CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

Advisory Circular
AC139-4

Revision 6

Aerodrome Rescue and Firefighting

19 August 2016

General

Civil Aviation Authority (CAA) Advisory Circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with aerodrome rescue and firefighting requirements under Civil Aviation Rule Part 139 *Aerodromes—Certification, Operation and Use*.

Related Rules

This AC relates specifically to rules 139.57, 139.59, 139.61, 139.63, 139.65, 139.67 and 139.67A.

Change Notice

Revision 6 adds an example of a rescue and firefighting service (RFS) 'response model'; and clarifies required actions when 'initiating the rescue'.

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1. Introduction

1.1 The principal objective

The principal objective of a rescue and firefighting service (RFS) is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome. The RFS is provided to create and maintain survivable conditions, to provide egress routes for occupants and to 'initiate the rescue' of those occupants unable to make their escape without direct aid.

The rescue may require the use of equipment and personnel other than those assessed primarily for rescue and firefighting purposes.

The most important factors bearing on effective rescue in a survivable aircraft accident are the:

(a) training received

(b) effectiveness of the equipment

(c) speed with which personnel and equipment designated for rescue and firefighting purposes can be deployed.

1.2 Explanation of initiate rescue

This subsection contains an example of a (RFS) 'response model' which identifies that the response objective can be split into three main parts (phases)[1]. The three phases are as follows:

- **Phase 1** – aerodrome RFS create and maintain survivable conditions, and facilitate rescue (aircraft occupants self-evacuate or receive limited assistance with evacuation).
- **Phase 2** – local fire authority(s) and support services respond to and assemble at the aerodrome.
- **Phase 3** – rescue of occupants who are unable to make their escape without direct aid.

CAA view regarding the extent of required actions or steps when 'initiating the rescue' is that it should be defined with regard to:

(a) rescue capabilities of aerodrome RFS

(b) rescue capability with back-up

(c) reliance on external provision.

These capabilities would have to be set out in the aerodrome emergency plan (AEP) as per rule 139.57 and remain acceptable to the Director. Any interpretation of 'initiate the rescue' must be considered against the context of the particular aerodromes operation, types of aircraft,

[1] This example is relevant to an aerodrome which has determined that on-board rescue efforts will not be undertaken until external fire services are present. Some aerodromes may have the capability to start Phase 3 prior to, or in parallel with, Phase 2.

geographical location, pre-determined attendance of local emergency services and time of response by local emergency services etc.

'Initiate the rescue' should at least involve ensuring that the local emergency services have been alerted. In some situations 'initiate the rescue' could be interpreted as opening aircraft doors/exits and positioning ladders/steps in readiness for support services to assemble and commence the rescue phase; whilst in other situations it might be necessary for the RFS to make provision to be able to carry out rescues themselves with limited aid from support services, as may be the case in remote locations. A task and resource analysis (TRA) can help clarify the aerodrome rescue capability and the role of external services.

CAA advises that aerodromes should collaborate with their local fire and rescue authority(s) and support service(s) to identify the steps required to meet Phase 3 of the response model and once agreed, this should be reflected in the responsibilities of each agency concerned in the AEP , and outlined in a mutual aid emergency agreements between all emergency and support services that may be involved.

2. Application

2.1 Aerodromes serving international or domestic routes

This advisory circular contains guidance for compliance with Part 139 requirements for rescue and firefighting. For simplicity this advisory circular refers to aerodromes to which rule 139.5(aa)(1) applies as "aerodromes serving international routes"; and aerodromes to which rule 139.5(aa)(2) applies as "aerodromes serving domestic routes.

Rule 139.59 should be read in its entirety to determine the fire and rescue category required at certificated aerodromes.

2.2 Electronic filing of differences (EFOD)

New Zealand has accepted that aerodromes serving international routes will comply with the applicable standard of ICAO Annex 14. At aerodromes serving domestic routes only, New Zealand has filed a difference with the ICAO, and a standard has been developed based on the characteristics of the aircraft being served by the aerodrome.

This advisory circular contains guidance for compliance with Part 139 requirements for rescue and firefighting. Coverage of the different aspects of rescue and firefighting is not exhaustive in this advisory circular which also addresses elements that need further expansion and guidance.

There are several publications available which address the elements of rescue fire in detail, and below is a list of some publications which can be referred to, for further guidance material.

- ICAO Annex 19 *Safety Management System*
- ICAO Doc 9683 *Human Factors Training Manual*
- CAP 1150 *Task and Resource Analysis*
- ICAO Annex 14 *Aerodromes*
- ICAO Doc 9137-AN/898 *Airport Services Manual Part 1 Rescue and Fire Fighting*
- ICAO Doc 7192-AN/857 *Training Manual Part E-2 Aerodrome Fire Services Personnel*
- National Fire Protection Codes - 402, 403, 424M, 1003 & 1500

- Information on the ICAO Documentation is obtainable from the ICAO web site at http://www.icao.int/icao/en/sales.htm
- Information on the National Fire Protection (NFPA) Codes is available from the NFPA website at http://catalog.nfpa.org/

3. Personnel

3.1 Personnel medical fitness

Personnel selected for rescue and firefighting duties should be free from any physical or mental condition or disability which might limit their performance or which might be aggravated by a sudden level of exertion.

The medical fitness of a prospective rescue and firefighting personnel should be determined by a medical examination and assessment conducted by a registered medical practitioner to the following standards:

(a) **Vision -** applicants should have:

(i) a distance visual acuity (without correction) of 6/12 in each eye separately. No standard is set for near visual acuity

(ii) normal fields of vision.

(b) **Colour perception -** applicants should have normal colour perception as tested by pseudo-isochromatic plates. If this is failed by more than 2 errors with a 24 plate set, they should demonstrate an ability readily to identify coloured lights of signal red, signal green and white as tested by the normally accepted lantern tests.

(c) **Hearing -** applicants should understand an average conversational voice in a quiet room, using both ears, at a distance of 2.5 m (8 feet) from the examiner, and with the back turned to the examiner. In cases of doubt, and on-the-job hearing assessment should be used to determine whether there is adequate ability to understand radioed instructions and verbal instructions under the conditions of background noise to be encountered in and around operating firefighting appliances.

(d) **Medical fitness -** applicants should be free from any congenital or acquired disability and the effects of medication or of drugs causing such degree of functional incapacity as is likely to interfere with the efficient performance of their duties during the period before the next medical review.

(e) Applicants should be free from any risk factor, disease, or disability which renders them likely to become suddenly unable to perform their assigned duties safely during the period before the next medical review.

(f) There should be no history or current diagnosis of the following:

(i) psychosis, depression or other psychiatric illness

(ii) alcohol or drug dependency

(iii) epilepsy

(iv) any disturbance of consciousness without an explanation

(v) coronary artery disease (whether successfully treated or not)

(vi) other cardiac conditions treated by surgical means (for example, valve replacement or insertion of a pacemaker)

(vii) any active disease (or functional disability) of the lungs

(viii) diabetes mellitus controlled by insulin.

In determining the complete fitness of a person, consideration should be given to the arduous nature of rescue and firefighting duties. Particular care should be taken if personnel are selected to wear respiratory equipment, where psychological factors are significant, in addition to physical suitability. The nature of testing, and procedures for assessing, the suitability of prospective rescue and firefighting personnel should be established and included in the aerodrome certification exposition.

3.2 Continued medical fitness of personnel

Medical fitness assessments specific to RFS should be developed. The medical fitness assessments should be conducted for pre-employment entry as rescue and firefighting personnel as well as ongoing medical fitness assessments for existing staff. The frequency of medical fitness assessments should be determined by local arrangement. The medical fitness framework assessments should be used to identify any underlying medical conditions, which may pose a risk to the individual rescue and firefighting personnel, during physically demanding activities.

The assessment should include a medical certificate:

(i) from a registered medical practitioner

(ii) with the periodicity of the checks set by the medical practitioner based on the rescue and firefighting personnel history, and results of examinations

(iii) with a maximum check periodicity of four years.

3.3 Continued physical fitness of personnel

The physical fitness assessments should be conducted for pre-employment entry as rescue and firefighting personnel as well as ongoing physical fitness assessments for existing staff to ensure that rescue and firefighting personnel are maintaining their level of physical fitness.

RFS should develop various types of tests to ensure that the aerobic endurance fitness, anerobic fitness and flexibility is tested to determine if the rescue and firefighting personnel has the required physical fitness level for the job. The physical fitness assessment should also be conducted at least once a year.

Aerobic endurance fitness is the ability to continue to exercise for prolonged periods of time at low to moderate or high intensity. This is typically what limits the ability to continue to run, cycle or swim for more than a few minutes and is dependent upon the body‘s heart, lungs and blood to get the oxygen to the muscles (VO2) providing the sustained energy needed to maintain prolonged exercise. Typical aerobic activities include walking, jogging, cycling, rope skipping, stair climbing, swimming, and or any other various endurance activities.

Anaerobic fitness works differently to aerobic fitness. It is an activity that requires high levels of energy and is done for only a few seconds or minutes at a high level of intensity. The term anaerobic means - without oxygen. Participation in anaerobic activities leads to anaerobic fitness, which may be defined as higher levels of muscular strength, speed and power. Examples of

anaerobic activities include heavy weight lifting, running up several flights of stairs, sprinting, power swimming, or any other rapid burst of hard exercises. Muscular strength is the ability to lift, pull, push and carry heavy objects over.

Flexibility refers to the ability to move the limbs and joints into specific positions at the end of their normal range of movement. Flexibility is important as it will allow the body to work in cramped positions without unduly stressing the muscles, tendons and ligaments and may reduce the risk of injury. Flexibility is best developed using slow controlled stretching exercises.

3.4 Entry training standards

A recruitment and retention policy should ensure that all rescue and fire personnel go through a detailed and comprehensive assessment process to ensure that the right candidate is selected for the position.

If rescue and fire personnel are recruited with no previous RFS experience, they should undertake an initial fire fighters course and be deemed competent on acquisition of skills. Competency assessments in both practical and technical aspects should be conducted within this course.

3.5 Continued rescue and firefighting personnel development

An environment conducive to learning and development should be provided, enabling personnel to have the opportunity to fulfil their potential.

All personnel in the aerodrome RFS, regardless of RFS experience on or off aerodromes should participate in an ongoing structured learning program (SLP). Competency assessments in both practical and technical aspects should be conducted within this program.

All RFS watches, shifts or crews should participate in comprehensive recurrent training appropriate to their roles and tasks to maintain skills necessary to ensure all RFS operations are carried out safely and effectively. This training should include:

(a) realistic fire drills commensurate with the types of aircraft in use at the aerodrome

(b) live fires associated with fuel discharge under very high pressure (requirement to be determined at local level)

(c) drills to maintain operational performance with fire service equipment

(d) training to include human performance and team coordination

(e) breathing apparatus training in heat and or smoke.

Typical courses and syllabi would be those available in the national qualifications framework system for “fire and rescue services – airport” under the New Zealand qualifications authority (http://www.nzqa.org.nz/) and the industry training organisation (http://skills.org.nz/http://skills.org.nz/.

3.6 RFS organisational structure

Aerodrome operators may use different titles in their organisational structure (such as firefighter, supervisor and manager) but they should equate to the following in terms of training, qualifications and accountability:

- **Rescue firefighter** - carries out day-to-day firefighting and other duties.

- **Rescue fire officer** - in charge of the watch at smaller fire stations or the crew of a fire appliance. Carries out day-to-day firefighting and other duties. Will attend incidents as officer in charge (OIC) of an appliance and will also take command of small-scale incidents. May undertake specialist duties such as training or fire safety.

- **Senior rescue fire officer** - responsible for management of a fire station or day-to-day work in a specific policy area. Will take charge of large-scale incidents or undertake specialist tasks such as support at an incident and any other duties.

Each RFS unit should establish a training syllabus, competencies and experience requirements for each supervisory and management level.

Sole duty RFS personnel should be able to display the competency requirements, knowledge and understanding of a rescue fire officer.

The RFS organisational structure should show clear lines of accountability so that it is apparent to all where safety responsibilities lie.

3.7 Protective clothing for personnel

It is essential that all personnel operating at an aircraft fire be provided with protective clothing designed to provide the firefighter with protection from radiated heat, occasional flame contact and injury from abrasive contact.

Consideration should be given to the extent to which it is necessary to wear continuously all or some elements of, the protective clothing so as to ensure immediate response when a call for attendance at an aircraft accident is received. Some forms of protective clothing create dressing problems which cannot easily be solved within the crew compartment of a moving vehicle.

On responding to a fire call, all RFS personnel should don as a minimum, their firefighter boots and leggings prior to mounting the fire vehicle.

Each rescue firefighter should be provided with at least the following items of protective clothing:

(a) protective helmet complete with visor

(b) bunker coat and leggings

(c) firefighting gloves

(d) firefighting boots

(e) firefighter's flash hood.

Self-contained respiratory equipment should be provided for those personnel who are required to enter a smoke filled cabin or operate in the presence of smoke or toxic gases.

Respiratory protection should be provided for those personnel who may be required to work in areas where breathing may be hazardous due to air borne particles (e.g. composite materials).

Each aerodrome should also assess the need for other items such as entry protective suits or chemical suits.

3.8 Personnel levels

The objective of providing an adequate level of competent personnel is to have available sufficient staff at all responsibility levels to ensure that:

(a) the RFS is capable of achieving the principal objective

(b) all vehicles and equipment can be operated effectively and safely

(c) continuous agent application at the appropriate rate(s) can be fully maintained (as determined in Part 139 for the applicable category)

(d) sufficient supervisory grades can implement a coordinated incident management system

(e) the RFS elements of the AEP can be effectively achieved.

The RFS vehicles should be staffed so as to ensure their ability to discharge at their maximum capability, extinguishing agents, principal and complimentary, both effectively and safely, at an aircraft accident / incident.

Any control room or communications facility operated by, and serving the RFS can continue to provide this service until alternative arrangements to undertake this function are initiated by the AEP.

In determining the minimum number of rescue and firefighting personnel and supervisory levels required, a task and resource analysis (TRA) should be completed, and the level of staffing and supervisory control are documented or referenced in the aerodrome exposition.

3.9 Task and resource analysis (TRA)

A TRA should be completed to establish justification as to the minimum number of competent personnel required to deliver an effective airport RFS.

When carrying out a TRA, it is essential to fully understand the complexity of the various roles an individual is required to do in terms of actions, in order to achieve the principal objective of the RFS.

The task analysis should observe human factor principles to obtain optimum response by all existing agencies participating in emergency operations. The principles should include the effect of human performance due to workload, capabilities, functions, decision aids, environmental constraints, team versus individual performance and training effectiveness.

When assigning operational duties to RFS personnel enroute to the incident attention should be given to the following.

(a) There is a need to approach the scene with extreme caution and watch for evacuating occupants, wreckage debris, fuel ponding, and other hazards. Avoid driving through any smoke which obscures your vision and potential evacuees. Avoid driving over any aircraft wreckage

(b) The monitor-operator is able to assume the operating position while the vehicle is in motion and operate the monitor through at least 60 degrees either side of the central axis of the vehicle.

The following items will assist in determining the basic contents of a TRA:

(a) Description of the aerodrome(s) including the number of runways.

(b) Promulgated RFS categories (Aeronautical Information Publication).

(c) Response time criteria (area, times and number of fire stations).

(d) Current and future types of aircraft movements.

(e) Operational hours.

(f) Current RFS structure and establishment.

(g) Current level of personnel.

(h) Level of supervision for each operational crew.

(i) RFS qualifications/competence (training programme and facilities).

(j) Extraneous duties (to include domestic and first aid response)

(k) Communications and RFS alerting system including extraneous duties.

(l) Appliances and extinguishing agents available.

(m) Specialist equipment: fast rescue craft, hovercraft, water carrier, hose layer, extending boom technology and high reach extendable turret technology.

(n) Initial emergency medical aid- role and responsibility.

(o) Medical facilities: role and responsibility.

(p) Pre-determined attendance- local council authority services, police, fire and ambulances, etc.

(q) Incident task analysis- feasible worst case scenarios, workload assessment, human performance/factors. It should include:

(i) mobilisation

(ii) deployment to scene

(iii) scene management

(iv) firefighting

(v) suppression and extinguishment

(vi) application of complementary agents

(vii) post fire security/control

(viii) personnel protective equipment

(ix) rescue teams

(x) aircraft evacuation

(xi) extinguishing agent replenishment *(note: the aim is to identify any pinch points within the current workload and proposed workload).*

(r) Appraisal of existing RFS provision

(s) Future requirements-aerodrome development and expansion

(t) Enclosures could include- airport maps, event trees to explain tasks and functions conducted by the RFS.

(u) AEP and procedures.

Note: *The above is not exhaustive and should only act as a guide.*

At aerodromes serving international routes, a fully trained senior rescue fire officer should arrive at the scene of the incident no later than the first responding RFS vehicle. This will allow an early appraisal of conditions to assess and direct firefighting operations.

At aerodromes serving domestic routes only, a fully trained senior fire officer or a suitably trained fire officer should arrive at the scene of the incident no later than the first responding RFS vehicle. This will allow an early appraisal of conditions to assess and direct firefighting operations.

4. Training

4.1 General

Personnel whose duties consist primarily of the provision of RFS for aircraft operations are infrequently called upon to face a serious situation involving lifesaving at a major aircraft fire. They will experience a few incidents and a larger number of standbys to cover movements of aircraft in circumstances where the possibility of an accident may reasonably be anticipated, but will seldom be called upon to put their knowledge and experience to the supreme test. It follows, therefore, that only by means of a most carefully planned and rigorously followed programme of training can there be any assurance that both personnel and equipment will be fit to deal capably with a major aircraft fire should the necessity arise.

Training of rescue and firefighting personnel falls into two broad categories.

(a) **Initial training** in the use and maintenance of equipment, and operational tactics training which covers the development of personnel and equipment to accomplish control of fire to permit rescue operations to proceed.

(b) **Structured learning program (SLP)** should be commenced on completion of the initial training course. All RFS personnel regardless of previous applicable experience, on or off the aerodrome should participate in a SLP. The core content of the program can be organised into nine topics as follows:

(i) fire dynamics, toxicity and basic first aid

(ii) extinguishing agents and firefighting techniques

(iii) handling of vehicles, vessels and equipment

(iv) airfield layout and aircraft construction

(v) operational tactics and manoeuvres

(vi) emergency communication

(vii) leadership performance

(viii) physical fitness

(ix) auxiliary modules (e.g. rescue in difficult terrain, response to biological/chemical threats etc).

The training program, in its entirety, should be designed to ensure that both personnel and equipment are at all times fully efficient. This represents a very high standard of achievement but anything less than full efficiency is unacceptable and may be dangerous both to those in need of aid and also to those who are seeking to give such aid. In addition, the training program should also be designed to build cohesiveness between key functional units of a RFS team in order to deliver a consistent level of proficiency during emergencies. To ensure a high standard of operational readiness, RFS should develop a competency audit framework, to assess the effectiveness of RFS training at both individual and team levels.

All initial training courses and all structured learning programs, should include an assessment of competence with oral technical, practical and written technical tests. The minimum competence standard for students should be established for each course.

4.2 Practical training

Each RFS unit should have access to a training ground or training area on their aerodrome at a location that does not compromise their response time. The area identified should be able to accommodate practical operational training activities such as:

(a) realistic fire drills commensurate with the types of aircraft in use at the aerodrome

(b) live fires associated with fuel discharge under very high pressure(requirement to be determined at local level)

(c) drills to maintain operational performance with fire service equipment

(d) training to include human performance and team coordination

(e) breathing apparatus training in heat and or smoke.

All RFS personnel at each RFS unit should be periodically assessed to determine their continued competencies in the practical activities identified above ((a) through (e)).

4.3 Theoretical training

Each RFS unit should have access to a training room or training area, on their aerodrome at a location that does not compromise their response time. The area identified should be conducive to learning and able to accommodate theoretical input and self-study.

Each RFS unit should provide training aids to support the delivery of the nine topics that make up the content of the SLP (refer to paragraph 4.1).

The training aids used for the study and instruction of the nine topics of the SLP can be from a variety of sources and in a variety of formats, such as:

(a) power point presentations

(b) visual aids

(c) fire service manuals

(d) interactive computer simulation

(e) locally agreed reference manuals.

All RFS personnel at each RFS unit should be periodically assessed to determine their continued competency in each of the nine topics that make up the content of the structured learning program.

4.4 Delivery of training

Each RFS unit should identify a person that is responsible for the coordination and supervision of rescue and firefighting training, and the maintenance of all training records.

Personnel used for the delivery of training should be suitably trained and experienced in the rescue and firefighting role or specialists in a particular aspect of the training syllabus.

The design of a course for a rescue and firefighting personnel at an aerodrome serving domestic routes only needs to address the fact that the rescue and firefighting personnel is not supported by a large organisation and could be the sole duty rescue and firefighting personnel. The training of such a person should consider this self-sufficiency with emphasis on proficiency at the aerodrome and on the equipment provided.

Each RFS unit should establish a training syllabus, competencies and experience requirements for each supervisory and management level.

Practical and theoretical forms of training are, understandably, a continuing commitment and should be resourced accordingly.

4.5 Annual live (hot) fire training

Each member of an airport RFS unit should participate in at least one live “hot” fire training exercise per 12 month period.

The objective is for airport RFS personnel to observe fire behaviour and demonstrate the practical tactics and techniques that are used to control and extinguish a live “hot” aircraft fire in a range of aircraft fire scenarios. These scenarios may include:

(a) live external fire on a static training rig simulating an aircraft fuselage

(b) live internal fire on a static training rig simulating an aircraft fuselage

(c) live fire of an underwing engine on a static training rig simulating an underwing engine fire

(d) live fuel pond fire

(e) live fire training to include human performance and team coordination.

The live hot fire training exercise should begin with all participants declaring themselves fit and well to take part. If deemed necessary, the fitness level of any participant may be ascertained by an on-site fitness test prior to taking part in the live hot fire training exercise. If a fitness test is required, suitable recovery time should be allowed before the participant takes part in the live hot fire training exercise.

The operational competence of each firefighter is key to the safe conclusion of the live hot fire training exercise and as such, individual operational competence should be ascertained prior to participation.

4.6 Fitness training

Fitness levels are to be maintained as an employment condition and may be reviewed during each operational shift.

5. Firefighting and Rescue Equipment

5.1 Firefighting equipment

Each RFS vehicle required under Part 139 should be equipped with at least the following firefighting equipment:

(a) fire delivery hose

(b) firefighting branches

(c) standpipe, key and bar.

5.2 Rescue equipment

Rescue equipment commensurate with the level of aircraft operations expected should be provided on the rescue and firefighting vehicle(s). Aerodromes serving international routes should have at least the following equipment available for rescue at the scene of any aircraft accident:

(a) portable lighting equipment providing flood and spot lighting

(b) power operated cutting tools that can be operated from a portable power source

(c) hand tools including wire and bolt cutters, screwdrivers of appropriate sizes and designs, crowbars, hammers, axes, metal and wood saws

(d) forcing equipment, usually hydraulically operated, for bending or lifting operations

(e) sufficient breathing apparatus sets

(f) medical first aid equipment, ideally consisting of pre-packed wound dressings in protective containers, scissors, adhesive dressings and burn dressings, stretchers or spine boards and blankets

(g) communications equipment in the form of radiotelephone units and a portable loud hailer

(h) miscellaneous items including shovels, grab hooks, lines (cordage), harness cutting knives, and ladders of appropriate type and length, related to the likely aircraft types involved

(i) a powered fan unit capable of extracting contaminated air from aircraft.

Items (a) to (i) inclusive should be carried in the rescue and firefighting vehicles to be available at the accident site within the required response times under Part 139.

Aerodromes serving domestic routes only should have at least the equipment listed in items (c), (f) and (h) except for stretchers, spine boards and blankets. The scale should be in relationship to the number of firefighting personnel being used. The equipment should be carried in the rescue and firefighting vehicles to be available at the accident site within the required response times under Part 139.

Records of all tests and inspections should be maintained by the RFS for a minimum period of two years. The records should include details of consequential action where an inspection has revealed a defect or deficiency.

5.3 Mutual aid emergency agreements

In developing an AEP and the water rescue service at aerodromes, consideration should be given to public services (such as military search and rescue units, harbour police, or fire departments) and private rescue services (such as rescue squads, power and communication companies, offshore oil field operators, or shipping and waterway operators), that may be available and are capable of rendering assistance. A signal system for alerting private or public services in time of emergency should be prearranged. The following should be considered:

(a) The close proximity of an airport to surrounding communities and the possibility of an off-airport aircraft accident give rise to the need for mutual aid emergency agreements.

(b) A mutual aid emergency agreement should specify initial notification and response assignments. It should not specify the responsibilities of the agency concerned as this will be contained in the AEP.

(c) Mutual aid emergency agreements should be prearranged and duly authorized. The airport authority may have to act as coordinating agency if more complicated jurisdictional or multi-agency agreements are necessary.

5.4 Operations in a difficult environment

For aerodromes serving international routes, the plan should include the ready availability of, and coordination with, appropriate specialist rescue services to be able to respond to emergencies, where an aerodrome is located close to water and/or swampy areas and where a significant portion of approach or departure operations takes place over these areas.

At those aerodromes located close to water and/or swampy areas, or difficult terrain, the AEP should include the establishment, testing and assessment at regular intervals of a predetermined response for the specialist rescue services.

An assessment of the approach and departure areas within 1,000m of the runway threshold should be carried out to determine the options available for intervention. Guidance material on assessing approach and departure areas within 1,000m of runway thresholds (refers to Part 1, Chapter 13 of the ICAO Doc 9137 *Airport Services Manual)*.

For aerodromes serving domestic routes only, the AEP should have specific procedures and specialist agencies involved when the aerodrome is located near large bodies of water, swamps or where the approach/departure areas are over water. This could include the use of coast guard, divers, boats/hovercraft and the local harbourmaster. The appropriate rescue services should be involved in testing of the emergency exercises on a regular basis.

If practicable, an assessment of the approach and departure areas within 1,000m of the runway threshold should be carried out to determine the options available for intervention. Guidance material on assessing approach and departure areas within 1,000m of runway thresholds (refers to Part 1, Chapter 13 of the ICAO Doc 9137 *Airport Services Manual)*.

5.5 Communications

When rescue and firefighting vehicles leave the fire stations and enter the manoeuvring area, the RFS personnel come under the direction of the control tower. These vehicles should be equipped with two-way radio communications equipment, through which their movements can at all times,

be subject to direction by the control tower. The choice of a direct air traffic control/fire service frequency, monitored in the master watch room, or a discrete airport fire service frequency, relaying airfield / air traffic control instructions and fresh information, will be a matter for the airport authority to determine, based on local operational and technical considerations.

The radio equipment on rescue and firefighting vehicles should accommodate communication between vehicles, en route to, and in operation at, an aircraft accident. Within individual vehicles there should be an intercommunication system, particularly between drivers and monitor-operators, to optimize the deployment of the vehicles at an accident. The provision of a communication facility within an appliance must recognize the likelihood of high noise levels, and this may require the use of noise-cancelling microphones, headsets and loudspeakers, for effective intercommunication.

The rescue and fire fighting vehicles should be provided with communication equipment capable of communicating directly with an aircraft in a situation of emergency using an aeronautical radio frequency. The aeronautical radio frequency permits the rescue and firefighting service and the emergency aircraft, to communicate with each other directly, allowing the rescue and firefighting crew to issue critical information regarding the exact nature of, and the hazards associated with an emergency in progress, along with recommendations for actions.

6. Extinguishing Agents

6.1 Complementary extinguishing agents

The complementary agent(s) required is:

(a) carbon dioxide (CO2) or

(b) dry chemical powders or

(c) a combination of the agents stated in items (a) and (b).

Compatibility must be ensured when selecting dry chemical powders for use with foam.

6.2 Halogenated hydrocarbons

In line with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, the production of halon 1301, 1211 and 2402 has been banned since 1994.

Halons are therefore no longer discussed in this document but may still be found in some aircraft fixed installations.

6.3 Foam concentrates

Any foam concentrate to be used in rescue and firefighting vehicles should meet or exceed the criteria of the ICAO specifications; so as to achieve performance level B (refers to Part 1 Chapter 8, Paragraph 8.1.3 of the ICAO Doc 9137, *Airport Services Manual*).

There is no direct relationship between this specification and specifications of other organisations such as the International Standards Organisation (ISO) or US defence force military specifications (Mil Spec).If such foam concentrates are used, users need to be able to show that they will produce foam meeting the ICAO performance level B requirements.

6.4 Foam characteristics

The quantity of foam concentrate separately provided on vehicles for foam production should be in proportion to the quantity of water provided and the foam concentrate selected.

The amounts of water specified for foam production are calculated on an application rate of 5.5 L/min/m² for foam meeting performance level B.

For agent substitution, the following equivalents should be used:

- 1 kg dry chemical powder or 2 kg CO2 = 0.66 L water for production of a foam meeting performance level B.

6.5 Reserve supply

A 200 percent reserve supply of foam concentrate for the runway category should be maintained on the aerodrome for vehicle replenishment purposes. Where a major delay in the replenishment of this supply is anticipated, the amount of reserve supply should be increased.

If the 200 percent reserve supply of foam concentrate is temporarily not available on the aerodrome the runway rescue and firefighting category need only be reduced, when the quantity of foam concentrate available falls below 100 percent of that for the normal category.

The quantity of foam concentrate provided on a vehicle should be sufficient to produce at least two loads of foam solution.

6.6 Water supplies

Supplementary water supplies, for the expeditious replenishment of rescue and firefighting vehicles, should be pre-arranged. The objective of providing additional water supplies at adequate pressure and flow is to ensure rapid replenishment of aerodrome RFS vehicles. This supports the principle of continuous application of extinguishing media to maintain survivable conditions at the scene of an aircraft accident.

Additional water to replenish vehicles may be required in as little as five minutes after an accident; therefore an analysis should be conducted to determine the extent to which it, and its associated storage and delivery facilities, should be provided.

When conducting the analysis, the following factors are amongst those items which should be considered but not limited to:

(a) sizes and types of aircraft using the aerodrome

(b) the capacities and discharge rates of aerodrome fire vehicles

(c) the provision of strategically located hydrants

(d) the provision of strategically located static water supplies

(e) utilisation of existing natural water supplies for firefighting purposes

(f) vehicle response times

(g) historical data of water used during aircraft accidents

(h) the need and availability of supplementary pumping capacity

(i) the provision of additional vehicle-borne supplies

(j) the level of support provided by local authority emergency services

(k) the pre-determined response of local authority emergency services

(l) fixed pumps where these may provide a rapid and less resource-intensive method of replenishment

(m) additional water supplies adjacent to airport fire service training areas

(n) overhead static water supplies.

7. Response Capability

7.1 Frequency of rescue and firefighting response verification

The holder of an aerodrome operating certificate should regularly complete a rescue and firefighting response time verification. Response time verifications should normally be held with a periodicity of between 1 and 3 months.

7.2 Response location

The verification should require a fire vehicle to produce water through the vehicle's monitor at the correct operating pressure, immediately upon arrival at a nominated location.

7.3 Response timing

The response time verification should be initiated using the normal emergency response activation procedures detailed in the AEP, and the time required from the activation to the production of water at the nominated location should be recorded.

The response timing verification should be carried out during periods of minimal or no traffic so that the fire vehicles are not disrupted during the verification and the vehicles can be serviced before the next scheduled aircraft movement. The timing verification should be carried out during daylight hours and with dry surface conditions.

8. Definitions of Emergencies and Incident

For the purposes of this advisory circular:

Aircraft accident means an aircraft accident which has occurred or is inevitable on, or in the vicinity of, the aerodrome.

Aircraft ground incident means an aircraft on the ground is known to have an emergency situation other than an accident, requiring the attendance of emergency services.

Full emergency means when it is known that an aircraft in the air is, or is suspected to be , in such difficulties that there is a danger of an accident.

Local standby means when it is known that an aircraft has, or is suspected to have, developed some defect but the trouble would not normally involve any serious difficulty in effecting a safe landing.

Weather standby means when the weather conditions are such as to render a landing difficult or difficult to observe.

Unlawful acts means an action to be taken in the case of any unlawful act will be contained in the aerodrome's emergency and contingency plan, which will be drawn up with the local Police.

Off-aerodrome accidents means an emergency orders should contain details of the action to be taken in the case of aircraft accidents occurring outside the aerodrome boundaries.

9. Aeroplane Classification by Aerodrome Category

9.1 Aircraft categories

Table 1 provides guidance to the types of aeroplanes with its respective category. However the actual aerodrome category specifies under Civil Aviation Rule 139.59(a) may differ from the guidance provided in Table 1.

The actual aerodrome category will be determined after considering the nature, size and frequency of aeroplane movements (rule 139.59(b) and (c)).

Table 1 – Typical aeroplane types and the respective category

Airport Category 1	**Aeroplane**	**Over-all fuselage length (m)** ***0=L < 9***	**Maximum fuselage width (m)** ***W ≤ 2***
	Cessna 172 Skyhawk	8.2	1.0*
	Cessna 182 Skylane	8.84	1.07*
	Cessna 185 Skywagon	7.8	1.12*
	Gippsland Airvan G8	8.94	1.5*
	Piper Cherokee 6 PA32	8.44	1.3*
	Piper Seneca PA34	8.7	1.3*
Airport Category 2	**Aeroplane**	**Over-all fuselage length (m)** ***9 ≤ L < 12***	**Maximum fuselage width (m)** ***W ≤ 2***
	Cessna 206G Stationair	8.6	2.3
	Cessna 207A Skywagon	9.68	2.3
	Cessna 421 Golden Eagle	11.09	1.4
	Cessna Caravan 675 & 208	11.5	1.6
	Beech King Air C90B	10.8	1.37
	Britten Norman Islander BN2 & BN2A	10.86	1.09

	Piper Aztec PA23	250	9.5
	Piper Chieftain PA31 350	10.6	1.27*
Airport Category 3	**Aeroplane**	**Over-all fuselage length (m)** ***12 ≤ L < 18***	**Maximum fuselage width (m)** ***W ≤ 3***
	Beech 99 Airliner	13.58	1.40
	Beech 1900 D Airliner	17.63	1.40*
	Beech Premier I	14.02	1.68*
	Beech King Air 200	13.4	1.37
	Beech King Air 350	14.2	1.37
	British Aerospace Jetstream 31 & 32	14.37	1.98*
	Cessna Citation CJ1	12.98	1.47*
	Cessna Citation CJ3	15.61	1.43*
	Cessna Citation Encore	14.9	1.49*
	Cessna Grand Caravan	12.7	1.6
	Dassault Falcon 10	13.85	1.46*
	Dassault Fan Jet Falcon D, E & F	17.15	1.87*
	Hawker 400 XP	14.76	1.5*
	Hawker 800 XP	15.6	1.83*
	Hawker 125	14.45	1.80*
	Learjet 31, 45 & 60	14.83, 17.6, 17.8	1.62, 1.8, 1.95
	Nomad GAF 22, & 24A	12.57, 14.36	1.44
	Piper Cheyenne PA42	13.2	
	Twin Otter DH-6 & Srs 300	15.77	1.61
Airport Category 4	**Aeroplane**	**Over-all fuselage length (m)**	**Maximum fuselage width (m)**

		18 ≤ L < 24	***W ≤ 4***
	Airtech CN235	21.40	2.90
	ATR42 320 & 500	22.67	2.86
	BAe Jetstream 41	19.25	1.85*
	Bombardier Challenger 300	20.91	2.34
	Bombardier Challenger 604	20.85	2.69
	Cessna Citation Sovereig	19.37	1.7*
	Cessna Citation X	22	1.7*
	Dassault Falcon 900	20.21	2.34*
	De Havilland Dash 8 DHC-8 100 & 200	22.25	2.69
	Dornier 328	21.22	2.41
	Douglas DC3 Dakota	19.63	2.03
	Embraer Brasilia EM120	20.00	2.28
	Friendship F-27 100	23.56	2.70
	Hawker Horizon	21.08	1.97*
	Hawker Siddeley HS-748	20.42	2.46*
	Metroliner 23 & III	18.1	1.68
	Saab 340	19.65	2.3*
Airport Category 5	**Aeroplane**	**Over-all fuselage length (m)** ***24 ≤ L < 28***	**Maximum fuselage width (m)** ***W ≤ 4***
	ATR72 200, 210 , 500 & 600	27.17	2.86*
	BAe 146 100	26.16	3.56*
	Bombardier Challenger 800	26.77	2.69
	Canadair RJ	24.38	2.69
	Convair 440 & 580	24.67, 24.84	2.39*
	De Havilland Dash 8 DHC-8 300	25.68	2.69
	Embraer 145	27.93	2.28

	Frendship F-27 500	25.1	2.3*
	Grumman Gulfstream II	24.36	2.39
Airport Category 6	**Aeroplane**	**Over-all fuselage length (m)** ***28 ≤ L < 39***	**Maximum fuselage width (m)** ***W ≤ 5***
	Airbus A318	31.44	3.96
	Airbus A319	33.84	3.96
	Airbus A320	37.57	3.96
	Boeing 737 300	33.4	3.76
	Boeing 737 700	33.6	3.76
	Bombardier Global Express	30.3	2.69
	De Havilland Dash 8 DHC-8 400	30.48	2.69
	Grumman Gulfstream GIV	29.4	
Airport Category 7	**Aeroplane**	**Over-all fuselage length (m)** ***39 ≤ L < 49***	**Maximum fuselage width (m)** ***W ≤ 5***
	Airbus A321	44.51	3.96
	Boeing 737 800	39.5	3.76
	Boeing 757 200	47.32	3.7
	Boeing 767 200	48.5	4.7
Airport Category 8	**Aeroplane**	**Over-all fuselage length (m)** ***49 ≤ L < 61***	**Maximum fuselage width (m)** ***W ≤ 7***
	Airbus A300 600	54.1	5.64
	Airbus A310 300	46.66	5.64
	Airbus A330 200	59.0	5.64

	Airbus A340 200	46.06	5.64
	Boeing 757 300	54.5	3.7
	Boeing 767 300	54.9	4.7
	Boeing 787 800	56.7	5.77
Airport Category 9	**Aeroplane**	**Over-all fuselage length (m)** ***61 ≤ L < 76***	**Maximum fuselage width (m)** ***W ≤ 7***
	Airbus A330 300	63.6	5.64
	Airbus A340 300	63.6	5.64
	Airbus A340 500	67.9	5.64
	Airbus A340 600	75.3	5.64
	Antonov AN124	69.1	6.4*
	Boeing 747 100, 200 & 300	70.6	6.1*
	Boeing 747 400	70.7	6.1*
	Boeing 767 300		
	Boeing 767 400	61.4	4.7
	Boeing 777 200	63.7	6.19
	Boeing 777 300	73.9	6.19
	Boeing 787 9 - Preliminary Data	62.8	5.77
	Boeing 787 10 -Preliminary Data	68.3	5.77
Airport Category 10	**Aeroplane**	**Over-all fuselage length (m)** ***76 ≤ L < 90***	**Maximum fuselage width (m)** ***W ≤ 8***
	Airbus A380, A380F 841 & 861	72.8	7.14
	Antonov AN225	88.4	6.4*

*Approximate