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International Strategy for Disaster Reduction

International Fire Aviation Working Group

Fire Aviation Guidelines

incorporating the

International Manual of Common Rules for Fire Aviation

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Part 1

Framework document

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Part 1 Framework document

FOREWORD

Used effectively, aircraft can provide valuable support in wildfire prevention, mitigation, and suppression. However, it is important to remember that significant limitations and considerations are inherent to the use of aerial means.

Fire aviation operates in a dynamic and hazard-laden environment. Accordingly, safe and effective use of aircraft requires detailed pre-planning and quality management and support.

It is in the best interests of nations, fire management agencies, and aircraft operators around the world that fire aviation is conducted to a high standard. Furthermore, enhanced interoperability in fire aviation will open up more opportunities for effective sharing of these highly specialised, very capable, but relatively expensive resources. This will generate significant economic benefits and improve the resilience of nations and communities to the adverse effects of fire.

Since its establishment in 2010 the International Fire Aviation Working Group (IFAWG)[1] has made significant progress in the collection and development of material designed to support fire managers in building and maintaining safe and effective fire aviation capabilities; as well as providing guidance to aircraft operators in maintaining and supplying high quality and reliable services.

The production of these Fire Aviation Guidelines represents an important milestone in an ongoing process to enhance safety, elevate standards, and improve interoperability of this important capability. Importantly, IFAWG also hopes that the Fire Aviation Guidelines will assist nations around the world to more effectively share aviation resources.

The Guidelines are a living document that needs to be continually developed, reviewed and improved. IAFWG urges nations, agencies, and aircraft operators to continue to support and participate in the ongoing process of developing and improving them.

These Fire Aviation Guidelines can only be truly beneficial if nations and aircraft operators across the globe commit to adopting and incorporating their advice into their own doctrines.

The International Fire Aviation Working Group commends these Guidelines to you and strongly encourages nations, agencies and aircraft operators to take appropriate steps to adopt them.

We sincerely thank all those who have already contributed to this important work and we look forward to continuing to collaborate and cooperate across the globe to foster improvements in the world of fire aviation.

International Fire Aviation Working Group 2014

[1] The International International Fire Aviation Working Group (IFAWG) is a working group of the UNISDR Wildland Fire Advisory Group. More information is available at www.ifawg.org.au

DEFINITIONS, ACRONYMS AND ABBREVIATIONS

Effective international collaboration on any technical or emergency issue is dependent on the use of common language that is understood by all parties. A key to this is the use of widely agreed definitions, acronyms, and abbreviations.

Definitions

As fire aviation is a specialist area that uses terminology not commonly used in other aspects of fire management, some of the definitions cited below have been developed specifically for this document.

Where definitions have been taken from pre-existing glossaries they have been referenced as such. These include:

- **WFMT** – the FAO/Global Forest Monitoring Centre Wildland Fire Management Terminology (revised 2003)
- **FMVG** – FAO Fire Management Voluntary Guidelines (2006)
- **EGWF** – European Glossary for Wildfires and Forest Fires, EUFOINET, 2012
- **HNS** – European Community Host Nation Support Guidelines

*Note: Within each definition, words or phrases used that are themselves separately defined elsewhere in the Glossary are highlighted in **bold** type.*

Aerial Firefighting — The operation of an aircraft in support of activities associated with, or training for, suppression of fires. Aerial firefighting includes, but is not limited to:

- **firebombing**
- air attack supervision
- **aerial ignition**
- reconnaissance
- intelligence gathering
- mapping
- command and supervision
- transport of personnel and supplies; and
- delivery of personnel and supplies through specialist methods such as winching, parachuting and rappelling.

Aerial Ignition — Ignition of wildland fuels by dropping incendiary devices or materials from aircraft, for example by a helitorch (cf. delayed aerial ignition devices, serial ignition device, helitorch, ping-pong ball system). (WFMT)

Aerodrome — An area of land or water (including any buildings, installations or equipment) intended for use wholly or partly for the arrival, departure or movement of aircraft. It also includes, but is not limited to, a landing ground, landing area, airfield, airstrip, and helipad.

Aircraft Operator	The organisation responsible for operating an aircraft, including ensuring that it is airworthy. In most instances the aircraft operator will also provide the **flight crew**. The aircraft operator may be a commercial, government or military organization.
Air crew or Aircrew	Certified or licensed person responsible for any aspect of the operation of an aircraft in flight to achieve its objectives, including **flight crew**, cabin crew and any other crew persons such as winch operators or rappel supervisors.
Air Operators Certificate	The regulatory instrument, or equivalent, issued by the **Civil Aviation Authority** or military authority in the relevant **State** that authorizes the **aircraft operator** to conduct the required fire aviation tasks.
Civil Aviation Authority	The organisation responsible for regulating and enforcing civil aviation in the relevant **State**.
Crew Resource Management	A procedure and training system used primarily for improving air safety. It focuses on communication, leadership and decision-making in an aircraft.
Daylight	The period commencing at the beginning of civil twilight (dawn) and concluding at the end of civil twilight (dusk).
Dispatch Facility	A facility that receives requests from duly authorised personnel for aircraft to support fire related activities and makes arrangements for the appropriate aircraft to carry out the required tasks.
Emergency Response Plan	A written document which establishes the parameters and outlines the procedures to deal with an emergency situation.
Fire Agency	The organisation responsible for the conduct of the **fire management** activity for which aircraft are engaged. Usually this will be the organisation that requests or engages the aircraft. The Fire Agency will normally be a fire authority, forest or land management agency or a landholder or resource manager. The Fire Agency may also be the **aircraft operator.** *An official group or organization compelled and authorized under statutes of law, with the responsibility for controlling fires within a designated area or upon certain designated lands (WFMT)*
Fire Aviation	The operation of an aircraft in support of activities associated with, or training for, the prevention or suppression of fires, including **aerial firefighting** and planned burning for fuel management or ecological objectives.
Firebombing	The dropping of **fire suppressant** or **fire retardant** from an aircraft for the purposes of modifying fire behaviour. Firebombing also applies to the dropping of substances for training, demonstration and simulation purposes.

Firebombing Delivery System	The aircraft equipment and systems used to dispense **fire suppressant** or **fire retardant** in the conduct of **firebombing** operations, including tanks, belly tanks and underslung buckets. A Firebombing Delivery System incorporates its component parts including doors, gates, valves, venting systems, suppressant injection systems, system controllers and controller software.
Fire Management	The discipline of using fire to achieve land management and traditional land use objectives, together with the safeguarding of life, property and resources through the prevention, detection, control, restriction and suppression of fire in forest and other vegetation in rural areas. This involves planned as well as naturally occurring fires, and includes research and technology transfer (FMVG). *All activities required for the protection of burnable forest and other vegetation values from fire and the use of fire to meet land management goals and objectives. It involves the strategic integration of such factors as knowledge of fire regimes, probable fire effects, values-at-risk, level of forest protection required, cost of fire-related activities, and prescribed fire technology into multiple-use planning, decision making, and day-to-day activities to accomplish stated resource management objectives. Successful fire management depends on effective fire prevention, detection, and pre-suppression, having an adequate fire suppression capability, and consideration of fire ecology relationships (WFMT).*
Fire Retardant	**Fire retardant compound** or **fire retardant slurry** depending on the context in which it is used.
Fire Retardant Compound	A substance that is generally mixed with water and applied to a fuel to retard combustion by a chemical reaction.
Fire Retardant Slurry	A mixture of dissolved or suspended Fire Retardant Compound and water prepared for application from the air or ground.
Fire Suppressant	**Fire suppressant concentrate** or **fire suppressant solution** depending on the context in which it is used. Fire suppressant may also refer to water without any additives.
Fire Suppressant Concentrate	A substance that is generally mixed with water designed to reduce the surface tension of water and/or to hold water in suspension thus increasing water's efficiency as a fire extinguishing agent. Types of fire suppressant concentrate include Class A firefighting foam, water enhancers and long and short chain polymer gels.
Fire Suppressant Solution	A mixture of **fire suppressant concentrate** and water prepared for application from the air or ground.
Fixed Wing Aircraft	A heavier than air aircraft which obtains lift for flight by forward motion of wings through the air.

Flight Crew	Certified persons, such as pilots and flight engineers, who are responsible for manipulating aircraft controls in-flight.
Host Nation	A country that is receiving international resources deployed by other States or other nations *(adapted from HNG)*.
Incident Command System	A standardized emergency management system which is specifically designed to allow its users to adopt an integrated organisational structure equal to the complexity and demands of single or multiple wildfire incidents. An ICS provides a standard framework within which individuals and teams present at an incident can work together safely and effectively (EGWF).
Incident Management Organization	The group or body responsible for directly managing or commanding or controlling the response to an emergency incident or a planned fire event. A typical example would be an Incident Management Team or Incident Command Team.
Regional Coordination or Command Facility	A facility responsible for coordination or command of fire management activities in a defined geographic region. Normally the geographic region will be a part of a State. *Any facility that is used for the coordination of agency or jurisdictional resources in support of one or more incidents (WFMT).*
Rotary Wing Aircraft	A form of aircraft whose lift is produced by engine driven rotors.
Safety Management System	An integrated, systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures.
Sending Nation	A State or nation providing its resources to another State (adapted from HNG).
State Coordination or Command Facility	A facility responsible for coordination or command of fire management activities in an entire jurisdiction, such as a country.
State	An entire jurisdiction such as a country, province, or region that has its own government.
Team Resource Management	A procedure and training system which is used primarily for improving air safety and efficiency. It focuses primarily on communication, leadership and decision making and the effective utilisation of all available resources both within and outside of an aircraft.

Acronyms and abbreviations

AGL	Above Ground Level
CRM	Crew Resource Management
EGWF	European Glossary for Wildfires and Forest Fires (2012)
EUFOINET	European Forest Fire Network
FMVG	Fire Management Voluntary Guidelines FAO Fire Management Working Paper FM17E 2006
GPS	Global Positioning System
GFMC	Global Fire Monitoring Center
GWFN	Global Wildland Fire Network (Thematic Platform to the UNISDR)
HNG	European Community Host Nation Support Guidelines
ICS	Incident Command System
IFAWG	International Fire Aviation Working Group (under WFAG)
IWPM	International Wildfire Preparedness Mechanism (under WFAG)
RCCF	Regional Coordination or Command Facility
SCCF	State Coordination or Command Facility
SMS	Safety Management System
TRM	Team Resource Management
UNISDR	United Nations International Strategy for Disaster Reduction
WFAG	Wildland Fire Advisory Group (an advisory group to the UNISDR)
WFMT	FAO/GFMC Wildland Fire Management Terminology (2003)

1. INTRODUCTION

The application of aerial means to assist wildfire suppression and support the use of prescribed or managed fire may well be almost as old as aviation itself. Certainly the use of manned balloons for military reconnaissance was well established in Europe by the early 19th Century and it is difficult to imagine that the technique was not extended to support other areas of public safety.

With the rapid evolution of powered flight through the 20th Century a world of aerial possibilities opened-up to fire managers. From the mid-1950s in particular, the use of aircraft in fire management expanded rapidly across the world as more capable aircraft were developed and new firefighting roles were tested and validated.

More recently, increasing wildfire risks to communities and the environment associated with factors such as changing settlement patterns and unnatural fire frequency and scale, has driven significantly increased demands for aerial support in fire management.

Today, aircraft are extensively used to support firefighters and fire managers in many jurisdictions and play a wide variety of important roles. These include:

- directly or indirectly attacking a fire by dropping water or fire suppressants and retardants, for a range of tactical purposes;
- dropping incendiaries to ignite managed fires;
- transporting and delivering firefighters, stores and equipment to the fireground;
- providing command and communication platforms;
- providing fire detection and reconnaissance services;
- enabling sophisticated mapping and intelligence gathering to assist the management of fire and to provide high quality information to threatened communities;
- delivering warnings or evacuation orders to communities;
- supporting fire prevention and enforcement; and
- conducting fire damage assessments.

1.1. Background

While the rapid expansion of aerial fire management over recent decades has generated significant benefits, it has also come at a cost.

Aircraft operation is expensive and can potentially divert resources and funding from other aspects of fire management. It also requires specialised and intensive management, supervision and support to ensure it is conducted safely and effectively. Although not necessarily inherently dangerous, operating aircraft in an emergency environment has particular risks that must be closely managed.

Many countries which regularly experience significant wildfires have now established some form of aerial fire management capacity, or are moving to develop an appropriate capability.

Most States have recognised that it is not always sensible or cost-effective to attempt to establish capabilities that provide the necessary means to deal efficiently with every possible situation, and have realised that considerable benefits can accrue from effective cross-border sharing of high-cost, specialised resources such as aircraft.

While there have been many good examples of cross-border sharing of aerial firefighting resources, there have also been many instances where the effectiveness of shared aircraft was diminished or negated by a lack of common operating practices or deficiencies in their supervision and management.

Given this background, the International Fire Aviation Working Group (IFAWG) was established in 2010 as an advisory committee of the United Nations International Strategy for Disaster Reduction (UNISDR), along with the Wildland Fire Advisory Group (WFAG) and the Global Wildland Fire Network (GWFN).

The IFAWG is comprised principally of people with responsibilities in managing and coordinating the use of aircraft for fire management, including the suppression of wildfires, in countries and jurisdictions where aerial operations are commonly used for this purpose.

In May 2011, the IFAWG resolved to develop a set of international voluntary guidelines for fire aviation practices. The guidelines are intended to serve two fundamental purposes:

a. Support the development and management of appropriate, effective, high quality aviation capability through the provision of consistent advice to adopting States regarding recommended minimum standards and appropriate best-practices; and

b. Enhance effective sharing of aviation capabilities between states by:

   i. Developing common standards and operating practices for fire aviation, thus enhancing interoperability; and

   ii. Providing recommended procedures and supporting information for effective sharing of fire aviation resources.

1.2. The Fire Aviation Guidelines and the International Manual of Common Rules

These Fire Aviation Guidelines have been prepared by a core technical group and has included expert consultations with IFAWG member countries, private sector organisations, and non-governmental and inter-governmental organisations.

The Guidelines are comprised of **two Parts**:

a. **The first Part** is this Framework Document which provides background information and sets out a number of Core Principles intended to underpin the development of fire aviation doctrine. Flowing from these core principles

are a number of Basic Strategies that are recommended for adoption by all States that are developing or maintaining a fire aviation capability.

b. **The second Part** is the *International Manual of Common Rules for Fire Aviation (IMCR)*.

The IMCR also has a number of separate Sections:

The first two sections (Section A and B) provide an Introduction, Key Standards and Recommended Practices, along with some further detail required to implement the Core Principles and Basic Strategies, and sets out recommended doctrine for the development and maintenance of fire aviation capability.

Section C provides some recommended procedures for international deployments of aerial firefighting resources.

Finally, Section D of the IMCR is comprised of **Practice Guides** which provide even more detailed information and recommendations regarding specific practices or situations.

The IMCR is intended to be a living document that will be built upon and revised as operational and management procedures and practices are developed, improved or refined. It is also intended to be a stand-alone reference for field operations.

1.3. Objectives

The objective of the Fire Aviation Guidelines, including the IMCR, is to establish an agreed doctrine that:

a. ensures that aerial operations provide optimum, effective, and integrated support to organisations or agencies with fire management responsibilities;

b. ensures that support provided by aerial operations is as safe, effective, and as efficient as is practicable;

c. encourages and supports cross-jurisdictional co-operation and resource-sharing;

d. provides realistic benchmarks for States with already established aerial firefighting capabilities; and

e. provides guidance to States striving to establish aerial firefighting capabilities.

1.4. Scope

These Guidelines are intended to apply to:

a. landscape-scale fire management including all aspects of wildfire suppression, and the planned use of fire to meet fire prevention or ecological objectives;

b. all fire-related aviation operations including, but not limited to: firebombing, aerial ignition, reconnaissance, intelligence gathering, mapping, command, supervision, transport of personnel and supplies, and specialist activities such rappelling and winching.

1.5. Application

Nothing in these Guidelines prejudices the rights, jurisdiction and duties of individual countries under international law as reflected in international conventions and agreements. The principles, strategic actions, and guidance that they contain are intended to complement the fire management guidelines, policies, programs and regulations currently in use in the organisations, agencies and governments of individual States.

Although of a non-binding nature, it is envisaged that these Guidelines will be useful in facilitating the cross-border sharing of information and resources, particularly in response to emergency wildfire situations. States sending or receiving aviation-related resources may agree to require adherence to part or all of the Guidelines, or may incorporate the Guidelines in pre-planned bi-lateral and multi-lateral resource sharing arrangements.

Countries which lack a fully developed aerial fire management capability are urged to adopt the principles and strategic actions of these Guidelines to ensure that their fire aviation capacity evolves in a safe, effective, and efficient manner.

1.6. Voluntary nature of the guidelines

Compliance with the Fire Aviation Guidelines, including the International Manual of Common Rules, is entirely voluntary.

An individual State adopting the Guidelines may of course require compliance with all or part of the Guidelines in that particular jurisdiction. Similarly two or more States may forge a bi-lateral or multi-lateral agreement that require all or part of the guidelines to be complied with in particular specified circumstances.

1.7. Aviation legislation and regulation

The Fire Aviation Guidelines, including the International Manual of Common Rules, are intended to be complementary to any legislation that governs or regulates aviation in any State. Generally, the guidelines aim to provide guidance that would not otherwise be covered by legislation.

The Fire Aviation Guidelines are not intended to prejudice or contravene any laws or regulations that administer or regulate aviation in the State where aircraft are operating, or the State in which the aircraft are registered. Where a conflict may exist, the relevant laws take precedence.

1.8. Relationship to other instruments

As these Fire Aviation Guidelines have been prepared with input from members of the IFAWG representing a range of different nations, they are related to the handbooks, manuals and planning documents that have evolved to guide aerial fire management operations in those countries. However, as they are advisory in nature, they are not intended to prejudice or contravene any existing laws or regulations that administer or regulate aviation in any country or jurisdiction where fire aircraft are operating.

Where appropriate, it is recommended that States with fire aviation capability consider incorporating material from these Guidelines into their own handbooks, manuals and guidance documents. Similarly, it is recommended that Aircraft Operators providing fire aviation services incorporate appropriate provisions from these Guidelines into their own policy and procedure manuals.

Countries and aircraft operators with an already well developed fire aviation doctrine may find these Guidelines to be a useful checklist for ensuring their own material is suitably comprehensive.

These Guidelines are also complementary to the principles and strategic actions outlined in the broader FAO Fire Management Voluntary Guidelines (2006). This framework document deliberately follows a similar structure to the Fire Management Voluntary Guidelines which were prepared in compliance with a range of United Nations conventions and declarations, including those addressing climate change, desertification, and biological diversity; and the UN Millennium Declaration.

The Fire Aviation Guidelines are intended to be complementary to other mechanisms implemented or proposed for implementation in order to enhance sharing of resources, or to facilitate the exchange of knowledge and good practice in fire management. Whilst it is envisaged that these Guidelines will be promoted for independent endorsement and application by individual agencies and operators, it is also appropriate that they be incorporated into or referenced by other fire management collaboration initiatives and bi-lateral or multi-lateral cooperative agreements.

As far as practicable these Guidelines are consistent with and complementary to other publications that offer international operational guidance in fire and emergency management and resource sharing. Examples include the UNDAC Handbook (UN OCHA 2006), the Host Nation Support Guidelines (EU 2012), and the INSARAG Guidelines (UN OCHA 2012).

1.9. Diversity of contexts and special requirements

Compared to broader fire management considerations which embrace a highly variable contextual landscape, fire aviation requirements typically apply to States which have a relatively uniform need to deal with potentially extreme fire risks.

Nevertheless, within this high risk context there is considerable sub and cross-jurisdictional variation associated with environmental, land tenure, and social and demographic features which govern the way in which fire aviation capability develops and is used.

For example, the demand for firebombing capacity is most acute where fire-prone vegetation and landscapes intersect with urban development creating huge potential for severe human and material wildfire losses. On the other hand, aerial ignition capability is a higher priority in more remote regions with extensive landscapes of fire-prone vegetation requiring management primarily for fuel reduction or ecological purposes.

The manner in which fire aviation services are provided in the different countries also varies considerably. In some countries, fire aviation is undertaken principally by military organisations, while in other countries it is entirely a civilian undertaking. It is also not unusual for a combination of service delivery mechanisms to apply in a single jurisdiction. In certain countries the Fire Agency may also be the Aircraft Operator.

As such, it is recognised that the Fire Aviation Guidelines may need to be applied selectively or may need to be adapted to suit the needs of a particular State. In these situations, States are encouraged to ensure that the Core Principles and Basic Strategies outlined in these Guidelines continue to guide the development of their fire aviation doctrine.

States are also reminded of the need to ensure, as far as is practicable, that there are consistent operating practices for countries exchanging or sharing resources, and that operation of aircraft outside a “home” jurisdiction will normally demand the highest standards of expertise to assure safety and effectiveness.

2. CORE PRINCIPLES

2.1. Safety

As with all aviation, safety is a core principle of aerial fire management operations that must not be compromised. The preservation of human life is an overriding consideration which applies equally to the broader community as well as to air crew and fire-fighters.

2.2. Environmental sustainability

The use of aircraft to support fire management activities should be environmentally responsible and sustainable as far as is practicable.

This is achievable through the adoption of aerial fire management practices that minimise environmental impacts arising from aircraft use, including the safe handling of aviation fuel and chemical substances such as fire retardants and suppressants. It is reasonable to balance potentially adverse environmental impacts from aircraft use against the damage that may be otherwise incurred by uncontrolled wildfires or alternative suppression methods.

2.3. Efficiency and effectiveness

a. The use of aircraft in fire management should always strive to be as efficient and effective as is practicable. This requires comprehensive, high standard management and supervision, and operational planning that:

   i. recognises the limitations of aircraft;

   ii. recognises the comparative advantages of aircraft over other means;

   iii. prioritises aircraft readiness and rapid dispatch;

   iv. appropriately matches aerial resources with levels of risk;

   v. effectively integrates aerial operations with ground-based strategies; and

   vi. facilitates intra and inter-jurisdictional resource sharing where appropriate.

2.4. Knowledge-based continuous improvement

a. The use of aircraft for fire management must be underpinned by knowledge and should strive for continuous improvement. This involves:

   i. developing a structured program of research and development;

ii. fostering inter-jurisdictional cooperation and collaboration to facilitate knowledge sharing; and

iii. using quality-assured management systems that focus on risk assessment, accountability, continuous training and feedback.

2.5. Good governance

Safe, efficient and effective aircraft operations must be supported by documented policies, procedures, standards, and operating practices that are based on the best available knowledge, and are regularly reviewed and updated.

2.6. Legality

As with all aviation, a non-negotiable core principle of aerial fire management operations is that they must comply with the relevant laws and regulations of the State pertaining to the use of aircraft.

3. BASIC STRATEGIES

3.1. Operational safety

a. The operational safety of aircraft crew and fire-fighters is closely tied to public safety. Unless aerial fire operations are conducted safely, they are unlikely to be effective or efficient in managing wildfire threats.

Broad strategies that can optimise operational safety include:

i. developing a safety culture within fire agencies and amongst aircraft operators;

ii. a strong management commitment to safety amongst fire agencies and aircraft operators;

iii. provision of appropriate operational systems, processes and resources;

iv. adoption of operational risk management systems, including dynamic risk assessments;

v. a strong focus on learning through investigation of accidents and near misses;

vi. rigorous processes for the selection and appointment of aircraft operators;

vii. rigorous processes for the selection and appointment of personnel performing safety-sensitive roles;

viii. effective processes for assuring quality of services provided by aircraft operators; and

ix. continuous improvement through competency-based training.

3.2. Competent management, supervision and support

a. To be safe, efficient and effective, aircraft operations must be managed, supported and supervised by fully trained, competent people working for high-reliability organisations which utilise technologies and systems that address the potential for error. Common traits of such organisations include:

i. highly-trained personnel;

ii. ongoing personnel training;

iii. frequent process audits;

iv. a well-developed system of precautionary checks and counter checks to reduce the potential for mistakes;

v. an acceptance of responsibility and accountability for reliability; and

vi. a culture which acknowledges that errors are always a possibility.

b. Good management is underpinned by documented policies, procedures, standards, and operating practices based on the best available knowledge; and is supported by quality-assured management systems focussed on:

i. ensuring that high quality services are delivered in a consistently timely manner;

ii. ensuring that high quality service is maintained by a process of continuous improvement;

iii. controlled documentation; and

iv. providing a level of compliance assurance and comfort to the "customer", including external scrutiny (given that the customer is often a government fire agency expending taxpayer funds).

c. Examples of effective support systems are:

i. an Incident Command System (ICS);

ii. competency standards; and

iii. accredited training systems.

d. The capability for competent management is indicated by:

i. acting appropriately with regard to when and where aircraft are to be used, and using tools that can assist management decision-making;

ii. investing appropriate funds into developing an aerial fire management capacity with the aim of avoiding wastage, excessive use or developing an unwarranted excess capacity;

iii. constant analysis of benefits and costs;

iv. using continuous improvement feedback loops to analyse actual performance against expectations; and

v. sharing resources, as required, to address surges in demand.

3.3. Efficiency and effectiveness

a. Recognising advantages and limitations

Although aerial firefighting is an effective wildfire suppression tool in many situations, there are significant operational limitations and circumstances where aircraft use will be unsafe, ineffective, or unwarranted. These circumstances may include, for example:

i. fires burning with severe intensity;

ii. fires burning under extreme weather conditions;

iii. fires burning in terrain that is operationally difficult to access;

iv. fires burning in terrain that is contaminated by unexploded ordnance (UXO), land mines or radioactivity;

v. fires where control objectives have already been achieved; and

vi. fires where sufficient alternative lower cost resources are available.

b. Operational limitations may include, for example:

i. meteorological conditions that limit or adversely affect the operation of the aircraft, such as high temperatures, significant turbulence or low visibility;

ii. lack of daylight;

iii. landing area or aerodrome limitations;

iv. orographic conditions and terrain;

v. legislative or regulatory restrictions including those placed on the aircraft, aircraft operator and air crews;

vi. uncontrollable conditions including collateral threats arising during times of political tensions or armed conflicts;

vii. insufficient qualifications, experience and skill of air crews;

viii. insufficient availability of essential systems such as communications; and

ix. insufficient quality of supervision and support.

Limitations may also prevent the transit of aircraft to the operating area even if conditions are satisfactory at the destination.

Acknowledging these limitations is a key to safe and effective aerial fire operations, and dictates that aircraft must be matched to the particular situation for which they are best suited. It is therefore beneficial to have a mix of aircraft types readily available to suit different circumstances.

Fire management organisations need to recognise these issues and implement appropriate plans and practices to account for the respective advantages and limitations of different aircraft when allocating resources to wildfire incidents.

c. Prioritising readiness and dispatch

Maximising the benefits of fire aviation largely relies on the major competitive advantage of aircraft to access wildfires much quicker than ground-based forces. By helping to restrict fires to a small size, aircraft use can avoid the need for more expensive suppression costs and reduce the cost of environmental damage.

Similarly, where aircraft are used to gather information and intelligence, the maximum benefit will be achieved if knowledge is obtained and provided as early as possible to the Incident Management Organisation and affected communities.

Accordingly, the benefit-cost ratio of aerial firefighting is optimised by giving a high priority to initial attack capability and rapid dispatch. This is aided by:

i. pre-positioning aircraft to enable rapid response to the highest risk geographic areas during predicted periods of heightened fire risk; and

ii. the capability to reliably assess the risks associated with an outbreak so as to make appropriate, timely decisions that activate an appropriately measured response.

d. Matching resources to risks

Aircraft use in fire management must be based on thorough and accurate assessments of the attached risks bearing in mind that it is generally neither possible nor efficient to have all potentially required resources available at all times to meet all potential wildfire scenarios.

Risk assessment is a fundamental principle underlying the preparedness of fire-fighting agencies or organisations. Resourcing levels should be dynamic and varied as far as practicable in accordance with the predicted wildfire risk or threat.

Risk assessment systems and decision-support tools for the allocation of aircraft resources should not be developed independently of the tools and systems used for all aspects of wildfire mitigation.

e. Integrating with ground-based strategies

The overall effectiveness of aerial operations in improving fire management outcomes is reliant on them complementing ground-based operations, particularly during wildfire suppression. Broad strategies that can facilitate effective integration with ground-based activities include:

i. good communication systems based on reliable, state-of-the-art technology;

ii. realistic strategic planning based on aircraft capabilities and limitations, including during wildfire suppression;

iii. the use standardised incident management structures such as ICS;

iv. well trained personnel who understand each other's roles; and

v. well trained fire managers with the capability to effectively integrate the safe use of aircraft into fire-fighting operations.

3.4. Knowledge-based improvement

Continuing research and cross-jurisdictional knowledge-sharing is vital if fire management is to advance with new knowledge, tools and technologies.

a. Research and development

A structured program of research and development is essential to support the safe, efficient and effective use of aircraft in fire management, and to improve standards and outcomes.

This would include analysis of the efficacy of past aerial operations both in terms of fire-ground outcomes, and economic effectiveness measured by cost-benefit analysis. The provision of such evidence-based knowledge can support decisions such as when and how to use aircraft, what types of aircraft should be used, and to what extent should they be used.

A key part of this will be the development of effective knowledge management protocols by fire agencies so that operational records of aerial fire management resourcing, conditions, and outcomes are stored and archived for ongoing analysis.

b. Communication

A critical element of facilitating knowledge-based improvement is providing effective pathways for new research and/or improvements in operational practices to be disseminated to where it is most needed. Such pathways are needed both within agencies and between agencies, including across jurisdictional boundaries.

3.5. Cooperation and collaboration

a. The capability to maintain and improve the effectiveness, efficiency, and safety of fire aviation is also reliant on cooperation and collaboration with other organisations and agencies both within and across jurisdictions.

This can include:

i. exchanging knowledge and information (from operational experience or formal research);

ii. sharing aircraft resources, personnel resources, or auxiliary systems in order to provide additional support or surge capacity in times of need; and

iii. reducing costs through cooperative equipment and support system purchasing, or through collaborative research and development.

b. Strategies to facilitate this include:

i. establishing bi-lateral or multi-lateral resource sharing arrangements supported by formal agreements;

ii. implementing effective resource sharing mechanisms, either for mainstream (regular) resource sharing or for sharing resources in emergency and disaster situations;

iii. developing and adopting common standards and practices;

iv. formalising the regular exchange of information;

v. developing arrangements for exchange of operational personnel in planning and development phases, as well as during operational phases;

vi. arranging or participating in programs to provide advice and support to countries that are in the process of developing a fire aviation capability; and

vii. actively participating in cross-jurisdictional bodies such as the IFAWG and mechanisms such as the IWPM[2].

[2] International exchange of knowledge and expertise in wildfire preparedness is facilitated by the International Wildfire Preparedness Mechanism (IWPM), which has been set up as a co-ordinated effort with these guidelines. More information on the IWPM may be found at www.fire.uni-freiburg.de/iwpm/index.htm

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