



# ARS

User Manual

Rev. 2.22

**CHURCHILL**  
NAVIGATION



## Welcome to ARS

To our Valued Customers:

ARS (**A**ugmented **R**eality mapping **S**ystem) is an advanced mission management and mapping system designed to augment full motion video in real time with geospatial information. While supporting extremely advanced mapping capabilities, ARS is also very easy to use, with an emphasis on “getting out of the way”, and “figuring out what the operator wants”. We believe that simple things should be simple, and difficult things should be possible. As you learn the few concepts behind ARS, we believe you will grow to appreciate the philosophy behind the design, and become a proficient operator with a dramatically increased ability to perform your mission.

ARS was designed not only to increase the speed and accuracy with which sensor operators can determine target locations, but to solve a longstanding problem – how to identify where the target is without taking your eyes off the action.

We encourage feedback, and look forward to your suggestions on how we can continue to improve ARS. You are the reason we do this – please let us know how we can serve you.

Sincerely,

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CEO, Churchill Navigation

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# Table of Contents

Document Revision History .....	4
About this Manual.....	5
Overview .....	6
User Interface.....	7
Basic Functionality .....	8
View Controls .....	9
On-screen Buttons .....	11
Video Mode.....	14
Map Mode.....	16
Split-Screen Mode.....	18
Map Orientation.....	19
Gimbal Orientation & Status .....	19
On-screen Information.....	20
Markers .....	22
Search (Find Button) .....	26
Search Radius Limit .....	28
Show All Search Results .....	28
Recording & Playing Back Video.....	30
The On-Screen Menu .....	33
Dynamic Layers .....	52
Creating New Layers .....	53
Search Patterns .....	57
Downlink Control Menu .....	67
Email.....	71
Picture in Picture (PIP) .....	72
Speed Measurement.....	74
Distance Measurement.....	80
Pilot Display.....	82
Requirements.....	82
Setup .....	83
System Calibration .....	83
INS Calibration.....	85
Diagnostics .....	89
Keyboard Controls (Hotkeys) .....	91
Terminology .....	93

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	Profiles section added		
	Search radius limitation section added		
	Email functionality section added		
	Pilot Display functionality section added		
	Distance measurement functionality detail expanded		
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2.22	Speed measurement validation, direction finding, calibration modes, misc. other refinements and updates.	--	NOV 2017
	Updates for new ARS UI elements, functions, and features.	--	

**Revision notation**

Changes from the previous version of the manual can be easily identified the presence of solid black lines in the page margin as shown here.

## Notice:

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All information depicted in this manual, including hardware and software names, versions, and part numbers, is subject to change and may not be up to date.

## About this Manual

This manual describes the functionality, procedures, and operating tips for the Churchill Navigation Augmented Reality System. Every effort has been made to make this document as complete and accurate as possible.

The following symbols for warnings, cautions, notes, and tips are used to throughout this manual.



### **Warning**

A warning symbol denotes an item where a potential hazard capable of producing injury to personnel or destruction of equipment exists if the approved procedure is not followed.



### **Caution**

A caution symbol denotes an item where, if not followed, damage to equipment or degradation of mission capability can occur.



### **Note**

The note symbol is used to identify important information for operators. While not directly related to safety or protection of equipment from damage, the note symbol identifies information to which attention should be paid during the operation of the equipment.



### **Tip**

ARS system usage tips are identified using the light bulb symbol and identify areas of best-practices or system operating shortcuts.

## Product Guarantee & Warranty Information

For details about Churchill Navigation's product guarantee and warranty, please see the Terms and Conditions page available at [www.churchillnavigation.com/agreement](http://www.churchillnavigation.com/agreement)

# Overview

Churchill Navigation's **Augmented Reality mapping System (ARS)** is an advanced airborne mission management system that offers a radical improvement in situational awareness. In addition to displaying mapping information and incorporating three-dimensional, high resolution satellite and synthetic imagery, ARS composites street information, parcel information, business names, or other custom data directly over EO/IR video in real time so the operator can stay focused on the target. The overlays are selectable and can be easily turned on and off with the press of a button on your keyboard.

ARS's use of perspective and awareness enhancing synthetic imagery gives the crew the ability to plan the mission well prior to the target location being in view. This can dramatically aid in intelligence gathering when the view from the sensor is less than ideal; from long distances, in poor weather conditions, or in darkness.

With the press of a single button, the gimbal can be slewed and locked to a location. Locations can be entered simply and quickly by entering the address, business name, coordinate, marker name, or other location information via the search dialogue box.

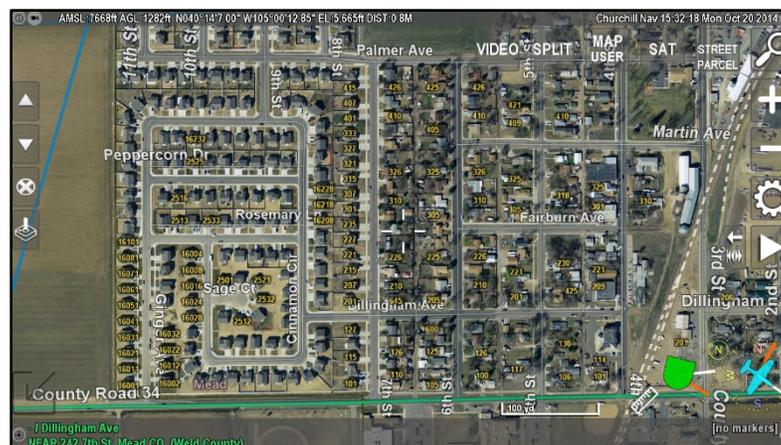
ARS also includes features such as speed/direction calculation, the ability to upload and save marker locations, automatic steering of the camera, and the option to incorporate customized imagery and overlay data.

Two channels of high definition or standard definition video can be recorded to removable media sources through ARS. The video is recorded in MP4 (H.264) and includes simultaneous playback and recording. KLV metadata (STANAG 4609 compliant) is recorded and can be downlinked or used in ground applications for review.

ARS is a robust **mission management system** with interface and control for an ever-growing list of external systems.



*ARS Video Mode with Street and Address Overlay*



*ARS top-down Map Mode with Synthetic Imagery*

## User Interface

There are two primary ways of interacting with ARS:

- Touchscreen Display
- Physical Keyboard

All ARS installations support both user interface devices, whether they are present or not. In some instances, a touchscreen-equipped installation may not have a physical keyboard but will use an on-screen keyboard. While nearly all tasks can be accomplished using either a touchscreen or a physical keyboard, there are unique aspects to each device which lend themselves to supporting some features that may not be available on the other device.

For example, you can place a marker anywhere on the screen by simply touching the monitor on touchscreen-equipped version of ARS. When using a keyboard, however, the X key (place marker) keyboard command will place a marker at the center of the screen.

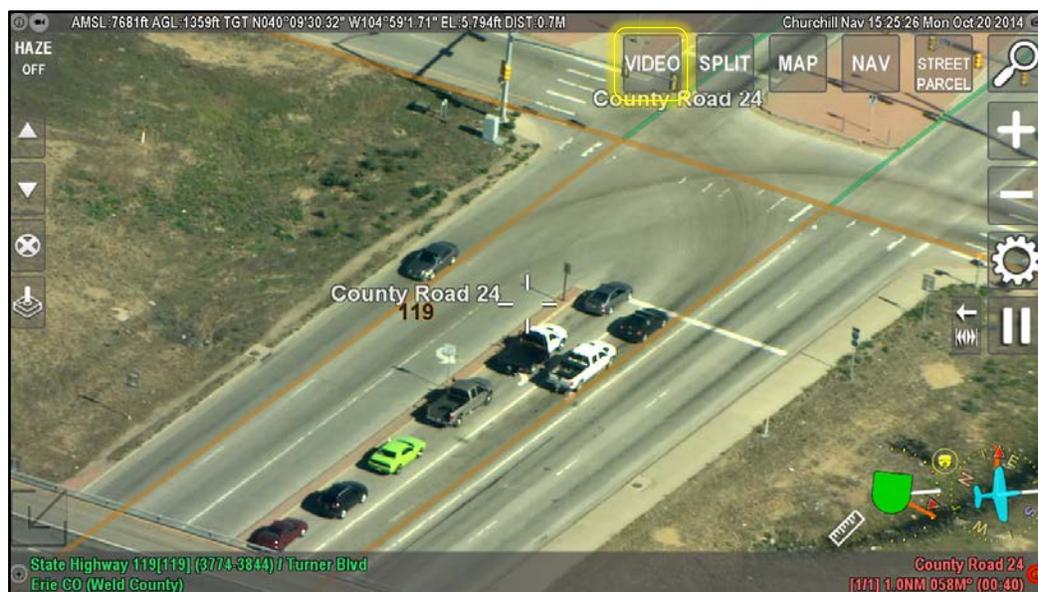


*Additional and custom user interface devices are available to suit your mission requirements. Contact Churchill Navigation for more information.*

## Basic Functionality

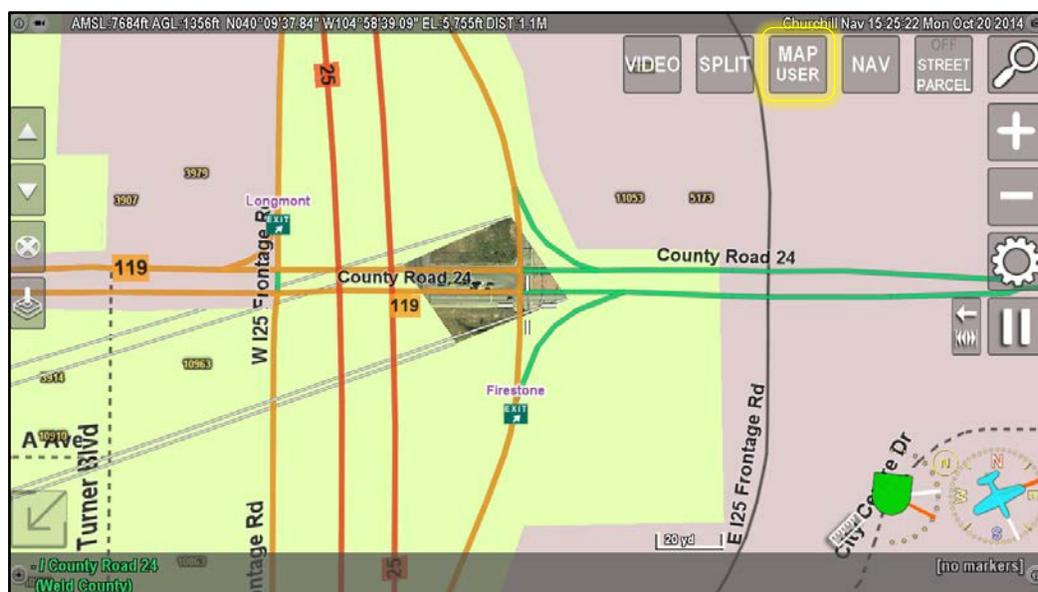
ARS has been designed with three primary display modes: **Video mode**, **Map mode**, and **Split mode**. Within each mode, the operator can toggle various pieces of on-screen information and configure the view to best suit the mission and his or her individual preference. The three main display modes are shown below and described in detail in the following pages.

### VIDEO MODE



To enter Video Mode, press the on-screen **VIDEO** button or the **F1** key. Real-time video is displayed along with ARS's configurable overlay data.

### MAP MODE



Map mode features three methods of centering the map mode view. To enter any of these modes, press the on-screen **MAP** button or the associated hotkey. Hotkeys will

center the map on the camera target (**F2**), the active marker (**F3**), or the aircraft (**F4**). Subsequent presses of the on-screen **MAP button** will cycle between these center points as well.

## SPLIT MODE

**F5**



Split mode allows the operator to simultaneously view both the live video feed as well as the map layer. It is enabled by pressing the **split button** on the screen or by pressing the **F5 key**.



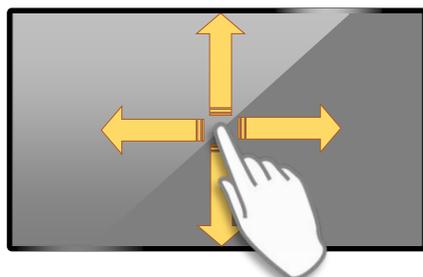
**TIP**

Split mode is especially useful when gathering information about the surrounding terrain (for example, viewing upcoming streets and intersections during a pursuit) while keeping the camera target in view.

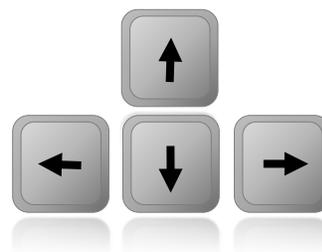
## View Controls

Moving around and zooming in and out of the view on various ARS modes can be easily accomplished via the touchscreen, keyboard, or a pointing device.

**PAN / MOVE** Panning or moving around the map in any mode is accomplished by swiping your fingers across the touchscreen in any direction, by using the **arrow keys** on the keyboard, or by clicking and dragging using the cursor of a pointing device.



*Touchscreen-based pan/move controls*

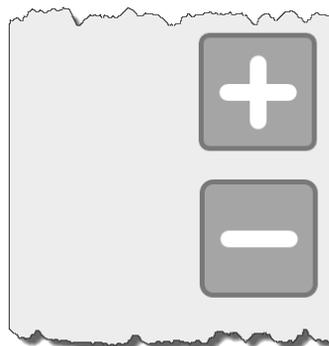


*Keyboard-based pan/move controls*

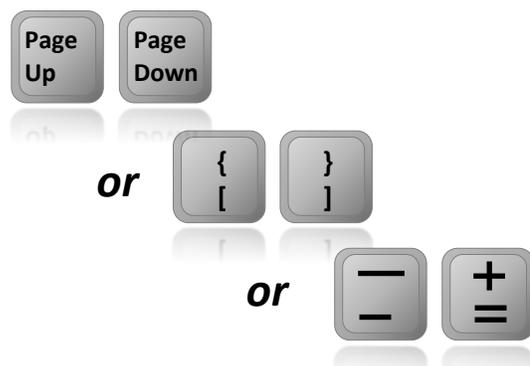
## ZOOM IN / ZOOM OUT

Zooming any view in or out can be done via the **plus** and **minus buttons** on-screen typically located on the right side of the ARS screen.

If you choose to use the keyboard, there are several key combinations that can be used to zoom in and out at various rates. These are: the square bracket keys, the page up / page down keys, and the plus and minus keys (non-numpad).



*On-screen zoom controls*



*Keyboard-based zoom controls*

When using the keyboard, press any two zoom keys to zoom in/out at a faster rate than if using a single key. For example, to zoom out quickly, simultaneously press and hold Page Down and the minus key.



**TIP**

Using a long-press (i.e. press and hold for roughly 3 seconds) on either the plus or the minus key will reset the zoom to the default zoom level.

## On-screen Buttons

ARS has been designed with the operator in mind. Easy to use on-screen buttons control many of the features of the system and can be selected by using a touch screen monitor or by using the cursor of a pointing device. Keyboard hot keys are also available and are described in this manual where applicable.

The on-screen buttons may vary slightly based on the interfaces included with your system. The *standard* on-screen layout and a description each button's functionality follows.



Select **HAZE DAY** to add filtering to the video image set for daytime use.  
 Select **HAZE NIGHT** to add filtering to the video image set for night use.  
 Select **HAZE OFF** button to turn all haze filtering of the video image off.

Note: Haze filtering is performed within the ARS video signal only and does not alter the raw video output from the gimbal.



Use the up arrow button to select the next marker.



Use the down arrow button to select the previous marker.



Use the delete marker button to delete the current, active marker. Hold the button to delete all markers.



If a marker has been given a type *other than temporary*, you will also see a secondary, red delete button. Press this button to remove markers with an assigned type. Select the joystick button to slew the camera to the active marker.



Select the **arrow** button to “declutter” or show/hide certain non-critical on-screen buttons.



Select the **VIDEO** button to toggle between Video and Synthetic Imagery mode.

- **VIDEO** mode displays the live video on-screen.
- **VIDEO SYN** displays a synthetic view (aerial imagery) of the area based on the camera view.



Select **SPLIT** to show a split screen display with the live video displayed on the one half of the screen and the selected map type displayed on the other half of the screen.

### Map Center

The Map Center button allows the operator to change the center point used by the system while operating in top-down map mode.



Select the map center button to select the top-down map center locations:

- **ACFT** centers the map on the current aircraft location.
- **TGT** centers the map on the camera target.
- **MRKR** centers the map on the active marker (requires an active marker).
- **USER** indicates the map has been centered in a location chosen by the operator.

Long-pressing on the **MAP** button will enable autozoom. This feature sets the ARS zoom level to allow the operator to keep both the marker and the aircraft, or the marker and the target in view while operating in map mode

### Map Imagery

Use the imagery button to select between the different imagery (base map) types loaded in ARS. The button name will change based on your selection as shown below.



Select the imagery button to select the top-down map imagery type:

- **SAT** displays satellite imagery.
- **TOPO** displays a topographic map.
- **AIR** displays aeronautical sectional charts (where available)
- **NAV** displays a vector-based street map.
- **NIGHT** show a night-optimized street map.



**Note:** The map data installed in ARS can vary based on area and availability. Other types of imagery such as nautical charts, trail maps, etc. can be configured based on operator needs. Contact Churchill Navigation for additional information.



Use the **OFF/STREET/PARCEL** button to select to display or hide overlay information.

**OFF** will turn off the street, house numbers, and parcel overlay but will not hide items selected for display in the Point Layers or Line Layers section of the menu (such as businesses).

Select **STREET** to display the street lines and street labels on-screen.

Select **PARCEL** to display the roof top address numbers on-screen. If parcel information has been added to your system, parcel plot outlines will also be displayed.



Select **FIND** to open the search feature within ARS to find a location. The complete functionality of this button is detailed later in this manual.



Zoom view in. Long-press to reset to default zoom level.



Zoom view out. Long-press to reset to default zoom level.



Select **MENU** to open the on-screen menu. The complete functionality of this button is detailed later in this manual.

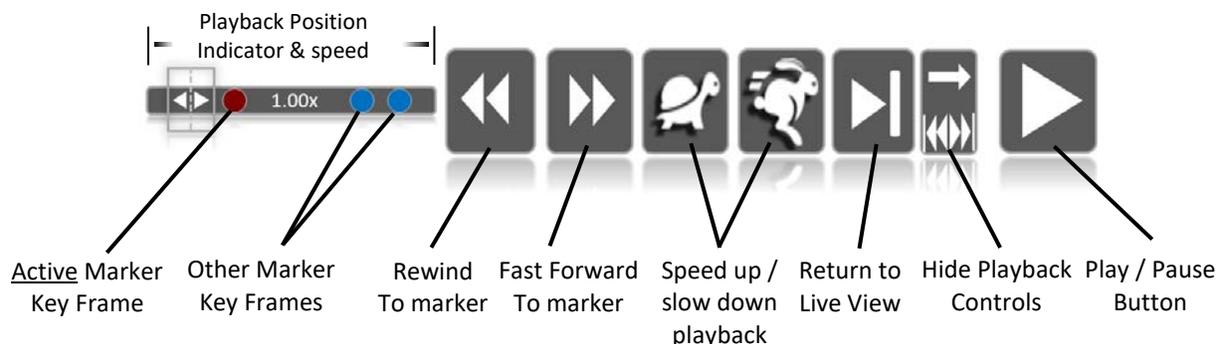


Select **REC** to start the recording of the connected video and audio. The text of this button will turn red when a recording is active. The complete functionality of this button is detailed later in this manual.

Note that a secondary label or button, **REC SCR** or **REC CAM**, etc., can be configured to record what you see on the ARS screen including overlays, etc., or “clean” video depending on setup.

## Playback Controls

ARS features “DVR-like” playback controls that can be used in conjunction with live video or while playing back a previously recorded video. See the *Video Playback Controls* section under *Recording & Playing Back Video* in this manual for a full explanation of functionality and keyboard hotkey combinations.



## Shortcut Bar

The shortcut bar is an optional function that can be added to the ARS interface to give operators quick access to frequently-used tasks and features. This element is highly configurable and can be used to give the operator “on-click” access to commonly-used menu options, functions, and tasks. Because of its highly-configurable nature, please contact Churchill Navigation for additional details.



The customizable Shortcut Bar can provide quick, one-button access to frequently used ARS features.

## Video Mode

In video mode, real time video is displayed through ARS. GIS information such as street lines, street names, roof top addresses, parcel outlines, and business names can be displayed on top of the live video. This gives the operator the ability to instantaneously orient and provide information about the target location.



Video Mode with street and parcel outline overlays.

## Video Mode Functionality



To enter Video mode, press the **video button** or the **F1 key**. A second press of the Video button will turn on the synthetic imagery view.



Use the **overlay button** or the **O key** to turn the on-screen overlay information on or off.

- **OFF** shows “clean” video only without overlay detail.
- **STREET** displays the street lines and street labels on-screen.
- **PARCEL** displays the roof top address numbers on-screen and parcel outlines (if available).



Press and hold the **F key** on the keyboard to fade between the live video image and the synthetic imagery layer.



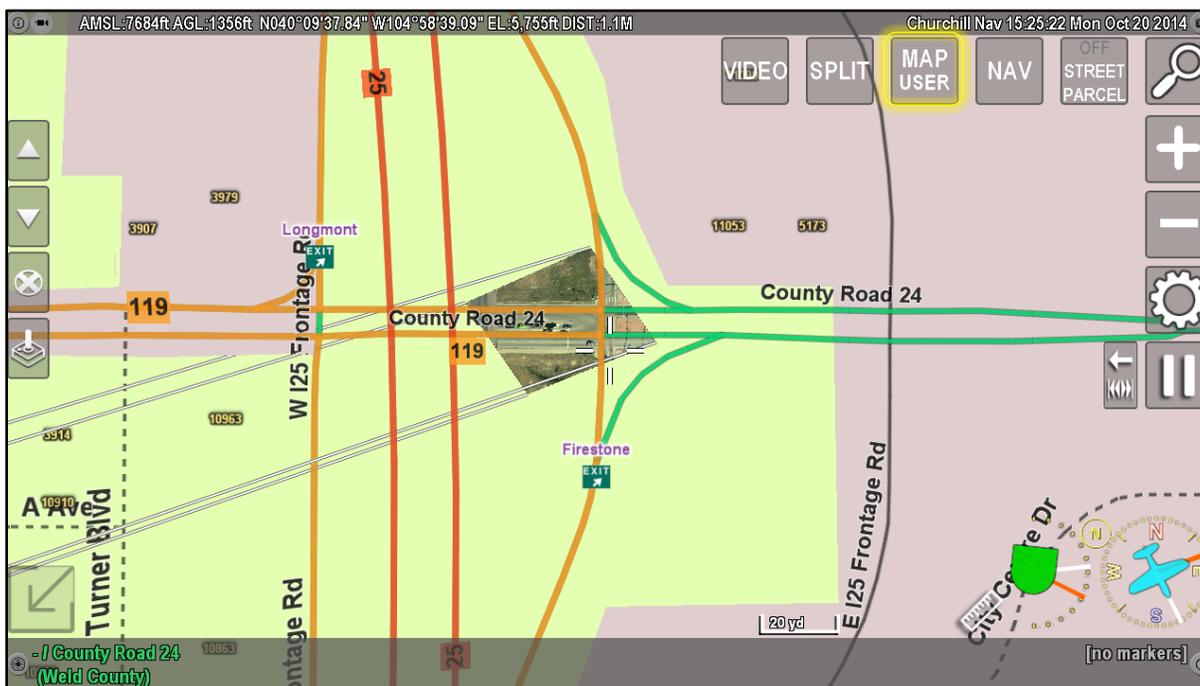
Use the plus and minus buttons on-screen or the Page Up / Page down on the keyboard *or* the left and right square-bracket, *or* plus and minus keyboard keys to zoom in and out of the view.



If zooming out beyond the camera’s field of view, the synthetic imagery layer will display behind the video giving the operator an extended, synthetic field of view.

## Map Mode

Map Mode provides a top-down view of the world within ARS. The system can be loaded with several types of maps including street maps, navigational charts, and satellite imagery. The maps loaded onto your system depend greatly on the geographical area, operator requirements, and availability of mapping data.



*Top-down map mode view centered on the camera target (street map display and camera projection frustum enabled)*

Within Map Mode, the operator can freely pan and zoom the map or to center the map at various pre-defined points. These points are 1) centered on the aircraft, 2) centered on the active marker, or 3) centered on the camera target. Use the **MAP** button to display a drop-down list to select between these points, or, you can use the assigned hotkey.

### Map Mode Functionality



MAP ACFT indicates that the map mode view is centered on the aircraft's position.

The **F4** key can also be used to center the map mode view on the aircraft's position.



If a marker has been placed, the MAP MRKR button will allow the user to center the map on the active marker.

The **F3** key can also be used to center the map mode view on the active marker. If no markers are present, this view center mode will not be available.

MAP  
TGT

Pressing the MAP TGT button will allow the map to be centered on the target (where the camera is currently pointing).

The **F2 key** centers the map mode view on the aircraft.

MAP  
USER

While not directly selectable as a preset map center location button, **MAP USER** indicates to the operator that the map center has been changed to something other than aircraft, marker, or map.

**TIP**

Long-pressing on the **MAP** button will enable autozoom. This feature sets the ARS zoom level to allow the operator to keep both the marker and the aircraft, or the marker and the target in view while operating in map mode.

SAT

The imagery button allows the operator to change base map imagery quickly and easily. Pressing the button triggers a drop-down list to appear, from which the desired imagery layer can be selected. Available imagery layers vary by installation, but a typical setup might include satellite imagery, topographic maps, aviation sectional, and street navigation-style maps.

The **I key** can also be used to toggle the base map imagery. Subsequent presses of the **I key** will display each different type of imagery.

OFF  
STREET  
PARCEL

Parcel and street data can be toggled on or off in map mode. Press the overlay button to configure the view to suit your mission needs.

## Split-Screen Mode

ARS can display output from both Video Mode and Map Mode simultaneously in a split-screen format. This can be very useful for increasing situational awareness or quickly developing a “big picture” view of the geography while keeping an eye on the camera target.



*Split-screen Mode showing live video (left) and satellite imagery top-down map (right)*

### Split-Screen Mode Functionality



To enter Split-Screen Mode, press the **SPLIT button** or the **F5 key**. To change the base map imagery type in Split-Screen Mode, press the imagery button or the **I key**.



While operating in Split-Screen mode, a dedicated overlay button is shown on-screen that will turn street overlays on or off for the video side of the split screen only.

To adjust the overlays for only the video side, use the dedicated overlay button or the key combination of **ALT+O**. All other controls apply to the map side of the split-screen.



**TIP**

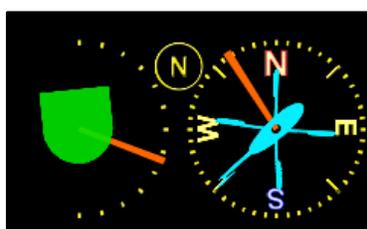
Screen layout can be formatted to meet individual operator preferences through Menu/User Preferences/Video Options. For example, one can choose to show video on the left or right side or set the video to show centered (example above) or zoomed-in to fill the assigned pane.

To turn off Split-Screen Mode, press the **SPLIT button** or the **F5 key** to return to the previous mode. If originally in Video Mode and the map has been changed in any way during Split-Screen operation (such as changing the map mode, panning the map, etc.), the system will return to Map Mode. If the map has not been changed, it will return to the Video Mode. If the system was in Map Mode before Split-Screen Mode was activated, it will return to Map Mode.

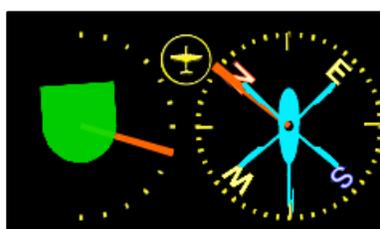
## Map Orientation

Map orientation can be changed by clicking on the **compass indicator** in the lower right of the ARS screen or by pressing the **F6 key**. The small yellow circle to the upper-left of the on-screen compass will display an icon denoting the selected orientation: north-up, track-up, or camera target-up.

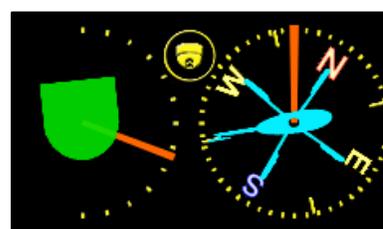
The compass indicator icon symbology for map orientation within ARS is as follows:



North-up orientation



Track-up orientation



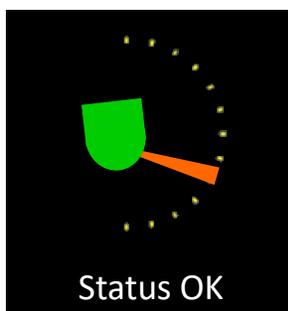
Camera Target-up orientation



Map orientation (and map center) cannot be changed in Video Mode as this is determined by the field of view of the camera and where it is pointed, i.e. camera “target”.

## Gimbal Orientation & Status

In all modes, the lower right corner of the ARS screen displays information pertaining to the gimbal orientation and status. Status is derived from information determined within ARS only and will not represent any diagnostics from the gimbal itself.



Status OK

**Green** – Everything is operating as expected.



Caution Range

**Yellow** – minimum feature size\* is not identifiable. Zoom in.

\* Used mainly for SAR patterns.

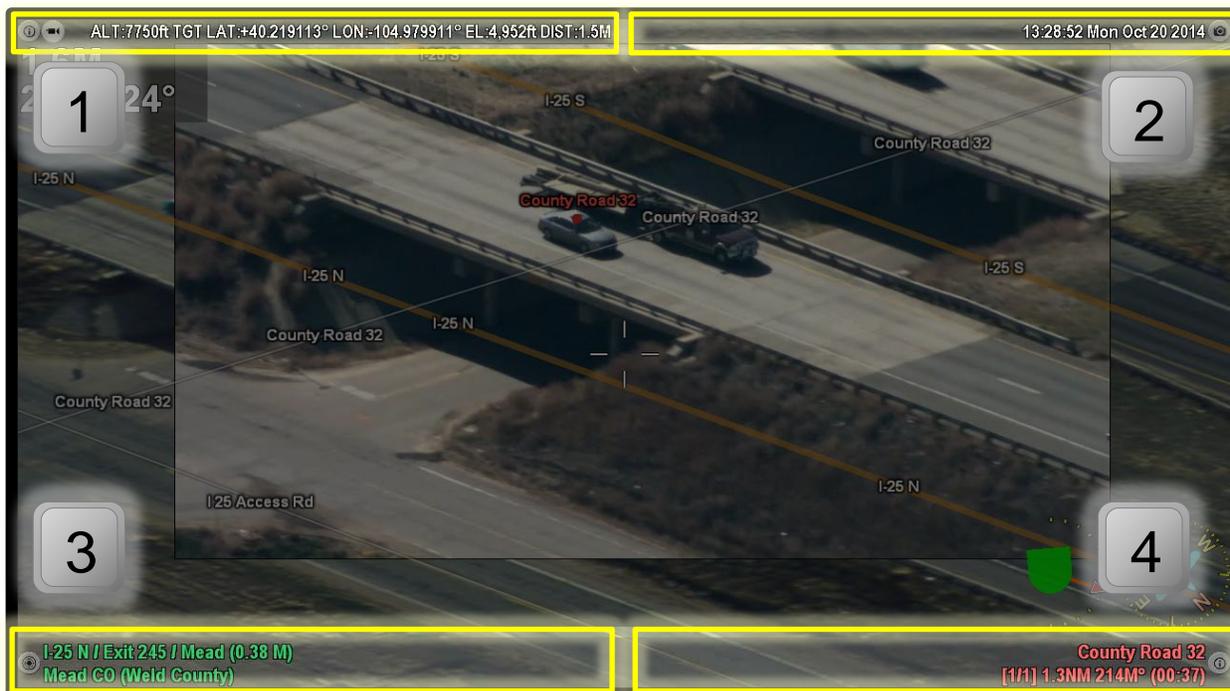


Warning Range

**Red** – Camera elevation is too high or too low and approaching gimbal lock.

## On-screen Information

The area in each corner of the ARS on-screen display can be configured to show advisory information or to perform or indicate a certain action. Three of the four corners display both primary and alternate textual information. Cycling from the primary to the alternate display is done by touching the area over the text or by pressing the designated hotkeys on the keyboard.



### Upper Left of Screen

1

Hotkey = 1

ALT:7750ft TGT LAT :+40.219113° LON:-104.979911° EL:4.952ft DIST:1.5M

**Primary Display:** Aircraft altitude; Aircraft (ACFT), Target (TGT), or Marker (MKR) latitude and longitude, elevation, and distance.

Playing (00:03:44/00:19:44) (ARS-FILENAME.TS)

**Alternate Display:** Recording status, elapsed time, clip length, file name, and recording device used.

### Lower Left of Screen

3

Hotkey = 3

I-25 N / Exit 245 / Mead (0.38 M)  
Mead CO (Weld County)

**Primary Display:** Closest street and intersection (address will display if available). If the camera is centered over a loaded area of interest such as a county, school, or park, this will be indicated as well.

*Note: Custom information can also be loaded in this location for items such as radio frequencies or precincts. Contact Churchill Navigation for more information.*

 123 OAK STREET, Mead CO (Weld County)  
Owner: SMITH GEORGE A

**Alternate Display:** Click the Lower Left Corner to display the address and property owner information if available. *Note: This click-spot is configurable and may instead toggle the north indicator.*

#### Lower Right of Screen



Hotkey = 4

County Road 32  
[1/1] 1.3NM 214°M (00:37) 

**Primary Display:** Marker location, sequence, distance, heading, and ETE to marker.

Weld County  
LAT :+40.219113° LON:-104.979911° EL:4952ft 

**Alternate Display:** Marker notes, latitude, longitude, and elevation.



**TIP**

If the marker has additional information, such as clicking on a business POI or adding a name to the marker, the indicator in the lower right will pulse red. Clicking on the indicator will show additional information for the marker (**A key**).



The upper right hand corner has both a primary display and a primary *function*. This function is used to take a screenshot, which is triggered by touching the upper right corner or by using a keyboard hotkey.

#### Upper Right of Screen



Hotkey = 2

DEMO (profile) 13:28:52 Mon Oct 20 2014 

**Primary Display:** Agency name, profile (if one is active), local time (UTC + time offset), and date.

**Primary Function:** Take a screenshot. Press the corner or use the **2 key** on the keyboard to take a screenshot. Screenshot will be saved to the removable media on the specified drive.

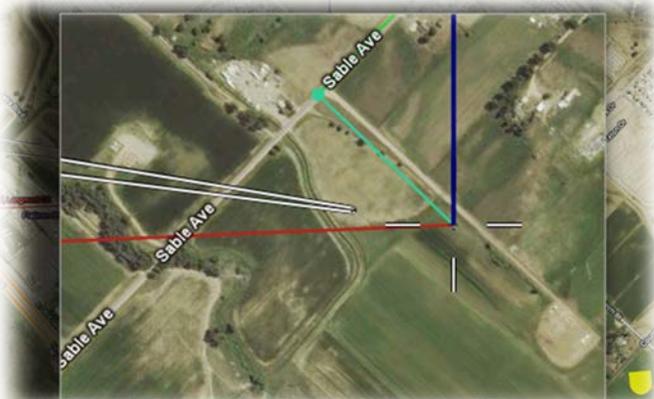


**TIP**

The system can be configured to place a marker whenever a screenshot is taken. This allows the operator to review screenshots for markers during flight. Using the additional marker information (**A key** or pulsing red icon), a screenshot icon will appear in the info box. Clicking on this icon (or **ALT+A**) will open the screenshot review dialog. You can then cycle through other screenshot markers, zoom in/out, move the image, or center it.

Just one example where this would be useful is capturing quick information about the number of suspects fleeing a vehicle. This feature allows the operator to take a screenshot and then later return to that moment in time of the suspects exiting a vehicle to help identify additional suspects.

## Lines on the Map:



A **red** line will connect from the aircraft to a current selected marker.

A **green** line will connect from the aircraft to the nearest street, and then to the nearest intersection.

When panning around the map, a **cyan** line (not shown, left) will connect from the center of the map to the aircraft to help in locating the aircraft on the map.

There are additional optional lines for heading (shown in **blue** above), north indication, and camera direction. These are configurable in the user preferences section of the main menu.

## Markers

Markers are used to designate, save, and label locations. Markers can be used to enter a destination, a steer to point for the camera, as a reminder of a specific area of interest, or to mark evidence that you may need to revisit.



Marking areas of interest in video mode

## General Information

A marker represents a location (usually on the ground) and may be created as a result of a search or by marking the location using the touchscreen or keyboard shortcut in any mode (Video, Map, Split-Screen). When a marker is placed, information such as the address, coordinates, ground elevation, and name will be captured. While there can be an unlimited number of markers, only one marker at a time can be the **active marker**. On-screen, the active marker is shown in red, all other markers are shown in blue.



**Markers are temporary and, unless saved, will be cleared when the system is powered off.**

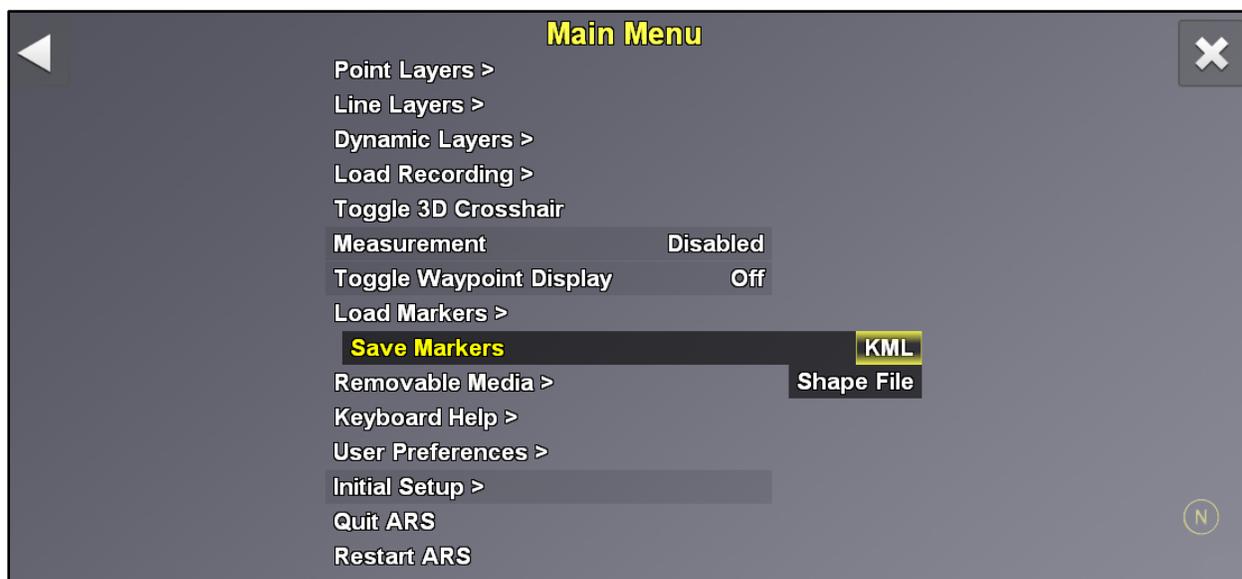
## Placing a Marker:

There are three methods for placing a marker in ARS:

- Using the touchscreen, touch anywhere on the screen to place the marker.
- Using the keyboard, press the **X key** to place a marker at the center of the screen.
- Using the search feature (**Find button**) to enter the marker location.

## Saving Markers:

If you wish to save the markers created during a session, use the **MENU button** (or **M key**) and select the option to “Save Markers”. Markers can be saved to the removable media as either a Keyhole Markup Language (\*.KML) file or a Shape File (\*.SHP).



*Saving markers via the ARS menu*

## Loading Markers

To load previously saved markers, use the menu (**M key**) and then, using the keyboard arrow keys, select “Load Markers”. ARS will present you with a list of saved markers from which you can choose. Use the keyboard to select the desired marker(s) and then press **Enter** to load.

## Editing a Marker Name

By default, a marker will be named using its address or location. To replace the default name with a more descriptive name, press and hold the lower right corner or use the **ALT+X** keys. Press the enter key to save your entry and associate it with the marker.

The new name will be shown in the lower right corner of the ARS screen.



**TIP**

This feature is particularly useful when you want to quickly identify and differentiate between several placed markers. In these cases, providing a descriptive name will make searching for a specific marker much easier.



*Renaming the active marker makes quick identification easier*

## Marker Controls

	<b>D</b> <b>ALT+D</b>	Delete the current, active marker.  Delete <u>all</u> markers.  <i>* In cases where a marker's type has been changed, a secondary (red) delete button will appear.</i>
Single Press or Press & Hold		
	<b>P / N</b>	<b>P</b> (Previous) and <b>N</b> (Next), used to cycle between markers.
	<b>G</b>	Slew camera to the active marker.
(Press & hold lower right)	<b>ALT+X</b>	Rename the active marker.
	<b>A</b>	Show additional marker information.
	<b>CTRL+Z</b>	Undo deletion of most recent marker. While the on-screen button will remain visible for 5 seconds, however, CTRL+Z is available until the next marker is deleted.

## Marker Notes:

- You can list all markers by going to the search function (**Find button** or by pressing the **Spacebar**) and choosing the markers tab. Use the touchscreen and/or the arrow keys to cycle between tabs and to choose selections within the tabs.

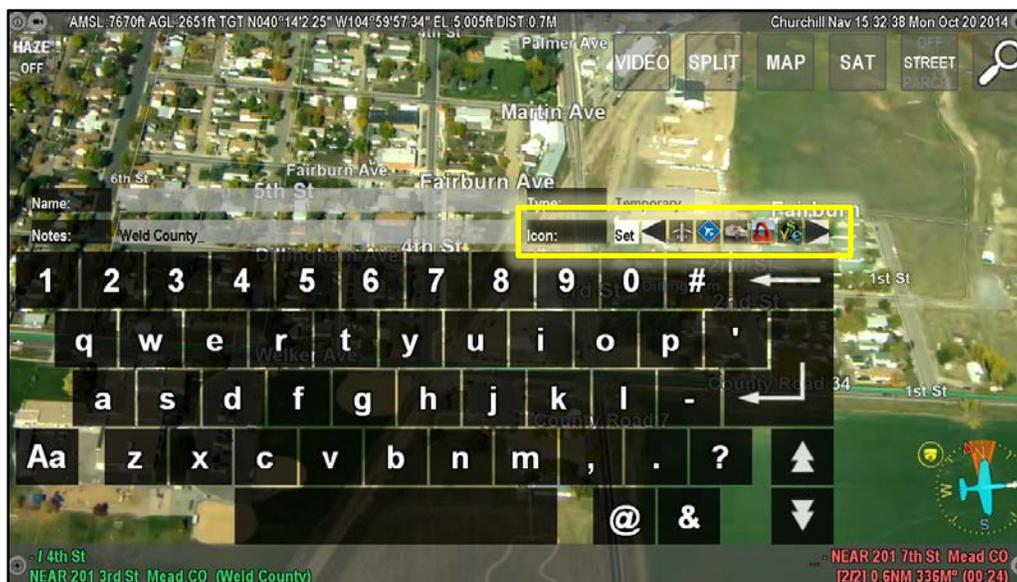
- **Markers are temporary and will be cleared when the system is powered off.** Use the Menu/Save Markers to save any markers from your session. These can later be reloaded by using Menu/Load Markers.
- Markers can be saved to a shape file .SHP or .KML by going into the menu and choosing “Save Markers”. Saved markers can be imported back into ARS, into Google Earth, or other GIS programs like ESRI.
- Slewing the camera to a marker behaves differently depending on your gimbal: On FLIR Star Safire cameras and Wescam MX systems, the camera will immediately point to the active marker and the system will enter geo-point mode in which control authority is immediately returned to the user.

On camera systems such as the FLIR U8XXX series, ARS enters “GEOHOLD” mode (indicated by text on the top of the screen) and needs to be exited to return authority to the FLIR hand controller. It is important to note that the FLIR U-8XXX can only be placed in ARS GEOHOLD mode when the camera is in “POS” mode (“Shift-POS” on the hand controller may be required for some installations).

The FLIR Talon will only enter GEOHOLD mode when “external control” is enabled via its menu.

## Marker Icons

Through the rename marker dialogue, operators can also change the marker icon. This allows the marker to be more noticeable or to signify other information within the system.

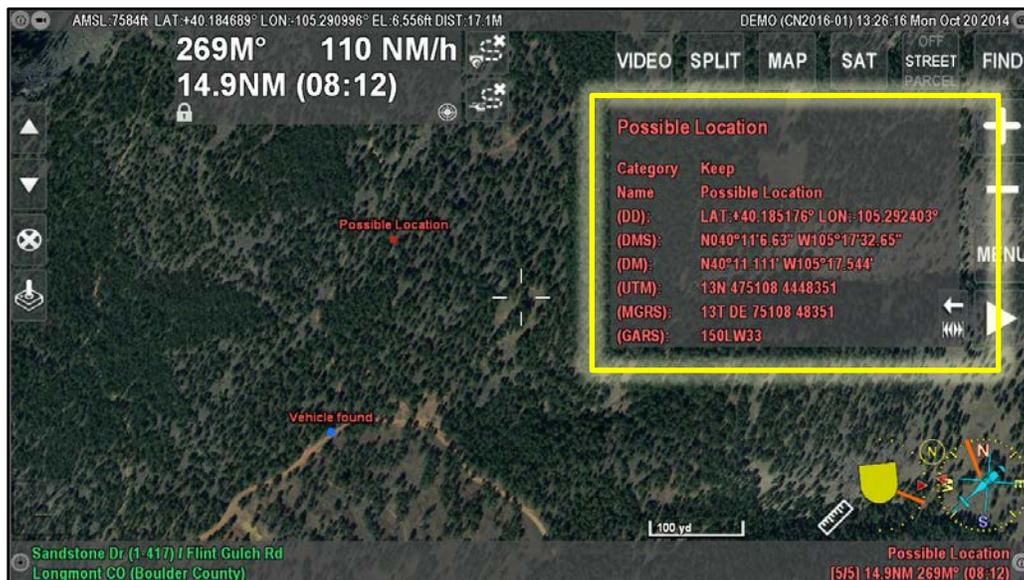


## Showing Additional Coordinates

For certain missions, operators may be asked to provide marker coordinates in multiple formats to assist ground units or other agencies. To configure the on-screen display to show the coordinates of a marker

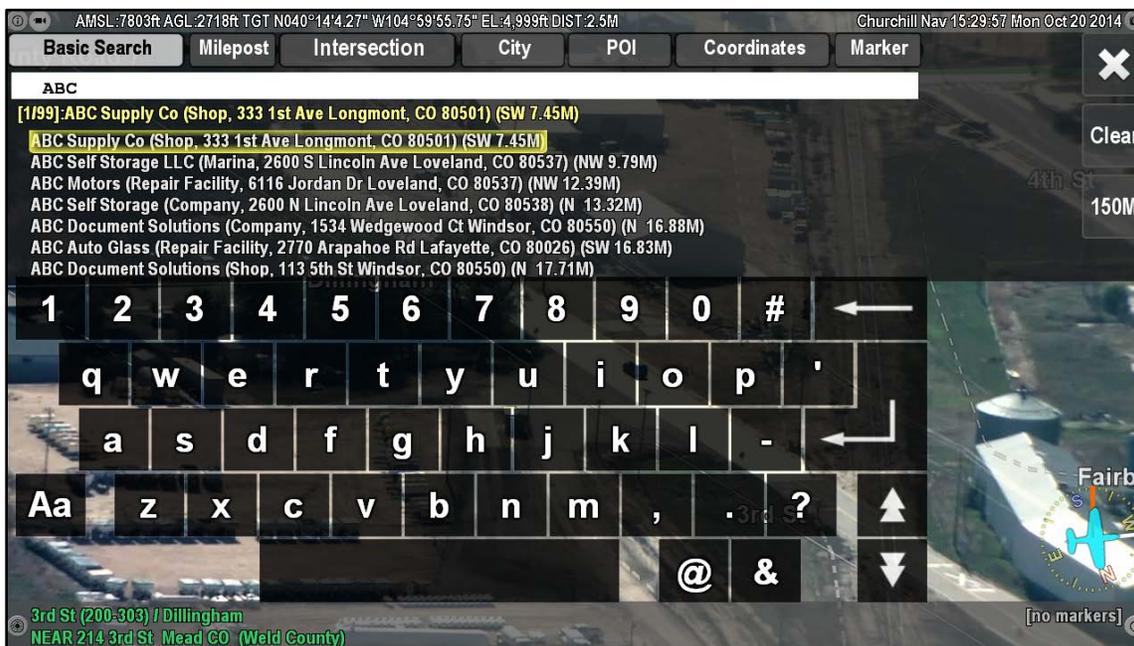
in all available formats, enable the “Additional Coordinates” feature in the User Preferences > Marker Options menu (User Preferences -> Marker Options -> Additional Coordinates -> ON).

Once enabled, click on the marker’s additional information indicator (ⓘ) in the lower right of the screen or press the “A key” to access the coordinate listing. This give the operator an immediate means of converting marker location to different coordinate systems.



A marker’s location shown in all configured coordinate systems.

## Search



Utilizing the Basic Search tab in ARS

## General Information

On the internet, Google has set the standard for search – It is simple, fast, and generally "does the right thing". This is the model we have set to emulate by eliminating special codes or the requirement to know in which county an address is located, and by adding as much searchable content as possible into ARS.



Press the **search icon** button or the **Spacebar** to bring up the search dialog box.

## Basic Search

The Basic Search tab includes most search options available including addresses, business names, markers, and cities. Most information can be entered and located using only the Basic Search tab. Additional tabs provide a more focused search for locations such as intersections, cities, points of interest, coordinates, and markers, and can be selected by using the touchscreen or arrow keys.

Once a location is entered from the search it will display on-screen and be added as a marker.

### To search for a Location/Business/POI/City/Marker

1. On the Basic Search tab, type the address, business name, POI, City name, or marker location name.
2. As you begin typing, a suggestion list is displayed with potential matches.
3. Select the desired match then press **ENTER** to confirm.

### To search for an Intersection

1. On the Intersection tab, enter the first street name in the box.
2. Use the touchscreen or press **Tab** to move to the next box and enter the second, intersecting street.



**TIP**

Intersection entry works best if you do not enter "East", "North", "South", or "West". The street name/number is all you will need. Generally, the less you type, the better off you'll be.

3. As you begin typing, a suggestion list is displayed with potential matches.
4. Select the desired match then press **ENTER** to confirm.

### To search by Coordinates

1. The Coordinates search tab allow you to search using several types of coordinate systems. Press the **arrow key** or press the Coordinates search tab to scroll through the different coordinate system options.
2. Enter the coordinates for which you wish to search in the corresponding format.

3. As you begin typing, the system will display representations of the same information in all supported coordinate system formats. This allows the operator to accept a coordinate in whatever format is given to them and to convert the coordinate on the fly to another format that may be more familiar to them.
4. Select the desired representation, then press **ENTER** to confirm.

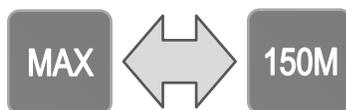
## Search Notes

- As you enter a search location or address, results or potential matches will be displayed below the search box, organized by proximity.
- Users can set the search center which dictates whether results will be sorted by distance from the aircraft or from the camera target. This is in Menu/User Preferences/Search Options/Search Center.
- If you are searching for addresses or locations in a specific area that is not nearby, change the map center (and thus default search area) by going to the City tab, entering, and selecting the new location, and then conducting your search. The suggestion list will now be sorted based on the new map center.
- The up and down arrows allow you to scroll through results that are off-screen.
- The Markers tab will list all current markers and are available to use as search locations.
- To clear the search text entry field, use the **Shift + Backspace keys** or to move the cursor position to modify the query text, press and hold the **SHIFT+(left/right) Arrow Key**.

To exit the search, press the “X” icon in the upper right of the screen or use the **Esc key**.

## Search Radius Limit

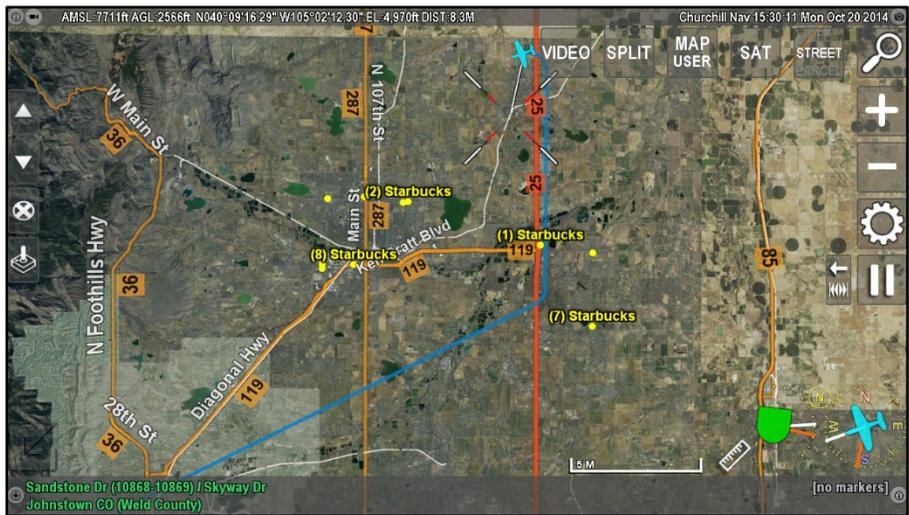
ARS allows users to limit the radius (with respect to the map center) of the area from which search results are returned. This limit is defined in User Preferences > Search Options > Search Radius (in meters) and displayed along the right side of the search window.



Once a search radius limit has been defined in the search options menu, the user can select the MAX button to toggle between the maximum (unlimited) search radius and the user-defined, limited search radius.

## Show All Search Results

Operators may choose to have all search results displayed simultaneously on the map. To do this, select the MAP option from the area to the right of the search results field. Once MAP is displayed, press the on-screen or physical enter button. This will display the number of instances on the top-down map only.



When the MAP option is selected, all locations that match the search query will be displayed on the map.

## Recording & Playing Back Video

ARS includes a built in digital HD/SD recorder which can record two channels of video and metadata to an external media source: SD cards and USB flash drives. The unit records in H.264 format which can be played back on most media devices, including computers, smart TVs, tablets, etc. An external USB or SD drive must be connected and available for the recording to take place. If a media source is not inserted, video will not be recorded. ARS provides playback while recording.

### To Start Recording:

1. Prior to recording, insert a removable drive into the port connected to ARS.
2. To start and stop recording, press the **REC button** (may also be labeled **REC SCR/REC CAM**) or use the key command of **ALT+Y** (or **ALT+U** for **REC SCR/REC CAM**).

ARS will search for an external drive (USB or SD card). Once a drive is located, the recording begins and the recording status icon in the upper left of the ARS screen will flash red.

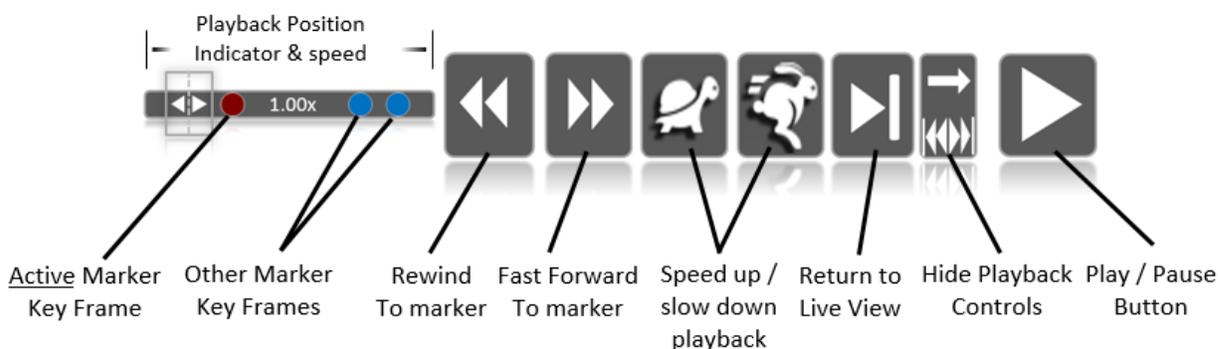


Additionally, the text of the REC button for the source you're recording will change to red.

3. Press the **REC button** or **ALT+Y** (or **ALT+U**) a second time to end the recording.

### Video Playback Controls:

Use the **video playback controls** to pause and control live video, move to different points in the recorded video, or speed up and slow down playback.



2. Use the playback speed and/or fast forward/rewind buttons to control playback position.
3. To playback a different video from the media, go to Menu/Load Recording and select the video from the list.
4. Press **CTRL+I** to end the playback and return to live video.

You may also use the following keyboard commands to control playback:

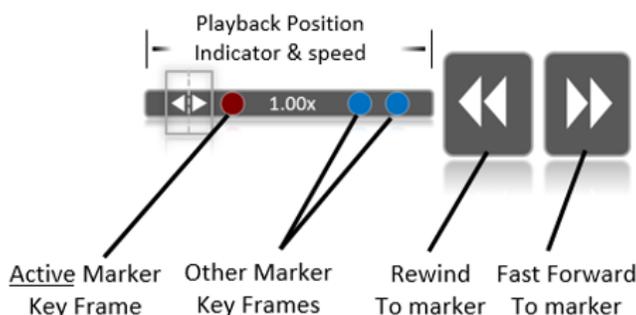
- **CTRL+S through J** = Rewind by different increments (see table below).
- **CTRL+W through U** = Fast Forward by different increments (see table below).
- **CTRL+ALT+A** = Speed up playback.
- **CTRL+ALT+Q** = Slow down playback.
- **CTRL+K** = rewind to the start of the recording.

### Incremental rewind/fast forward hotkey combinations

Incremental Fast Forward		Incremental Rewind	
CTRL+W	3 seconds	CTRL+S	3 seconds
CTRL+E	10 seconds	CTRL+D	10 seconds
CTRL+R	30 seconds	CTRL+F	30 seconds
CTRL+T	2 minutes	CTRL+G	2 minutes
CTRL+Y	10 minutes	CTRL+H	10 minutes
CTRL+U	60 minutes	CTRL+J	60 minutes

### Navigating Between Markers During Playback

Marker positions are indicated on the playback position indicator. A red circle indicates the position in time where the currently active marker resides; blue circles indicate the position of other markers. When markers are present, use the rewind and fast forward to marker buttons to move playback to that section of video.



The following keyboard hotkey combinations can also be used to skip forward or backward to marker locations during playback.

- **CTRL+Q** skips to next marker in playback
- **CTRL+A** skips to previous marker in playback

### Recording Notes:

- One hour of HD video will consume roughly 4 GB of drive space. Be sure to plan drive capacity accordingly.

- Most consumer, off-the-shelf drives are formatted to FAT32. However, for best performance, drives should be formatted to NTFS or exFAT.

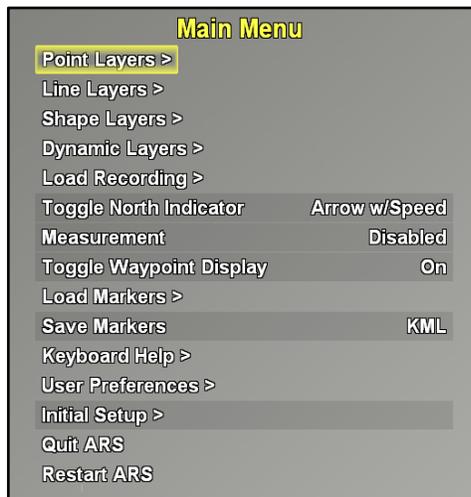
**TIP**

If recording to a FAT32 formatted media source, the recorded files will break into 4GB files. This will not happen if the media source is formatted to NTFS or exFAT. If you will be using an Apple product to review or edit videos, it is recommended that the media source be formatted to exFAT.

- To set the preferred drive for recording, go to Menu/Removable Media/Set Preferred drive while the drives are connected.
- A configurable recording buffer will record approximately 15 seconds prior to pressing the record button.
- If ARS has been configured to do screen recording, the image that is displayed on-screen, including the overlay if displayed, will be recorded when the **REC button** or **ALT+Y** is selected. Please note, the video will be recorded in the resolution selected for the monitor, not the resolution of the camera video.
- The default recording format is H264 video with AAC audio in a TS (Transport Stream) file. Other video encoding and audio encoding options are available if your video editing software is not compatible with this format.

# The On-Screen Menu

## General Information



The ARS menu is accessed by pressing the MENU button or by using the M key. Use the menu to select features and layers, to configure the system, or to format items shown on-screen. Menu items in white text are selected for display and items in black text will be hidden from view. While the menu is open, information about the selected menu option will display in the lower right corner of the screen. Press the back button (upper left) or use the **Backspace key** to return to the previous menu.

By default, any changes made in the menu will be saved upon exit. If you prefer not to have changes saved, go to Menu/Initial Setup and select **Auto-save Settings to Off**.

To close the menu, press the ESC key or click the X button.

## Point Layers

Use the Point Layers menu to select point information or icons to display or hide from view. Select the items you would like to display on-screen. The display of Point Layers is independent of the selection made from the **OFF/STREET/PARCEL** overlay button, which hides only street and address data but will NOT hide the items selected for display under this option.

Layer options can vary based on area and data availability but can include:

- Cities/Places
- Airports
- Parks
- Schools
- Antenna Structures
- Dams
- Golf Courses
- Hospitals
- Rail Stations
- Rest Areas
- Beaches
- Border Crossings
- Ferry Terminals
- Mines
- Tunnels
- Highway Exits
- Highway Mileposts
- Counties

## Line Layers

The Line Layers menu allows you to select lines or layers to display or hide from view. The display of Line Layers is independent from the selection made from the **OFF/STREET/PARCEL** overlay button. Layer options can vary based on area and data availability but can include:

- Airspace
- Rail Roads
- Water Lines
- Trails
- Cities
- Unincorporated areas
- County Outlines

## Shape Layers

Shape Layers are shaded polygons that indicate various ground features in the NAV and NIGHT map modes. Shape Layers contain items such as:

- Cities
- Unincorporated Areas
- Schools
- Parks
- Water
- Runways
- Buildings

## Dynamic Layers

Use the Dynamic Layers menu to display or save changing layers of data like the flight path of the aircraft, camera path, and camera area viewed. Dynamic Layers can also be used to draw lines, layers, perimeters, search patterns, and to upload and unload data.

ARS creates several dynamic layers automatically. Each of these layer types have the following available menu options:

<b>Show</b>	Select <b>Show</b> to display on-screen the path selected.
<b>Save</b>	Select <b>Save</b> to save the trail to a USB drive. You may save the file as a KML file (compatible with ARS and Google Earth) or as a Shape file (compatible with ARS and ESRI). Once saved, the path can be uploaded into ARS for display or into Google Earth, ESRI or another mapping type application.
<b>Color</b>	Select <b>Color</b> to format the color of the path as displayed on-screen.
<b>Reset</b>	Select <b>Reset</b> to delete the current path and begin a new line.
<b>Disable</b>	Select <b>Disable</b> to hide the on-screen display of the path.

### Aircraft Breadcrumb

Select **Aircraft Breadcrumb** to display, format, and save the path that the aircraft has traveled.

### Camera Breadcrumb

Select **Camera Breadcrumb** to display, format and save the path that the camera has traveled.

### Camera Area Viewed

Camera area viewed will paint on-screen the area viewed by the camera. It is useful in SAR efforts to see the entire area covered and to identify any areas that might have been missed. Select **Camera Area Viewed** to display, format and save the area that the camera has viewed.

### Other System Layers

Certain integrations with external products can be used to create Dynamic Layers. Examples include AIS (vessel IDs), ADS-B (aircraft IDs), AVL (EMT & patrol vehicles), and direction finders. These layers can be hidden when they are not needed and will only appear if they are generating information.

## Create New Layer

**Create New Layer** (shortcut key, **ALT+L**) allows points, lines, shapes, and search patterns to be created and displayed on-screen. This feature can be used to outline a fire perimeter, to draw a line for the camera to follow, or to highlight an area of interest such as an oil spill or to generate search patterns on-screen.

When the **Create New Layer** option is selected from the menu, the layer menu is displayed in the upper left corner of the screen. For detailed information on creating layers, please refer to the Drawing and Layers section of this manual.



### Layer

Once a layer is created it will be added to the Dynamic Layers menu, titled *Layer\_yyyy-mm-dd-time*. Select the layer name for the list to display, hide, save, follow with the aircraft, follow with the camera, center on, rename, edit, delete or lock that layer.

- |                       |  |
|-----------------------|--|
| <b>Show/Hide</b>      | Select <b>Show</b> to display the layer on-screen and whether the layer is visible in the video and map mode, or both.   |
| <b>Save</b>           | Select <b>Save</b> to save the layer to the connected USB drive. Select the format (KML or Shape file). If no USB drive is inserted, you will not be able to save the layer.   |
| <b>Color</b>          | Select <b>Color</b> to format the color of the layer. You may select: <ul style="list-style-type: none"> <li>• Red</li> <li>• Green</li> <li>• Blue</li> <li>• Purple</li> <li>• Cyan</li> <li>• Orange</li> <li>• Yellow</li> </ul> |
| <b>Show Info</b>      | Displays basic information about a layer, such as number of features, perimeter, and area.   |
| <b>Vehicle Follow</b> | Select <b>Vehicle Follow</b> to follow the layer, line or perimeter with the aircraft. Turn on Waypoint display to display a CDI and information on-screen to direct the pilot to the layer.   |

<b>Camera Follow</b>	Select <b>Camera Follow</b> to direct the camera to follow the layer, line or perimeter. Turn on Waypoint display to display a CDI and on-screen buttons to control speed, direction and pause capabilities of camera follow mode.
<b>Center</b>	Select <b>Center</b> to center the display on the layer.
<b>Rename</b>	Select <b>Rename</b> to edit or add a name to the selected layer.
<b>Edit</b>	Select <b>Edit</b> to edit the points in an existing Layer. To edit, select the Move, Delete or Name button and select the point to make it active. Once your changes have been made select <b>Done</b> .
<b>Remove</b>	Select <b>Remove</b> to delete the selected layer from the system.
<b>Lock</b>	Select <b>Lock</b> to save the layer to be available after the shutdown of the system.
<b>Unlock</b>	<b>Unlock</b> the layer to allow it to be deleted upon power down.

### Load Layer

Select **Load Layer** to upload a layer for display. Once the Load Layer option is selected a list of all layer files available on the connected media sources will display. The naming convention for layers is: *Layer\_Date- and a sequential number of the file*. Select the desired layer to upload it into the system for display.

### Unload All Custom Layers

Select **Unload All Custom Layers** to remove all custom layers from the system.

## Load Recording

Select **Load Recording** to load a video recording from the connected media source for playback through the system.

## Toggle North Indicator

Select **Toggle North Indicator** to toggle the north indicator arrow between off, display of the north indicator or display of the north indicator with speed and direction display. You may also use the keyboard **C key**.

## Measurement

Select **Measurement** to toggle between display of Speed Measurement, Distance Measurement, or disabling the measurement tool. For detailed information on the use of Speed Measurement, please refer to the Speed Measurement section of the manual. The measurement tool can also be displayed using the **V key** on the keyboard.

## Toggle Waypoint Display

The Waypoint Display provides the crew with information that can be used to navigate to the active marker. Select **Toggle Waypoint Display to ON** to turn on the waypoint. You may also use the **W key** on the keyboard to toggle the display. The information displayed aids the crew by providing heading to the marker, aircraft speed, distance and ETE to the marker location. This information is displayed as follows:



Select **On w/Arrow to** show the waypoint display with an on-screen arrow/overhead compass showing direction to the active marker as well as the azimuth where the camera is pointed.

### Locking Markers in the Waypoint Display

The lock marker feature allows the operator to “lock” the waypoint display’s information onto a certain marker. This is helpful in situations where the aircraft is enroute to a marker location but the operator needs to place additional markers not related to the destination marker (the one to which the aircraft is flying). By locking the destination marker in the waypoint display, the crew will always be provided with navigational information to that marker regardless of how many other markers are added. Keyboard users can use the E key to lock/unlock the marker.

When locked on to a marker, you may wish to return the active marker to the destination marker (i.e. to slew the camera to that location or obtain other information about it). To do this quickly, press the target button in the lower right corner of the waypoint display box or use the **ALT+E keys**.



To unlock the marker in the waypoint display using a touchscreen display, simply press the lock button a second time or, with the keyboard, press the **E key** a second time.

### Load Markers

Select **Load Markers** to upload a saved marker file into ARS. When selected, a list of all the saved marker files available on the connected media will list on screen. Select the file and the markers will be uploaded. Uploaded markers will display on-screen and be available to search through the Search feature.

### Save Markers

Select **Save Markers** to save the current markers to the USB/SD media source to transport to an ARS Ground Station, an external mapping program such as Google Earth or ESRI or to save for re-import later into ARS.



**Markers are temporary and will be deleted when the system is powered off unless the markers are saved by using the Save Markers feature.**

When “Save Markers” is selected, you will be prompted for the type of file:

- **KML**                      Select **KML** format to be used with ARS and compatible with Google Earth.
- **Shape file**              Select **Shape file** format to be used with ARS and compatible with ESRI.

## Keyboard Help

Select **Keyboard Help** to see a list of Keyboard Shortcuts available through the system.

## User Preferences

Select **User Preferences** to select set up and display options for the system.

### Profiles:

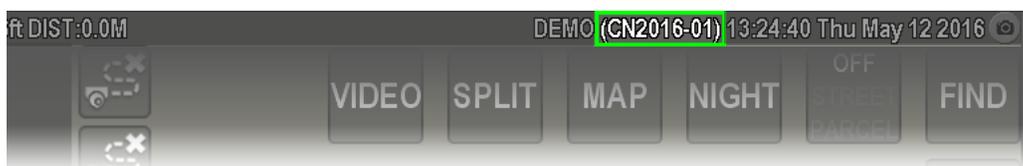
By default, ARS uses a single default configuration that applies to all users. Changes made to the settings in the *User Preferences* section of the menu are applied to this default configuration and are available to all system users.

The profiles feature allows an operator to change system settings to suit individual preference or mission requirements and then to save the changes to a user-specific profile. There is no limit to the number of profiles that can be stored in the system and operators can create multiple profiles for various missions. Profiles can be saved and exported to other ARS installations as well.

### Steps for creating a new profile:

- 1) Access the Profiles feature under the “User Preferences” menu.
- 2) Choose the menu option for “Create Profile” and provide a name for the profile. Press the enter key to save the profile name.
- 3) Make the desired changes to the preferences and settings.
- 4) Finally, save your settings by selecting your profile under the User Preferences -> User Profiles -> (your profile name) and selecting the option to “Save”.

Subsequently, when a profile is active, any changes made to the user preferences will need to be re-saved to the profile to be associated with the active profile. When a profile is active, the name of the profile will be shown in the upper right on-screen text (as shown below).



Profiles can be saved at any time but loading or unloading a profile requires a system restart. If desired, users can apply password protection to their profile. This will protect the profile from being accessed or changed by unauthorized users.



**Note: Unload the active profile prior to changing any setting in the “Initial Setup” menu in ARS. Once you have completed your changes, use the Initial Setup > Advanced > Save Default Config menu option to save changes prior to re-loading your profile.**

## Recording

The recording menu allows you to control various aspects of the recording operation within ARS including formatting the removable media, controlling the record indication “light”, setting duplicate recordings, and setting preferred primary and secondary drives for recording primary and AUX video.

## Format Media

Select **Format Media** to format the drive to NTFS, FAT32, or exFAT for use through ARS. If using Microsoft Windows we recommend NTFS format for recording video. For greater compatibility when using an Apple product or Samsung Smart devices for reviewing video, we recommend exFAT format.



Formatting will delete everything on the formatted drive.

## Pulse Light

The behavior of the recording indicator “light” in the upper left corner of the screen can be controlled with the settings in this menu option.

## Recorder Duplicate Recordings

ARS can be configured to record up to three channels of video. When set to “enabled”, these options will output two identical copies of the recorded video to two separate drives. Video sources can include, primary, AUX, etc.

## Preferred & Secondary Drives

Select **General Preferred Drive** to select which of the connected drives will be used to record video through ARS. Configure additional preferred and secondary drives based on video sources.

## PIP Location

Select **PIP Location** to select where on-screen the picture-in-picture window will display. For detailed information on the use of Picture in Picture please refer to the Picture in Picture section of the manual. You may select:

- Custom
- Lower left
- Upper left
- Upper right
- Lower right

## Coordinate System

Select **Coordinate System** to select the coordinate system preferred for location display through ARS. Operators may select:

- |               |                       |
|---------------|-----------------------|
| • Decimal     | • OS Numeric          |
| • Deg-Min-Sec | • OS Zones            |
| • Deg-Min     | • Swiss Grid          |
| • UTM         | • SweRef 99           |
| • MGRS        | • Swedish Grid (RT90) |
| • GARS        |                       |

## Units

Select **Units** to set the units of measurement displayed through ARS for Ground Units, Minor Ground Units, Altitude Units, Air Units, Pattern Units, and Measurement Units. You must exit and restart ARS or reboot the system to see the changes made through the Units selection of the menu. Operators may select:

- Miles (M)
- Kilometers (km)
- Feet (ft)
- Meters (m)
- Yards (yd)
- Nautical Miles (NM)

Measurement Direction can also be set through the **Units** option. Measurement Direction can be set to:

- Cardinal
- True bearing
- Magnetic Bearing
- Hours (“7 o’clock”, etc.)

## Waypoint Mode

Waypoint Mode controls how the information displayed within the on-screen waypoint display is shown. It can be set to either a) Elevation and Azimuth of the camera; or b) Range (ETE) to the active marker, in addition to distance, speed, and heading.

## North Indicator

Select **North indicator** to choose the format the north indicator crosshairs will display in Video mode. The North Indicator appears at the center of the ARS screen and can be toggled via the menu or by using the C key.



### TIP

The speed readout near the compass indication on the North Indicator shows the speed of the reticle across the ground, not necessarily the speed of the target.

### Size Mode

Size mode options include: Same Size on Screen or Fixed Length in World (value set by “Radius” setting).

When set to “Fixed Length in World”, the North Indicator will ALWAYS be twice the radius distance from tip to tail. For example: if the radius is set to 5 meters, the arrow will always be 10 meters from tip to tail when displayed on-screen.

When set to “Same Size on Screen” dynamic sizing is enabled and the arrow will change in size based on the zoom level of the display. If displaying the speed on screen, a distance will display as well showing distance from the center of the arrow to the tip or the circle center to edge. If displaying Transparent Arrow, the displayed distance relates to the area between the goal posts as shown on screen.

**Appearance**

Select the appearance of the North Indicator. Options include:

- XYZ - Shows the X, Y, and Z axis (N, S, E, W, and Up)
- Arrow - Displays a simple arrow pointing north
- Transparent Arrow - Shows a thick transparent arrow pointing north
- Circle - Displays a circle displaying the Radius entered with red pointing north

The appearance of the North Indicator can be changed to the following:



*Arrow (with speed)*



*Transparent Arrow*



*Circle*

**Radius**

Enter the **Radius** (in meters) and press Enter. The radius will be used to calculate and display the circle crosshair display and to determine the size of the arrow if dynamic sizing is disabled. The radius value is entered in meters.

**Altitude Display**

The Altitude Display setting controls the display of aircraft altitude in the upper left corner. Available options are: None, AMSL, AGL, or Both.

**Distance Display**

Distance Display controls the display of distance to the target in the upper left corner. Available options are: Ground Distance, Slant Range, or Both.

**Marker Heading**

Select **Marker heading** to set the heading reference to the active marker; Aircraft, True North, Magnetic North, or Aircraft Verbose. This will affect the heading value in the marker information display at the bottom right side of the screen.

**Waypoint Heading**

Select this option to change how the heading to the locked or active marker is displayed in the waypoint display only: Relative to Aircraft, True North, Magnetic North, Aircraft Verbose (uses the aircraft as the point of reference, ex: "40° left"), or Hours (ex: 10 o'clock, 5 miles).

**Mouse Cursor**

If your system is equipped with a mouse or touchpad, this setting enables the mouse cursor to be visible on the screen. For most touchscreen installations, this setting is defaulted to "off".

**ARS Crosshairs**

Select **ARS Crosshairs** to turn the crosshair display within ARS on or off. This crosshair display is separate from any camera-based crosshairs that may also display on the live video feed. Operators can change the appearance of the crosshairs; size, color, and width.

**Search Options**

Select **Search Options** to determine what actions ARS will take when a location is entered through the search feature.

- Post-Search** Select **Post Search Behavior** to select what action ARS will take (what will display) when a location is entered though the Search feature.
- Select **Stay on Current** to direct ARS to remain centered on the current display mode.
- Select **Video** to switch to Video Mode centered on current camera location.
- Select **Target** to switch to Map Mode centered on target (camera center). This is set by Default.
- Select **Search Result** to switch to Map Mode centered on the location entered.
- Select **Aircraft** to switch to Map Mode centered on aircraft location.
- Select **Split Video/Target** to switch to a split window with Video mode on the left and Map mode centered on the target (camera area viewed) on the right.

- Search Center** When entering locations though the Search feature in ARS, there is no need to enter the city, county, or state of that location. Simply enter the street address, business name, etc. and ARS will list the matching locations in proximity to either the camera target or the aircraft location. Use the **Search Center** option to choose proximity of the Camera Target or Aircraft when entering a search location.

- Coordinates Numpad** Coordinates Numpad controls display of the on-screen number pad on the coordinates entry. Set to: On / Off

- Reset Search Tab** Reset Search Tab defaults the search feature to the “Basic Search” tab if enabled.

- Reset Search Fields** Reset Search Fields controls whether the text from the previous search will remain in the search field following a search.

- Auto Geopoint** Auto Geopoint controls the behavior of the camera when using search. If set to On, the camera will be commanded to automatically move to (geopoint) the search result.

- Search Radius** The search radius option allows operators to set the radius within which search results will be provided. For example, if set to a value of 160,934 meters (100 miles) only results that are within that distance will be shown in the search feature.

### Video Options

Select **Video Options** to format how the split screen and the video is displayed.

- Split Location** Select **Split Location** to determine if split-screen video will display in the **Left, Right, Bottom, or Top** of the screen.

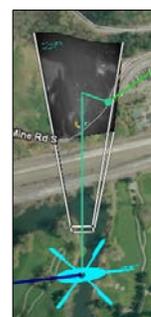
<b>Split Mode</b>	Split mode determines the layout of split screen mode; <b>side by side</b> or with the <b>map</b> or <b>video inset</b> .
<b>Split Offset Left</b>	The value used in the <b>Split Offset Left</b> setting determines the distance of the split inset window from the left side of the screen.
<b>Split Offset Bottom</b>	The value used in the <b>Split Offset Bottom</b> setting determined the distance of the split inset window from the bottom of the screen.
<b>Split Scale Width</b>	<b>Split Scale Width</b> is the amount of screen taken up by the split screen while in split screen mode. Values should be entered as a decimal value between 0 and 1. For example, .25 will allow the split screen 25% of the screen width.
<b>Split Scale Height</b>	The value in the <b>Split Scale Height</b> setting determines the height of the split screen for inset mode only. Values should be entered as a decimal value between 0 and 1. For example, .25 will allow the split screen 25% of the screen height.
<b>Split Zoom</b>	Select <b>Split Zoom</b> to determine if the video will be <b>Centered</b> or <b>Zoomed</b> when displayed in the split screen. <b>Centered</b> shows the entire video image in the pane. <b>Zoomed</b> shows a zoomed video image, trimmed to fit the pane.
<b>Preferred Zoom</b>	Set the <b>Preferred Zoom</b> to <b>1</b> to fit the screen. Select <1 to zoom in and >1 to zoom out. This is meant to show more or show less of the camera symbology on-screen and allows the default to be selected.

## Map Options

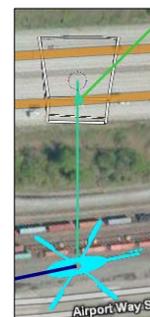
The Map Options menu allows configuration items displayed on-screen.

<b>Startup View</b>	Operators can change the mode in which ARS will start: <b>Video</b> , <b>Map</b> (centered on the target, marker, or aircraft), or <b>split screen</b> mode
<b>Overhead Compass</b>	Select <b>Overhead Compass</b> to turn the compass display on or off.
<b>Heading Line</b>	Select <b>Heading Line</b> to turn the heading display <b>On</b> or <b>Off</b> . If the heading line is turned on, it a black line will display from the front of the aircraft to show the current aircraft heading.
<b>Map Lines</b>	Select <b>Map Lines</b> to select which lines to display on screen. Depending on the selection entered, the system can display lines to the marker, to the vehicle and to the nearest street.  Selections include: <ul style="list-style-type: none"> <li>• Marker, Vehicle, and Nearest Street</li> <li>• Marker Only</li> <li>• Marker and Vehicle</li> <li>• Off to hide all lines</li> </ul>

<b>Camera Line</b>	Show or hide the line that is drawn from the aircraft to the camera target (i.e. center point of the camera FOV).
<b>Target Reticle</b>	The <b>Target Reticle</b> setting displays a secondary reticle on the map indicating where the camera is “looking” (target). The value in this setting can be used to scale the size of the target reticle. Note: The default value is .05.
<b>Map Lines</b>	Map Lines controls what line (or lines) will be shown on-screen. These include: <ul style="list-style-type: none"> <li>• Marker, Vehicle, Nearest Street</li> <li>• Marker Only</li> <li>• Marker and Vehicle</li> <li>• Off</li> </ul>
<b>Map Scale</b>	Map Scale controls the presentation of the map scale indicator in the Map mode, video mode, both, or off.
<b>Show Vehicle Icon</b>	Select <b>Show Vehicle Icon</b> to turn the selected vehicle icon <b>On</b> or <b>Off</b> . This will display a vehicle icon at current location on-screen.
<b>Show Vehicle 3D Model</b>	Select <b>Show Vehicle 3D Model</b> to display the 3D model image of the vehicle at current location. Select <b>Off</b> to hide this display.
<b>Vehicle 3D Model Style</b>	The <b>Vehicle 3D model style</b> setting allows the operator to set the on-screen vehicle to either a <b>fixed size in the world</b> , i.e. as the operator zooms the screen out, the vehicle will get smaller, etc. or it can be set to <b>same size on screen</b> , which will not change the vehicle size based on zoom level.
<b>Vehicle 3D Model Size</b>	The <b>Vehicle 3D Model Size</b> setting can be used to scale the size of the vehicle on the screen to suit operator preference.
<b>Map Projection</b>	<p>The <b>Map Projection</b> option determines how the camera footprint will be represented on-screen. Shortcut key: Shift+P</p> <p>Select <b>Video Projection</b> to display the footprint as the projection of the video on screen.</p> <p>Select <b>Footprint Outline</b> to display the outline of the camera footprint on-screen without video.</p>
<b>Split Map Projection</b>	Toggles the camera projection on and off in split window display.
<b>Camera Frustum</b>	<b>Camera Frustum</b> changes how the camera target is displayed on the map. If Frustum is set to <b>On</b> , the camera target will be represented with a cone-like depiction. If set to <b>Off</b> , only the video footprint is shown on-screen.



Video Projection



Footprint Outline

**Zooming** Turn **Smooth Zoom** on or off to select zoom action when entering locations. If **Smooth Zoom** is set to **On**, when a location is entered through the Find feature the system will zoom out move across to the new location and zoom in smoothly. This is also true when, cycling the active marker while in **MAP MRKR**. If set to **Off** when the location is entered, the new location will be shown immediately.

**Default Map Height AGL** and **Default Map Height Aircraft** allow the user to set the desired height that will be used as the default zoom for the map in their respective modes. When **Default to Autozoom** is selected, these settings are ignored.

**Aircraft Orientation** Use **Orientation for Aircraft** to specify the orientation of the map when in aircraft center mode. Select from North up, Course up, Target up or No change.

**Target Orientation** Select **Orientation for Target** to specify the orientation of the map when in target center mode. Select from North up, Course up, Target up or No change.

**Marker Orientation** Select **Orientation for Marker** to specify the orientation of the map when in marker center mode. Select from North up, Course up, Target up or No change.

**Aircraft Always Up** Select **Aircraft Always Up** to display the aircraft up regardless of mode or map state.

**Geopoint Behavior** Select Geopoint Behavior to select what action ARS will take (what will display) when Geo-pointing. Selections include:

- **Stay on Current** to remain centered on the current mode.
- **Video** to switch to Video mode centered on camera location.
- **Target** to switch to Map mode centered on the camera target.

**Map Button Behavior** Select the behavior for the Map button when switching from video. You can select to cycle through the options in order or to select the last mode first.

**Video Off Behavior** Select the behavior for ARS if the video signal is turned off or lost. You can select to stay on the video display or to switch to map mode.

### Streets/Labels Options

The Streets/Labels options menu allows configuration items displayed on-screen.

**Road/Label Transparency** The **Road/Label Transparency** option changes the transparency of the overlaid roads and layers. Select 100%, 75%, 50% or 25%. 100% will decrease the opaqueness of the overlay, making the lines and text more vivid. While 25% will increase the opaqueness allowing more of the video image to show through. Once this selection is made a reboot is required.

**Outlines** Font **Outlines** can be disabled or enabled based on viewing needs

**Font Size** The **Font Size** option allows you to adjust the font size upward from the default setting.

**Hinged/Video Disable Hinged** The Hinged option aligns street label with the orientation of the street in the top-down map. Video Disable Hinged aligns the street labels in video mode with the camera's vantage point.

### Marker Options

The **Marker Options** menu allows changes to how marker labels are displayed and what information is saved.

**Marker Labels** Select how the markers should be labeled.

- Select **None** to display only points, no labels.
- Select **Named Highlighted** to show labels for only the active marker once a name has been entered.
- Select **Named All** to show labels for markers that have been named.
- Select **Highlighted** to show only the active marker.
- Select **All** to display labels for all markers.

**Saved Markers Projection** Saved Markers Projection allows the user to change the type of map projection used; Geographic, UTM, Alberta 10TM, or OS Grid.

**Info Prompt** If enabled, as soon as the user places a marker info prompt will display the keyboard prompting the user to name the marker and/or provide additional info.

**Search Range** The search range (in meters) specifies the distance from the marker to the nearest POI.

**Auto Screenshot** With auto screenshot enabled, a screenshot will be taken and saved each time a marker is placed.

**Additional Coordinates** When enabled, each marker will display additional coordinate sets via the "additional information" feature (A-key or bottom right indicator icon).

**Waypoint Isolation** **Waypoint Isolation** allows the operator to show direction indicators and information only if a marker is locked and being used as a waypoint (being navigated toward). No direction information will be provided for unlocked markers.

**Waypoint Autolock** When set to **off**, the operator must manually lock search result markers. If set to **on if nothing locked**, each search result marker will lock provided there are no other existing locked markers/waypoints. If set to **Always**, each search result marker will be automatically locked as a waypoint.

## Layer Options

Use the Layer Options menu to configure the parameters of automatic layer following.

<b>Orbit helper</b>	Allows the operator to set desired radius of the orbit helper in nautical miles.
<b>Hide User Layers</b>	Select <b>Hide User Layers</b> to hide the layers during Video mode view and only display during Map mode.
<b>User Layer Line Width</b>	Specifies the width of the line in dynamic layers. (default setting of 5)
<b>Distance</b>	Set the <b>Distance</b> to determine how far away a POI can be for ARS to track and follow it. This distance is entered in meters.
<b>Height</b>	Select <b>Height</b> to enter any ground height offset. For example, if following a pipeline that is 5 meters above ground level, enter 5.
<b>Zoom Speed Reduction</b>	Determines how speed will change in camera following at different zoom levels. Set 0 to disable and 1 for linear.
<b>Speed Increment</b>	This setting determines the amount of speed (in meters/sec) added or subtracted by each press of the corresponding buttons in the follow modes.
<b>Fixed Speed</b>	Defines a set speed to use when in one of the follow modes.
<b>Hug Ground</b>	<b>Hug Ground</b> allows the selection of whether to always follow the ground + offset or to interpolate between points.
<b>Camera Follow</b>	Select the type of line following; preset speed (in meters/sec) or aim the camera at the nearest POI.
<b>Search Source</b>	Select where to start the search in camera follow mode, at the vehicle or at the camera.
<b>Mode</b>	Mode allows the follow software to be tested. For regular use this selection should be set to Aircraft.
<b>Min Feature Size</b>	<b>Min Feature Size</b> determines the minimum size in meters required to be met to highlight a viewed area.
<b>Auto Record Following</b>	If enabled, this setting starts recording immediately once a follow mode is entered.

## Video Playback

Select **Live Vehicle Only** when using ARS in the aircraft. If using a ground station, select **Recorded Vehicle Allowed**.

## Screen Shots

The **Screen Shots** option allows defaults to be selected for the creation and saving of screen shots.

<b>Format</b>	Select the file format to be used when saving screen captures. You may select, PNG, JPEG, or BMP.
<b>Disable HUD</b>	If <b>Disable HUD</b> is set to <b>Raw</b> it will hide all ARS-related information from the screenshot and capture the image <i>at the native resolution for the camera</i> . If set to <b>Minimal</b> , only certain on-screen information will show, including overlays and layers. If set to <b>All</b> , the ARS interface will be shown in the screen shot and the screenshot will be captured at screen resolution.
<b>VASCAR Auto</b>	Set <b>VASCAR Auto</b> to <b>On</b> , to take a screen shot each time a marker is placed while in VASCAR mode.
<b>Auto Marker</b>	Set <b>Auto Marker</b> to <b>On</b> to automatically place a marker on-screen each time a screen shot is taken.

## Email Settings

Configuration for the email settings within ARS are contained in this menu section. These are:

<b>Screenshot Drawing</b>	When enabled, this allows the operator to annotate on top of the screenshot prior to sending it via email.
<b>Active Maker</b>	When enabled, the active marker will be attached to the email in the format specified in the subsequent setting, marker format.
<b>Marker Format</b>	Defines the format, KML or SHP, of the marker to be attached to the email.
<b>Address Book</b>	The address book provides a place for operators to enter the email addresses they use frequently. This menu option brings-up the on-screen keyboard so that an email address entry can be made. Operators can also manage default settings for each contact such as the subject and message body. Contacts can be set as default for all emails sent through ARS or removed from this menu.
<b>SMTP Settings</b>	The desired outgoing email server SMTP settings are configured via this menu option.

## Export Configuration

Select **Export Configuration** to save the current configuration to a connected USB drive.

## Restore Configuration

Select **Restore Configuration** to reload the saved configuration from the USB drive.

## System Check

The **System Check** menu option allows operators to validate the operation of ARS. If any errors or faults are present, details will be displayed in this location. Additionally, clicking on a warning or advisory message displayed in the lower left of the ARS screen will display details about the error.

## Initial Setup

The Initial Setup menu is used to configure, calibrate, and troubleshoot the system. **Once your system is configured, items in this menu should not be changed unless directed by Churchill Navigation Support.**

### Save Settings

Select **Save Settings** to save the settings through ARS.

### Save Default Settings

Selecting **Save Default Settings** will update your backup for default settings. Your default settings are saved prior to the system being shipped so that you can return to the default settings in ARS. Selecting this option will replace the factory default settings with the current selections and so is not recommended.

### Auto-save Settings

Select **Auto-save Settings** to **On** to have ARS save any menu changes automatically when exiting from the menu. If this is set to **Off** the settings will not be saved unless **Save Settings** is selected.

### Backup time

To prevent data loss in the event of an unexpected loss of mission power or unintended system restart, ARS can backup the system state at an operator-specified time interval. This feature is enabled via the Initial Setup menu where a configurable menu option sets a time threshold for each backup. By default, this setting is off, but it can be set to any number value (in seconds) to enable the automatic backup. Churchill Navigation recommends a minimum value of 120 seconds. When enabled, the state of the ARS unit – including vehicle paths, dynamic layers, markers, etc. – is backed-up to the removable drive and can be restored upon system restart.

### Regional Customer Settings

The **Regional Customer Settings** allows entry of information for display.

- |                              |  |
|------------------------------|--|
| <b>Save Default Location</b> | Select <b>Save Default Location</b> to save the current active marker as the default location for display when first starting the system. Once the system receives an active GPS location the current location will display on-screen. |
| <b>Select Country</b>        | Select the country where ARS will be used.   |
| <b>Agency Name</b>           | Enter the <b>Agency Name</b> which will display on screen in the upper right corner.   |
| <b>Tail Number</b>           | Enter the <b>Tail Number</b> which will be used as the prefix in the title of video recordings.  |

<b>Time Offset</b>	Enter the <b>Time Offset</b> from UTC/GTM for time display within the system. This time will also be used to title video recordings, screen shots and various data. This does not include daylight savings time.
<b>Auto Time Offset</b>	Set the <b>Auto Time Offset</b> to <b>On</b> to automatically change the time offset based on the current location.
<b>Auto Time Zulu</b>	Set <b>Auto Time Zulu</b> to <b>On</b> to automatically pull the time from the GPS time for the entire system.
<b>Aircraft Type</b>	Select the type of vehicle that is being used, to display this vehicle type when selected through the menu. You may select: Helicopter, Airplane, Blimp, Boat, Predator, F-16, Global Hawk, or a Car. Once a selection is made ARS will automatically reboot, before changes will take effect.

### Configuration Mode

The settings under **Configuration Mode** determine how the ARS software will register key system components and should not be changed unless specifically directed by Churchill Navigation.

### VASCAR Min Distance

Enter the minimum distance required for speed tracking to be valid. Once this distance is surpassed the speed in the speed management display will change from red to green.

### Admin Password

To set an **Administrative Password**, enter the Password.

### Initial Mic

Select **Initial Mic** to **On** for live mic and set to **Off** for mute. Once this selection is made ARS will automatically restart before changes take place.

### Touch Screen Controls

Set the **Touch Screen Controls** option to **Enable** if using a touch screen display. If not using a touch screen set this option to **Disable**. Once a selection is made ARS will automatically reboot before changes will take effect.

### Lower Left Corner Action

The **Lower Left Corner Action** allows what will happen when the lower left corner of the screen is pressed, to be selected. This can be set to **Show Ownership Information**, which will display ownership information if parcel data has been loaded on ARS when the lower left corner is pressed. Or it can be set to **Toggle North Indicator**, to toggle the north pointer from off, to display of the arrow/north pointer in the center of the screen, to display of the arrow north pointer with speed and direction display, when selecting the lower left corner of the screen.

### Calibrate Deviation

The **Calibrate Deviation** option will calibrate the VASCAR calculations when no INS (Inertial Navigation System) is being used.

### **Laser Behavior**

The **Laser Behavior** option allows selection of how ARS will respond when the laser is fired. You may select to **Do Nothing**, **Add a Marker**, or **Cycle Layers**.

### **Calibrate Optical Center**

The **Calibrate Optical Center** option allows the calibration procedure to be completed. Please see the section on Calibrating Optical Center for more information.

### **Calibrate Payload to Sensor**

The **Calibrate Payload to Sensor** option allows the calibration procedure to be completed. Please see the section on Calibrating Payload to Sensor for more information.

### **Calibrate FOV**

The **Calibrate FOV** option allows the calibration procedure to be completed.

### **Diagnostics**

The **Diagnostics** option is a trouble-shooting tool and should be set only when directed by a member of Churchill Navigation's support team.

#### **Save Diagnostics**

**Save Diagnostics** downloads the Diagnostics page to a connected USB drive. This can then be saved or emailed to Churchill Navigation support for aid in troubleshooting.

### **Advanced**

The Advanced Option allows for selection of the DHCP service for the sensor, the selection of the turret, INS and Interface, selection of command mode, and arms and lever arms and offsets. **We do NOT recommend making any changes through this menu without direction from Churchill Navigation support staff.**

## **Quit ARS**

Select **Quit ARS** to close ARS. Once the software is closed, click on the ARS icon on the desktop to reopen ARS.

## **Restart ARS**

Select **Restart ARS** to close and restart the system. This is useful when changing menu items that require a reboot such as resetting the Units of measure.

## Dynamic Layers

ARS allows for a wide range of layers to be selected, imported, created, and drawn on-screen. These layers come in several types. Dynamic layers are constantly changing layers of data like the flight path of the aircraft, camera path and camera area viewed, which can be displayed or downloaded.

### Aircraft Breadcrumb

Select **Aircraft Breadcrumb** to display, format and save the path that the aircraft has traveled.

### Camera Breadcrumb

Select **Camera Breadcrumb** to display, format and save the path that the camera has traveled.

### Camera Area Viewed

**Camera Area Viewed** will color the on-screen area viewed by the camera. This feature is useful in SAR efforts to see the entire area covered by the search and to identify any areas that might have been missed. Select **Camera Area Viewed** to display, format and save the area that the camera has viewed.



*Aircraft Breadcrumb*



*Camera Breadcrumb*



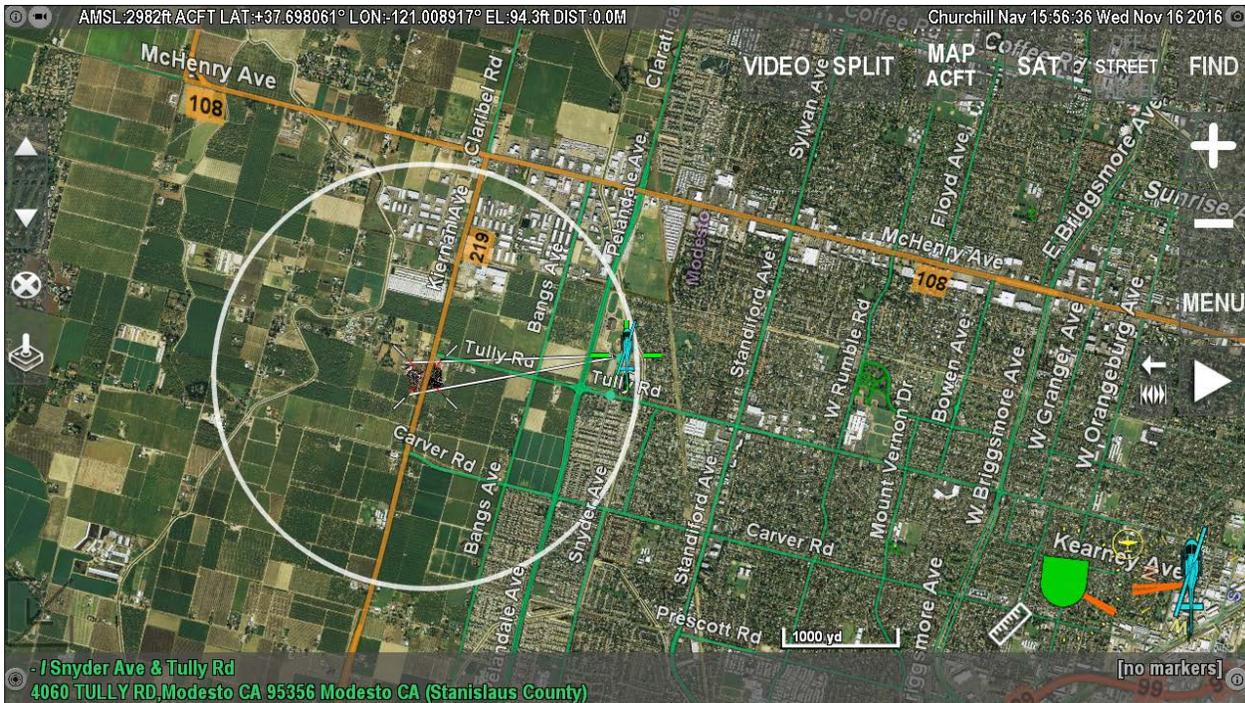
*Camera Area Viewed*

### Orbit Helper

**Orbit Helper** is a dynamic layer that is used to provide the crew with a visual indication of the desired orbit around the camera target. To set up orbit helper, the operator should first set their desired radius in the Main Menu > User Preferences > Layer Options > Orbit Helper Radius. A desired radius can be a factor of the optimal downward angle of the camera as well as desired standoff distance from / slant distance to the target.

Next, choose the option to show the orbit helper via the Dynamic Layers menu. The orbit helper can be shown on the views for top-down map, live video, or both.

Once the orbit helper circle is visible, the pilot need only to fly the profile of the layer outlined on the map or video mode, whichever is visible at the time.



Here, the operator has set the desired radius to 1 nm and the aircraft is tracking around the orbit helper orbit (outlined in white).

Each of these layer types have the following available menu options:

- Show**            Select **Show** to display on-screen the path selected. The path will be shown on screen.
- Save**             Select **Save** to save the trail to a USB drive. You may save the file as a KML file (compatible with ARS and Google Earth) or as a Shape file (compatible with ARS and ESRI). Once saved, the path can be uploaded into ARS for display or into Google Earth, ESRI or another mapping type application.
- Color**            Select **Color** to format the color of the path as displayed on-screen.
- Reset**            Select **Reset** to delete the current path and begins a new path line.
- Disable**          Select **Disable** to hide the on-screen display of the path.

## Creating New Layers

The **Create New Layers** feature available from the Menu or the keyboard shortcut **ALT+L** allows points, lines, shapes, and search patterns to be created and displayed on-screen. Once the layer is created, information about that layer is displayed in the bottom left of the screen. All layers that are not saved will be cleared from the system when it is powered down. Layers can be saved to an external drive or locked in the system so that they can be available after shutdown.

When the Create New Layer option is selected, the layer editor bar is displayed in the upper left corner of the screen. Some buttons have multiple functions that can be selected by pressing the corresponding button.



## Layer Editor Buttons



**RESET**

Deletes all features in a layer and resets the layer creation process.

### New Layer Creation Tools



**NEW**

Click on-screen to create points to draw the feature. The type of layer is dependent on the SHAPE/LINE/POINT/FREE/TRACE setting.



**MOVE**

Click **MOVE** to select a point in the active feature and move that point to a newly selected location. This mode is also used to create brand new points.



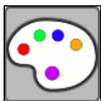
**DELETE**

Select **DELETE** to delete a point or line segment in the active feature.



**NAME**

Select **NAME** to add a name or label to a feature.



**COLOR**

Select **COLOR** to change the color of a feature.



**AIRCRAFT TRACE**

Use the **AIRCRAFT TRACE** button to create the shape using the flight path of the aircraft. Points are placed every second if the aircraft is in motion.



**CAMERA TRACE**

Use the **CAMERA TRACE** feature to create the shape using the camera. Points are placed every second if the camera is in motion.

Pressing the shape button will allow the operator to select between the following functionality.



**SHAPE**

Select **SHAPE** to create a polygon shape. The points of the polygon will be connected to create a perimeter. When the shape is created information about that shape will be displayed in the bottom left corner of the ARS screen, including:

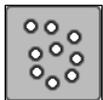
- Total number of points
- Calculated area
- Segment length
- Perimeter distance



**LINE**

Select **LINE** to draw a line on-screen by touching the desired points on-screen. The points will be connected to complete the line. When the line is created, information about the line will be displayed in the bottom left corner, including:

- Total number of points
- Segment length
- Perimeter distance



**POINT**

Select **POINT** to draw a point or a series of points.



**FREE**

Select **FREE** to draw a free shape or line by dragging your finger or the cursor along the screen. When the shape or line is created information about that shape will be displayed in the bottom left corner, including:

- total number of points
- segment length
- perimeter distance

**Search Pattern Shapes**



**PATTERN**

Select **PATTERN** to create and display search patterns on-screen. Several types of patterns can be created and once entered will display on-screen. For detailed information on the use of Search Patterns, please refer to the Search Pattern section of the manual.



**UNDO**

**UNDO** will delete the most recent point if the operator makes a mistake.



**CANCEL**

Select **CANCEL** to cancel creating the layer. This button will change to the SAVE LAYER button once a shape has been started.



**SAVE LAYER**

Once the shape is finalized, press the **SAVE LAYER** button to finalize and save the layer/shape.

### To create a new feature inside an existing layer:

1. Select the type of layer to draw using the Shape Toggle button (Shape, Line, Point, Free, or trace draw).
2. Select the **NEW** button to start the new feature.
3. Touch the screen, use the cursor, use trace, or press the **X** key to place the points for the layer.
4. Press **SAVE LAYER** when the layer is complete.

### To Edit or Save a Layer after it is created:

Choose Edit from the specific layer you wish to edit. Once the layer is complete, you must select the layer from the Dynamic Layers menu. It is titled Layer\_yyyy-mm-dd-time. Select the layer name for the list to display, hide, save, follow with the aircraft, follow with the camera, center on, rename, edit, delete, or lock that layer. Keyboard users can press **CTRL+L** to edit the last created layer.

### Importing layers from third party products:

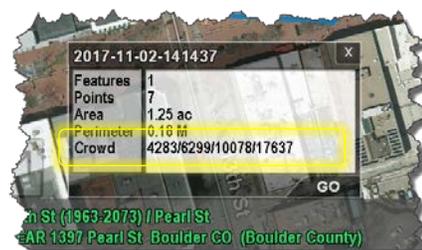
ARS supports custom icons in KMZ files. If the KMZ file has the icons exported into the file, ARS will display them. Default icons in products like Google Earth and Google Maps will not be displayed as they will not be exported into the KMZ file.

## Crowd Density Estimation

ARS can display a crowd density/size estimation using the polygon dynamic layer tool. Commonly-accepted crowd density values for congregation, marching, standing, packed densities (0.85, 1.25, 2.0, and 3.5 people per square meter, respectively) are applied to the area encompassed by the polygon dynamic layer. During the dynamic layer creation process, values for the estimated crowd density/size will be displayed along with other information about the polygon (shown below).



Once the polygon has been created, select the “layer info” option for the polygon to display the crowd density/size estimation information for the completed shape.

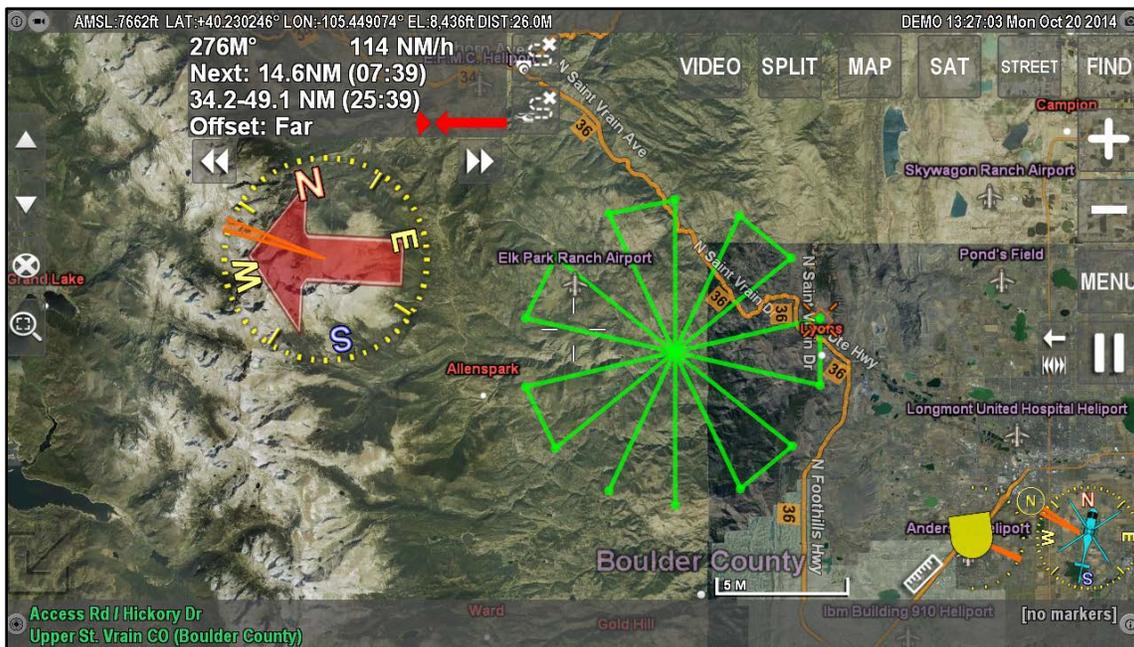


# Search Patterns

Search Patterns can be created and displayed through ARS to aid operators in Search and Rescue missions. Several types of patterns can be designed and once entered, will display on-screen. The patterns can be created by entering the necessary information in the on-screen form or by drawing the pattern out by selecting points with the touch screen. ARS includes the ability to automatically follow a line or search pattern with the camera, allowing the speed of the camera to be adjusted. Completed legs of the pattern are shown in red. Formatting options such as selecting colors and editing names is also available through the Menu. Search Patterns are temporary and will be deleted at power off unless saved. A pilot Waypoint display can be shown on-screen designating the direction and distance from the aircraft to the pattern.

Several Types of Search Patterns can be created and displayed on-screen:

-  **Creeping Line Search**
-  **Expanding Square Search**
-  **Sector Search**
-  **Expanding Creeping Line Search**
-  **Radius Circle**



Sector search pattern drawn in ARS

## How to Create a Search Pattern

Search Patterns can be created by entering the pattern information in the on-screen form or can be manually drawn on-screen using the touch screen by selecting points to be used in the pattern.



### To create and display a Search Pattern:

1. Select the **Menu** button.
2. From the Menu, select **Dynamic Layers** and select **Create New Layer**.
3. The Layer menu will display.
4. To enter a Search Pattern, select the **PATTERN** button.
5. Enter the pattern information.
6. Select **Create**.
7. **Clear** will clear the On-screen dialog box.
8. **Reset** will clear the pattern and let you start again.

## Creeping Line Search

Select Pattern: ⏪ ⏩ ⏴ ⏵ ⏶ ⏷

Start:   📍

Orientation:

Leg Width:

Spacing:

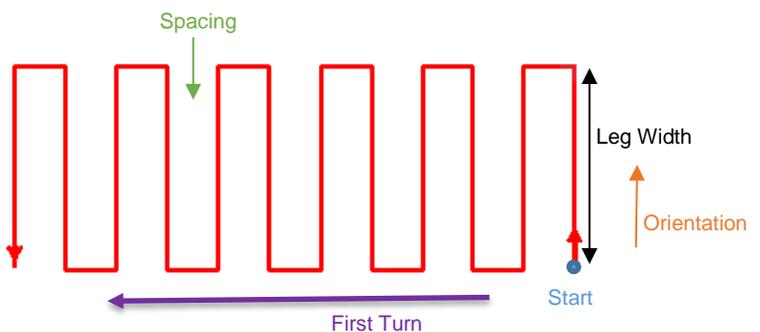
First Turn:

Legs:

Or Distance/Exit:

Start & Finish Coordinates  
 LAT:+40.021013° LON:-105.275394°  
 LAT:+40.021880° LON:-105.307989°

**Clear** **Create**



**Start:** To create the search pattern, select the point where you would like the pattern to begin.

The start location can be entered by:

- Typing a latitude and longitude into the Start field
- Clicking the start point on-screen
- Selecting the **Find** button  and entering the location

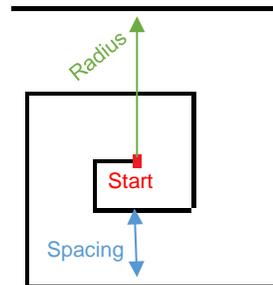
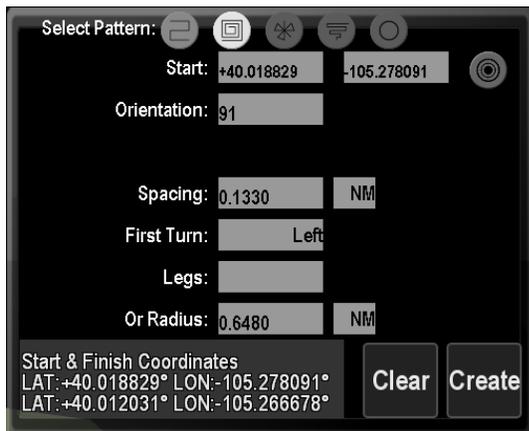
**Orientation:** Select the Orientation of the pattern in degrees (1-360°).

<b>Leg Width:</b>	Enter the width of the legs of the pattern.
<b>Spacing:</b>	Enter the track Spacing.
<b>First Turn:</b>	Select Left or Right to determine the First Turn of the pattern.
<b>Legs:</b>	Enter the number of legs in the pattern, <i>or...</i>
<b>Distance/Exit:</b>	Enter the total Distance of the pattern or the Exit distance.
<b>Clear</b>	Click <b>CLEAR</b> to clear the entry and start again.
<b>Create</b>	Click <b>Create</b> to create and display the pattern on-screen. Once the <b>Create</b> button is selected the latitude and longitude for the Start point and Finish point will be displayed in the form and the pattern will be displayed on screen.
<b>Done</b>	Select <b>Done</b> to close the Pattern Entry dialog box.

#### **To manually draw the Creeping Line Search:**

1. Using the touch screen or cursor, select the start point by clicking on the screen.
2. Enter the orientation and leg width by selecting a second point on the screen.
3. Enter the spacing and first turn direction by entering a third point on the screen.
4. The distance/exit will be calculated by clicking on the screen at the end point of the pattern.
5. Select **Create** and **Done** to display the pattern.

## Expanding Square Search



**Start:** To create the search pattern, select the point where you would like the pattern to begin.

The start location can be entered by:

- Entering a latitude and longitude into the Start dialog box
- Clicking on the spot on-screen
- Clicking the **Find** button  and selecting the location from the menu

**Orientation:** Select enter the Orientation in degrees (1-360°).

**Spacing:** Enter the leg Spacing.

**First Turn:** Select Left or Right to determine the First Turn of the pattern.

**Legs:** Enter the number of Legs in the pattern, *or...*

**Radius:** Enter the Radius of the pattern.

**Clear** Click **Clear** to clear the entry and start again.

**Create** Click **Create** to create and display the pattern on-screen.  
Once the **Create** button is selected the latitude and longitude for the Start point and Finish point will be displayed in the form and the pattern will be displayed on screen.

**Done** Select **Done** to close the Pattern Entry dialog box.

### To manually draw the Expanding Square Search:

1. Select the Start point by clicking on the screen.
2. Select the second point by clicking on the screen, which will enter the Orientation of the pattern.
3. Enter the Spacing and First Turn by selecting a third point.
4. The Radius is entered by clicking on the screen at the outside point of the pattern.
4. Select **Create** and **Done** to display the pattern.

## Sector Search

Select Pattern: [Icons]

Center/Datum: +40.074776 -105.292950 [Find]

Orientation: 358

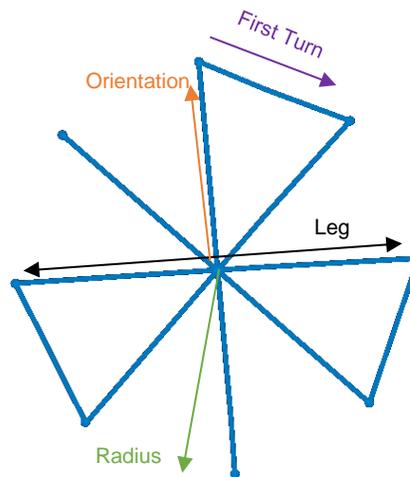
Radius: 7.0266 NM

First Turn: Right

Legs: [Field]

Start & Finish Coordinates  
LAT: +39.957849° LON: -105.287623°  
LAT: +40.154574° LON: -105.404766°

Clear Create



**Center:** To create a sector search, select the center point for this pattern to begin by:

- Typing a latitude and longitude into the Center portion on the on-screen form
- Clicking on the spot on-screen
- By clicking the Find button  and selecting the location from the menu.

**Orientation:** Select enter the Orientation in degrees. (1-360°).

**Radius:** Enter the Radius of the pattern.

**First Turn:** Select Left or Right to determine the First Turn of the pattern.

**Legs:** Enter the number of Legs in the pattern.

**Clear** Click **Clear** to clear the entry and start again.

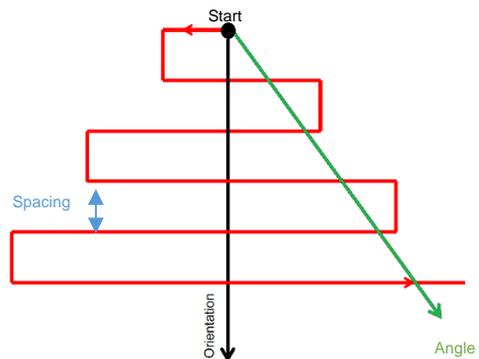
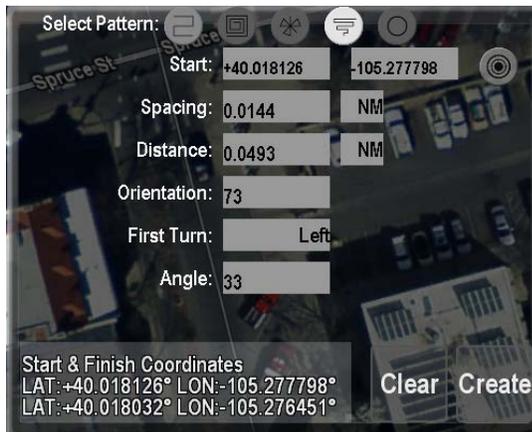
**Create** Click **Create** to create and display the pattern on-screen. Once the **Create** button is selected the latitude and longitude for the Start point and Finish point will be displayed in the form and the pattern will be displayed on screen.

**Done** Select **Done** to close the Pattern Entry dialog box.

## To manually draw the Sector Search

1. Select the center point by clicking on the screen.
2. Select the second point which will enter the orientation and radius of the pattern.
3. Enter a third point to determine the first turn direction.
4. Select **Create** and **Done** to display the pattern. Sector Search will default to four segments unless a different number of segments is entered in the form.

## Expanding Ladder/Creeping Line Search

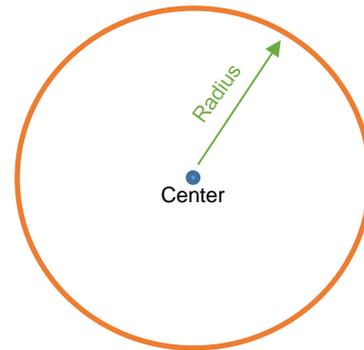
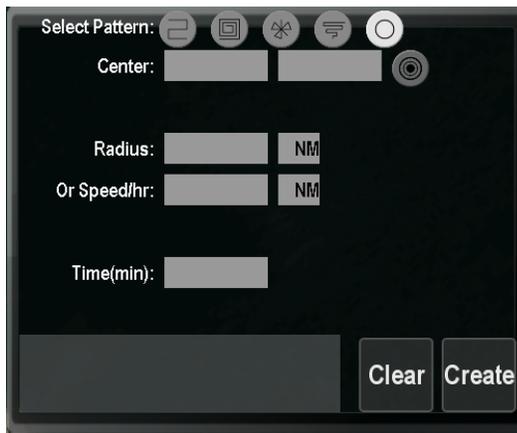


- Start:** To create the pattern, enter the start point by:
- Typing a latitude and longitude into the Start or Center portion on the on-screen form
  - Clicking on the spot on-screen
  - By clicking the Find button  and selecting the location from the menu.
- Spacing:** Enter the leg Spacing.
- Distance:** Enter the Distance for the pattern.
- Orientation:** Select enter the Orientation in degrees (1-360°).
- First Turn:** Select Left or Right to determine the First Turn of the pattern.
- Angle:** Enter the Angle in degrees (1-360°).
- Clear** Click **Clear** to clear the entry and start again.
- Create** Click **Create** to create and display the pattern on-screen. Once the **Create** button is selected the latitude and longitude for the Start point and Finish point will be displayed in the form and the pattern will be displayed on screen.
- Done** Select **Done** to close the Pattern Entry dialog box.

### To manually draw the Expanding Ladder Search:

1. Select the start point by clicking on the screen.
2. Select the second point which will enter the Spacing of the pattern.
3. Enter a third point to determine Distance, Orientation, and First Turn.
4. Enter an end point to define the angle and calculate the distance.
5. Select **Create** and **Done** to display the pattern.

## Radius from Center Point



**Center:** To create the search pattern, select the center point by:

- Typing a latitude and longitude into the Center portion on the on-screen form
- Clicking on the spot on-screen
- By clicking the Find button  and selecting the location from the menu.

**Radius:** Enter the Radius of the pattern, *or...*

**Speed/Hr:** To create a circle based on the speed and time allotted from the center point, enter the Speed per hour.

**Time:** If selecting the Speed per hour also enter the time (in minutes). The system will create the circle based on the amount of time and speed per hour entered and draw the radius/circle based on the distance possible to be traveled from the center point.

**Clear** Click **Clear** to clear the entry and start again.

**Create** Click **Create** to create and display the pattern on-screen. Once the **Create** button is selected the latitude and longitude for the Start point and Finish point will be displayed in the form and the pattern will be displayed on screen.

**Done** Select **Done** to close the Pattern Entry dialog box.

### To manually draw the Radius:

1. Select the center by clicking on the screen.
2. Select a second point by clicking on the screen, to show the outside radius required for the circle.
3. Select **Create** and **Done** to display the pattern.

## How to Edit a Search Pattern

Once the search pattern is complete, you must select the pattern from the Dynamic Layers menu. It will be titled Layer\_YYYY-MM-DD-time. Select the layer name from the list to display, hide, save, follow with the aircraft, follow with the camera, center on, rename, edit, delete, or lock that pattern.

## Camera and Vehicle Follow Modes

ARS features two follow modes that can be used in conjunction with dynamic layers to either automatically steer the camera along a line, around a polygon layer, through a search pattern, or to provide the crew with information necessary to fly the aircraft (vehicle) along/around the layer shape.

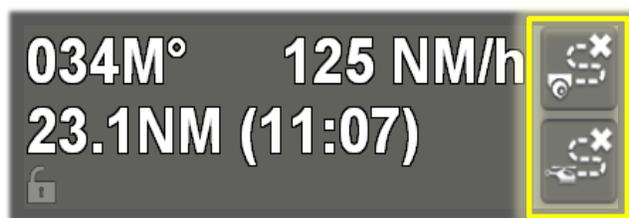


**TIP**

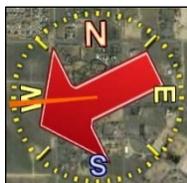
You must first create a feature within a dynamic layer to enable the follow modes. This feature can be a line, polygon, or search pattern. After you've created the feature, use the waypoint display or the Dynamic Layers menu to active the desired follow mode.

### Follow modes via the Waypoint Display

Press the **W** key on the keyboard or select **Toggle Waypoint Display (ON)** from the menu to show the on-screen waypoint display. The two buttons on the right side of the waypoint display allow quick access to the follow modes: Camera follow (top right) or vehicle follow (bottom right).



Keyboard users can select the desired layer in the Dynamic Layers menu and then select "Camera Follow" or "Vehicle Follow".



When used in conjunction with the waypoint display, the compass will show the aircraft heading in a manner that is easy to interpret at a glance.

The red arrow points to the direction of the search pattern. The orange line or cone shows where the camera is looking.

### Camera Follow Mode

With camera follow mode, the camera will automatically follow the feature (line, polygon, or search pattern). The on-screen buttons available in the waypoint display give quick access to changing the camera start point, direction, and speed. The camera movement can be sped-up, slowed down, paused, and resumed.

To start camera follow, click the camera follow button. Use the rabbit button to increase the speed of the camera movement along the feature. Use the turtle button to decrease the speed of the camera movement along the feature.

### Buttons (Camera Follow)



Select the Camera follow button to automatically follow the feature with the camera



Use the arrow buttons to select a starting point on the feature.



The reverse direction button switches the direction of movement along the feature.



The pause button pauses camera follow mode. Once the pause button is re-selected, the camera will pick up at the location the camera was stopped and continue to follow the feature.



To slow the speed of the camera along the feature, select the turtle button.



To speed up the camera along the feature, select the rabbit button.

### Data Displays (Camera Follow):

Finish:	Distance to the last point in the pattern
Offset:	Offset displays the offset of the aircraft
Progress:	Progress along the feature; current point out of how many total points
AGL	The altitude above ground level (AGL) of the aircraft
ETA:	Estimated Time of arrival
CDI:	The green arrow will display direction to the feature. The longer the arrow, the farther away the aircraft is from the feature.

### Vehicle Follow Mode

When vehicle follow mode is enabled, ARS will direct the crew toward an entry point and then along the line, polygon, or search pattern. The on-screen information available in the waypoint display gives quick access to directional information.

### Buttons (Vehicle Follow)



Select the Aircraft Follow button to have directions display to follow the feature with the aircraft.



Use the arrow buttons to select a starting point on the feature.

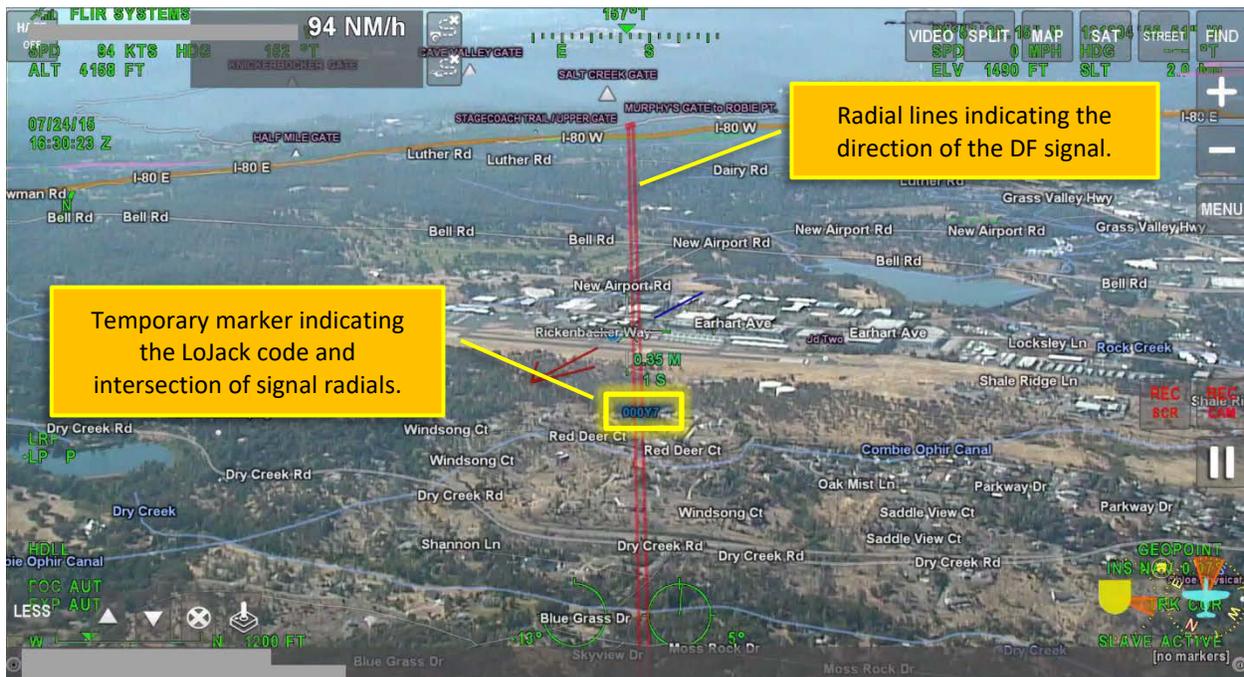
## Display (Vehicle Follow)

Heading	The direction in degrees to the feature
Next:	Distance to the next closest point in the feature
Finish:	Distance to the end-point in the feature
Offset:	Current aircraft offset from the feature
Progress:	Progress along the feature; current point out of how many total points
ETA:	Estimated Time of Arrival to first point
ETC:	Estimated Time to Completion of the entire feature
CDI:	The green arrow will display direction to the feature. The longer the arrow, the farther away the aircraft is from the feature

## Direction Finding Modes (LoJack/RhoTheta)

When supplied with bearing information from the direction-finding system (DFS), ARS will display lines emanating from below the aircraft outward in the direction of the signal. ARS depicts signal strength by the color of the radial line and will gradually shift from blue, indicating lower signal strength, to red, showing higher signal strength. Operators can choose whether to show the DFS information in the augmented reality video mode, the top-down map mode, or both. Many customers choose to use a split screen layout with the DFS information displayed only on the top down map.

When the radial lines intersect, ARS will place a temporary marker indicating a possible position for the signal origin. For LoJack instances, the code will be display as the temporary marker's name. For RhoTheta integrations, ARS will also display an area of certainty visually represented by yellow lines. This allows the operator to see how confident the direction finder is of the bearing.

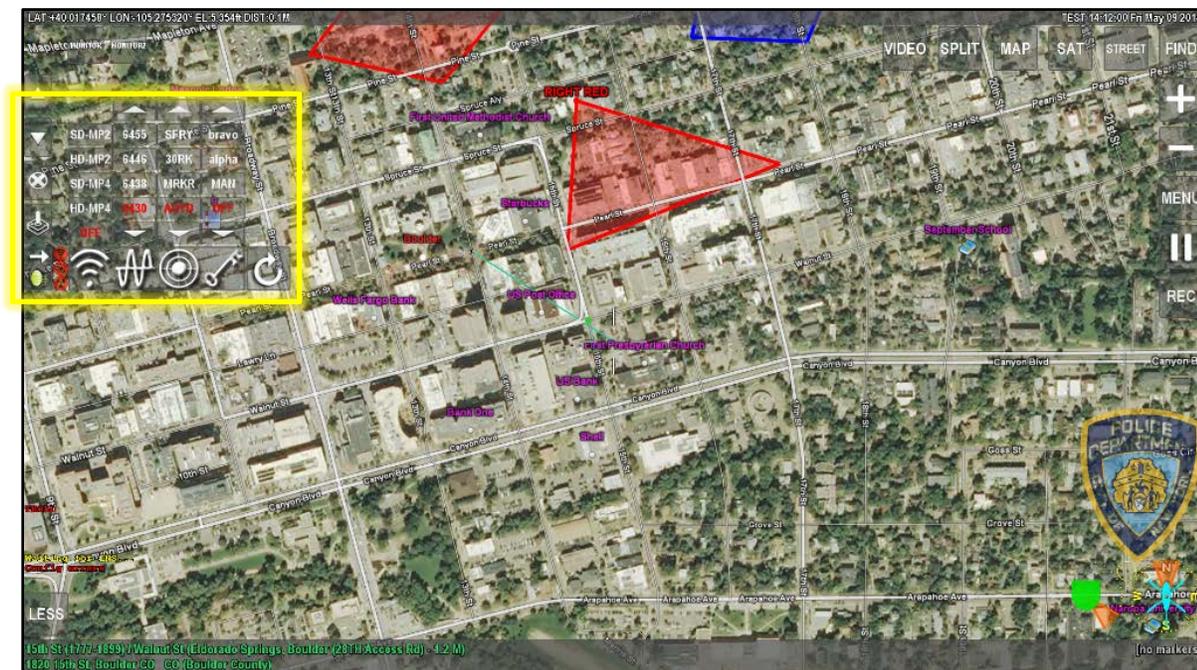


The position of this temporary marker will update as the aircraft converges on the signal source and the signal becomes more certain. Note that the location of the temporary marker should not be considered the absolute position of the signal origin, but rather a possible origin and that operators should be vigilant while searching in the area indicated.

Information about the DFS layer can be shown by choosing the “layer info” for the DFS layer in the ARS dynamic layers menu. This will display the IDs when they are provided (LoJack or Cospas-Sarsat).

To turn off the DFS display overlay, access the ARS menu, select the direction finding dynamic layer, and finally select disable.

## Downlink Control Menu



On-screen downlink controls within ARS

An on-screen interface and control menu for downlinks has been incorporated into ARS. This interface communicates with the downlink for touch screen control of the basic functionality of the downlink. Options such as: transmission, signal output, selection of transmission frequencies, selection of antenna receive sites, encryption keys and system reboot have been incorporated. Downlink transmission status, Inertial Navigation System status and the Radiation Sensor status can also be displayed. Not all features are available for all integrations or all models of downlinks and the user interface and control menu may differ based on the system integrated.

The ARS downlink interface has been integrated for the Troll C90, IMT Skymaster, and Vislink systems and may not be available for other models or systems. Please contact Churchill Navigation for details.

## How to access the Downlink Menu



To access the downlink control menu, select the on-screen downlink icon. The downlink menu will display.



To close the menu, select the downlink icon again.

## Downlink Status Display

The status of the downlink transmission, inertial navigation system (when using Troll system INS) and the radiation sensor are displayed on-screen, next to the downlink interface button. The Status icons will display in Green when the signal is active or transmitting and will display in Red when not active or experiencing an issue.



The transmission icon will display in green when the downlink signal is active and transmitting. When the downlink signal is off and/or is not transmitting, the icon will display red.



The receive site icon will display in green when the downlink's Inertial Navigation System (INS) is active and communicating. This icon will display in red if the downlink INS is not initialized or not communicating with ARS.



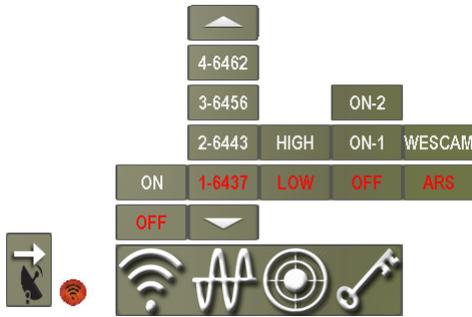
The radiation sensor icon will display in green when the RAD sensor is active and transmitting. This icon will display in red when the RAD sensor is off and/or is not transmitting.



## On-screen Downlink Menu

The on-screen menu allows for communication control to the downlink system. Using the touch screen control, press a button to select the option. The system will communicate with the downlink and once the downlink confirms this selection, the selected option will display in red. This process may take a few seconds.

The on-screen downlink menu may vary slightly depending on the model of downlink that has been integrated with ARS and/or another customization.



Downlink Menu standard



Downlink Menu custom

## Output Transmission Signal

Select the **ON** button to turn on the output transmission signal or select the type of video you would like to send via the downlink, for example:

- ON** Select **ON** to turn on the output transmission signal.
- OFF** Select **OFF** to turn the downlink transmission off.
- SD-MP2** Outputs Standard Definition Video (MPG 2)
- HD-MP2** Outputs High Definition Video (MPG 2)
- SD-MP4** Outputs Standard Definition Video (MPG 4)
- HD-MP4** Outputs High Definition Video (MPG 4)

## Frequencies

Select the frequency preset for the transmission of the downlink signal. Use the UP ARROW and DOWN ARROW keys to move through the list of available frequencies.

## Antenna Receive Site or Broadcast Power

Select the Antenna Receive Site or Broadcast Power for the transmission of the downlink. Use the UP ARROW and DOWN ARROW keys to move through the list of available options or preprogrammed receive sites.

- HIGH** Select **HIGH** to set the transmitter broadcast power to High.
- LOW** Select **LOW** to set the transmitter broadcast power to Low.

**MRKR** Select **MRKR** to slew the antenna to a designated location for transmission to mobile ground crews or to downlink to a non-programmed receive site. Markers can be entered through ARS by touching the location on screen or by entering your location through the Find feature (address, latitude longitude, business name, etc.).

**AUTO** The **AUTO** selection activates the auto function through the downlink unit. This will slew the antenna to the closest receive site programmed through the downlink.

## Encryption

Select the encryption key for the transmission of the downlink signal. Use the UP ARROW and DOWN ARROW keys to move through the list of available encryption options.

**MAN** Selects the Manual encryption setting

**OFF** Turns encryption off

## Video Input Switching

An optional video switch has been incorporated when interfacing with some downlink systems to facilitate video input switching between two video sources. Often this is used to downlink and switch between the RAW camera video and the ARS overlay video.

## Reboot

A reboot button has been incorporated with the downlink control interface. Press and hold for at least one second, to reboot the downlink if necessary.

## Email

ARS can be configured to allow the operator to email a screenshot and the current active marker (if desired) using the aircraft's on-board internet. When enabled, the pressing email button will open a secondary on-screen dialogue that allows the operator to email the screenshot to a designated recipient. Please contact Churchill Navigation Support for more information on how to enable this feature.

### Prerequisites:

- 1) The aircraft must have onboard internet via LTE/Satellite, etc. and verified connectivity.
- 2) At setup, the operator must supply an email address as well as the login credentials and SMTP (outgoing) server information for the email account.

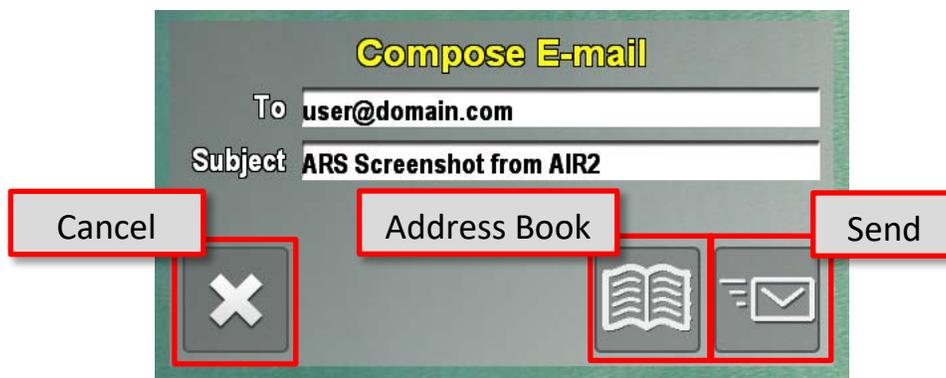
### Interface:



To access the email composer, click on the email icon button located in the lower left of the ARS screen, or press the associated shortcut bar key. This will simultaneously capture a screenshot and bring up the email editor window.

In the email composer window, enter the recipient's email address in the "To:" field or use the address book icon to access your predetermined list of contacts. Note: At present, address book contacts are defined during setup and cannot be added through the system interface directly.

Edit or change the subject line to the desired text. Pressing Shift + Backspace will clear all text entries.



*Email Composer window*

Press the send button in the lower right or the **enter key** to send the email. After pressing the send button, a confirmation message will appear in the lower left corner of the ARS screen informing the operator if the email was sent successfully.

The recipient will receive both the screenshot and, depending on desired configuration, a KML or SHP file used to precisely locate where the screenshot was captured.

### Shortcut keys:

ALT+C cycles through address book contacts  
Use Enter to send the email

# Picture in Picture (PIP)



Advanced Features

ARS can display two video inputs on-screen simultaneously in a Picture in Picture (PIP) format. In the example above, the PIP window is displayed in the lower left corner. The PIP window location can be selected from the menu. PIP selection buttons are located along the top center of the screen and allow the video inputs to be swapped and the PIP window to be turned on and off. The first two video inputs connected to ARS can be displayed though the PIP feature.

## To Display Picture in Picture

-  Press the Screen button to display the picture-in-picture view. (or use ALT+P)  
Press the button again to toggle back to Full Screen mode, turning PIP mode off.
-  Press the Swap button to swap the videos displayed in the picture in picture view. (or use ALT+I)  
Press the button a second time to swap the displayed videos back to the original configuration.

## To Select the location of the Picture-in-Picture window

The location of the Picture in picture window can be selected from Menu.

1. Open the menu and select **User Preferences** from the list.
2. Select **PIP format**.
3. Select the desired location from the list; Custom, Lower Left, Upper Left, Upper Right, or Lower Right. Note: Custom location can be set by Churchill Navigation Support.

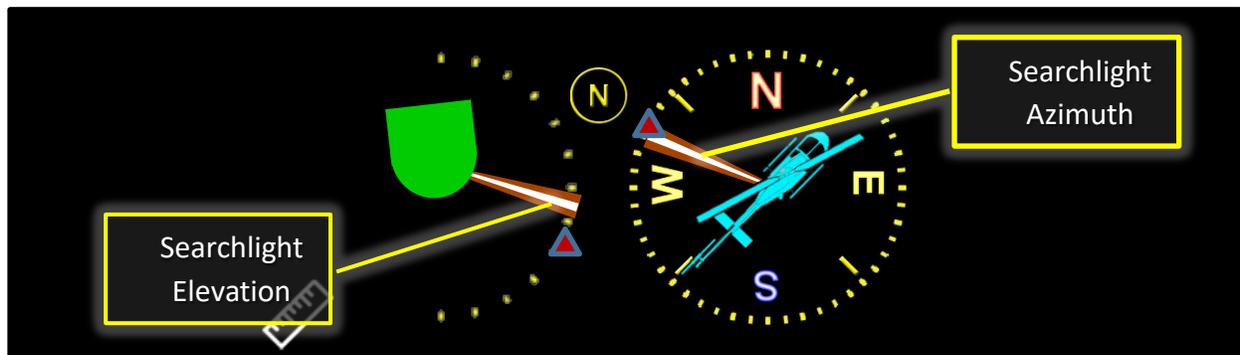
# Search Light Slaving

ARS can be used to automatically command a searchlight in one of three slaving modes: To the camera target (i.e. where the camera is “looking”), locked to a marker location, or using a pre-determined diversionary azimuth offset from the camera target. These modes are indicated via the search light button in the left-center of the ARS screen. Pressing the button multiple times toggles each mode: TGT (Target), MKR (Marker), or OFFSET (Offset).



Advanced Features

Searchlight position, whether being commanded by ARS or not, is indicated via the icons in the lower right corner of the ARS screen. The searchlight’s elevation and azimuth will show as a white cone superimposed on the camera elevation and azimuth orange cone. In the example below, the searchlight is operating in TGT mode where the camera and searchlight position are the same.



The protocol for communicating ARS information to the searchlight is always active, meaning when the searchlight is put into slave mode, the slaving mode selected in ARS will become active. The searchlight

position will always be very close to the camera position if it has been properly calibrated. The searchlight retains this calibration even when system power is turned off. With some searchlights, the operator may continue to make manual adjustments via hand controller or cyclic control while in slave mode.

 ARS must be receiving INS position information before searchlight slaving will work reliably.

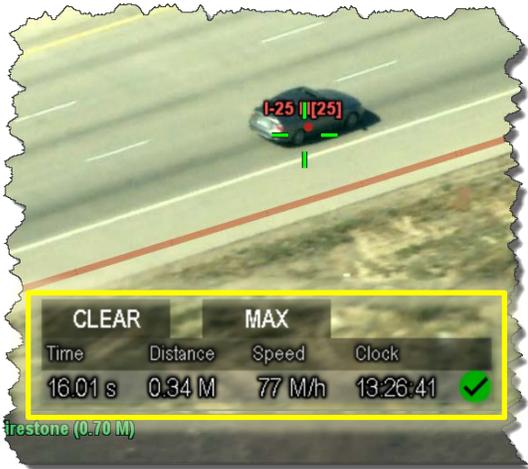
 The searchlight’s lockout areas are enforced even when it is operating in an ARS slaving mode. As a result, if the aircraft is positioned in such a way that the searchlight will pass through one of its lockout areas, the searchlight’s position may move to avoid the lockout area. It will then return to the location specified by ARS once the lockout area is not longer a factor.

When the operator no longer wants to use ARS to command the searchlight, simply exit slave mode using the searchlight hand controller or control unit.

# Speed Measurement

## Speed Measurement

Speed Measurement is an ARS feature that enables the operator to accurately determine the speed of a ground-based vehicle. Using markers placed on the tracked vehicle, ARS uses the time and distance the vehicle has traveled to calculate and display the vehicle’s speed on-screen in real time.



## Prerequisites

To ensure accurate speed measurement results, operators should ensure the following conditions are met prior to conducting airborne speed measurement using ARS.

### 1) VASCAR Minimum Distance Setup

VASCAR Minimum Distance allows the operator to specify a minimum distance (in meters) the tracked vehicle must travel for speed measurement results to display as valid within ARS. Churchill Navigation recommends a minimum of .25 miles (402 meters) be used to attain at least 95% or greater certainty in the speed measurement results. Distances greater than .25 miles are permissible. Access the VASCAR Minimum Distance setting under the Initial Setup menu. Once set, operators should not need to change this setting.

### 2) Perform Gimbal INS or Deviation Calibration Every 24 Months or After Maintenance

INS calibration (for gimbals with external IMU/INS) or Deviation Calibration (for gimbals with internal IMU/INS) should be performed under the following schedule:

- a) Following the initial installation of the ARS unit;
- b) Each time after ARS maintenance or software/hardware updates;
- c) Following gimbal maintenance or upgrade;
- d) Every 24 calendar months.

Operators will have menu options for either INS calibration or deviation calibration (not both) based on their hardware. Access the INS Calibration or Deviation Calibration setting under the Initial Setup menu.

### 3) Ensure no INS Errors are Present on Every Flight

ARS needs to have INS positional information to conduct speed measurement. Without it, speed and distance measurement is not possible. On each flight, operators should verify that ARS is not displaying a “Waiting on INS” or similar error in the lower left of the ARS screen.

If an INS error is present, power-cycling the camera may remedy the issue. If that does not clear the INS error, power-cycle the camera and fly several S-turns to assist the camera to acquire INS lock.

### 4) Conduct Pre- and Post-tests on Every Flight

Churchill Navigation recommends that a pre- and post- validation test are conducted prior to and after each speed enforcement mission to ensure the validity of the speed measurement results. Conducting a pre- and post- test is recommended to ensure the validity of speed measurement results for enforcement purposes. For information on the recommended procedures, see the Pre-test and Post-test section that follows.

## Enabling Speed Measurement

There are three ways to enable speed measurement in ARS:

### Touchscreen

1. Select the  button located on the lower right of the screen once to display the speed measurement window.

### Menu

1. Open the **Menu**.
2. Select **MEASUREMENT** from the list.
3. Select **SPEED** as the measurement feature.

### Keyboard

1. Press the **V key** to display the speed measurement window.
2. To close the speed measurement window, press **V** twice more.



## Speed Measurement Interface

Once speed measurement is enabled, the speed measurement window will appear in the lower center of the display. This window displays the time and the distance the vehicle has travelled since the placement of the initial marker. From that information, speed is calculated and displayed next to a clock (used for reference).



Once the tracked vehicle has travelled far enough to exceed the VASCAR minimum distance setting (usually one quarter of a mile), the indicator on the speed measurement window will turn from red to green indicating that the measurement process now has enough distance to return data with at least 95% certainty.

## Using Speed Measurement

To use speed measurement in ARS, the operator will need to place a minimum of two markers; the initial marker and current marker. The detailed steps are:

1. Enable the speed measurement screen as described above (ruler icon or the V key once).
2. Place the initial marker on the vehicle. Note that the indicator will initially be **red** (❌) indicating that vehicle has not travelled far enough for ARS to provide a valid speed.
3. Place another marker on the vehicle (current marker). If the text is still red, wait a few seconds and place another marker on the vehicle.
4. When the indicator turns **green** (✅), note the speed. At that point, ARS has calculated the **lowest average speed** of the vehicle between the initial and current markers. **This is the minimum speed at which the vehicle was travelling.**
5. ARS will continue to calculate the average speed of the vehicle until the speed measurement process is stopped or the markers are deleted.
6. An unlimited number of markers can be placed and the average speed will be calculated based upon the distance and time from the first marker to the last marker placed (current marker).



In this example, the vehicle was moving at least 74 mph over the measured distance (.60 miles) and time (29.15 sec).



Don't confuse reticle speed (if displayed on-screen via the north indicator) vs. speed measurement. Reticle speed is an instantaneous readout of how fast the camera's reticle is moving across the ground. Speed measurement is a much more precise process of accurately determining the speed of a vehicle on the ground.

The **CLEAR** tab will reset the interface and allow the operator to perform another speed measurement. See more in the section "Clearing Speed Measurement" below.

The **MAX** tab allows the operator to review the maximum speed that was recorded by the speed measurement process.

## Speed Between Markers

ARS calculates the average speed between the initial marker and current marker. The initial marker placed on the vehicle is always used as the starting point for calculations. If speed measurement continues for the same vehicle, ARS supports additional markers used to calculate the average speed over a longer distance. By placing another (third, fourth, etc.) marker on the vehicle, ARS will instantly calculate the average speed based on the distance and time from the initial marker to the last marker placed (i.e. current marker).

As each marker is selected, the speed measurement window will update to reflect the average speed for the selected distance and time. Remember that the initial marker is always used as the starting point for speed calculations.

Example: A total of five markers have been used during the speed enforcement surveillance of a vehicle. ARS can display the speed calculation based upon the distance and time of the initial marker to any of the remaining four markers. Just as in the instance of using two markers (initial and current), the marker selected as the "second marker" is the current marker for purposes of the average speed calculation.

### Menu

1. Use the  buttons on the left side of the screen to change which marker is the current marker for purposes of displaying the average speed calculation.

### Keyboard

1. Press the **P** key to select the previous marker and press the **N** key to select the next marker.

## Clearing Speed Measurement

Before a new speed recording for another vehicle is performed, Speed Measurement must be reset by clearing the results. This section describes how to delete only the markers used to calculate the average speed used during speed measurement. **NOTE: Closing the speed measurement window does NOT clear the results.**

### Touchscreen

1. Using either the touchscreen or cursor, select **CLEAR** in the upper left of the speed measurement window.
2. The speed measurement window and all associated markers will be cleared.

## Keyboard

1. Simultaneously press the **ALT + V** keys then release.
2. All distance markers will be deleted and the distance measurement window clear.



Using the usual methods of clearing markers in ARS (D, ALT+D, touchscreen delete button) will delete all markers, not just those used for speed measurement. To ensure that only the speed measurement markers are deleted, only use the CLEAR button or ALT+V in the speed measurement window.

## Accuracy of Speed Measurement

The average speed reported by ARS will be accurate with an error of less than 5%. To be assured of this level of accuracy, ARS Speed Measurement should be used under the following conditions:

- Validation should be performed once every 24 months or sooner if camera maintenance occurs or ARS software updates are installed. (See the **Speed Measurement Validation** section below)
- It is preferable that the section of road used to determine the average speed is:
  - Straight rather than having many curves
  - No bridges or overpasses
  - Continuous grade rather than many inclines and declines

ARS performs speed calculations based on the following formulas:

**Speed** - The calculation to determine speed is  $((\text{distance}/\text{time}) \times 3600)$ .

**Distance** - The calculation to determine distance is  $((\text{speed}/3600) \times \text{time})$ .

**Time** - The calculation to determine time is  $((\text{distance}/\text{speed}) \times 3600)$ .

## Pre- and Post-test Procedures

The pre- and post-test process ensures the accuracy of the system by individually validating the time and the distance measurement components of ARS, as well as the calculated speed value. For most agencies, this process should be used to confirm system accuracy prior to and immediately following any speed enforcement activity.

Operators can choose to perform time and distance measurement validation **OR** validation against an external standard. The processes for each are described below.

### Time Measurement Pre- and Post-test

The process for confirming the accuracy of the time measurement component utilizes a timing device and the clock within ARS. This test can be performed in-air or on-ground; however, Churchill Navigation recommend on-ground testing due to the ease of completing this process.

1. Open the speed measurement window in ARS.
2. Hold the timing device in one hand and simultaneously start the timer while pressing **X** (or touch the screen) with the other hand to start the ARS clock.
3. When the timing device reaches approximately 60 seconds, stop the timer and simultaneously press **X** (or touch the screen) to stop the ARS clock.

- Since a vehicle was not being tracked, disregard the speed and distance calculation, and only compare the time displayed on the timing device to the time displayed on the ARS speed measurement window.



- The times should be within one second of each other. If not, re-test with both the keyboard and the touchscreen (if installed). If the timing difference continues to be greater than one second, contact Churchill Navigation.

### Distance Measurement Pre- and Post-test

The process of confirming the accuracy of distance measurement in ARS must be performed in-air as it involves comparing the distance reported by ARS to pre-measured marks on the ground.

- Open the speed measurement window in ARS.
- Fly directly over the pre-measured area at a relatively low altitude with the camera pointed as straight down as possible to minimize slant angle error.
- Position the camera so the first pre-measured mark appears in the center of the lens and place a marker.
- Repeat for the second pre-measured mark.
- Since a vehicle was not being tracked, disregard the speed and time calculation, and only compare the distance displayed on the ARS speed measurement window to the known distance between each pre-measured mark.



- The distances should be within 5% of each other. If not, re-test in case the placement of the markers in ARS was not exactly on the pre-measured marks. If the distance difference continues to be greater than 5%, gimbal calibration should be performed.

### Validation Against an External Standard

The availability to perform speed measurement validation using an external standard (patrol vehicle with a certified speedometer or certified radar) will vary by operator. However, where available, this is an acceptable means of confirming the accuracy of the ARS speed measurement process. This test must be performed in-air as it involves comparing the speed reported by ARS to the known speed of the external standard (patrol vehicle). Ensure the vehicle is travelling along a flat section of road, free from bridges, overpasses, or changes in elevation.

- Open the speed measurement window in ARS.
- Place the initial marker on the patrol vehicle traveling at a known speed.

- After the vehicle has met/exceeded the VASCAR minimum distance criteria (default is .25 miles), place another marker on the patrol vehicle.
- Note the speed reported by ARS and compare it with the known speed of the external standard.



- Speed should be within 1 MPH of the external standard. If not, re-test in case the placement of the markers in ARS was not exactly on the vehicle. If the speed difference continues to be greater than +/- 1 MPH, gimbal calibration should be performed.

## Distance Measurement

### Distance Measurement

The process of measuring distances in ARS is very similar to the speed measurement process described in the previous section. In fact, distance measurement is built into the same tool as speed measurement and can be accessed by pressing the  button **twice** or by pressing the **V key twice**.

Distances can be measured in any mode; video, map, or split-screen mode. When using the distance measurement tool, you will always see the distance from the initial marker to the current marker.

### Enable Distance Measurement

There are three ways to enable distance measurement in ARS:

#### Touchscreen

- Press the  button located on the lower right of the screen **twice** to display the distance measurement window.

#### Menu

- Open the **Menu**.
- Select **MEASUREMENT** from the list.
- Select **DISTANCE** as the measurement feature.



#### Keyboard

- Press the **V key twice** to display the distance measurement window.
- To close the Speed measurement screen press **V** once more.

### Distance Measurement Interface

Once distance measurement is enabled, the distance measurement window will appear in the lower center of the display. This window displays the distance and direction from the first marker.



In this example, discarded evidence has been located 8 yards north of the road marker.



**TIP**

When placing markers used for distance measurement, it's helpful to keep in mind the saying "...from us to them" or "from good guys to bad guys". This will ensure that the direction provided is in reference from the initial marker to the current marker. This is helpful when passing along distance information to units on the ground.

## Clearing Distance Measurement

The distance provided in the distance measurement process is not cumulative – meaning that each time you place a marker, the distance and direction provided is from the previous marker to the current marker. Therefore, it's not necessary to clear the markers used for distance measurement each time the operator wishes to measure a new distance. *NOTE: Closing the distance measurement window does NOT clear the results.*

### Touchscreen

1. Press and hold the delete markers button to clear the all associated markers used for distance measurement.
2. All markers will be deleted and the distance measurement window will now be clear.

### Keyboard

3. Simultaneously press the **ALT + V** keys then release.
4. All distance markers will be deleted and the distance measurement window clear.



Using the usual methods of clearing markers in ARS (D, ALT+D, touchscreen delete button) will delete all markers, not just those used for speed measurement. To ensure that only the speed measurement markers are deleted, only use the CLEAR button or ALT+V in the speed measurement window.

## Pilot Display

Designed as a companion app to ARS, Pilot Display is an iOS compatible app developed to provide relevant navigational and gimbal data to the pilot via a mobile device.

The app communicates wirelessly with ARS and provides a pilot-centric display of information from ARS such as gimbal orientation, camera field of view, current aircraft position relative to the active marker, ETE and ETA to the active marker, slant distance information and much more.

Markers and dynamic follow layers are set in ARS and that information is displayed via Pilot Display, providing the pilot with the situational awareness to quickly and easily fly the aircraft to the defined location(s).



*Pilot Display [Apple iPhone]*

## Compatibility

Pilot Display has been designed to work with iOS (Apple) iPhone and iPad mobile devices with iOS version 9.2 or higher. Please contact Churchill Navigation Support if you are unsure if your device will work with Pilot Display.

## Requirements

Prior to using the Pilot Display app, you must have the following:

- Churchill Navigation ARS**
- Wireless router (TPLink, Pepwave, etc.) connected to the ARS unit.**
- Configuration to enable Pilot Display data and streaming video**



Churchill Navigation will provide the configuration update free of charge via remote connection. It is not recommended that this update be performed by the end-user unless specifically directed by Churchill Navigation. To schedule a time to complete the update, contact Churchill Navigation Support.

- Your iOS device must be connected to the same network as ARS.**



Your iOS device must be connected to the network of the router that is connected to the ARS unit. For router hardware recommendations and/or setup information, please contact Churchill Navigation.

## Setup

Pilot Display uses a wireless router acting as an access point to wirelessly transmit video and position data from ARS to an iOS mobile device.

Once you have confirmed that the Wi-Fi network is visible to the device on which you'll be running the Pilot Display app, complete the following steps:

### Connection Steps

- 1) Go to the "Settings" menu.
- 2) Select "Wi-Fi".
- 3) Connect your iOS device to the Wi-Fi network.
- 4) Confirm the connection status by verifying that the Wi-Fi logo (  ) is present.
- 5) Open Pilot Display. You will see a series of connection messages as Pilot Display establishes a connection to the ARS host and then the app will open.



Please see the **Pilot Display Manual** for full setup details and usage tips.

## System Calibration



**Do not attempt to alter the selections in the *Initial Setup* section of the ARS menu unless specifically instructed to do so by Churchill Navigation. Incorrect settings in this menu area can adversely impact your software operation.**

## Optical Center Calibration

The optical center of a camera refers to the location on the screen about which the camera zooms in, and about which lens distortion ("pincushion" or "barrel" effects) occur. During manufacturing of your camera, if the imaging chip was precisely centered behind the lens (and the lens was mounted in a plane precisely parallel to your sensor), your optical center will be perfect. Because the sensing elements are so small on the focal plane array (the digital sensor), however, this rarely occurs.

This presents a problem for mapping systems because, while the gimbal is telling the world it is looking at the same position when zoomed in as well as zoomed out (since you haven't physically changed where the camera is pointing), it is actually looking at two different locations. If the amount of error is egregious, you may consider contacting your gimbal manufacturer and requesting that they replace your camera.

For gimbals with an internal IMU, the manufacturer generally attempts to minimize these effects

through camera selection and/or lens collimation procedures, but they may still be present. Regardless, the internal IMU has already been bore-sighted with the camera at unknown focal length (typically they will choose one extreme or the other, or average the two) and there is no opportunity for ARS to improve matters.

Calibrating the optical center only needs to be done once for each camera: Regardless of whether you remove the camera or the INS for maintenance, the relationship of the lens to the sensor is unlikely to change and will be constant for the life of your camera unless changed by the manufacturer during servicing. (This is most likely to occur if your camera is equipped with a tele-extender lens).

For this reason, lower end gimbals often do not have an accurate optical center. This frequently comes as a surprise to users, but is easily observed (if present) by following the steps listed below.

#### **How to check if you have a good optical center calibration:**

1. Null the gyros if necessary so there is no drift; consult the gimbal manufacturer's manual for instructions on how to do this if you are unfamiliar with the procedure.
2. Choose an object, place it in the crosshairs (Figure 10), and zoom in (Figure 11). If the optical center is not the camera center, you will notice that you are zooming in to something else.

The process of calibrating the optical center can be performed in-air or on-ground. We recommend on-ground testing due to the ease of completing this process.

1. Using the gimbal, view an object that is far enough away that it will remain in-focus when the gimbal is at maximum zoom.
2. Zoom-in to the maximum limit of the gimbal and make sure to null out the drift.
3. Enable the camera calibration mode in ARS.

#### **Touchscreen**

1. Access the Main Menu by either choosing MENU.
2. Select INITIAL SETUP from the list.
3. Select CALIBRATE OPTICAL CENTER.
4. Select START in the upper right corner.

#### **Keyboard**

**Press CTRL+ALT+F9**

5. Zoom back out to the widest setting.
6. Using either the arrow keys on the screen or the arrows on the keyboard, position the crosshair back on the object chosen.
7. Verify the calibration by zooming in and out. The object should remain in the center of the screen. If it does not, the procedure must be repeated. You can adjust the offset in either the maximum or minimum zoomed in modes – the goal is to ensure the center of the target is centered in the crosshairs at both zoom levels.
8. When the optical is successfully calibrated, exit the camera calibration mode.

# INS Calibration

For cameras with external IMUs, performing an INS calibration is highly recommended when the camera or IMU has been removed/reinstalled and/or received any software updates. Cameras with integrated IMUs only need to have their *deviation* calibrated for speed patrol purposes. Systems with integrated IMUs that do not use the speed feature can skip the INS calibration and will not have INS calibration as a menu option.

**IMPORTANT:**

The INS calibration process must be performed in-air. Also, the position of the location the pilot chooses to orbit and the active marker / camera target are important. The orbit should not be too close to the marker and the orbit should not center on the marker, but should instead center on a position offset from the marker.

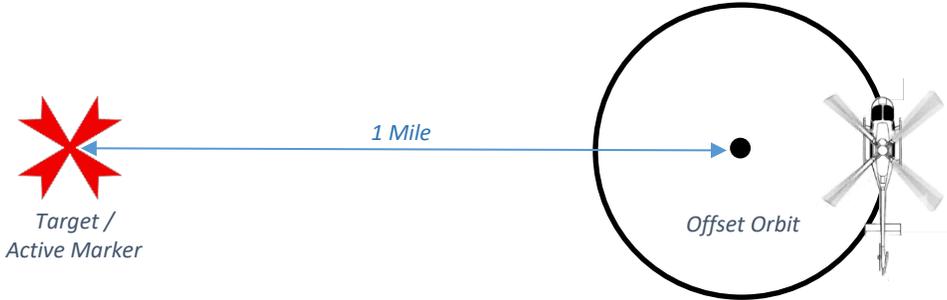
When the aircraft performs an offset orbit, the camera rotates a full 360°. By collecting points along the full rotation of the camera, ARS can accurately determine the difference between what the camera and IMU are reporting.

**While Flying**

1. Identify a feature that is clearly visible in ARS in MAP mode as well as easily located in the video. The location must be at ground level in a relatively flat area. Usually, any kind of sports field works well. In the case of a statue, the operator should keep the crosshairs focused on the base of the statue.
2. While using the MAP mode of ARS, place a marker at that location. This is your Target.
3. The pilot should pick a separate reference point around which they will fly an **OFFSET ORBIT**, centered roughly 1 mile away (no less than 0.5 miles to the marker on the inner section and not more than 3 miles on the outer section). Flying at a higher altitude is better due to a more optimal slant angle. You should use as narrow of a field as possible.



**IMPORTANT:** *The pilot should fly an offset orbit from the target – i.e. not centered on the target you select, but offset in any direction by roughly 1 mile.*



4. Once the pilot has established a consistent turn rate, select VIDEO on ARS and find your Target using the Hand Control Unit (HCU).
5. Enter calibration mode by selecting the Menu > Initial Setup > Calibrate INS menu option.

6. Select START in the upper right corner of the ARS screen. For keyboard users, use **CTRL+ALT+F6** in place of any button presses.
7. Select NEXT in the upper right corner of the ARS screen.
8. Keep the camera on a narrow zoom centered on the Target for a full 360° orbit.
9. Select NEXT in the upper right corner of the ARS screen.
10. Tap the Target on the screen *making sure to click on the actual physical target in the video, not the marker which was placed on the target*. This is called placing a point.
11. Place at least 20 points, one every few seconds. Avoid placing points when the camera is shaking or moving rapidly.
12. Select SAVE in the upper right corner of the ARS screen and verify the new calibration.

**NOTE:**

During ARS calibration, you may see the following message: “BAD INS ALIGN”. On the same screen, underneath you should see a set of numbers – Attitude Error and Position Error.

This error appears if the Attitude Error is greater than 0.15 degrees or the Position Error is greater than 10 meters. Most of the time, the above message simply means that INS did not have enough time to align.

Before attempting re-calibration, fly for 10-15 minutes with as much motion as possible (S-turns, sharp orbits, frequent change in direction, etc.). All of this will help the INS to align.

If, after all of this, you still get that message while attempting calibration, take note of the position error and the Attitude error and continue the process. The message will NOT prevent you from completing calibration.

## Calibrate Deviation

Operators who have an integrated IMU and are involved in airborne speed measurement activities should perform a deviation calibration when the camera has been removed/reinstalled and/or received any software updates. This will ensure that the speed measurement process is correctly accounting for known errors in the camera’s positional accuracy.

**IMPORTANT:**

The process of calibrating deviation must be performed in-air. Also, the position of the location the pilot chooses to orbit and the active marker / camera target are important. The orbit should not be too close to the marker and the orbit should not center on the marker, but should instead center on a position offset from the marker.

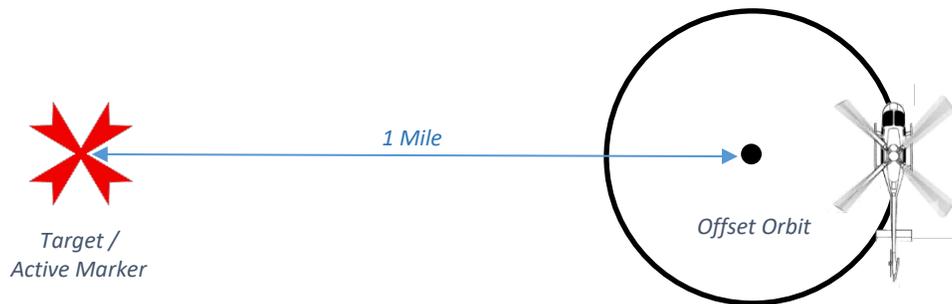
**While Flying**

1. Identify a feature that is clearly visible in ARS in MAP mode as well as easily located in the video. The location must be at ground level in a relatively flat area. Usually, any kind of sports field works well. In the case of a statue, the operator should keep the crosshairs focused on the base of the statue.
2. While using the MAP mode of ARS, place a marker at that location. This is your Target.

- The pilot should pick a separate reference point around which they will fly an **OFFSET ORBIT**, centered about 1 mile away (no less than 0.5 miles to the marker on the inner section and not more than 3 miles on the outer section). Flying at a higher altitude is better due to a more optimal slant angle. You should use as narrow of a field as possible.



**IMPORTANT:** *The pilot should fly an offset orbit from the target – i.e. not centered on the target you select, but offset in any direction by roughly 1 mile.*



- Once the pilot has established a consistent turn rate, select VIDEO on ARS and find your Target using the Hand Control Unit (HCU).
- Enter deviation calibration mode by selecting, Menu > Initial Setup > Calibrate Deviation on your monitor.
- Select START in the upper right corner of the ARS screen. For keyboard users, use **CTRL+ALT+F7** in place of any button presses.
- Select NEXT in the upper right corner of the ARS screen.
- Keep the camera on a narrow zoom centered on the Target for a full 360° orbit.
- Select NEXT in the upper right corner of the ARS screen.
- Tap the Target on the screen *making sure to click on the actual physical target in the video, not the marker which was placed on the target.* This is called placing a point.
- Place at least 20 points, one every few seconds. Avoid placing points when the camera is shaking or moving rapidly.
- Select SAVE in the upper right corner of the ARS screen and verify the new calibration.

## Calibrate Payload to Sensor

For Cameras with integrated IMUs, the calibrate payload to sensor option can be used to create a physical offset in the overlay position to account for the camera's positional errors. This option should only be used when instructed to do so by Churchill Navigation.

### While Flying

- While using the VIDEO mode of ARS, observe the current location of the overlays.
- It is not necessary to fly an orbit when perform a payload to sensor calibration.
- Enter the payload to sensor calibration mode by selecting, Menu > Initial Setup > Calibrate Payload to Sensor on your monitor.

4. Select START in the upper right corner of the ARS screen. For keyboard users, use **CTRL+ALT+F10** in place of any button presses.
5. Select START in the upper right corner of the ARS screen.
6. Use the arrows around the perimeter of the screen or keyboard arrow keys to reposition the overlay.
7. Once you are satisfied with the position of the overlays, press the SAVE button or **CTRL+ALT+F10**.

## Field of View (FOV) Calibration

Some cameras will report different values for the field of view (FOV) than what is actually present in the video. ARS allows you to correct for these variances. The visual representation of a variance in FOV can be determined by looking at two vertically aligned roads in the Video mode view and comparing that to the overlaid roads. If the overlaid roads are either farther apart or closer together than the roads in the video, the FOV should be calibrated. Note that this calibration is for each individual sensor (such as daylight, low-light, IR, etc.).

**IMPORTANT:** Total system calibration is a factor of all three calibration procedures: Optical center, INS, and FOV. You will receive the most accurate results by repeating the INS and FOV calibration an additional time after the first pass has been made at both.

### While Flying

1. In Video mode, identify a set of parallel roads and observe them as they approach a vertical orientation. Look for the overlays being wider or narrower than the actual roads. Ignore any offsets at this point – only look for the width of the overlay vs the actual roads.
2. If a significant deviation is observed, enter the calibration mode using **Menu>Initial Setup>Calibrate FOV** or **CTRL+ALT+F11**.
3. Pause the video with the pause button or **CTRL+X** once the vertical roads are visible.
4. Use the arrows keys to align the image. Note that this aligning is **ONLY** for calibration purposes and will not be saved. It allows the operator to change the size of the roads more easily.
5. Use the + and – buttons or the **SHIFT+UP ARROW** and **SHIFT+DOWN ARROW** to change the size of the road overlays to best match the roads in the video.
6. Unpause the video and verify the road overlays are more accurate. Repeat the process at both the widest zoom level and the narrowest zoom level and for each sensor as required.
7. If any errors are made in the process, use the RESET button to clear the calibration or **CTRL+ALT+R**.
8. When finished with the current zoom level, click the next button or **CTRL+ALT+F11**.
9. When done with all sensors and zoom levels, click the SAVE button or **CTRL+ALT+F11**.
10. To abort the procedure, use the CANCEL button or **ESC key**.

# Diagnostics

## Error Messages

In the event of a problem, ARS will display error codes to notify the operator that there may be an issue. Critical errors are displayed in red and should be reported to Churchill Navigation. Yellow warnings usually mean the system is waiting for GPS or INS or some other system. If unsure of anything the system does, please bring your concerns to our attention at [support@churchillnavigation.com](mailto:support@churchillnavigation.com) or (720) 744-3300.

## General Troubleshooting

To assist your support engineer, become familiar with taking screenshots and recording video. Using these two tools, many communication problems and delays will be minimized. Ensure you have a flash drive inserted into the system and capture screenshots and videos of the problems that are occurring. If Wi-Fi is available in the hangar (personal MIFI devices as well), Churchill Navigation can recommend a Wi-Fi USB dongle that will enable remote support and small updates to be performed on the system.

## Updating the system

Your support representative has three general options for providing updates. For larger updates, a new data drive is provided. This drive is then swapped out with the existing drive, and the old drive is returned. The smaller updates, an update can be provided electronically to be installed by the operator on a flash drive. If ARS has internet connectivity, the unit can be remotely updated. In many cases, before an update is performed, the support engineer will request the aircraft's current configuration. Instructions are below for obtaining and sending that information.

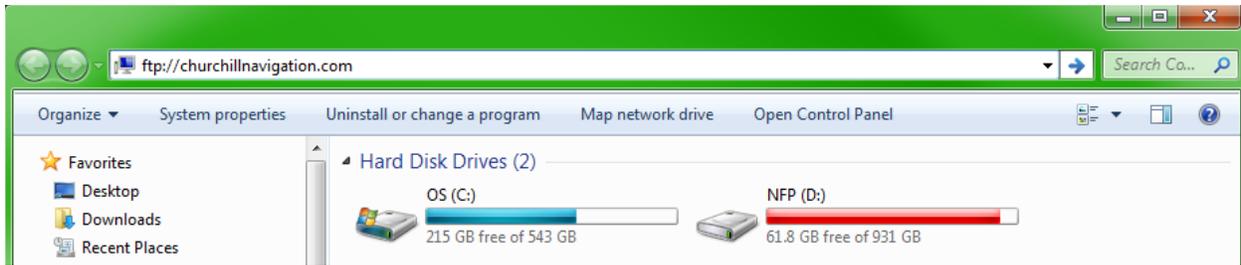
## Sending Your Configuration

If Churchill Navigation Support asks you to send your configuration file, please follow the instructions listed below:

1. Install a USB flash drive in the ARS Unit.
2. With the ARS unit on (ground power or ship's power), press M to enter the menu.
3. For ARS Versions greater than 3.0, select User Preferences/Save Configuration.
4. For older ARS versions, select Save Configuration to USB or Initial Setup/Save Configuration to USB.
5. Retrieve the USB drive and insert it into a desktop computer with an internet connection.
6. For ARS Versions greater than 3.0, locate the ARS\_ (Aircraft) directory on the flash drive. In Windows, right click on the folder and choose to send to a compressed zip folder.
7. For older ARS versions, locate the config.js file and any other .js files (such as user\_config.js) on the flash drive. In Windows, select these files and choose to send to a compressed zipped folder.
8. Send the new zip file to your support engineer. If using email and your email provider prevents sending ZIP files, please rename the file to .zi instead of .zip. If any other problems are encountered due to network restrictions on sending files, you can also use <http://churchillnavigation.com/upload>

In some rare cases, you may be asked to directly upload files to our server via FTP. Below are instructions for Windows users:

1. Go to My Computer in the start menu (or Computer).
2. In the location box in the computer window, type in "<ftp://ftp.churchillnavigation.com>" (without the quotes).



3. When prompted, enter the following user credentials:  
Username: **guest**  
Password: **boulder**
4. Drag and drop your files into the window that is connected to Churchill Navigation's FTP. Files should upload automatically.

# Keyboard Controls (Hotkeys)

Hotkey shortcuts have been programed to allow most ARS features to be selectable using only the keyboard.



**F1**

Camera



**F2**

Map on Camera  
(Target)



**F3**

Map on  
Marker



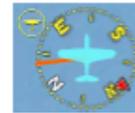
**F4**

Map on Aircraft



**F5**

Split Screen



**F6**

Compass  
Orientation

## BASICS

<b>C</b>	Displays on-screen compass and Speed of camera movement
<b>I</b>	Toggles between display of different map types
<b>O</b>	Toggles overlay and address info on and off
<b>ALT+O</b>	Toggles overlay in split screen
<b>V</b>	Toggles between measurement tool and speed tracking
<b>2</b>	Takes a screen shot
<b>M</b>	Opens the menu
<b>BKSP</b>	Previous menu
<b>1</b>	Toggles between target locations information and recorder status bar
<b>3</b>	Intersection information toggle
<b>4</b>	Marker detail toggle
<b>L</b>	Less more user interface toggle
<b>Q</b>	Image improvement toggle (haze filter)
<b>F</b>	Fade between Live video and synthetic imagery
<b>ALT+P</b>	PIP toggle
<b>SHIFT+P</b>	Toggle projection
<b>ALT+I</b>	Invert PIP
<b>CTRL+P</b>	Select PIP source
<b>U</b>	Show Underground map
<b>W</b>	Waypoint display
<b>ALT+J</b>	Follow pattern with aircraft
<b>ALT+H</b>	Follow pattern with camera

## SEARCH

<b>SPACE BAR</b>	Search
<b>SHFT + BKSP</b>	Clear entry field
<b>TAB</b>	Switch fields
<b>ARROW KEYS</b>	Switch tabs
<b>ENTER</b>	Select Result
<b>ESC</b>	Exit Search

**MARKERS**

<b>A</b>	Display additional marker info (coordinates, notes, etc.)
<b>D</b>	Delete current
<b>E</b>	Lock marker
<b>G</b>	Slew camera
<b>N</b>	Next
<b>P</b>	Previous
<b>X</b>	Mark Spot
<b>ALT+E</b>	Go to locked marker
<b>ALT+X</b>	Name
<b>ALT+D</b>	Delete All
<b>ALT+V</b>	Clear measurement markers only

**MAP MOVEMENT**

<b>UP ARROW</b>	Move map up
<b>DOWN ARROW</b>	Move map down
<b>RIGHT ARROW</b>	Move map right
<b>LEFT ARROW</b>	Move map left
<b>PAGE UP</b>	Zoom In
<b>PAGE DOWN</b>	Zoom out
<b>(+) PLUS KEY</b>	Zoom in (alternate). Can be combined with page up to zoom in quickly.
<b>(-) MINUS KEY</b>	Zoom out (alternate). Can be combined with page down to zoom out quickly.

**LAYERS**

<b>ALT+L</b>	Create a new layer
<b>CTRL+L</b>	Last layer
<b>ESC</b>	Exit editor
<b>D</b>	Delete/Move/Name toggle
<b>N</b>	New Shape
<b>T</b>	Toggle layer type
<b>P</b>	Search pattern dialogue
<b>X</b>	Create point
<b>ALT+D</b>	Delete all shapes
<b>ALT+N</b>	Layer info

**RECORDER/PLAYBACK**

<b>CTRL+X</b>	Pause
<b>CTRL+I</b>	Live
<b>CTRL+K</b>	Move to Beginning
<b>CTRL+S-J</b>	Rewind
<b>CTRL+W-U</b>	Fast forward
<b>ALT+Y</b>	Record toggle
<b>ALT+U</b>	Screen Record toggle (ALT+Y may also be used if multiple sources are recordable)
<b>CTRL+Q</b>	Skip to next marker in playback
<b>CTRL+A</b>	Skip to previous marker in playback
<b>CTRL+ALT+A</b>	Speed up playback
<b>CTRL+ALT+Q</b>	Slow down playback

# Terminology

**ACFT:** Aircraft.

**ADS-B:** Automatic Dependent Surveillance Broadcast. Used by aircraft to indicate latitude, longitude, altitude, and identifier.

**AIS:** Automatic Identification System. Used by marine vessels to provide locations and identifiers.

**AVL:** Automatic Vehicle Locator. Used by many agencies to keep track of moving targets.

**FOV:** Field of View. Describes the zoom level of the camera.

**GIS:** Geographic Information System. Describes a system that deals with geographical data.

**HCU:** Hand Control Unit.

**IMU:** Inertia Measurement Unit. Measures the heading, pitch, and roll of the aircraft.

**INS:** Inertial Navigation System. Integrates an IMU with GPS data to provide full positional data.

**LOS (Line of Sight):** An imaginary line extending from the camera lens to the TGT. The slant range is the distance of this line.

**MGRS:** Military Grid Reference System.

**POI:** Point of Interest.

**TGT:** This indicates where the camera is pointed.

**UTM:** Universal Transverse Mercator.