Study on wild fire fighting resources sharing models

Final report

October 2010

A report to DG ECHO, European Commission

European Policy Evaluation Consortium (EPEC)
Brussels contact address: 146, rue Royale – B-1000 Brussels
Tel: +32 2 275 0100 Fax: +32 2 275 0109
E-mail: contact@epec.info URL: www.epec.info

Contact name and address for this study:

Andrew Jarvis, Principal
E-mail: andrew.jarvis@ghkint.com
Tel: +4420 7611 1100; Fax: +4420 3368 6900
GHK Consulting,
Clerkenwell House,
67 Clerkenwell Road
London EC1R 5BL.
United Kingdom

Study on wild fire fighting resources sharing models

Final report

A report submitted by GHK Consulting on behalf of the
European Policy Evaluation Consortium

19 October 2010

Document control

Document Title	Study on wild fire fighting resources sharing models : draft final report
Job No.	30257478
Prepared by	Gabriel Pierard, Andrew Jarvis
Checked by	ARJ
Date	19/10/2010

Contents

1 Introduction

1.1 This report

This is the final report of a study on wild fire resourcing sharing models carried out by the EPEC consortium on behalf of DG ECHO (Humanitarian Aid and Civil Protection)[1]. The project team was provided by GHK Consulting[2], working with the ad-hoc support of two external experts, Mr Mark Jones, Chairman of the CTIF (International association of fire and rescue service) Forest Fires Commission, and the Professor Johann Goldammer, Head of the Global Fire Monitoring Centre (GFMC), at Freiburg University, Germany), as well as experts from EU Member States .

1.2 Purpose of the assignment

The objectives of the study were:

- To analyse the systems for sharing assets for wildfires and forest fires that have been put in place in 5 different non-EU countries. The system descriptions should include at least:
  - General organisation and arrangements for the sharing of aerial fire fighting resources and for collective governance of such resources at international / bilateral and national / regional levels;
  - An inventory and description of all key players at different levels (authorities, bodies, entities) in the five case studies, involved in the preparedness and response to forest fires;
  - Procedures regarding the decision-making in case of conflicting needs, the activation and Standards of Operations of the assets
  - Ownership of the assets
  - Financial arrangements, including insurance-related issues;
  - Training, lessons learnt and exercises; and
  - The process of development of these systems and lessons learnt in the process;
- To compare those systems among each other, in order to look for good practices and lessons to be avoided, by looking in particular at the degree of integration in terms of ownership, sharing and/or controlling of aerial fire fighting resources.
- To propose options that could improve the European arrangements.
- To make an assessment of the advantages and disadvantages of the proposed options, if applied at EU level, including economical efficiency (taking into account both financial and economic costs and benefits of these options).

1.3 Content and structure

This report is structured as follows:

- Chapter 2 sets out an overview of the current EU situation regarding the sharing of aerial firefighting assets and provides an outline 'problem definition' by profiling the

[1] Contract Ref: No 07405/2009/55218/FRA/A3 implementing Framework Contract No BUDG 06/PO/01/Lot 001/ABAC-101931 lot 1

[2] Details of GHK are provided at www.ghkint.com

current system's vulnerabilities and risks. It describes the core components of the EU system and considers the strengths and weaknesses of present arrangements;

- Chapter 3 describes the arrangements in place in five countries around the world for the sharing of such assets within their own borders and with other countries. It provides a summary of the key lessons drawn from the study of these five systems; an overview table of the key features of these systems as well as outline descriptions of the systems for sharing these assets and a graphical representation of each country's governance model;
- Chapter 4 draws on the two preceding chapters to identify options that could help to address the challenges that the EU faces, based on lessons of experience in the five case study countries. In accordance with the terms of reference of this scoping project, our focus here has been to generate ideas that take inspiration from the overseas case studies. The issues raised by the options are discussed and costs identified where possible.
- Chapter 5 provides concluding remarks.

The appendices to this main report, respectively present:

- details of international lease costs for Canadair water bombers (Annex 1);
- information on the aerial firefighting assets of selected states participating in the EU Civil Protection Mechanism (Annex 2);
- data on international fleets and markets for aircraft used in firefighting (Annex 3);
- details of potential aircraft lease arrangements (Annex 4);

The full case studies – on USA, Canada, South Africa, Australia and New Zealand - are separately bound in a second volume. The case studies analyse the situation of each country in terms of:

- Wildfire trends and policy responses (Part 1);
- Key actors, governance; and operations (Part 2);
- Asset ownership, contracting and procurement (Part 3);
- Decision-making procedures and SOPs (Part 4);
- Financial /cost-sharing arrangements (Part 5);
- Training (Part 6); and
- Lessons learnt from the development and operations of these systems (Part 7).

That separate volume also contains:

- details of the individuals who contributed to the overseas case studies and also the consultees in the Participating States who advised on the EU situation;
- a description of the study methodology;
- an example of the questionnaire used during the research phase.

2 The context to this study

2.1 Introduction

Many countries within the European Union, especially those in the south, face an ongoing threat from wildfires. The number of large forest fires has been increasing – a trend attributed variously to climate change, protracted droughts, the abandonment of large tracts of land in the Mediterranean countries and the expansion of the wildland-urban interface[3].

Experience of recent years, including the severe fires of the summer of 2007, has shown how wildfires continue to damage lives, infrastructure and the natural environment. The scale of response needed to deal with large fires often exceeds national capabilities. When asked, Member States have been quick to offer assistance to others in the form of aircraft, aircrews and other support to help tackle wildfire emergencies. But events have also demonstrated the limitations of current arrangements – in terms of the capacity of the aerial assets available within the EU to provide help where it is needed, the speed of deployment, and the efficacy of those assets when deployed against wildfires.

Significant progress has been made through bilateral cooperation for wildfire fighting among the most severely affected countries, and in building capacity at EU level for the monitoring of fire risks and coordination of response. Yet it is clear that Europe could do better. By harnessing the spirit of solidarity that underpins existing cooperation, and building on the foundations laid by Member States and the European Commission, there is the potential to construct a more effective and efficient system for the benefit of the EU citizens and recipients of EU assistance elsewhere.

The Treaty of Lisbon, which came into force in December 2009, established the area of civil protection as a formal policy area in the EU[4] for the first time. Civil protection is now defined as an area of 'support competence', that is, an area where the European Union can support, coordinate or supplement the actions of the Member States[5].

In that strategic context, and in view of the wildfire fire risk management issues discussed above, the European Commission is now working towards the development of proposal for building a more effective wild firefighting capability in the EU. The purpose of this study is to provide evidence and analysis to support that effort and inform the ensuing dialogue by:

- looking at how similar issues have been addressed in other countries beyond the European Union;
- evaluating the strengths and weaknesses of those arrangements; and
- using that analysis, together with evidence from the EU, in the development and appraisal of options for possible consideration in the improvement of the EU's aerial capability to tackle wildfires.

Many countries around the world have had to consider how best to organise the resources they have for fighting wildfires. Aerial assets – aeroplanes, helicopters and the associated equipment and supporting infrastructure – present a particular challenge as they are only in active use for a part of the any given year, are often specialised in design and tend to be costly to purchase and to operate. Sharing such resources within a country and between countries is a logical way of reconciling the twin objectives of providing an aerial means of attack against wildfires and prudent financial management.

[3] Over the period 1971-2000, the annual number of forest fires has increased visibly, from 40,000 on average in 1971-1980 to 95,000 on average in 1991-2000. The increase has been particularly noticeable in the 1990s (source: FAO and Freiburg University). The surface area burnt has not increased at the same rate.

[4] with a specific article, Article 196 'Civil Protection'

[5] See Article 2(5) and 6(f) TFEU.

In the EU, individual Member States have responsibility within their own territorial jurisdictions for managing wildfires. They manage their own assets and follow their national command systems. The European Commission provides support and operates as a coordinator among the Member States. There are also *ad hoc* bilateral agreements between countries for fire suppression activities.

The study is not concerned with Member State's domestic civil protection arrangements and does not make recommendations on national systems or expenditure. Our focus is on the European level and how to build a system that meets the agreed civil protection objectives for the EU as a whole. To that end, the research has focused on the systems that have been developed overseas for the sharing resources between nation states and among the different jurisdictions of large federal states. We have examined the systems operating in five countries: the USA; Canada; Australia; New Zealand and South Africa. Collectively, the experience gained in these countries provides some useful lessons and ideas for the EU as it seeks to manage its own civil protection priorities.

The remainder of this chapter provides an overview of current institutional arrangements in the EU for civil protection and wildfire management. It is not intending to be exhaustive, but rather to highlight the key infrastructure and issues, and to set out a high level analysis of the strengths, weaknesses, opportunities and threats associated with the present system in the context of the wildfire threat that the EU faces. It provides a reference for comparison with overseas examples and for the development of possible improvement options.

2.2 The European Union Civil Protection Mechanism

In the 1980s and 1990s there was some exchange of expertise on firefighting within the EU but little in the way of formal cooperation. The Community Civil Protection Mechanism (now known as the European Union Civil Protection Mechanism, or the Mechanism), was established in 2001[6] and further strengthened in 2007[7]. It provided a new capacity for coordination for Europe. It now plays a central role in the EU forest fire risk prevention and forest firefighting coordination at EU level. There are currently 31 countries participating in the Mechanism – the 27 Member States of the European Union (EU) together with Iceland, Liechtenstein, Norway and Croatia[8]. In this report these are referred to collectively as the 'Participating States'.

The Mechanism, which is managed by the European Commission, has tools to cope with wildfires in three phases of the disaster management cycle. The main responsibilities and the tools allocated to the European Commission are outlined here under headings of (i) monitoring and prevention, (ii) preparedness and (iii) response.

2.2.1 Monitoring and prevention

The core body in the operation of the European Union Civil Protection Mechanism is the Monitoring and Information Centre (MIC). The MIC's three major roles are:

- to provide a coordination platform for exchange of requests for assistance and offers of resources among Participating States;
- to be an agent for information exchange and dissemination on natural and man-made disasters worldwide and the Mechanism interventions;
- to be a coordinator that identifies gaps and develops solutions on the basis of the information it receives, and facilitates the pooling of common resources where

[6] Council Decision of 23 October 2001

[7] Council Decision 2007/779/EC, Euratom

[8] The presence of non-EU countries explains the use of the phrase 'Participating States' rather than 'Member States' in this document and elsewhere.

possible, and supplies expert teams in the field of disaster to tackle the problems more effectively.

The Common Emergency Communication and Information System (CECIS) facilitates coordination between the MIC and national authorities. The main tasks of CECIS include hosting a secure and reliable database on potentially available assets for assistance; handling requests for assistance on the basis of these data; and facilitating the exchange of information and documenting all action and message traffic.

The MIC receives fire risk assessment information from the European Forest Fire Information System (EFFIS). This web-based platform, which consists of a scientific and technical infrastructure, was developed jointly by the European Commission Joint Research Centre and Directorate General Environment (European Commission).

2.2.2 Preparedness

The EU Civil Protection Mechanism intermediates dissemination activities and exchange of best practice among Participating States and provides training programmes and exercises to intervention teams. It organises informative activities, seminars, conferences and pilot projects on the main aspects of interventions.

It also provides access to the assets in the European Union Forest Fire Tactical Reserve (EUFFTR), a pilot project designed to step up cooperation between Member States on combating forest fires during high risk seasons. The project, to which two Canadair CL-215 aircraft were allocated during the summers of 2009 and 2010, was activated in the cases where Member States were not in a position to provide assistance to a requesting country due to their aerial resources being needed in their own territory or because they could not reach the fire site quickly enough.

The Mechanism develops implementing rules for module development and administers the CECIS module database.

2.2.3 Response

Through the EU Civil Protection Mechanism, the European Commission is able to:

- Mobilise small teams of experts to the site of an emergency;
- Provide and distribute information during an emergency/intervention;
- Play a facilitating role in the coordination of assistance requests and offers from Participating States
- Coordinate with other actors at the international level and with other EU services; and
- Provide co-financing for the transport of assistance to the affected areas, on the request of the offering Participating States.

The EU Civil Protection Mechanism is well-accepted and increasingly used by Participating States. Twenty-eight requests for assistance were received by the MIC in 2009 – 10 from the EU and 18 from third countries, compared with just three in total in 2002. The Mechanism coordinates and facilitates voluntary efforts - each Participating State decides on its contribution on an *ad hoc* basis.

Currently, the majority of the requests receive responses because Participating States are willing to help. There are, however, a number of shortcomings to be addressed if the efficiency and the effectiveness of aerial assistance for wildfire fighting are to be increased.

The Mechanism facilitates as well the process of drawing lessons after each intervention, and respectively after each fire-fighting season. The organisation of weekly video-conferences with the Southern Participating States, prone to forest fires and owning aerial forest fire fighting assets, and of lessons learnt meetings with all Participating States feeds into the organisation of the consequent operations.

2.3 The strengths and weaknesses of current EU arrangements

The current EU arrangements:

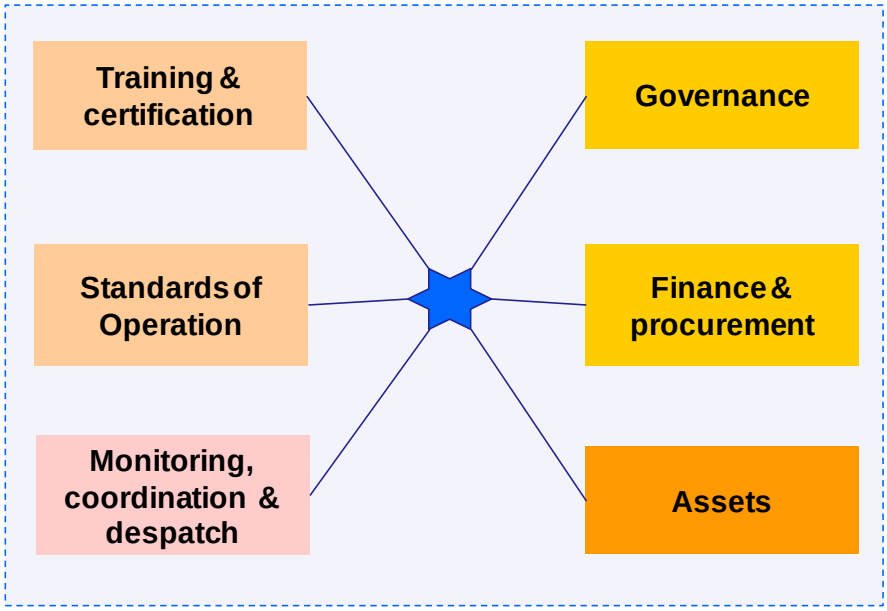
- Are 'light touch' and flexible;
- Have evolved in response to user needs and have seen an increased level of asset sharing over time;
- Have provided a means of organising responses in a way that engages with Participating States' willingness to help one another on a voluntary basis on principles of mutual reciprocity, strengthening social solidarity among the States.

But the current system faces a number of challenges and has some acknowledged weaknesses. It is limited in capacity and relies on a voluntary model for donation of assets rather than having access to a dedicated pool of resources (i.e. aircraft and suitably trained crews). There is the risk that it will be unable to respond when there are multiple simultaneous emergencies. It tends to be considered by Participating States as a 'system of last resort', to be called upon only at the moment when national capacities are exhausted (a consequence of this paradigm being that Participating States often wait too long to call for the assistance of the MIC). It is not clear whether it represents the most cost-effective way for the Participating States to secure access to specialist aerial firefighting capacity.[9] Finally, there are questions about how effectively resources are shared and used when they are deployed due to lack of: coordination on site between international and local intervention teams; specific forest fire-fighting training; host nation support and interoperable systems.

The rapid appraisal that follows is structured around the highly simplified model of firefighting aerial asset sharing arrangements shown in Figure 2.1. This has six components: aerial assets; finance & procurement arrangements; a governance model; standards of operation; a monitoring, coordination and despatch component; and, finally, training and certification.

[9] No P&L (profit and loss) account has been established by MS, but there is a feeling that receiving and providing assistance are balanced over time.

Figure 2.1 A simplified system model for the sharing of aerial firefighting assets



2.3.1 Standards of operation

The countries participating in the EU Civil Protection Mechanism operate 31 different standards of operations (SOPs). Variations in operating procedures create practical barriers to the creation of a fully effective firefighting mechanism in the EU.

When a country offers its assistance, its pilots might legitimately expect to be immediately integrated in the host country aircraft fleet being used to tackle the wildfire. But research has shown how differences in standards of operations and poor coordination can result in aerial assets being deployed to little or no effect. This was highlighted in interviews conducted under this study and the expert workshop convened for the project on 13 April 2010[10]. The 2007 and 2009 fires in Greece illustrated that, even when aircraft are available, a fire situation will not be controlled if these assets are not properly used.

The level of host nation support to incoming fire crews matters, as does the compatibility of command systems. In contrast to most disasters (earthquakes, flooding, etc.) there is usually a degree of normality and a functioning infrastructure in the countries affected by wildfires beyond the area immediately affected. In principle it therefore ought to be easier to standardise the host nation support for wildfires fighting than for other disaster situations.

2.3.2 Training & qualifications

At present there are no formal EU-sponsored schemes for training personnel from different Member States in how to work effectively together when aerial assets are shared between countries, either in the form of training courses, simulations or 'live' exercises.

[10] The workshop had been convened in support of the study to present the preliminary lessons to be learnt from overseas, but also to improve the understanding of the study team of the situation and 'problem' in the EU – i.e. the environment within which the options would be applied. This was not formally part of the terms of reference for the study but evidence had been gathered in the course of the study, and it was thought that a consensus on the key issues at the workshop would help in providing a baseline for option development.

Some interaction of this kind took place among the FIRE 5[11] countries. Some work has, for instance, already been undertaken in terms of training certification by France, Italy, Spain, Portugal and Greece as well as Malta (harmonising training; maintenance qualifications; renewing the knowledge of pilots of water scooping points, etc.). Studies have been undertaken on the levels of equivalence of training in the framework of this group. There are also small-scale initiatives such as the Eurofire competency standards for ground-base fire management developed under the Leonardo programme as a potential model of competency-based aerial firefighting standards[12].

However, these FIRE 4 / FIRE 5 training exercises have been mainly dedicated to the use of terrestrial firefighting and there is a case for enlarging the framework to the EU as a whole. There have been two combined exercises in the last six years, but there is no joint training on aerial firefighting. In addition, when the topic of use of aerial assets has been mentioned during training events, this was more related to the safety of participants than towards common standards of operations. Experts consulted in the EU have stressed that there would be merit in reducing the terrestrial component and reinforcing the aerial aspects of these exercises.

The EU does not have specific and common qualification requirements for pilots of aircraft used for fighting wildfires, nor does it have a common 'doctrine' on forest fire fighting (e.g. aggressive initial attack). As such there is no simple means of certifying and recognising those individuals who have skills and experience required to make effective use of such aircraft in tacking wildfires.

Some work on training and equivalence of experience has been done by the FIRE 5 group which has documented the different levels in the training of ground forces for France, Spain and Portugal, Italy and Greece. A table of equivalence shows the number of hours necessary to train staff at different levels (e.g. tactical directors, operations directors and leaders, team leaders, rescue officers and fire fighters). The group has also produced a table showing the equivalence of the different political levels of the FIRE 5 group, and of the different levels of command and coordination in those countries. This work maps and relates the various country structures (notably the political and operational chains of command), but does not mean that qualifications have been harmonised.

2.3.3 Monitoring, coordination and despatch

The rules for dispatch and utilisation of aerial assets differ among Participating States. In addition, within each Participating State, such rules are defined by different kinds of authorities. In France they are fixed by the COGIC (the Centre Opérationnel de Gestion Interministérielle de Crises, the French operational centre for crisis management), whereas in Italy the aerial assets are engaged by SOREM, a state-owned company that is the official operator of fire fighting aircraft for the Italian Civil Protection Agency.

Rules of engagement often differ for the same aircraft, even within the different members of the FIRE4 / FIRE 5 group. For instance, national authorities have fixed different operational standards for Canadairs. These different rules are not necessarily known by the commander of the rescue operations in the host country (although they have to be known by pilots).

Some Participating States also suffer from a lack of sufficient infrastructure outside metropolitan areas, which impedes efficient deployment of aerial resources. Likewise, those countries also lack sufficient capacity in aerial evacuation and treatment of burn victims.

[11] FIRE 5 is a regional initiative of countries, gathering five Mediterranean countries amongst the most affected by forest fires (i.e. Spain, Portugal, France, Italy and Greece); its aim is to work towards the standardization of training and operational procedures for ground and aerial wildfire fighting. Initially, there were only four countries - the FIRE 4 group, comprising Spain, Portugal, France and Italy. FIRE 4 and its continuation - FIRE 5 - are two projects co-financed by the European Commission, under the Civil Protection Financial Instrument.

[12] http://www.fireparadox.org/fp1/spip.php?article55

The MIC acts a communication hub for emergency relief operations and provides a coordination platform for requests and offers of assistance for the EU as a whole. It provides a communication centre that facilitates access and information sharing and which decreases administrative burdens for the affected country, making the whole system more efficient. The MIC disseminates updated information on early warning alerts regarding natural disasters worldwide as well as for Mechanism interventions.

The MIC has to be in a position to assess needs, which it does through an EU-level incident management system. As mentioned above there is a lack of an EU-wide recognised standard for incident management as well as areas for improvement in the existing European wildfire danger and risk rating systems (i.e. towards systems that are well populated and benefit from a high level of resolution).[13]

Consultations suggest that decisions on dispatching aircraft tend to be politically, rather than technically, driven. There is a case for dispatch of aerial resources for wildfire fighting to be made, or at least endorsed, by technical experts or 'implementing agents' that have technical firefighting experience. This might also allow for less 'political' reviews and lessons learnt exercises after fire incidents and a more open analysis of the efficacy and cost-effectiveness of aerial responses.

2.3.4 Assets

There is a history of bilateral asset-sharing for fire suppression within the EU, particularly among certain southern Member States. A more developed structure for sharing of aerial assets has been provided in recent years by the EU in the context of the EU Civil Protection Mechanism. The MIC facilitates assets sharing through the Mechanism at two levels. First, it helps to balance demand and supply. This includes identifying needs gaps and developing solutions on the basis of the information it receives, and facilitating common resource pooling where possible. Secondly, in the field, in third country emergencies, the MIC can deploy assessment and coordination teams to identify how problems could be tackled more effectively.

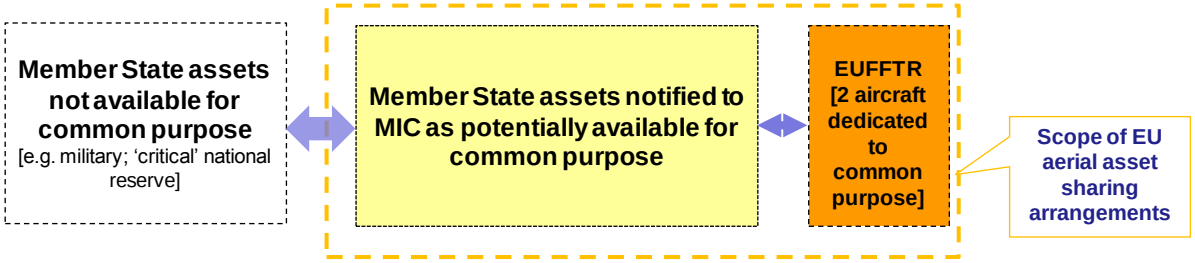
Member States have national aerial firefighting capability which, depending on the country, is generally provided by a mix of state-owned and leased aircraft that are specifically designed for firefighting or adapted for that purpose. Call-when-needed contracting during 'peaks of danger' is used in several countries. In 2008, for instance, France leased heavy helicopter water bombers. There are signs that Participating States are also trying to avoid incurring the opportunity costs of assets standing idle by acquiring more versatile aircraft. As an example France has acquired Dash 8 aircraft (originally designed for the transportation of passengers, these have a large capacity and can be used for the passenger transportation outside of the fire season). France uses them for other assignments of the Ministry of Interior (e.g. they have been used in the aftermath of Haiti's earthquake to transport rescue crews and materials and then to evacuate wounded people to Martinique).

[13] The EFFIS system, the European system of fire danger monitoring, is one of the best developed systems of its kind in the world. There is nonetheless interest in achieving further improvements, in e.g. with respect to mapping of burnt fire perimeters and the monitoring the size of fires. Challenges to achieving this include frequency of satellite paths, which influence the resolution and rate of renewal of information/ data input. Obtaining a higher resolution would only possible with a lower frequency of information update (notably because it is necessary to wait that the cloud coverage/the smoke dissipates after a fire, in order to obtain a clear view of the affected ground). For fire danger ratings, the information relies on weather data rather than satellite data. There are three levels of spatial resolution of fire danger data. 50 km and 30 km (updated every six days) used to be the standard resolution. 7km spatial resolution is in test phase, with maps updated every three days. No country works at a higher resolution than 7 km.

There is a debate about whether there are enough forest fighting aircraft in the EU. For some, the August 2007 wildfires in Greece, and the July 2009 situation in several Mediterranean countries[14] seemed to highlight a shortage of resources. The need for a higher capacity and availability arises in particular when forest fires break out in more than one state at the same time. In order to tackle this problem, there have been calls for aerial resources to be increased. Conversely, the Italian proposal made in April 2010 for reinforcing the Mechanism coordinating role for forest firefighting was based on the proposition that the problem is not that of a lack of resources, but rather an inefficient use of the assets that do exist. This view has been supported by several experts, notably in France. Technical capacity issues (e.g. lack of twin-engine water-bombers) and staff shortages can also limit Participating States' capacity to guarantee aircraft deployment.

Additional, 'common purpose', capability has been available over the past two years in the form of two Canadair water bombers. These were leased by France on behalf of the European Commission over the summer fire season and stationed in France. They have been available to service requests channelled through the MIC, to help tackle fires in any Participating State (with no possibility of deployment to a third country). This common purpose capability has been made available within a pilot project, the EUFFTR[15], an evaluation of which will be produced later in 2010.

Figure 2.2 Schematic representation of the EU aerial firefighting assets in 2009 and 2010 (with EUFFTR pilot project in operation)



Within the Mechanism, a modular approach has been developed with respect to assets that may be deployed during an emergency response operation, with the aim of helping planning and logistics (as component assets are predefined) and of enhancing interoperability. According to the Commission's Decision 2004/277/EC, Euratom[16] as amended by Decisions 2007/779/EC, Euratom, and 2010/481/EU, Euratom, two types of aerial forest fire fighting modules are defined: one using helicopters and one with airplanes. The helicopter module includes three helicopters with a capacity of 1.000 litres each with crew, guaranteeing that at least two helicopters are operational at any time. The airplane module using includes two aircraft each with a capacity of 3.000 litres, and a minimum of three crews. Two more types of forest fire fighting modules have been added to the list, as Decision 2010/481/EU, Euratom was published. These refer to (1) ground forest fire fighting module and (2) ground forest fire fighting using vehicles. Both will include sufficient human resources for continuous

[14] Wildfires broke out across France, Greece, Italy, Spain, and Turkey in July 2009. Strong winds spread the fires during a hot, dry period of weather. At least eight people died, six in Spain.

[15] The European Union Forest Fire Tactical Reserve (EUFFTR) is a pilot project, established in the summers 2009 and 2010, in order to step up cooperation between Member States on combating forest fires. The EUFFTR, which was financed directly from the EU budget, for €3.5m (in 2009), is operated under the MIC and no country can request deployment of the EUFFTR directly. In 2009, it consisted of two Canadair CL 215 fire-fighting aircraft that were available during the summer of 2009, from 1 July – 30 September. The EUFFTR was deployed when other Participating States were not in a position to provide assistance because their resources were needed in their own territory, or they could not reach the fire site quickly enough.

[16] Commission Decision 2004/277/EC, Euratom as regards rules for the implementation of the Council Decision 2007/779/EC, Euratom establishing a Community civil protection mechanism

operation for 7 days, shall be available for departure in no more than 6 hours, and include relevant equipment. More details on the main components of the modules, self-sufficiency conditions, and availability for deployment are included in the above mentioned Decision.

Three aerial forest fire fighting modules using airplanes are currently registered in CECIS, by France, Italy and Greece, each of them including 2 CL-415.

2.3.5 Finance

Current aerial asset sharing in the EU is based on the principle of solidarity - Participating States' willingness to help each other in times of need. Consultations suggest that cost sharing arrangements apply to some bilateral exchanges with the host country meeting the cost of fuel, pilots' accommodation etc. There is no formal agreement at EU level governing the recovery of standby or operational costs associated with aerial assets made available to other Participating States.

The pilot EUFFTR project for the provision of a central reserve was financed through EU funds. The coordinating function provided by the MIC is also financed by the Commission. The MIC can also cover co-financing for aerial forest firefighting transport (i.e. helicopters and planes). The rules allow for a maximum co-financing rate of 50% to be covered by the European Commission[17].

2.3.6 Governance

The EU has not had formal governance arrangements for sharing of aerial assets between Member States, although a set of bilateral agreements exit between participating states (for instance, France has 19 such arrangements[18]). The basic foundations of such a system have begun to emerge through the EU Civil Protection Mechanism and the work of the MIC, though this is a specific application of a generic civil protection facility rather than a dedicated institution. Also, the Mechanism is based on volunteering assets and supply is uncertain, which may render it unresponsive during multiple simultaneous emergencies.

European arrangements are considered by Participating States as a 'system of last resort', to be called upon only at the moment when national capacities are exhausted rather than considered as a more integrated part of the intervention, before circumstances become critical.

2.3.7 National arrangements

The governance models operating within Participating States have not been reviewed in detail as that was beyond the scope of this study. No detailed written comparisons of Participating States' contracting, governance and other operating arrangements have been identified. There may be examples of good practice in internal organisation of aerial asset sharing within and among Participating States that can also provide lessons for Europe but research into those areas is beyond the scope of this study.

2.3.8 SWOT

Figure 0.0Table 4.11 provides a strengths-weaknesses-opportunities-threats analysis of the current situation regarding aerial assets sharing in the EU and the implication of the current agreements. The appraisal is GHK's, and draws on interviews with Participating States and

[17] A total of eight transport grants have been allocated within the European Community Civil Protection Mechanism, between August 2007 and December 2009, for a total of € 888,869. In 2010 (before the Pakistan emergency), 30 grants and 1 transport service, for a total of € 5 million have been awarded. One grant was related to the transportation of aerial forest firefighting means: € 30,481 was allocated to Italy for the transportation of two firefighting aircrafts from Italy to Albania in August 2007.

[18] Conversation with the French Ministry Of Interior, Directorate For Civil Protection (May 2010)

Commission staff, and examination of documentation on various aspects of the system's operation.

Table 4.11 SWOT analysis of the current situation regarding aerial assets sharing

Strengths	Weaknesses
System well accepted by Participating States (PS) System increasingly used by PS In the majority of the cases the system works well As provision of assistance by PS through the Mechanism is on purely voluntary basis it is a practical demonstration of EU solidarity EU-level capacities were recently tested through the creation of EUFFTR Availability of co-financing for deploying aircraft through the EU Civil Protection Mechanism (only for the transport between the place of departure in the offering country and the base of operations in the affected country). There is usually a degree of normality and a functioning infrastructure in the countries affected by wildfires beyond the area immediately affected. Therefore it ought to be easier to standardise the host nation support for wildfires fighting than for other disaster situations	Mechanism is based on volunteering assets and supply is uncertain Unresponsive during multiple simultaneous emergencies European arrangements considered by PS as a 'system of last resort', to be called upon only at the moment when national capacities are exhausted rather than considered as a more integrated part of the intervention, before circumstances become critical[19] Aircraft resource shortages at some PS and EU level, for fire suppression and rescue staff transportation (although this is a statement not fully endorsed by all actors interviewed) Technical capacity and staff shortages to guarantee aircraft deployment in some PS Lack of information on specific equipment or expertise categories Lack of sufficient infrastructure outside metropolitan areas Lack of sufficient capacity in aerial evacuation and treatment of burn victims The inter-operability of assets could be improved (31 different existing Standards of Operations)
Opportunities	**Threats**
Increased public awareness of climate change threats Increased sensitivity of public opinion to environment and biodiversity preservation imperatives Agreement among EU citizens that the EU can do more regarding disaster prevention, preparedness and response[20] Acknowledgement of European solidarity principles across large sections of EU public opinion Potential for increased EU firefighting capacity through acknowledgement of climate change impacts	Increased social, economic and environmental vulnerabilities to wildfires, as a result of population growth, urbanisation, etc. (expansion of the wildland-urban interface in most Mediterranean countries) Inevitable Mediterranean forest fires due to climatic regime in these countries, despite prevention efforts (e.g. extremely dry vegetation, lightning from summer thunderstorms, dry storms, etc) Lack of consensus in the EU-27 on future EU role in the field of forest fires which hampers implementation of innovative initiatives and further developments

[19] While this is one of the main principles of the Mechanism's activations, in case of fire-fighting operations a rapid response is needed and is most of the times preferable to a late request,

[20] http://ec.europa.eu/public_opinion/archives/ebs/ebs_328_en.pdf

Case Study 1: FIRE 4 / FIRE 5

The EU has supported projects whose objective is to improve responses to natural disaster through better cross border cooperation. The FIRE 4 project was designed to strengthen operational cooperation between the directorate-generals for civil protection in the participating states, and to improve the interoperability of the available assets in order to reduce risks, protect citizens and manage crises. It covered wildfires as well as earthquake risk. The lead partners were Spain, France, Italy and Portugal. Cyprus, Greece, Hungary, Czech Republic, Malta, and Slovenia were all associate members. The project started in March 2007, ran for 30 months and involved: two self-training workshops; ten classes of general and specialised training; four exchanges of experts; and two 'real-life' training exercises. FIRE 4 'lead partners' group was then enlarged to include Greece and FIRE 4 thus became FIRE 5.

General training classes

The main objective of the general training class was to reinforce the European intervention capability through improved cohesion of the civil protection teams and a better coordination of crews and modules involved. Recommendations emerging from these classes were to:

- quickly implement the wildfires civil protection modules with aerial means, as well as to define terrestrial intervention modules;
- develop specific training for liaison officers;
- elaborate a common glossary and terminology;
- facilitate and improve the coordination of aircraft engaged in firefighting operations through common guidelines /'order of operations'. These could be devised in the framework of the EU Civil Protection Mechanism by developing a table showing the equivalence of the different political levels of the "FIRE 4 " group, as well as of the different levels of command and coordination between those countries;
- reinforce policy on exercises, regarding the training and implementation of the modules;
- use the same cartography, as well as the same geographical information system;
- develop a user guide concerning the engagement of the modules before and during a mission.

These recommendations were implemented during the first 'real-life' training exercise in Sardinia in 2008.

Specialised training classes

Four classes specialised on "wildfires" and "earthquake risk" focused on improving the organisation of the coordination of firefighting and rescue teams as well as to enhance the command of safety rules. The recommendations that have been expressed concerned:

- the activation procedures of the MIC: necessity to include an 'anticipation procedure' based on the operational situation in each participating state with the possibility (if a situation of exceptional risk is confirmed) to immediately send a liaison officer to the national civil protection operational centre of the requesting country;
- to develop material describing standard fire attack procedures and other manoeuvres in a graphical and text format that can be used jointly by personnel from different Participating States, to aid communication and effective transmission of orders;
- a table of equivalence of the training used in each of the FIRE 4 countries, also including Malta and Cyprus;
- the possibility to set up a special training for liaison officers as well as for the heads of modules;
- the definition of a minimum standard equipment for individual and collective protection of the personal involved;
- self-sufficiency rules for the engagement of the wildfires terrestrial modules.

Self-training workshops

The wildfires workshop that took place in France in 2008 agreed on:

- a proposal for airlifted wildfire terrestrial modules, that could reinforce the organisations in place, with the possibility to airlift 30 firefighters with helicopters;

- a wildfires civil protection module equipped with light intervention vehicles, and 16 to 32 firefighters and or rescue personnel;
- a wildfires civil protection module with heavy intervention vehicles, and about 20 firefighters and or rescue personnel;
- a glossary for common interventions in five languages (Spanish, French, Italian, Portuguese and English);
- rules regarding ground command and information reporting to MIC;
- the precise definition of the conditions necessary to mobilise FIRE 4 countries in case of disasters, within the European Civil Protection Mechanism

Training for the heads and vice-heads of detachments

Specific training, which lasts three days, occurs before each exercise. The first training event focused on how to improve the consistency of engagement of different wildfires fighting modules, both aerial and terrestrial.

Exchanges of experts

The first two exchanges took place in 2008 in France and Spain. The experts visited the regional and departmental operational centres as well as mobile command posts and had exchanges with their French and Spanish colleagues.

'Real-life' training exercises

The first exercise dedicated to forest fires took place in Italy in 2008. Among the lessons learnt were:

- The necessity for good communication between the heads of detachments of the different teams as well as on the use of a common glossary of technical terms;
- The need to be able to adapt the reaction capabilities to the multiplication of fire events;
- The lack of a numerical or even paper cartography, lack of common symbols etc, was a problem which hindered the proper conduct of operations;
- Communication problems between teams (language barriers) were a major problem, suggesting the necessity of having bilingual liaison officers, and more use of the English language as a primary necessity; and
- The need for harmonisation of the techniques of wildfires fighting among different intervention teams.

Proposal were developed in the areas of: training (setup of a system of 'academic' equivalences between the national schools for civil protection in each participating state); operations (cartography with common symbols); joint operational planning; and the establishment of a European 'cell' within the command post of countries requesting assistance from the Mechanism.

Furthermore, the need to reinforce the coordinating role of the MIC has been emphasised (role of the MIC 'duty officer'). It has been proposed that the MIC is reinforced with liaison officers from the participating states for specific and long-term operations.

The implementation of the Council's conclusions on the EU's additional capacities has been tested during the exercises, but also in operational situations, therefore allowing developing the notion of 'standby modules' in the framework of the Community Civil Protection Mechanism.

The experience gathered from the FIRE4 / FIRE 5 workings and experiments has allowed improvements to the European policy of projection and deployment of civil protection assets, through reinforcing the coordination between a core-group of states within the Mechanism. The European Parliament has also built on this experience to adopt various resolutions on the reinforcement of the EU disaster response capacity.

3 International models and mechanisms – case study overviews and key lessons

3.1 Purpose of this chapter

This chapter describes in outline the arrangements for sharing of aerial firefighting assets within selected countries and also between those countries and other states. The case study countries are the United States of America, Canada, Australia, New Zealand and South Africa. These were selected to illustrate a range of different resource sharing systems that are generally regarded as serving the immediate needs of users across a number of jurisdictions (mostly within large, federal territories).

The chapter:

- begins with a cross-cutting analysis of how particular elements of the mechanism for sharing aerial firefighting assets is organised in each case study country; and
- continues with a summary description of arrangements in each country.

The full text of the case studies summarised here is provided in a separately bound appendix to this report.

3.2 Diagnostic overview

3.2.1 Systems of governance in fighting wild fires

Systems of responsibility and governance in wildfire management in the five case study countries range from the centralised to the highly decentralised. They include locally and privately managed systems.

The **US** has a predominantly centralised system of financing, resourcing and coordinating wildfire management. Local fire agencies are responsible for the initial response, but they then turn to a hierarchy of actors at the regional and then national level according to the severity of the fire. By contrast, in **Canada** responsibility for wildfire management is decentralised, lying primarily with provincial/territorial agencies which are networked via a purpose-built intermediary body: the Canadian Interagency Forest Fire Centre (CIFFC). The CIFFC is operated by provincial/territorial representatives and other stakeholders.

A similarly decentralised system is found in **Australia** where responsibility for fighting wildfires and forest fires rests with individual states and territories, which are then coordinated by a National Aerial Firefighting Centre (NAFC). The NAFC is constituted as a limited company whose shareholders are the states/territories and the federal government. There is an emphasis on collective governance within the NAFC and its stakeholders include federal government departments, research institutes and emergency service authorities. The system has been designed so as to allow difference levels of engagement and commitment from participating states.

In **New Zealand**, large forestry companies and private land owners are the primary actors and providers of aerial resources in wildfire management. This system is heavily decentralised, largely privately-managed, and informally coordinated, as well as relying very much on local volunteers (notably land owners who participate in Rural Fire Authorities - RFAs). These RFAs are largely autonomous, but supervised by a National Rural Fire Authority (NRFA) and listed in a National Emergency Resource Directory. Cooperation between actors is generally good but there is a notable lack of national coordination and standardised asset sharing in the system. Furthermore, the absence of national standards means there is less protection in cases of national disasters.

In **South Africa**, a similar locally-managed system of 163 registered Fire Protection Associations (FPAs) is funded by local cooperatives of landowners . However, gaps in the

scope and capabilities of the work of the FPAs have led to more responsibility for wildfire being taken on by a government programme, Working on Fire (WoF). Responsibilities for wildfire suppression also fall to the state-managed National Disaster Management Centre. There is, however, again a notable gap in coordination between the national and local actors.

The different choices and methods of wildfire management in each of the case study countries are in part a reflection on the country-specific topographical and ecological contexts and of the different forms of land management and ownership in each. For example, in the **US**, one third of the land mass comprises federally-owned forests, parks, or reserves, which part-explains the heavy federal government involvement in wildfire management. By comparison, in **Canada** 80% of land is under provincial/territorial jurisdiction. In **New Zealand**, where fires tend to be small and localised, and where land ownership is predominantly private, wildfire management is locally run on a voluntary basis. Differences in constitutional law do not seem to have had a particular influence on system design.

3.2.2 Asset procurement

Among, and within, the case study countries there is variation in whether firefighting resources (particularly aircraft) are purchased or leased. In the **US**, there is a strong reliance on federal procurement of aerial assets, and on contracting rather than purchase for accessing resources. Aerial firefighting assets are procured by the US Forest Service (on a fairly decentralised basis) and the Bureau of Land Management (centrally, though the Department of Interior). In **Canada**, provincial/territorial authorities procure aerial firefighting assets and share these within the CIFFC sharing mechanism. The federal government does not possess any aerial assets.

In **South Africa**, local FPAs – which essentially require flexibility and adaptability – procure their aerial resources through leasing; whereas WoF, which need to use aerial resources all year round, now prefers to purchase and own its resources. This system seems to work well for each agency. In the **US** a firefighting system based mainly on contracting (at least 90% of resources are leased) has led to a lack of efficiency in resource planning and inconsistency in the acquisition process, and has had repercussions in terms of training standards. In **Australia**, where leasing is also more common than purchasing, the NAFC provides an interface between the needs of States and Territories and the suppliers of resources, and the system runs quite well. Cost sharing and insurance arrangements have also been built into this system.

In **New Zealand**, forestry companies and landowners play a major role in rural fire fighting and contribute significantly to equipment, training and aircraft provision. The country possesses a very large number of small aircraft (one of the highest densities in the world given the size of its population) all of which are privately/ commercially owned.

3.2.3 Resources Sharing and Management

In **Canada**, the CIFFC acts as a hub for resource exchange for all member agencies and is called upon by the federal government and individual land owners. All members with control of resources (human/personnel, aircrafts and other equipment) agree to share them through the Mutual Aid Resources Sharing (MARS) Agreement. In **Australia**, resources are procured by and shared through the NAFC, as legislated by the Resource Management Agreement between the states and territories. Where there are disputes over deployment conflicts, the Board of Directors prioritise where the need is greatest. Australia does not have a nationally accredited procedure for organising and managing fire suppression at ground level and lacks coordinators. In the **US**, the dispatch and tracking of firefighting aircraft is operated by 11 Geographic Area Coordination Centres, which also issue requests for large multi engine aircraft to the National Interagency Coordination Centre (NICC) in Boise (Idaho). All aircraft requested for sharing across jurisdictions are tracked at national

level by the NICC, which also directs the operational base-location and dispatch of the largest (type 1) aircraft.

In **New Zealand** the RFAs primarily contract aircraft from private owners or operators. Aircraft are hired on a day-to-day basis. Contractors are very flexible and the aircraft can be deployed to help immediately, on an *ad hoc* basis, in case of wildfires. Because of the large number of aircraft used for agricultural purposes (itself largely explained by the topography of the country), firefighting is mainly aerial. Firefighting labour is supplied mainly through volunteering.

3.2.4 Operational Standards and Response Mechanisms

Aerial wildfire fighting operations in the **US** exist in something of a legal 'void', as aerial fire suppression falls under the 'private' or 'State aircraft' category of aircraft operations of the FAA (federal aviation administration) which avoid general aerial regulation. This poses some safety issues (for safety reasons the USFS requires, however, that the industry adhere to certain FAA standards).

In **Canada**, the CIFFC acts as a platform for the standardisation of practices between member agencies at the national level. For example, since 2002, under CIFFC's guidance, all Canadian fire management agencies at national, provincial and local levels have adopted a Canadian version of the Incident Command System (ICS). The Automated Flight Following (AFF) system, which was financed on the CIFFC budget, is an important standardised element for the communication between the pilots and the provincial monitoring centres during interventions. The system automatically tracks the location, altitude, course, and speed of aircraft, providing this information in real time to dispatchers, aviation managers, and other system users.

In all of the case study countries, local fire agencies are responsible for initial response, located at county/municipality/town level. Responsibility is shifted to regional and then national level according to the severity and scale of the fire. South Africa as a case study shows the importance of anticipating needs.

Some case study states have taken steps to ensure the mobility of aerial assets within the country. **South Africa** has two fire seasons according to rainfall patterns (the dry summer months in the Western Cape, and the dry winter months in the Highveld and Lowveld regions and in KwaZulu Natal). WoF therefore moves its aerial and ground resources from one province to the other in preparation for the next fire season. Similarly, in **Australia**, the national fleet is procured through a public tendering process and contracts drawn up between aircraft operators and the national / federal level (NAFC), to ensure that aircraft can be easily moved from one state to another.

In **South Africa**, another successful element of WoF (although not applying to aerial operations) is its modular response. Each WoF ground firefighting unit is self-contained and self-sustaining. WoF crews work as modular and homogenous firefighting units under their respective crew leaders and supervisors. There are 18 strategically placed dispatch centres with partners and eight provincial coordinating centres. Dispatch centres are coordinated by the relevant Provincial Coordination Centre which in turn reports to a National Coordinator, based at the National Disaster Management Centre. In the **US**, a recently implemented computer-based Resource Ordering and Status System (ROSS) helps to monitor firefighting assets, at national as well as at local level during a fire, and can also be used to identify additional firefighting 'resource-persons'. This allows for decision making and quick resource-deployment in emergency situations and at a national level.

3.2.5 Cost sharing and system financing

Funding for both wildfire management and suppression in the **US** is primarily a federal responsibility. Two of the five land management agencies (the Bureau of Land Management and the US Forest Service) finance aircraft resources, and other agencies fund fire suppression on federally-owned land (such as national parks). State forestry departments

and other non-federal entities also benefit from the federal State Fire Assistance (SFA) and disaster response schemes, as well as from forestry assistance programmes supporting State and private forestland. Federal and non-federal entities do, however, share costs on the basis of agreements set up in each State, but there is a concern that the federal government continues to bear more than its share of the cost[21].

By contrast in **Canada** the cost of firefighting is born mainly by the provincial and territorial agencies. The member agencies provide about two thirds of the CIFFC's total revenue, with the federal government contributing the remaining one third of the budget. Where recovery costs after a wildfire exceed what individual provinces or territories can reasonably be expected to bear, the federal government provides assistance through Disaster Financial Assistance Arrangements (DFAAs). In **Australia**, the federal government has greater financial involvement in the NAFC and this involvement is seen as an incentive to States and Territories to join the NAFC, however fire suppression costs are born by Provincial/Territorial Authorities.

In **South Africa**, firefighting is funded primarily through a cooperative and a cost-based system. FPA members pay a fee which covers fixed costs of firefighting and user-fees cover variable costs when resources are used. As FPA members are usually landowners and companies, public land (70% of land in some areas) - which lacks vested commercial interest - often falls outside of the FPA remit and thus is unprotected from wildfire. The costs of any operation are paid by users. WoF funds up to 50% of fixed costs, but like the FPA charges user costs for operations and relies on shareholders and FPAs for the remaining 50% of fixed costs.

In **New Zealand**, a federal Rural Fire Fighting Fund provides some financing to cover wildfire fighting costs. However, the cost of fighting wildfires is usually passed on to the landowner, or the person who caused the fire. In general, forest owners contribute to the fire management effort well beyond the level expected for protection of their own areas, and bear the actual costs incurred by fire protection. This system seems to be cheap to operate, notably because 70% of personnel tending to rural fires are volunteers. Also, as forestry companies cannot make claims against the NRFA for fires in their estate, they are encouraged to independently manage aerial fire suppression operations within their areas.

In most of the case study countries, recovery assistance is primarily the responsibility of the federal government. However, in **Canada**, where wildfire management falls primarily to the Provinces/Territories, recovery is financed and managed in part at provincial level, and in New Zealand costs of fighting wildfires can be passed on to the landowner.

3.2.6 Monitoring systems and preparedness

Monitoring and risk assessment systems are mostly centralised at national government level. The **Canadian** Forest Fire Danger Rating System (CFFDRS), developed by the Canadian Forest Service (CFS) under the federal government, is managed and used collectively by the federal government and provincial and territorial agencies. The **US** federal bodies use weather and risk analysis data in mapped form or linked tables in a web-based system, used by the 11 Geographic Area Coordination Centres and the NICC. Information sharing of incidents is effectively organised between States/territories in **Australia**. The main resource management related report is Bushfire Information and Significant Incidents (BISI) report that provides information on incident situation, resource availability and outlook across the states and territories. All incidents are managed under the Australian Inter-service Incident Management System (AIIMS). In addition, NAFC has adopted a national (standard) approach to the provision of tracking and event logging services for aircraft

[21] The federal level is concerned that the existing framework for sharing suppression costs, coupled with the availability of federal emergency assistance, insulates state and local governments from the cost of providing forest fire protection in the wildland-urban interface (and that the federal government therefore still bears more than its share of that cost). As a result, state and local governments would have less incentive to adopt laws (such as building codes) that, in the long run, could help reduce the cost of suppressing forest fires.

involved in firefighting and related operations. In **South Africa**, the fire danger rating system is used to order the standby status of aerial resources, as well as what controlled burning operations are allowed, the activation of fire-fighting crew, who should be on fire duty, the alertness and working hours of foresters, and operational day staff. One of the Fire Protection Associations (FPA) also utilises computerised detection which enables aerial resources to be used as an initial, first line of attack, often before a landowner is even aware of a fire having started[22]. The approach has meant that 90% of the fires are controlled within the initial attack period (i.e. less than 5 hours), and is thought to have reduced flight time and costs by 30%.

3.2.7 Training & Qualifications

Some countries have established common training standards, sometimes even financed by a tax, levied on all the participating forest fighting agencies (like in **Canada**). In addition, most of the case study countries have standardized ICS[23] training at national level. ICS, where used, is deemed to significantly increase the efficiency and effectiveness of an emergency response[24]. However, there is generally a lack of cross-border/ joint operational trainings for pilots between States/ jurisdictions. Joint training for intervention and control teams, as well as simulated missions for air tankers is sometimes organised on *ad hoc* basis but this practice is not the rule.

In most countries, there are both national and state/territorial competency standards. Inter-agency exchange requirements for pilots/ suppression crews exist (pilots dispatched for assistance mostly have to have the highest possible certification - Type 1 certification). Generally, competency development rests with federated states, and decisions are made at state/territory level on how training curricula are used. There is however a lack of accreditation programmes for supervising personnel and pilots, across federated states in most case-study countries.

The importance of developing system-wide standards (i.e. policy, standard operating procedures, contracts, call-when-needed arrangements, resource sharing) and aviation training across all member agencies was stressed by those consulted in a majority of the case study countries. In some countries the absence of national qualification standards may reveal to be a weakness in case of catastrophic events across jurisdictions.

3.2.8 International Cooperation

In the **US**, congressionally-ratified agreements between states and across borders aim to provide their members with the means to cope with large fires that may be beyond their individual capabilities. Five 'Regional Compacts' bring together 26 Americans states and 9 Canadian provinces. The US also cooperates with the rest of the world through

[22] The Zululand FPA uses a computerised fire detection system (Firehawk) whereby rotating digital cameras covering large forestry areas transmit information to a base station where the Firehawk software differentiates between fire, smoke and glow and automatically raises an alarm. Cameras are solar or wind powered, mounted on high masts and can detect a fire up to 20 kilometres away. The live video image is transmitted via microwave back to the Operations Centre, which can be up to 65 kms away. These video images are fed to a central command base where they are processed and the alarm is sounded if a fire is detected. Each camera scans the horizon every 3 minutes and fires can be cross-referenced from different cameras to determine the exact location. FPA members pay fees that vary according to whether they wish to be on the first or second call, and whether they grow timber.

[23] Incident Command System (ICS) consists of a standard management hierarchy and procedures for managing emergency response operations of any kind or size. It lays down procedures for selecting and forming temporary management hierarchies to control funds, personnel, facilities, equipment and communication. ICS provides a flexible, scalable and common response framework within which multiple agencies can work together effectively. ICS is meant to reduce organisation and communication barriers by establishing a uniform emergency management protocol in order to allow coordinated interagency action which effectively allocates suppression resources in dynamic, multiple fire situations.

[24] Further information on ICS is available at http://www.fire.uni-freiburg.de/iffn/iffn_29/IWFS-3-Paper-3.pdf.

international firefighting agreements with Canada (the CANUS), New Zealand, Australia and Mexico. All these agreements share common features in terms of:

- information and coordination procedure;
- liabilities, claims and compensations;
- operating plans and operational guidelines,
- border crossing arrangements and
- links to disaster management plans of the receiving countries.

For example, in New Zealand, where firefighting resources are deployed overseas, the agency that makes the request pays for all the costs of deployment. The NRFA takes charge of insurance, and the cost of this insurance is paid for by the foreign party.

3.2.9 Summary

Table 3.2 provides a summary of the above information.

Table 4.11 Systemic overview: diagnosis of 5 case studies' key features

	Australia	New Zealand	Canada	USA	South Africa
Main responsibility with wildfire management	**States and Territories**	**Landowners, local authorities and Dept of Conservation (grouped under RFAs – Rural Fire Authorities)**	**Provinces**	**Mixed (Federal + States + countries)**	**Government programme run by private company, Working on Fire (WoF) and private Landowners organised in Fire Protection Associations (FPA)**
Key Strengths	Clear division of responsibilities Response managed within a state/territory	A system that is flexible and close to the needs of stakeholders	Fair distribution of responsibilities given the geographical size of the provincial and territorial jurisdictions.		At a national and regional level, WoF has built considerable operational capacity and successfully works with partners (particularly FPAs). At a local level, system successfully places responsibility upon private landowners (where FPAs are well-established)
Main weaknesses	**L**ack of interoperability standards between states Sharing of resources more difficult for multi-agency cross-state incidents[25]	Inconvenience of this very decentralised and autonomous system: rural fire forces help with much more than fire[26] Because of the voluntary system, forestry companies need to independently manage aerial fire suppression		Costs responsibilities are difficult to define between the different jurisdictions	Lack of sufficient engagement from government increases the vulnerability of some areas. Where commercial interests are absent, FPAs struggle to find the necessary financial capacity.

[25] At national level the organisation of aerial resource-sharing is based on resource brokering facilitated by NAFC. However, when an incident occurs on both sides of a state border, the management of the incidents is more difficult, since at state level resources are managed according to a "command and control" system.

[26] In 2003, rural fire forces spent more than 1,700 hours at emergency incidents other than wildfires fires (i.e. incidents for which they have no jurisdictional authority). This equates to about 56% of their total emergency response activity.

	Australia	New Zealand	Canada	USA	South Africa
		operations within their areas.			WoF not being an official government agency causes uncertainties about budgets and enforceability.
Assets sharing system (General)	**Resource-Broker (with own pool of resources, commonly procured with distributed deployment)**	**None/ informal sharing with in the same zone (most fires are very local)**	**Pure Resource-Broker**	**Regional resource-brokers (centrally coordinated)**	**Resource-Broker (with own pool of resources) (WoF)**
Key Strengths	Easy to pool resources for interstate deployment Lean procurement system with better purchase price and common standards States/territories leasing assets for a required period only	Great flexibility Transparency: aerial operators are identified in the Fire Plan and an expanded list is available on the National Emergency Resource Directory.	Efficient and effective mechanism. No territorial jurisdiction is left out in the system, even those which do not own any resources.	A relatively flexible mechanism, at operational level. The system of inter-State resource sharing arrangements has expanded, including beyond the U.S. borders, to include adjoining Canadian Provinces.	Efficient and effective means of mobilising resources, in cooperation with aerial resources of FPAs
Main weaknesses	Management of procurement contracts may require additional resources			Governance confusion: variety of agencies that have juxtaposed or overlapping mandates, as well as several separate national 'interagency coordinating bodies'; diverse missions and unclear standards of federal land management agencies.	No tactical reserves, all resources are used. Co-ownership of some resources makes mobilisation difficult when needs conflict
Assets monitoring in operations	**Centralized (NAFC)**	**(Highly) Decentralized (87 RFAs)**	**Centralized**	**Mix Central tracking (NICC) +**	**Mix Local + Centralized**

	Australia	New Zealand	Canada	USA	South Africa
	Under Resource Management Agreement			**11 regional GACCs + local incident controllers**	
Key Strengths	Central organisation acts as facilitator Same high level overview of the situation available to all states/territories	Wildfire fighting operations in NZ are essentially local, given the very small average size of wildfires	Existence of the CIFFC under MARS agreement	Flexibility: the GACC as well as State offices and the State emergency management agencies have the authority to prioritise the allocation, pre-positioning and movement of all aircraft assigned to the Bureau of Land Management (BLM) within their State	Use of Incident Command System ensures Incident Commander monitors use of assets. Frequent and consistent reports sent to provincial and national dispatch and coordination centres ensures constant overview
Main weaknesses	States/territories also have their own systems that may not fully match to the central system			Absence of effective performance measures for wildland firefighting	Where the Incident Command System is not used, the efficiency and effectiveness of an operation's monitoring is reduced
Assets dispatch/ deployment and coordination	**Mix Regional (State fleets) + Centralized (NFAC arrangement)**	**Local (RFA-level)**	**The resources are allocated efficiently. Mechanism is effective to respond forest fires.**	**Mix State and local (small assets) + Regional (11 Regions) (large aircraft)**	**Mix Regional + Centralized (NDMC – efficiency issues)**
Key Strengths	Centralised pool of resources with equal standards across the states/territories Centralised joint monitoring mechanisms for national fleet	Under agreements between the NZ Fire Service and RFAs the NZ Fire Service will use its resources for suppression of wildfires in rural areas. These resources provide an initial attack response to rural fires. 90% - 95% of rural fires can be contained in this manner	Shortage of resources in the future vis-à-vis increasing risk.	Effective decision-making on deployment made by staff close to the incident who are now supported by real time information	National and provincial dispatch and coordination centres (coordinated between WoF and FPAs) ensure effective and efficient mobilisation of resources

	Australia	New Zealand	Canada	USA	South Africa
Main weaknesses	States reliant on national aircraft only without their own reserve and more reliant on co-operative arrangements working effectively		**Mix**		Where the authorisation of the National Disaster Management Centre (NDMC) is required, the response can be delayed and cost recovery difficult. Co-ownership of some resources makes mobilisation difficult when needs conflict
Role of central agent in asset sharing + coordination	**Important role coordinating sharing of state aerial assets for fire suppression**	**None (except for international operations)**	**Regional (Provinces fleets) + Centralized (for additional support)**	**Medium role tracking the sharing of large aerial assets only dispatch of aircraft at regional and local level**	**Medium role WoF centralises assets sharing but, not being a Govt agency, requires that a national response is authorised by the NDMC**
Key Strengths	Central coordinator facilitates effective resource sharing system Management and monitoring of sharing of resources is clear Reliance on personal relationships and networks in reduced and formality added	Wildfire fighting operations in NZ are essentially local, given the very small average size of wildfires	Effective exploitation of national inventory across Canada. Import-export balance is achieved.	All aircraft requested for sharing across jurisdictions are tracked at national by the NICC, which also directs the operational base-location and dispatch of the largest (type 1) aircraft	On national level, WoF the only operational capacity so mobilisation is mostly efficient and effective. On a provincial level, WoF has a good working relationship with coordinating asset sharing with FPAs.
Main weaknesses	May create sense of in depth level of coordination, although the main responsibility still lies within a state			Juxtaposed or overlapping agencies/ a mix of interagency coordinating bodies that can slow deployment decisions	In some cases, authorisation of NDMC is required, whose delayed response can create inefficiencies

	Australia	New Zealand	Canada	USA	South Africa
Assets ownership (federal/ regional)	**Mix** **National fleet (privately contracted) + State fleets (pub/ priv)**	**Local exclusively** **(no national ownership)**	**Provincial exclusively**	**Mix** **(federal/ State/ county)**	**Mix** **"national" (WoF) + local (FPAs)**
Key Strengths	Access to more expensive and larger aircraft Leasing of resources possible for a specified period Pooling of resources across the states	Most of these aircraft are privately owned (a few belong directly to the RFAs). The NRFA doesn't own any aircraft. Aircraft are mostly contracted by RFAs to private owners or aircraft operators	(no national ownership and some private ownership for lands under private ownership)		WoF owns the large majority of aerial resources. Co-ownership of some resources with FPAs
Main weaknesses	Potentially creates incentive to reduce state level resources (those permanently owned by state/territory) Potential risk of sharing resources when deployment should stay within a state			Efficiency issues in planning the needs for fire fighting assets: The federal land management agencies have no standardised budgeting and resource allocation process, and thus are unable to determine wildland fire budget needs and to allocate resources in an integrated way across fire management activities.	Most FPAs cannot afford aerial resources, and so usually rely on the resources of WoF. Co-ownership of some resources makes mobilisation difficult when needs conflict.
Assets procurement (private/ public)	**Privately contracted, for national fleet (centrally procured, distributed deployment)** **Mix (pub. ownership, private contracts) for State fleets**	**Privately contracted, essentially** **(a few RFAs have their own aircraft)**	**Cost-effective.**	**>90% Privately contracted** **~10% of resources are owned and operated by the government** **(for federal fleet)**	**Ownership (WoF) and privately contracted (FPAs)**

	Australia	New Zealand	Canada	USA	South Africa
Key Strengths	Centralised procurement process with equal standards across the states/territories Lean system for access to specialist aircraft and crew	Highly decentralised system relying on a very important number of (small) aircraft, given the size of the population, one of the highest densities in the world		Private contract resources give federal and State agencies supporting flexibility. Relative flexibility to procure additional aircraft from the military.	Contracts provide FPAs with flexibility. Ownership increases predictability and reliability, and gives WoF year-round access to aerial resources (important due to the two fire seasons).
Main weaknesses	Resources are needed to manage procurement contracts		**Mix**	Efficiency issues in acquisition of assets: Firefighting agencies lack an effective system for cost-effective acquisition: requirements vary from contract to contract; inadequate administration and oversight of the agreements by the agencies result in poor contractor performance and high rental rates.	Ownership requires sufficient financial resources. Contracting assets can be problematic where there are issues with reliability and availability
Main leasing method used (Long Term Exclusive Use vs. Call When Needed)	**Long Term Exclusive Use**	**Call When Needed**	**(e.g. British Columbia fully contracted; Ontario owns its aircraft)**	**Call When Needed with recent shift to Long Term Exclusive Use**	**Seasonal and can call additional resources when needed**
Key Strengths	Each state/territory has ownership of national aircraft for the period of high fire risk season that can be immediately deployed	There is usually no need to contract from overseas, given the large pool of aircrafts resources in NZ		New 'Exclusive Use' contracts (from USFS) should guarantee that the larger aircraft (in particular the Type 1 helicopters) are available for fire operations.	Cost effective and provides flexibility
Main weaknesses	No obvious weaknesses apart from paying standing			Shortages are possible	Where reliability and availability of resources are

	Australia	New Zealand	Canada	USA	South Africa
	cost of aircraft when it is not in use				an issue, can be problematic to ensure sufficient operational capacity
Access to private aircraft fleet **Effective use** **Ease of access**	**High use – lease market for specialised aircraft**	**High use** **– high density of privately-owned agricultural aircraft** **High flexibility**	Provincial governments allocate their own financial resources accordingly.	**High (at federal level) – theoretically large lease market** **However limitations (no federal standards for FF aircraft) and strains (contracting to other industries –oil, etc.)**	**High use – within strong financial limitations**
Key Strengths	Contact between NAFC and private providers ensures aircraft are easily moved between states/territories	System relying on a very important number of (small) aircraft, given the size of the population, one of the highest densities in the world	**Cost-effective.**	Private contract resources give federal and State agencies supporting flexibility.	Asset sharing between WoF and FPAs means FPA have access to aerial resources even if they themselves lack such resources.
Main weaknesses	Potentially harder to manage private contractors, although rules are laid down in the service contract			Shortages are possible	Lack of direct government contribution means that areas without strong commercial interests are not able to finance their own aerial resources, leaving areas vulnerable
Role of the central (monitoring/ dispatch) agent in asset procurement	**Yes** **shared leasing (NFAC)**	**No**	**Long Term Exclusive Use**	**No** **(Federal procurement through 2 Fed agencies, BLM centrally-operating)** **USFS decentralized**	**Yes** **(WoF both owns and lease + FPAs lease)**
Key Strengths	Clear mechanism to manage and share resources	The NRFA monitors deployment of only if NZ resources get requested for overseas deployments	The contract season is specified. The resources are not 'wasted' during off season period.		

	Australia	New Zealand	Canada	USA	South Africa
	System to manage disputes	NZ can deploy resources overseas very quickly, within two days because of the existing arrangements in place			
Main weaknesses	Need for joint agreement between the states/territories for what type of aircraft to procure. However, this has not been a problem.				
Integrated resource-ordering + assets monitoring system	**Yes**	**No**	**Medium use**	**Yes (ROSS – since 2009)**	**No**
Key Strengths	Clear overview of who possess which assets at a particular point in time Clear overview of which state has available resources and which state is in need for resources		(see above)	Efficient monitoring of firefighting assets during a fire. Reduction of suppression costs by making it easier to use local firefighting assets. ROSS can also be used to identify 'resource-persons' and helps increase the use of incident commanders at local level, and reduce the need to mobilise more costly incident management teams.	
Main weaknesses	Effective and timely central coordination is needed Reliance on states/territories providing		Flexibility and more alternatives in access to resources.		

	Australia	New Zealand	Canada	USA	South Africa
	information				
Seasonal shifts in fire risk allow greater use of assets	**Yes (System takes into account of sharing resources during high risk season)**	**No**	**No**	**No**	**Yes**
Key Strengths	System facilitates situation where a state with low fire risk can offer resources to state with high fire risk (e.g. through BISI report)				Seasonal fire shifts mean needs can be anticipated in advance, and resources mobilised accordingly
Main weaknesses	Potential for over commitment of resources, although hasn't proven to be an issue to date			The use of assets is essentially concentrated in summer, although they may be local climatic variations, and assets may be mobilised throughout the year	Means aerial assets are needed year-round and are constantly in use
Effective Cost sharing agreements across jurisdictions	**Yes**	**No**	**Yes**	**Mixed situation**	**Yes (WoF provides up to 50% of the fixed costs where partners can afford to contribute. Users are responsible for all flying costs on a user pays basis.)**
Key Strengths	The cost of national fleet is shared across the states and the federal government also contributes		Full-cost recovery principle enables efficient allocation of resources.		The user pays principle ensures costs are recovered and ensures WoFs and FPAs financial sustainability. FPA fixed costs are covered by membership fees.

	Australia	New Zealand	Canada	USA	South Africa
Main weaknesses	n/a		Transparency and fairness in financial contribution.	Cost-sharing agreements do not provide clear guidance for federal and non-federal officials to follow in deciding which method to use for a specific fire. Consequently, the distribution of costs between federal and non-federal entities differs among States. Federal government may also continue to bear more than its share of that cost.	The success of FPAs partly depends on economies of scale, given membership fees are determined on a per hectare basis. Cost recovery for WoF can be slow with some partners (e.g. NDMC) post-operation.
Effective aircraft insurance costs sharing	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Key Strengths	Yes, clear provisions are set in the Resource Management Agreement for all the parties		Efficient allocation of resources.		
Main weaknesses	If state owned resources would be used outside of the NAFC procured aircraft, the provisions could be different and agreed between the states				
Standards operating procedures	**Yes**	**No (Guidelines only, no national standards)**	**Yes**	**Yes**	**Mix (WoF and some FPAs only)**
Key Strengths	These are produced by NAFC and AFAC level to which states/territories form part. This ensured higher compliance	The essentially local nature of rural fires does not necessary call for national standards	Quicker and more effective actions undertaken in different geographical areas.	Effective decision-making on deployment made by staff close to the incident, who are now supported by real time information.	Ensures a consistent approach. Use of ICS by WoF is especially advantageous for enabling an effective response.

	Australia	New Zealand	Canada	USA	South Africa
Main weaknesses	Some operating procedures and protocols of working are still organised at a state level, not everything has been harmonised			Inadequate aviation policies and standards. Many differences subsist between Forest Service and Department of Interior aviation policies. Aerial fire suppression operations in the US falls under the 'private' or 'federated State aircraft' category of aircraft operations, the FAA (federal aviation administration) is not directly involved in the regulation of aerial fire suppression	Some actors do not have Standard Operating Procedures, making effective responses difficult.
Common training Standards/ certification (for pilots, ground crew)	**Partial**	**No**	**Yes**	**Mixed**	**Yes (through WoF)**
Key Strengths	Common certification of pilots and common competencies for incident management	The local fire environment is very well understood by RFAs	Quicker and more effective actions undertaken in different geographical areas.	USFS contracts have minimum aircraft requirements and pilot standards. Contract pilots must also attend a course conducted by the USFS. The USFS also expects that any prospective contractor meet FAA requirements prior to any approval of contracts. BLM pilots conduct the check and training rides for BLM's contracted pilots.	Ensures that most training is uniform and consistent given dominance of one organisation in training provision.

	Australia	New Zealand	Canada	USA	South Africa
Main weaknesses	Some standards of operations are organised at a state level and not shared nationally Risk for different operating procedures when human resources are deployed from another state	The absence of national standards may reveal to be a weakness in case of catastrophic events		Discrepancies between federal pilots and contractors training Underfunded and inadequate training system There are no contract incentives to encourage operators to maintain full time safety officers to supervise and manage aircrew training. The current training system does not develop civil firefighting capabilities, such as consistent drop accuracies and other operational effectiveness measures.	Pilot training done outside of WoF, however some additional 'top up' courses are held by WoF
Effective cross-border training (across jurisdictions)	Yes (ad-hoc basis)	No	No	No	Yes (ad-hoc basis)
Key Strengths	Based on identified need and linking to interstate competency requirements			No cross-border training. However ICS is now a key component of training in all case study countries.	Long standing informal arrangement between US and WoF ensures sharing of best practice and experience
Main weaknesses	Staff across states are not trained to a same standard Operating and environment situations in states are different				The informal nature of most arrangements are not as sustainable as they could be
Effective integrated fire risk	Yes	Yes	Yes	Yes	Yes

	Australia	New Zealand	Canada	USA	South Africa
monitoring/ predictive system	(BISI)	(FWSys)	(CFFDRS)	(NFDRS)	(Australian system)
Key Strengths	Frequent sharing of information relating to incident management and availability of resources	The Fire Weather Monitoring System (FWSYS) is a tool for short- to medium-term fire management decision support, that provides good quality fire weather/fire danger maps and reports	Creating a common basis assessing fire danger, setting preparedness levels, and efficiently allocating resources.	Provision of reliable weather and risk analysis data (in mapped form or linked tables in a web-based system) shared between coordination centres	Long standing use, established means of communication and good familiarity of the system across users. Risk status determines standby status of aerial resources and other relevant factors
Main weaknesses	Is mainly reactive rather than proactive approach to monitoring				Government is responsible for developing a risk monitoring system, but has not been able to do so as yet. Concerns that the system will conflict with the existing one.
Effective integrated systems for measurement of aerial suppression performance	No	No	Yes (in some provinces)	No	No
Key Strengths			Correct assessment and planning, and efficient allocation of resources for coming risk season.		
Main weaknesses				Effectiveness of fire suppression delivery not properly measured	
Underlying system for managing fire emergency response	Incident Command System (ICS)	Incident Command System (ICS) (essentially for international deployments)	Incident Command System (ICS)	Incident Command System (ICS)	Incident Command System (ICS)

	Australia	New Zealand	Canada	USA	South Africa
Key Strengths	unknown		Standardisation in fire suppression process, easier and quicker movement of the personnel and hence a more effective response mechanism.	ICS has significantly increased the efficiency and effectiveness of emergency response	Significantly increases the effectiveness, efficiency and overall success of a response operation
Main weaknesses	unknown				Most effective when all involved parties are trained in ICS, the engagement of some parties in South Africa is lacking and therefore limiting its effectiveness

3.3 Case study summary: USA

The US has seen a marked increase in the surface area burned in the recent years. Expenditure on fire suppression has spiralled upwards. Contributory factors are climate change, urban sprawl and the consecutive developments of the wildland-urban interface.

Forests, parks or reserves in federal ownership cover a third of the US surface area. Fire suppression has become the dominant activity of federal forestry agencies, to the detriment of their other programmes. Policies have evolved and the federal agencies responsible have increasingly emphasised firefighting strategies that focus on land management objectives (as embodied in the 2000 National Fire Plan).

Land ownership and responsibilities for wildfire management are spread across various stakeholders

The main responsibilities for wildfire management in the US are shared between the federal government, the states and local authorities. Federal tasks are shared among the five federal agencies responsible for forestry and land management (four agencies of the Department of Interior - The Bureau of Land Management, the Fish and Wildlife Service, the National Park Service, and the Bureau of Indian Affairs - and the US Forest Service (USFS) which is attached to the Department of Agriculture).

At state level wildfire management is typically the responsibility of the Departments of Forestry and Fire Protection.

The system of assets mobilisation and sharing is based on a centrally coordinated network of regional resource brokers.

Local fire agencies, often located at county level, are responsible for the initial response to a forest fire. If the fire continues to grow the local agency can seek help from the relevant Geographic Area Coordination Centre. There are 11 such regional coordination centres in the US in charge of location and dispatch of small or mid-sized firefighting aircraft. When a regional centre has exhausted its resources, it can turn to the National Interagency Coordination Centre (NICC), located in Boise, Idaho, in order to help it locate the resources it requires to face a fire.

The monitoring of the operations is the primary responsibility of local incident commanders, under the control of the relevant Geographic Area Coordination Centre. The role of the NICC (the central agent) is limited to the central tracking of resources requested by lower levels (regional, state or local levels) as well as the operational-base location and dispatch of large multi engine aircraft (‘type 1’ aircraft).

Inter-state and cross-border co-operation also occur, on an *ad hoc* basis, within the framework of the Regional Fire Compacts. Five such compacts exist. They connect, in total, 26 American states as well as nine Canadian provinces. These congressionally-ratified agreements aim to provide their members with the means to cope with large fires that may be beyond their individual capabilities. These regional agreements however, integrate into the general framework of resources tracking and dispatch (the Compacts’ Coordination Centres are generally the Geographic Area Coordination Centre of the region they cover).

The US also cooperates with the rest of the world through international firefighting agreements with Canada (the CANUS), New Zealand, Australia and Mexico. These agreements share common features, in terms of information and coordination procedure; liabilities, claims and compensations; operating plans and operational guidelines, border crossing arrangements and links to disaster management plans of the receiving countries.

Decision-making procedures, Standards of Operations and supporting systems are being improved

As aerial fire suppression falls under the ‘private’ or federal aircraft’ category of aircraft operations the Federal Aviation Administration (FAA) is not directly involved in its regulation.

Aerial wildfire fighting operations in the US exist in a kind of legal vacuum which has safety implications (though for safety reasons the USFS requires that the industry adhere to certain FAA standards).

New technologies have been adopted in the US to help make the assets mobilisation and sharing system more effective and efficient. Recent improvements have been achieved in the utilisation and dispatch of aerial assets. The agencies have shifted from a manual, paper-based system for requesting and assigning firefighting assets to a new computer-based Resource Ordering and Status System (ROSS). This is intended to more effectively and efficiently monitor firefighting assets, at national as well as local level, during a fire. The federal agencies can also use ROSS to identify 'resource-persons' in various firefighting conditions, which will help increase their use of incident commanders at local level, and reduce the need to mobilise more costly incident management teams. Effective decision-making on deployment made by staff close to the incident is now supported by real time information.

The provision of reliable weather and risk analysis data (in mapped form or linked tables in a web-based system) is strength of the US system of decision making and resource deployment.

There are various assets management models in use but contracting has grown in significance.

The institution responsible for the coordination of assets at a national level (the NICC) has no responsibility in the procurement of these assets. Two federal land management agencies, the Forest Service and the Bureau of Land Management, have responsibility for purchasing and managing all federal wildfire fighting aerial resources (fixed wing and helicopters). These two agencies contract most of the aircraft under their responsibility (about 90%). Their contracting processes differ (the U.S. Forest Service contracts at regional level whereas the Bureau of Land Management contracting process is centrally managed, at the Department of Interior). About 10% of the federally managed resources are owned and operated by the federal agencies.

Contracting has gained in importance since the 1980s when, faced with shrinking resources and increasing wildfires, federal and state firefighting organisations started their relationship with the aircraft leasing industry. The access to a private aircraft fleet is, in principle, easy, given the large lease market in the US, and the size of the aircraft services contracting industry. However, this access also faces practical limitations, given the lack of federal standards for firefighting aircraft and strains in the market (notably due to the increased contracting of large helicopters by the oil industry in the recent years).

Until about 2003-05, call when needed (CWN) contracts were the main method of contracting used to cope with the increasing number of emergency situations. Since then, there has been a shift in federal contracting towards long-term exclusive use contracts, in order to better guarantee the availability of resources.

Several weaknesses have been noted in the assets contracting system, notably efficiency issues in resources planning (due to the lack of a standardised budgeting and resource allocation process in the federal agencies), and in the acquisition process itself (e.g. inconsistency in the contracts requirements, inadequate administration oversight of the agreements by federal agencies), often resulting in poor contractor performance and sometimes putting the safety of pilots at risk.

The weaknesses of the private contracting industry also have repercussions in terms of training standards. Although federal agency contracts all have minimum aircraft requirements and standards for pilots, the training system of contractors is deemed to be underfunded and inadequate.

Financial /cost-sharing arrangements

Aircraft resources at federal level are financed in two different ways: centrally through the Department of Interior budget, for BLM resources, and through the Forest Service 'regions', for the USFS. Funding for fighting wildfires on federal territory (i.e. for fire suppression and supplemental contingency or emergency funds) has fluctuated widely over the past decade, from less than US$430 million (in FY1999) to US$2.5 billion in FY2008.

In addition to individual state funding, state departments of forestry receive federal assistance (State Fire Assistance, SFA) for wildland fire management and suppression. The federal government also has more than a dozen forestry assistance programmes, including rural/forest fire fighting programmes and numerous programmes to support state and private forestlands. Wildfires fighting also benefits from the financing of disaster response schemes. The Federal Emergency Management Agency (FEMA) provides financial assistance to non-federal entities for controlling major fires on public or private forest land (non-federal entities can be reimbursed for 75% to 90% of the fire suppression costs).

In the international aerial firefighting agreements signed by the US, the participant sending resources should be reimbursed by the receiving participant for the costs it incurred in supplying aircraft. The costs may also include the cost of premiums to purchase death and personal injury insurance for employees. The specific costs and procedures for reimbursement are defined in the Annual Operating Plans of these agreements, which are binding contracts.

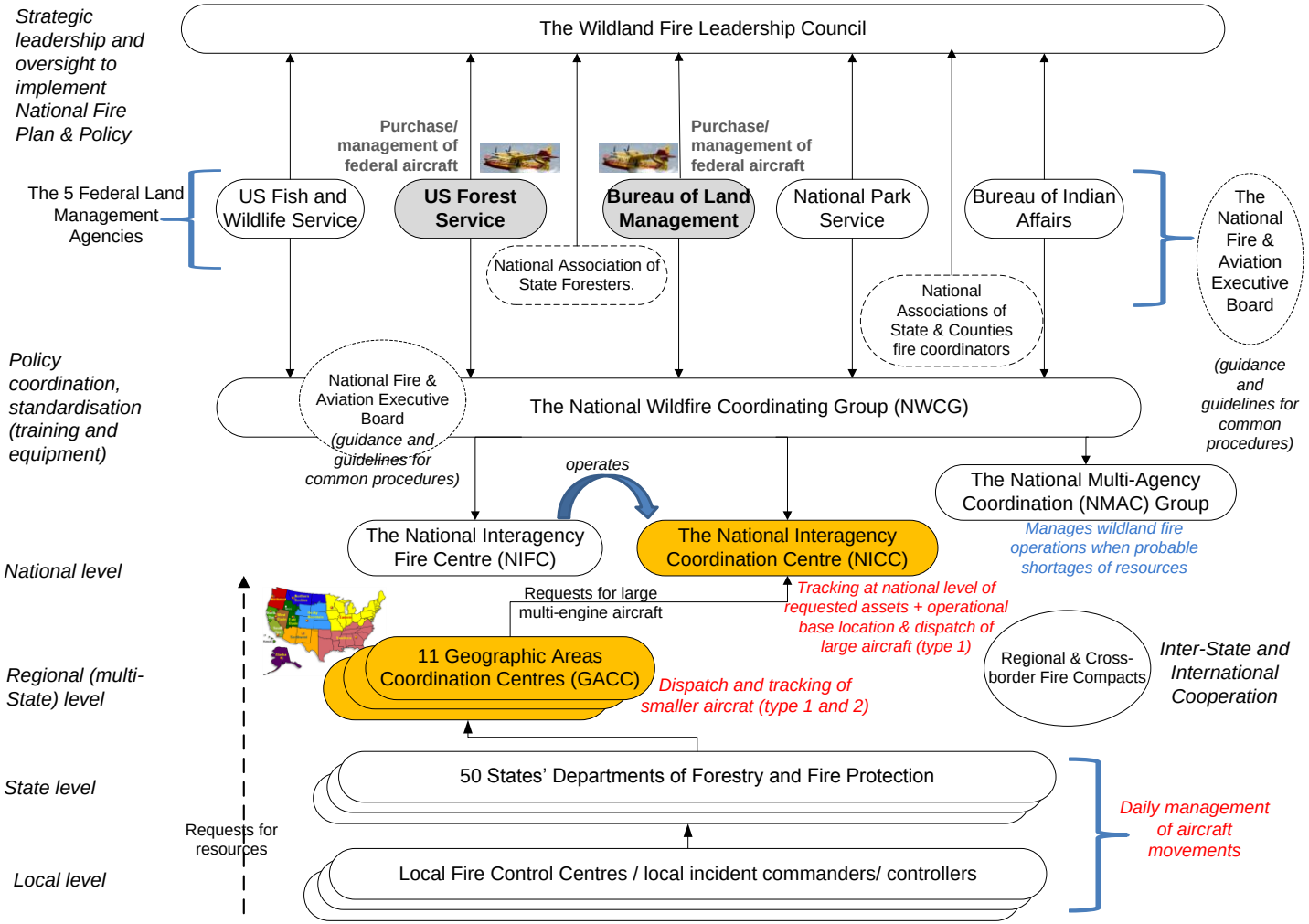
With regard to sharing the costs of fighting wildland fires between federal and non-federal entities, master agreements are usually signed in the framework of each state. These documents specify how costs are to be shared for each fire that burn across multiple jurisdictions. Cost-sharing methods generally include surface area burned, cost distribution, or variations of these two methods.

Although these agreements they provide a general framework, they do not provide clear guidance for federal and non-federal officials to follow in deciding which method to use for a specific fire. Consequently, the distribution of costs between federal and non-federal entities differs, sometimes substantially, among states. There is also a concern at federal level that the federal government continues to bear more than its share of that cost. The continuing expansion of the wildland-urban interface and the increasing costs of protection call, however, for a resolution of those long standing cost-sharing issues.

Conclusion

The US coordination system is effective in providing emergency capacity to service peaks in demand and at mobilising large aircraft relatively quickly. However this is possible only at a large cost and the system suffers from a lack of long term resource planning. The US invests heavily in aerial fire fighting but lacks systems for evaluating effectiveness of fire suppression delivery, or system delivery in general. There are also weaknesses in crucial building blocks of the system (such as the contracting process and training of air crews). The legal and financial responsibilities of the different stakeholders have not been clearly defined.

Figure 3.1 US system governance model



3.4 Case study summary: Canada

Sharing of aerial assets for wildfire suppression in Canada is based on a brokering system in which provincial/territorial resources are allocated through the Canadian Interagency Forest Fire Centre (CIFFC). The federal government's involvement in the system and the degree of interaction between the federal government and provinces/territories vary at different stages of the wildfire management process.

The provincial/territorial agencies have primary responsibility for wildfire management. About 80% of total Canadian land is under the jurisdiction of these agencies. Each provincial or territorial agency is responsible for its own territorial jurisdiction and manages the aerial resources within it. All provincial ministries have introduced legislation and regulation to mitigate risks and improve outcomes related to wildfires. The firefighting management mechanism involves provincial agencies under the relevant ministry, the Office of the Fire Commissioner and other staff at smaller geographical units (fire centres and zones).

Asset management and procurement

The approach adopted for management and ownership of aerial firefighting resources varies among provinces/territories depending on forest resources and values at risk (e.g. forestry industry). Some of the provinces (e.g. Ontario) own their aircraft while in others the provincial agency (e.g. the British Columbia Forest Service, Wildfire Management Branch) leases the resources from private contractors. British Columbia, for example, relies on fixed wing air tanker delivery of fire retardant to approximately 18% of all wildfires actioned and meets this need by contracting with private suppliers. The agency publishes public tenders to purchase, through the provincial budget, services in long term contracts (e.g. 7-10 years).

The Canadian federal government does not own any aerial firefighting resources and entirely relies on aircraft shared through the CIFFC. Some private landowners (who control circa 7% of total land area) have their own firefighting resources but most rely on CIFFC's mediation.

Coordination, activation and allocation

The CIFFC plays a crucial role in providing intelligence and balancing supply and demand in the Canadian forest fire management framework. The Centre informs the provincial agencies about the fire situation through 'situation reports'; identifies available resources in the provinces and exposes the number, size, capability and availability of these resources and help the member agencies position their aerial and terrestrial resources accordingly, and finally operates as a hub for resource exchange between provinces, territories and the Federal Government. The Canadian Interagency Mutual Aid Resources Sharing (MARS) Agreement (1983) forms the official basis of the resources sharing system, including equipment, personnel and aircraft, among the Canadian province and territories. Statistics show that since the creation of the CIFFC, the exchange of resources among Canadian provinces/territories has increased considerably.

A provincial/territorial agency, the federal government, or even a private landowner, can activate the CIFFC mechanism when the resources in its territorial jurisdiction are fully allocated and it needs further assistance. The party in need sends CIFFC a request for assistance (including the specific quantitative and qualitative requirements to address the fire in question). The CIFFC then contacts the appropriate agency that has resources available and the former sends the requesting party resources for assistance. The MARS agreement defines the post-assistance conditions such as cost recovery or insurance-related cost issues. According to the MARS agreement, any party providing resources

under this agreement will receive full cost compensation for the resource sharing and benefits distributed to injured employees or dependents of deceased employees.

Financial /cost-sharing arrangements

The CIFFC is largely funded by the provincial and territorial agencies. The member agencies contribute about two thirds of the CIFFC's total revenue, with fees set according to the size of their territorial jurisdictions. The remaining one third of income comes from the federal government. In addition, the CIFFC receives further income such as through the 3% fee that it charges on the costs paid annually by each member agency for resources 'imported' through the assistance mechanism. In 2006, the CIFFC's total revenue was about €515,000.

Canadian provinces/territories also share aerial firefighting resources through bilateral and multilateral agreements. These agreements with other Canadian agencies (or the relevant state agencies from the US) play an important role in wildfire suppression. They identify the procedures for cross-jurisdictional interventions to suppress wildfires in a specific fire cooperation zone around the boundaries of the agreed parties and are based on a full-cost recovery principle.

Other systems and services

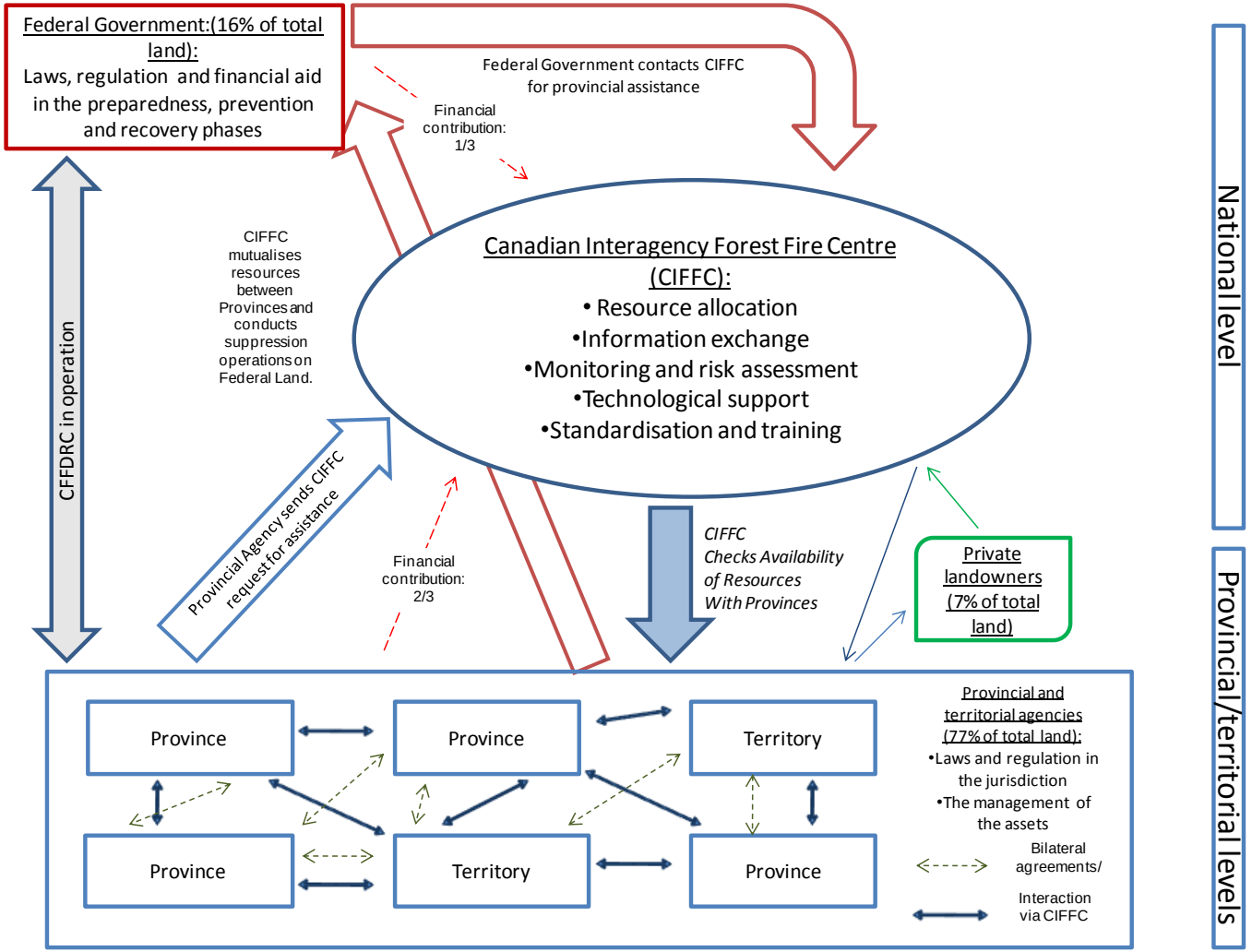
In addition to its resource sharing, mediation and information exchange functions, the CIFFC acts as a platform for the standardisation of practices among member agencies at the national level. For example, since 2002, under CIFFC's guidance, all Canadian fire management agencies at national, provincial and local levels have adopted a Canadian Incident Command System (ICS). Also, the Automated Flight Following (AFF) system, which was financed on the CIFFC budget, is an important standardised system facilitating communication between pilots and provincial monitoring centres during interventions.

The Federal Government of Canada has a minor role in the response stage of the fire management system. It has responsibilities in the preparedness, prevention and recovery stages of the fire management. For instance, the Canadian Forest Fire Danger Rating System (CFFDRS), developed by the Canadian Forest Service (CFS) (a federal body), is managed and used collectively by the federal government and provincial and territorial agencies. The federal government also provides assistance to the provinces/territories through Disaster Financial Assistance Arrangements (DFAAs) where recovery costs exceed what individual provinces or territories could reasonably be expected to bear on their own. This is administered by Public Safety and Emergency Preparedness Canada.

Conclusion

In summary, the Canadian management mechanism includes effective tools to respond to wildfires. The creation of the CIFFC is deemed to have increased efficiency in coordination (in terms of time-saving and cost-effectiveness) and made the national firefighting network more effective. This is particularly important given challenges such as climate change and the increasing wildland-urban interface (WUI), and financial constraints. The stakeholders and experts consulted in Canada argued that the CIFFC structure is currently the most cost-effective mechanism for the resource sharing. An area for further development is to develop a capability for it to act as a platform for strategic thinking to resolve mutual problems and improve wildland fire management policies and practices.

Figure 3.2 Canadian system governance model



3.5 Case study summary: South Africa

South Africa is an interesting case in wildfire management, given the unusual and key role played by a government programme that is run by a private company, and that of local cooperatives. The case study shows that in the absence of a strong government response, a private initiative (or joint private/public initiative) and an emphasis on local participation can be successful.

Institutional arrangements

South Africa's wildfire strategy works on the principle of scaled response. Local capacity is used and only once this is thought to be exhausted are further, regional, resources called in. If these are exhausted, provincial resources are called in. If the fire has still not been controlled then a national emergency is declared and national resources are deployed.

Working on Fire (WoF) is a government programme that serves as the main operational resource for wildfire fighting in South Africa. It was initially established as a poverty relief and skills development programme, but has evolved to become South Africa's only national and regional response mechanism for dealing with wildfires. Initially, the legislative framework placed the burden of controlling fires on the shoulders of landowners, through the establishment of Fire Protection Associations (FPAs). These are groups of landowners, who organise themselves into local geographical units and with backing of legislation, take charge of their own fire-related affairs. Because resources in terms of capacity, skills and funding are limited in most of the affected areas, Umbrella Fire Protection Associations (UFPAs) are envisaged to provide the overarching, co-ordinated support, including aerial fire-fighting support, in provinces.

Although there are some well-established and successful FPAs and UFPAs, the system is still under-developed. This has created the conditions and necessity for WoF to become more active than originally anticipated, and to act as the main actor in wildfire management.

There are examples of FPAs and UFPAs that are very successful. Where this is the case, the scaled response works very well. FPAs that are well-developed and properly funded by their members can be virtually self-sufficient. In one case, additional resources are only needed every 5-7 years when the weather and other factors combine to create conditions that outstrip all the available capacity. Conditions affecting the success of FPAs include:

- **Financial viability**: adequate financial support is crucial to making FPAs successful. FPA funding is based on membership fees which cover fixed costs, and user fees that cover variable costs incurred when resources are used. The model is more successful where there are strong vested commercial interests, and/or significant numbers of private landowners to subscribe to the FPA. Where these interests are lacking, there is a need for significant public support. This can happen where public land forms a substantial part of the land occupied and/or vulnerable to fire within the boundaries of an FPA. Such financial support is lacking, leaving an estimated 70% of land in some areas, and the people who live on it, without adequate protection against fire.
- **Economies of scale**: the size of an FPA is critical to its financial viability (as charges are set on a per hectare basis). Only once economies of scale can be taken advantage of is it possible to reduce individual membership fees to the extent where it makes it possible for certain landowners to join the FPA and gain access to aerial resources.
- **Level of organisation**: ideally, FPA boundaries should match with those of larger municipalities. UFPAs should be formed at the provincial level, to best coordinate responses with provincial disaster management centres and WoF. There are cases where several FPAs are being formed within one municipality, which negates the cost efficiencies and coordination benefits of forming FPAs in the first place. In one small local municipality, 4 FPAs have been formed.

- **Coordination with regional and national efforts**: regardless of how well-resourced and successfully an FPA is organised and implemented, there will be times when its own capacity will be outstripped and additional assistance will be required. For these needs to be met in a timely manner when they arise, there needs to be constant and consistent coordination and feedback between any national or regional resource (in this case both with UFPAs and WoF), and that of the FPA itself.
- **An appetite for cooperation**: where FPAs are less successful, it is partly because of the lack of an appetite for cooperation amongst private and public landowners. As a result, very small FPAs involving only a few landowners are being formed. The lack of buy-in from municipalities is an especially critical issue.
- **Fire Protection Officers (FPOs):** In order for FPAs to maximise their effectiveness and efficiency, an FPA requires a dedicated and qualified FPO. This is lacking in many cases, where FPOs are only available part-time, and oftentimes are only local farmers interested in fire protection.

The way WoF has been organised and implemented also illustrates some key considerations, conditions for success, as well as characteristics which hinder that success.

- **Partnerships with clearly delineated responsibilities are critical**: WoF ensures this is the case by requiring each partner to enter into a Memorandum of Agreement which is tailored to the needs and capacities of the partner. A standard partnership agreement states that firefighters' salaries and equipment are paid by WoF. During a fire the partner provides the logistical support.
- **User pays principle**: WoF charges users for the resources that they use. This ensures that variable costs can be recovered to ensure the organisation's financial sustainability.
- **Formal authorisation to act on government's behalf:** WoF is an implementing agent of government, and not a government agency. This has implications for its implementation (especially in terms of budgets), enforcement and especially for international agreements. It has consequences for the sustainability of the current system, and will need to be addressed to ensure its continued success in the future.
- **Organisation and coordination of responsibility:** WoF is dedicated to wildfire management, which overlaps with the responsibilities of the National Disaster Management Centre, who is also responsible for wildfires on a national level. There are benefits to this, but there are also benefits to incorporating the wildfire response into the National Disaster Response, such as the avoiding the duplication of efforts. If the operational capacity for wildfires is removed from the overarching national disaster response strategy, coordination is crucial to ensure an effective response with the right support so that efforts are not duplicated, and also, so that all aspects are covered and do not fall through any gaps.

Use of aerial resources

South Africa has two fire seasons dictated by rainfall patterns - dry summer months in the Western Cape, and dry winter months in the Highveld and Lowveld regions and in KwaZulu Natal. WoF moves its aerial and ground resources from one province to the other in preparation for the next fire season. This prepositioning of resources means aircraft are located in the areas of need before demand arises, allowing quicker response times and therefore greater success in managing any wildfires.

South Africa illustrates that well developed dispatch and coordination centres can ensure an efficient and effective response. These are located at provincial level and coordinate WoF's provincial firefighting resources and additional resources available through Fire Protection

Agencies (FPAs) in their province. They are also responsible for all WoF movement outside the active fire season and the movement of WoF air resources in the seasonal relocation.

A crucial part of WoF's success is its modular response. Each WoF ground unit is self-contained and self-sustaining. When a call comes in, a modular unit is dispatched (for instance a unit of 22 firefighters with all equipment). The benefit of this modular and replicable system is that at the fire line WoF crews work as a homogenous fire-fighting unit under their respective crew leaders and supervisors. WoF also deploys a heli-attack crew where necessary. This involves a helicopter working with ground firefighters that have had helicopter movement training, and heli-support vehicles for in-field refuelling.

A further element of success in responding to a wildfire is the use of the Incident Command System, which all interviewees noted has significant benefits when several organisations at several levels are involved in fire-fighting.

One FPA has been particularly successful in using computerised detection of fires. It has enabled aerial resources to be used as an initial, first line of attack, often before a landowner is even aware of a fire having started. The approach has meant that 90% of the fires are controlled within the initial attack period (i.e. less than 5 hours), and is thought to have reduced flight time and costs by 30%.

A robust fire danger rating system is crucial but only of use if users are familiar with it, and if the rating is actually communicated to interested and affected parties. The fire danger rating system is used to dictate the standby status of aerial resources, as well as what controlled burning operations are allowed, the activation of fire-fighting crews, who should be on fire duty, the alertness and working hours of foresters, etc.. Pilots are informed when actual conditions exceed forecast and standby times are adjusted accordingly.

Ownership of aerial assets

WoF and FPAs use different ownership models for aerial assets. WoF used to lease several of its aircraft, but is now moving towards a model where aerial resources are owned and maintained by WoF itself. FPAs lease their aircraft. Contracts are seasonal, and give FPAs the option to call the aircraft in at any other time they feel the existing resources cannot cope with the fire incidences or extreme fire behaviour.

Ownership suits WoF since this gives it access to aerial resources year-round (due to the two fire seasons). It also increases predictability and means the reliability of suppliers is not a concern. For FPAs, leased contracts provide flexibility.

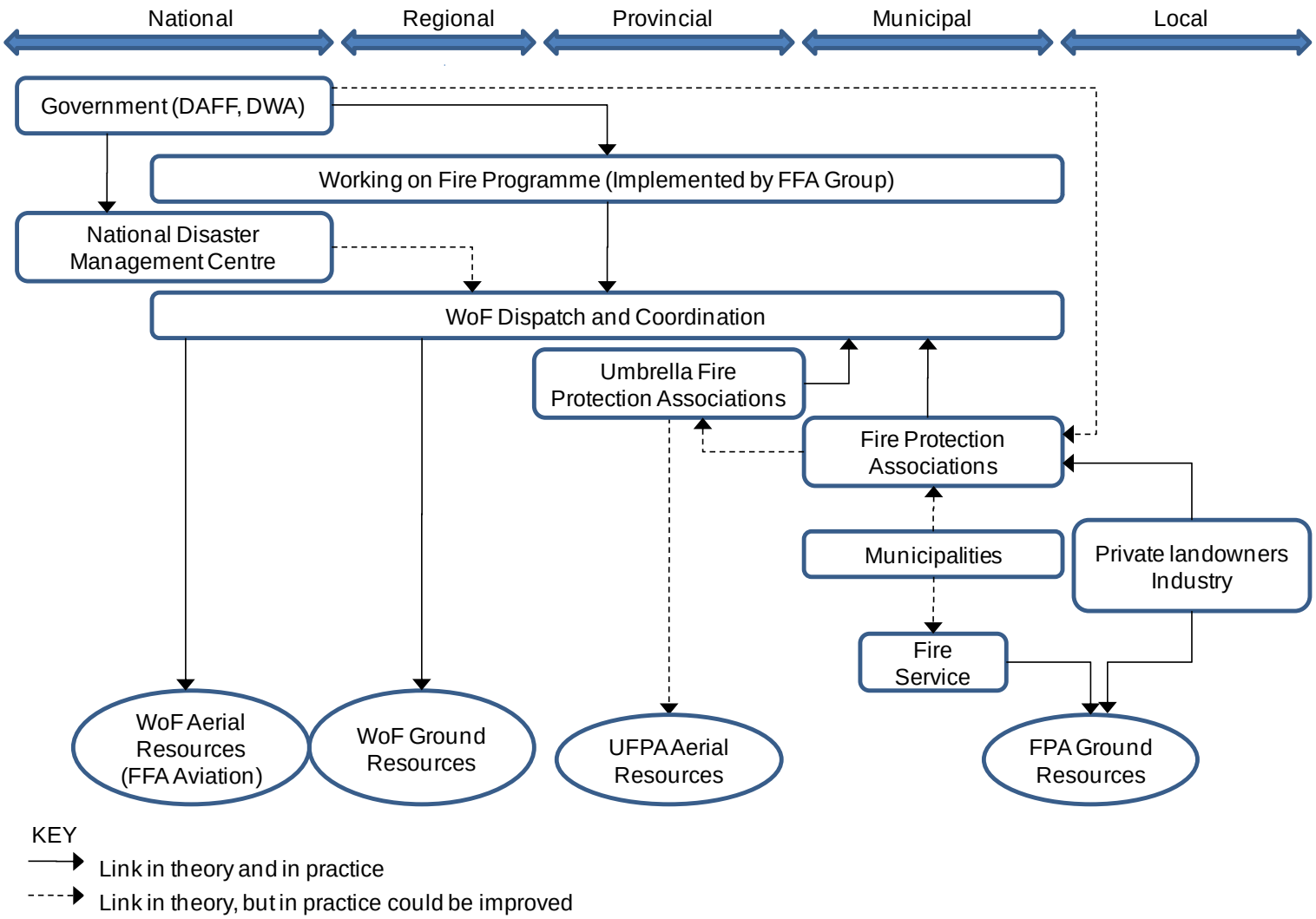
Financial arrangements

WoF provides up to 50% of the fixed costs where FPAs and partners can afford to contribute and all of the fixed cost where communities cannot afford to contribute. Fixed costs include pilot costs, insurance and the provision of aircraft. Partners contribute significantly towards the funding of the programme by paying approximately 50% of the costs of maintaining base facilities and for variable unbudgeted expenses ranging from transport, to rations for firefighters. Any partner calling on WoF's aerial firefighting services are responsible for all flying costs on a user pays basis.

Although having partners and FPAs cover 50% of costs enables WoF to increase its capacity and availability of resources, it is worth noting that this model also can cause difficulty when resources need to be mobilised but there are conflicting calls on where aerial resources should be allocated to.

For FPAs, members pay an annual membership fee based on acreage and according to the hierarchy of needs; members who require aerial resources on a priority basis pay a higher subscription fee. Additionally, members who use the FPA's own resources are charged per hour for the aerial resources used. Additional charges can also include call-out fees and charges per load.

Figure 3.2 South African system governance model



3.6 Case study summary: Australia

Australia is the sixth largest country in the world and about twice the size of the European Union by area. Responsibility for fighting wild fires rests within the eight states and territories. Bushfires pose a threat in nearly all parts of Australia at different times of the year. The estimated annual average cost of these fires is about AUD77 million (€53.9m[27]). Research has shown that due to climate change there is likely to be rise in weather-related fire risk by 2020 in most areas, including an increase in the average number of days when the Forest Fire Danger Risk rating is very high or extreme.

The National Aerial Firefighting Centre (NAFC) plays a crucial role in resource brokering

Australia has adopted an innovative solution to joint response in fighting wildfires. No legislative changes were needed and the resource sharing system is designed to be light on bureaucracy. Seven of the eight states and territories are members of the National Aerial Firefighting Centre (NAFC). This was formed by the states and territories in July 2003 to provide a cooperative national arrangement for combating bushfires.

NAFC is constituted as a limited company whose shareholders are the participating states/territories[28]. It is governed by a Board of Directors (with nominees from each participating state/territory) and is subject to company law and regulations that also ensure transparency.

Participation in the NAFC is encouraged by the federal government, acting through the Attorney General's Department. It also contributes to the fixed cost of the national fleet aircraft (currently 43 aircraft) by paying different levels of the fixed cost of making specialised firefighting aircraft available, normally 40-50%. This has led to deepening collaboration both among the states/territories and between the states/territories and the federal government. It has also enabled to procurement of larger aircraft and the effective pooling of resources across state jurisdictions.

The model is based on resource brokering, with the NAFC playing a key coordinating role between procuring national aircraft services from commercial aircraft providers, and coordinating and assisting aerial resource sharing among the states/territories. The NAFC's role includes co-ordination of the procurement, deployment and logistical support of firefighting aircraft on behalf of the states and territories. Resource sharing is organised through a Resource Management Agreement which is a legal agreement among the states and territories to share resources. The agreement covers both resources and liabilities.

The national aircraft fleet is procured through a public tendering process. The contract, between the aircraft operator and NAFC, is designed to ensure that the aircraft can be easily moved from one state or territory onto another. The states and territories send an order directly to NAFC detailing their requirement for aircraft, on the basis of which NAFC leases the aircraft for their use for a specified period. This system facilitates resource sharing at the time of need when states request additional resources to fight wild fires in their jurisdiction. In an event of deployment disputes, the NAFC Board makes a decision as to which state/territory the aircraft will be deployed and the period for which that state/territory will be in control of the aircraft.

Cost sharing and insurance arrangements have been built into the Resource Management Agreement. When states/territories provide support to each other, the receiving state is normally required to reimburse all the operating costs to the providing state. The aircraft

[27] Exchange rate used is 0.700675 (AUD to Euro) 30 Apr 2010.

[28] The federal government is eligible to be a member but at this stage has chosen to manage the relationship via a formal funding agreement rather than actual membership.

contractors are required to insure NAFC and all potential users of the aircraft and are required to maintain public indemnity insurance. Each state/territory also severally indemnifies NAFC against all damages costs or expenses that may be incurred or suffered by NAFC and all actions, proceedings, claims or demands that may be brought against NAFC relating to supply agreement or aircraft procured via NAFC.

The NAFC is integrated into a wider national network of institutions that have interests in wildfires

The overall policy relies on states' ability to collaborate. Informal networking between the states plays an important role. Collective governance is organised by the state entities and collaboration is based on risk assessment. Incident managers (normally chief officers) at state level often discuss risks and types of resources that could be shared before a formal request to additional resources is made.

In addition, federal government departments, research institutes and other organisations contribute to the functioning and development of the wild fire fighting response. This integrates key stakeholders into the operations of NAFC. Organisations that play an important role include the Australasian Fire and Emergency Service Authorities Council (AFAC).[29] The Council nominates a member to the NAFC Board and its activities include developing training packages and common standards for fire operations. The Attorney General's Department assists states and territories in developing their capacity for dealing with emergencies and disasters, and provides physical assistance to requesting states or territories when they cannot reasonably cope during an emergency. The Bushfire Cooperative Research Centre brings together researchers from universities, the Commonwealth Scientific and Industrial Research Organisation and other government organisations, and private industry or public sector agencies in long-term collaborative arrangements that support research and development. The organisation does significant research related to effective and efficient use of aerial fire fighting resources.

There are standardised systems for sharing of data on incidents but interoperability at ground level could be improved

The sharing of information about incidents between the states/territories is effectively organised. The main resource management report is the Bushfire Information and Significant Incidents (BISI) report. This provides information on the incident situation, resource availability and outlook across the states and territories. All incidents are managed under the Australian Inter-service Incident Management System (AIIMS) which provides a structure for delegation to ensure that all management and information functions, including incident control, operations, planning and logistics, are adequately performed. AIIMS also provides for the command and coordination of multi-agency incidents.

In addition, NAFC has adopted a national (standard) approach to the provision of tracking and event logging services for aircraft involved in firefighting and related operations. The new integrated model allows aircraft operators to select their own provider of tracking and logging services but the aircraft operator's tracking provider must arrange to forward the tracking data (to the required standard) to the assigned central integrator. The central integrator stores and forwards the data to the various user agencies and organisations.

Despite these management systems there is no overarching nationally accredited standard procedure for organising and managing fire suppression at ground level across the states and territories. Although AIIMS is a nationally accredited standard procedure and is universally adopted for incident management, including for management of aerial firefighting, there are some differences in training and certification for personnel to undertake the roles defined in AIIMS. This brings challenges, in particular when human

[29] AFAC is the industry body for fire, land management and emergency service organisations in Australia and New Zealand. AFAC members are drawn from every state and territory in Australia and New Zealand and from around the Pacific. AFAC is also represented in the NAFC Board.

resources from another state are deployed to assist in an operation. The basic competency requirements are set out in legislation. The formal provisions include a common certification of pilots that is organised by Civil Aviation Safety Authority and national standards set by AFAC for aviation that cover common competencies e.g. for incident management.

Effectiveness of the national resource brokering system

The stakeholders consulted for this research regard the resource brokering system as simple, with little bureaucracy and easy to operate. The federal government contribution, although not large relative to total expenditure, creates positive incentives and brings parties together. Consultations also suggest general satisfaction with the current organisation of resource sharing arrangements, including the degree of integration in aerial fire fighting. Areas for future improvement include further harmonisation of operating practices, procedures and technical requirements between the states, and better sharing of information, in particular that relating to safety. Training also seems to be most needed in how to most effectively deploy effort to suppress wild fires and in operational management of these activities.

As the states constitutionally have individual accountability for their respective areas, the successful functioning of the system depends, to a degree, on the enthusiasm of senior stakeholders within those states. A larger degree of standardisation could improve the operational functioning of the system. In addition, a centralised coordinating centre would enable a pre-emptive approach in which incidents are not only monitored as they occur but also enable some centrally-orchestrated risk management. The starting point would be to use and share strategic and operating standards between the states/territories and harmonise operating systems further.

3.7 Case study summary: New Zealand

There has been a 50% decline in the area lost to wildfires each year in New Zealand compared to the 1990-2000 period. 5,000 to 7,000 ha of land now burn in a typical year. However, there have been, in recent years, significant reductions in the size of the forestry estate owing to land conversion. The average fire is very small, burning between 1.25 and 1.55 ha only. This explains the very local nature of wildfire fighting organisation in the country.

New Zealand has a highly decentralised rural fire management system that relies heavily on volunteering

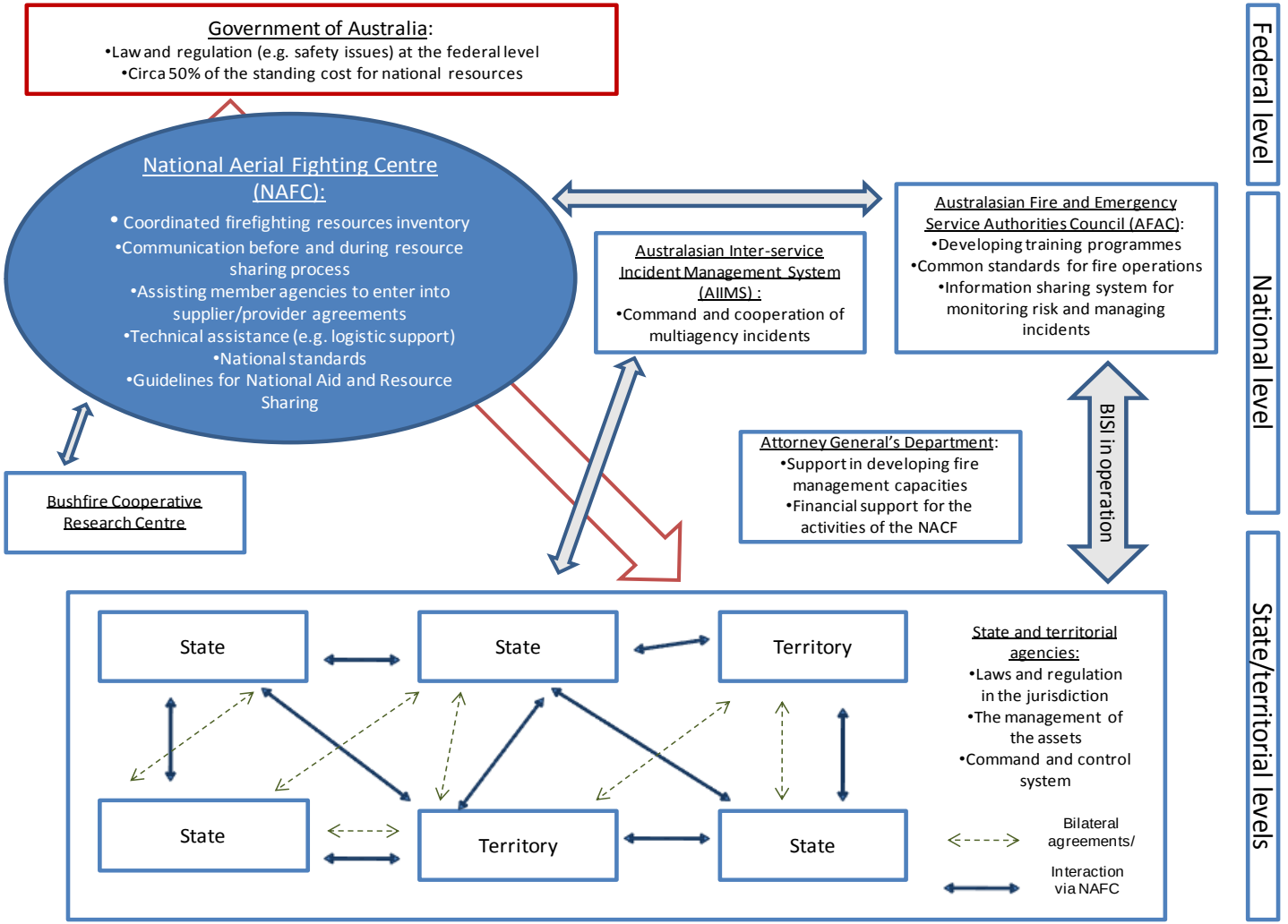
There are two types of fire management services in New Zealand: a national 'urban' service provided by the New Zealand Fire Service (NZFS) and a 'rural' system. Both systems rely heavily on volunteer fire fighters. Plantation forestry has always been a significant component of the country's economy and forest owners make significant contributions to the rural fire management effort.

The rural system has a highly decentralised structure. It is controlled by 87 Rural Fire Authorities (RFAs). 97% of New Zealand's land area lies outside fire districts classified as 'urban', and the RFAs are responsible for fire management on this land.

The RFAs provide the core of rural fire management operations. They largely proceed from the Rural Fire District Committees (i.e. forestry companies and large landowners), or of public bodies like the Department of Conservation (DoC) for national areas (which manages the 30% of New Zealand's land area that is national parks and reserves), and territorial authorities.

The RFAs are supervised by a National Rural Fire Authority (NRFA) but have a significant degree of autonomy. The NRFA is not a national fire management agency, but "gives a national perspective to rural fire management". It defines the rural fire control measures to be taken by RFAs, and has statutory powers to declare emergencies.

Figure 3.2 Australian system governance model



The coordination of the 87 autonomous RFAs is achieved through 11 Regional Rural Fire Committees. Within each RFA, the Principal and Rural Fire Officer manage fire fighting operations and undertake fire control measures. Each RFA is divided into sectors which have people and equipment needed to respond to a fire.

Large forestry companies and landowners play a major role in rural firefighting, contributing equipment, trained firefighters, and firefighting aircraft. A feature of this decentralised and autonomous system, which is largely based on volunteer labour, is that rural fire fighting forces end up helping with much more than fire. In 2003, they spent more than 1,700 hours at emergency incidents other than wildfires fires (i.e. incidents for which they have no jurisdictional authority) - about 56% of their total emergency response activity.

New Zealand is also a member of the Australasian Fire and Emergency Service Authorities Council (AFAC), an industry body for fire and emergency service organisations in Australia and New Zealand that operates a system for sharing information about risks.

There is an absence of national wildfires coordination structures and a heavy reliance on a dense network of private local assets

New Zealand lacks a national asset coordination centre and has a high degree of decentralisation of its rural fire organisation.

The country has a large number of small aircraft (especially agricultural aircraft) given the size of its population. The heavy use of aircraft for agricultural work (fertilising, spraying, etc.) is explained by the topography of the country. In many areas the land is too steep for tractors to operate.

There are 850 registered helicopters in New Zealand, including 150 to 200 used for fire fighting activity (in comparison, Australia has 50 to 80 aircraft coordinated across the whole country).

All of these aircraft are privately owned (none belong to the RFAs, nor to the NRFA. The RFA primarily contracts aircraft from private owners or operators. Aircraft are hired on a day-to-day basis - contractors are extremely flexible and the aircraft can be deployed to help immediately, on an *ad hoc* basis, in case of wildfires.

The successful operation of this flexible, decentralised system is helped by the fact that private operators (of agricultural aircraft) are often also undertaking contract work for plantation landowners or farmers. From a cultural perspective, they see firefighting as a priority task that gets precedence over day-to-day tasks. This results in a high degree of flexibility as well as transparency. Aerial operators are identified in the National Fire Plan and an expanded list is available on the National Emergency Resource Directory.

There is usually no need to contract aircraft from overseas given the large pool of resources available in New Zealand. There have been some instances of exchange with Australia. Some arrangements exist between private aircraft companies in New Zealand and other countries. These are made purely on a commercial basis. For instance, contracts have been signed with New South Wales and Queensland Victoria Tasmania (but purely on a private basis, without any involvement of New Zealand rural fire authorities).

Operations are essentially confined to the local level

Given the small average wildfire size, wildfire fighting operations in New Zealand are primarily local. New Zealand's fire fighting strategy relies heavily on (small size) aeroplanes and on an aggressive initial attack on the fire.

Under an agreement between the New Zealand Fire Service and the RFAs, the Fire Service will use its ground resources for suppression of wildfires in rural areas. These resources provide an initial attack response to rural fires. 90-95% of rural fires can be contained in this manner. The remaining and more persistent 5-10% rural fires extend into hours or days. Such situations require each RFA to activate its own or contracted resources. It is in these situations that aircraft and other heavy equipment are normally required.

The NRFA operates the Fire Weather Monitoring System (FWSYS), a tool for short to medium term fire management decision support that provides fire-area weather/fire danger maps and reports. It monitors resource deployment only in case domestic resources are deployed overseas on request.

Owing to the flexibility of the existing structure, the country can deploy resources overseas as rapidly as within two days. A national register records all the necessary information (passports, photographs, medical records) required for a deployment.

The wildfire fighting effort is mostly financed by forest owners

The Rural Fire Fighting Fund, set up in 1992, provides some federal financing to cover wildfires fighting costs. Over the past ten years, payments worth NZ$ 27mn (€ 14mn) have been made by the Fund.

The predominance of agricultural aircraft in fire fighting explains why 40-45% of the costs of fire fighting in New Zealand are aircraft related. Essentially, these are operating costs. Indeed, these resources entail little standing cost to the RFAs, being for the most part involved in other agricultural / commercial activities.

The cost of fighting wildfires can be passed on to the landowner, or the person who caused the fire (there are powers under the Forest and Rural Fires Act 1977 to recover the costs from individuals, based on *ad hoc* decisions of the NRFA or the relevant RFA). In general, forest owners contribute to the fire management effort well beyond the level expected for their areas being protected.

In case of deployment overseas, the agency that makes the request pays for all the costs of deployment. The NRFA takes charge of insurance, and the cost of this insurance is paid for by the foreign party.

This system has several merits: primarily, it is highly flexible and cost efficient. 70% of personnel tending to rural fires are volunteer Fire Service fire fighters who do not receive payment for their time and services. Moreover, as forestry companies cannot make claims against the NRFA for fires in their estate, they are encouraged to independently manage aerial fire suppression operations within their areas.

The good understanding of the local fire environment makes up for the lack of national training standards

Due to the essentially local nature of rural fires, there are some guidelines but no set of national standards on how aerial fire fighting operations should be managed. The local fire environment has, therefore, to be very well understood by the RFAs.

Liaison meetings are organised between RFAs, but these remain informal – the small size of the country has often been cited as an enabling factor for efficient (although informal) organisation. The only concern is that the absence of national standards may prove to be a weakness in case of occurrence of a catastrophic event.

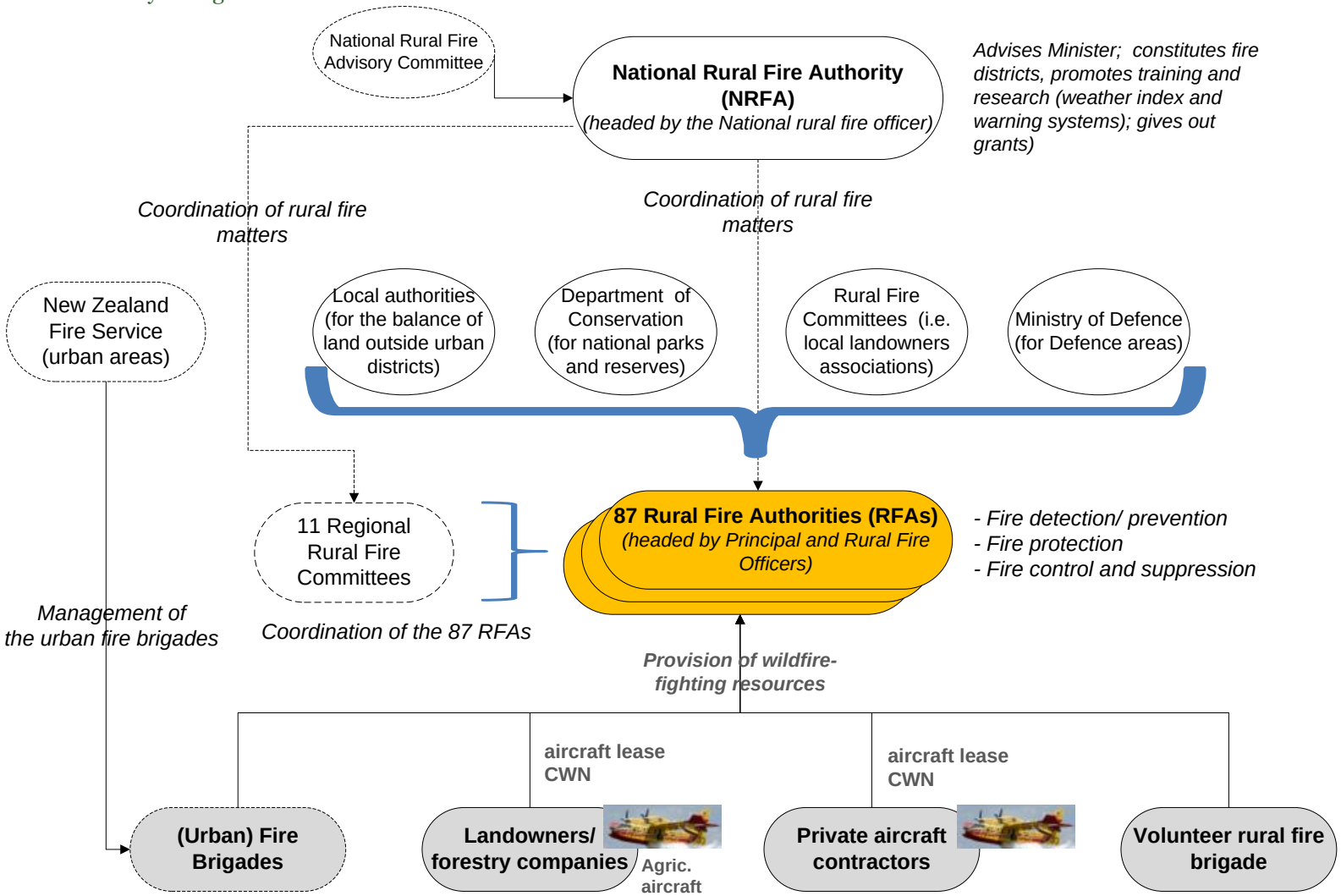
New Zealand is a member of the Australasian Forest Fire Management Group that was established by Australia and New Zealand as a subcommittee of the Asian Forestry Commission run by the FAO/UN. Several official assistance agreements have been signed. In the late 1990s, for instance, an agreement was signed with the USA and the province of Victoria in Australia, and in 2009, an agreement was signed with Canada. Discussions are in progress with South Africa for a similar agreement. These agreements provide for support when additional resources are required, as well as sharing of knowledge and training exchanges, standards of competence and fitness, and training on the Incident Command System (ICS). Ten deployments have been made within the framework of these arrangements since 2000.

It is a nimble and cost effective system that may, however, have difficulties in sustaining attacks on large-scale fires

The economic cost of wildfires in New Zealand is now less than what it was in the 1990s, contrary to all other case study countries. This underlines the efficiency of the highly decentralized and flexible New Zealand system.

However, the government is looking to consolidate RFAs, aiming at a possible 12-20 RFAs rather than the current 87. This may be a sign that the current organisational structure may be at risk of not being sufficiently reactive or resilient in case of very large wildfires across several jurisdictions.

Figure 3.2 New Zealand system governance model



4 Options for strengthening Europe's ability to respond to wildfires

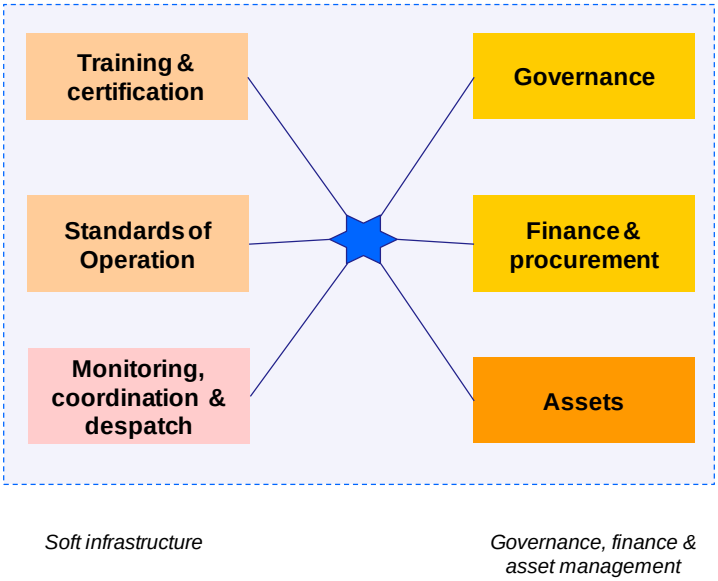
4.1 Purpose of this chapter

This chapter draws on the appraisal of the current situation within the EU Civil Protection Mechanism in Chapter 2 and the analysis of overseas practice in Chapter 3 in order to identify and evaluate options that could improve:

- The Mechanism's collective capacity to respond to wildfires;
- The efficacy of that response, i.e. its contribution to tackling wildfires and reducing the damage they cause;
- The cost-effectiveness of maintaining and deploying such capacity, for the Mechanism as a whole.

The presentation of options takes as a starting point the basic 'system model' shown in 3.4.12.0Figure 4.1.

Figure 4.1 A basic system model for aerial wildfire fighting capacity



4.2 Standards of Operation

The research illustrates the value of common standards of operation, which allows for the teams deployed through a resource sharing mechanism to be able to fit into the host command system on arrival and be used effectively.

Each Participating State has its Standards of Operations which are well embedded in domestic practice. Participating States are unlikely to contemplate wholesale changes to their existing systems simply to make intra-EU exchanges of personnel more effective. The international baseline is changing as more countries around the world adopt the Incident Command System model.

The value of looking across different national systems and identifying ways to ensure effective collaborative working has been identified in previous preparatory actions and projects.

4.2.1 Option S1– Host nation support agreement

There is, however, scope for improving current arrangements by getting collective agreement on matters such as **guidance for host country liaison and support for visiting aerial firefighters**. Such guidance would cover matters such as:

- rules governing utilisation of aerial assets in the host country (e.g. number of hours of flight allowed per day; number of drops allowed per day);
- air-ground integration in the host country (link between fire fighters on the ground, pilots, liaison officers, and the margin of autonomy that pilots have in the host country) (see also section 4.4);
- national operational standard / rules of engagement in the host country per type of aircraft;
- practical support, accommodation and ancillary services to visiting flight crews; and
- available water scooping points.

This guidance could form the basis of a promise from the requesting country of adequate logistical support and effective integration of aircraft from other jurisdictions deployed on firefighting operations. This 'guarantee' from the requesting state, and a matching 'guarantee' from the providing state that crews are adequately trained in firefighting operations (see below), are two important building blocks in the construction of a more effective resource-sharing system for Europe.

The development of host-nation support guidance has started with the work of a dedicated working group (a sub-working group of the Working Group on Modules). The discussion so far has focused on agreeing non-binding guidelines, applicable within the states participating to the Mechanism, for assistance offered by another Participating State. Under the Belgian Presidency, Council Conclusions on this subject are expected to be agreed by the end of 2010. These will give indication on the further direction of development on this matter.

Each country would develop its own material (presumably at its own cost) on the basis of a commonly agreed structure.

4.2.2 Option S2 – SOPs analysis

Detailed analysis of the current situation in the EU was out of scope of this study but further investigation of the operational challenges posed by variation in SOPs among Participating States would be worthwhile. Such analysis could:

- consider the impacts of variations in SoPs on operational effectiveness;
- benchmark the situation in forest firefighting against that in other areas of civil protection; and
- assess the fit between systems in use and the emerging international standard (ICS).

The purpose of such an analysis would be to improve interoperability of aerial resources engaged in assistance operations within the EU. That could also be a first, practical, step towards building a common EU aerial forest fires fighting 'doctrine' that would be shared and could be 'exported'. Initial consultations suggest support among certain Participating States, including those that experience higher levels of wildfire risk, for guidance of the kind outlined above. A guidance document could be developed through establishment of a Participating State expert committee supported by the Commission, with costs limited to those expenses

required to support the dialogue, with technical/advisory inputs if required. A decision on whether to give the guidance a formal (legal) status could be taken at a later stage.

An expert study of the variation in SoPs and their impacts as per the above outline specification should not cost in excess of €150,000. Any such study should make use of the foundations laid by the FIRE 4/5 project. Such a study should focus on the situation and systems of countries most frequently involved as donors and recipients of aerial firefighting assistance. Recommendations emerging from FIRE 4/5 activities include:

- a glossary for common interventions in five languages;
- development of material based on graphics and diagrams that could enable personnel from different Participating States to communicate instructions and situation reports more effectively;
- the definition of a minimum standard equipment for individual and collective of personnel protection ;
- an 'anticipation procedure' based on the operational situation in each Participating State with the possibility (if a situation of exceptional risk is confirmed) to immediately send a liaison officer to the national civil protection operational centre of the requesting country (see next section).

4.2.3 Summary - Standards of Operation

Options for this section are summarised below. The host country support measure is one example of the 'no-regrets' activities that would help to strengthen the EU's aerial asset sharing system.

Table 4.1 Option summary – Standards of Operation

Option	Activity
S1	Host nation support guidance for visiting aerial firefighting modules
S2	Study on variation in SOPs within Europe

4.3 Training and certification

Though there are resource-sharing arrangements in Europe at present their operational efficiency is negatively impacted by the fact that:

- The requesting nation cannot be sure that the crews of the aircraft deployed in response to its request for help have the experience its specific geographic conditions (or even, as some past events illustrate, significant prior experience of aerial firefighting operations) that are required to make them fully effective in tackling wildfires; and
- Differences in language, support systems, terminology, etc. hinder effective ground-air coordination.

The combination of aircrews lacking in appropriate training and poor air-to-ground coordination can result in aerial firefighting interventions which have little impact and which are thus not cost-effective.

Options proposed to improve the current situation focus on further development of the 'soft infrastructure' of the system through investment in capacity-building and skills development. Specific options identified are to:

- Develop a **training package for air crews of shared aircraf**t;
- Establish **certification mechanisms** for pilots of firefighting aircraft and aerial operations coordinators; and

- Cofinance joint **networking and live practice** events for air crews and ground crews from different Participating States before each European fire season;

The box below describes international approaches to training and certification for personnel involved in aerial firefighting. Specific options identified for Europe are discussed in the next subsection.

4.3.1 Option T1: Training package for air crews of shared aircraft and other operational staff

Consultations and previous projects suggest that there would be value in training that helped to strengthen the skills of personnel involved in aerial firefighting operations that involve exchange of assets between countries.

The training should be focused on rendering joint firefighting efforts (i.e. those where some assets are provided by another participating state) more effective, building a pool of people:

- trained to a consistently high level in the use of aircraft in tackling wildfires; and
- with a shared body of knowledge about terminology, strategy, etc..
- able to work effectively on missions where aircraft are deployed outside their home country.

Such a package could consist of training modules such as:

- Specific training for the personnel responsible for coordinating, supervising and managing aerial operations (the value of having highly experienced and skilled resources at this level was stressed throughout the case study consultations).

  This could also take the form of the development of mentoring between participating states, with a progressive introduction to more operational roles and clearly defined progression.

- Training modules on the integration of ground and aerial operations. The specific needs of participating states should be taken into account in this regard. For instance the French approach to aerial firefighting is adapted to the French theory of rapid initial attack on fires as long as they remain small – but such an approach may not be shared amongst all participating states. There may be merit in fostering a debate about these issues in the framework of current firefighting training exercises; and

- Training on the safety rules of operations: the development of a common and consistent safety culture amongst participating states is also something that comes out of the case studies.

The overall training package could also involve:

- Use of computer-based training and simulations in order to increase the level of integration and interaction of firefighting personnel (from incident management officers, to pilots of airplanes and helicopters, through to team leaders and fire trucks drivers). This could range from the use of simple, computer-based training on procedures through to more complex multi-role, interactive simulators; and

- The further development of flying skills through a training programme for pilots involved in aerial firefighting (see also below).

This work should build on the foundations laid by the FIRE 4/5 project and preparatory action projects (see case study).

Difficulties in communication have also been highlighted as a potentially important source of misunderstandings and coordination problems during multinational interventions. The English language skills of the key personnel are also therefore relevant.

Box 4.1 International approaches to training and certification for personnel involved in aerial firefighting

Canada

In Canada there are training and certification arrangements that place a strong focus on safety, efficiency, effectiveness of aircraft use, as well as on the efficiency evaluation of operations and systems. Air operations personnel (notably the 'air attack officers', whose role is to monitor and control the effectiveness of government expenditure on aerial firefighting operations) are carefully selected.

Training follows a multi-tiered approach, with progression involving formal mentoring, supervised practical experience and evaluation. The training provided at provincial level is recognised nationally (with British Columbia being regarded as a centre of excellence).

There are no accreditation requirements for pilots of firefighting aircraft. The quality is maintained by the very good level of accreditation and progression system of pilots from contracting companies. This is supported by a system of contracts that are of sufficient length to sustain the provision of good quality in-house pilot training and progression systems.

United States

The US training and certification system is very structured, but also highly complex, with significant variation in training requirements between agencies and jurisdictions. There is, however, a move in the direction of common standards between agencies, specifically at the federal level. The approaches are very different at the operational level, which still require several different training systems. For example, the US Forest Service (USFS) still uses lead planes piloted by experienced fire crew to oversee and harmonise water bombers operations but they have recently started to manoeuvre lead planes with Air Tactical Group Supervisors (Air Attack Supervisors) on board. This provides a more tactical approach to air operations, and brings USFS operating procedures more in line with those of other agencies.

The pilot accreditation process in the US provides background training in ground operations and training on air operations that is based on oral tests, flight tests and attendance at an aerial firefighting academy. A sophisticated computer-based training simulator for air operations has been developed by the USFS. It provides for the simultaneous interactive operation of up to five aircraft in a variety of fire scenarios, in a very realistic setting. Ground-based operations are not integrated into its scenarios.

Air operations specialists, notably Air Attack Supervisors (AAS) are carefully trained and selected. The ability to effectively integrate ground and aerial fire suppression operations is also considered of great importance.

Four 'national incident management organisation teams' have been established by federal agencies. These teams are staffed with some of the most experienced fire managers. Based in the USFS, they work with all wildland fire agencies to improve firefighting strategic decisions over time. These teams have several assignments, including managing the largest, most complex and costly fires; identifying and disseminating good practices, in terms of management, throughout the federal agencies; and working with staff at the national forests outside the 'fire season' where large fires are particularly likely to occur, to improve staff response preparation.

Strategic decisions about how to manage a fire are made by managers of the agencies' individual land management units, that is, national forest supervisors, BLM district managers, and others line officers.

A training programme was initiated by the Forest Service in 2007. It is geared towards certifying line officers to manage a fire at different competency levels (low, medium, or high complexity). If a fire exceeds the line officer's certification level, a more experienced officer is assigned to coach the less experienced officer; final decisions on strategies, however, remain the responsibility of the line officer of the unit where the fire is burning

Table 4.2 Estimated costs of pilots training (extrapolated from French expenditure) – ab-initio training and competency maintenance

	Central government: Number of water-bomber aircraft Number of Canadairs	Estimated total number of pilots/ co-pilots (a)	Number of 'non-CL-415' pilots (pilots to be trained)	Cost of CL-415 training (ab initio) for existing water-bomber pilots (b)	Annual cost of competency maintenance and training to inter-operability procedures (c)
France	23 12 (CL-415)	90	0	0	270,000
Italy	18 (CL-415) *[15 operational at any one time]*	60	0	0	180,000
Spain	40 19 CL-215 6 CL-415	160	34	3,570,000	480,000
Greece	21 13 CL-215 8 CL-415	84	13	1,365,000	252,000
Portugal	20 (exclusively single-engine aircraft – no Canadairs)	80	80	8,400,000	240,000
Croatia	12 (CL-415)	48	0	0	144,000
Total	**125 incl. 56 CL-415**	**522 Incl. 400 Canadair pilots (approx.)**	**127**	**13,335,000**	**1,566,000**

(a) Assumption: 4 trained pilots/ co-pilots per aircraft.

(b) Training 'ab initio' for a professional CL-415 pilot, ATPL (Airline Transport Pilot Licence) with a minimum of 2,400 flying hours (2 years minimum, 3 years 'ideal'). Training would include 150 flying hours, including CL-415 qualification and hydro-flight and water-bombing qualification – **Total €105,000 per pilot.**

Note: training for a professional DASH 8 (Q 400) pilot (only possible for pilots who already have a water-bomber qualification) : €20,000 for basic qualification (in Toronto or Stockholm), 1 'control flight' and 25 water-bomber flights **– Total €195,000 per pilot.**

(c) Extrapolation based on costs of training 'competency maintenance' (2009) for water-bombers flying crew in France (Civil Protection Department airbase of Marignane) : 279 630 € (for about 90 pilots) = ~ €3,000 per pilot/co-pilot per annum.

Source: French Sécurité Civile / Civil Protection (courtesy of Mr Jacques Bonneval, expert on international flight safety, and forest fires fighting) – French Senate - Airlines.Net.

The additional cost of such an option would depend on how it was integrated into national training programmes and the extent to which existing training infrastructure could be used. Our estimate is if the participating states members of the FIRE4 / FIRE 5 group of countries made the same *per capita* 'competency maintenance' expenditure as France then they would collectively be spending around **€1.5 million a year** maintaining the standards of their flight crews (estimate based on the actual costs of water bomber pilots training in France)[30].

Training of national (government) pilots is a Member State responsibility. However, the development (and potentially the delivery) of training materials that could support more effective resource-sharing is something in which there is an EU interest and EU co-financing could be considered. Training programmes that involved flight crews from several Participating States could be considered. In this regard, our estimate is if the participating states members of the FIRE 5 group of countries chose to upgrade the training of all their existing pilots, i.e. train their current "non-CL-415" water-bomber pilots to the standards of CL-415 piloting (CL-415 being the most widely shared large water-bomber in the EU), they would collectively be spending **€13.4 million** - that training being concentrated exclusively on upgrading Spain, Greece and Portugal capabilities. This calculation is based on the assumption that such an upgrade was considered necessary, e.g. to support a virtual pool of aerial forest fire fighting assets.

4.3.2 Option T2: Networking and exchange of experience

Alongside formal training programmes, investment in events designed to promote exchange of experience and discussion about firefighting strategies within the EU's cadre of pilots of firefighting aircraft could be considered. These events, for air crews and ground coordinators rather than administrators, could include

- 'lessons learnt' exercises that focus on experience in the previous fire season; and
- 'real-life' training exercises.

They could demonstrate approaches covered in the training programmes (above).

Some events of this kind have been organised via the FIRE 4 / FIRE 5 initiatives. Lessons learnt following a forest fire-fighting season are organised by the MIC, with the participation of all Participating States. However, most of the time they are not attended by pilots or experts directly involved in the operations. There is, therefore, room for improving the current 'Lessons Learnt' process, by enlarging the participation or organising several meetings – each targeting a specific category of staff involved in the operations.

On the basis of the number of central governments water-bombers (see Table 4.2, we estimate that there is a total pool of approximately 500 flying crew that might be eligible to take part in such events, including 400 pilots of Canadair/ CL-415s, the most interoperable aircraft. Costs could be contained if the events were focused on those most likely to be involved in inter-state exchanges of personnel and aircraft. The actual costs of an annual

[30] There are three possible ways to become a Civil Protection pilot in France:

- Class A: pilots, called for being water-bombers commanders – 2400 flying hours, 12 years experience, age limit at recruitment: 43
- Class B: pilots, called for being co-pilots on water-bombers – 500 flying hours, 2 years experience, age limit at recruitment: 27
- Class C: liaison aircraft pilots – 1500 flying hours, 5 years experience (including training), age limit at recruitment: 50

networking / lessons learnt and live exercise for crews and ground support involved in aerial asset resource exchanges in the previous fire season would be determined by, for instance, what contributions in kind could be secured from participating states.

4.3.3 Option T3 : Certification mechanism for pilots of firefighting aircraft and aerial operations coordinators

Ultimately it would be helpful if skilled pilots of firefighting aircraft could be recognised through certification. The certification would be contingent upon completion of prescribed training, practical experience and language capability. Once a certification system was in place and widely adopted, the EU resource-sharing system could require that pilots of aircraft shared through the mechanism were qualified under it - providing assurance to the requesting nation of the capability of the pilots despatched to aid them.

Fire aviation specialists, notably aerial operations coordinators, have been highlighted as a scarce resource in the case study countries as well as in the EU. Adopting a common certification system for aerial operations coordinators would these specialists to be exchanged among firefighting agencies of participating states when there is a shortage of skilled personal during emergencies. Coordinators need strong fire management backgrounds and a good understanding of wildfire behaviour and tactical strategies, as well as the ability to safely and effectively integrate ground and aerial suppression operations.

Developing a new European certification system for pilots and/or aerial operations coordinators would require participating states, potentially with the support of the Commission, to agree on learning outcomes, and then design the content. There would also be a need to size the different training units, defining the different levels of qualifications, the value of the credits to be earned, the proportion between guided learning hours and self learning hours, and a pathway to qualification. Teaching and assessment materials would also have to be developed to assist those delivering and assessing it, as well as guidance and support to those who will use the qualification.

The additional cost of putting flight crews through such a certification programme would necessarily depend on how it would be integrated into national training programmes. Unit costs would depend on teaching group sizes, guided learning hours and assessment methods. Potential variable costs include flying time or usage of flight simulators during the certification, teaching, assessing (internal and external verifiers are usually required). This initiative would result in fixed costs being incurred for the initial training and development of trainers and assessors, replacing teaching and assessment materials, and equipment.

The Commission could play a facilitating role in devising certification criteria, which could be developed by representatives of the states participating in the European Civil Protection Mechanism, working together through EU committees.

Such a programme could be delivered within the framework of a “European aerial fire fighting academy”, a concept that has already been under discussion in some expert circles, notably in France. The Corte University, in Corsica, is currently setting the foundations of such a programme, within its forestry/ environmental physical systems department, with the assistance of aerial fire fighting experts from the French Civil Protection Department (Sécurité Civile).

It would be helpful if such a system did not exclude pilots from outside the EU from supporting firefighting operations within the EU. Mutual recognition of certification systems from certain other countries could be considered.

4.3.4 Summary - training and certification

Investment in training that improves the skills of the personnel involving in aerial firefighting and also their interoperability among participating states is a key part of building a better system for Europe. Options range from basic lessons learnt events and live exercises

through training to certification of pilots and personnel in other key roles. Certification systems operated in North America provide possible comparators.

Table 4.3 Option summary – Training and certification

Option	Activity
T1	Develop training package for air crews of shared aircraft
T2	Provide finance support for networking and training events for air crews and ground crews before each European fire season
T3	Establish an EU certification mechanism for pilots of firefighting aircraft, as well as aerial operations coordinators

4.4 Monitoring, coordination and despatch

The EU has a facility (the MIC) able to help with the monitoring, coordination and despatch of shared aerial resources for firefighting operations. Barriers to more effective use being made of this facility include:

- The uncertainty of the supply of assets available to it (especially when fire risk is elevated simultaneously in several Participating States);
- Its inability to pre-position aircraft when that would facilitate a faster response – although pre-positioning is theoretically possible, following a request for pre-positioning of a Participating State, and it was used for the EUFFTR planes in 2009, this is not a standard practice. One of the reasons is that the MIC does not have the complete overview of the available assets at Participating State level;
- Information systems available to support decision making, specifically:
  - The lack of a standardised, EU-wide real-time aerial assets tracking system;
  - A central database that is able to help with the monitoring of the location of assets and of fire events, and to help in the analysis of the effectiveness of initial attack and in the development of forward-looking pre-positioning and deployment strategies;
  - Standardised EU weather and fire risk prediction products to allow consistent risk comparisons across Participating States (EFFIS is an initiative that tries to reduce this gap but there is scope for further improvement in its functionality).

The uncertainty of supply of assets and the options for pre-positioning of aircraft are discussed elsewhere in this chapter. This section focuses primarily on the information systems, and specifically the development of facilities that would:

- Provide greater and shared 'visibility' of EU aerial assets and first attack capabilities;
- Help improving the quality of decision making in the deployment of aircraft to forest fires; and
- Allow an efficient prepositioning for a faster response, and integration with ground forces.

4.4.1 Option M 1 : Improving the 'visibility' of shared assets

As the EU's system for coordinating aerial firefighting resources develops, there is an increasing value-added in developing systems that provide near-real time information on the location of aircraft declared as available for common purpose activities within the EU. Such

an information system is a logical part of the supporting infrastructure for a voluntary pool arrangement, as discussed in section 4.7.

For such a system to work, Participating States would need to provide data on the availability and location of aircraft to the MIC on a regular basis. Italy proposed to provide this type of information during the preparations for the 2010 fire campaign, but the wider appetite among Participating States for supplying and sharing such data is not known.

The development of the computer systems that would hold and present the data, and the system's maintenance, do not appear to be significant barriers. According to the Joint Research Centre (JRC), there are no technical constraints for developing a tool providing information on aircraft deployment. JRC staff advises that it could be done at low cost using the Google Earth application. JRC staff working on EFFIS would be available to administer the tool.

4.4.2 Option M 2 : Developing systems of operational reporting, effectiveness measurement and fire risk assessment through international cooperation

Given the expense involved in deploying aerial assets, there is value in understanding when and how they can be used most effectively in order to inform future deployments and investments, and to support the development of 'self-improving' system that learns from experience.

Performance monitoring systems of this type generally require that data for each aircraft deployment are entered to a database within a few hours of the pilots returning to their base. The system, once developed, can be used to generate statistics on parameters such as distance to fire; fire size on arrival; fire size on completion; cost efficiency. These statistics can then be used as performance measures to monitor the effectiveness of resource positioning, response times, and detection systems. They can also be used to justify expenditures on aircraft purchasing or contracting budgets.

There is potential for Europe to learn from, and perhaps cooperate with, some of the case study countries (notably Canada), where efficiency of aerial deployments is measured and evaluated. Supporting the exchange of best practice among Participating States in developing and using such systems and the associated performance metrics is a potential area of European activity.

A first step to this could be launching an operational data collection programme amongst Participating States that would support the subsequent development of efficiency indexes and fire ranking/ fire behaviour tools (that would describe the difficulty of suppression in a format suitable for the widest possible range of users).

4.4.3 Option M 3 : Prepositioning of pooled assets outside national borders

A feature of some of the international case studies is the mobility of shared assets. Pre-positioning aircraft in areas of elevated fire risk can facilitate more rapid deployment and thus a more effective first attack.

Pre-positioning assets around the EU is currently not a standard practice but it could prove beneficial. Pre-positioning would be 'enabled' by further development of a pool of assets available for common purpose actions. The EU interest in pre-positioning would apply only to assets in a common purpose pool, and would require that such aircraft could be supported from more than one operating base within the EU. The EUFFTR module has been pre-positioned during the summer of 2009. Although pre-positioning of Participating States' assets is theoretically possible, following a request for pre-positioning of another Participating State, it is not seen as a standard practice. Pre-positioning of assets upon MIC's advice, on the basis of the wildfire forecasts and availability of assets in the common purpose pool, is likely to increase the overall efficiency of the use of assets available at European level.

4.4.4 Option summary – Monitoring, coordination and despatch

Options identified under the heading monitoring, coordination and despatch are listed. Option M1 and M2 represent investments in 'enabling' systems that could help to ensure that Europe's scarce and expensive aerial firefighting assets are deployed more efficiently and to greater effect. Pre-positioning of assets beyond the EUFFTR is not an imminent prospect, nor a high priority, but a potential consideration for the future if an asset pool is developed.

Table 4.4 Option summary - monitoring, coordination and despatch

Option	Activity
M1	Improving the 'visibility' of shared assets
M2	Developing systems of operational reporting & effectiveness measurement
M3	Pre-positioning of common purpose assets

4.5 Governance

This section considers 'governance' arrangements, i.e. the structures and systems through which decisions are taken about priorities, investments and responsibilities within the aerial asset-sharing system.

The EU has little in the way of formal system governance structures to manage asset-sharing arrangements. The MIC provides a coordinating role and delivers expertise and there is, in the EU Civil Protection Mechanism, a facility through which joint activities can be pursued. There is no facility other than standard EU administrative and political processes through which EU Member States can meet to discuss overall capacity or other issues relevant to the further development of the system. The existing arrangements are more similar to the arrangements the case study nations have in place for exchange of assets with other countries than those that they have established internally.

The international review provided no 'model' governance models for aerial firefighting asset-sharing *among* countries but there are interesting models *within* federal systems from which lessons can be drawn for Europe (while recognising in doing so the different constitutional context). If the EU wishes to exploit the advantages of a more developed intra-EU aerial asset sharing system, then there are some lessons to be drawn from some aspects of the arrangements adopted elsewhere.

4.5.1 Options for the EU

Options identified are:

- ***Status quo (business as usual)*****,** with a central coordinating function provided by the European Commission but no further development in common governance arrangements.
- ***A new agreement (concordat)*** on principles for sharing of aerial assets for fire fighting, which also codified rules on cost recovery, competency of crews, etc. This agreement could be a voluntary '*concordat'* that participating states could choose to sign up to, or a more formal and binding agreement common to all. No further 'institutional' development need be implied and there could be a continuing role for the MIC in practical matters of resource coordination, exchange of information, etc.
- A ***new***, ***independent, 'arms length' body*** for Europe, modelled on the Canadian and Australian experience, within which interested Participating States together with the European Commission would work together to develop a stronger system for asset sharing and associated procedures for cost recovery, and procurement of common assets. This would still be consistent with the MIC providing a coordination and despatch function (e.g. as part of the EU contribution to the initiative).

There is a close link between the governance model and the financial model to be adopted, as discussed further below.

4.5.2 Option G 1 : Business as usual

Under this option the EU would still, given the mandate in matters of civil protection granted by the Treaty of Lisbon, work to foster improvements to the EU's 'soft infrastructure' using current institutional and legal frameworks. Such activity could involve facilitating progress on issues such as:

- supporting improvements in fire-fighting proficiency for shared missions;
- the development and coordination of an EU-level training programme and competency frameworks; common purchasing/ private contracting;
- standards of operations; and
- enhanced lessons learnt.

Advantages of this option include:

- attention can be focused on value-added activities that build confidence in, and efficiency of, resource-sharing arrangements (as outlined elsewhere in this chapter) rather than risk being distracted by debates about new structures; and
- there would be no incremental system management costs.

Disadvantages of this option include:

- that the pace of system development (and thus improvements in the capacity and efficacy of the system) is likely to be slower than it could be;
- there is no forum within which collective needs and interests of Participating States can be discussed, ideas explored, beyond the formal processes of Commission/Member State dialogue; and
- the current arrangements cannot as easily support some of the more creative collaborative solutions (e.g. joint procurement) that could be achieved with alternative governance arrangements.

4.5.3 Option G 2 : Concordat

Under this option the collective ambition for system development (such as those laid out in other sections of this chapter) would be codified in an agreement, voluntary or binding, of Participating States. Support to, and management of, this concordat would (presumably) be vested with the Commission.

Advantages of this option include:

- Expectations of the various Participating States and the Commission with regard to the further development of the system would be clearly identified.
- A political agreement that codifies the collective ambition of participating states for the further development of the resource-sharing system could help to inject greater pace and purpose into the effort, and release resources for that purpose.
- A new discussion and decision-making group could be established under the auspices of such an agreement to provide a forum for debate and decision-making (e.g. to consider and review cost recovery rates, or the size of the central reserve);
- The option represents an incremental development on current arrangements, and as such may be achievable.

Disadvantages of this option include:

- The current institutional framework cannot easily support some of the more creative collaborative solutions (e.g. joint procurement) and efficient financing arrangements that could be achieved with alternative governance arrangements.
- It is difficult to reconcile with the new institutional framework laid down in the Treaty on the Functioning of the European Union, as the 'concordat' would be a purely intergovernmental act in respect of which the European Parliament would have no say.
- It is likely to be less flexible than the option below.

4.5.4 Option G 3 : New arms-length body

This third option takes inspiration from the systems established in some of the case study countries. It involves examining the feasibility of a new, ***independent, 'arms length' body*** that would steer the development of the aerial firefighting resource-sharing system within Europe.

This option is modelled on the Canadian and Australian systems. These countries organise aspects of their resource sharing systems through an institution that is, in formal terms, independent of the federal government. In the case of Australia this is constituted as a company, with the various governments as shareholders and board members. In the case of Canada the institution is a private, non-profit organisation funded by provinces/territories and the federal government. Both are small organisations with a limited remit.

The most important aspect of these structures is the way that they provide vehicles for efficient and flexible organisation of system finances, and for decision-making. The central government has a vote and a voice, but is one in a community of 'users'. It plays a useful supporting and 'enabling' role - helping deliver efficient procurement outcomes, providing co-financing, coordination and technical support – but the system as a whole is organised around the needs of users rather than being a 'top-down' structure.

These organisations, and the governance arrangements that go with them, provide an independence and transparency that helps to keep them focused on their core business. They can also support transparent and sustainable financial management, and facilitate the flexibility to determine cost-recovery rules that best serve the needs of users. They do not need to provide services themselves.

If adopted for Europe, the asset sharing organisation would primarily be a vehicle for identifying user requirements, commissioning services and facilitating sharing of assets – it would not need to supply any services itself and would need very little infrastructure of its own (thus being comparatively cheap to operate – see table below).

This option could be complemented by a possible delegation of aviation safety matters to the **EASA (European Aviation Safety Agency)**, notably with regard to regard to joint-procurement of aircraft, unifying standards of operations, authorization of commercial operators, etc. The EASA is based in Cologne, and its responsibilities include:

- expert advice to the EU for drafting new legislation on aviation safety;
- implementing and monitoring safety rules, including inspections in the Member States;
- crews licensing, training;
- type-certification of aircraft and components, as well as the approval of organisations involved in the design, manufacture and maintenance of aeronautical products;
- authorization of third-country (non EU) operators;
- safety analysis and research.

EASA's responsibilities are being enhanced to meet the challenges of developments in the aviation sector. In a few years, the EASA will also be responsible for safety regulations regarding airports and air traffic management systems.

Table 4.5 The NAFC - the organisation through which Australia's central asset supply agreements are channelled– illustrates how such bodies can be run on a 'lean' model with expenditure focused on meeting user requirements

	Expenditure	Share
Disbursements made under supply agreements	$14,077,800	97.8%
AFAC Staff Support Expenses	$174,705	1.2%
Consultant expenses	$34,377	0.2%
Contractor expenses	$39,362	0.3%
Travel expenses	$27,487	0.2%
Other expenses	$43,297	0.3%

Source: National Aerial Firefighting Centre, Annual Report 2009, http://www.nafc.org.au/documents/NAFC_AnnReport_FA.pdf

The establishment of a legal entity ought not to be a significant barrier – the EU and its Member States have established a wide variety of arms-length 'vehicles' for various special purposes over the years, many of which have worked successfully (see box below).

Advantages of such a model include:

- As a membership-driven organisation, the new legal entity would work as a **commissioner of services** working for members to deliver the outputs they require. The structure, and the governance arrangements that come with it, provides an independence and transparency that helps to keep it focused on its core business;
- The participating countries would be able to **pool financial resources** for securing access to assets up to the level that they, individually and collectively, believe to be necessary;
- It could give members access to **EU-wide economies of scale** in asset operation and procurement that may become increasingly attractive as public expenditure cuts bite;
- Members would have an interest in **efficient procurement**, e.g. comparing the costs of securing assets from the pool against the costs of securing equivalent capacity via a call-when-needed lease arrangement, helping to keep a control on expenditure;
- The **different interests** of fire-prone countries and those less subject to wildfire risks can be accommodated in the membership structure;
- It provides a **forum within which participating states can discuss unmet needs** and future requirements vis-á-vis aerial asset sharing in a collaborative and cooperative environment;
- It can also **support transparent and sustainable financial management**, and facilitate the flexibility to determine **cost-recovery rules** that best serve the needs of users. It does not need to provide services (e.g. coordination and despatch) itself;
- It 'enables' **consideration of financial and procurement options** which are difficult to implement under present arrangements. For example, a subscription-based approach to providing access to shared assets from a virtual pool and/or a central reserve (see below), is probably only sustainable, from a political and practical point

of view, if combined with an institutional arrangement that would give participating states power over the amounts of money raised, and the allocation of funds;

- The model can be designed to **accommodate different levels of strategic interest** of participating states – e.g. those for whom wildfire is not a major strategic risk as well as those for whom it is being associate / full 'members', with different voting rights and financial commitments.

Example - The European Maritime Safety Agency (EMSA)

The European Maritime Safety Agency (EMSA), established by Regulation (EC) N° 1406/2002 (5 August 2002), contributes to the enhancement of the overall maritime safety system in the EU. It aims to reduce the risk of maritime accidents, marine pollution and the loss of human lives at sea.

Following major shipping disasters in European waters, such as the sinking of the ferry Estonia and the tankers Erika and Prestige, new EU legislation has been adopted to improve maritime safety and to reduce pollution from ships. An ongoing process of dialogue and cooperation is necessary to ensure a proper, harmonised and effective implementation of this legislation among all the parties concerned. The main task of EMSA is to organise and structure this dialogue between 27 European States and the European Commission.

The Agency provides technical and scientific assistance to the Commission in the field of maritime safety, prevention of and response to marine pollution. It also works very closely with Member States, responding to their specific requests in relation to the practical implementation of the EU legislation (such as the directive on traffic monitoring), and organises appropriate training activities. EMSA aims to facilitate co-operation between Member States and disseminate best practices in the EU. The Agency also plays a role in the process of the EU enlargement, by assisting the accession countries in the implementation of the EU legislation on maritime safety and prevention of pollution from ships.

The Agency also contributes to the process of evaluating the effectiveness of EU legislation by providing the Commission and Member States with objective, reliable and comparable information and data on maritime safety and on ship pollution.

The activities of EMSA can be divided in two broad parts:

1. **Implementation (of EU legislation) Activities (safety assessments and inspections; ship safety; environment, training and statistics)**
2. **Operational Activities (pollution preparedness, detection and response; vessel tracking and reporting services)**

   Member States have the primary responsibility to respond to an incident and the co-ordination of the response. However EMSA's pollution preparedness & response activities include management of an oil recovery service which "tops-up" the efforts of coastal states by focusing on oil spills beyond the national response capacity of individual Member States. This model might also be explored in the context of action against wildfires. EMSA has **stand-by contracts for oil recovery vessels pre-positioned all over Europe** (oil/product tankers and bunker vessels), that do commercial operations on a daily basis, but are also equipped for responding to oil spills if requested. These stand-by capacities are the last resort and represent also the largest vessels for oil pollution interventions in Europe. EMSA pays the stand-by costs and training activities, while the affected state bears the operational costs which later should be recovered from the polluter. This activity was not in the original EMSA's mandate, but it was included at a later stage.

The Australian and Canadian systems show that such entities can be used to secure economies of scale in procurement, aggregating demand to secure a better deal from the market. Aircraft that are centrally procured in this way can subsequently be divested or leased to members for operational purposes[31].

This model is entirely compatible with the MIC retaining its present monitoring and coordination role. MIC services would represent an EU contribution-in-kind to the system. Under this model the European Commission could also continue to co-finance the delivery of EU public goods as defined above, supporting the development or a more effective capacity across Europe through training, certification, etc.

Disadvantages of this option include:

- That it may be a step too far / fast for participating states at this time. As discussed elsewhere, detailed analysis of the situation in the EU and consultation with Participating States on their perceptions of 'the problem' and appetite for different solutions is not part of the terms of reference of this current study, but consultations suggest that there are differences of view among Participating States on how far and fast the EU should develop its resource-sharing system and consider additional investment in assets and systems;
- Even if run on a lean model, there would be some additional cost to establishment and operation of the organisation.

The costs of such a facility would depend on the functions dedicated to it when it was constituted on a 'lean'/virtual model or a 'heavier' agency. The core costs of the Australian NAFC (excluding disbursements under supply agreements) equate to around €225,000 a year (see Table 4.5), which suggests that an ambition to operate an EU equivalent system for less than €500,000 a year ought to be achievable. This is significant, but less than the typical monthly operating cost of one CL-415 Canadair.

4.5.5 Option summary

The advantages and disadvantages of the various options are summarised in Table 4.6. In essence the progression from option G1 to G3 implies greater commitment in return for access to greater prospective benefits in terms of flexibility of service organisation.

[31] Analyses conducted at Member State level have previously identified the potential value of collaborative procurement at EU level and/or the development of EU fleet capacity as an issue to consider as existing national fleets approach retirement. One example is a 2006 report to the French Senate which highlighted the challenges facing France with regard to the renewal of its Canadair fleet by 2020. Rapport d'information fait au nom de la commission des Finances, du contrôle budgétaire et des comptes économiques de la Nation sur la flotte aérienne de la sécurité civile. Mr Claude HAUT, Senator. 2006.

Table 4.6 Comparison of the governance options

	Advantages	Disadvantages
G1 : Business as usual	• Attention can be focused on value-added activities that build confidence in, and efficiency of, resource-sharing arrangements (as outlined elsewhere in this chapter) rather than risk being distracted by debates about new structures • No incremental system management costs.	• The pace of system development (and thus improvements in the efficacy of the system) is likely to be slower than it could be • There is no forum within which collective needs and interests of Participating States can be discussed, ideas explored, beyond the formal processes of Commission/Member State dialogue • Current arrangements cannot as easily support some of the more creative collaborative solutions that could be achieved with alternative governance arrangements.
G2 : Concordat	• Expectations of participating states and the Commission with regard to the further development of the system clearly identified; • A political agreement codifying collective ambition of Participating States for the development of the resource-sharing system could help to inject greater pace and purpose, and release resources • A new decision-making group could be established under this auspices of such an agreement to provide a forum for debate and decision-making • The option represents an incremental development on current arrangements, and as such may be achievable	• Present arrangements cannot as easily support some of the more creative collaborative solutions (e.g. joint procurement) and efficient financing arrangements that could be achieved with alternative governance arrangements; • It is likely to be less flexible than the option below. • It is difficult to reconcile with the new institutional framework laid down in the Treaty on the Functioning of the European Union, as the 'concordat' would be a purely intergovernmental act in respect of which the European Parliament would have no say.
G3: Arms length body	• The participating countries would be able to pool financial resources for securing access to assets up to the level that they, individually and collectively, believe to be necessary; • It could give members access to EU-wide economies of scale in asset operation and procurement that may become increasingly attractive as public expenditure cuts bite; • Members would have an interest in efficient procurement, e.g. comparing the costs of securing assets from the pool against the costs of securing equivalent capacity via a call-when-needed lease arrangement, helping to keep a control on expenditure; • The different interests of fire-prone countries and those less	• Political feasibility uncertain. Consultations suggest that there are differences of view among Participating States on how far and fast the EU should develop its resource-sharing system and consider additional investment in assets and systems; • Even if run on a lean model, there would be some additional cost to establishment and operation of the organisation.

Advantages	Disadvantages
subject to wildfire risks can be accommodated in the membership structure; • It provides a forum within which participating states can discuss unmet needs and future requirements vis-á-vis aerial asset sharing in a collaborative and cooperative environment; • It can also support transparent and sustainable financial management, and facilitate the flexibility to determine cost-recovery rules that best serve the needs of users. • It 'enables' consideration of financial and procurement options which are difficult to implement under present arrangements • The model can be designed to accommodate different levels of strategic interest of participating states – e.g. those for whom wildfire is not a major strategic risk as well as those for whom it is being associate / full 'members', with different voting rights and financial commitments.	

Table 4.7 Summary appraisal of governance options

Options		Suitability Will the option address the key organisational and economic issues?	Feasibility Is the option a realistic and practical possibility?	Efficiency – Is the option economically and financially efficient?
1:	**Business as usual**	Consistent with a *de minimis* approach but unlikely to realise the potential scale or pace of system improvements that could be achieved	Yes No change required	The option is consistent with present models of resource sharing but less likely to achieve efficiency improvements potentially on offer in service delivery and collaborative procurement
2:	**Concordat**	Could help to give recognition to the key strategic issues and set out a development pathway for the resource sharing system	Yes - no technical barriers	Could lay the foundations for actions and agreements which improve the efficiency of present operations
3:	**Arms length body**	Potentially highly flexible solution addressing organisational and economic issues	No legal barriers. Political appetite for this option undetermined.	In principle, yes. Establishment would need to be set up on to be lean, as with overseas examples (Australia, Canada) or existing .European 'arms-length' bodies.

4.6 Financial sustainability and cost recovery

A key point to emerge from the overseas case studies is that financial sustainability, based on clear and agreed principles for cost recovery, is a key ingredient of a successful integrated resource sharing system. As the level of resource sharing increases and dependencies within the system increase, it becomes progressively more important for those holding (and donating) assets to be able to recover the costs they incur in supporting others.

A second lesson of the case studies is that financial structures should not be considered in isolation. There can be important, and helpful, linkages between the financial arrangements, governance arrangements and the asset procurement and management strategy.

Consultations with selected Participating States and the European Commission suggest that cost recovery is not applied to asset sharing within the EU at present:

- Bilateral resource sharing between Participating States is undertaken on the solidarity principle, without claims for recovery of costs incurred;
- Activations of assets managed through the MIC have not been subject to cost recovery and there is no existing agreement on cost-sharing;
- Costs (both standby and operating) of the EUFFTR were largely met from EU funds (the project was coordinated by France and benefited of 80% Commission financing).

Costs for development of what might be termed 'EU infrastructure', such as the MIC and exchange of experience projects have been financed through EU funds.

Current arrangements within the EU are more similar to those that apply to (the less frequent) trans-national asset sharing activity by overseas case study countries than to their internal arrangements.

4.6.1 Options identification

The strategic question here is whether the EU asset sharing system should continue to operate on the current, 'basis, or move onto a more structured financial basis, with agreed rules for cost recovery.

Three options have been identified. As noted above there are important links between financial arrangements and governance structures. The first two options are compatible with current institutional arrangements. The third would support the alternative governance structure proposed in option G3 above.

The options identified are:

- **Business as usual** – for operations to continue on the present basis, with no cost recovery on assets shared among Participating States,;
- **Discussing and agreeing, among the Participating States and the Commission, on a set of principles for finance and cost recovery** of aerial asset sharing that would govern:
  - Exchanges of assets mediated via the MIC;
  - Investment in the creation of 'EU public goods', i.e. skills, capacity and systems that improve the efficacy of the system for the benefit of all Participating States in ways that could not be achieved by individual Participating States working alone.

- **Move to a subscription-based model for asset sharing**, managed through a legal entity that is governed by its membership (members being participating countries and the European Commission).

4.6.2 Option F1 – Business as usual (or "quasi-BAU")

This 'option' simply recognises that arrangements could continue on the present basis, with Participating States donating assets on a good will basis, and the European Commission supplementing that capacity with centrally procured seasonal leases using EU funds (whether via pilot projects or on a more permanent basis), as agreed by Member States Continuation with centrally procured seasonal leases using EU funds would, however, require new arrangements as the preparatory action that has been used so far does not extend beyond 2010.

The advantages of this option are:

- It avoids any (actual or perceived) challenge to the solidarity principle which underpins much of the existing aerial asset sharing;
- It could allow more attention to be focused on improving system efficacy through the training and certification actions discussed elsewhere in this chapter.

However, the lack of agreed cost allocation and recovery principles can create barriers to the further development of the EU asset-sharing system:

- If a participating state has more aerial capacity than is necessary for its usual requirements there is no (financial) incentive for it to make those available for the benefit of other participating states;
- Participating states which are persistent net recipients of aerial firefighting assistance are, in effect, subsidised by the aerial firefighting budgets of the donor participating states;
- Participating states that make limited use of the asset sharing system are likely to oppose a deepening or expansion of that system if the (implicit or explicit) assumption is that it will have to be paid for entirely from EU funds (to which they contribute, without receiving a significant benefit).

The disadvantages of the business as usual option therefore include:

- As a matter of principle, that it fails to recognise that firefighting planes are expensive assets that have a real and ongoing cost to national budgets;
- That it fails to provide Participating States that have aerial assets with a financial incentive to make them available for common purpose, which in the context of an ever tighter public spending environment across Europe could pose a risk to future supply;
- It could encourage 'free-riding' by Participating States that, at the margin, know that they can expect 'free' access to assets from other Participating States;
- It is does not encourage Participating States to work collaboratively in dealing with deficits in overall capacity across the EU.

4.6.3 Option F2 – Agreement on cost sharing principles

Our analysis of overseas practice and the EU situation suggests that if the EU wants to move forward with its aerial asset sharing system it will need to look at the transparency and sustainability of the financial arrangements governing the sharing of assets.

Properly implemented, that development could:

- Unlock some of the structural / political barriers to improving asset-sharing arrangements for the common good, and the cost-efficiencies that could be realised;
- Result in a fairer distribution of financial burdens among donors and recipients of assistance (within the EU and other Participating States);
- Define more clearly the areas in which EU financial support is best allocated;
- Aid procurement decisions through aerial assets becoming potential sources of income as well as expenditure.

The challenge is to do this in a way that does not undermine the solidarity and goodwill on which the current system is founded, and which does not discourage use of the Mechanism as a resource sharing system.

Under this option the Participating States and the Commission would work towards agreement on a set of principles for finance and cost recovery of aerial asset sharing that would define the respective roles and responsibilities of Participating States and the EU (European Commission) and governance. Should this require new legislative proposals or revision of the current ones, the co-decision procedure would apply, meaning that the European Parliament would be an equal decision-maker with Member States (Council):

- Exchanges of assets mediated via the Mechanism; and
- Investments in development of a more effective system.

Specific suggestions for the scope and content of such an agreement are:

- With regards availability and exchange of assets:
  - Rules governing the recovery of 'additional' costs of deployment of aircraft to host country (fuel, aircrew time and other additional aircraft operating costs; accommodation, food and other on-the-ground costs);

    These would involve the recipient country reimbursing the donor country for marginal costs of deployment. The agreement should be aligned with the host country support agreement discussed elsewhere (which, *inter alia*, codifies accommodation, food and other support services to be provided);
  - Use of EU funds to pay a proportion of the stand-by costs of assets made available to the pool declared to the MIC should be considered where required to increase the capacity and reliability of the asset pool (i.e. where there is a systemic deficit of capacity in the pool or deficits develop at times of high demand);

    Encouraging participating states to make resources available to the pool by meeting a share of the standby costs of those assets with funds from other Participating States is more easily achieved under the subscription model discussed below in Option 3 than under this option.

    Any 'top up' capacity financing with EU funds ought to be subject to cost recovery on a similar basis. The starting position would be EU funds meeting any standby costs (or other fixed costs under a call-when-needed framework contract) and recipient Participating States meeting the additional costs of deployment. The issue of asset capacity and management is discussed in more detail in section 4.7.
- With regard to investment in system development
  - EU expenditure in the system is best allocated where it leads to the creation of 'EU public goods', i.e. skills, capacity and systems that improve

the efficacy of the system for the benefit of all participating states in ways that could not be achieved by individual Member States working alone.

This suggests a focus on investment in 'soft infrastructure' and 'systems' (i.e. exchange of experience; common training and certification of pilots; guidance for host country support to aircrews deployed). The advantages of such initiatives have been observed in the framework of the pilot projects implemented so far. However, there is a need for a long-term, broad scope, further development, supported by adequate funding (potentially similar to the general Mechanism training programme). .

Advantages of this option are:

- As a matter of principle, it would encourage the recognition of firefighting planes as assets that have a real economic value;
- It could help to encourage countries to make assets available to the shared pool;
- It would reduce the net costs of maintaining aerial assets for countries that offer assets into the share pool, in a period during which public expenditure is under tight control;
- It could help to address some of the risks of countries 'free-riding' on the asset investments and good will of others, once they are paying the actual costs of deploying the assets they request;
- It could provide a more sustainable basis for use of common purpose capacity secured by the Commission;
- The greater clarity on the conditions under which EU funds should be used and a shift towards user-pays principle could help to address the concerns of some Participating States about EU funds being invested in firefighting capacity that benefits only a minority of countries.

Potential disadvantages are:

- 'Leakage' of asset exchanges away from the Mechanism if Participating States agreed to provide assets on a bilateral basis outside the Mechanism-based system and without cost recovery being applied;
- A perceived risk to the solidarity principle that underpins asset sharing.

There are not enough data in the public domain with which to estimate the additional cost to Participating States of donating assets to operations in other participating states. This would need further investigated during feasibility work on these proposals.

Collecting data on the costs of past resource sharing operations within Europe was beyond the scope of this study but some information has been collected on the costs incurred by various Participating States for aerial firefighting operations during the 2009 " fire season" (see Table 4.8). These costs of course relate primarily to domestic operations. Using data obtained from the agencies managing aerial fire fighting assets in Italy and France, it is estimated that the average cost of flying hour per Canadair CL 415 [32] is in the region of €11,000**.** This estimate is inclusive of fuel, flying crew, standby costs (including maintenance and prepositioning), insurance, fire retardants and where applicable, flight tracking. It excludes the amortised cost of the aircraft. On this basis, the average total monthly cost, during a 'typical' fire season, of a CL-415 in France and Italy is in the region of € 650,000[33].

[32] The most frequently used aircraft, and according to experts, the most efficient on the market.

[33] vs. € 424,500 for the average recorded leasing price per month in North-America - Quebec to California – see Annex 1 – Table A.1.1.

Table 4.8 Costs components of aerial fire fighting operations (CL-415) in France and Italy

	Yearly cost (in million €)	Cost per hour flown (in €)	Cost per month ('fire season' average) (in €)
FRANCE (11 CL-415- 2006 data)			
Deployment/ flying costs (fuel)	1.6	588	34,105
Maintenance (a)	*22*	*8,085*	468,945
Structure (b)	*0.5*	*184*	10,658
Crew (c)	*5.2*	*1,911*	110,842
Standby costs *(a+b+c)*	27.7	10,180	590,445
Total (excl. amortisation)	**29.3**	**10,768**	**624,550**
Amortisation	14	5,145	298,420
Grand Total (incl. amortisation)	**43.3**	**15,913**	**922,969**
ITALY (15 CL-415- 2009 data)			
Deployment / flying costs (fuel) (a)	*6.7*	*1,887*	*109,465*
Other (retardants, foams, etc.) (b)	*2.3*	*648*	*37,577*
Sub-total flying costs + retardants (a+b)	9.0	2,535	147,042
Standby costs	32.9	9,254	536,704
Total (excl. amortisation)	**41.9**	**11,789**	**683,746**
FR-IT average			
Deployment costs		1,562	74,210
Standby costs (incl. crew costs)		9,717	563,574
Total (excl. amortisation)		**11,278**	**654,148**

Source: GHK, based on:

- *France: audit office of the French Ministry of Finance data (2006) "la maintenance des aeronefs de la sécurite civile", avril 2006 -- fleet of 11 CL-415 at the time -- record of 2,721 flying hours (year of record not specified)*
- *Italy : based on Italian Ministry of Defence data (2009) -- fleet of 15 CL-415 available -- record of 3,550 flying hours (2009)*

The all-inclusive cost for Spain (based on various sources) is in the region of €8,000 per flying hour (however there are significant data gaps for Spain).

Table 4.9 Basis for flying hours assumptions in table 4.8: Number of FH per Canadair per month ('fire season' average)

58	based on 4-year French average for CL-415 (330 FH per year, 70% of which are realised during a 4-month fire season)
46	*based on FH of the 2 Canadair CL-215 of the EUFFTR, over the 3-months fire season (2009): 275.8 hours*

On the basis of the collected data France spent nearly €100 million in aerial firefighting operations in 2009 at national level, using 26 aircraft (of four different types). France spent about €37 million for the operations of its 12 Canadair CL-415s, and Italy nearly €42 million for operating 15 Canadair CL-415s. It is estimated that Spain spent about € 82 million (estimate, based on several sources) at national level in operating 66 various aircrafts. International comparisons are however difficult, given the differences in the make-up of costs, for the same type of aircraft, between participating states.

Average yearly operational costs (all-inclusive except amortisation) for a Canadair CL-415 are about €2.3 million in Spain, €2.8 million in Italy and €3.1 million for France.

Using the various data and estimates compiled, Table 4.10 provides an illustration of potential expenditure for the EU and Participating States for maintaining a voluntary pool under different cost-sharing scenarios.

4.6.4 Option F3 - Subscription model

This option takes its inspiration from the Australian and Canadian systems. In both of these cases the system users, together with a central government authority, have come together to establish a legal entity to support the asset sharing system. The governance aspects of this option are discussed in section 4.5. The key point for current purposes is that the system is user-driven – decisions on cost-sharing, investment, expenditure are made by the member organisations, not by the centre. The subscription model is not likely to be viable unless a special purpose vehicle, of a legal form to be determined, is established. As discussed below, there are precedents or 'analogues' of institutions with similar structures already in existence performing special functions for the EU which might provide models for this case.

In this option:

- Participating States would pay an annual 'subscription' into the organisation;
- The organisation would use these funds to procure services – from Members and/or the private market, principally the supply of aerial firefighting resources;
- The assets would be run by one of the Participating States, on the basis of an implementation agreement or similar;
- The costs of deploying assets from the pool to fight forest fires would be recovered by the donor country from the recipient country based on a set of rules agreed by the membership;

Table 4.10 Cost sharing scenarios

	scenario 1: 100/0		scenario 2: 75/25		scenario 3: 50/50		scenario 4: 25/75		scenario 5: 0/100	
	EU	PS	EU	PS	EU	PS	EU	PS	EU	PS
Number of flying hours (assumption: 175 hour over a 3-month fire season)*	175		131	44	87.5	87.5	44	131	0	175
Deployment costs (in €)	273,283	-	204,572	68,711	136,641	136,641	68,711	204,572	-	273,283
Standby costs (incl. crew costs) (in €)	1,700,440	-	1,272,901	427,539	850,220	850,220	427,539	1,272,901	-	1,700,440
Total costs per season (in €)	**1,973,723**	**-**	**1,477,473**	**496,250**	**986,861**	**986,861**	**496,250**	**1,477,473**	**-**	**1,973,723**

** Assumption based on 4-year French average for CL-415 (330 FH per year, 70% of which are realised during a 4-month fire season)*

:

Table 4.11 Elements of the costs of aerial firefighting operations in Italy, France and Spain (2009 fire season)

Member States	Aircraft	Annual number of FH	Total costs of aerial firefighting assets (2009 fire season) (€)	Average yearly cost per aircraft (€)	Average cost of flying hour per aircraft (€)
Italy	Canadair CL-415	3,550	**41,900,000**	**2,793,333**	**11,803**
France	Canadair CL-415	3,446	37,106,528	**3,092,211**	**10,768**
	Tracker	2,593	22,922,120	2,546,902	8,840
	Dash 8	969	17,444,907	8,722,454	18,003
	Beechcraft King Air 200	738	3,490,740	1,163,580	4,730
	Total France	7,746	80,964,295	3,114,011	
Spain	AIR TRACTOR Fire Boss AT-802	1,350	7,567,506	840,834	5,606
	AIR TRACTOR AT- 803	1,188	6,107,579	1,017,930	5,141
	BELL 212 Helicopter	300	1,585,140	317,028	5,284
	Helicopter SOKOL PZL	3,499	19,607,696	1,031,984	5,604
	Canadair CL-215	1,000	8,211,800	**2,052,950**	**8,212**
	Canadair CL-415	3,000	25,205,400	2,291,400	8,402
	Helicopter Kamov K32A 11 BC	1,120	10,726,016	1,340,752	
	CESSNA PUSH-PULL	1,000	3,103,800	775,950	3,104
	Total Spain	12,457	**82,114,937**	1,244,166	

Source: Italian Ministry of Defence, French Ministry of Interior, Spanish Ministry of Defence - Autonomous Community of Catalonia (directorates for civil protection), Tangent Link.

Acronyms: FH = flying hours

- As on the Australian model, a tiered membership structure (e.g. 'full' and 'associate' membership) could be used to facilitate participation by countries that did not expect to use the fire fighting services very often. For instance,
  - full members would pay a high annual subscription charge but lower usage charges, and have 'voting rights' in the central management body (as suggested in Option G3);
  - associate members would pay a low annual subscription but higher 'use' charges if they did have to call upon aerial assets from the central reserve or virtual pool.

If members agreed, the organisation could contract additional capacity on a call-when-needed basis, to supplement the pooled assets offered by members. It could also, for instance, use subscription funds to countries that make assets available to a shared pool, paying a contribution for assets offered into the pool on agreed rates - thereby encouraging members that have (short/long term) capacity surplus to make that available to others.

As previously discussed, rules governing the 'offer' and 'withdrawal' of assets from the pool would need to be agreed. The value of such a system is the certainty of access to support. A tiered approach to this could potentially be developed, with a higher rate of financing being offered to assets that are committed to the pool on a long term basis.

Agreement would be needed on how to finance the deployment of any central assets managed by the entity to countries beyond the EU/membership in case of emergency. Such deployments might, for instance, be financed by central EU funds once agreed through the applicable EU decision-making process.

This has the advantages of the cost recovery option above plus also providing:

- A fully flexible means of aligning financial structures and incentives with the interests of users – procuring aircraft services from members or beyond depending on demand and prices;
- Facility to find cost-effective solutions in supply and procurement;
- An ability to support differentiated user groups, e.g. participating states engaging as either 'full' or 'associate' members depending on their exposure to fire risk
- Supporting greater transparency in the system.

The disadvantages are that:

- Given where the EU is on the journey towards a more efficient, effective and integrated system this may be a too far / fast a development at the present time.

4.6.5 Option summary

A summary of the options is presented in Table 4.12.

Table 4.12 Summary appraisal of options on financial and cost recovery

Options		Suitability Will the option address the key organisational and economic issues?	Feasibility Is the option a realistic and practical possibility?	Efficiency – Is the option economically and financially efficient?
1:	**Business as usual**	Low	High	Low
2:	**Agreement on cost sharing principles**	Yes Potentially significant improvement	Medium No practical barriers – practice overseas and within the EU on other issues provides templates and precedents	Medium Applies user pays principle to support cost recovery for donor countries + any central assets, which should encourage pooling of resources More difficult to distribute standby costs for pooled assets
3:	**Subscription model**	Yes Contingent on Participating States adopting the governance model that goes with this option (e.g. EMSA precedent)	Medium-Low No practical barriers to implementation but current appetite for this option is uncertain	High Provides maximum flexibility and opportunities for cost efficiencies in procurement and deployment in a user-driven system

4.7 Assets

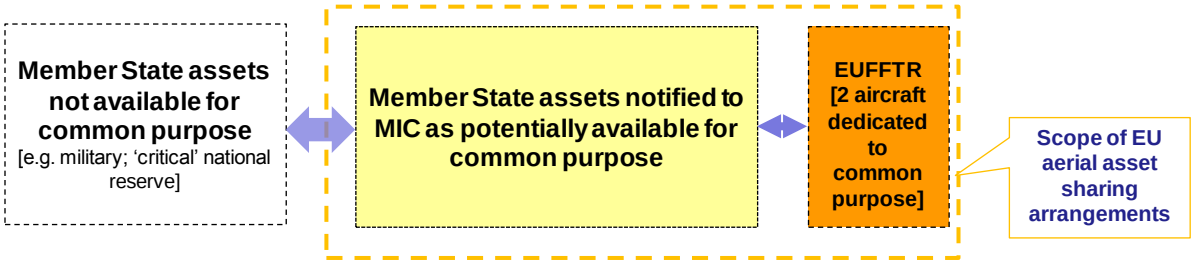
This section considers options for assets and asset management strategies that would support an effective EU-wide response to wildfires.

4.7.1 Present arrangements

At present responses to the requests for assistance in tackling wildfires that are notified to the MIC are provided by aircraft operated by the Participating States. Over the last two years there have also been two Canadair water bombers on seasonal lease arranged by the European Commission, co-financed through a pilot project, positioned in France, and known as the EU Forest Fire Tactical Reserve (EUFFTR).

This arrangement is shown graphically in Figure 4.2 below. The relative size of the block of assets potentially available and the block that is definitively not available for common EU purpose is in practice unknown. There is no central database which records all the Participating State assets. Information is held only on those assets notified to the Commission as potentially being available – the number of which varies over the fire season in response to fire risks and fire events within the Participating States concerned.

Figure 4.2 Schematic representation of current EU aerial firefighting assets in 2009 (with EUFFTR pilot project in operation)



Looking to the future, and to the asset base in particular, the challenge is to deliver a system which simultaneously provides greater:

- ***Certainty*** – so that Participating States can be more confident of a response being available from the Mechanism and plan accordingly;
- ***Capacity*** – with access to enough firefighting aircraft to meet peak demand;
- ***Efficiency*** – in terms of the costs incurred across Europe in managing wildfires through aerial interventions.

Certainty

Under current arrangements there is some uncertainty about whether assets will be available to respond to calls for assistance. Nominally 'available' assets may be withdrawn to serve domestic requirements. Also, aerial firefighting officials from the Participating States (notably those gathered on the occasion of 13 April 2010 workshop in Brussels) have mentioned aircraft shortages at national and EU level, for fire suppression and well as rescue staff transportation, (though consultations suggest that the idea that there is a capacity deficit is not accepted by all Member State officials).

The options for improving certainty, discussed below, provide ways to encourage the supply of assets and making clearer the terms of their offer and withdrawal from the pool.

Capacity

Given the size of the total asset base, and the uncertainty of the availability of assets for common purpose actions, there are concerns that the present system will be unresponsive when multiple simultaneous emergencies in different Participating States. At best this could result in delays and

the supply of less appropriate aircraft with crews lacking the aerial firefighting expertise necessary for an effective response.

Determination of what the 'optimal' aerial capacity is for Europe is probably not possible due to factors that include:

- The fact that there will be some uncertainty and 'flex' at the boundary between strategic national reserves (and private lease fleets) and the stock of assets available for common purpose activities;
- Collective agreement on the acceptable level of risk (of not be able to respond to fires) may be difficult;
- The operational efficacy of assets in helping to tackle wildfires has been shown to vary enormously (the skills of the crews and how the assets are deployed matters, as much as the assets themselves[34]).

The analysis above argues for an incremental, systems-based approach which seeks to build a better, more effective capability, and:

- takes decisions about the scale of (for example) centralised assets on the basis of past experience and expectations of future fire risks; and
- aims to improve 'quality' and efficacy rather than focusing exclusively on 'quantity' (of assets).

Efficiency

Asset strategies, when combined with clear, credible and efficient policies for cost recovery[35] should help to improve intra-EU sharing of resources whilst avoiding perverse incentives that discourage Participating States from making prudent investment in national civil protection and 'free-riding' on the investments and commitments of others.

The specialist aircraft used in aerial firefighting, and their crews, are expensive assets. The future system should also foster incentives that encourage assets to be efficiently utilised – with supply matched to demand (as far as the latter can be anticipated).

Efforts to raise quality/efficacy in tackling fires, through measures such as those discussed in section 4.3 will help improve the cost-effectiveness of expenditures on such assets.

The package of options ultimately adopted should promote progress towards all of the three objectives identified above.

4.7.2 Options identification

The options identified for development of the asset base are:

- ***Strengthening of the present pool arrangements***;
- The development of a ***'virtual pool'*** arrangement for selected aerial firefighting resources;
- and
- A ***seasonal central reserve***.

The central reserve option is compatible with either of the pool arrangements.

[34] Essentially, only two types of aircraft are deemed by European experts to be the adequate aircraft for massive and rapid attack: the Canadair, CL-415 (6,000 litres capacity of water and retardant), and the Dash 8 (10,000 litres capacity of water and retardant),

[35] See section 4.6.

The discussion below covers the organisation and operational issues involved. A third, and very important, consideration is the financial implications of such options. This is covered mainly in section 4.6 with some discussion here.

This section also provides a brief discussion of asset procurement and explores whether participating states might achieve more cost-effective outcomes by working together on asset procurement.

4.7.3 Option A1 - Strengthening of the present pool arrangements

Present pooling arrangements could be strengthened without changing the nature of the 'offer' from Participating States by implementation of the supporting measures discussed elsewhere in this chapter. Examples include:

- Measures to improve the visibility of resources;
- Measures to put in place cost-recovery agreements that might increase the 'offer' of assets to the pool;
- Measures to increase exchanges of experience within the aerial firefighting 'community';
- Making progress towards assured quality of service, greater inter-operability and better ground-air coordination when assets are shared among countries.

Confidence-building measures of this kind could, over time, lead Participating States to seek closer cooperation and/or new ways of working together, such as the virtual pool, and the governance systems described above.

4.7.4 Option A2 - Virtual pool

The virtual pool option is defined as follows:

- There is a pool of specialised aerial assets declared as being available for 'common purpose' activities, i.e. tackling wildfires within participating states;
- The assets are owned and operated by Participating States;
- Terms of the 'offer' and 'withdrawal' of assets to/from the pool are agreed among participating states and with the Commission. These terms include:
  - a presumption that assets registered with the pool are available for deployment inside or outside the Union, on agreed terms and with agreed period of notice;
  - provision of exceptions to that presumption, such as when the participating state is experiencing a high level of domestic fire risk and/or the assets are actively deployed fighting wildfires.
- Assets are deployed in response to requests registered with the MIC, with the MIC then contacting the Participating State authority and, subject to the exceptions, the Participating State then despatching the assets (with crews etc);

Given adequate time for the development of supporting structures it would be possible for the use of the pool to be subject to quality and performance rules for donors and recipients of assistance:

- Assets registered with the pool would need to comply with the 'quality assurance' measures discussed in section 4.3, e.g. pilots that are qualified under the new competency framework for aerial firefighting pilots.
- Requesting countries to provide host nation support in accordance with the terms of the common agreement on that issue, including liaison officers;

The supply of assets to the pool could be encouraged through co-financing arrangements in which EU funds cover an agreed share of standby and/or deployment costs. Section 4.6

discusses possible arrangements for the recovery of costs incurred by donor countries when deploying assets.

Potential short-run benefits of moving from the present situation, where the Mechanism pool shows assets that might 'potentially' be available, to one in which the assets can be assumed to be available include:

- the greater 'visibility' of assets;
- the increased certainty of a response being available;
- Participating States being able to factor the availability of pool assets into their planning for the annual fire season.

Potential long run benefits could include the development of a more effective pooling arrangement that makes better and more efficient use of the stock of specialist firefighting aircraft within the EU.

Case Study 2: Australia

In Australia, the National Aerial Firefighting Centre (NAFC) has been formed by the Australian states and territories in July 2003 to provide a cooperative national arrangement for combating bushfires. NAFC facilitates the coordination and procurement of a fleet of highly specialised firefighting aircraft that are readily available for use by state and territory emergency agencies across Australia. NAFC also plays a key role in ensuring that aerial firefighting resources are shared between fire agencies throughout Australia, and in the development of national protocols and systems for aerial firefighting. Resource sharing is organised through a Resource Management Agreement to which the states and territories are signatories. At present, only the Northern Territory is not participating in the resource sharing arrangement. Historically the territory has not been a fire risk area.

The national fleet managed by NAFC receives funding support from the Australian Government (the Attorney General's Department provides approximately 25% of the funding for aircraft resources covered by the resource management arrangement), as well as state and territorial governments and complements aerial firefighting resources that are managed by the states and territories . The funding received from the Australian government toward financing the national fleet has notably supported the shift in focus to larger capacity aircraft and an impetus towards deepening national arrangements.

The NAFC co-ordinates the procurement, deployment and logistical support of firefighting aircraft on behalf of the states and territories of Australia, except for the Northern Territory.

NAFC was formed as a limited company whose shareholders are the federal government and the participating states/territories. This was considered to be the most pragmatic arrangement which did not require implementation of new national or state level legislation. The current arrangement therefore is not statutory and participation is voluntary. NAFC is subject to company laws and regulations that also ensure transparency. It is governed by a Board of Directors, which has nominees from each participating state/territory. They are normally Commissioners or Chief Officers of the main state level firefighting organisation.

Under the current framework NAFC administers a resource administration/management agreement, which is a legal agreement between the states and territories to share resources. The agreement covers both resources and liabilities. Collective governance is organised by state entities. The resource management agreement provides the contractual basis for sharing resources in cross-border situations.

Collaboration is based on risk assessment. Incident managers at state level (chief officers) discuss risks and types of resources that could be shared. NAFC procedures require a formal request made to NAFC which then brokers the resource sharing between the states. Hence, although at a state level the organisation of aerial resource sharing is a command and control system, at a national level it is based on resource brokering facilitated by NAFC.

In the event of a wildfire, each state and territory uses its own available resources in the first

instance. This may include national fleet resources which are positioned in that state or territory. NAFC membership provides access to additional national fleet aircraft during periods of higher demand. Some states and territories also have additional resources managed outside of the NAFC arrangement (and excluded from the resource sharing agreement).

Although all redeployments (resource sharing) are arranged between the individual NAFC members (i.e. the states and territories), NAFC establishes and maintains the resource sharing framework and operational procedures and will, where practicable and appropriate, act as a broker and facilitator to:

- Assist members in their awareness of resources that may be available from, or may be supplied to, other members;
- Facilitate communication between members regarding re-deployment;
- Activate pre-planned process to support resource sharing; and
- Assist members enter into supplier/provider agreements.

States and territories can also pro-actively offer aircraft or related resources for redeployment even though no particular requirement has been communicated by another state or territory. This includes circumstances where the risk of a damaging wildfire is expected to remain relatively low for a period of time in the potential suppliers' jurisdiction.

4.7.5 Option A3 - Seasonal central reserve

This option involves the provision of firefighting aircraft that are dedicated to common purpose activities, i.e. they are available to support wildfire suppression across the EU, under the direction of the MIC or of a central coordinating body, depending on the governance model chosen to operate this reserve (and knowing that this option can also be implemented alongside either of the assets pooling arrangements, i.e. strengthening of the present arrangements, under the direction of the MIC, or virtual pool). The purpose of these aircraft is to meet the gap between the demand and the capacity in the virtual pool (or volunteered assets, in a scenario where there is no virtual pool), which is likely to shrink when risk of fire is high in several Participating States simultaneously.

This 'top-up' capability is likely to only be needed in the summer when fire risks are highest. This capability would be established on a small scale at first (i.e. a few aircraft) so that the level of demand and effectiveness of the measure could be established, picking up from the EUFFTR pilot project.

Currently the only aerial assets dedicated to 'common purpose' firefighting activities are the planes secured on a seasonal basis via the European Union Forest Fire Tactical Reserve (EUFFTR), a pilot project designed to step up cooperation between Participating States on combating forest fires during high risk seasons. The project, to which two Canadair CL-215 aircraft were allocated, is activated in the cases where Participating States are not in a position to provide assistance due to their aerial resources being needed in their own territory or because they cannot reach the fire site quickly enough.

The pilot EUFFTR project for the provision of a central reserve was financed through EU funds. The coordinating function provided by the MIC is also financed by the Commission. The MIC can also cover co-financing for aerial forest firefighting transport (i.e. helicopters and planes). The rules allow for a maximum co-financing rate of 50% to be covered by the European Commission.

EUFFTR aircraft have provided helpful supplementary supply of air attack capacity but there is premium attached to operating a strategic reserve of this kind. The report on EUFFTR activity in 2009 notes the two aircraft were used for between 135 and 140 flying hours each over the 3

month lease[36]. Another source suggests that the French core Canadair fleet typically averages around 230 flying hours in each fire season[37] - significantly higher than the EUFFTR utilisation.

The wider analysis conducted for this project suggests that there could be a useful role for central reserve capacity in the future EU aerial firefighting 'model' but the size and operating basis of that reserve need careful consideration. At noted above, in the absence of an answer to the question of how large a specialist firefighting fleet should be maintained in the EU, the optimum size of the central reserve cannot be determined. A prudent approach would be to monitor demand and scale investment in central capacity accordingly.

Such planes might be available on lease from Participating States with surplus assets, but a more likely scenario is that the planes would be leased from the private market and supplied with crews competent in aerial fire suppression. They could be provided through comprehensive service contracts (including aircraft and pilots), with one or several global aircraft operators, during the fire season. Choosing operators that work globally, notably with the southern and northern hemisphere, would increase the chances of aircraft availability.

Leasing aircraft provides flexibility and is often cost-effective but there can be disadvantages. Where aircraft are leased, the lessee has necessarily less leverage on the conditions of maintenance and on the standard of the pilots, than if the aircraft are owned outright. Maintenance operations' tracking is also an issue with leased aircraft, as has been highlighted in case study countries, but also in the EU.

There is experience in Europe with seasonal and call-when-needed leasing at Participating State level. In 2008, for instance, France leased heavy helicopter water bombers. Seasonal leases are also used in Spain. Leasing of large specialist aircraft is constrained by the market supply. The option of securing access to planes from the southern hemisphere during the European 'fire season' warrants further investigation.

Dedicated common purpose assets could, in principle, be arranged under a number of different governance and financial models. For example:

- As an EU project with no cost-recovery mechanism;
- As an EU initiative in which users pay for use but the EU met some share of standby/availability costs;
- As part of a fully integrated, user-driven, subscription-based system of the kind explored elsewhere in this chapter.

As an example, the contracts could be signed by the EU Commission for a minimum number of prepaid flying hours (or a certain number of hours of 'wet lease'[38]) within the fire season, for one or several years (with possible extensions clauses[39]). Participating States could then draw on this common contracted resources on a Call When Needed (CWN) basis, at a clearly defined cost. Rules would be needed to determine access to the planes. As examples:

[36] EUFFTR report EU Forest Fires Tactical Reserve. EU FFTR 2009. Rapport Final. Ref Contrat de subvention 070404/2009/524057/SUB/A3.

[37] Year-to-year utilisation is highly variable but a report to the French Senate quotes an average of 330 flying hours a year, of which 70% (i.e. 230 hours) is estimated to be during the 'fire season'. Source: Rapport d'information fait au nom de la commission des Finances, du contrôle budgétaire et des comptes économiques de la Nation sur la flotte aérienne de la sécurité civile. Mr Claude HAUT, Senator. 2006.

[38] A wet lease is a leasing contract whereby one airline (lessor) provides an aircraft, complete crew, maintenance, and insurance (ACMI) to another airline (lessee), which pays by hours operated. The lessee only supplies fuel and covers charges such as airport fees, and any other duties, taxes, etc. In commercial aviation, a wet lease is generally signed for a period of one month minimum (anything less would be considered as 'call when needed' agreement).

[39] In Canada, the Province of British Columbia has been identified as having 7 years aerial contracting arrangements, with a 3-year option for a possible extension. Also, according to French Civil Protection experts, it is unlikely that aircraft operators of large water bombers, e.g. CL-415 or Dash-8, would accept contracts of less than 9-years and 5-months over a year.

- The EU Commission could define prioritisation criteria, to be able to quickly assess and decide 'when needed', which states would have first call, second or third call; or
- Participating States could directly draw on a central pool of resources (without the intermediation of the Commission/ the MIC) on a Call When Needed (CWN) basis. This would probably be more costly than the first option as it would allow less margins of manoeuvre in the definition of the contractual requirements, the choice of aircraft available on a CWN basis, etc.

Research suggests that in an illiquid market Canadair leases cost perhaps €0.5m / month. Despite extensive efforts, it has not been possible to obtain the core for fixed and variable costs from which alternative cost recovery models could be illustrated.

4.7.6 Option A4 – Use of international lease market for the central reserve and/or collective leasing

A further possible area of collective action and option development is in relation to procurement of aircraft used for tackling wildfires. A feature of some of the international case studies is the way states have bundled their asset purchase or lease requirements together in order to increase their buying power and improve overall efficiency. Management (and sometimes ownership) of the assets is subsequently devolved back down to the operational level. Some case study countries also make active use of the private lease market to supplement their base fleet.

There may be opportunities for EU Civil Protection Mechanism Participating States to realise economies of scale in seasonal lease contracts or aircraft purchase through collaborative procurement – whether under lease, purchase or hybrid contract models. At present there is no organisation or forum well placed to help identify, orchestrate and broker such collective purchases. However, some of the governance options discussed under section 4.5 could foster an environment within which Participating States could identify and exploit such opportunities.

There may also be opportunities to use the private lease market as a source of aircraft for any central 'common purpose' aerial assets, such as the EUFFTR.

Pricing and liquidity in the lease market

Preliminary analysis suggests scope for savings in use of the international lease market when securing capacity for an EU seasonal central reserve.

Canadair water bombers are widely preferred for use in rapid initial attack - a policy that is increasingly adopted by European firefighting agencies. The EUFFTR project sourced two such aircraft for common purpose operations from Societa Ricerche Esperienze Meteorologiche (SoREM), An Italian company that owns and leases abroad five Canadair CL-215.

Analysis conducted for this study suggests that if the EUFFTR was continued, or an equivalent facility provided, there could be savings for the EU to be gained by leasing the planes from the international market. Estimated savings are in the region of 17% of present costs (implying a saving of ~ €550,000 on current annual expenditure of €3.1 million). This saving does not take into account the added value of benefiting from the faster aircraft (CL-415 vs. CL-215) available from the market (see Annex, Table A1.2)[40].

Whilst a lease for a small number of aircraft may be practicable, the scarcity of large water bombers on the international market suggests it may be difficult to scale up that model to a significantly larger number of aircraft. There are no more than 125 CL-215 existing today, and 77 of the more modern CL-415 (87 by 2012, taking into account new orders) (see Annex 3:). Most belong to state civil protection/ firefighting agencies, and therefore are a 'sovereign' resource

[40] On the basis of the costs provided by Italy and France, the average complete cost per flying hour of a Canadair CL-415 in its fleet is estimated to be €11,200. Taking into account the number of hours actually flown by the two Canadair CL-215 of the EUFFTR fleet, the actual cost of the EUFFTR project is estimated by GHK to be in the region of €3.25 million (or 93% of the €3.5 million budget). The two international examples of international leasing obtained for this study show a price an average price of €2.55 million for leasing two Canadair CL-415 for a 3-month fire season. The data supporting these estimates are provided in Annex 2.

unlikely to be leased internationally (though the Province of Quebec in Canada regularly leases CL-415 internationally, notably to California).

Research suggests that there are no Canadair water bombers available for lease in the southern hemisphere (Australia, New Zealand or South Africa). Other water bombers of smaller dimensions may be available for lease, though in the EU and neighbouring Mediterranean countries there is an established preference for large water bombers.

Dash-8 convertible aircraft are, however, present in large numbers on the international market. Originally transportation aircraft[41], Dash-8 can be transformed into water bombers though fixing a water or retardant reservoir. This reconfiguration process takes 24 hours, which limits their flexibility in fire emergency situations, but could perfectly work in a situation where these aircraft would be leased in their 'water bombing' configuration. Their reservoirs have a capacity of 10,000 litres (vs. 6,000 litres for Canadairs). These aircraft, can also actively contribute to fire surveillance. They have a maximum speed of 660 km/h (vs. 376km/h for Canadair CL-415).

It is estimated that there are 824 Dash-8s in operation worldwide. There are 77 in Australia, 23 in New Zealand and 153 Dash-8 in the US, all operated by private companies (see Annex 3 for details). These countries could represent a potential pool of lease aircraft for the EU. European countries already participate in various pooling and collective purchase arrangement that provide access to unusual aircraft needed for special purposes. Two examples are the SALIS and SAC facilities described in the case studies below.

4.7.7 Summary - Assets

A brief summary of the options discussed in this section is provided below.

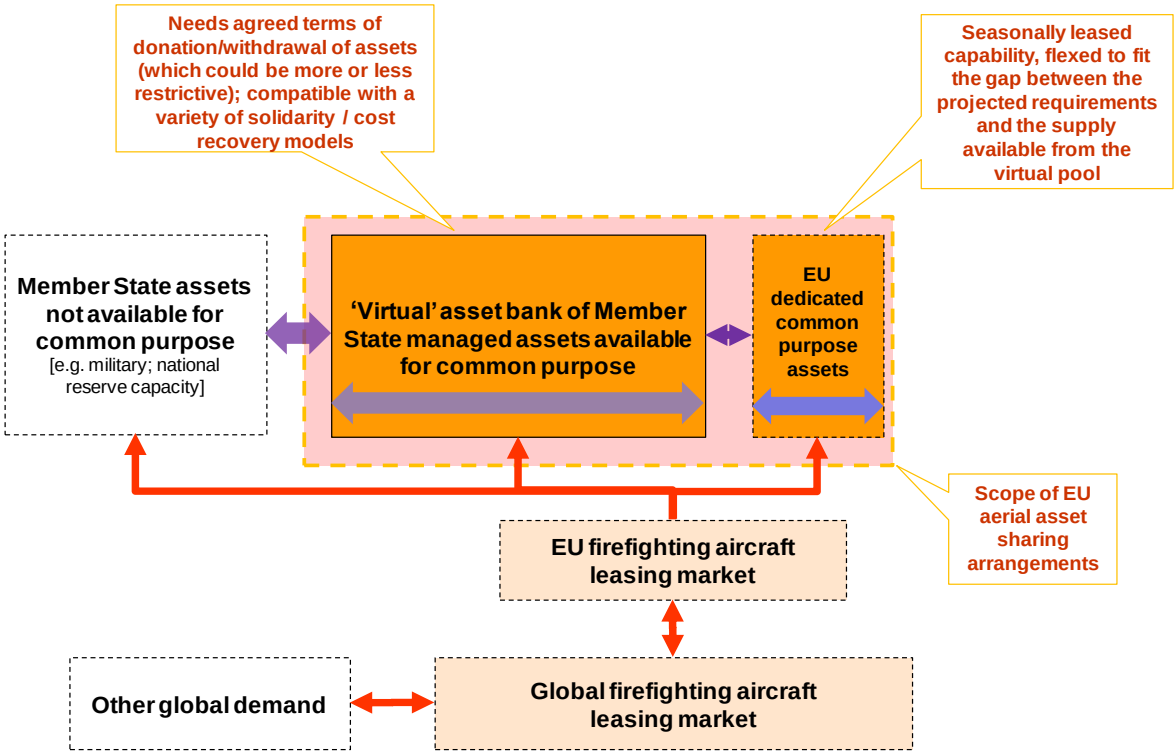
Table 4.13 Summary of asset options

Option	Title	Description
A1	Virtual pool	Developing a pool of MS assets which, when offered, are committed as being available for common purpose
A2	Strengthening of current pool arrangements	Building confidence and integrity of pooling operations, while retaining current basic pool model
A3	Seasonal central reserve	Small number of aircraft capacity dedicated to 'common purpose' activity
A4	Use of international lease market	Private leases of specialist aircraft via collaborative procurement models, and for seasonal central reserve

The relationship between various components of the EU asset bank and the wider international market is illustrated in Figure 4.3.

[41] Each Dash-8 is able to carry 64 personnel or 9 tonnes of material.

Figure 4.3 Schematic representation of a possible future arrangement for EU aerial assets



4.8 Support and oversight of actions

If the options identified here are taken forward there will be implications for the workload placed on the Commission's services, both:

- In terms of the level and type of activity in the MIC relating to wildfires;
- In respect of the administrative workload associated with the procurement or administration of system development options (e.g. pilot certification mechanism).

These impacts should be considered, and taken into account if/as options are taken forward.

Case Study 3: The Strategic Airlift Interim Solution (SALIS)

SALIS is a "guaranteed charter lease" grouping several participating states that provides access, via a private contractor, to a certain number of aircrafts. Access is guaranteed within a specified time period, after activation of an 'assured access clause' by a participating state.

Participating states

SALIS is a multinational consortium of 18 countries. The consortium is led by Germany and includes Canada, the Czech Republic, Denmark, France, Hungary, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and Turkey.

Number, type and characteristics of aircraft

Access is guaranteed to up to six Antonov (An-124-100) aircraft. These Russian-Ukrainian aircraft are being used as an interim solution to meet shortfalls in European strategic airlift capabilities, pending deliveries of Airbus A400M aircraft, expected to start in 2010. This is why the project is called SALIS - Strategic Airlift Interim Solution.

The An-124-100 was chosen to satisfy the European outsize requirement for a variety of reasons, including cost and cargo capacity (up to 120 tonnes of cargo per aircraft). NATO has used Antonovs in the past to transport troops to and from Afghanistan, deliver aid to the victims of the October 2005 earthquake in Pakistan, and airlift African Union peacekeepers in and out of Darfur.

Contract provisions: guaranteed period of access & flight hours allocations

The contract is for three years and renewable, rolling on a yearly basis until 2012. The contract can be extended, via NAMSA (the contracting authority, see below), on a yearly basis, until 2021.

After activation of the assured 'access clause' by a participating state, access is granted;

- two Antonov An-124-100 are on full-time charter (for individual requests);
- two more are on six days notice (for multinational operations); and
- another two are on nine days notice (for multinational operations).

Participating states have access to flight hours (activation rights) according to a predetermined sharing key.

The SALIS contract allocates a specified number of flight hours (2,000 in total) to participating states; a larger, number of hours (2,800) are being offered to other potential carriers.

Purpose of the flight operations

Participating states use their flight hours for national missions, but they are also free to make them available for joint operations. For instance, France has announced that its (approximately 450) flight hours under the contract will be allocated, as a priority, to EU activities.

Both NATO and the EU have the right to call on SALIS aircraft.

Consortium management and coordination

An existing organization, NATO's Maintenance and Supply Agency (NAMSA), acted as the contracting authority on behalf of participating nations and coordinated the procurement process with the providers (Volga-Dnepr and Antonov Airlines).

Strategic airlift co-ordination is done by the Strategic Air Lift Co-ordination Centre, and is co-located with the European Airlift Centre (EAC), which already coordinates air transport and air-to-air re-fuelling between member nations.

The EAC was established at the at the Royal Netherlands Air Force base in Eindhoven, Netherlands, in February 2002, the original members being those participating states that were members of the European Air Group; Belgium, France, Germany, Italy, the Netherlands, Spain and the UK. Norway joined the EAC as an associate participant in 2004.

Case Study 4: The Strategic Airlift Capability (SAC)

The NATO Strategic Airlift Capability is an initiative of currently 15 NATO members and 2 partner countries, Sweden and Finland, to work together to purchase and operate strategic aircraft.

Participating states

The 13 initial participants were Bulgaria, the Czech Republic, Denmark, Estonia, Italy, Latvia, Lithuania, the Netherlands, Poland, Romania, the Slovak Republic, Slovenia and the United States. Later on Hungary, Finland, Norway and Sweden (the last two being members of the Partnership for Peace - PfP) also signed the Letter of Intent. Denmark announced in late 2007 that it was withdrawing from the programme.

Number, type and characteristics of aircraft

SAC will have access to three Boeing C-17 Globemaster III strategic aircraft. The C-17 is a large strategic transport aircraft capable of carrying 77,000 kg of cargo over 2,400 nautical miles (4,450 kilometers) and which is able to operate in difficult environments and severe conditions.

The planes are configured and equipped to the same general standard as C-17s operated by the US Air Force. The crews and support personnel will come from the participating countries and be trained for mission profiles and standards agreed by the countries.

Agreements provisions

'To acquire, manage, support and operate' 3 Boeing C-17 strategic transport aircraft.

Final approval was given in June 2007. The aircraft were delivered in 2009. Two aircraft were procured under the Foreign Military Sales (FMS) programme, the US government's programme for transferring defence assets and training to allied countries and international organisations (under FMS, the US government procures on behalf of the foreign customer). In certain cases these assets and training may be obtained on a grant basis. The Defence Security Cooperation Agency (DSCA) administers the FMS program for the US Department of Defence (DoD). The US provided the third aircraft as a grant contribution.

Purpose of the flight operations

These strategic lift aircraft are to be used to meet national requirements, but could also be allocated for NATO, UN or EU missions, or for other international purposes (e.g. humanitarian airlift and disaster relief) as agreed by the participating states.

Consortium management and coordination

The aircraft are operated in a fashion similar to NATO's AWACS aircraft, with multinational crews, under the command of a multinational military structure - the Heavy Airlift Wing (HAW). The HAW is currently commanded by a US Air Force officer with a Swedish Air Force Deputy Commander. The HAW will be manned by personnel from all participating states.

In June 2007, the North Atlantic Council approved the Charter of a NATO Production and Logistics Organisation (NPLO), which authorises the establishment of the NATO Airlift Management Organisation (NAMO). The Charter came into effect in September 2008. The Charter authorised the establishment of the NATO Airlift Management Agency (NAMA) to acquire, manage and support the airlift assets on behalf of the SAC nations (different airlift management organisation from that for the SALIS agreement).

5 Concluding remarks

There is an opportunity to build on the foundations laid by the EU Civil Protection Mechanism and by Participating States in their collaborative efforts on wildfires and to deliver a system that could provide:

- For States requesting help:
  - An assured competency of aircrews, with pilots certified accordingly and crews that have been through a common training programme;
  - Confidence that the system will be better able to respond to requests;
- For 'donor' States providing assets the reassurance of knowing that:
  - There will be host nation support and coordination;
  - The economic value of the assistance offered is recognised in a way that helps with budget management.
- For all parties:
  - A stronger and more coherent framework for resourcing sharing that reduces the barriers to collaboration and improves the efficiency of use of the Participating States' resources (notably reducing the risk of aircraft staying idle) and efficacy of assets when deployed;
  - Transparent governance arrangements;
  - A flexible mechanism for securing an additional seasonal EU reserve if required;
  - The comfort of having a fair set of principles and agreed processes for the recovery of costs;
  - The safety of an improved technical compatibility between shared aircraft (in terms of transit speed; manoeuvrability; extinguishing load capacity etc.);

The options set out above show how different parts of this future system could be constructed. There are some 'no-regrets' investments to be made in building the 'soft infrastructure' of the system – such as common training platforms and protocols for host country support. There are choices to be made about finances and cost-recovery, and how the system that facilitates these resource exchanges is to be governed in the best interests of its users and Europe as a whole.

Where, how far, and how fast the process of developing the resource-sharing system is taken forward are choices that which will need to be resolved through dialogue and debate.

The best foundation for such a debate is a common consensus on the scale and scope of challenges that the EU faces in this area, and the priorities it needs to address. The consultations conducted with Participating States for this study suggest that there is more to do to build that consensus and so create positive, 'enabling conditions' for progress. Some of the options identified here could potentially help in removing current blockages to wider system development, an example being the model of a system with a common EU platform for skills and training but differentiated approaches to asset sharing.

Annex 1: International lease costs for Canadair water bombers

Table A1.1 Costs of international leasing for Canadair CL-415 water bombardier

Published deals:	**2 Canadair CL-415 for 3-month fire season**	**Leasing price per CL-415 per month (incl. maintenance, pilots and flight hours)**
City of San Diego, California, leasing from Province of Quebec (2008)	**€ 2,630,000** ($3,400,000)	**€ 436,000**
State of California leasing from Province of Quebec (1998, at 2010 prices)[42]	**€ 2,480,000** ($3,210,000)	**€ 413,000**
Average	**€ 2,555,000**	**€424,500**

Table A1.2 Potential savings for the EU from leasing on the international market

Potential savings for the EU from leasing on the international market		
Flying hours (FH) of the 2 Canadair CL-215 of the EUFFTR, over the 3-months fire season (2009)	275.8 hours	Source: EUFFTR *Rapport Final*
Average complete cost per FH per Canadair CL-415	€11,200	Based on Italy's data Inclusive of standby costs, maintenance, pilots and fuel - excl. aircraft amortisation
Amount budgeted for the EUFFTR 2009 project	€3,500,000	Source: EUFFTR *Rapport Final*
Actual cost of the EUFFTR 2009 project	€3,088,960	EUFFTR number of FH (x) complete cost of Canadair (in Italy)
International market price of leasing 2 Canadair CL-415 for a 3-month fire season	€2,550,000	Canadair CL-215 and 415 roughly offer the same capabilities, in terms of payload, the main difference being in the maximum speed
Potential savings from leasing 2 Canadair on the international market	€538,960	This saving does not take into account the added-value of benefiting from a faster aircraft (CL-415 vs. CL-215)
Potential savings from leasing 2 Canadair on the international market - %	**17%**	

[42] The actual deal was a €1.65 million rental price ($1.60 million in 1998 and $2.14 million at 2010 value -).for 2 Canadair CL-415 (including maintenance, pilots and flight hours) for 2 months.

Annex 2: Aerial firefighting assets of selected Participating States

Table A2.1 Inventory of aerial firefighting assets of Spanish administrations 2009

Type of material	**Number of aircraft Autonomous communities**	**Number of aircraft Central government**	**Total**
Amphibious aircraft (5500 litres)	-	16	16
Amphibious aircraft (3500 litres)	4	6	10
Aircraft (3100 litres)	38	9	47
Transport helicopters	144	19	163
Bomber helicopters	10	8	18
Aerial coordination aircraft	18	4	22
BK 117 transport helicopter	-	1	1
Total aerial means	**214**	**63**	**277**
Percentage	**77%**	**23%**	
Total load capacities (litres)	**339,200**	**199,00**	**538,200**
Percentage load capacity	**63%**	**37%**	

Source: Spanish Ministry of Interior and Autonomous Community of Catalonia

Table A2.2 Inventory of aerial firefighting assets of French administrations 2009

Type of material	Number of aircraft Central government	Number of aircraft local authorities (the 10 Mediterranean Départements)	Total capacity
Canadair CL415	12	-	12
Tracker	9	-	9
Dash 8	2	-	2
EC 145 transport helicopter (also referred to as BK117)	*6*	-	*6*
Ecureuil (observation)	*3*	-	*3*
Beechcraft King Air 200 (fixed wing) (observation)	*3*	-	*3*
Water bomber helicopters or light fixed-wing water bombers (agricultural aircraft)	0	31	31
Total water bombers	**23**	**31**	**54**
Percentage	**43%**	**57%**	
Total load capacities (litres)	**122,000**	**31,000**	**153,000**
Percentage load capacity	**80%**	**20%**	

Source: French Ministry of Interior

Table A2.3 Inventory of aerial firefighting assets of French administrations 2009

There are 23 aircraft in the French national fleet (with a total reservoir capacity of about 120,000 litres). The fleet is managed by the Ministry of Interior. It is composed of:

- Twelve Canadairs CL415. These scooper hydro-aircrafts have a capacity of about 6,000 litres. They are essentially dedicated to 'direct attack' (but can also in some cases carry out surveillance operations in cases of particularly high risks). Their primary quality is their ability to rapidly get back to the fire after scooping on a water surface, close to the fire. They have a maximum speed of 340 km/h.
- Nine Trackers. The water 'refuelling' of Trackers takes place on the ground (they are not 'scoopers'). They have a capacity of 3,300 litres and are essentially dedicated to surveillance operations and first intervention on the fire (i.e. 'aerial armed surveillance' – or GAAR). They can also contribute to spreading retardants (if that does not go beyond their mission of initial surveillance). They have a maximum speed of 320 km/h.
- Two Dash 8. Originally transportation aircraft, these can be transformed into water bombers though fixing a water or retardant reservoir (this reconfiguration process takes 24 hours – which limits flexibility in fire emergency situations), with a capacity of 10,000 litres. These aircraft, which have two turbo propulsion engines, are primarily used to drop water or spread retardants, but they also actively contribute to surveillance. They have the ability to project detachments to conduct civil protection operations (64 men or 9 tonnes of material). They have a maximum speed of 660 km/h.

Other aircraft contribute to the aerial firefighting organisation in France:

- Six EC 145 (capacity: 1 pilot + 9 passengers) and three 'Ecureuil' (1 pilot + 5 passengers) of the Helicopters Group of the Ministry of Interior (as well as two military Puma helicopters for transportation of commandos) can also be used for rescue operations in the Mediterranean region of France, in order to perform commanding duties, to provide guidance to water bombers aircrafts and to transport personal on terrain that is difficult to access. They have a maximum speed of 240 km/h.
- The French civil protection authority also has three 'Beechcraft King Air 200' (fixed wing) aircraft, with a capacity of 8 to 10 passengers. They essentially carry out fire surveillance missions, as well as safety coordination assignments.
- Local aircraft are also used to complement the water bombers. They are engaged by the local authorities and are adapted to a local intervention (because of their reservoir capacity, their engagement has to be immediate - hence decisional time of engagement and transits have to be strictly limited). These local aircraft are mostly water bomber helicopters, with reservoir between 800 and 1,400 litres, or light water bombers, derived from agricultural aircraft with an average capacity of 1,000 litres. There were 31 of these aircraft in use in 2009, leased by and deployed in the 10 Mediterranean Départements (local authorities).

Source: French Ministry of Interior

Annex 3: Data on international fleets and markets

Table A3.1 The global Canadair market

Country/ owner institution	Number of CL-215 in service	Number of CL-415 in service
Canada		
Conair Group, Abbotsford, British Columbia	**4**	
Government Air Services, Manitoba - 7 CL-215P; 5 will be phased out and replaced with 4 Bombardier 415s (delivery in 2010 (1), 2011 (2), and 2012 (1).	**2**	**8**
Government of Newfoundland and Labrador	**6**	**4**
Buffalo Airways, Yellowknife, Northwest Territories	**7**	
Ministry of Natural Resources, Ontario	**9**	**9**
Bombardier Inc., Montreal, Quebec	**4**	
Ministry of Natural Resources and Wildlife, Quebec	**14**	**8**
Ministry of the Environment, Saskatchewan	**6**	
Croatia		
Croatian Air Force		**12**
France		
Sécurité Civile (Interior ministry)	**-**	**12**
Greece		
Hellenic Air Force	**13**	**8**
Italy		

Country/ owner institution	Number of CL-215 in service	Number of CL-415 in service
• Societa Ricerche Esperienze Meteorologiche (SoREM)	**5** leased abroad	
Protezione Civile		**18** (incl. 3 on order)
Portugal		
	2 operated by SoREM	
Spain		
Spanish Air Force -	**14**	**6** (incl. 2 on order)
Ministry of Environment (CEGISA)	**5**	
Malaysia		
Malaysian Maritime Enforcement Agency		**2** (on order)
Thailand		
Royal Thai Navy	n/a	
Turkey		
Istanbul Metropolitan Municipality	*2 operated by SoREM*	
Turkish Ministry of Forestry	*2 operated by SoREM*	
Turkish Aeronautical Association	**7**	
Venezuela	n/a	
United States		
Aero Flite, Kingman, Arizona	n/a	
Division of Forest Resources, North Carolina	n/a	
Department of Natural Resources, Minnesota	n/a	
Yugoslavia		
Yugoslav Air Force - five CL-215 in from 1981, until four sold to Greece in 1995	**-**	
Total	**125**	**87**

Source: http://www.airliners.net/ and Wikipedia

Table A3.2 Technical comparisons between Canadair CL-215 and Canadair CL-215

	Canadair CL-215	Canadair CL-415
Power plants	Two 1565kW Pratt & Whitney R-2800 83AM 18 cylinder radial piston engines driving three blade constant speed propellers.	Two 1775kW Pratt & Whitney Canada PW123AF turboprops driving four blade constant speed propellers.
Performance	Max cruising speed 290km/h. Initial rate of climb 1000ft/min. Range at max cruising speed 1715km (925nm), at long range cruising speed 2095km (1130nm).	Max cruising speed 376km/h, long range cruising speed 270km/h (145kt), patrol speed 240km/h (130kt). Initial rate of climb 1375ft/min. Ferry range with 500kg (1100lb) payload 2430km (1310nm).
Weights	Empty 12,220kg, max takeoff from land 19,730kg, from water 17,100kg,.	Empty 12,333kg, max takeoff from land 19,890kg, from water 17,168kg
Dimensions	Wing span 28.60m, length 19.82m, height 8.98m. Wing area 100.3m2.	Same except wing span over wingtips 28.63m.
Capacity	Flightcrew of two, plus accommodation in special missions variants for a third flightdeck member, a mission specialist and two observers. Passenger configuration for 30 at 79cm pitch, or in a combi configuration for 11, with firebombing tanks retained and freight in forward fuselage. Fire retardant payload capacity of 6123kg.	
Date of operation	**1969**	**1994**
Production to date	**125**	**87** (including orders up to 2012)

Source: http://www.airliners.net/ and Wikipedia

Table A3.3 Purchase price of new Canadair CL-415 and Dash-8

CL-415	€ 27 million (negotiable)
Dash-8 multi-mission (water-bomber, passenger transportation and freight)	€ 27 million (negotiable)

Source: French Civil Protection Department

Table A3.4 The Global Market for Dash-8 Convertible Aircraft

Country	Companies	Number of Dash-8 aircraft operated
Algeria	8 aircraft operated by Tassili Airlines	8
Angola	5 aircraft operated by Heli Malongo	5
Angola	1 aircraft operated by the Angolan Government	1
Antigua & Barbuda	18 aircraft operated by LIAT	18
Australia	23 aircraft operated by Sunstate Airlines	23
Australia	19 aircraft operated by Eastern Australia	19
Australia	10 aircraft operated by Skytrans Regional	10
Australia	10 aircraft operated by Skytrans Regional	10
Australia	8 aircraft operated by Skippers Aviation	8
Australia	5 aircraft operated by National Jet-Surveillance	5
Australia	1 aircraft operated by Cobham Aviation	1
Australia	1 aircraft operated by LADS	1
Austria	19 aircraft operated by Austrian Arrows	19
Austria	4 aircraft operated by Inter Sky	4
Austria	1 aircraft operated by Tyrolean Airways	1
Bahamas	6 aircraft operated by Bahamasair	6
Bangladesh	3 aircraft operated by GMG Airlines	3
Bangladesh	2 aircraft operated by United Airways	2
Bangladesh	1 aircraft operated by Royal Bengal Airlines	1
Cameroon	1 aircraft operated by Schreiner Airways Cameroon	1
Canada	64 aircraft operated by Air Canada Jazz	64
Canada	18 aircraft operated by Porter Airlines	16
Canada	9 aircraft operated by Regional 1 Airlines	9
Canada	9 aircraft operated by Air Inuit	9
Canada	8 aircraft operated by Air Creebec	8
Canada	6 aircraft operated by Voyageur Airways	6
Canada	5 aircraft operated by Provincial Airlines	5
Canada	4 aircraft operated by North Cariboo Flying Service	4
Canada	4 aircraft operated by Canadian Air Force	4
Canada	3 aircraft operated by Hawkair AS	3
Canada	3 aircraft operated by Canadian North	3
Canada	3 aircraft operated by Hydro-Quebec	3
Canada	2 aircraft operated by Arctic Sunwest Charters	2
Canada	2 aircraft operated by Labrador Airways	2
Canada	2 aircraft operated by Nav Canada	2
Canada	1 aircraft operated by Government of Quebec	1

Canada	1 aircraft operated by De Havilland Canada	1
Chad	1 aircraft operated by CHC Airways Chad	1
Croatia	6 aircraft operated by Croatia Airlines	6
Denmark	2 aircraft operated by Air Greenland	2
Ethiopia	5 aircraft operated by Ethiopian Airlines	5
Ethiopia	5 aircraft operated by Ethiopian Airlines	5
France	2 aircraft operated by Securite Civile (Ministry of Interior)	2
Gabon	4 aircraft operated by Air Service	4
Gabon	2 aircraft operated by Air Affaires Gabon	2
Germany	10 aircraft operated by LGW Luftfahrtgesellschaft Walter	10
Germany	10 aircraft operated by Augsburg Airways	10
Greece	16 aircraft operated by Olympic Air	16
Greece	1 aircraft operated by Athens Airways	1
Greece	1 aircraft operated by Aeroland	1
Hungary	4 aircraft operated by MALEV	4
Iceland	3 aircraft operated by Air Iceland	3
Iceland	1 aircraft operated by Icelandic Coast Guard	1
Indonesia	2 aircraft operated by Wings Abadi Air	2
Indonesia	1 aircraft operated by Travira Air	1
Jamaica	1 aircraft operated by Air Jamaica Express	1
Japan	11 aircraft operated by Japan Air Commuter	11
Japan	5 aircraft operated by Japan Coast Guard	5
Japan	4 aircraft operated by Air Nippon - ANK	4
Japan	2 aircraft operated by Oriental Air Bridge	2
Japan	1 aircraft operated by Amakusa Airlines	1
Japan	1 aircraft operated by Japan Civil Aviation Bureau	1
Kazakstan	1 aircraft operated by Prime Aviation	1
Kenya	7 aircraft operated by Blue Bird Aviation	7
Kenya	4 aircraft operated by Fly540.com	4
Kenya	3 aircraft operated by Aircraft Leasing Services	3
Kenya	3 aircraft operated by Kenya Air Force	3
Kenya	3 aircraft operated by CMC Aviation	3
Kenya	1 aircraft operated by Air Kenya	1
Kenya	1 aircraft operated by 748 Air Services	1
Latvia	2 aircraft operated by Air Baltic	2
Luxembourg	4 aircraft operated by Luxair	4
Maldives	4 aircraft operated by MALDIVIAN	4
Malta	2 aircraft operated by Medavia	2

Marshall Islands	1 aircraft operated by Air Marshall Islands	1
Mexico	2 aircraft operated by SETRA-Banco de Mexico	2
Mexico	1 aircraft operated by Mexican Air Force	1
New Zealand	23 aircraft operated by Air Nelson	23
Nigeria	3 aircraft operated by AeroContractors	3
Nigeria	2 aircraft operated by Arik Air	2
Nigeria	1 aircraft operated by Niger Gvmt	1
Nigeria	1 aircraft operated by CHC Helicopters International	1
Norway	32 aircraft operated by Wideroe	32
Panama	1 aircraft operated by Air Panama	1
Papua New Guinea	9 aircraft operated by Airlines of PNG	9
Papua New Guinea	8 aircraft operated by Air Niugini	8
Papua New Guinea	2 aircraft operated by Asia Pacific Airlines	2
Philippines	5 aircraft operated by Philippine Airlines	5
Philippines	3 aircraft operated by Airphil Express	3
Portugal	6 aircraft operated by SATA Air Açores	6
Russia	4 aircraft operated by SAT Airlines	4
Russia	1 aircraft operated by Sakhalin Airlines	1
Rwanda	1 aircraft operated by Rwandair Express	1
Saudia Arabia	3 aircraft operated by ARAMCO	3
Solomon Islands	1 aircraft operated by Solomon Airlines	1
South Africa	7 aircraft operated by South African Express Airways	7
Spain	13 aircraft operated by Air Nostrum	13
Switzerland	2 aircraft operated by Baboo	2
Switzerland	1 aircraft operated by Sky Work Airlines	1
Taiwan	8 aircraft operated by Uni Airways	8
Tanzania	3 aircraft operated by Air Tanzania	3
Trinidad & Tobago	5 aircraft operated by Caribbean Airlines	5
Trinidad & Tobago	5 aircraft operated by Caribbean Airlines	5
United Arab Emirates	6 aircraft operated by Abu Dhabi Aviation	6
United Kingdom	53 aircraft operated by Flybe	53
United Kingdom	5 aircraft operated by Air Southwest	5
USA	43 aircraft operated by Piedmont	43
USA	40 aircraft operated by Horizon Air	40
USA	16 aircraft operated by Mesa Airlines	16
USA	16 aircraft operated by CommutAir	16
USA	14 aircraft operated by Colgan Air	14
USA	11 aircraft operated by Lynx Aviation	11
USA	3 aircraft operated by Aloha Island Air	3

USA	3 aircraft operated by ERA Aviation	3
USA	3 aircraft operated by US Air Force	3
USA	2 aircraft operated by Win Win Services	2
USA	2 aircraft operated by Island Air	2
USA	2 aircraft operated by Presidential Airways	2
USA	1 aircraft operated by Vision Airlines	1
Yemen	3 aircraft operated by Yemenia	3
Total		**824**

Source: http://www.speednews.com/ Aviation News and Information

Annex 4: Lease options

There are several lease models which could be considered in the context of EU level contracting of aerial firefighting capacity. This annex describes three such models:

- common assured access agreements;
- pooled chartering; and
- joint long-term leasing.

Common 'assured access agreements'

These are contracts with commercial companies which:

- Guarantee the availability of a specific number of flight hours;
- Are charged at a pre-paid price (pre-paid hours are charged at a favourable rate, with extra hours charged at open-market rates);
- Provide for predetermined assets at a predetermined state of readiness (the provider can use those assets for commercial purposes when not required for civil protection or military service).

Within this general model variants include:

- *Assured access charter agreement*: these are a charter-type contract between a carrier/provider and a national or multinational institution. They specify the number of aircraft and/or the minimum number of flying hours (FH) that the contractor will make available to the customer at a certain notice and for a specific duration, as well as details on the exercise of activation rights. Countries pay a significant premium over the market charter rate for assured access.
- *Dormant contracts:* these are agreements used for requisitioning commercial aircraft (in times of crisis). This option would however be difficult for individual Participating States. Each government would need to negotiate with its commercial suppliers and ensure the availability of trained "reservists" to run the equipment, and providers would need significant incentives to risk their revenue generation and market share in order to provide ad-hoc capability to governments. Also, there is a doubt as to the availability of sufficient aerial firefighting capacity to be requisitioned in individual Participating States to this end. However, dormant contracts would certainly be easier to setup at EU level than at individual Participating state level (hence the advantage of the pooling system in that particular legal configuration). Their advantage would be to spread across European providers the burden for providing assets in case of requisition when large fires occur. Should states experience shortfalls in capacity, they would be able to use contracted aircraft capacity, for several types of contingencies.
- Private finance initiative / public private partnership models: since 1995, the UK has used such schemes to acquire several types of (military) capabilities, such as sealift and tanker aircraft capability. Staggered funding allows for an increase in the investment capacity of the public sector, with higher quality of services.

In assured access contracts the price is fixed in advance and usually has the following components:

- *Charter fee*: the market/spot rate, which expresses the cost of securing the assets in the open market;
- *Retainer fee*: the premium paid to obtain guaranteed access, that is, to ensure that the assets are available when needed;

- *Handling or management fee*;
- *Risk insurance*: compensation for operating in hostile environments, if the individual country or provider does not assume that.

Crews are a national responsibility when state assets are involved and the responsibility of the carrier for commercial assets (similar to charter situations).

Pooled chartering

Pooled chartering is a kind of *ad hoc* arrangement for the provision of aerial capacity, for specific missions (fixing the number of missions/ flight hours) and time frames. These timeframes have to be sufficiently broad e.g. of all fire season. Chartering is less binding than off-the-shelf purchase of assets or leasing. It can cover shortfalls at times of peak usage. Chartering does not involve infrastructure costs.

Charter rates include several types of costs:

- Fixed costs, such as pilots, depreciation, risk insurance, and interest;
- Variable costs (usage costs). These costs represent the largest share of charter costs. They can be expressed in terms of flight hours; : maintenance (personnel, infrastructure) and operating costs (fuel, landing fees, engineering/logistic support);
- Profit for the charter company.

Usage costs are charged at spot market rates that vary according to market conditions and demand. The additional costs of a central management organisation also have to be considered.

By working together in a European pool or joint chartering arrangement Participating States could have a higher bargaining power and status, and so be able to access more aerial firefighting aircraft on better terms. Chartering could also potentially provide access to aerial firefighting capability for a larger number of countries ('buying a share in a pool') – such as those for whom outright purchase of aircraft is not an attractive option.

A possible constraint is the liquidity of international markets for firefighting aircraft, especially where a rapid response is required. Mobilisation of commercial aerial firefighting capacity (during peak fire risk periods) could indeed disrupt the regular commercial activity of chartering/leasing companies creating a risk of price escalation (because of competing demands for limited firefighting aircraft resources - notably at the peak of the fire season).

Joint long-term leasing

In a long-term leasing configuration the provider of the aircraft (typically an aircraft manufacturer, bank or commercial leasing company) owns the assets and receives annual payments from the leaseholder (a government or potentially the EU) for their use. A variation of this option is a lease-to-buy contract, in which the leaseholder has the option to buy assets after a certain lease period. Assets can be leased and operated jointly by several participating states. An advantage of joint leasing is that it does not require (as in the case of ownership) a support and logistics organisation, since the provider of the aircraft usually provides logistic support for the leased aircraft.