Tohoku University

Windnauts

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What is Windnauts?

We make the human powered aircraft (HPA) for participating in the Birdman rally at Biwa lake. We compete distance from taking off to landing on the water surface.

In 2019, 53 members belonged to our team.



Official name	Human-powered flight club
Team name	Windnauts
Starts	1993
Number of people in each grade (1/2/3)	21/18/14

Activity Location of Windnauts

Test Flight (Tohoku Univ.)





We make the HPA and test flight it at Tohoku Univ. Kawauchi Camps.



Activity Location of Windnauts

The distance of srope in Camps is short.

So we also take test flight at Kakuda Gliding Field on every weekend.(in May ~ July)

Tohoku Univ.



The Process to Competition



Design concept

Our Design concept is "Fly Safely and Fast"

Last year, the wing of our aircraft was broken because of bad condition.
Of course, in order to win, it is necessary to fly faster than ever.

So we designed Fast and strong aircraft against the wind



Making

We have 7 teams, and each team makes components in charge.



Wing Team



Fairing Team



Cockpit Team



Steering Team



Drive Team



Avionics Team



Propeller Team

Making Scenery



Making Scenery







Load Test

To check strength of wing beam Take a load 1.5 times as much weight as steady flight.



Test Flight

The purpose of Test Flight is...

- Training of the pilot and the members.
- Check-up of assembly correctness.
- Training of airplane handling.

Test Flight at Kawauchi camps

The main purpose is checking safety of the aircraft and flight short distance.



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	Date	purpose
1 st	June.3	Assembly and Running test
2 nd	June.5	Center of gravity measurement
3 rd	June.9	Thrust control
4 th	June.13	Elevator test
5 th	June.18	Elevator test
6 th	June.21	Elevator and Rudder test
7 th	June.26	Elevator and Rudder test
8 th	July.9	Elevator and Rudder test
9 th	July.11	Elevator and Rudder test
10 th	July.18	Take off practice

Test Flight at Kawauchi camps



Test Flight at Kakuda

The main purpose is training of airplane handling.

Flight relatively long distance and high speed (design speed)

	Date	Purpose
1 st	June.29	 Assembly and Running test Center of gravity measurement Elevator and ladder test
2 nd	July.6	►Canceled
3 rd	July.15	Final Confirmation of AircraftSteady Flight

Test Flight at Kakuda



The incident of 2nd TF in Kakuda



Taking off (The Birdman Rally 2019)



Unstable flight (The Birdman Rally 2019)



Result of The Competition

- 🛣 Date: July. 28, 2019
- Rank: 5th
- Flight distance: 5438.19 [m]
- Flight time: 25 [min]

Rank(preliminary)	Team	Record[m]
1	Birdman House Iga	60,000.00
2	Nihon Univ.	38,010.28
3	Osaka Prefecuture Univ.	19,000.00
4	Altair	5469.96
5	Tohoku Univ.(Windnauts)	5438.19

The reason why result was not good

Lack of pilot steering training (at Kakuda). Cur original schedule of our flight was delayed and replaced with Nihon Univ.

 \rightarrow We are forced to wait 2 hours on platform.(35°C)

 \rightarrow Pilot and our members were exhausted on the platform and the wind became stronger(1~1.5[m/s] \rightarrow 4~4.5[m/s]).

The pitch of aircraft was not stable for some reasons.(wind, skills, weight...)

Summary

Our aircraft cannot fly steadily and long.
We improve aircraft and complete making aircraft quickly and run more tests in Kakuda.
We believe to win the next competition.



Additional Slides

Specifications

Specification		Pro	opeller
Gross weight	82.5[kg]	Airfoil	Milly-Terry(original)
Empty weight	29.5[kg]	Rudius	1.60[m]
Design cruising speed	7.4[m/s]	Rotational speed	135[rpm]
Need Power	218[W]	Thrust power	23.8[N]

Ν	/lain wing			
Airfoil	DAE21-DAE31			
Span of wing	31.0[m]			
Wing area 27.13[m^2]				
Aspect ratio	35.43			
	DAE21	3.8[deg]		
Angle of attack	DAE-21,31	3.8-2.4[deg]		
	DAE-31	2.4-1.2[deg]		
Dihedral angle	4.0[deg]			

Columnar beam made by CFRP

Making columnar beam made by CFRP is most important work of all. So, we set to work it all member. We spend every weekend on making them.

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-26	90deg							

Designing beam efficiency. Arranging each lamination parts on prepreg



Drawing line using pencils and ruler. Cutting follow the line using scissors.

Columnar beam made by CFRP



Lamination Ply1 90° Ply2 0° Ply5~ base on Ply3 45° Ply4 -45°



Cloth is overlaid with prepreg. Cloth absorbs futile epoxy, and beam become light. Surface became rough, and workability are increase.