Getting Started with a Marine Canvas Digital Workflow and PhotoModeler

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Introduction

This paper describes the steps and requirements for getting started in a marine canvas digital workflow. That is, replacing traditional patterning techniques with on-boat digital measurement and CAD work. For the reader that has an existing digital workflow (using another measurement technology and CAD), some of this document will be repetition. This paper is an outline and does not go into detail operations - as those are covered in other PhotoModeler documents and videos.

Getting Started with a Canvas Digital Workflow

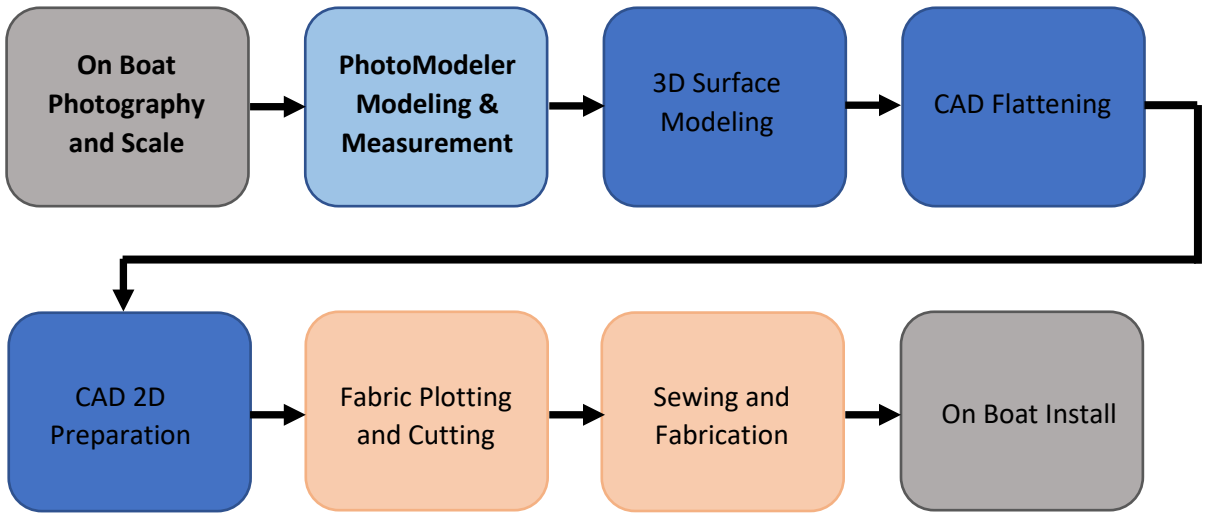
You can get started with digital canvas fabrication in stages. This will help keep costs down as you learn these new systems and decide if it is right for you. Below you will see a section on what you will need to start your evaluation at minimal cost, and then a section for what you will need if you use this digital workflow for full production of your canvas. This document does not discuss frame bending / fabrication.

Long term, your team will need to have knowledge and experience in:

- Basic photography
- PhotoModeler measurement and modeling
- 3D and 2D CAD skills used in canvas
- The running of a digital plotter, or cutter
- Traditional canvas fabrication methods

Where PhotoModeler Fits in Your Canvas Digital Workflow

A digital workflow for canvas replacement work has several steps – some of which are common to more traditional techniques.



The PhotoModeler tutorial videos cover the first two boxes. The last two boxes are traditional canvas fabrication methods. The boxes in between (CAD through plotting/cutting) are not covered well by

currently available materials, and while these are outside the scope of the PhotoModeler work, we hope to provide some assistance on this over time. See the *Resources for CAD Canvas Design* section below.

Caveats: Digital workflows for canvas and 3D measurement are quite new to the industry. As such, if you are new to CAD and/or computers, we suggest finding somebody to assist with the more complex tasks.

Getting Started with PhotoModeler

This is what you need to start evaluating PhotoModeler as part of your digital canvas workflow:

- A PhotoModeler Standard licence (free evaluation, subscription, or permanent)
- A camera (See document in step 1 below. For evaluation, a phone camera may suffice)
- Printer for printing PhotoModeler coded target pages
- A tape measure
- CAD software license (e.g., Rhino CAD) (free evaluation or paid license)
- CAD flattening (add-on software, or built-in flatteners such as in Rhino)
- A method for plotting or printing full size cut sheets. (See *Plotting or Printing Canvas Designs* below)

Alternate way to start if you have patterns

If you have existing paper or mylar patterns / templates of canvas, another good way to get started is to use PhotoModeler to digitize your templates (see PhotoModeler web pages and videos on 2D template digitizing) and start to work in CAD in 2D. This allows you to skip some of the more complex 3D steps so that you can familiarize yourself with PhotoModeler and 2D CAD first. Eventually, the goal would be to implement the first two boxes above so you can skip the paper/mylar templating step.

Steps to Start

See explanations below for steps ending with †.

1. Review this document and the USING PHOTOMODELER TO MEASURE MARINE CANVAS document.
2. Familiarize yourself with the PhotoModeler videos on the canvas page.
3. If you are brand new to PM, complete some projects with your camera and paper targets in your office or home. Do not start on a boat. Measure a shape on the floor or something simple.
4. Print paper coded target sheets and layout the targets to cover the area of interest in your test project. If paper, tape them down.
5. Consider the form of camera calibration that will be used. †
6. Following the tutorial videos, take photos from different angles, positions, and heights.
7. Use the tape measure to note some distances between target points and other features in your area. During the photography and measurement step ensure the targets do not move.
8. Import photos into PhotoModeler, and following the videos, process and model your area.
9. Export the 3D model data to CAD through a common shared format (like DXF or 3DM). †

You can execute the above steps on some simple projects to start and that are easy to access so you can redo the photography if needed. Do not hesitate to contact PhotoModeler Support if you have any questions. Once you are comfortable getting to this stage with a few projects, you can proceed to the CAD stage.

10. Import your PhotoModeler 3D model into CAD, and work to lay out your fabric panels to drape or attach to the 3D model created by PhotoModeler. †
11. Flatten your 3D design to 2D panels. †
12. Work on 2D designs to prepare for cutting. †
13. Generate true-to-size plots.

† Note for steps

Step 5: Camera calibration is the process of turning your camera into an accurate measuring instrument. With PhotoModeler there are a few options for camera calibration including pre-calibration or field calibration (before project, and at same time with project photos). For easiest start up we recommend pre-calibration using the technique shown in this decking video (1:54 to 6:36).

Step 9: PhotoModeler steps will involve measuring and modeling points on the deck surface, snaps with points, tracks with dot points and curves, and tubes with the Bent Tube tool. The resulting 3D model is exported to a 3D CAD program like Rhino 3D, and then surface tools are used to create canvas panels to fit that model. The 3D surfaces are split apart and flattened, and then 2D CAD work is done to add pockets, seam allowances, trim marks, alignment references, etc.

Step 10: Doing canvas work with 3D CAD work is not well documented in the industry. We hope this will improve over time and we will add materials over time. See the *Resources for CAD Canvas Design* section below.

Step 11: Flattening, is a crucial step. The conversion from 3D to 2D is mathematically difficult, especially for more complex shapes! The designed 3D canvas needs to be converted to 2D panels before additional 2D CAD work is carried out (adding allowances, trim lines, darts, pockets, etc.). The Rhino 3D package has some flattening capability, and some customers work with this alone. There are two plugins for Rhino (and other CAD packages) that perform more advanced flattening functions, as well as help with automation of such things as seam allowances, etc. The two common ones in the field are ExactFlat and MPanel.

Step 12: 2D CAD canvas work, like its 3D counterpart, is not well documented in the industry. We hope this will improve over time and we will add materials over time. John Bland, from Tecsew, has some YouTube videos where these processes are outlined. These are listed at the end of this document.

Once you have completed a couple of projects around the office, you can start some modeling tests on a small tube frame, or an easily accessed small boat. We strongly recommend not starting with a customer project as your learning platform.

PhotoModeler in Production

In addition to the items described above, to move to full production you will (or may) need:

- PhotoModeler Standard license(s)
- CAD software license(s) (Rhino 3D)
- A good camera with good lens and ability to shoot from a pole (DSLR, Mirrorless =24MP)
- PhotoModeler Rubber Backed Letter Sheet Target set
- PhotoModeler Dot Tape

- CAD flattening and fabric layout software (ExactFlat or MPanel)
- Better plotting/cutting options – see below

* The rubber backed PhotoModeler Letter Sheet targets make it convenient to place targets down without having to tape paper down and they last longer. They are optional.

Plotting or Printing Canvas Designs

To get your 2D canvas design onto fabric there are several options. In order of increasing capital cost:

- Sending CAD drawings to a service firm for large format plotting. *
- Purchasing a large format paper printer/plotter. *
- Purchasing a table plotter than will draw directly on fabric. *
- Purchasing a fabric cutter (from table-based to fully automated feed)

* These methods necessitate manual cutting directly on plotted lines, or on pinned paper templates.

PhotoModeler Premium

While the PhotoModeler Standard software is most often used for marine fabrication work, the full-capability PhotoModeler Premium software is occasionally used for its SmartMatch and automated target-less automation capability. In some cases, the camera positions can be solved without the use of targets by taking more photos and using PhotoModeler Premium's SmartMatch orientation. Then depending on the task at hand, either proceeding as normal with modeling points, lines, curved tracks, and tubes in PhotoModeler, or executing a dense point cloud modeling step in Premium to get a point cloud that can be used to drape canvas panels in CAD (this last step is only suited to loose-fitting covers). This is a more complex approach requiring a different type of photography (see How DSM Works page).

Resources for CAD Canvas Design

PhotoModeler is one piece of a larger digital workflow for fabricating marine canvas. Several of the techniques (cutting, sewing, parts, and fitting) follow traditional canvas fabrication methods and are covered by several books and courses. The processes carried out in CAD (3D panel creation, flattening, and 2D panel modifications) are not well covered at this time.

Here are some videos that provide some background for canvas work in CAD:

- First presentation to the MFA by Tecsew on 3D CAD design, an Introduction
- Second presentation to the MFA by Tecsew on 3D CAD design
- Third presentation to the MFA by Tecsew on 3D CAD design
- ExactFlat Marine playlist
- ExactFlat Marine Canvas Pattern Making Best Practices
- MPanel Production video

For those newer to canvas fabrication methods, or if you want to check out another method, the Hood Method can be useful. This method, while not a full digital templating method, uses a pattern the same way PhotoModeler creates the shell of the enclosure fitted over a frame. The Hood method is an engineering-driven design that fits well to digital methods. Note there is no association between PhotoModeler and Hood Canvas. The Hood Method (see site for a book, videos, and workshops for sale)