Failure of Spar Pin Carry Through @ n < 6.0

Current Activities

AIAA Design-Build-Fly since 2007

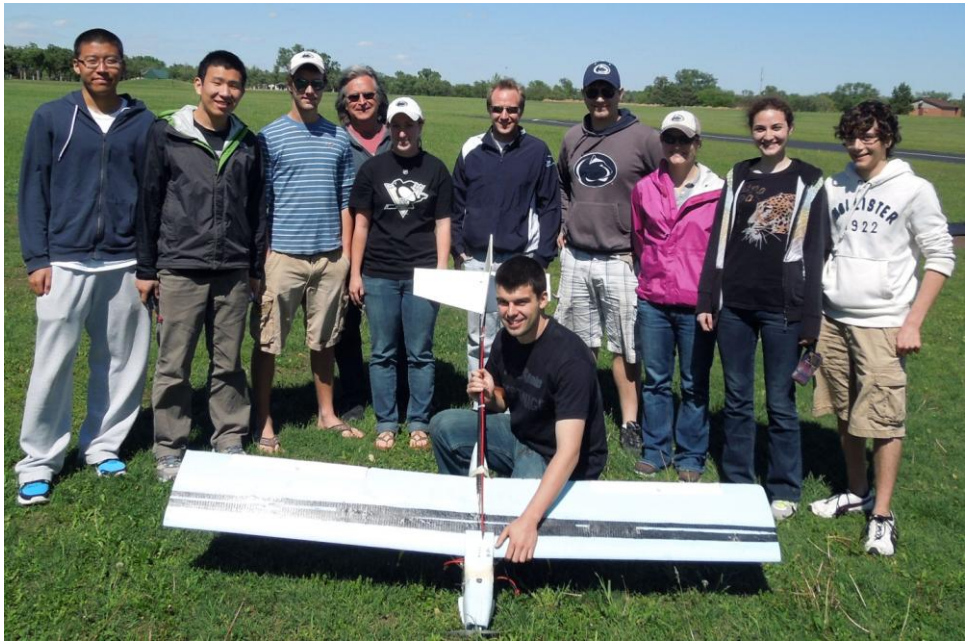
Cessna Aircraft Company
Raytheon Missile Systems
AIAA Foundation

Human-powered airplane to compete for the Kremer Sport HPA Prize - Zephyrus

2007

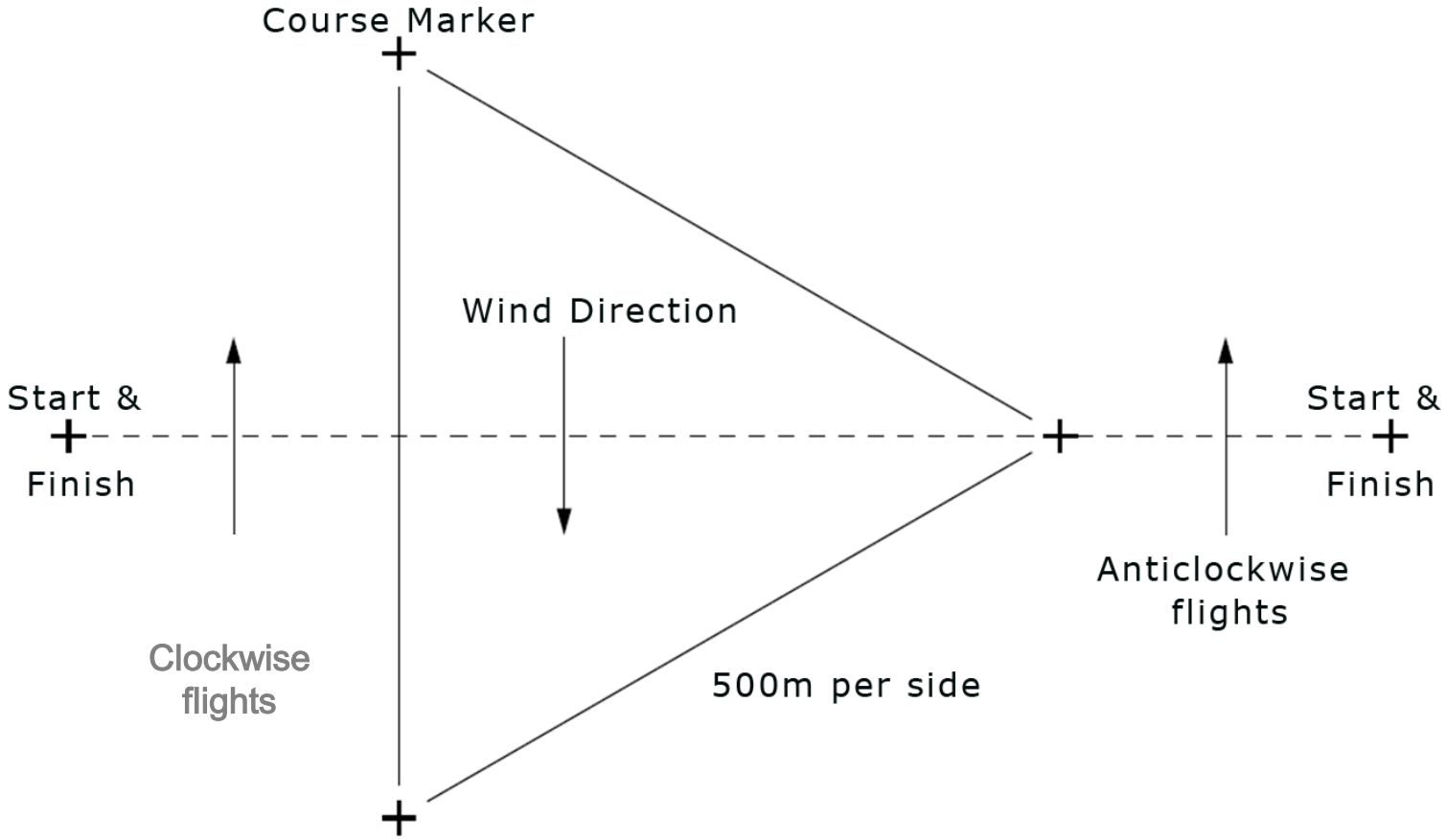
2009

2008

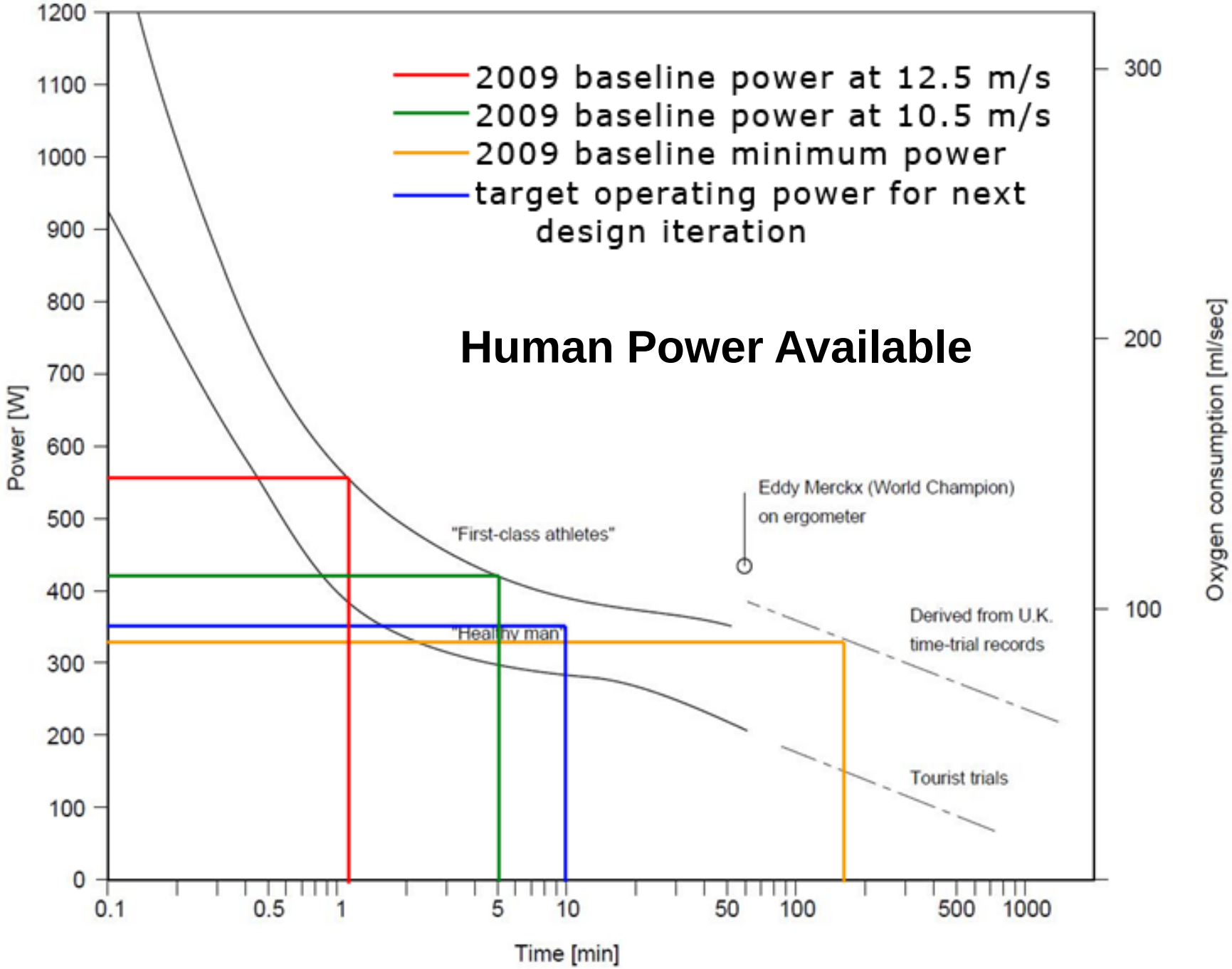


2012

Background: Kremer Prize (Sport)

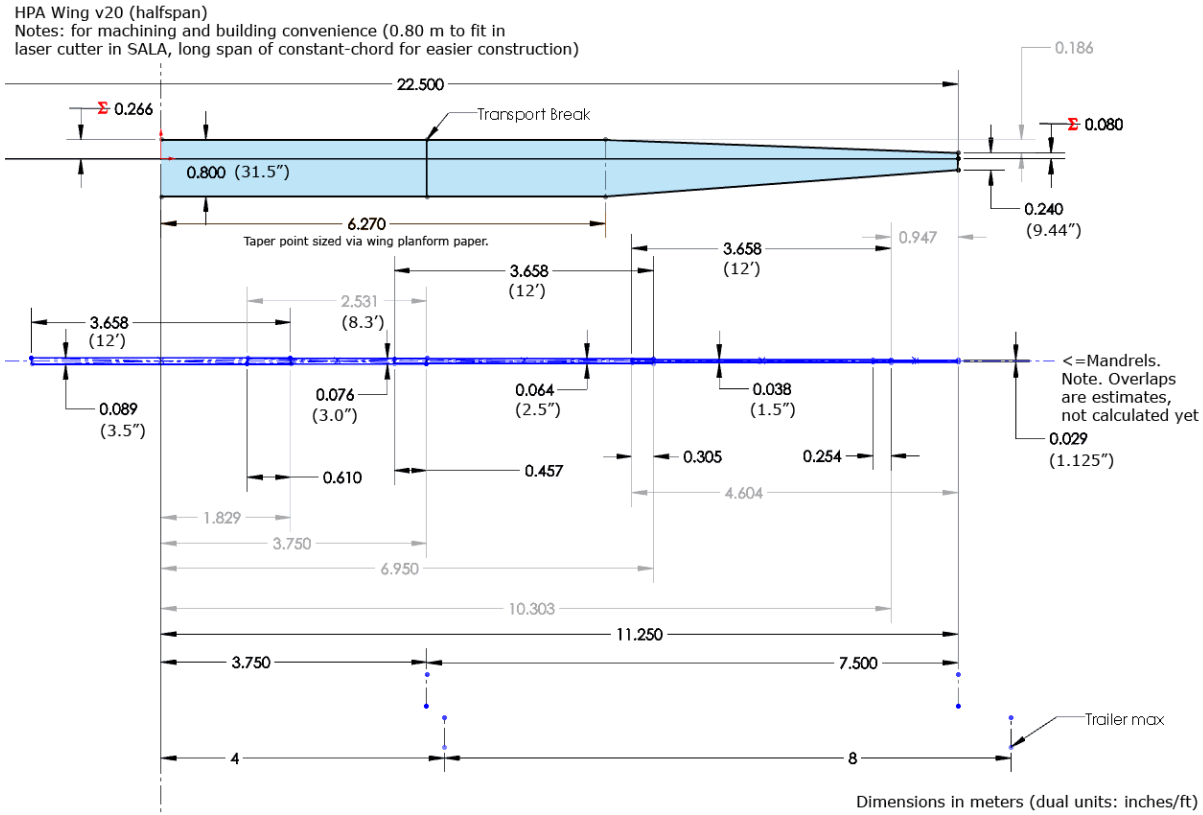


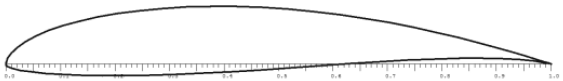
Two laps; totaling 7 minutes within 1 hour
Wind: 5 m/s (11.2 mph or 9.7 kts) nominal

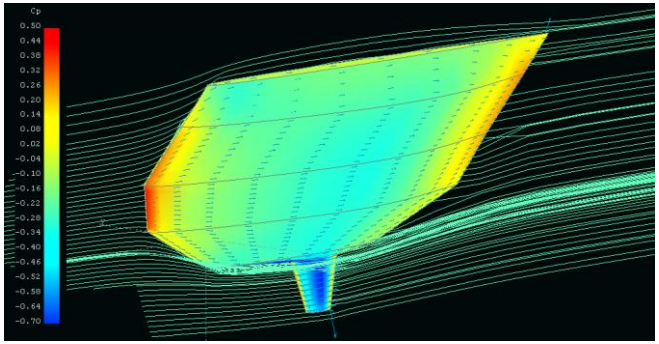

2009 baseline power at 12.5 m/s
2009 baseline power at 10.5 m/s
2009 baseline minimum power
target operating power for next design iteration
Human Power Available
Power [W]
Oxygen consumption [ml/sec]
Time [min]
"First-class athletes"
"Healthy man"
Eddy Merckx (World Champion) on ergometer
Derived from U.K. time-trial records
Tourist trials
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
300
200
100
0.1
0.5
1
5
10
50
100
500
1000

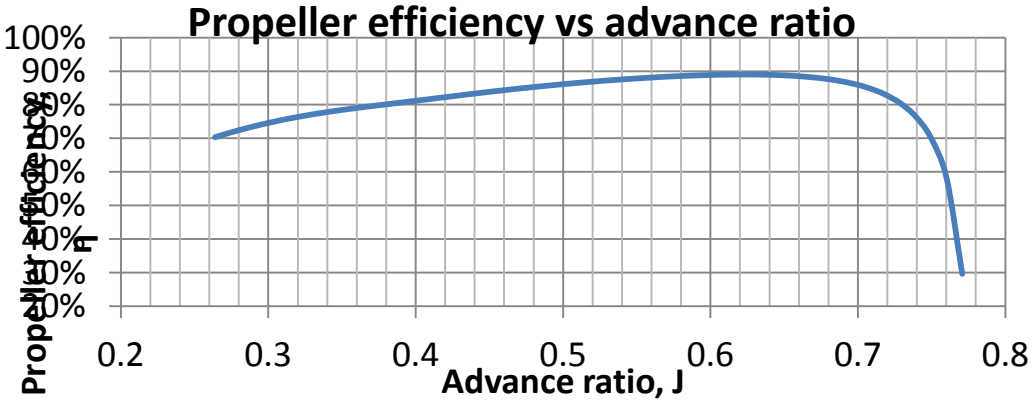
Design Challenges:

- Wing
- Airfoils
- Propeller
- Pod
- Structures
- Flight Mechanics









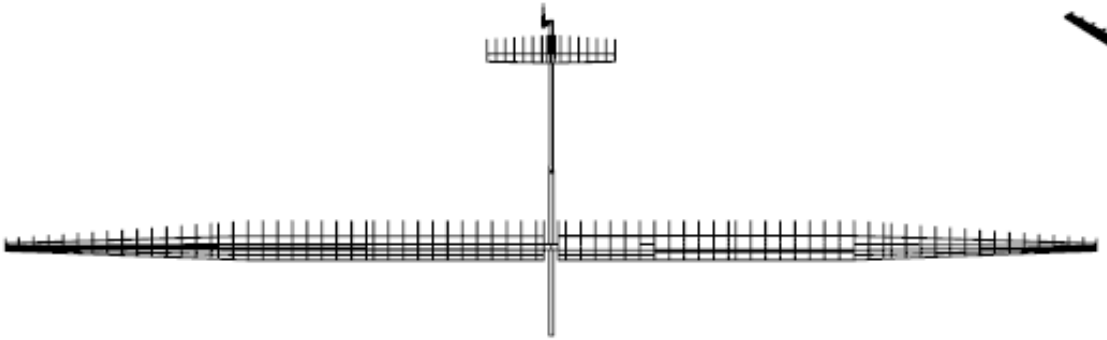
Penn State Zephyrus HPA

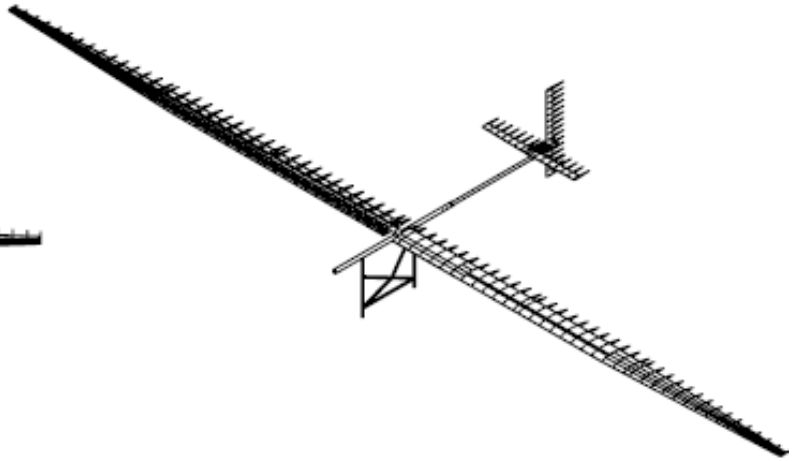
Span = 22.5 m (74 ft)

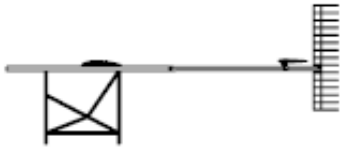
Area = 15.2 m^2 (164 ft^2)

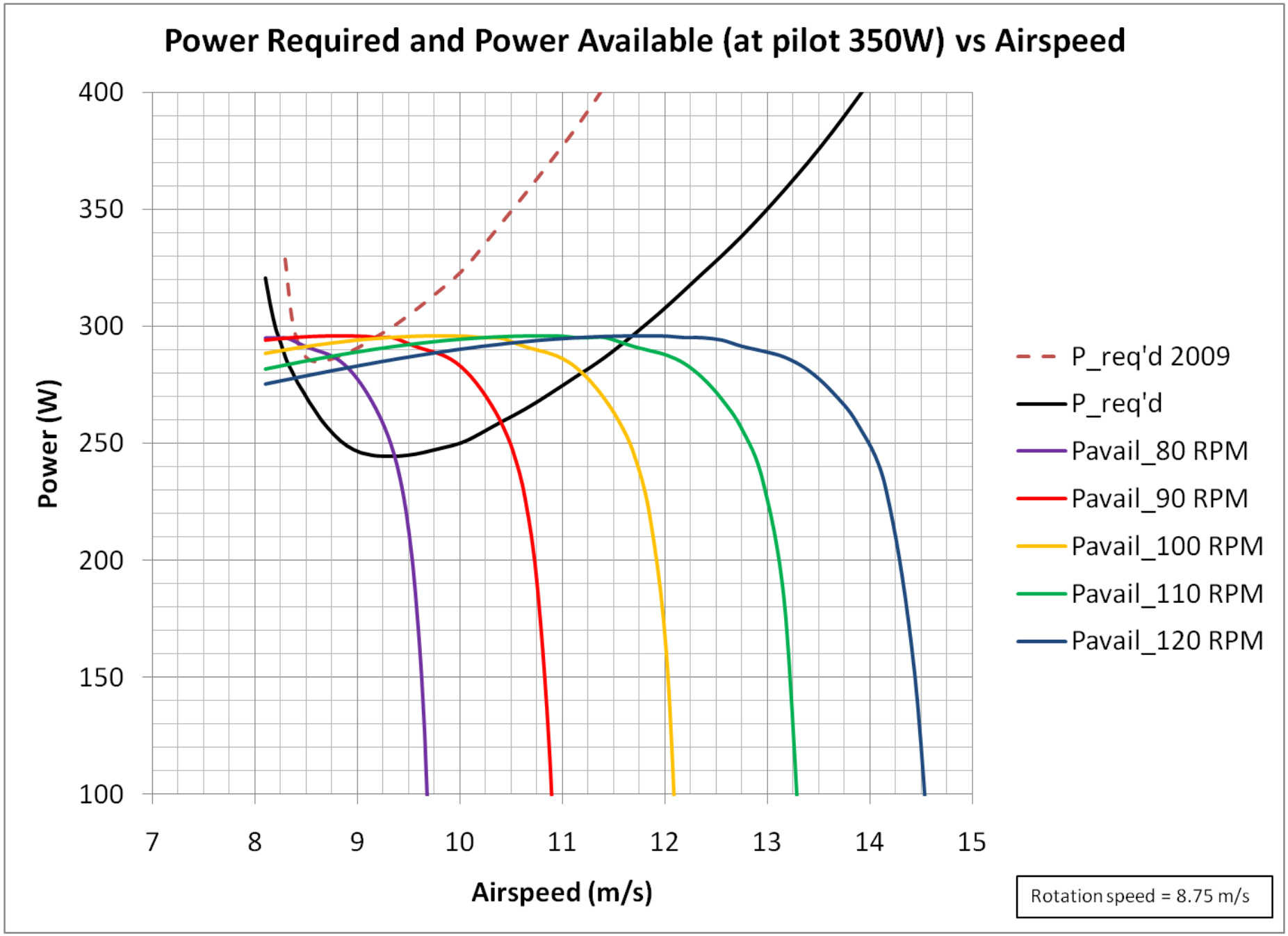
Empty Weight = 60 lbs

Pilot Weight = 140 lbs








Power Required and Power Available (at pilot 350W) vs Airspeed
400
350
300
250
200
150
100
Power (W)
7
8
9
10
11
12
13
14
15
Airspeed (m/s)
P_req'd 2009
P_req'd
Pavail_80 RPM
Pavail_90 RPM
Pavail_100 RPM
Pavail_110 RPM
Pavail_120 RPM
Rotation speed = 8.75 m/s