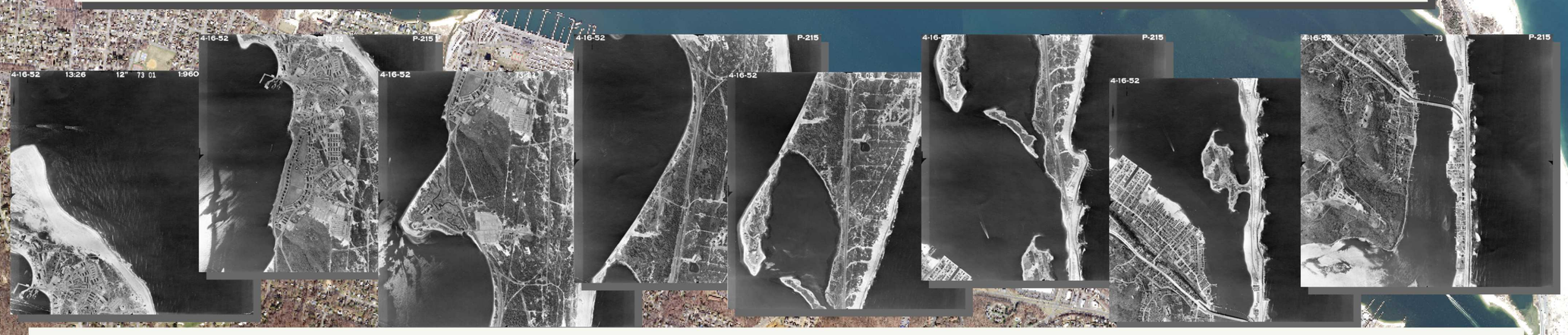
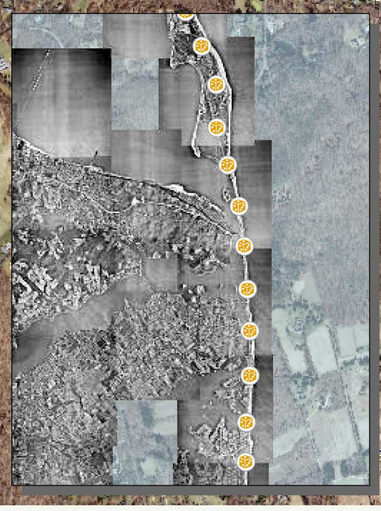
Transforming Historical Coastal Imagery Into Map Layers

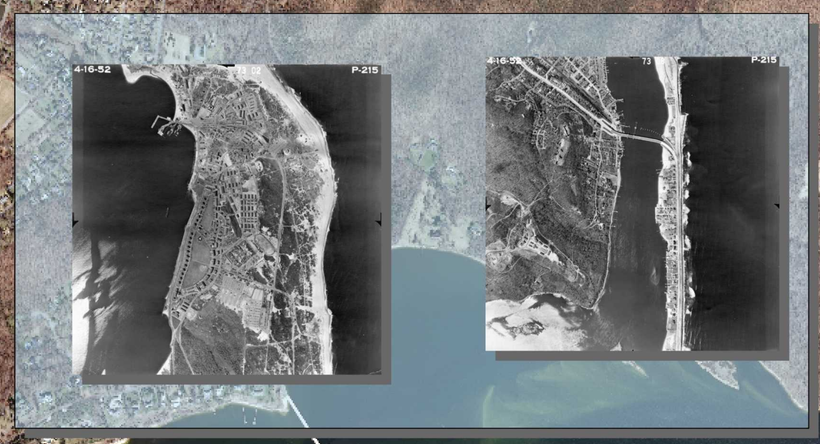


The Bureau of GIS at DEP has begun a project transforming hard copy historical aerial imagery of the coast into digital GIS map layers for the purpose of studying how storms impact the New Jersey coastline. The images above are examples of 8 of the 141 frames taken after a storm event in 1952. Using a high resolution scanner, the frames are scanned at 1200 DPI and saved as uncompressed TIFF images. These archive image files are then georeferenced to generate the map layer. The panels below illustrate the primary steps followed to complete the task.

Within ArcGIS Pro, an existing georeferenced enterprise image layer serves as the base reference layer for the georeferencing process. Because imagery in this event was taken in 1952, a 1951 image layer of the entire state of New Jersey was the primary base image layer used.



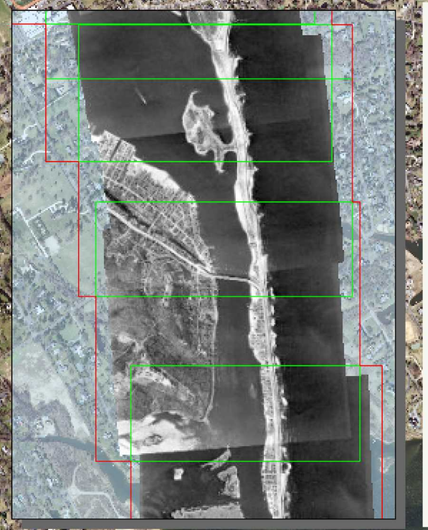
Before the raw images are added to the application, general photo location points for each image scanned are created in a file geodatabase feature class. The points represent the approximate location of the image centers, using the enterprise image layer to set the locations. The points simplify orienting each image for georeferencing. As shown in the panel, the location points span the entire extent of the collection, in this example going from the tip of Cape May to the tip of Sandy



To begin georeferencing, the raw image files are added to an active map session. Since these images have no spatial referencing, they will draw without any real-world orientation or location. But once an unreferenced image is added, a 'Georeferencing ' toolset is activated. With the photo locator points added, the point generated for an added image can be selected and used to set the initial map view location and scale. The 'Fit to Display' tool can then be used to re-position the image to the general location linked to the locator point. Additional tools to move, rotate or scale the image can then be used to better refine this initial fit. Once the initial fit is set, georeferencing is done using the 'Add Control Points' tool. For this project, 6-8 points are chosen as links using features which are visible on both the raw image and the reference image such as road intersections, parking lot lines. and sidewalk or driveway corners. As links are added, the raw image will be repositioned using the control points to direct the fit. Once an accurate fit has been defined, the newly oriented image is saved as a new image file that retains the spatial referencing. When this new image is added to the map, it'll immediately draw in its correct spatial orientation and scale.

After all images are georeferenced, they are cropped or clipped. Cropping is done to remove portions of the image edges where camera markings or information about the image may be located. Also, since these images were taken with frame-to-frame overlaps of 30-60%, portions of each image can be removed to reduce the file sizes while ensuring that all areas covered by the image set are included in the final mosaic. The first step in the cropping is to generate a new polygon feature class. Polygons defining the cropping extent for each image are then delineated in an editing session and coded with the image frame ID.

Once the cropping polygons are delineated, they are used with the ' Extract by Mask tool' in ArcGIS Pro. All portions of each image outside of its polygon cropping boundary are removed, with the portion within the polygon boundary extracted and saved as a new image file. Once all of the images are cropped, there is one final step needed to



The final step is to create the Mosaic Dataset. This is a special raster data set which resides in a file geodatabase. The mosaic is built using all of the cropped images which are loaded into a blank data set envelope. The mosaic is then enhanced and optimized using tools such as "Calculate Statistics" and "Build Overviews" to improve performance and display. The finished layer now consists of our clipped image files managed and displayed as one continuous image layer along with the associated boundary and footprint files showing the extent of the collection and of each individual image section.

During my time at the DEP, I scanned and inventoried over 1000 aerial images, georeferenced and cropped over 500 images, and created image mosaic datasets for three collections: October 1949, April 1952, and November 1953.