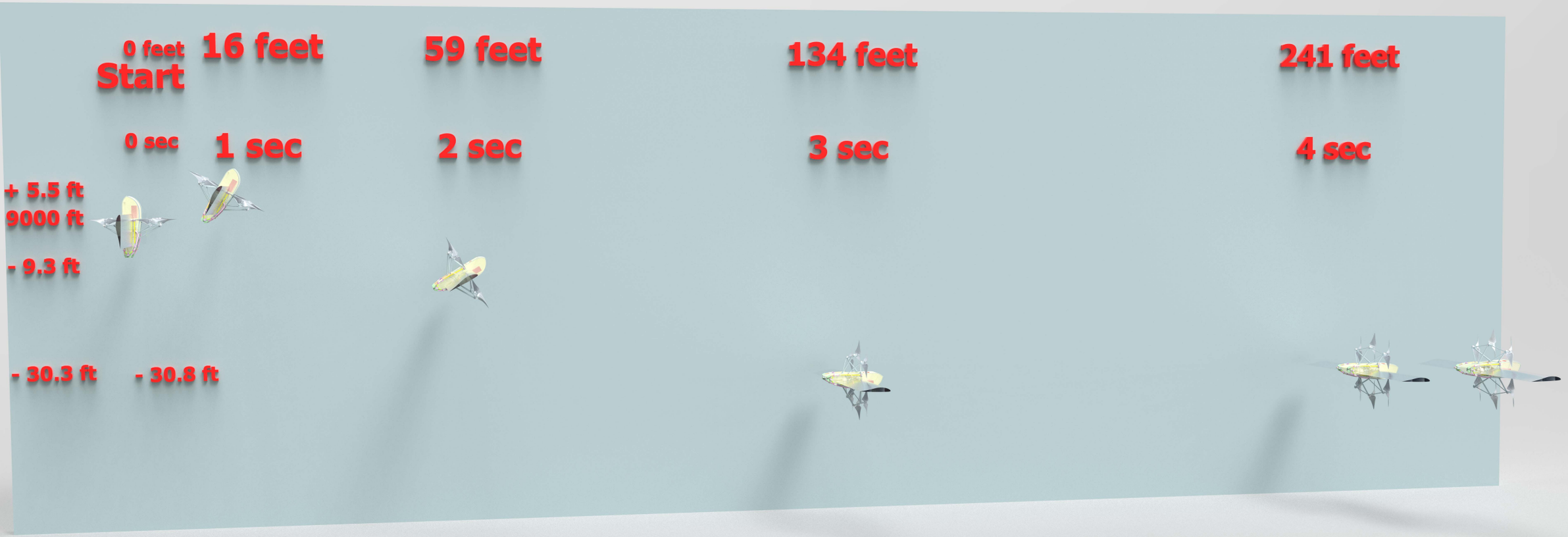

0 feet
Start
16 feet
59 feet
134 feet
241 feet
0 sec
1 sec
2 sec
3 sec
4 sec
+ 5.5 ft
9000 ft
- 9.3 ft
- 30.3 ft
- 30.8 ft

0 feet

16 feet

59 feet

Start

0 sec

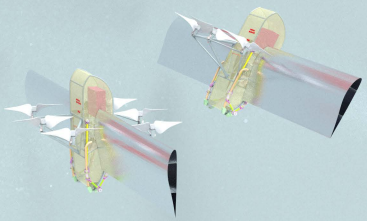
1 sec

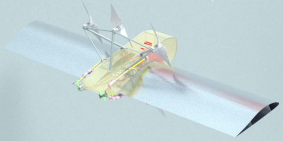
2 sec

+ 5.5 ft

9000 ft

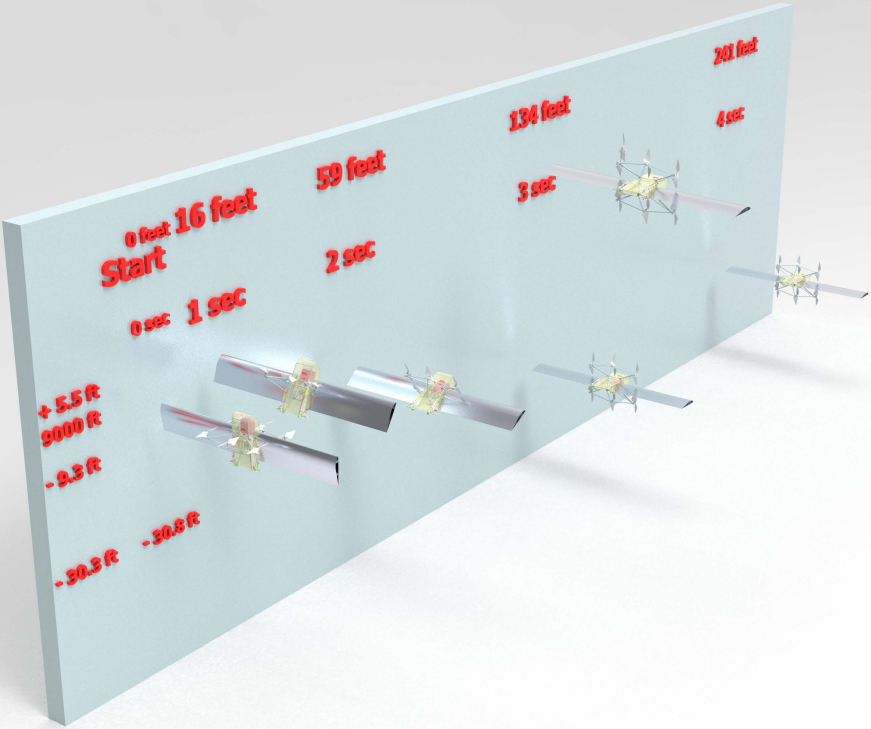
- 9.3 ft

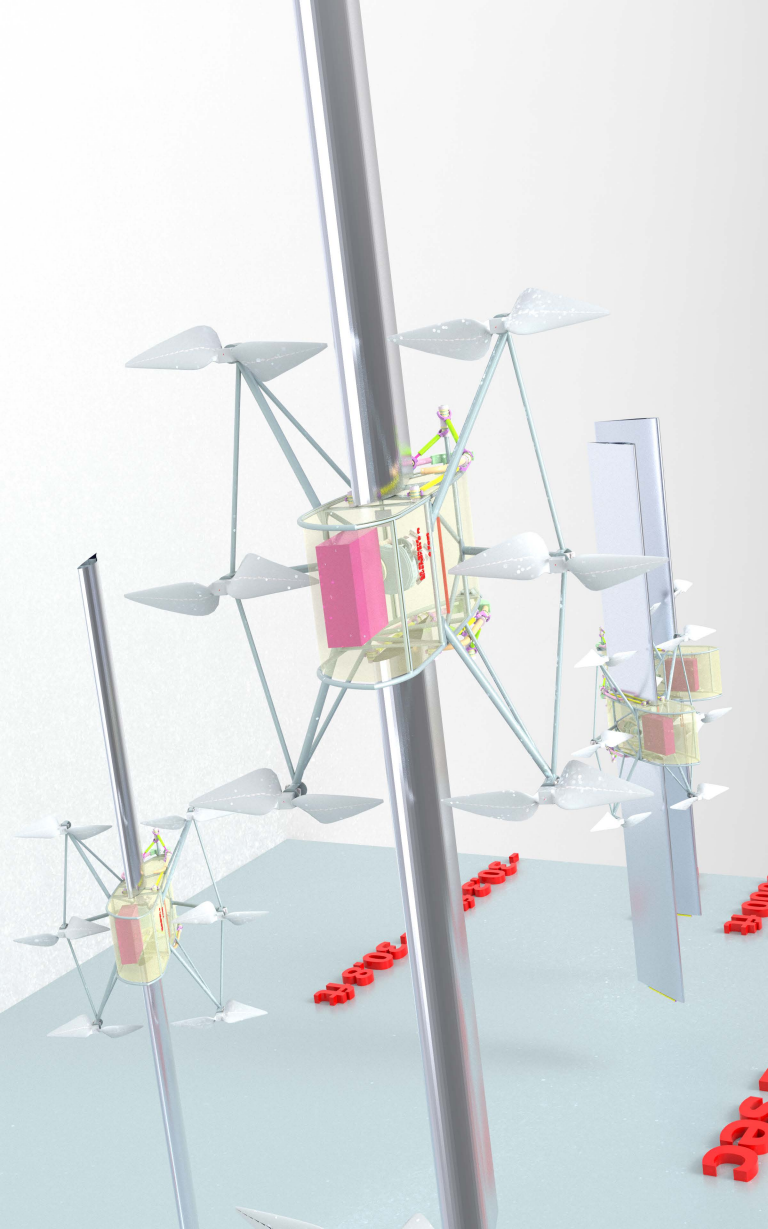


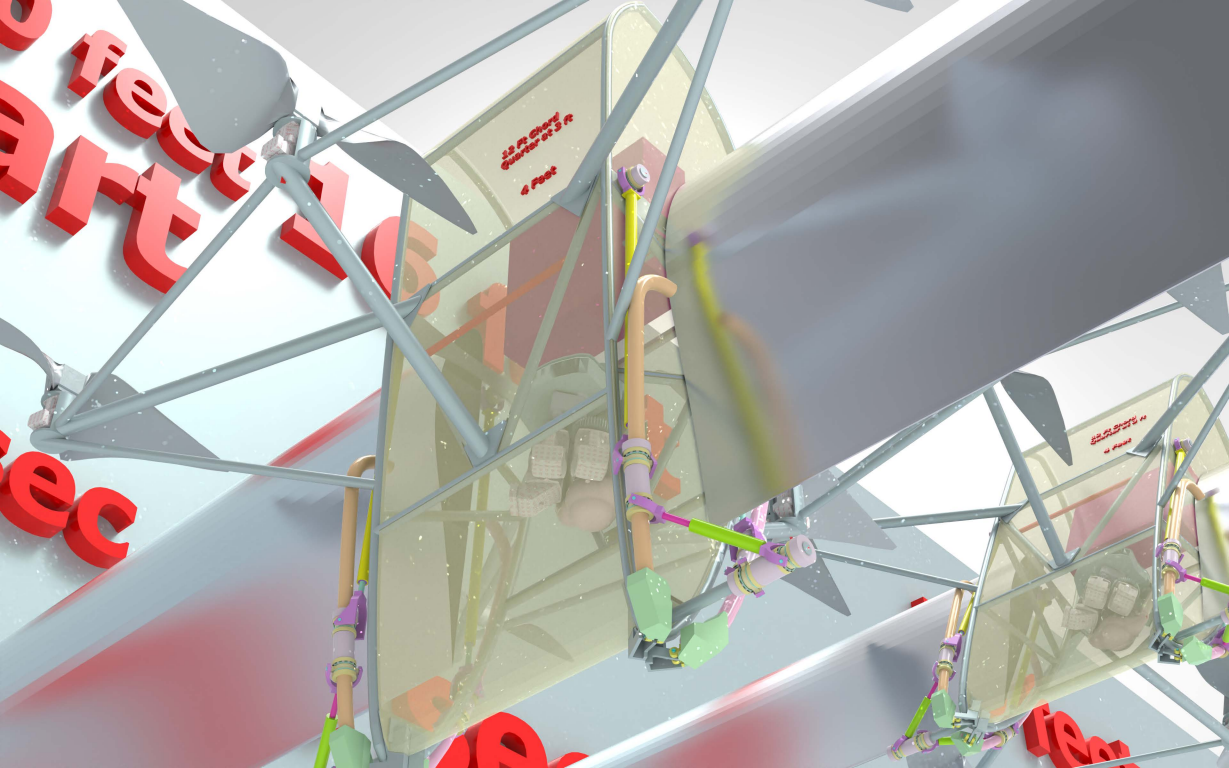


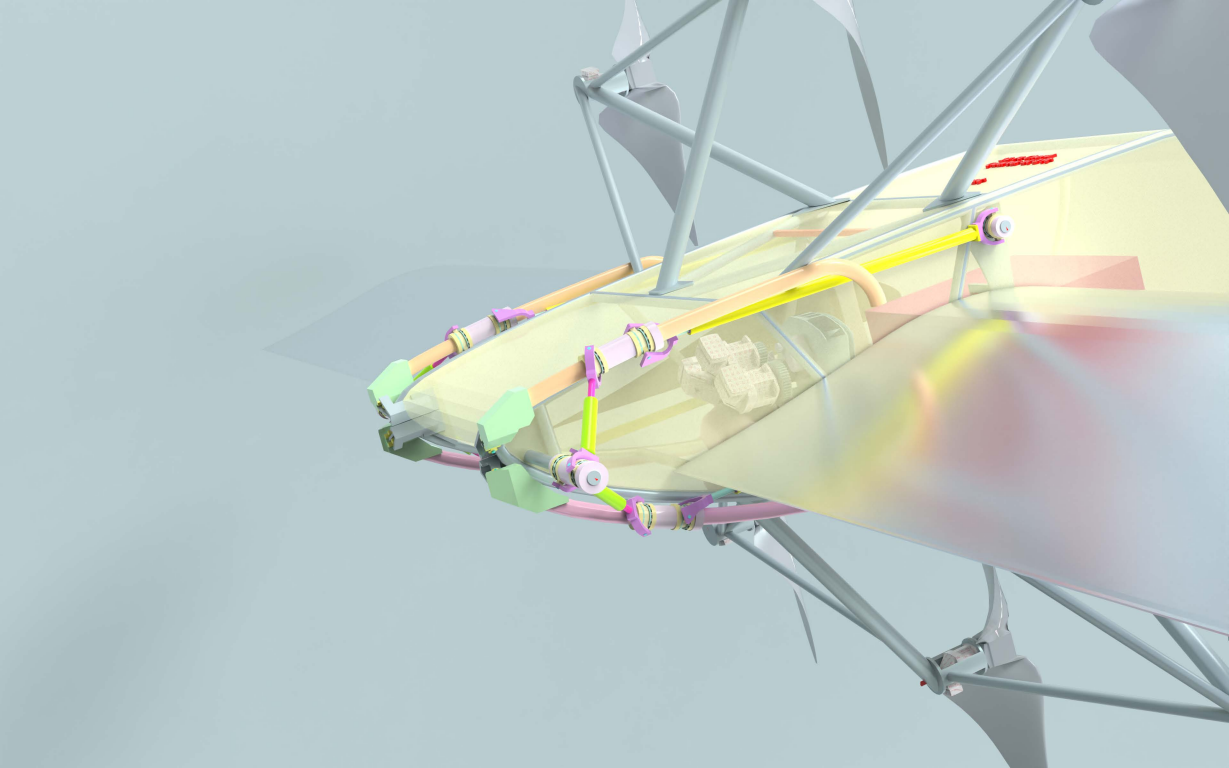
- 30.3 ft

- 30.8 ft


0 feet
Start
16 feet
59 feet
134 feet
241 feet
0 sec
1 sec
2 sec
3 sec
4 sec
+ 5.5 ft
9000 ft
- 9.3 ft
- 30.8 ft
- 30.8 ft




13 Ft Chord
Quarter at 3 ft
4 Feet



Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 6.5 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS: (•) FEET ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 4358915

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0006

FRICTION COEFFICIENT (Assuming Turbulent): 0.0034

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Airfoil Assignments

(Unless otherwise noted, all units are in feet.)

		Buttline: (span)	Chord:	Incidence:	C/4 Offset:
Root Airfoil	MyAirfoil_1: AH 80-140	0	6.5	0	0
Airfoil #1	MyAirfoil_1: AH 80-140	22	6.5	0	0
Airfoil #2	MyAirfoil_2: this is v16 flipped ups				
Airfoil #3	MyAirfoil_2: this is v16 flipped ups				
Airfoil #4	MyAirfoil_2: this is v16 flipped ups				
Airfoil #5	MyAirfoil_1: AH 80-140				
Actions ------->		EVENLY	EVENLY	EVENLY	Zeros

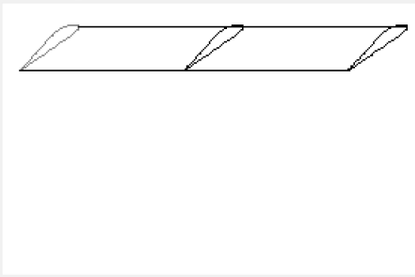
Dihedral: 0 Degrees

Mean Aerodynamic Info: Mean Chord: 6.50 Ft.; Span Location: 11.00 Ft.

Resulting Parameters: Wing Area: 286.00 Sq. Ft.; Wingspan: 44.00 Ft.; Aspect Ratio: 6.77; Taper Ratio: 1.00; QC Sweep: 0.00 Deg.

Trailing Edge Thickness: 0.25 Inches

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 6.5 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS

(•) FEET

( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot) 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit) 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second) 758.6 (Miles Per Hour) 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 4358915

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0006

FRICTION COEFFICIENT (Assuming Turbulent): 0.0034

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Atmospheric Conditions

UPDATE Altitude 1000 Feet

Density: 0.002308 Slugs/Cubic Foot

Temperature: 55.45 °F

Pressure: 2040.80 Pounds/Square Foot

Dynamic Pressure: 13.44 PSF

Speed Of Sound: 1112.4 Feet Per Second

Viscosity: 0.0000003717300 (lb-sec / Ft^2)

(Press the UPDATE button after changing ALTITUDE)

Root Airfoil Reynolds Number and Velocity

(Note: Based on root chordlength from Wing Layout)

Get From Atmospheric Model

4358915

Send Value To Virtual Wind Tunnel

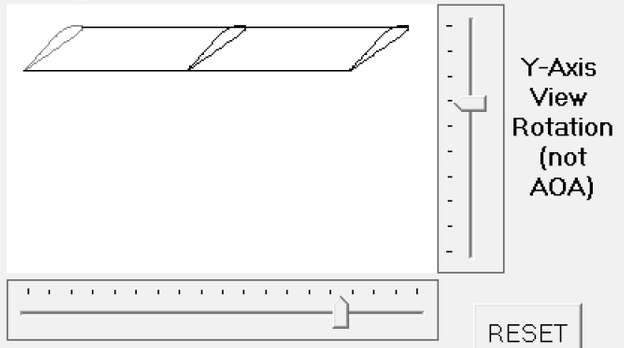
Get Velocity From Reynolds Num

108.0 Feet Per Second

Get From Atmospheric Model

Resulting MACH NUMBER: 0.097

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME

03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 6.5 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS: (•) FEET ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 4358915

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0006

FRICTION COEFFICIENT (Assuming Turbulent): 0.0034

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Airfoil Assignments

(Unless otherwise noted, all units are in feet.)

		Buttline: (span)	Chord:	Incidence:	C/4 Offset:
Root Airfoil	MyAirfoil_1: AH 80-140	0	6.5	0	0
Airfoil #1	MyAirfoil_1: AH 80-140	22	6.5	0	0
Airfoil #2	MyAirfoil_2: this is v16 flipped ups				
Airfoil #3	MyAirfoil_2: this is v16 flipped ups				
Airfoil #4	MyAirfoil_2: this is v16 flipped ups				
Airfoil #5	MyAirfoil_1: AH 80-140				
Actions ------>		EVENLY	EVENLY	EVENLY	Zeros

Dihedral: 0 Degrees

Mean Aerodynamic Info: Mean Chord: 6.50 Ft.; Span Location: 11.00 Ft.

Resulting Parameters: Wing Area: 286.00 Sq. Ft.; Wingspan: 44.00 Ft.; Aspect Ratio: 6.77; Taper Ratio: 1.00; QC Sweep: 0.00 Deg.

Trailing Edge Thickness: 0.25 Inches

3D Wing View

Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help | Close

My Airfoils (Long Term Storage)

AH 80-140 — PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80- — PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 6.5 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS: (•) FEET ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 4358915

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0006

FRICTION COEFFICIENT (Assuming Turbulent): 0.0034

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Wing Analysis Options

[x] Assume elliptical lift degradation

Oswald Efficiency Factor: 0.8

Root-Airfoil Angle Of Attack: 7.24 Degrees

Set To ZERO

NOTE: Stall is not predicted with this tool.

BUILD / ANALYZE

Drag RESULTS

Frictional Drag: 33.49 Pounds

Induced Drag: 174.81 Pounds

TOTAL DRAG: 223.62 Pounds

Frictional Cd: 0.0087

Induced Cd: 0.0454

TOTAL Cd: 0.0581

Frictional Cd*S: 2.49

Induced Cd*S: 12.99

TOTAL Cd*S: 16.61

Lift RESULTS

Total Lift Force (LBS): 3384.54

Total Lift Coefficient: 0.879

L/D: 15.13

Moment RESULTS

Total Pitching Moment: -1137.04 FootPounds

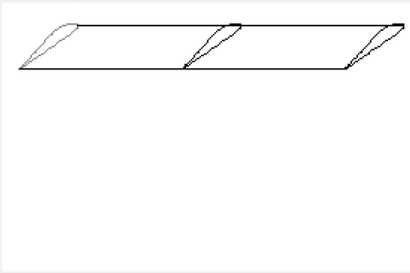
Moment Coefficient: -0.045

(•) Referenced to Root Quarter Chord

( ) Referenced to Root Nose

( ) No Transfer (Debugging Only)

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 12 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS: (•) FEET ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 8047227

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0005

FRICTION COEFFICIENT (Assuming Turbulent): 0.0031

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Airfoil Assignments

(Unless otherwise noted, all units are in feet.)

		Buttline: (span)	Chord:	Incidence:	C/4 Offset:
[x] Root Airfoil	MyAirfoil_2: this is v16 flipped ups	0	12	0	0
[x] Airfoil #1	MyAirfoil_2: this is v16 flipped ups	2	12	0	0
[ ] Airfoil #2	MyAirfoil_2: this is v16 flipped ups				
[ ] Airfoil #3	MyAirfoil_2: this is v16 flipped ups				
[ ] Airfoil #4	MyAirfoil_2: this is v16 flipped ups				
[ ] Airfoil #5	MyAirfoil_1: AH 80-140				
Actions ------->		EVENLY	EVENLY	EVENLY	Zeros

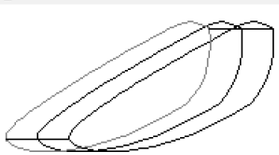
Dihedral: 0 Degrees

Mean Aerodynamic Info:
Mean Chord: 12.00 Ft.
Span Location: 1.00 Ft.

Resulting Parameters
Wing Area: 48.00 Sq. Ft.
Wingspan: 4.00 Ft.
Aspect Ratio: 0.33
Taper Ratio: 1.00
QC Sweep: 0.00 Deg.

Trailing Edge Thickness: 0.25 Inches

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help | Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 12 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS

(•) FEET

( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 8047227

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0005

FRICTION COEFFICIENT (Assuming Turbulent): 0.0031

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Atmospheric Conditions

UPDATE

Altitude: 1000 Feet

Density: 0.002308 Slugs/Cubic Foot

Temperature: 55.45 °F

Pressure: 2040.80 Pounds/Square Foot

Dynamic Pressure: 13.44 PSF

Speed Of Sound: 1112.4 Feet Per Second

Viscosity: 0.0000003717300 (lb-sec / Ft^2)

(Press the UPDATE button after changing ALTITUDE)

Root Airfoil Reynolds Number and Velocity

(Note: Based on root chordlength from Wing Layout)

Get From Atmospheric Model

8047227

Send Value To Virtual Wind Tunnel

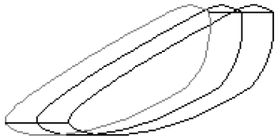
Get Velocity From Reynolds Num

108.0 Feet Per Second

Get From Atmospheric Model

Resulting MACH NUMBER: 0.097

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME

03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Dense Endpoints | 71

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 12 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS: (•) FEET ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 8047227

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0005

FRICTION COEFFICIENT (Assuming Turbulent): 0.0031

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Airfoil Assignments

(Unless otherwise noted, all units are in feet.)

		Buttline: (span)	Chord:	Incidence:	C/4 Offset:
Root Airfoil	MyAirfoil_2: this is v16 flipped ups	0	12	0	0
Airfoil #1	MyAirfoil_2: this is v16 flipped ups	2	12	0	0
Airfoil #2	MyAirfoil_2: this is v16 flipped ups				
Airfoil #3	MyAirfoil_2: this is v16 flipped ups				
Airfoil #4	MyAirfoil_2: this is v16 flipped ups				
Airfoil #5	MyAirfoil_1: AH 80-140				
Actions ------->		EVENLY	EVENLY	EVENLY	Zeros

Dihedral: 0 Degrees

Mean Aerodynamic Info:

Mean Chord: 12.00 Ft.

Span Location: 1.00 Ft.

Resulting Parameters

Wing Area: 48.00 Sq. Ft.

Wingspan: 4.00 Ft.

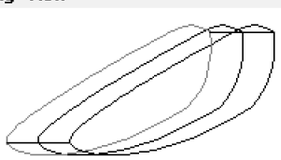
Aspect Ratio: 0.33

Taper Ratio: 1.00

QC Sweep: 0.00 Deg.

Trailing Edge Thickness: 0.25 Inches

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help | Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

Standard Atmosphere Model

INPUTS

ALTITUDE: 1000 (FEET)

REF. LENGTH: 12 (FEET)

FLIGHT SPEED: 108.0 (Feet Per Second) Help Convert

Help

UNITS
- (•) FEET
- ( ) METERS

PUSH TO UPDATE ALL VALUES

SEND BACK REYNOLDS NUMBER

SEND BACK REYNOLDS NUMBER and SPEED

RESULTING ATMOSPHERIC AND PERFORMANCE VALUES

DENSITY: 0.002308 (Slugs Per Cubic Foot)

PRESSURE: 2040.86 (Pounds Per Square Foot); 0.964 (Atmospheres)

TEMPERATURE: 55.43 (Degrees Fahrenheit); 515.1 (Degrees Rankine)

SPEED OF SOUND: 1112.6 (Feet Per Second); 758.6 (Miles Per Hour); 659.2 (Knots)

VISCOSITY: 3.71719857e-7 (lb-sec / Foot^2)

REYNOLDS NUMBER: 8047227

MACH NUMBER: 0.0971

DYNAMIC PRESSURE (Q): 13.4610 (Pounds Per Square Foot)

CRITICAL CP (where Sonic flow appears): -70.99

FRICTION COEFFICIENT (Assuming Laminar): 0.0005

FRICTION COEFFICIENT (Assuming Turbulent): 0.0031

WingCrafter(tm): Wing Layout & Preliminary Performance Tool

Flow Conditions | Wing Layout | ANALYZE | Stall Speeds / W/S | CFD Export/Slice | CAD Export | WING Imp/Exp

Wing Analysis Options

[x] Assume elliptical lift degradation

Oswald Efficiency Factor: 0.8

Root-Airfoil Angle Of Attack: 4.434 Degrees

Set To ZERO

NOTE: Stall is not predicted with this tool.

BUILD / ANALYZE

Drag RESULTS

Frictional Drag:	5.25 Pounds	Frictional Cd*S: 0.39
Induced Drag:	37.36 Pounds	Induced Cd*S: 2.78
TOTAL DRAG:	45.86 Pounds	TOTAL Cd*S: 3.41
Frictional Cd:	0.0081	
Induced Cd:	0.0578	
TOTAL Cd:	0.0710	

Lift RESULTS

Total Lift Force (LBS): -141.47

Total Lift Coefficient: -0.219

L/D: -3.08

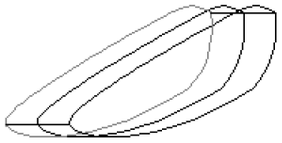
Moment RESULTS

Total Pitching Moment: 751.83 FootPounds

Moment Coefficient: 0.097

- (•) Referenced to Root Quarter Chord
- ( ) Referenced to Root Nose
- ( ) No Transfer (Debugging Only)

3D Wing View



Y-Axis View Rotation (not AOA)

Z-Axis View Rotation

(Drag box with left mouse button to zoom)

RESET

WING LAYOUT NAME: 03-22 HeavyLift WINGBODY

BUILD / ANALYZE

NOTE: Stall is not predicted with this tool.

Help | Close

My Airfoils (Long Term Storage)

AH 80-140

PUSH TO STORE STORAGE-1

this is v16 flipped upside down AH 80-

PUSH TO STORE STORAGE-2

DAT, DF & DXF Airfoil File Importer

FILE OPERATIONS:

no modifications of ah80140 by pg v3.dat
shrunk by one half ah80140 by pg v10.dat
v11 shrunk by one half ah80140 by pg.dat
v12 shrunk by one half ah80140 by pg.dat
v13 shrunk by one half ah80140 by pg.dat
v14 shrunk by one half ah80140 by pg.dat
v15 shrunk by one half ah80140 by pg.dat
v16 shrunk by one half ah80140 by pg.dat
v17 flipped upside down using v16 shrunk by o

Browse Files... | View File Contents

Notes About Airfoil From Imported File

this is v16 flipped upside down AH 80-136: v16 shrunk by one half ah80140 by pg.dat

File Properties | Import Fixes

Raw Chordlength: 1.000
Raw Percent Thickness: 27.104%

Number Of Points

Upper	Lower	Total
0000	0000	71

Force Thickness? 12

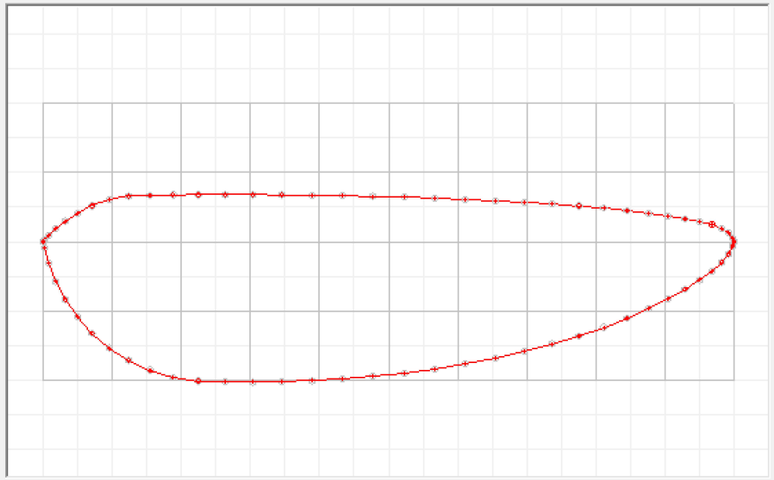
Help | Restore View

File Error Summary

No duplicates found.

Spline Options

- Use Raw Points
- Use R-Spline
- Use Alt-Spline
- Alt Nose



-> Drag A Box With Left Mouse to ZOOM In
-> Hold SHIFT And Drag Left Mouse to PAN
-> RIGHT-CLICK Mouse To DELETE Point

v17 flipped upside down usin...

File Edit Format View Help

```
this is v16 flipped upside down AH 80-
136: v16 shrunk by one half ah80140 by
pg.dat
12.000000      -0.010500
11.975850      -0.074419
11.903580      -0.212540
11.783780      -0.361240
11.617410      -0.511253
11.405810      -0.666773
11.150690      -0.830751
10.854100      -0.996769
10.518430      -1.159511
10.146380      -1.324498
9.740939       -1.486965
9.305382       -1.633533
8.843212       -1.774715
8.358150       -1.905527
7.854102       -2.017778
7.335126       -2.122035
6.805399       -2.208562
6.269189       -2.279073
5.730811       -2.340101
5.194601       -2.379156
4.664874       -2.413596
4.145898       -2.427242
3.641850       -2.437337
3.156788       -2.427007
2.694618       -2.417165
2.259061       -2.351937
1.853624       -2.230180
1.481571       -2.061065
1.145898       -1.846442
0.849307       -1.591736
0.594187       -1.308778
0.382591       -1.004915
0.216223       -0.689592
0.096422       -0.377724
0.024154       -0.102698
0.000000       0.000000
0.024154       0.026478
0.096422       0.105699
0.216223       0.221418
0.382591       0.355412
0.594187       0.495804
0.849307       0.623348
1.145898       0.726457
```

Ln 1, C | 100% | Windows (CRLF) | UTF-8

v17 flipped upside ...

File Edit Format View Help

```
1.853624       -2.230180
1.481571       -2.061065
1.145898       -1.846442
0.849307       -1.591736
0.594187       -1.308778
0.382591       -1.004915
0.216223       -0.689592
0.096422       -0.377724
0.024154       -0.102698
0.000000       0.000000
0.024154       0.026478
0.096422       0.105699
0.216223       0.221418
0.382591       0.355412
0.594187       0.495804
0.849307       0.623348
1.145898       0.726457
1.481571       0.791065
1.853624       0.806085
2.259061       0.810847
2.694618       0.815664
3.156788       0.815404
3.641850       0.815131
4.145898       0.810573
4.664874       0.805213
5.194601       0.795884
5.730811       0.785651
6.269189       0.771258
6.805399       0.754767
7.335126       0.734737
7.854102       0.710822
8.358150       0.685052
8.843212       0.654446
9.305382       0.620020
9.740939       0.583145
10.146380      0.539036
10.518430      0.492576
10.854100      0.445650
11.150690      0.397145
11.405810      0.346404
11.617410      0.293219
11.783780      0.232477
11.903580      0.153771
11.975850      0.059369
12.000000      0.010500
```

100% | Windows (CRLF) | UTF-8

Airfoil Construction Parameters (COMMON)

Point Distribution: Dense Endpoints
Number Of Points: 71
Thickness Increments: 1.00
Coordinate Values: X/C: 96.81% Y/C: 2.44%
Construction Method: Standard NACA
Draw Elements: Surface Points, Camber Lines
Normalized Chordlength?: Normalize to 1.0

HELP

My Airfoils (Long Term Storage)

AH 80-140	PUSH TO STORE STORAGE-1
this is v16 flipped upside down AH 80-	PUSH TO STORE STORAGE-2
GOE 509 AIRFOIL	PUSH TO STORE STORAGE-3
PG-11-04-20-v1	PUSH TO STORE STORAGE-4
PG-11-04-20-v1	PUSH TO STORE STORAGE-5

t a new capture area

<---- EXPAND VIEW ---->

Adjust the desired Option(s).

JavaProp

Version 1.70 - August 1, 2021.

• Translations
· Translation to English by Martin Hepperle, 2001.
· Translation to German by Martin Hepperle, 2001.
· Translation to French by Giorgio Toso, 2002.
· Translation to Italian by Giorgio Toso, 2002.
· Translation to Portuguese (European) by João Alveirinho Correia, 2008.

• Your current system settings
· Your user name is Bobbi.
· You are running Windows 10, Java version 1.8.0_321, Java memory is 498688 kB.
· System language code is en.
· Selected country is United States, selected language is English.

Country Settings:	English (United States)	(decimal character is: '.')
Density ρ:	1.1895	[kg/m³]
Kinematic Viscosity ν:	0.000014607	[m²/s]
Speed of Sound a:	340.29	[m/s]

Save... | Load... | Clear preferences on exit | Air | Water

JavaProp

Design | Airfoils | Geometry | Modify | Multi Analysis | Single Analysis | Flow Field | Options

Enter Design Parameters and press the 'Design It!' button.

Propeller Name:		
Number of Blades B:	2	[-]
Revolutions per minute rpm:	2000	[1/min]
Diameter D:	2	[m]
Spinner Dia. Dsp:	0.1000	[m]
Velocity v:	32	[m/s]
Power P:	64000	[W]
shroud chord:	60.000	[-]
shroud angle:	60.000	[°]

☐ shrouded rotor ☐ square tip ☐ open hub

Propeller			
v/(nD)	0.582	v/(ΩR)	0.185
Efficiency η	67.491 %	loading	medium
Thrust T	604.81 N	Ct	0.0409
Power P	28.68 kW	Cp	0.0353
Torque Q	165.96 Nm	Cs	1.1357
β at 75%R	16.2°	Pitch H	1.37 m

Remark: The RPM setting is also used for Analysis page.

Design It! | Copy Text | Copy (HTML)

Ready.

JavaProp

Design | **Airfoils** | Geometry | Modify | Multi Analysis | Single Analysis | Flow Field | Options

Select the desired airfoils and angle of attack for each station.

r/R = 0.00: Clark Y, Re=100,000

angle of attack: 3.0 [°]

r/R = 0.333: Clark Y, Re=100,000

angle of attack: 3.0 [°]

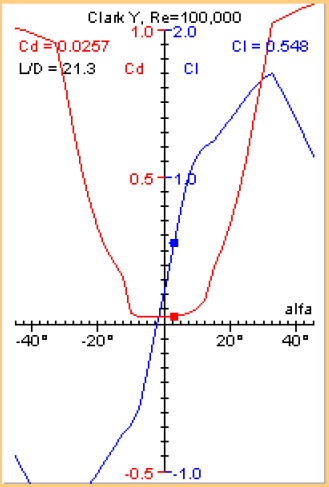
r/R = 0.667: Clark Y, Re=100,000

angle of attack: 3.0 [°]

r/R = 1.00: Clark Y, Re=100,000

angle of attack: 3.0 [°]

☐ suppress airfoil drag



Ready.

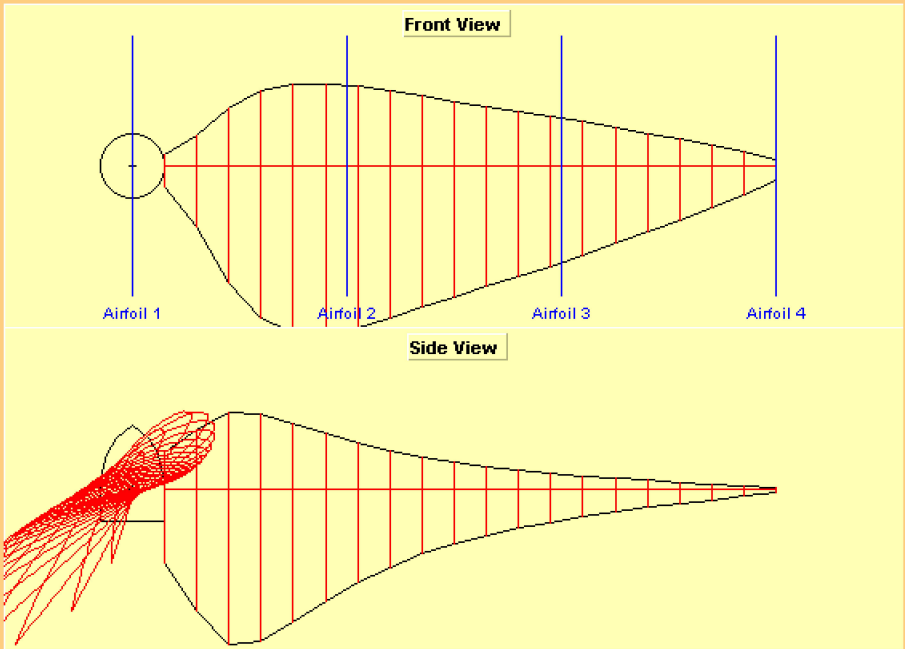
JavaProp

Design | Airfoils | **Geometry** | Modify | Multi Analysis | Single Analysis | Flow Field | Options

Propeller Geometry.

r/R	c/R	β	H/D	r	c	H	t	Airf
[-]	[-]	[°]	[-]	[mm]	[mm]	[mm]	[mm]	[-]
0.0000	Spinner	-	-	-	-	-	-	-
0.0500	0.1777	73.9	0.5	50.0	177.7	1088.4	21.6	interpol
0.1000	0.3138	63.4	0.6	100.0	313.8	1254.7	38.2	interpol
0.1500	0.4499	52.9	0.6	150.0	449.9	1246.2	54.7	interpol
0.2000	0.4969	44.9	0.6	200.0	496.9	1252.3	60.4	interpol
0.2500	0.4924	38.7	0.6	250.0	492.4	1258.4	59.9	interpol
0.3000	0.4653	33.9	0.6	300.0	465.3	1266.6	56.6	interpol

show: **Views** | Pitch/Diameter



Copy Text | Copy (HTML) | Print... | Save... | Import...

Ready.

JavaProp

Design | Airfoils | Geometry | **Modify** | Multi Analysis | Single Analysis | Flow Field | Options

Modify Propeller Geometry.

Change Blade Angle by:	0.000	[°]	
Scale Blade Angle by:	1.000	[-]	
Increase Chord by:	0.000	[mm]	
Scale Chord by:	1.000	[-]	
Taper Chord by:	1.000	[-]	tip/root
v/V at r/R = 0 (1.0 = undisturbed inflow):	1.000	[-]	
r/R where v/V = 1:	0.500	[-]	
Threading line at % chord:	33.000	[%]	
Trailing edge thickness:	0.500	[%]	

Modify It! | Defaults

Ready.

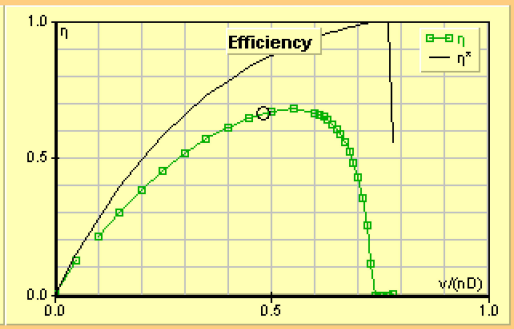
JavaProp

Design | Airfoils | Geometry | Modify | **Multi Analysis** | Single Analysis | Flow Field | Options

Propeller Off-Design Analysis for full v/nD range.

258904	9.999999	9.999999	30.33	39.38	0.00 !	10.00	2000	92.026	2.7912	439.39
345906	7.880574	9.999999	38.31	49.45	0.00 !	13.33	2000	91.099	2.6177	434.96
434938	4.637481	9.999999	45.35	58.40	0.00	16.67	2000	88.453	2.4069	422.33
525503	2.950149	5.718842	51.59	66.05	0.00	20.00	2000	85.484	2.2049	408.15
618778	1.957924	3.438772	56.94	72.64	0.00	23.33	2000	81.624	1.9917	389.73
715804	1.331214	2.168146	61.40	78.30	0.00	26.67	2000	76.821	1.7688	366.79
818148	0.912736	1.406712	64.88	83.14	0.00	30.00	2000	70.966	1.5349	338.84
928193	0.621149	0.924038	67.22	87.29	0.00	33.33	2000	63.946	1.2895	305.32
049696	0.411351	0.604432	68.06	90.83	0.00	36.67	2000	55.673	1.0333	265.82

show: **Coefficients Cp, Ct** | Coefficients Pc, Tc | Thrust | Power | rpm | Torque



☐ Add to existing plots | Analysis with rpm=prescribed | (Results are valid for B, rpm, D, ρ from Design card)

Analyze! | Copy Text | Copy (HTML) | Print... | Save...

Ready.

JavaProp

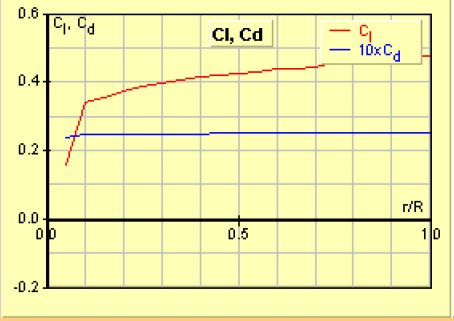
Design | Airfoils | Geometry | Modify | Multi Analysis | **Single Analysis** | Flow Field | Options

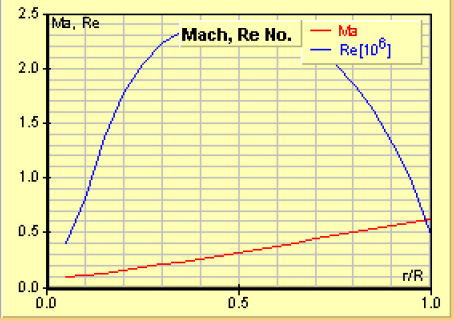
Propeller Off-Design Analysis for single v/nD value.

v/(nD)	0.48	v/(ΩR)	0.153	Ω*R/v	6.545		Propeller
CT	0.06569	CP	0.04746	PC	1.09273	η	0.66444

r/R	α	Cl	Cd	L/D	Re	Ma	a	a'
[-]	[°]	[-]	[-]	[-]	[-]	[-]	[-]	[-]
0.000	Spinner	-	-	-	-	-	-	-
0.050	-0.6	0.156	0.02381	6.54	406332	0.098	0.00567	0.146
0.100	1.1	0.342	0.02455	13.94	812168	0.111	0.04581	0.160
0.150	1.2	0.354	0.02461	14.39	1363039	0.130	0.08498	0.126
0.200	1.4	0.373	0.02470	15.09	1770329	0.153	0.11961	0.098
0.250	1.5	0.386	0.02476	15.59	2044974	0.178	0.14586	0.077
0.300	1.6	0.397	0.02482	15.99	2223674	0.205	0.16533	0.060

show: **Aerodynamics** | Local Performance | Loads | Wake





☐ Add to existing plots (Results are valid for B, rpm, D, v, ρ from Design card)

Analyze! | Copy Text | Copy (HTML) | Print... | Save...

Ready.

JavaProp

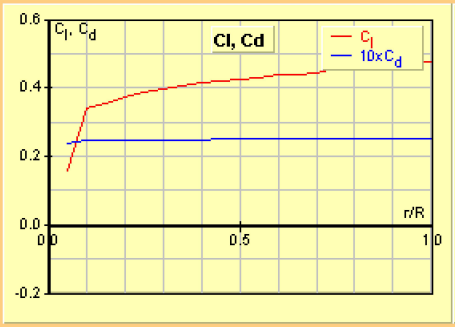
Design | Airfoils | Geometry | Modify | Multi Analysis | **Single Analysis** | Flow Field | Options

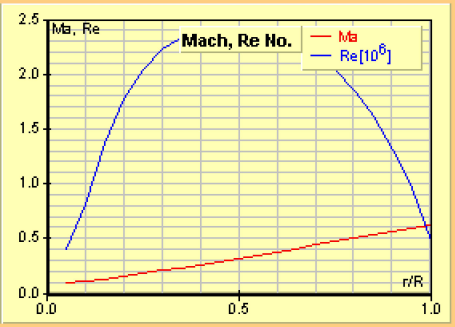
Propeller Off-Design Analysis for single v/nD value.

v/(nD)	0.48	v/(ΩR)	0.153	Ω*R/v	6.545		Propeller
CT	0.06569	CP	0.04746	PC	1.09273	η	0.66444

0.600	2.0	0.438	0.02504	17.51	2393336	0.379	0.21232	0.020
0.650	2.0	0.438	0.02504	17.50	2341137	0.409	0.21377	0.017
0.700	2.0	0.444	0.02507	17.70	2212458	0.439	0.21270	0.015
0.750	2.2	0.455	0.02513	18.11	2034267	0.469	0.21126	0.013
0.800	2.2	0.457	0.02514	18.18	1844135	0.500	0.20650	0.011
0.850	2.3	0.467	0.02520	18.52	1615234	0.530	0.20437	0.010
0.900	2.3	0.472	0.02523	18.71	1308360	0.560	0.19698	0.008
0.950	2.3	0.474	0.02524	18.77	958088	0.591	0.19576	0.007
1.000	2.3	0.475	0.02525	18.83	479171	0.621	0.19453	0.007

show: **Aerodynamics** | Local Performance | Loads | Wake





☐ Add to existing plots (Results are valid for B, rpm, D, v, ρ from Design card)

Analyze! | Copy Text | Copy (HTML) | Print... | Save...

Ready.

Drone Ascent Using Excess Power Flying Considerations

A rate of climb can be calculated by comparing the power needed for level flying compared against the power available

Will bring drone to 1000ft altitude via VTOL vertical flying

Excess power climb calculations begin at 1000ft altitude

Flying considerations for level flight at 1000ft altitude

WING alt 1000ft, 108 ft/sec, AOA 7.24 deg, Lift 3382 lbs
drag 224lbs, moment -1137lbs

BODY alt 1000ft, 108 ft/sec, AOA 4.434 deg, Lift - 141lbs
drag = 45lbs, moment +751 lbs

Total drag = 224+45 = 269 lbs = 1196N

We will use two props for the ascent, so 1196N÷2 = 598N per PROP

PROP considerations: 1000ft altitude, density 1.1895, 1650 rpm

30.25 m/s, 31 kW, 703 N, 181 Nm
33.00 m/s, 26 kW, 522 N, 150 Nm

Interpolation for values at 32 m/s= meters/sec =108 ft/sec

32.00 m/s, 24.4 Kw, 583 N, 161 Nm

Thus for level flying at 1000ft altitude using 2 props,
we need 24.2 kW per prop or (24.4x2=48.8) 50kW total

Drone Ascent Using Excess Power Flying Considerations

A rate of climb can be calculated by comparing the power needed for level flying compared against the power available

We can choose to run the prop at 2000rpm

PROP data (altitude 1000ft, 32 m/s, 108 ft/sec):

will use the 33 m/s data 64 kW, 1.28 N, 305 Nm

Run the engine at 1.064 % of normal power
6061 rpm x 1.064 = 6401 rpm Gearing 25:45= 0.53 35:40= 0.6
6401 x 0.53 = 3392 rpm 6401 x 0.6 = 3840 rpm

Motor q= $\frac{(59.8)(2000)}{(1000)(0.95)}$ = 126 L/min 126x6 = 756 L/min

Motor $\frac{(305)(63)}{(59.8)(0.95)}$ = 338 Bar

Pump $\frac{(110.1)(338)}{(63)(0.95)}$ = 621 Nm

Pump #1 $\frac{(110.1)(3392)(0.95)}{1000}$ = 354.7 L/min

Pump #2 $\frac{(110.1)(3840)(0.95)}{1000}$ = 401.6 L/min

354.7+401.6=756.3 L/min

Drone Ascent Using Excess Power Flying Considerations

A rate of climb can be calculated by comparing the power needed for level flying compared against the power available

We can choose to run the prop at 2000rpm

Pump #1 (621 Nm)(0.53) = 329 Nm

Pump #2 (621 Nm)(0.60) = 373 Nm

329+373= 702 Nm

702 Nm at 6401 rpm = 471 kW = 631 HP

Excess Power considerations:

6 props total each putting in 64 kW 64x6= 384 kW

Actual power need for level flying 1000ft altitude
using 2 props is 25 kW per prop, total is 50 kW

Excess power is (384 kW being used) - (50 kW actually needed)

384-50 = 334 kW excess power can be used

from website wt 3300lbs drone wt at 108 ft/sec
with excess power of 334 kW, yields:

climb rate based on excess power of 76 ft/sec

Drone Ascent Using Excess Power Flying Considerations

A rate of climb can be calculated by comparing the power needed for level flying compared against the power available

from website wt 3300lbs drone wt at 108 ft/sec
with excess power of 334 kW, yields:

climb rate based on excess power of 76 ft/sec

The engine power requirements for this rate of climb was:

702 Nm at 6401 rpm = 471 kW = 631 HP

Note: See Fuel Use calculations pages for fuel use details

0 altitude to 1000ft altitude vertical ascent at 3.01 m/s,
=9.87 ft/sec 1000÷9.87 = 101 sec, power needed 562.5 HP
(101 sec)(0.000194 lbs fuel/sec-HP)(562.55 HP) = 11 lbs fuel

1000ft altitude to 9000 ft altitude via excess power flying

9000-1000= 8000ft at 76 ft/sec = 105 seconds

(105 sec)(0.000194 lbs fuel/sec-HP)(631 HP) = 13 lbs fuel

0000ft alt to 1000ft alt	11lbs fuel
1000ft alt to 9000ft alt	13lbs fuel

Using power excess flying (0 ft to 9000ft)
Total fuel use 24 lbs, total ascent time 206 seconds (3.4 min)

Using completely vertical flying (0 ft to 9000ft)
Total fuel use 100 lbs, total ascent time 872 seconds (14.5 min)