Session III

In this chapter we will address the topic of geoprocessing sonar survey data. When creating Sonar Image Maps (i.e., SIMs), geoprocessing involves the transformation of sonar image snapshots captured with a Humminbird® SI system into mosaic raster layers that can be overlain with other spatial data in a GIS. Our processing approach requires the software identified to the right, in addition to the sonar processing toolkit Thom developed for ArcGIS 9.2+.

This chapter first presents a general overview of different geoprocessing approaches, then proceeds to discuss the approach we have developed for processing data obtained via the snapshot approach. The technical details of this aspect of sonar habitat mapping are fully described in the Sonar Imagery Geoprocessing Workbook. This workbook can be downloaded separately from the Tools and Training page of the website.

Geoprocessing

Required software

- ArcGIS 9.2 or greater
- ET Geowizards
- Irfanview

Thom developed tools that automate the process of transforming raw sonar images into rectified raster layers (mosaics). We will demonstrate the use of these tools in this chapter.

ArcGIS 10

ArcGIS 9.2 or 9.3

Session III

The Humminbird® SI system enables the capture of imagery, coordinates, and depth data that can be displayed or processed in a variety of ways. This includes marking features-of-interest as waypoints, collecting navigational routes, and capturing images and video of the underwater landscape. During this chapter we will briefly discuss Geoprocessing Options 1, 2, and 4, but will primarily focus on Option 3- processing sonar snapshot images into georeferenced sonar image maps (SIMs).

Geoprocessing Options

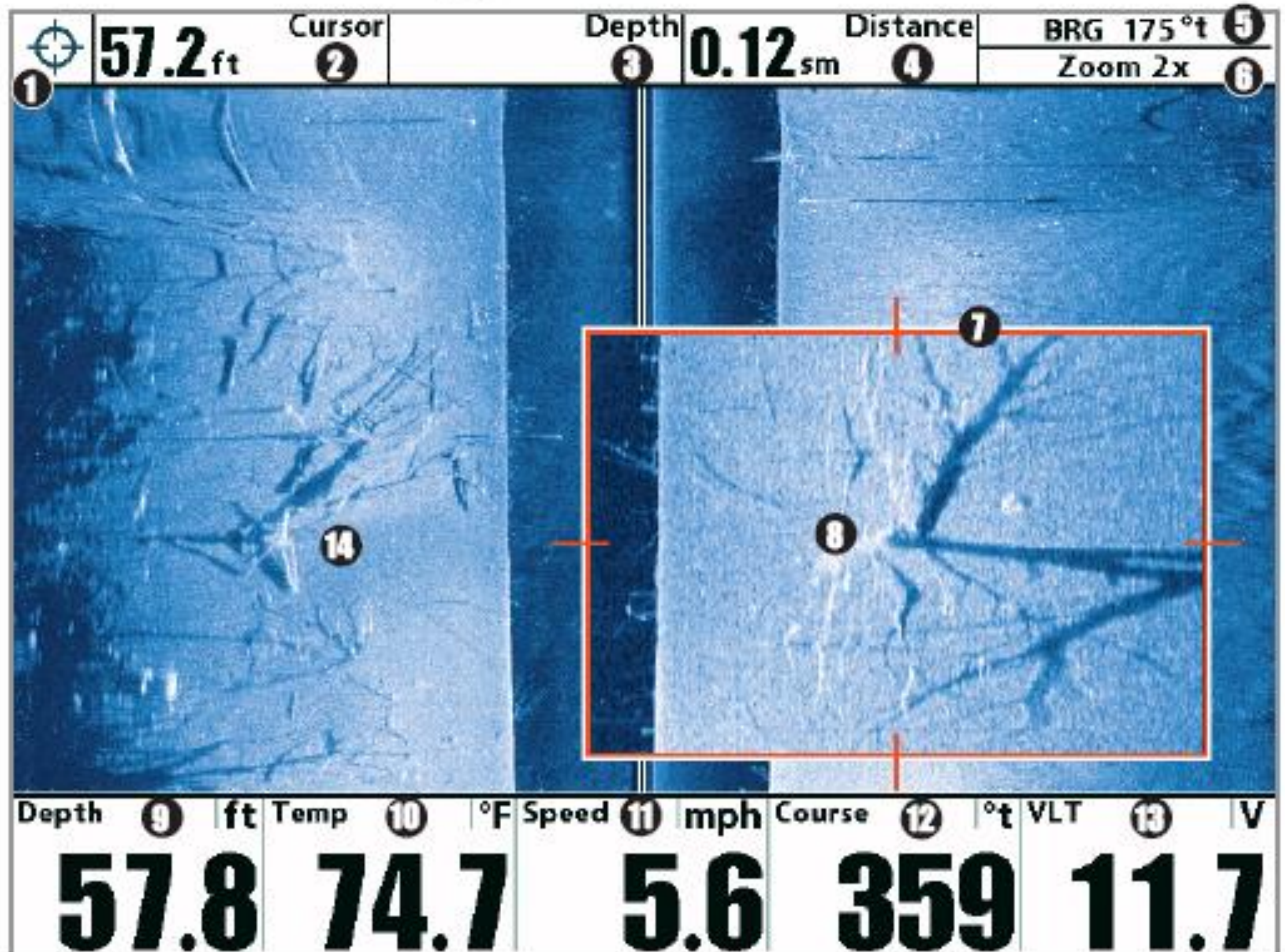
1) **Mark features on-the-fly or during video playback using the Active/Sonar Cursor, display in Google Earth (GIS not required)**
2) **Hotlinking Sonar Images in GIS**
3) **Image Transformation (also called rectification), <u>necessary for accurate areal/length estimation</u> of features**
4) **Video Processing**

The sonar cursor

A useful feature of the Humminbird® SI system is the ability to mark feature-of-interest (FOI) waypoints for objects observed on screen using the sonar cursor. To capture FOI waypoints a GPS unit must be connected to the control head and the sonar cursor must be activated (by pressing the directional keypad in any direction). Moving the cursor with the directional keypad to the feature and pressing the MARK button on the control head will create a waypoint at the cursor location rather than at the top and center of the image (where the boat icon normally appears). Waypoints are saved to the control head, where up to 3000 waypoints may be stored (check system documentation for specific waypoint storage capacities as these may vary from unit to unit). It is also important to reiterate that waypoint names are assigned automatically with a sequential, alphanumeric code. Thus, if you are recording notes for a given waypoint be sure to note the waypoint number that flashes on the screen while saving. Waypoint names can be edited later using the Waypoint submenu.

Option 1a) Marking features with the sonar cursor

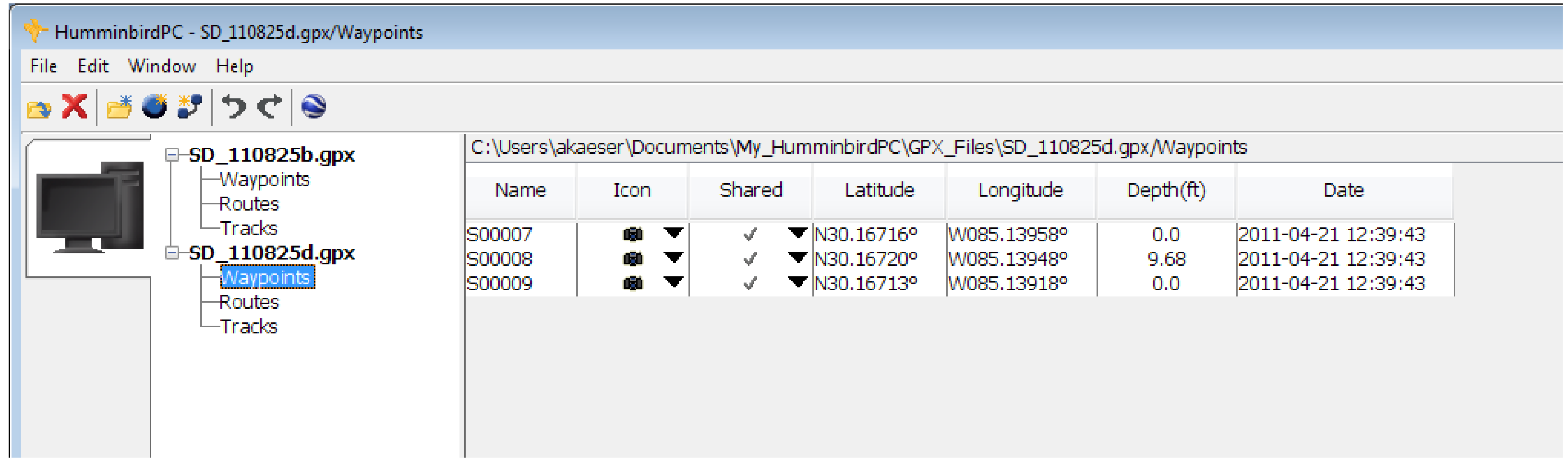
Side Imaging® View, with Active Cursor and Zoom

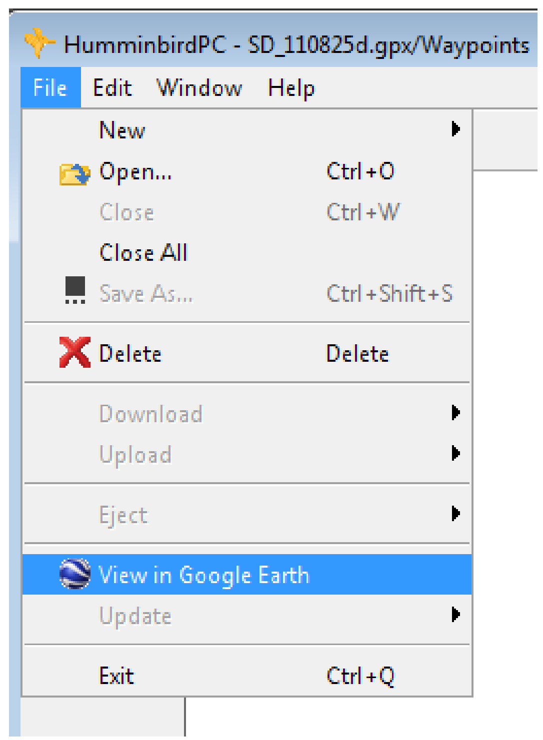


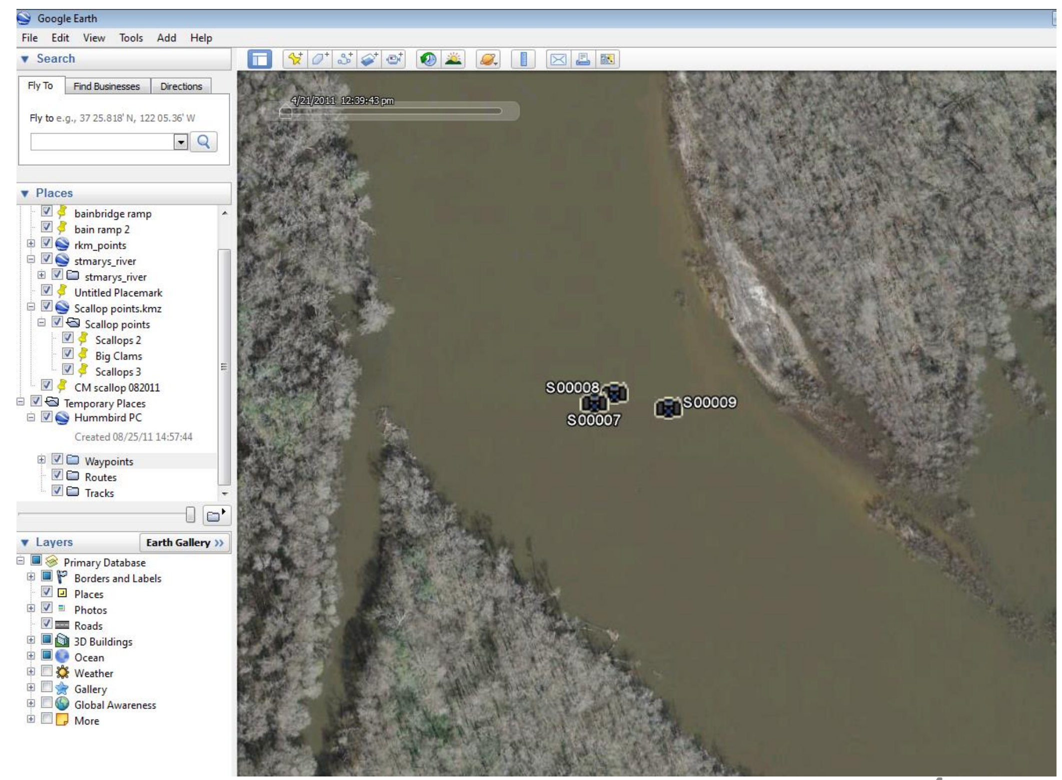
Viewing in Google Earth

Saved waypoints can be transferred (exported) to an MMC/SD card using the Export All Nav Data option under the NAV menu. Once the waypoints are saved to the card, you can open the file using Humminbird® PC. From here there are multiple options for viewing and saving your data. One of the easiest, however, is to download and install the free version of Google Earth (if you haven't already) and use the View in Google Earth file option in Humminbird® PC to plot your waypoints on a map, as demonstrated on the right.

1b) Waypoints in Google Earth







What is hotlinking?

If your Humminbird® SI system is set to capture snapshot images, has an MMC/SD card in the card slot, is connected to a GPS, and the cursor is NOT activated, a waypoint representing the image capture location (at the position of the boat icon) and an image snapshot are captured by pressing the MARK button. The waypoint and image are assigned the same sequential alphanumeric code. This allows for quick geo-positioning of the snapshot image using a "Hotlink" procedure in a GIS. This procedure, available in most common GIS software packages, establishes a relationship between the waypoint and its associated image enabling the user to visualize image capture locations on a map and retrieve the raw image by clicking on a waypoint. See your GIS software package documentation for specific "Hotlinking" instructions.

Shown right is an example of "Hotlinking" in ArcGIS, whereby a user selects a waypoint using the "Hotlink" tool (see ◯ yellow lightning bolt icon). This action results in a pop-up window displaying the image captured at the selected location. While this can be useful, the image is not fit to its geographic space and the orientation and overall dimensionality of the image may be incorrect.

2) Hotlinking images

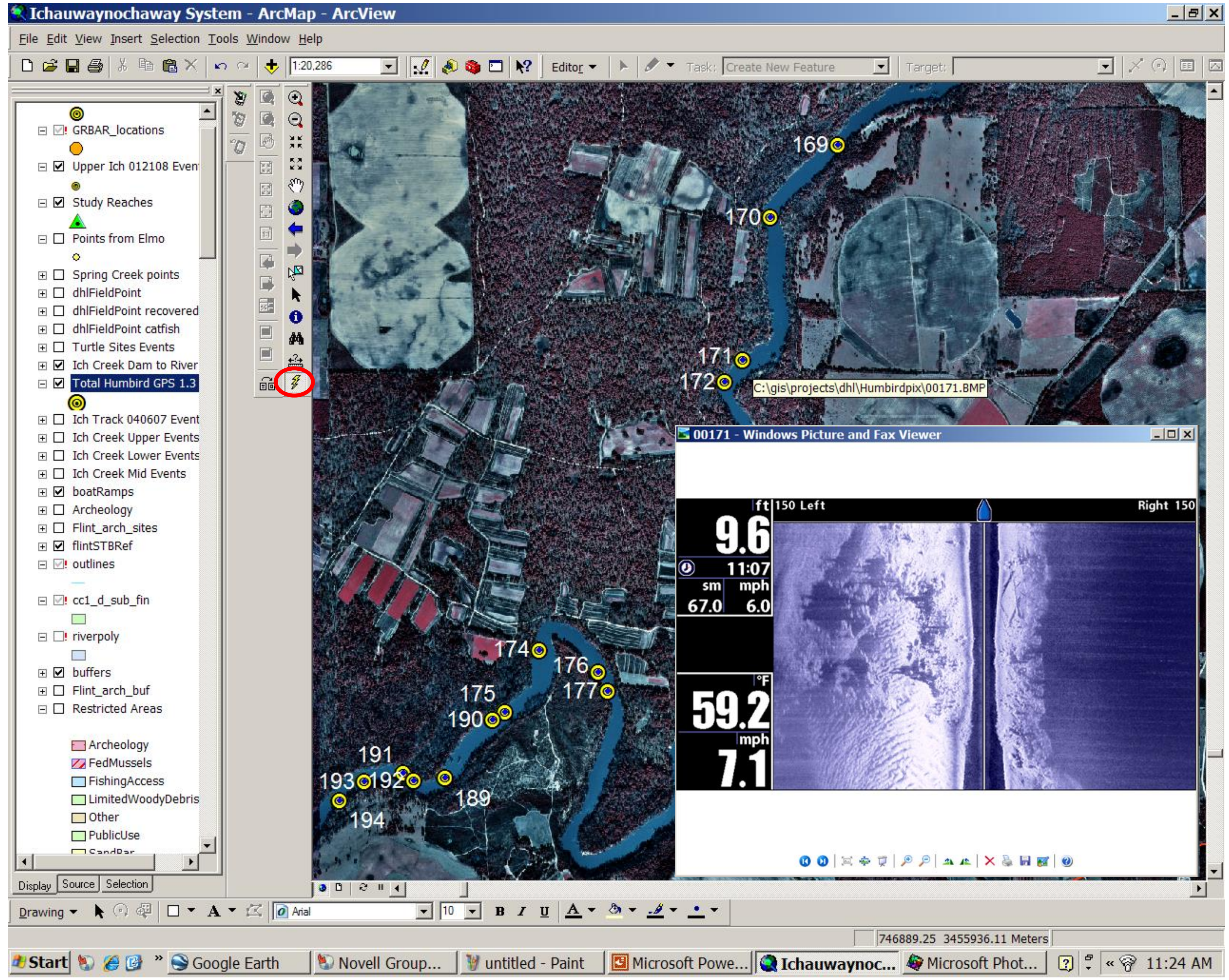


Image transformation

When we began investigating methods to georeference Humminbird® imagery there were no tools available to view or process Humminbird® sonar videos. The only way to view a sonar video was to play it back on the control head. With no way to access and transform the proprietary .son format of the sonar video file into a format that could be processed by other software we set out to develop a method that could georeference (transform) snapshot images into sonar image maps (SIMs) instead.

The first step toward the development of SIMs is the simultaneously collection of three specific data sets during the field survey: 1) consecutive, overlapping sonar snapshot images, 2) geographic coordinates of image capture locations, and 3) geographic coordinates representing the survey route. Collection of these data is fully detailed in Session II – Part B.

The collected image data is then processed (transformed) into SIMs using ArcGIS-based processing tools and two supporting open-source software packages- Irfanview and ET Geowizards. Processing includes the following steps: Data Preparation, Control Point Network Generation, and Image Rectification and Mosaicking.

These processes are fully described in great detail in the accompanying Sonar Imagery Geoprocessing Workbook, and summarized in the next series of slides.

3) Image Transformation

Via our method…

uses images and coordinate data captured via the "Sonar Snapshot" approach,

…and software tools and techniques we have developed.

The process involves the following steps:

The snapshot series

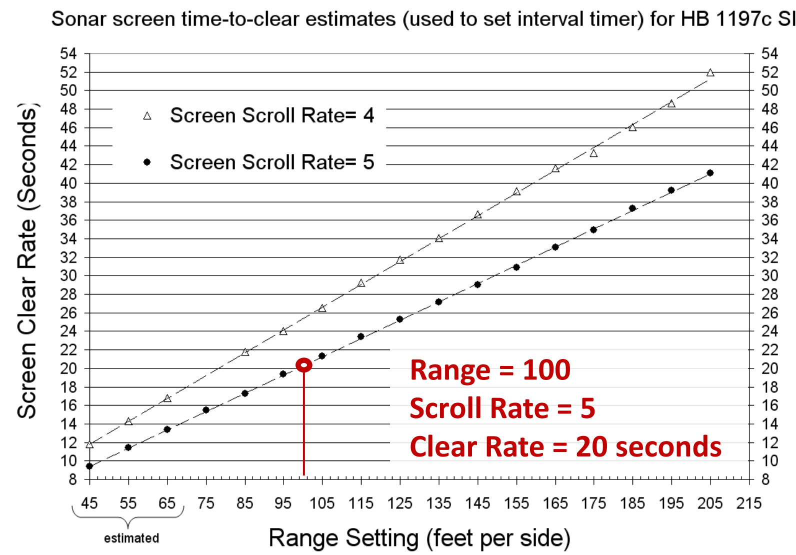
The most import step in the development of SIMs is the collection of high quality, overlapping, consecutive images. For this reason, this process is being revisited here.

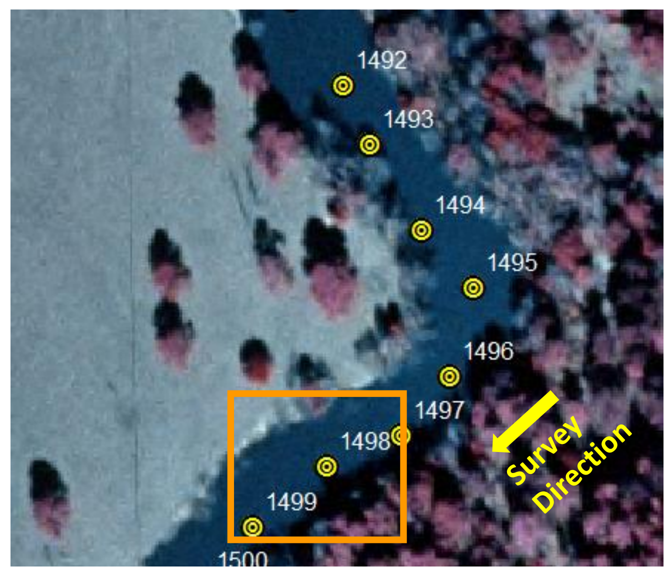
To summarize, an interval timer is used to ensure that users capture a small region of overlap between consecutive images. The rate, or interval, at which images are captured depends upon the range and screen scroll rate setting used during the survey. We have developed a chart of expected screen clear rates (shown right) for various settings. Examining the chart, you can see a survey range setting of 100 feet per side will result in screen clear rate is ~20 seconds. To ensure overlapping imagery, you would set your interval timer to 17 or 18 seconds. **Screen clear rates may vary between units and scanning conditions so it is important to track this visually in the field and confirm the estimated rates presented in this table.**

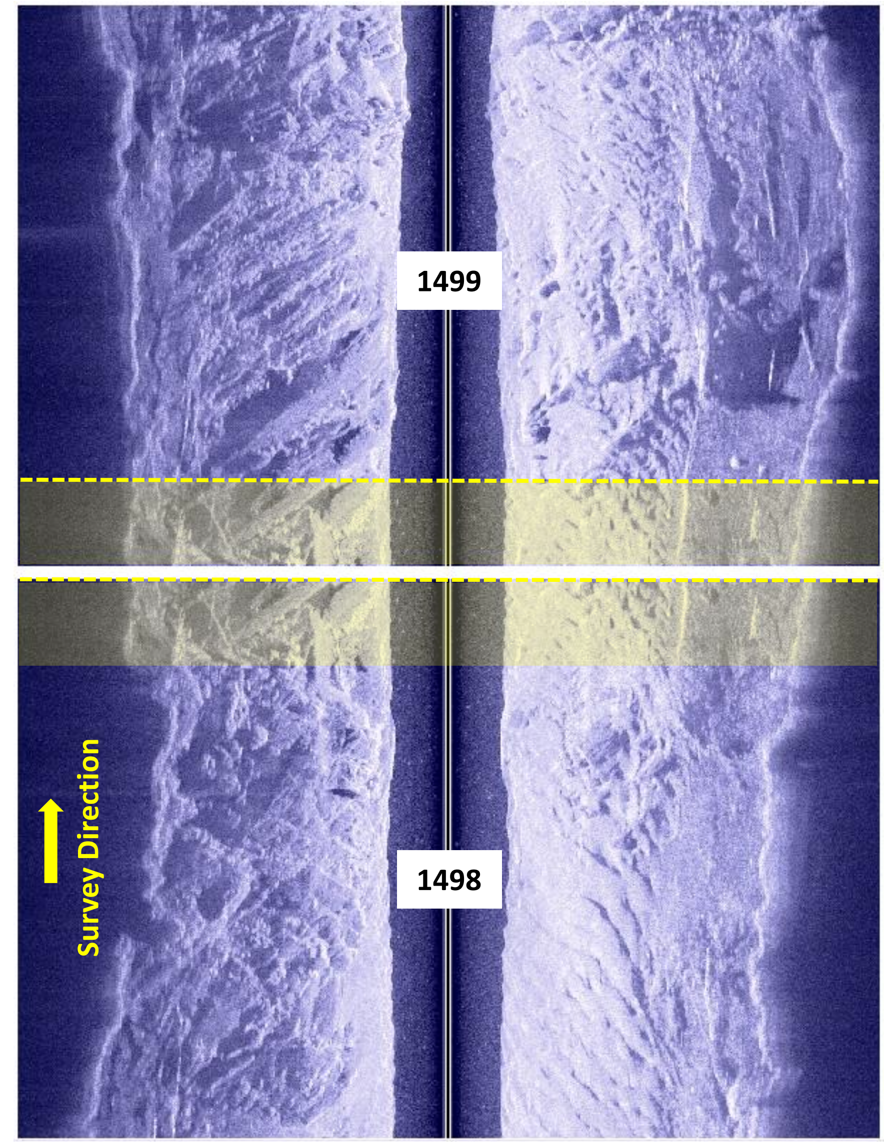
Shown right are consecutive, overlapping images 1498 and 1499. Note the yellow highlighted overlap between the images. This amount of overlap, or a little less, is what you should strive to achieve during the survey.

For more detail on the collection of overlapping imagery and a full size chart see Session II – Part B or the accompanying Sonar Imagery Geoprocessing Workbook.

Step A. Capture consecutive (overlapping) images







Next steps

The following slides provide an overview of data organization, control point generation, and image rectification/mosaicking. **For detailed information on image processing please review the Sonar Imagery Geoprocessing Workbook**.

Step B. Data Preparation

1. **Import, clean, organize, and process GPS data (ArcGIS/ETGeowizards)**
2. **Subset Images – collar removal (IrfanView / Batch processing)**
3. **Image matching – identify overlap (clip) (ArcGIS)**

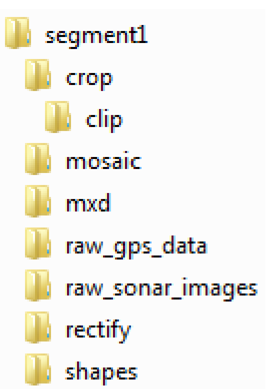
Step C. Control Point Generation

Step D. Rectification and Mosaicking

Organize segment data

Data organization is driven by data collection, as described on the right. We highly recommend surveys be conducted with as few interruptions/breaks as possible to expedite both the organization and processing of data.

Below is an example of the folder structure we use to organize data. For multiple survey segments repeat segment1 folder structure and rename it segment2, 3, 4 etc.



segment1: root folder for the surveyed segment

crop: stores image after collar removal

clip: folder is nested within crop and is required for image matching step; stores clipped images from the image matching process

mosaic: folder stores final, mosaicked images derived from individual rectified images

mxd: stores ArcGIS projects

raw_gps_data: stores raw gps data collected during the survey

raw_sonar_images: stores raw survey images

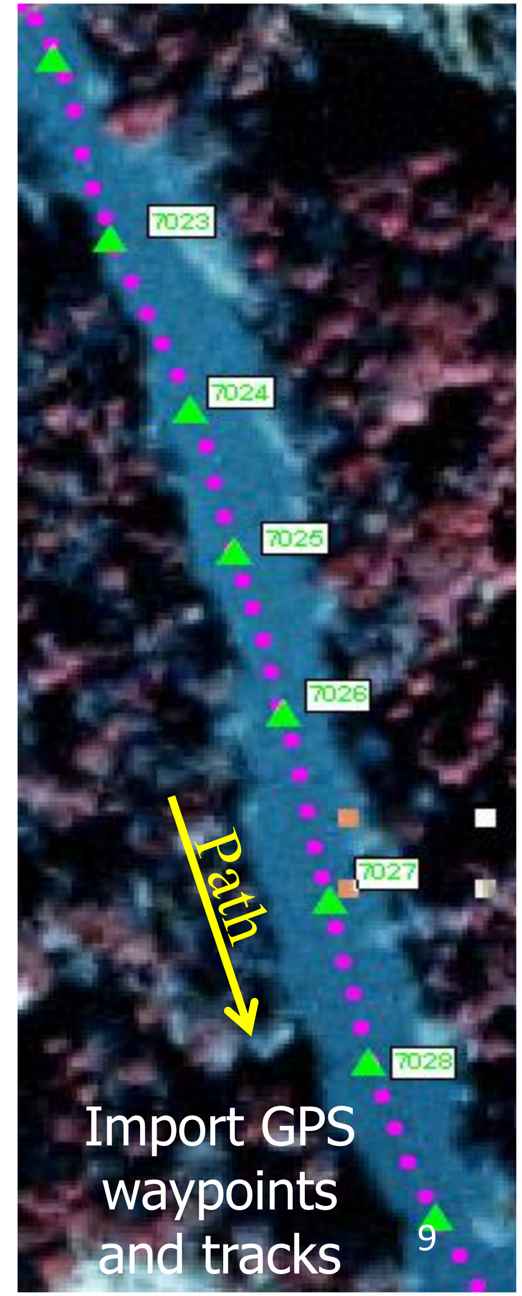
rectify: stores individual, rectified images

shapes: stores projected shapefiles representing waypoints, trackpoints and tracklines

Step B1. Import, Organize Data

Organizing data into processing segments

- During sonar surveys, breaks in the consecutive, overlapping image series are inevitable
- Breaks occur whenever a survey run is stopped or paused (e.g., lunch break), or whenever the range setting is changed
- You must organize data sets into discrete processing segments based these break points (field notes help)
- This is done by creating folders for each segment and moving appropriate GPS and image data into segment folders
- All GPS and image processing steps are then performed on each segment data set



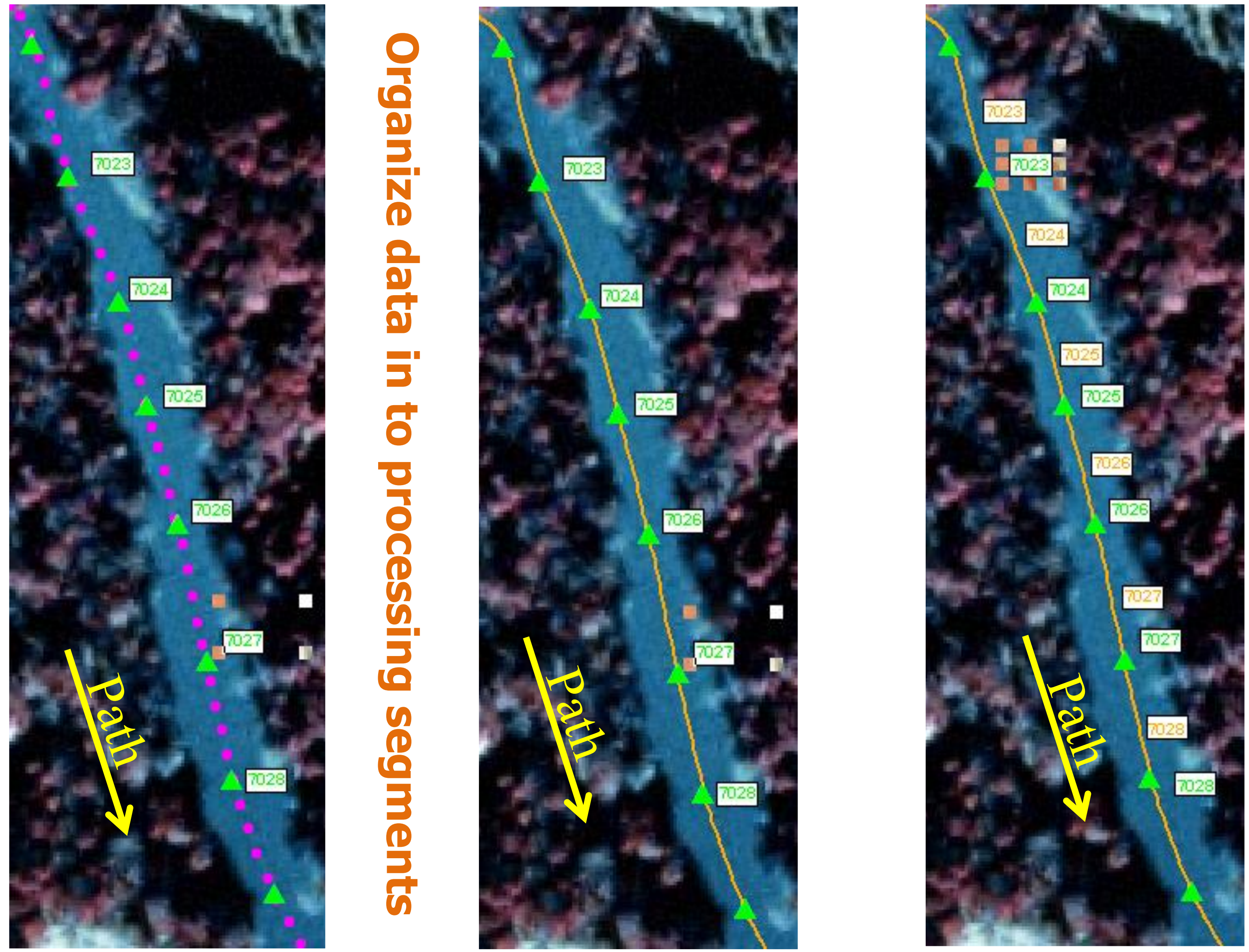
Coordinate processing

Processing GPS data is a key step that results in a data set that enables the automated generation of the image control networks required to transform raw images into sonar image maps. The following steps are completed using ArcGIS and ETGeowizards. (Alternatively, most ET Geowizards operations can be conducted using ArgGIS tools available at the ArcINFO level).

1. Download raw GPS waypoint and trackpoint data from GPS and control head to a computer.
2. Subset data into processing segments as dictated by survey breaks.
3. Convert raw waypoints (image capture locations) and trackpoints (representing survey navigation) to projected (e.g. UTM) shapefiles <ArcGIS>. *Recall: the waypoint file contains the corresponding image name prefix (e.g., S00324).
4. Convert the projected trackpoint shapefile to a trackline <ETGeowizards>.
5. Split the trackline with the waypoint shapefile <ETGeowizards or Sonar Processing Tools>.
6. Join the waypoint attribute file to the split trackfile attribute table such that the image capture waypoint number is now associated with the appropriate trackline segment.

The resulting polyline shapefile serves as the "backbone" or spline for deriving image control networks, as described later in Step C.

Step B1. Process GPS data



Import GPS waypoints and trackpoints

Convert tracks to a trackline

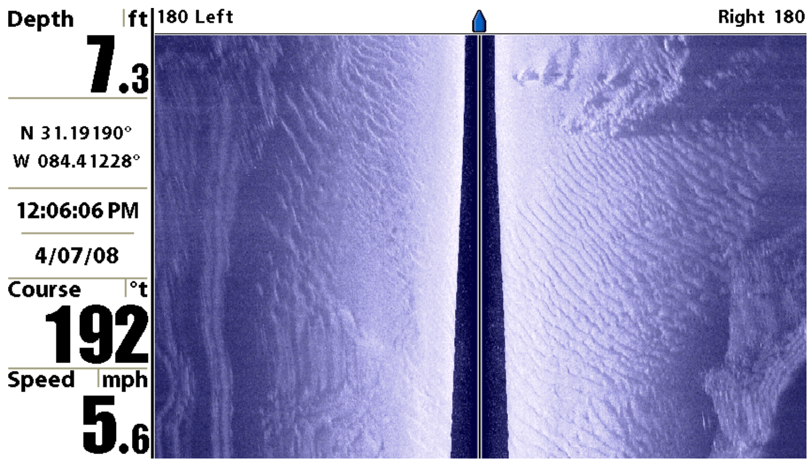
Split trackline at waypoints, join attributes

Image cropping

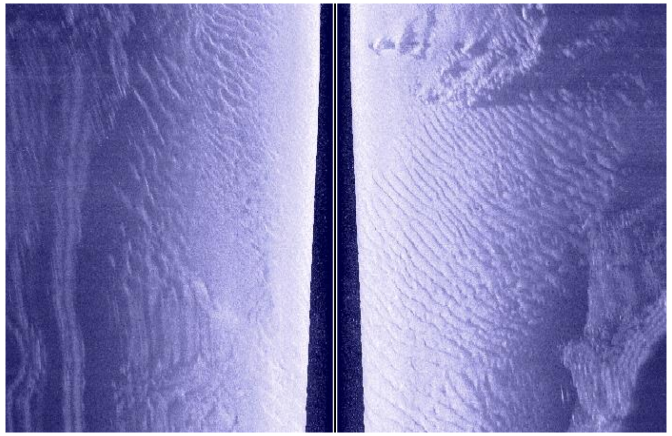
Image cropping is performed using the open source Irfanview software. The purpose of this step is to remove the collar information from raw sonar images. This process is run in batch mode where thousands of images can be processed in seconds. The resulting cropped images are then used in image matching described in Step B3.

Step B2. Crop images to remove collar

Raw Image



Cropped Image



- **Cropping is done in Irfanview, an open source software**
- **Images are cropped in batch mode**
- **1000's of images can be cropped in seconds**

Image clipping

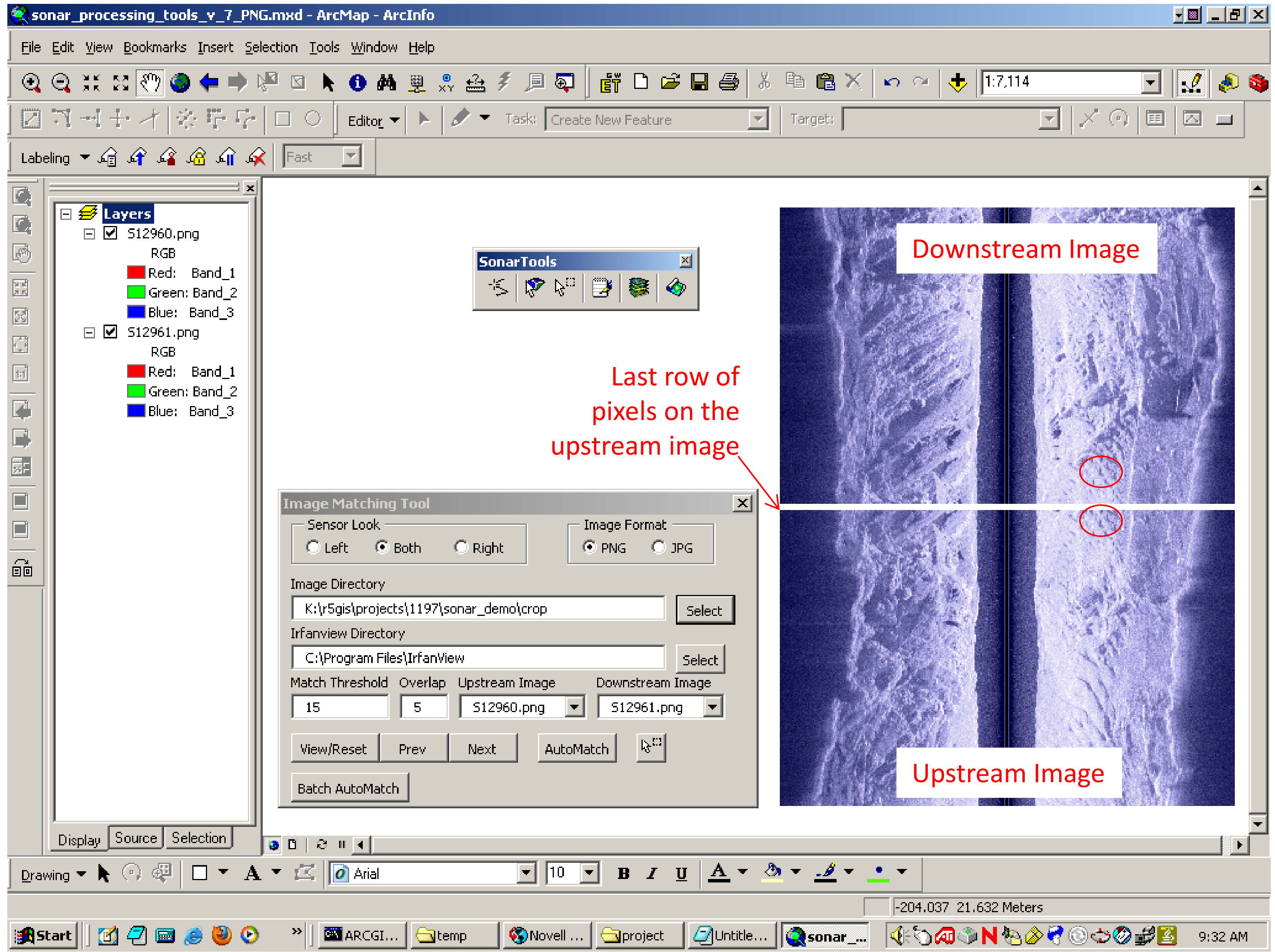
Image matching is performed using ArcGIS and the Sonar Tools Thom developed. The Image Matching Tool is designed to identify the overlap point between a pair of consecutive images. The tool can identify overlap points in left only, right only, or right/left (both) looking sonar imagery stored in either JPG or PNG format. Overlap points can be identified manually, or by using the individual AutoMatch or Batch AutoMatch functions. The tool uses Irfanview as a background processor, therefore the path to the Irfanview program must be defined. The default location displayed in the tool dialog is the default Irfanview install location for 32-bit systems. If Irfanview is installed elsewhere, the user <u>must</u> define this location as the current Irfanview Directory.

The Match Threshold defines how precisely the last row the upstream image must match the overlap row in the downstream image. The smaller the threshold, the more precise the match must be. A Match Threshold of 15 works well in most situations.

During rectification and mosaicking it is possible that tiny slivers of black pixels may display between consecutive images. To eliminate slivers, a small overlap of pixel rows is generally kept on downstream images, upstream of the overlap point. An Overlap of 5 rows of pixels works well in most situations.

Upstream and downstream images are populated automatically as defined by the selected Image Directory. The Prev and Next buttons are used to move through the image set.

Step B3. Image Matching (clip)

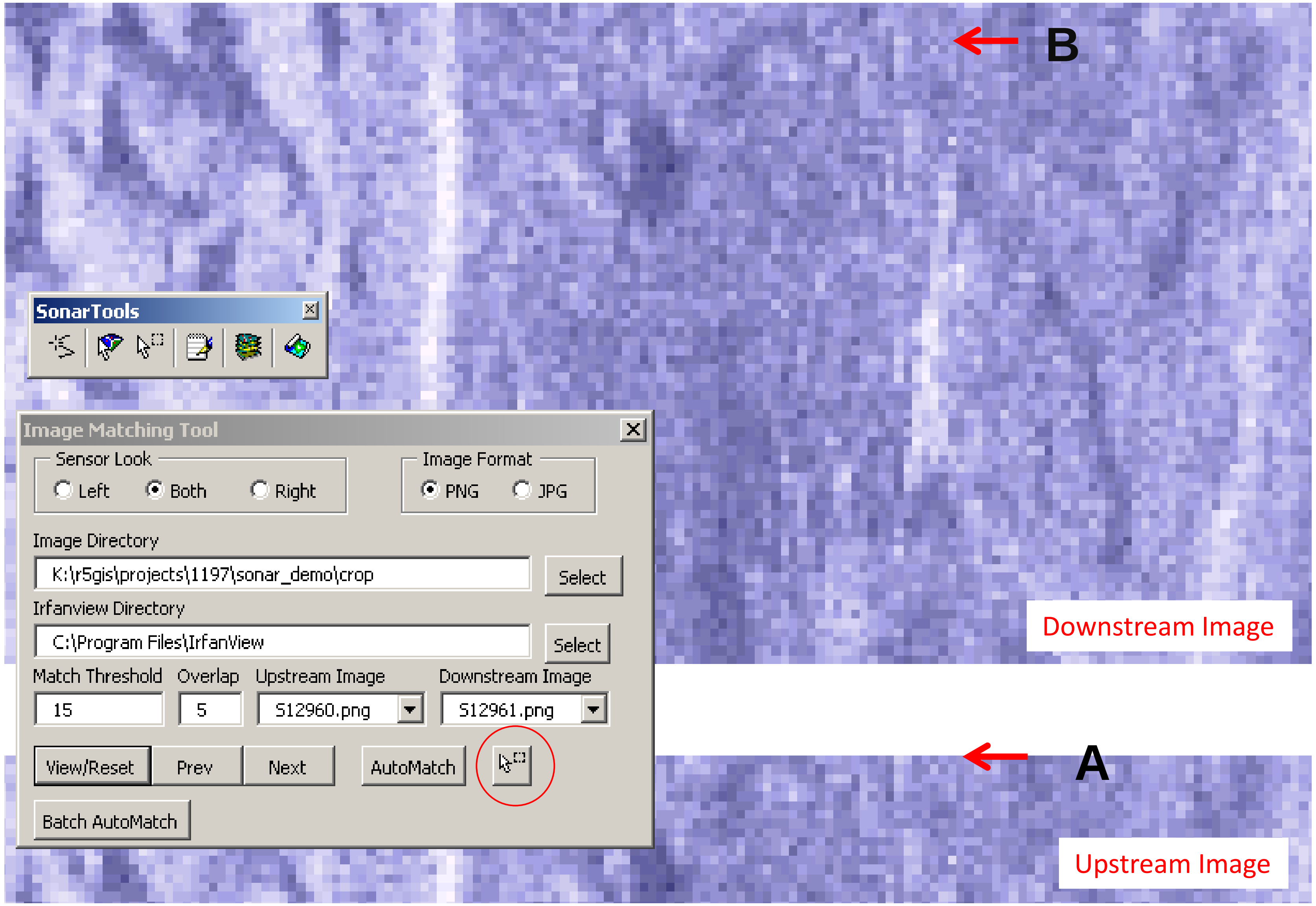


Manual image clipping

Manual image matching requires that the user visually identify the matching row between upstream and downstream images. In the figure to the right, Arrow A is pointing to the last row of the upstream image and a group of patterned pixels. Arrow B is pointing to the corresponding row of patterned pixels in the downstream image. Please note that this area of overlap was identified first by inspecting the images at full scale, then zooming into the overlap area (shown here) using the magnifying glass tool in ArcGIS. When manually matching images, the user selects the image matching tool (circled on the dialog in red) and clicks on row represented by Arrow B on the downstream image. The downstream image is automatically clipped at this point and the clipped image is saved into the clip folder, which must be nested within the crop folder in the project directory. As you might imagine, manual image matching is a tedious process so we recommend that one of the Automatching tools be used during this step. In the odd event that an image cannot be matched automatically, yet the images actually do overlap as confirmed visually by the user, this tool can be used to manually select the overlap point.

As always, detailed instructions on Manual Image Matching are provided in the Sonar Image Geoprocessing Workbook.

Step B3. Manual image matching



Automated image clipping

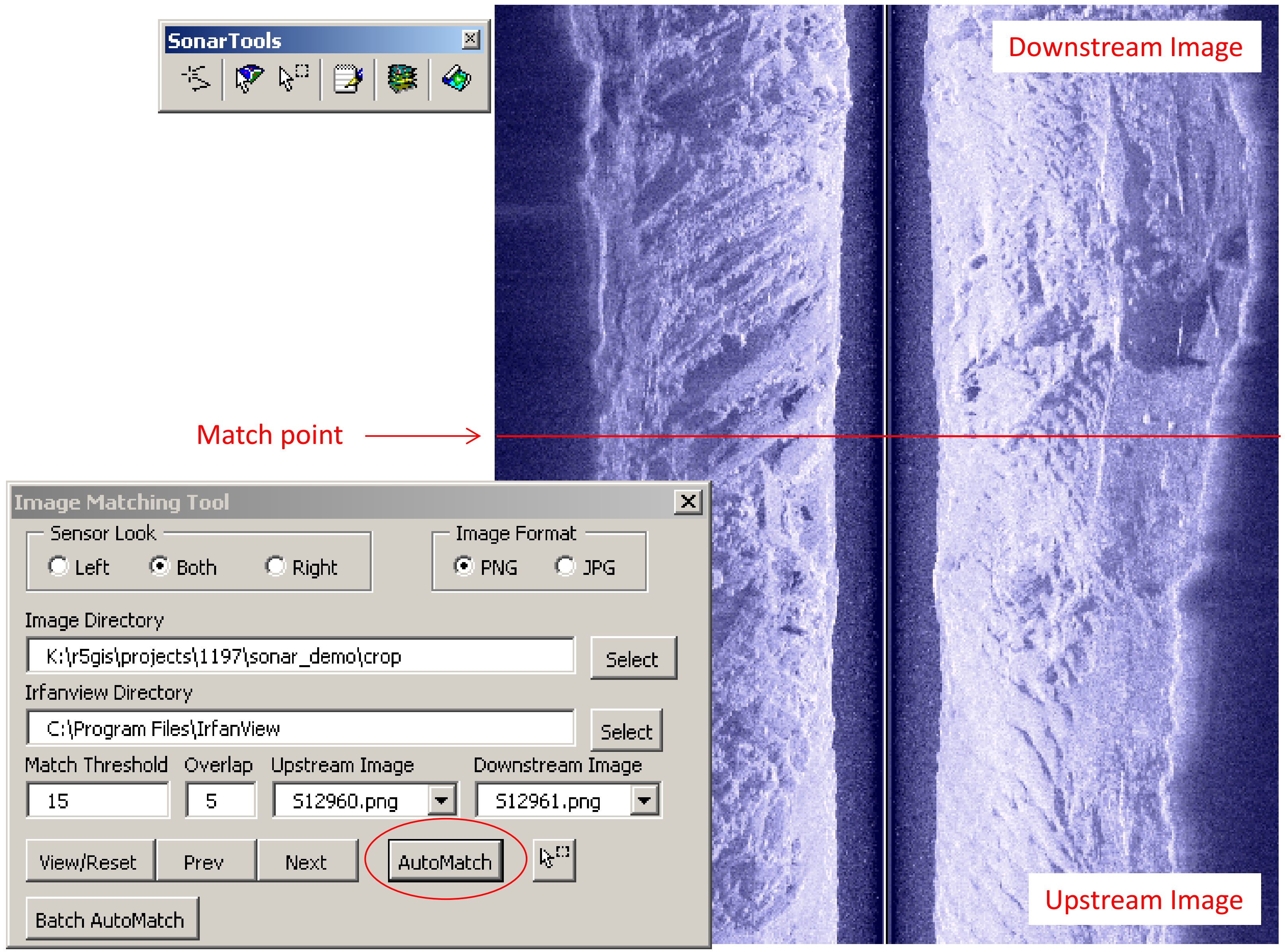
To further accelerate image processing, we developed an automated method to detect overlap points. The automated method can be performed on a per-image basis or run in batch mode.

Individual images are matched automatically by clicking the AutoMatch button (circled on the right). Upon clicking this button, the downstream image match point is automatically detected and the resulting clipped image is saved to the clip folder. This method allows you to verify the auto-detected match point as you move through the image set, one by one. Once the match is made, the images are married together on screen and a red line appears to identify the overlap point. (This line is for visualization only). By visually reviewing match results, it is possible to detect match errors; such errors are however quite rare.

For matching large image sets that have been carefully acquired in proper fashion during a survey, we recommend the use of the Batch AutoMatch Tool. The Batch Automatch Tool works similarly to the individual AutoMatch Tool. During Batch AutoMatch all images in the selected Image Directory are matched at once; images cannot be reviewed as they are matched. Though not described here, the toolkit provides an Image Review tool that allow users to quickly review matched images after matching is complete.

Detailed instructions on Image AutoMatching and Review are provided in the Sonar Image Geoprocessing Workbook.

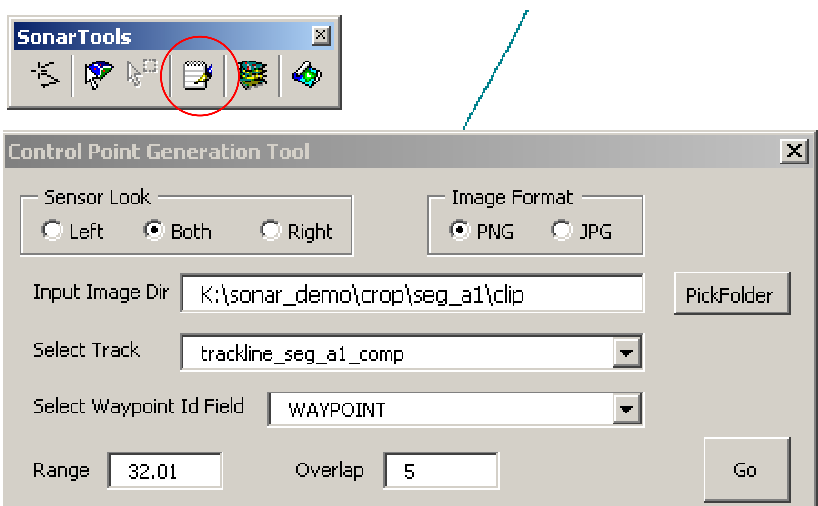
Step B3. Auto image matching



Ground control network

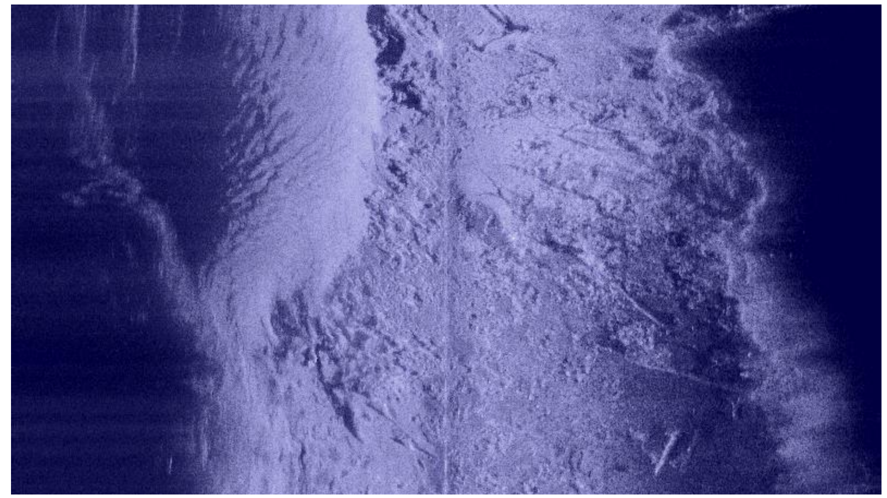
In this step, an image-to-ground control network is developed to establish a relationship between individual clipped images and their geographic image space. A table containing pairs of image and ground control coordinate points is stored as a text file in the clip folder.

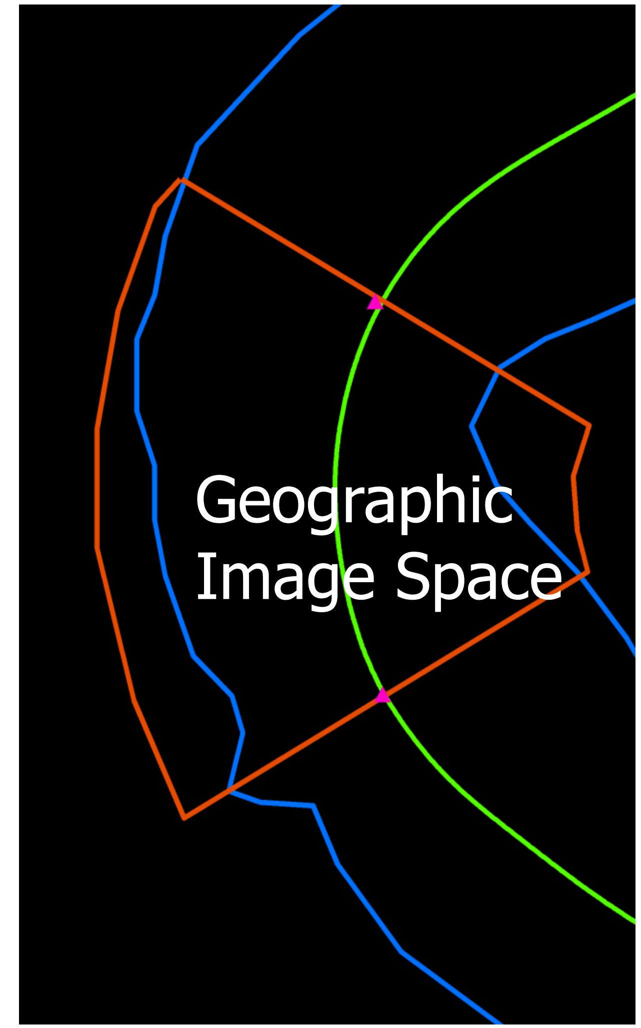
The Control Point Generation Tool enables users to automatically derive a control point network for each image in survey segment. In the tool dialog, the user must select the Input Image Directory (location where the clipped images for a given survey segment are stored), the split and joined trackline shapefile created in Step B1, the attribute table field name in the trackline shapefile that contains the waypoint id information, the range (in the units defined for the trackline shapefile), and the overlap (which is the same as defined in Step B- Image Matching). Clicking Go generates the control point network files required in Step D- Image Rectification.



Step C. Generate Ground Control Network

Clipped Image





- Objective is to fit the clipped image, produced in the previous step, to its geographic image space
- An image-to-ground control network (or control point network) is a set of reference coordinates that relate physical points on an image to real-world, spatial positions

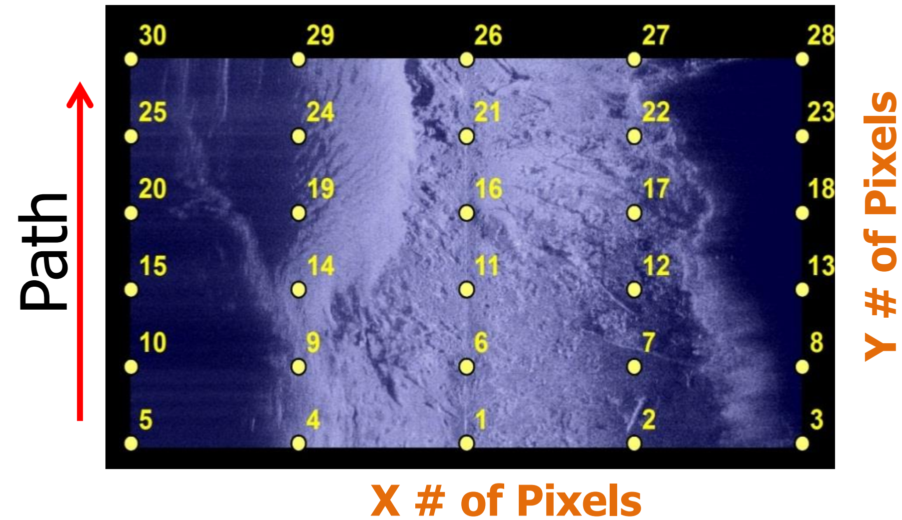
Ground control network

Shown right is the visual relationship between the image control coordinates and their "ground" position in geographic space. Traditional means of generating a control point network requires that a user define the network manually by identifying well defined points throughout a raw image and their corresponding locations in a previously georeferenced product, such as a Digital Ortho Quarter Quad or Digital Raster Graphic. Alternatively, the features identified on the raw image are measured by going afield and capturing geographic coordinates of these features with a GPS. As you might expect, this approach is unfeasible when dealing with submerged features in sonar imagery.

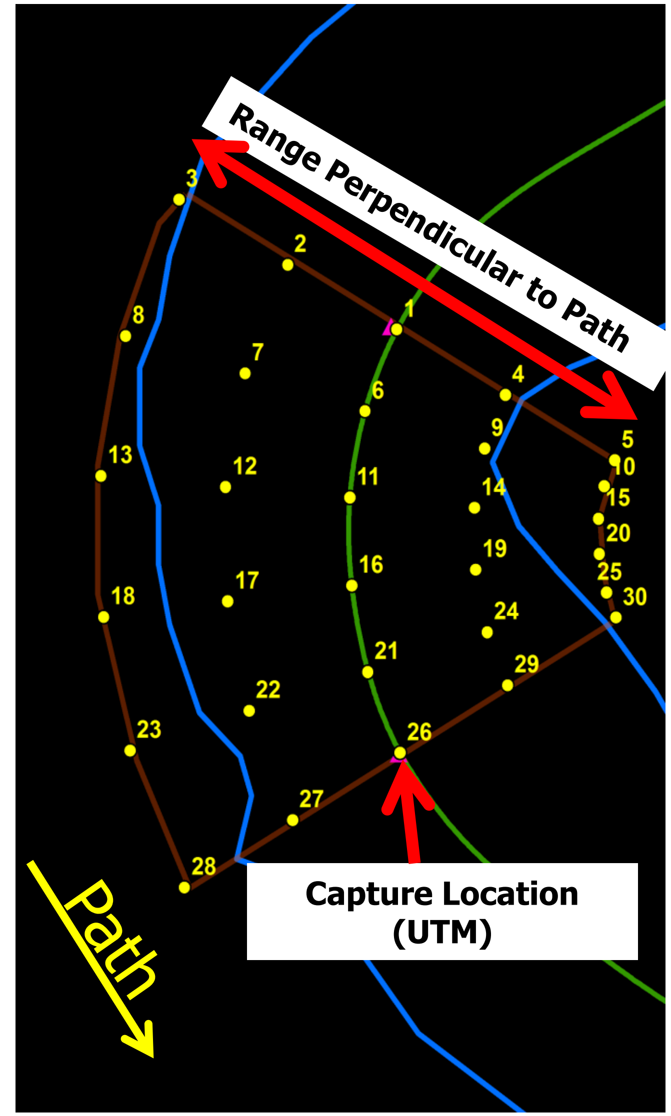
The rigid dimensionality of the clipped sonar imagery, coupled with the known x,y coordinates at the image capture location, the survey range, and the ability to measure required spatial information within ArcGIS through scripting, allowed us to develop an automated control point generation routine. This routine measures points in the cropped and clipped image at 20% intervals in the Y-dimension, 25% intervals in the X-dimension and results in a total of 30 image coordinate control points. Corresponding ground coordinate control points are measured in a projected coordinate system (e.g., Universal Transverse Mercator) at the same intervals along the navigational track (Y-dimension), the survey range (X-dimension) and perpendicular to the navigation track. A control point network file is generated for each image and used to rectify images.

Step C. Generate Ground Control Network

Cropped and Clipped Image

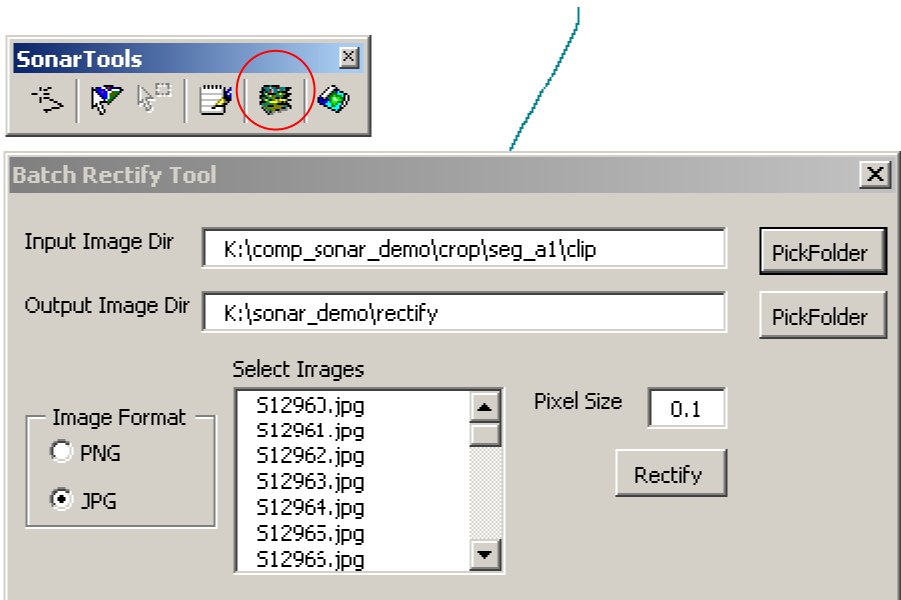


- Basic image geometry and survey geographic data relationships used
- Known are the image pixel dimensions (x and y pixel count), image range/width (m), image length (m), and a single image capture location (UTM (control point 26))
- Using this information it is possible to automate the generation of a unique control point network for each image



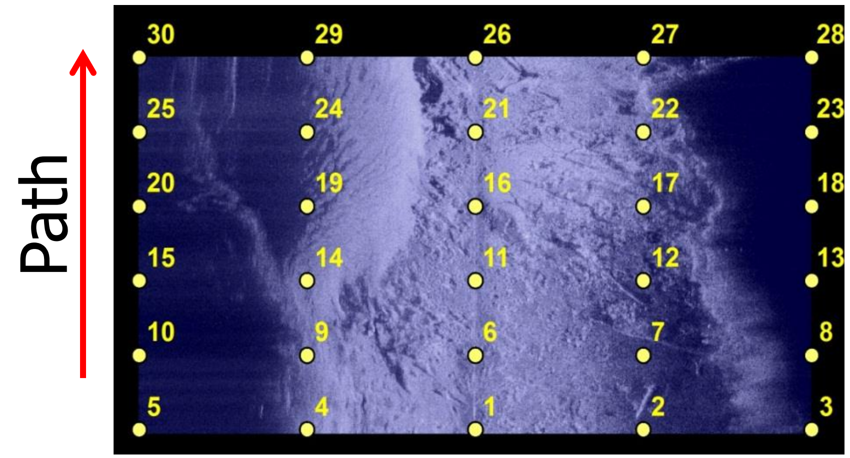
Transformation of image

Once the clipped images and their corresponding control point network files are derived it is time to rectify (transform) the images from raw image space to their proper ground position. This is accomplished using the Batch Rectify Tool, which will rectify all images in the Input Image Directory and place the transformed images in the defined Output image directory. This tool requires you to define the input file type (JPG or PNG), the output pixel size in output units (e.g. meters for UTM), and to select the images to rectify. Clicking the rectify button initiates the process to transform the image(s) as shown right. In the example shown here, the output rectified images will be rendered with a pixel size of 10 cm (0.1 m)

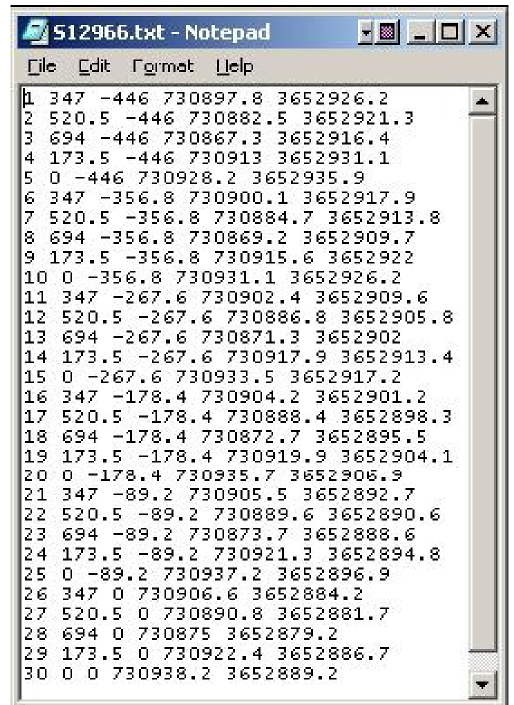


Step D. Image Rectification

Cropped and Clipped Image



Control point network files are stored as text files and contain an id, x image coordinate, y image coordinate, x ground coordinate, and y ground coordinates



S12966.txt - Notepad

File Edit Format Help

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2 520.5 -446 730882.5 3652921.3
3 694 -446 730867.3 3652916.4
4 173.5 -446 730913 3652931.1
5 0 -446 730928.2 3652935.9
6 347 -356.8 730900.1 3652917.9
7 520.5 -356.8 730884.7 3652913.8
8 694 -356.8 730869.2 3652909.7
9 173.5 -356.8 730915.6 3652922
10 0 -356.8 730931.1 3652926.2
11 347 -267.6 730902.4 3652909.6
12 520.5 -267.6 730886.8 3652905.8
13 694 -267.6 730871.3 3652902
14 173.5 -267.6 730917.9 3652913.4
15 0 -267.6 730933.5 3652917.2
16 347 -178.4 730904.2 3652901.2
17 520.5 -178.4 730888.4 3652898.3
18 694 -178.4 730872.7 3652895.5
19 173.5 -178.4 730919.9 3652904.1
20 0 -178.4 730935.7 3652906.9
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22 520.5 -89.2 730889.6 3652890.6
23 694 -89.2 730873.7 3652888.6
24 173.5 -89.2 730921.3 3652894.8
25 0 -89.2 730937.2 3652896.9
26 347 0 730906.6 3652884.2
27 520.5 0 730890.8 3652881.7
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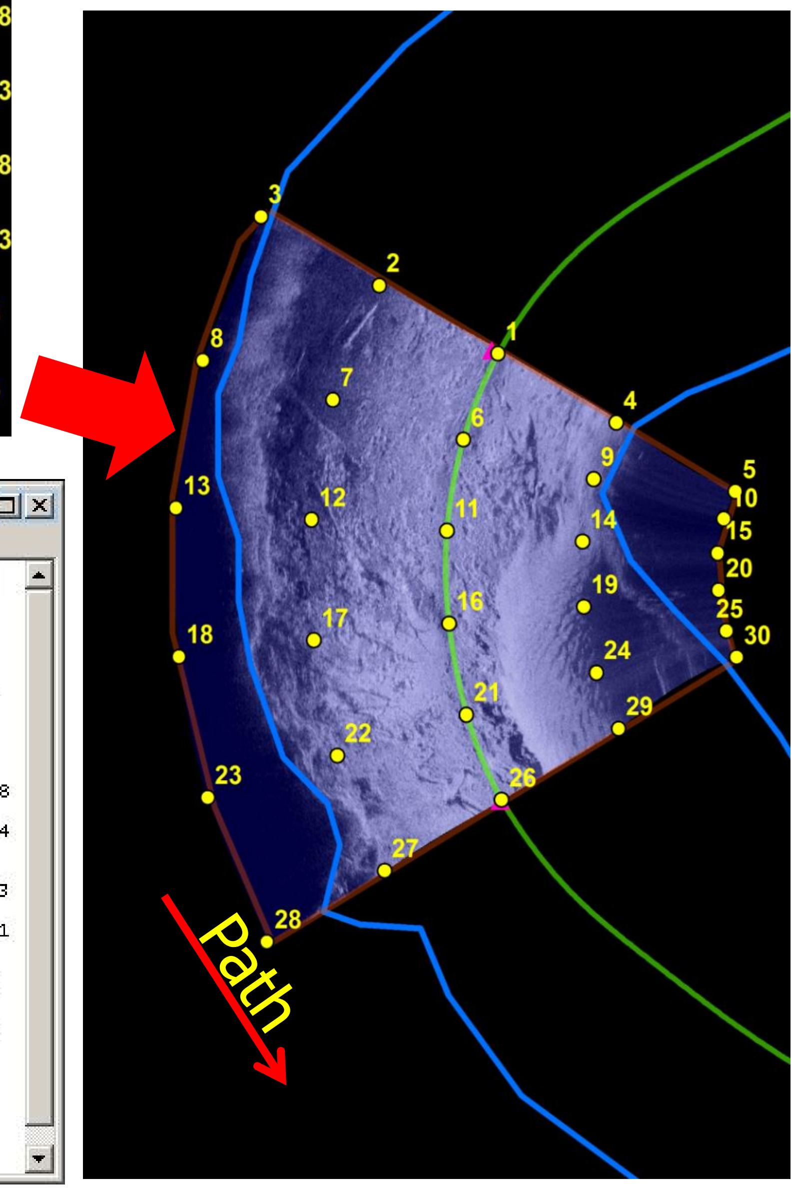


Image mosaic

Mosaicking is the final step in image processing and results in what we call Sonar Image Maps or SIMs. This process takes individual rectified images and merges them into seamless image mosaics representing survey segments.

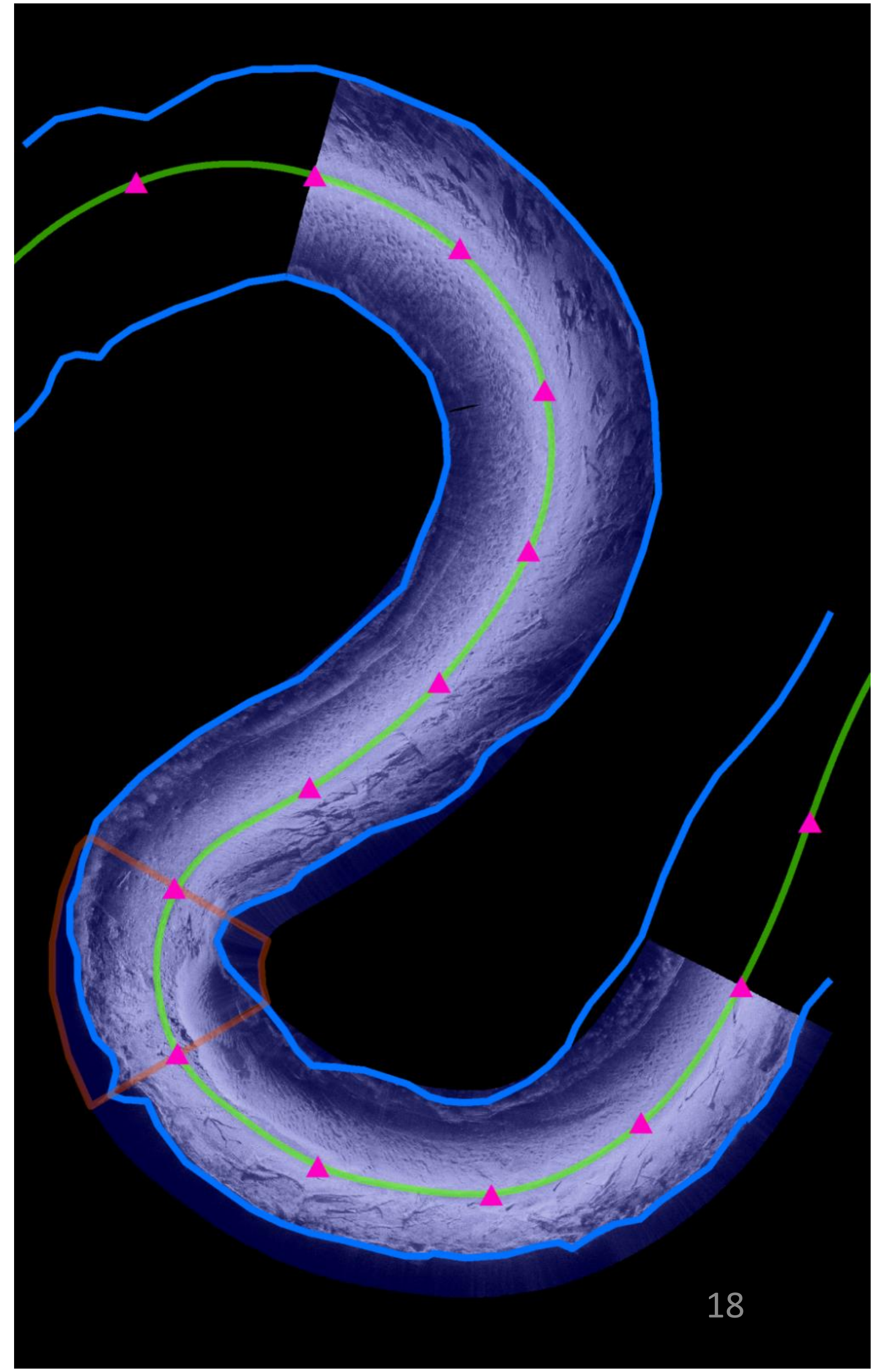
The preferred method for generating SIMs is to create them in a file geodatabase. These steps are native to ArcGIS and fully described in the Sonar Image Geoprocessing Workbook. In short, you create a file geodatabase and raster catalog using ArcCatalog, then populate the raster catalog using the ArcGIS Toolbox >Data Management >Raster Catalog tools. The resulting raster catalog is a mosaic, however the raster catalog simply references individual rectified images. This is fine for individual use, but if you must deliver your data to others the process can be taken one step further by creating a raster dataset and using Arc Toolbox >Data Management >Raster Dataset tools to convert the catalog to an self contained raster layer.

The number of images in a mosaic is dictated by survey breaks, so we recommend long continuous survey runs to improve efficiency. We have not found a limit to the maximum number of images in a raster catalog or raster dataset, and have batch processed individual segments as long as 25 kilometers without the need to subset the data into shorter segments. The ability to geoprocess- in semi-automated fashion- sonar imagery obtained during long, continuous survey segments is a major benefit of our custom approach.

Step D. Image Mosaicking

Given a series of rectified images, it is then possible to generate a seamless mosaic of many images – hundreds, or more, depending on the length of the processing segment

***Important Tip**- To reduce the length of time spent geoprocessing, concentrate on generating long, continuous processing segments during sonar surveys (limit breaks)



Rectification issues

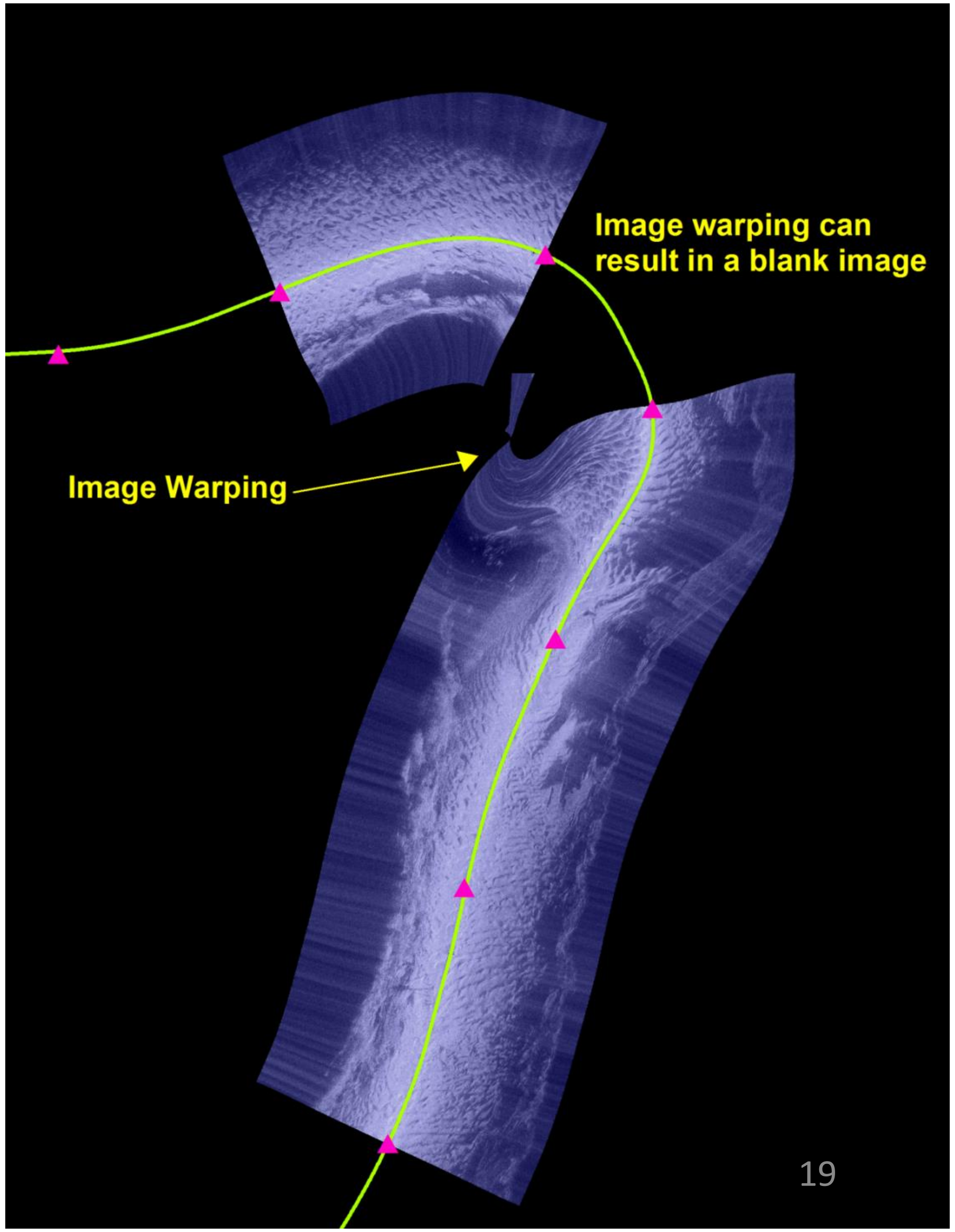
Side scan sonar performs optimally with straight line survey transects, an approach that is not usually possible in rivers or along reservoir shorelines. As a result, images captured in tight bends may be warped or may fail to rectify. Warping or rectification failures occur when assigned points in the image control point network overlap or fall out of sequential order on the inside of a tight bend. In these cases the computer may fail to find a transformation solution.

An example of an image not rectifying is shown on the right. Slight warping can be observed along the left side of the next downstream image as well. These problems are generally quite rare, and typically occur only during surveys of narrow and highly sinuous streams (i.e., transects) when sharp navigational turns are executed in the field. We recommend that you review your mosaics in raster catalog format before converting them to raster datasets, inspecting for areas of warping or rectification failure.

Quite fortunately, our approach to image processing enables users to correct warped or non-rectified images in most instances. The means to correct such problems lies in the user's ability to access and manipulate the image control point network on a per-image basis, as necessary. There are also survey techniques that can be employed to mitigate the potential for warping.

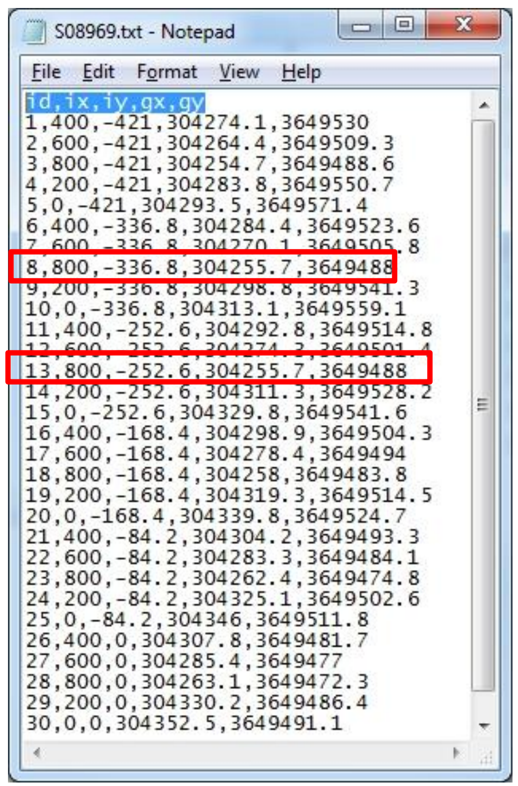
Warping and Rectification Issues

- Side scan sonar is designed for **straight** line surveys
- In rivers and reservoirs – this is not always (usually) possible
- Sharp bends may cause images to be warped or blank
- Fortunately, warped and blank images can often be corrected



What causes warping?

Warping occurs during rectification as the computer tries to transform a rectangular image into a wedge shape in tight bends. In these instances, the ground control points, which normally increment by 5 along the survey path, have the potential to overlap on the inside bend. Due to the nature of the bend in this example, points 8 and 13 occupy nearly the same space and the increment of control points is out of sequential order- 3, 13, 8, 18, etc. Warping can be resolved by simply deleting points 8 and 13 from the control point network file and re-rectifying the warped image. This procedure is detailed in the Sonar Image Geoprocessing Workbook.


S08969.txt - Notepad

File Edit Format View Help

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id,ix,iy,gx,gy
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4,200,-421,304283.8,3649550.7
5,0,-421,304293.5,3649571.4
6,400,-336.8,304284.4,3649523.6
7,600,-336.8,304270.1,3649505.8
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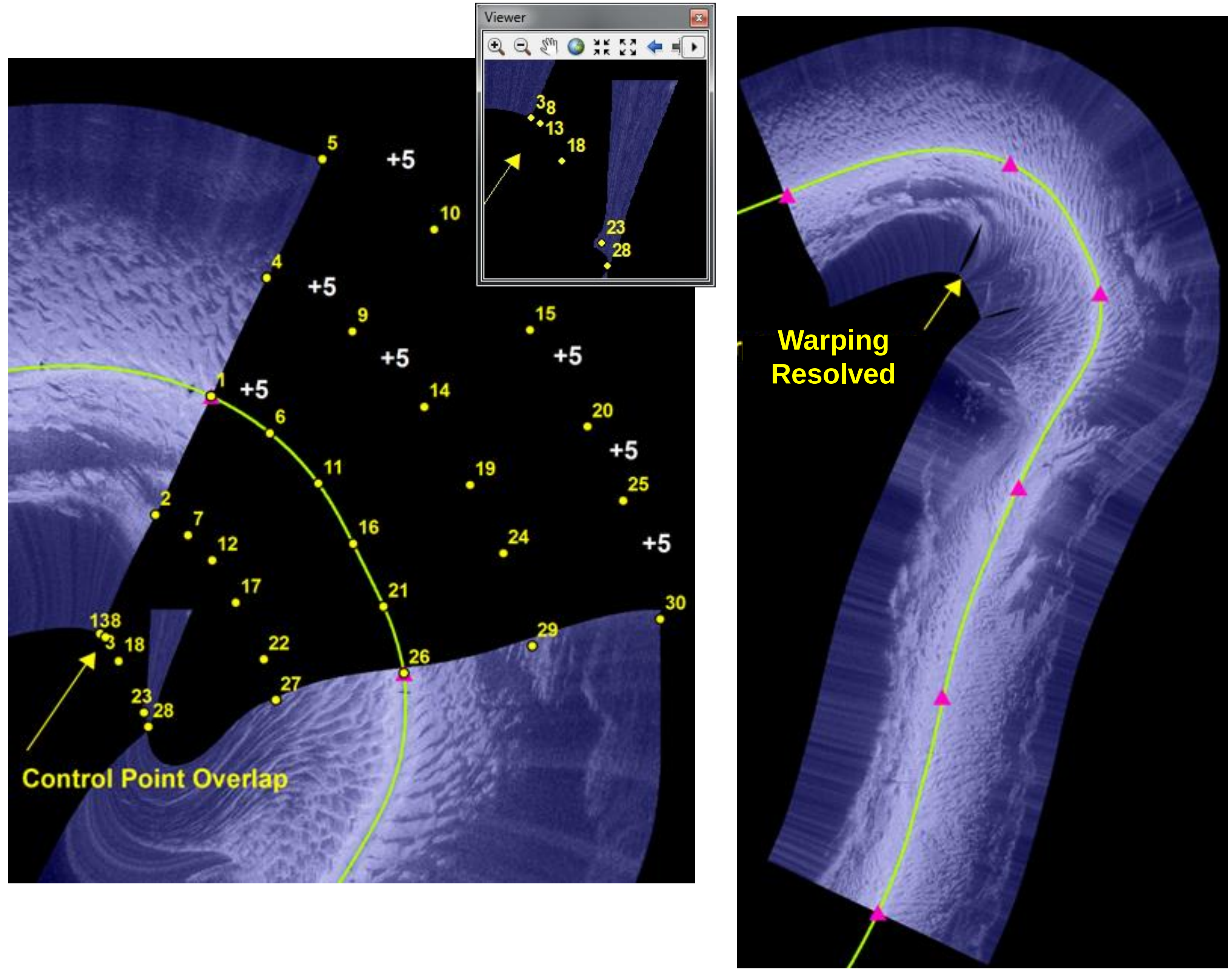
```

Delete Control Points 8 & 13

Cause of Warping



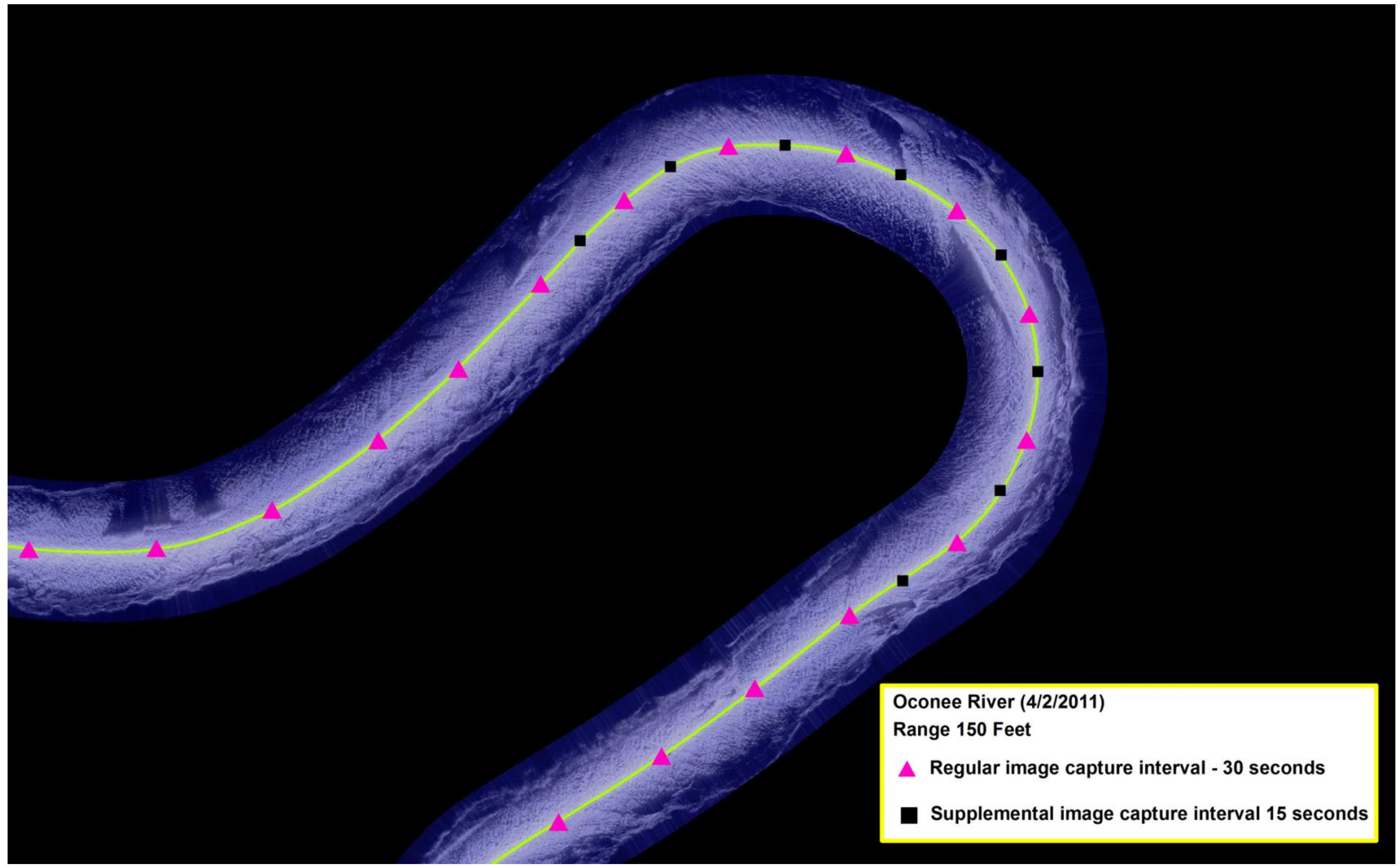
How to avoid warping

As described previously, warping occurs during rectification as the result of trying to fit a rectangular image into a tight bend. It is possible, however, to mitigate for warping by adjusting the image capture interval during the survey. In the example to the right, the range is set at 150 feet with a specified image capture interval of 30 seconds. Supplementing image capture at 15 second intervals while surveying will greatly reduce the ground image footprint size, and in doing so, should reduce the potential for warping in the bend during rectification.

Note: It is not necessary to stop the survey and reset the timer to 15 seconds. Rather, watch the timer and capture an image at 15 seconds and then again when the alarm sounds at 30 seconds. The reduced-interval, supplemental capture of images can be conducted throughout the entire bend while the survey is underway (i.e., no breaks or stops).

Preventing Warping

Supplemental image capture during survey to preempt warping



Sonar video files

As mentioned early in the program, several free programs are now available that convert the .son sonar video recording file format to the .xtf format that can be processed by commercially available software packages. Softwares vary considerably in price, from hundreds to thousands of dollars. Given our early success with the development of the snapshot approach, we have only spent a bit of time examining a few of the software packages available for Humminbird sonar video file processing. We have long discussed the idea of conducting a more rigorous evaluation of processing methodologies, but have not yet found the time to do so. Done properly, an assessment could provide a lot of useful information to users who are deciding which image capture and processing option to pursue. Several important factors that should be evaluated include: time demands and cost, end-product image quality/resolution, and overall performance in sub-optimal scanning environments such as in narrow canopied streams, or along tortuous (i.e, highly sinuous) routes.

Snapshot vs. Video Approaches

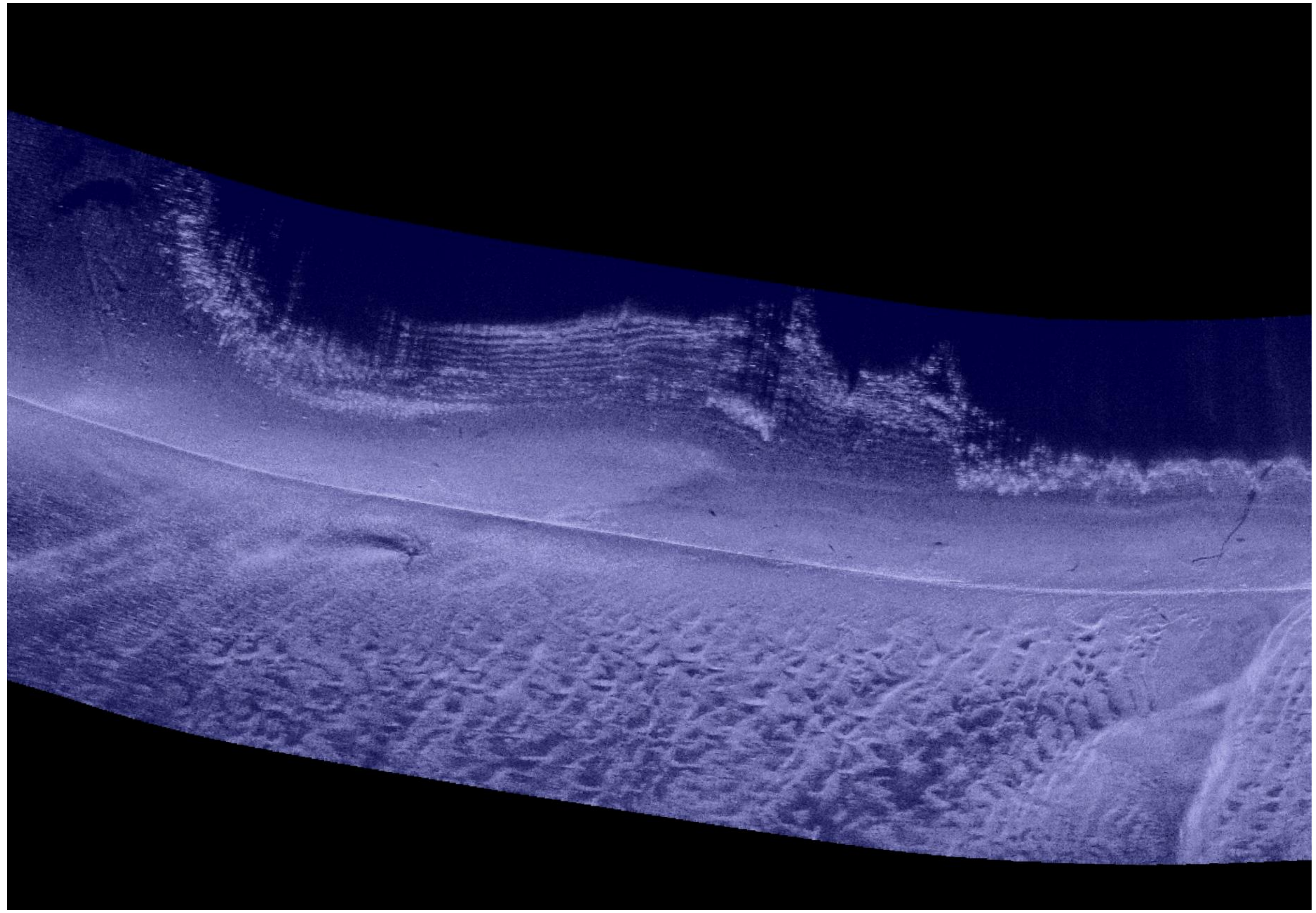
- **HSI video file .son to .xtf conversion tools now available (e.g., son2xtf program)**
- **Processing Humminbird video files converted to .xtf now possible via 3rd party, commercially available software packages**

Examples- Hypack ($4300), Dr. Depth ($225), SonarTRX ($90 Humminbird version, 130$ xtf)

Snapshot processing

Although our evaluations are limited, the following three slides provide an singular example for comparing the output from two different video processing softwares to the snapshot approach output (shown here in this slide). This processed image represents a scan of the right bank of a short reach of the Apalachicola River. The imagery is not very detailed in this reach, yet some of the differences in bedform (ripples, dunes, and plane bed) can be seen, in addition to the stippled signature of the partially submerged, bank-side willow stands (upper right and left sides of image).

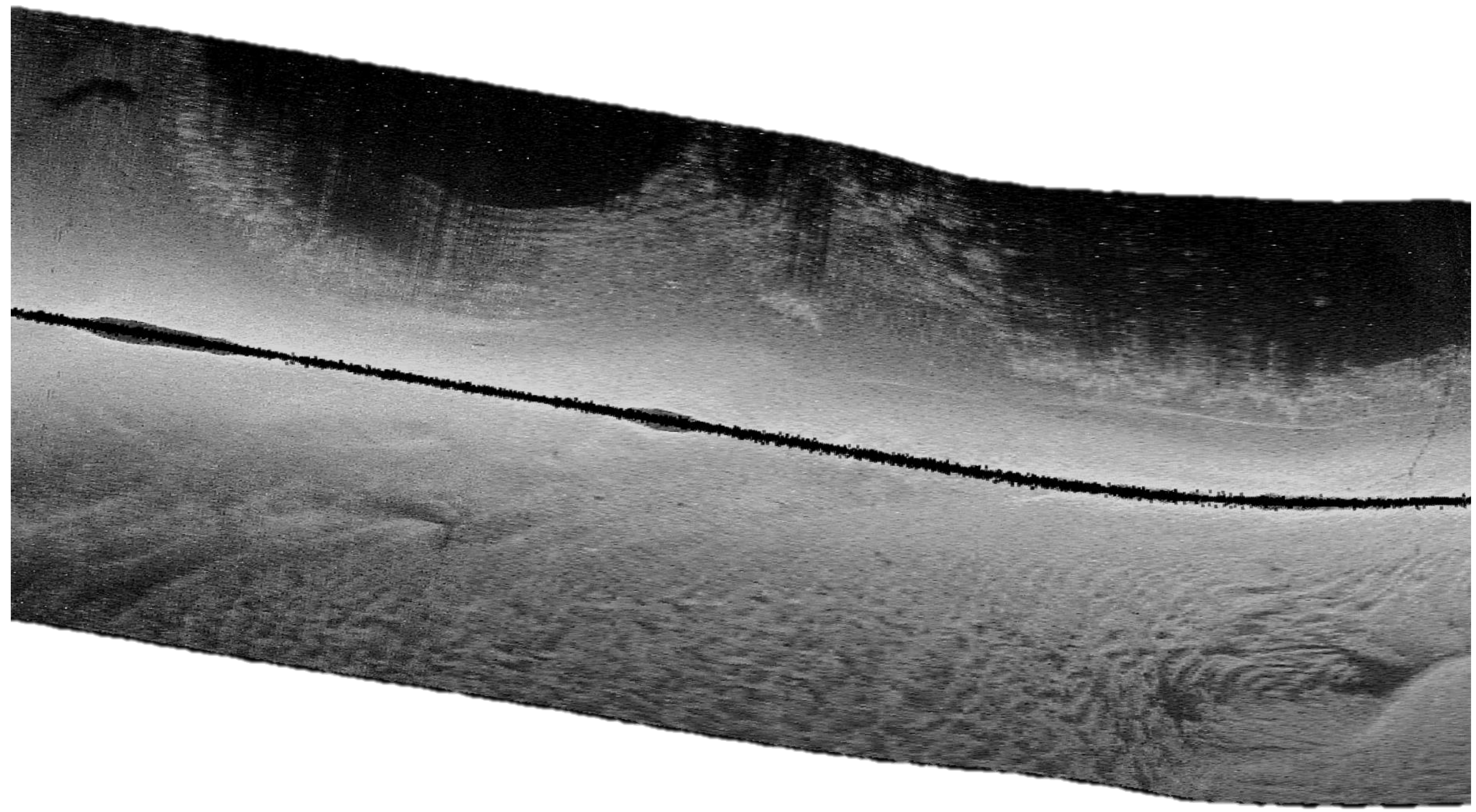
Our Method



Video processing

Hypack is a commercially available software package that is capable of doing a lot more than just processing Humminbird .son files, but costs range in the thousands of dollars. This image example was not processed by us, but rather by a Hypack representative who was provided the file. The imagery from this example was captured on a different day, thus bedforms may have changed to some degree. Nevertheless, some differences in overall image quality are evident.

Hypack

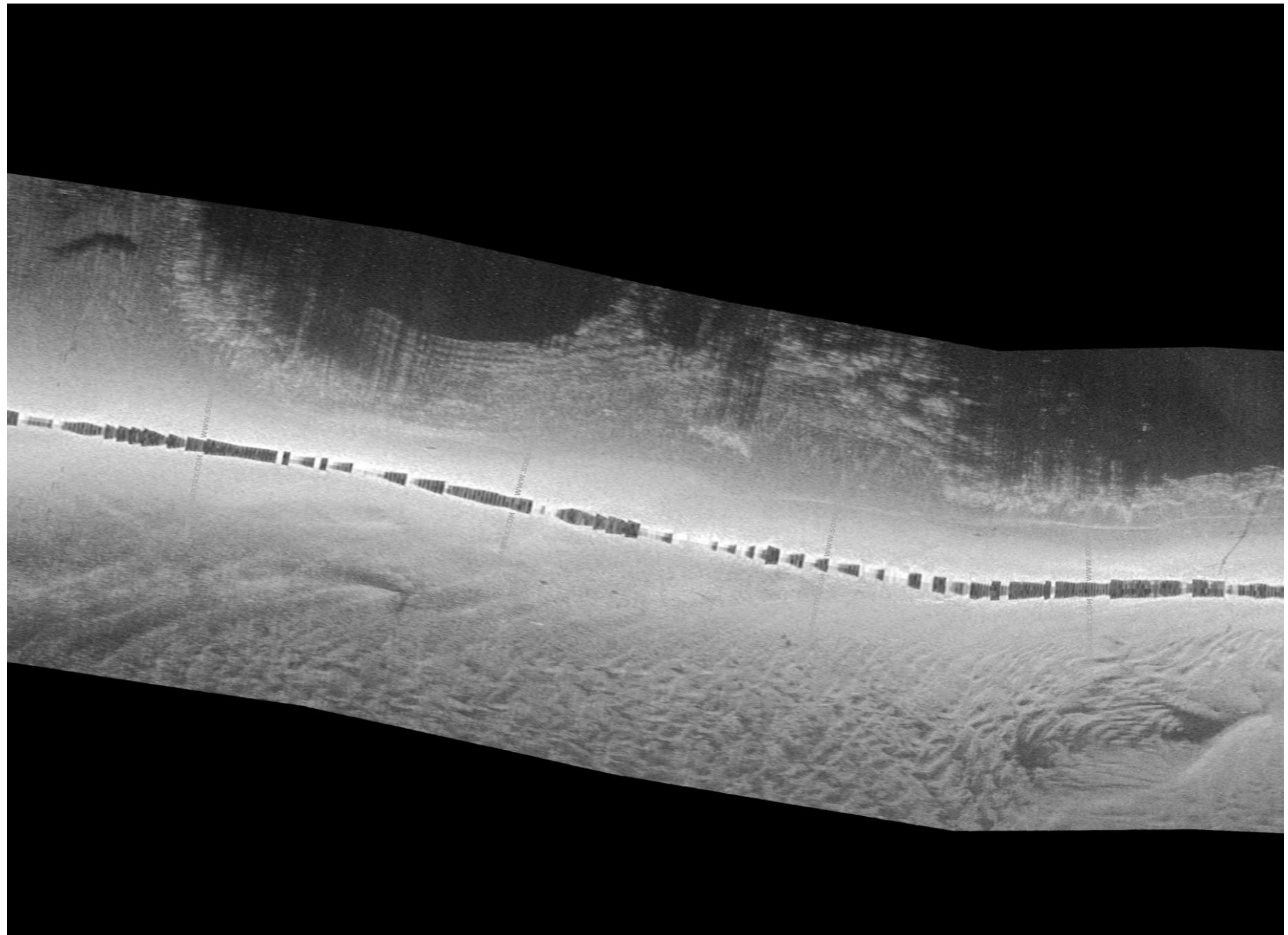


Video processing

This example image was processed by the authors using a trial version of the software package called SonarTRX. This software is quite inexpensive, in the hundreds of dollars. The .son file used for processing was the same as that used in the previous example from Hypack.

Surely this one example is not sufficient to draw any conclusions regarding the efficacy or performance of one software or approach versus another. On the other hand, from what we have seen in this reach and others we have examined, the snapshot approach is clearly capable of yielding reliable, high quality results that are on par with, if not superior to other commerically available softwares for sonar image processing.

SonarTRX



Merits of the approach

Although we cannot yet speak from a fully informed perspective on commercially available software for image processing, we can discuss several of the noteworthy advantages of the snapshot approach, and suggest taking the following factors into consideration.

The snapshot approach uses software (ArcGIS) that is commonly available and familiar to natural resource professionals. The approach yields high quality results, and can be completed rapidly (3-4 minutes of total processing time per swath kilometer, assuming an experienced user). The snapshot approach is inherently flexible; a single image or a series of hundreds of images can be processed at a time. Issues associated with weak GPS signal (i.e., drift of coordinates) can be corrected during processing, as can issues associated with image warping. These corrections are possible because the user has access to the raw coordinate data and control point files to perform the manipulations required. In other words, the snapshot approach is less "black-box" and affords the user more control over final products. Raw sonar imagery is captured in a format that is easily accessed during mapping. The snapshot approach also maintains a high level of data integrity and safeguards. The image quality you see on screen during the survey is what you will get on the back end. Error notifications appear during a snapshot survey if images fail to save, or if the GPS signal is lost. Quick corrections can be made on the fly to address these issues. What happens during a sonar recording survey when such issues present is unknown/untested at this point.

Advantages of Snapshot Approach

Uses available software (plus our tools are FREE!)

Produces high quality results, fast

Inherent Flexibility

- A single image or a series of hundreds of images can be processed at a time
- Raw images very easily referenced and recalled for viewing during image interpretation/map production
- Image control point network at scale of individual image can be manipulated to correct warping
- GPS drift can be assessed and corrected during processing

Data Integrity Safeguards

- You get what you see on-screen during the survey
- Notice of file corruption- if an image fails to save get instant error message (What happens if a sonar video file is corrupted, or the memory on SD card exceeded?)
- What happens when GPS signal is lost during a video recording?