



Department of **Biodiversity,
Conservation and Attractions**



INTERNATIONAL KNOWLEDGE EXCHANGE PROGRAM

Trip Report

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Western Australia

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At the request of the Portuguese government (specifically the Special Unit on Integrated Rural and Wildfire Management or Agência para a Gestão Integrada de Fogos Rurais) and with the logistical support and financial assistance (for travel expenses) of the Australian Embassy, Pedro Palheiro and Paul Dunstan of the Department of Biodiversity, Conservation and Attraction's, Parks and Wildlife Service (DBCA/Parks and Wildlife Service), spent 31 days in Portugal from 20 August 2018 to 20 September 2018.

The objectives of the visit were to:

- a) meet with staff from several Portuguese government departments and visit areas impacted by the devastating wildfires of June and October of 2017 in order to provide observations regarding improvements to the current system of fire management with attention to the safety and efficiency of operations; and
- b) to share best practice and lessons learned associated with the use of machinery for fire line construction, air attack supervisor roles and to advise on training gaps and opportunities for development of shared training between Portugal and Australia.

The primary contacts with the Portuguese government were:

- Special Unit on Integrated Rural and Wildfire Management / Agência para a Gestão Integrada de Fogos Rurais
 - Tiago Oliveira, Unit Head
 - Antonio Salgueiro, Technical Advisor
 - Joao Tome, Technical Advisor
 - Paulo Mateus, Technical Advisor
 - Ana Diogo, Analyst
- Autoridade Nacional da Proteção Civil
 - Miguel Cruz, Technical Leader
- Instituto da Conservação da Natureza e das Florestas
 - Rui Almeida, Technical Leader

The 31-day program (see Appendix 1) was extensive and intensive and included site visits in Lisbon, Aveiro, Braganca, Mirandela, Alfandega da Fe, Seia, Loule, Abrantes, Castelo Branco, Trancoso, Loriga; and field visits to areas impacted by recent bushfires in Alfandega da Fe, Loule and Loriga to facilitate the development of observations to improve the current Sistema de Gestão Integrada de Fogos Rurais (Table 1):

Table 1. Perceptions and observations to improve bushfire suppression in Portugal

1. BUSHFIRE COORDINATION	
Perceptions	Observations
Fire management agencies, while very effective in their own right during different stages of fire suppression, more collectively they appear to have different operating procedures and command structures	All agencies to work under consistent operating procedures and command structure and explore all joint training opportunities. To assist with this process ensure fire operational staff document their actions through the use of fire diaries. Fire diaries will also be valuable to assist with the reconstruction of events and further improvements of the processes.
	Take advantage of prescribed burning opportunities to train operational staff from different agencies thereby improving cooperation, collaboration and understanding of collective skill bases.
Apparent inefficiencies in radio communications between fire agencies	For handling emergencies ensure the existing dedicated radio network is available to all agencies throughout the country
2. FIRE LINE CONSTRUCTION WITH MACHINERY	
Perceptions	Observations
As witnessed in several location throughout the country, a very good training package exists and is already being delivered (Districts of Braganca, Faro and Castelo Branco)	This training package should be made available to all agency and contract machine operators on an annual basis
No dedicated operators from either Volunteer brigades, FEB or GNR	Ensure dedicated operators are embedded within fire crews responsible for extended attack. Need to identify experienced operators to pass on their knowledge and training through practical operation and succession planning

	Training of staff to supervise machine operations and support role (ongoing maintenance requirements on the fire ground)
High rotation of machine operators within the armed forces creates lack of continuity in fire and machine experience. Operators stay within this role for a short 2 to 3 year period.	Create opportunities for existing machine operators to potentially have career options within fire suppression agencies
Machinery not being utilised to its full potential in active fire suppression	Where terrain permits, increase the use of direct and parallel attack tactics with support from both vehicle and aircraft. When possible utilise prescribed burning to train operators in this type of suppression work
Limited used of machinery for dry mopup techniques at fires creating risk of re-ignition	Where possible, use machinery to speed up the mop up process around the fire. This will also reduce the workload of and water use by fire crews.
Only bulldozers are being used for fire suppression	Explore the use of other machines such as front end loaders and skid steers to complement the dozer work. These types of machines can also be used in areas where dozers cannot be used and reduce the environmental impact of fire line construction and mopup techniques
Lack of dealing with unburnt pockets near the edge of the fire during and after fire suppression operations	All unburnt pockets created during suppression fire line construction activities should be burnt out or excluded by a mineral earth break to limit the potential of fire escape or reignition of these areas
Only manufacturers operators protective systems are currently on machinery (factory fitted protection systems)	Explore the adoption of existing protective equipment adapted to both dozers and front end loaders with the inclusion of a fire suppression device for engine bay as already developed in places such as Western Australia
Deficient lighting on machinery creating potential safety hazards	Increase number of lights including colored lights to increase visibility in heavy dust and smoke areas (yellow or green color). For safety reasons, machines with

	inadequate lighting should not be allowed to operate in deficient light conditions and at night
Deficient communications with machine operator	Each machine must have a standard form of radio communication with fire support crews. Without communication the machine should not be allowed on the fire ground.
No apparent rehabilitation of fire breaks constructed with machinery is being conducted	Utilise machines such as excavators to minimise environmental impact and improve erosion control
Machinery is not being cleaned down for soil and weed control	Implementation of a standing operating procedure for fire management works involving the use of machinery where each machine must be cleaned and checked prior to commencement of any works to reduce likelihood of introduction of weeds and other diseases

3. AERIAL COORDINATION

Perceptions	Observations
Minimal coordination between air and ground crews	<p>Introduction of an air attack supervisor role such as the model adopted in Western Australia by both the Department of Biodiversity Conservation and Attractions (DBCA) and Department of Fire and Emergency Services (DFES). This role involves the upskilling of ground personnel regarding their understanding and appreciation of aerial suppression tactics and basic aircraft operations;</p> <p>DBCA is available to assist with this process by facilitating the training of future Portuguese air attack supervisors and offering observation opportunities throughout the fire season in Western Australia.</p>

	The air attack supervisor role increases the safety of air and ground crews by ensuring effective communication between operating aircraft and ground crews thereby ensuring clear ground before each water drop while also maintaining vigilance for other hazards for aircraft
	The air attack supervisor role increases the effectiveness and efficiency of air operations by ensuring that water drops are placed where required in a timely manner in conjunction with advice from ground controller. While providing essential feedback to waterbombing pilots, the air attack supervisor ensures constant adjustments are being made to ensure the best outcomes.
The ground controller role (COPAR) is currently required to manage complex air operations from the ground which compromises the safety of both air and ground crews due to limited communication abilities and lack of feedback on water drops.	Ensure the COPAR role exists as a dedicated role to assist air attack supervisor with communications to ground operations.
Lack of annual refresher training between all aerial operational staff including pilots, ground controller (COPAR), air attack supervisors and other relevant staff	Introduce an annual refresher training program for these roles prior to commencement of fire season

4. RURAL FIRE SUPPRESSION CAPABILITIES

Perceptions	Observations
Large amount of rural urban interface throughout the country creates complexities in managing rural fires. During large scale bushfires, the majority of resources are allocated to the evacuation and protection of communities while a limited amount of resources are dedicated to combating the spread of the fire from these areas. This results in more communities being at risk due to an	Increase the number of fire crews dedicated to active fire suppression in rural areas to protect the greater population and infrastructure by limiting the size and extent of bushfires;

increase in fire size, placing increased strains on available resources and increasing the risk for the wider community and firefighters.

High fuel loads surrounding isolated houses and communities

Implement low fuel buffer zones around communities to increase safety for both population and fire crews

Horizontal continuity of high fuel loads throughout the landscape creates hazardous conditions leading to the occurrence of large-scale bushfires

Work cooperatively with different agencies to identify strategic bushfire risk mitigation areas and actively implement fuel reduction programs to reduce the likelihood of large-scale bushfires

Utilise existing high level of skills and knowledge within different agencies in Portugal to implement a large-scale fuel reduction program

Ensure the continuity of the fuel reduction program

Implement a successional training program to develop the knowledge of future generations of fire crews

Time delay between activation of waterbombing aircraft to bushfire on high risk days

Implement automatic dispatch of heavy water bombers under these circumstances

Lack of readily available information about fuel characteristics and age to assist with the dispatch of fire resources during initial attack

Development of accurate annual fuel age maps to be shared among all relevant agencies to assist with the dispatch of appropriate level of fire response

SUMMARY

It is our view that the skills and knowledge of Portuguese fire crews within different agencies is of a very high standard. Portugal would greatly benefit from actively creating opportunities for different agencies to share their knowledge and work together on fire mitigation and suppression as outlined in the observations above.

The efficiency of mop-up and bushfire suppression would be greatly increased by the expanded use of machinery, and operator training. Machines are currently being used throughout the country with several examples of successful application. Where possible, lessons learned should be adopted as standard procedures for the appropriate management and control of bushfires, while assisting to mitigate the risk of reignition.

The number of aircraft currently being used for bushfire suppression requires an adequate command structure and management of operations to ensure both safety and work efficiency of air and ground resources. The adoption of the air attack supervisor role and continuous improvement of training programs for ground controllers is highly recommended. The Department of Biodiversity, Conservation and Attractions Parks and Wildlife Service is available to include future Portuguese air attack supervisors and ground controllers in existing training programs and fire operations in Western Australia in future. Rural fire suppression capabilities would greatly benefit from an increased bushfire risk focus on mitigation activities in strategic locations by implementing a large-scale fuel reduction program. This management approach provides the added benefit of creating low fuel buffer zones around communities, while creating opportunities for joint training for fire agencies, enabling development of skills and cooperation in a controlled environment.

The current international knowledge exchange program being implemented by AGIF is of great value as it will benefit Portuguese fire agencies as well as all countries involved in the program. The program provides opportunities to improve work practices and promotes the sharing of lessons learnt between fire agencies throughout the world, contributing to the common goal of increasing the safety of the wider community. We are honored and privileged to have become part of this process and acknowledge Portugal's efforts to initiate this program to help minimize the effects of large-scale bushfires and their impacts on the general population.

APPENDIX 1

VISIT ITINERARY

DATE	DESCRIPTION
20/08/2018	- Paul Dunstan and Pedro Palheiro of DBCA departed from Perth to Lisbon
21/08/2018	- Arrival in Lisbon
22/08/2018	- Rest day
23/08/2018	<ul style="list-style-type: none">- Welcoming session and short meeting at the Secretaria-Geral da Presidencia do Conselho de Ministros (General Secretariat of the Presidency of the Council of Ministers) with the president of the Agencia para a Gestao Integrada de Fogos Rurais (AGIF - Special Unit on Integrated Rural and Wildfire Management) Mr. Tiago Oliveira and Ana Diogo;- Briefing regarding expectations and program during our stay in Portugal: we were requested to deliver presentations about the use of machinery for fire line construction and the air attack supervisor role to different fire agencies throughout the country;- DBCA participated in part of the fire weather training being held at the Portuguese Bureau of Meteorology (IPMA) by Amanda Cunningham (Fire Weather Technical Specialist Incident Meteorologist) from the USA;- Short discussion in the afternoon with AGIF officers Antonio Salgueiro and Joao Tome to fine tune plans for the following weeks;
24/08/2018	<ul style="list-style-type: none">- Phone meeting with Mike Meinema to discuss AGIFs expectations during our stay. We have requested permission to:<ul style="list-style-type: none">o Use and share our departmental training power points;o Arrange a training session in WA for 2-4 Portuguese fire operations staff in air attack supervisor role;o Demonstrate Spatial Support System and the Electronic Prescribed Burn System;o Requested Job Description Forms for fire roles to assist AGIF with defining training needs and responsibilities;- Preparation of presentations and other materials for the following days.
25/08/2018	- Finalise presentations and other materials
26/08/2018	- Rest day

27/08/2018	<ul style="list-style-type: none"> - Drive to Serra de Sintra and surrounding areas to observe different fuel types, and assess fire risk adjacent to Lisbon; - Meeting with Antonio Salgueiro to finalise plan for our visit.
28/08/2018	<ul style="list-style-type: none"> - Participation at weekly briefing at the National Civil Protection Centre in Lisbon - Meeting with Antonio Salgueiro - Departed to Aveiro
29/08/2018	<ul style="list-style-type: none"> - Presentation delivered to Guarda Nacional Republicana (GNR) GIPS Aveiro: <ul style="list-style-type: none"> o Fire line construction with machinery
30/08/2018	<ul style="list-style-type: none"> - Presentation delivered to GNR GIPS Aveiro: <ul style="list-style-type: none"> o Air attack supervisor role o Burnover drill o Discussion regarding incidents (Black Cat Creek and Guadalajara fire) - Overnight in Braganca
31/08/2018	<ul style="list-style-type: none"> - Visit to forest areas around Braganca and Parque Natural de Montesinho; - Meeting with CODIS Braganca and visit to the District Civil Protection Operations Centre (CDOS) in Braganca
01/09/2018	<ul style="list-style-type: none"> - CODIS Braganca delivered presentation about use of machinery in bushfire suppression; DBCA delivered presentation about fire line construction with machinery; - CODIS Braganca presented case study about Alfandega da Fe bushfire; - Visit to BV Mirandela and Alfandega da Fe; - Visit to bushfire in Alfandega da Fe with discussion about suppression strategies;
02/09/2018	<ul style="list-style-type: none"> - Delivered presentation to GNR GIPS Mirandela about safety and burnover procedures;
03/09/2018	<ul style="list-style-type: none"> - Meeting with Canadair pilots in Seia aerodrome to discuss the suitability of an air attack supervisor role in Portugal - Overnight Lisbon
04/09/2018	<ul style="list-style-type: none"> - Day off
05/09/2018	<ul style="list-style-type: none"> - Meeting in Lisbon with Australian Ambassador Mr. Peter Rayner - Drive to Loule
06/09/2018	<ul style="list-style-type: none"> - Presentation to Civil Protection / GNR GIPS Loule <ul style="list-style-type: none"> o Fire line construction with machinery o Air attack supervisor role o Burnover drill

	<ul style="list-style-type: none"> ○ Discussion regarding incidents (Black Cat Creek and Guadalajara fire)
07/09/2018	- Visit to Monchique bushfire with Luis Simoes (BV Loule) and Domingues (BV Messines) and 2 military GNR GIPS officers
08/09/2018	- Drive to Lisbon. Preparation of presentation for Monday
09/09/2018	<ul style="list-style-type: none"> - Pedro – Rest day - Paul – preparation of presentation about air attack for Monday’s meeting / rest day
10/09/2018	- Meeting in Lisbon with Armed Forces at NATO headquarters to deliver presentation about air attack role in Western Australia. Discussion about implementation of this role in Portugal;
11/09/2018	- Participation at the weather workshop with Amanda Cunningham
12/09/2018	<ul style="list-style-type: none"> - Presentation in Abrantes to Armed Forces, CODIS Castelo Branco, ICNF and AFOCELCA <ul style="list-style-type: none"> ○ Fire line construction with machinery - Practical demonstration of dozers working
13/09/2018	<ul style="list-style-type: none"> - Presentation in Abrantes to Armed Forces, CODIS Castelo Branco and AFOCELCA <ul style="list-style-type: none"> ○ Fire line construction with machinery - Visit to CDOS Castelo Branco
14/09/2018	<ul style="list-style-type: none"> - Presentation in Trancoso to 2CODIS Guarda, BV Trancoso, BV Pinhel, BV Loriga and FEB <ul style="list-style-type: none"> ○ Fire line construction with machinery - Visit to Loriga fire with Cmdte BV Pinhel and Cmdte BV Loriga - Overnight COTF Lousa
15/09/2018	- Preparation of report
16/09/2018	- Preparation of report
17/09/2018	- Preparation of report
18/09/2018	- Meeting with Escola National Bombeiros Lisboa
19/09/2018	<ul style="list-style-type: none"> - Presentation at Instituto Superior de Agronomia (Lisbon School of Agriculture) about Fire Management in Western Australia - Meeting with Australian Ambassador Mr. Peter Rayner at 17:30
20/09/2018	- Flight to Perth

BIO/RESUMÉ

Paul Dunstan

Current Employee at the Department of Biodiversity Conservation and Attractions Parks and Wildlife, with 16 years' experience in fire management. Including undertaking conservation employee, overseer, machine operator, mentor and training officer responsibilities.

5 years as a lieutenant with the Kalamunda Volunteer Bushfire Brigade.

Formal qualifications and experience:

- Cert IV Training and Assessment
- Cert IV Land Management
- Cert II PUA Public safety Fire (Fire Fighter crew member and crew leader)
- Air Attack Supervisor and Air operations ground controller
- Fire Operations Officer (including sector & divisional commander)
- Heavy vehicle operator (including off road 4x4)
- Machine operator
- Advanced faller

Current training and assessment responsibilities:

- Crew member
- Crew leader
- Tree felling / chainsaw maintenance and operation
- 4WD operations
- Fire line construction
- Machine operation

Pedro Palheiro

Bachelor Degree - Forestry.

Started his career in 2001 as Research Scientist at the Forest Fire Research Centre (University of Coimbra, Portugal) developing works in fuel modelling and fire behavior. From 2006 – 2014 worked as Fire Operations Officer in Portugal being responsible for planning and implementing burn programs in Portugal's Central Region. During the bushfire season I was integrated into the Specialized Fire Operations Unit (GAUF) from the Portuguese National Forest Authority providing technical support to the Incident Controller in large multiple-day bushfires and being responsible for planning and implementing backburn operations as crew leader. In 2014 started working with the Department of Biodiversity Conservation and Attractions (DBCA) as a Seasonal Conservation Employee based in Jarrahdale, Perth Hills District. During this period, as part of the fire crews assisted in prescribed burns, bushfire suppression and participated on daily works as required, including maintenance and construction of departmental assets. In 2015 employed as Fire Operations Officer based in Millstream Chichester National Park being responsible for planning and implementing programs and operations relating to fire management including training, prescribed burning and bushfire preparedness within the Pilbara Region. From 2017 onwards, as Regional Leader Fire Management in the Pilbara Region, carries responsibility for the management of the DBCA's Pilbara Regional Fire program, heavily focused on the protection of visitors, infrastructure and conservation of biodiversity values through the implementation of a large-scale prescribed burning program. Responsible for annual training of regional staff for prescribed burning and bushfire suppression, as well as liaison with other fire agencies and neighbors for coordinated cross-tenure fire management. Rostered Regional Duty Officer for managing all bushfire events within the Region and ensuring communication with State Duty Officer, dispatch of crews and control of Level 1 fires as Incident Controller.

APPENDIX 4

SWOT ANALYSIS

A. BUSHFIRE COORDINATION

1) Strengths

- a) Fire agencies highly effective during initial suppression of bushfires;
- b) Adequate number of fire crews available throughout the country;
- c) Existing technical knowledge within different agencies; and
- d) Remote video vigilance within the CDOS visited, is an effective tool to guide decision-making.

2) Weaknesses

- a) Fire management agencies, whilst very effective in their own right during different stages of fire suppression, more collectively they appear to have different operating procedures and command structures; and
- b) Apparent inefficiencies in radio communications between agencies (inability from COS to speak with GIPS initial attack crews).

3) Opportunities

- a) Fire agencies could operate under consistent operating procedures and command structures and explore all joint training opportunities; and
- b) Utilise prescribed burning programs as training opportunities to improve skills and competencies.

4) Threats

- a) Loss of efficiency during operations due to inability of different agencies to communicate effectively;
- b) Increased risk to the safety of operational staff due to lack of communications; and
- c) Inconsistent training of operational staff may result in loss of operational effectiveness and increase the risk during operations.

B. FIRE LINE CONSTRUCTION WITH MACHINERY

1) Strengths

- a) Adequate number range and types of machinery readily available in the country
- b) Effective training package being delivered in several Districts (Districts of Braganca, Faro and Castelo Branco) with experienced trainers and operators available; and
- c) Existing awareness of the need to create a fire break around the perimeter of the bushfire to reduce the number of reignitions.

2) Weaknesses

- a) No dedicated machine operators from either Volunteer Brigades, FEB or GNR, as most operators work for private companies;

- b) High rotation of machine operators within the armed forces creates lack of continuity in fire and machine experience. Operators stay within this role for a short 2 to 3-year period;
- c) Machinery not being utilized to its full potential in active fire suppression;
- d) Limited use of machinery for dry mop-up techniques at fires creating a risk of re-ignition;
- e) Only bulldozers are being used for fire suppression;
- f) Lack of dealing with unburnt pockets near the edge of the fire during and after fire suppression operations;
- g) Only manufacturers operator protective systems are currently on machinery (factory fitted protection systems);
- h) Deficient lighting on machinery creating potential safety hazards;
- i) Deficient communications with machine operator;
- j) No apparent rehabilitation of fire breaks constructed with machinery is being conducted; and
- k) Machinery is not being cleaned down for soil and weed control.

3) Opportunities

- a) Training packages should be made available to all machine operators, both agency staff and contractors on an annual basis;
- b) Ensure dedicated operators are embedded within fire crews responsible for extended attack within either volunteer brigades, FEB and/or GNR;
- c) Need to identify experienced operators to pass on their knowledge and training through practical operation and succession planning;
- d) Training of staff to supervise machine operations and support roles (ongoing maintenance requirements on the fireground);
- e) Create opportunities for existing machine operators to potentially have career options within fire suppression agencies;
- f) Where terrain permits, increase the use of direct and parallel attack tactics with support from both vehicle and aircraft. When possible utilise prescribed burning to train operators in this type of suppression work;
- g) Where possible, use machinery to speed up the mop-up process around the fire perimeter. This will also reduce the workload of and water use by fire crews;
- h) Explore the use of other machines such as front-end loaders and skid steers to complement the dozer work. These types of machines can also be used in areas where dozers cannot be used and reduce the environmental impact of fire line construction and mop-up techniques;
- i) All unburnt pockets resulting from fire line construction activities should be burnt out or excluded by a mineral earth break to limit the potential of fire escape or reignition of these areas;

- j) Explore the adoption of existing protective equipment adapted to both dozers and front-end loaders with the inclusion of a fire suppression device for engine bay as already developed in places such as Western Australia;
- k) Increase the number of lights including colored lights to increase visibility in heavy dust and smoke areas (yellow or green color). For safety reasons, machines with inadequate lighting should not be allowed to operate in deficient light conditions and at night;
- l) Each machine must have a standard form of radio communication with fire support crews. Without communication the machine should not be allowed on the fire ground;
- m) Utilise machines such as excavators to minimise environmental impact and improve erosion control; and
- n) Implementation of a standing operation procedure for fire management works involving the use of machinery where each machine must be cleaned and checked prior to commencement of any works to reduce the likelihood of introduction of weeds and other diseases.

4) Threats

- a) Added difficulty in ensuring the perimeter of the bushfire is safe from re-ignitions; and
- b) Increased difficulty in suppression of active fire.

C. AERIAL COORDINATION

1) Strengths

- a) Adequate number of aircraft available throughout the country;
- b) Existing technical knowledge within different agencies;
- c) Existing awareness within different fire agencies regarding the need to coordinate multiple aircraft for complex multiple day bushfires;
- d) Waterbombing pilots are fully supportive of the air attack supervisor role being introduced and implemented;

2) Weaknesses

- a) Minimal coordination between air and ground crews;
- b) The ground controller role (COPAR) is currently required to manage complex air operations from the ground which compromises the safety of both air and ground crews due to limited communications abilities and lack of feedback on water drops; and
- c) Lack of annual refresher training between all aerial operational staff including pilots, ground controller (COPAR), air attack supervisors and other relevant staff.

3) Opportunities

- a) Introduction of an air attack supervisor role such as the model adopted in Western Australia by both the Department of Biodiversity, Conservation and Attractions (DBCA) and Department of Fire and

Emergency Services (DFES). This role involves the upskilling of ground personnel regarding their understanding and appreciation of aerial suppression tactics and basic aircraft operations;

- b) DBCA is available to assist with this process by facilitating the training of future Portuguese air attack supervisors and offering observation opportunities throughout the fire season in Western Australia;
- c) The air attack supervisor role increases the safety of air and ground crews by ensuring effective communication between operating aircraft and ground crews thereby ensuring clear ground before each water drop while also maintaining vigilance for other hazards for aircraft;
- d) The air attack supervisor role increases the effectiveness and efficiency of air operations by ensuring that water drops are placed where required in a timely manner in conjunction with advice from ground controller. While providing essential feedback to waterbombing pilots, the air attack supervisor ensures constant adjustments are being made to ensure the best outcomes;
- e) Ensure COPAR role exists as a dedicated role to assist air attack supervisor with communications to ground operations; and
- f) Introduce an annual refresher training program for these roles (pilots, ground controller, air attack supervisor and other relevant staff) prior to commencement of fire season.

4) Threats

- a) Ineffective communication between operating aircraft and ground crews results in inability to confirm clear ground before each water drop;
- b) Increased risk of incidents between aircraft and/or with ground crews;
- c) Inability to assess the effectiveness of water drops and aerial waterbombing operations; and
- d) Increased risk to ground crews due to lack of information regarding fire behaviour and potential threats to crews.

D. RURAL FIRE SUPPRESSION CAPABILITIES

1) Strengths

- a) Awareness of existing fire agencies that the bushfire risk needs to be mitigated at a landscape level to mitigate impacts on rural urban interface;
- b) Capability of fire crews to suppress bushfire fires within the initial attack phase;
- c) Number of fire crews available throughout the country; and
- d) Dispatch of fire crews well organised and prioritised according to bushfire risk.

2) Weaknesses

- a) Large amount of rural urban interface throughout the country creates complexities in managing rural fires. During large-scale bushfires, the majority of resources are allocated to the evacuation and protection of communities while a limited amount of resources are dedicated to combating the spread of the fire from these areas. This may potentially result in more communities being at risk due to an

increase in fire size, placing increased strains on available resources and increasing the risk for the wider community and firefighters;

- b) High fuel loads surrounding isolated houses and communities;
- c) Horizontal continuity of high fuel loads throughout the landscape creates hazardous conditions leading to the occurrence of large-scale bushfires;
- d) Time delay between activation of heavy waterbombing aircraft to bushfire on high risk days; and
- e) Lack of readily available information about fuel characteristics and fuel age to assist with the dispatch of fire resources during initial attack.

3) Opportunities

- a) Increase the number of fire crews dedicated to active fire suppression in rural areas to protect the greater population and infrastructure by limiting the size and extent of bushfires;
- b) Implement low fuel buffer zones around communities to increase safety for both the general population and fire crews;
- c) Work cooperatively and collaboratively with different agencies to identify strategic bushfire risk mitigation areas and actively implement fuel reduction programs to reduce the likelihood of large-scale bushfires;
- d) Utilise existing high level of skills and knowledge within different fire agencies in Portugal to implement a strategic large-scale fuel reduction program on government-managed lands;
- e) Ensure the continuity of the existing fuel management program to protect communities and infrastructure through the implementation of the program as guided by existing legislation and policies;
- f) Implement a successional training program to develop the knowledge of future generations of fire crews;
- g) Implement an automatic dispatch of heavy water bombers under high (or above) fire risk days;
- h) Develop and maintain updated fuel age maps to be shared among all relevant agencies to assist with the dispatch of resources at an appropriate level of fire response and planning of future fuel reduction burns;

4) Threats

- a) Large scale bushfires increase general threats resulting in greater impacts to people, economy, social setting, governance, infrastructure and natural environment;
- b) Increased likelihood for more houses to be impacted and potentially destroyed by bushfires; and
- c) Large-scale bushfires homogenize fuel ages across vast areas. Planning and implementation of strategic fuel reduction treatments is essential to ensure adequate management of future bushfire risk.

APPENDIX 6

OTHER INFORMATION

Relevant documentation (provided on attached USB flash drive)

Fire line construction with machinery

- DBCA presentation on Fire Line Construction with machinery (PowerPoint);
- AS 2291.1 Earth-moving machinery – Protective structures;
- SOP065 Identifying hazardous trees inspecting roads;
- SOP024 Prescribed burn and bushfire security;

Aerial coordination

- DBCA presentation on Air attack supervisor role (PowerPoint);
- Western Australian Aerial Fire Suppression Operating Procedures 2016-2017;
- Incendiary Operations Supervisor (course outline);
- Ground Controller (Water bombing) (course outline);
- Air Observer (course outline);
- Air Attack Supervisor (course outline);