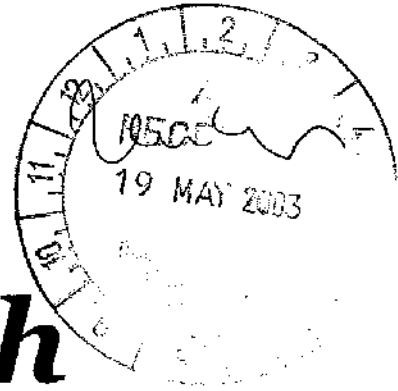


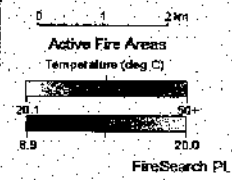
Submission No.312



# FireSearch

## Yongal Fire

Thermal Digital Data Flown 17th January 2003 between 2.08am and 4.22 am



**SUBMISSION TO THE INQUIRY  
OF THE  
HOUSE SELECT COMMITTEE ON  
THE RECENT AUSTRALIAN BUSHFIRES**

*Using Thermal Imagery in the Management of Bushfires*

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## USING THERMAL IMAGERY IN THE MANAGEMENT OF BUSHFIRES

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### ACRONYMS AND TERMS

Please note that further detailed definitions can be found at the GIS Development site:  
<http://www.gisdevelopment.net/glossary/index.htm>

DEM Digital Elevation Model

GEOREFERENCE OR GEOGRAPHIC CALIBRATION - Information that relates raster cells or vector/computer aided design elements to a specified coordinate system or map projection.

GIS Geographic Information Systems

GPS Global Positioning System

GRAYTONED IMAGE OR RASTER - An image or raster object that contains tone levels and intensities that grade gradually from black (no intensity) to white (high intensity).

GROUND TRUTH - Information collected at the same site and at the same time as a remote sensing system is collecting data. Ground truth is considered more accurate, and is used to interpret and calibrate remotely sensed observations.

IMU Inertial Measurement Unit (measures inertia)

IMT Incident Management Teams

MIP Micro-Images Product

MOSAIC - A large image assembled from segments. Each segment may come from a different source and have a different cell size and angle of orientation, but all the segments must be geometrically rectified and calibrated to a common coordinate framework.

NOAA - National Oceanographic and Atmospheric Administration

ORTHOPHOTOS - aerial photographs that have been ortho-rectified -that is, they have been geometrically corrected so that ground locations are in their true positions on the image and any given area on the photo equals a proportional area on the ground

AUTOMOSAICED – the process by which one image is laid on another and they are set out on a topographical map or other grid, providing a mosaic of images.

RASTER or RASTER OBJECTS The words raster and grid are often used interchangeably. However GIS Development defines a raster as a single, related, two dimensionally grouped set of numbers of a single data type. Each number represents the value of some parameter. Its position in the group represents its relative position to the other values. A raster object is a raster that is stored in an RVC project file.

RFS Rural Fire Service

RAPID MOSAICING PROGRAM – quickly provides a series of information overlays on the one image (see Mosaic)

REAL TIME INFORMATION – within 15 minutes

VECTOR - A quantity possessing magnitude and direction, represented by an arrow, the direction of which indicates the direction of the quantity and the length of which is proportional to the magnitude" (random house). In connection with GIS and computer graphics, this term is used more loosely to refer to a set of vectors joined end to end to make an arc or irregular line with a uniform set of properties.

**TERMS OF REFERENCE**

*The Select Committee on the recent Australian Bushfires* seeks to identify measures that can be implemented by governments, industry and the community to minimise the incidence of, and impact of bushfires on, life, property and the environment with specific regard to the following:

- (a) The extent and impact of the bushfires on the environment, private and public assets and local communities;
- (b) The causes of and risk factors contributing to the impact and severity of the bushfires, including land management practices and policies in national parks, state forests, other Crown land and private property;
- (c) The adequacy and economic and environmental impact of hazard reduction and other strategies for bushfire prevention, suppression and control;
- (d) Appropriate land management policies and practices to mitigate the damage caused by bushfires to the environment, property, community facilities and infrastructure and the potential environmental impact of such policies and practices;
- (e) Any alternative or developmental bushfire mitigation and prevention approaches, and the appropriate direction of research into bushfire mitigation;
- (f) The appropriateness of existing planning and building codes, particularly with respect to urban design and land use planning, in protecting life and property from bushfires;
- (g) The adequacy of current response arrangements for fire-fighting;
- (h) The adequacy of deployment of fire-fighting resources, including an examination of the efficiency and effectiveness of resource sharing between agencies and jurisdictions;
- (i) Liability, insurance coverage and related matters;
- (j) The roles and contributions of volunteers, including current management practices and future trends, taking into account changing social and economic factors.

**1. OFFER TO THE COMMITTEE OF INQUIRY FOR A DEMONSTRATION**

*FireSearch* would like to make the following offers to the *Select Committee on the recent Australian bushfires*:

- To provide a computer demonstration of the data processing system that is used to deliver thermal images and data products.
- *FireSearch* would be willing to appear before the Committee to expand or clarify any of the issues raised in this submission.

Arrangements can be made by contacting either:

Mr Paul Osborne, CEO of *FireSearch*  
in the ACT –

Phone: 0418 274 316

Email: OsborneP@cdrleague.com.au

Mr Chris Humphries, Managing Director  
at his Office in Moree –

Phone: (02) 6752 7073

Email: humphriescd@bigpond.com.au

## **2. EXECUTIVE SUMMARY**

*FireSearch Pty Ltd* provides an imaging system that delivers accurate georeferenced orthorectified digital data that is rapidly produced and available in many formats. In this submission *FireSearch* explains the role that thermal imaging has played and can play in the management of resources when fighting bushfires.

The thermal imaging provided by *FireSearch* has been helpful in understanding the progress of fires and has been particularly useful in clear identification of hot spots to assist in improving the efficiency of pre back burn, monitoring during back burn and mop-up operations. Through aerial surveillance, thermal imaging allows a georeferenced representation of the source of heat on the ground to within less than half a degree Celsius accuracy.

In the location of hotspots a map reference can be identified to between five and ten metres on regular ground and within twenty metres on rough terrain.

We have attempted to present not only a history of the company's involvement in fire-fighting over the last two seasons but have been frank in our explanation of the issues that are still facing this emerging technology. The challenges are not only in delivery of better services but also in the development of the technology, the personnel and the training.

This submission clearly illustrates the capability of the range of products and services that *FireSearch* can provide to managers in order to assist them in the efficient allocation of personnel and other resources to the areas of highest priority.

Attached to this submission as an annex is a report of the company's involvement in the preceding fire season.

In order to improve fire-fighting outcomes with the use of thermal imaging we suggest the following recommendations be included in the report of the Inquiry into the recent Australian bushfires by the *House Select Committee on the recent Australian bushfires*:

1. The government provide adequate funding to the RFS and other emergency services to allow the use of Thermal Imaging where appropriate in the management of bushfires.
2. The government invest in further development of thermal imaging through a grant managed by the RFS or appropriate emergency service organisations, to ensure that the thermal imaging system is used to its full potential.
3. The government support adequate measures to provide training in the use of thermal imaging data and GIS in the management of bushfires to senior managers prior to the commencement of the bushfire season.

### **3. SUBMISSION**

#### **3.1 INTRODUCTION**

*FireSearch* is pleased to be able to present a Submission to the *Inquiry into the recent Australian bushfires*.

*FireSearch* is an Australian owned company recently set up following the purchase of an Australian registered patent including processing software. *FireSearch* operates an aircraft based digital thermal and colour imaging camera system. *FireSearch* has continued to develop bushfire mapping and imagery products with the support and tasking of the NSW Rural Fire Service (RFS).

As a new company set up in December 2002, the recent demands for fire information, our business has had to ramp up its operational capability, including personnel and equipment that arrived from the US in November 2002. From 7<sup>th</sup> December 2002 to February 24, 2003 *FireSearch* has completed 80 fire-tasking operations. *FireSearch* has operated out of the Incident Management Team (IMT) Control centres, including both the Queanbeyan and Jindabyne sites under the tasking control of the Rural Fire Services GIS unit.

The *FireSearch* Imaging system delivers accurate georeferenced orthorectified digital data that is rapidly produced and available in many formats. With radio data download from the operating aircraft, fire maps can be generated in near real time at the control site of the Incident Management Team (IMT). *FireSearch* information has been successfully integrated into the data information systems of the GIS unit of RFS and has also provided data directly to planning units in many IMTs.

The unprecedented demand for fire information from our system during this fire period has tested and identified many limitations, including our shortage of trained GIS technicians and a very slow Internet communication capability for our data transfer to remote management. Our system is extremely accurate but has limited coverage capability operating with only one system and with our current authorised aircraft restricted to operating at a maximum of 10,000ft.

Despite these current limitations, our data was successfully integrated with existing reconnaissance methods. Our accurate information was critical particularly under high levels of smoke when conventional reconnaissance was restricted. Operating under high demand and difficult weather conditions, our team successfully developed new information formats and delivered large volumes of accurate data for fire management. In conclusion, our technology has been well received by management at both state and IMT operational levels.

*FireSearch* is committed to a program of constructive review, research and development. Our company has a high regard for the many volunteers who fight fires in cooperation with government agencies and we strive to provide cost effective accurate information that will minimise the risk and loss from bushfire events.

## USING THERMAL IMAGERY IN THE MANAGEMENT OF BUSHFIRES

### 3.2 FIRESEARCH'S APPROACH TO THE TERMS OF REFERENCE

Although our submission covers most of the general preamble to the Terms of Reference (TOR), it is the intention of *FireSearch* to focus our response to TORs within our area of expertise and involvement. The main focus of the submission, therefore, will be on TORs (e), (g) and (h).

#### 3.2.1 TOR (e)

- (a) *Any alternative or developmental bushfire mitigation and prevention approaches, and the appropriate direction of research into bushfire mitigation;*

*FireSearch* has been engaged by the NSW RFS from December 2002 to provide digital thermal imagery and associated data for bushfire emergencies. Preparation for the bushfire season was initially limited by the business restructure and delayed company formation. The GIS unit of the RFS has been responsible for the deployment of the *FireSearch* aircraft based system and personnel to key centrally located fire control centres.

In responding to the January and February 2003 Bushfires, *FireSearch* was notified by RFS of the probability of deployment several days prior to formal deployment to Queanbeyan. *FireSearch* was deployed on January 9 to an area covering from McIntyre's Hut near ACT to the Victorian Border. Information provided by the RFS consisted of georeferenced satellite based National Oceanographic and Atmospheric Administration (NOAA) thermal and lightning data and contained multiple (in excess of 20) fire location references.

Five fire control centres were contacted via email by the GIS unit and phone contact details of all centres was included. Tasking was for the mapping of regional fires particularly those in the Snowy Mountains area. Tasking was often reprioritised from the southern fire areas back to fires towards the west of the ACT. These fires included those based initially at Mt Morgan, Gingera, Stockyard, Bendora, Brocken Cart and McIntyre's Hut. Demand for image data exceeded our operational capability particularly when significant ferrying or travel distances that precluded the use of direct radio download were involved. As a direct result many requests for images in the Snowy areas in the initial stages could not be met. A radio link aerial was set up at the Queanbeyan location that provided download for the McIntyre Hut fire area only.

*FireSearch* data provided accurate thermal digital data for the evaluation and management of the majority of the bushfires during this period. When operating from IMT control centre such as the Queanbeyan site, tasking is sometimes delegated to the Incident control team so that responsive demand for fire information could be achieved.

The following information transfers were established during this fire period:

**GIS Unit Tasking from Rosehill:** Data was processed into vector outputs and emailed to the GIS unit or placed on the Intranet K drive. If data was from the local IMT control area, this data was quickly transferred to the planning section of the IMT in CD format. To facilitate data availability, vector data was emailed directly to remote control centres, including the ACT Emergency Service Bureau. Apart from the McIntyre Hut fire area, all data from other fires could not be downloaded direct from radio link due to distances exceeding 60 kilometres. Data could only be processed at the completion of the flight (often four hours) and retrieval from the aircraft using a quick release removable computer hard drive.

**GIS Unit tasking from mobile bus:** The GIS unit operated from a mobile bus office located beside the Queanbeyan control centre. This facilitated the direct tasking and data transfer to the state based planning unit.

## **USING THERMAL IMAGERY IN THE MANAGEMENT OF BUSHFIRES**

**Urgent Data**, including data rapidly mapped from real time radio link download was made available to remote managers or planners:

- On screen,
- As printed maps to operations; or
- Via phone or fax

Computer screen maps provide instant GPS location of any selected point on the screen map as well as the estimated temperature of that point location. Printed maps in the same scale and datum and projection were sometimes placed under the operational wall transparency map and the exact fire location transcribed directly.

Printed maps were also faxed to remote IMTs as this was a much quicker method than emailing vector data that also required longer processing time. *FireSearch* will present evidence that planning, preparation and response to bushfires has entered a new phase with the introduction of digital thermal imaging to the management of bushfires.

### ***Specific Recommendations for this TOR:***

**Preparation:** Adequate pre-fire season arrangements should be made to ensure that management has thermal imaging tools available to assist in managing the bushfire season adequately. Bushfire risk can be much better understood with the benefit of real-time information (within 15 minutes) gleaned from thermal imaging. In preparation for fire season, GIS data base information should be prepared for integration with thermal data. The availability of topographic and Digital Elevation model data in specified datum projection and scale prior to the season would be essential for our technology and improved response times.

**Hazard Reduction:** Using digital thermal imaging prior to back burning enables management to ensure that the terrain temperature is suitable for a successful operation. Monitoring during back burn allows for an increased level of back burn safety, significantly reducing the risk of fires getting out of control and allowing a clear indication of the progress of the back burning operation. Additionally, digital thermal imaging is particularly useful in guiding resources to hotspots during mop-up operations. The ability to be able to identify hot-spots to within 5-10 metres, depending on the ruggedness of the terrain allows proper use of resources in preventing a flare up of the back burn.

This type of monitoring during hazard reduction will also reduce liability.

**Planning:** A sensible approach to planning a response to a specific bushfire will mean appropriate lines of communication and a request to *FireSearch* for assistance. *FireSearch* is able to present 'real-time' information that allows for appropriate planning for the use of the resources that are available at the time.

**Response:** Information gained through thermal imaging and updated at fifteen-minute intervals (real-time) means a better understanding of what is happening and provides the opportunity for optimum deployment of available resources in the most effective way. To provide near real time information data transfer distance has to be adequate, requiring improvements in transfer distance and or co-location with emergency services near the fire site. This may require the provision of an elevated radio aerial with defined frequency to improve distance and short notice relocation or even multiple locations for data processors.

Early surveillance by aircraft using digital thermal imaging may be used to verify reports of lightning strike or other causes of fire. This allows managers to make decisions for early intervention and mitigation.



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## USING THERMAL IMAGERY IN THE MANAGEMENT OF BUSHFIRES

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### 3.2.2 TOR (g)

(b) *The adequacy of current response arrangements for fire-fighting;*

*FireSearch* has operated effectively with the NSW Rural Fire Service (RFS). It is important that downloaded thermal images and the information available is appropriately coordinated and available to all decision makers within an adequate time frame.

Although Thermal Imaging was used effectively in assisting in the management of bushfires in the past season, it is clear that there was considerable improvement over the preceding summer season. *FireSearch* believes that it is critical for improved management of bushfires that the development of this sort of technology and improvements in the way it is applied to the management of bushfires is developed in a carefully researched and methodical manner.

In terms of the stage of development of thermal imaging, it may well be argued that bushfire management was adequate. However, the application of this new technology to fires is in its relative infancy and *FireSearch* and its associated companies are keen to work with the RFS and other bushfire fighting agencies to ensure that we understand the needs of management and are able to develop the technology to meet those needs in a timely and accurate manner.

### 3.2.3 TOR (h)

(c) *The adequacy of deployment of fire-fighting resources, including an examination of the efficiency and effectiveness of resource sharing between agencies and jurisdictions;*

Although *FireSearch* digital imaging equipment was deployed in the management of New South Wales and the ACT bushfires, future management will need to be aware of the constantly developing equipment and skills that are available to increase the knowledge and understanding of a bushfire.

Effective coordination between bushfire control centres will mean that thermal images downloaded or prepared and faxed can be automatically shared for a better understanding of fire behaviour at the time. Early notice and coordination means that the digital imaging resources can be shared effectively between jurisdictions when carrying out the following hazard reduction operations:

- Pre back burn
- Monitoring during back burn
- Mop up

#### ***Specific Recommendations for this TOR:***

Thermal Imaging is able to provide real time advice that allows an unprecedented knowledge of the behaviour of a bushfire for a range of management purposes.

- The provision of high capacity data email and intranet systems to facilitate the large data file size transfer is essential,
- Further development of air to base communication and download will improve the immediacy of information available to bushfire managers,
- Coordination between jurisdictions to allow for appropriate sharing of aerial surveillance thermal imaging equipment in hazard reduction for pre back burn, monitoring during back burn.