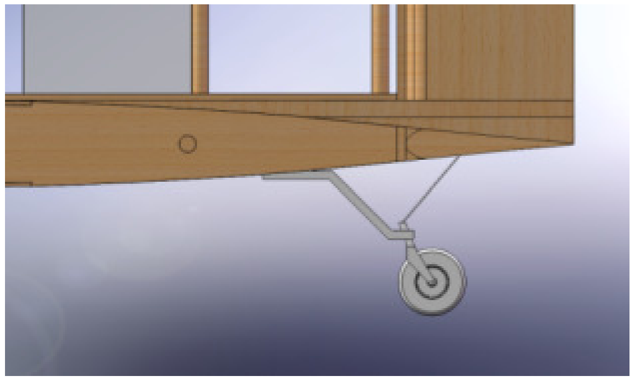
Appendix A – Tail Dragging Configuration



Appendix B – Servo Sizing

Take off and Landing			
K	0.3		40 degree flap for landing
Lift	40.0		pounds
Flap Chord	2.5		inches
Flap Area	90.0		inches squared
Wing Area	342.0		inches sqaured
Cl	2.2		dimensionless
servo arm/horn arm	0.8		a good guess?
Moment_Hinge	3.6	in-lb	57.4 in-oz
Moment Servo	43.1	in-oz	

Suppose the aeroplane is turning			
k	0.2		turning coefficient
Cl	2.2		dimensionless
Lift	80.0		40 lbs * 2 g's acceleration
Flap Chord	2.5		inches
Flap area/wing area	0.3		
servo arm/horn arm	0.8		
Moment_Hinge	3.6	in-lb	57.4 in-oz
Moment Servo	43.1	in-oz	

Appendix C – Vortex Panel Method Code (MATLAB)

```
%%% Nick Bruno
%%% Aerodynamics 442
%%% Dr. Acker
%%% Fall 08
%%% CP 10 Vortex Panel Method

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                              Variable Bank                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%   x =         loaded data
%   l =         length data
%   alpha =     angle of attack in degrees
%   Alpha =     alpha*pi/180 = angle of attack in radians
%   Vinf =      freestream velocity (m/s)
%   rho =       freestream density (kg/m^3)
%   pts =       number of points defining airfoil
%   xp =        dummy variable
%   xpoints =   x endpoints for each panel
%   yp =        dummy variable
%   ypoints =   y endpoints for each panel
%   M =         dummy variable (number used for iterations)
%   MP1 =       M + 1 (used for iterations)
%   xmid =      x control points
%   ymid =      y control points
%   xdelta =    change from x(i) to x(i+1)
%   ydelta =    change from y(i) to y(i+1)
%   S =         length of panel
%   theta =     angle panel makes with horizontal in first quad.
%   Sine =      sin(theta)
%   Cosine =    cos(theta)
%   RHS =       right hand side of eqn used for solving gamma
%
%   Variables derived from integration include:
%   A,B,C,D,E,F,G,P,Q
%
%   CN1,2 and CT1,2 are values used to simplify calculations and are a
%   function of variables previously defined
%
%   AT and AN are influence coefficients based off of CN and CT
%   gamma =     strength of vortex panel at verticies
%   V =         dimensionless velocity
%   Cp =        pressure coefficient
%   gamave =    average strength over a panel
%   GAM =       circulation at each control point
%   GAMtot =    total circulation
%   Lprime =    lift per unit span
%   chord =     airfoil chord length
%   x_c =       percent cord for each control point
%   y_c =       percent height for each control point
%   cl =        lift coefficient

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                              Begin Program                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Clear all variables
%Clean command window
%Load Data into variable X
clear all
clc

x = load('example.dat');
data = x;
l = length (data);
alpha = x(2,1);
Vinf = x(1,2);
rho = x(1,1);
pts = x(2,2);
```

```matlab
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Get x endpoints from data
%Make x endpoints a column vector
    xp = data(:,1);
xpoints = xp(3:end);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Get y endpoints from data
%Make y endpoints a column vector
    yp = data(:,2)    ;
    ypoints = yp(3:end);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Sets variable M, MP1, and angle of attack
M = length(xpoints)-1;

MP1 = M + 1;

Alpha = alpha * pi/180;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Get x midpoints from data
%Make x midpoints a column vector
%If xendpoints are the same, the midpoint is the endpoint
%If xendpoints are the opposite, the midpoint is zero
%If xendpoints are on the left of the y axis add to neg x
%If xendpoints are on right side of y axis, add to pos x
%Last line sets the control point for the last iteration
%Make x midpoints a column vector (these are control points)
for i = 1:length(xpoints)-1;
    if xpoints(i) == xpoints(i+1);
        xmid(i) = xpoints(i);
        elseif xpoints(i) == -xpoints(i+1);
        xmid(i) = xpoints(i)+xpoints(i+1);
            elseif abs(xpoints(i)) > abs(xpoints(i+1));
        xmid(i) = (xpoints(i) - xpoints(i+1))/2 + xpoints(i+1);
        else abs(xpoints(i)) < abs(xpoints(i+1));
        xmid(i) = (xpoints(i+1)-xpoints(i))/2+ xpoints(i);
    end
end
xmid = xmid';


%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Get y midpoints from data
%Make y midpoints a column vector
%If yendpoints are the same, the midpoint is the endpoint
%If yendpoints are the opposite, the midpoint is zero
%If yendpoints are on the left of the x axis add to neg y
%If yendpoints are on right side of x axis, add to pos y
%Last line sets the control point for the last iteration
%Make y midpoints a column vector (these are control points)
for i = 1:length(ypoints)-1;
    if ypoints(i) == ypoints(i+1);
        ymid(i) = ypoints(i);
        elseif ypoints(i) == -ypoints(i+1);
        ymid(i) = ypoints(i)+ypoints(i+1);
            elseif abs(ypoints(i)) > abs(ypoints(i+1));
        ymid(i) = (ypoints(i) - ypoints(i+1))/2 + ypoints(i+1);
        else abs(ypoints(i)) < abs(ypoints(i+1));
        ymid(i) = (ypoints(i+1)-ypoints(i))/2+ ypoints(i);
    end
end

ymid = ymid';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Plots the x endpoints and y endpoints (Shape of object)
% Plots the control points
```

```matlab
% figure(1)
    plot(xpoints,ypoints,'-o');
    hold on
    plot(xmid,ymid,'r+')

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%Finds change in x from one point to the next
%Sets last delta X to zero (due to clockwise iteration)
%Changes Xdelta into a column vector
for i = 1:M
    xdelta(i) = xpoints(i+1) - xpoints(i);
end
xdelta=xdelta';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds change in y from one point to the next
%Sets last delta y to last change (due to clockwise iteration)
%Changes ydelta into a column vector
for i = 1:M
    ydelta(i) = ypoints(i+1) - ypoints(i);
end
ydelta=ydelta';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Sets Variables S(i), Theta, sine, cosine, and RHS
for i = 1: length(xmid)
     S(i) = sqrt(xdelta(i).^2 + ydelta(i).^2);
     theta(i) = atan2(ydelta(i),xdelta(i));
     sine(i) = sin(theta(i));
     cosine(i) = cos(theta(i));
     RHS(i) = sin(theta(i) - Alpha);
end
S = S';
theta = theta';
sine = sine';
cosine = cosine';
RHS = RHS';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds Variables A,B,C,D,E,F,G,P,Q, CN2, CN1, CT2, CT1
%Sets boundary conditions for variables CN2, CN1, CT2, CT1
for i = 1:M
    for j = 1:M
        if i == j
            CN1(i,j) = -1.0;
            CN2(i,j) = 1.0;
            CT1(i,j) = 0.5*pi;
            CT2(i,j) = 0.5*pi;
        else
            A = -(xmid(i)-xpoints(j))*cosine(j) - (ymid(i) -ypoints(j))*sine(j);
            B = (xmid(i) - xpoints(j))^2 + (ymid(i)-ypoints(j))^2;
            C = sin(theta(i) - theta(j));
            D = cos(theta(i) - theta(j));
            E = (xmid(i)-xpoints(j))*sine(j) - (ymid(i)-ypoints(j))*cosine(j);
            F = log(1+S(j)*(S(j)+2*A)/B);
            G = atan2(E*S(j),B+A*S(j));
            P = (xmid(i) - xpoints(j))*sin(theta(i)-2*theta(j)) + (ymid(i)-
ypoints(j))*cos(theta(i)-2*theta(j));
            Q = (xmid(i) - xpoints(j))*cos(theta(i)-2*theta(j)) - (ymid(i)-
ypoints(j))*sin(theta(i)-2*theta(j));
            CN2(i,j) = D + 0.5*Q*F/S(j) - (A*C+D*E)*G/S(j);
            CN1(i,j) = 0.5*D*F + C*G - CN2(i,j);
            CT2(i,j) = C + 0.5*P*F/S(j) + (A*D-C*E)*G/S(j);
            CT1(i,j) = 0.5*C*F - D*G - CT2(i,j);
        end
    end
end
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds Variables AN, AT and sets B.C. for each
for i = 1:M
    AN(i,1) = CN1(i,1);
    AN(i,MP1) = CN2(i,M);
    AT(i,1) = CT1(i,1);
    AT(i,MP1) = CT2(i,M);
    for j = 2:M
        AN(i,j) = CN1(i,j)+CN2(i,j-1);
        AT(i,j) = CT1(i,j) + CT2(i,j-1);
    end
end
AN(MP1,1)= 1.0;
AN(MP1,MP1) = 1.0;
for j = 2:M
    AN(MP1,j) = 0;
end
RHS(MP1) = 0;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds panel strength at each vertex

gamma = AN^-1*RHS;

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds dimensionless velocity at control points
for i = 1:M
    V(i) = cos(theta(i) - Alpha);
    for j = 1:MP1
        V(i) = V(i) + AT(i,j)*gamma(j);
    end
end

V = V';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds pressure coefficient at each control point
for i = 1:M
    Cp(i) = 1 - (V(i))^2;
end

Cp = Cp';

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Finds average panel strength
for i = 1:M
gamave(i) = (gamma(i+1) + gamma(i))/2;
```

Appendix D–Spreadsheet Calculator

Craft Dimensions

Wings		
Wing Span	7	ft
Wing Cord Length	1	ft
Wing Thickness	0.13	ft
Wing LE Radius	0.065	ft
Wing Weight	3.375	lb
CL Max	1.5753	Unitless
Fuselage		
Fuselage Length	2	ft
Fuselage Width	0.5	ft
Fuselage Height	0.75	ft
Boom Length	3	ft
Fuselage Weight	2	lb
Horizontal Tail		
Tail Span	2	ft
Tail Cord Length	1	ft
Tail Thickness	0.12	ft
Tail LE Radius	0.06	ft
Tail Weight	0.1875	lb
Vertical Tail		
Tail Span	2	ft
Tail Cord Length	0.67	ft
Tail Thickness	0.07992	ft
Tail LE Radius	0.03996	ft
Tail Weight	0.1875	lb
Engine		
Frontal Area	0.04166	ft^2
Static Thrust	11.41	lb
Engine Weight	1.475	lb
Fuel Weight	0.5	lb
Landing Gear		
Frontal Area	0.020833	ft^2
Landing Gear Weight	0.8125	lb

Resin	0
Prop	0.125
servoes	0.5625
payload bask	0.8125
engine moun	0.125
receiver	0.08125
batteries	0.5
bolts	0.5

Air Quality/ Physical Quantities

	Gravity	32.2	ft/s^2
75 F	Air Temperature	534.67	R
1000ft	Air Pressure	2040.9	psf
	Universal Gas Constant	1716.6	ft*lb/slugR
	Dynamic Viscosity	3.677E-07	slugs/ft-sec
	Air Density	0.002223652	slugs/ft^3
	Velocity of Plane (Freestream)	51.66864275	ft/s

Dimensions Taken From White Paper

R	1.05
L	1.2
e	0.934
k'	0.048686125
k''	0.01947445
Total Cdmin (laminar)	0.040996739
Total Cdmin (Turbulent)	0.096532412

Cd = 0.041 + 0.068160575 (CL - 0.92)^2

Craft Calculated Dimensions

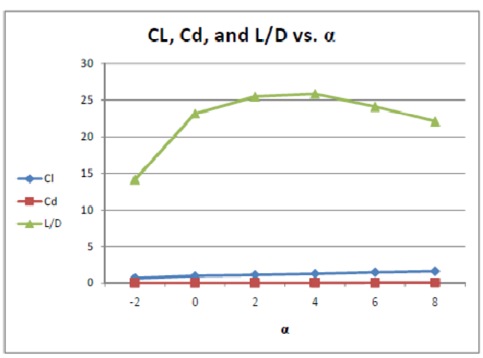
Wing		
AR	7	Unitless
Wetted Area of wing (exposed)	15.08	ft^2
Wing Planform	7	ft^2
Characteristic Length	1	ft
Frontal Area	0.91	ft^2
Reynolds Number	312464.2	Unitless
FF	1.243789	Unitless
Cf (laminar)	0.004751	Unitless
Boundary Layer Thickness (lam)	0.008945	ft
Cdmin (Laminar)	0.012731	
Cf (Turbulent)	0.011784	Unitless
Boundary Layer Thickness (Turb)	0.029461	ft
Cdmin (Turbulent)	0.031576	
Gurney Flap Thkness 2%c	0.24	in
Fuselage		
Wetted Area of Fuselage (exposed)	5.25	ft^2
Fuselage Planform	1	ft^2
Characteristic Length	2	ft
Frontal Area	0.375	ft^2
Reynolds Number	624928.3	Unitless
FF	2.628333	Unitless
Perimeter	2.5	ft
Equivalent Diameter	0.6	ft
Finesse Ratio	3.333333	Unitless
Cf (laminar)	0.00672	Unitless
Boundary Layer Thickness (lam)	0.01265	ft
Cdmin (Laminar)	0.013246	
Cf (Turbulent)	0.020518	Unitless
Boundary Layer Thickness (Turb)	0.051294	ft
Cdmin (Turbulent)	0.040445	
Horizontal Tail		
AR	2	Unitless
Wetted Area of wing (exposed)	4.72	ft^2
Wing Planform	2	ft^2
Characteristic Length	1	ft
Frontal Area	0.24	ft^2
Reynolds Number	312464.2	Unitless
FF	1.222973	Unitless
Cf (laminar)	0.004751	Unitless
Boundary Layer Thickness (lam)	0.008945	ft
Cdmin (Laminar)	0.003918	
Cf (Turbulent)	0.011784	Unitless
Boundary Layer Thickness (Turb)	0.029461	ft
Cdmin (Turbulent)	0.009718	
Vertical Tail		
AR	3.003003	Unitless
Wetted Area of wing (exposed)	3.036907	ft^2
Wing Planform	1.332	ft^2
Characteristic Length	0.67	ft
Frontal Area	0.15984	ft^2
Reynolds Number	208101.1	Unitless
FF	1.222973	Unitless
Cf (laminar)	0.005822	Unitless
Boundary Layer Thickness (lam)	0.0073	ft
Cdmin (Laminar)	0.003089	
Cf (Turbulent)	0.012782	Unitless
Boundary Layer Thickness (Turb)	0.021282	ft
Cdmin (Turbulent)	0.006782	
Engine		
Cdmin (6 in^2)	0.002	
Landing Gear		
Cdmin	0.006012	
Winglets		
Wetted Area of wing (exposed)	1.33332	ft^2
Wing Planform	0.66666	ft^2
Characteristic Length	0.6666	ft
Frontal Area	0.08333	ft^2
Reynolds Number	208288.6	Unitless
Cf (laminar)	0.00582	Unitless
Boundary Layer Thickness (lam)	0.007303	ft
Cdmin (Laminar)		
Cf (Turbulent)	0.01278	Unitless
Boundary Layer Thickness (Turb)		ft
Cdmin (Turbulent)		

Airplane Total

Frontal Area + span+perp ailer	7.947333	ft^2
Aircraft Weight	11.24375	lb
Airplane Mass	0.349185	slugs
Payload Weight	11.2	lb
Total Weight	22.44375	
Total Mass	0.697011	

Performance Calculations

V (t,o)	51.66864	ft/s	35.23 mi/h
V (Stall)	46.21384	ft/s	31.51 mi/h
Crolling	0.03		Unitless
Thrust at Takeoff (Dynamic)	6.239741	lb	(function of takeoff velocity)
V (t,o) * 0.7 (for A-mean)	36.16805	ft/s	24.66 mi/h
Thrust at V (t,o)*0.7 (A-mean)	6.2755	lb	
Drag at 0.7 V (t,o)	1.115788	lb	
CL Groundroll (alpha = 0)	0.7		
Lift during groundroll	6.108524	lb	
Acceleration (mean) @ 0.7 V(t,o)	6.699545	ft/s^2	
Takeoff Distance	199.241	ft	
Velocity on Landing	60.07799	ft/s	
CL landing	0.93213		
Cd landing	0.042187		
Flight Drag on Touchdown	1.345441	lb	
Friction Drag on Landing gear	0.673313	lb	
Total Drag Force on Landing	2.018754	lb	
Horizontal Acceleration	-2.8963	ft/s	
Landing Distance	623.099	ft	



Cl	Cd	L/D
0.65	0.045966	14.141
0.95	0.041058	23.13795
1.1	0.043205	25.45993
1.25	0.048419	25.81608
1.45	0.060143	24.10919
1.6	0.072514	22.06465

Appendix E – Winglet Calculations

With Winglets

Typical density of balsa wood = 140 kg/m^3 = 8.74 lb/ft^3

Volume of winglets => 4 ribs/each side

12“ chord

10% Thickness of chord => 1.2” wide

3/16” thick

Volume = 2.7in^3 each => 21.6 in^3 Total

Total weight of winglets => 0.10925 lb

$L = \frac{1}{2}\rho v^2 C_L A$ if V = 30ft/s, A = 7ft^2, L = 0.10925 lb, ρ = 0.0023 slug/ft^3, Re = 180,000

$\Delta C_L = 0.01507$ to account for extra weight of winglets

Without Winglets

$$\alpha_i = \frac{C_L}{\pi AR} = \frac{1.1}{\pi * 7} = 0.05\, rad \;\; \rightarrow \;\; \alpha_i = \;2.8625°$$

$$\alpha_{eff} = \;\alpha_{geo} - \alpha_i$$

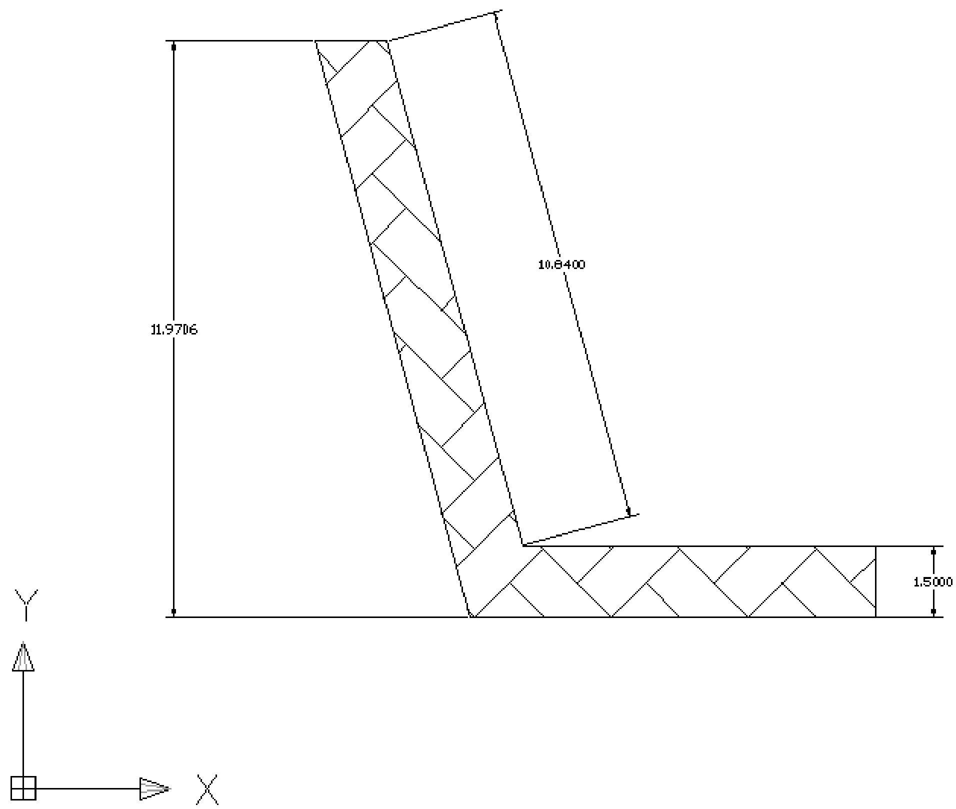
If $\alpha_{geo} = 3°$(incidence)

$$\alpha_{eff} = 0.1341° \rightarrow C_L = 0.85$$

$\Delta C_L = 0.25$; We lose 0.25 Cl if we have no winglets

Since we lose 0.25 Cl with no winglets, and if adding winglets requires a 0.01507 increase in Cl, it is very beneficial to use winglets.

Not Tapered Winglet (Drag Calculations)



For V = 10 ft/s, 20 ft/s, and 30 ft/s

$$Re = \frac{\rho v D}{\mu} = \frac{0.0023(10)(1)}{3.67 * 10^{-7}} = 62.6e3, 125.3e3, 188.01e3 = Reynolds\ Numbers$$

$$C_f = \frac{0.074}{R^{\frac{1}{5}}}(2) = skin\ friction\ coefficient = 16.25 * 10^{-3}, 14.14 * 10^{-3}, 13.04 * 10^{-3}$$

$$D = Drag = q_{\infty} C\, C_f = 13.5 * 10^{-3} \frac{lb}{span}, 6.05077 * 10^{-3} \frac{lb}{span}, 1.8688 * 10^{-3} \frac{lb}{span}$$

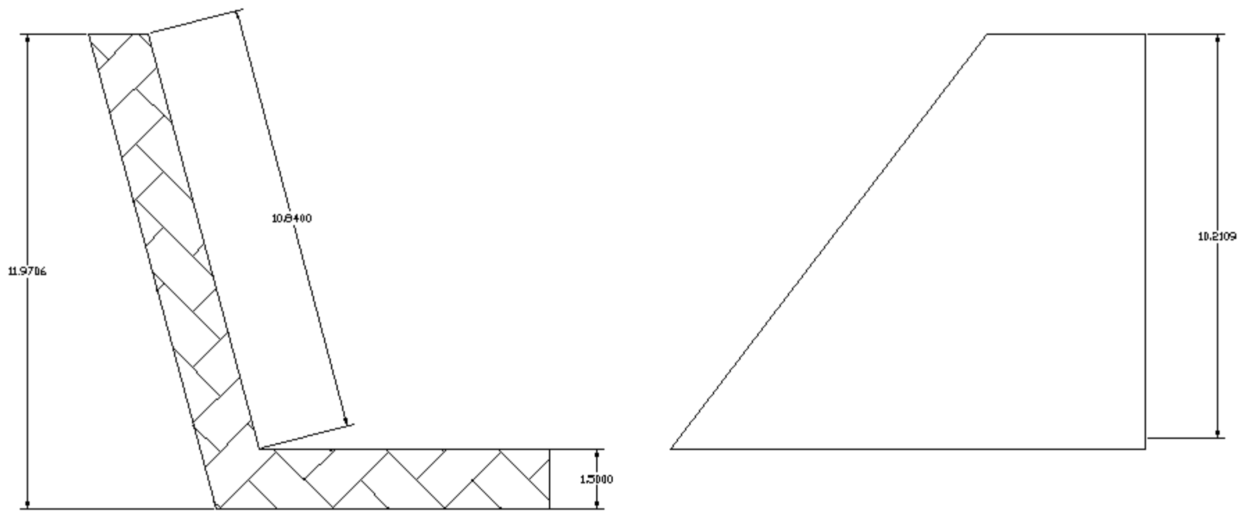
Where span = 11” = 0.91667ft, and C = chord length = 1 ft

$$D_{v=10} = 0.00171\ lb$$

$$D_{v=20} = 0.005965\ lb$$

$$D_{v=30} = 0.01237\ lb$$

Tapered Winglets



Note: Average Reynolds Numbers will be used

$$Re = \frac{\rho v D}{\mu} = \frac{0.0023(10)(1)}{3.67 * 10^{-7}} = 41.78 * 10^3, 83.54 * 10^3, 125.34 * 10^3 = Reynolds\ Numbers\ (avg)$$

$$C_f = \frac{0.074}{R^{\frac{1}{5}}}(2) = skin\ friction\ coefficient = 8.81 * 10^{-3}, 7.76 * 10^{-3}, 7.07 * 10^{-3}$$

$D_{v=10} = 0.000617\ lb$

$D_{v=20} = 0.00229\ lb$

$D_{v=30} = 0.00446\ lb$

*Values above were found for one winglet (for two sides) The following information is a comparison for two winglets (values multiplied by 2)

Two winglet comparison

Not Tapered	*Tapered*
$D_{v=10} = 0.00342\ lb$	$D_{v=10} = 0.001234\ lb$
$D_{v=20} = 0.0119\ lb$	$D_{v=20} = 0.00458\ lb$
$D_{v=30} = 0.02474\ lb$	$D_{v=30} = 0.008933\ lb$

V = 10

Drag savings by using tapered winglets = 0.002186 lb

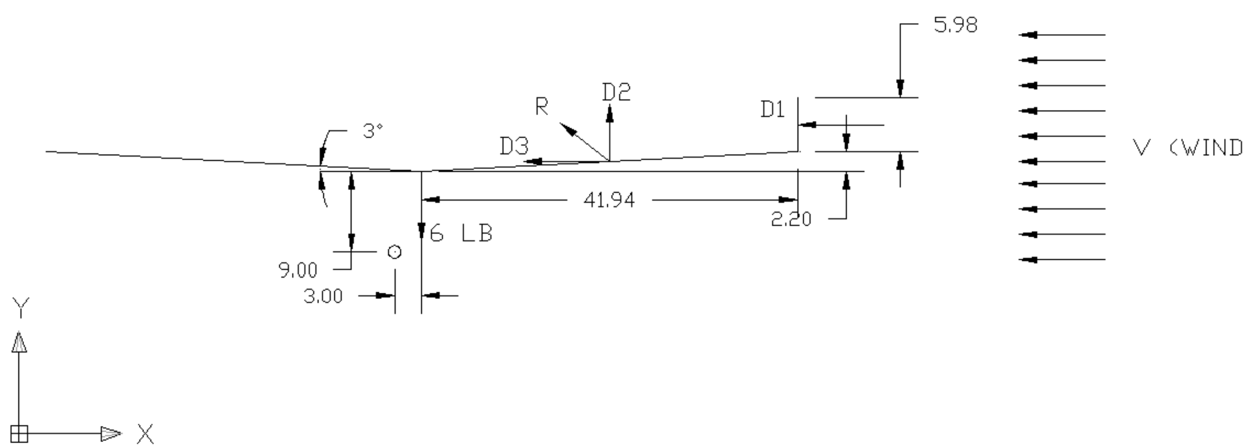
V = 20

Drag savings by using tapered winglets = 0.00732 lb

V = 30

Drag savings by using tapered winglets = 0.0158 lb

Crosswind Calculations



Assume:
Fuselage = 9" Tall; 6" wide
Wheel @ base of fuselage
6lb empty plane
Horizontal crosswind V
Neglect Tail
Chord = 12"
Span = 7 feet
Cd = flat plate = 2.0

D2 = R sin(87)

D3 = R cos (87)

$$\sum M_{A,wheel} = 3" * 6lb = 18\ lb * in$$

$$D = \frac{1}{2}\rho v^2 C_d A$$

$$\rho = 1.331 * 10^{-6} \frac{slug}{in^3}$$

$$\sum M_A = -D1 * 17.2\text{-D2*21"} - D3 * 10.1"$$

$D1 = 191.664*10^{-6} V^2$
$D2 = 669.9*10^{-6} V^2$
$D3 = 1.839*10^{-6} V^2$

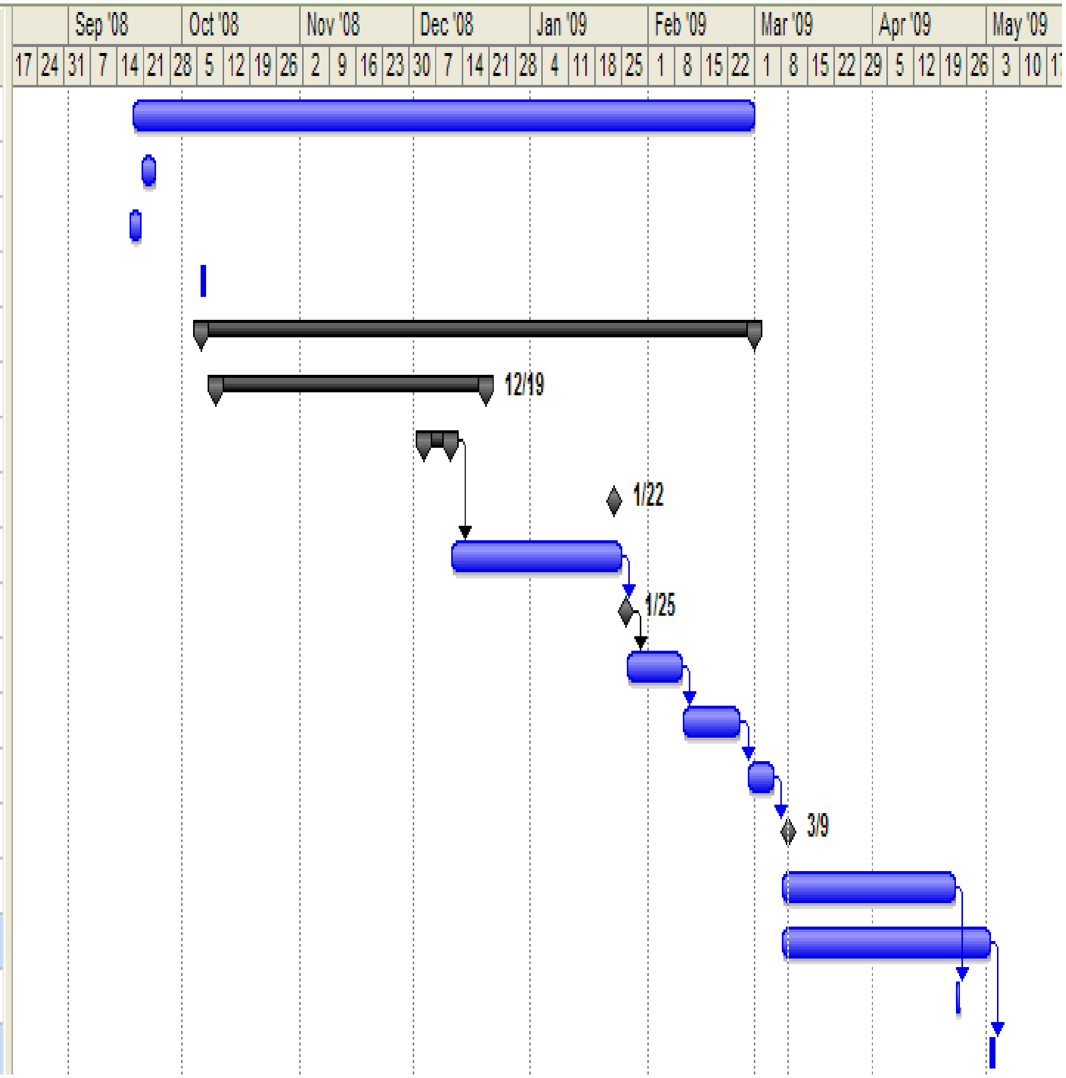
$$\sum M_A = -3.2966 * 10^{-3}v^2 - 14.0679 * 10^{-3}v^2 - 18.57 * 10^{-6}v^2 = -17.38 * 10^{-3}v^2 = 18\ lb * in$$

V = 32.179 in/s for one wing
V = 16.08 in/s for both wings
V = 1.34 ft/s = 0.91363 mi/h

It is recommended that the wheel base is larger than 6” otherwise the plane will tip over with a slight breeze. Note, this is not including the vertical stabilizer.

Appendix F – Gantt Chart

		Task Name	Duration	Start	Finish
1		SOTA Research	164 days	Thu 9/18/08	Sat 2/28/09
2		Team by laws	4 days	Sat 9/20/08	Tue 9/23/08
3		Team inventory	3 days	Wed 9/17/08	Fri 9/19/08
4		SAE organization and team registration	1 day	Mon 10/6/08	Mon 10/6/08
5		+ **Fundraising etc**	**146 days**	**Mon 10/6/08**	**Sat 2/28/09**
10		+ **Design of prototype**	**71 days**	**Fri 10/10/08**	**Fri 12/19/08**
29		+ **Analysis of design and capabilities**	**7 days**	**Thu 12/4/08**	**Wed 12/10/08**
33		SAE Report Submittal	5 days	Sun 1/18/09	Thu 1/22/09
34		Construction of Prototype	45 days	Thu 12/11/08	Sat 1/24/09
35		Construction Complete	1 day	Sun 1/25/09	Sun 1/25/09
36		Prototype Testing	15 days	Mon 1/26/09	Mon 2/9/09
37		Refine prototype	15 days	Tue 2/10/09	Tue 2/24/09
38		Practice flights	7 days	Fri 2/27/09	Thu 3/5/09
39		Competition in California	4 days	Fri 3/6/09	Mon 3/9/09
40		Prepare For CEFNS Presentation	46 days	Sun 3/8/09	Wed 4/22/09
41		Develop Final Report	55 days	Sun 3/8/09	Fri 5/1/09
42		CEFNS Presentation	1 day	Thu 4/23/09	Thu 4/23/09
43		Submit Final Report	1 day	Sat 5/2/09	Sat 5/2/09



Appendix G – Individual Budget

Member Summary

	Card #	Date	Type	Reason		
Joel						
($41.12)	4088	11/7/2008	Flagstaff Hobbies LLC	Construction	Reimbursed by MVM	
($14.41)	4088	11/12/2008	Home Depot	Thrust Testing	Reimbursed by MVM	
($1.37)	4088	1/19/2009	Wal-Mart	3 Dowel Rods	Reimbursed by MVM	
($6.50)	4088	1/26/2009	Ace	Construction	Reimbursed by MVM	
($130.50)	4088	1/30/2009	Flagstaff Hobbies LLC	supplies	Reimbursed by MVM	
($4.66)	4088	13-Feb	Home Depot	supplies	Reimbursed by MVM	
($102.06)	4088	2/16/2009	Home Depot	Travel Tool Kit	Reimbursed by MVM	
($450.00)	?	10/6/2008	Registration	Registration	Reimbursed by Purina	
($70.33)	Credit	December	Balsa USA	Construction	Reimbursed by Purina	
($232.46)	4088	12/20/2008	Flagstaff Hobbies LLC	Wood	Reimbursed by Purina	
($15.08)	4088	1/22/2009	Flagstaff Hobbies LLC	Construction	Reimbursed by Purina	
($23.97)	4088	2/7/2009	Tower Hobbies	Wheels and Supplies	Reimbursed by Purina	
($71.81)	4088	2/14/2009	Flagstaff Hobbies LLC	Monokote and supplies	Reimbursed by Purina	
($12.36)	4088	January	Home Depot	Construction		
($30.16)	Card #	December	Book	Construction		
($5.13)	4088	12/13/2008	Flagstaff Hobbies LLC	Construction		
($1.56)	4088	12/13/2008	Wal-Mart	Ruler/Tape		
($10.30)	4088	2/18/2009	Flagstaff Hobbies LLC	Servo Arm		
($14.44)	4088	1/20/2009	Du-Bro RC	rear landing gear		
($15.78)	Card #	12/7/2008	Amazon Marketplace	Book		
($23.85)	4088	3/4/2009	Autozone	Battery		
($402.78)	4088	3/8/2009	Airtel Plaza Hotel	Travel		
($372.78)	4088	3/8/2009	Airtel Plaza Hotel	Travel		
($2.71)	4088	3/4/2009	Flagstaff Hobbies LLC	Monokote		
($59.58)	4088	2/27/2009	Golden Corral	Travel	$525.77	
($9.94)	4088	3/1/2009	Mcdonalds	Construction		
($5.39)	4088	3/1/2009	Home Depot	Rivets	($966.76)	
Total ($2,131.03)						
Sean						
($20.12)	visa card	2/10/2009	Tower Hobbies	Servo Stuff	Reimbursed by Purina	
($28.47)	5754	10/31/2008	Propellers	Construction	Reimbursed by Varga	
($4.35)		12/6/2008	Plywood	Stencil	Reimbursed by Varga	
($21.55)	2171	2/28/2009	Express Way	Travel	Reimbursed by Varga	
($25.75)	2171	2/27/2009	Hallum Stores	Travel	Reimbursed by Varga	
($4.96)	2171	2/7/2009	Home Depot	JB Weld	Reimbursed by Varga	
($14.46)	2171	2/28/2009	In n Out	Travel	Reimbursed by Varga	
($74.80)	5754	2/3/2009	Flagstaff Hobbies LLC	Supplies		
($29.78)	2171	2/28/2009	Skyshark Hobbies	Wood, wheels, maxi cure		
($9.68)	2171	2/13/2009	Walmart	Supplies		
($8.68)	2171	2/28/2009	Walmart	Supplies		
($5.82)	5754	1/7/2009	Walmart	Supplies	sean owes	
($2.39)	2171	2/28/2009	Safeway	Supplies	$67.20	
($44.03)	2171	3/7/2009	Subway	Travel		$440.00
($13.54)	2171	2/5/2009	Homco Ace	Aluminum	($372.80)	
($5.42)	uknown	2/6/2009	K & M Tool, inc	Aluminum		
($74.80)	visa card	2/3/2009	Flagstaff Hobbies LLC	Servos		
($103.86)	2171	3/8/2009	Marie Callender's	Travel		
	The team gave Sean cash for this meal and he paid with card. Nick $16, everyone else $20, sean had remainder…					
Total ($492.46)						

Nick

($44.27)	3620	2/3/2009	Fiberglass	Kevlar
($5.41)	1742	11/7/2008	Circle k	9V battery Testing
($27.27)	3620	2/3/2009	:e composite Products	Resin
($4.73)	1742	5/18/2009	Target	Supplies
($27.66)	1742	2/28/2009	Pilot	Travel
($41.33)	3620	3/5/2009	Lenwood Road Valero	Travel
($10.30)	1742	2/27/2009	Giant	Travel
($26.00)	3620	3/8/2009	Alliance Mini Market	Travel
($23.92)	3620	3/8/2009	Flying J	Travel
($10.09)	1742	2/25/2009	Home Depot	Construction
($6.16)	1742	2/28/2009	Arby's	Hired Help
($27.52)	3620	3/8/2009	In n out	Travel
($38.02)	3620	3/5/2009	Pilot	Travel
Total ($292.68)				

Kevin

($4.31)	5973	12/9/2008	Home Depot	Jigsaw blds
($11.13)	Cash	11/26/2008	Ace Home	Safety Hasp/ SGL Cut Key
($35.36)	5973	2/28/2009	Home Depot	Rivets/ Jigsaw blds
($31.57)	5973	3/5/2009	In n out	Travel
($47.93)	5973	3/8/2009	Love's	Travel
($43.86)	5973	3/5/2009	Pilot	Travel
($23.11)	6404	1/21/2009	Papa Johns	Group Meeting
Total ($197.27)				

Total Spent: ($3,113.44)

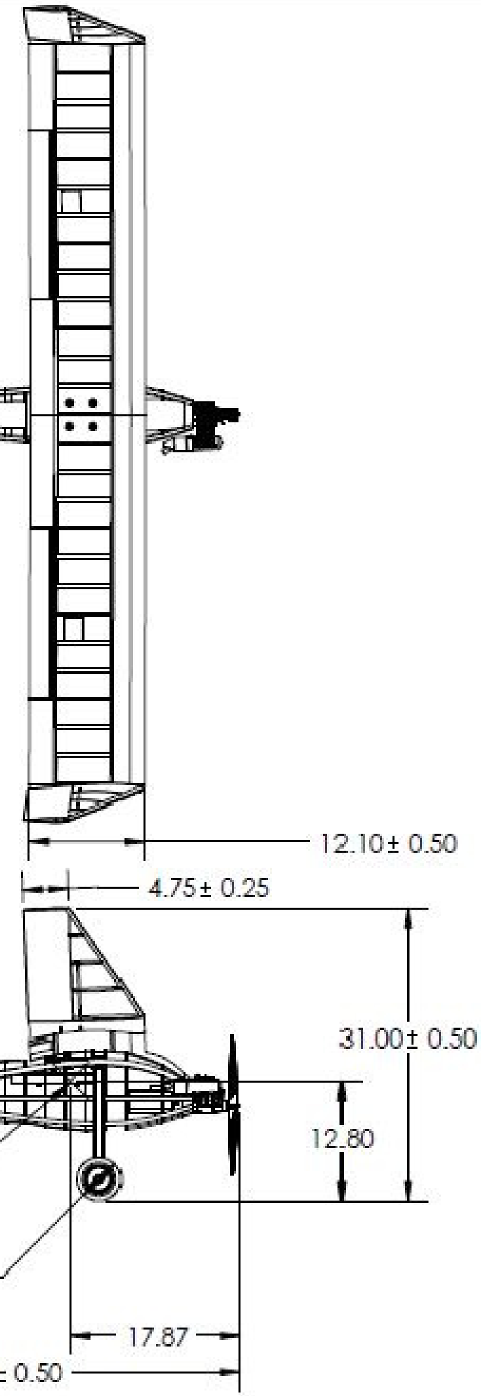
Sponsorships

$100.00	Grandpa Varga
$300.00	MVM
$1,000.00	Purina

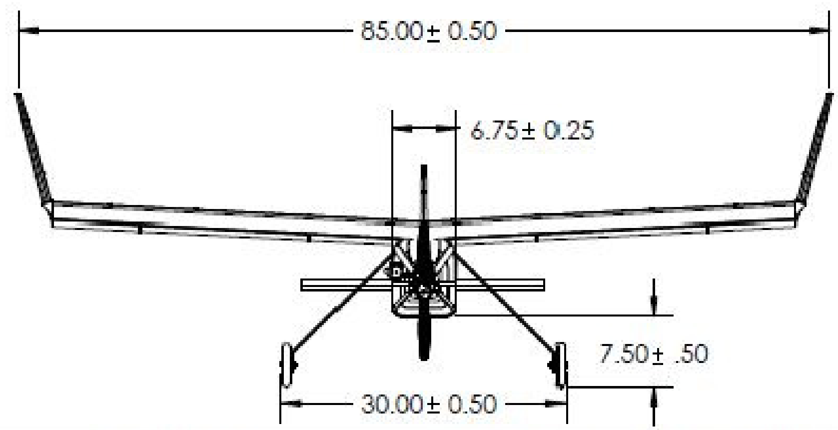
Total Received: $1,400.00

Cumulative Total ($1,713.44)

		Remaining funds
Reimbursed by MVM	($300.62)	-$0.62
Reimbursed by Purina	($883.77)	$116.23
Reimbursed by Grandpa Varga	($99.54)	$0.46



Wingspan	85.00± 0.5 in
Dry Weight	9 lbf
Engine	o.s. 061 FX
Muffler	E-4010
Class	Regular
Aitfoil	Eppler 423
Total L+W+H	167.25± 1.50 inches
Main Wing Planform	7.0 ± 0.125 sqft
Tail Fin Planform	2.0 ± 0.125 sqft
Cargo Bay Volume	250 sq inches



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

NEXT ASSY | USED ON
APPLICATION

Team Number: 013

Northern Arizona University

SIZE B | Team Name: Team Ninja Turtles | REV

SCALE: 1:16 WEIGHT: SHEET 1 OF 1