VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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Synopsis

On

"FABRICATION OF ADVANCED SOLAR AIRCRAFT"

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Submitted in partial fulfillment of the requirements for the award of degree of

Bachelor of Engineering

in

Aeronautical Engineering

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Introduction:

The job of associate degree engineer is to simply accept the challenges of conveyance new concepts and ideas to life. The aviation industry and manufacturer's unrelenting passion to enhance the performance of commercial and military aircraft is constantly driving the development of improved high performance structural materials with low fuel consumption. Composite materials are one such class of materials that play a significant role in current and future aerospace components. Composite materials are particularly attractive to aviation and aerospace applications because of their exceptional strength- and stiffness-to-density ratios and superior physical properties. In addition to the main benefit of reduced weight and formability, composite materials offer better resistance to some forms of corrosion than metal alloys and good resistance to fatigue and crack in the brittle fiber is halted, when it meets the tougher resin matrix.

The solar powered aircraft can provide emission free air travel and reduce the environmental burden of aviation fuel it has also reduced the dependence on foreign oil and fossil fuels. We can use these for continuous flight without refueling. Though there is no consumption of fuel it can be used in all other purposes like aerial survey, cargo, military purpose etc. These aircrafts are light weighted and hence it has the capacity of carrying less weight in the lower altitude.

Objectives:

Our main objective of this project is to design, fabricate and conduct the performance test on the composite based solar aircraft. Aircraft engineers have been making consistent efforts to improve upon aircraft design and its numerous key components. One of the challenges has been to keep the weight of the aircraft down by the use of new light-weight materials. Composites offer a very attractive option in modern aircraft development as they are lighter than metal and just as strong. The greatest value of composite materials is that they can be both lightweight and strong. The heavier an aircraft weighs, the more fuel it burns, so reducing weight is important to aeronautical engineers. Hence in this projected we have made use of composite material to build entire aircraft. Another vital problem in aviation sector is the fuel. The aviation industry faces significant challenges in improving environmental sustainability and reducing its carbon footprint. Therefore this aircraft is designed to fly using solar proportional energy, and provide an enormous output of flying hour. It is a hybrid solar aircraft equipped with air cushion landing, parachute, humidifier, and camera and even has PIR motion sensor.

This aircraft has advance landing method, through aircushion it can take off and land from any kind of surfaces such as water, sand, snow etc. Here the aircraft is equipped with parachute for emergency landing, and camera along with GPS helps us track the aircraft. The camera installed will also help us get 180° view, at canopy PIR motion sensor is installed which works as a camouflage and sense the movements nearby. Even when the aircraft is landed on dense forest, deep water body, or desert these sensors helps to sense and locate the enemy movements nearby.

Methodology:

Design of aircraft: The design process of the entire aircraft was initially divided into four segments:

a) canopy

b) centre fuselage

c) rear fuselage

d) Delta wing

In conceptual design, the basic configuration arrangement, size, weight, and performance are calculated. Then, designing the CATIA V5 modelling of individual parts in order to meet the required targets and optimizing it are done in preliminary design.

Table 2.1: Mission specification

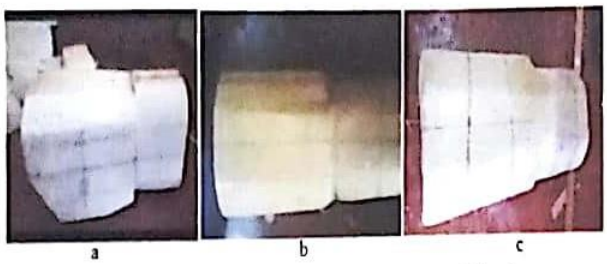
Parameters	SI units
Gross weight	2.5 kg
Payload	0.5 kg
Altitude	30-50m
Take-off distance	None (hand toss launch)

Fabrication:

An initial preparation of all the materials and tools that are going to be used is a fundamental standard procedure when working with composites. This is mainly because once the resin and the hardener are mixed, the working time (prior to the resin mix gelling) is limited by the speed of the hardener chemically reacting with the epoxy producing an exothermic reaction. Also, as part of the initial preparation, the woven cloth must be cut according to the shape of the part.

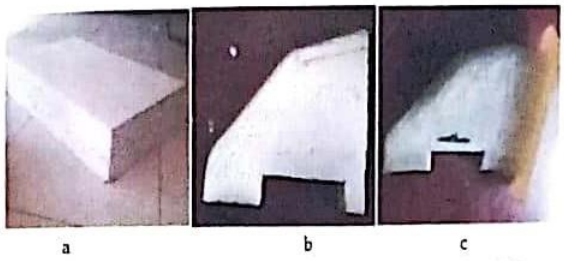
Initial procedure for layup was to make mold using White Extruded polystyrene (XPS). Once the mold is done to the required shaped as in design, mold has to be cleaned with a clean cloth, once cleaned we applied we releasing agent throughout the mold.The first step is to mix the resin and the hardener. The proportions are usually given by the supplier and can be found on the containers of the hardener or resin. For this layup the ratio taken is 3:1. Next an adequate quantity of mixed resin & hardener is deposited in the mold and a brush is used to spread it around all surface along with pieces of paper cards as reinforcement. The first layer of fiber reinforcement is then laid. This layer

must be wetted with resin and then softly pressed using a brush. If the fiber is not completely wet, more resin can be added over the top and spread around. At this stage a second layer of glass fiber is added and special care must be taken to eliminate all air bubbles possible. This can be accomplished by brushing out the air bubbles with a paint brush. The part can be cured at room temperature. Generally, the proper curing time of each type of resin-hardener, as well as the working time, is 12 hours. For the purposes of this experiment and using an epoxy resin system, room temperature curing is adequate.



a b c

Fig: (a) Mold of fuselage (b) taped mold of Fuselage (c) fabricated fuselage



a b c

Fig: (a) Foam cut in dimension of 350x500mm (b) Foam cut to design (c) fabricated wing

To trap the solar radiation, the solar panels will be placed throughout the surface of wings. We have installed 10A intelligence LCD solar controller and the power obtained will be supplied to propulsion group and on-board electronics. Here the concept is to attach air cushion to the bottom of aircraft fuselage. Air cushion uses blowers to produce a large volume of air below the hull that is slightly above atmospheric pressure. The pressure difference between the higher-pressure air below the hull and lower-pressure ambient air above it produces lift, which causes the hull to float above running surface. To make this solar aircraft more innovative there is a parachute deceleration system used to slow down aircraft during landing. The design of parachute is driven by loads. Loads are calculated by using atmospheric density, velocity, parachute, drag area and mass. The parachute will be made out of 2 durable lightweight fabrics: Polyester and nylon.

Conclusion:

As per the previous records the material used will be strong in compression, tension and bending, and would also result in higher mechanical strength that will be served for domestic thermal insulation. The implementation of the aircushion would result in landing and takeoff of aircraft on any kind of surface that will be much beneficial in military and emergency situations. The parachute equipped will help the aircraft breakdown its speed, in case of emergency landing which in turn will save the aircraft from crash land. The use of humidifier would help us predict of climate in general and weather in particular, especially with the possible negative consequences that may occur, which will help the aircraft to fly without any obstacle. This aircraft is also equipped with

MPPT, this not only maintains solar charge but also charges other batteries used. For advancement of aircraft we have installed parachute for emergency landing, aircushion which helps in takeoff and landing from any kind of surface, camera is installed in canopy for 180° view, GPS for tracking location, and PIR motion sensors is used as camouflage which can detect the movement of object nearby.

Scope for future work:

A growing number of commercial and military aircraft are using composite materials, which is driving the expansion of the aerospace composites market value. Additionally, aviation sector is into development of fuel-efficient light weight aircraft, installation of solar panels will provide enormous amount of flying hour with no carbon footprints which helps in emission free flying. Therefore in future solar aircraft made of composite will satisfy two major problems in aviation. In military sector landing and takeoff has also been a problem because of limited runways, by using aircushion that enables aircraft to takeoff and land from any kind of rough surfaces, this helps pilot to attack enemy field without worrying about landing or takeoff surfaces. For safety purpose this aircraft is installed with camera, GPS, and PIR motion sensors, these device help in providing the aerial view with location, the camera can also be used to know the illegal activities happening. When pilot decides to hide in enemy area PIR motion sensors act as camouflage, it detects the movement of objects nearby and sends information digitally. During flight to avoid sudden breakage of network due to weather effect, humidifier is used to measure critical air quality parameters including particulate matter, VOC, humidity, and temperature in a compact and the result is fully calibrated digital output. Here we have used parachute for emergency landing but in future it can be used for sound free landing.