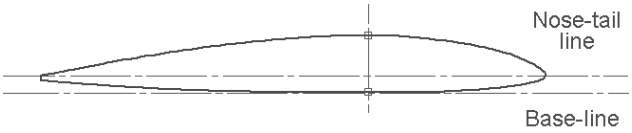
Definition of Section Offsets in PropCad

A HydroComp Technical Report
Report 121

This report expands on the coordinate specifications used to define propeller blade section offsets in PropCad. Procedures to convert data from other formats are presented.

STANDARD DEFINITION

PropCad adheres to the coordinate system used by the majority of commercial stock manufacturers and designers. This system is based on developing each section in the expanded view, as shown in the graphic below.



The "base-line" of each section is also known as the pitch line. By viewing all pitch lines from root to tip, a pitch plane is developed.

The notable feature of this definition is that the base-line is located at the lowest point of the pressure side (i.e., the face) of the propeller. This definition has been adopted because most commercial stock propellers are based on a propeller type that has a significant portion of its geometry as a flat face which will conveniently lie on the pitch line. (For example, the Gawn, B-series, Kaplan, AU and SK propellers all share this feature.) All blade offsets will thus be positive values above this base-line.

DEFINITION BY THE NOSE-TAIL LINE

One alternative format is to define the propeller section with a base-line passing through the leading edge "nose" and the trailing edge "tail". A section defined in this way will show the offsets as distances above or below this "nose-tail line".

The use of this format is not recommended for a number of reasons:

1. The numerical performance models used in software such as PropExpert rely on pitch being defined in the standard way. Often, the nose-tail line is not parallel to the pitch line (as you can see from the B-series section above), leading to an incompatible pitch value between the performance model and the geometric definition.
2. The flat face provides a logical base-line for documentation or measurement, and for repair with pitch blocks.
3. Local changes to the section may alter the nose or tail location without changing the principal geometry of the section. For example, one cure for root cavitation control is to cut back on the leading edge for a more rounded nose. Another example is with cup, where the majority of the blade remains unchanged, but the tail is deflected.

Converting data in this nose-tail format to the standard format is easy - simply find the maximum pressure side offset and lower the base-line (or raise the offsets) by this amount. Keep in mind that the new base-line will be parallel to the nose-tail line. You may need to revise the offsets if you wish to locate the base-line along the pressure face.

One additional refinement can be performed if you wish to locate the sections in their exact prior axial location in space. You can apply values for the rake distribution equal to the base-line shift. (A negative value will shift the section aft from the generating line). In other words, you can exactly match the prior geometry by relocating the base-line, then shifting the rake distribution by the same amount.

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