THE MOST CONVENIENT WAY TO OBTAIN THE BLADE ANGLES IS TO SIGHT ALONG THE BLADE (THROUGH THE PLEXIGLASS).

THIS IS WHAT I CAME UP WITH:

![Diagram of fan and first stator in booster]

**NOTE:**
- THE RADIUS IS ABOUT 16'' AT ENTRANCE TO THE BOOSTER.
- THE TIP RADIUS IS 30''

THERE ARE TWO WAYS TO ESTIMATE THE BLADE SPEED:

1) FLOW SHOULD BE ROUGHLY ALIGNED WITH FAN BLADE LEADING EDGE (OR A SMALL + ANGLE OF ATTACK) — IF NOT, FLOW WILL SEPARATE.

2) FLOW WILL LEAVE FAN TRAILING EDGE AT METAL ANGLE AND MUST ROUGHLY LINE UP WITH STATOR BLADE LEADING EDGE ANGLE (OR A SMALL + ANGLE OF ATTACK).

**FOR ESTIMATE 1):**

\[
\text{Axial velocity } \rightarrow M = 0.5 \approx 160 \text{ m/s}
\]

\[
\frac{W - V}{160 \text{ m/s}} = 45^\circ
\]

SO WHAT WILL \( W_r \) GIVE ROUGHLY A 45° FLOW ANGLE INTO THE FAN?

\[
W_r = 160 \tan 45^\circ = 160 \text{ m/s}
\]
FOR ESTIMATE 2):

\[ \frac{\omega_f + 160 \tan 20^\circ}{W_2} = \tan \beta_2 \]

\[ 160 \tan 50^\circ - 160 \tan 20^\circ = \omega_f = 132 \text{ m/s} \]

Since \( \gamma = 0.4 \text{ m} \) then \( \omega = 394 \text{ rad/s} \) (ESTIMATE 1)

\[ \omega = 325 \text{ rad/s} \] (ESTIMATE 2)

\( \omega \text{ rad/s} \rightarrow \text{ convert to RPM} \)

\[ \frac{394}{\text{s}} \times \frac{60}{\text{min}} \times \frac{\text{rad}}{2\pi \text{ rad}} = 3760 \text{ RPM} \]

\[ \frac{325}{\text{s}} \times \frac{60}{\text{min}} \times \frac{\text{rad}}{2\pi \text{ rad}} = 3100 \text{ RPM} \]

b) If we take it as 3500 RPM, \( \omega = 366.5 \text{ rad/s} \)

Tip radius = 0.76 m so Tip speed is 279 m/s

(Note: This is why the blades are twisted, since \( \beta' \) changes with radius)

\[ V = \sqrt{160^2 + 279^2} = 322 \text{ m/s} \]

About \( M \approx 1 \)

Relative to the fan