

# Title: Science Fair Logbook

Name: William - Grade: 11 - Renert School

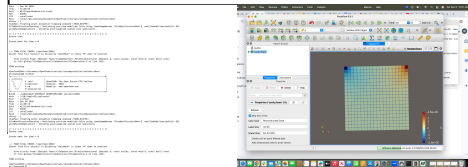
DATE	ACTION	RESOURCES USED	OTHER NOTES
September 15 2025	Started researching AeroShark, interest picked up from summer readings. Looked into emissions savings and general structure.	Perplexity AI	Found potential technology that connects to summer readings.
September 19 2025	Created Science Fair doc and log book. Researched research behind AeroShark and other papers similar to it. Found papers from Perplexity.	Google Docs Google Slides Perplexity AI <a href="#">Shark skin-inspired designs that improve aerodynamic performance   Journal of The Royal Society Interface</a>	First CYSF Choice Friday Class. Project initiation.
September 23 2025	Related destruction of boundary layer to reduced flow separation over airfoil, and found research in that area through Perplexity.	<a href="#">Novel herringbone riblets for mitigating flow separation in a linear diffuser cascade - ScienceDirect</a> <a href="#">POLYMER RIBLET SURFACE COATINGS FOR GREEN AVIATION</a> <a href="#">Three-Dimensional Analysis of Biomimetic Aerofoil in Transonic Flow - PMC</a> <a href="#">(PDF) Shark-Skin Surfaces for Fluid-Drag Reduction in Turbulent Flow: A Review</a>	Confirmed idea through papers and found research topic.
October 4 2025	Finished initial research from papers found by Perplexity and received a mentor Mr. Carlos in class. Met mentor after class	<a href="#">Passive separation control of shortfin mako shark skin in a turbulent boundary layer - ScienceDirect</a> <a href="#">Effects of Riblets on Skin Friction in High-Speed Turbulent Boundary Layers</a> <a href="#">Multi-fidelity modelling of shark skin denticle flows: insights into drag generation mechanisms - PMC</a>	Received a mentor for project. Ready to start proposal draft.

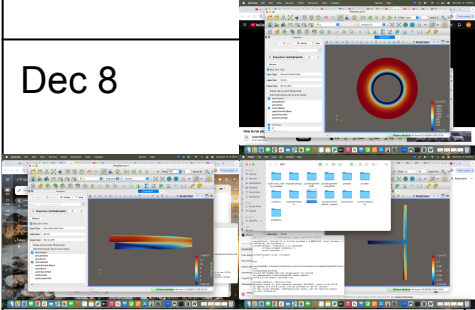
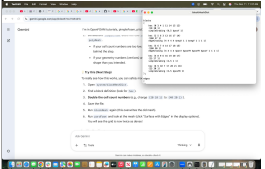
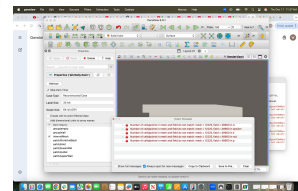
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October 10 2025	<p>Started CYSF Pitch slides and finished background research.</p> <p>Reached out to contacts from over the summer with Pitch slides.</p>	<p>Google Slides Gmail</p>	<p>Cold-emailed and met on Zoom with 2 professors July - August 2025</p>
October 11 2025	<p>Looked for more researchers researching airfoil simulations</p>	<p>Google Perplexity AI Papers used for background research University Websites</p>	<p>Cold emailed 23 professors in July 2025, only 5 replied and 2 could meet.</p>
October 16 & 17 2025	<p>Finished CYSF Pitch slides and presented to Mx. Dallas. Received lots of feedback.</p>	<p>Google Slides</p>	<p>Slides were messy and unclear. Presentation did not communicate project idea.</p>
October 18 2025	<p>Started a new CYSF Pitch slideshow using Mx. Dallas's feedback</p>	<p>Google Slides</p>	<p>Less crammed, impact and procedure prioritized</p>

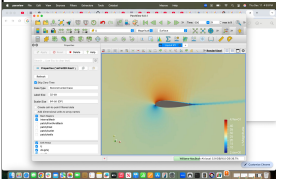
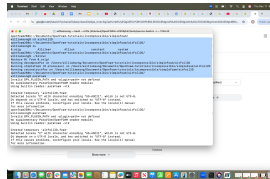
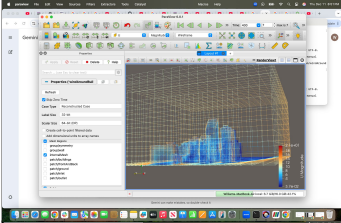
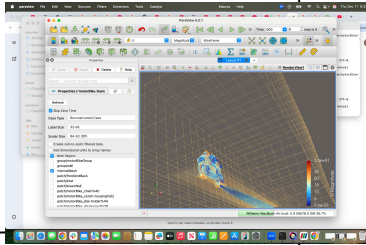
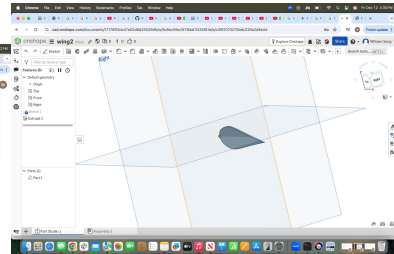

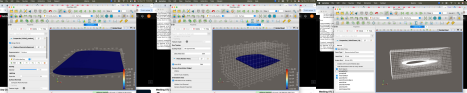
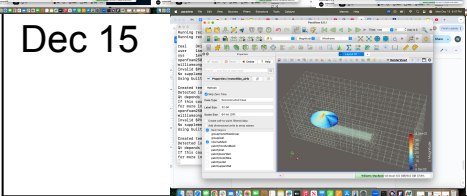
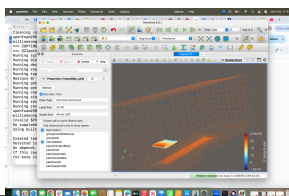
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October 23 & 27-28	A professor that I emailed on October 10 replied and recommended another professor. Recommended professor was not available to meet.	Gmail	N/A
October 19-23 2025	Finished second version of CYSF Pitch slides  Met with mentor to review slides and practice pitch	Google Slides	Found more info could be added to pitch during practice
October 24 2025	Pitched the slides to Renert Science Department and created list of areas of improvements and schedule	Google Docs	Improvements in delivery and impact. Went a bit overtime.
November 19 2025	UMich professor I emailed on October 10 replied and is able to meet for project.	Gmail <a href="https://atowne.com/">https://atowne.com/</a>	Last meeting was talking about his work and simple questions about aerodynamics. Drop off in progress due to busy November break.

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Nov 22/23	Tried to download OpenFoam on my mac with YouTube videos and run tutorial simulations. Spent the entire weekend and was unsuccessful.	<a href="#">How To Install OpenFOAM On Mac</a> <a href="#">OpenFOAM® Installation on Mac using Docker</a> Docker, XQuartz, ParaView	Faced difficulty opening ParaView and tutorials did not work.
Nov 25	Met with Professor Towne and got directions on how to proceed with project. Wasn't able to help with simulations but recommended another UMich professor using denticles for ships.	Gmail Zoom Google Slides	Advised using RANS turbulence simulation and recommended more background research. Simulations are really hard to pull off.
Nov 25	Reached out to Professor Maki but their lab was unable to help and he did not know of anyone else doing these simulations. Reached out to Professor Dabiri and he also didn't know anyone.	OpenFoam Gmail	There are not many people doing these simulations.
Dec 1	Researched RANS models (RAS in OpenFoam) and watched videos.	<a href="#">RANS Simulations using OpenFOAM Software</a> <a href="#">OpenFOAM: User Guide: Reynolds Averaged Simulation (RAS)</a> <a href="#">First simulation by Jozsef Nagy - OpenFOAM Wiki</a>	Still looked for an OpenFoam mentor


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Dec 1	Reached out to robotics teacher Mr. Chris to learn CAD to model the airfoil with denticles.	Fusion 360 Onshape	Used Onshape as Fusion 360 was unstable on mac.
Dec 2	Looked online at UCalgary labs for labs that use CFD that might help. Found some and reached out.	<a href="#">Research   Laboratory for Turbulence Research in Aerodynamics and Flow Control   University of Calgary</a> <a href="#">Research   Aerospace and Compressible Flow Research Group   University of Calgary</a> <a href="#">Assessment of Turbulence Modelling for Compressibility Effects in Ejector Ramjet Applications</a>	Reached out to in the past to AeroCore lab.
Dec 4	Computer teacher at school Mr. Gordon showed Dry-Lab how to use Gromacs. Asked him to help with OpenFoam	InnoSkate	Gromacs and OpenFoam are similar source-code run in terminal.
Dec 5	Met with Mr. Gordon after school and downloaded OpenFoam and tutorials. Successfully ran a tutorial 'icofoam cavity' and saw results on ParaView.	OpenFOAM-v2506 app for mac ParaView <a href="#">2.1 Lid-driven cavity flow</a>	Planned future weekly meetings

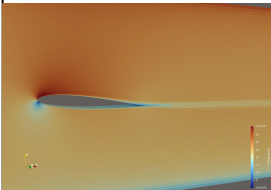
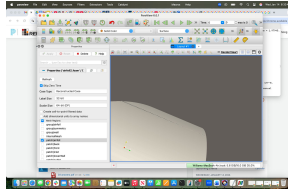

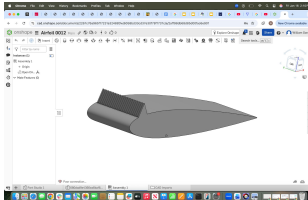
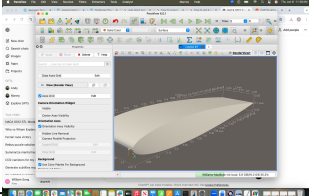
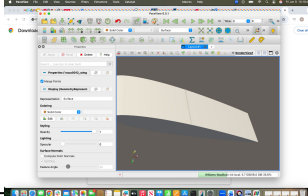


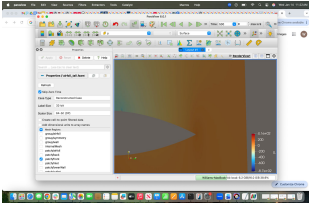
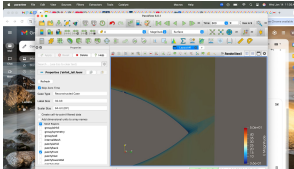
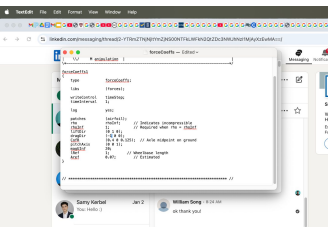
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Dec 6/7	Watched a video on inputting CAD model into OpenFoam meshing (snappyHexMesh) over weekend. Learned a lot more about OpenFoam.	OpenFoam snappyHexMesh blockMesh Youtube: <a href="#">Meshing STL Using snappyHexMesh in OpenFOAM</a>	snappyHexMesh is OpenFoam mesh for surfaces
Dec 8 	Ran some more OpenFoam tutorials. Many did not work when typed: blockMesh (type)Form Made a list of all tutorials that work, pitzDaily and simpleRotor	OpenFoam ParaView <input checked="" type="checkbox"/> <a href="#">OpenFOAM - pitzDaily - Tutorial 1 How to run your first simulation in OpenFOAM® - Part 1 - tutorial (download link to msh files below)</a> <input checked="" type="checkbox"/> <a href="#">#OpenFOAM Tutorial   motorBike (simpleFoam)</a>	Only functions learned were blockMesh and (type)Foam Type is found by folder, ex: simpleFoam, icoFoam
Dec 10	Confused about types of OpenFoam run commands, asked Professor Towne and he recommended simpleFoam for the project.	simpleFoam pimpleFoam pisoFoam Gmail <a href="#">PitzDaily- OpenFOAM : Steady State (SimpleFoam) Vs RANS (PimpleFoam) Vs LES (PisoFoam)</a>	simpleFoam runs turbulent RANS models RANS is an average Reynolds number simulation
Dec 10 	Used Gemini to learn more about blockMesh and snappyHexMesh. Gemini suggested to try doubling some hex values. They worked but caused an error, which did not affect simulation.	OpenFoam ParaView Gemini 	Still error after changing values back, no error after changing values again with Mr. Gordon

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<p>Dec 11</p> 	<p>Met with Mr. Gordon again and reviewed how to download clean tutorial cases to edit. Then found how to run the tutorials that did not work. Then learned beginner CAD with Mr. Chris.</p>	<p>Onshape Fusion 360 OpenFoam ParaView Gemini Beyond Compare</p> 	<p>Most tutorials did not work as pressure files were not found, but run with ./Allrun Beyond compare used to revert error.</p>
<p>Dec 11</p> 	<p>After meeting Mr. Gordon, ran all the rest of the tutorial downloads and found results for simulations similar to experiment. Created some 3D airfoil models without denticles in Onshape</p>	<p>OpenFoam ParaView Onshape</p> 	
<p>Dec 13</p>  	<p>Watched 2 tutorials on how to set up a CAD file into OpenFoam and mesh it with snappyHexMesh. Spent literal entire day. Kept notes of Mr. Gordon sessions, CAD sessions, and the videos.</p>	<p><a href="#">Naca 0012 Airfoil 3D File Download   Marathon OS</a> FreeCAD OpenFoam ParaView <a href="#">Meshing STL Using snappyHexMesh in OpenFOAM</a> <a href="#">Import Any CAD Model into OpenFOAM in 3 Simple Steps   For snappyHexMesh   FreeCAD</a></p>	<p>snappyHexMesh was successful. motorBike directory from simpleFoam used. 3D model of airfoil from Marathon OS</p>
<p>Dec 15</p> 	<p>Met with Mr. Gordon after school and figured out how to run any .obj CAD file in simpleFoam motorBike. Successfully simulated a small airfoil in simpleFoam.</p>	<p>OpenFoam ParaView TinkerCAD</p> 	<p>Used TinkerCAD to convert .stl files into .obj. First simulation! lowerWall was in the simulation and needs to be removed. Mesh refinement box may also need to be refined for airfoil.</p>

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Dec 16/17	Emailed Professor Towne progress to show progress. Asked if the meshing and lowerWall from Dec 15th simulation was appropriate.	Gmail	Advised to make blockMesh box larger and simulate span-width of wing. Have 100 grids in width of wing to simulate small denticles. Also wanted to angle airfoil at 5 degrees.
Dec 18	Met again with Mr. Gordon and found data from simulation results, including lift and drag coefficients. I can implement the meshing and airfoil angling over winter break. Still unable to remove lowerWall.	<a href="https://www.openfoam.com/documentation/overview">https://www.openfoam.com/documentation/overview</a> <a href="https://www.openfoam.com/documentation/user-guide">https://www.openfoam.com/documentation/user-guide</a> <a href="https://www.openfoam.com/documentation/tutorial-guide">https://www.openfoam.com/documentation/tutorial-guide</a> OpenFoam ParaView Google Gemini AI <a href="https://docs.google.com/spreadsheets/d/1i74pvrucYYN1j2dB3QDYfXGqKAY1gp7iSX_0x5Z50/edit?gid=33557495#gid=33557495">https://docs.google.com/spreadsheets/d/1i74pvrucYYN1j2dB3QDYfXGqKAY1gp7iSX_0x5Z50/edit?gid=33557495#gid=33557495</a>	Mr. Gordon showed these websites and I will read them over winter break with the video tutorials. Used Gemini AI for help.
Dec 19	Tried changing the blockMesh and snappyHexMesh boundaries by myself but they resulted in an error message.	<a href="https://www.youtube.com/watch?v=ehDEcCVN2MI">https://www.youtube.com/watch?v=ehDEcCVN2MI</a> OpenFoam ParaView Gemini AI	Will read websites and try again. Didn't work as video tutorial deleted many items.
Dec 23/24	Emailed Professor Towne with the results of the simulation. The lowerWall created ground effect which made wonky values.	Gmail	Will try either to make my own OpenFoam case or change the lowerWall accordingly.

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Jan 1-2 2026	Watched some more videos on Codeynamics YouTube channel and tried to run simulation on meshed case. However, they did not work.	<a href="https://www.youtube.com/watch?v=ehDEcCVN2MI">https://www.youtube.com/watch?v=ehDEcCVN2MI</a> OpenFOAM ParaView <a href="https://www.youtube.com/watch?v=hOvGF1DUh8A">https://www.youtube.com/watch?v=hOvGF1DUh8A</a>	Codeynamics has the most up to date and videos with best explanation.
Jan 3 2026	Bought Codeynamics YouTube membership for access to beginner's and intermediate course. Started watching Beginner Class 1.	<a href="https://www.youtube.com/watch?v=Ak_hZx8mdro">https://www.youtube.com/watch?v=Ak_hZx8mdro</a> YouTube OpenFOAM ParaView	
Jan 4-7	Continued watching beginner's course. Emailed Professor Towne to update him on simulation progress. Reached out to Codeynamics through email for questions on my simulation and his course.	Gmail <a href="https://www.youtube.com/watch?v=Ak_hZx8mdro">https://www.youtube.com/watch?v=Ak_hZx8mdro</a> YouTube OpenFoam ParaView	Tried all course exercises. Codeynamics offers to answer questions on course with membership.
Jan 10	When snappyHexMesh-ing the airfoil with denticles, there was an error and the denticles were not meshed, leading to a flat top surface. Included this in message to Codeynamics.	<a href="https://www.youtube.com/watch?v=Ak_hZx8mdro">https://www.youtube.com/watch?v=Ak_hZx8mdro</a> Gmail OpenFoam ParaView	

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<p>Jan 11</p> 	<p>Finally able to get the case to run after implementing some of Codeynamics's feedback and can run the case for all airfoils and denticles. Entirely new case from the previous mesh, not modifying motorBike tutorial. Emailed Professor Towne to show him paraFoam results.</p>	<p>Gmail OpenFoam ParaView</p> 	<p>Still missing forceCoeffs. Inlet velocity changeable. Walls and patches sorted Much finer block and snappyHexMesh. Control dict from OpenFoam tutorial airfoil2D.</p>
<p>Jan 12</p> 	<p>Ran simulations on a regular base NACA 0012 airfoil. Tried to add forceCoeffs (and modified) from OpenFoam motorBike tutorial and resulted in negative drag.</p>	<p>OpenFoam ParaView <a href="https://docs.google.com/spreadsheets/d/1I74pvruocYYN1j2dB3QDYfXGqKAY1gp7iSX_0x5Z50/edit?gid=33557495#gid=33557495">https://docs.google.com/spreadsheets/d/1I74pvruocYYN1j2dB3QDYfXGqKAY1gp7iSX_0x5Z50/edit?gid=33557495#gid=33557495</a> ChatGPT FreeCAD</p>	<p>Got ChatGPT to make some more denticles altering their placement % on the chord. FreeCAD for mesh.</p>
<p>Jan 7</p>	<p>Met with Mr. Chris after school to get help with denticle CAD modelling. Was able to create some triangular denticles and angle for my airfoil 5 degrees. FreeCAD for ASCII stl mesh.</p>	<p>OnShape FreeCAD</p> 	<p>Triangle denticles and denticles in general are very time consuming to make. Only use ASCII stl mesh for OpenFoam.</p>
<p>Jan 8</p> 	<p>Asked ChatGPT to see if it could make a downloadable stl CAD model of an airfoil with denticles. It worked. Made another Google account for more file generation.</p>	<p>ChatGPT Google</p> 	<p>Took some time for it to generate smooth airfoils, right angle of attack, right denticle shape and gap. Both Mx. Dallas and Mr. Carlos said it was an appropriate use of AI. Other AI's were unable to generate proper airfoils or downloadable files.</p>

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<p>Jan 13</p> 	<p>Created a taller denticle (<math>h = 0.002\text{m}</math>) to be able to visualize denticle's effects on velocity and pressure. Showed Mr. Carlos, Mr. Gordon, and emailed Professor Towne. Also sent data.</p>	<p>OpenFoam ParaView ChatGPT</p> 	<p>ChatGPT to generate taller denticles at specific chord areas of the airfoil. Same other dimensions.</p>
<p>Jan 9</p>	<p>Presented in CYSF Choice Friday to Mx. Dallas (one of the CYSF guide teachers) with all subsets of needed paper. Scheduled some time to present to mentor Mr. Carlos.</p>	<p>Google Slides</p>	<p>Talking was much calmer and points were communicated clearly. No data yet, but lots of images were helpful in learning timeline.</p>
<p>Jan 13</p> 	<p>Tried to set up forceCoeffs in OpenFoam to find force coefficients. Used same file from motorBike as much of case is based off of it. Got wonky values. Gemini recommended changing the axes.</p>	<p>OpenFoam ParaFoam Google Sheets Gemini</p>	<p>The forceCoeffs does not work because there are a lot of different lines of code you need to set for each. Each case needs different lines.</p>
<p>Jan 14</p>	<p>Modified forceCoeffs but still did not know correct code. Emailed Codeynamics for what each line of forceCoeffs file means to set up force coefficients. Replied Sunday with an intermediate class video that I watched later.</p>	<p>YouTube Codeynamics Intermediate OpenFoam Course OpenFoam Google Sheets Gmail</p>	<p>After forceCoeffs, the case setup will be complete and bulk simulations can begin!</p>

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Jan 14-26	For my F1 Aero Choice Friday class, I built a wind tunnel with Mr. H who is running the elective with me. Wind tunnel to test cars that the class makes and also useful for the entire school. Can see CNC denticles in it too.	Amazon PC Fan Black and White Foam Boards Gorilla Tape	By running a class for middle & high schoolers, my speaking has gotten better. Taught F1 aero and aerodynamic principles learned so far. Also introduced OpenFoam for simulating their cars.
Jan 16	Professor Towne recommended that shear stress of the wing should be found. Asked Gemini Pro how to set it up and was able to generate some data values. Still needed to find shear stress of a spot behind the denticles through paraFoam	Gmail OpenFoam Gemini Pro (school account has pro model) ParaFoam to visualize wallShearStress <a href="https://royalsocietypublishing.org/rsif/article/15/139/20170828/35771/Shark-skin-inspired-designs-that-improve">https://royalsocietypublishing.org/rsif/article/15/139/20170828/35771/Shark-skin-inspired-designs-that-improve</a>	Reason of shear stress is that 1 row of denticles may not affect pressure drag much, so important to see if reduction in skin drag caused reduction in drag. Total drag = skin drag + pressure drag. ***The 2018 paper did not account for this.***
Jan 17/18	Set up forceCoeffs from Codeynamics video. Cd turned negative, but had to change x direction. Cd started off negative, but after ~500 timesteps, turned positive and converged. Cl stabilized quickly.	Codeynamics YouTube Gemini OpenFoam ParaView	Got a negative Cd, but negative x direction fixed.
Jan 18	Emailed Professor Towne new data. Asked if I should take 100 data points before data converges. Said that was correct.	Gmail	N/A

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Jan 26-29	Continued building the wind tunnel. Foam boards cut and attached the fan (PC fan) and started cutting straws to create laminar flow.		
Jan 19/20	Found how to generate wallShearStress X magnitude on airfoil with 3D glyphs with Gemini and found "hover cell data".	OpenFoam ParaView Gemini	The second snappyHexMesh refinement box needed for denticles altered wallShearStress. Color scale was different but values were same.
Jan 21 / 22	Asked Professor Towne why this happened, and he said to make the mesh more similar between both refinement boxes. Changed refinement levels from 2 to 4.	OpenFoam ParaView Gmail	
Jan 22	Researched Lufthansa Technik and De Havilland, both companies in Calgary.	Google Innovate Calgary	Plan to reach out when done project.

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Jan 24/25	Re-did the snappyHexMesh by making the refinement levels of the first refinement box 4 from 6 to make the mesh more similar with the denticles.	OpenFoam	
Jan 27	Ran simulations with fine mesh for baseline and denticle airfoils. Realized that wallShearStress did not differ from the coarse first refinement box, CI was consistent too. Only Cd changed.		
Jan 28	Returned to coarse mesh and ran simulation for a 0.004m tall denticle. Cd converged negative after 1,500 timesteps. Ran again with fine mesh and got similar Cd result.	OpenFoam ParaView	
Jan 28	Remembered Professor Towne mentioned to focus on trends rather than exact values as RAS is not super accurate. Found trends in CI and wallShearStress for different denticle heights.		However, Cd changed significantly and was negative still for the 0.004m tall denticle.

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Jan 29	Emailed Professor Towne asking about trends and convergence. Responded saying that trends was right and I should increase timesteps for 0.004m tall denticle.	Gmail	
Jan 30	Ran simulations with the fine mesh and new 2,500 timesteps. Much larger Cd for all cases but similar Cl and wallShearStress. Cd of the 0.004m tall case was still negative and converged before 1,500 timestep.	OpenFoam ParaView	
Feb 2-11	Messaged Professor Towne about why there was a negative Cd. He wasn't sure and that this was a fundamental issue with RANS. It would take a PhD student a year to find a satisfactory reason. Gemini wasn't sure either.	Gmail OpenFoam Gemini Pro	It is tempting to discard the 0.004m Cd, but is very likely the reason for significant Cd drop from 0.001 - 0.002m tall denticles
Feb 7	Decided that a second snappyHexMesh refinement box for 40% chord for a new baseline airfoil would be needed to compare denticles at different % chord placements.	OpenFoam ParaView	Can not make 1 big fine snappyHexMesh as it would be too expensive.

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Feb 6	Continued building the wind tunnel. Finished 3D printing a holder to put the straws. Then constructed the structure by hot gluing and taping the foam boards to PC fan.	FreeCAD Gorilla Tape Hot Glue Gemini Pro	Also cut plexiglass panels to see inside.
Feb 9-15	Cut straws to create laminar flow entering tunnel. First used scissors but found an electric saw that could cut really quickly. Also assembled a water mist maker and hose for flow visualization.	Gemini Pro Amazon	Worked well and showed Choice Friday class. Mr. H said a green laser would help visualize mist.
Feb 12	Decided to use the coarse snappyHexMesh with 2,500 timesteps. Professor Towne recommended switching to another RANS solver like k-omega.	Gemini Pro <a href="https://www.researchgate.net/post/Which_model_is_better_for_simulating_the_flow_over_an_airfoil_k-omega_SST_or_Spalart--Allmaras_model3">https://www.researchgate.net/post/Which_model_is_better_for_simulating_the_flow_over_an_airfoil_k-omega_SST_or_Spalart--Allmaras_model3</a>	Researched how to set up k-omega solver. Realized that it may not benefit as it also smears turbulence and the backwards recirculation bubble.
Feb 13	Modified forceCoeffs with a smaller frontal area and set timesteps to 10,000. Cd still converged negative for 0.004m tall denticle.	OpenFoam ParaView	Decided to look into k-omega.

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Feb 15	Eureka! I figured out how to estimate total drag from CI and wallShearStress. The new method keeps the original OpenFoam runs and similar level of accuracy.	OpenFoam ParaView ChatGPT	Immediately generated and ran a 40% chord placement and a baseline airfoil with 40% mesh. We already have data and trends for 25% chord height manipulation, did not reduce total drag.
Feb 16	Ran simulations for the 55% baseline airfoil and 0.001h denticle. Found first denticle geometry that decreased total drag.	OpenFoam ParaView Google Sheets Gmail	Emailed Professor Towne to tell him about the new method.
Feb 17	Ran simulations for the 0.002m tall denticle at 55% chord and a baseline 70% airfoil. Had to make snappyHexMesh second refinement box larger to mesh at 70% chord.	OpenFoam ParaView Google Sheets	Same height trend for 0.002h denticle, did not reduce total drag.
Feb 18	Ran simulations for regular denticle at 70% chord and a narrow gap denticle at 55% chord. Neither reduced total drag.	OpenFoam ParaView Google Sheets	Found chord % trend for wallShearStress

DATE	ACTION	RESOURCES USED	OTHER NOTES
Feb 19	Started writing the paper's Introduction, Theory, and Problem sections. Also ran a wide gap denticle and a long denticle at 55% chord.	OpenFoam ParaView Google Sheets Google Docs	Found a sweet spot for denticle spanwise gap. Neither geometry reduced total drag.
Feb 20	Wrote the method section of the paper. Ran simulations on a short denticle and two 2 staggered rows lengths at 55% chord.	OpenFoam ParaView Google Sheets Google Docs	Found a sweet spot for denticle length too. No geometry reduced total drag.
Feb 21	Finished the simulations with final 2 staggered rows at 55% chord. Started writing Data Extraction section of the paper to explain Cd troubles and the new drag estimation method.	OpenFoam ParaView Google Sheets Google Docs	Found a sweet spot for 2 staggered rows length, but none reduced total drag.
Feb 22-23	Wrote the Results and Analysis section. Cross referenced advanced fluid dynamics concepts with websites and videos. Mr. Carlos edited the Intro to Data Extraction sections.	<a href="#">Bluff Body Flows – Introduction to Aerospace Flight Vehicles</a> <a href="#">Recent advances in understanding the flow over bluff bodies with different geometries at moderate Reynolds numbers - ScienceDirect</a> <a href="#">Flow Separation - an overview   ScienceDirect Topics</a>	Emailed Professor Towne to look over my analysis and reasoning.

DATE	ACTION	RESOURCES USED	OTHER NOTES
Feb 25	Finished the paper by adding a Conclusion, Abstract, and Keywords. Professor Towne was happy to look over the paper when finished.	Google Docs Google Sheets Google Drive Gmail	Disclosed all use of AI in project: only ChatGPT for generating CAD models. Provided ChatGPT prompt, all CAD models, and example OpenFoam case in Supplementary Information section.
Feb 26	Mr. Carlos looked over my paper and gave some suggestions, mostly minor formatting and readability areas. Implemented feedback.	Google Docs Gmail	Sent paper to Professor Towne and asked Mr. H, Mx. Dallas, and Mr. Cammack to review my paper.
Feb 27	Mr. H and Ms. Rachel were really impressed by depth of research and analysis. Also feedback on readability which were implemented. Gave a brief 30min presentation of my project to my Choice Friday class and later to Ms. Rachel.	Google Docs	The presentations were good, my speaking was clear, and the topics were communicated well to non-physics audience. Mr. Wu 3D printed a baseline airfoil for wind tunnel and to use in video.
Feb 28	Expanded on tasks in Logbook and polished the paper in some areas.	Google Docs Google Slides	

DATE	ACTION	RESOURCES USED	OTHER NOTES
Mar 1	Began making slides for video presentation. Continued writing the paper implementing feedback as they trickled in.	Google Slides	
Mar 2	Filmed the video presentation with Mr. Carlos. Set up wind tunnel for 3D printed airfoil run. Professor Towne gave some feedback and confirmed all analyses.	QuickTime Player Google Docs Google Slides	
March 3 2026	Completed the CYSF Platform. Cited all sources for paper (access date was written down beforehand) and last minute adjustments.	Google Docs Gmail CYSF Platform	Professor Towne wrote a statement on my paper's graduate-level research.