未完

— MIKAN —

TOYO UNIVERSITY

Shuhei.W Toshiya.T

Indoor flight robot contest September 26 27,2015

CONCEPT

FOR SURE ACHIEVEMENT OF 3MISSIONS

In order to achieve on-board payload, carriage of relief supplies and operation with no hand, we selected the propeller with sufficient thrust performance, constructed the durable main wing even under the large wing load and realized the main wing with high flight ability under the region of low Re number.

ROBUST MAIN WING

EPP is adopted to construct the durable main wing to a number of crashing. Furthermore, the carbon pipe is used as the spar and the film is pasted over the main wing to realize high strength and high durability. The main wing have the robustness to repeatedly bending force and the restorability of the original form.

TOTAL WEIGHT

+

PAYLOAD

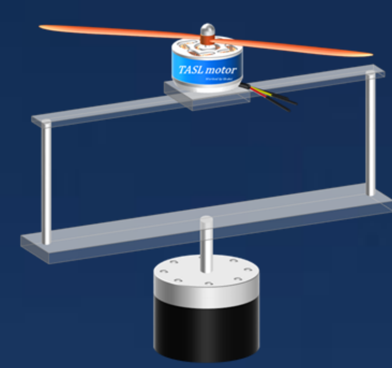
+


RELIEF SUPPLIES

= 251g

SELECTION OF PROPELLER

Thrust performances about four kinds of the propellers with 2-cells brushless motor are compared using 6-component load cell. From the experimental results, 8×6 propeller with the light weight and with the maximum thrust is adopted.


Load Cell

RESULTS OF THRUST MEASUREMENT

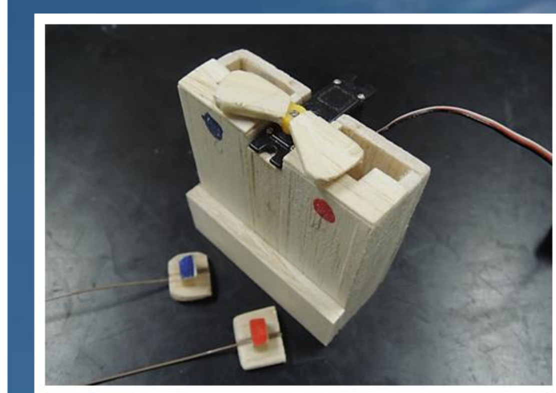
	① 8×6	② 8×4	③ 8×4	④ 8×6
Weight [g]	4.3	3.9	7.1	7.1
Max Thrust [N]	1.66	1.52	1.53	1.27
Moment [N · m]	0.028	0.032	0.027	0.029

SPECIFICATION

Length	810mm	Weight	191g
Span	900mm	Wing Area	17.95dm^2
Height	210mm	Battery	Li-po 2s


SIDE VIEW OF MIKAN

TRANSPORT DEVICE


DROPPING SYSTEM

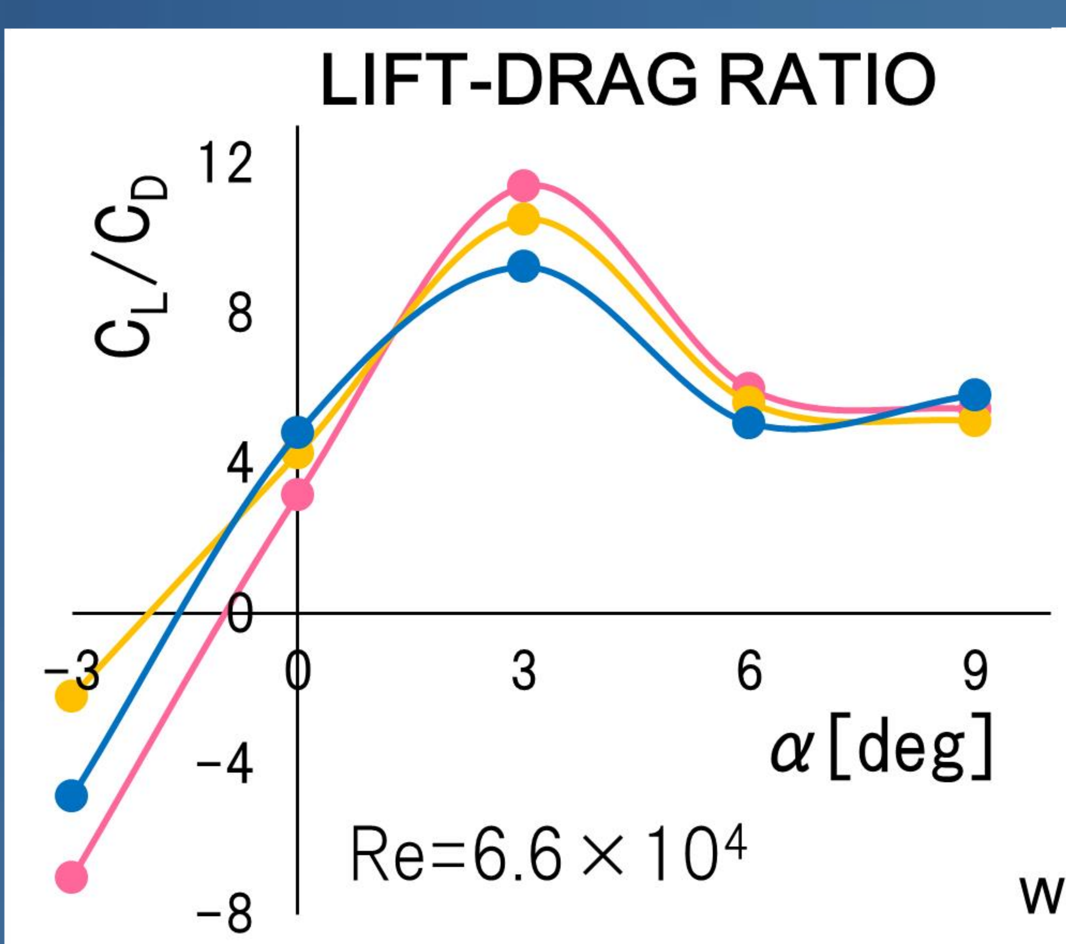

PICKING UP SYSTEM

For the weight reduction, the balsa wood is used to the dropping system. Two relief supplies are reliably dropped by driving servo motor. Picking-up system is designed using the neodymium magnet to capture the items.

DESIGN METHOD AND WING PERFORMANCE

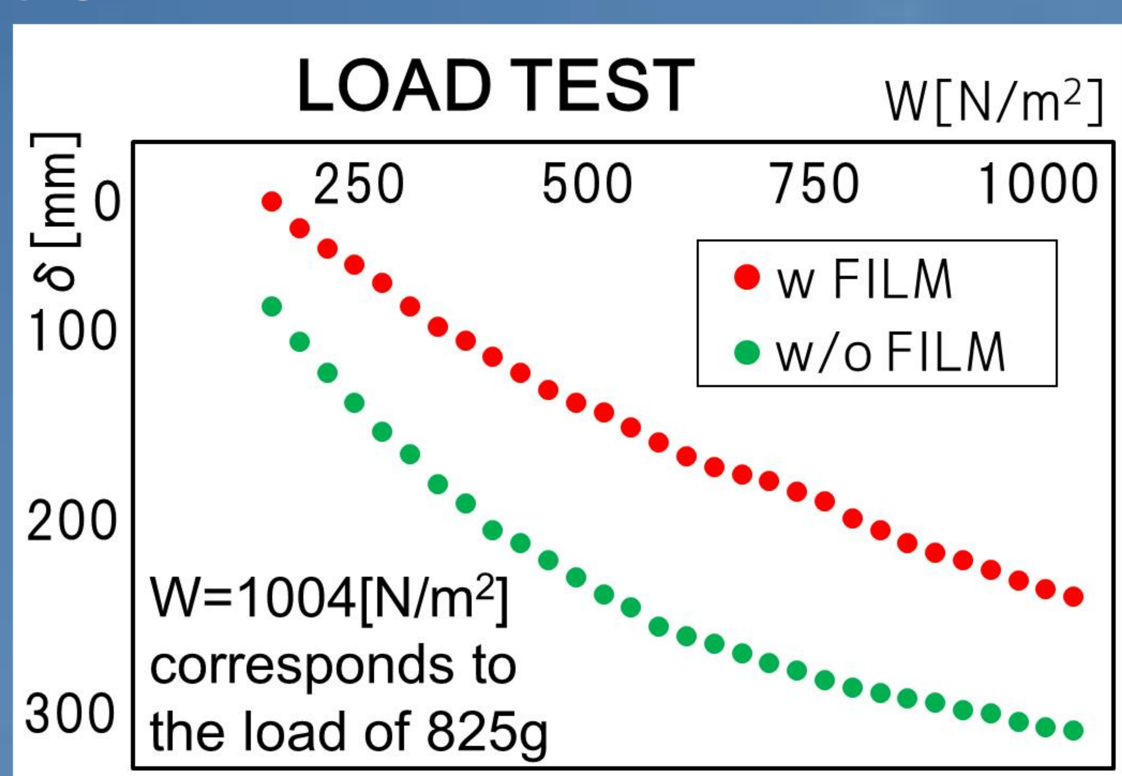
In order to investigate the wing performance, we measured the aerodynamic forces using the 6-component load cell. We tested three kind wing model which is produced using 3D printer. Our experiments are performed under Re=6.6×10^4. We selected “KLARK Y6” with the most lowest drag and the maximum L/D at α=3deg.

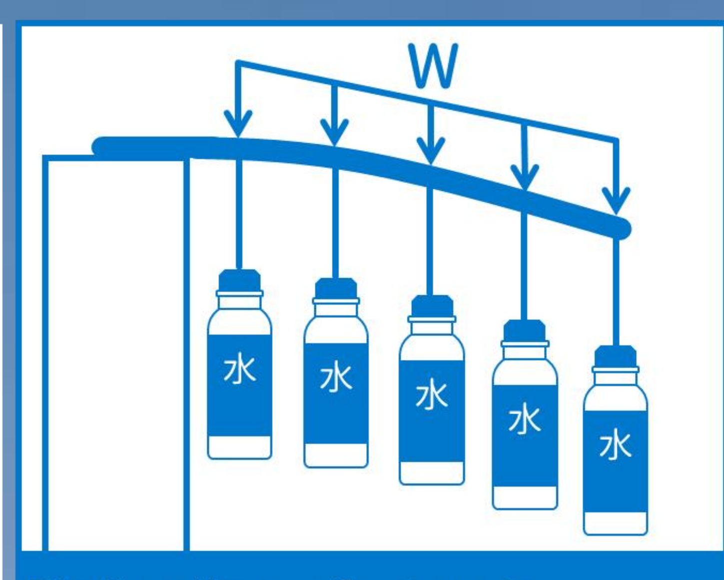

WING MODEL




WIND TUNNEL TESTING DEVICE

EPP is cut off using the heated nichrome wire with the appropriate tension and is manufacture as “KLARK Y6” of thin airfoil with maximum thickness of 7mm. Through the load test , we confirmed that the main wing can bear even at the maximum load of 850g and the strength of wing is reinforced by applying the film.

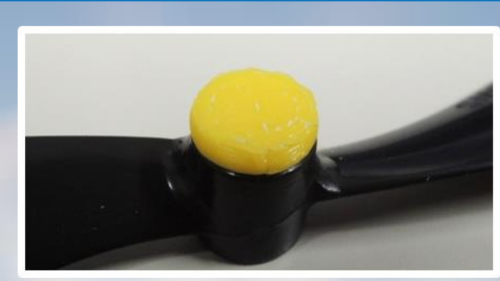




Deflection of wing is measured per every 25g of water in the loading test.

SAFETY

An impact of crash is absorbed using the sponge attached at the leading edge of propeller plug produce using the 3D printer.


PROPELLER PLUG

How supersonic airplanes such as with a delta, double delta, or rhombus wing flies at low speed ?

Kohei KUDOH[1*], Keishiro HASHIGUCHI[1] & Tatsuya ISAYAMA[2**],
Team Flutter, Dept. of Aerospace Systems Engineering, Sojo University, Kumamoto, Japan
[1] Sophomore, [2] Senior, * Leader, ** Designer

Concept : A supersonic airplane must has the ability to fly at both high and low speed, which conforms to various missions of the present contest. Thus, two types of wings used for supersonic airplanes were adopted; a rhombus wing structure was considered to fly at the contest if possible and a double delta was the next; actually both single and double delta wing airplanes were made as shown in Fig.1.

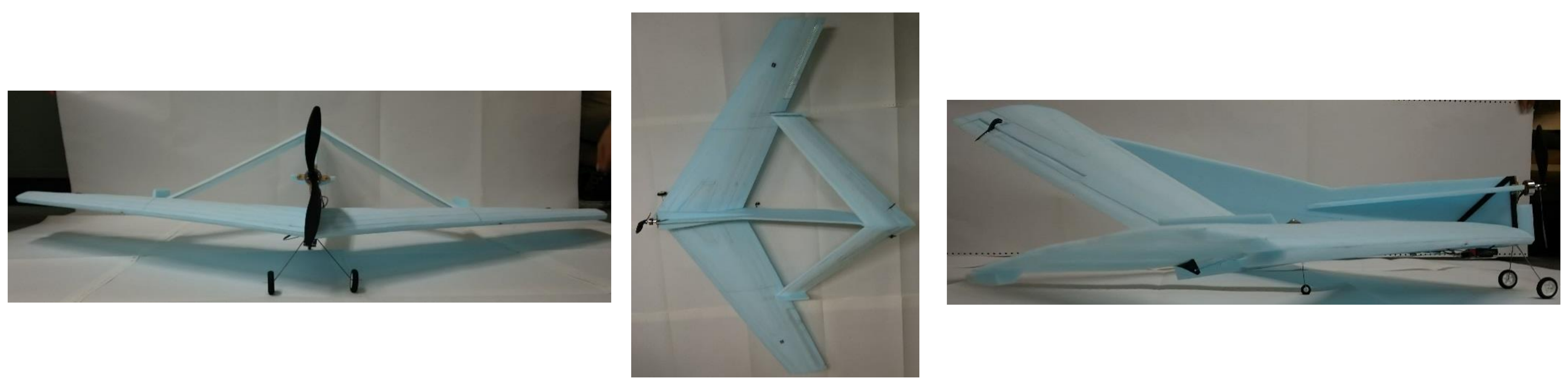


Fig.1-1 Rhombus wing airplane: L=9.2, 2b=12, H=2.5(in dm), W=190grf, A=24.2 dm^2, W/A=7.9grf/dm^2; less roll performance; crashed in the test flight.

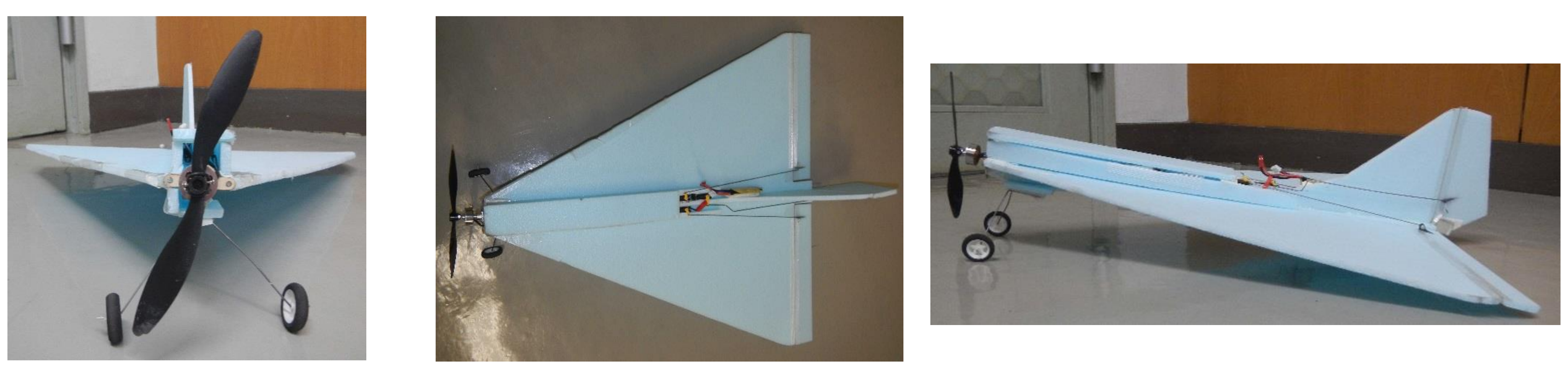


Fig.1-2 Single-delta wing airplane: L=5.5, 2b=5, H=1.65(in dm), W=148grf, A=12.8dm^2, W/A=11.6grf/dm^2; flight ability less than double delta; recorded.

Fig.1-3 Double-delta wing airplane: L=7.1, 2b=7.2, H=2.3(in dm), W=172grf, A=20.8dm^2, W/A=8.3grf/dm^2; damaged in recording and repaired.

Design method

Rhombus wing : A wing structure with spars and ribs frequently becomes unsymmetrical due to the accumulation of small errors in cutting and adhesive joining process. Thus, slender tapered plates with the rectangular cross section were stacked and adhered to form an airfoil like a Wright flyer one with additional steps. A symmetric swept wing was easily obtained since the cutting line is linear and the cutting surface is perpendicular to the plate surface. Then, the upper surface were smoothed by a design knife and the lower stepped surface left alone had an additional role as stringers.

The horizontal stabilizer had a forward swept wing structure and a taper ration of a little bit larger than 1. Its tip section was adhered to the main wing to make the main structure rigid.

Delta wing : Symmetric and rigid structure is obtained by using only a 5mm-thick polystyrene foam plate. A double delta wing is made by adhering a trapezoid with a concave to the trailing edge of a single delta wing, where the adhesion line has a U-shape and the strong shear resistance is expected.

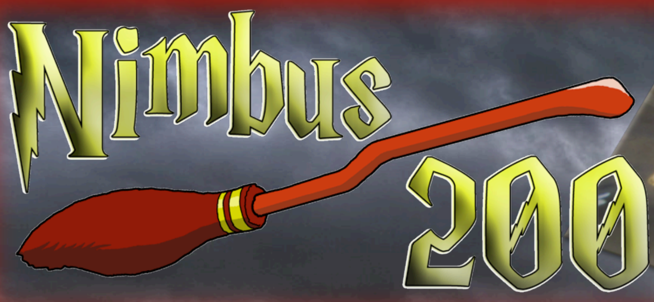
Manufacturing and Test flight : Smoothing the upper surface with a design knife was a time-consuming process. The rigidity within the rhombus structure was high as expected; almost a third of the main wing was outside of the rhombus to set an aerodynamically effective aileron there. However, the resulted rolling performance was not appropriate at low speed and crushed against the concrete pillar in the vacant machine shop space during the flight test for rolling performance.

A delta wing airplane was quite easy to integrate and the rigidity was high as expected. However, controlling the flight was not easy and it does not seem to have enough ability for gliding neither for unrestrained flight.

A double delta airplane showed an acceptable flight ability. Unfortunately, a typhoon in August damaged the large gymnasium of Sojo University whose reservation for video-recording was forced to be cancelled, and the double delta hit against the extruded shelf of the small hanger in the flight for recording and was damaged. Thus, the flight of the single delta was performed in the same hanger; fortunately, it could fly without any accident during recording. The double delta airplane, an improved version of the single delta was repaired successfully in time for the contest.

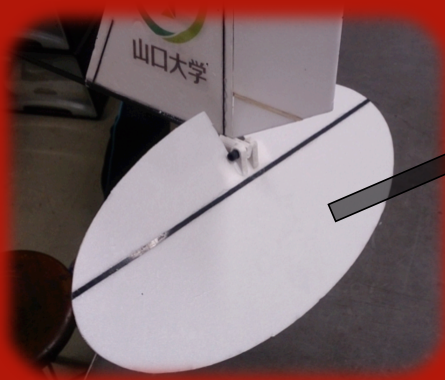
Safety : A double delta wing airplane in Fig.1.3 has the required safety such as turning off the power at emergency, a safety cover on the extrusion to the forward direction, and fail safe design in the throttle channel of transmitter and receiver.

Nimbus 200



CHARACTERISTICS

ALL-MOVING TAIL



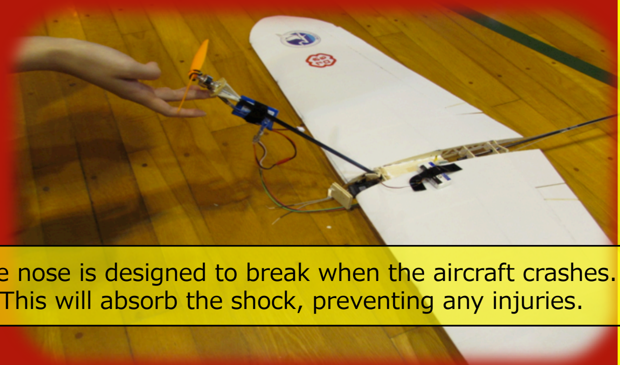
Stabilizer + Elevator

- Drag reduction
- Pitch controllability
- High gliding performance

SPECIFICATION

LENGTH x WIDTH x HEIGHT [mm]	1145x1240x175
WING AREA [dm^2]	32.9
EMPTY WEIGHT [g]	182
WING LOADING [g/dm^2]	5.5
CONTROL SURFACE	Rudder, Elevator, Ailerons

SAFETY DESIGN



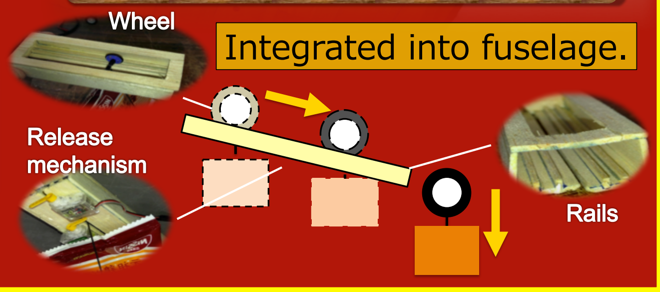
The nose is designed to break when the aircraft crashes. This will absorb the shock, preventing any injuries.

SALVAGE MECHANISM

MAGNETIC FORCE

DROPPING MECHANISM

Integrated into fuselage.



YAMAGUCHI UNIVERSITY

DEN-NO HIKO 2015 (Manual Flight)
Hashimoto Ryuichi, Taguchi Yudai,
Kadogawa Haruna, Nomoto Masaaki

Tokyo Metropolitan College of Industrial Technology

EMPRESS

Concept

The airplane is inflatable in structure and **only air** is injected into it.

Specifications

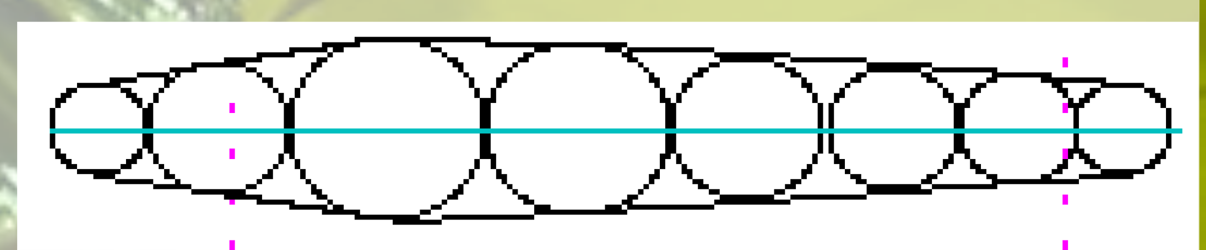
Length	610mm
Wing Span	1140mm
Wing Area	48.4dm^2
Wing Loading	3.96g/dm^2
Height	310mm
Weight	191.7g
Injected Gas	Air

Retention of Shape

The envelope which is a little weak to be bent is covered with Polymawraps for maintaining its shape.

Design

Airfoil is formed with the ream of column.



Manufacture

Films of evaporated aluminum are glued with impulse heat sealer.

Safety

Because it is in flexible structure, the shock is very small even if EMPRESS hits something.

Transportation and Setup

We can carry EMPRESS by folding small. It can be easily set up by injecting only air.

How to Fly

Probably everybody misunderstands that a helium gas is in EMPRESS, but it has only air.
So, EMPRESS flies not by buoyancy but **by lift.**

Team Members

Momoka KAKUDATE
Masashige KURODA
Takumi TOMITA

Baleia

Tokyo university of Agriculture and Technology

Concept and Feature

Baleia is designed as a **hybrid air ship**.

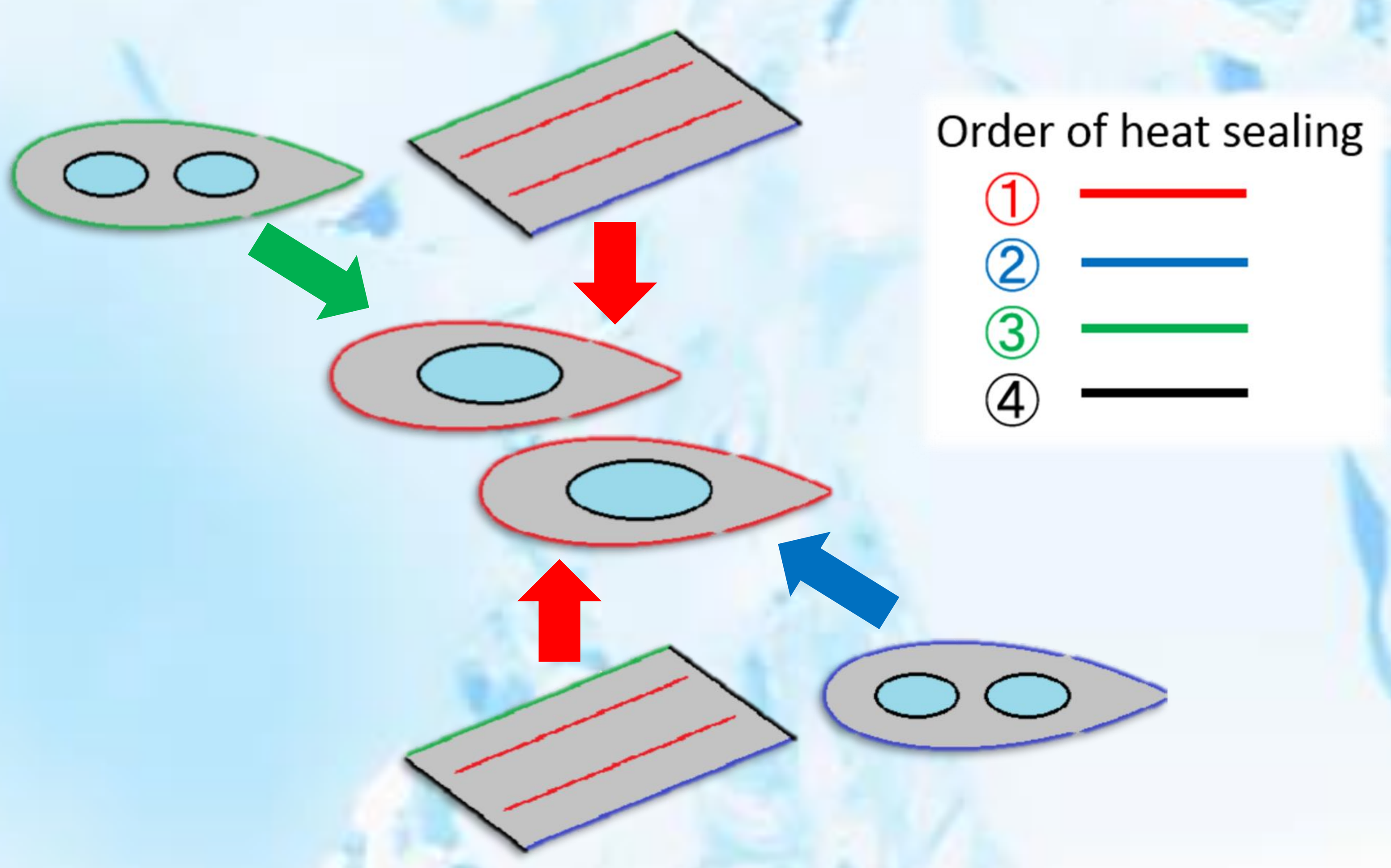
The main feature of **Baleia** is a **wing-shaped envelope**.
This envelope enables to **fly slowly like an air ship** and **fly fast like an airplane**.

Safety

The balloon covers all facilities of **Baleia** so that the balloon works as a **shock absorber** when it collide.

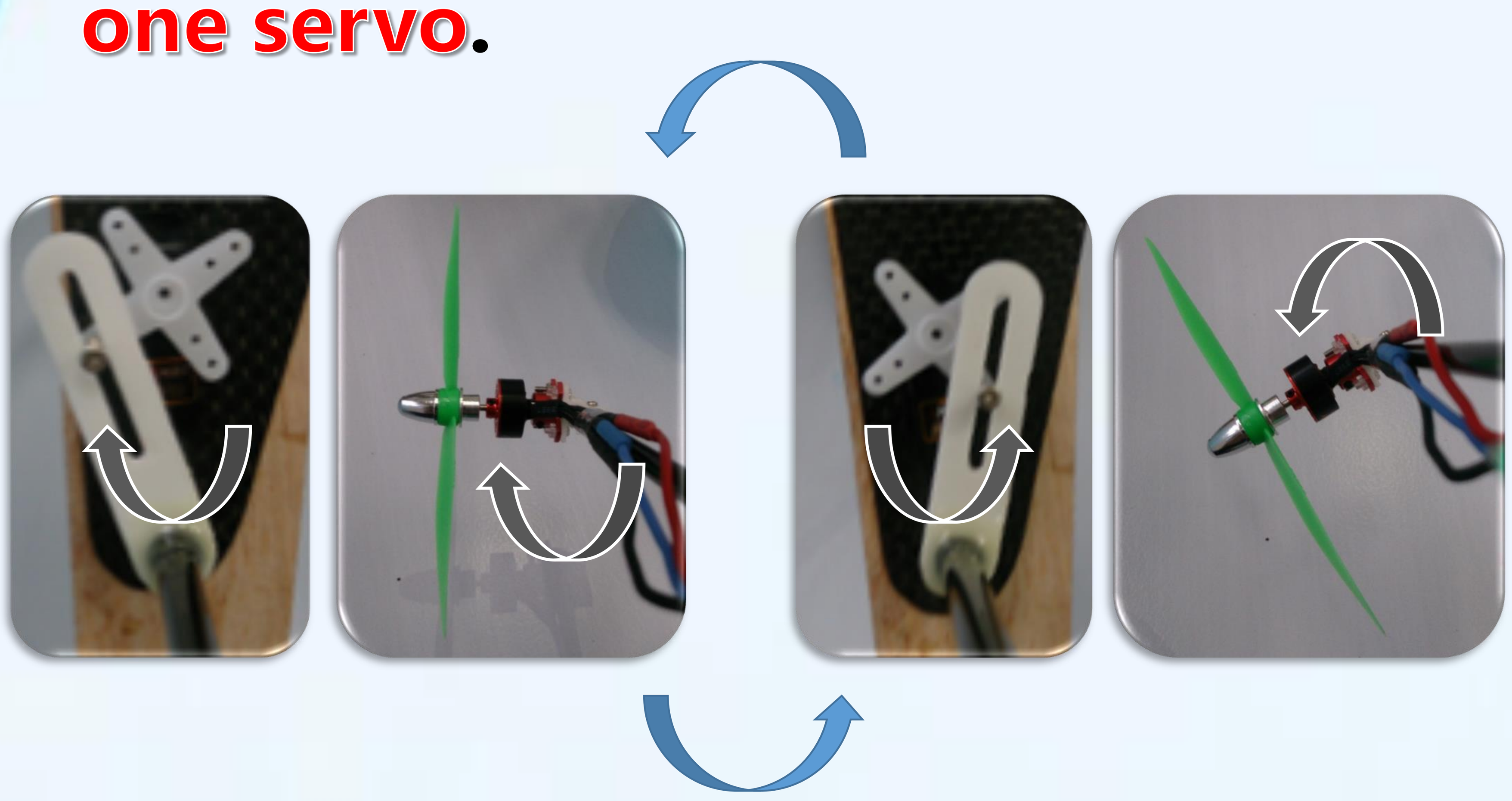
How to make

This unique balloon is made of **six sheets of films**.



Thrust Vectoring System

Thrust vectoring system enables to **change the thrust direction**.
The system can **tilt two motors by one servo**.



Specification

length	1250 mm
width	600 mm
height	480 mm
volume of balloon	$0.145\ m^3$
empty weight	215 g

National Institute of Technology, Akita College

Rising Eagle

Member

Ryo Okabe
Yusuke Miura
Shogo Saito
Yuma Matsuda
Kouki Oguma

Advisor

Yoshinori Konda
Masamitsu Wakoh

Specification

Length: 1015mm
Width: 1640mm
Height: 350mm
Motor: Dualsky XM2223-10
Battery: Hyperion LiPo 550mAh

Concept

High Adaptability to Mission
More Stiffness

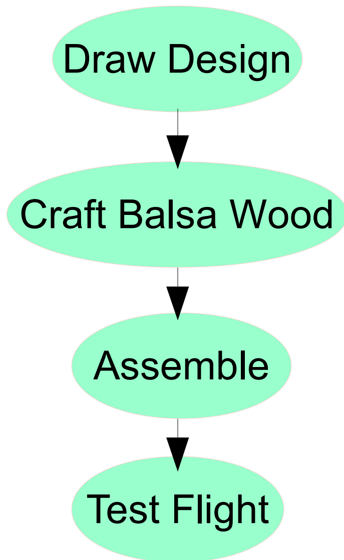
Design

Rising Star (RS), last year's our flying robot, has fulfilled to reduce induced drag and extend gliding time.
This year, we developed Rising Eagle (RE), which is successor to RS as our monoplane.
We have some updates: improved stiffness and expanded wing. They will make missions easy such as time trial mission, loop mission, and payload flight mission.

Safety

RE is made of soft balsa wood, so it will be broken before injure someone when it hit them.
Pusher propeller will also work to avoid touching rotating propeller.

Production Method



“The Eagle Rises.”

Kyutan

九試単座戦闘機 （カ-14）

Concept

High-Speed, Highly Maneuverable Aircraft featuring the Inverted Gull Wing

Specification

Overall : 1090mm
Wing Span : 1510mm
Height : 340mm
Weight : 180g
Main Wing Area: 43.2 dm2
Wing Loading : 4.2 g/dm2

The Inverted Gull Wing

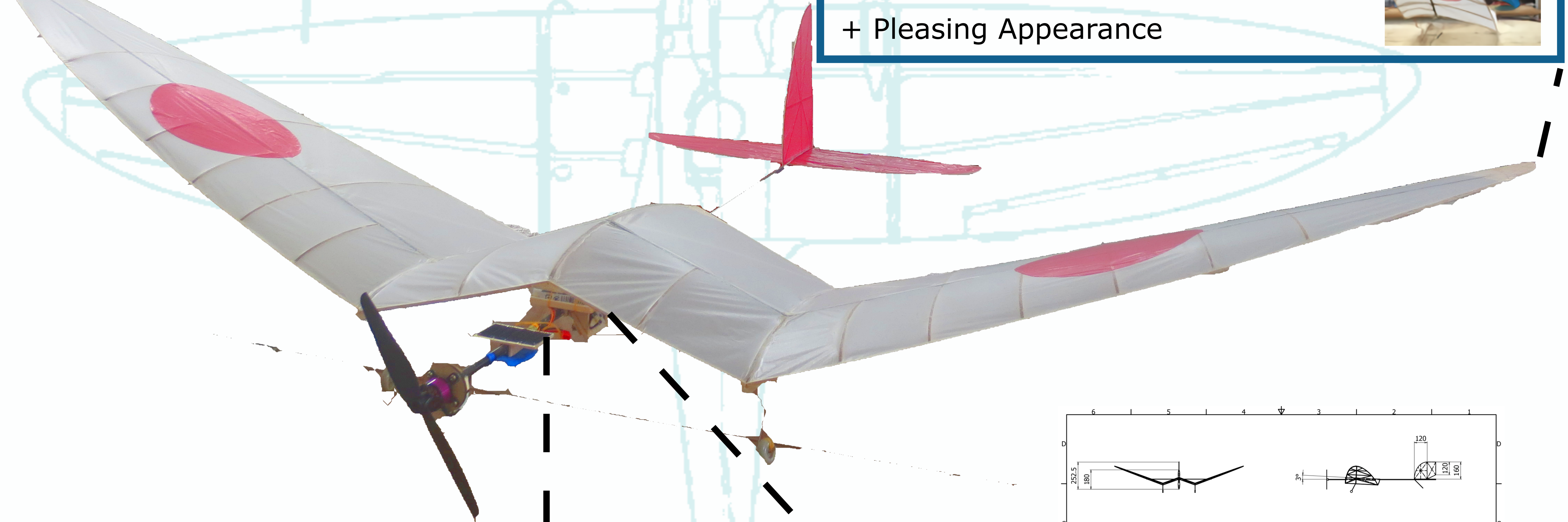
Characteristics

1. Aiming to Decrease Air Resistance by Covering the Wing-Body Join

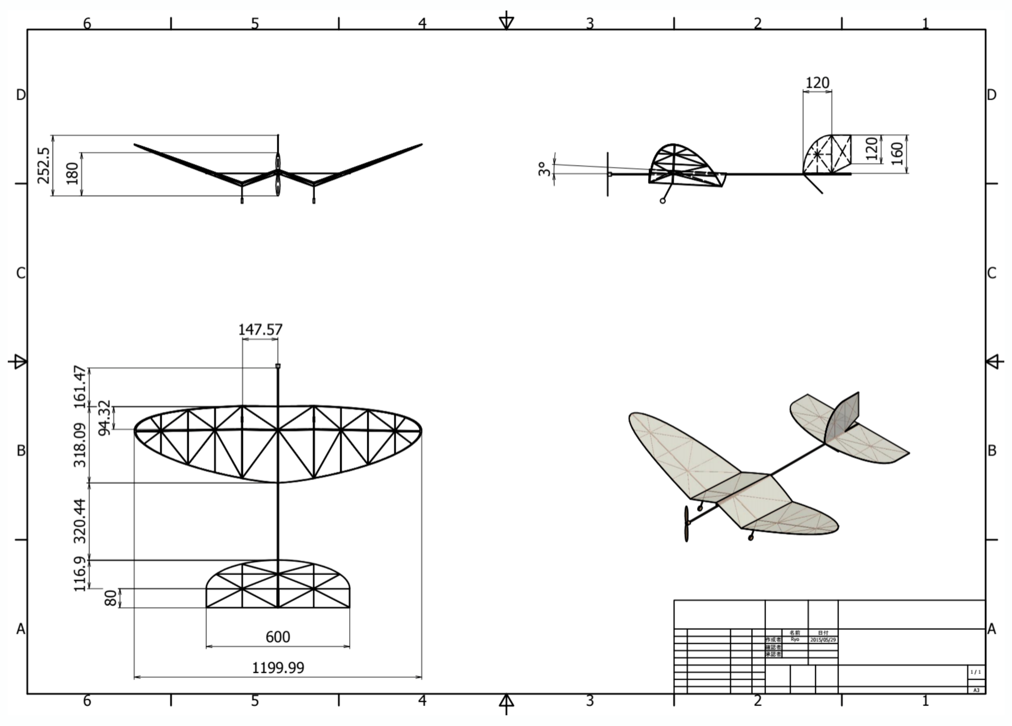
2. Decreasing Inductive Resistance by Introducing Hand-Curved Wingtips

3. Reducing Weight with Short Legs

\+ Pleasing Appearance



If you want to fly, a hint of good taste is all that it takes.

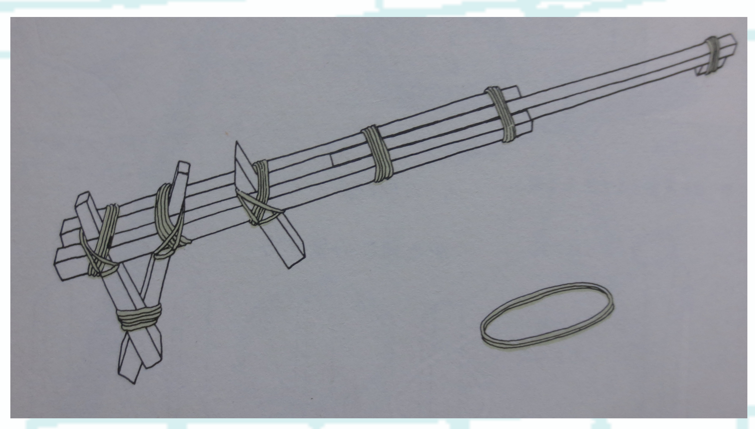


Designed using Inventor(CAD)

How WE Distribute Chicken-Ramens

1. Rotating the servomotor 45 degree CCW, the 1st chicken-ramen mini drops.
2. Rotating the servomotor 90 degree CW, the stopper supporting the 2nd ramen is released.
3. Rotating the servomotor 90 degree CCW, the 2nd ramen drops.

Repeating this method for necessary times, we can drop as many chicken-ramens as we want.



Works the same as Automatic Rubber Band Guns

cf. CW : clockwise
CCW: counterclockwise

THE UNIVERSITY OF TOKYO FLYING ROBOT PROJECT

FOXTROT
NAVIX - f

S.SAITO, H.DEGUCHI
T.ASAI, Y.YAMADA

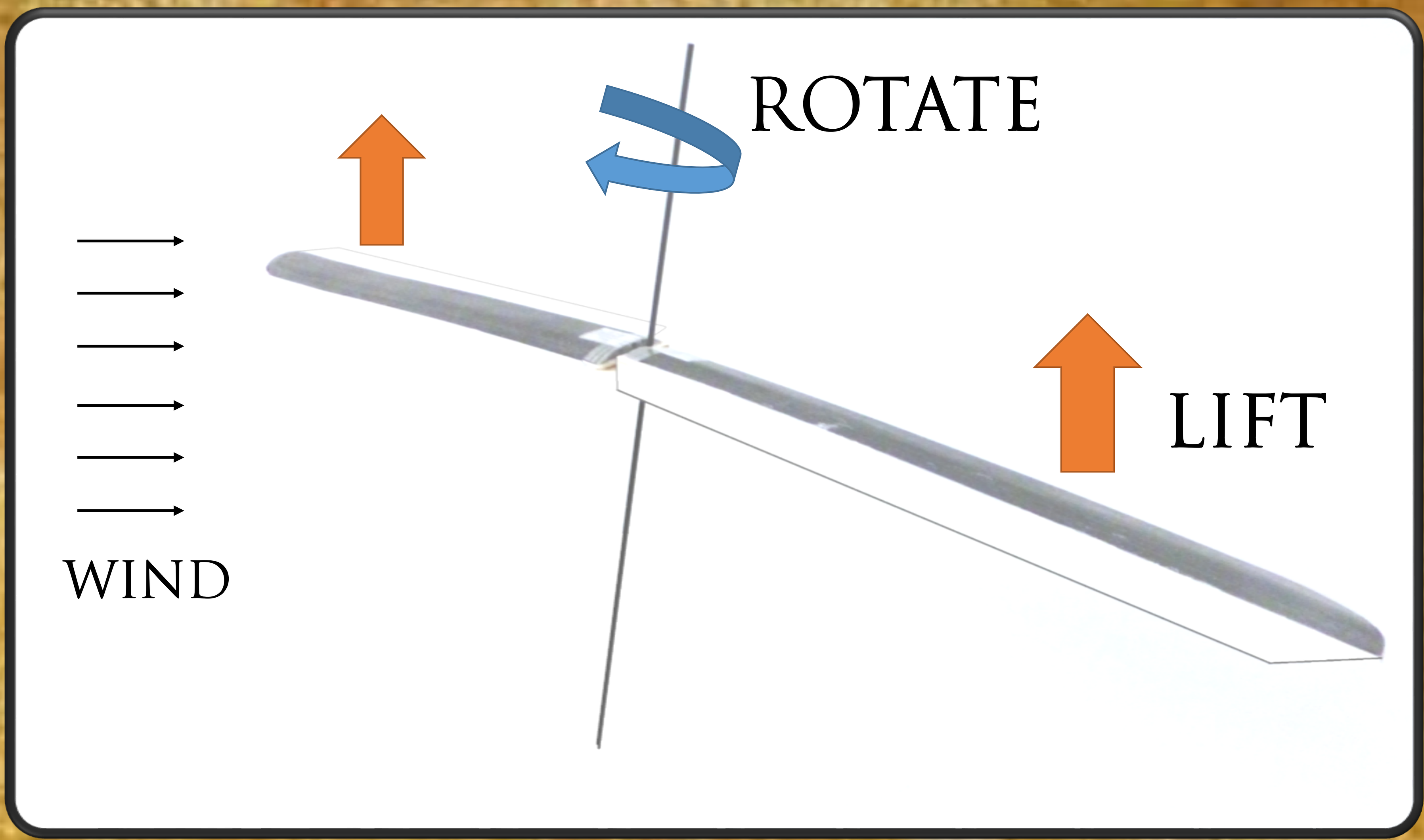
•AIRCRAFT PRODUCTION (CONCEPTS AND DESIGNS)

AUTO-GIRO GETS LIFT BY UNPOWERED ROUTER ON THE TOP. (THE ROTOR GETS THE AIR FLOW AS THE BODY GOES AHEAD, AND TURNS)

ADDITIONALLY, IN OUR AIRFRAME, MAIN WING IS INSTALLED AND IT ENABLES HIGH SPEED FLIGHT.

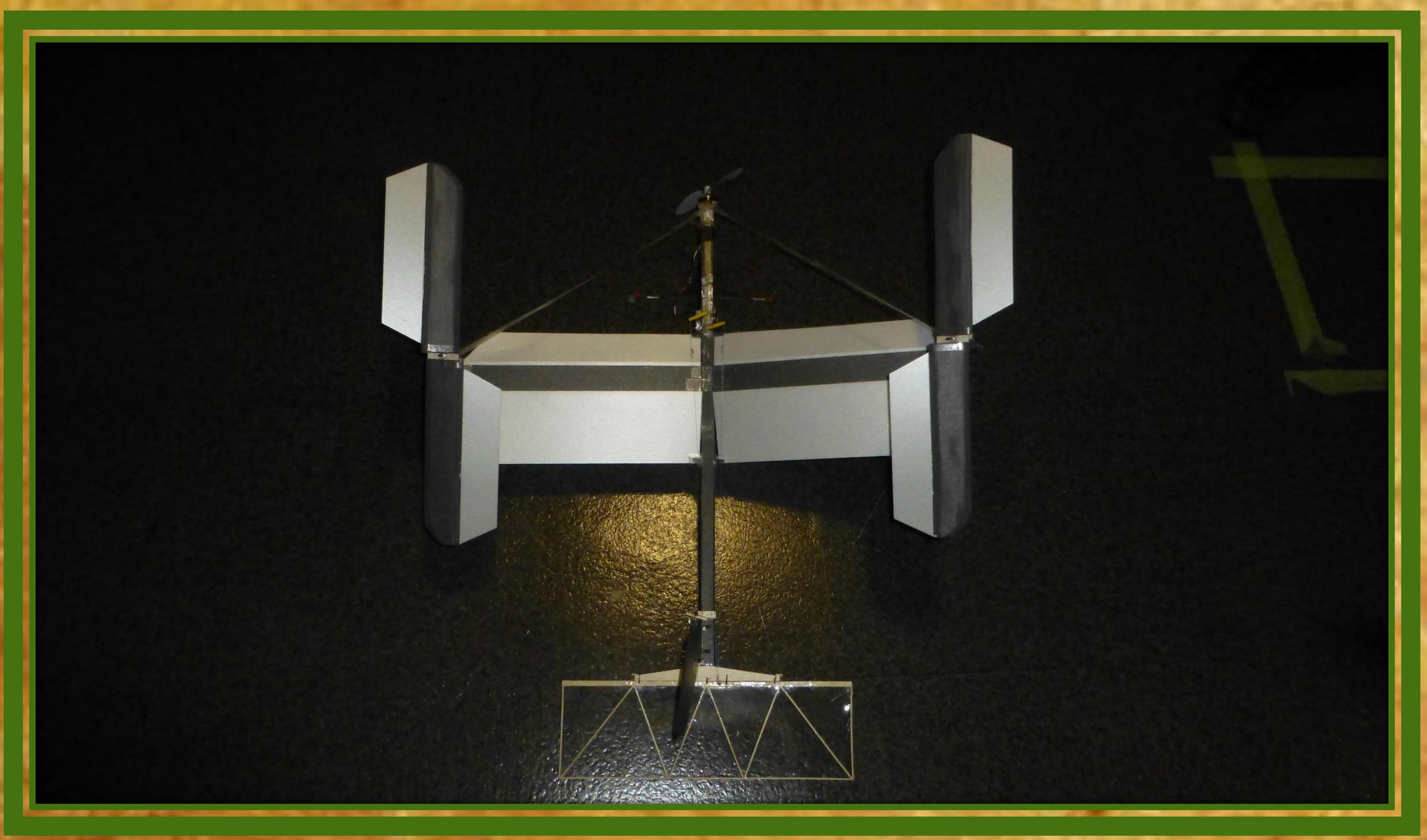
THE DRAGS BY THE HEADWIND ARE CHANGED THE ENERGY OF ROTATION, BY THE TILT ROUTER WITH PITCH.

SO UNLIKE THE HELICOPTER, THERE'S NO POWER TO THE ROTOR.



<MAIN WING>

・LIFT STABILITY OF HIGH-SPEED FLIGHT



<ROTER BLADE>

・LIFT STABILITY OF SLOW FLIGHT
・REQUIRES SHORTER RUNWAY

•SYSTEMS AND SAFETY

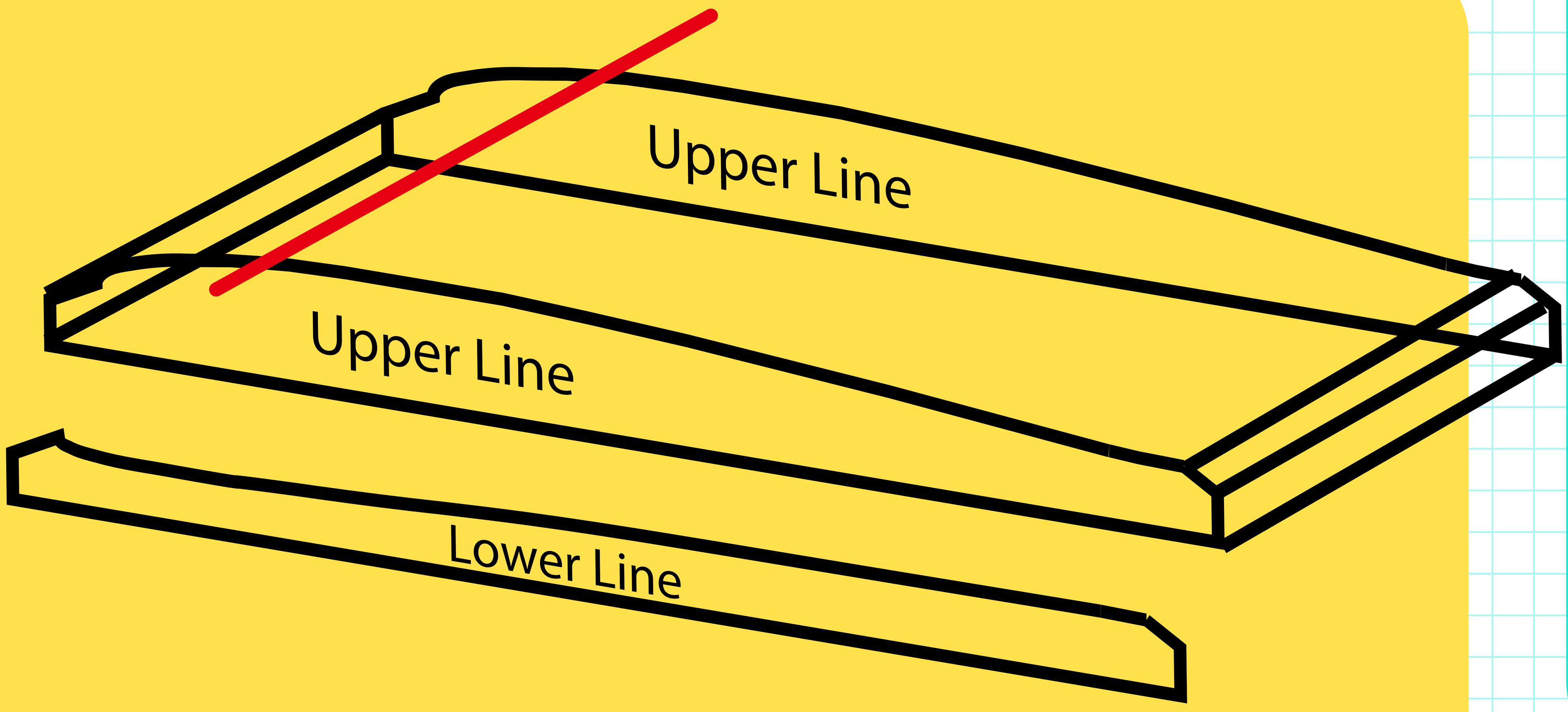
FOR COLLISION, THE BODY IS MADE OF THE SOFT POLYSTYRENE.
WHEN YOU STOP THE MOTOR, THIS AIRFRAME STOPS IMMEDIATELY.

Noob1

Keinosuke.K

I.Matsumoto

Accurate cutting wings with hot wire cutter.



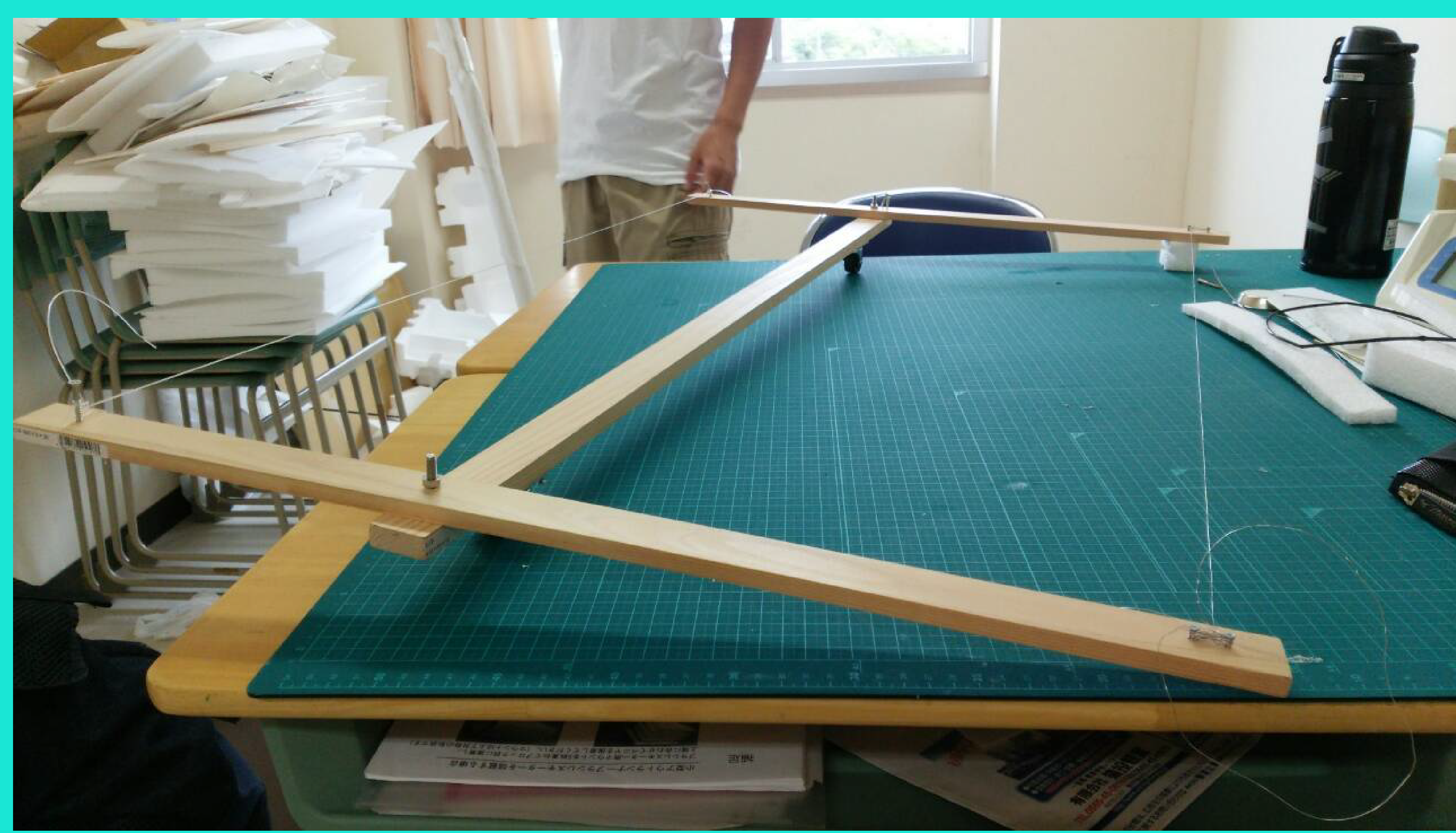
We prepared the upper line and the lower line for the airfoil.
We used the illustrator for accuracy for this process.
Then we stuck the airfoil on the EPP,
and used the cutter after adjusting it to the scale

Front View

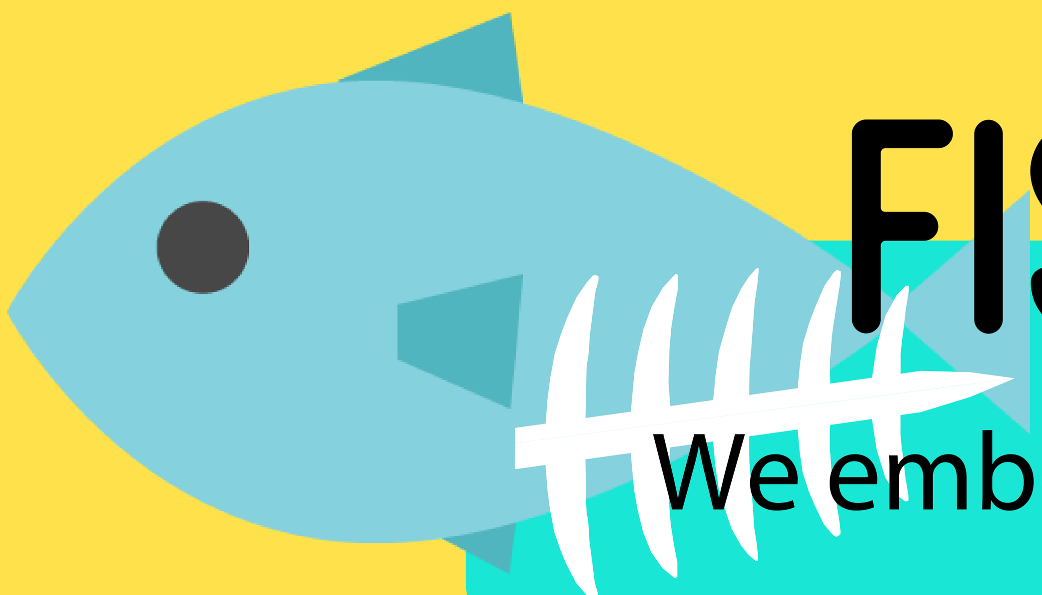
Top View

EPP

It's resistant to strong impacts, so it's doesn't beak easily if it's crashed indoors.



Hot wire cutter has a simple structure, and home centres have all materials for it.



FISHBONE STRUCTURE

We embedded carbon in to it to have stiffness in 3mmEPP.

Specification

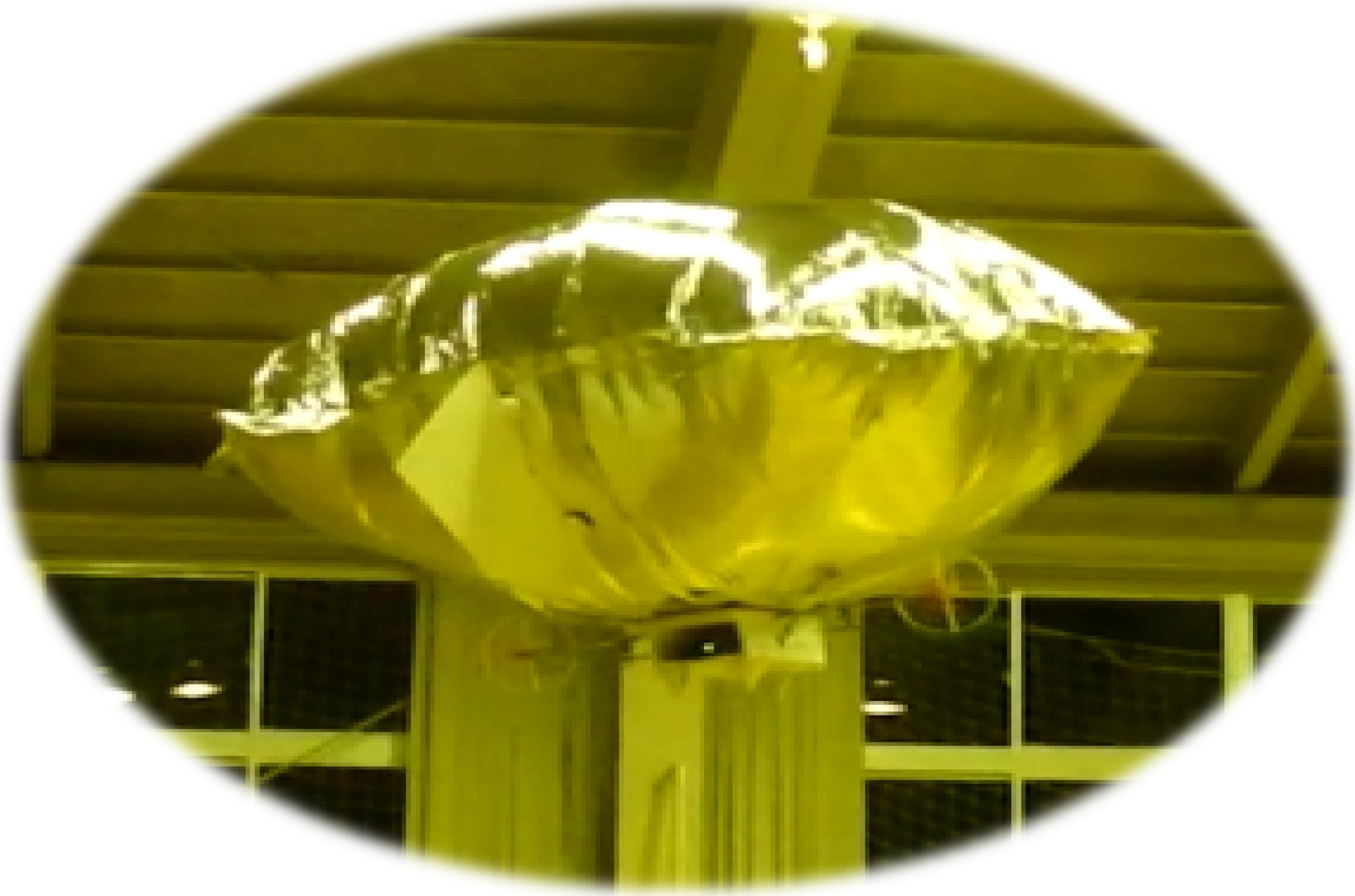
Length	mm
Span	mm
Wing area	dm^2
Empty Weight	g

NIT,Toyota College

Eins

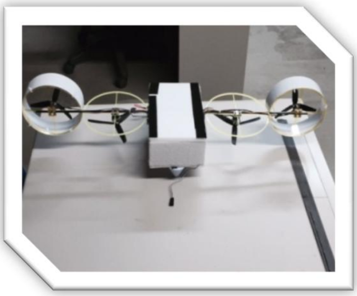
Team [Eins]

POLYTECHNIC COLLEGE AOMORI
Electric energy control a department
Member Yuta Wakayama, Hidetoshi Nagasaki, Riku Yoshizaki

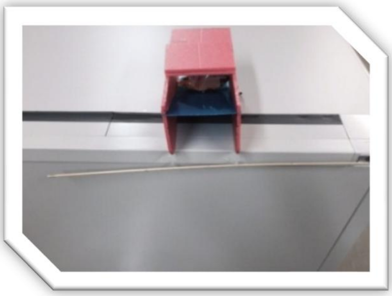


Characteristic : Because the width of the body is wide, air resistance is big, and speed at the time of the free-fall is slow, and time to grounding is long.

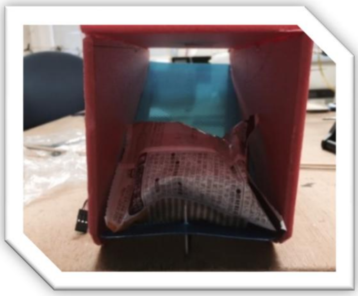
Length	:	**1100mm**
Width	:	**1130mm**
Height	:	**840mm**



Gondola



Recovery System



Jettison Gear

高知工科大学
KOCHI UNIVERSITY OF TECHNOLOGY

SPECIFICATION

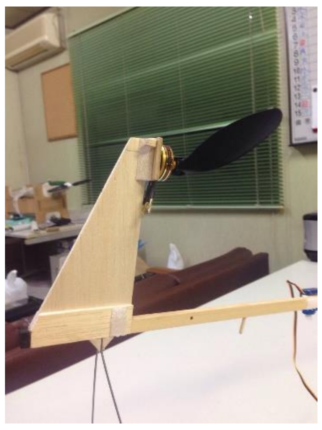
length	900mm
span	1198mm
height	417mm
wing area	$36.4dm^2$
wing load	$4.78g/dm^2$
weight	174g

CONCEPT

- Use special product of Kochi prefecture
- Easy transport
- Large wing area

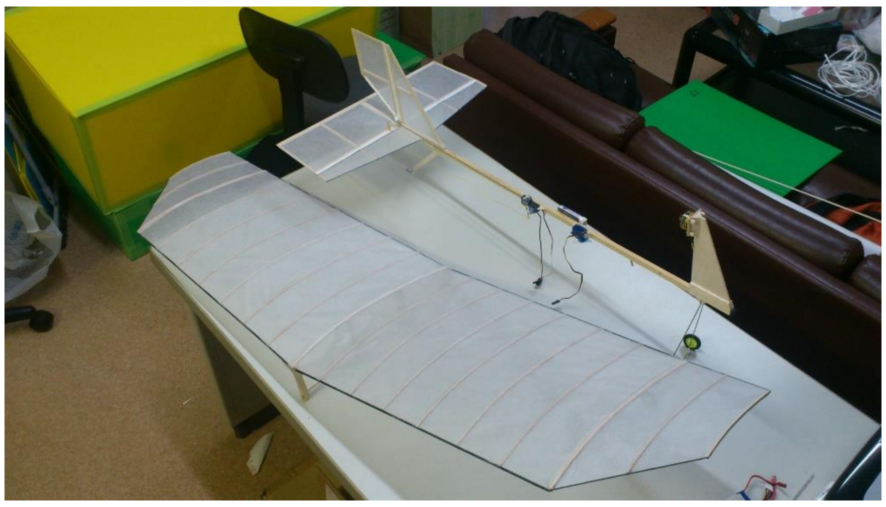
SAFETY

Pusher propeller



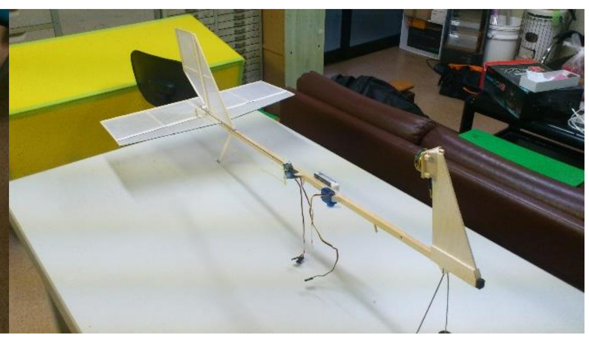
DESIGN

Main wing is removable



HOW TO MAKE

- Body is made of *hinoki*
- Main wing, horizontal stabilizer and vertical tail are made of *tosa washi*, Japanese paper made in Kochi



Tokai University

Fantasista ~ Evo

1. Concept of Aircraft

This aircraft has improved the following items from the aircraft until last year.

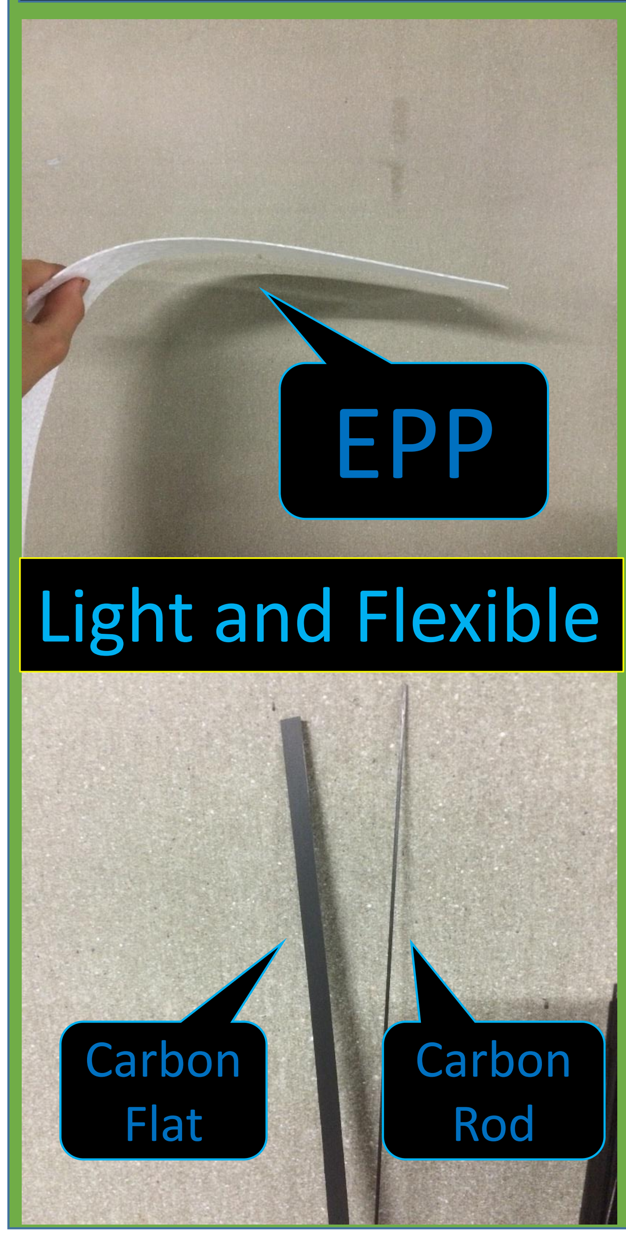
- Mounting of increased relief goods
- Drop of relief goods
- Long-term non-powered glide
- Increase of wing area
- Weight saving
- Improvement of operability

2. Specification

A comparison of the performance of the previous aircraft and the current airframe it is shown below.

			2014	→	2015	
Overall length	[mm]	:	**970**	→	**1250**	28.9% UP
Overall width	[mm]	:	**960**	→	**1300**	35.4% UP
Height	[mm]	:	**370**	→	**290**	21.6% DOWN
Total weight	[g]	:	**175**	→	**165**	5.7% DOWN
Wing area	[dm^2]	:	**19**	→	**28.9**	52.1% UP
Wing loading	[g/dm^2]	:	**8.4**	→	**5.71**	32.0% DOWN

3. Safety



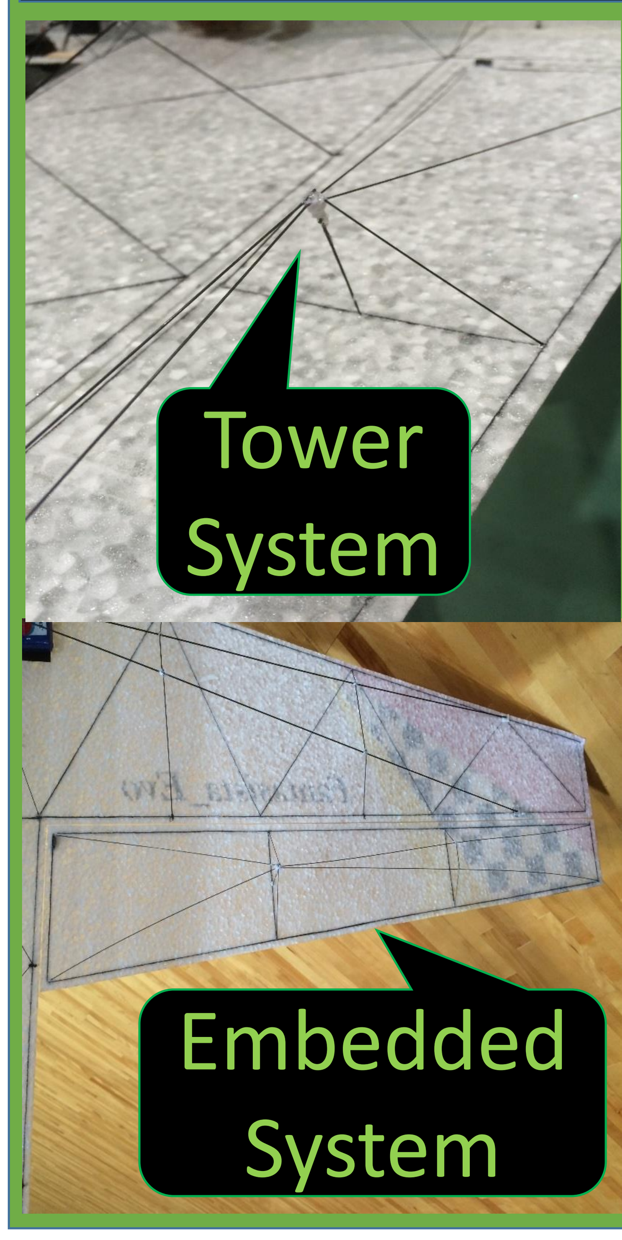
This aircraft is a lightweight and flexible because it uses a firing material.

It is safe even when in contact with a person for that.

In addition, This aircraft is capable of low-speed flight.

Therefore, it is possible to avoid the aircraft even if the emergency uncontrollable and was carried towards the human.

4. Materials & Structures



Material of this aircraft is mainly EPP (Expanded Poly Propylene), and carbon.

Change the thickness of the EPP from 3mm up to last year to 1.5mm, and attempted to weight.

And the method of embedding the carbon flat so far of the EPP, to be to both adopt a method of partnering the carbon rod as sterically tower, was working to increase the structural strength.

5. Design

Review the structure and materials of the aircraft, it was to have a room in the weight.

Then, it was an increase in the wing area without compromising that exercise performance can be as large as to allow the weight of the aircraft.

Vote Section

1	2
3	4
5	Thank you for your help!

SATEGIS ver.3

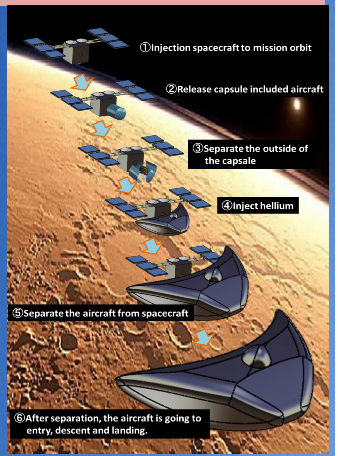
Shota Yuhara, Okihira Ohta, Katsuya Shibata and Taketo Kobayashi
Kawamura Laboratory, Teikyo University

Background

In our laboratory, **TIPS (Teikyo Inflatable Probe in Space) project** started 2 years ago, and the flexible structure flying object (here in after referred to as "**SATEGIS**") with a lift and buoyancy aimed to enter Mars atmosphere has been developed and demonstrated. This concept (Fig. 1) is the following.

1. The probe mounted on SATEGIS is transported to Mars, and after entering in the circular orbit, SATEGIS is separated from the probe.
2. SATEGIS expands with the mechanical mechanism and the injection of helium gas and enters Mars atmosphere.

The purpose of this competition is to fabricate and test-fly the prototype model of SATEGIS as part of the verification of a configuration, a method of fabrication and flight performance.



Overview of SATEGIS

SATEGIS is an airship used the membrane material "Eval"; its configuration is a **flying-wing**. SATEGIS has 5 components or systems: battery (2s1p), thruster, control system of the center of gravity (we call "wiper"!!), dropping system and steering system (rudder & ailerons).

Specification	
Length [mm]	1030
Width [mm]	1700
Height [mm]	500
Mass [g]	300
Volume [m^3]	0.3


SATEGIS ver.3

Update Contents

In this competition, the ailerons and the wiper are mounted on SATEGIS to improve its turning performance. A pair of ailerons is synchronized with a change of thrust direction (drive unit). For example, when the drive unit turns right, the right aileron turns down and the left aileron turns up. Moreover, the wiper moves the center of gravity to turn. By moving the drive unit, the wiper and the rudder at the same time, the turning performance of SATEGIS is able to improve.

FIORENTINA

TATSUSHI KOBAYASHI SOUKI UCHINO MASAYUKI CHIWATA RIKUTO FUJII YUYA HIROSE

~CONSEPT~

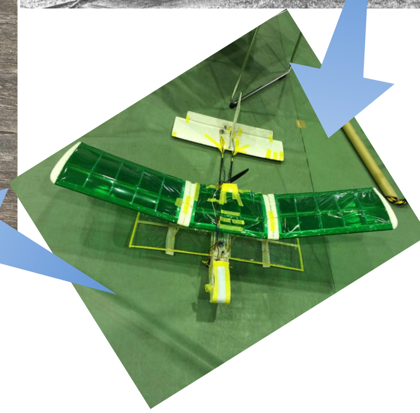
CARRYING MORE MORE DURABLY MORE EASILY

SPECS

Weight: 195 g
Length : 730mm
Height : 230mm

Width: 900mm
Airfoil :Goettingen436
Moment arm: 0.50m
-Main wing-
Wing area:0.414m^2
Wing span:0.23mm
Aspect ratio:3.9
Wing loading:471g/m^2
-Horizontal tail-
Wing area: 0.4m^2
Tail volume: 0.3
-Vertical tail-
Wing area: 0.2m^2
Tail volume:0.15

PROTOTYPE



~DESIGN~

We have adopted a biplan for large lift and high Strength. Strength increased because the load to main wing is dispersed along two main wing.

Dihedral curve makes it possible to prevent concentration of the force on a point.

Tail was made by bending a banboo for strength,weight light,and design.

Corbon pipe moment arm can achieve high strength and light weight. Reliability of tail control was increased by passing the linkage through the moment arm.

Wind produced by propeller hitting on the main wing makes large lift.
It also acts on the tail causing good operability.

~TRANSPOAT~

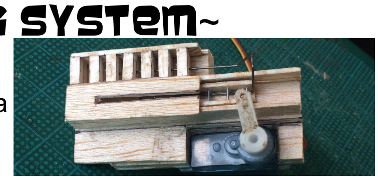
This airplane was carried in a box. It ispossible to separate the main wing and body to carry easily.

~SAFTY~

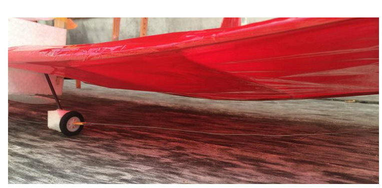
Propeller was placed behind the body for safety. Soft material was used for body to absorb the impact of collision.

~DROPPING SYSTEM~

The goods will be dropped by moving a servomotor.



~RECOVERED SYSTEM~



The goods will be recovered by sticking steel wire to the magnet.

NATIONAL INSTITUTE OF TECHNOLOGY, KURUME COLLEGE PRODUCED BY "TORIBU"

Kanazawa Institute of Technology

eagle11

Team member:
Hirotaka Wanibe ,Ryota Taniguti,
Hironori Matsushima,Ken Sasaki,
Syotaro Ohata

Concept: Enhance airframe durability

Feature①

CFRPsandwichspar

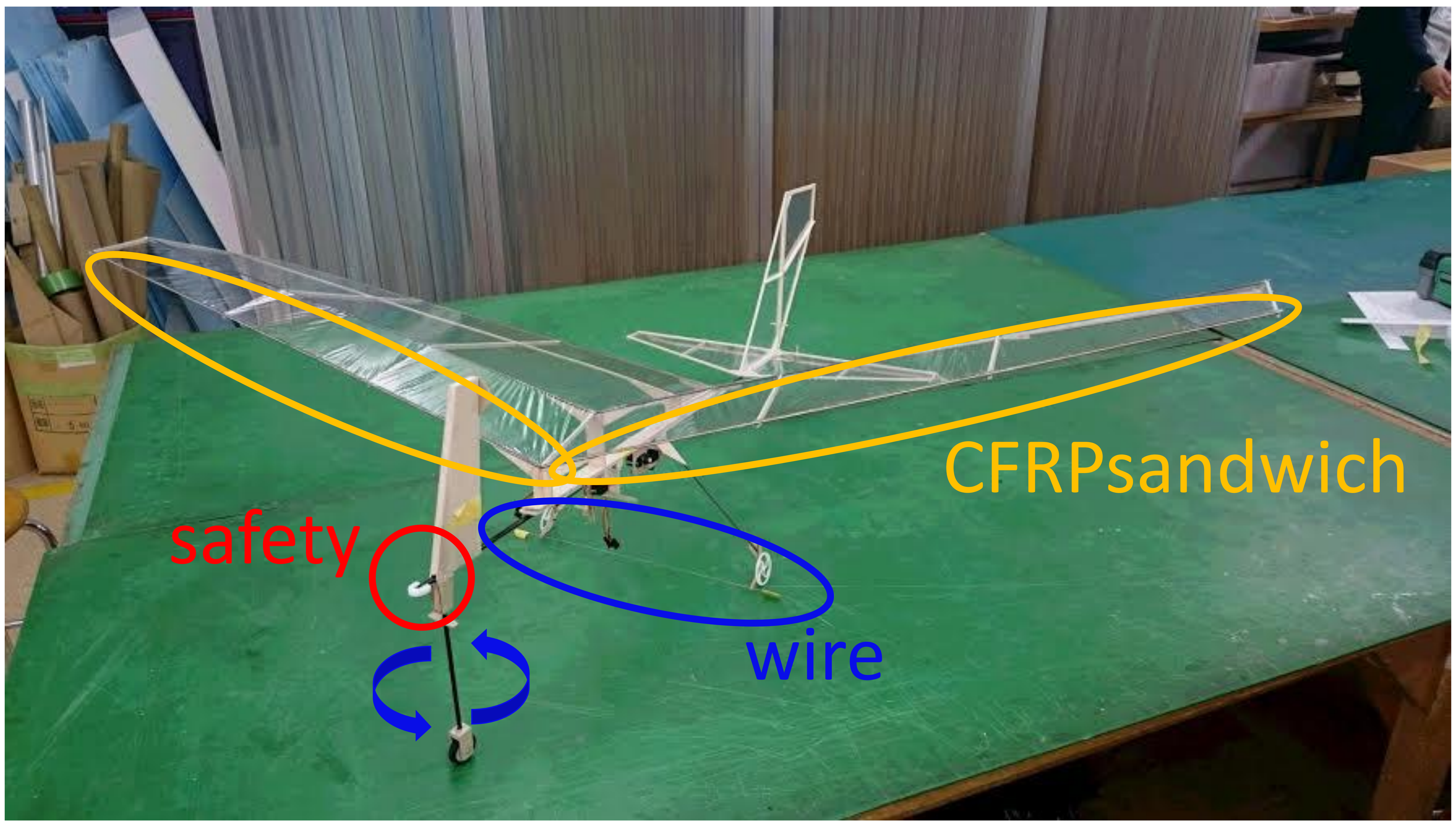
Use carbon spar to Leading Edge and Trailing edge. Stronger Airframe than balsa only.

CFRPsandwich

Type A

Type B

Compare 1.0mm(TypeA) carbon and 1.5mm(Type B) carbon.→TypeA and TypeB have equal durability. But TypeA lighter than typeB.So we use TypeB



Feature②

Supply Goods Collector

Set wire on Landing gear. Collect Supply Goods by magnetic force. Front landing gear link rudder. It make easy for pilot to turn.

Feature ③

Thin angular airfoil

Small Moment Coefficient

Simple form make easy for us cut parts with accuracy.

Design・Production

Use CAD software (Solid Edge ST4)

Use Utility knife for product parts

Safety

EPP Cushion on Nose

Prevent Injury

libellen-15

Dept. of Aerospace Eng.
CST Nihon Univ.

Member:
Captain : K.Momoka
Pilot :Y.Otomo
Adviser : S.Itagaki
secretary : D.Nakajo

You can see the flight video of Libellen-15 from this bar code!

SPECIFICATION

Total weight:170[gf]
AR:6.2[-]
Wing Span:1240[mm]
Total Length:880[mm]
Chord Length:250[mm]
Taper ratio:0.72[-]

Concept

Twin fuselages to have plane's strength and to carry many payloads.

How to make

Our plane is handcrafted. Main wing and body are made by balsa.

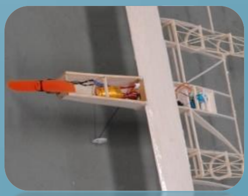
How to design

Our plane's strength is acquired by truss structure.

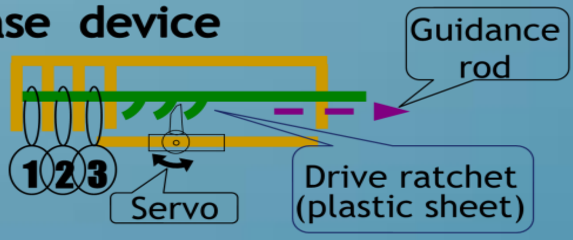
We use S4083 airfoil to have high glide ratio.

Safety

Electrical systems are in the fuselage . Main wing and body are crushable.



Release device



Controlled by single servo ⇒
Total weight…8g