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The **Aircraft Rescue & Fire Fighting Working Group (ARFFWG)** is a non-profit international organization dedicated to the sharing of Aircraft Rescue &Fire Fighting (ARFF) information between airport firefighters, municipal fire departments, and all others concerned with aircraft fire fighting. With membership participation from around the world, your membership is welcomed. Join us now! To learn about the different membership options and the benefits that are extended to you as a member of the ARFFWG, please call us at 817-409-1100 or visit our website at *ARFFWG.org*.

Being Safer at a Small Aircraft or Helicopter Accident Scene

Fortunately, airplane accidents rarely occur, so few occupations have specific training to work at an aircraft accident site (usually only airport rescue firefighters (ARFF) and accident investigators). There are usually about 1500-1700 accidents in the US per year. A majority of these accidents involve small aircraft or helicopters. Most current training for aircraft accidents involves scenarios on larger commercial aircraft accidents. Make no mistake, larger aircraft accidents represent the large-casualty situations and demand that first responder skills are sharp and ready. Statistically, however, you as a first responder are much more likely to encounter an accident involving a small aircraft or helicopter.

A lot of different groups have a stake in an airplane accident: the operator, the rescuers (from many disciplines), the manufacturers and the investigators. They all have something to offer and something to gain in sharing their knowledge. In this article, we will cover how the FAA got into this training, how a lot of different groups helped contribute, how the training is laid out, and finally, some of the considerations and hazards at an accident scene.

Training Development

In recent years, several recommendations by the National Transportation Safety Board (NTSB) focused on ballistic parachute systems (BPS) installed on many small aircraft and light sport aircraft. These ballistic parachutes consist of an actuation handle in the cockpit that ignites a rocket. The rocket pulls out a large parachute that can lower the entire aircraft to the ground. The rocket can be up to three inches in diameter and, as expected, can move very fast. If this rocket were to deploy from an accident aircraft on the ground and someone at the accident site was in the way, the result could be fatal. The system gives aircraft a great safety advantage but may pose a hazard when the aircraft is on the ground.

The FAA queried several first responder groups about ballistic parachute systems and their safe identification. Additional investigation confirmed, with the exception of airport firefighters, most first responder groups were unaware BPS exists let alone know how to identify or safely work around the systems. Undeployed BPS pose a hazard to anyone around an accident aircraft. Training for BPS hazards has been available, but the training has been relatively limited.

The FAA's interest in aircraft accident hazards grew from BPS to aircraft airbags in seatbelts, composite structure, and then a larger collection of hazards that set an aircraft accident apart from an automobile accident. As the hazard list grew, the target audience grew too, from ARFF to local structural firefighters, EMS, law enforcement, coroners, recovery crews, investigators, and anyone else likely to be around an accident—airport employees, pilots, and the civil air patrol.

The FAA Small Airplane Directorate joined up with the FAA Rotorcraft Directorate to develop training for safety at small aircraft or helicopter accident scenes. The training development started with identifying interest in various professional first responder organizations, like the Airport Rescue Fire Fighting Working Group (ARFFWG). At the same time, several aircraft manufacturers and aircraft systems manufacturers, like the BPS manufacturers and the aircraft airbag manufacturers were contacted for help. The General Aviation Manufacturer Association (GAMA) offered to tie in a larger collection of aircraft manufacturers. Numerous government organizations were asked to review and comment on the material, like the FAA Safety Team (FAASTeam), the NTSB, National Fire Academy, and the Civil Air Patrol.

Training Modules

The varying levels of involvement led to different training modules that focus on the targeted material or audience. For example, ARFF training focuses on aircraft accidents in particular; however, they may benefit from more in-depth material offered in module 4 about the BPS. On scene commanders and law enforcement need to know about the hazards at the aircraft but will not have a self contained breathing apparatus or extrication equipment. They would probably benefit more from modules 3 and 5.

A link to the aircraft accident hazards training program can be found at http://www.faa.gov/aircraft/gen_av/first_responders/

Module 1 Systems and Material Hazards

- Recommended for firefighters and EMS.
- Primary module that identifies hazards unique to aircraft accidents.

Module 2 Aircraft Type Familiarization and Mission Specific Hazards

- Recommended for firefighters and EMS.
- Outlines aircraft variations in service and hazards associated with certain aircraft usage.

Module 3 Command and Recovery

- Recommended for firefighters, EMS, and law enforcement for aircraft accident protocol development.
- Recognizes operational protocol for managing an accident scene and requirements related to the investigation of the accident.

Module 4 Ballistic Parachute System Familiarization

- Recommended for firefighters and recovery personnel.
- Provides information that will detail the installation, operation, and techniques used by manufacturers to disable a ballistic parachute system so that the first responder will have a better understanding if tasked by the manufacturer to disable the system.

Module 5 **Systems and Material Hazards for Rescuers**

- Recommended for police, airport personnel, the aviation community, or others that may be tasked with initial rescue.
- Provides material from module 1, however recognizes that personal protective equipment may not be equivalent to firefighter/EMS self-contained breathing apparatus and does not address extrication.

Module 6 is being developed to promote safety for helicopter operations, most commonly EMS and law enforcement operations. However, this module would be of value to anyone that may be expected to work around a helicopter. This includes material that shows the best ways of selecting and setting up a safe landing zone, protocol at the landing zone, and how to approach and depart a helicopter. This material is still under development but will be presented in the same manner as the earlier training modules.

The training modules are currently being developed into downloadable presentations, online versions with quizzes as required for certification, and versions that may fit into online learning management systems.

Crash guides for various makes of automobiles are common. Unfortunately, the equivalent for aircraft is not widely available. In the spirit of this, GAMA is collecting material from manufacturers that will share aircraft and component manufacturer accident safety data. The GAMA first responders' website represents a hub that has links to various manufacturer-maintained safety websites devoted exclusively to their products. Additional places for accident response information are found on the FAA training website, like the FAA ARFF website.

Now we'll explore some of the material from the training…..

Approaching the accident site

The first human reaction at the sight of someone in need is to render immediate aid. Each airplane accident has a different twist, and the same approach for all accidents will not always be the right one. While there are some "never do this" items, the most effective way to train is with a best practices approach. A better understanding of how the airplane works helps. A lot of areas on an airplane you know about, but you may not know how those areas could be damaged by fire or impact or how those damaged areas could react if disturbed. Keep in mind, most cautions exist because someone was either hurt or nearly hurt in a past incident.

Before running up to the airplane, consider what kind of airplane it is or what kind of job the airplane was doing. Aside from pleasure flying, people use aircraft for many different types of jobs. Even though that seems obvious, the job they were doing will let you know what you might be dealing with on the ground. For example, an agricultural aircraft may carry hundreds of pounds of pesticide, an EMS helicopter may have large oxygen bottles on board, or a law enforcement aircraft may have weapons and ammunition on board.

Is it burning? It could start soon. What do you have to protect yourself? Firefighters should use SCBA and full bunker gear to provide protection from heat, tactile, and respiratory hazards. PPE can be adjusted accordingly after the situation can be more fully assessed. You must consider combustion byproducts, chemicals on board, and biohazards from the occupants. These hazards spread over a large area due to impact. Approach the scene from upwind if possible. Also, when you leave the site, remember that your shoes, clothing, tools and anything else you took with you may have contamination.

Depending on the situation, you generally want to approach the aircraft from the sides. Be on the lookout for signs of ballistic parachute systems (BPS). A relatively small percentage of the aircraft in service have BPS installed, but they present a big hazard and must be respected. We'll discuss these later.

In addition, every aircraft accident is subject to an investigation by the National Transportation Safety Board or the Federal Aviation Administration to determine the probable cause. Because of this, you must take care to not damage the evidence investigators may need involving the accident. If you drive up to the scene, you may be disturbing evidence sooner than you think. Wreckage, ground scarring, or even occupants may not be at the main accident site but spread out over a large area. You must also try to contact law enforcement to secure the accident scene. An aircraft accident attracts media attention and media along with members of the general public will likely show up at the scene. When you leave, try to back out over the same path you arrived to minimize compromising the scene.

Ideally, you should photograph or document any disturbance to the scene if possible. Be prepared to debrief the investigators when they arrive about what you saw; actions you took to disturb the wreckage, locations and conditions of wreckage; and noted hazards like airbags, BPS presence, or spilled fuel.

At the accident site

If you can't render aid or it's too late, back away and do your best to keep other bystanders out too. Think about the following areas for your own personal safety.

Engines: They probably won't be running, but, if they still are, stay clear of the propellers, inlets, exhausts, and the plane of rotation (the area directly perpendicular to the rotating parts). If the engines stop quickly, they could throw parts. Stationary propellers are cause for concern. Don't touch them; they could kickback or highly-loaded springs in the hub could release and throw parts if they are damaged and then are disturbed.

Stability: Think about how the aircraft is positioned. Will it move or collapse if you put your weight on it given its orientation or the landscape it is on? How did the fire and impact affect the aircraft? Composite airframe structure may look intact when burned, but it will be like stepping on cloth and won't hold you if the resin is burned away. Step carefully if the structure looks compromised and be careful around jagged structure.

Accessibility: Of course, first head for the doors or escape hatches to access the occupants. Aircraft that fly at higher speeds may have flush handles that lay flat on the aircraft skin. They may be a little more complicated to find and operate. If you have access to aircraft now, you could survey the types of handles at a local general aviation airport or it may be a good excuse to visit an airshow.

Access through the windshield is not a good idea, especially the forward windshield. They were built for taking impacts, so they will be ready for the blows of your ax. Make sure to share any safety related information that you have recognized from the accident with the first investigators. If you find yourself in the situation of trying to extract an occupant by cutting the aircraft, think about where you cut. For example, if you cut one of the window posts on a high-wing aircraft, you could sever a fuel line. Any cut has the potential of cutting through different aircraft systems including hydraulic, fuel, electrical, or even a cable that could deploy a ballistic parachute system (BPS).

Airbags: If you are in the cabin trying to help the occupant, be careful what you touch. More and more aircraft are equipped with airbags. Airbags in aircraft are actually located in the seatbelt straps and can be identified by very thick straps. While it is not likely that they would go off, they are powered by at least 6000 psi compressed gas from a small tank usually under the seat. Airbags can definitely hurt you if you are in the way should they deploy. Additionally, the system is independent of the aircraft electrical system. Use caution in the cabin. Limit your contact with the controls and be sure not to pull or disturb any big red T-handles for BPS.

Stored energy: On an accident scene, you must consider the stored-energy components that aircraft use. There could be remaining energy in hydraulic systems, pneumatic systems, suspension struts, wheels and batteries. The systems and the parts that contain them may have been compromised in the accident, and you don't want to be around if they discharge or otherwise release. Aircraft must be light to fly. Because of this, the parts are made of materials that are generally lighter and may be more susceptible to damage than the equivalent heavy steel parts that might be used in similar systems on an automobile.

Composites: Composite structure is becoming more and more common in aircraft. Composite refers to strong fibers (usually glass or carbon) held together in a resin. That resin is a plastic and puts off toxic fumes when it burns along with all of the other materials used in aircraft construction. When the fibers in the composite are set free, they can be inhaled and cause further health hazards. If the resin burns away and you disturb the structure, the fibers will become airborne. If the composite structure is just fractured, it can break into sharp shards that can easily penetrate a boot. PPE is very important; a mask and leather gloves at a minimum should be worn in an accident scene involving a composite aircraft.

Biohazards: Biohazards may be present from the occupants or from cargo, and the accident impact could spread the biohazards over a large area. Investigators wear full impermeable suits with hoods, goggles, rubber gloves covered with leather gloves, and rubber boots that cover their own boots. Occupations that work in accident scenes take recurrent blood-borne pathogen awareness courses. You should take self-protection seriously. Remember also, that anything you take into the accident scene should be considered contaminated including your tools and especially your footwear.

BPS: Ballistic Parachute Systems are becoming increasingly popular in small aircraft. The system is rather simple in concept. It has an actuation T-handle (usually red), within reach of the pilot attached to a sheathed cable like that on a bicycle brake. This cable runs directly into the rocket igniter on the end of the rocket. The rocket is attached to the parachute container.

In most cases, the parachute deploys up and aft and the entire assembly is located close to the aircraft center of gravity-around where the wing and fuselage meet. If this rocket were to deploy from an accident aircraft on the ground and someone at the accident site was in the way, the result would likely be a fatality. Most aircraft will have a triangular warning label that indicates where the rocket leaves the aircraft. If you see that triangular warning label, you should avoid that area.

Additional labels may be on the aircraft indicating installation of a BPS, usually located near the entrance to the aircraft. If the parachute system was deployed and the parachute is out of the aircraft, don't enter the aircraft until the parachute canopy is collapsed. If the canopy were to reopen and catch the wind the airplane will follow. These parachutes have dragged otherwise undamaged accident aircraft for over a mile on the ground. The straps and suspension lines could be an entanglement hazard as well. The canopy can be collapsed by spraying it with water or carefully cutting the suspension lines. Roll up and secure a collapsed canopy to prevent reinflation.

As aviation develops, manufacturers continually incorporate new technologies into aircraft that make them easier and safer to fly. It is the FAA's mission to promote safety for aircraft and their operation. As with any machine, accidents can and sometimes do occur. When an accident occurs, someone comes to the rescue. Occasionally bystanders arrive at an accident scene first, but firefighters, EMS, and law enforcement are usually the first people on the scene of a small airplane or helicopter accident. Anyone on the accident scene takes a risk. With a little knowledge, accident responders can better manage that risk.

Summary:

In summary, there are a lot of hazards in an aircraft accident scene. Think about how the impact and fire may have affected the aircraft and its systems. Many things that are normally safe could hurt you as a result of a crash. Minimizing your disturbance of the accident scene is the best way to keep yourself safe.

An airplane accident is one of the last places you would ever want to be, hopefully you will never have to use this information. But if you ever do find yourself in the wrong place at the wrong time, with a little extra knowledge you might be able to extend that helping hand at the right time but in a much safer manner.

About the Author:

Bob Stegeman is an aircraft structures engineer with the FAA Small Airplane Directorate in Kansas City. He has held similar positions in the airline industry. In his career in aviation he has participated in several aircraft accident investigations and accident-related design reviews. He has presented this new training material to many professional organizations. In putting together this training, he has developed numerous new relationships in the first responder community. He has found it very rewarding to be able to share this aircraft safety information with the leading edge crews that work so hard to protect us all.