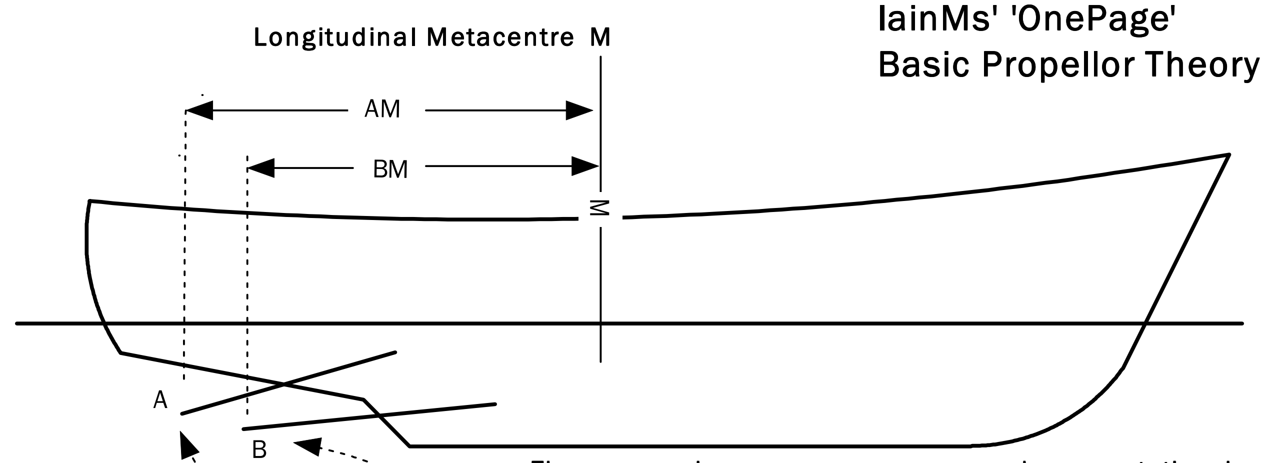
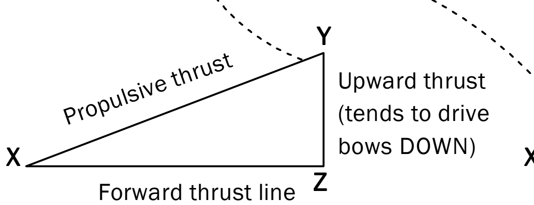
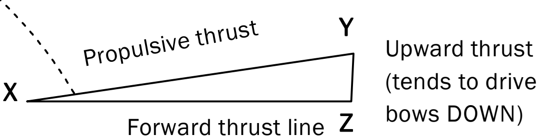
IainMs' 'OnePage'
Basic Propellor Theory



These examples assume same prop and same rotational speed; therefore the propulsive thrust will be equal in both cases. (length XY will be the same in both A and B)





Case A

Greater inclination of prop shaft to horizontal results in an increased upward thrust (represented by length YZ) thus pushing the bow down more than in Case B.
Thrust available to push boat thru water = XZ

Case B

Here the shaft inclination is less and therefore the upward thrust is also less (length YZ is less than in A). Note that, in addition, because the forces must balance out, the reduced upward thrust results in an increase in the thrust available to push the boat.

<u>**NOTE : The following does NOT apply to 'surface breaking' props**</u>

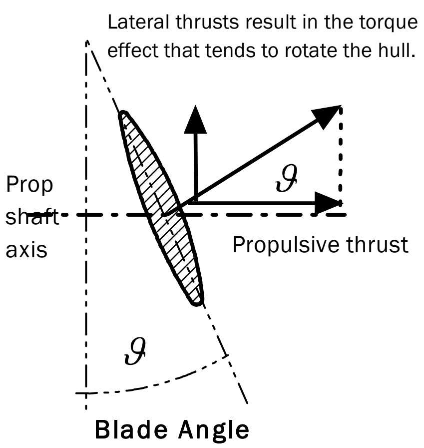
Single Blade

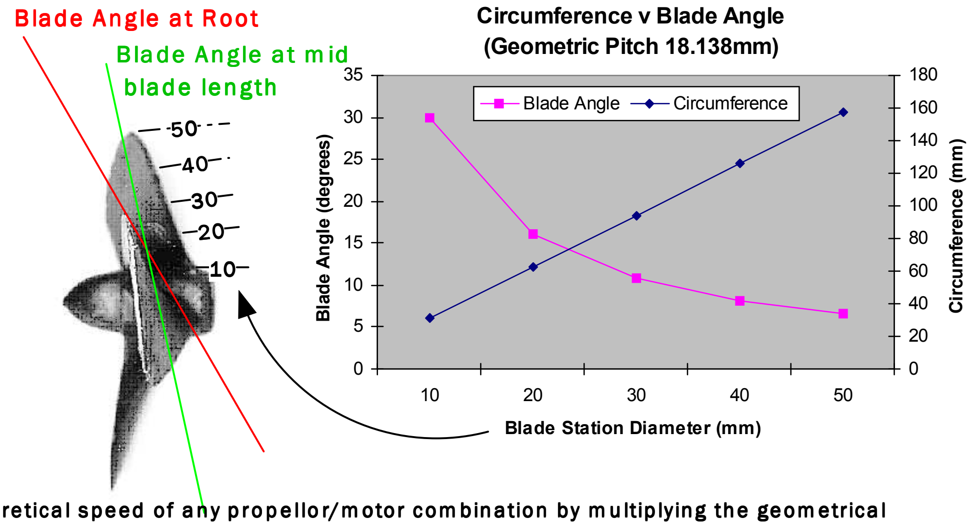
The distance moved by the prop (x) in one rotation can be calculated as follows:

$$X = \tan\theta * \pi * d$$

where θ is the blade angle measured at diameter 'd'.
This is called the '**Geometric Pitch**'

In one revolution, the distance moved by the tip of the prop blade is greater than the distance moved by the root. This means that, if the blade has a constant blade angle, the tip will try to move through the water approx. 5 times further than the root. Clearly this is not possible.
For this reason, the angle of the blade (pitch) is progressively reduced from root to tip. This is calculated in such a way that the 'geometric pitch' is much the same at each blade 'station'.





It is possible to calculate the theoretical speed of any propellor/motor combination by multiplying the geometrical pitch at 3/4 prop diameter by the propellor RPM. This takes no account of 'slip' that, at low RPM, can be as high as 35% (measurements by others show values of between 8% and 35% across the speed range for a particular prop design).

This shows a prop that is generating tip cavitation from the blades.

In addition, any propellor will suffer from cavitation along the length of the blades that, in full size applications certainly will give rise to cavitation pitting & erosion resulting in rough surfaces on the forward surface and on the rear surface at the trailing edge of the blade.

Generally this is not a concern in models, although, if the prop blades are too close to the hull bottom, it can affect the efficiency.