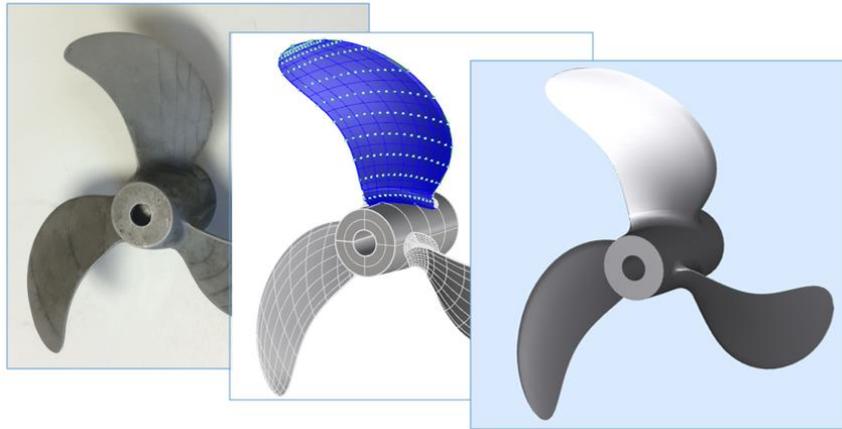


February 2, 2016

## Reconstruct Existing Designs with Scan Converter

*Convert 3D inspection data into a PropCad design, 2D drawing, and reports!*

PropCad is being used to interpret existing propellers, patterns, and scan reports in order to recreate legacy designs. The **Scan Converter** utility, which is now a part of **PropCad Premium**, is used to extract propeller parameters such as pitch, chord, skew, rake, and thickness using 3D data points collected from a physical propeller.



Scan Converter processes the data and recreates the propeller blade by extracting individual sections from the geometry and deriving the geometric distributions. Once the design is in PropCad, additional documentation such as 2D drawings, pitch inspection reports, and 3D offsets can be easily generated for customers, clients, and record keeping.

### 3D Data Sources

The data used by Scan Converter has a variety of sources, including: *traditional pitch-o-meter and inspection probe readings, organized 3D point clouds, and CAD models generated through full-3D digitization scans*. These 3D data points can be in Cartesian (X-Y-Z) or Polar (X-R- $\theta$ ) formats. The data can be sampled on both the face and back of the blade, or just the face with a corresponding thickness measurement.



## Enter 3D Data

First, the primary characteristics of the propeller are identified, such as units, rotation direction, coordinate format, number of blades, and diameter. Next, the sampled radial positions (r/R) and number of sampled points per section are entered. HydroComp recommends a minimum of six radial positions, and seven or more chordwise points per section.

**STEP 1 -** Enter Scan data, Design propeller and Sections specifications that correspond to your scanned propeller. You can Open and Save your Scan Converter data to a file. Click the Scan data tab to enter the 3D scanned data points.

**Scan data specifications**

Units: in Scan coordinates are: XYZ  
 Rotation: Right Positive X (axial) is: Fwd

**Design propeller specifications**

Blades: 2 Diameter: 20 in  
 Nominal pitch: 20 in

**Sections**

| Section | r/R    | Radius  | Points |
|---------|--------|---------|--------|
| 1       | 0.0000 | 10.0000 | 26     |
| 2       | 0.9875 | 9.8750  | 26     |
| 3       | 0.9750 | 9.7500  | 26     |
| 4       | 0.9500 | 9.5000  | 26     |
| 5       | 0.9000 | 9.0000  | 26     |
| 6       | 0.8000 | 8.0000  | 26     |
| 7       | 0.7000 | 7.0000  | 26     |
| 8       | 0.6000 | 6.0000  | 26     |
| 9       | 0.5000 | 5.0000  | 26     |
| 10      | 0.4000 | 4.0000  | 26     |

12 sections  
 Insert  
 Remove

**Point cloud source**

Back: F:\HC Dev\PropCad2014\Development\B  
 Processed 312 data points in the back file.  
 Face: F:\HC Dev\PropCad2014\Development\B  
 Processed 312 data points in the face file.  
 Tolerance to detect a new section: 0.25 %D  
 Detected 12 common radial positions.  
 Omitted 0 sections from face.  
 Omitted 0 sections from face.

Process Point Cloud

Open file Save file Help

The 3D data for each section is entered and a preview of the derived 2D section data is shown. The derived data for each section is shown above the plot:

**STEP 3 -** These 2D section offsets are derived from the 3D scan data. Use the Section list box to review and select offsets. You can define the Pitch plane to pass through any two points. Click Build to close this form and build a design.

Section: 7

r/R: .7 Max T: .312 in p/Phomina: 1  
 Chord: 7.6916 in MidC:GL: -.1837 in Face:RL: -1.2343 in

Pitch plane Lock  
 Trailing: TE  
 Leading: LE

Build  
 Face Back

Plot showing 2D section offsets for Section 7. The x-axis ranges from -8.0 to 0.0, and the y-axis ranges from 0.0 to 8.0. A blue curve represents the back of the blade, and a green curve represents the face of the blade.

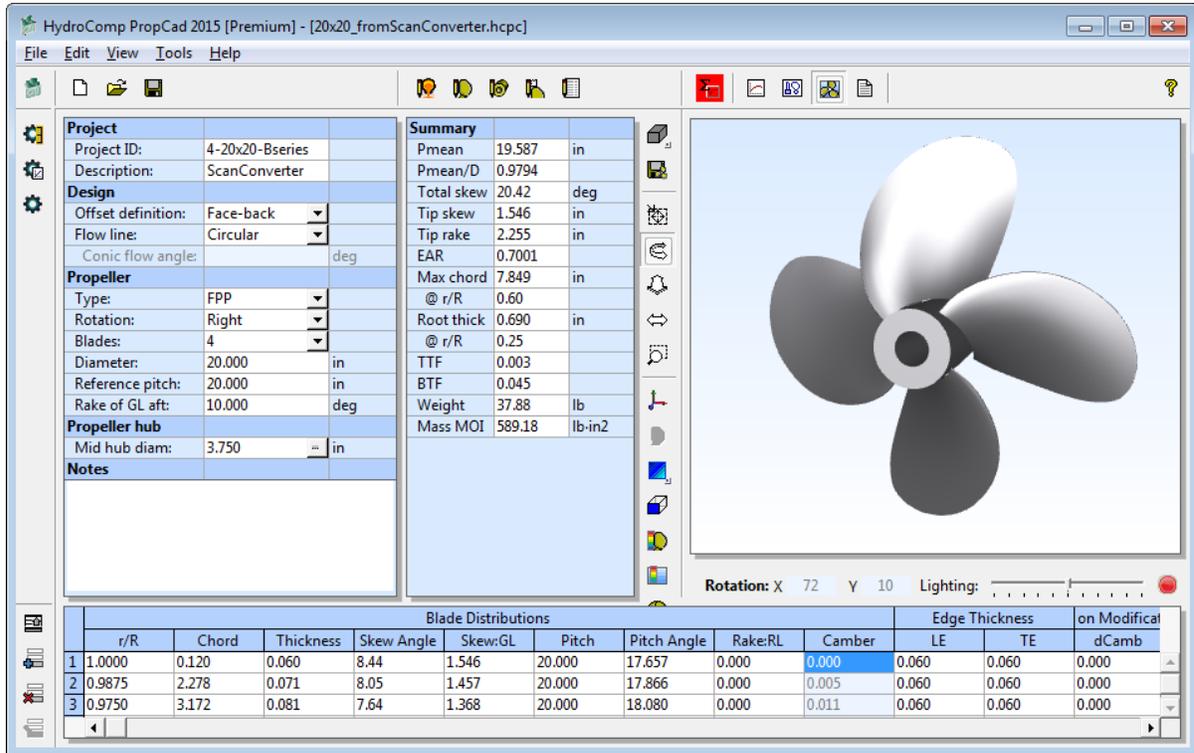
| Back   | TE    | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| X      | 7.692 | 7.385 | 7.078 | 6.771 | 6.464 | 6.156 | 5.848 | 5.540 | 5.232 | 4.924 | 4.615 |
| Y-Back | 0.060 | 0.095 | 0.127 | 0.157 | 0.184 | 0.208 | 0.230 | 0.250 | 0.266 | 0.280 | 0.292 |
| Use    | On    |

| Face   | TE    | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| X      | 7.692 | 7.384 | 7.076 | 6.769 | 6.461 | 6.153 | 5.846 | 5.538 | 5.230 | 4.923 | 4.615 |
| Y-Face | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Use    | On    |

Open file Save file Help

## Build and Review

From here, we can Build the propeller to back-calculate the parameters and create 3D models 2D drawings, and reports:



The screenshot displays the HydroComp PropCad 2015 software interface. The main window shows a 3D model of a four-bladed propeller. The interface is divided into several sections:

- Project Information:** Project ID: 4-20x20-Bseries, Description: ScanConverter.
- Design Parameters:** Offset definition: Face-back, Flow line: Circular, Conic flow angle: (blank).
- Propeller Parameters:** Type: FPP, Rotation: Right, Blades: 4, Diameter: 20.000 in, Reference pitch: 20.000 in, Rake of GL aft: 10.000 deg, Propeller hub Mid hub diam: 3.750 in.
- Summary Table:**

|            |        |        |
|------------|--------|--------|
| Pmean      | 19.587 | in     |
| Pmean/D    | 0.9794 |        |
| Total skew | 20.42  | deg    |
| Tip skew   | 1.546  | in     |
| Tip rake   | 2.255  | in     |
| EAR        | 0.7001 |        |
| Max chord  | 7.849  | in     |
| @ r/R      | 0.60   |        |
| Root thick | 0.690  | in     |
| @ r/R      | 0.25   |        |
| TTF        | 0.003  |        |
| BTF        | 0.045  |        |
| Weight     | 37.88  | lb     |
| Mass MOI   | 589.18 | lb-in2 |
- Blade Distributions Table:**

|   | Blade Distributions |       |           |            |         |        |             |         | Edge Thickness |       | on Modificat |       |
|---|---------------------|-------|-----------|------------|---------|--------|-------------|---------|----------------|-------|--------------|-------|
|   | r/R                 | Chord | Thickness | Skew Angle | Skew:GL | Pitch  | Pitch Angle | Rake:RL | Camber         | LE    |              | TE    |
| 1 | 1.0000              | 0.120 | 0.060     | 8.44       | 1.546   | 20.000 | 17.657      | 0.000   | 0.000          | 0.060 | 0.060        | 0.000 |
| 2 | 0.9875              | 2.278 | 0.071     | 8.05       | 1.457   | 20.000 | 17.866      | 0.000   | 0.005          | 0.060 | 0.060        | 0.000 |
| 3 | 0.9750              | 3.172 | 0.081     | 7.64       | 1.368   | 20.000 | 18.080      | 0.000   | 0.011          | 0.060 | 0.060        | 0.000 |

## About HydroComp

Celebrating its 30th year of operation in 2015, HydroComp provides software and services for resistance and propulsion prediction, propeller sizing and design, and forensic performance analysis. HydroComp is proud to have served over 700 industry, research, academic, and government clients from more than 60 countries.

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