Modeling Flat Panels

AN INTRODUCTION TO REPLACING PHYSICAL TEMPLATES WITH PHOTOS

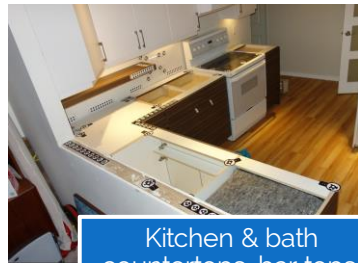### PHOTOMODELER TECHNOLOGIES

Do you manufacture custom products that require accurate field measurement of flat shapes with complex-shaped outlines? For example:
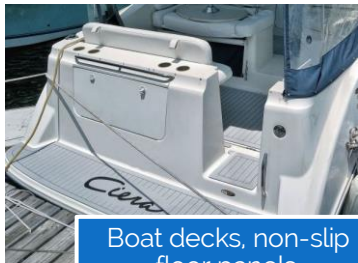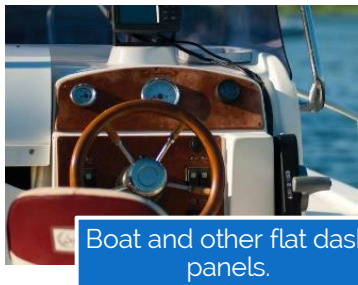

Boat decks, non-slip floor panels.

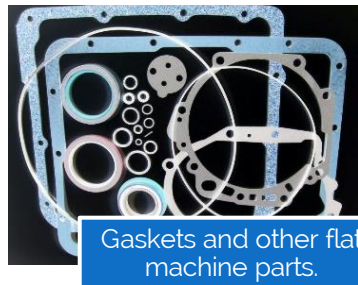Stair, floor, wall panels and coverings.

Kitchen & bath countertops, bar tops.

Glass/Glazing, windows, furniture, mirrors.

Boat and other flat dash panels.

Gaskets and other flat machine parts.

When manufacturing or reverse-engineering these types of products, you will need measurements and diagrams of the panel or the shape and its outline. Traditionally, this has been done by creating a physical template on site. You cut or draw or trace on paper, plastic, or wood the outline of the existing shape. The pattern is used to cut and form the final pieces. The final pieces are then returned to the site for fitment.

Measuring, templating, or digitizing shapes in the field has always been a time consuming and labor-intensive process, and prone to error! With the advent of digital workflows and CAD/CAM manufacturing, the ability to work digitally is ever more important.
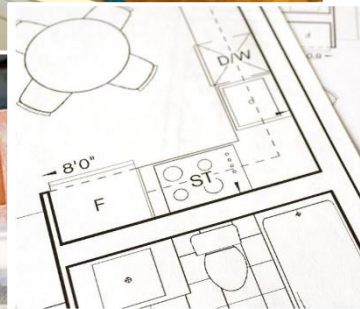
Yes, you can! You can do these measurements with your camera and PhotoModeler®. The software. is based on photogrammetry – the science of taking measurements from photographs. The software tool is used to digitize the shapes, and the resulting model can be exported and electronically sent to a manufacturer or your CNC/CAD software for production.

The preparation that traditionally took hours can now be done in minutes, with many of the steps in PhotoModeler fully automated. Get rid of that messy and time-consuming templating step!
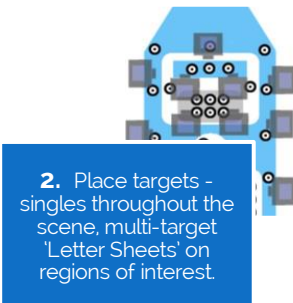

BASIC STEPS – OVERVIEW

The steps are summarized below and can be generally applied to any project where a flat shape or panel needs to be modeled and manufactured. While the examples shown here are mostly boat deck related, similar steps are used with other applications.

**1.** Print or purchase targets and target sheets

2. Place targets - singles throughout the scene, multi-target 'Letter Sheets' on regions of interest.
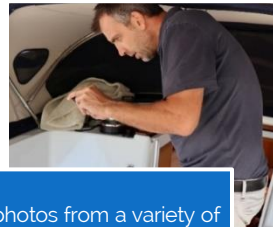
3. Take photos from a variety of angles with overlap and plenty of crisp targets. Also take birds-eye view photos of areas of interest.

**4.** Optionally, take a measurement between targets. In many setups, the project will be scaled automatically based on the Letter Sheet targets, but sometimes you need to set at least one scale using a known measurement between two targets.
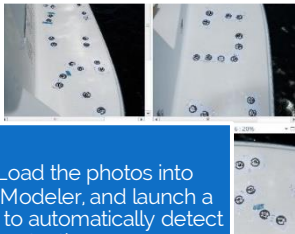
5. Load the photos into PhotoModeler, and launch a project to automatically detect the targets …the cameras are 'oriented' and 3D points generated at target locations.
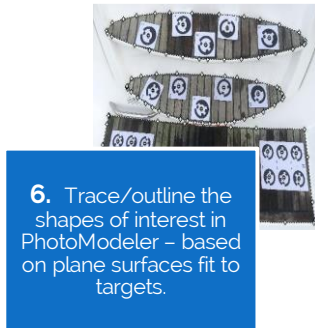
6. Trace/outline the shapes of interest in PhotoModeler – based on plane surfaces fit to targets.
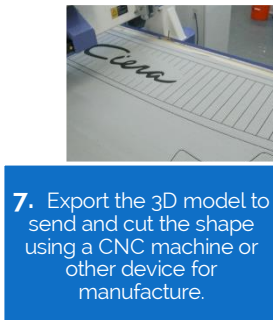
7. Export the 3D model to send and cut the shape using a CNC machine or other device for manufacture.
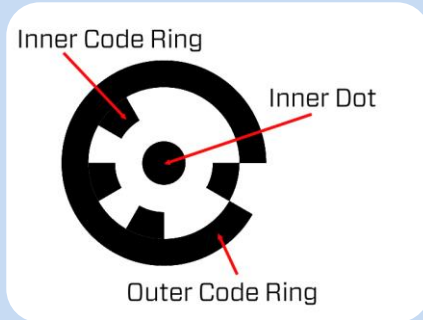
8. Install the finished product for a perfect fit!

Two important aspects of these projects are a) the use of Coded Targets and b) the Photography. The additional instructions below provide important guidance.

CODED TARGETS

Inner Code Ring

Inner Dot

Outer Code Ring

Target detection can fail when the code rings are occluded or blurred, or the target isn't big enough in the images. Target inner dots should appear in the images at least 10 pixels in diameter. When printing the targets from within PhotoModeler, target sizes can be calculated based on the camera, and the typical approximate distance from the camera to model object.

Targets should be spread throughout the scene and not just in specific areas of measurement interest. Targets should be crisp in the photos and large enough for detection and must not move for the duration of photography (if need be, targets should be temporarily affixed to the surface).

Check that targets in view are *fully* in view and no part of the target or code ring is obscured, occluded, or cut off by the image frame. With a good point count, a few discarded problem targets won't be a problem, but if it's simply a matter of panning or tilting the camera slightly to capture a target, it's a good idea to try to capture as many of them as possible.
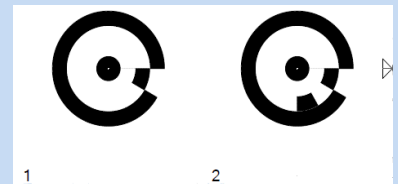
### Target Types
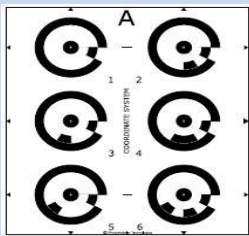
Letter Sheet Targets

Single Target

Paired Offsets

PHOTOGRAPHY

Even though a project can be completed with just a few photos (and sometimes even just a single photo), always take more photos than you think you might need. Remember, it's a lot easier to lay down more targets at the onset and take more photos than you think you might need than it is to go back to the site for a project redo.
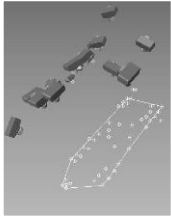

A systematic approach to photography is best. That is, at each panel/shape location of interest take a series of overlapping photos. Then move to the next panel/shape location, make sure photos capture enough 'connection' targets so that regions are connected. For boat decks, you would take most photos pointing straight down – like you were 'flying' over the deck. Countertops and glazing applications would use different angles to get full coverage.

Sometimes getting the right angles is tricky in a confined space such as a boat cockpit or kitchen interior, so getting creative with camera positions can help. For a boat deck example, take photos through canvas or hatch openings, from the dock and from above if possible. Also, again, if the panel areas of interest are separated, make sure to lay down some targets between these areas – these targets won't necessarily be used for measurement or tracing, but do help digitally connect the sections of the model.

If multiple panel models are required, they can be modeled individually in separate projects, or, if there are suitable 'tie' targets in the scene, they can be traced in a single model project.
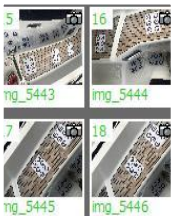
Ensure enough targets are clearly visible in each photo (at least 6, ideally more), that photos are taken from a variety of camera angles, and that there is enough overlap between photos.
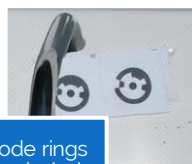
Most importantly, avoid photography where the targets are blurred, occluded or obscured, over-exposed, or too much perspective:

Distorted by motion blur

Obscured by shadows

Code rings occluded

Over-exposed

Perspective distortion

SUMMARY

This document showed an overview of the procedure to produce a model of a flat panel shape in PhotoModeler - by placing some targets and taking some photos, a 3D digital model can be quickly and accurately built, and from that model, the product can be accurately manufactured.

FOR MORE DETAILED INFORMATION ON THE WORKFLOW AND STEPS, PLEASE REFER TO THE ADDITIONAL VIDEOS AND DOCUMENTS ON THIS PAGE: MODELING FLAT PANELS.
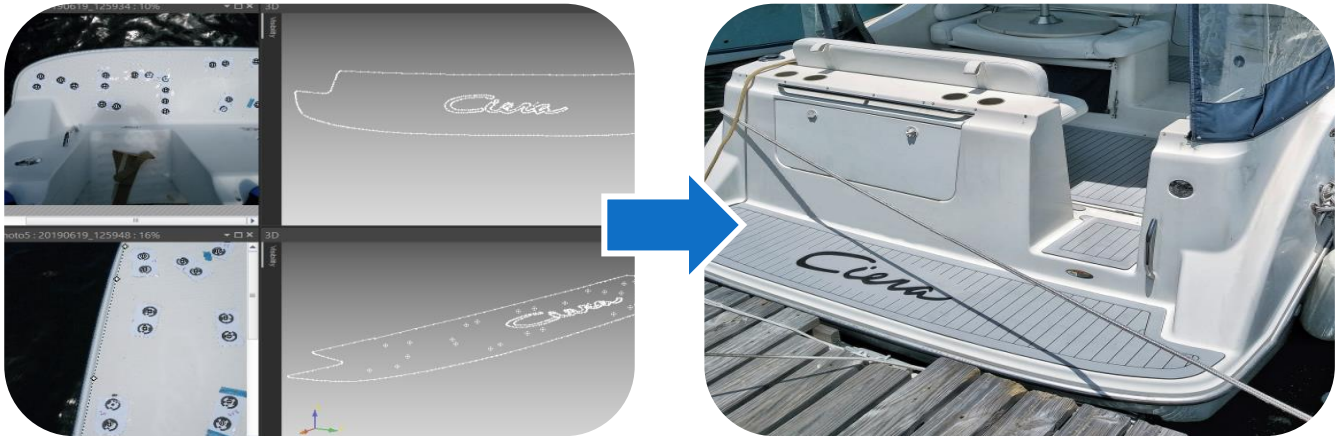
Modeled

Installed

OTHER USEFUL LINKS:

The Other Photogrammetry Automation – Coded Targets

PhotoModeler Coded Targets and Automation - How to automate some measurement tasks

Using PhotoModeler's Surface Draw Tools to Outline Shapes

How to Measure Boat Decks without Physical Templates

How and When to use PhotoModeler's Automated Coded Target Method

Targeted Projects Resources

Digitize 2D Patterns and Templates with a Camera

Using PhotoModeler's Surface Draw Tools to Outline Shapes