ENGINEERING AND PRODUCT DESIGN PORTFOLIO

PAARTH SONI
(B.Tech – Mechanical Engineering)

Hello, I am Paarth !

I am an Engineer by Profession and possess an eye for aesthetically appealing and highly detailed designs.

I believe in tackling real world problems with a creative mindset implied through simple design and technological innovation. Having a base foundation in Mechanical Engineering, I have been exposed to industry demands for dynamic design, impeccable functionality and an overall user convenience while operation. I have ensured to offer the same in order to polish my core competencies in the domain.

In my opinion, user-centric design of Products behaves as a silent ambassador for any brand, and thus I make sure that all of my designs cater to my claim in this infinite game of making the most useful designs.

I have been trained in conventional techniques of manufacturing at GITAM – Deemed to be University, Hyderabad as a part of my UG Curriculum, and taught myself to implement Rapid Prototyping with FDM, and several other techniques.

(The photographer in me has advertised himself in order to make this portfolio appealing and thus hopes that the viewer shall find the images in the portfolio equally engaging and hereby, thank the reader to invest their time in taking a glance at a brief history of my work.)

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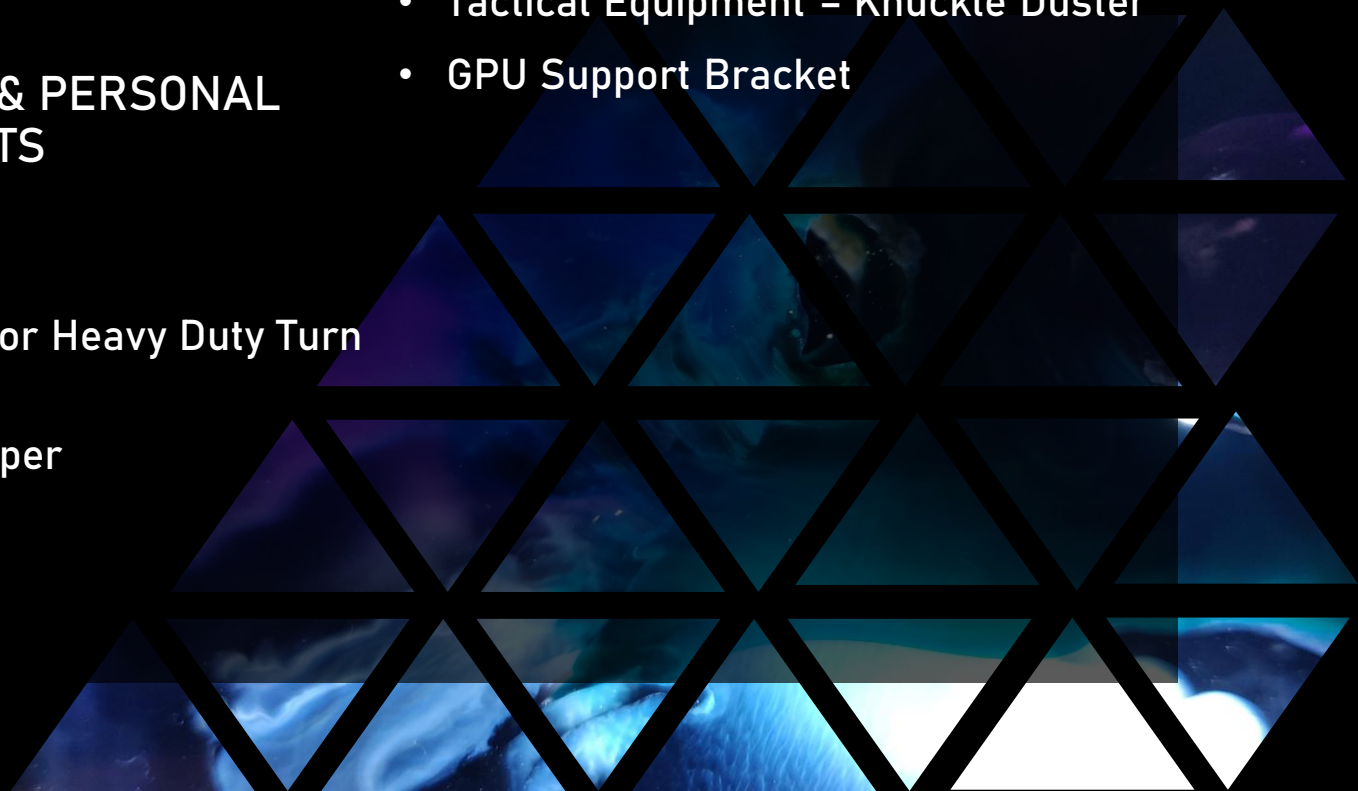
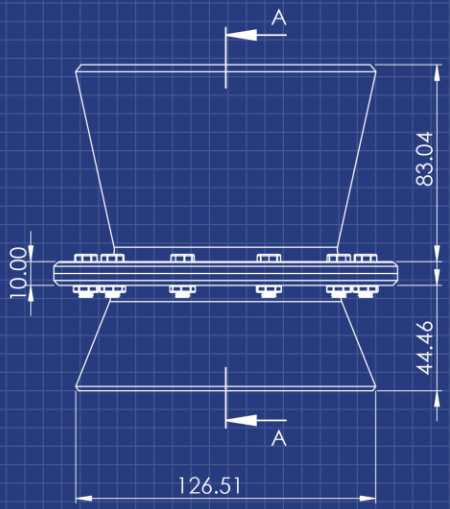
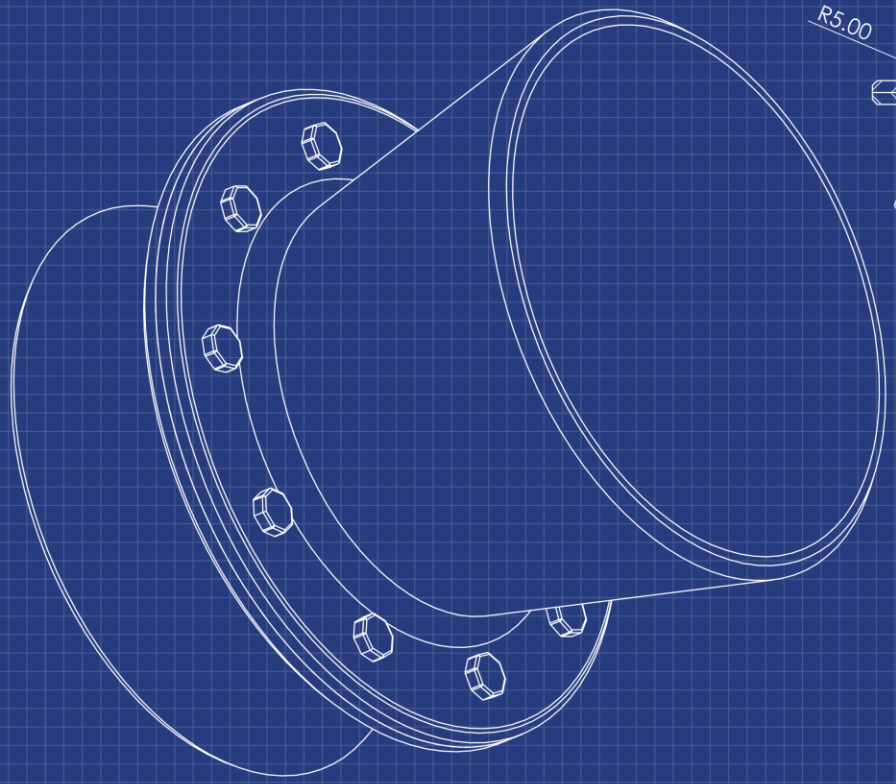


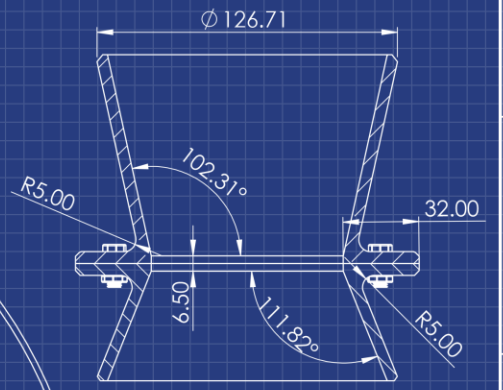
ACADEMIC PROJECTS

This category furnishes a set of projects which were undertaken as a part of my Undergraduate Curriculum of Mechanical Engineering and submitted to GITAM University for the award of the degree – Bachelor of technology

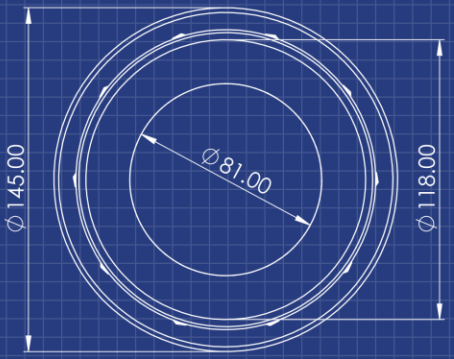
EVACUATION SLIDE ASPIRATOR







SECTION A-A



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE: Evacuation Slide Aspirator		
DRAWN	PAARTH SONI					
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A3
				WEIGHT:	SCALE:1:2	SHEET 1 OF 2

MAJOR PROJECT: EVACUATION SLIDE ASPIRATOR

TITLE: Design, Analysis and Manufacture of Evacuation Slide Aspirator

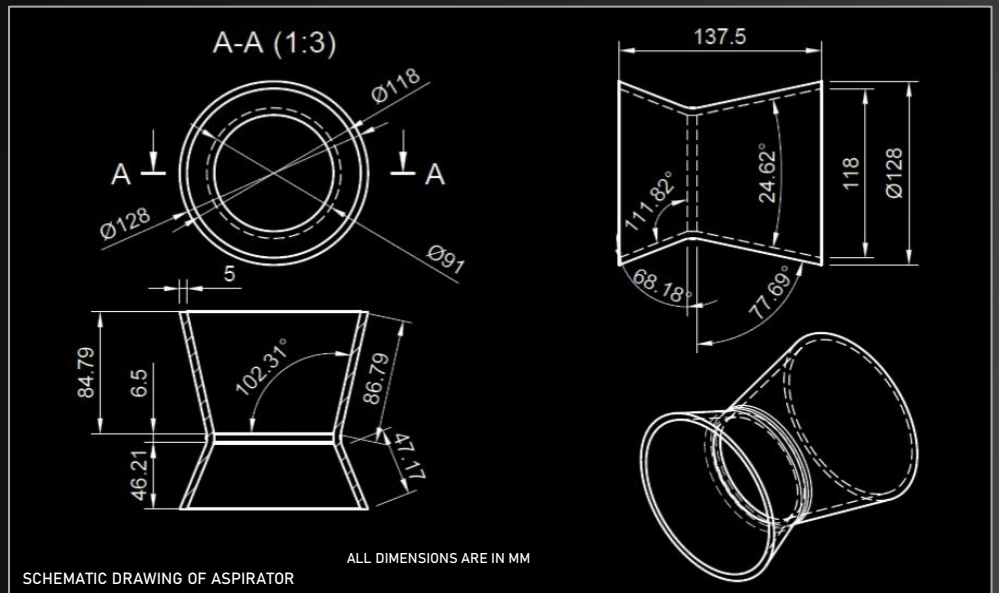
AIM: To design and prototype an aspirator which is capable of inflating an Aeroplane's evacuation slide with 25000 litres of air in less than 6 seconds and offer longer time for the passengers to evacuate the aircraft during an emergency landing over a waterbody. To also carry out an experiment at an undergrad level.

In order to test the Volumetric flow rate offered by the Aspirator , Me and My team of 4 members decided to make use of the compressor which was at our disposal for experimentation at our college.

Operating the compressor to offer an inlet pressure of 10 bar as an Active source of air supply, Contrary to the working pressure of 40 Bar in a commercial aspirator used in evacuation slides was the foundation stone for designing the aspirator.

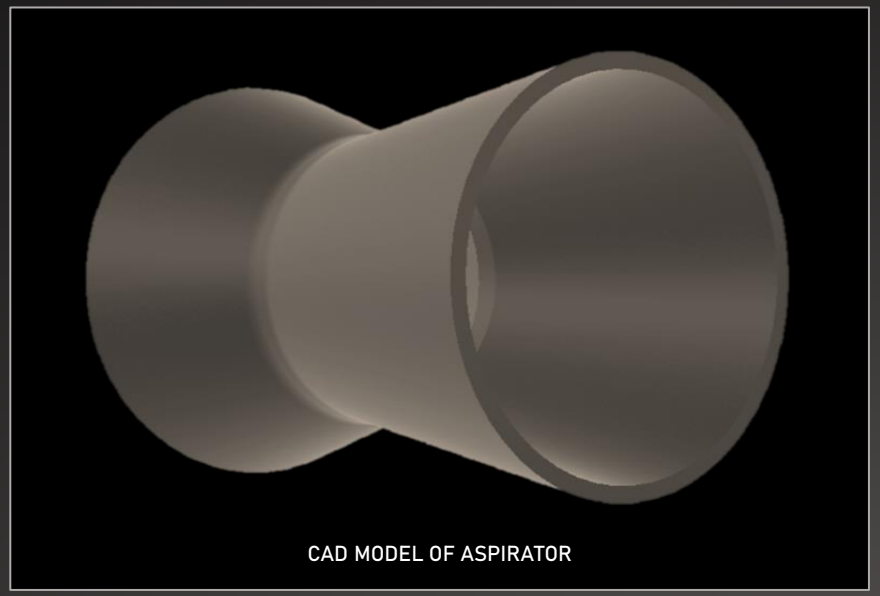
Since, the primary air supply is offered at the centre of the inlet from a P.V.C. Duct, the aspirator creates a negative pressure at the throat due to Venturi Effect and thus initiates a secondary air flow by sucking in ambient air, resulting in an increase in the total volumetric flow rate at the exit of the Aspirator.

The Simulation setup required meshing of the geometry and giving operating conditions at the Inlet to test the flow output.

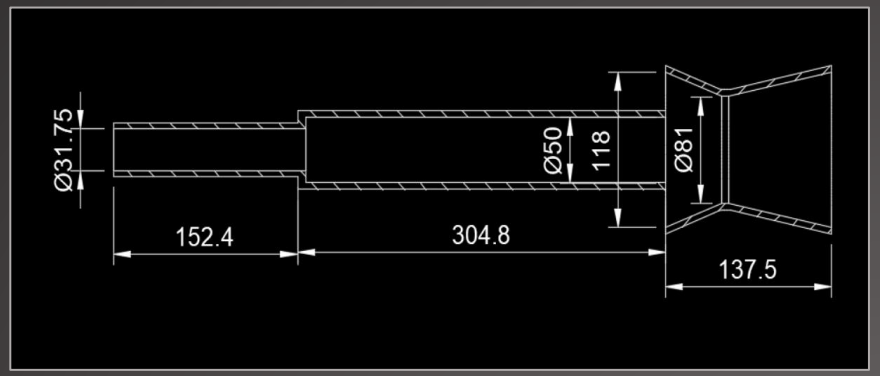


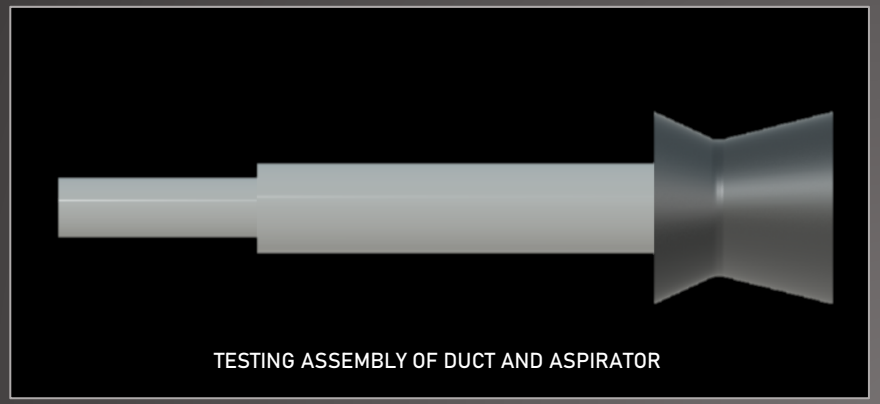
ALL DIMENSIONS ARE IN MM

SCHEMATIC DRAWING OF ASPIRATOR



CAD MODEL OF ASPIRATOR





TESTING ASSEMBLY OF DUCT AND ASPIRATOR

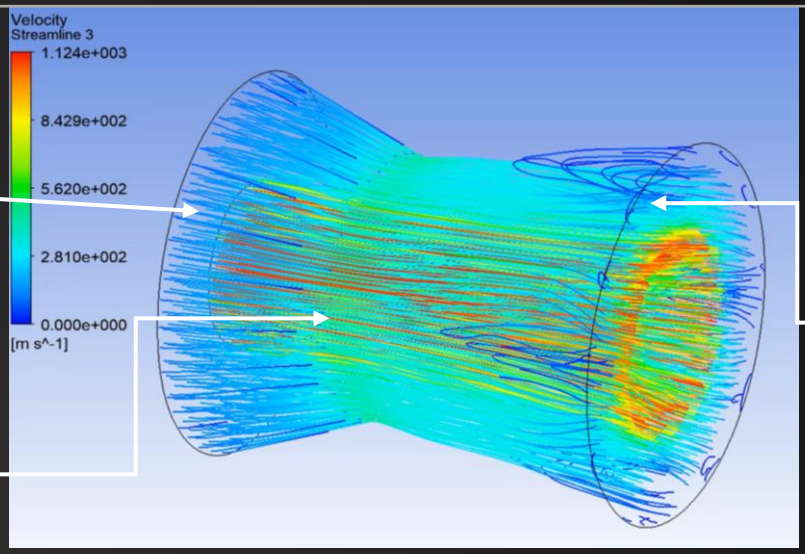
APPROACH AND C.A.E. RESULTS

APPROACH:

- Groundwork on existing technologies like: Evacuation Slides, Sugar refinery ejectors, Significance of NXP for desired flow rate and conceptualization of experimental set up.
- Calculating dimensions of Aspirator based on desired output bearing in mind the available resources to develop the boundary conditions for building the experimental setup.
- Calculating dimensions of ducting as Primary source of air inlet at Nozzle Exit Position (NXP) = 0.
- CAD Modelling with FUSION360 and analysis with ANSYS, *Academic Research Mechanical, Release 19.*
- Developing mesh in ICEM CFD and importing in ANSYS Fluent for CAE.
- Modifying the attributes of the design for achieving desired results based on the simulation output.

Passive flow induced by active flow due to pressure variation. Magnitude: 560-925 m/s

Exit velocity at core: 1150 m/s Active inlet velocity



Stalling (or) Flow separation at exit due to Converging – Diverging profile and pressure drop at throat resulting in suction from the outlet end, later being overcome by high velocity towards the outlet

SIMULATION RESULTS SHOWING PROMISING RESULTS

The simulation results are furnished below:
Outlet velocity At core: 1128 m/s
Passive Flow velocity: 280-520 m/s
Approximate Discharge: 6-10 m^3/s
Thus, the Aspirator is capable of inflating an evacuation slide with 25000 litres within a span of 4 seconds.

PROTOTYPE AND EXPERIMENTAL OBSERVATIONS

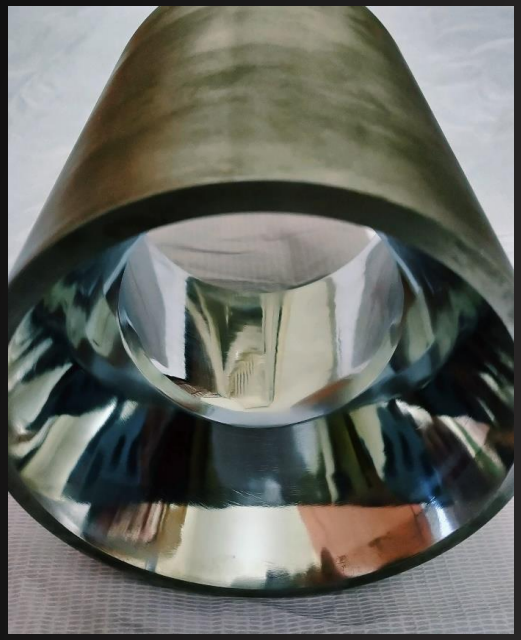
Experiment Observations:
Total Canvas Bag length (h): 1.829 m
Diameter of the Bag: 0.128 m $\rightarrow$ r = 0.064 m
Volume of the Bag = π ×r^2× h = π ×0.064^2× 1.829 = 0.023 m^3

Air vessel pressure reading: 10 bar.

Pressure loss incurred at the exit due to external piping having:

Number of Elbow bends	: 5 + 1 Ball valve
Expansion couplings	: 1
Number of Couplings	: 2
Reducers in PVC Duct	: 2

Carrying out the experiment at the available compressor led to unwanted drop in outlet pressure due to the air traversing through multiple bends and hindered ball valve calibration present in the external piping and condenser coils which behave as disruptive factors for the flow and offer a discharge of 2.2 m^3/s.



CONVENTIONALLY MANUFACTURED PROTOTYPE

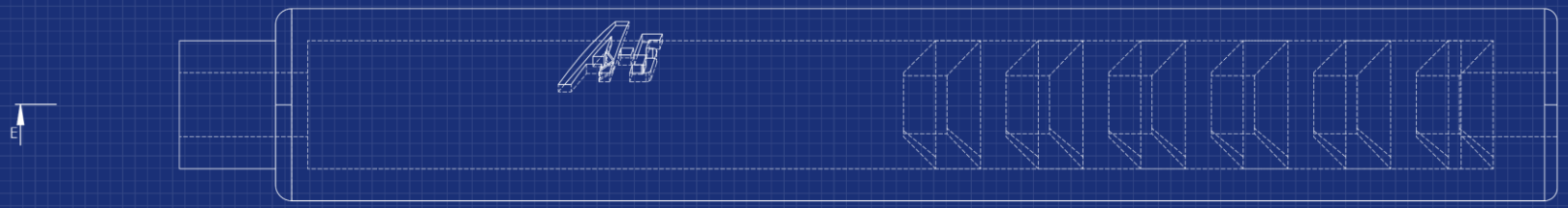
The study helped in understanding flow development in various geometries as well as greatly contributed to refine my competencies of designing and Analysis with C.A.E Tools.

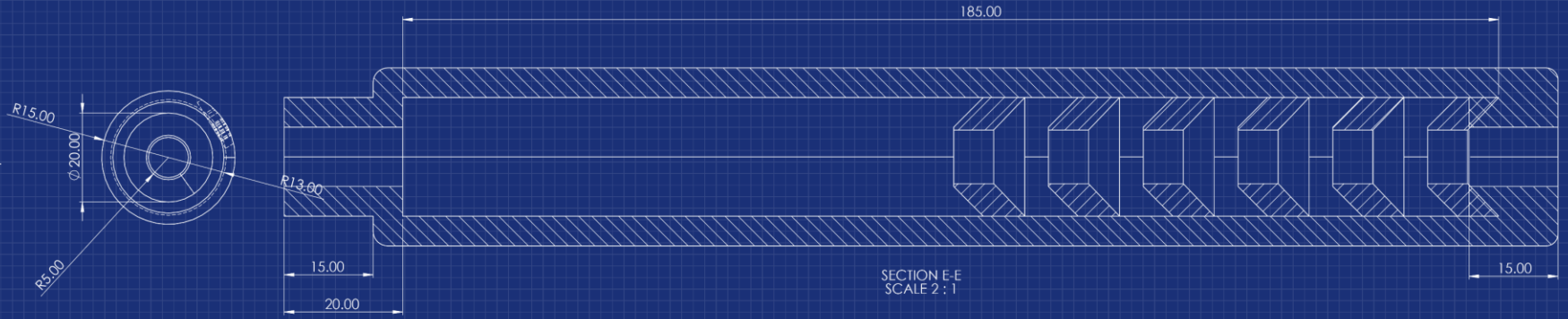
The prime motive of developing an Aspirator capable of producing 25000 litres of Air in under 6 seconds was not only achieved but shortened by 2 seconds.

Me and my team practiced a ‘divide-and-conquer’ policy in order to even out the work load and provide effective output in each of our undertaking. My commitment towards designing, calculations and analysis was brought into fruition by my team members who procured materials and prototyped our first project for the University.

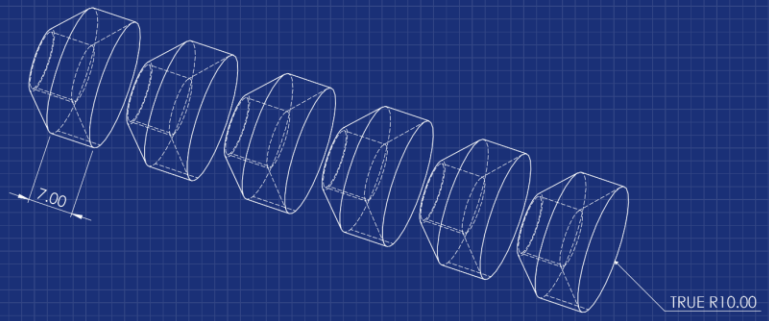
This project also helped in understanding various materials for construction and conventional manufacturing operations in order to develop a high precision demanding product for matchless performance.

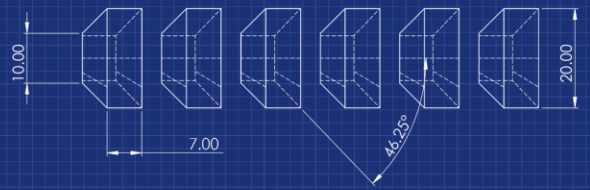
FIREARM SUPPRESSOR





SECTION E-E
SCALE 2 : 1





UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:				DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				TITLE:
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL:			DWG. NO. Firearm Suppressor A2
				WEIGHT:			SCALE:1:1 SHEET 1 OF 1

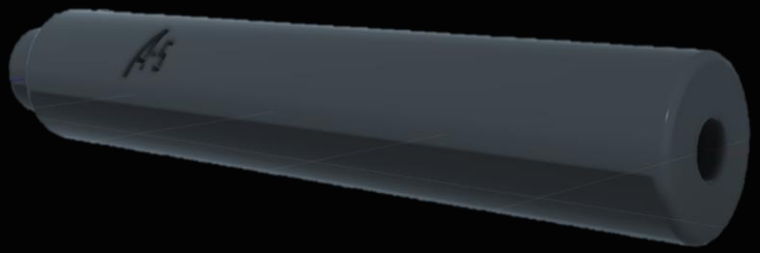
MINOR PROJECT: FIREARM SUPPRESSOR/ SILENCER

TITLE: Design and Analysis of Firearm Silencer

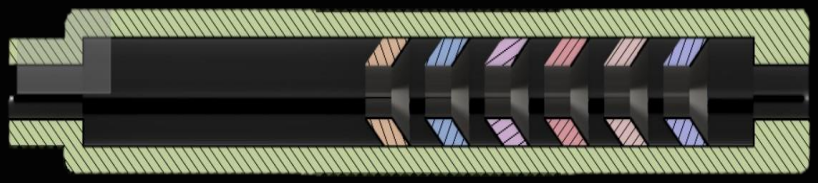
AIM: To design and analyse a firearm silencer which is capable of reducing the acoustic pressure below the human ear's audible limit and at the same time study and simulate the gunshot effects.

APPROACH :

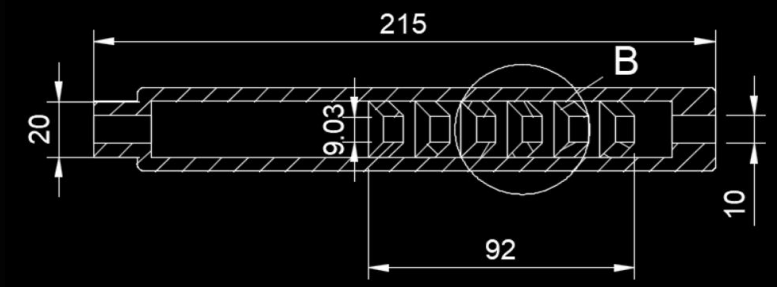
- To study existing designs and their impact on acoustic pressure at the exit of the suppressor.
- Selecting a Bullet calibre and a gun model for sizing the suppressor's design.
- Comparing the conventional suppressor's material and selecting alternative materials for reducing the raw material and production cost and simultaneously ensuring the material properties are promising for a robust design.
- Orienting the Baffle design at an angle as opposed to a perpendicular baffle wall, to ensure forced expansion of propellant gases thereby resulting in a substantial drop in acoustic pressure.
- Designing a 9 mm caliber bullet with a dome shaped shell for interacting with the geometry after firing.
- Meshing the regions of interaction between the Bullet and Baffle walls of the suppressor.
- Assigning rigid and non rigid properties to materials and testing for explicit dynamics in LS – DYNA.



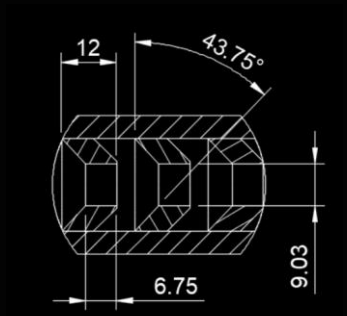
CAD MODEL OF SUPPRESSOR
M.O.C – AISI 1018



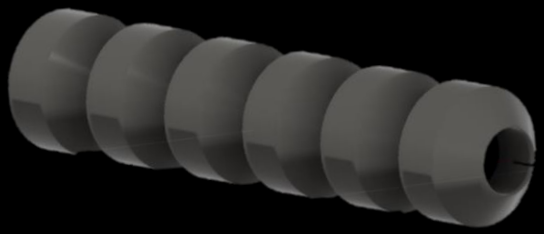
CUT SECTION OF SUPPRESOR ASSEMBLY



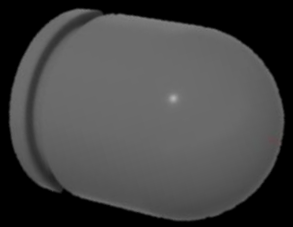
SCHEMATIC DIAGRAM OF SUPPRESSOR ASSEMBLY



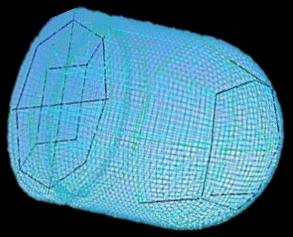
CAD GEOMETRIES AND MESHED BOUNDARIES



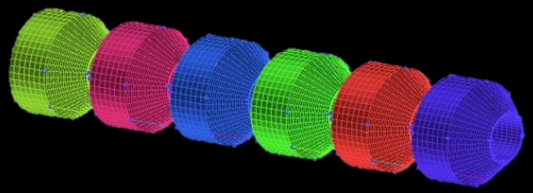
6 BAFFLED SUPPRESSOR CAD GEOMETRY
M.OC. – AISI 4140



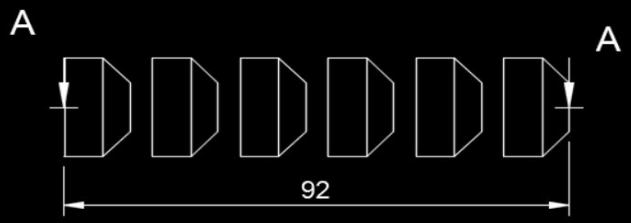
9mm CALIBER BULLET PROJECTILE
M.O.C - Lead



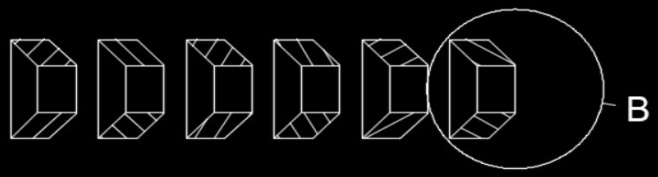
MESHED PROJECTILE IN ICEM
total number of elements = 82316
The total number of nodes = 85956

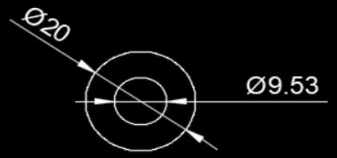


MESHED BAFFLE STACK, number of elements: 2784 X 6 = 16704

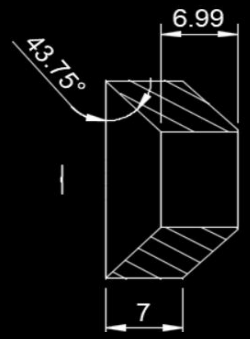


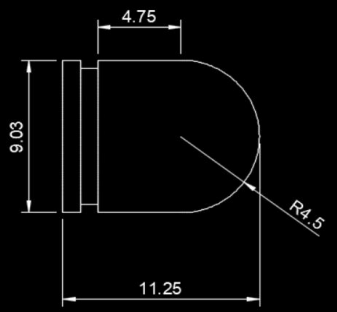
A-A (1:1)

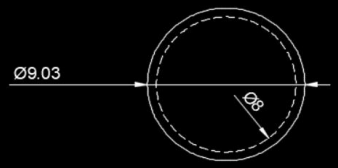


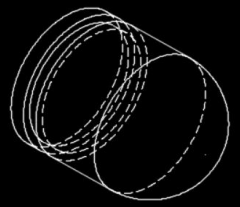


B (2:1)

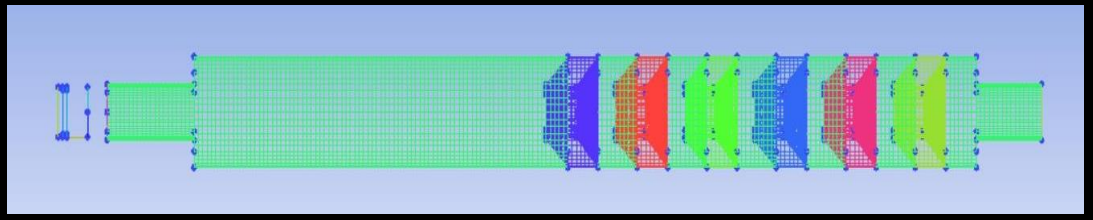






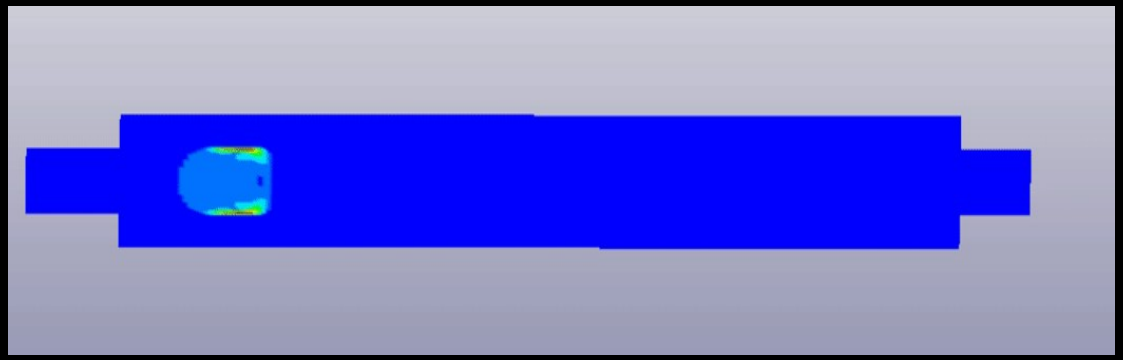


ALL DIMENSIONS IN MM

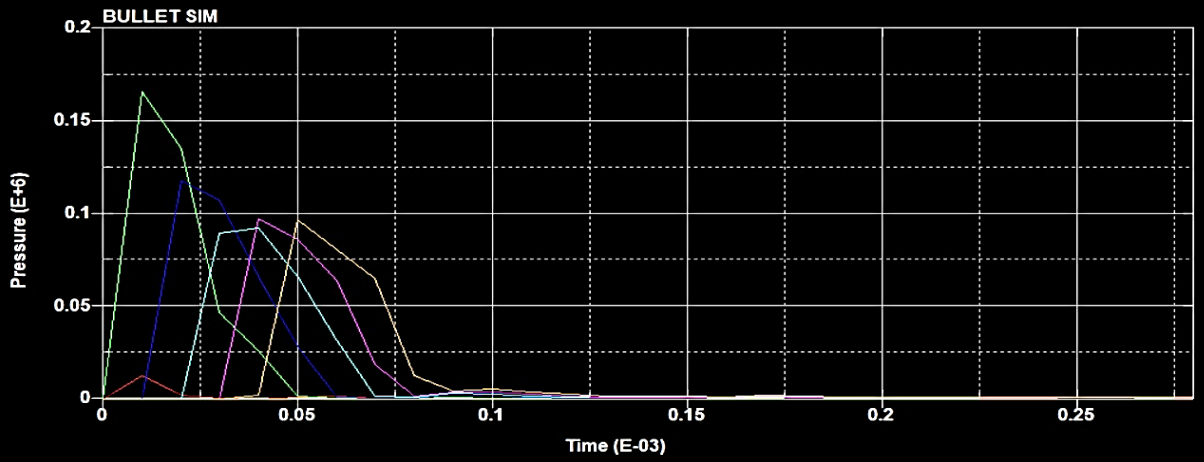


BOUNDARIES OF INTERACTION BETWEEEN BULLET AND SUPPRESSOR
The total number of nodes obtained are: 334680
The total number of elements obtained are: 327600

PROJECT RESULTS AND OUTCOME



FRINGES REPRESENTING PRESSURE DROP IN THE SUPPRESSOR CHAMBER



PRESSURE V/S TIME GRAPH FOR DIFFERENT POINTS OVER THE LENGTH OF THE SUPPRESSOR

RESULTS AND CONCLUSIONS

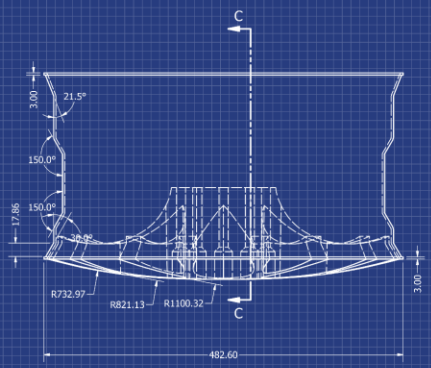
ACOUSTIC PRESSURE DROP OBSERVED:

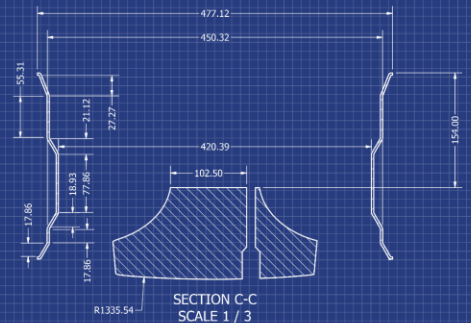
Initial pressure at inlet : 26 bar Pressure at first baffle : 1.2 – 4 bar

- The drop in pressure observed is within the human audible limit of 2 bar.
- The design serves for the pressure drop as expansion of air within the chamber is provided with inclined baffles instead of straight baffles.
- The materials assigned help in retaining the structural integrity and are cost efficient when compared to conventionally used materials.

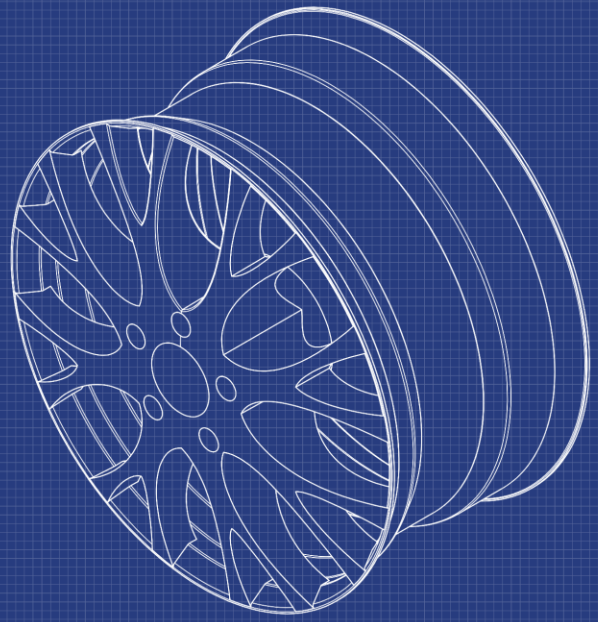
PERSONAL & PROFESSIONAL DESIGN PROJECTS

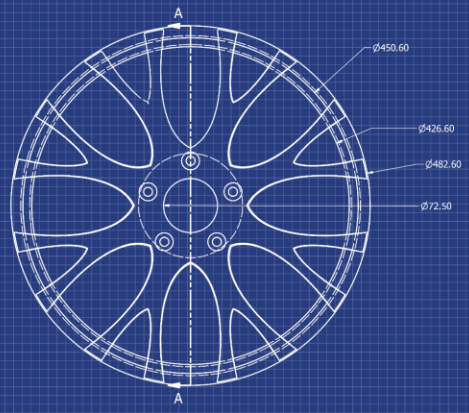
BMW M5 RIM

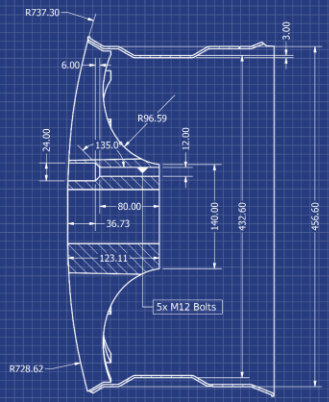




SECTION C-C
SCALE 1 / 3







SECTION A-A
SCALE 1 / 3

DRAWN	Paarth Soni	12-12-2019	
CHECKED			
QA			
MFG			
APPROVED			

TITLE: BMW M5 RIM

SIZE: D | DWG NO | REV

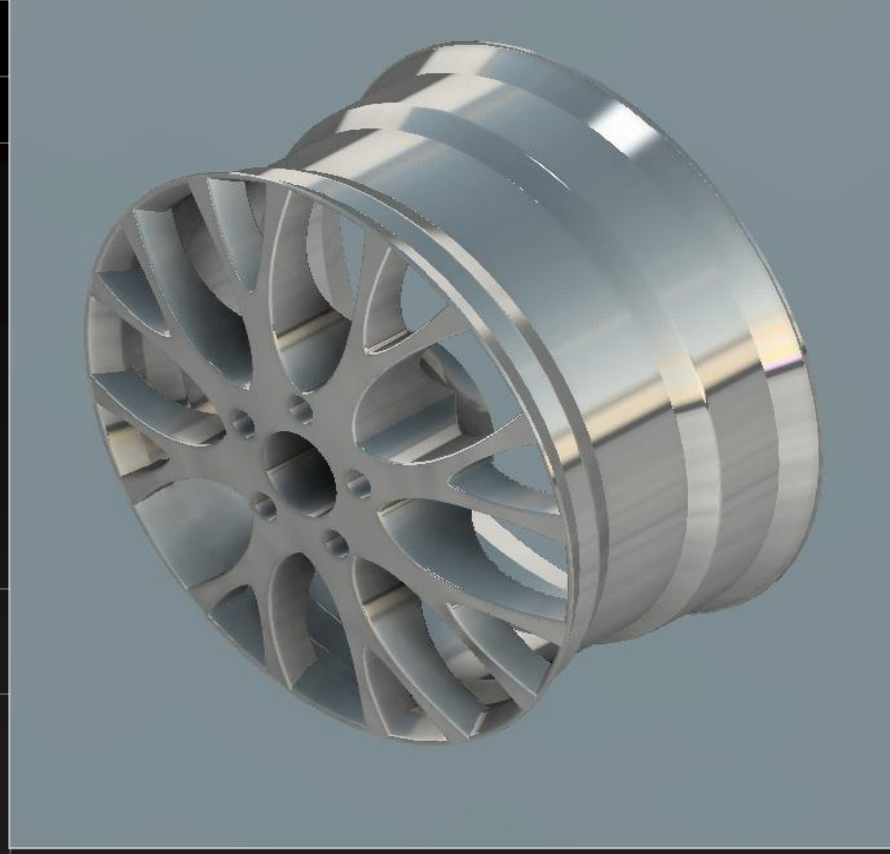
SCALE: 1 / 3 | SHEET 1 OF 1

BMW M5 RIM

This project was taken up as a practice of my design competencies along with exercising the available rendering tools, drafting skills and finally run an FEA Analysis with materials of construction being similar to that of commercially sold BMW M5 Rims.

Software used:

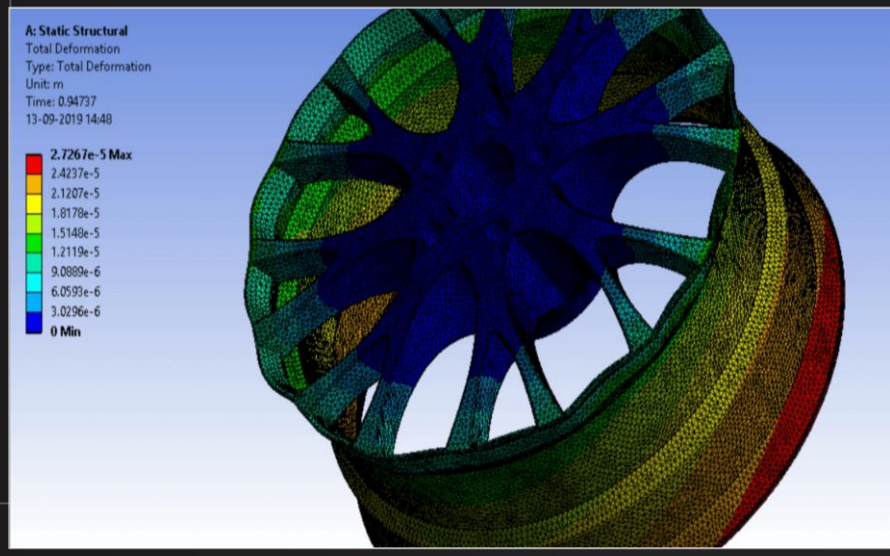
CAD : Autodesk Inventor
Analysis : ANSYS Workbench R19



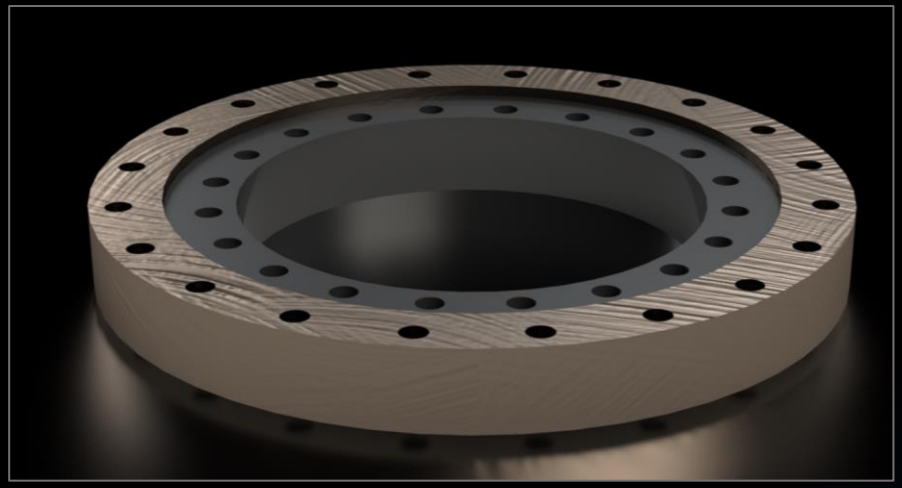
This project however doesn't affiliate itself to the named company in any manner whatsoever and is solely carried out for the purpose of learning and practice.

The details furnished below enlist the Simulation setup followed by simulation results:

M.O.C	: Aluminium Alloy
Remote force along curvature	: 1500 N
Displacement at lug holes	: Zero
Displacement at centre cap bore	: Zero
Element size	: 0.001 m

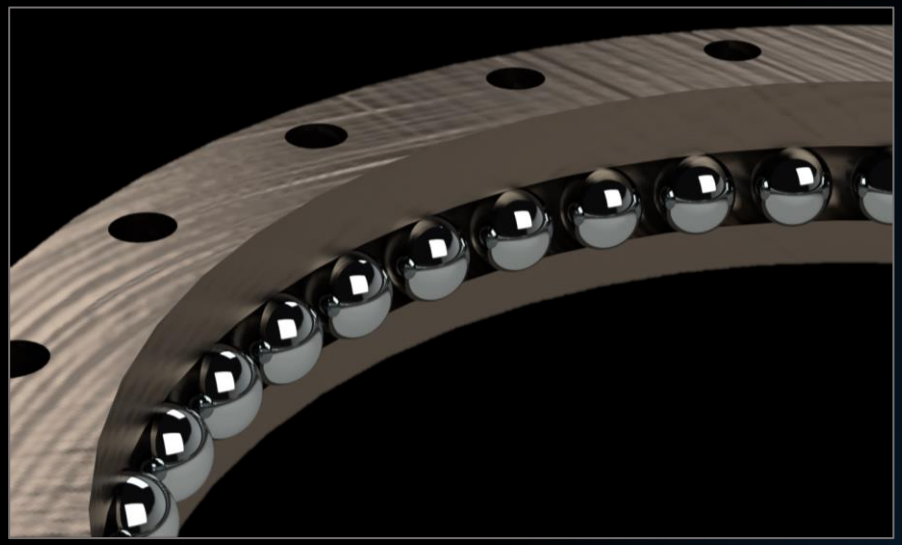


Result: The rim undergoes a maximum deformation of 0.027 mm under a Uniformly distributed load equal to 1/12th of a BMW M5



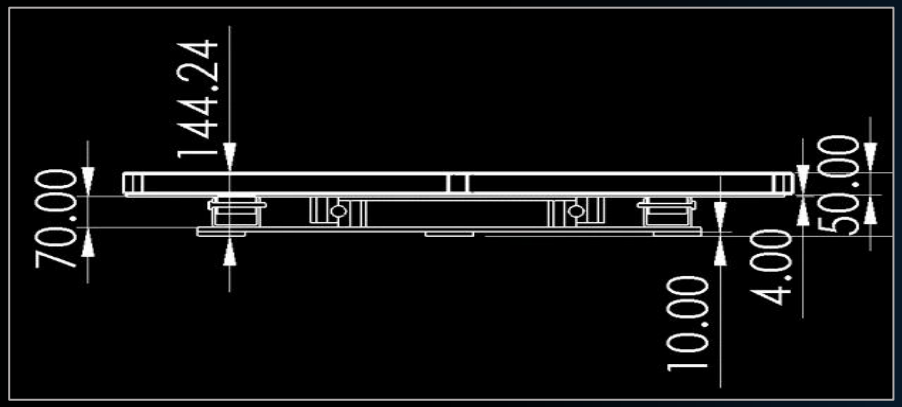
SWIVEL BEARING FOR HEAVY DUTY TURN TABLE

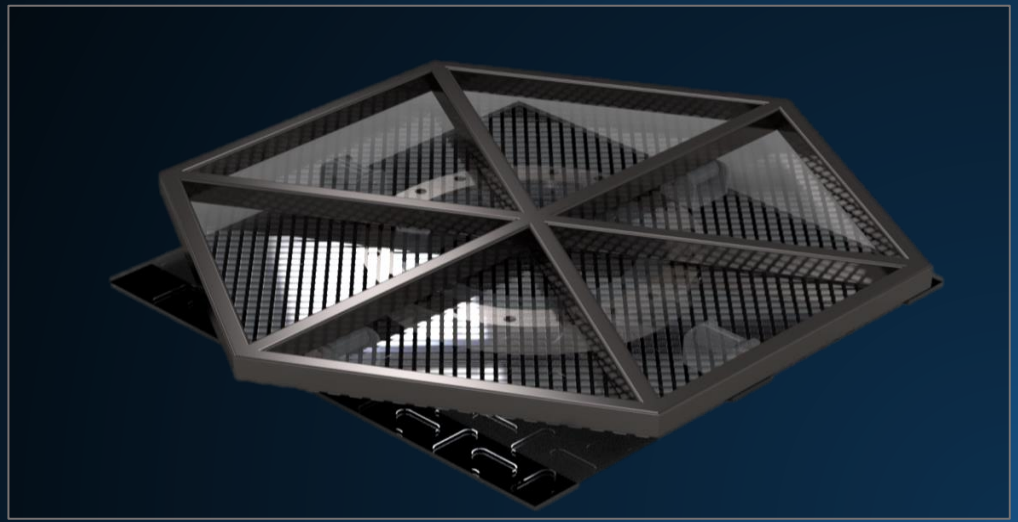
During my training at Chem Colloids in 2019, I was given the task to design a manual turn table which would be used to load 4 chemical filled barrels weighing a total of 900 Kilos and the height of the total construction must not exceed 150 mm from the ground.
I modelled a Swivel bearing separately as per the industrial dimensions and used it in my model to present it to my employer.



Approach for Design: I opted a swivel bearing popularly known as 'Lazy Susan bearing' so as to cater to our constraint of height in the design and implemented a 20 inch(OD), 50Mn Carbon Steel Swivel Bearing to ensure resilience to cyclic loading.

The final turntable height came out to be 145 mm higher from the ground.



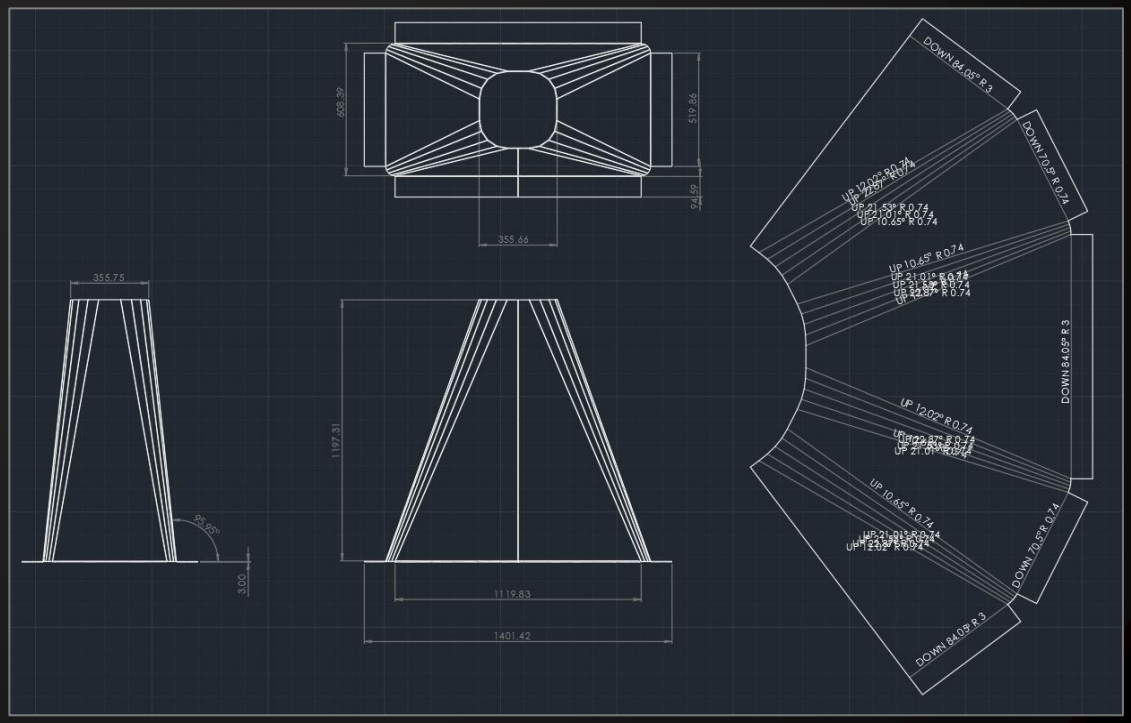


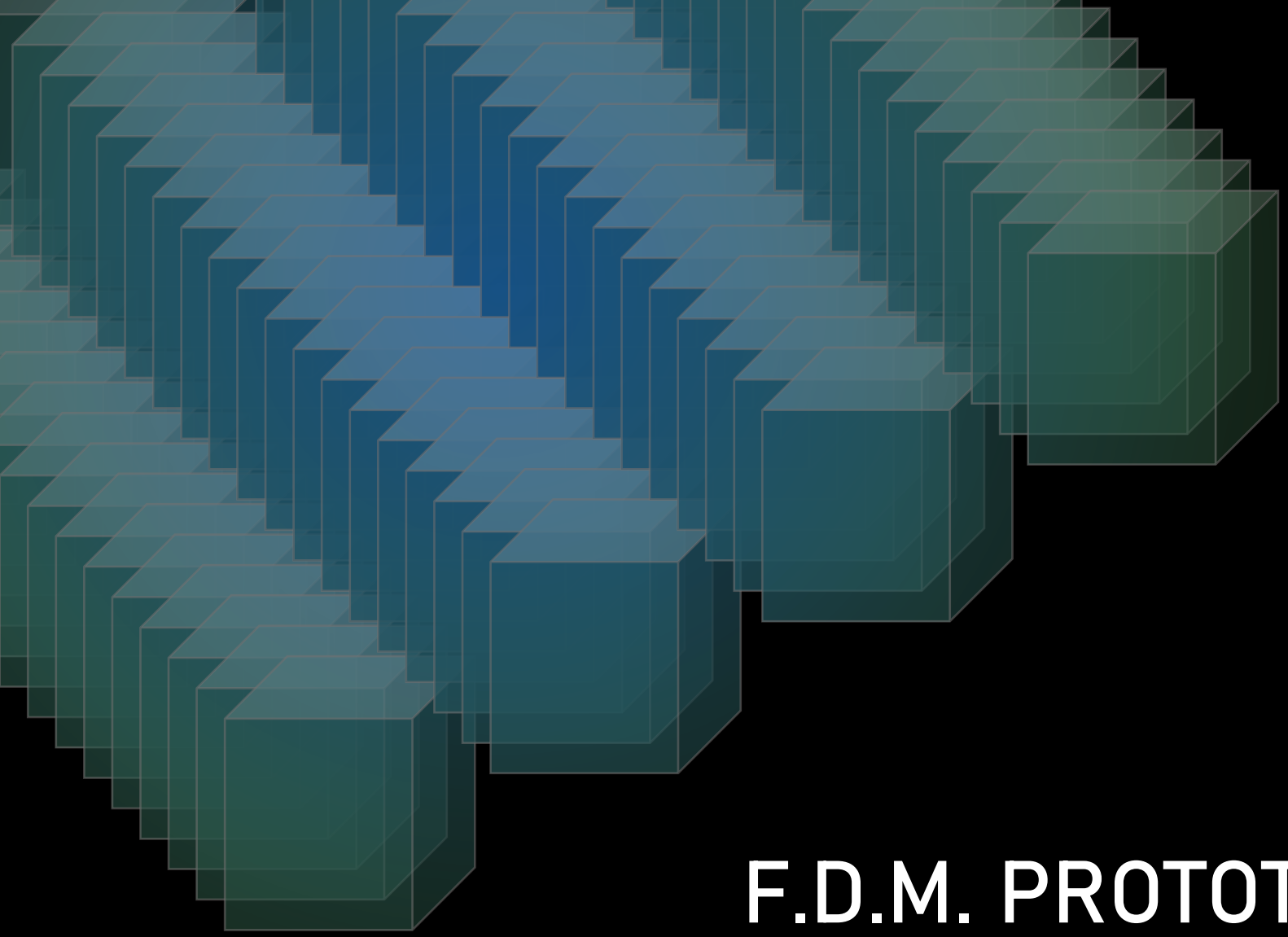
SHEET METAL HOPPER

The element of the highest utility in my project of designing a Chemical Processing plant for Chem Colloids Pvt. Ltd.; was a hopper of 200 kg capacity which had to be custom made for our requirement.

I took this opportunity to learn sheet metal drafting and further my knowledge about propagation of vibrations through geometric constructions with bends, curves and flat surfaces in order to dispense processed bulk solids for further conveyance.

The implemented hopper was constructed out of 3mm thick Mild steel sheet in most of the applications and Fibre Reinforced Polymer where the materials were saturated grains of powder.





F.D.M. PROTOTYPED DESIGNS

VRUK WRITING INSTRUMENTS

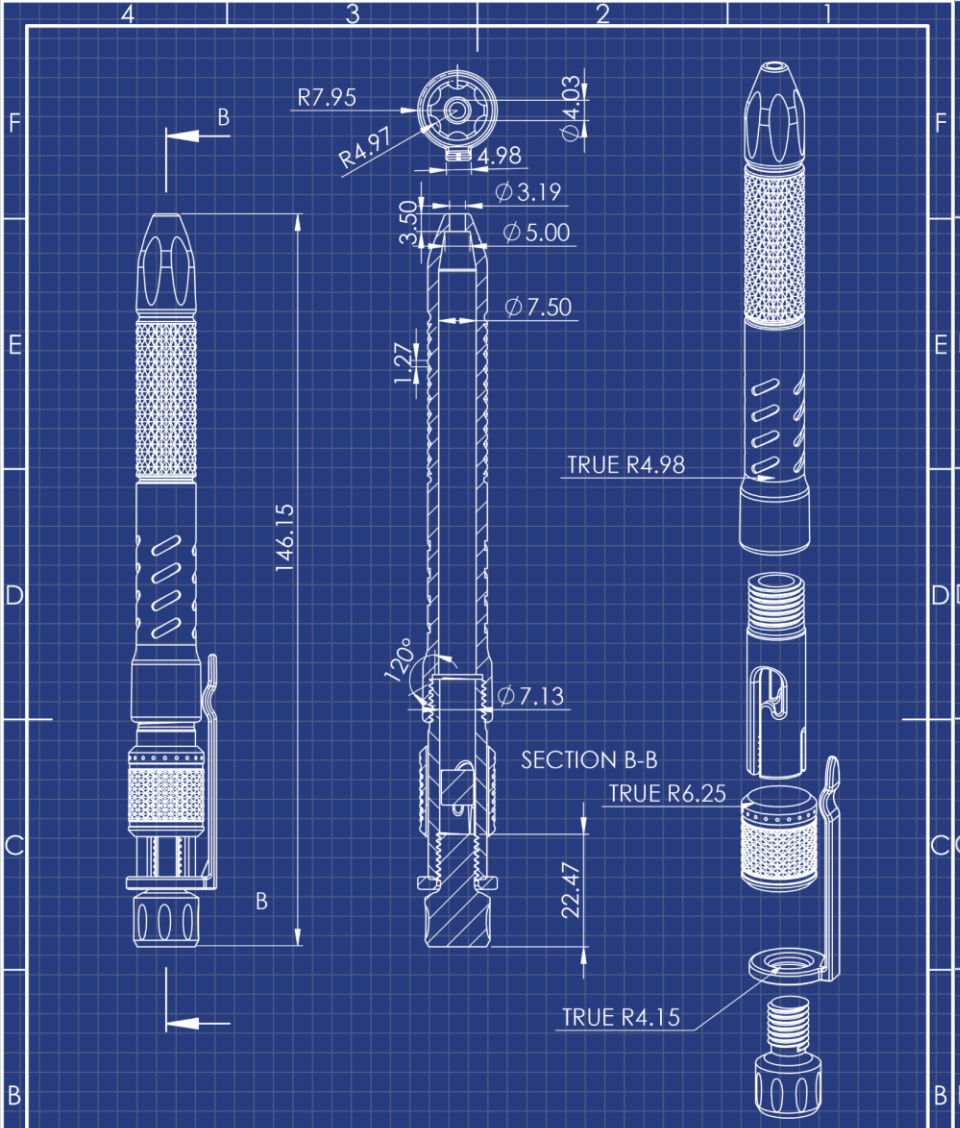
'A wolf on top of the hill is not as hungry as a wolf climbing the hill'

The above quote inspires me and my work to be a symbol of exploration and ardour for establishing user centric design.

The single syllable word '*Vruk*' is Sanskrit for Wolf, and also what I brand my pens and other concepts of design in everyday carrying tools [EDC tools].

This project derived from my fondness for carefully designed writing instruments, and observing them with a judgemental vision to further improve the overall appearance bearing in mind the writer's cognitive ergonomics.

The first 2 models of Vruk pens house a Pilot V7 cartridge and work with a twist mechanism as opposed to the generic click.



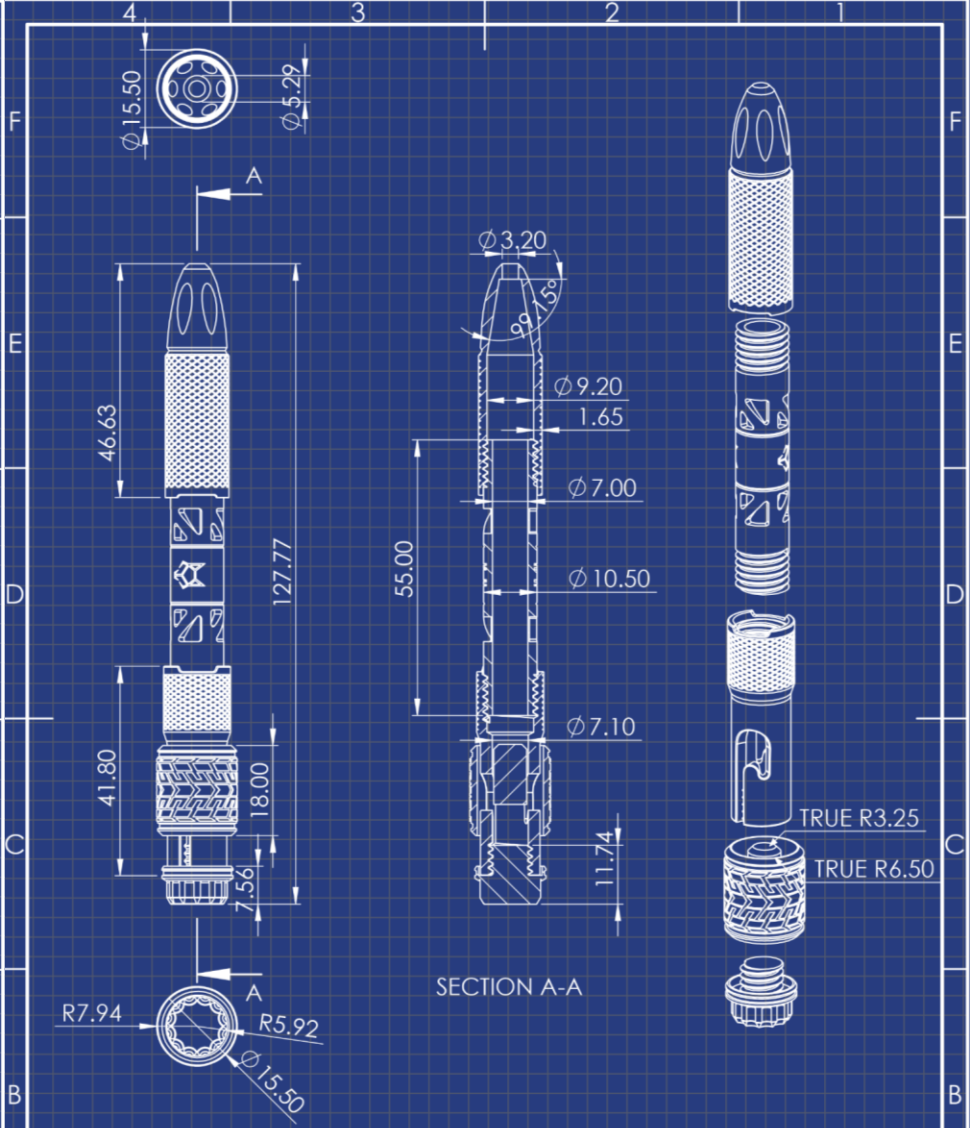
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION

	NAME	SIGNATURE	DATE
DRAWN	PAARTH SONI		
CHK'D			
APPV'D			
MFG			
Q.A			

TITLE: MARK_II

MATERIAL: | DWG NO. | A4

WEIGHT: | SCALE:1:1 | SHEET 1 OF 1



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING / REVISION

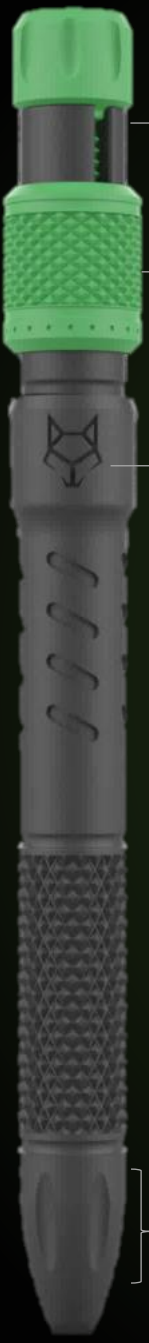
	NAME	SIGNATURE	DATE
DRAWN	PAARTH SONI		
CHK'D			
APPV'D			
MFG			
Q.A			

TITLE: MARK_III

MATERIAL: | DWG NO. | A4

WEIGHT: | SCALE:1:1 | SHEET 1 OF 1

VRUK SERIES PENS COMPONENT LIST



J-Slot cylinder for guiding the twist cam

Twist cam with knurling pattern for easy grip during twist action with a single hand.

Twist cam with tyre tread pattern designed for KTM inspired version of the same model

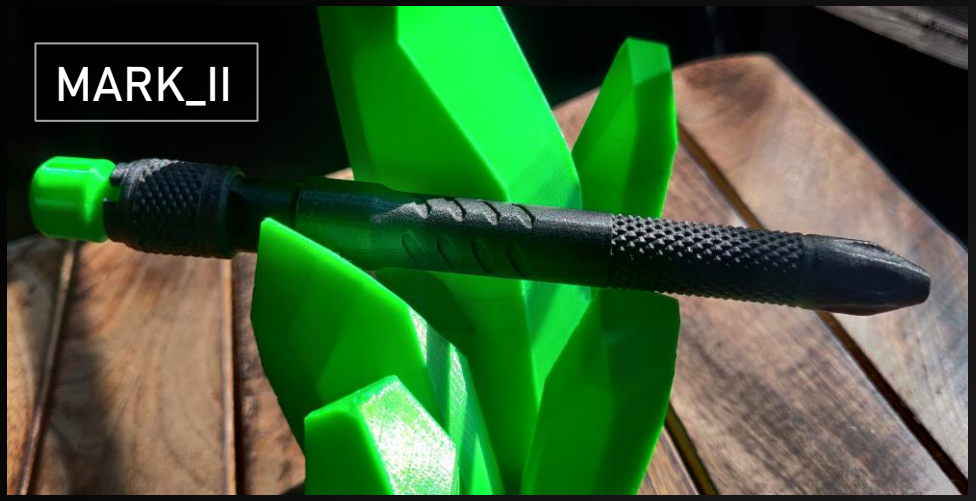
Embossed Vruk Logo

Intermediate barrel for manufacturing smaller parts in lesser time with less risk of material wastage upon failure of 3D prints.

Knurl pattern grip with varying depth in each of the models

Pen tip with slots for weight/ material reduction and extra grip.

FOREMOST PROTOTYPES



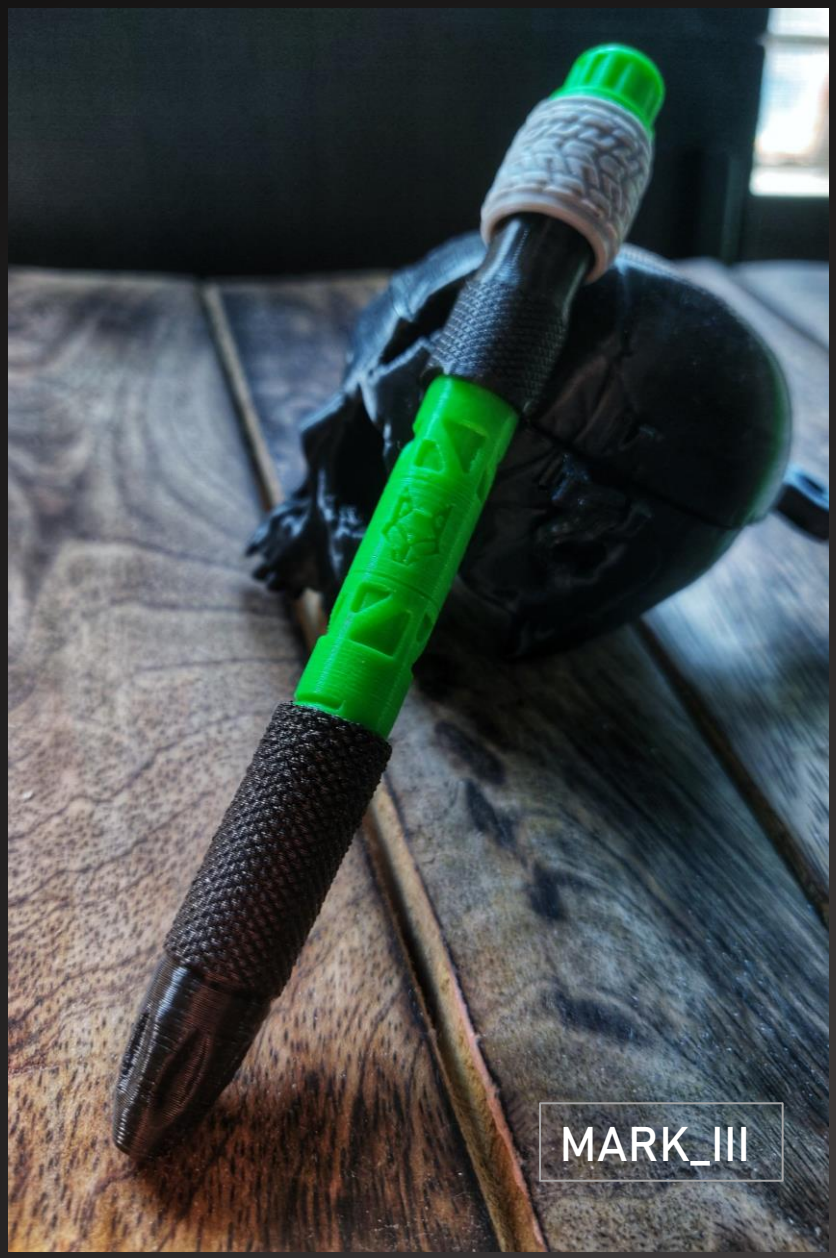
MARK_II:

4 component pen excluding Cartridge and spring
Time taken for Prototyping: 6 Hours
Filament Used: Carbon Fibre PLA
Post processing of Carbon Fibre PLA : NIL

MARK _III :

5 Component pen excluding Cartridge and spring

Capable of housing cartridges of Pilot V7 and Pilot G2 with slight modifications
Time taken for prototyping: 5 hours
Filament Used: Generic PLA
Post Processing: Melting strings
(if any)



NIGHT LAMP SHELL

A broken ceramic bulb shell after failed attempts of fixing was replaced with something attention grabbing and modern with a pinch of evolutionary technology.

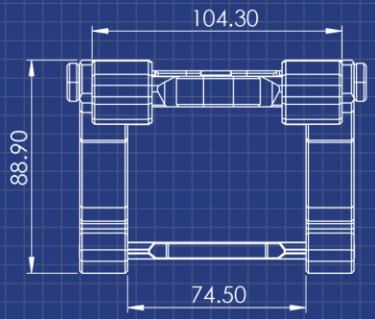
I designed and 3D printed the bulb casing out of generic PLA after considering the dimensions of the bulb for its CAD geometry and the temperature reached by the ambient air around the bulb.

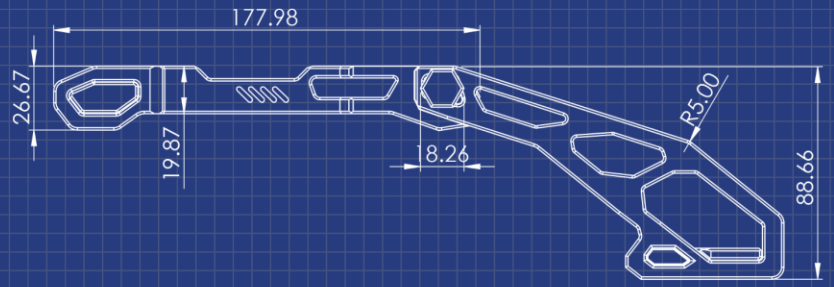
TACTICAL EQUIPMENT - KNUCKLE DUSTER

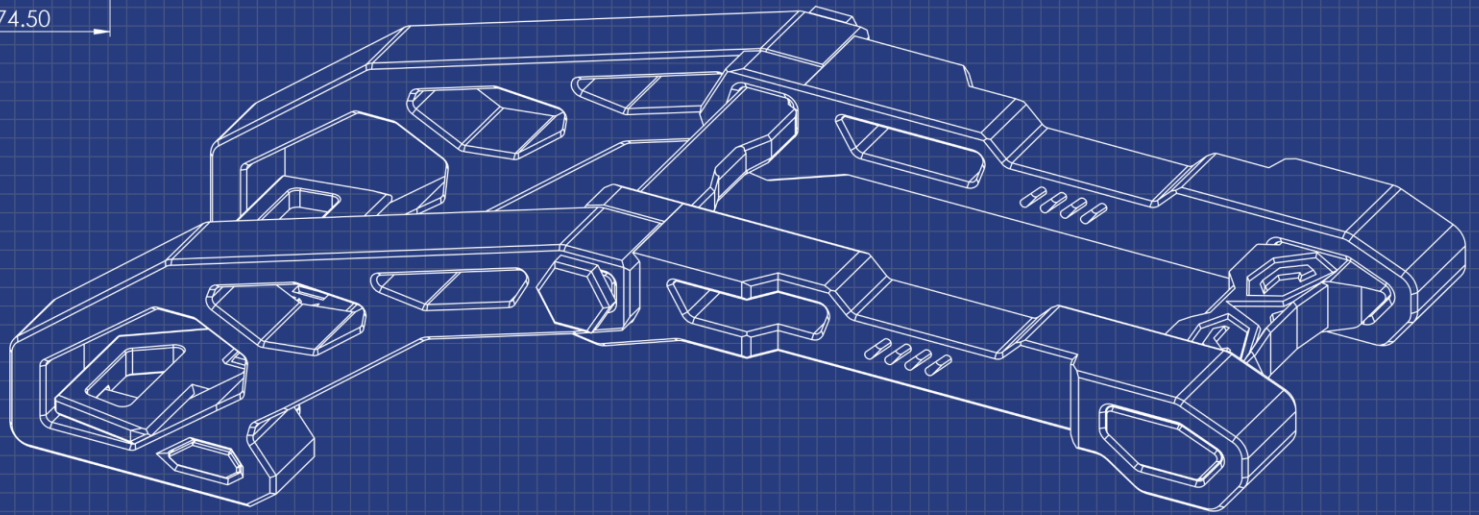
This particular project was designed keeping women safety in mind, as knuckle dusters have a controversial image of being the most effective weapon in hand – to –hand combat and being banned in countless parts of the world.

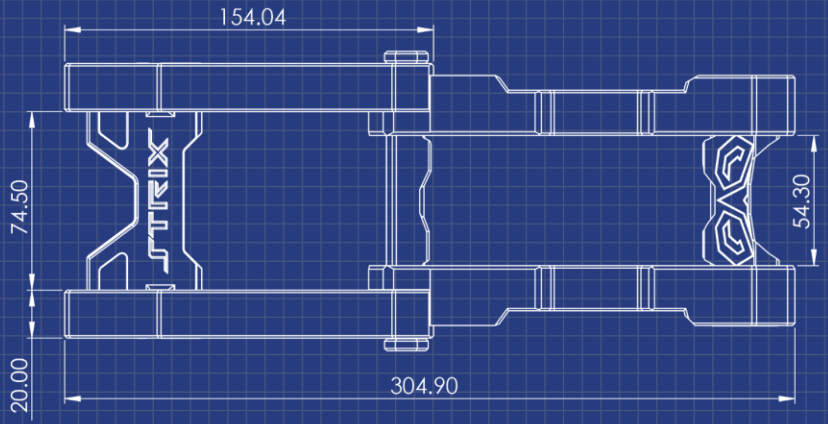
SCOPE OF IMPROVEMENTS IN DESIGN

Integration of Taser electrodes at the point of contact which are activated with curved capacitive fingerprint sensors installed at the rings of the knuckle duster in order to make it usable only by the registered owner.







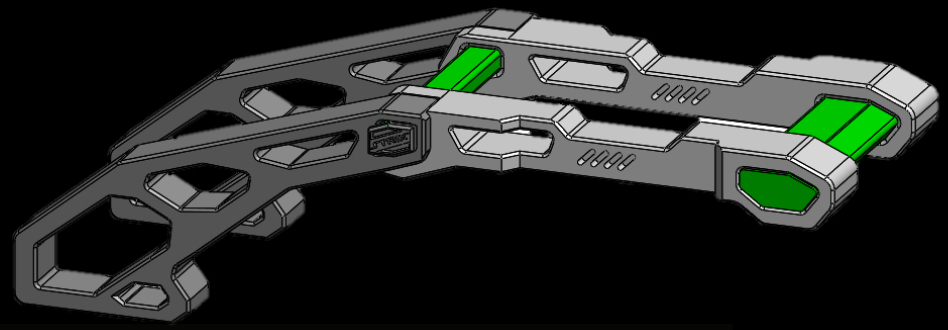


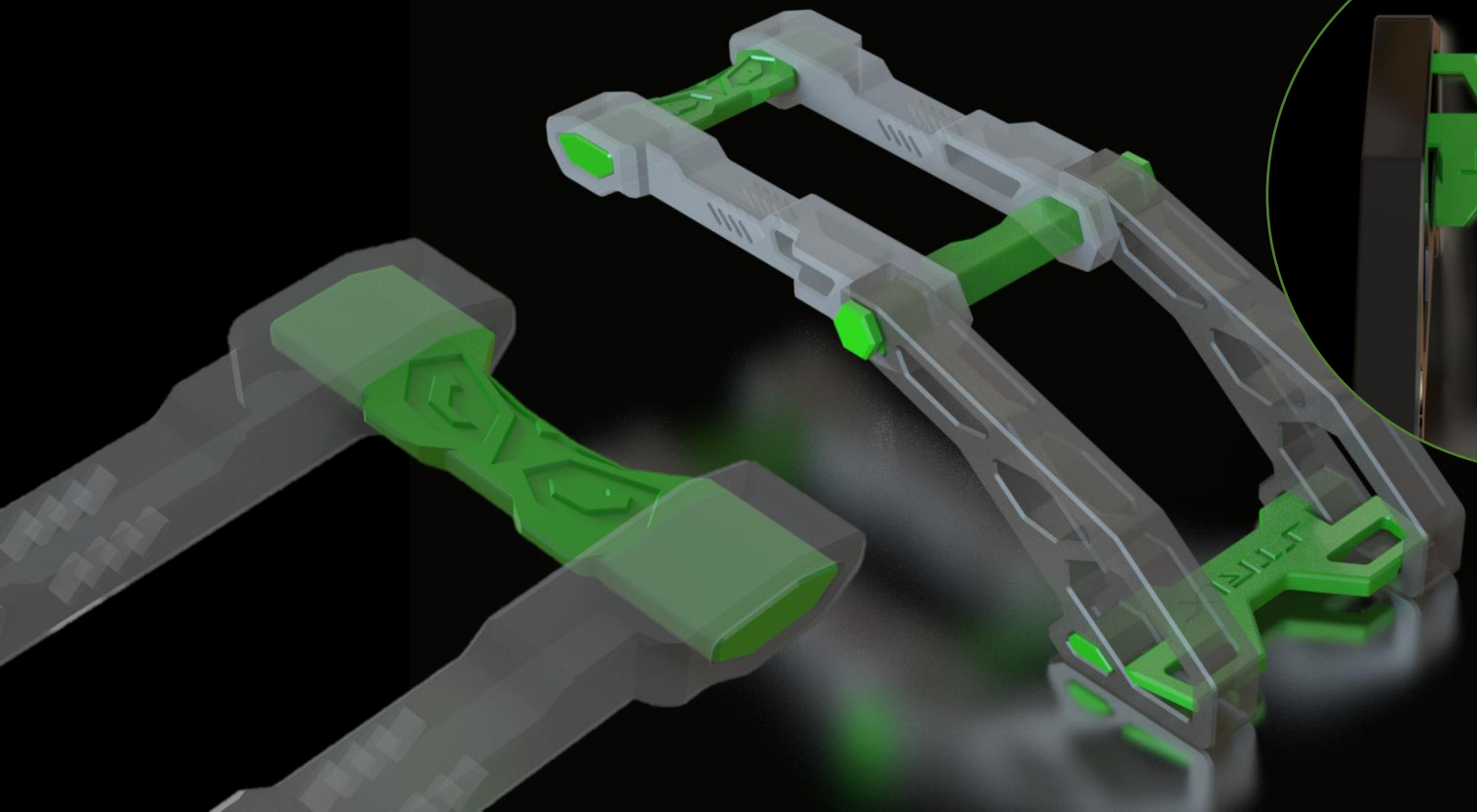
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE: GPU SUPPORT BRACKET		
DRAWN	PAARTH SONI					
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A3
				WEIGHT:	SCALE:1:2	SHEET 1 OF 1

GPU SUPPORT BRACKET

The aim of this project was to design and 3D Print a support structure for a friend's Computer GPU which was undergoing physical sagging and translating load onto the contact pins of the motherboard and PCIe connection.

This project was carried out with the sole purpose of developing a personalised support bracket specifically for Asus GTX 980 Strix.





BEFORE:

Sagging GPU due to lack of support, Cantilever joint and timely heating up, bending the contact pins on the motherboard.

AFTER:

Supported GPU with nullified sag and a support along the total length, Resistant to thermal cycles as the CPU has multiple cooling fans.

Want some insights on my work ?
Feel free to contact me over :

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: Paarth Soni

Liked the Photos ? Swing by for more at :

https://www.eyeem.com/u/paarth_soni30

I would enjoy to take the time in discussing about the projects exhibited in this portfolio and brainstorm over ideas of era defining potential.