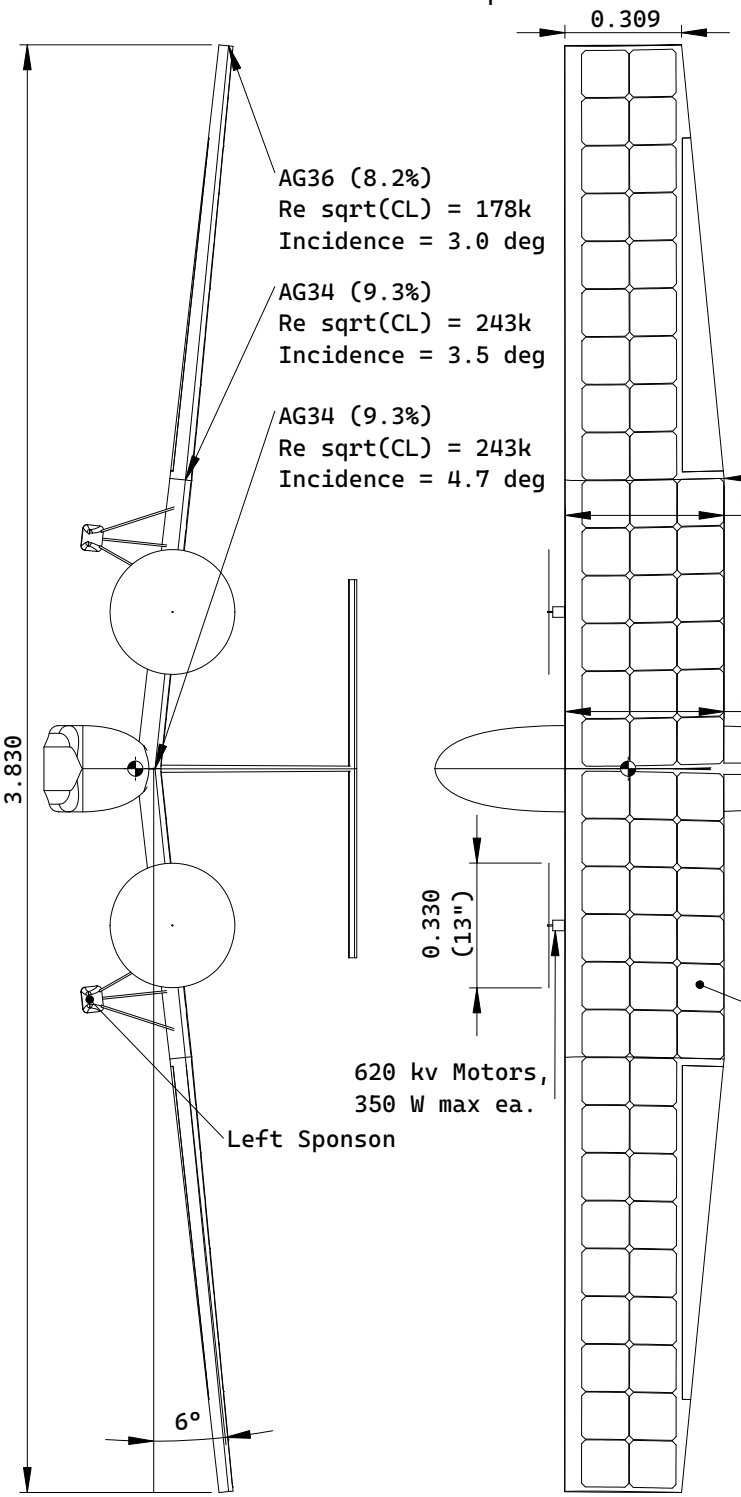
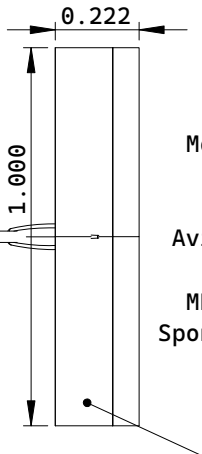
Seaway-Mini, Initial Point of Departure for 16.821
Peter Sharpe 2/4/2023

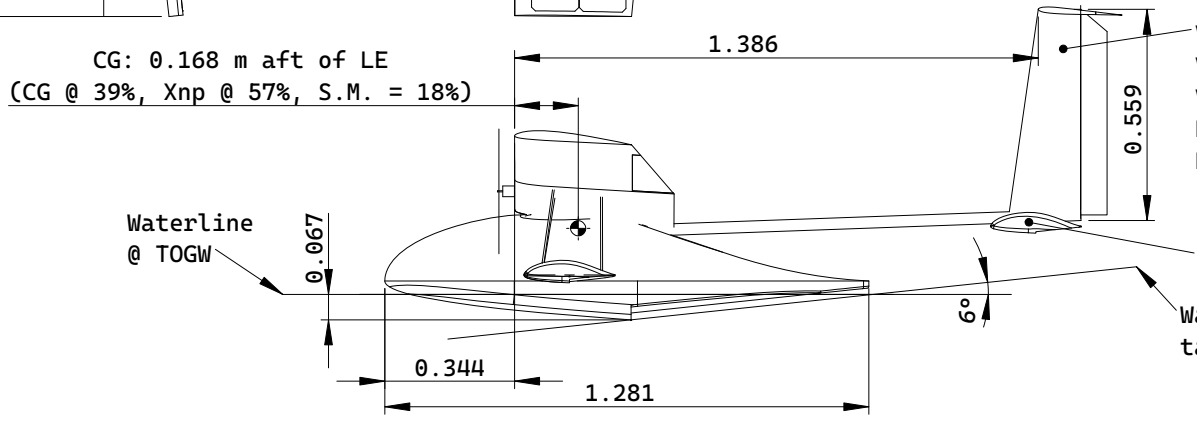
1:20 Scale. Units in meters unless specified.





72x Sunpower C60 Solar Cells
2 strings total (left/right)
2x Genasun CV-5-Li-16.8V MPPTs
Bus voltage LiPo 4S (14.8 V)

HStab area: 0.222 m^2
HStab AR: 4.50
Vh = 0.47
Incidence = 3.0 deg
HT14 (7.5%)
Re = 143k



CG: 0.168 m aft of LE
(CG @ 39%, Xnp @ 57%, S.M. = 18%)

VStab area: 0.120 m^2
VStab AR: 2.46
Vv = 0.030
HT14 (7.5%)
Re @ MAC = 143k

Waterline
@ TOGW

Aft Sponson

Waterline @
takeoff rotation

Sizing Summary:

Expected total mass = 6.581 kg (14.51 lbm)
Wing span (w/ dihedral) = 3.848 m (12.62 ft)
Wing area = 1.499 m^2 (16.13 ft^2)
Wing loading = 43.1 Pa (14.39 oz/ft^2)
Aspect ratio = 9.88

Aerodynamic Design Point (min-sink):

Cruise airspeed = 9.38 m/s (30.8 ft/s)
Cruise AoA = 0.40 deg
Cruise CL = 0.80
Elevator deflection = 0 deg (incidence-trimmed)

Performance Summary at Aerodynamic Design Point:

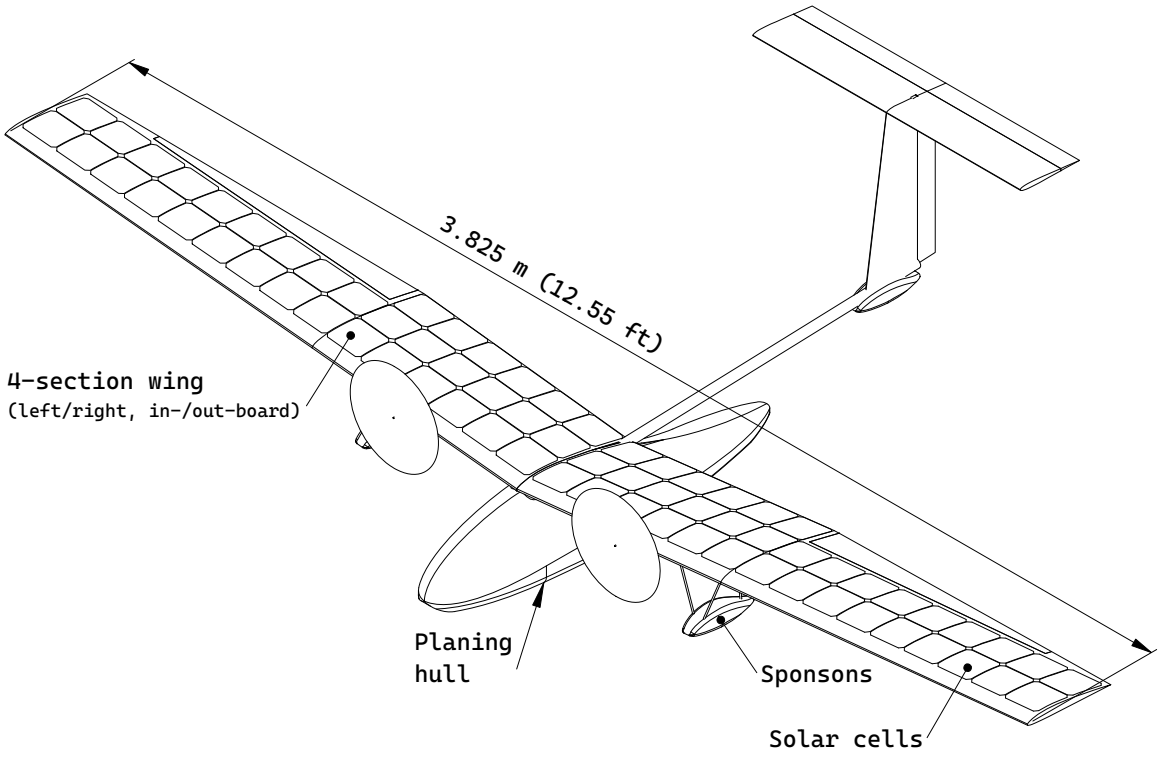
Assumes "as-flown" performance, not ideal, unless specified
L/D = 14.8 (ideal: 19.7)
No-power sink rate = 0.63 m/s (ignores prop drag)
Power to airstream = 40.9 W
Total power consumption = 75.1 W (incl. 8 W avionics)

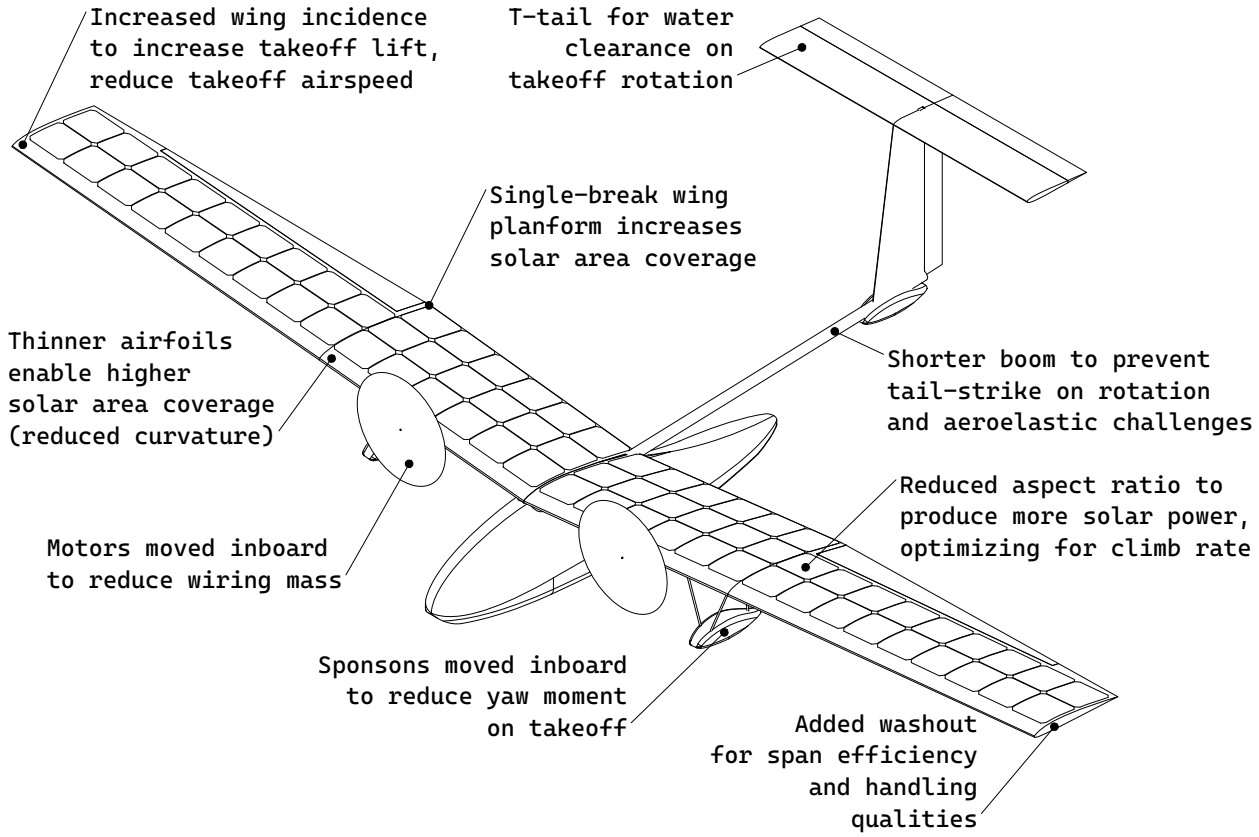
High-level Mass Budget:

Wing = 2.646 kg
HStab = 0.132 kg
VStab = 0.063 kg
Fuselage = 0.643 kg
Boom = 0.512 kg
Motors, Mounts, = 0.397 kg
Props, & ESCs
Battery = 0.494 kg
Avionics, Servos = 0.110 kg
Solar Cells, = 0.865 kg
MPPTs, & Wiring
Sponsons + Mounts = 0.232 kg
Glue Weight = 0.487 kg

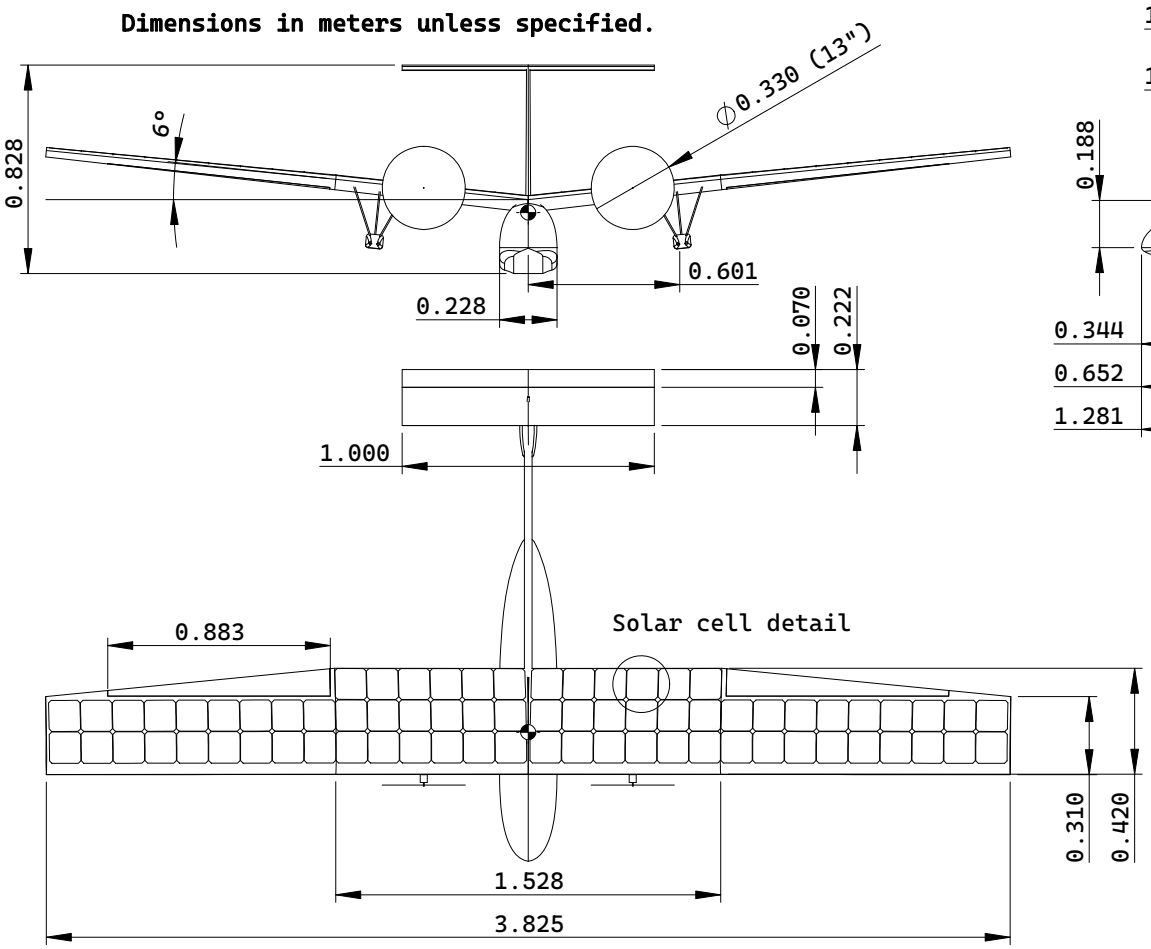
Power Generation Summary:

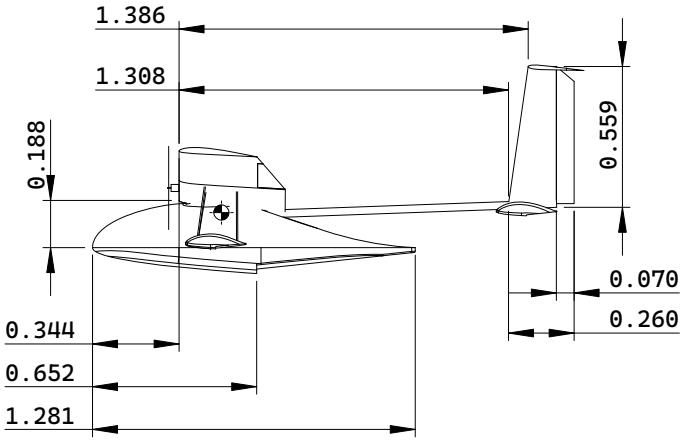
Assuming solar conditions:
Boston (42.36 N), April 1, 2 p.m. solar time
Total solar energy = 784.6 W
Realizable solar eff. = 21.0% (incl. MPPTs)
Total power generation = 165.0 W
Breakeven climb rate = 0.85 m/s (167 ft/min)
Breakeven climb gradient = 5.18 deg

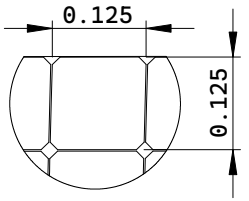

3.825 m (12.55 ft)
4-section wing
(left/right, in-/out-board)
Planing
hull
Sponsons
Solar cells


Increased wing incidence
to increase takeoff lift,
reduce takeoff airspeed
T-tail for water
clearance on
takeoff rotation
Single-break wing
planform increases
solar area coverage
Thinner airfoils
enable higher
solar area coverage
(reduced curvature)
Shorter boom to prevent
tail-strike on rotation
and aeroelastic challenges
Reduced aspect ratio to
produce more solar power,
optimizing for climb rate
Motors moved inboard
to reduce wiring mass
Sponsons moved inboard
to reduce yaw moment
on takeoff
Added washout
for span efficiency
and handling
qualities

Dimensions in meters unless specified.







Solar cell detail

Solar cell detail