



SPCE WAVE

BHARTIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
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A BRIEF INTRODUCTION ABOUT SPCE W.A.V.E.

1 – FOUNDATION:

SPCE W.A.V.E. (Wing of Aerial Vehicle Engineers) was established in 2017 with the aim of promoting aero-modelling in the younger generation of our country and allowing aero-enthusiasts work on something near to their heart and in turn learn and develop skills that would be useful for their future careers.

2 – VISION AND MISSION:

The Vision of our club is to represent India across the globe at International aero-modelling competitions and to bring laurels to the country and to spread knowledge about UAV's and light a flame of passion within the youngsters of the country. Our mission for upcoming years is to participate in real life as well as virtual aero-modelling competitions to showcase our teams' expertise.

3 – FACULTY COORDINATOR AND STUDENT'S TEAM:

3.1 – CLUB HEADS:

- Raj Savla (Academic Year: 2017-2018)
- Brian David (Academic Year: 2018-2019)
- Nathan D'Souza (Academic Year: 2019-2021)
- Prachi Sahu (Academic Year: 2021-Present)

3.2 – CURRENT AND FORMER MEMBERS: (ACC. TO YEAR OF JOINING)

2017-18:

- Brian David (Year of Passing: 2020)
- Vivek Ger (Year of Passing: 2021)
- Shaunak Salunke (Year of Passing: 2021)
- Suparno Ghosh (Year of Passing: 2020)
- Hatim Lakdawala (Year of Passing: 2020)

Faculty Co-ordinator: Dr. R S Maurya, MED, SPCE

2018-19:

- Nathan D'Souza
- Vedant Patil
- Chinmay Dabholkar
- Jui Karmalkar
- Anukul Bokade
- Rudrajit Das (left in 2021)
- Piyush Waman (left in 2021)
- Prakarsha Meshram (left in 2020)

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Department of Mechanical Engineering, SPCE

2019-21:

- Prachi Sahu
- Miheer Kulkarni
- Sadhvi Chaubey
- Dhanashree Mehare
- Isha Likhite
- SushrushaTakone (left in 2020)
- Sejal Ule (left in 2020)
- Harkishan Patil (left in 2020)
- Trisha Pawar (left in 2020)
- Yash Kondkar (left in 2020)
- Aniruddha Deshpande (left in 2020)
- Jay Kapadia (left in 2020)
- Jainam Mehta (left in 2020)
- Anas Menon (left in 2020)
- Shreya Shete (left in 2021)

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2021-22:

- Soham Hirlekar
- Atharva Nene
- Sagar Kadel
- Vaibhav Ramesh
- Nidhi Shah
- Pratik Bhosle
- Lina Patil
- Vedanti Wadhav
- Manjyotsingh Oberoi
- Ayush Jain
- Sakshi Kolekar
- Saloni Raut
- Umesh Lahoti
- Pramesh Kanase
- Janhavi Gite

- Yash Ade
- Roshan Sakhare
- Harsh Habbu

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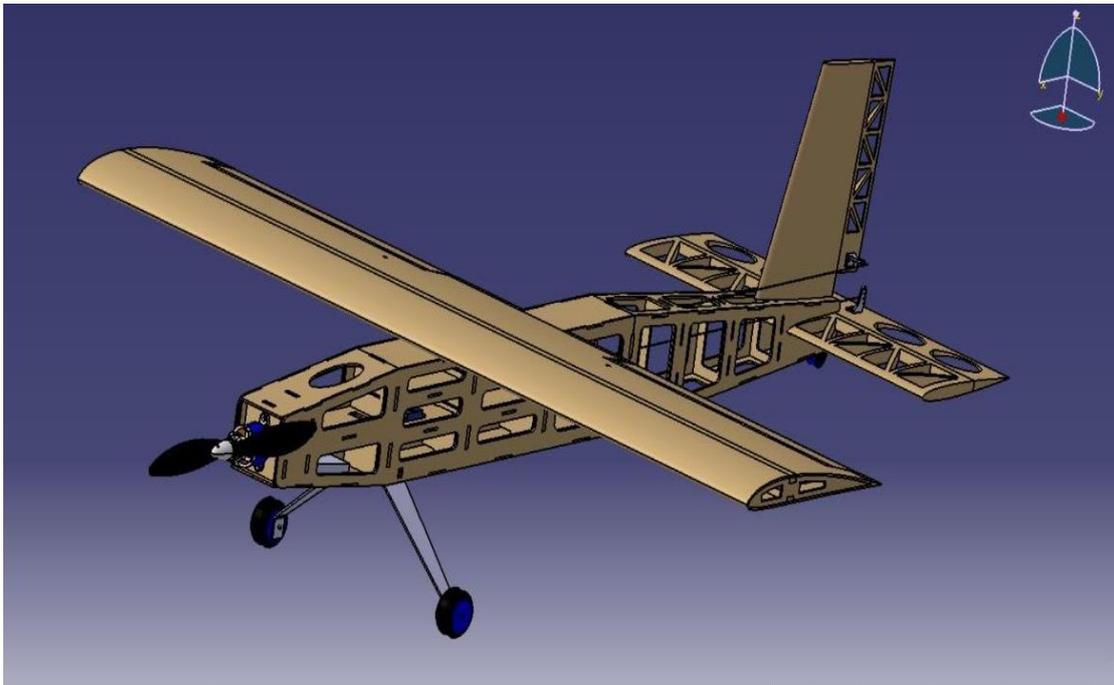
3.4 – COMPETITIONS THE CLUB HAS PARTICIPATED IN SINCE ITS INCEPTION:

- Participated in **IIT Bombay Techfest Aerovaccine** competition in December 2020 and bagged an overall **AIR 2** amongst other teams
- Participated in **SAEINDIA Aero Design Challenge, Southern Section** at Coimbatore in **February 2020**. Team SPCE W.A.V.E. bagged an overall **AIR 8** in the Regular Class category.
- Participated in SAEINDIA Aero Design Challenge, Southern Section at Chennai in **July 2019**. Team SPCE W.A.V.E. bagged an overall **AIR 11** in the Regular Class category.
- Participated in SAEINDIA Aero Design Challenge, Southern Section at Chennai in **August 2018**. Team SPCE W.A.V.E. bagged an overall **AIR 12** amongst 52 teams competing in the Regular Class category

3.5 – EVOLUTION OF OUR DESIGNS OVER THE YEARS:

- **2018:**

Being a rookie team, the design for our first competition was relatively basic as compared to the successive designs. The design was based on the criteria for the competition which was to carry the maximum amount of payload without exceeding the weight and the dimensional constraints. We started with the aerodynamic analysis in XFLR and the validated the same in ANSYS FLUENT (CFD). The aircraft was modelled in CATIA and was subsequently tested in ANSYS STRUCTURAL and ANSYS TRANSIENT STRUCTURAL. We managed to lift an All Up Weight of 5.4 kg, with a payload of 1 kg. We had some issues with the aileron control response which was an obstacle for the plane to be controlled at higher loads. Despite the minor flaws in this aircraft, being our first one ever built with no professional help, we got an AIR 12. This design gave us many new ideas for future projects.

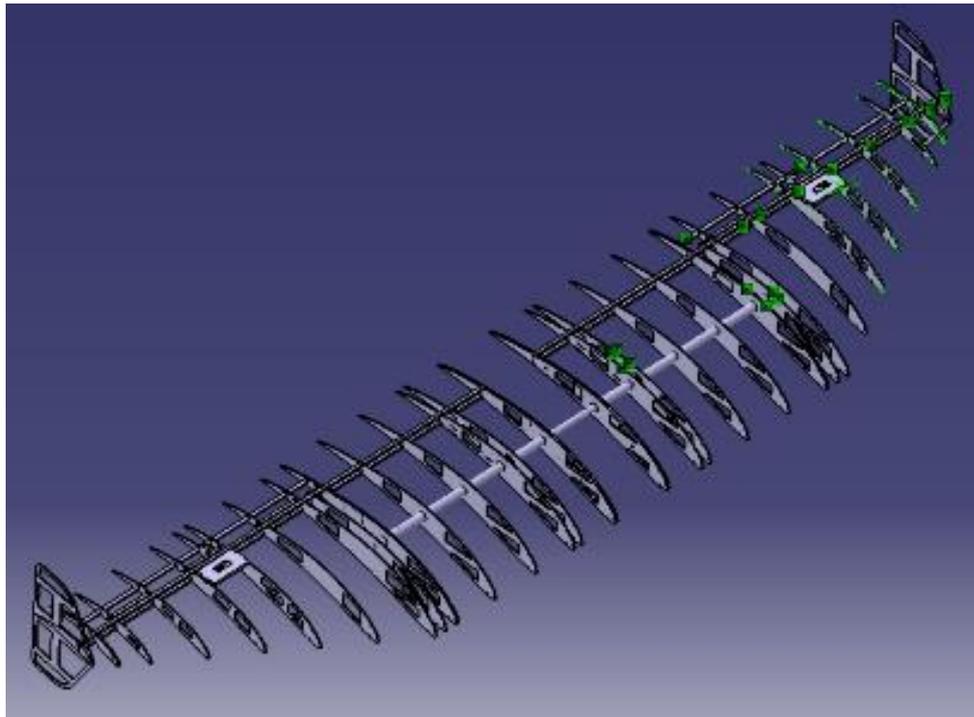


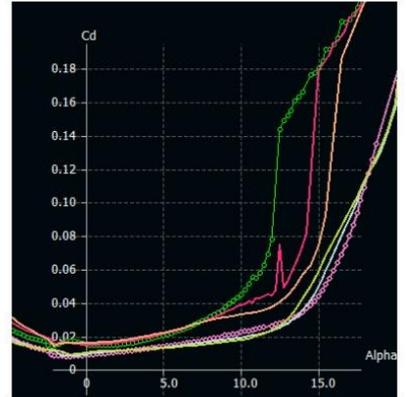
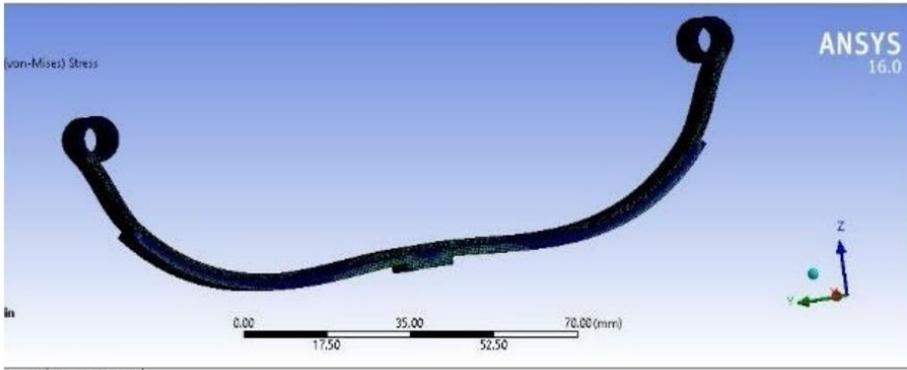
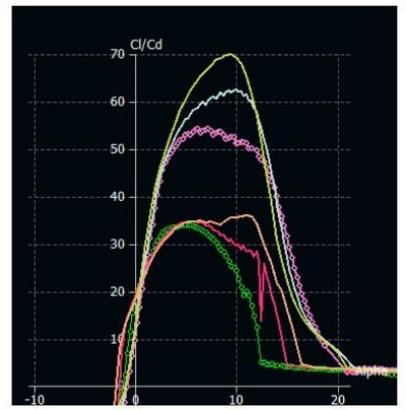
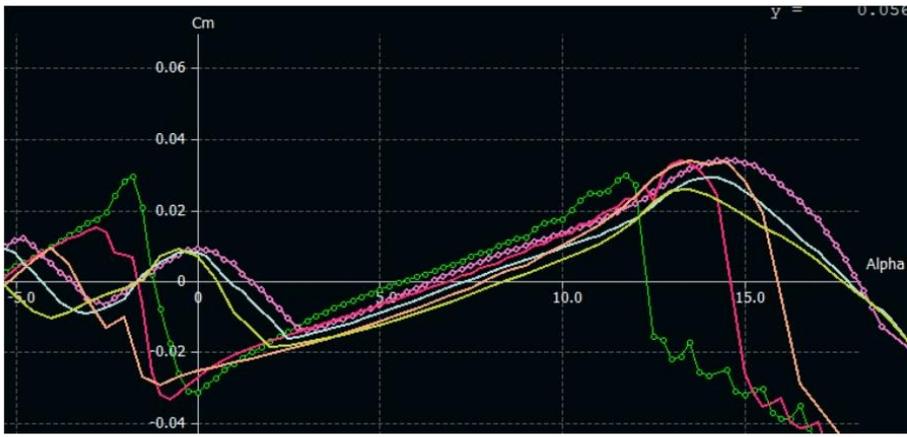
- **2019**

For our second year we started off with a fresh team and fabricated a new plane from scratch, completely different from the previous one. We performed extensive analysis for our design structure to ensure air-worthiness. There were major improvements in the manufacturing process since the design called for a lot of precision. We used fixtures for shaping the plane, a combination of a heat-gun and a monokoting iron, which was an improvement from our manufacturing setup from the previous year. This year also included Leaf Springs as suspension for the landing gear, all of which were designed, analysed, machined and assembled by the team. The analysis was quite similar to the previous year's approach. The design also involved winglets to improve the aerodynamic

performance of the aircraft and the ailerons were resized giving us much better control. We managed an All Up Weight of 6.2 kg, with a payload of 1.9 kg, which is an improvement from the previous year.

This year we also ventured into a new domain by manufacturing a flying wing aircraft, which was designed as a hand launched aircraft capable of taking off without a runway and being launched in tight situations. This called for more sophisticated electronics which involved a 3 axis gyroscope and a flight controller. This aircraft being relatively smaller had an empty weight of 0.75kg and could lift around 0.45kg of payload with a payload to empty weight ratio of 0.6:1

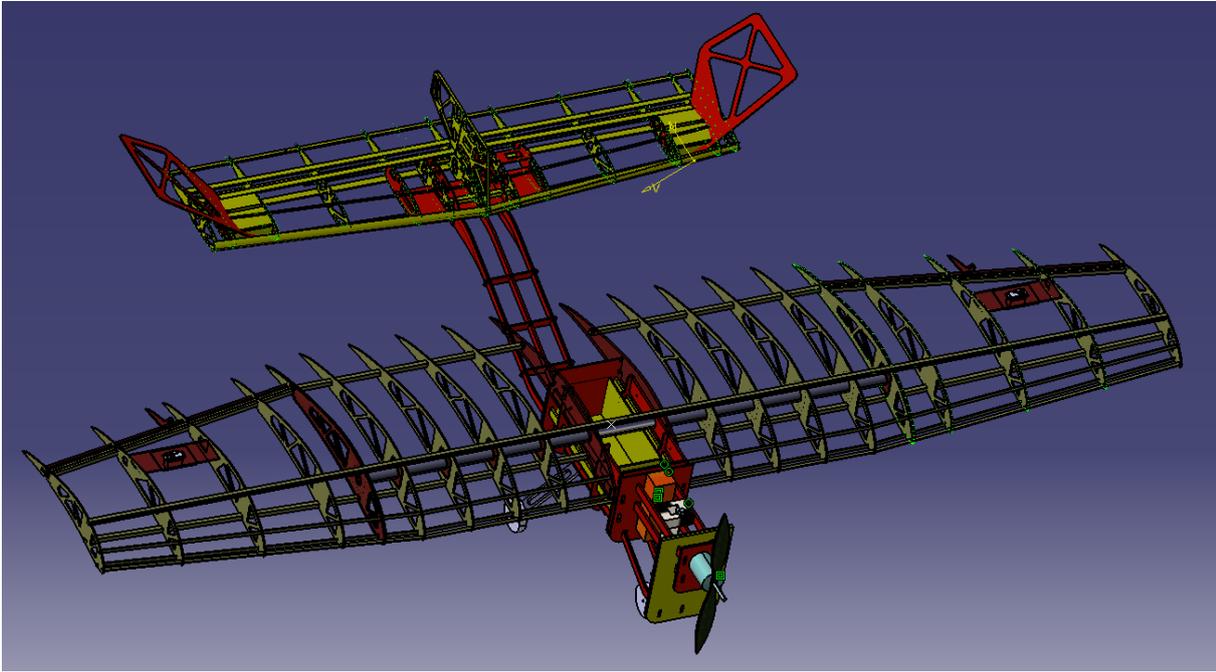






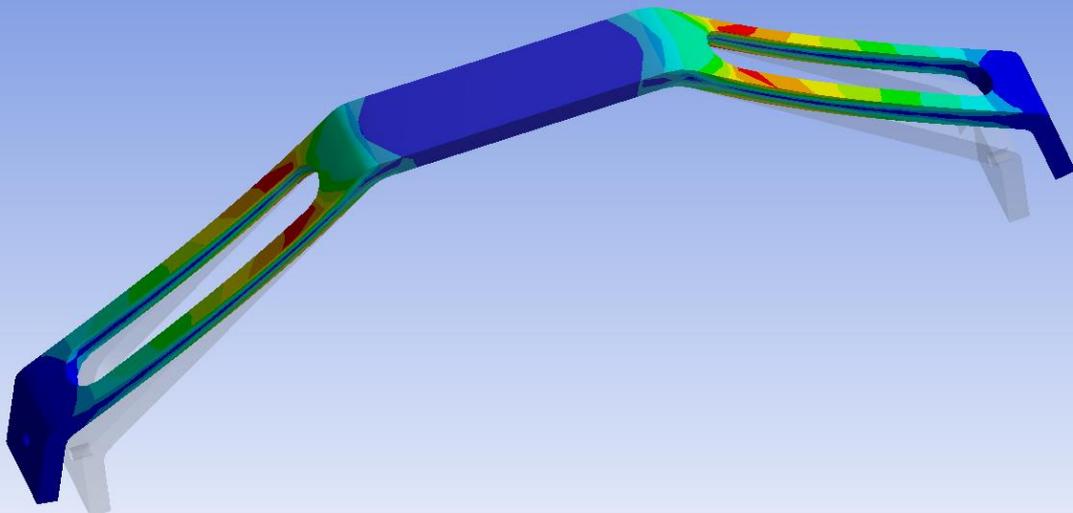
- **2020**

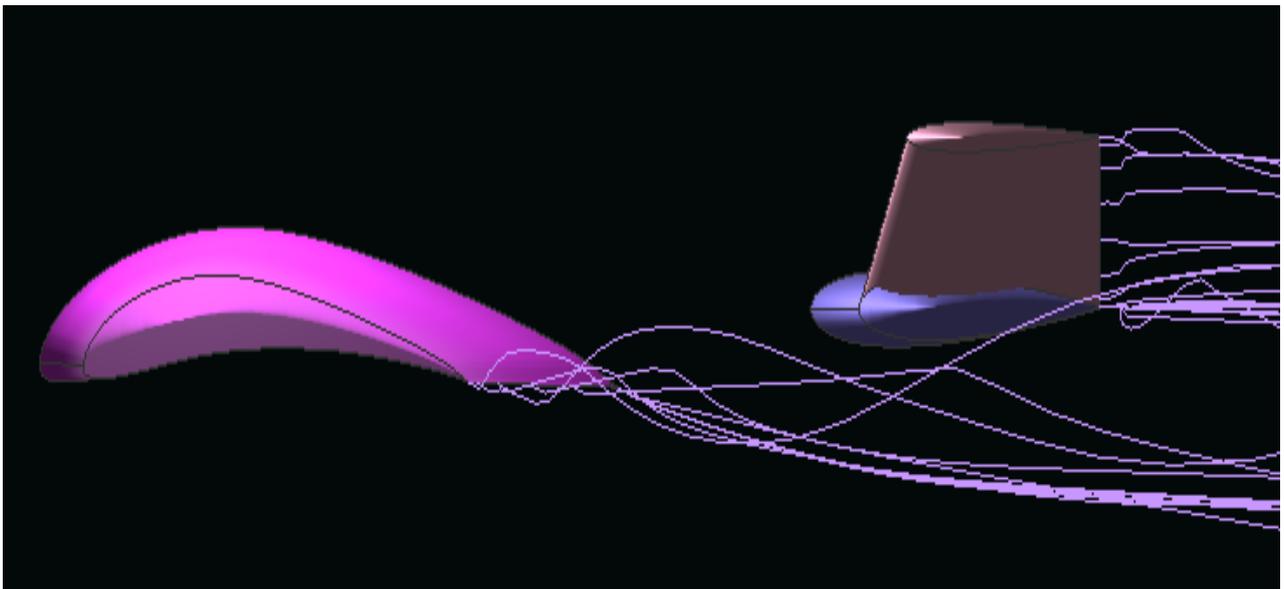
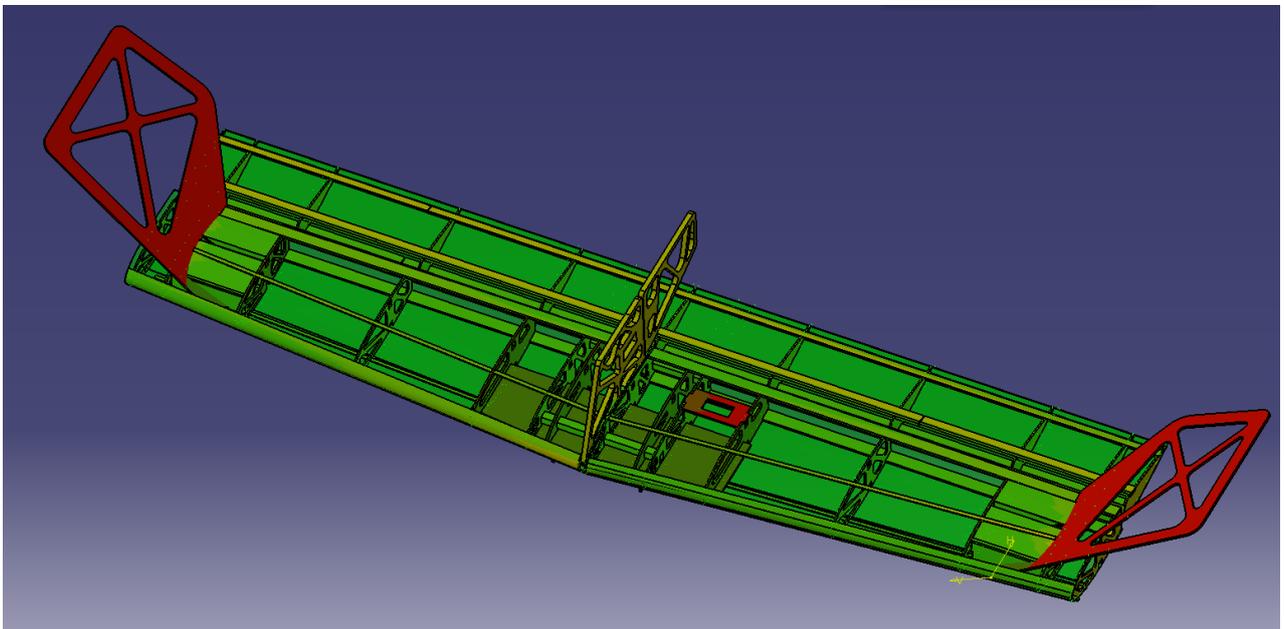
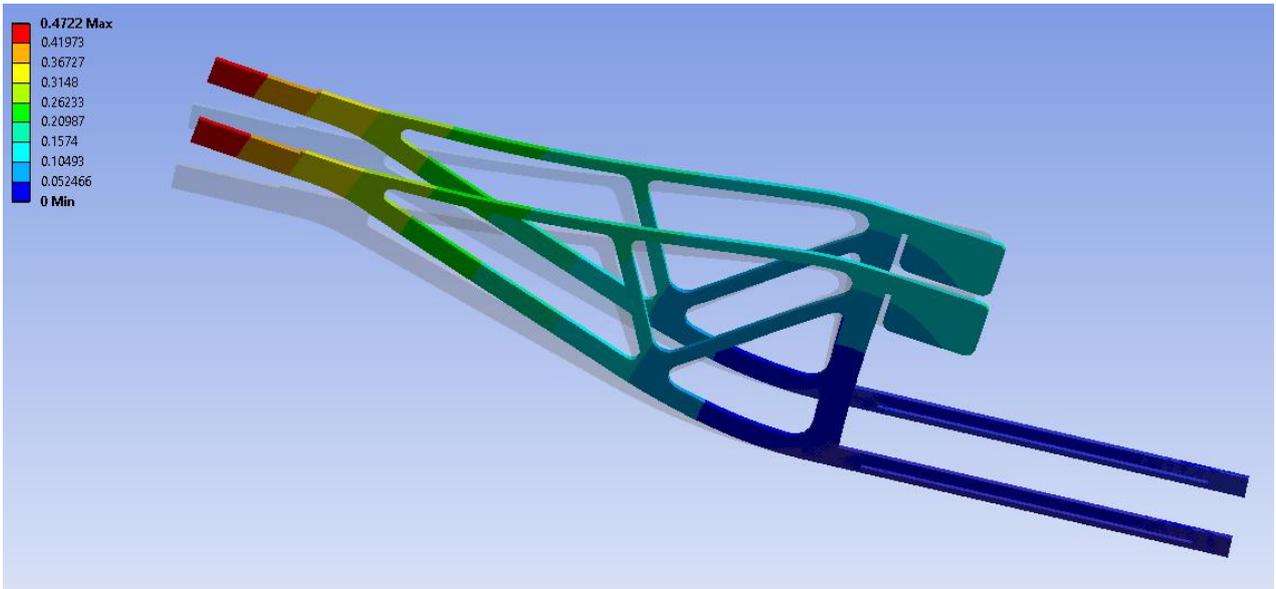
With an experienced team, a new plane was created. This year the plane was rather unconventional since we merged modern ideas with the conventional aircraft design. All the previous analyses were conducted with special emphasis on the structure of the fuselage connecting the tail to deal with the fluttering of the tail and the aerodynamic analysis of a rather unconventional tail. Since the competition was preponed, the entire plane was designed and manufactured in 3 months, which was a big feat. Despite having a larger wingspan than its predecessor it weighed less and also had a shorter overall length due to the constraints, which involved a rigorous optimization process to find the best possible solution. The highlights of this aircraft were that it had a maximum All Up Weight of 14.5 Kg, which was a massive improvement from its predecessors. It had an impressive All Up Weight : Empty Weight ratio of 2.9 : 1 with Thrust : AUW ratio of 0.27 : 1 and due to the dimensional constraints and an attempt to maximize the flight scores the aircraft had an unconventional Wingspan : Total Length ratio of 1.78 : 1, which is unconventional yet works in a spectacular way. The weight optimization was much more successful than the previous years with a potential weight saving of around 1.4 kg (when the previous year's models were extrapolated to the current size). This was the first time in the club that a steerable nose landing gear was manufactured by the team. Other aspects involved manufacturing our own wheels, connecting rods and nose gear mechanism.



G: Copy of 13cm t=7mm
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: MPa
Time: 1
15-Jan-20 9:18 PM

146.86 Max
130.55
114.23
97.916
81.6
65.204
48.969
32.653
16.338
0.021878 Min







3.6 – MANUFACTURING DETAILS

Transition from detailed 3D virtual model to a highly functioning aircraft involves employing manufacturing techniques like CNC milling, 3D Printing, Laser Cutting, Grinding and Welding to name a few.

- Laser cutting: First step is laser cutting wherein the parts of the plane are made out of balsa and plywood based on the CAD design provided. Wing and tail ribs, Servo supporting plates, Fuselage formers etc. are a few parts manufactured by this process.
- 3D Printing: Few components of the plane built with the help of 3D printing.
- Lathe Turning: Employed specifically for the landing gear wheels. Blocks of Nylon are turned in wheels using the lathe machine.

- CNC Milling: Metal plates, Nose gear, saddle, landing gear are a few of the many components which utilizes CNC milling.
- Grinding and Welding: These play a crucial role in the manufacturing of the nose gear.
- Assembly: The pieces of balsa and ply are fixed together with adhesives. This process is aided by fixtures and design plans.
- Monokoting: After assembly, a film of lightweight plastic is used to cover the plane that gives it a smooth outer skin.

All of these pieces are brought together to bring our virtually designed model to life. This step requires a lot of precision and is also crucial in realising design oversights which makes this an overall important stage of the fabrication process.

3.7 – THE INDIVIDUALS BEHIND OUR SUCCESS:









3.8 – FUTURE PLANS:

We aspire to represent India on a global platform. With our rapidly growing success in India (AIR 8 in just 3 years and AIR 2 at IIT Bombay Techfest Aero vaccine competition in our first attempt), in the nearer future we plan on representing India at an international level at SAE International Aero Design, where we could bring laurels to the country at a global level.



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Good News from SPCE WAVE Team

Dear All Stakeholders,

It gives us immense pleasure to inform you that the **SPCE W.A.V.E.** has secured a **2nd Rank Overall** at the **AeroVaccine Competition** held at **IIT-Bombay's Techfest 2020** on the **19th - 20th December, 2020**.

The aim of the competition was *to design a conceptual Vertical Takeoff and Landing (VTOL) aircraft to carry and distribute vaccines to remote areas.*

The competition was divided into 2 stages. The 1st stage consisted of the design report submission wherein teams from all over India needed to submit their design report which elaborated their detailed designs (aerodynamic, structural and logistic) and innovative ideas and based on the feasibility, innovation, cost effectiveness and designing capabilities teams were selected for the 2nd round. In the 2nd round teams had to present their ideas and detailed aircraft designs to a panel of judges who then evaluated the teams based on the above criteria.

The competition's official website can be found here:

<https://techfest.org/m/competitions/aerovaccine>

We are extremely grateful for your undiminished support and the help you have rendered us throughout our journey which has helped us achieve this position.

We received an official email with our results on the 26th December, 2020 and are *still awaiting the official rank list and our merit certificates.*

We once again thank you for your support and for believing in us. We are grateful for the same.

Yours Sincerely,

SPCE W.A.V.E.



Result and Rank for competition, Techfest

Inbox



Nisarg Toliya

to me

[Hide details](#)



From: Nisarg Toliya nisarg.techfest1@gmail.com

To: anukul.bokade.27@gmail.com

Date: Dec 26, 2020, 10:43 AM

[View security details](#)

Greetings from Techfest, IIT Bombay
Congratulations, Your team has secured a position
in Aerovaccine .
Your team, 202045, has secured 2.

Please fill this form [https://forms.gle/
PU934tgMjjVp6VL87](https://forms.gle/PU934tgMjjVp6VL87)

And, Please send your bank details as following to
shubhamgautam@techfest.org

FORMAT OF MAIL : Subject: Aerovaccine , team id,
Position

Body of mail:

1. Account Holder's Name
2. Account Number
3. Bank name and Branch name.
4. IFSC Code