

NFPA® 402

Guide for Aircraft Rescue and Fire-Fighting Operations

2013 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization



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ISBN: 978-145590428-0 (Print)
ISBN: 978-145590477-8 (PDF)

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NFPA® 402

Guide for

Aircraft Rescue and Fire-Fighting Operations

2013 Edition

This edition of NFPA 402, *Guide for Aircraft Rescue and Fire-Fighting Operations*, was prepared by the Technical Committee on Aircraft Rescue and Fighting. It was issued by the Standards Council on May 29, 2012, with an effective date of June 18, 2012, and supersedes all previous editions.

This edition of NFPA 402 was approved as an American National Standard on June 18, 2012.

Origin and Development of NFPA 402

These standard operating procedures were first developed by the sponsoring NFPA committee in 1947 and were first adopted by the Association in 1949. They were amended in 1951, 1969, 1973, and 1978. In 1984, the Committee combined the text of NFPA 406M, *Manual on Aircraft Rescue and Fire Fighting Techniques for Fire Departments Using Structural Fire Apparatus and Equipment*, with the text of NFPA 402, *Recommended Practice for Aircraft Rescue and Fire Fighting Operational Procedures for Airport Fire Departments*, and reidentified the document as NFPA 402M. The entire texts of both NFPA 402 and NFPA 406M were revised to create NFPA 402M. The 1989 edition of NFPA 402M was a complete revision of the manual. This guide was revised again in 1991.

The aircraft figures were deleted for the 1996 edition. A comprehensive collection of figures is now available in a publication titled *NFPA Aircraft Familiarization Charts Manual*.

The 2002 edition was a partial revision.

The 2008 edition was a partial revision.

For the 2013 edition, the Committee updated several photos of aircraft and appliances that are no longer in use or just out of date, and brought the document up to date with the *NFPA Manual of Style*. The Committee also updated the use and application of foam and foam types due to potential environmental impacts regarding the use of certain foams.



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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on aircraft rescue and fire-fighting services and equipment, for procedures for handling aircraft fire emergencies, and for specialized vehicles used to perform these functions at airports, with particular emphasis on saving lives and reducing injuries coincident with aircraft fires following impact or aircraft ground fires. This Committee also shall have responsibility for documents on aircraft hand fire extinguishers and accident prevention and the saving of lives in future aircraft accidents involving fire.



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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in advisory sections of this document are given in Chapter 2 and those for extracts in the informational sections are given in Annex G. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text should be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex G.

Chapter 1 Administration

1.1 Scope.

1.1.1 This guide provides information relative to aircraft rescue and fire-fighting operations and procedures for airport and structural fire departments.

1.1.2 Statistics indicate that approximately 80 percent of all major commercial aircraft accidents occur in the critical rescue and fire-fighting access area. This is the primary response area for airport-based ARFF services. Approximately 15 percent of the accidents occur in the approach areas. In such instances the community/mutual services could be the prime responders.

1.1.3 Some airport fire departments have the total fire prevention and fire protection responsibility for the entire airport, including structural fire-fighting responsibilities in terminal buildings, aircraft hangars, airport hotels, cargo buildings, and other facilities. Procedures for these fire prevention and protection operations are not covered in this guide.

1.2 Purpose.

1.2.1 This guide has been prepared for the use and guidance of those charged with the responsibility of providing and maintaining aircraft rescue and fire-fighting (ARFF) services on airports.

1.2.2 This guide’s content is also intended for the use of structural fire departments to assist them in developing methods to effectively handle aircraft incidents that might occur within their jurisdiction. It also provides for a basis of understanding, relative to emergencies on airports, that would enhance structural fire departments’ effectiveness when called to assist airport fire departments.

1.3 General.

1.3.1 Providing protection for the occupants of an aircraft takes precedence over all other operations. Fire control is frequently an essential condition to ensure such survival. The objectives of the airport fire department should be to respond to any aircraft emergency in the minimum possible time and employ rescue and fire-fighting techniques effectively. These objectives can be accomplished when properly trained personnel work together as a team and apply the operational procedures presented in this guide.

1.3.2 Governmental and organizational publications frequently referenced in this guide can be found in Annex G.

1.4 Units and Formulas.

1.4.1 If a value for measurement as given in this guide is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value might be approximate.

1.4.2 Metric units of measurement in this guide are in accordance with the modernized metric systems known as the International System of Units (SI). One unit (liter), outside of, but recognized by SI, is commonly used in international fire protection.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this guide and should be considered part of the recommendations of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, 2009 edition.

NFPA 405, *Standard for the Recurring Proficiency of Airport Fire Fighters*, 2010 edition.

NFPA 407, *Standard for Aircraft Fuel Servicing*, 2012 edition.

NFPA 414, *Standard for Aircraft Rescue and Fire-Fighting Vehicles*, 2012 edition.

NFPA 424, *Guide for Airport/Community Emergency Planning*, 2013 edition.

NFPA 1003, *Standard for Airport Fire Fighter Professional Qualifications*, 2010 edition.

NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*, 2013 edition.

2.3 Other Publications.

2.3.1 FAA Publications. Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591.

FAA Advisory Circular 150/5220-7, *Aircraft Rescue and Fire-fighting Communications*.

FAA Advisory Circular 150/5220-17, *Aircraft Rescue and Fire-fighting Training Facilities*.

2.3.2 ICAO Publications. International standards and recommended practices are promulgated by the International Civil Aviation Organization, 999 University St., Montreal, Quebec, Canada H3C 5H7.

Airport Services Manual, Part 7: "Airport Emergency Planning," second edition, 1991.

2.3.3 Research and Special Programs Administration, Materials Transportation Bureau. Request for single free copy for emergency service organizations may be addressed to U.S. Department of Transportation, Materials Transportation Bureau, 400 Seventh Street SW, Attention: DMT-11, Washington, DC 20590.

Emergency Response Guidebook, U.S. Department of Transportation, 2004 edition.

2.3.4 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 18, U.S. Code, Section 2332a, "Use of Weapons of Mass Destruction."

2.3.5 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Advisory Sections.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2010 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2010 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2011 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition.

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*, 2010 edition.

NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, 2009 edition.

NFPA 408, *Standard for Aircraft Hand Portable Fire Extinguishers*, 2010 edition.

NFPA 424, *Guide for Airport/Community Emergency Planning*, 2013 edition.

NFPA 472, *Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*, 2013 edition.

NFPA 600, *Standard on Industrial Fire Brigades*, 2010 edition.

NFPA 921, *Guide for Fire and Explosion Investigations*, 2011 edition.

NFPA 1051, *Standard for Wildland Fire Fighter Professional Qualifications*, 2012 edition.

NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*, 2009 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2007 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter apply to the terms used in this guide. Where terms are not defined in this chapter or within another chapter, they should be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, is the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Guide. A document that is advisory or informative in nature and that contains only nonmandatory provisions. A guide may contain mandatory statements such as when a guide can be used, but the document as a whole is not suitable for adoption into law.

3.2.4 Should. Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Air Accident Investigations Branch (AAIB). A UK agency that is responsible for investigating and determining the probable cause of all British aircraft accidents.

3.3.2 Aircraft.

3.3.2.1 Pressurized Aircraft. Sealed, modern-type aircraft within which the internal atmospheric pressure can be regulated.

3.3.2.2 Turboprop Aircraft. An aircraft powered by one or more turbine engines each of which drives a propeller.

3.3.3 Aircraft Accident. An occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flight and until all such persons have disembarked and in which any person suffers death or serious injury or in which the aircraft receives substantial damage. [403, 2010]

3.3.4* Aircraft Accident Pre-Incident Planning. The process of forecasting all factors that could possibly exist involving an aircraft accident that could bear upon the existing emergency resources.

3.3.5 Aircraft Defueling. See 3.3.52, Fuel Servicing.

3.3.6 Aircraft Familiarization. Refers to the knowledge of vital information that rescue and fire-fighting personnel should learn and retain with regard to the specific types of aircraft that normally use the airport and other aircraft that might use the airport due to weather conditions at scheduled destinations.

3.3.7* Aircraft Fire Fighting. The control or extinguishment of fire adjacent to or involving an aircraft following ground accidents/incidents.

3.3.8* Aircraft Incident. An occurrence, other than an accident associated with the operation of an aircraft, that affects or could affect continued safe operation if not corrected.

3.3.9* Aircraft Rescue and Fire Fighting (ARFF). The fire-fighting action taken to prevent, control, or extinguish fire involved or adjacent to an aircraft for the purpose of maintaining maximum escape routes for occupants using normal and emergency routes for egress.

3.3.10 Aircraft Rescue and Fire-Fighting Vehicle. A vehicle intended to carry rescue and fire-fighting equipment for rescuing occupants and combating fires in aircraft at or in the vicinity of airports.



3.3.11 Air-Cushioned Vehicle (ACV). A vehicle that can travel on land and water.

3.3.12 Airport (Aerodrome). An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes buildings and facilities.

3.3.13 Airport Air Traffic Control (ATC). A service established to provide air and ground traffic control for airports.

3.3.14 Airport Familiarization. Refers to the knowledge that rescue and fire-fighting personnel must maintain relative to locations, routes, and conditions that will enable them to respond quickly and efficiently to emergencies on the airport and those areas surrounding the airport.

3.3.15 Aluminum. A lightweight metal used extensively in the construction of aircraft airframes and skin sections.

3.3.16 Area.

3.3.16.1 Critical Rescue and Fire-Fighting Access Area. The rectangular area surrounding any runway within which most aircraft accidents can be expected to occur on airports. Its width extends 150 m (500 ft) from each side of the runway centerline, and its length is 1000 m (3300 ft) beyond each runway end.

3.3.16.2 Practical Critical Fire Area (PCA). This area is two-thirds of the theoretical critical fire area (TCA). (See also 3.3.16.3, *Theoretical Critical Fire Area*.)

3.3.16.3 Theoretical Critical Fire Area (TCA). The theoretical critical fire area (TCA) is a rectangular area, the longitudinal dimension of which is the overall length of the aircraft and the width includes the fuselage and extends beyond it by a predetermined set distance that is dependent on the overall width. Therefore, the aircraft length multiplied by the calculated width equals the size of the TCA.

3.3.17 Auxiliary Power Unit (APU). A self-contained power source, provided as a component of an aircraft, that is used to energize aircraft systems when power plants are not operating or when external power is not available.

3.3.18 Backdraft. A phenomenon that occurs when a fire takes place in a confined area, such as a sealed aircraft fuselage, and burns undetected until most of the oxygen within is consumed. The heat continues to produce flammable gases, mostly in the form of carbon monoxide. These gases are heated above their ignition temperature and when a supply of oxygen is introduced, as when normal entry points are opened, the gases could ignite with explosive force.

3.3.19* Bogie. A tandem arrangement of aircraft landing gear wheels.

3.3.20 Cockpit Voice Recorder (CVR). A device that monitors flight deck crew communications through a pickup on the flight deck connected to a recorder that is usually mounted in the tail area of the aircraft and that is designed to withstand certain impact forces and a degree of fire.

3.3.21 COMBI. An aircraft designed to transport both passengers and cargo on the same level within the fuselage.

3.3.22 Command Post (CP). The location at the scene of an emergency where the incident commander is located and where command, coordination, control, and communications are centralized.

3.3.23* Composite Materials. Lightweight materials having great structural strength. They are made of fine fibers embedded in carbon/epoxy materials. The fibers are usually boron, fiberglass, aramid, or carbon in the form of graphite.

3.3.24 Dangerous Goods. This term is synonymous with the terms *hazardous materials* and *restricted articles*. The term is used internationally in the transportation industry and includes explosives and any other article defined as combustible liquids, corrosive materials, infectious substances, flammable compressed gases, oxidizing materials, poisonous articles, radioactive materials, and other restrictive articles.

3.3.25 Deck Gun (Deluge Set). See 3.3.97, Turret.

3.3.26 Departure. An aircraft taking off from an airport.

3.3.27 Dry Chemical. A powder composed of very small particles, usually sodium bicarbonate-, potassium bicarbonate-, or ammonium phosphate-based with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking), and the proper flow capabilities. [17, 2009]

3.3.28 Dry Powder. Solid materials in powder or granular form designed to extinguish Class D combustible metal fires by crust- ing, smothering, or heat-transferring means. [10, 2010]

3.3.29 Empennage. The tail assembly of an aircraft, which includes the horizontal and vertical stabilizers.

3.3.30 Evacuee. An aircraft occupant who has exited the aircraft following an accident/incident.

3.3.31 Exposure. Any person or property that could be endangered by fire, smoke, gases, runoff, or other hazardous conditions.

3.3.32 Extinguishing Agent.

3.3.32.1 Complementary Extinguishing Agent. Refers to an extinguishing agent that has the compatibility to perform fire-suppression functions in support of a primary extinguishing agent and where extinguishment might not be achievable using only the primary agent.

3.3.32.2 Primary Extinguishing Agent. Agents that have the capability of suppressing and preventing the reignition of fires in liquid hydrocarbon fuels.

3.3.33 Extinguishing Agent Compatibility. Related to the requirement that the chemical composition of each agent be such that one will not adversely affect the performance of other agents that might be used on a common fire.

3.3.34 Extrication. The removal of trapped victims from a vehicle or machinery. [1670, 2009]

3.3.35 Federal Aviation Administration (FAA). An agency of the United States federal government charged with the primary responsibility of regulating aviation activities.

3.3.36 Fire Classifications.

3.3.36.1 Class A. Ordinary combustibles.

3.3.36.2 Class B. Flammable liquids.

3.3.36.3 Class C. Electrically charged components.

3.3.36.4 Class D. Combustible metals.

3.3.37 Fire Wall. A bulkhead designed to stop the lateral spread of fire in a fuselage or engine nacelle.

3.3.38 Flashback. The tendency of flammable liquid fires to reignite from any source of ignition after the fire has once been extinguished.

3.3.39 Flashover. A transition phase in the development of a compartment fire in which surfaces exposed to thermal radiation reach ignition temperature more or less simultaneously and fire spreads rapidly throughout the space, resulting in full room involvement or total involvement of the compartment or enclosed space. [921, 2011]

3.3.40 Flight Attendants. Those members of the flight deck crew whose responsibility includes the management of activities within the passenger cabin.

3.3.41* Flight Data Recorder (FDR). An instrument that monitors performance characteristics of an aircraft in flight.

3.3.42 Flight Deck Crew. Those members of the crew whose responsibility includes the management of the aircraft's flight control and ground movements.

3.3.43 Flight Technical Crew (FTC). Includes pilots, flight engineers, and flight attendants who crew on aircraft movement.

3.3.44 Foam.

3.3.44.1* Aqueous Film Forming Foam (AFFF) Concentrate. A concentrate based on fluorinated surfactants plus foam stabilizers and usually diluted with water to a 1 percent, 3 percent, or 6 percent solution. [16, 2011]

3.3.44.2 Film Forming Fluoroprotein Foam Concentrate (FFFP). A protein-foam concentrate that uses fluorinated surfactants to produce a fluid aqueous film for suppressing hydrocarbon fuel vapors. [11, 2010]

3.3.44.3* Fluoroprotein Foam. A protein-based foam concentrate to which fluorochemical surfactants have been added.

3.3.44.4 Protein Foam. A protein-based foam concentrate that is stabilized with metal salts to make a fire-resistant foam blanket. [403, 2009]

3.3.45 Foam Application Rate. The amount of foam solution in liters or gallons per minute expressed as a relationship with a unit of area, usually square meter or square foot.

3.3.46 Foam Blanket. A covering of foam over the surface of flammable liquids to provide extinguishment and prevent ignition.

3.3.47 Foam Burnback Resistance. The ability of a foam blanket to retain aerated moisture and resist destruction by heat and flame.

3.3.48 Foam Drain Time. The foam drain time — commonly the 25 percent drainage time (or ¼ drainage time) — is the time required for 25 percent of the original foam solution (foam concentrate plus water) to drain out of the foam.

3.3.49 Forcible Entry. Techniques used by fire personnel to gain entry into buildings, vehicles, aircraft, or other areas of confinement when normal means of entry are locked or blocked.

3.3.50 Forward Looking Infrared (FLIR). A thermal imaging system (camera), which can be vehicle-mounted, designed to detect thermal energy.

3.3.51 Frangible Gate/Fence. Gates or fence sections designed to open, break away, or collapse when struck with the bumper of an ARFF vehicle responding to an emergency.

3.3.52 Fuel Servicing. Fueling and defueling of aircraft fuel tanks, not including aircraft fuel transfer operations and design of aircraft fuel systems during aircraft maintenance or manufacturing operations.

3.3.53 Fuselage. The main body of an aircraft.

3.3.54 Gear.

3.3.54.1 Main Gear. Refers to the two or more larger landing gear structures of an aircraft, as opposed to wing, nose, or tail gear assemblies.

3.3.54.2 Nose Gear. That mechanical part of a landing gear system mounted under the nose of an aircraft. It can be designed either as a stationary component or one that retracts into the fuselage.

3.3.55 Grid Map. A plan view of an area with a system of squares (numbered and lettered) superimposed to provide a fixed reference to any point in the area. [424, 2013]

3.3.56 Halogenated Agent. A liquefied gas extinguishing agent that extinguishes fire by chemically interrupting the combustion reaction between fuel and oxygen. Halogenated agents leave no residue.

3.3.57 Halon 1211. A halogenated agent whose chemical name is bromochlorodifluoromethane, CBrClF_2 , and that is a multipurpose, Class ABC-rated agent effective against flammable liquid fires. [408, 2010]

3.3.58 Halon 1301. A halogenated agent whose chemical name is bromotrifluoromethane, CBrF_3 , and that is recognized as an agent having Class ABC capability in total flooding systems. [408, 2010]

3.3.59 Hazardous Materials. A substance (either matter — solid, liquid, or gas — or energy) that when released is capable of creating harm to people, the environment, and property, including weapons of mass destruction (WMD) as defined in 18, *U.S. Code, Section 2332a*, and as well as any other criminal use of hazardous materials, such as illicit labs, environmental crimes, or industrial sabotage. [472, 2013] (*See Annex F.*)

3.3.60 Hot Brakes. A condition in which the aircraft's brake and wheel components have become overheated, usually due to excessive braking during landing.

3.3.61* Ignition Temperature. Minimum temperature a substance should attain in order to ignite under specific test conditions. [921, 2011]

3.3.62 Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [472, 2013]

3.3.63 International Air Transport Association (IATA). An international group composed of the major airlines of the world that reviews aviation policy, including safety items.

3.3.64 International Civil Aviation Organization (ICAO). An international aviation body, operating under the auspices of the United Nations, that produces technical safety documents for civil air transport.

3.3.65 Jet Blast. The thrust-producing exhaust from a jet engine.

3.3.66 Joint Aviation Authority (JAA). An agency in Europe charged with the responsibility of regulating safety in civil aviation.



3.3.67 Knockdown. The reduction of flame and heat to a point where further extension of a fire has been abated and the overhaul stage can begin.

3.3.68 Magnesium. Refers to either pure metal or alloys having the generally recognized properties of magnesium marketed under different trade names and designations.

3.3.69 Master Stream. A portable or fixed fire-fighting appliance supplied by either hose lines or fixed piping and that has the capability of flowing in excess of 1140 L/min (300 gpm) of water or water-based extinguishing agent. [600, 2010]

3.3.70 Mutual Aid. Reciprocal assistance by emergency services under a prearranged plan.

3.3.71 National Transportation and Safety Board (NTSB). A U.S. federal agency that is responsible for investigating and determining the probable cause of aircraft accidents.

3.3.72 Overhaul. The process of final extinguishment after the main body of a fire has been knocked down. All traces of fire must be extinguished at this time.

3.3.73 Penetrating Nozzle. An appliance designed to penetrate the skin of an aircraft and inject extinguishing agent.

3.3.74 Post Aircraft Accident. The specific time when all fires have been extinguished, persons have been accounted for, survivors have been removed, and the hazards have been identified.

3.3.75 Preservation of Evidence. After an aircraft accident/incident, it is imperative that investigative evidence be preserved after life safety and rescue operations have been concluded.

3.3.76* Protective Clothing. Equipment designed to protect the wearer from heat and/or hazardous materials, or from the hazardous component of a weapon of mass destruction contacting the skin or eyes. [472, 2013]

3.3.77 Rescue. Those activities directed at locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility.

3.3.78 Rescue Path. A fire-free path from an aircraft accident site to a safe area. This path, normally selected by evacuees, must be maintained by fire fighters during the evacuation process.

3.3.79 Resources. All personnel and major items of equipment that are available, or potentially available, for assignment to incidents. [1051, 2012]

3.3.80 Response Time. See 3.3.93.2.

3.3.81 Restricted Articles. See 3.3.24, Dangerous Goods.

3.3.82 Runoff. Liquids that flow by gravity away from an aircraft accident and might include aviation fuel (ignited or not), water from fire-fighting streams, liquid cargo, or a combination of these liquids.

3.3.83 Runway. A defined rectangular area on a land airport prepared for the landing and taking off of aircraft along its length. Runways are normally numbered relative to their magnetic direction.

3.3.84 Salvage. A fire-fighting procedure for protecting property from further loss following an aircraft accident or fire.

3.3.85* Self-Contained Breathing Apparatus (SCBA). An atmosphere-supplying respirator that supplies a respirable air atmosphere to the user from a breathing air source that is

independent of the ambient environment and designed to be carried by the user. [1981, 2007]

3.3.86 Size-Up (Risk Assessment). A mental process of evaluating the influencing factors at an incident prior to committing resources to a course of action. [1670, 2009]

3.3.87 Skin. The outer covering of an aircraft fuselage, wings, and empennage.

3.3.88 Smoke Ejector. A mechanical device, similar to a large fan, that can be used to force heat, smoke, and gases from a post-fire environment and draw in fresh air.

3.3.89 Stabilizer.

3.3.89.1 Horizontal Stabilizer. That portion of an aircraft's structure that contains the elevators.

3.3.89.2 Vertical Stabilizer. That portion of the aircraft's empennage that contains the rudder.

3.3.90 Surface Movement Guidance and Control System (SMGCS). A process or plan used by airports conducting operations in visibility conditions less than 366 m (1200 ft) runway visual range (RVR).

3.3.91 Tabletop Training. A workshop style of training involving a realistic emergency scenario and requiring problem-solving participation by personnel responsible for management and support at emergencies.

3.3.92 Threshold. The beginning of that portion of the runway usable for landing.

3.3.93 Time.

3.3.93.1 Evacuation Time. The elapsed time between an aircraft accident/incident and the removal of all surviving occupants.

3.3.93.2 Response Time. The total period of time measured from the time of an alarm until the first ARFF vehicle arrives at the scene of an aircraft accident and is in position to apply agent to any fire.

3.3.94 Titanium. Refers to either pure metal or alloys having the generally recognized properties of titanium metal, including the fire or explosion characteristics of titanium in its various forms.

3.3.95 Triage. The sorting of casualties at an emergency according to the nature and severity of their injuries.

3.3.96 Triage Tag. A tag used in the classification of casualties according to the nature and severity of their injuries.

3.3.97 Turret. A vehicle-mounted master stream appliance.

3.3.98 Undercarriage. All components of an aircraft landing gear assembly.

3.3.99 United Kingdom Civil Aviation Authority (CAA). A UK agency charged with the responsibility of regulating safety in civil aviation.

3.3.100* Ventilation. The changing of air within a compartment by natural or mechanical means. [302, 2010]

3.3.100.1 Mechanical Ventilation. A process of removing heat, smoke, and gases from a fire area by using exhaust fans, blowers, air-conditioning systems, or smoke ejectors.

Chapter 4 Pre-Incident Planning for Aircraft Emergencies

4.1 General.

4.1.1 Many accidents within the critical rescue and fire-fighting access area involve undershoots, overshoots, and rejected takeoffs, and are generally survivable. Accidents occurring outside of the critical rescue and fire-fighting access area could involve impact with adverse terrain, with resultant rupture of the aircraft structure. Rapid response to these areas is crucial for the purpose of saving lives.

4.1.2 In addition to routine training programs, airport ARFF services and all structural fire departments and community emergency services with jurisdictions adjacent to an airport or its traffic patterns are encouraged to frequently schedule and participate in multi-agency training sessions based on the material in this guide. The objective of these sessions should be to focus on achieving maximum unity, compatibility, and effectiveness at aircraft emergencies, should they be on or off the airport. (See Section 4.5.)

4.1.3 All ARFF personnel should participate in regular exercises involving simulated aircraft accidents throughout the year. Frequent command-level training for those persons assigned to major roles in the airport/community emergency plan is also essential. Command training can be presented in the form of workshop or tabletop exercises designed to develop effective emergency management techniques. Guidance for emergency plan exercises is provided in NFPA 424, *Guide for Airport/Community Emergency Planning*.

4.1.4 Command authority at any accident site should be predetermined according to the jurisdictional responsibilities of the agencies involved and as designated in their airport/community mutual aid agreement.

4.2 Emergency Response Preplanning.

4.2.1 All ARFF vehicles in use at the airport should be able to meet the provisions of NFPA 414, *Standard for Aircraft Rescue and Fire-Fighting Vehicles*, upon acceptance from the manufacturer and should be maintained in a manner to ensure such levels of performance. Special training should be provided to enhance the skills of all vehicle operators, as their performance is critical to successful vehicle utilization, particularly under unfavorable conditions. ARFF drivers should actually drive all service roads and be familiar with any gates.

4.2.2* Operators assigned to each ARFF vehicle should make trial runs to all areas of the airport in all weather conditions during which flight operations take place. Particular emphasis should be placed on the ability to respond to the critical rescue and fire-fighting access area as this is where most accidents occur. These runs will demonstrate each vehicle's operational capability and the time required to reach each site. Because many aircraft accidents occur in the overrun areas of the runways, it is important to provide suitable routes for use by the vehicles to enable them to reach these areas. Bridges spanning gullies, streams, ditches, cattle grids, or other ground surface appurtenances should be capable of supporting at least 120 percent of the weight of the heaviest emergency vehicle.

4.2.2.1 Some airports have installed Engineered Material Arresting Systems (EMAS) at runway ends. These passive systems are designed to bring overrunning aircraft to a safe stop.

4.2.2.2 ARFF equipment can safely traverse these installations, but ARFF crews should be advised regarding specific maneuverability precautions and evacuation issues. (See 9.3.3.1.)

4.2.3 Where construction work of any kind is likely to affect the response capability or operational performance of the ARFF service, prior notification of the work should be provided so that amendments can be made to operational procedures to overcome or minimize their effect. This is particularly important where work on airport water mains is likely to close down one or more fire hydrants.

4.2.4 In order to provide multivehicle access to the accident site, service roads should be constructed so that one vehicle cannot block ingress or egress for other emergency vehicles. This can be accomplished by providing roads of sufficient width or suitable passing and turnaround areas. An access for service roads should also be strategically placed and maintained near the ends of runways, or key taxiways that will allow ARFF crews all-weather access. Where gates are secured using locks, all airport gates should be capable of being opened using the same key. Where remotely controlled, the operation should be provided from each ARFF vehicle.

4.2.5 Gates should be located at strategic locations to allow rapid access by ARFF vehicles to areas outside the airport boundary. Keys to gate locks should be carried on each authorized emergency vehicle, and by airport security personnel and designated local emergency services.

4.2.6 Grid maps should be provided for each airport and its environs. They should be ruled with numbered and lettered grids, as shown in Figure 4.2.6, to permit rapid identification of any response area. The area covered by a grid map should be a distance of 8 km (5 mi) from the center of the airport. This distance can vary depending upon the type of terrain or location of the airport in relation to other emergency facilities. Map nomenclature should be compatible with that used by off-airport public safety authorities. Two or more maps might be required where the area exceeds an 8 km (5 mi) radius. One map should display medical facilities, heliports, and other features according to the airport/community emergency plan. Where more than one grid map is used, grid identifications should differ by color and scale to assist in their identification. Prominent local features, access routes, staging areas, and compass headings should be shown to facilitate locating accident and medical facility sites. Copies of grid maps should be prominently displayed at ATC, the airport operations office, each airport and community fire station, and all mutual aid services, and should be carried on all appropriate emergency vehicles.

4.2.7 Backup systems should be provided in airport fire stations to allow for the rapid operation of vehicle bay doors, for the efficient reception/transmission of vital communications, and for the provision of emergency lighting.

4.2.8 A communication system from the airport to community or regional emergency services should be provided. The reliability of the system should be tested daily.

4.2.9 Any off-airport emergency services authorized to respond to an on-airport incident should pre-incident plan access to the various areas of the airport, particularly the designated staging areas. Personnel should also be trained in the special procedures to be followed once at the airport.



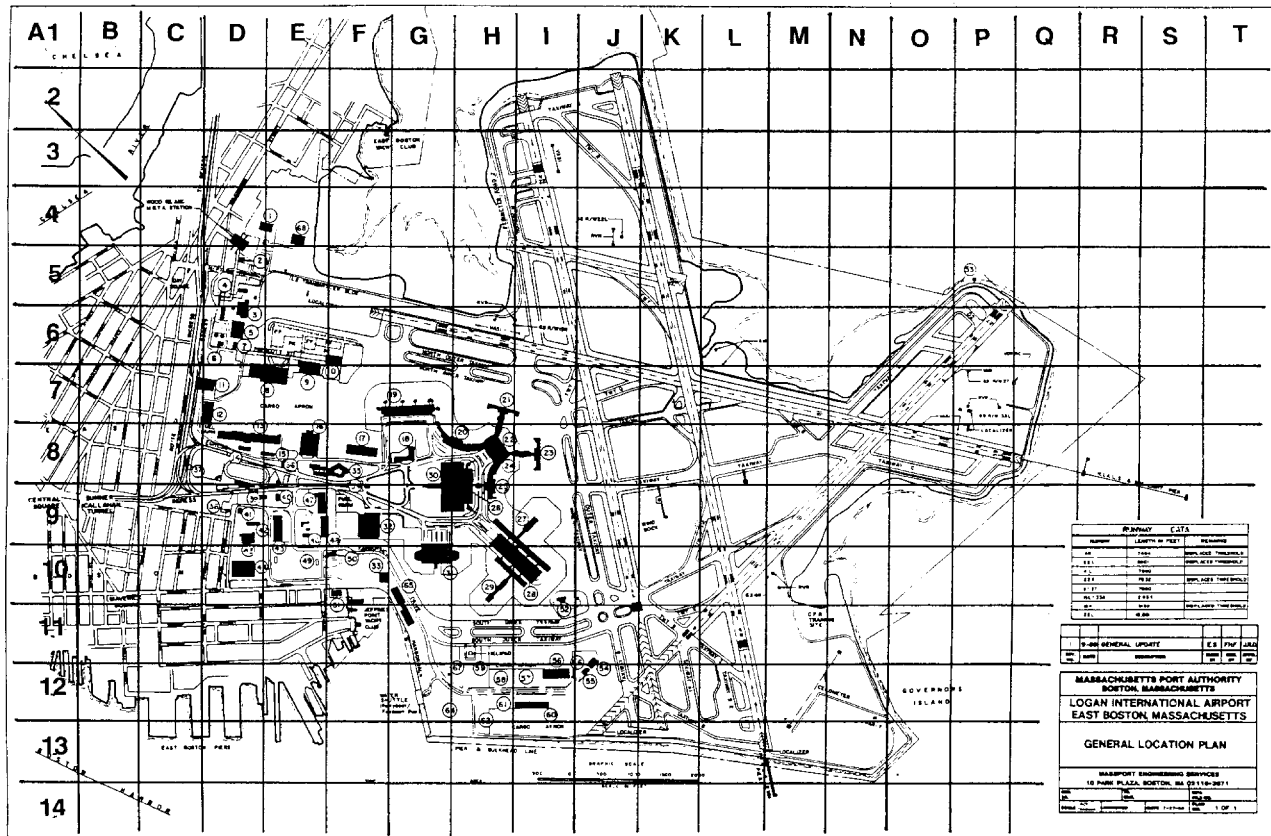


FIGURE 4.2.6 Typical Airport Grid Map.

4.2.10 Sufficient ARFF vehicles and equipment should be provided to meet the required level of protection as specified in NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*, for the airport during flight operations. When this protection level is reduced for any reason (e.g., off-airport response, mechanical breakdown, lack of qualified personnel, etc.), all incoming and departing aircraft should be notified of the change in ARFF capability.

4.2.11 It is important that pre-incident planning includes response of additional pumping vehicles, ladder trucks, elevated platform vehicles, portable lighting equipment, hoisting and lifting equipment, medical supplies, and any other available specialized equipment or vehicle for which a requirement is anticipated. It is extremely important that the pre-incident plan also ensures the immediate availability of the special vehicles and equipment, provision for qualified driver/operators, and especially the availability of an approving authority on an around-the-clock basis.

4.3 Airport Fire Fighter Basic Knowledge.

4.3.1 To assure that airport fire fighters have a suitable degree of skill, basic training should be provided in accordance with NFPA 1003, *Standard for Airport Fire Fighter Professional Qualifications*.

4.3.2 Comprehensive, continuous in-service training in accordance with NFPA 405, *Standard for the Recurring Proficiency of Airport Fire Fighters*, should be provided to maintain each fire

fighter's proficiency. For further information on training subjects, see the references listed in Chapter 2 and Annex G.

4.3.3 The complexity of modern aircraft and the variety of types in service make it difficult to train ARFF personnel in all the important design features of each model. However, personnel should become as familiar as possible with each type of aircraft that normally uses the airport. Particular emphasis should be placed on all of the following:

- (1) Location and operation of normal and emergency exits, cargo doors, equipment, and galley access doors
- (2) Seating configurations
- (3) Type of fuel and location of fuel tanks
- (4) Location of ejection seats and armament (military aircraft)
- (5) Locations of batteries, hydraulics, and oxygen systems
- (6) Positions of break-in points on the aircraft
- (7) Location of rapidly activated standby generators or turbines
- (8) Fire access panels
- (9) Location of aircraft construction materials (carbon fibers, composite materials, etc.) that are subject to releasing hazardous/toxic substances while burning

4.3.4 Airports are large commercial complexes that contain many potential life and fire hazards. These hazards vary relative to aircraft operations, time of day, weather conditions, construction, or a combination of these factors. It is, therefore, vital that ARFF personnel become extensively knowledgeable about the airport and any changes that could adversely affect immediate

response or the efficient performance of their rescue and fire-fighting responsibilities. Minimum requirements should include knowledge of all of the following:

- (1) Water supply locations (hydrants)
- (2) Runway identifications and locations
- (3) Taxiway identifications and locations
- (4) Airport lighting systems
- (5) Most effective response routes and alternatives
- (6) Fuel handling and storage areas
- (7) Key airport locations
- (8) Airport service roads
- (9) Gates and fences
- (10) Airport drainage systems

4.4 Communications.

4.4.1 All airport emergency vehicles should be provided with multi-channel two-way radios operating on the airport's assigned ground control frequency and other airport emergency frequencies.

4.4.2 It is desirable that airport ARFF vehicles be able to monitor or be in direct voice communications with an aircraft during an emergency situation. This procedure is especially important when airport control towers are not in operation. A discrete emergency frequency (DEF), where available, should be used for communications between the aircraft crew and the ARFF incident commander. (*See 10.4.2.1 for additional information on this topic.*)

4.4.3 At an aircraft accident site, power megaphones can be valuable tools to coordinate flight deck crew/ARFF activities, direct evacuating aircraft occupants to safe locations, and so forth.

4.4.4 Portable radios can be utilized at an accident site to communicate with the command post, airport emergency dispatcher, airport management, arriving back-up units, and so forth. Where personnel and vehicles from more than one agency will operate in mutual support, common radio frequencies or other interoperable solutions should be available. If common frequencies or other interoperable solutions are not used, pre-incident planning procedures should be established so that portable radios can be exchanged, the use of messengers employed, or methods of relaying messages through the command post utilized. When portable radios are exchanged, consideration should be given to avoiding channel saturation and the maintenance of communication discipline.

4.4.5 Experience from recent accidents has shown that the use of automated voice notification systems greatly facilitates emergency response/mutual aid notification.

4.4.6 The use of cellular telephones in ambulances, in supervisory vehicles, and in command post vehicles can provide significant benefits in command and control functions.

4.5 Mutual Aid Considerations.

4.5.1 It is essential to have mutual fire-fighting assistance agreements with community and regional off-airport fire departments. Successful rescue operations and handling of aircraft accident fires both on and off the airport depend on pre-incident planning the effective use of mutual aid (*see also Annex F*). The following considerations are significant:

- (1) Special attention should be given to ensuring compatibility in equipment designs (e.g., fire hose threads, communications equipment) and to fire control operational techniques.

- (2) It is important to familiarize structural fire department personnel with the special problems relating to aircraft rescue and fire fighting, including methods of access to aircraft operating areas and how to operate vehicles while at the airport.

4.5.2 Airport orientation visits should be arranged by fire departments bordering airports for consultations with the airport fire department, airlines, the military services, and others as appropriate. Their training in airport/aircraft familiarization should include those items listed in 4.3.3 and 4.3.4, and grid maps of the airport and surrounding area.

4.5.3 Structural fire-fighting vehicles normally carry small amounts of water compared to the amounts usually carried on major airport ARFF vehicles. However, they can be useful in relaying water from hydrants, reservoirs, or other sources to maintain ARFF vehicle supplies.

4.5.4 Structural fire fighters can be utilized to provide assistance to airport ARFF personnel by handling hose lines, operating tools and equipment, assisting in rescue operations, and protecting exposures.

Chapter 5 Flight Deck Crew and ARFF Personnel Responsibilities

5.1 Areas of Responsibility.

5.1.1 The flight deck crew, flight attendants, and ARFF personnel should have the skills to deal with aircraft emergencies and should be familiar with each others' responsibilities to ensure that all their efforts are clearly directed toward the common goals of life and fire safety.

5.1.2 The prime mission of all concerned is the safety of all persons aboard the aircraft and any others involved in the emergency. Duties and responsibilities can generally be defined as follows:

- (1) Flight deck crews hold the primary responsibility for the aircraft and for the safety of its occupants. The final decision to evacuate an aircraft, and how to do so, is made by the flight deck crew, provided they are able to function in the normal manner at the time.
- (2) Flight deck crews and flight attendants share responsibility for the aircraft and for the safety of its occupants. The final decision to evacuate an aircraft, and how to do so, is made by the flight deck crew and flight attendants, provided they are able to function in the normal manner at the time.
- (3) It is the duty of responding ARFF personnel to create conditions in which survival is possible and evacuation or rescue can be conducted. As visibility from within an aircraft is limited, any external features or situations likely to be of significance in the evacuation process should be communicated to the aircraft's crew. Should it become apparent that crew incapacitation precludes their initiation of evacuation, the incident commander of the ARFF personnel should take the initiative to do so.

5.1.3 To prevent injury when an emergency aircraft evacuation takes place, consideration should be given to assisting occupants in using the aircraft slides.

5.2 Communications.

5.2.1 Effective communications between flight deck crew and ARFF personnel is very important during emergencies. Con-



tact should be established at the earliest possible time between persons in charge of each group. Exchange of pertinent information can assist in developing better decisions and plans of action. Several methods of direct communication are generally available, such as aircraft interphone, tower relay, direct radio communication via approved DEF, or visual signals.

5.2.2 Where aircraft engines are operating, radio communications near the aircraft can be very difficult. Most aircraft are equipped with intercom systems and provided with plug-in jacks normally located under the forward portion of the aircraft near the nose gear. ARFF personnel should be aware of this means of communication and carry the necessary headset and microphone to plug into these facilities. Even with the engines operating, direct communications with the flight deck crew can be established by use of this system as long as the power is on.

5.2.3 Where a more direct means of communication cannot be established, a designated ARFF individual should go to the left side of the aircraft nose and establish direct eye contact and voice communications with the captain of the flight deck crew. If engine noise is a problem and a power megaphone is not available, it might be necessary to resort to hand signals to communicate. Figure 5.2.3 depicts standard international ground-to-aircraft hand signals that should be used by ARFF personnel to communicate with the captain during emergencies. These hand signals are established for emergency communication between the ARFF Incident Commander and/or ARFF Fire Fighters and the Cockpit and/or Cabin Crews of the Incident Aircraft. ARFF Emergency Hand Signals should be given from the left front side of the aircraft for the cockpit crew. (Note: In order to communicate more effectively with the cabin crew, Emergency Hand Signals may be given by ARFF Fire Fighters from other positions.)

5.2.4 If aircraft engines are operating, ARFF personnel should use extreme caution when approaching an aircraft for communications purposes as described in 5.2.2 and 5.2.3. The aircraft should be approached only from the front and well ahead of the nose and, if possible, in full view of the captain. Vehicle and hand-held lights should be used in periods of darkness and poor visibility. See Table 5.2.4 for light-gun signals.

Recommend Evacuation — Evacuation recommended based on ARFF Incident Commander's assessment of external situation.



Arm extended from body, and held horizontal with hand upraised at eye level. Execute beckoning arm motion angled backward. Non-beckoning arm held against body.

Night — same with wands.

Recommend Stop — Recommend evacuation in progress be halted. Stop aircraft movement or other activity in progress.



Arms in front of head, crossed at wrists.

Night — same with wands.

Emergency Contained — No outside evidence of dangerous condition or "all clear."



Arms extended outward and down at a 45-degree angle. Arms moved inward below waistline simultaneously until wrists crossed, then extended outward to starting position (umpire's "safe" signal).

Night — same with wands.

FIGURE 5.2.3 Standard International Ground-to-Aircraft Signals. (Photos courtesy of the Air Line Pilots Association.)

Table 5.2.4 Standard Air Traffic Control Tower Light-Gun Signals

Color and Type of Signal	Movement of Vehicles, Equipment, and Personnel	Meaning	
		Aircraft on the Ground	Aircraft in Flight
Steady green	Cleared to cross, proceed, or go	Cleared for takeoff	Cleared to land
Flashing green	Not applicable	Cleared for taxi	Return for landing (to be followed by steady green at the proper time)
Steady red	STOP	STOP	Give way to other aircraft and continue circling
Flashing red	Clear the taxiway/runway	Return to starting point on airport	Airport unsafe, do not land
Flashing white	Return to starting point on airport	Return to starting point on airport	Not applicable
Alternating red and green	Exercise extreme caution	Exercise extreme caution	Exercise extreme caution

Chapter 6 Emergency Response

6.1 General.

6.1.1 The survivable atmosphere inside an aircraft fuselage involved in an exterior fuel fire is limited to approximately 3 minutes if the integrity of the airframe is maintained during the impact. This time could be substantially reduced if the fuselage is fractured. When the aluminum skin is directly exposed to flame, burnthrough will occur within 60 seconds or less, while the windows and insulation may withstand penetration for up to 3 minutes. Because of this serious life hazard to occupants, rapid fire control is critical. Therefore, whenever flight operations are in progress, ARFF vehicles and personnel should be located so that optimum response and fire control can be achieved within this time frame.

6.1.2 At many airports portions of the critical rescue and fire-fighting access areas, as shown in Figure 6.1.2, might be outside the airport boundaries. There also can be obstructions created by natural features, highways, or railroad right-of-ways that would delay or preclude access by ARFF vehicles. In these instances, consideration should be given to providing specialized vehicles where conventional vehicles can be restricted due to unusual terrain characteristics. Any delay in response time is critical, and mutual assistance agreements with off-airport agencies should be established to provide optimum response in problem areas.

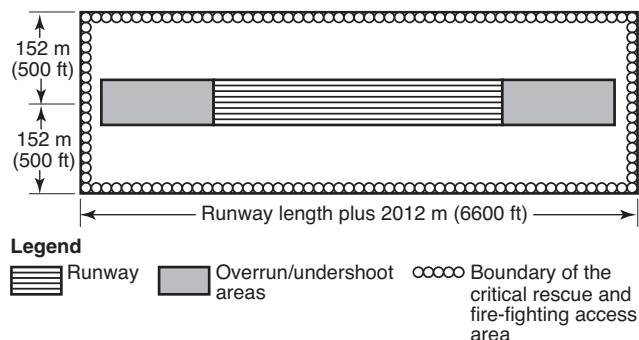


FIGURE 6.1.2 Critical Rescue and Fire-Fighting Access Area.

6.1.3 To obtain the desired response, pre-incident planning should include a wide range of factors such as adequate alarm systems, fire station locations (or prepositioning of resources), vehicle operator training, airport familiarization, and staging areas for outside assistance.

6.1.4 Fire stations should be located to allow rapid direct access to the operational runway(s) so that maximum acceleration rate and top speed of the vehicles can be utilized to enable them to reach any point on the runway(s). The access road to the runway(s) should be as direct as possible.

6.1.5 All-weather access routes to the critical rescue and fire-fighting access area suitable for ARFF vehicles should be designated and should be maintained in usable condition while flight operations are in progress.

6.1.6 To minimize response times, operational procedures should exist through which ATC would stop or divert all aircraft and nonessential traffic that would conflict with responding emergency vehicles.

6.1.7 Airports updating their master plan for airport development should consider the location of obstructions in the critical rescue and fire-fighting access area, such as ditches, mounds, vegetation, or nonfrangible structures that could cause extensive damage to any overrunning aircraft or obstruct the positioning of emergency vehicles.

6.2 Low-Visibility Operations.

6.2.1 New and improved techniques for instrument takeoff and landing permit flight operations to continue under adverse weather conditions. Low-visibility operations criteria vary from one airport to another depending upon the type of instrument landing system available, the level of natural and manmade obstructions in the surrounding terrain, the type of runway lighting, and the capability of the onboard instrument systems of the aircraft using the airport. Such operational minimums can vary from 5 km (3 mi) visibility to 100 m (300 ft) for landings, with similar restrictions for takeoff. ARFF personnel should ascertain operational restriction levels from the local ATC agency or airfield operations, or both, in order to establish response capability under low-visibility conditions.

6.2.2* Although aircraft operational navigational weather minimums might not be in effect, fully staffed Local Standby Alert procedures should be initiated when flight operations are in progress and surface visibility and conditions are less than 800 m (½ mi). Whenever operational or environmental conditions exist that have the potential to impede a timely ARFF response, an assessment should be made regarding ARFF personnel and equipment or repositioning of resources or both. (See also Section 10.2.)

6.2.3 Standbys during low-visibility operations and adverse weather conditions should have at least one major ARFF vehicle located at a distance no closer than the taxiway hold line adjacent to the midpoint of the active runway, unless the fire station(s) location(s), as shown in Figure 6.2.3, permits effective response times. When on standby, vehicle operators should keep engines running and such lights operating as needed to effectively mark the position of the vehicle. If the vehicle is equipped with a Forward Looking Infrared (FLIR) system, it should be fully operational with an in-cab display.

6.2.4 ARFF personnel assigned to any standby should monitor all applicable radio frequencies.

6.2.5 ATC should be made aware of the exact location of the ARFF vehicles assigned to standby duty. Where available, surface navigational aids, such as ground radar (ASDE), should be fully utilized through coordination between ARFF personnel and the control tower.

6.2.6 ARFF vehicles can be equipped with an infrared vision system to help the crew of the vehicles locate and respond to emergencies in low-visibility conditions.

6.2.7 Positioning equipment (e.g., DEVS) can be installed on ARFF vehicles so drivers know their position on the airport at all times.

6.3 Considerations for Airports Adjacent to Water.

6.3.1 Where airports are situated adjacent to large bodies of water such as rivers or lakes, or where they are located on coastlines, provisions should be made for the availability of specialized water rescue vessels or helicopters, or both, and equipment should be in place.

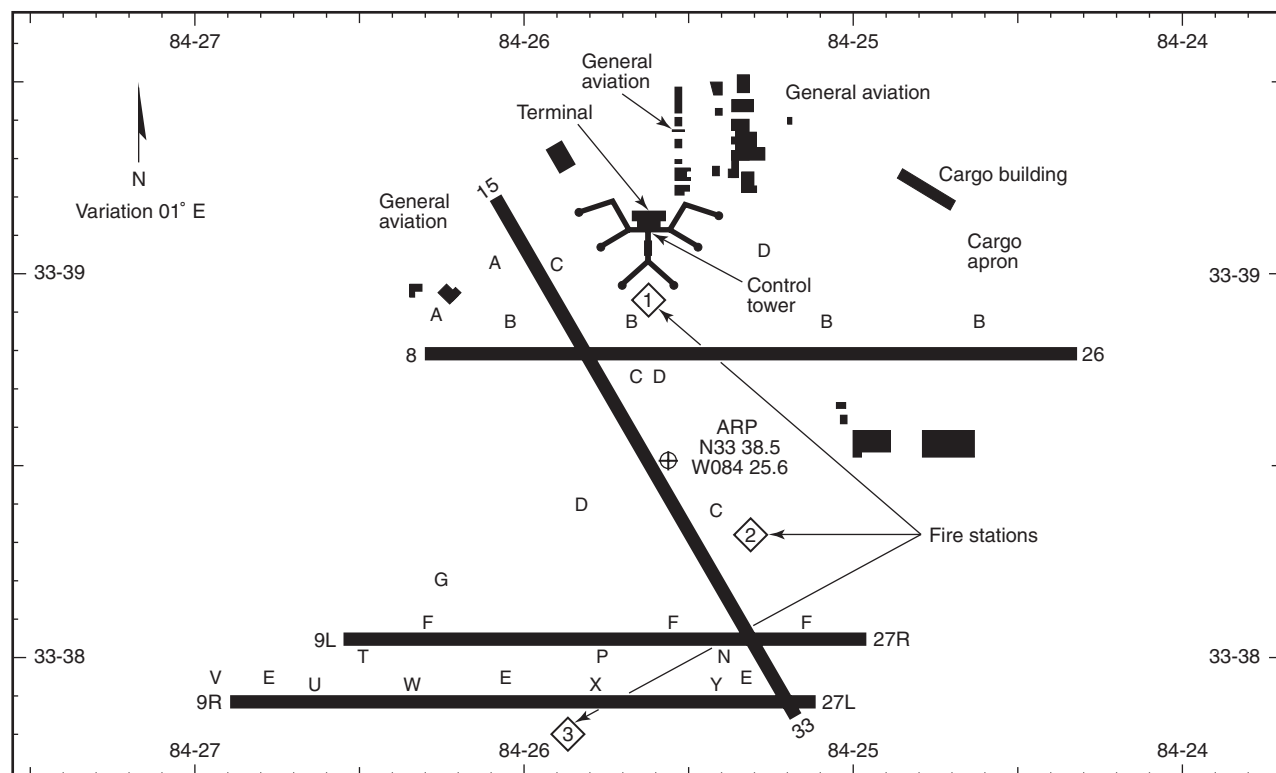


FIGURE 6.2.3 Example of Airport Fire Station Locations.

6.3.2 Inclined ramps or docking facilities should be considered by airports located adjacent to large bodies of water to allow rapid response to aircraft accidents. Launch ramps should be located adjacent to the overrun areas of the critical rescue and fire-fighting areas. Where appropriate, ARFF crews should have navigational maps available.

6.3.3 For rescue purposes, the vessel(s) should be equipped with flotation platforms, rafts and/or personal flotation devices, or a combination of these for the maximum number of occupants carried on the largest aircraft regularly scheduled into the airport.

6.3.4 Rescue vessels should be capable of rapid response to the accident site.

Chapter 7 Factors Common to Airport Emergencies

7.1 General.

7.1.1 The primary hazard associated with aircraft accidents is that liquid fuels are likely to be released and ignited during the accident sequence. A secondary hazard is that fuels released but not ignited could subsequently be ignited prior to or during the egress of occupants. In addition, fires can occur involving combustible materials such as interior furnishings, stored goods, and aircraft system components. Further complications could result if the aircraft comes to rest in such an attitude that forcible fuselage entry or shoring for stabilization might be required.

7.1.2 During all aircraft emergencies, all persons not directly involved in the ARFF phase of the incident, including the news media, should be required to stay well clear of the site until

evacuation, occupant care, full fire control, and site safety security are completed. Responsibility for site security should be preassigned to the law enforcement agency of primary jurisdiction and could be augmented by other law enforcement agencies, guards, military personnel, and volunteers as needed.

7.1.3 The various emergencies that can be anticipated include emergencies involving aircraft in flight (*see Section 7.2*), as well as emergencies that occur on the ground. The emergency declarations associated with pre-flight and post-flight aircraft operations, maintenance, and servicing are generally referred to as aircraft ground emergencies. Information on aircraft ground emergencies can be found in Sections 12.1 through 12.10 of this document.

7.2 Types of Alerts.

7.2.1 The terms used to describe categories of emergency alerts are not standardized. The Federal Aviation Administration (FAA) terms, "Local Standby Alert," "Full Emergency Alert," and "Aircraft Accident Alert," and the International Civil Aviation Organization (ICAO) terms, "Local Standby," "Full Emergency," and "Aircraft Accident," are equivalent. Individual airports might have adopted their own nomenclature for "Local Standby Alert," "Full Emergency Alert," or "Aircraft Accident Alert". This must be coordinated with the appropriate authority.

7.2.2 Local Standby Alert (Local Standby). When an aircraft has or is suspected to have an operational defect, the incident should be considered a Local Standby Alert. The defect should not normally cause serious difficulty for the aircraft to achieve a safe landing.

7.2.2.1 Under Local Standby Alert conditions, at least one ARFF vehicle should be staffed and positioned to permit immediate use in the event of an accident.

7.2.2.1.1 If time and conditions permit, ARFF personnel should be advised of the following:

- (1) Aircraft type
- (2) Number of passengers and crew
- (3) Amount of fuel remaining
- (4) Nature of the emergency
- (5) Type, amount, and location of dangerous goods aboard
- (6) Number and location of nonambulatory passengers on board, if any

7.2.2.1.2 All other in-service ARFF vehicles should remain available for immediate response.

7.2.2.2 A Local Standby Alert should also be initiated when an aircraft approaching the airport is known or suspected to have developed some defect, but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing.

7.2.2.3 Whenever operational or environmental conditions exist that have the potential to impede a timely ARFF response, an assessment should be made regarding ARFF personnel and equipment or repositioning of resources or both.

7.2.2.4 Operational policies should be in effect for aircraft movements not normally encountered by the airport.

7.2.2.5* A Local Standby Alert should also be initiated when an aircraft is involved in an operation that could present an additional life hazard risk.

7.2.3 Full Emergency Alert (Full Emergency). When an aircraft has or is suspected to have an operational defect that affects normal flight operations to the extent that there is danger of an accident, the incident should be considered to be a Full Emergency Alert, or a Full Emergency.

7.2.3.1 When a Full Emergency Alert emergency is declared, ARFF personnel should be provided with detailed information that allows preparation for likely contingencies. A full response should be made with the ARFF vehicles staffed and in position with engines running and all emergency lights operating so that the fastest response to the accident/incident site can be accomplished.

7.2.3.2 It is important that appropriate radio frequencies be continuously monitored by ARFF personnel. One or more major ARFF vehicles should be able to initiate fire suppression within the briefest period of time after the aircraft comes to rest. Standby positions for ARFF vehicles should be established for the type of emergency and aircraft involved.

7.2.3.3 ARFF personnel should be informed of any changes in a distressed aircraft's emergency situation.

7.2.4 Aircraft Accident Alert (Aircraft Accident). This alert denotes that an aircraft accident has occurred on or in the vicinity of the airport.

7.2.4.1 Regardless of the source of an Aircraft Accident Alert alarm, full ARFF response should be put into effect. When possible, all known pertinent information should be relayed via radio by ATC to responding units and include, as accurately as possible, the accident location using landmarks and grid map coordinates.

7.2.4.2 When an accurate accident location is not available, ARFF personnel should anticipate the worst situation and stand

by until signs of an accident are evident or better information is received. Mutual aid assistance should be initiated in accordance with the airport/community emergency plan. (See also *NFPA 424, Guide for Airport/Community Emergency Planning*, and *ICAO Airport Services Manual, Part 7*.) During all Aircraft Accident Alerts, ARFF crews should always assume there are survivors.

7.3 Vehicle Response to Aircraft Accidents.

7.3.1 ARFF vehicles should approach any aircraft accident by the route that provides the quickest response time. This might not necessarily be the shortest distance to the scene. Traversing unimproved areas can take longer than traveling a greater distance on paved surfaces such as taxiways, ramps, and roads. Total response time is vital. Preferred routes, especially those within the critical rescue and fire-fighting access area, should be preselected. Practice response runs should be made under both ideal and inclement weather conditions.

7.3.2 In some cases, runways and taxiways are blocked by aircraft awaiting taxi clearance or takeoff. Vehicle operators should be aware of alternate routes that can be used so as not to delay response.

7.3.3 The load-bearing characteristics of the airport soil structure under various weather conditions should be known, and vehicle operators should be trained to deal with off-road driving conditions.

7.3.3.1 When responding in rough terrain conditions, ARFF responders should consider alternate routes.

7.3.3.2 For those airports that have Engineered Material Arresting Systems (EMAS) installed at runway ends, ARFF personnel should be mindful of the following:

- (1) While vehicles may depress the material, the material should not cause the vehicles to become bogged down.
- (2) While material is inherently noncombustible, it could absorb fuel.

7.3.4 When nearing the accident scene, vehicle operators should be alert to avoid all persons in the area, especially those who might be injured, unconscious, or wandering about in a dazed condition. In darkness, periods of low visibility, or when operating in areas of tall vegetation, extra caution and effective use of lighting equipment, audible warnings, FLIR systems, or a combination of these might be needed.

7.4 Positioning of ARFF Vehicles.

7.4.1 Information from the flight deck crew relative to the nature of the emergency will assist the ARFF personnel to better determine the most advantageous positioning of the vehicles upon arrival at the scene of an aircraft emergency.

7.4.2 Piston-type engine aircraft provide different options for initial positioning of ARFF vehicles than do turbojet aircraft that have swept-back wings and produce a jet blast hazard. ARFF personnel should therefore consider an approach from the nose of jet aircraft. However, this should not become a standard procedure as wind conditions, terrain, type of aircraft, location of engines, cabin configurations, and other factors can dictate the optimum approach in a given circumstance.

7.4.3 Vehicle position should never obstruct aircraft evacuation or interfere with the deployment of evacuation slides. (See also *Chapter 9*.)

7.4.4 Propellers turning on turboprop or piston-type engine aircraft present a hazard to evacuees and ARFF personnel.

