

Volume

1

FLIGHT MANAGEMENT SYSTEMS

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Digital Moving Map

FLIR / FMS User  
Manual

FLIGHT MANAGEMENT SYSTEMS

# Digital Moving Map

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## FLIGHT MANAGEMENT SYSTEMS

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Chapter  
1

# 1. Quick Start

When the computer boots up it will auto start to the moving map program. The screen will show the aircraft's present GPS position, North will always be up, and the map will be at a medium magnification, like that shown in Figure 1, below.

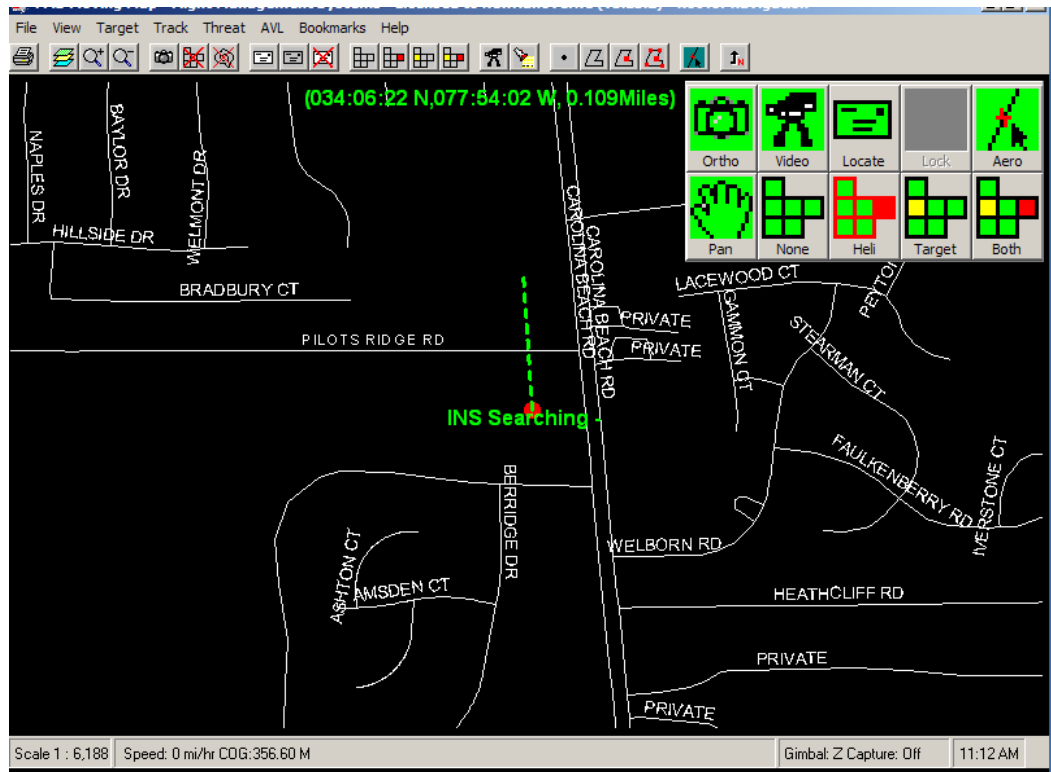


Figure 1: Application Startup Screen

The Lock button is grey because the FLIR has not yet been switched on, or because it hasn't finished its internal boot-up sequence. The map may be used in this mode, but the FLIR cannot yet be controlled by FMS.

Once the FLIR has begun communicating with FMS, the startup screen will change to that shown below in Figure 2, indicating that the FLIR can now be properly controlled by FMS.

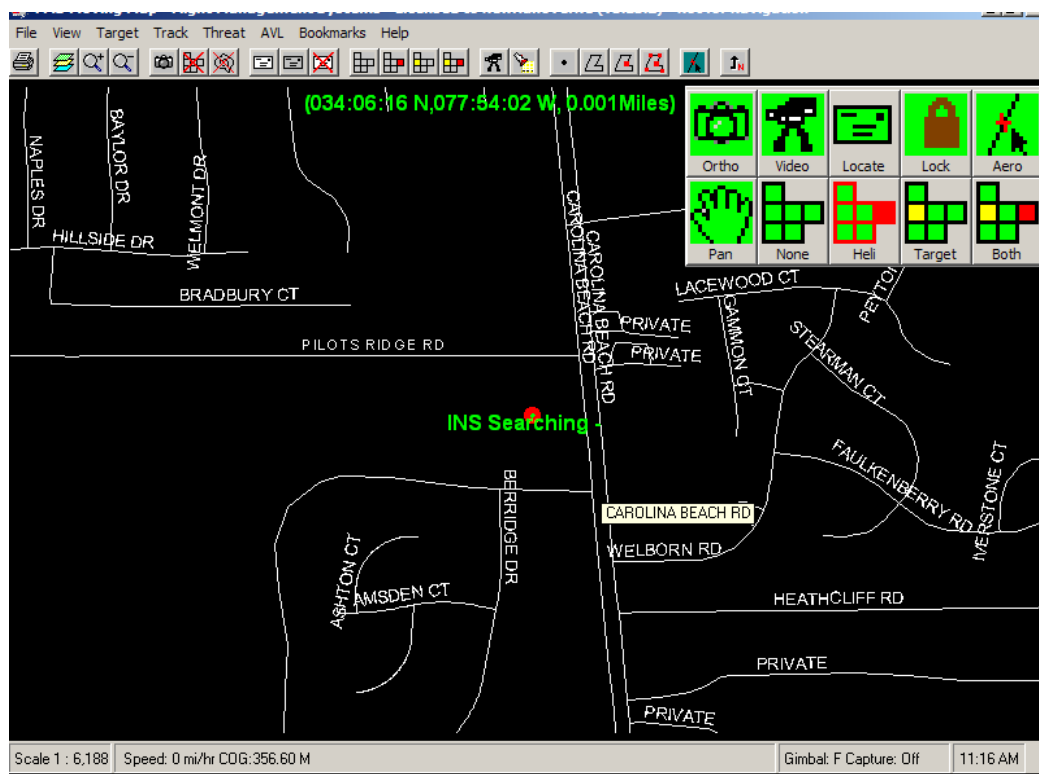


Figure 2: FLIR Communications Established

The 'INS Searching' message will persist until the aircraft has moved far enough, and fast enough, for the INS (Inertial Navigation System) to obtain a position lock. This typically requires a mile or so of flight with a speed faster than 10 knots. The aircraft icon will change from the donut image to an outline of the helicopter at its current location when this occurs, as shown in Figure 3.

As the aircraft begins its patrol, the helicopter icon will move across the city showing its location. Pressing <F5> will move the map presentation to the aircraft's location and keep the aircraft in the centre of the screen. Pressing <F3> (to **Z**oom in) and <F4> (to **Z**oom out) allows the user to customize the field of view of the map presentation.

Pressing <F8> will bring up the **Address Search** box. Enter the target location, either address, GPS location, or street intersection, using the proper address conventions (covered in Section 2). The up and down arrow keys toggle through the matches if more than one selection is available; pressing **Enter** chooses the target. At the same

time, approach data may be entered such as a perimeter radius and a search pattern, if desired. Usage of these selections is covered in Section 4.

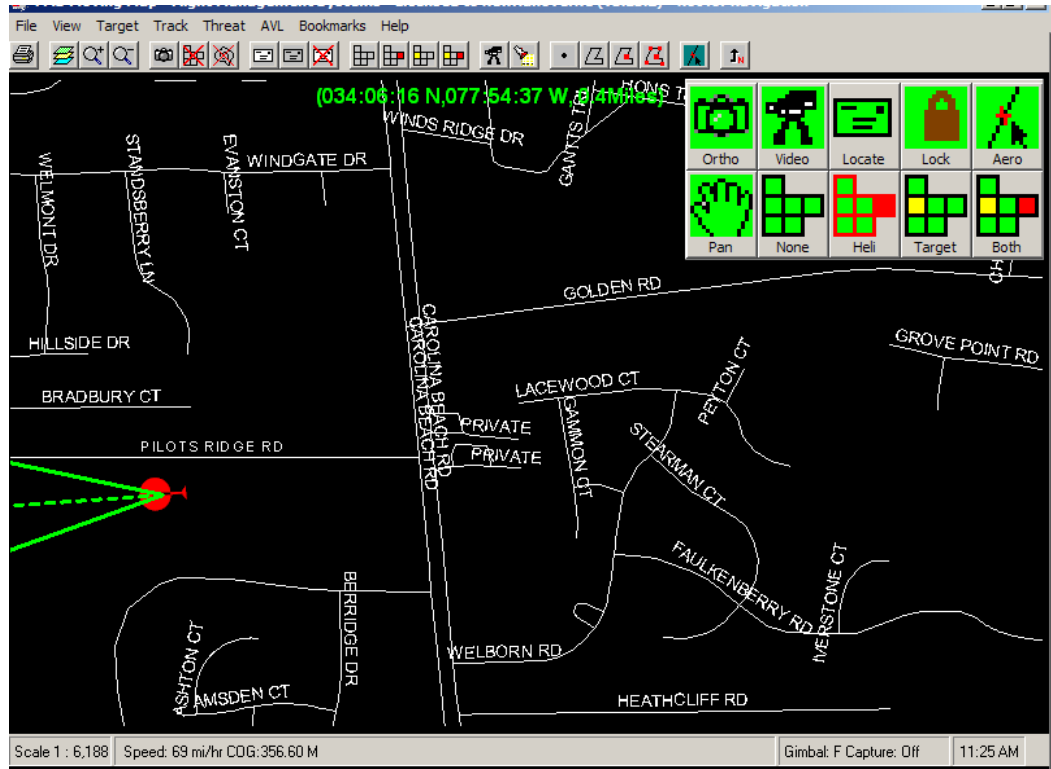


Figure 3: Aircraft Location Established

Once the target location has been entered and chosen, a bearing line will be drawn on the map screen from the aircraft's present location to the target location. The distance, ETA, ground speed, bearing to the target, and Course over Ground will be displayed on the status bar, as shown in Figure 4.

Once the target has been identified, the address search window can be hidden by pressing **<F9>**. **This does not clear the target address from memory.**

Pressing **<F7>** will show the target location and the aircraft on the map screen at the same time. As the aircraft approaches the target location, the map will "auto-zoom," adding more detail, and keeping both icons on the screen.

Pressing the touch screen **video** button will show the FLIR image on screen at ¼ size.

**Note:** The FLIR video output shows the operating mode of the camera system. On the left side of the screen the operating mode is shown: **STANDBY, RATE, POS**. Ensure that the FLIR is in the correct operating mode before engaging or tracking a target: **RATE** allows manual control, **POS** allows FMS control. Changing the operating

mode uses two buttons on the hand controller: SFT and POS. The SFT button MUST be pressed first, and the button combination toggles the operating mode between RATE and POS modes.

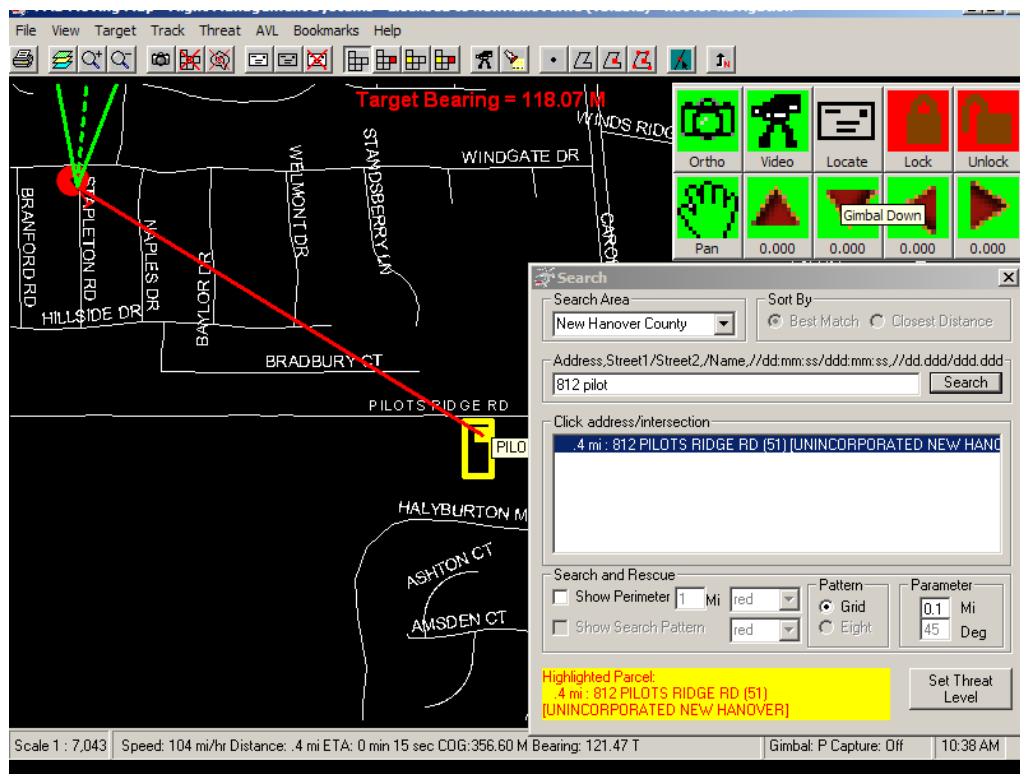


Figure 4: Target Chosen and Locked

**To couple the FLIR to the map**, press the on-screen Lock button, or press <SHIFT><LEFT CTRL> on the keyboard. Put the FLIR into POS mode, and the FLIR sensor will be driven by the map and slew to keep the target location centered, as shown in Figure 5. Small offsets may be eliminated using the touch screen arrow buttons (or the keyboard arrow keys). This feature allows the sensor target to be adjusted around the target area.

**To uncouple the FLIR from the map**, return the gimbal to the rate mode. Pressing the Unlock button, or pressing <CTRL> <RIGHT SHIFT>, also resets any offsets that may have been used on a previous location to zero. To return to the target, press the Unlock button again (if pressed) and put the gimbal back into position mode.

**To release the target and uncouple the FLIR from the map**, press the Lock button, or press <CTRL> <LEFT SHIFT>, and return the gimbal to rate mode. This clears the previously searched target address, releases the FLIR, and prepares the system for a new address.



The **FOV** button toggles the Gimbal Field of View markers for the gimbal.

Pressing the <F10> key **clears the target address** from memory, removes the ETA, Bearing, and Distance information from the status bar and leaves the system ready for the next call.

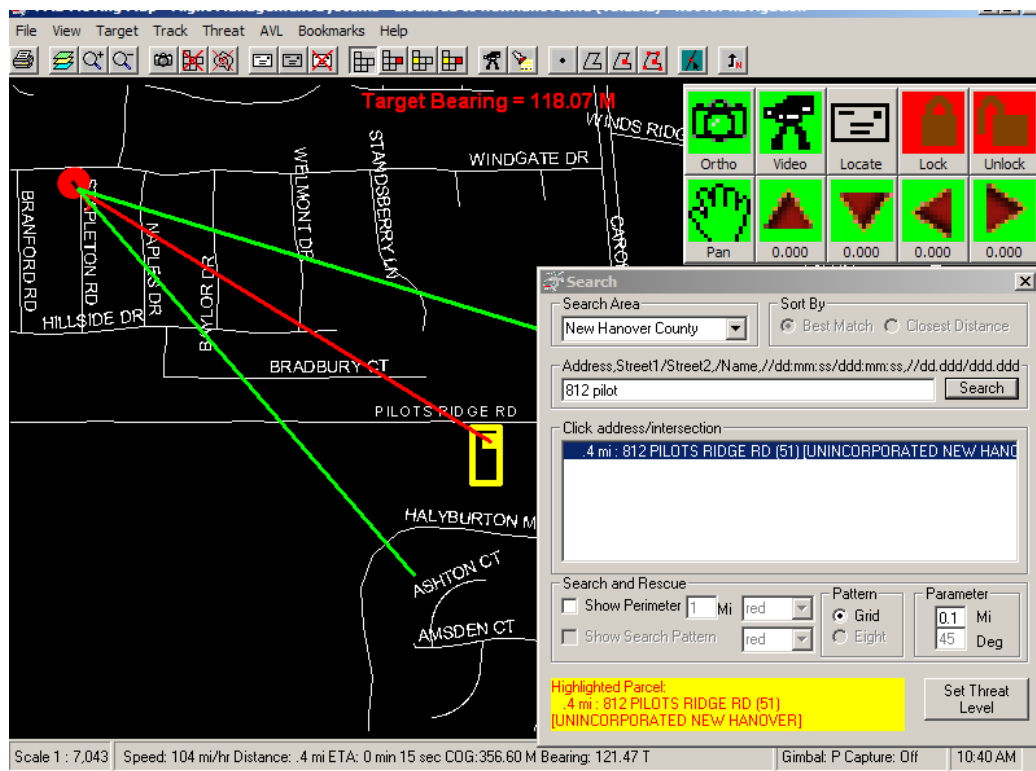


Figure 5: FLIR Pointing to Target

## 2. Search Types

### A. STREET NAMING CONVENTIONS

The FMS moving map application searches for address matches initially using the address ranges and complete street names on the road network data set. This data set also includes rural road names where the data has been made available. Match “scores” improve with the use of the corporate address format and correct spelling of the street name, (**misspelling is allowed**) including the street type. Within the city limits, target addresses will also be compared to the corporate address data base for exact matches to parcel addresses.

A “Good” address parcel will highlight the parcel outline and draw a bearing line directly to the target address. The address will be **highlighted in green** in the ‘Highlighted Parcel’ area of the search window. This is illustrated in Figure 6, below.

An address parcel that matches the search address to the spelling precision configured for this map installation will highlight the address in yellow and draw the parcel outline and bearing line to the target address as before. This is illustrated in Figure 7, below.

“Bad” addresses are broken into two groups: those that can be poorly located, and those that can’t be located at all. For those that can’t be located, the address bar highlights red, indicating an error such as using an improper address type, or bad spelling beyond the configured leeway.

For poorly located address parcels, the bearing line will be placed on the street in front of the estimated location of the street the address. The ‘Highlighted Parcel’ block will be yellow, similar to Figure 7.

The corporate address format is house number, street name, street type, and quadrant.

Example:

10012 Jasper Avenue NW

**Note: The program will forgive a certain amount of misspelling, and the quadrant is not essential for a successful search.**

Example:

10012 jaspr av

will still result in a successful search, and locate the same address.

groat/st alebrt

will find the intersection of Groat Road NW and St Albert Trail NW successfully.

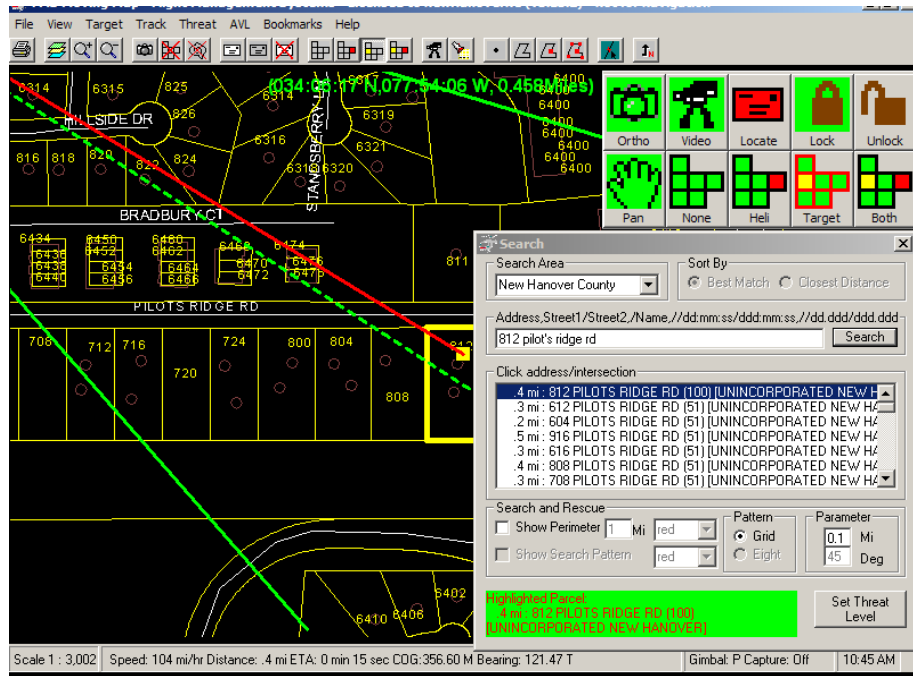


Figure 6: Exact Address Match

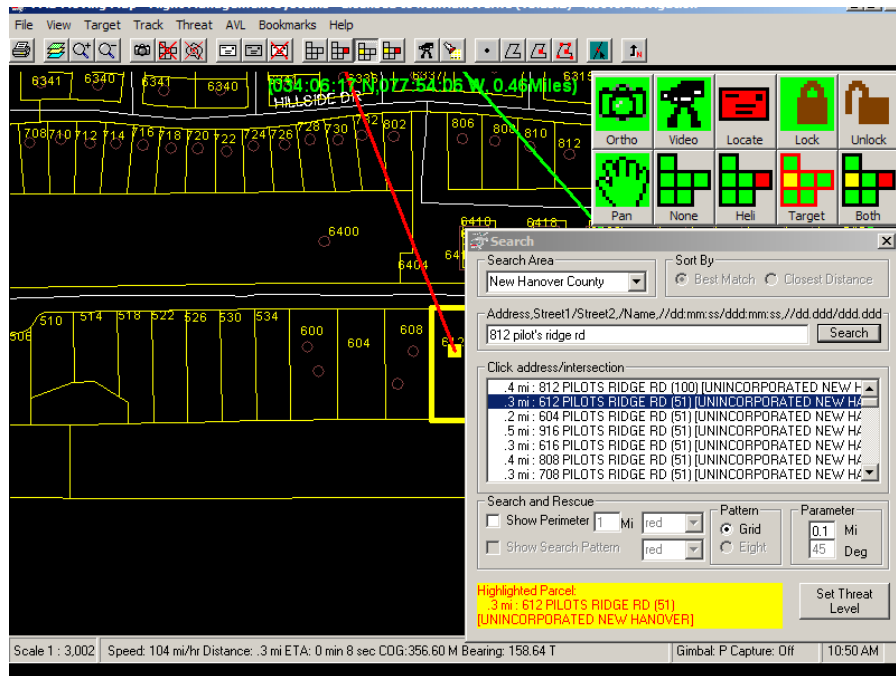


Figure 7: Close Address Match

## **B. SEARCH ADDRESSES**

Search addresses within the city limits should resemble the following:

10012 jasper av

11119 groat rd

Search addresses in rural areas are similarly formatted

263009 RGE RD 52

28305 HWY 2

## **C. SEARCH INTERSECTIONS**

Search Intersections separated by forward or back slash. / or \

jasper av/101 St

whyte av\ groat rd

85 st/108 av

## **D. SEARCH COMMON PLACE NAMES**

Common Place Names must begin with a forward or back slash / or \

/city . This will bring up all places beginning with city

\ royal Will bring up all places beginning with Royal.

This will generate a list. Use the up and down arrow keys to scroll through the list, and select with ENTER.

## **E. SEARCH GPS COORDINATES**

GPS locations must begin with two forward slashes (//) or back slashes (\\) and either a forward or back slash is used to separate the latitude and longitude. A colon, semi-colon or period is used to separate the Degrees, Minutes and Seconds.

[\\53:34:30\113:30:10](#) OR //53.34.30/113.30.10

**Note:** By convention and definition, the longitude is a three-digit value. That means that 80 degrees West longitude would be entered as "080".

**Note:** FMS has changed to allow two-digit longitude data entry. // 53.0.0/ 80.0.0 now specifies 53 degrees North latitude and 80 degrees West longitude. It is incumbent on the user to enter the latitude first.

## **F. SEARCH FIRE MAPS**

This is an optional feature. If installed, Fire map coordinates must be entered with a decimal and zero (.0) preceding the Fire Map number. If the page number of the Fire Map manual is entered, the search window will display the base number as well as the subordinate numbers. If the page number and the subordinate numbers are entered, then the specific location will be identified on the map. When located, the FLIR can be slaved to that location.

.01722 OR .01722-13

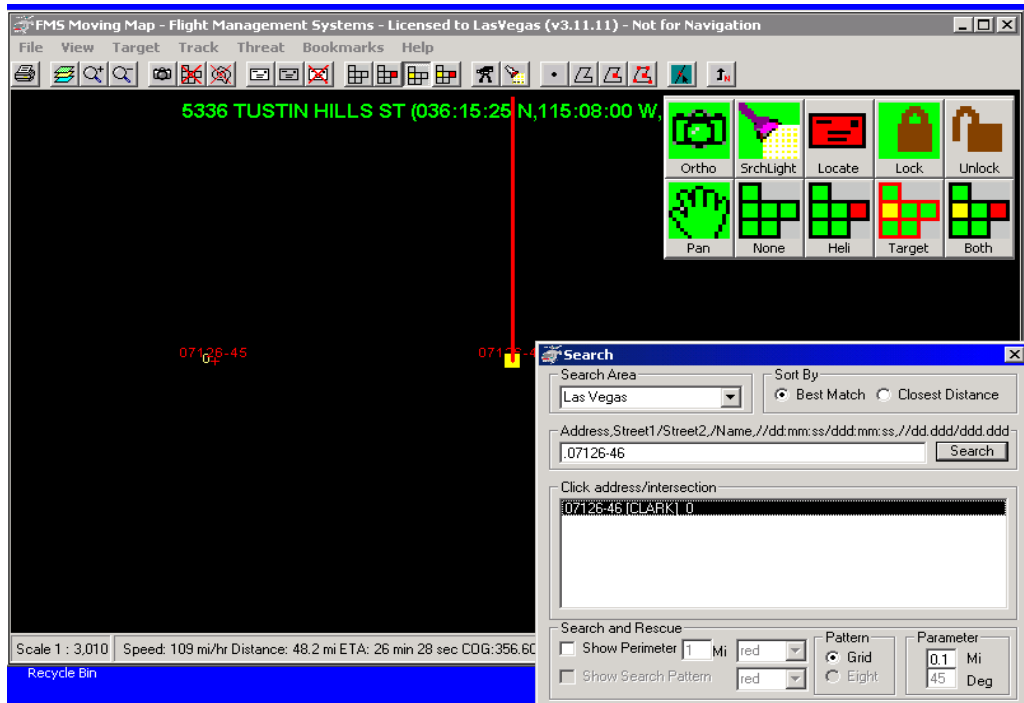


Figure 8: Fire Map Search in Rural Area

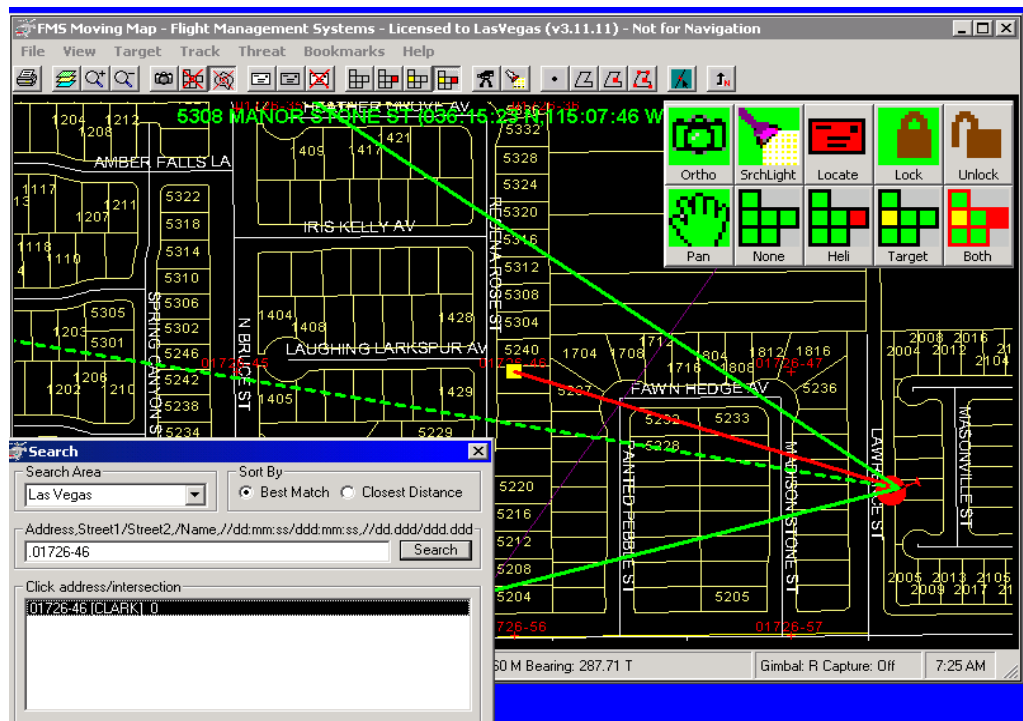


Figure 9: Fire Map Search in Metro Area

## G. SEARCH RURAL ROADS

This is an optional feature. If installed, unpaved road numbers must be entered with a decimal (.) preceding the road number. When located, the FLIR can be slaved to that location.

.71 will bring up all fire roads with numbers beginning with “71”.

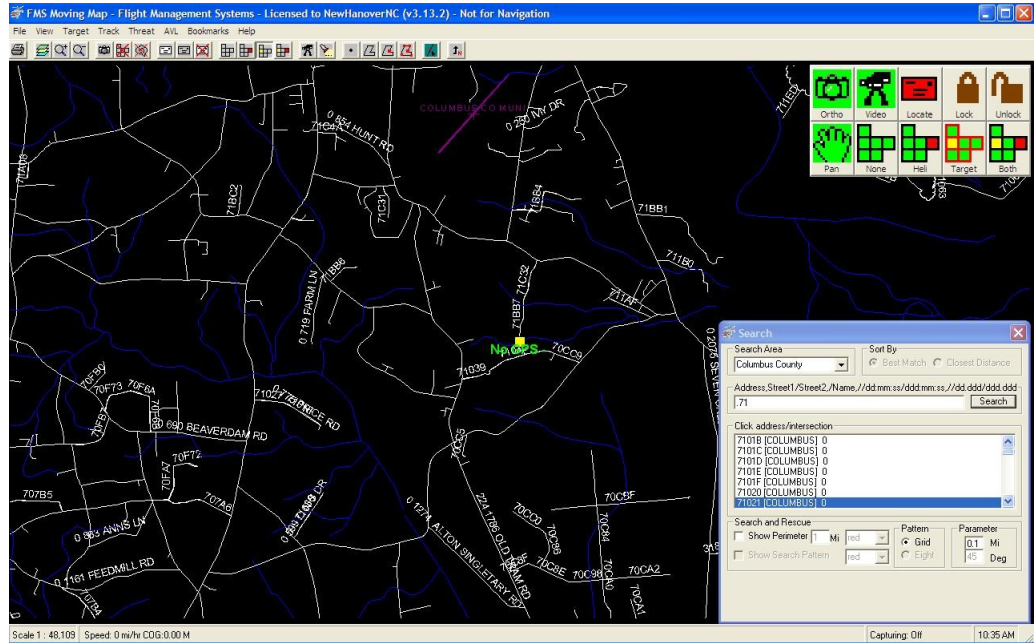


Figure 10: Rural Road Search

# 3. Detailed Description

## A. GPS FUNCTIONALITY

The application starts with the screen shown in Figure 11. The red icon indicates the location of the aircraft as determined by processing the GPS signal. As the aircraft moves around in the mapping system's domain, the aircraft icon moves on the map image. Street names and other data are presented at varying levels of magnification of the map image. That is, at low magnification (simulating high flying altitude) only major roads and geographical objects such as rivers and mountains are shown. As the magnification is increased, individual street names are shown, then parcels' outlines, and finally, street addresses of the parcels.

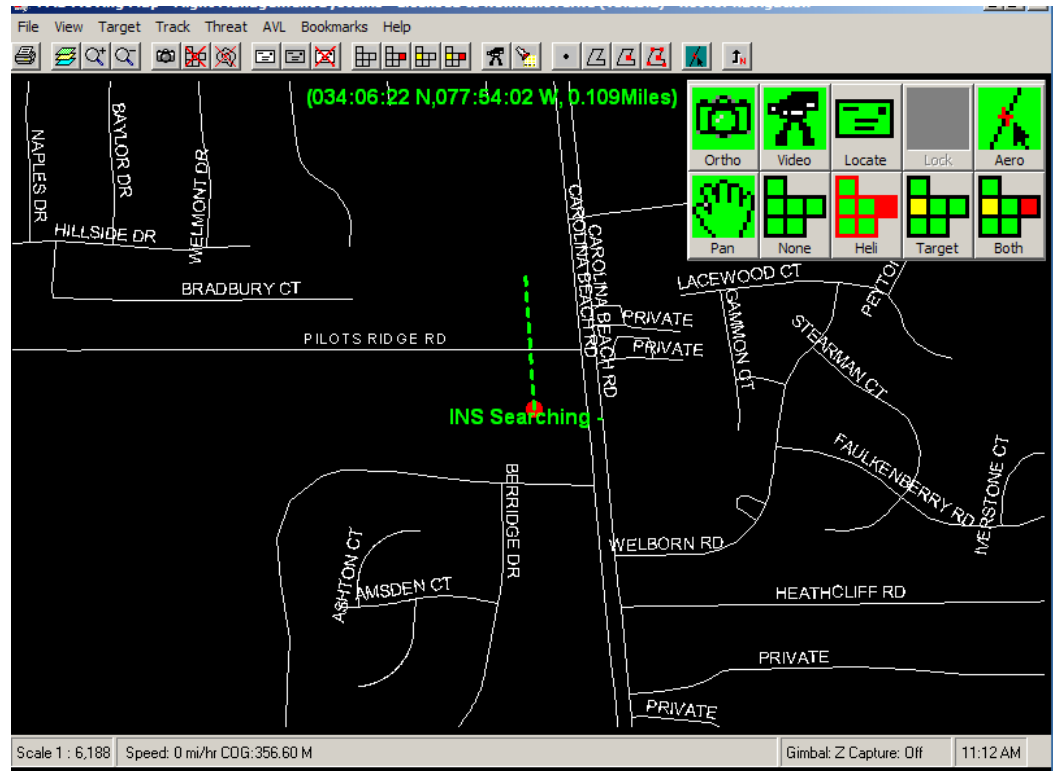


Figure 11: Startup, Medium Map Magnification

## B . B U T T O N S

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There are several function buttons, across the top of the screen that can be accessed using the mouse. **These buttons perform the same operations as the function keys.**

**There are three zoom keys:**

- Zoom Full Extent (F2)** ----- Zooms Out to show the entire city.
- Zoom In (F3)** ----- Zooms In one magnification setting.
- Zoom Out (F4)** ----- Zooms Out one magnification setting.

**There are three address matching keys:**

- Find Target (F8)** ----- Drops down the address entry box .
- Hide Box (F9)**--Hides the address box but keeps the target address on the screen.
- Close Target (F10)** ----- Clears the target address from memory.
- Hide FLIR Buttons (F12)** ---- Hides the FLIR on-screen icons.

## B 1 . T R A C K I N G F U N C T I O N S

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**Track None** -----This track allows the user to move any location in the map domain to the center of the map without regard to the aircraft location. This feature is useful to ‘scan ahead’ several miles without changing the map magnification.

**Track Heli (F5)** ----- This track keeps the aircraft position in the center of the screen (Red Icon) by moving the map imagery, and refreshes the screen when the aircraft icon gets an inch or so from a screen boundary. If the screen is refreshing too frequently, try zooming out a bit. At the highest magnification, a fast moving aircraft will cross the screen in less than two seconds, and the mapping system will continuously refresh the screen.

**Track Target (F6)** ----- This track centers the target address (Yellow Dot), and will keep the target address in the center of the screen. When the approaching aircraft enters the target area at the displayed magnification, the red aircraft icon will also be displayed.

**Track Both (F7)** ----- This track will keep both the aircraft location and the target address on the screen together by changing the map magnification as necessary. In this view, shown below in Figure 12, neither the aircraft nor the target is centered on the map screen. As the aircraft gets closer to the target address, the system will “auto zoom” to the next magnification setting, still keeping both on the screen. Once the aircraft is within one kilometer, the system will center the target address and the aircraft will be shown in its position relative to the target on the screen.



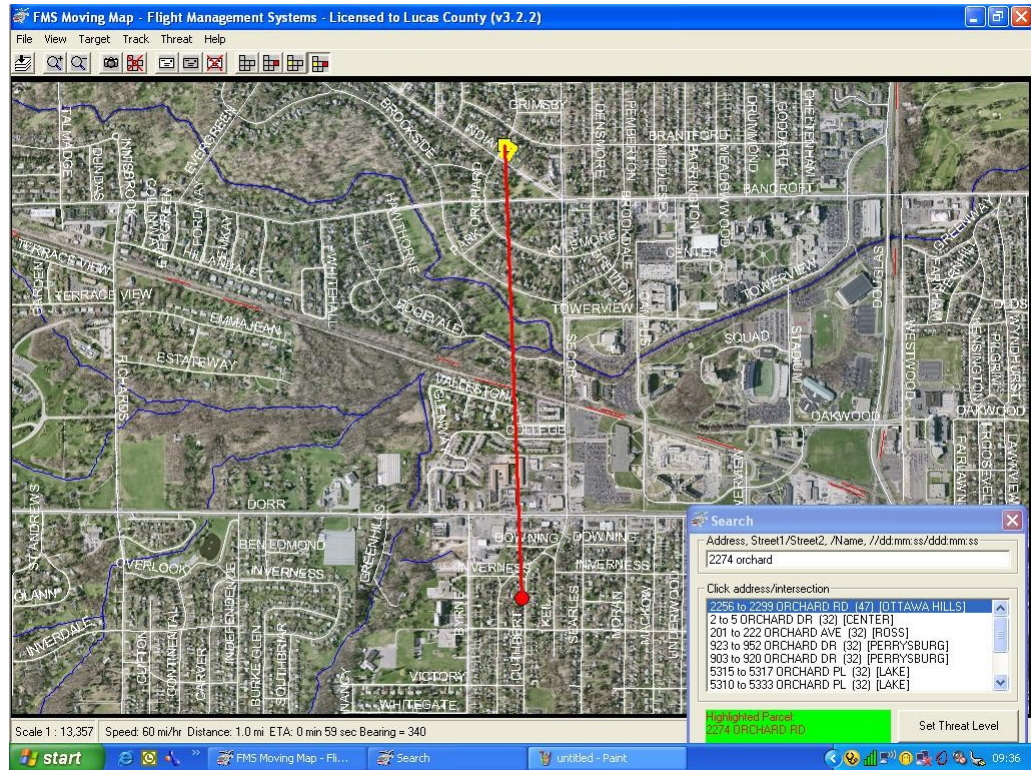


Figure 12: 'Track Both' Example Screen

## B 2 . TOUCH SCREEN FUNCTION KEYS

**When FMS is OFF** there is no connection to the FLIR control system and the FLIR should function normally and autonomously. In this operating mode, the FLIR video is viewed through the cockpit display's analog input.

**When FMS is ON:**

**FOV** Button toggles the FOV/ LOS (Field of View, Line of Sight) lines which let the operator know where the gimbal is pointing.

**VIDEO** Toggle: This button displays a copy of the FLIR screen on the FMS screen. This option is **provided to improve situational awareness ONLY**. In normal use, the FLIR should be viewed using the cockpit's analog display, not through FMS. On displays with Picture in Picture, both can be viewed with proper resolution.

**SEARCH** Button: Brings up the Search window to allow address input and search. **Always CLEAR (F10) the existing target before entering a new search.** Grey is unavailable, GREEN when available and RED when it is in use.

**LOCK** Button: Locks the FLIR to the target address. **Gimbal MUST be in Position mode.** Grey is unavailable, Green when available Red when it is in use.

If manual use of FLIR is needed hit the UNLOCK button which will allow manual FLIR searches but will keep the target address in memory. If return to target address is needed, hit LOCK again and FMS will take over control of the FLIR and point at the target address.

**UNLOCK** Button: decouples FMS from the FLIR. When using the UNLOCK button put the **FLIR in Inertial mode** and the thumb transducer will allow tracking an object away from center of the parcel or engage the video tracker (if equipped) to track a moving object leaving the target.

**ARROWS** When locked on a target the arrow buttons allow “fine tuning” of the gimbal. Be sure that FMS is “active” when you switch to the FLIR screen and the keyboard arrow keys will adjust the gimbal position

To LOCK on an address or GPS position, aim the FLIR at the target and press the LOCK button to lock the FLIR on the position.

## **ALWAYS Shut Down Through Windows**

### **C .    F U N C T I O N   K E Y S**

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The keyboard function keys duplicate the program buttons.

<b>F1</b>	Toggle Ortho
<b>F2</b>	Zoom Full Extent
<b>F3</b>	Zoom In
<b>F4</b>	Zoom Out
<b>F5</b>	Track Heli
<b>F6</b>	Track Target
<b>F7</b>	Track Both
<b>F8</b>	Find Target Address
<b>F9</b>	Hide Address Box
<b>F10</b>	Close Target Address
<b>F12</b>	Toggle FMS Keys Visible

#### D. MOUSE ACTIONS

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**Left Mouse Click** behaves just like any computer mouse, but if you click and hold it on the map, and drag, you will drag the map across the screen. On systems equipped with a touch screen, this function is implemented as touching the screen in the map area and dragging your finger across the surface of the screen.

This is used to move the map over a bit to get a look at something off the edge of the current presentation. If a Track feature is active, the map will move while the drag is active, then snap back to the proper centering (aircraft, target, or both) when the click is released. To scroll to a map area for view, ensure that 'Track None' is selected.

**Right Mouse Click**, hold it down, drag a box, and release, and the map will zoom to the box as its screen image. Starting from low magnification (high altitude), this feature is very useful to quickly zoom to a particular area of the map without entering an address.

#### E. ARROW KEY ACTIONS

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When using the **Find Target** drop down menu, there will be a list of addresses below that closely match the target address. Use the up and down arrow keys to scroll through the list until the proper address is highlighted, and then press Enter and the map will automatically zoom to the target address. The map will also draw a line from the current aircraft position to the target address, and display the distance to the target, E.T.A., and bearing to the target.

#### F. THREAT LEVEL FUNCTION

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The **Threat Level** function allows you to identify a target address as a threat to the ground personnel, and provide a warning to them as they are approaching.

This function will let you select the threat level, and provide a note associated with the address, on the fly. The files are saved to the "Capture" folder.

There are three threat levels

1. RED High Threat Eg: Unstable weapons offender
2. YELLOW Medium Threat Eg: Chop Shop
3. GREEN Low Threat (Informational) Eg: Mayors Home

#### G. RECORDING FLIGHTS

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<CTRL><C> This feature will begin "Capture" and will record aircraft positions and system control data to a file. These files can be "replayed" at any time to view the course and attitude of the aircraft. Select File>Playback> and the file name. **This file is time and date stamped** for easy recognition. The saved file can be played back later for debriefing, or in flight, and can be a few minutes, or the entire flight, as long as the "Capture" feature is enabled.

Hitting <CTRL><C> again will turn off the feature.

<CTRL><I> This feature will send a snapshot screen capture to a file. This feature is useful for an **“Incident”**. For example the suspect throws something out of the car at this location, hit <CTRL><I> and continue the chase. When it is convenient, you can bring up the screen, and direct a ground unit to the location to search for whatever was thrown from the vehicle.

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#### H . DATA TRANSFER

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Large files can be installed or copied from the computer using a “USB Drive” through one of the USB ports. Capture files, screen images, and threat level data are saved in the “Capture” folder inside the “FMS” folder, usually located on the desktop.

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#### I . ORTHO PHOTO LAYER

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The Ortho Photo layer can be toggled on and off with <F1> function key, or the “Ortho” button. With the Ortho layer on, you can select to hide all of the line layers (parcel boundaries, streets, contours, etc.) using the “Ortho” button with the X on it. This is to allow a clear view of the residence without property lines, and is useful when setting up points or directing ground personnel to a safe location.

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#### J . PURSUIT KEY

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The pursuit button will cause the map to highlight upcoming streets and streetnames from the aircraft’s GPS location so they can be identified for ground pursuers.

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#### K . CAPTURE CLICKED POINTS

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The button with the “Dot” toggles on and off the Capture Clicked Points feature. If your map has the parcel data layer it can be used to click on a house, and that address will be saved to the Capture File. This feature is very useful to collect large amounts of addresses for any reason and to be able to download the file and use it with most GIS (Geographic Information System) software. This feature will also collect GPS positions of clicked points and allow a quick note to be attached to each location. This is useful for collecting Hot Spots after a fire. All of this collected data is date and time stamped and stored in the Capture Folder. The data can be downloaded, printed, and used by any GIS software or a copy of FMS at base.

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#### L . DISPLAY CLOSEST FEATURE

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Clicking on this button will highlight the closest land feature. This is mostly used when flying offshore, to show you the distance to land, but will also show the closest police station, hospital, or other feature in the database.

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#### M . TRACK NORTH / TRACK FLIGHT DIRECTION

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In most urban situations it has been determined that having North up allows for better situational awareness for the flight officer. It is too distracting to have the map constantly rotating when circling a scene call, in fact it has caused flight officers to become queasy. The

**Track North Toggle** allows you to switch to having the direction of flight up, when making a long flight to a scene.

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#### N . C O N T O U R L I N E S T O G G L E

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Contour lines (when installed) can clutter up an urban map, so use this toggle to turn them off, if they are distracting.

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#### O . F I R E A R E A C A L C U L A T O R

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This enhancement allows you to calculate the area of a fire, for example, or any feature on the ground. Simply click on the “Capture an Area” icon to “enable” the feature. Begin clicking on the edge of the area you wish to calculate and continue around the object clicking as many times as you like. **Finish the area by Double Clicking on the last point.** The marked area will be shaded and the area displayed on the screen. Click on the icon again to “disable” the feature. This **safety feature** allows you to visually mark an area, instead of using GPS coordinates to mark the area. Now, you don’t have to fly through the smoke on the downwind side of the fire to calculate the area of the fire.

To add a point to the area simply click on the “Insert an Area Point” icon and click along the edge of the previously marked area to add a point.

To move an area point, click on the “Move an Area Point” icon and click on a point you wish to move. Drag the point where you would like it to be, and release the point. It will now be in the new position, and the area will be recalculated.

To save a screen print of your area click File> Capture Image and it will be saved to the capture folder as a Bit Map file that can be viewed in flight, downloaded, or printed to have a hard copy of the fire location.

If you wish to have a record of the flight, select File> Capture GPS (or <CNTL><C>) and a log of your flight is saved to capture folder and time and date stamped. This can be viewed in flight by selecting File> View GPS and a series of points are displayed on the screen. This can also be saved, downloaded and printed as required.

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#### P . F I R E M A P P I N G

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**Collecting Hot Spots.** See K (Capture Clicked Points) above.

Click ON the Capture Threats Icon. Begin collecting hot spot information. When you click on a hot spot the spot pops up on a pre-populated screen as a GPS coordinate or an address. You can add notes if you wish about the location. Click Save (Or Enter) and FMS asks for a confirmation. Yes or Enter again and the location is saved to a file. To stop capturing points click the point icon again to stop collecting points. All of the collected points are saved in a time and date stamped file in the Capture Folder of FMS.

**Show Threats.** Under the Threats drop down menu, if you click Show Threats, all collected hot spots are displayed.

**Export Threats.** Click export threats and all of the threats collected are saved in the Capture folder in time and date stamped file. This file can be downloaded directly to handheld GPS devices for firefighters on the ground.

**Load Area.** This allows loading a shape file from a stick or email into FMS, for display of a new fire you need to work on.

**Capture Area.** Is the same as the Capture an Area icon.

**Edit Area.** Is the same as the Edit area Icon.

**Move Area.** Is the same as the Move area Icon

**Save Area.** This will save a marked area from FMS to a time and date stamped file in the Capture Folder. This area is a shape file and can be shared with other GIS software.

**Clear Area.** Clears the area from the screen.

From the File drop down menu:

**Capture GPS.** This saves a breadcrumb trail of the aircrafts flight to a time and date stamped file in the Capture folder.

**Show GPS.** Displays the breadcrumb trail and can be shown in flight as it is being flown.

**Export GPS.** This downloads the GPS breadcrumb trail to a time and date stamped file in the Capture Folder.

**Clear GPS.** This clears the breadcrumb trail from the screen.

**Capture BMP Image.** This saves a bitmap screen capture to a file in the Capture Folder.

**Capture JPG Image.** This saves a JPG screen capture to a file in the Capture Folder.

**View Image** is a quick way to view the Capture Image on screen, in flight.

**Print Map.** On a fire you can collect all of the information you like, fire perimeter, any hot spots, breadcrumb trail to show where you have covered and display all of it on screen. This screen can then be printed. The format asks a few questions like aircraft tail number, date, crew, fire number and prints out a color map with all of the information collected during the flight.

# 4. Search and Rescue

## A. STARTING LOCATION

Any of the location entry methods outlined in Section 2 may be used to define the starting location for the search. A successful entry will generate a list of selections (with the exception of GPS data entry), and a search perimeter and search pattern may be displayed over the map.

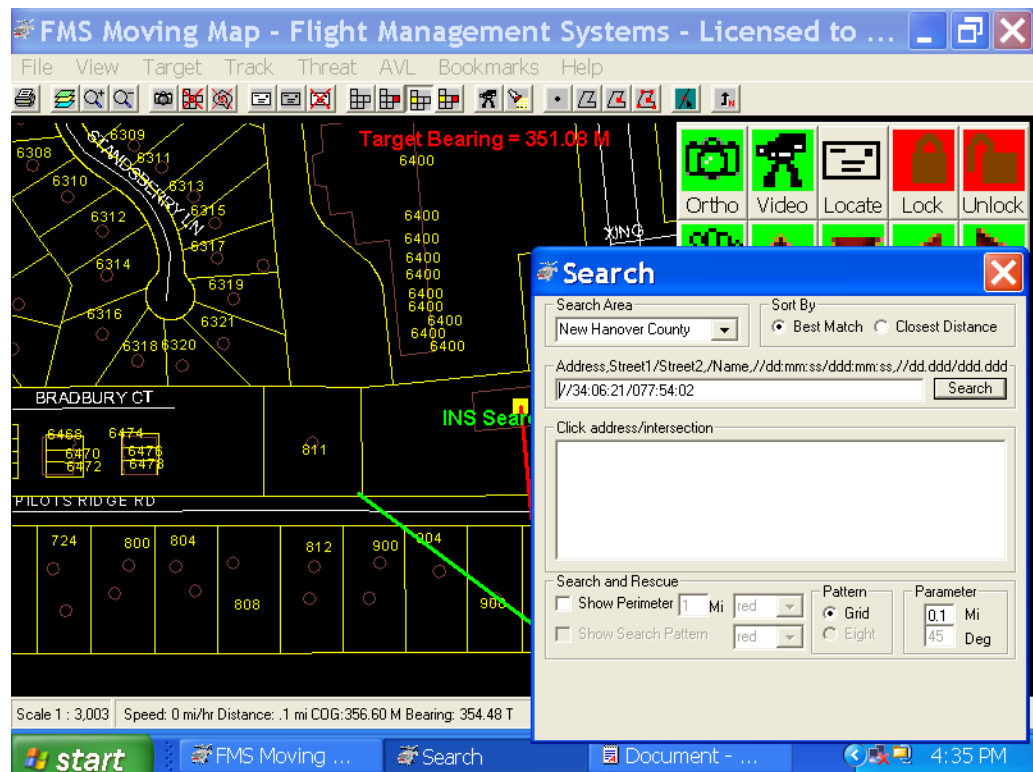


Figure 13: Search Screen Using Geo-Hold

After checking the “Show Perimeter” box, the search radius and color of the on-screen boundary may be chosen. The default is a one mile radius in red. A search pattern may also be chosen, either a standard grid search or a figure-eight pattern.

The grid search is most often used when the target location is defined only to an area. The flying pattern gives even coverage over the entire search area.

The figure-eight search is used when a target’s last location is reasonably known. The flying pattern concentrates the search coverage over the known location.

Note: Once inside the search perimeter, typing <CTRL><C> drops “breadcrumbs” along the flight path so the covered area is easily identified. Additionally, the searched data is stored and may be reviewed during flight, or later.

## B. GEO-POINT

Once a target is chosen, the FLIR can be slaved to the target location during approach. This allows the pilot and TFO to view the area during approach while independently maintaining the FLIR lock on the target.

## C. GEO-HOLD

The FLIR can be directly locked to a target without entering a location (address, GPS, etc.). With FMS not locked on a target and the FLIR in rate mode and pointing to a desired target, pressing <SHIFT> <LEFT CTRL> will identify the target to FMS. The map screen will be similar to Figure 14.

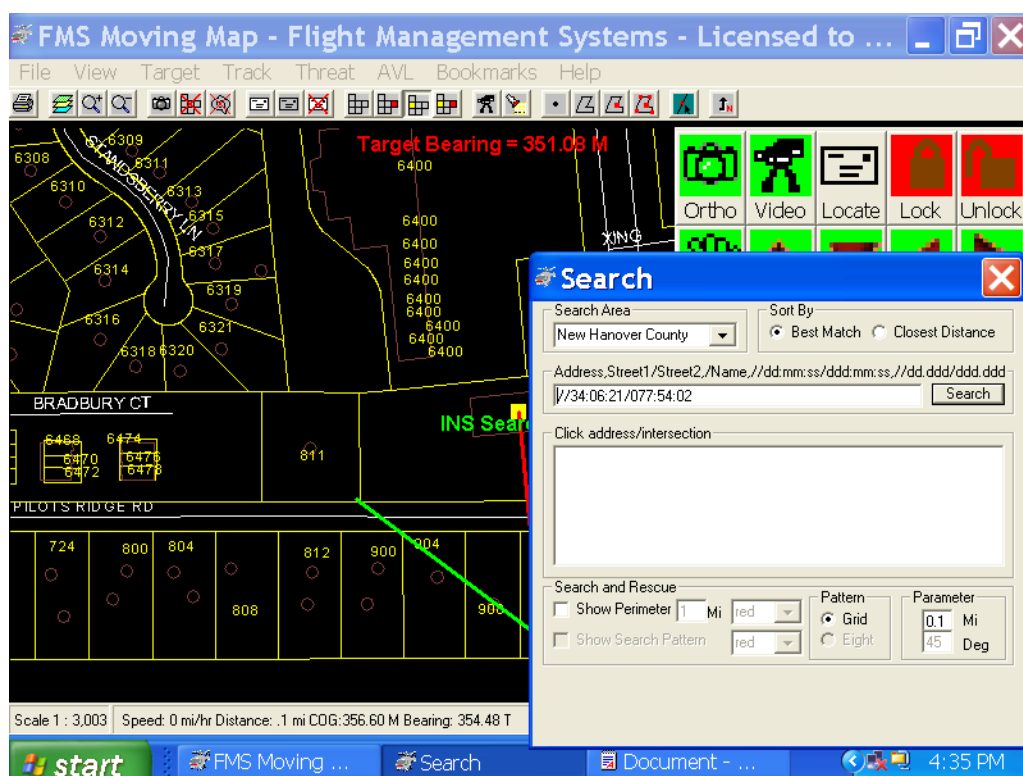


Figure 14: Search Screen Using Geo-Hold

Note: The accuracy of the target identification depends on many things, most strongly the pointing angle down from the aircraft to the target. Straight down gives best accuracy,



eliminating all but the altitude variation from the calculations. Angles less than 45 degrees should be avoided.

To point the FLIR to the identified target put it into position mode (SFT POS on the hand controller). <F9> hides the search box, allowing the TFO to use the map to communicate important map features (closest roads, cross streets, etc.) to the search teams. As with any of the search modes from Section 2, putting the FLIR into rate mode (SFT-POS on the hand controller) allows manual searching. Putting the FLIR back into position mode (SFT-POS on the hand controller) points the camera back to the original target location.