BOEING – IIT NATIONAL AEROMODELLING COMPETITION: SOUTH ZONE

TEAM DESCRIPTION PAPER

TEAM DETAILS

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Technical Description of Plane

1. Give a brief description of the construction of plane and the structural materials used in the construction of the plane.

   The structurally firm construction of our plane was done using the stressed skin construction method. It is a type of structure which is halfway between a monoque and a rigid frame structure in which the compression taking elements are localized and tension taking elements are

distributed. The fuselage is built almost entirely out of tension-taking coroplast (sunpack) with compression-taking sunboard plates at suitable locations to provide reinforcement and prevent buckling. Coroplast is a very well-known material and is used by many RC Plane enthusiasts. It is a tension-taking plastic sheet which is extremely durable and does not get damaged by wet grass unlike foam. Its durability stands even in the most fatal of crashes because it tends to bend rather than break apart. At some internal locations of the fuselage, we have installed two coroplast sheets of which the flutes are orthogonally oriented to provide further strength and elsewhere carbon fiber rods have been inserted in the flutes to avoid bending and warping. Sunboard is a brittle substance and hence is strong under compressive loads. However, it is heavy and fractures easily, so we have placed it at strategic locations to provide extra strength at a smaller expense of weight. The fuselage is streamlined by providing a sleek taper which helps to reduce drag. The wings, horizontal stabilizer and vertical stabilizer are also made of coroplast. The wing has an outer covering of a coroplast sheet around airfoil shaped ribs of depron and sunboard separated by a suitable distance. The wing is mounted on a wedge (made of sunboard) at an angle of attack of 3° using rubber bands and Velcro. The empennage design used is that of a conventional tail and the horizontal and vertical stabilizers are mounted at the aft of the fuselage. The motor is mounted on a thick plate attached to the coroplast at the nose of the

fuselage. Appropriate weight distribution is carried out to keep the center of gravity in the center of the payload bay.

2. Give the total weight of the plane and an estimate of the weight of each structural and electrical component used in the plane.

   Total Weight (without payload): 895gm

   (i)Wing: 304gm
   (ii)Fuselage (along with horizontal and vertical stabilizer):300gm
   (iii)Battery: 153 gm
   (iv)ESC: 25gm
   (v)3 Servo motors each 10gm
   (vi)Motor: 51gm
   (vii)Propeller: 10gm
   (viii)Receiver: 16gm

3. Mention the Specifications of all The Electronic Components Used (Battery voltage and capacity, ESC Rating and motor characteristics).

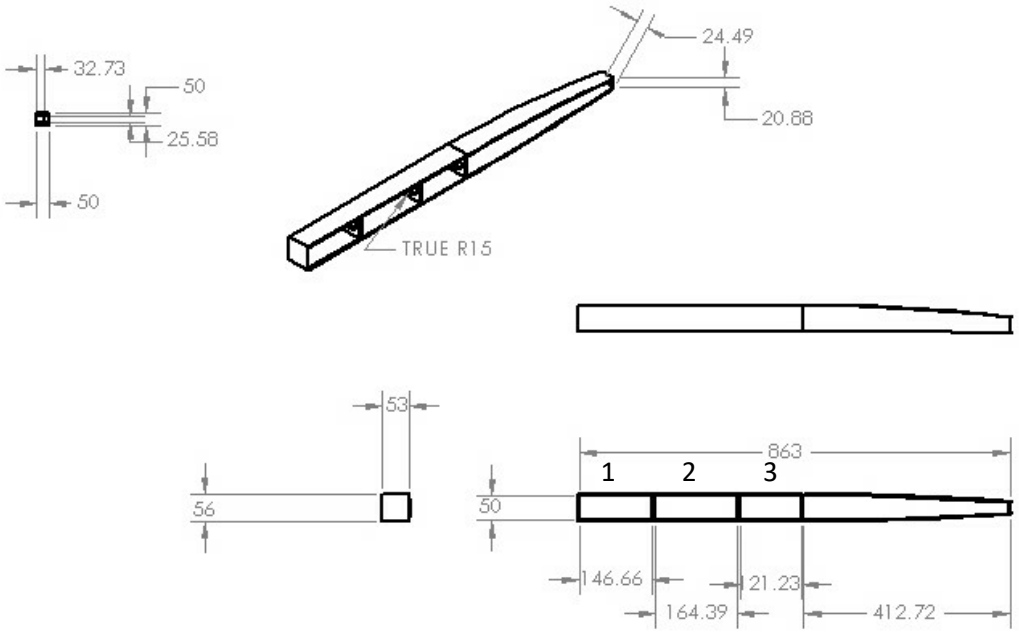
   (i)Battery Voltage and capacity: 1500mAh 3S LiPo(11.1V)
   (ii)ESC: 30 Amp
   (iii)Servo Motor: Micro servo SG90
   (iv)Motor: 1000 kV, BLDC motor.

4. What is the propeller size and the maximum thrust produced by this with your motor? Mention the T/W value for Your plane (Refer to the problem statement for regulations of T/W, wingspan, propeller dimensions, etc.).

   (i)Propeller size: 9*7.5
   (ii)Maximum thrust = 660gm (measured using a spring balance apparatus-least count 20gm)
   (iii)T/W ratio: 0.737 (<0.75)

5. Give Dimensions of the plane and the approximate position of CG.

   Following are the dimension of the fuselage:



   The wing will be placed on the 2nd cavity. The CG of the plane is in the center of the 2nd cavity.

6. Mention the desired cruise speed and the dimensions of the wing and give an approximate value of lift produced at this speed.

   The wingspan of our rectangular wing is 119cm (including a dihedral at wingtip of 17 degrees) and the chord length is 24 cm. The wing is placed so as to have a 3 degree angle of attack.

   The coefficient of lift from wing found through ANSYS Fluent analysis in the operating speed range is 0.36.

   (i) For lifting the plane without payload optimum speed comes out be 11.5 m/s to 12 m/s.

   (ii) For lifting the plane with 3 payload balls optimum speed is 13 m/s to 14m/s.

7. What is the estimated length of runway required for the plane to takeoff?

   The plane is going to be hand launched, there is no need of a runway.

8. Describe the Dropping Mechanism Used and the maximum payload which can be lifted by the plane.

   The dropping mechanism consists flap below the payload bay which opens outside the plane. The flap is shut using a spoke which is attached to the

servo. When the servo is actuated the spoke is pulled and the flap drops down. The flap is further has a rubber band attached to it and on the lower surface has one side of the Velcro and the other side is on the side. When the flap drops the rubber band pulls the flap back with force and it sticks to the Velcro. The flap remains open and the payload is dropped. Refer to the video added in the link containing the photos. The plane is designed to carry three payload balls as mentioned in rulebook (3*45 = 135 grams).

9. Share some Pictures and Videos taken of the plane during and after Construction via a drive link.

   The link is as follows:

   https://drive.google.com/drive/folders/1gZdMQx8EAefbdUhapHs47POzatlQ3BwO?usp=sharing

10. Safety of bystanders is a major concern for Drone aviation. What safety considerations does your drone incorporate. Does it have something like a kill switch?

    Yes. The drone is fail-safe as it has a kill switch. The kill switch can be set in the transmitter such that the plane either remains in air so that bystanders are not harmed or can also be set that the throttle is -100% so that the plane crashes down in case of failure.