Happy landings

The growing integration of heliports in the urban landscape is resulting in a greater need for effective fire protection. Felipe of IBOT, Mexico, summarises ICAO's standards and explains some of the emerging technologies.

It is increasingly common to see helicopters moving from one place to another in Mexico City as officials and corporate executives find in helicopters a viable means of transportation to avoid traffic congestion.

This has transformed the cityscape with a growing number of buildings crowned with heliport facilities. Last year Mexico experienced increased activity in the aviation environment with foams, specifically in jobs and projects related with equipping heliports.

A heliport is an aerodrome intended only to be used by helicopters but as with any aerodrome heliports are regulated by the local and international aviation authorities who require them to be equipped with fire protection systems.

These systems are composed of a diverse array of equipment with varying degrees of sophistication, depending on the complexity and risk to protect but in all cases require foam application devices.

The International Civil Aviation Organisation's Document 9261-AN/903, Manual of Heliports sets the regulations governing every aspect of these sites, including the firefighting and rescue requirement for all types of heliports.

Firefighting foams in the aeronautical field

ICAO document 9261-AN/903 sets as principal extinguishing agent firefighting foam with performance level 'B' and establishes the applicable fire protection and the quantities of extinguishing agents. The classification of foams made by ICAO sets the performance levels of foam concentrates according to their actual ability to extinguish.

The level of efficacy of the foam is defined by ICAO Document 9137-AN/898, Manual of Airport Services (Part 1) and in its most recent revision of 2013 it refers to foams with performance levels A, B and C, where the C level is the most effective in extinguishing fires. It establishes testing protocols to determine the effectiveness of the foams and their normal application rate at 5.5 l/min per m^2 in a specific area called the 'critical area'. This application must be guaranteed for a period of two minutes for surface heliports and ten minutes for elevated heliports.

The critical area is 'the area adjacent to a helicopter in which fire must be controlled for the purpose of ensuring temporary fuselage integrity and provide an escape area for occupants of the helicopter' [1]. It is defined by the length and

Oscillatory station monitor with self-educting foam nozzle and Solberg Re-healing RF3 3% foam. The pictured foam holds ICAO certification level B in addition to FM, UL-162 and European EN-1568 listings.

width of the fuselage (main body) of the helicopter, which in turn influences the design of the heliport. Heliports are classified by their location (i.e on the surface or on elevated helidecks) and into H1, H2 and H3, according to the size of the helicopter[2].

- H1 is for an overall helicopter length of less than 15m
- H2 for an overall helicopter length between 15m and 24m
- H3 for an overall helicopter length between 24m and 35m

These parameters define the fire protection equipment the heliport must carry.

According to ICAO [3] surface heliports should have at least 500, 1,000 and 1,600 litres of water storage for producing foam and a discharge rate of 250, 500 and 800 litres per minute respectively for heliport categories H1, H2 and H3.

As regards complementary agents, H1, H2 and H3 heliports should carry 23kg, 45kg and 90kg respectively of dry chemical or halogenated agents, or 45kg, 90kg and 180kg of CO_2.

For category H1 elevated heliports, the minimum equipment is a hose station capable of applying a jet of foam at 250 l/min, complemented by portable extinguishers capable of applying complementary agents at 45kg of dry chemical or halogenated agents, or 90kg of CO_2.

In addition to the hose station and mobile extinguishers, H2 and H3 heliports must carry two fire monitors that can apply a foam blanket across the surface to be protected, regardless of the direction in which the wind blows. They should be located where they would not be compromised in the case of an accident, in opposite positions and preferably outside the natural trajectory of helicopter takeoff and landing. After analysing the area to be protected and the prevailing wind conditions common to the heliport it may be necessary to consider the installation of more than two monitors.

The design of the supply system should take include back-up devices to ensure monitors can continue operating even when one of the monitors has been involved in an accident.

Self-contained CAFS. CAFS are the most technologically advanced alternatives for foam application today.

ICAO and NFPA – note the differences

The classification of heliports into H1, H2 and H3 (i.e. based on the overall length of helicopters) is similar for ICAO and NFPA 418, the only difference being that ICAO refers the length in meters while NFPA refers the length in feet, so there are slight differences after conversion.

In regards to the foam application criteria, as is explained in this article, ICAO's fire protection concept is based on a critical area defined as 'the area adjacent to a helicopter in which fire must be controlled for the purpose of ensuring temporary fuselage integrity and provide an escape area for occupants of the helicopter' (6.5.1 ICAO Helicopter Manual). This area is a rectangle that does not cover the total surface of the heliport platform. The criterion is consistent and makes no distinction between fire protection using a hand-held hose line or a fixed system. However, in NFPA 418 when a fixed system is used the area of application that has to be considered is the total surface of the helipad.

In regards to the foam application rate, ICAO specifies 5.5 l/min per m^2 for a duration of 10 minutes for roof-top heliports, while NFPA 418 recommends a foam discharge rate of 4.1 l/min per m^2 with a duration of foam discharge from a fixed system of 5 minutes.

The criteria followed will influence the design of the foam fire protection.

Systems and equipment: key election for proper protection

It is essential to select equipment of robust construction, superior quality, good design and durable materials for heliports as this equipment will be exposed to adverse environmental conditions and in many cases to poor maintenance.

How to proportion the exact percentage of foam into the system or equipment is a decision that is dependent on the system and equipment of choice. Whether or not to use automated protection depends on the circumstances of the heliport site; for example, whether or not the heliport has a fire brigade service. While an automated system obviously minimises the need for human intervention, on the other hand it represents a higher initial investment (further on we will discuss automated systems applicable to heliports).

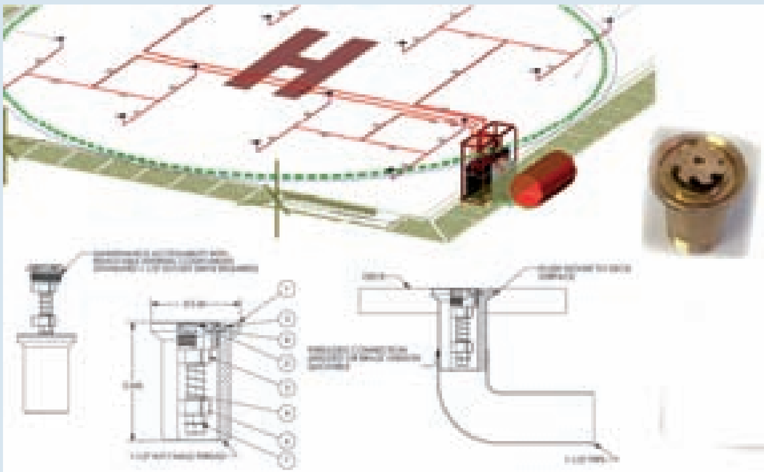
If the heliport has a fire brigade service and there is already a fire protection installation capable of delivering sufficient water flow and pressure to operate simple foam proportioning devices, then the initial investment will be low.

The simplest devices take advantage of the virtues of an inline eductor or proportioner capable of providing the right amount of foam to a manually-operated hose line. However, for these devices to operate properly it is critical that the flows between the nozzle and the inline educator are matched as well as ensuring sufficient flow rate and pressure to obtain an accurate proportion of the solution to produce effective finished foam. Only by meeting these criteria will the system of inline eductors operate correctly and therefore protect the heliport.

Automated systems

It is common to find arrangements of monitors fed from a dedicated fire main and which include automatic oscillating devices capable of applying finished foam on the heliport via self-educting nozzles or even conventional nozzles fed by a bladder tank system that supplies the water-foam solution.

Bladder tank systems consist of a pressure vessel equipped with an internal bladder containing foam concentrate. An increase in water pressure compresses the bladder which



CAFS with pop-up deck surface sprinklers.

then injects the foam concentrate into the system and through the metering devices. While it is also feasible to use more complex systems such as automatic balanced pressure pump systems, these would only be justified if they provided fire protection to other facilities in addition to the heliport.

New technologies for protecting heliports

Another type of automated system comprises foam spray heads located on the surface of the helipad. These types of systems activate their heads automatically using conventional foam systems or high efficiency CAFS (compressed air foam system).

The CAFS is one of the most technologically advanced alternatives for foam application today to the extent that they are being incorporated into the latest revisions of several standards related to heliport protection[4].

These systems are capable of generating large volumes of high-quality foam by the injection of air or nitrogen into the water-foam solution before it reaches the discharge point, so that when the discharge takes place all the foam applied is fully expanded, 'finished' foam. The foam expansion obtained with these systems reaches up to a 1:12 ratio providing a variety of interesting applications in the protection of heliports.

Among the benefits offered by CAFS is the possibility of being totally self-contained; the ability to generate large volumes of high quality finished foam with low moisture content and high drainage time; simplicity of installation, operation and maintenance; and low consumption of foam concentrate.

CAFS can be configured in multiple ways, ranging from a self-contained hose station to systems combining monitors and high-efficiency surface sprinkler systems.

In order to take full advantage of the qualities of a CAFS it is essential to understand the nature of its design and how it interacts with its ability to generate higher volumes of finished foam.

The normative documents referred to in this article relate to amounts of water storage necessary for the production of finished foam at a rate of application of 5.5 l/min per m^2 on the critical areas as outlined in ICAO document 9137-AN/898.

Using conventional foam proportioning methods the volume of water required to generate the required amount of foam is undoubtedly as indicated in those documents. But when it comes to CAFS the water required is drastically reduced; in fact, only a small amount of water-foam solution is needed to generate the volume of finished foam the system is capable to produce, due to the effect of the large expansion ratio created by the injection of gas in the solution before it is discharged as finished foam.

This means that a high-efficiency CAFS is capable of generating the maximum foam volume with only an amount of solution equivalent up to 1/12 of the volume of the finished foam generated. In other words, a CAFS with storage of 227 litres of water-foam solution can produce up to 2,725 litres (i.e. 227x12) of finished foam.

Final thoughts

Human beings instinctively avoid danger but the appearance of safety can mask the presence of a hazard or the magnitude of a risk. When it comes to a heliport the mere presence of on-site systems and fire protection equipment can convey a sense of security to those who use it. However, it is not enough just to have some fire equipment in sight, it is imperative that fire protection equipment and systems are not only operative but that they can perform effectively and in line with the risk they protect.

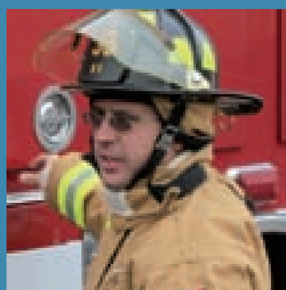
There are countless examples of heliport facilities that do not meet these requirements. The difference between saving a life and having a false sense of safety lies in the fact that the equipment or system chosen operates without failure, with full efficiency and effectiveness.

Fire protection on heliports is a specialty that requires specific knowledge of various technologies and mastery of design aspects. All these, applied properly, fulfill the primary purpose of providing efficient and reliable protection under applicable regulatory requirements. To achieve this purpose, the responsible selection of reliable extinguishing agents and the design, installation and maintenance of systems and equipment play a critical role.

References

[1] 6.5.1 ICAO Helicopter Manual.
[2] Table 6-1 ICAO Heliport Manual.
[3] Document 9261-AN/903.
[4] UK Civil Aviation Authority, Safety Regulation Group, CAP 437 Standards for offshore helicopter landing areas, Appendix D, Helideck fire-fighting provisions for existing normally unattended installation (NUI) assets on the United Kingdom continental shelf.
ISO 7076-5:2014 Fire protection – foam fire extinguishing systems – Part 5: Fixed compressed air foam equipment.

ABOUT THE AUTHOR



Felipe Hanhausen holds a BS degree in civil engineering with a specialty in projects and construction from the Universidad Iberoamericana in Mexico City. As a professional engineer he has collaborated on many large-scale infrastructure projects and public works including several subway lines, urban bridges, tunnels and highways, as well as the installation of heliports and fire protection systems. He is the founder of the Hanhausen-Varcacía Group and President of IBOT, a company providing special services and products in the fields of engineering, fire protection and human safety.