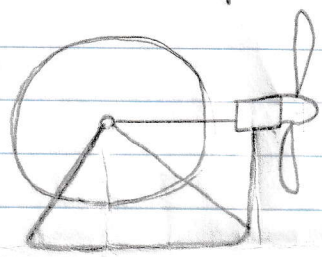
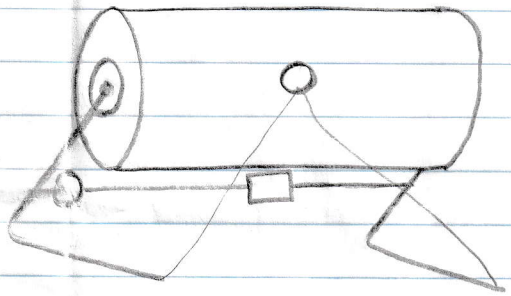
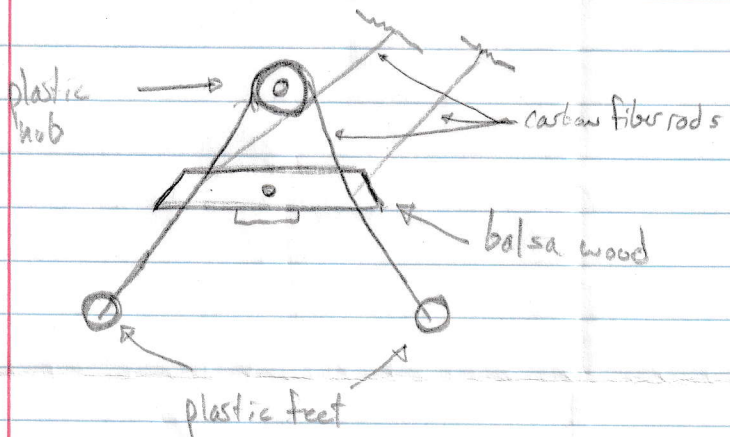
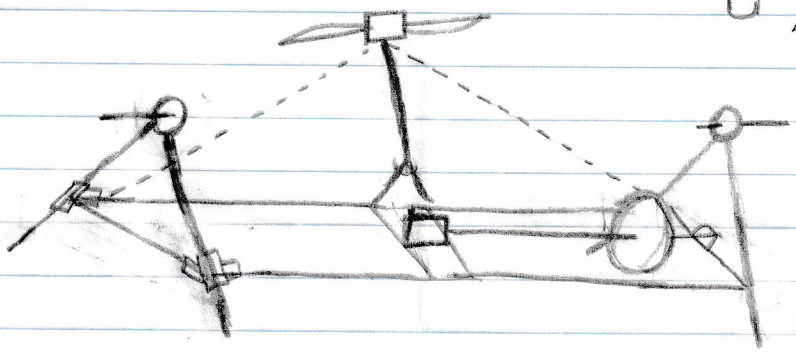
1/14/2023

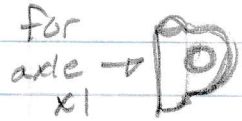
Version 2/3



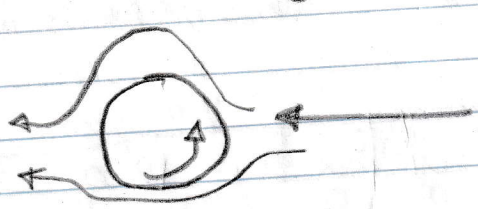








Lift of Magnus Protocraft



"Backspin"

path over top is longer

* $L = \rho G V$, where $G = 2\pi b V_r$

so...

$L = \rho 2\pi b V_r V$, where ρ = density of air (slugs/ft)
b = radius of cylinder (ft)
$V_r = 2\pi b s$

so...

$L = \rho 2\pi b 2\pi b s \cdot V \rightarrow \boxed{4\rho\pi^2 b^2 s \cdot V}$

where V = velocity of airflow (ft/sec)

$\rho = 0.0023769 \frac{\text{slugs}}{\text{ft}^3}$

$L = 4(0.0023769)\pi^2 (b)^2 \cdot \underbrace{s}_{2\text{ ft}} \cdot V \Rightarrow 0.093836\, b^2 \cdot s \cdot V$

* Box fan ≈ 200 CFM
⇔ 200 $\frac{\text{ft}^3}{\text{min}}$

2 ft → 200 $\frac{\text{ft}^3}{\text{min}}$ ⇒ 3 1/3 $\frac{\text{ft}^3}{\text{sec}}$ / 2 ft²

Velocity of airflow ≈ 5/3 ft/sec

→ $0.156393 \cdot b^2 \cdot s$

74 grams heavy Version 2		≈ 1,100 rpm to fly 127 grams heavy Version 3 → 0.927 ft long
	b = 0.25	b = 0.3166 ft
	0.9583 ft long	
60 rpm		
120 rpm s = 1 →	0.00977 Lb/ft (4.43 g/ft)	→ 0.01567 (7.10 g/ft)
180 rpm s = 2 →	0.01954 Lb/ft (8.86 g/ft)	→ 0.03135 (14.22 g/ft)
240 rpm s = 3 →	0.02932 Lb/ft (13.29 g/ft)	→ 0.04702 (21.32 g/ft)
300 rpm s = 4 →	0.03909 Lb/ft (17.73 g/ft)	→ 0.06270 (28.44 g/ft)
s = 5 →	0.04887 Lb/ft (22.16 g/ft)	→ 0.07838 (35.55 g/ft)

$L = 0.093836 \cdot b^2 \cdot s \cdot V$ where b = radius in ft
s = rev/sec
V = speed of airflow in ft/sec

CFM of Lasko brand 20" Box fan = 1820
housewholesale.com/ceiling-fans/ceiling-fan-wind-speed

$\approx$ 4.84 MPH $\rightarrow$ 7.09 ft/sec

Version 2

74 grams $\rightarrow$ 0.163142 lb
0.25' radius

$L = 0.0415810775 \cdot s$
$0.163142 / 0.0415810775 = 3.92$

$s = 3.92$
$\approx$ 235 rev/min
to achieve lift

$\frac{235}{0.9583} = 245$ rev/min

+10% = 270 rev/min

Version 3

127 grams $\rightarrow$ 0.279987 lb
0.3166' radius

$L = 0.0666844419 \cdot s$
$0.279987 / 0.0666844419 = 4.19$

$s = 4.19$ rev/sec
$\approx$ 252 rev/min
to achieve lift

$\frac{252}{0.927} = 272$ rev/min

+10% = 300 rev/min