</td>
<td>4</td>
<td>5120-00-234-8913</td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>4</td>
<td>5120-00-234-8912</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6 inches long</td>
<td>2</td>
<td>5120-00-227-7356</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>2</td>
<td>5120-00-278-1283</td>
</tr>
<tr>
<td>Socket, #2 Phillips tip 3/8-inch drive</td>
<td>4</td>
<td>5120-00-293-0318</td>
</tr>
<tr>
<td>Socket, #30 Torx tip 3/8-inch drive</td>
<td>2</td>
<td>5120-01-398-7940</td>
</tr>
<tr>
<td>Socket set, 1/2-inch drive</td>
<td>1</td>
<td>5120-00-081-2307</td>
</tr>
<tr>
<td>Socket set, 3/8-inch drive</td>
<td>1</td>
<td>5120-00-322-6231</td>
</tr>
<tr>
<td>Socket, 7/32 hex bit, 3/8 drive</td>
<td>10</td>
<td>4240-01-568-3219</td>
</tr>
<tr>
<td>Strap cutter (rescue knife)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>T-handle 7/32 hex wrench</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thermal imaging camera (TIC)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Tool roll</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Vacuum, high efficiency (.3 micron filter)</td>
<td>1</td>
<td>5120-00-640-6365</td>
</tr>
<tr>
<td>Wrench, torque (0-250 foot-pounds)</td>
<td>1</td>
<td>5120-00-240-5328</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>1</td>
<td>5120-00-246-3796</td>
</tr>
<tr>
<td>Wrench, firehose, spanner</td>
<td>2</td>
<td>5120-00-018-1519</td>
</tr>
</tbody>
</table>

Special tools are required for rescue, hoist point panel removal, and manufacturer’s sling installation (assembled from tool inventory listed previously). It is recommended that dedicated salvage and rescue kits are created and assembled from this list. Table 5-3 is the crash and salvage tool roll kit.

### Rescue

**F-18 A/B/C/D/E/F/G**
- 3/8-inch speed handle
- 1/4-inch hex drive to 3/8-inch drive adapter

**F-35 JSF**

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5-38
- 3/8-inch speed handle & 3/8-inch drive 12-inch extension
- 1/4-inch hex drive to 3/8-inch drive drill adapter

**Overhaul**

**EA-6B (Birdcage access)**
- 3/8-inch speed handle
- 7/32 hex bit, 3/8 drive socket

**F-18 A/B/C/D/E/F/G (Avionics bay and LOX/OBOGS access)**
- 7/32-inch hex T-handle wrench

**Hoist Point Panel Removal**

**E-2C**
- Two #3 Phillips screwdrivers

**EA-6B**
- Four #2 Phillips screwdrivers
- Four 3/8-inch drive speed handles
- Four #2 Phillips bit socket, 3/8-inch drive

**F-18 A/B/C/D**
- Four 3/8-inch drive speed handles
- Four 3/8-inch drive step down to 1/4 inch drive adapters
- Four HTS-3 tips

**F-18 E/F/G (Forward panels)**
- Two 3/8-inch drive speed handles
- Two 3/8-inch drive Torx-30 tips

**F-35 JSF**
- 7/32-inch hex T-handle wrench

**Manufacturer’s Hoisting Sling Installation**

**E-2**
- Two 1/2-inch drive ratchets
- Two 1/2-inch drive 6-inch extensions
- Two 1/2-inch drive 3/8-inch sockets

**Crash and Salvage Tool Roll** (Assembled from tool inventory previously)
Table 5-3 — Crash and Salvage Tool Roll

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>1</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 8 1/2-inch locking (vise grip)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 10-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 6-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>1</td>
</tr>
<tr>
<td>Plugs, tapered (6), 3 rubber</td>
<td>3</td>
</tr>
<tr>
<td>Plugs, tapered (6), 3 wooden</td>
<td>3</td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack, frame</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack spare blades</td>
<td>6</td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6-inches long</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Strap cutter (rescue knife)</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, firehose, spanner</td>
<td>2</td>
</tr>
<tr>
<td>Tool roll</td>
<td>1</td>
</tr>
<tr>
<td>T-handle 7/32 hex wrench</td>
<td>1</td>
</tr>
</tbody>
</table>

Crash Crane

All CVNs shall have a crane with a lift and roll capability for immediate response of moving the heaviest aircraft supported. There shall be a manufacturer aircraft hoisting sling available for immediate response of each aircraft type embarked. The air boatswain shall notify the type commander (TYCOM), via the chain of command, of any aircraft embarked without a required manufactured hoisting sling.

Crash Forklift

A 20,000-pound lift capacity forklift, a 6,000-pound lift capacity forklift, and a salvage platform/rescue basket [as detailed in NATOPS Aircraft Salvage Manual, NAVAIR 00-80R-19(afloat)] shall be maintained on the flight deck during air operations for use in effecting rescue/aircraft salvage.

Hangar Deck Salvage Forklift

A 20,000-pound lift capacity forklift shall be maintained on the hangar deck.

Hangar Deck Tool Inventory

NOTE
Use Allowance Equipment List (AEL)
CVN/LHA/LHD/LPD/ACS AIRCRAFT CRASH AND SALVAGE TOOL INVENTORY, 2-830024010 (Table 5-4) to purchase tool inventory items.
Table 5-4 — Hangar Deck Tool Inventory

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axe, crash/fire</td>
<td>3</td>
<td>5110-00-293-2336</td>
</tr>
<tr>
<td>Bar 36-inch pry</td>
<td>1</td>
<td>5120-00-242-0762</td>
</tr>
<tr>
<td>Bar, crow (26-inch)</td>
<td>1</td>
<td>5120-00-224-1372</td>
</tr>
<tr>
<td>Cutters, bolt (36-inch)</td>
<td>1</td>
<td>5110-00-188-2524</td>
</tr>
<tr>
<td>Halligan tool</td>
<td>1</td>
<td>5120-00-009-5044</td>
</tr>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>1</td>
<td>5120-00-061-8545</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>1</td>
<td>5120-00-237-4969</td>
</tr>
<tr>
<td>Helmets, firefighters (DC/FF Helmet)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>meeting the requirements of NFPA 1972 or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1971 to be stowed in area of the SCBA's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>designated for use by V-3 personnel.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: The helmets required above are the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>type that is red in color and worn by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the Damage Control/Firefighting Team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>members. They are NOT required to be</td>
<td></td>
<td></td>
</tr>
<tr>
<td>proximity firefighting helmets which</td>
<td></td>
<td></td>
</tr>
<tr>
<td>are the helmets that include</td>
<td></td>
<td></td>
</tr>
<tr>
<td>aluminized covers and reflective face</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shields.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hose control devices, 2 1/2-inch</td>
<td>3</td>
<td>Contact COMNAVAIR for N73 for procurement</td>
</tr>
<tr>
<td>Hose control devices, 1 1/2-inch</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Hoses, spare (collapsible)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1 1/2-inch, or</td>
<td></td>
<td>4210-01-131-0249</td>
</tr>
<tr>
<td>1 3/4-inch</td>
<td></td>
<td>4210-01-143-1404</td>
</tr>
<tr>
<td>Hoses, spare, 2 1/2-inch</td>
<td>6</td>
<td>4210-01-131-0247</td>
</tr>
<tr>
<td>Ladder, with a minimum straight length</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>capability of 15 feet. Ladder shall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>meet the requirements of NFPA 1931 or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>have at least an OSHA duty rating of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1A, industrial extra heavy duty,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with a minimum working load of 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pounds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Megaphone, battery-powered (public</td>
<td>1</td>
<td>5830-00-412-9206</td>
</tr>
<tr>
<td>address set)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFFPE</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Pliers, 8 1/2-inch locking (vise grip)</td>
<td>2</td>
<td>5120-00-277-4244</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>2</td>
<td>5120-00-239-8251</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch)</td>
<td>2</td>
<td>5120-00-278-0352</td>
</tr>
<tr>
<td>(Channel Locks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>2</td>
<td>5110-00-224-1532</td>
</tr>
<tr>
<td>Pliers 10-inch (Slip-joint)</td>
<td>2</td>
<td>5120-00-223-7398</td>
</tr>
<tr>
<td>Pliers 6-inch (Slip-joint)</td>
<td>2</td>
<td>5120-00-223-7396</td>
</tr>
<tr>
<td>Pliers, Long Nose (Needle Nose)</td>
<td>2</td>
<td>5120-00-247-5177</td>
</tr>
<tr>
<td>Plugs, Tapered rubber</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Plugs, Tapered wooden</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SCBA, 45-minute positive-pressure (which</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>includes bottles) will be prepositioned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in the hangar bay for use by Hotsuitmen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Air Department personnel clearly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>marked as such</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCBA, spare 45-minute air bottles</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Punch, Drift (8 inch)</td>
<td>2</td>
<td>5120-00-293-0448</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>2</td>
<td>6230-00-299-3035</td>
</tr>
<tr>
<td>Saw, Hack, frame</td>
<td>2</td>
<td>5110-00-289-9657</td>
</tr>
<tr>
<td>Saw, Hack spare blades (12 spare blades</td>
<td>2</td>
<td>5110-00-277-4589</td>
</tr>
<tr>
<td>per frame)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screwdriver Phillips #2</td>
<td>2</td>
<td>5120-00-234-8913</td>
</tr>
<tr>
<td>Screwdriver Phillips #3</td>
<td>2</td>
<td>5120-00-234-8912</td>
</tr>
<tr>
<td>Screwdriver, Flat tip 3/16-inch tip, 6-</td>
<td>2</td>
<td>5120-00-227-7356</td>
</tr>
<tr>
<td>inches long</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screwdriver, Flat tip 5/16-inch tip, 10</td>
<td>2</td>
<td>5120-00-278-1283</td>
</tr>
<tr>
<td>inches long</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socket 1/2-inch drive set</td>
<td>1</td>
<td>5120-00-081-2307</td>
</tr>
</tbody>
</table>

5-41
Table 5-4 — Hangar Deck Tool Inventory (Continued)

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socket 3/8-inch drive set</td>
<td>1</td>
<td>5120-00-322-6231</td>
</tr>
<tr>
<td>T-handle 7/32 Hex wrench</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thermal Imaging Camera (TIC)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tool roll</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Vacuum, high efficiency (.3 micron filter)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>2</td>
<td>5120-00-246-3796</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>2</td>
<td>5120-00-240-5328</td>
</tr>
<tr>
<td>Wrench, firehose, spanner</td>
<td>4</td>
<td>5120-00-018-1519</td>
</tr>
</tbody>
</table>

**NOTE**

A typical tool roll (Table 5-5) shall contain pockets or straps to maintain the tools in an orderly manner. The tool roll may be of local design and manufacture. Refer to the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14 appendix H for general design and characteristics to assist in locally manufacturing a tool roll.

Table 5-5 — Hangar Deck Tool Roll

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer, ball peen (1-1/2-pound)</td>
<td>1</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 8 ½-inch locking (vise grip)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 10-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 6-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>1</td>
</tr>
<tr>
<td>Plugs, tapered rubber</td>
<td>3</td>
</tr>
<tr>
<td>Plugs, tapered wooden</td>
<td>3</td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack, frame</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>1</td>
</tr>
<tr>
<td>T-handle, 7/32 hex wrench</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, firehose, spanner</td>
<td>2</td>
</tr>
<tr>
<td>Tool roll</td>
<td>1</td>
</tr>
</tbody>
</table>

Mobile Firefighting Equipment

Mobile Fire Fighting Vehicle Requirements

Each crash and salvage organization shall maintain a minimum ready stock of one vehicle/equipment load of AFFF (total tank capacity) for each MFFV assigned. The minimum ready stock shall exclude the initial load of agent in the tank.

Supply departments for air activities should maintain an equal amount of agent.
Three MFFVs should be provided to support flight operations. The MFFVs should be positioned as follows during flight quarters.

### Launch
- Ships with two MFFVs operational — during prelaunch starts, checkouts, and launch, position one MFFV at a location that will provide the best view of the FLY 2 area and the bow catapults. Position the second MFFV at a location that will provide the best view of the FLY 3 area and the waist catapults.
- These units shall be positioned, manned, and running from the time “start engines” is announced until the launch is completed.

### Recovery
- Ships with two MFFVs operational — One MFFV shall be positioned so that a downwind approach can be made to the landing area. One shall be positioned in the FLY 1 area.
- These units shall be manned and running from commencement of recovery until recovery is completed.

### Respot
One MFFV shall patrol the entire flight deck during all respots, rearming, and/or refueling evolutions.

### Fueling
The MFFV-assigned roving patrol on the flight deck fulfills the requirements for portable fire extinguishers during JP-5 refueling operations.

### Limited Flight Operations
- Single launch and recovery — One MFFV shall be manned and positioned in the vicinity of flight operations.
- Carrier qualifications (CARQUALs) — During CARQUALs, one MFFV shall be manned and positioned for a downwind approach to the touch-and-go area, and one MFFV shall be positioned in the FLY 1 area for a downwind approach to aircraft refueling and the best view of the bow catapults.

### Maintenance Turnups
- Flight deck maintenance turnups — when not at flight quarters, one MFFV shall be manned and centrally located to the aircraft conducting the maintenance turnup.

### NOTE
If only one MFFV is available, a 1 1/2-inch AFFF hose shall be manned, have visibility of, and have an unobstructed path to cover aircraft conducting refueling and turn-up operations. The hose shall be properly manned with a plug man.

These duties and responsibilities are primary in nature for the crash and salvage crew. No other duties shall be assigned while aircraft are embarked.
• Hangar deck maintenance turnups — one manned AFFF hose team shall be positioned with an unobstructed view of and at a safe distance from the aircraft.

Ordnance Handling Evolutions, Underway Replenishment
One MFFV shall be manned with a clear approach to each concentrated weapons loading evolution.

NOTE
If no MFFV is available, a hose team shall be available within a reasonable vicinity to respond to a hose station and with a clear path to each weapons evolution.

Training Requirements
All personnel assigned duties incidental to flight operations shall attend a formal aviation firefighting school as required by ship training requirement Office of the Chief of Naval Operations Instruction, (OPNAVINST) 3541.1(series).

Embarked On-the-Job Training Requirements
The ACHO shall ensure that all personnel assigned duties incidental to flight operations (including embarked aviation activities) receive continuous training in the following areas:

• Organization and leadership of the crash, salvage, and rescue team
• Fire reporting procedures
• Communications
• First-aid and self-aid
• AFFF/saltwater station operation on flight and hangar decks including hangar deck sprinkler system
• Aircraft firefighting procedures
• Hazardous ordnance cooling and jettison procedures
• MFFVs (familiarization)
• Catapult steam smothering
• Portable Halon 1211, PKP, and CO₂ extinguishers (operation and location)
• Appropriate firefighting actions to perform until assistance arrives
• Basic handling of composite materials and hazardous materials produced after a crash or fire

Air department training team (ADTT) will be responsible, under the direction of the ACHO, for the training of flight deck, hangar deck, air wing, and emergency response personnel.

Crash and Salvage Crewmember Training
Personnel assigned to crash and salvage shall attend (as a team) the aircraft firefighting shipboard team training (AFSTT) course C-780-2012A once during an 18-month cycle or whenever the team experiences a greater than 40-percent turnover. They shall also receive additional (in-depth) training to include the following:

• MFFVs
• Personnel rescue procedures
• Hazardous ordnance cookoff times, weapons cooling, and jettison procedures
• Mobile crash handling equipment
• Aircraft entry (normal, manual, forced, and emergency)
• Aircraft hoisting equipment
• Maintenance of crash handling equipment
• Crash dolly usage
• Boat and aircraft crane (when applicable)
• Aircraft salvage procedures
• Aircraft jettison procedures
• Emergency flight and hangar deck repairs
• Aircraft familiarization
• Hazardous material (HAZMAT) containment
• SCBA
• TIC

Hazardous Material Training

All personnel assigned to the crash and salvage organization shall receive in-depth training on chapter 6 of the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14 to ensure they are capable of handling hazardous materials produced after a crash or fire.

Fire-Involved Ordnance Training

The cooling of fire-involved ordnance is one of the most important aspects of aircraft firefighting operations. Crash and salvage crews and flight deck personnel should familiarize themselves with the various types of ordnance carried by embarked aircraft, as presented in chapter 2 of the *NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual*, NAVAIR 00-80R-14 and the cook-off times listed in *Figure 5-1*.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All aircraft fire training drills should incorporate the following: various types of simulated fire exposed ordnance; the receipt and reporting of information concerning them; the on-scene identification and cooling procedures of dedicated hose teams; and the realistic verbal or other means of communication among flight deck control, the on-scene leader, and EOD/weapons personnel at the scene.</td>
</tr>
</tbody>
</table>

MFFV Training

All preplanning and training should be directed toward a “worst-case” scenario. Accordingly, shipboard fire drills should include the requirement to practice nursing/replenishment of mobile vehicles.
Drills
Drills shall be conducted with sufficient frequency to maintain the level of proficiency in the fundamentals of aircraft firefighting and salvage operations as specified in the Commander, Naval Air Forces Instruction *Aircraft Carrier Training and Readiness Manual*, (COMNAVAIRFORINST) 3500.20(series).

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash and salvage personnel shall be cross-trained to meet the requirements listed herein.</td>
</tr>
</tbody>
</table>

Crash and salvage teams should utilize available facilities (e.g., fleet training centers, naval air stations) whenever possible to fight live fires for the purpose of continuing individual personnel qualifications and team training.

Conduct of Drills
The following information shall be provided to the scene leader by the exercise observer while conducting drills in accordance with the *Aircraft Carrier Training and Readiness Manual*, COMNAVAIRFORINST 3500.20(series).

1. Class of fire, location, and aircraft damage
2. Types of ordnance hazards
3. Casualties (personnel and material)
4. Fire under control (when initial firefighting equipment is at scene)
5. Fire extinguishment

Drill Sequence of Events
For training purposes, the scene leader shall utilize the following checklist when fighting aircraft fires (simulated) on the flight or hangar deck. Sequence should be followed to the maximum practicable extent in combating actual fires (quotes indicate report to be made).

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene leader may change sequence to fit situation. Additional procedures for aircraft fires on the hangar deck can be referenced in <em>NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual</em>, NAVAIR 00-80R-14 chapter 7.</td>
</tr>
</tbody>
</table>

1. “Initial firefighting equipment/personnel at the scene”.
   a. MFFV(s) (nursed)
   b. Scene leader
   c. Hose team leaders
   d. Four manned AFFF hoses
2. Nozzles on/Move in; “Hose teams moving in”.

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3. “Weapons cooling in progress”/“Fire under control”.

4. Effect rescue.
   a. “Seats safe”
   b. “Rescue in progress”
   c. “Rescue complete”
   d. “Number of casualties”

5. “Fire’s out”.
6. “Back out” (to a safe distance) (for non-weapons cooling hoses).
7. “Nozzles off” (for non-weapons cooling hoses).
8. Deploy TIC, at air boatswain’s discretion, to determine surface temperature of weapon, and continue cooling if necessary.

9. “Nozzles off, back out” (weapons cooling hose).
10. “EOD to scene”/“Weapons safe” or “continue to cool”.
11. Download and jettison weapon(s).
12. Overhaul of residual fire/Remove LOX converters/Disconnect batteries.
   a. “Overhaul in progress”
   b. “Overhaul complete”

13. Set reflash watch.
   a. “Reflash watch set by Hose Team #____ or P-25”

14. With squadron maintenance personnel present, scene leader turns over the scene to Crash and Salvage, and commences salvage operations.

15. “Estimated time to ready deck is ____”.

WARNING
Personnel shall step over all firefighting hoses to avoid personal injury.

NOTE
Clock starts for weapons cooling provided hoses are dedicated and weapons are no longer exposed to fire.

NOTE
Hose streams shall not be applied to weapons during TIC readings.

NOTE
Disconnect batteries, and remove LOX converters during overhaul, as applicable.
16. Conduct foreign object debris (FOD) walkdown; hazardous material shall be brought to the attention of the background assistance leader, who will delegate its removal to cognizant personnel.

17. “Ready deck”.

### NOTE
Background assistance leader shall inform scene leader via messenger when background assistance equipment/personnel are available or at background.

18. ADTT debrief/Crew debrief.

For training purposes the scene leader shall utilize the following checklist when fighting fuel station fires on the flight or hangar deck. Sequence should be followed to the maximum practical extent in combating actual fires (quotes indicate reports to be made).

1. Initial response equipment at the scene (MFFVs, four AFFF hose teams for flight deck and two AFFF hose teams for hangar deck).

### WARNING
Personnel shall not enter enclosed fuel stations without a self-contained breathing apparatus.

### NOTE
Back out P-25 as soon as practical to maximize range of hose teams, to reduce noise for commands between scene/hose leaders, and crash and salvage personnel available for salvage.

2. “Nozzle on, move in.

3. “Fire under control”/“Fuels repair on scene”/“Station isolate” and all electrical power secured.

### NOTE
Hose team response shall be one team to firefighting porthole for cooling; the remaining team shall commence fighting the fire from the door.

4. Effect “rescue”/“casualties” (if required/applicable).

5. “Fire out.”

6. “Back out, nozzles off.”

7. Overhaul (flight deck only).

8. Set reflash watch.

9. Turn scene over to fuels repair personnel, report estimate damage/time of repair.

10. Fuels repair personnel to commence repair operations.

11. FOD walkdown.

12. Ready deck.
Aircraft Firefighting Tactics and Procedures


Introduction

Flight and hangar deck aircraft firefighting, crash, and rescue techniques are well defined, but no two fire situations will be identical. Success will continue to depend on training, planning, leadership, and teamwork by both ship's company and embarked air wing personnel. Supervisory personnel and fire parties should take advantage of every opportunity to drill and acquire knowledge of their ship's fixed and mobile firefighting equipment, aircraft configurations, fuel and weapons loads, and firefighting procedures specified within this manual. The following procedures discuss certain additional situations not discussed in detail elsewhere in the manual.

NOTE
The following suggested procedures are recommended for training purposes.

Notification

Reporting of a mishap should be accomplished by the most expeditious method in accordance with the ship’s operating instructions. In the event of a pending emergency, the air officer shall notify flight and hangar deck personnel by use of the hangar deck (3 MC) and flight deck (5 MC) announcing systems and flight deck warning alarm. The flight deck crash alarm shall be sounded to notify flight deck personnel of an actual on-deck aircraft mishap.

NOTE
When fire occurs on the flight and/or hangar deck, word shall be passed on the ship’s (1 MC) announcing system. At this time, designated personnel shall man assigned AFFF proportioning station. Immediate communications shall be established with the AFFF station.

Initial and Background Response Equipment/Personnel

All preplanning and training shall be directed toward providing the following minimum initial response to an actual mishap or drill.

1. Initial firefighting equipment/personnel
   a. MFFV(s)
   b. Scene leader
   c. Hose team leaders
   d. Four manned AFFF hoses

2. Rescue personnel.
   a. Rescue personnel are positioned in proximity to the scene leader

3. Background assistance equipment/personnel
   a. Two stretchers/two first-aid kits
   b. Two spare hose rolls
c. Forcible entry equipment

d. Messengers/phone talkers

e. Two portable extinguishers (halon 1211, PKP, or CO₂)

f. AFFF hose(s) for weapons staging area(s) (bomb farm) protection properly manned

g. Two spare 1 1/2-inch and two spare 2 1/2-inch hose control devices (with appropriate vari-nozzles attached)

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**NOTE**

In the event hose control devices are deployed, personnel shall be assigned to monitor charged fire hoses restrained with hose control devices. These personnel shall ensure prompt response to conditions that affect the fire stream, such as wind change and/or other disruptions.

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**NOTE**

It is emphasized that nothing herein is intended to discourage immediate firefighting action by individuals while awaiting the arrival of organized teams. On the contrary, 1 1/2-inch AFFF hose reels and variable pattern nozzles are specifically designed and installed for rapid deployment by one person, if necessary. Accordingly, the training provided to all air department and embarked aviation personnel should cover activation procedures and firefighting techniques for emergency operation of 1 1/2-inch hose reels by the first person on the scene.

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4. Scene leader

a. The scene leader assumes command and directs available personnel and equipment in firefighting procedures and tactics, ordnance cooling, and personnel rescue as the situation requires.

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**WARNING**

- Personnel shall exercise extreme caution when approaching an aircraft prior to engine shutdown.

- The scene leader shall immediately make an appraisal in regard to the presence of hazardous ordnance and request confirmation from flight deck control. The leader shall direct firefighting teams in weapons cooling.
5. MFFV Driver/Operators
   a. Designated driver/operators shall immediately position the vehicle at the scene of a fire in a location that will afford the most efficient control of the fire, cool ordnance, and provide protection for personnel rescue. All attempts should be made to position the vehicle upwind of the fire. Upon arrival to the scene, the initial response MFFV shall simultaneously fight the fire, cool the cockpit area, and cool exposed ordnance until relieved.

6. Air officer
   a. The air officer assesses the fire situation, advises the CO, and requests assistance commensurate with the gravity of the incident.

7. Air boatswain
   a. The air boatswain is responsible to the ACHO for organizing and supervising the response to all aircraft-related emergencies on the flight and hangar deck.

   **NOTE**
   In the event of a fire on the flight or hangar deck, sufficient air department or air wing personnel from the unaffected area shall stand by to provide assistance, as necessary, for fire containment and casualty control under the air boatswain supervision.

8. AFFF hose teams
   a. These teams attack the fire and/or cool ordnance as directed by the hose team leaders. Hose teams should maintain a position and stance which affords the most effective and safe hose handling techniques see *Surface Ship Firefighting Naval Ship’s Technical Manual (NSTM)*, Chapter 555 for illustrations of nozzle man techniques.

   **NOTE**
   Due to smoke, heat, and explosion hazards, hose teams should maintain a profile as low as possible.

9. Overhaul team personnel
   a. The scene leader directs two personnel attired in PFFPE and SCBA; these personnel shall be equipped with a portable fire extinguisher with a positive agent check, halligan tool/crash axe, and TIC to ensure no residual fire exists.
b. Overhaul starting point shall be determined by the location of the LOX converters and battery access panels.

c. The junior firefighter will maintain the extinguisher nozzle under the arm of the senior firefighter at all times.

d. Overhaul team will disconnect batteries and LOX converters.

**NOTE**
Rescue personnel attired in complete PFFPE and SCBAs shall be positioned in proximity to the scene leader and keep the overhaul team in sight at all times.

e. The location of residual fires can be identified by using a TIC or by feeling with the back of the hand.

f. Every attempt should be made to access all compartments/panels on the aircraft.

g. If residual fire is located and it is not in the area of a fuel cell or access panel a small hole can be made in order for an extinguishing agent to be directed in.

h. The senior firefighter shall lead the junior firefighter away from the aircraft in such a way the junior can continue to face the overhaul area at all times.

i. The senior firefighter shall report the completion of overhaul of aircraft, LOX converter and batteries disposition to the scene leader.

10. Messengers

a. The messengers position themselves directly behind the scene leader.

11. Background assistance leader

a. Assembles additional personnel not required at scene.

b. Ensures immediate assignment of personnel to provide nursing/replenishment hose to the initial response MFFV at the scene

**NOTE**
When using SCBA, background assistance will establish an SCBA control.

c. Ensures adequate flow of messengers to the scene leader

d. Dispatches fresh firefighting personnel to relieve fatigued hose team members, as required

e. Assembles two backup AFFF hoses properly manned

f. Effects the removal of aircraft adjacent to the scene

G. Provides medical personnel and stretcher bearers

h. Provides personnel to other areas if additional fires occur

i. Dispatches support personnel as required by scene leader
j. Coordinates manning of appropriate elevators, as necessary
k. Ensures fuel repair, electrician, and maintenance representatives are available, as necessary
l. Ensures external electrical power to aircraft involved is secured
m. Ensures one person (plug man) is stationed at each deployed AFFF actuation control box. Personnel manning actuation control boxes maintain direct communication with the AFFF proportioning station operator and 03-level AFFF injection station operator
n. If the on-scene leader (OSL) and background assistance (BGA) have established communications with sound-powered phones, messengers are no longer required

**Nursing/Replenishment of MFFVs**

Specific guidance for each situation cannot be provided since vehicle repositioning and/or redeployment as a result of additional fires may be necessary. After initial minimum response actions are completed, the decision to nurse/replenish MFFVs from an AFFF fixed system outlet should be coordinated by the scene leader.

The following considerations are provided for the scene leader in determining whether or not nursing/replenishment will be affected:

1. Location and initial position of the vehicle relative to the fire scene.
2. Type fire and number of AFFF hose teams responding to the scene.
3. Vehicle mobility requirements.
4. Multi firefighting deployment capability exists through utilization of turret and handlines and requires minimum personnel.
5. Length of hose and fire main pressure.

**NOTE**

- Nursing/replenishment of MFFVs is highly recommended for multiaircraft mishaps and a single aircraft mishap that spreads to one or more aircraft with or without weapons involvement.
- When the MFFV is nursed at the scene, it can be considered the equivalent of one AFFF hose team.

Vehicle nursing/replenishment support functions:

1. Personnel shall be provided for direct hookup of the nursing/replenishment hose to the initial response MFFV.
2. A 2 1/2-inch and/or 1 1/2-inch reducing adapter shall be carried on the vehicle to facilitate nursing/replenishment from either size fixed AFFF hose station outlet.
3. Personnel support from background assistance will be required to move the nursing/replenishment hose to the fire scene.

**NOTE**

Rescue and firefighting evolutions should be conducted simultaneously once a rescue path is provided.
Rescue

Rescue Path
When an adequate rescue path is provided, the scene leader will direct the rescue of personnel. The leader reports the commencement and completion of the rescue and the number of casualties.

Rescue Personnel
1. Rescue team personnel should work in pairs throughout the rescue and salvage effort. Each rescue effort should be directed toward evacuating one incapacitated person at a time.
2. Investigate the surrounding area (e.g., catwalks, gun tubs) for additional casualties.

NOTE
- Trained rescue personnel shall affect the rescue of aircrews and passengers.

Information of aircraft entry, engine shutdown procedures, ejection seat safetying, and personnel removal may be found in *NATOPS U.S. Navy Aircraft Emergency Rescue Information Manual, NAVAIR 00-80R-14-1*.

Background Personnel
The background assistance personnel will provide immediate first aid to casualties and evacuate them as necessary.

Completion of Rescue
Upon completion of rescue, the scene leader continues to direct the hose teams until the fire is extinguished.

Weapons Cooling
As AFFF hose teams arrive on the scene, they shall knock down fire and smoke to enable identification of fire-exposed ordnance. Once fire-exposed ordnance is identified, ordnance suspected of being heated by the fire shall be assessed and cooled until it is determined by EOD/Weapons personnel that it can be safely downloaded and jettisoned/returned to service. While cooling ordnance, the hose team shall lock their agent on that particular weapon or weaponry as a weapons cooling team. They shall remain locked on the weaponry unless hose control devices are installed, or they are relieved by other cooling teams or the on-scene leader.

As firefighting hose teams shift their positions to enable firefighting coverage or to take advantage of shifting wind directions, they shall relieve ordnance cooling teams who are locked in position.
NOTE
Once the weapon is cooled and downloaded, the air gunner will make the determination to jettison the weapon on behalf of the commanding officer.

WARNING
- During catastrophic aircraft debris pile/running fuel type fires, the temperatures generated can cause wing-mounted weapons ejection cartridges to explode, thus dropping weapons to the deck level and into or under aircraft debris. Accordingly, information derived from the aircraft weapons status board in flight deck control shall be passed to the on-scene leader and EOD/Weapons personnel to enable the accountability of all accident-involved weapons.

- Internal portions of ordnance, once heated, may continue to stay at elevated temperatures in spite of a cooled ordnance surface. This heating may lead to cook-off of the weapon well after the incident. Fire exposed ordnance that is not jettisoned should be monitored closely for any signs of residual internal heat (e.g., periodic surface temperature checks that indicate increasing surface temperature via heating from the inside out, changing exterior appearance). Where residual internal heating is suspected, strong consideration shall be given to jettisoning the affected ordnance.

NOTE
- Ordnance cooling hose team leaders shall ensure minimum manning of hose team personnel immediately upon lock on for weapons cooling. Once the team is in place, personnel shall squat in position to lower the team’s physical silhouette should a deflagration or explosion occur.

- Ordnance cooling teams may lock in place hose control devices for extended cooling and personnel safety. The teams shall then evacuate the scene leaving one firefighter to tend the nozzle.
Residual Fire Overhaul/Reflash Watch

Scene Leader

The scene leader directs two personnel attired in PFFPE and SCBA; these personnel shall be equipped with a portable fire extinguisher with positive agent check, halligan tool/crash axe, and TIC to ensure no residual fire exists.

Background Assistance Detail

This detail assembles to commence FOD walk down, restore gear, and provide personnel to the crash and salvage officer.

Estimated Ready Deck/Salvage

Scene Leader

The scene leader gives estimated ready deck time to PRIFLY if salvage operations are not required or turns command of the scene over to the crash, salvage, and rescue officer to effect removal of aircraft.

Crash, Salvage, and Rescue Officer

The crashes, salvage, and rescue officer (air boatswain) estimates time to ready deck and reports to PRIFLY, updating as necessary.

NOTE

- At the discretion of the air boatswain, a TIC may be employed to assess the surface temperature of the weapon in order to expedite the download and disposition of the weapon.

- The actual time for the cooling of weapons shall be determined by the air boatswain based upon the degree of actual exposure of the weapon to the fire. Historically weapons have been cooled for a minimum of 15 minutes or until deemed safe by EOD personnel. However, post assessment cooling for minimal exposures may be of a duration of less than 15 minutes. Severe exposures may require cooling in excess of 15 minutes.

NOTE

In the event of a fire on either the flight or hangar deck, sufficient personnel from the unaffected area shall stand by to provide personnel and equipment augmentation, as necessary, for fire containment and casualty control. The decision to commit these assets will normally be made by the air officer.
CVN Hangar Deck

The following additional procedures for aircraft fires on the hangar deck shall be followed:

1. Return elevators to the flight deck level.
2. Close divisional doors immediately.
3. Close all doors and hatches from the hangar to the interior of the ship.
4. Close all weapons elevator doors/hatches.
5. Open elevator doors to provide ventilation of heat and smoke.
6. Leave all hangar deck lights on.
7. Initial response personnel without SCBA shall be immediately relieved by the background assistance/repair party personnel with SCBA.
8. Background assistance should be established in an adjacent unaffected hangar bay.
9. Cooling teams shall be posted on opposite side of divisional doors of affected bay to monitor temperature and cool as necessary.
10. Activate appropriate zones of the hangar bay AFFF sprinkler system for any multi-aircraft fire or when a fire is judged to be beyond the capability of the hose teams, or if determined necessary to minimize collateral damage.

NOTE
Items listed above are specific to air department/hangar deck fire party; additional actions by the damage control organization will be necessary in conjunction with these actions, such as establishing fire boundaries and cooling adjacent spaces.

Hangar Deck Ventilation

Cross ventilation may be accomplished by use of aircraft elevator doors to facilitate the venting of smoke, heat, and combustion products to aid firefighter access and fire control. The ship’s direction can also be used to maximize ventilation efforts. The following additional procedures for aircraft fires on the hangar deck shall be followed:

⚠️ WARNING ⚠️
If the doors must be operated remotely from a conflagration station (CONFLAG), use a safety observer at the door to be operated and make 3MC announcements from CONFLAG/HDC prior to movement.

1. Fully open all elevator doors in the affected bay.
2. Request the ship execute a turn in order to position the door closest to the fire on the leeward side.
3. Adjust doors as necessary to maximize firefighting efforts.

Local Hangar Deck Firefighting/Emergency Procedures Instruction

Due to the unique requirements and challenges associated with combating aircraft fires on the hangar deck, and the departmental/training team integration challenges associated, a shipboard instruction
shall be developed and used as a single reference source to outline responsibilities, procedures and requirements. Refer to the NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14 appendix G, for a through example of a hangar deck firefighting/emergency procedures instruction to assist the ship’s air department training team (ADTT), with the assistance of the damage control training team (DCTT) and integrating training team (ITT), in establishing responsibilities; outlining requirements and procedures; and identifying training/drill requirements in accordance with (IAW) applicable references.

The hangar deck firefighting/emergency procedures instruction should be detailed enough to eliminate all conflicting procedures between training teams/departments that must integrate in order to effectively combat hangar deck fires. To be effective, the instruction at a minimum must: identify locations and quantities of all equipment; assign specific roles, duties, and tasks to personnel and/or work centers; and define lines and methods of communication.

Fuel Station Fire Tactics

Due to the unique challenges associated with responding to and combating internal fuel station fires, the following tactics and procedures are provided and shall be used in place of the aircraft firefighting tactics that do not apply to fuel station fires, and to clarify additional tactics and procedures specific to fuel stations. Crash crews should familiarize themselves with the layout and obstacles in and around each fuel station.

Flight Deck Internal Fuel Stations

1. Upon notification of fire or smoke in a fuel station, JP-5 pumping shall be secured throughout the ship. Damage control central will dispatch fire party personnel to establish internal fire boundaries in accordance with Shipboard Firefighting Naval Ships’ Technical Manual (NSTM), Chapter 555 (vol. 1). V-4 division shall mechanically and electrically isolate the fuel station and notify flight deck control.

2. The MFFV should make an upwind approach and utilize the turret and hand line to affect initial attack of the fire and protect nearby aircraft.

3. All attempts should be made by flight deck personnel to insert an AFFF hose with the nozzle set for wide angle fog into the station porthole. If heat and smoke becomes too intense, the hose and nozzle can be pushed further through the porthole into the station allowing hose team personnel to fall back and observe the hose from a safe distance until properly attired crash and salvage personnel arrive. Initial response should be based on the one person activation and operation concept for AFFF hose reels.

4. As additional hose teams form up at the scene they should be deployed in a manner to prevent fire from being able to extend beyond the station, impinging on nearby aircraft and to keep the deck cool. Intermittent applications of AFFF should be used for deck cooling.

⚠️ WARNING ⚠️

Hose teams should maintain a profile as low as possible to avoid smoke and heat.
5. The first two crash and salvage personnel attired in complete PFFPE with SCBAs shall take over the hose at the porthole and adjust the nozzle pattern so a blanket of AFFF is applied throughout the fuel station.

NOTE
All doors in the vicinity of the fueling station leading to the interior of the ship shall be closed and dogged.

6. The second two crash and salvage personnel attired in complete PFFPE with SCBAs shall take over the nearest AFFF hose and advance toward the fueling station entrance to attack the fire from the doorway.

NOTE
- The scene leader should immediately evaluate the fire and make recommendations to PRIFLY for maneuvering the ship to provide for athwartship winds to allow for greater access.
- Initial equipment consists of four attack hose teams with one backup hose team. Additional hoses may be required to protect aircraft and adjacent equipment.

WARNING
To prevent injury to hose team members, the second hose team shall make every attempt to extinguish the fire from the doorway.

7. At the discretion of the scene leader/air boatswain the port hose team nozzle should be secured to improve firefighting conditions from the door and allow for ventilation.

8. When the fire is out, the second hose team will remain at the door to provide protection for the overhaul team.
Overhaul

1. The scene leader directs two personnel attired in complete PFFPE with SCBAs to ensure no residual fire exists. The senior firefighter shall have a non-sparking implement such as a broom handle, a halligan tool/crash axe and the TIC. The junior firefighter shall have a portable fire extinguisher with a positive agent check.

2. Prior to entering the fueling station the TIC should be used to determine if any hot spots exist. Additional applications of AFFF should be applied to hot spots prior to entering space.

3. Deck integrity shall be determined using a non-sparking implement.

4. If necessary, at the discretion of the scene leader/air boatswain, the space may be hydraulically ventilated through the port hole in order to increase visibility in the fuel station.

5. Fueling hoses should be manipulated with the halligan tool/crash axe so the TIC can be used to determine if any deep-seated hot spots exist.

6. Fire extinguishers in the space that were exposed to fire should be removed from the space and jettisoned.

7. Upon completion of the overhaul, the reflash watch hose team shall remain on scene until heat and fumes have been ventilated sufficiently to prevent reflash, as determined by the air boatswain.

8. Once the scene has been turned over to fuels repair personnel, the damage estimate and time to repair assessment should take place after the fuel station has been determined safe to re-enter. SCBAs shall be worn if damage assessment is required before the space has been sufficiently ventilated.

NOTE

- Two additional personnel should be positioned on the flight deck to relay information from the fuel station to the scene leader (e.g., fire is under control, fire is out).
- The rescue team can be utilized to affect a rescue if there are casualties in the station or if the hose team needs assistance.
- One additional overhaul/rescue team attired in complete PFFPE with SCBAs (regulators relaxed) should be positioned in proximity to the scene leader to assist or provide a relief as required and be immediately available for overhaul.

NOTE

- The second hose team shall keep the overhaul team insight at all times.

WARNING

Personnel shall not enter internal fuel stations without a self-contained breathing apparatus until the space has been sufficiently ventilated.
Hydraulic Ventilation

Fueling stations with a clear opening to the weather overboard can be quickly ventilated of heat and smoke through hydraulic ventilation with an AFFF hose line and vari-nozzle. Once the fire in the space is extinguished, the entry hose team should aim a narrow stream pattern out through the fuel line portal. This stream pattern will draw heat and smoke out through the portal. The following steps should be taken:

1. Ensure fire inside the space is extinguished.
2. Ensure outside door to station is open to provide outside replacement air.
3. Ensure that a rescue hose team is positioned near the door and can see the interior hose team.
4. Ensure that the area outside of the fuel station fuel line portal is clear of personnel.
5. With the nozzle positioned approximately 5 feet or greater from the portal, aim a straight stream pattern out through the portal.
6. Adjust the nozzle pattern to the widest pattern possible that permits the entire stream to flow out of the portal and still leaves air gaps between the hose stream and the portal frame for smoke to flow.
7. Maximum venting can be achieved by either adjusting the nozzle pattern or moving the nozzle closer to or further away from the portal.
8. Continue until smoke is cleared.

WARNING

All personnel performing this operation must be dressed out in full PFFPE and SCBA with sufficient air available.

Hangar Deck Fuel Stations

Crash crews and V-3 personnel should familiarize themselves with the layout and obstacles in each internal fuel station.

1. Upon notification of fire or smoke in a fuel station, JP-5 pumping shall be secured throughout the ship. Damage control central will dispatch fire party personnel to establish internal fire boundaries in accordance with Shipboard Firefighting Naval Ships’ Technical Manual (NSTM), Chapter 555 and ship’s operating instructions. V-4 division shall mechanically and electrically isolate the fuel station and notify flight deck control.

WARNING

If the door is closed, it shall remain closed and no attempt shall be made to make entry into the space until the scene has been turned over to the ship’s fire party.

2. Hangar deck personnel in the area shall immediately activate the closest AFFF hose reels and respond in order to prevent fire from extending beyond the station and impinging on nearby aircraft by directing agent at the door from a safe distance. Initial response should be based on the one person activation and operation concept for AFFF hose reels.
3. Activate fuel station AFFF sprinkling (as equipped/required).

4. Divisional doors shall be closed immediately. Elevator doors shall be configured to vent heat and smoke out of the hangar IAW ships doctrine.

5. Remaining hangar deck personnel shall evacuate the hangar bay; don SCBAs, flash hoods, and gloves; and then relieve the non-protected personnel on the AFFF hose lines.

6. As additional hose teams, attired in SCBAs, flash hoods, and gloves, form up at the scene to relieve the initial response personnel, they should be deployed in a manner to discharge AFFF into the fueling station, to prevent the fire from spreading and to protect nearby aircraft. Intermittent applications of AFFF should be used for bulkhead cooling.

7. V-3 division and crash and salvage rescue teams shall don complete PFFPE with SCBAS and report to the scene leader for tasking. The scene shall be turned over to the ship’s fire party, fully attired in SCBAs and firefighting ensembles. Hangar deck personnel shall provide assistance and support as directed by the ship’s fire party scene leader. The ship’s fire party shall assume the scene for interior attack, overhaul, de-smoking, de-watering, etc.

**Multiaircraft CONFLAG**

In the event of multiaircraft CONFLAG on the flight or hangar deck, many additional requirements must be considered in establishing procedures for life safety, damage control, and fire suppression.

**NOTE**

As a result of a multiaircraft CONFLAG, mass casualty reactions may be required.

**Response to the Scene**

The initial response to the scene shall include equipment and personnel together with all available stretcher bearers, stretchers, and first-aid kits. A constant resupply and augmentation of portable extinguishers, hoses, and AFFF for MFFVs should be made available, contingent upon the on-scene leader requirements.

**Additional Actions to Cover Mass Casualty Scene**

The actions, as outlined above, shall be the same with the following additions.

Air Officer

- The air officer shall have the overall responsibility for the firefighting effort on the flight deck. The air officer should activate appropriate zones of the flight deck sprinkling system for any multiaircraft fire or when a spill fire is judged to be beyond the capability of the initial hose team/firefighting vehicle. In addition to activation of the zone in which fire is located, at least one upwind zone should be activated. Approximately 15 knots relative windspeed provides optimum distribution of AFFF from the flight deck extinguishing system.
ACHO

- This officer establishes the area for collection and disposition of personnel casualties
designates the aircraft/weapons elevator used for movement of casualties and is responsible
for all safe aircraft movement on the flight and hangar bay.

Hangar Deck Officer (HDO)

- The HDO shall man the applicable CONFLAG control station. The HDO or competent authority
shall supervise the activation of appropriate zones of the hangar sprinkling system for any
multiaircraft fire or when a spill fire is judged to be beyond the capability of the initial hose
team. Sprinklers should be operated until the fire is verified to be under control by the on-site
leader.

CONFLAG Station Operator

- The CONFLAG operator shall activate appropriate zones of the sprinkling system under the
supervision of the HDO or competent authority when multiaircraft or spill fires are judged
beyond the capability of the initial hose team.

Medical Officer

- The medical officer processes personnel casualties and coordinates all efforts of battle
dressing station personnel.

Embarked Squadron Commanders

- The embarked squadron commanders provide personnel to assist the air department in
firefighting, casualty evacuation, and damage assessment and repair.

Air Wing Commander

- The air wing commander shall provide personnel to assist the air department in firefighting,
casualty evacuation, and damage assessment and repair.

Weapons Staging Area (Bomb Farm) Fire Response AFFF Hose Teams

In the event of a fuel spill or fire on the flight deck when ordnance is stowed in a weapons staging
area, properly manned AFFF hose teams shall be deployed forward and/or aft of the weapons
staging area to conduct rapid fire extinguishment or provide weapons cooling protection. The scene
leader should evaluate the threat and recommend activation of bomb farm AFFF sprinkling and/or
adjacent flush-deck sprinkler zones as appropriate.

Aircraft Debris Pile/Running Fuel Fires

This type of three-dimensional fire normally results during catastrophic aircraft crashes when the
fuselage and wing fuel cells have been torn open. Often one or more aircraft may be involved. These
situations allow aerated fuel to rain downward and into deep-seated aircraft debris, which often
shields the fire from direct attack by AFFF hose teams. These debris pile/running fuel type fires can
easily become self-generating, in that as more fuel is fed from ruptured tanks, more fire is generated
to further degrade and open additional fuel cells. This results in a higher, hotter fire of growing
intensity and very high radiant heat. Containing, controlling, and combatting this type of fire requires a
highly organized effort among the scene leader and hose teams along with effective use of the ship’s
fixed AFFF flush deck systems.
As containment of the fire is achieved, the scene leader should assemble the hose teams close together for a coordinated attack on the weakest and most advantageous point of approach to the debris fire. The teams should be directed in their approach to provide both high-point cooling and low-point AFFF firefighting coverage. This is best accomplished with two nozzles on wide fog pattern to block the radiant heat and two nozzles on narrow fog pattern to knock down and extinguish the fire. Their approach should be dedicated to getting as close to the seat of the running fuel fires as possible. This is accomplished by a coordinated advance combined with a methodical sweeping of the fire area.

When the hose teams have achieved their close-in attack positions, and the intensity and high radiant heat of the fire have been diminished, crash crewman with portable halon 1211 or PKP extinguisher may enter between the two center low-point AFFF hose teams and expel a full charge of halon 1211 or PKP directly into the seat of the fire. This procedure may be repeated, as necessary, until the fire is extinguished.

### Liquid Oxygen Converter Bottles

Liquid oxygen converter bottles may leak or vent because of overheating, improper installation, crash impact, or ruptured seals. Freshwater fog should be sprayed on the area to ice over and seal the leak prior to removal. In the shipboard environment pressurized 2 1/2-gallon freshwater extinguishers should be kept readily available for this purpose.
Aircraft Engine Wet Start Fires

These fires are caused when an accumulated residual fuel ignites within the engine or tail assembly area. Depending upon the amount of ignited fuel and wind directions, fire, smoke, and heat may exit from the intake or exhaust areas of the aircraft. A fire of this type more often occurs during initial engine startup during cold weather operations. During flight deck operations, wet starts may also occur when the aircraft is being rapidly turned around from the previous mission in preparation for the next mission’s launch.

Wet starts are normally brought under control by the director signaling the pilot to increase engine rpms to blow the fire out. Aircraft residual fires on shutdown can often be extinguished by wind milling the engine with a jet start unit.

If the above procedures are not successful and fire extinguishing agents are brought into play, halon 1211 should be the initial agent of choice. The fire should be attacked from the windward side of the aircraft with halon 1211 first being introduced directly into the tail-pipe assembly. If this procedure fails to extinguish the fire, halon 1211 should be introduced into the aircraft intake.

Installed or Fixed Firefighting Protection Systems/Flight Quarters Preparation

The crash, salvage, and rescue officer and the HDO shall ensure inspection of their respective areas when flight quarters is sounded to evaluate the readiness and availability of firefighting equipment. They shall report the results of the inspection to the ACHO. Discrepancies shall be reported to the CO.
via the air officer as soon as they are detected. A decision to conduct flight operations when discrepancies are known to exist in firefighting equipment shall be made only by the CO.

**CONFLAG Stations**

CONFLAG stations with capability of actuating all fixed firefighting systems on the hangar deck shall be continuously manned when aircraft are spotted on the hangar deck. A minimum of one CONFLAG station in each hangar bay shall be manned during all ordnance loading/off-loading evolutions.

**AFFF Proportioning System**

An AFFF station consists of a 600-gallon AFFF concentrate tank, typically a single-speed injection and a balanced pressure AFFF proportioning system, electrical controllers, valves, and necessary piping. Saltwater and AFFF flow is controlled by hydraulically operated valves which are actuated by solenoid-operated pilot valves (SOPVs). The SOPVs are activated by electrical switches at user locations (PRIFLY, NAVBRIDGE, hose stations, and CONFLAG stations). The injection pump system supplies the flush-deck nozzles on the flight deck and, on CVNs, the deck-edge nozzles.

The balanced pressure proportioning utilizes a 65 gpm pump and a balancing valve to mix AFFF concentrate and seawater at a nominal 6 percent over a wide range of flows. Excess concentrate from the pump is diverted back to the tank as necessary to maintain a nominal 6 percent AFFF solution. This system supplies all services other than flight deck sprinkling.

**AFFF Flight Deck Fire Extinguishing Systems**

CVN flight decks have an AFFF firefighting system consisting of flush-deck and deck-edge nozzles installed in combination with the saltwater washdown system. AFFF from the concentrate tank is injected into the saltwater (the injection point is on the 03 level just downstream of the saltwater control valve) via a positive displacement pump, at 60 gpm. This injection pump serves the flush-deck and cannon-type nozzles. Deck-edge nozzles are supplied by the single-speed system on CVNs.

Controls for the flight deck fixed fire extinguishing system are located in both PRIFLY and on the navigation bridge.

The controls allow for selection of salt water, AFFF, or system shutdown. On CVN 72 and follow-on ships countermeasure wash-down (CMWD) is controlled only from the navigation bridge.

**Flight Deck Weapons Staging Area (Bomb Farm) AFFF Sprinkler System**

The weapons staging area is protected by an AFFF sprinkler system consisting of deck edge nozzles. The number and spacing of the deck edge nozzles are of a design that provides adequate coverage regardless of the placement of bomb skids and carts. The system is used to rapidly extinguish an aviation fuel spill fire prior to heat buildup sufficient to initiate weapons cook-off conditions. In the event of a bomb farm/weapons staging area conflagration, or upon activation of the weapons area sprinkler system, immediate deployment of AFFF hand lines should be initiated to assist with fire extinguishment and simultaneous weapons cooling.
AFFF is supplied via a single speed pump system. Controls to start and stop flow are located in PRIFLY, NAVBRIDGE, flight deck control, and on the fore and aft ends of the island.

Hangar Deck AFFF Sprinkler System
AFFF sprinkler systems are installed in the overhead of the hangar deck. The sprinkler system is divided into groups that can be individually actuated. Each group is supplied from two risers: one from a port AFFF proportioning station and one from a starboard AFFF proportioning station. Controls to start and stop flow to individual sprinkler groups are located in the CONFLAG stations and along each side of the hangar deck in the vicinity of the related sprinkler group.

AFFF Proportioning System Manning Requirements
The following manning requirements of the AFFF system during flight quarters shall be observed:

- All AFFF proportioning and 03-level injection stations shall be aligned and filled for remote operation from all applicable control stations.

- AFFF proportioning and injection stations need not be continuously manned except as noted below in Conditions for Operable AFFF Services.

- When an aircraft emergency occurs on the flight, and/or hangar deck, word shall be passed on the ship's announcing system (1 MC). At this time, the personnel designated in the watch quarter station bill shall immediately respond to assigned AFFF proportioning stations and 03-level injection stations.

AFFF Proportioning System Inspection and Reporting
The following inspection and reporting procedures shall be observed during all periods aircraft are embarked.

Flight quarters — as early as possible before the first launch, the air boatswain, HDO, and the ship's air gunner shall advise the ACHO of the status of their respective AFFF services.

NOTE
Discrepancies and changes in systems status shall be reported to the CO via the air officer as soon as they are detected.

Services Defined
In specifying the readiness requirements for AFFF systems, a service is defined as one AFFF “outlet” (for example, a group of flight deck nozzles supplied by one group control valve is one “outlet”).

1. Flight deck services — the types of services installed for flight deck protection are:
• Hose stations: one 1-1/2-inch hard rubber hose and one 2-1/2-inch soft hose connected to the outlet
• Flush-deck sprinkling group (includes fantail sprinkling groups)
• Deck-edge sprinkling group
• Upper stage weapons elevator AFFF flooding system
• Bomb farm sprinkling

**NOTE**
On CVNs the flush-deck and deck-edge sprinkling groups are supplied by the same control valve. On these ships, the flush-deck and deck-edge nozzles in one group are considered a single service.

2. Hangar deck services — The three types of services installed for hangar deck protection are:
   • Hose stations: One 1 1/2-inch hard rubber hose and one 2 1/2-inch soft hose (or one 1 3/4-inch soft hose connected to a 2 1/2-inch outlet via a wye gate in lieu of 2 1/2-inch hose)
   • Overhead AFFF sprinkling group
   • Lower stage weapons elevator AFFF flooding system

**Conditions for Operable AFFF Services**
An AFFF system service shall be considered operable if:

1. The cognizant engineering department officer has reported to the air officer via the cognizant air department representative that engineering department firefighting equipment and engineering installations associated with hangar and flight deck firefighting, have been inspected, aligned, and found to be operable.

2. The flight deck or hangar bay service and the associated second deck station are aligned properly (valves and electrical power), the AFFF tank is full (top of the sight glass) of AFFF concentrate, either the provision of item 3 or item is fully implemented, and the provision of item 5 is met.

3. Planned maintenance system (PMS) checks and post-repair testing have been satisfactorily completed, indicating that the service can be successfully actuated from all local and remote control stations.

4. PMS checks or post-repair testing indicates that a service will not operate from all remote control stations, but can be actuated manually or from another remote control station. In this case, the service must be continuously manned at the inoperable remote control station and at the local or remote control station. Communications must be established between all manned stations.

5. Flow tests demonstrate a minimum of 90 percent of the nozzles in a flight deck sprinkling group are unplugged. A group may contain flush deck and/or deck edge nozzles. Each group is one service.

6. Flow tests demonstrate a minimum of 90 percent of the nozzles in a hangar sprinkling group are operational. Each group is one service.

For detail information on aircraft carrier flight and hangar deck AFFF firefighting readiness requirements/identification of inoperable services can be found on *NATOPS U.S. Navy Aircraft*
General Readiness Requirements

- All flight deck and hangar deck AFFF system services should be operable as outlined.

- When aircraft are embarked, and the ship has set non-flight quarter conditions, all flight deck and hangar deck AFFF system services should be operable.

- A minimum of 75 percent of the installed fire pump capacity shall be available in each of the YOKE fire main groups to provide adequate AFFF coverage for flight quarters. This requirement applies regardless of the fire main segregation condition in effect.

Readiness Requirements — Hangar Deck

The following are the maximum inoperable AFFF services permitted on the hangar deck. During flight quarters, the criteria given below should be applied to the entire hangar deck. During non-flight quarter conditions, the criteria apply only to the aircraft “parking area” of all hangar bay sprinkling group deck areas that are to contain parked aircraft.

- One supply to hangar bay sprinkling groups that have two supplies may be inoperable. A maximum of two non-adjacent groups may be in this condition.

- A maximum of one hangar bay sprinkling group can be inoperable at a time (both supplies to group out of service).

- Hoses and lower stage weapons elevator flooding systems supplied by a maximum of two second deck AFFF stations may be inoperable, provided inoperable services of the same type, such as hoses, are not adjacent to each other. Adjacent services are defined as sprinkling groups that share a common boundary or hose stations next to each other around the hangar bay perimeter. Weapons elevator flooding systems are not to be considered when determining adjacent service.

- Whenever one or more AFFF system hangar bay services are not operable (a hose or a sprinkling group), an operable AFFF hose line shall be identified to provide coverage to the area affected by the inoperable service, as approved by the ACHO.

For detail information on aircraft carrier flight and hangar deck AFFF firefighting readiness requirements/identification of inoperable services can be found on NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14, page 7-43, or the Shipboard Firefighting Naval Ships’ Technical Manual (NSTM), Chapter 555.

NOTE
If the fire main is in ZEBRA segregation condition, it may be necessary to shift to YOKE condition for major fire involving multiple AFFF stations to assure adequate fire main capacity. The ship’s information book (damage control section) contains specific guidelines for proper fire main segregation conditions.
Flight Deck Readiness Requirements

The following are the maximum inoperable AFFF services permitted on the flight deck. During flight quarters, the criteria given below apply to the entire flight deck. During nonflight quarter conditions, the criteria apply only to the “parking areas” that are to contain parked aircraft. Backup mobile equipment requirements also are given.

1. All or any combination of the services (deck-edge nozzle group, flush-deck nozzle group, upper stage weapons elevator flooding systems, and hoses) supplied from two of the second deck AFFF stations may be inoperable, provided inoperable services of the same type, such as inoperable hoses supplied by one station, are not adjacent to those from a second inoperable station. Adjacent services are defined as sprinkling groups sharing a common boundary or hose stations next to each other around the flight deck perimeter. Weapons elevator flooding systems are not to be considered when determining adjacent services.

2. Whenever one or more AFFF system flight deck services are not operable, one MFFV shall be manned, engine running, and stationed on the flight deck. During nonflight quarter conditions it is not required that the MFFV be manned. Qualified MFFV operators must be aboard and available to go to the MFFV when called on the 1 MC announcing system.

Procedures Concerning Inadequate AFFF Coverage During Non-Flight Quarters Posture

If the flight or hangar deck has inadequate AFFF coverage to permit parking of aircraft during non-flight quarter conditions:

- Do not permit aircraft maintenance, aircraft fueling/defueling, or hot work in any “parking area” sprinkling groups containing an inoperable service.
- Submit a casualty report indicating the conditions in the AFFF systems and the planned actions.
- Accomplish repairs and retest of defective AFFF system equipment. Submit a casualty correction report when the corrective action is completed.

Procedures Concerning Inadequate AFFF Coverage to Permit Flight Quarters

If the flight or hangar deck has inadequate AFFF coverage to permit flight quarters:

1. Postpone flight quarters and flight operations until requirements can be met.
2. If postponement of flight quarters is restrictive to the ship mission, the Commanding Officer may elect to conduct flight quarters and permit no aircraft maintenance, aircraft fueling/defueling, or hot work in any hangar bay sprinkling group deck areas containing an inoperable service.
3. Submit a casualty report indicating the conditions in the AFFF systems and the planned actions.
4. Accomplish repairs and retest of defective AFFF system equipment. Submit a casualty correction report when the corrective action is completed.

LHA/LHD Crash, Salvage, and Rescue Team

The crash, salvage, and rescue team (also referred to as crash and salvage) is the flight deck repair team. From its station in the island structure it serves to effect rescue of personnel from damaged aircraft on the flight deck, clear away wreckage, fight fires on the flight deck, and make minor emergency repairs to the flight deck and associated equipment.
Team Organization During Normal Flight Operations

Table 5-6 is a guideline only and should be adapted to meet individual ship requirements. A well-organized crash and salvage team shall be assigned individual responsibilities during flight operations. Each individual assigned should be cross-trained in all aspects of crash and salvage.

Table 5–6 — LHA/LHD Crash and Salvage Team Organization During Normal Flight Operations

<table>
<thead>
<tr>
<th>NAME</th>
<th>RATE***</th>
<th>FUEL SPILL</th>
<th>A/C FIRE</th>
<th>A/C CRASH (SALVAGE)</th>
<th>A/C IN CATWALK</th>
<th>A/C JETTISON</th>
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<tr>
<td>ABHC</td>
<td>SCN LDR</td>
<td>SCN LDR</td>
<td>SCN LDR</td>
<td>SCN LDR</td>
<td>SCN LDR</td>
<td>SCN LDR</td>
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<tr>
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<td>SPVSR</td>
<td>SPVSR</td>
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<td>SPVSR</td>
<td>SPVSR</td>
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<tr>
<td>ABH-2</td>
<td>S/W NZL</td>
<td>CRANE</td>
<td>CRANE</td>
<td>CRANE</td>
<td>CRANE</td>
<td>CRANE</td>
</tr>
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<td>FRKLFT</td>
<td>FRKLFT</td>
</tr>
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<td>ABH-3</td>
<td>—</td>
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<td>FRKLFT</td>
<td>FRKLFT</td>
<td>FRKLFT</td>
</tr>
<tr>
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<td>MFFV</td>
<td>MFFV</td>
<td>SLING</td>
<td>SLING</td>
<td>SAFETY</td>
<td>SAFETY</td>
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<tr>
<td>ABH-3</td>
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<td>SLING</td>
<td>SLING</td>
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<td>ABHAN</td>
<td>MFFV*</td>
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<td>SLING</td>
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<td>RESCUE</td>
<td>DOLLY</td>
<td>DOLLY</td>
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<td>EQUIP</td>
<td>EQUIP</td>
<td>AS RQD**</td>
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<td>EQUIP</td>
<td>AS RQD**</td>
<td>AS RQD**</td>
</tr>
</tbody>
</table>

* Normally one MFFV will respond to fuel spill while the other MFFVs cover flight ops.
** Applicable to jettison stations with portable coaming and safety nets with lowering capability
*** Or qualified personnel

Note
After providing required equipment, all personnel perform duties as directed by the supervisor.

Duties and Procedure Requirements

The following aircraft firefighting team organization and duties are essential to meet the training and procedure requirements contained herein.

Scene Leader

The scene leader is a trained individual in the vicinity of an incident who understands the requirements of the emergency and accepts responsibility for directing all available firefighting assets at the scene.

NOTE
The scene leader shall maintain visual contact or hand signal and voice communications with hose team leaders and overhaul personnel.
MFFV Driver and Operator
The driver, turret operator, and one hand line operator for the P-25 provide immediate response and initial firefighting actions. MFFV driver should be equipped with a flight deck wire free communications system headset.

Hose Team Leader
The hose team leader is positioned directly beside the nozzle man and is responsible under the direction of the scene leader for the hose team.

Hose Team/Deployment
AFFF hoses shall be deployed to the scene using maximum personnel participation. When in place, a hose team shall consist of one AFFF hose with a minimum of five persons (maximum seven) on each 2 1/2-inch hose and a minimum of three persons (maximum five) on each 1 1/2-inch hose. A minimum of one person for initial response eventually establishing a minimum of the three persons on each 1 1/2-inch or 1 3/4-inch hose, and five persons on a 2 1/2-inch hose.

Messengers
Messengers are responsible for relaying information from the scene leader to flight deck/hangar deck control.

Rescue Personnel
Rescue personnel shall be available for immediate response and properly attired in PFFPE and SCBA while performing firefighting duties. Rescue personnel should always work in pairs as directed by the scene leader.

NOTE
The hose team leader shall only provide direction to the hose team and not operate the hose.

AFFF Station Operator (Plug Man)
The plug man operates the station at the direction of the hose team leader, and maintains direct communication on the sound-powered X50J with the AFFF proportioning station operator.

Background Assistance Leader
This person organizes and dispatches background assistance personnel in support of the scene leader.

NOTE
All flight deck or hangar deck and embarked squadron personnel not actively engaged at the fire scene or involved in other critical duties, shall muster clear of the scene with the background assistance detail leader to provide additional support as required.

Medical Personnel
Medical personnel shall report to the background assistance leader for assignments.
EOD/Weapons Personnel

During all fixed and rotary wing operations involving ordnance, or whenever ordnance is on the flight deck, properly equipped EOD personnel shall be stationed in flight deck control or at the discretion of the ACHO. They shall be dispatched to the scene by the ACHO to provide technical assistance and weapons cooling temperature checks and weapons disposal as required by the scene leader. The ordnance handling officer shall maintain a status board that confirms type, quantity, and location of all weapons on the flight/hangar deck and/or aircraft. This information shall be provided to the scene leader and ACHO.

Aviation Fuels Repair Personnel

These personnel shall respond to the background assistance detail and be available to provide technical assistance and system repair. Additional V-4 personnel shall be dispatched to isolate affected stations/quadrants of the JP-5 system and notify flight deck control when affected systems are isolated.

Marine and Navy Aviation Squadrons/Detachments

Marine and Navy aviation squadrons/detachments are to provide a senior maintenance representative for technical assistance to be included in the background assistance leader’s detail. Additionally, all embarked squadron personnel shall provide immediate assistance in all firefighting or training evolutions.

NOTE

- V-22 extension wands may be used to meet extension pipe requirement.
- All ships operating the V-22 shall maintain V-22 wands as part of flight deck equipment.

Equipment

WARNING

If fire occurs in an enclosed fuel station, personnel shall not enter the fuel station without an SCBA.

SCBA

SCBA shall be made available to all firefighters/salvage personnel required in the immediate vicinity of an aircraft mishap.

Flight Deck Extinguishers

Halon 1211, CO₂, or dry chemical extinguishers shall be provided in accordance with this chapter. As a minimum, the size of these extinguishers shall be 20 (halon), 15 (CO₂), and 18 (PKP) pounds.

One CO₂ and one PKP extinguisher shall be mounted at each AFFF hose station on the flight deck and gallery walkway areas and shall be readily available to all flight deck areas. A CO₂ extinguisher with appropriate mounting hardware shall be provided for each spot on LHAs and LHDs and shall be permanently fitted with insulated extension pipes 7 feet long. All V-22 spots shall be equipped specifically with the V-22 extension wand described in paragraph 6.2.1 in the NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14. Extinguishers on weather deck shall not have tags or labels of any kind which could be caught by air currents and present a hazard to
aircraft and personnel. A CO₂ extinguisher without an extension wand shall be provided in the area of all fuel stations.

**Hangar Extinguishers**
One CO₂ and one PKP extinguisher shall be mounted near each AFFF hose station and shall be readily available to all hangar areas.

**AFFF Hose Outlets**
Hangar bay AFFF hose outlets are located port and starboard in the general vicinity of the AFFF injection stations from which they are supplied. A pushbutton control is located adjacent to each AFFF hose station.

Flight deck AFFF hose outlets are located in catwalks and in the vicinity of the island. The station consists of one 1 1/2-inch hose reel and one 2 1/2-inch hose outlet with hose and nozzle preconnected. A pushbutton control is located adjacent to each AFFF hose station.

**Hose Outlets**
Hoses shall be of sufficient length to permit reaching all areas on the flight deck, adjacent weather decks, and the hangar deck from at least two outlets.

**Equipment for Saltwater and AFFF Hose Outlets (Hangar and Flight Decks)**
1. Hose outlet valves
2. Vari-nozzles
3. Hoses
4. Spanner wrenches (two) (hangar deck only)
5. One CO₂ and one PKP extinguisher (AFFF outlet only)

**Vari-Nozzles and In-Line Eductors**
Vari-nozzles are used on all AFFF and saltwater hose lines. Flow rates are 250 gpm for all 2 1/2-inch hose lines. Nozzles on 1 1/2-inch AFFF hoses on flight and hangar decks are the 125 gpm units. Nozzles on 1 1/2-inch and 1 3/4-inch saltwater lines and those used with AFFF in-line eductors are 95 gpm models. All nozzle gpm flow ratings are based on 100 psi pressure at the nozzle inlet. The portable in-line eductors are stowed in repair lockers and are used to mix saltwater and AFFF concentrate from 5-gallon containers to produce AFFF solution for combating fires. This in-line eductor may be placed anywhere in the hose line but is recommended to be near or on the saltwater outlets as a minimum of 100 psi at the inlet is optimum for proper proportioning. Hose downstream of the eductor is typically limited to 150 feet on the same deck or one deck above the saltwater outlet.

Locating the eductor at the outlet allows the plug man to handle transferring the pickup tube between AFFF containers and moves this activity off to the side.

**NOTE**
Emergency lighting shall be checked daily. Emergency lighting is provided at each reel station. Controls are located in PRIFLY and on the NAVBRIDGE.
Hose Control Devices

Hose control devices shall be attached to AFFF hose outlets near large concentrations of weapons (i.e., forward and aft of the bomb farm). Alternate stations should be designated for firefighting coverage.

NOTE

- Use allowance equipment list (AEL) CVN/LHA/LHD/LPD/ACS AIRCRAFT CRASH AND SALVAGE TOOL INVENTORY, 2-830024010 to purchase tool inventory items.
- Crash and salvage shall establish a written, monitored tool control program.

Flight Deck Tool Inventory

LHA/LHD crash box / crash locker containing the firefighting/rescue tools and equipment listed in Table 5-7 shall be maintained for use in emergencies. All equipment shall be inspected daily prior to commencement of flight operations. Requirements for salvage equipment can be found in NATOPS Aircraft Salvage Manual, NAVAIR 00-80R-19(afloat).

Table 5-7—Crash Tool Inventory

<table>
<thead>
<tr>
<th>TOOL</th>
<th>QTY</th>
<th>NSN</th>
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<tbody>
<tr>
<td>Adapter, 1/4-inch hex drive to 3/8-inch drive drill</td>
<td>1</td>
<td>5110-00-293-2336</td>
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<td>Axe, crash/fire</td>
<td>2</td>
<td>5110-00-221-7958</td>
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<td>Bar, 1/2-inch drive breaker</td>
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<td>5120-00-242-0762</td>
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<tr>
<td>Bar, 36-inch pry</td>
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<td>5120-00-244-0608</td>
</tr>
<tr>
<td>Bar, 60-inch pry</td>
<td>1</td>
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<td>Bar, crow (26-inch)</td>
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<td>Cutters, bolt (36-inch)</td>
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<td>Extension, 3/8-inch drive, 12-inch</td>
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<td>5120-00-243-1691</td>
</tr>
<tr>
<td>Extension, 3/8-inch drive, 6-inch</td>
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<td>5120-01-437-1726</td>
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<td>Extinguisher, Halon 1211 (These are inclusive to those installed on the MFFVs.)</td>
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<tr>
<td>Extinguisher, CO₂</td>
<td>2</td>
<td>4210-00-203-0217</td>
</tr>
<tr>
<td>Extinguisher, PKP</td>
<td>2</td>
<td>4210-00-935-1656</td>
</tr>
<tr>
<td>Extinguisher, fresh water</td>
<td>3</td>
<td>4210-00-720-1815</td>
</tr>
<tr>
<td>Ground locks for each type of aircraft assigned</td>
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<td></td>
</tr>
<tr>
<td>Halligan tool</td>
<td>1</td>
<td>5120-00-009-5044</td>
</tr>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>2</td>
<td>5120-00-061-8545</td>
</tr>
<tr>
<td>Harness, safety, lanyard</td>
<td>4</td>
<td>4240-00-022-2518</td>
</tr>
<tr>
<td>Harness, safety</td>
<td>4</td>
<td>4240-00-022-2522</td>
</tr>
<tr>
<td>Hook, 4-pound, grapnel trailed with 12-foot chain</td>
<td>1</td>
<td>2040-00-287-9644</td>
</tr>
<tr>
<td>Hose control devices, 2 1/2-inch</td>
<td>4</td>
<td>4210-01-131-0249</td>
</tr>
<tr>
<td>Hose control devices, 1 1/2-inch</td>
<td>4</td>
<td>CONTACT COMNAVAIRFOR N73 FOR PROCUREMENT</td>
</tr>
<tr>
<td>Hoses, spare, 1 1/2-inch</td>
<td>8</td>
<td>4210-00-131-0247</td>
</tr>
<tr>
<td>Hoses, spare, 1 1/2-inch</td>
<td>8</td>
<td>4210-00-131-0247</td>
</tr>
<tr>
<td>Jack kit, 10 ton port-a-power</td>
<td>1</td>
<td>5120-00-595-8388</td>
</tr>
<tr>
<td>TOOL</td>
<td>QTY</td>
<td>NSN</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-----</td>
<td>-------------------</td>
</tr>
<tr>
<td>Ladder with a minimum straight length capability of 15 feet. Ladder shall meet the requirements of NFPA 1931 or have at least an OSHA duty rating of Type 1A, Industrial Extra Heavy Duty, with a minimum working load of 300 lbs.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Megaphone, battery-powered (public address set)</td>
<td>1</td>
<td>5830-00-412-9206</td>
</tr>
<tr>
<td>Nozzles, 1 1/2-inch, 125 gpm spare</td>
<td>4</td>
<td>4210-00-601-0986</td>
</tr>
<tr>
<td>Nozzles, 2 1/2-inch, spare</td>
<td>4</td>
<td>4210-00-465-1904</td>
</tr>
<tr>
<td>PFFPE</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>PFFPE, spare</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pliers 8 1/2-inch locking (vise grip)</td>
<td>2</td>
<td>5120-00-277-4244</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>2</td>
<td>5120-00-278-0352</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>2</td>
<td>5110-00-224-1532</td>
</tr>
<tr>
<td>Pliers 10-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-223-7398</td>
</tr>
<tr>
<td>Pliers 6-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-223-7396</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>2</td>
<td>5120-00-239-8251</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>2</td>
<td>5120-00-247-5177</td>
</tr>
<tr>
<td>Plugs, tapered wooden</td>
<td>3</td>
<td>5510-00-260-8958</td>
</tr>
<tr>
<td>Plugs, tapered, rubber</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Powered extrication tool</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>2</td>
<td>5120-00-293-0448</td>
</tr>
<tr>
<td>Ratchet, 3/8-inch drive</td>
<td>2</td>
<td>5120-01-474-5182</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>2</td>
<td>6230-00-299-3035</td>
</tr>
<tr>
<td>Saw, gasoline portable forcible entry</td>
<td>2</td>
<td>5130-00-134-1207</td>
</tr>
<tr>
<td>Saw, gasoline portable forcible entry blades (10 spare blades per portable saw) Note: Do not store blades and gasoline/oil mixtures together.</td>
<td>2</td>
<td>5110-00-289-9657</td>
</tr>
<tr>
<td>SCBA, 45-minute positive-pressure (which includes bottles)</td>
<td>6</td>
<td>5110-00-277-4589</td>
</tr>
<tr>
<td>SCBA, spare 45-minute air bottles</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>2</td>
<td>5120-00-234-8913</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>2</td>
<td>5120-00-234-8912</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6-inches long</td>
<td>6</td>
<td>5120-00-227-7356</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10-inches long</td>
<td>2</td>
<td>5120-00-278-1283</td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 7/32 hex tip</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 3/16 hex tip</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 3/4-inch</td>
<td>2</td>
<td>5120-01-335-0866</td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 1/8-inch apex hex tip</td>
<td>4</td>
<td>5120-01-367-3454</td>
</tr>
<tr>
<td>Socket set, 3/8-inch drive</td>
<td>1</td>
<td>5120-00-322-6231</td>
</tr>
<tr>
<td>Socket set, 1/2-inch drive</td>
<td>1</td>
<td>5120-00-081-2307</td>
</tr>
<tr>
<td>Speed handle, 3/8-inch drive</td>
<td>9</td>
<td>5120-00-237-4969</td>
</tr>
<tr>
<td>Strap cutter (rescue knife)</td>
<td>10</td>
<td>4240-01-568-3219</td>
</tr>
<tr>
<td>T-handle, 7/32 hex wrench</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thermal imaging camera</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tool roll</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Vacuum, high efficiency (.3 micron filter)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wrench, torque 1-600 inch pounds</td>
<td>1</td>
<td>5120-00-288-8865</td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
<td>5120-00-246-3796</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>2</td>
<td>5120-00-240-5328</td>
</tr>
<tr>
<td>Wrench, fire hose, spanner</td>
<td>4</td>
<td>5120-00-018-1519</td>
</tr>
</tbody>
</table>
Flight Deck Crash and Salvage Tool Roll

The flight deck crash, salvage, and rescue team and the hangar deck rescue team shall each maintain a minimum of one tool roll. The tool roll shall contain the tools listed below in Table 5-8.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers 8 1/2-inch locking (vise grip)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, side cutting (10-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers 10-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers 6-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>1</td>
</tr>
<tr>
<td>Plugs, tapered, rubber</td>
<td>3</td>
</tr>
<tr>
<td>Plugs, tapered, wooden</td>
<td>3</td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack with six spare blades</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Speed handle, 3/8-inch drive</td>
<td>2</td>
</tr>
<tr>
<td>Strap cutter (rescue knife)</td>
<td>2</td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, fire hose, spanner</td>
<td>2</td>
</tr>
<tr>
<td>7/32-inch hex tip socket 3/8-inch drive</td>
<td>1</td>
</tr>
<tr>
<td>3/16-inch hex tip socket 3/8-inch drive</td>
<td>1</td>
</tr>
<tr>
<td>Tool roll</td>
<td>1</td>
</tr>
</tbody>
</table>

Crash Crane

All LHAs/LHDs shall have a crane with a lift and roll capability for moving aircraft. A manufacturer’s aircraft hoisting sling shall be available for immediate response of each aircraft type embarked. The air boatswain shall notify the TYCOM, via the chain of command, of any aircraft embarked without a required manufactured hoisting sling.

Crash Forklifts and Salvage Platforms/Rescue Basket

A 20,000-pound lift capacity forklift, a 6,000-pound lift capacity forklift, and a salvage platform/rescue basket as detailed in the NATOPS Aircraft Salvage Manual, NAVAIR 00-80R-19(afloat) shall be maintained on the flight deck during air operations for use in effecting rescue/aircraft salvage.
Hangar Deck Tool Inventory

Crash and salvage tool inventories containing the firefighting/rescue tools and equipment listed in *Table 5-9* shall be maintained for use in hangar bay emergencies.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axe, crash/fire</td>
<td>2</td>
<td>5110-00-293-2336</td>
</tr>
<tr>
<td>Bar, 36-inch pry</td>
<td>1</td>
<td>5120-00-242-0762</td>
</tr>
<tr>
<td>Bar, crow (26-inch)</td>
<td>1</td>
<td>5120-00-224-1372</td>
</tr>
<tr>
<td>Cutters, bolt (36-inch)</td>
<td>1</td>
<td>5110-00-188-2524</td>
</tr>
<tr>
<td>Cutters, cable (14-inch)</td>
<td>1</td>
<td>5110-00-224-7053</td>
</tr>
<tr>
<td>Halligan tool</td>
<td>1</td>
<td>5120-00-009-5044</td>
</tr>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>2</td>
<td>5120-00-061-8545</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>2</td>
<td>5120-00-237-4969</td>
</tr>
<tr>
<td>Hose control devices, 1 1/2-inch</td>
<td>2</td>
<td>CONTACT COMNAVAIRFOR N73 FOR PROCUREMENT</td>
</tr>
<tr>
<td>Hoses, spare, 1 1/2-inches</td>
<td>6</td>
<td>4210-01-131-0249</td>
</tr>
<tr>
<td>Firefighters helmets (DC/FF Helmet)</td>
<td>22</td>
<td>4210-01-493-7428</td>
</tr>
</tbody>
</table>

*Note:* The helmets required above are the type that are red in color and worn by the Damage Control/Firefighting Team members. They are NOT required to be proximity firefighting helmets which are the helmets that include aluminized covers and reflective face shields.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladder with a minimum straight length capability of 15 feet. Ladder shall meet the requirements of NFPA 1931 or have at least an OSHA duty rating of Type 1A, Industrial Extra Heavy Duty, with a minimum working load of 300 pounds.</td>
<td>1</td>
<td>CONTACT COMNAVAIRFOR N73 FOR PROCUREMENT</td>
</tr>
<tr>
<td>Megaphone, battery-powered (public address set)</td>
<td>1</td>
<td>5830-00-412-9206</td>
</tr>
<tr>
<td>PLFPE</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Pliers, 8 1/2-inch locking (vise grip)</td>
<td>2</td>
<td>5120-00-277-4244</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>2</td>
<td>5120-00-278-0352</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>2</td>
<td>5110-00-224-1532</td>
</tr>
<tr>
<td>Pliers, 10-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-223-7398</td>
</tr>
<tr>
<td>Pliers, 6-inch (slip-joint)</td>
<td>2</td>
<td>5120-00-223-7396</td>
</tr>
<tr>
<td>Pliers, lineman</td>
<td>2</td>
<td>5120-00-239-8251</td>
</tr>
<tr>
<td>Pliers, long nose (needle nose)</td>
<td>2</td>
<td>5120-00-247-5177</td>
</tr>
<tr>
<td>Plugs, tapered wooden</td>
<td>3</td>
<td>5510-00-260-8958</td>
</tr>
<tr>
<td>Plugs, tapered, rubber</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>2</td>
<td>5120-00-293-0448</td>
</tr>
<tr>
<td>SCBA, 45-minute positive-pressure (which includes bottles) will be prepositioned in the hangar bay for use by hotsuitmen and air department personnel clearly marked as such</td>
<td>26</td>
<td>CONTACT COMNAVAIRFOR N73 FOR PROCUREMENT</td>
</tr>
<tr>
<td>SCBA, spare 45-minute air bottles</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>2</td>
<td>6230-00-299-3035</td>
</tr>
<tr>
<td>Saw, hack, frame</td>
<td>2</td>
<td>5110-00-277-4589</td>
</tr>
<tr>
<td>Saw, hack spare blades (12 spare blades per frame)</td>
<td>5110-00-277-4589</td>
<td></td>
</tr>
</tbody>
</table>
Table 5-9 — Hangar Deck Tool Inventory (Continued)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>2</td>
<td>5120-00-234-8913</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>2</td>
<td>5120-00-234-8912</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6 inches long</td>
<td>2</td>
<td>5120-00-227-7356</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>2</td>
<td>5120-00-278-1283</td>
</tr>
<tr>
<td>Socket set, 3/8-inch drive</td>
<td>1</td>
<td>5120-00-322-6231</td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 7/32 hex tip</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 3/16 hex tip</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>T-handle 7/32 hex wrench</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Thermal imaging camera</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tool roll</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Vacuum, high efficiency (.3 micron filter)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
<td>5120-00-246-3796</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>2</td>
<td>5120-00-240-5328</td>
</tr>
<tr>
<td>Wrench, fire hose, spanner</td>
<td>2</td>
<td>5120-00-018-1519</td>
</tr>
</tbody>
</table>

Hangar Deck Tool Roll

The tool roll shall contain the tools listed in Table 5-10, which shall be assembled from tool inventory listed in Table 5-9.

Table 5-10 — Hangar Deck Tool Roll

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer, ball peen (1 1/2-pound)</td>
<td>1</td>
</tr>
<tr>
<td>Handle, 3/8-inch drive speed</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 8 1/2-inch locking (vise grip)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, rib joint, water pump (10-inch) (channel locks)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, side cutting (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 10-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, 6-inch (slip-joint)</td>
<td>1</td>
</tr>
<tr>
<td>Plugs, tapered, wooden</td>
<td>3</td>
</tr>
<tr>
<td>Plugs, tapered, rubber</td>
<td>3</td>
</tr>
<tr>
<td>Punch, drift (8-inch)</td>
<td>1</td>
</tr>
<tr>
<td>Safety flashlight</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack, frame</td>
<td>1</td>
</tr>
<tr>
<td>Saw, hack spare blades (12 spare blades per frame)</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #2</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Phillips #3</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 3/16-inch tip, 6 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, flat tip, 5/16-inch tip, 10 inches long</td>
<td>1</td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 7/32 hex tip</td>
<td>1</td>
</tr>
<tr>
<td>Socket, 3/8-inch drive, 3/16 hex tip</td>
<td>2</td>
</tr>
<tr>
<td>T-handle, 7/32 hex wrench</td>
<td>1</td>
</tr>
<tr>
<td>Tool roll</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 12-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, 8-inch adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Wrench, fire hose, spanner</td>
<td>2</td>
</tr>
</tbody>
</table>
Mobile Firefighting Equipment

Each crash and salvage organization shall maintain a minimum ready stock of one vehicle/equipment load of AFFF (total tank capacity) for each MFFV assigned. The minimum ready stock shall exclude the initial load of agent in the tank.

Supply departments for air activities should maintain an equal amount of agent.

Two P-25s shall be provided to support flight operations.

The MFFVs should be positioned as follows during flight operations.

NOTE
If no MFFV is available, a hose team shall be available within a reasonable vicinity to respond to a hose station and with a clear path of each weapons evolution.

Firefighting Tactics

Launch

Position one MFFV at a location that will provide the best view of the entire flight deck. Position the second MFFV unit as required in standby (air boatswain).

Recovery

- The MFFV shall be positioned so that an unobstructed downwind approach can be made to a maximum number of the landing spots in use.

Operations

- The MFFV shall be positioned so that an unobstructed downwind approach can be made to a maximum number of the landing spots in use.

Respot

During the respot, one MFFV shall be manned and positioned so that it may readily respond anywhere on the flight deck.

Fueling

The MFFV-assigned roving patrol on the flight deck fulfills the requirements for portable fire extinguishers during JP-5 refueling operations.
Limited Flight Operations
During limited flight operations, such as single aircraft launch or recovery, a minimum of one MFFV shall be manned, running and positioned in the immediate vicinity of the area from which the flight operations will occur.

Extended Flight Operations
The equipment shall be manned, running, and positioned in accordance with limited flight operations.

Maintenance Turnups
One MFFV shall be positioned in the immediate vicinity of the aircraft for maintenance turnups, helicopter engine (APU) auxiliary power units, (APP) auxiliary power plant, (GTS) gas turbine starter starts, or any time rotors are to be engaged.

Ordnance Handling Evolutions, Underway Replenishment
One MFFV shall be manned with a clear approach to each concentrated weapons loading evolution.

Training Requirements
All personnel assigned duties incidental to flight operations shall attend a formal aviation firefighting school as required by Office of the Chief of Naval Operations Instruction, (OPNAVINST) 3541.1(series).

Embarked On-the-Job Training Requirements
The air officer shall ensure that all personnel assigned duties incidental to flight operations (including embarked aviation activities) receive continuous training in the following areas:
- Organization and leadership of the crash, salvage, and rescue team
- Fire reporting procedures
- Communications
- First-aid and self-aid
- AFFF/saltwater station operation on flight and hangar decks including hangar deck sprinkler systems
- Aircraft firefighting procedures
- Hazardous ordnance cooling and jettison procedures
- MFFVs
- Portable CO₂, PKP and halon 1211 extinguishers (operation and location)
- Appropriate firefighting actions to perform until assistance arrives
- Basic handling of composite and hazardous materials produced after a crash or fire

Aviation training team (ATT) will be responsible, under the direction of the air officer, for the training of flight deck, hangar deck, air wing, and emergency response personnel.

Crash, Salvage, and Rescue Crewmember Training
Personnel assigned as crash, salvage, and rescue crewmembers shall attend (as a team) the AFSTT course C-780-2012 once during an 18-month cycle or whenever the team experiences a greater than 40-percent turnover. They shall also receive additional (in-depth) training to include the following:
HAZMAT Training

All personnel assigned to the crash and salvage organization shall receive in-depth training on chapter 6 of the NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14 to ensure they are capable of handling hazardous materials produced after a crash or fire.

Fire-Involved Ordnance Training

The cooling of fire-involved ordnance is one of the most important aspects of aircraft firefighting operations. Crash and salvage crews and flight deck personnel should familiarize themselves with the various types of ordnance carried by embarked aircraft, as presented in chapter 2 of the NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14. Cook-off times are listed in Figure 5-1 of this chapter.

NOTE

All aircraft fire training drills should incorporate the following: various types of simulated fire exposed ordnance; the receipt and reporting of information concerning them; the on-scene identification and cooling procedures of dedicated hose teams; and the realistic verbal or other means of communication among flight deck control, the on-scene leader, and EOD/Weapons personnel at the scene.

MFFV Training

All preplanning and training should be directed toward a “worst-case” scenario. Accordingly, shipboard fire drills should include the requirement to practice nursing/replenishment of mobile vehicles.
Drills

Drills shall be conducted with sufficient frequency to maintain the level of proficiency in the fundamentals of aircraft firefighting and salvage operations as specified in training and operational readiness information services (TORIS)/training figure of merit (TFOM).

Conduct of Drill

The following information shall be provided to the scene leader by the exercise observer while conducting drills in accordance with current directives.

1. Class of fire, location, and aircraft damage
2. Type of ordnance hazards
3. Casualties (personnel and material)
4. Fire under control (when initial firefighting equipment is at scene)
5. Fire extinguishment

Drill Sequence of Events

For training purposes, the scene leader shall utilize the following checklist when fighting a fire (simulated) on the flight or hangar deck. Sequence should be followed to the maximum practicable extent in combating actual fires (quotes indicate report to be made).

1. “Initial firefighting equipment/personnel at the scene”
   a. MFFV(s) (nursed)
   b. Scene leader
   c. Hose team leaders
   d. Four manned AFFF hoses
2. Nozzles on/Move in; “Hose Teams moving in”

   \[\text{WARNING}\]
   Personnel shall step over all firefighting hoses to avoid personal injury.

   \[\text{NOTE}\]
   Back out P-25 as soon as practical to maximize range of hose teams, to reduce noise for commands between scene leader and hose team leaders, and make crash and salvage personnel available for salvage.

3. “Weapons cooling in progress”/“Fire under control”

   \[\text{NOTE}\]
   Clock starts for weapons cooling, provided weapon is no longer exposed to fire.
4. Effect rescue
   a. “Rescue in progress”
   b. “Rescue complete”
   c. “Number of casualties”
   d. “Seats safe”
5. “Fire’s out”
6. “Back out” (to a safe distance) (for non-weapons cooling hoses)
7. “Nozzles off” (for non-weapons cooling hoses)
8. Deploy TIC, at air boatswain’s discretion, to determine surface temperature of weapon, and continue cooling if necessary

   **NOTE**
   Hose streams shall not be applied to weapons during TIC readings.

9. “Nozzles off, back out” (weapons cooling hose)
10. “EOD to Scene”/“Weapons safe” or “continue to cool”
11. Download and jettison weapon(s)
12. Overhaul of residual fire/disconnect batteries
   a. “Overhaul in progress”
   b. “Overhaul complete”
13. Set reflash watch
   a. “Reflash watch set by Hose team #_____ or P-25”
14. With squadron maintenance personnel present, scene leader turns over the scene to crash and salvage, and commence salvage operations
15. “Estimated time to ready deck is ___”
16. Conduct FOD walk down; HAZMAT shall be brought to the attention of the background assistance leader, who will delegate it removal to cognizant personnel
17. “Ready deck”
18. ADTT debrief/crew debrief

   **NOTE**
   Background assistance leader shall inform scene leader, via messenger when background assistance equipment/personnel is or at background.

---

**Drill Sequence of Events for Fuel Station Fires**

For training purposes the scene leader shall utilize the following checklist when fighting fuel station fires on the flight or hangar deck. Sequence should be followed to the maximum practical extent in combatting actual fires (quotes indicate reports to be made.)
1. Initial response equipment at the scene (MFFVs, four AFFF hose teams for flight deck and two AFFF hose teams for hangar deck)

   ![WARNING]
   
   **WARNING**
   
   Personnel shall not enter enclosed fuel stations without a self-contained breathing apparatus.

2. “Nozzle on, move in”

   ![NOTE]
   
   **NOTE**
   
   Back out P-25 as soon as practical to maximize range of hose teams, to reduce noise for commands between scene leader and hose team leaders, and make crash and salvage personnel available for salvage.

3. “Fire under control”/“Fuels repair on scene”/“Station isolate” and all electrical power secured

4. Effect “rescue”/“casualties” (if required)

5. “Fire out”

6. “Back out, nozzles off”

7. Overhaul

   ![NOTE]
   
   **NOTE**
   
   When fire occurs on the flight and/or hangar deck, word shall be passed on the 1 MC announcing systems. At this time, designated personnel shall man assigned AFFF proportioning station. Immediate communications shall be established with the AFFF station.

8. Set reflash watch

9. Turn scene over to Fuels Repair personnel, report estimate damage/time of repair

10. Fuels repair personnel to commence repair operations

11. FOD walk down

12. Ready deck

13. Debrief

**Aircraft Firefighting Tactics and Procedures**

Flight and hangar deck aircraft firefighting, crash, and rescue techniques are well defined, but no two fire situations will be identical. Success will continue to depend on training, planning, leadership, and teamwork by both ship’s company and embarked air wing personnel. Supervisory personnel and fire parties should take advantage of every opportunity to drill and acquire knowledge of their ship’s fixed and mobile firefighting equipment, aircraft configurations, fuel and weapons loads, and firefighting procedures specified within this manual. The following procedures discuss certain additional situations not discussed in detail elsewhere in the manual.
Notification

Reporting of a mishap should be accomplished by the most expeditious method in accordance with the ship’s operating instructions. In the event of a pending emergency, the air officer shall notify flight and hangar deck personnel by use of the 3 MC and 5 MC announcing systems and flight deck warning alarm. The flight deck crash alarm shall be sounded to notify flight deck personnel of an actual on-deck aircraft mishap.

Initial and Background Response Equipment/Personnel

All preplanning and training shall be directed toward providing the following minimum initial response to an actual mishap or drill:

1. MFFV(s)
2. Scene leader
3. Hose team leaders
4. Four manned AFFF hoses

NOTE

When the MFFV is nursed at the scene, it can be considered the equivalent of one AFFF hose team.

NOTE

It is emphasized that nothing herein is intended to discourage immediate firefighting action by individuals while awaiting the arrival of organized teams. On the contrary, 1 1/2-inch AFFF hose reels and variable pattern nozzles are specifically designed and installed for rapid deployment by one person, if necessary. Accordingly, the training provided to all air department and embarked aviation personnel should cover activation procedures and firefighting techniques for emergency operation of 1 1/2-inch hose reels by the first person on the scene.

Organization Responsibilities

Rescue Personnel

Rescue personnel are positioned in proximity to the scene leader.

Background Assistance Equipment/Personnel

- Two stretchers/two first-aid kits
- Two spare hose rolls
- Forcible entry equipment
• Messengers/phone talkers

**NOTE**
In the event hose control devices are deployed, personnel shall be assigned to monitor charged fire hoses restrained with hose control devices. These personnel shall ensure prompt response to conditions that affect the fire stream, such as wind change and/or other disruptions.

• Two portable extinguishers (halon 1211, PKP, or CO$_2$)
• AFFF hose(s) for weapons staging area(s) (bomb farm) protection properly manned
• Two spare 1 1/2-inch and two spare 2 1/2-inch hose control devices (with appropriate vari-nozzles attached).

**Scene Leader**
The scene leader assumes command and directs available personnel and equipment in firefighting procedures and tactics, ordnance cooling, and personnel rescue as the situation requires.

**NOTE**
- The scene leader should evaluate the fire and make recommendations to PRIFLY for maneuvering the ship to provide favorable wind conditions.
- Scene leader shall ensure hose teams attack the fire from a 45° angle when able.

**MFFV Driver/Operators**
Designated driver/operators shall immediately position the vehicle at the scene of a fire in a location that will afford the most efficient control of the fire, cool ordnance, and provide protection for personnel rescue. All attempts should be made to position the vehicle upwind of the fire. Upon arrival to the scene, the initial response MFFV shall simultaneously fight the fire, cool the cockpit area, and cool exposed ordnance until relieved.

**Air Officer**
The air officer assesses the fire situation, advises the CO, and requests assistance commensurate with the gravity of the incident.

**WARNING**
- Personnel shall exercise extreme caution when approaching an aircraft prior to engine shutdown.
- The scene leader shall immediately make an appraisal in regard to the presence of hazardous ordnance and request confirmation from flight deck control. Leader shall direct firefighting teams in weapons cooling as specified previously in this chapter.
Air Boatswain

The air boatswain is responsible to the air officer for organizing and supervising the response to all aircraft-related emergencies on the flight and hangar deck.

NOTE
In the event of a fire on the flight or hangar deck, sufficient air department or air wing personnel from the unaffected area shall stand by to provide assistance, as necessary, for fire containment and casualty control under the air boatswain supervision.

AFFF Hose Teams

These teams attack the fire and/or cool ordnance as directed by the hose team leaders. Hose teams should maintain a position and stance which affords the most effective and safe hose handling techniques.

NOTE
Due to smoke, heat, and explosion hazards, hose teams should maintain a profile as low as possible.

Overhaul Team Personnel

1. The scene leader directs two personnel attired in complete PFFPE and SCBAs to ensure no residual fire exists. The senior firefighter shall have a halligan tool/crash axe. The junior firefighter shall have a portable fire extinguisher with a positive agent check.

NOTE
Rescue personnel attired in complete PFFPE and SCBAs shall be positioned in proximity to the scene leader and keep the overhaul team in sight at all times.

2. Overhaul starting point shall be determined by the location of the battery access panels.
3. The junior firefighter will maintain the extinguisher nozzle under the arm of the senior firefighter at all times.
4. Overhaul team will disconnect battery.
5. The location of residual fires can be identified by using a TIC or by feeling with the back of the hand.
6. Every attempt should be made to access all compartments/panels on the aircraft.
7. If residual fire is located and it is not in the area of a fuel cell or access panel a small hole can be made in order for an extinguishing agent to be directed in.
8. The senior firefighter shall lead the junior firefighter away from the aircraft in such a way the junior can continue to face the overhaul area at all times.
9. The senior firefighter shall report the completion of overhaul of aircraft battery disposition to the scene leader.

Messengers

The messengers position themselves directly behind the scene leader.
Background Assistance Leader

- Assembles additional personnel not required at scene
- Ensures immediate assignment of personnel to provide nursing/replenishment hose to the initial response MFFV at the scene
- Ensures adequate flow of messengers to the scene leader
- Dispatches fresh firefighting personnel to relieve fatigued hose team members, as required
- Assembles two backup AFFF hoses properly manned
- Effects the removal of aircraft adjacent to the scene
- Provides medical personnel and stretcher bearers
- Provides personnel to other areas if additional fires occur
- Dispatches support personnel as required by scene leader
- Coordinates manning of appropriate elevators, as necessary
- Ensures fuel repair, electrician, and maintenance representatives are available, as necessary
- Ensures external electrical power to aircraft involved is secured
- Ensures one person (plug man) is stationed at each deployed AFFF actuation control box. Personnel manning actuation control boxes maintain direct communication with the AFFF proportioning station operator and 03-level AFFF injection station operator
- If the scene leader and background assistance have established communications with sound-powered phones, messengers are no longer required

NOTE
When using SCBAs, background assistance will establish an SCBA control.

Scene Nursing/Replenishment Coordination

Specific guidance for each situation cannot be provided since vehicle repositioning and/or redeployment as a result of additional fires may be necessary. After initial minimum response actions are completed, the decision to nurse/replenish MFFVs from an AFFF fixed system outlet should be coordinated by the scene leader.

NOTE
Nursing/replenishment of MFFVs is highly recommended for multi-aircraft mishaps and a single aircraft mishap that spreads to one or more aircraft with or without weapons involvement.

Nursing/Replenishment Considerations

NOTE
When the MFFV is nursed at the scene, it can be considered the equivalent of one AFFF hose team.
The following considerations are provided for the scene leader in determining whether or not nursing/replenishment will be effected:

1. Location and initial position of the vehicle relative to the fire scene.
2. Type fire and number of AFFF hose teams responding to the scene.
3. Vehicle mobility requirements.
4. Multifirefighting deployment capability exists through utilization of turret and hand lines and requires minimum personnel.
5. Length of hose and fire main pressure

**Nursing Support Functions**

- Personnel shall be provided for direct hookup of the nursing/replenishment hose to the initial response MFFV.
- A 2 1/2-inch and/or 1 1/2-inch reducing adapter shall be carried on the vehicle to facilitate nursing/replenishment from either size fixed AFFF hose station outlet.
- Personnel support from background assistance will be required to move the nursing/replenishment hose to the fire scene.

**Rescue**

When an adequate rescue path is provided, the scene leader will direct the rescue of personnel. The leader reports the commencement and completion of the rescue and the number of casualties.

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**WARNING**

Adequate fire protection shall be maintained for rescue persons during rescue evolutions.

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**NOTE**

Rescue and firefighting evolutions should be conducted simultaneously once a rescue path is provided.

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**Rescue Personnel**

1. Rescue team personnel should work in pairs throughout the rescue and salvage effort. Each rescue effort should be directed toward evacuating one incapacitated person at a time.
2. Investigate the surrounding area (e.g., catwalks, gun tubs) for additional casualties.

**Background Personnel**

The background assistance personnel will provide immediate first-aid to casualties and evacuate them as necessary.

**Completion of Rescue**

Upon completion of rescue, the scene leader continues to direct the hose teams until the fire is extinguished.
Weapons Cooling

As AFFF hose teams arrive on the scene, they shall knock down fire and smoke to enable identification of fire-exposed ordnance. Once fire-exposed ordnance is identified, ordnance suspected of being heated by the fire shall be assessed and cooled until it is determined by EOD/Weapons personnel that it can be safely downloaded and jettisoned/returned to service. While cooling ordnance, the hose team shall lock their agent on that particular weapon or weaponry as a weapons cooling team. They shall remain locked on the weaponry unless hose control devices are installed, or they are relieved by other cooling teams or the on-scene leader.

**NOTE**

- The actual time for the cooling of weapons shall be determined by the air boatswain based upon the degree of actual exposure of the weapon to the fire. Historically weapons have been cooled for a minimum of 15 minutes or until deemed safe by EOD personnel. However, post assessment cooling for minimal exposures may be a duration of less than 15 minutes. Severe exposures may require cooling in excess of 15 minutes.
- Once the weapon is cooled and downloaded, the air gunner will make the determination to jettison the weapon on behalf of the CO.

**NOTE**

- Ordnance cooling hose team leaders shall ensure minimum manning of hose team personnel immediately upon lock-on for weapons cooling. Once the team is in place, personnel shall squat in position to lower the team’s physical silhouette should a deflagration or explosion occur.
- Ordnance cooling teams may lock in place hose control devices for extended cooling and personnel safety. The teams shall then evacuate the scene leaving one firefighter to tend the nozzle.

Residual Fire Overhaul/Reflash Watch

**Scene Leader**

The scene leader directs two personnel attired in PFFPE and SCBA; these personnel shall be equipped with a portable fire extinguisher with positive agent check, halligan tool/crash axe, and TIC to ensure no residual fire exists.

**Background Assistance Detail**

Background assistance detail assembles to commence FOD walk down, restore gear, and provide personnel to the air boatswain.
Estimated Ready Deck/Salvage

Scene Leader
The scene leader gives estimated ready deck time to PRIFLY if salvage operations are not required or turns command of the scene over to the air boatswain to effect removal of aircraft.

Air Boatswain
The crash and salvage officer (air boatswain) estimates time to ready deck and reports to PRIFLY, updating the estimate as necessary.

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<td>In the event of a fire on either the flight or hangar deck, sufficient personnel from the unaffected area shall stand by to provide personnel and equipment augmentation, as necessary, for fire containment and casualty control. The decision to commit these assets will normally be made by the air officer.</td>
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LH/LHD Hangar Deck
The following additional procedures for aircraft fires on the hangar deck shall be followed:

1. Return elevators to the flight deck level.
2. Close all doors and hatches from the hangar to the interior of the ship.
3. Close all weapons elevator doors/hatches.
4. Open elevator doors, sponson doors and well deck doors in accordance with 8.6.10 to provide ventilation of heat and smoke.
5. Leave all hangar deck lights on.
6. Initial response personnel without SCBA shall be immediately relieved by the background assistance/repair party personnel with SCBA.
7. Background assistance should be established in an adjacent protected space.
8. Activate appropriate zones of the hangar bay AFFF sprinkler system for any multi-aircraft fire or when a fire is judged to be beyond the capability of the hose teams, or if determined necessary to minimize collateral damage.

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<td>Items listed above are specific to air department/hangar deck fire party; additional actions by the damage control organization will be necessary in conjunction with these actions, such as establishing fire boundaries and cooling adjacent spaces.</td>
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**Hangar Deck Ventilation**

Cross ventilation may be accomplished by use of aircraft elevator, sponson and well deck doors to facilitate the venting of smoke, heat, and combustion products to aid firefighter access and fire control. The ship’s direction can also be used to maximize ventilation efforts. The following additional procedures for aircraft fires on the hangar deck shall be followed:

1. Fully open all elevator doors.
2. Request the ship execute a turn in order to position the door closest to the fire on the leeward side.
3. Adjust doors as necessary to maximize firefighting efforts.

![WARNING]

*If the doors must be operated remotely from a CONFLAG station, use a safety observer at the door to be operated and make 3MC announcements from CONFLAG/hangar deck control prior to movement.*

**Local Hangar Deck Firefighting/Emergency Procedures Instruction**

Due to the unique requirements and challenges associated with combating aircraft fires on the hangar deck, and the departmental/training team integration challenges associated, a shipboard instruction shall be developed and used as a single reference source to outline responsibilities, procedures and requirements. Appendix G, *U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14* gives an example of the instruction.

Hangar deck firefighting/emergency procedures instruction assists the ship’s ADTT, DCTT, and ITT in establishing responsibilities, outlining requirements and procedures, and identifying training/drill requirements IAW applicable references.

The hangar deck firefighting/emergency procedures instruction should be detailed enough to eliminate all conflicting procedures between training teams/departments that must integrate in order to effectively combat hangar deck fires. To be effective, the instruction, at a minimum, must: identify locations and quantities of all equipment; assign specific roles, duties, and tasks to personnel and/or work centers; and define lines and methods of communication.

**Mass Casualty/CONFLAG**

In the event of mass casualties or a CONFLAG on the flight or hangar deck, many additional requirements must be considered in establishing procedures for life safety, damage control, and extinguishment of fire.

**NOTE**

As a result of a multi-aircraft CONFLAG, mass casualty reactions may be required.

**Response to the Scene**

The initial response to the scene shall include equipment and personnel stipulated in previous text together with all available stretcher bearers, stretchers, and first-aid kits. A constant resupply and augmentation of portable extinguishers, hoses, and AFFF for MFFVs should be made available, contingent upon the on-scene leader requirements.
Additional Actions to Cover Mass Casualty Scene

The actions, as outlined above, shall be the same with the following additions.

Air Officer

- The air officer shall have the overall responsibility for the firefighting effort on the flight deck. The air officer should activate appropriate zones of the flight deck sprinkling system for any multiaircraft fire or when a spill fire is judged to be beyond the capability of the initial hose team/ fire fighting vehicle. In addition to activation of the zone in which fire is located, at least one upwind zone should be activated. Approximately 15 knots relative wind speed provides optimum distribution of AFFF from the flight deck extinguishing system.

ACHO

- This officer establishes the area for collection and disposition of personnel casualties, designates the aircraft/weapons elevator used for movement of casualties and is responsible for all safe aircraft movement on the flight and hangar bay.

HDO

- The HDO shall man the applicable CONFLAG control station. The HDO or competent authority shall supervise the activation of appropriate zones of the hangar sprinkling system for any multiaircraft fire or when a spill fire is judged to be beyond the capability of the initial hose team. Sprinklers should be operated until the fire is verified to be under control by the on-scene leader.

CONFLAG Station Operator

- The CONFLAG operator shall activate appropriate zones of the sprinkling system under the supervision of the HDO or competent authority when multiaircraft or spill fires are judged beyond the capability of the initial hose team.

Medical Officer

- The medical officer processes personnel casualties and coordinates all efforts of battle dressing station personnel.

Embarked Squadron Commanders

- The embarked squadron commanders provide personnel to assist the air department in firefighting, casualty evacuation, and damage assessment and repair.

Air Combat Element (ACE) Commander

- The ACE commander shall provide personnel to assist the air department in firefighting, casualty evacuation, and damage assessment and repair.

Weapons Staging Area (Bomb Farm) Fire Response AFFF Hose Teams

In the event of a fuel spill or fire on the flight deck when ordnance is stowed in a weapons staging area, properly manned AFFF hose teams shall be deployed forward and/or aft of the weapons staging area to conduct rapid fire extinguishment or provide weapons cooling protection. The scene leader should evaluate the threat and recommend activation of bomb farm AFFF sprinkling and/or adjacent flush-deck sprinkler zones as appropriate.

Aircraft Debris Pile/Running Fuel Fires

This type of three-dimensional fire normally results during catastrophic aircraft crashes when the fuselage and wing fuel cells have been torn open. Often one or more aircraft may be involved. These situations allow aerated fuel to rain downward and into deep-seated aircraft debris, which often
shields the fire from direct attack by AFFF hose teams. These debris pile/running fuel type fires can easily become self-generating, in that as more fuel is fed from ruptured tanks, more fire is generated to further degrade and open additional fuel cells. This results in a higher, hotter fire of growing intensity and very high radiant heat. Containing, controlling, and combatting this type of fire requires a highly organized effort among the scene leader and hose teams along with effective use of the ship’s fixed AFFF flush deck systems.

As containment of the fire is achieved, the scene leader should assemble the hose teams close together for a coordinated attack on the weakest and most advantageous point of approach to the debris fire. The teams should be directed in their approach to provide both high-point cooling and low-point AFFF firefighting coverage. This is best accomplished with two nozzles on wide fog pattern to block the radiant heat and two nozzles on narrow fog pattern to knock down and extinguish the fire. Their approach should be dedicated to getting as close to the seat of the running fuel fires as possible. This is accomplished by a coordinated advance combined with a methodical sweeping of the fire area.

When the hose teams have achieved their close-in attack positions, and the intensity and high radiant heat of the fire have been diminished, crash crewman with portable halon 1211 or PKP extinguisher may enter between the two center low-point AFFF hose teams and expel a full charge of halon 1211 or PKP directly into the seat of the fire. This procedure may be repeated, as necessary, until the fire is extinguished.

Aircraft Engine Wet Start Fires

These fires are caused when an accumulated residual fuel ignites within the engine or tail assembly area. Depending upon the amount of ignited fuel and wind directions, fire, smoke, and heat may exit from the intake or exhaust areas of the aircraft. A fire of this type more often occurs during initial engine startup during cold weather operations.

During flight deck operations, wet starts may also occur when the aircraft is being rapidly turned around from the previous mission in preparation for the next mission’s launch. Wet starts are normally brought under control by the director signaling the pilot to increase engine rpms to blow the fire out. Aircraft residual fires on shutdown can often be extinguished by wind milling the engine with a jet start unit. If the above procedures are not successful and fire extinguishing agents are brought into play,
Halon 1211 should be the initial agent of choice. The fire should be attacked from the windward side of the aircraft with halon 1211 first being introduced directly into the tail-pipe assembly. If this procedure fails to extinguish the fire, halon 1211 should be introduced into the aircraft intake.

**Aircraft Jettison**

It is conceivable that a situation that dictates the jettison of an aircraft may arise. Specific procedures for jettison shall be included in the ship operating instructions based upon assigned equipment and in accordance with *NATOPS Aircraft Salvage Manual, NAVAIR 00-80R-19(afloat).*

**NOTE**

Only the CO may authorize the jettison of aircraft.

**Installed or Fixed Firefighting Protection Systems/Flight Quarters Preparation**

The air boatswain and the HDO shall ensure inspection of their respective areas when flight quarters is sounded to evaluate the readiness and availability of firefighting equipment and shall report the results of the inspection to the ACHO. Discrepancies shall be reported to the CO via the air officer as soon as they are detected. A decision to conduct flight operations when discrepancies are known to exist in firefighting equipment shall be made only by the CO.

**NOTE**

- Appropriate liaison shall be coordinated with cognizant engineering department officers with responsibilities for firefighting services affecting hangar deck and flight deck.
- Appropriate liaison shall be coordinated with cognizant aircraft intermediate maintenance department (AIMD) intermediate maintenance activities (IMA) officers regarding responsibilities that effect operational and intermediate maintenance of MFFVs.

**AFFF Proportioning Systems**

An AFFF station consists of an AFFF concentrate tank (LHA — 1,000 gallons; LHD — 2,000 gallons), an AFFF pump/proportioning unit, electrical controllers, valves, and necessary piping. Saltwater and AFFF flow is controlled by hydraulically operated valves that are actuated by SOPVs. The SOPVs are activated by electrical switches at user locations (PRIFLY, navigation bridge, hose stations).

**Balanced Pressure Proportioner**

Balanced pressure proportioners are installed on LHDs and LHAs. The balance pressure proportioner mixes AFFF concentrate with saltwater at a nominal 6 percent over a wide range of flows. Excess
AFFF concentrate from the pump is diverted back to the AFFF concentrate tank, as necessary, to maintain nominal 6-percent AFFF. Balanced pressure proportioners supply a foam piping loop which serves all AFFF systems (AFFF flight deck, hangar deck, well deck, vehicle stowage, JP-5 pump room, and machinery space systems).

**AFFF Flight Deck Fire Extinguishing System**

Flush-deck nozzles are installed to provide AFFF coverage on the flight deck. On LHAs and LHDs, the nozzles are supplied from the foam loop. Controls to start and secure the flight deck systems are located in PRIFLY and on the navigation bridge. The flush-deck nozzles can also be operated to flow saltwater only as part of the wash down countermeasures system.

**Hangar Deck AFFF Sprinkler System**

AFFF sprinkler systems are installed in the overhead of the hangar deck and are divided into groups which can be activated individually. Controls to start and stop flow to individual groups are located in the CONFLAG stations and around the hangar bay in the vicinity of the related sprinkler group.

**Flight Deck Weapons Staging Area (Bomb Farm) AFFF Sprinkler System (LHA, LHD)**

The designated weapons staging area is protected by an AFFF sprinkling system discharging through deck edge nozzles. The number and spacing of nozzles are of a design that provides adequate coverage regardless of the placement of bomb skids and carts. The system is used to rapidly extinguish an aviation fuel spill fire prior to heat buildup sufficient to initiate weapons cook-off. In the event of a bomb farm/weapons staging area conflagration, or activation of the weapons staging area sprinkling system, immediate employment of AFFF hand lines should be initiated to assist with fire extinguishment and simultaneous weapons cooling. Control switches to start and stop flow are in PRIFLY and on the island or superstructure for all ships, and, depending on ship class, may also be in flight deck control, navigation bridge, and damage control central.

**CONFLAG Stations**

CONFLAG stations with capability of actuating all fixed firefighting systems on the hangar deck shall be continuously manned during flight quarters and when aircraft are spotted on the hangar deck. A minimum of one CONFLAG station in the hangar shall be manned during all ordnance loading/offloading evolutions.

**AFFF Proportioning System Manning Requirements**

The following manning requirements of the AFFF system during flight quarters shall be observed.

1. All AFFF proportioning stations shall be aligned and filled for remote operation from deck-edge and/or hangar deck controls.
2. When an emergency occurs on the flight and/or hangar deck, word shall be passed on 1 MC announcing system. At this time, the personnel designated in the watch quarter station bill shall immediately respond to assigned AFFF proportioning stations and 03-level injection stations.
3. Manually operated AFFF proportioning stations shall be manned continuously during flight quarters.

**Inspection and Reporting**

The following inspection and reporting procedures shall be observed when aircraft are embarked.

1. Flight quarters
As early as possible before the first launch, the air boatswain, HDO, and the ship’s air gunner shall advise the ACHO of the status of their respective AFFF services.

2. Non-flight quarters posture

   - During this period, the systems readiness requirements are applicable to those AFFF services within areas of the flight and hangar decks used to park the aircraft. The capability to perform systems maintenance should be considered during this period.

**Services Defined**

In specifying the readiness requirements for AFFF systems, a service is defined as one AFFF “outlet” (for example, a zone of flight deck nozzles supplied by one zone control valve is one “outlet”).

The types of services installed for flight deck protection are:

1. Flight deck services
   - Hose stations: one 1 1/2-inch non-collapsible rubber hose and/or one 2 1/2-inch soft hose connected to the outlet
   - Flush-deck sprinkling zone (includes fantail sprinkling groups)
   - Deck-edge sprinkling zone
   - Upper stage weapons elevator AFFF flooding system
   - Bomb farm sprinkling

   **NOTE**
   On amphibious assault ships the flush-deck and deck-edge sprinkling groups are supplied by the same control valve. On these ships, the flush-deck and deck-edge nozzles in one zone are considered a single service.

The three types of services installed for hangar deck protection are:

2. Hangar deck services
   - Hose stations: one 1 1/2-inch non-collapsible rubber hose and/or one 2 1/2-inch soft hose
   - Overhead AFFF sprinkling group
   - Lower stage weapons elevator AFFF flooding system

**Conditions for Operable AFFF Services**

An AFFF system service shall be considered operable if:

1. The cognizant engineering department officer has reported to the air officer via the air boatswain that engineering department firefighting equipment and engineering installations, associated with hangar and flight deck firefighting, have been inspected, aligned, and deemed operable.

2. The flight deck or hangar bay service and the associated second deck station are aligned properly (valves and electrical power), the AFFF tank is full (top of the sight glass) of AFFF concentrate, either the provision of item 3 of this section or item 4 of this section is fully implemented, and the provision of item 5 of this section is met.
3. PMS checks and post-repair testing have been satisfactorily completed, indicating that the service can be successfully actuated from all control stations.

4. PMS checks or post-repair testing indicates that a service will not operate from all control stations, but can be actuated manually or from another control station. In this case, the service must be continuously manned at the inoperable control station and at an operable control station. Communications must be established among all manned stations.

5. Flow tests demonstrate a minimum of 90 percent of the nozzles in a flight deck sprinkling zone are unplugged. A zone may contain flush deck and/or deck edge nozzles. Each zone is one service.

6. Flow tests demonstrate a minimum of 90 percent of the nozzles in a hangar sprinkling group are operational. Each group is one service.

For detail information on aircraft carrier flight and hangar deck AFFF firefighting readiness requirements/identification of inoperable services can be found on NATOPS U.S. Navy Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14 page 8-43 or the Shipboard Firefighting Naval Ships’ Technical Manual (NSTM), Chapter 555.

**Hangar Deck Readiness Requirements**

The following requirements are the maximum inoperable AFFF services permitted on the hangar deck. During flight quarters, the criteria given below should be applied to the entire hangar deck. During non-flight quarter conditions, the criteria apply only to the aircraft “parking area” of all hangar bay sprinkling group deck areas that are to contain parked aircraft.

AFFF supply services (such as concentrate tanks and proportioners) can also be the supply source of flight deck outlets. Therefore, discrepancy reports for inoperative services should include an evaluation of effect on the total hangar and flight deck system.

- One supply to hangar bay sprinkling groups that have two supplies may be inoperable. A maximum of two non-adjacent groups may be in this condition.
- A maximum of one hangar bay sprinkling group can be inoperable at a time.
- Hoses and lower stage weapons elevator flooding systems supplied by a maximum of two second deck AFFF stations may be inoperable, provided inoperable services of the same type, such as hoses, are not adjacent to each other. Adjacent services are defined as sprinkling groups that share a common boundary or hose stations next to each other around the hangar bay perimeter. Weapons elevator flooding systems are not to be considered when determining adjacent service.
- Whenever one or more AFFF system hangar bay services are not operable (a hose or a sprinkling group), an operable AFFF hose line shall be identified to provide coverage to the area affected by the inoperable service, as approved by the air officer.

**Flight Deck Readiness Requirements**

The following are the maximum inoperable AFFF services permitted on the flight deck. During flight quarters, the criteria below apply to the entire flight deck. During non-flight quarter conditions, the criteria apply only to the “parking areas” that are to contain parked aircraft. Backup mobile equipment requirements also are provided.

1. All or any combination of the services (deck-edge nozzle zone, flush-deck nozzle zone, upper stage weapons elevator flooding systems, and hoses) supplied from two of the second deck AFFF stations may be inoperable, provided inoperable services of the same type, such as inoperable hoses supplied by one station, are not adjacent to those from a second inoperable
station. Adjacent services are defined as sprinkling zones sharing a common boundary or hose stations next to each other around the flight deck perimeter. Weapons elevator flooding systems are not to be considered when determining adjacent services.

2. Whenever one or more AFFF system flight deck service is not operable, one MFFV shall be manned, engine running, and stationed on the flight deck. During non-flight quarter conditions it is not required that the MFFV be manned. Qualified MFFV operators must be aboard and available to go to the MFFV when called on the 1 MC announcing system.

Procedures Concerning Inadequate AFFF Coverage to Permit Flight Quarters
If the flight or hangar deck has inadequate AFFF coverage to permit flight quarters, postpone flight quarters and flight operations until requirements can be met.

1. If postponement of flight quarters is restrictive to the ship’s mission, the CO may elect to conduct flight quarters and permit no aircraft maintenance, aircraft fueling/defueling, or hot work in any hangar bay sprinkling group deck areas containing an inoperable service.

2. Submit a casualty report indicating the conditions in the AFFF systems and the planned actions.

3. Accomplish repairs and retest of defective AFFF system equipment. Submit a casualty correction report when the corrective action is completed.

Procedures Concerning Inadequate AFFF Coverage During Non-Flight Quarters Posture
If the flight or hangar deck has inadequate AFFF coverage to permit parking of aircraft during non-flight quarter conditions proceed with the following action:

1. Do not permit aircraft maintenance, aircraft fueling/defueling, or hot work in any “parking area” sprinkling groups containing an inoperable service.

2. Submit a casualty report indicating the conditions in the AFFF systems and the planned actions.

3. Accomplish repairs and retest of defective AFFF system equipment. Submit a casualty correction report when the corrective action is completed.

General Readiness Requirements
1. All flight deck and hangar deck AFFF system services should be operable as all flight deck and hangar deck AFFF system services should be operable as.

2. When aircraft are embarked, and the ship has set non-flight quarter conditions, all flight deck and hangar deck AFFF system services should be operable.

3. A minimum of 75 percent of the installed fire pump capacity shall be available in each of the YOKE fire main groups to provide adequate AFFF coverage for flight quarters. This requirement applies regardless of the fire main segregation condition in effect.

NOTE
If the fire main is in ZEBRA segregation condition, it may be necessary to shift to YOKE condition for major fires involving multiple AFFF stations to assure adequate fire main capacity. The ship’s information book (damage control section) contains specific guidelines for proper fire main segregation conditions.
End of Chapter Questions Chapter 5  
Aircraft Firefighting (CVN/LHD/LHA)

Review Questions

5-1. In order to smother a fire, what element of the fire triangle needs to be removed?
   A. Fuel
   B. Heat
   C. Oxygen
   D. Tetrahedron

5-2. In order to starve a fire, what element of the fire triangle needs to be removed?
   A. Fuel
   B. Heat
   C. Oxygen
   D. Tetrahedron

5-3. In order to cool a fire, what element of the fire triangle needs to be removed?
   A. Fuel
   B. Heat
   C. Oxygen
   D. Tetrahedron

5-4. What class of fire is the burning of energized electrical equipment?
   A. A
   B. B
   C. C
   D. D

5-5. What class of fire is the burning of petroleum based products?
   A. A
   B. B
   C. C
   D. D

5-6. What class of fire is the burning of magnesium and aluminum?
   A. A
   B. B
   C. C
   D. D
5-7. Which of the following extinguishing agents is used initially on class “C” fires?

A. AFFF  
B. CO₂  
C. Halon  
D. PKP  

5-8. Which of the following extinguishing agents is used as a last resort on class “C” fires?

A. AFFF  
B. CO₂  
C. Halon  
D. PKP  

5-9. On CVN class ships, what is the capacity of the hangar deck salvage forklift?

A. 6,000  
B. 10,000  
C. 20,000  
D. 30,000  

5-10. What is the minimum number of personnel it takes to deploy a 1 ½-inch AFFF hose?

A. 3  
B. 5  
C. 7  
D. 9  

5-11. What is the maximum number of personnel it takes to deploy a 2 ½-inch hose?

A. 3  
B. 5  
C. 7  
D. 9  

5-12. During a flight deck fire evolution, what person is responsible for the organization and dispatch of personnel to the scene leader?

A. Air boatswain  
B. Aircraft handling officer  
C. Background assistance leader  
D. Hose team leader  

5-13. Who is responsible for providing assistance to the air department for casualty evacuation?

A. Air boatswain  
B. Air officer  
C. Aircraft handling officer  
D. Air wing commander
5-14. During a multiaircraft fire in the hangar bay of an LHD, who will supervise the activation of the hangar bay sprinkler system?

A. Air boatswain
B. Aircraft handling officer
C. Damage control assistant
D. Hangar deck officer

5-15. What type of fire extinguisher should be kept readily available for a ruptured liquid oxygen converter?

A. CO₂
B. Halon
C. PKP
D. Water

5-16. How many personnel are required for immediate response manning using the P-25 firefighting vehicle?

A. 1
B. 2
C. 3
D. 4

5-17. Controls for operating the emergency lighting on the AFFF hose outlets are located in________.

A. damage control central
B. flight deck control
C. hangar deck control
D. primary flight control
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230 Chevalier Field Avenue
Pensacola, FL 32508
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