

GAZIANTEP UNIVERSITY

AIRCRAFT AND AEROSPACE ENGINEERING
DEPARTMENT

AE403 AERONAUTICAL ENGINEERING DESIGN

Assignment-1

XFLR-5 Wing And Plane Design

Student Name: Mustafa Can Emre

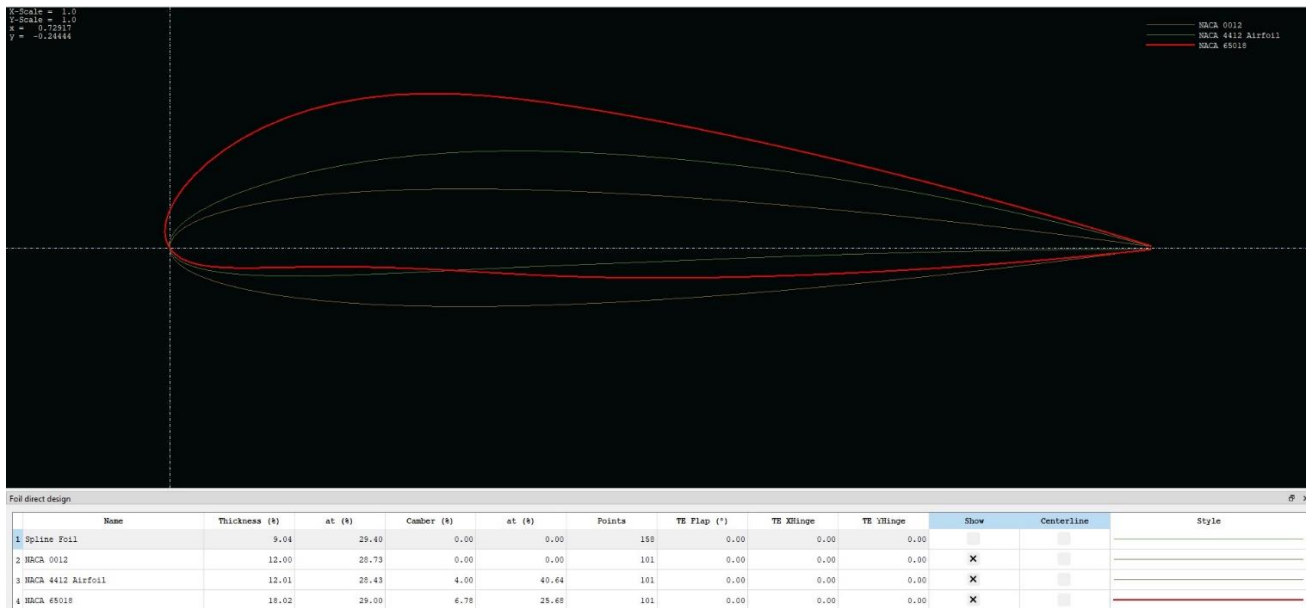
Student Number : 201616263

Submitting To : Asst.Prof.Dr. SOHAYP ABDUL
KARIM

XFLR-5 2D Analysis of Airfoils

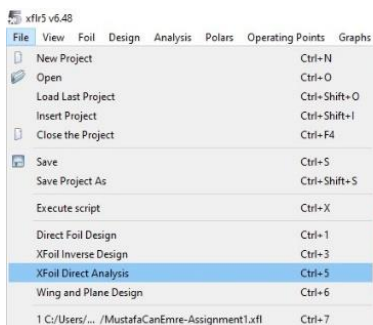
In this section airfoils are going to be analyzed by xflr5 2d analysis feature. I imported the foils as an .dat file. Zenith STOL 750 's airfoils are shown in the figure below ;

XFLR5→File→Direct Foil Design



After Foils are imported to xflr5 I can analyse wing and tails 2d behavior at different reynold numbers. In assignemnt file reynold numbers are given as ; 1.2E6,2.4E6,2.9E6,3.2E6,4.4E6 But there is an error when I just use these numbers so I decided to calculate between 1E+06 to 1E+07 with 10.000 increasement and Angle of Attack changes -10[deg] to 18 [deg] with 2 [deg] increasement.

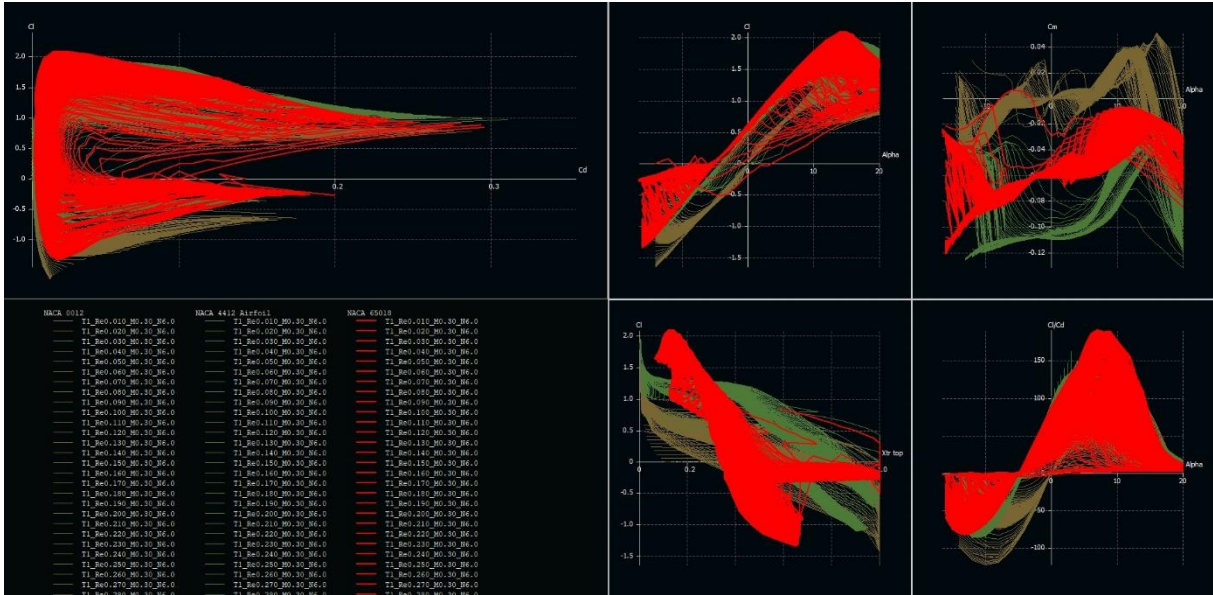
XFLR5→File→XFoil Direct Analysis→Analysis→Batch Analysis



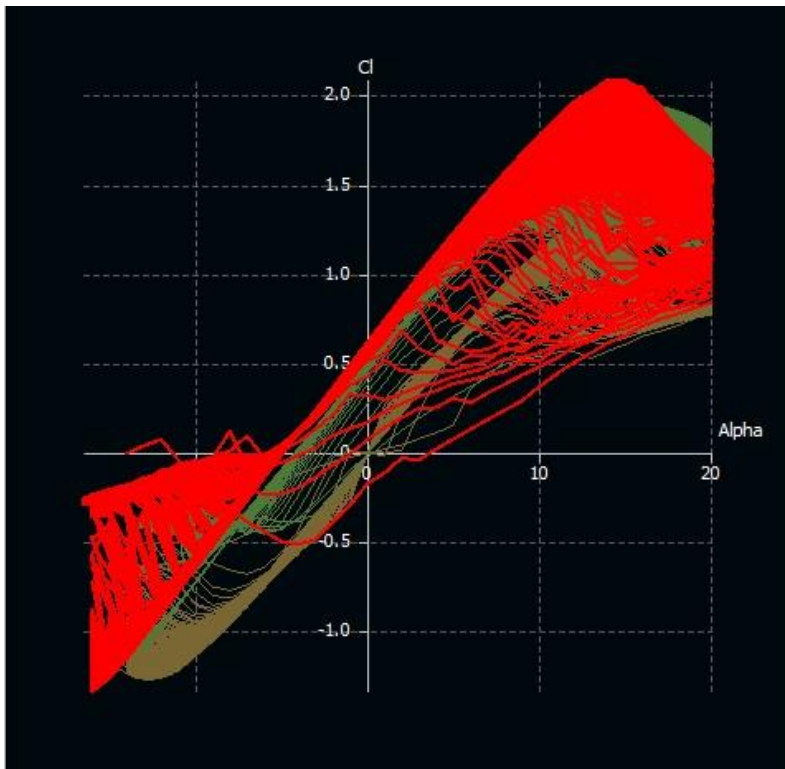
Red line - Naca 65018 (Main Wing)

Green line - Naca 4412 (Elevator)

Brown Line - Naca 0012 (Vertical Tail)



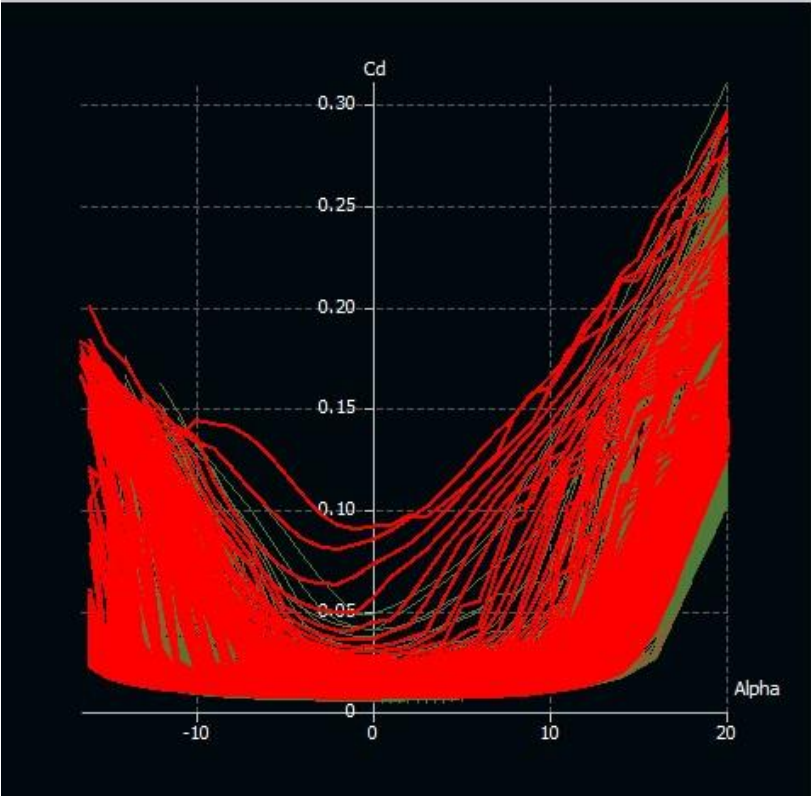
Cl/AoA:



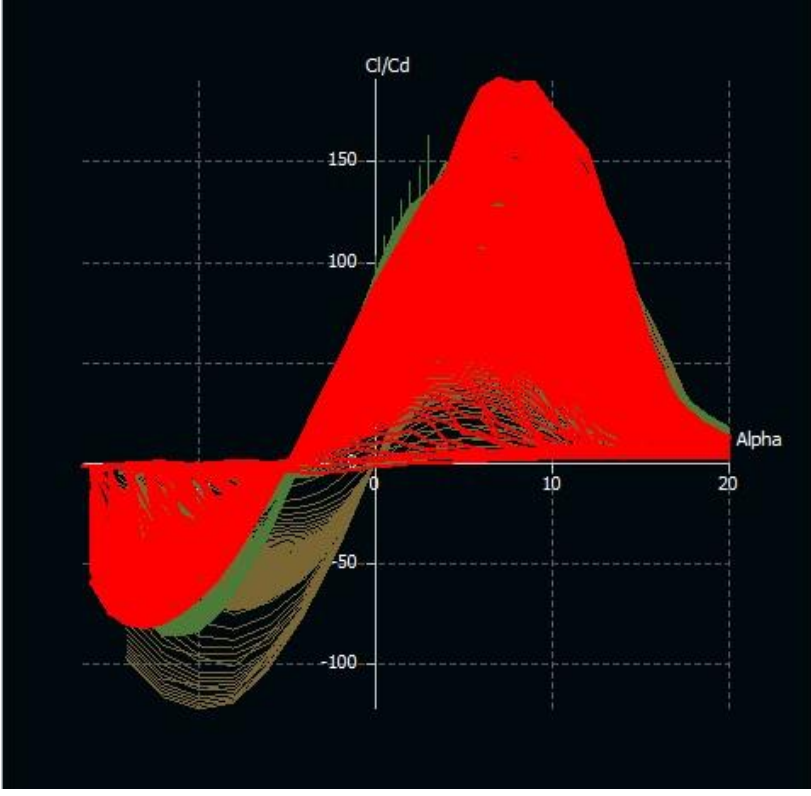
At higher Reynold Numbers (after 7E+6) Cl, Cd, Cm variables are corrupting

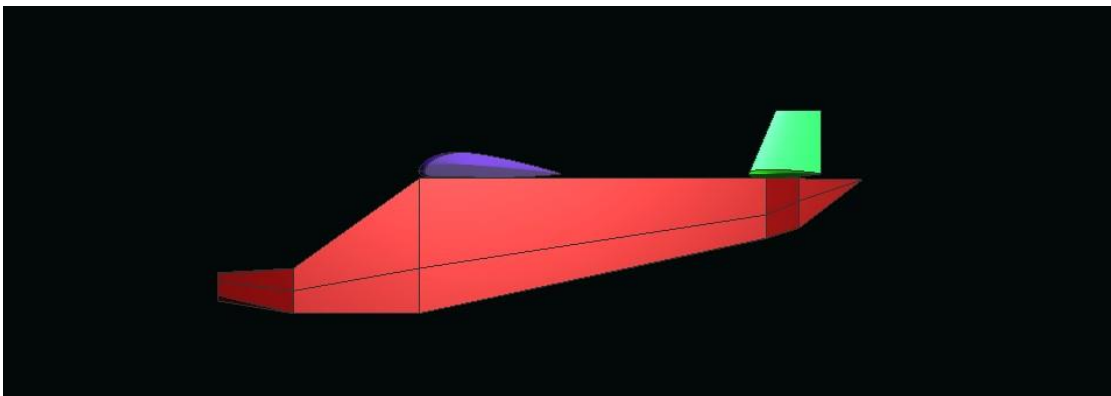
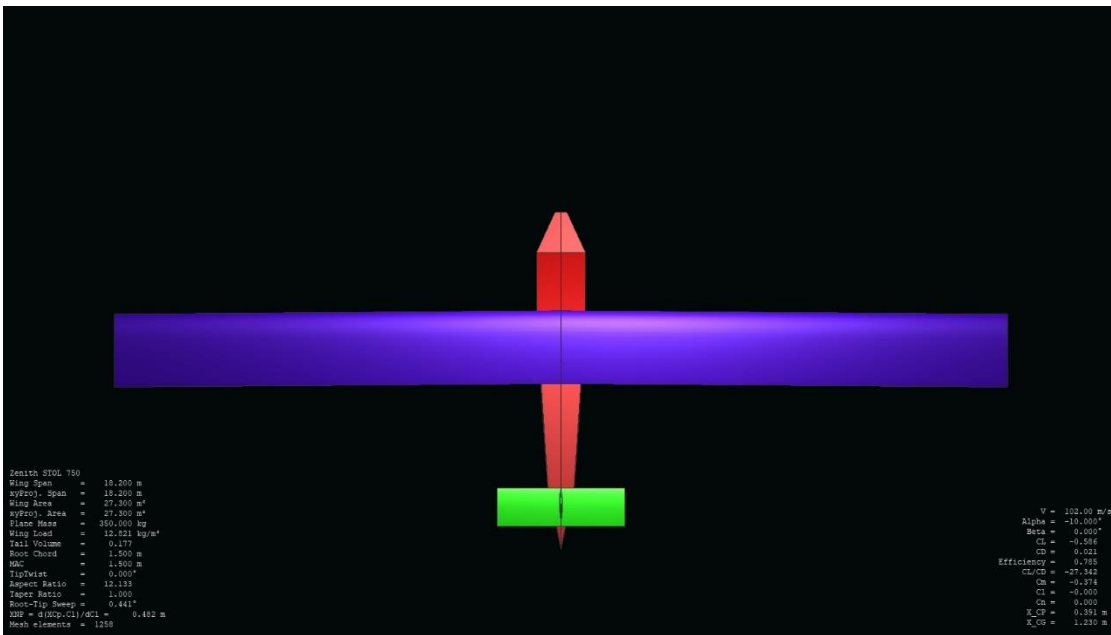
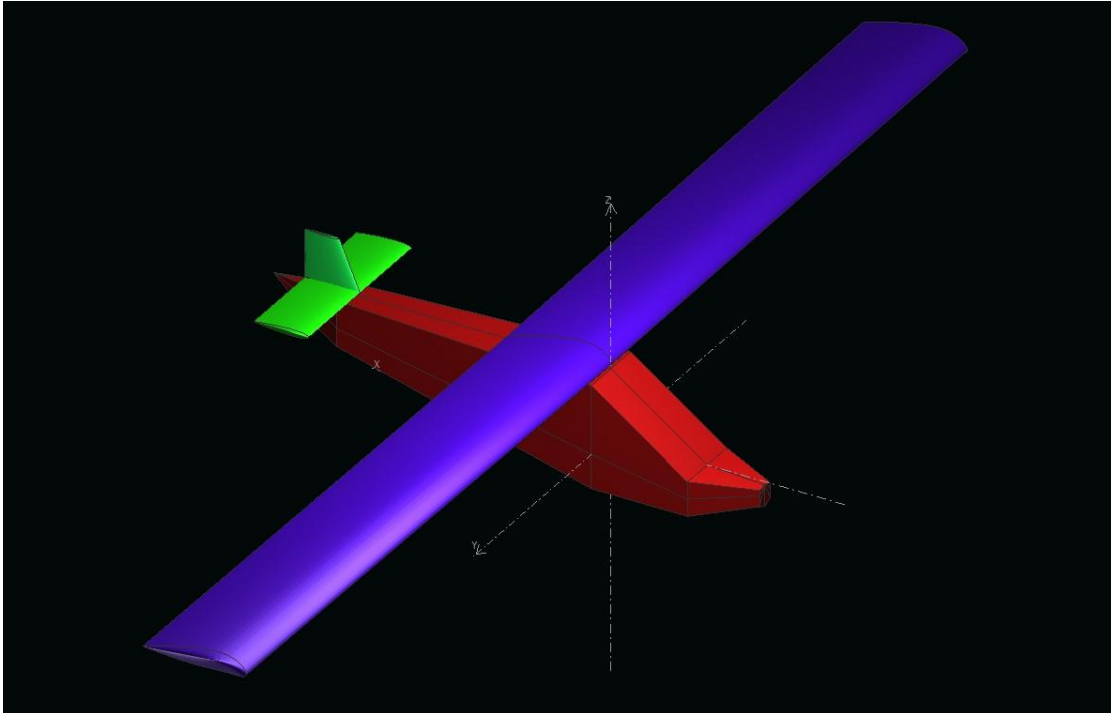
I can observe that Main wing stall after 16-17 [deg]

Cd/AoA:



CL/CD vs AoA:





After drawing plane I started to analyze Aircraft.

Analysis → Define an analysis(F6 for shortcut)

At this point I chose free stream speed from assignment1 file which are 34m/s, 68s/s 85m/s, 102 m/s, 119 m/s(at this velocity aircraft doesn't support to fly also xflr5 doesn't analyze).These speeds are calculated from MACH(1)=0.1,0.2,0.25,0.3,0.35 . Altitude also taken from assignment1 : 1000m,2000m,3000m,4200m,5000m,6000m.Aircraft's mass taken as total 350 Kg

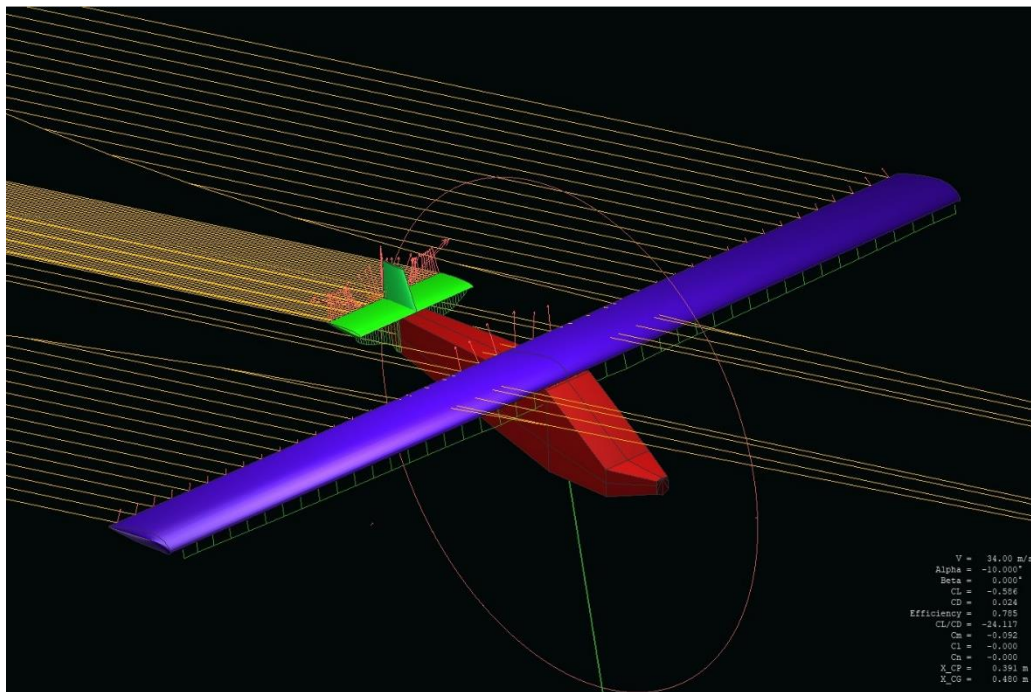
First, I added results at min and max AoA then I added all graphs.

Note: Lift (green arrows), Ind. Drag(yellow) , Down wash(Red arrows), Moment(circle around aircraft and it is on zx axis).For 34m/s At 18 deg I get error so I chose max deg 16 .

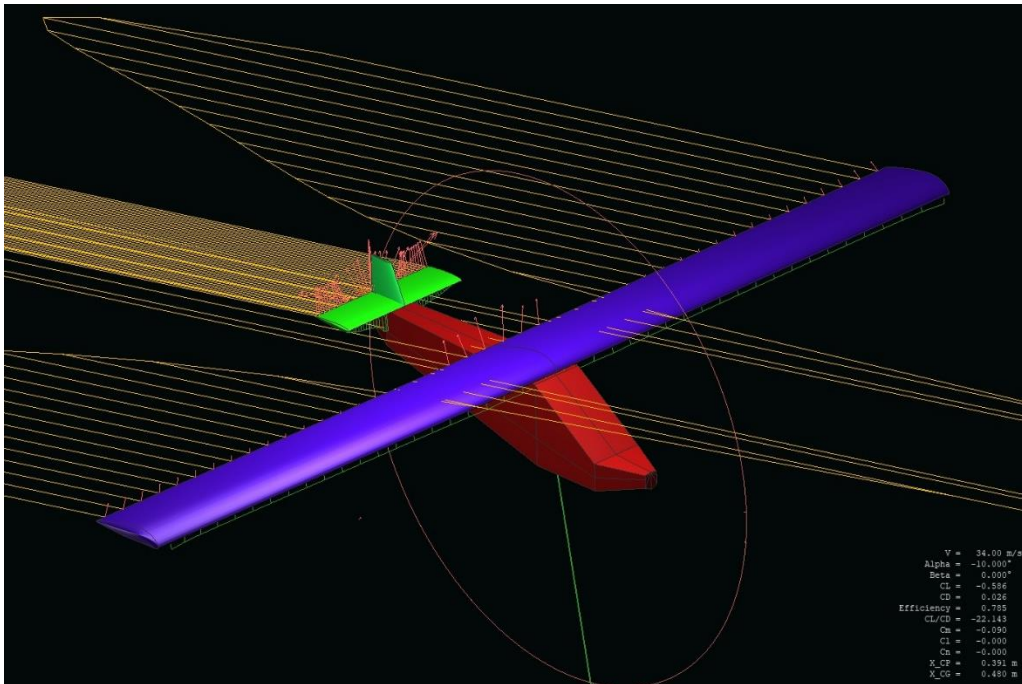
34m/s

-10 [deg] 1000m and 6000m

1000m:

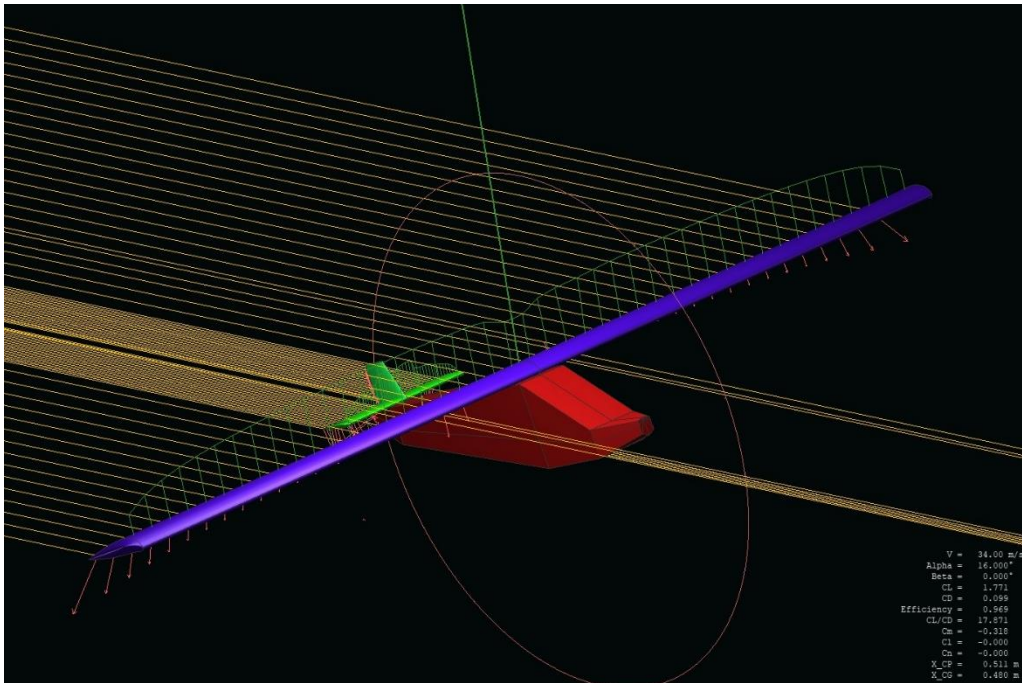


6000m:

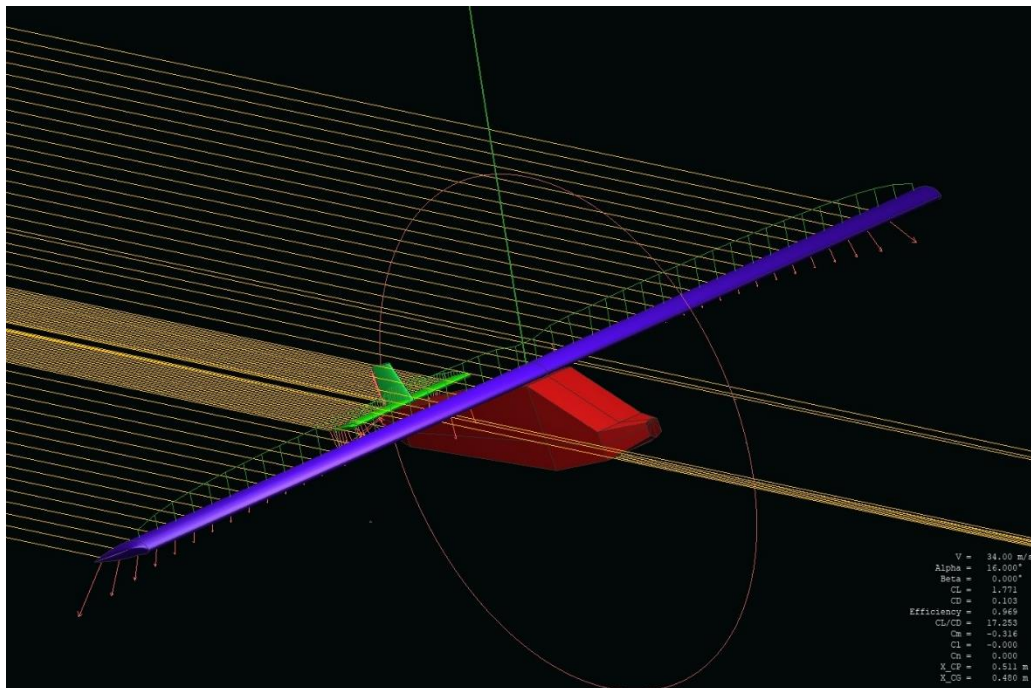


16 [deg] 1000m and 6000m

1000m



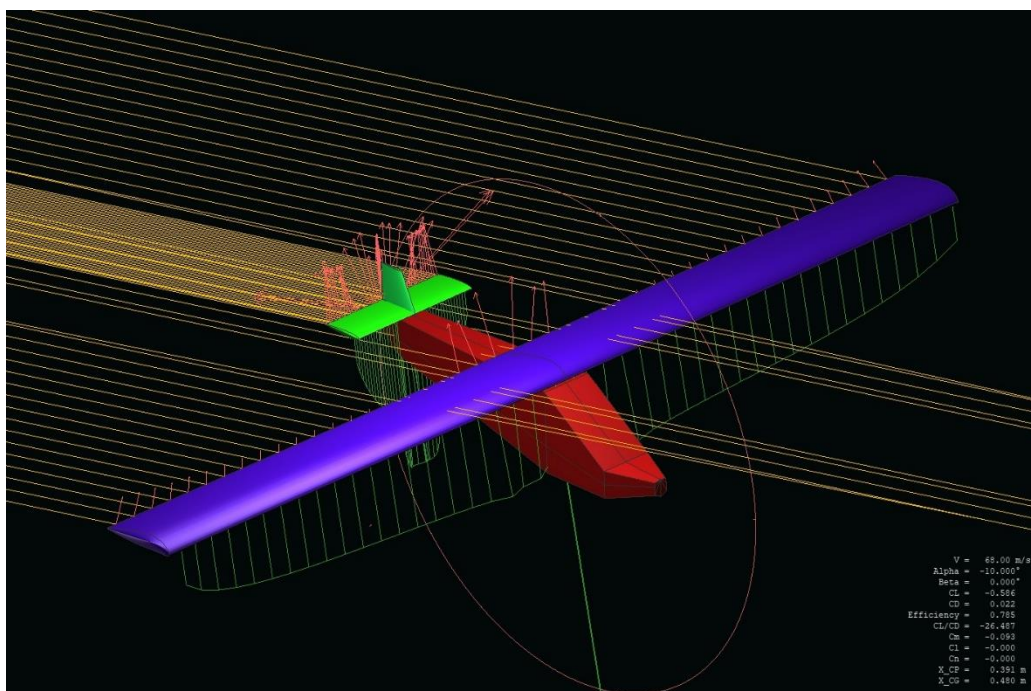
6000m



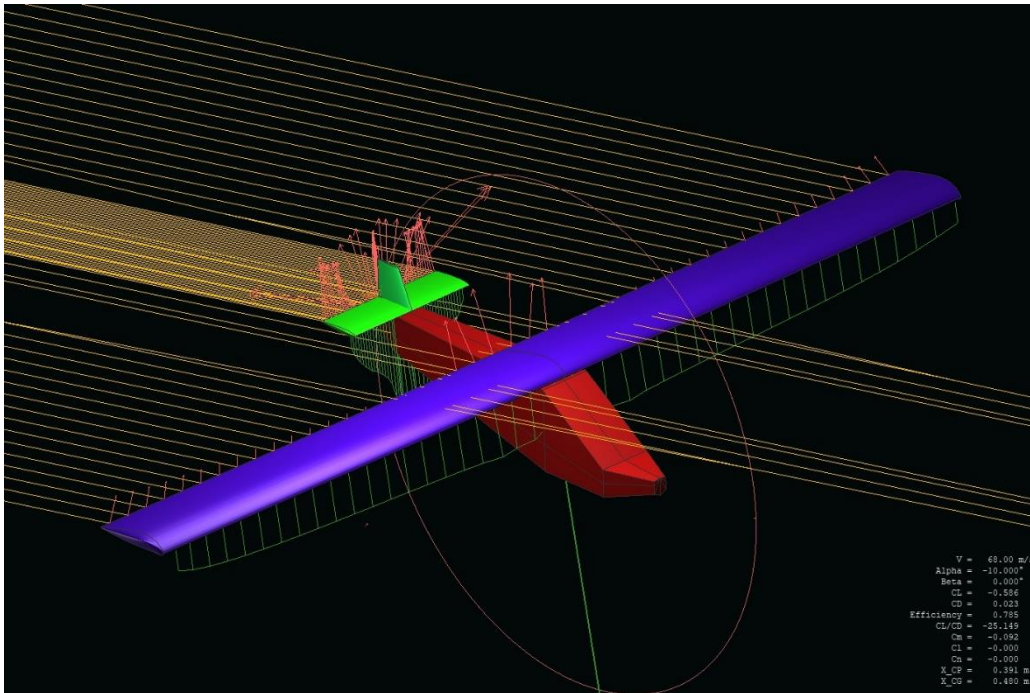
68m/s

-10 [deg] 1000m and 6000m:

1000m

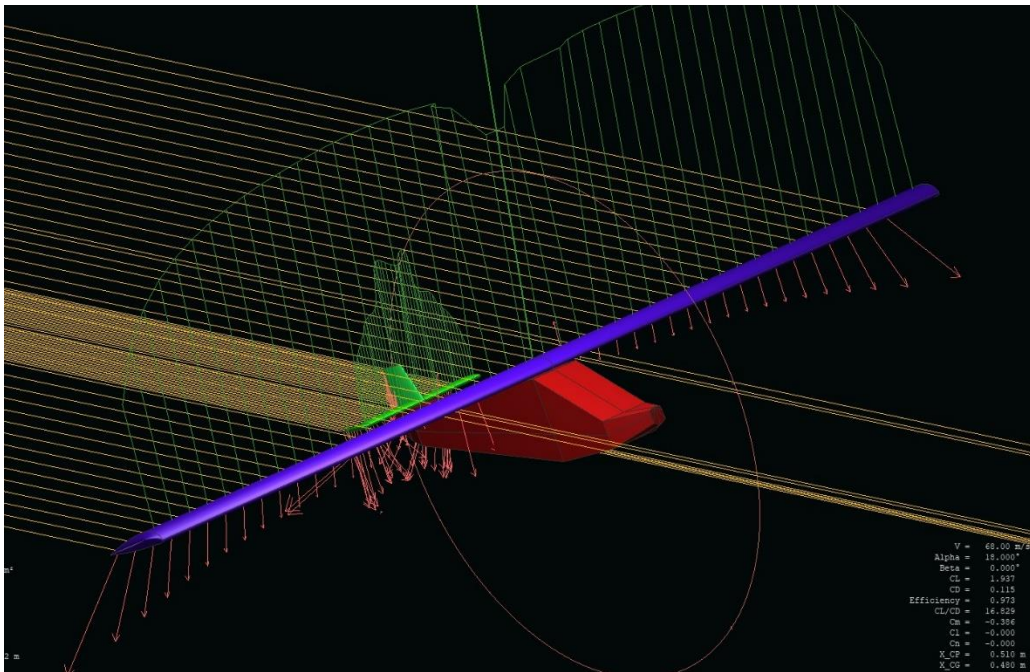


6000m

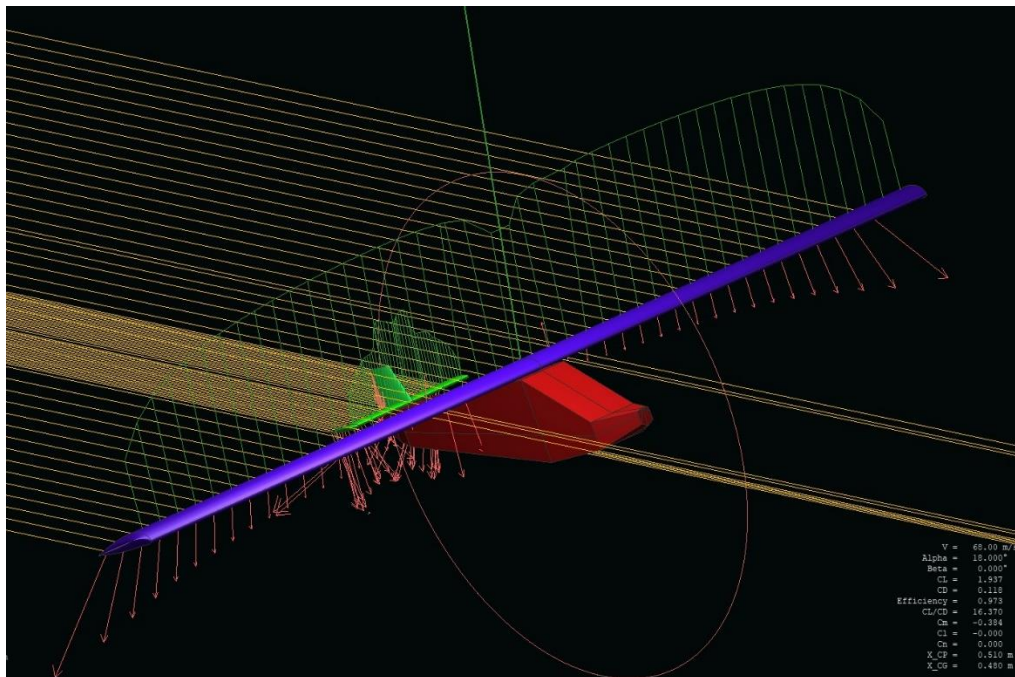


18 [deg] 1000m and 6000m:

1000m



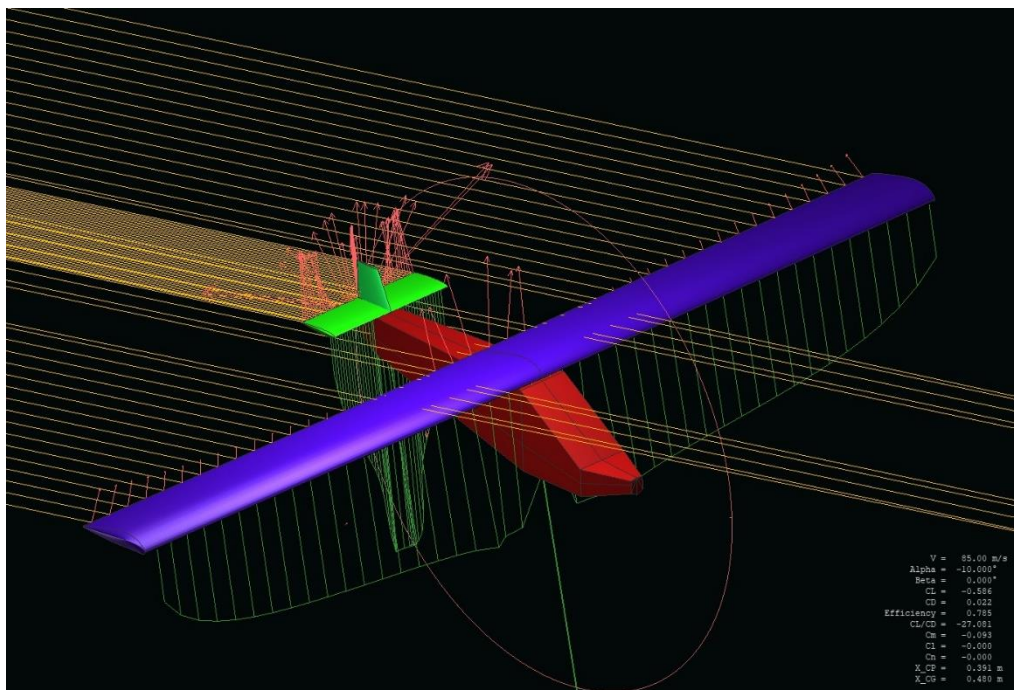
6000m



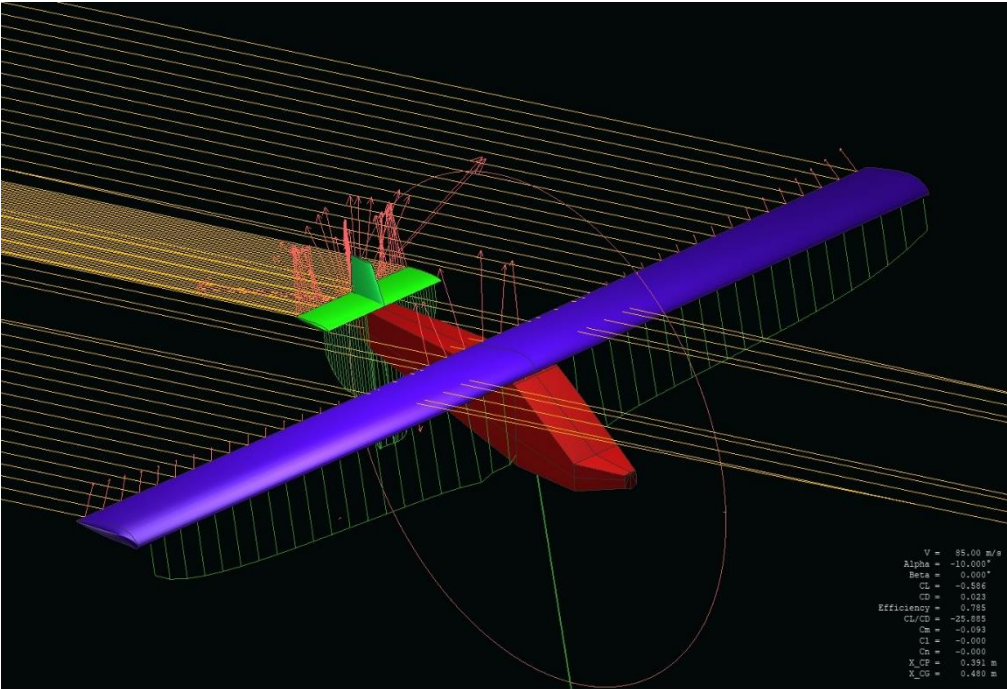
85m/s

-10 [deg] 1000m and 6000m:

1000m

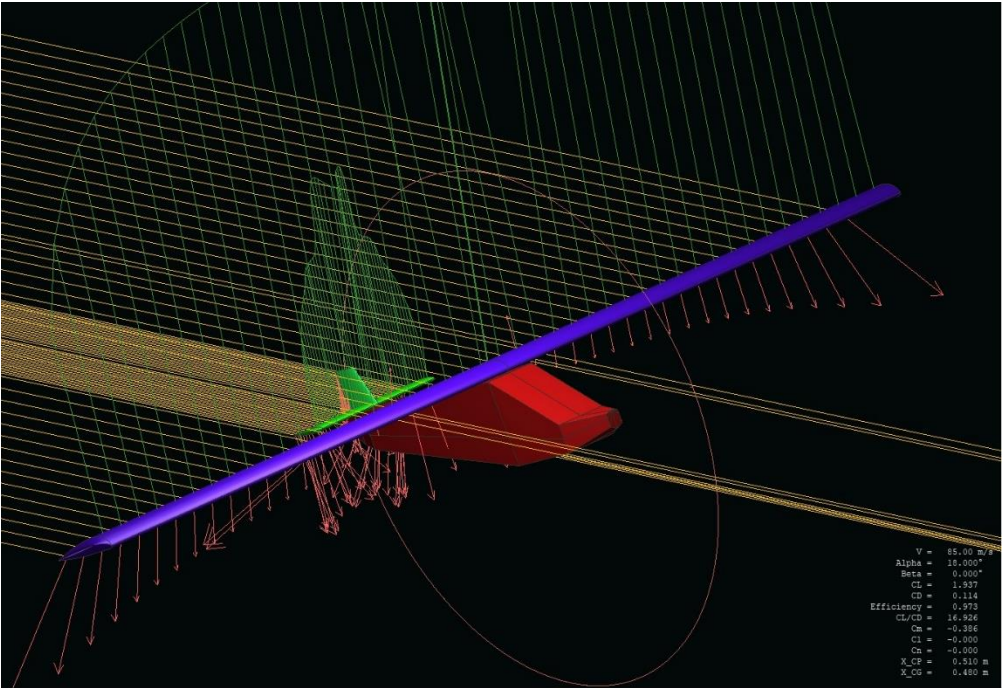


6000m

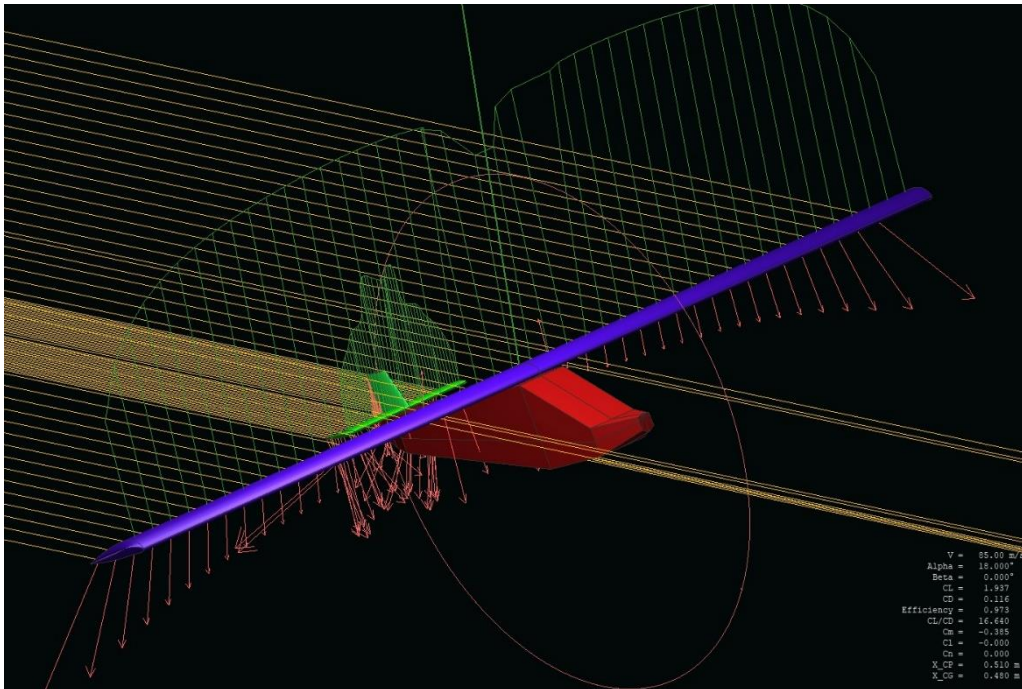


18 [deg] 1000m and 6000m:

1000m



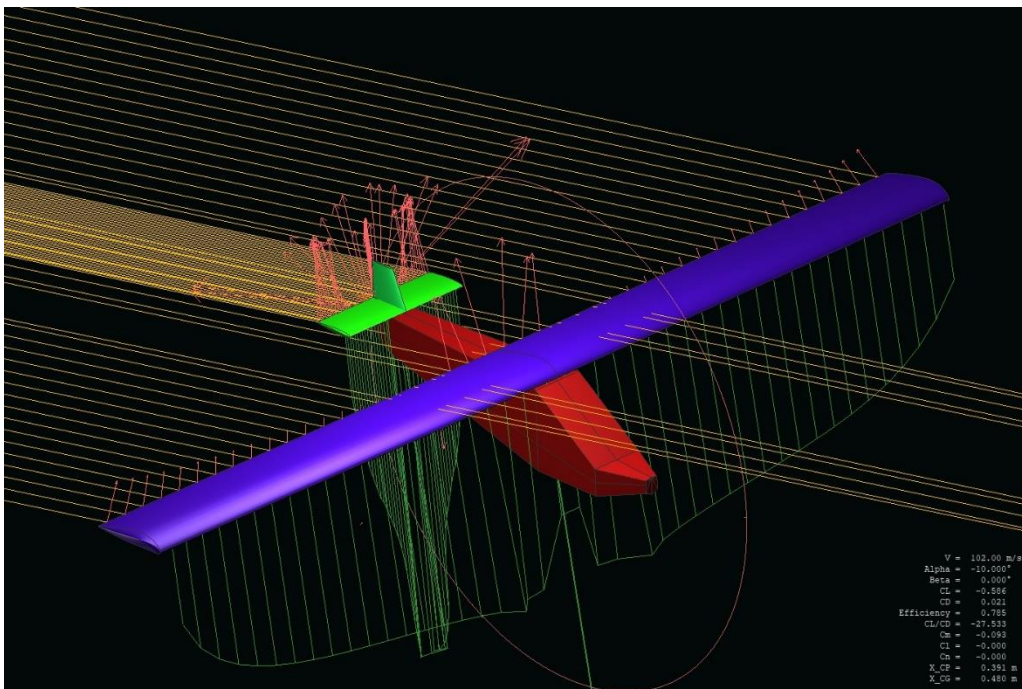
6000m



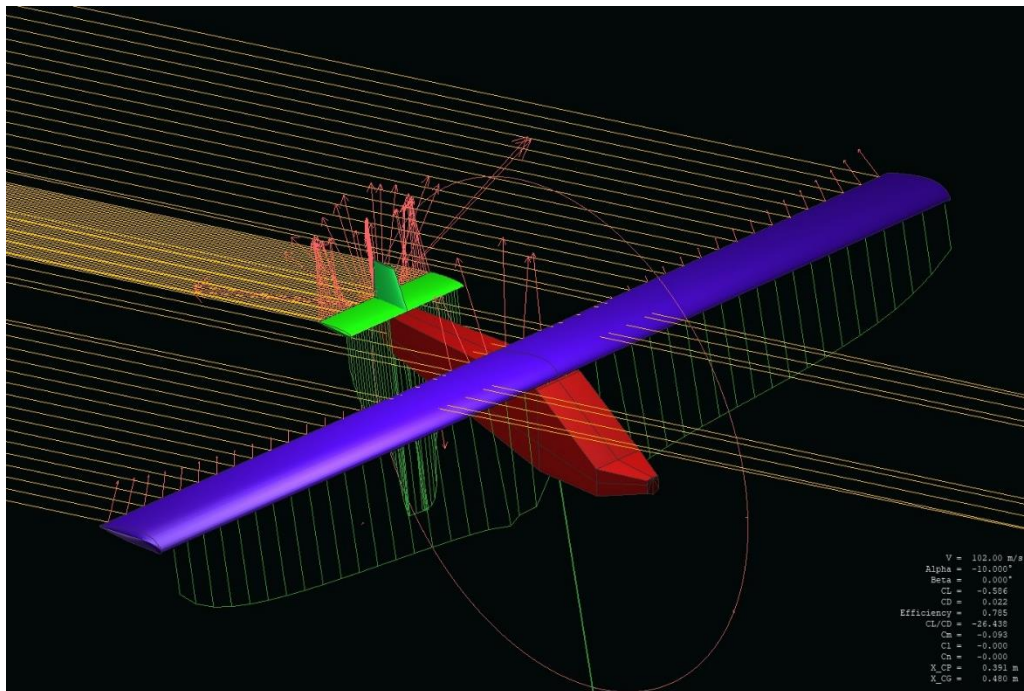
102 m/s

-10 [deg] 1000m and 6000m:

1000m

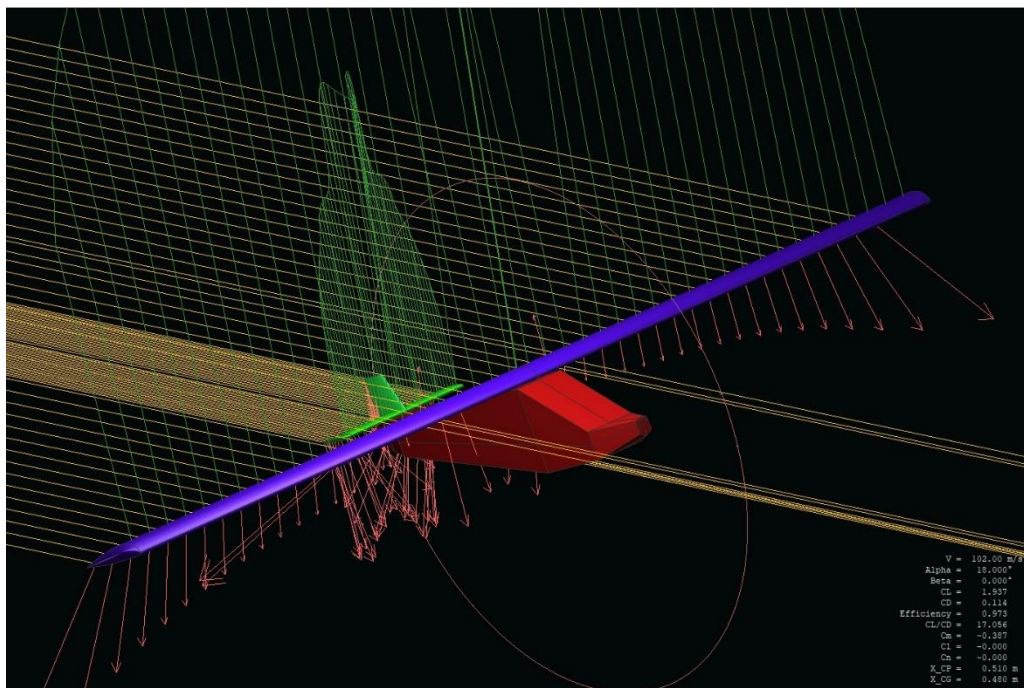


6000m

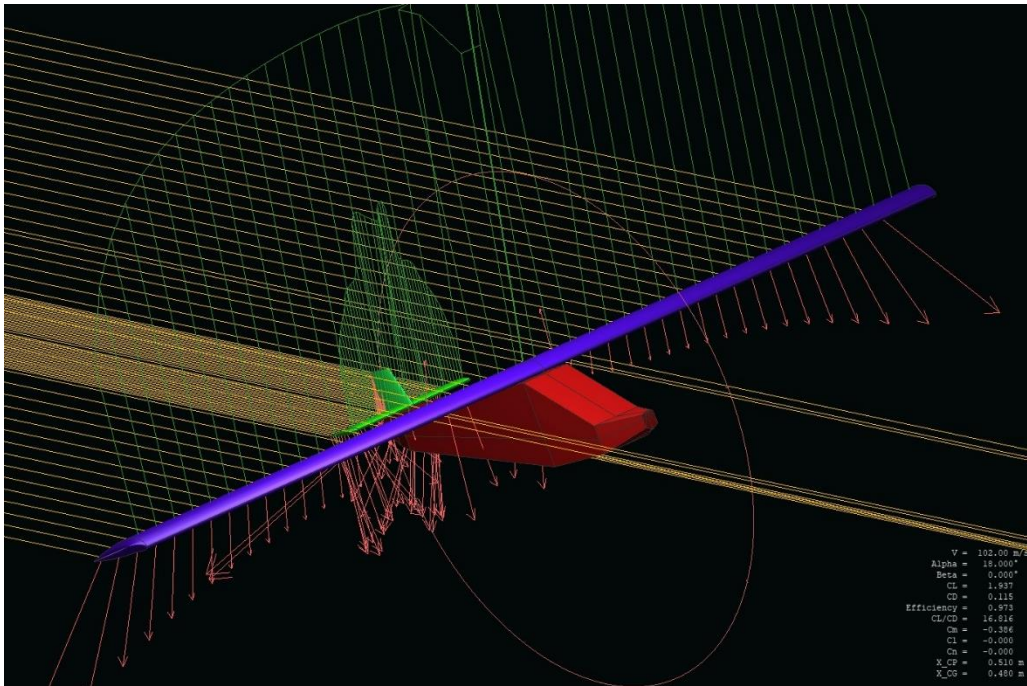


18 [deg] 1000m and 6000m:

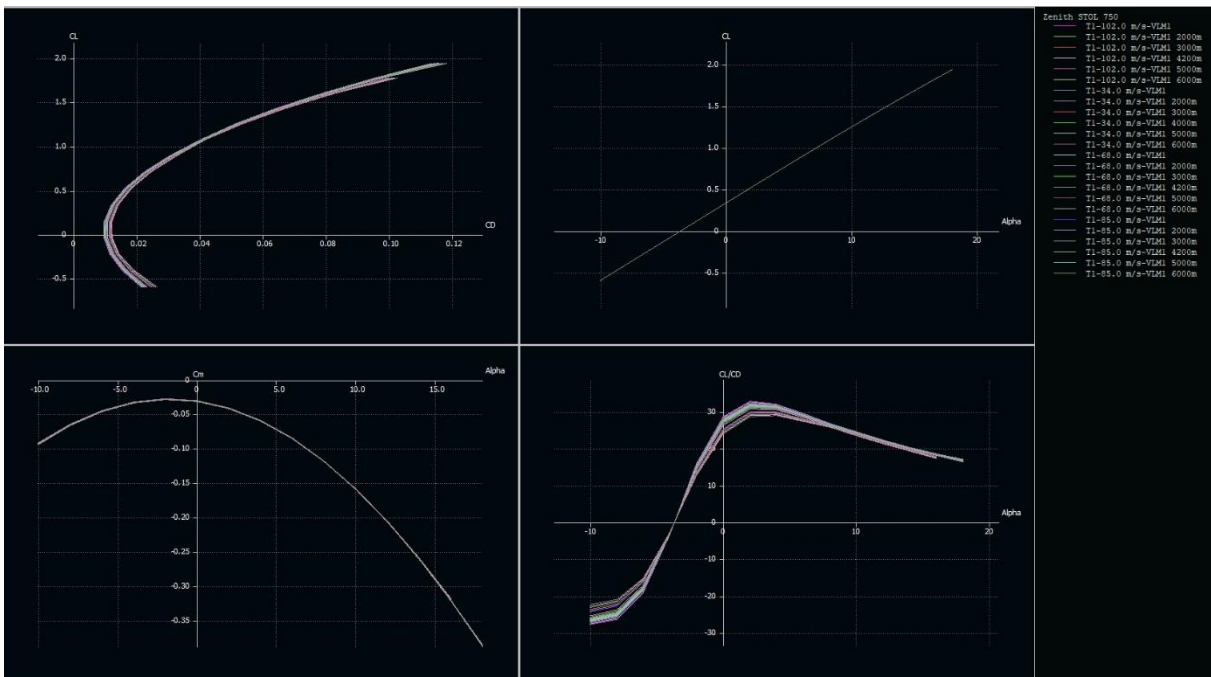
1000m



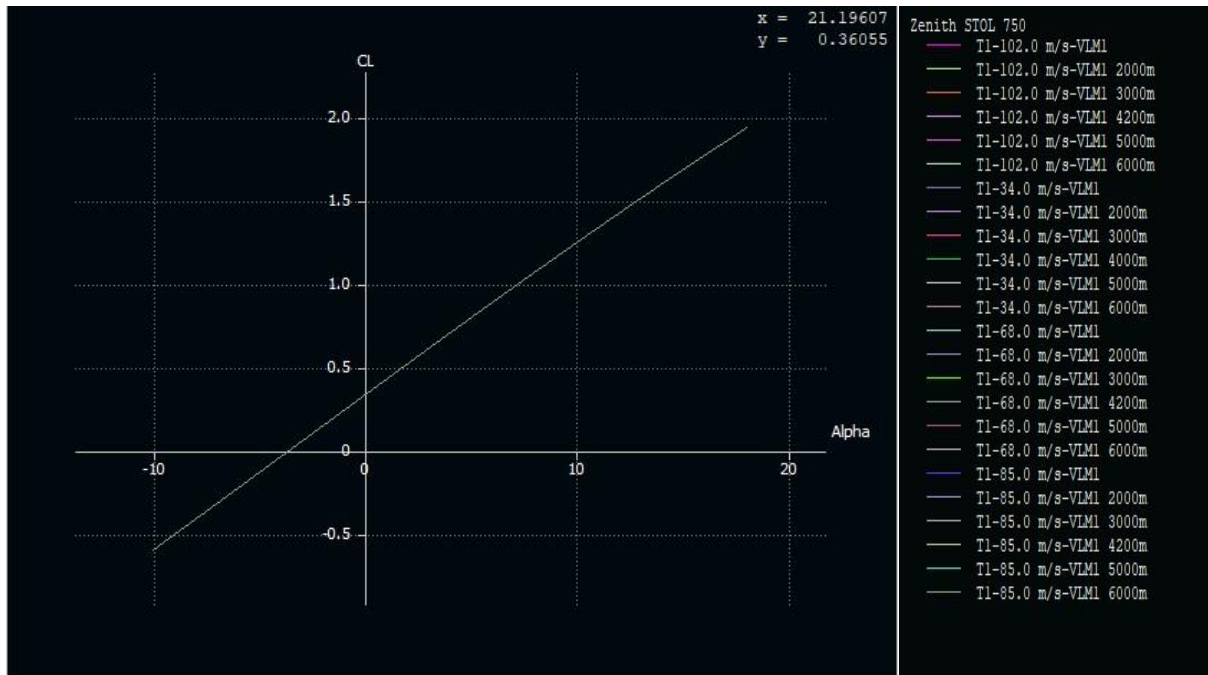
6000m



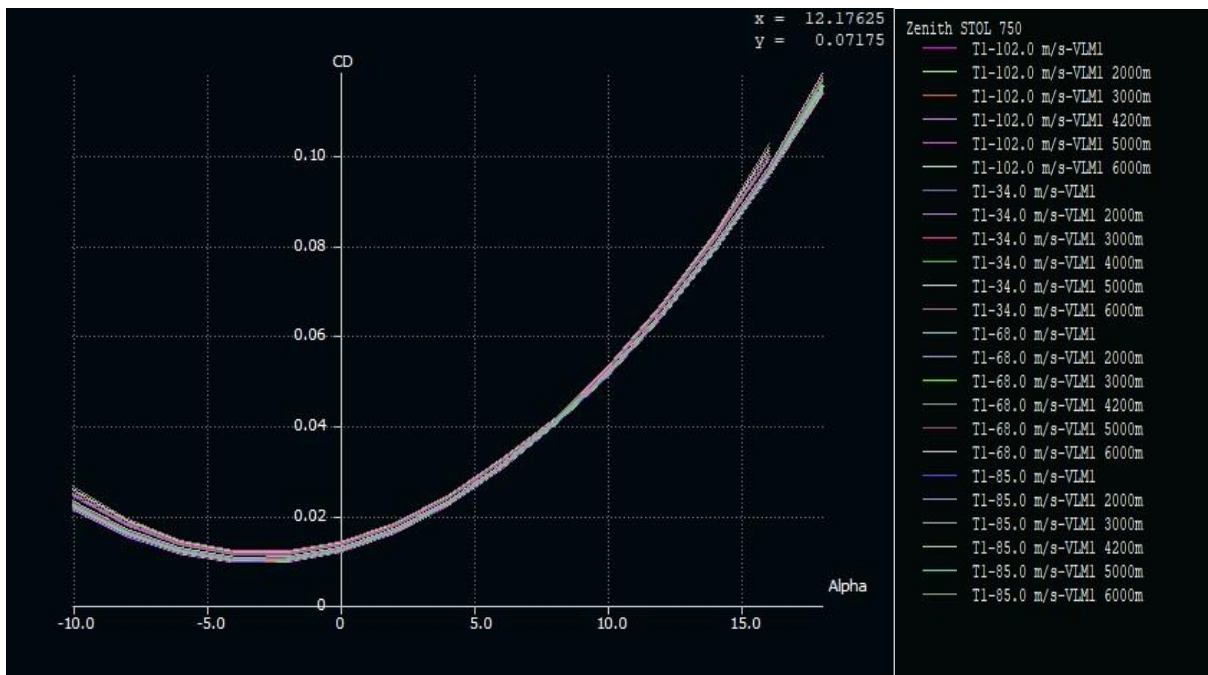
3D Analysis Graphs



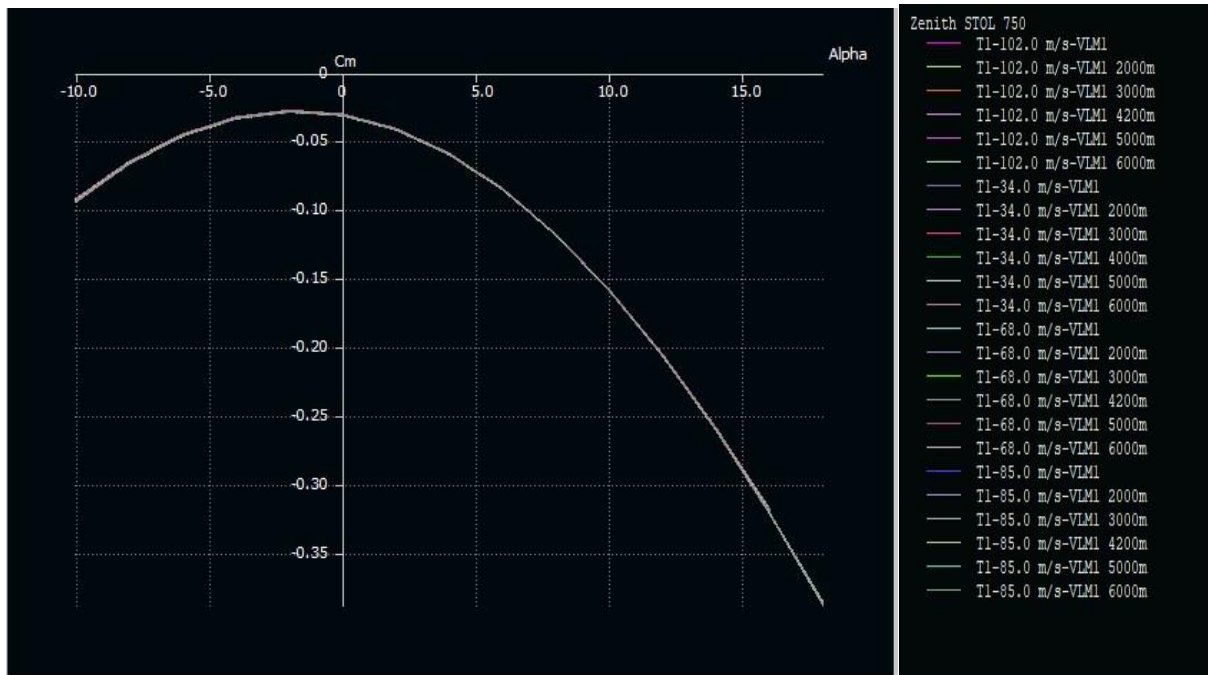
CL vs AoA (angle of Attack)



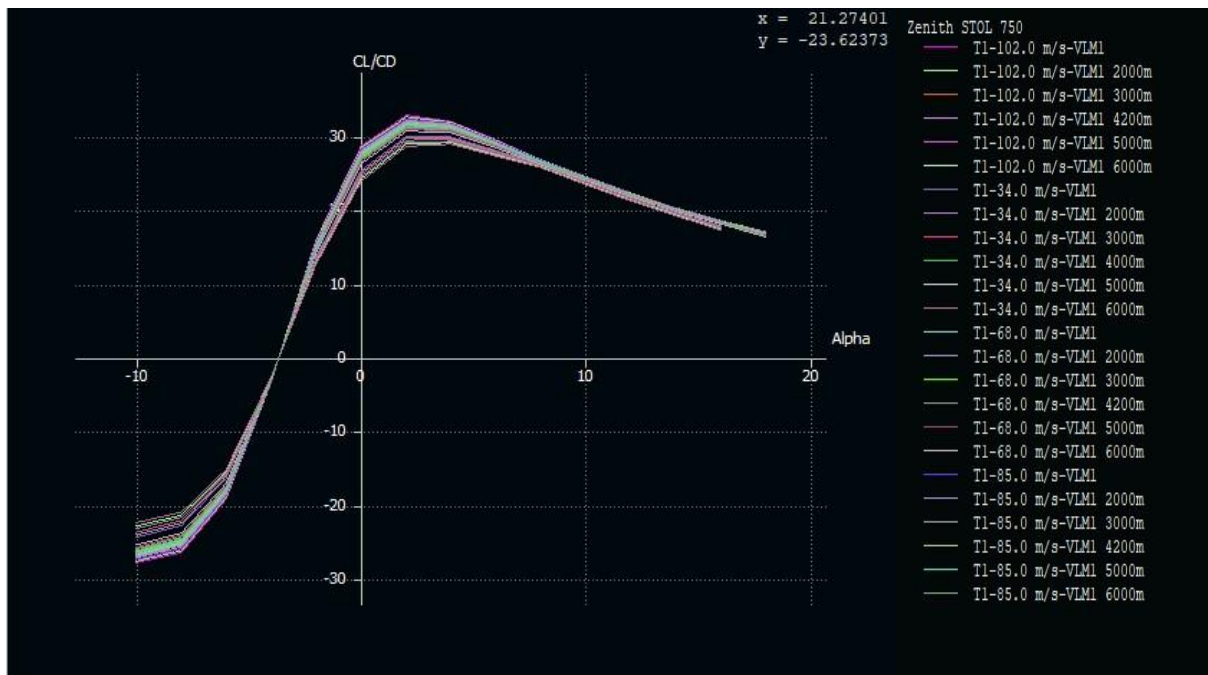
CD vs AoA



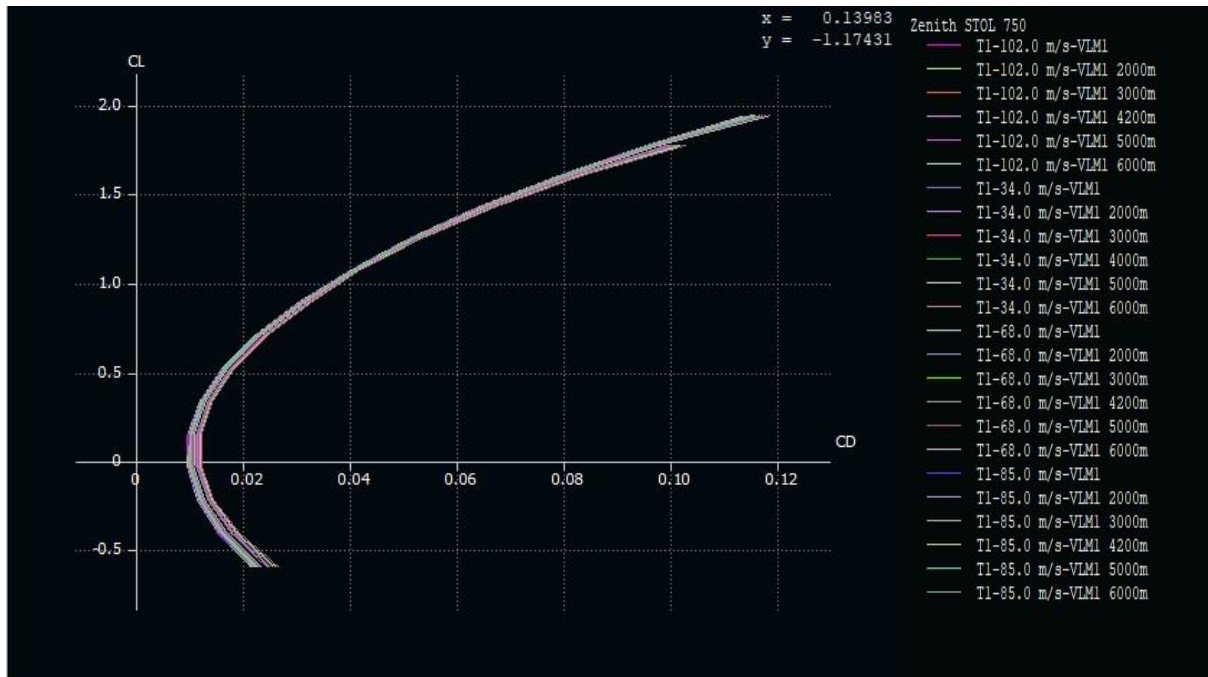
Cm vs AoA



CL/CD vs AoA



CL vs CD



Yawing moment Cn vs AoA

