NATIONAL HANDHELD INFRARED SCANNER USAGE SURVEY

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ABSTRACT:

Alberta Wildfire Management Aviation and Geomatics Section is interested in researching current infrared (IR) scanner technology and identifying potential next-generation IR scanners. A survey was identified as a tool for understanding the current use of IR scanners among Canadian wildfire agencies, with the intention of leveraging existing expertise. FPInnovations was tasked with conducting this survey.

Nine Canadian wildfire management agencies responded to the survey. The results identified the IR scanners currently in use, their applications, and the pros and cons associated with the respective scanners.

Eight of the agencies surveyed are using handheld scanners for wildfire operations; one agency (Prince Edward Island) is not. The scanners are used primarily to scan hotspots and fire perimeters from a helicopter. In total, 13 models of IR scanners are used by the participating wildfire management agencies.

It is recommended that the common features and specifications of handheld IR scanners currently used by wildfire management agencies be analyzed further.

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INTRODUCTION

Alberta's Wildfire Management Aviation and Geomatics Section currently uses the "Scout" infrared (IR) scanner for regular program work such as aerial (helicopter) hotspot detection and ground-executed hotspot detection. The Scout has been used for approximately 10 years, and although it provides acceptable results, it has some shortfalls. For instance, the Scout has complicated device restrictions, a poor charging design, and maintenance issues. Given the age of the Scout scanners, an expanding need for additional scanners, and the likelihood of new technology becoming available, the Aviation and Geomatics Section is interested in researching current IR scanner technology and identifying potential next-generation IR scanners.

A survey was identified as a tool for understanding the current use of IR scanners among Canadian wildfire agencies, with the intention of leveraging existing expertise.

FPInnovations was tasked with conducting this survey on behalf of Alberta Agriculture and Forestry. The survey covered the following topics:

- usage
- detailed IR scanner product information
- training
- future of the technology

The survey was distributed to all Canadian wildfire agencies. This report presents the results of the survey, which include the IR scanners currently in use, their applications, and the pros and cons associated with the respective scanners.

SURVEY PARTICIPANT INFORMATION

FPInnovations conducted the survey using Google Forms. The survey was sent to 13 Canadian wildfire management agencies; nine responded (Table 1). Alberta, Manitoba, Quebec, and Nova Scotia did not respond to the survey.

Table 1. Wildfire management agencies that responded to the survey

Agency	Abbreviation[a]	Representative	Position
British Columbia	BC	Justin Nicholas	Research analyst
Yukon Territory	YT	Mike Sparks	Wildfire operations manager
Northwest Territories	NT	Jason Currie	Training and standards officer
Saskatchewan	SK	Dave Young	Forest protection officer
Ontario	ON	Blair McKenzie	Fire suppression systems specialist
		Paul Riopel	Fire suppression systems specialist
New Brunswick	NB	Mathew Ruff	Provincial fire equipment coordinator

Prince Edward Island	PE	Nick Thompson	Forest auditor
Newfoundland and Labrador	NL	Gerard Carroll	Forest fire protection, west region
Parks Canada	PC	Katie Ellsworth	National fire management officer

ª Abbreviations and order of wildfire agencies used in this report are in accordance with the Canadian Interagency Forest Fire Centre Inc. Directory, 2019.

SECTION 1: USAGE

Does your agency use handheld infrared scanners for wildfire operations?

Eight of the agencies surveyed use handheld IR scanners for their wildfire operations; only one (PE) does not.

How are handheld IR scanners used in your agency?

Handheld IR scanners are used for different applications across agencies (Table 2). Seven agencies use IR scanners to scan hotspots and fire perimeters from a helicopter; eight use them to scan hotspots from the ground. Only SK and ON use IR scanners to scan burn piles. The agencies did not identify any other applications related to wildfire operations.

Table 2. Use of handheld IR scanners by wildfire management agencies

Application	Agency
Scan hotspots from a helicopter	BC, YT, NT, SK, ON, NL, PC
Scan hotspots from the ground	BC, YT, NT, SK, ON, NB, NL, PC
Scan fire perimeters from a helicopter	BC, YT, NT, SK, ON, NL, PC
Scan burn piles	SK, ON

What level of use do your IR scanners experience?

The level of use of IR scanners varied among agencies (Table 3). IR scanners are used primarily for scanning hotspots and fire perimeters from a helicopter. Scanning hotspots from the ground was a secondary use. Use of IR scanners for burn pile scanning was minimal. BC refrained from answering this question because each fire centre uses IR scanners differently.

Table 3. Level of use of IR scanners by wildfire management agencies

Application	Level of use	Agency
Scan hotspots from a helicopter	Minimal use: 1–5%	
	Moderate use: 6–20%	YT, SK

	Major use: 21–50%	ON, NL
	Primary use: 50–100%	NT, PC
Scan hotspots from the ground	Minimal use: 1–5%	NT, NB
	Moderate use: 6–20%	YT, SK, ON
	Major use: 21–50%	NL, PC
	Primary use: 50–100%	
Scan fire perimeters from a helicopter	Minimal use: 1–5%	
	Moderate use: 6–20%	YT, SK
	Major use: 21–50%	NL, PC
	Primary use: 50–100%	NT, ON
Scan burn piles	Minimal use: 1–5%	SK, ON
	Moderate use: 6–20%	
	Major use: 21–50%	
	Primary use: 50–100%	
Other		None

Please describe potential use cases for IR scanners other than what they are currently used for (if applicable).

Three agencies identified additional potential uses for IR scanners (Table 4).

Table 4. Potential additional uses for IR scanners

Agency	Potential use
YT	Search and rescue
SK	Type 1 initial attack crews are issued a handheld scanner to use on the fireline to scan the fire start prior to leaving the fire area after the fire has been extinguished.
ON	Search and rescue (people), building heat loss, animal search

SECTION 2: IR SCANNER PRODUCT INFORMATION

Please list the current handheld IR scanner models being used by your agency.

Table 5 lists the models of handheld IR scanners currently being used by the wildfire management agencies surveyed, as well as the pros and cons of the models and how much they are used.

In total, 13 models of scanners are being used. Five models are still commercially available; six are no longer available. Two models—Bullard IR 250 and Flametronics 965—could not be found on the internet. It is safe to assume that both models are no longer available.

Table 5. Handheld IR scanner models currently being used by wildfire management agencies

Agency	Model	Pros/Cons	Usage (%)
BC	Handheld IR scan may be purchased by individual fire centres, along with standard IR scanner models within BC Wildfire Service. Most aerial IR scan missions are now carried out by external contractors.	Not answered.	Not answered.
YT	Bullard IR 250 Handheld, Flametronics 965, Rathgon IR250	Pros – easy to use with basic training and light weight. Cons – limited battery shelf life.	65% of actioned fires use scanning as a tool to check for hotspots along the perimeter. We will also see an increase in early spring scanning of winter burning in association with timber harvesting.
NT	FLIR P640	Cons – P640 has a weird angle from the view to the camera lens. Toggle is at a diagonal. Too many features are not needed.	100%
SK	FLIR TG165, Fire Finder Professional Thermal Scanner Model 955, ISG Infrasys XRHR 100K Resolution	Pros – The FLIR TG165 is an inexpensive IR scanner that provides good results and has a viewing screen. The ISG scanner is used primarily from a helicopter and provides good results.	The FLIR TG165 has just been introduced to our agency, so staff are just starting to use it. The use of other scanners is dictated by the number of fires—both large

		Cons – The Fire Finder Professional is more expensive and detects only by sound.	and small—and the direction given by the local fire centre based on if a scan is necessary. The ISG scanner is used primarily on large fires for perimeter scanning.
ON	ISG Infrasys K85	Pros – This is a small, lightweight, and user-friendly unit; only need to point and shoot; requires little training; not many cons for our use scenarios. Cons – I guess the number of batteries it could go through, but they last at least a fuel cycle, so it's not that bad.	100%
NB	Raytek Raynger ST	Only used the scanner a couple times.	100%
NL	Bullard T3X for helicopter, Red Hawk for ground crews	Pros – help detect small hotspots not visible, in a reasonably fast, easy way. Cons – still limited to time of day and cannot work beyond 9:00 a.m.; just a slower process resulting in more helicopter time; however, not a deal breaker.	Bullard T3X all major fires (larger size). Red Hawk spot fires.
PC	Agema, IR Flex Cam, FLIR, FLIR ONE	Battery life during use—generally good, but can be impacted by cold weather; some of the settings are complicated and not useful for fireline scanning. The handheld units are suitable only for short distance scanning but are very useful for crews on the line scanning for hotspots. Useful distance with the larger FLIR units is good; ability to change settings/colour/temp etc. is very useful. Cons – have to use them when it's cool out to get a good reading; this requires early flying and can be problematic. Having one that worked well at a wider range of ground temperatures would be useful.	Unknown...likely FLIR is used more than the rest.

		Cons – it's a "clunky" process to produce a map of hotspots; you need a scanner and a person with a GPS/computer/map in the front seat; this process can have errors built in; having a product that automatically identified the location of the area scanning and stored to produce a map or GPS coordinate automatically would be easier.	

Table 6 lists the five models of IR scanners that are available on the market. More information is provided in Appendix 1. Note that only the Bullard T3X and FLIR TG165 are suitable for use on a helicopter.

Table 6. Commercially available handheld IR scanners

Model	Price	Agency	Intended use
Bullard T3X	US$9000	NL	Ground, helicopter
FLIR TG165	US$490	SK	Ground, helicopter
Fire Finder Professional Thermal Scanner Model 955/Model 955L Red Hawk™ Thermal Scanner	US$1000	SK, NL	Ground
FLIR ONE	US$400	PC	Ground
Raytek Raynger ST	US$270	NB	Ground

What is the BEST handheld IR scanner for wildfire operations, in your opinion, regardless of whether it is on the list above, and why?

YT, SK, ON, and NL recommended the units they currently use (Table 7). Other agencies stated that they cannot make recommendations due to limited experience with other units.

Table 7. Handheld IR scanners recommended by wildfire management agencies

Agency[a]	Recommended IR scanner
YT	Bullard IR 250
SK	FLIR TG165 – inexpensive and easy to use
ON	Not that familiar with many other agency scanners. Various trials on K85 were conducted in the past and showed it was simple to use.
NL	We find the Bullard T3X very user-friendly, very accurate, sleek, and portable; battery longevity good with optional AA battery pack if you get in a jam or forget to charge the batteries overnight (it happens). Also has a secondary screen for another operator in the helicopter to observe in case the first observer misses the hotspot on the screen (e.g., first observer sneezes). It produces great results.

PC	Unknown. I'm more familiar with the larger FLIR units, which makes them seem better than the rest, which might not be accurate.

a BC, NT, and NB did not answer or could not answer the question.

Have you used the temperature measurement function on handheld IR scanners? Please list the situation(s). "No" for never use this function.

Three agencies do not use the temperature measurement function on the handheld IR scanner (Table 8). Five agencies use the function; however, three of them indicated that it is not important for their operations. Only NL and PC indicated that they actively use the function.

Table 8. Use of handheld IR scanners' temperature measurement function by wildfire management agencies

Agency	Use of temperature measurement function
BC	Not answered
YT	Yes, but not real important as were just looking for hotspots.
NT	Yes, didn't seem to make a difference.
SK	No
ON	No. It makes no difference to me. If it's hot, we go check it. If it's cold, we don't. Helps identify source hotspot when small.
NB	No
NL	Yes, very important tool. After 8:00 a.m., it will start to pick up heated rocks from the sun; however, the user will determine actual hotspots vs. heated rocks by observing the temperature. Scanning is still attainable at this point; however, it slows down the process. We usually shut down scanning from the helicopter by 9:00 or 10:00 a.m. depending on the day or level of importance (fire edge). From previous models we had, after 7:00 a.m., it's not attainable at all.
PC	Yes, when hot you can adjust the temperatures to reduce the "noise" from background temps.

SECTION 3: TRAINING

Table 9 lists answers from the agencies regarding user training and confidence. Four agencies said their operators have training in the use of handheld IR scanners; one agency said their operators do not. Three agencies answered "maybe", implying that some but not all operators may have training.

Three agencies selected "very confident" in their use of IR scanners; three other agencies selected "I can figure it out as I go". The remaining two agencies selected "unknown" or did not answer.

Four agencies said a training course or workshop would help their operators; four others answered "maybe". No agencies answered "no".

Table 9. Operator training and confidence in the use of handheld IR scanners

Agency	Have the users of handheld IR scanners in your agency undergone training?	What level of confidence in the equipment do users of IR scanners in your agency exhibit?	Would a training course or workshop help IR scanner (camera) users within your agency?
BC	Maybe	Unknown	Maybe
YT	Yes	I can figure it out as I go	Maybe
NT	Yes	Very confident	Yes
SK	Yes	I can figure it out as I go	Yes
ON	Yes	Very confident	Yes
NB	No	Not answered	Maybe
NL	Maybe	Very confident	Yes
PC	Maybe	I can figure it out as I go	Maybe

SECTION 4: THE FUTURE

Does your agency intend to adapt and continue the use handheld IR scanners for operational use?

Seven agencies want to continue using handheld IR scanners for operational use; another answered "maybe" (Table 10). PE currently does not use handheld IR scanners and does not intend to use in the future.

Table 10. Does your agency intend to adapt and continue the use handheld IR scanners for operational use?

Agency	Answer
BC	Yes
YT	Yes
NT	Yes
SK	Yes
ON	Yes
NB	Maybe
PE	No
NL	Yes
PC	Yes

Please list IR scanners that you're keen on trialing or testing in wildfire operations.

BC is interested testing cell phone-attached scanners; PC is testing drone technology (Table 11). Three agencies expressed interest in testing the units they already have in service. Four agencies have no interest at this moment.

Table 11. IR scanners that agencies are keen on trialing or testing in wildfire operations

Agency[a]	IR scanners to be tested
BC	We had tested some cell phone-attached scanners last year and would like to have wide field operational test by crews in the future.
YT	Any new technology when we replace existing units
NT	No testing last 5 years
SK	FLIR TG165 and ISG scanner
PC	We have been testing drone technology for fire line perimeter and hotspot scanning.

[a] ON, NB, PE, and NL answered "None at this moment".

Please list other general comments on handheld IR camera usage and this survey.

Table 12 lists general comments provided by the surveyed agencies. ON described the standard training it provides in the use of handheld IR scanners. YT stressed that durability and easy of use of IR scanners are important factors. PC provided comments on drone technology, the addition of GPS capability, and small IR scanners that attach to cell phones.

Table 12. General comments

Agency[a]	Comments
YT	Scanners must be easy to use, and durability are the biggest factors in selecting
ON	We use this tool a lot. On large fires it is almost a must have tool if you need to prioritize line or want to call large sections of line out. We can source out this service as contracts, but it seems to be increasingly hard to find contractors lately. We are doing this more in-house recently. IR operator training includes helicopter open door training, as well as how to use a body harness and lanyard, and how to complete mandatory inspection of the harness/lanyard. Training also has a ground field component: participants search for hidden hot packs.
PC	As drone technology becomes more advanced, these options are becoming more appealing. They generally work at night, don't require people in a machine to do the scanning, and we have found that the product they produce is generally higher quality than the product we can produce using a handled scanner.

	A handheld unit that would connect to a GPS unit and save points and send automatically to Avenza or another type of software would be useful and make the end-product faster and more accurate than the traditional way. As well, the FLIR ONE units that attach to smart phones are useful for crews in the field, but they have a small battery life and can be a little finicky.

[a] BC, NT, SK, NB, PE, and NL had no additional comments.

CONCLUSION

FPInnovations conducted this survey to understand the current use of handheld IR scanners among Canadian wildfire management agencies. The survey was distributed to 13 agencies; nine responded.

Eight of the agencies that responded to the survey use handheld IR scanners for wildfire operations; only one (PE) does not. IR scanners are used primarily for aerial (helicopter) hotspot detection and perimeter identification; hotspot scanning from the ground is a secondary use. Only SK and ON scan burn piles, but in a minimal capacity. Other potential uses are not necessarily related to fire operations—for example, search and rescue.

In total, 13 models of IR scanners are used by the participating wildfire management agencies. Eight models are no longer available on the market. Five models can still be commercially acquired, but only the Bullard T3X and FLIR TG165 are suitable for use on helicopters.

The agencies surveyed identified both positive features and shortcomings of the IR scanners they are using. In general, positive features were listed as light weight, durable, inexpensive, simple to use, and require minimal training. Shortcomings were short battery life during operations and in storage, and complicated settings with too many features.

Five agencies use the temperature function; however, but three of them indicated that it is not important nor make a difference for their operations because all suspicious hotspots that stand out from the background are checked regardless of the temperatures recorded in the scanning results. Only NL and PC indicated that they actively use the function.

Four agencies said their operators have undergone training in the use of handheld IR scanners. Another three indicated that some but not all operators may have training. Only one agency said their operators have not received any training. ON has a dedicated training program for its IR scanner operators.

Most of the surveyed agencies are confident in their use of IR scanners. Four agencies said that a training course or workshop could help their IR scanner operators; the other four agencies answered "maybe".

Most of the surveyed agencies want to continue using handheld IR scanners for wildfire operations. Only NB answered "maybe". PE currently does not use handheld IR scanners and does not intend to use in the future.

It is recommended that the common features and specifications of handheld IR scanners currently used by wildfire management agencies be further analyzed. Combined with the internal survey of Alberta Agriculture and Forestry 's current handheld IR scanner operators, this information will help in the development of an evaluation matrix that can be used to select handheld IR scanners in the future.

Consideration could be given to sharing various agency training materials to help improve agency-specific training or create national standardized training.

APPENDIX 1: DETAILED IR SCANNER INFORMATION

Scanners available on the market

Bullard T3X (NL uses for helicopter operations)

The price is not available and requires a quote. The estimate price from another internet source (https://legacy.mitn.info/Bids/ViewAllAwards2.asp?TN=145441&GroupID=1077&AwardLink=Y) is approximately US$9000 in 2016.

https://www.bullard.com/product/t3x

FLIR TG165 (SK)

US$490

https://www.flir.ca/products/tg165/

955L Red Hawk™ Thermal Scanner (SK, NL uses for ground operations by crews)

US$1000

http://dyn-optics.com/?product=model-955-red-hawk-thermal-scanner

FLIR ONE (PC)

US$400

https://www.flir.ca/flir-one/

Raytek Raynger ST (NB)

US$270

https://www.raytek-direct.com/product/raytek-rayst20xbusvb-st-pro-xb-portable-ir-thermometer-with-12-1-optics-32-to-535c
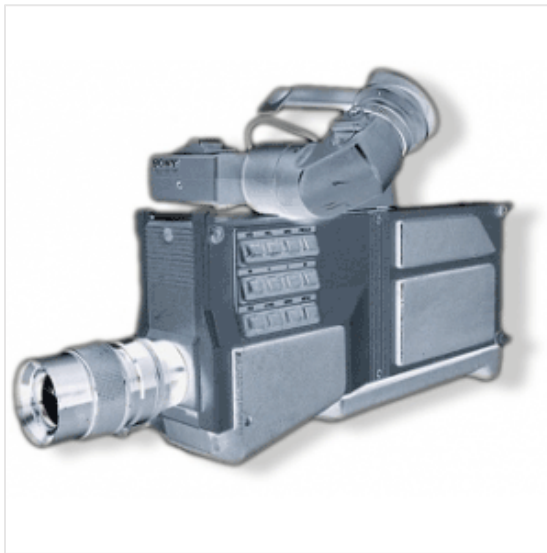

Scanners no longer available on the market

Fluke IR FlexCam (PC)

https://www.amazon.com/Fluke-FLK-Ti55FT-IR-Fusion-Technology-Temperature/dp/B009NIN912?th=1

Agema (PC)

https://www.x20.org/product/agema-thermovision-470/

Infrasys XRHR 100K Resolution (SK)

http://www.hitechfireny.com/products/thermal_image_camera/xrhr.html

ISG Infrasys K85 (ON)

https://www.fireapparatusmagazine.com/2010/06/01/thermal-imaging-makers/#gref

Rathgon L3 Palm IR-250 Night Vision Camera (YT)

https://www.x20.org/product/palm-ir-250-a-infrared-camera/

FLIR P640 (NT)

https://www.testequipmentdepot.com/flir/pdf/p640.pdf

Information unavailable

Bullard IR250 (YT)

Could not find this product.

Flametronics 965 (YT)

Could not find this product.

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