Tohoku University

Windnauts

taka Hanada

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.
- We have 5 times victory at the competition.
- In 2017, 49 members belonged to our team.

Grade	Number of People
1	17
2	22
3	10

Activity Location of Windnauts

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

Test Flight (Tohoku Univ.)

Workshop

Sendai Station

Tohoku Univ.
Kawauchi Camps

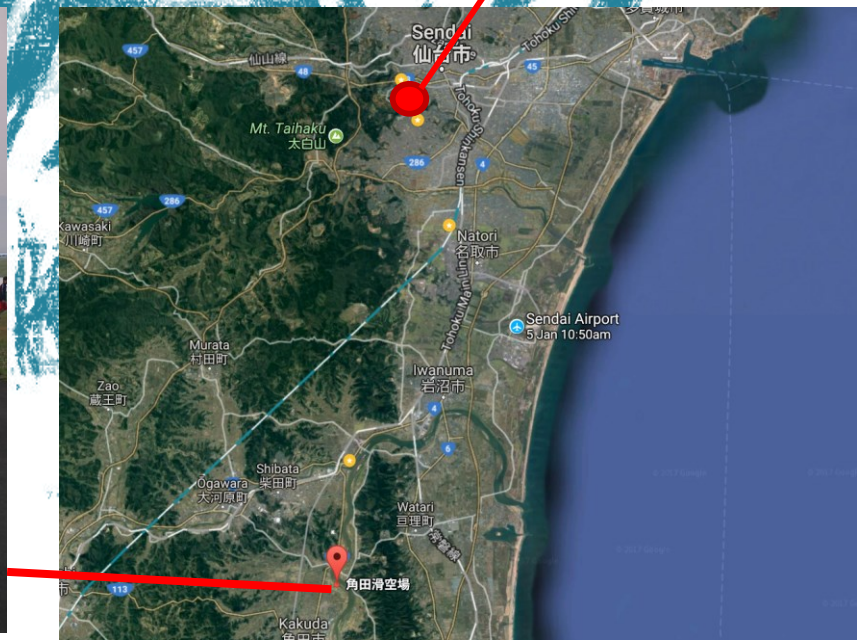
Tohoku Univ.
Katahira Camps

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)

Kakuda Gliding Field

Tohoku Univ.



About this year

Design concept

- Last year, we participated the Birdman rally as a Defending Champion.
- But, the wind was so strong and we could not win the competition.

So this year…

<u>We designed a strong aircraft to the wind.</u>

	2016	2017
Air speed	7.2m/s	7.3m/s
Span	31.6m	30.4m
Weight	30.6kg	30.4kg

Making Scenery

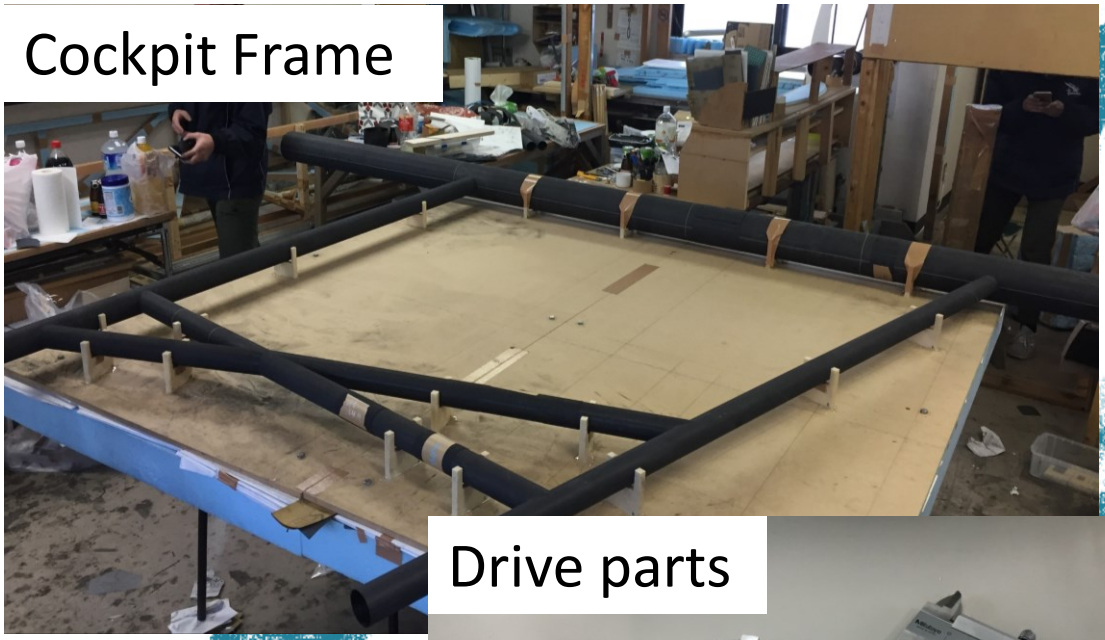
Wing

Propeller

Fairing

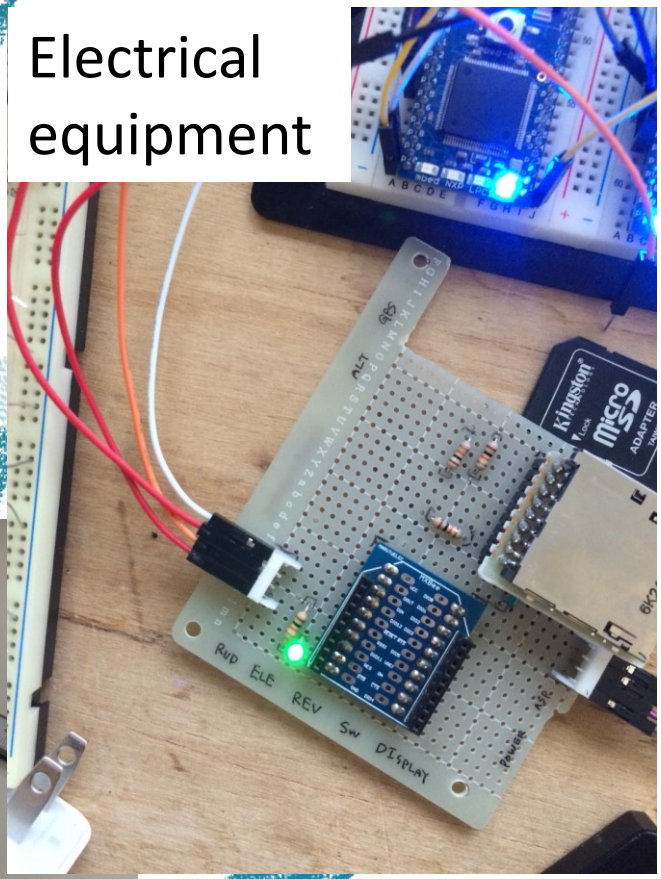
Making Scenery

Cockpit Frame



Drive parts

Electrical equipment



Load Test

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

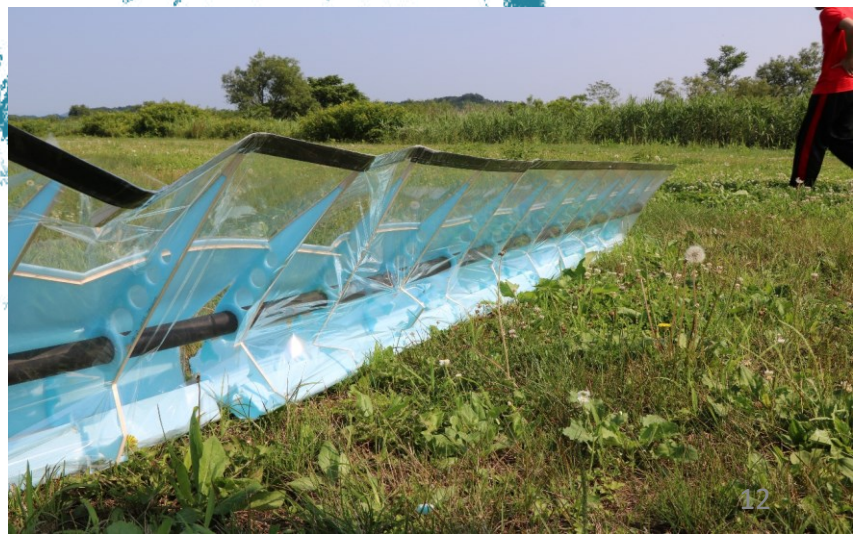
Test Flight

- 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 Kakuda

The crash accident

- 3 weeks before the competition, on July 8, our aircraft stalled just after taking off, and crashed.
- Pilot had a slight injury in the left hand.
- Our aircraft was badly damaged.



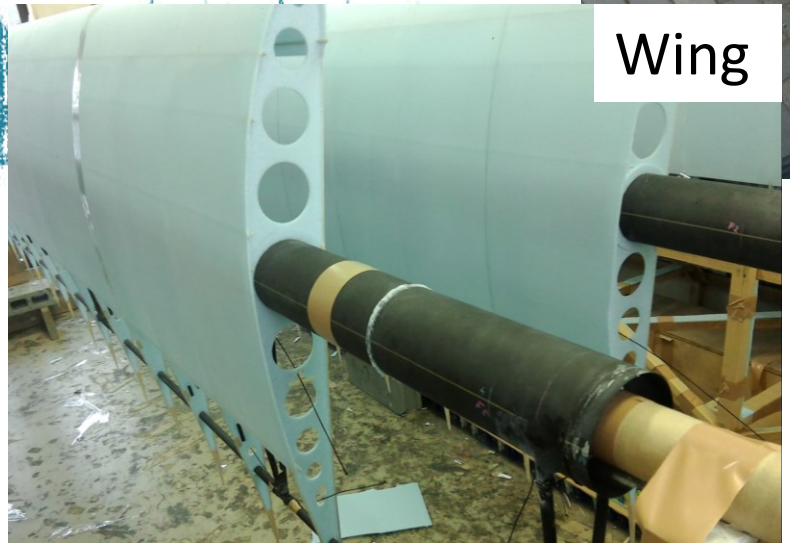
Repair of the aircraft

- Although the damage was serious, we repaired the aircraft in only 2 weeks.

Tail Beam

Main Beam

Wing



Checking the safety

- To check the safety of our repaired aircraft, we took load test, propeller rotating test, and steering test.

Last test flight

- 3 days before the competition, the pilot completely recovered from the injury.
- We checked the safety of the aircraft at first, took the last test flight at Kawauchi Camps, and decided to participate the competition.

Test Flight at Kawauchi Camps

Taking off (Birdman Rally 2017)

By the courtesy of Yomiuri TV

Steady flight

By the courtesy of Yomiuri TV

Rained at point 20km

By the courtesy of Yomiuri TV

Landing on The Water

By the courtesy of Yomiuri TV

Result of The Competition

- Date : July. 30, 2017
- Rank:3rd(1st in University teams)
- Flight distance:22,657 [m]
- Flight time : 40[min]

Flying route

Rank	Team	Record
1	Birdman House Iga	40,000m
2	ROKKO WORKS	30,221m
3	Tohoku Univ.(Windnauts)	22,657m

Summary

- Our aircraft crashed and was badly damaged three weeks before the competition.
- However, we repaired it, and won the first prize in university teams at the competition.


Windnavi
TOHOKU UNIV.

Additional Slides

Specifications

Specification	
Gross weight	87[kg]
Empty weight	30.4[kg]
Design cruising speed	7.3[m/s]
Need Power	215[W]

Propeller	
Airfoil	Milly-Terry(original)
Rudius	1.55[m]
Rotational speed	135.5[rpm]
Thrust power	22.8[N]

Main wing		
Airfoil	DAE21-DAE31	
Span of wing	30.4[m]	
Wing area	26.17[m^2]	
Aspect ratio	35.31	
Angle of attack	DAE21	4.3[deg]
	DAE-21,31	4.3-3.0[deg]
	DAE-31	3.0-1.8[deg]
Dihedral angle	4.0[deg]	

機体諸元

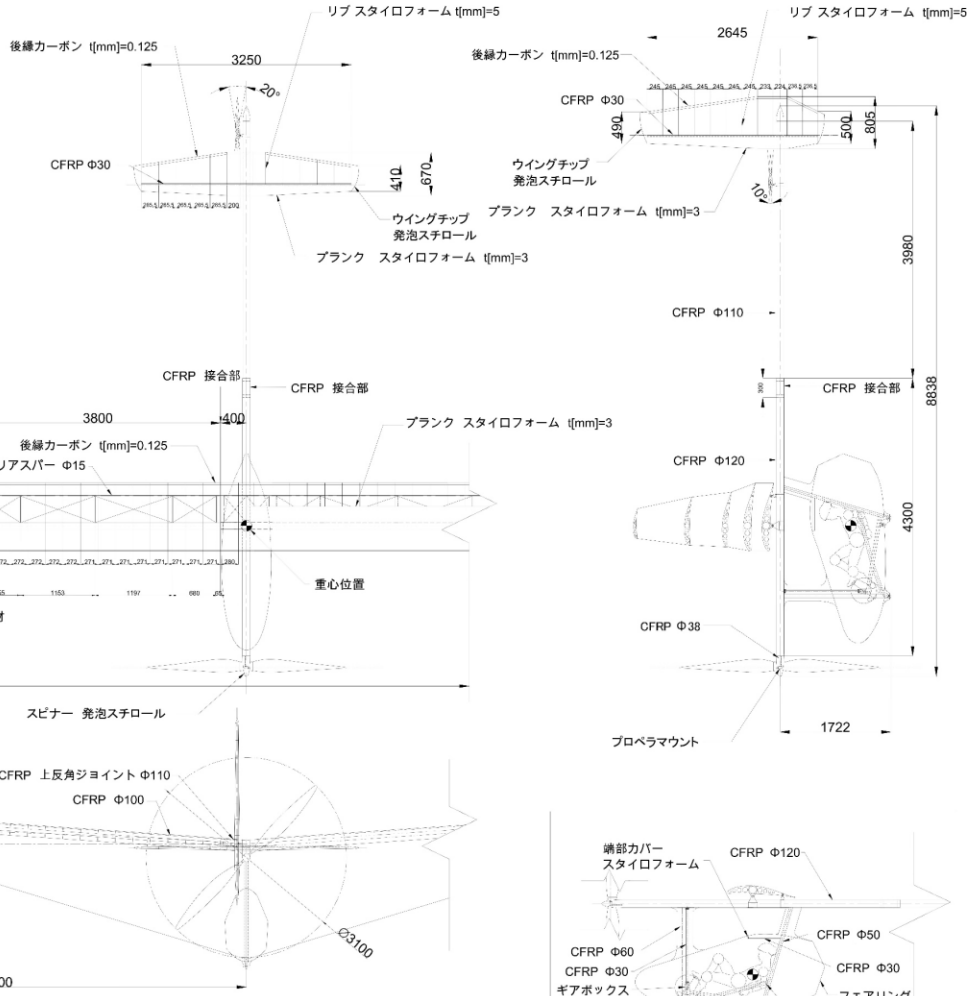
総重量	85[kg]
空虚重量	30[kg]
パイロット重量	55[kg]
巡航速度	7.3[m/s]
必要パワー	215[W]
重心位置	0.39[mac]

主翼	翼型	DAE21 - DAE31
	スパン	30.4[m]
	翼面積	26.17[m²]
	平均空力翼弦	0.89[m]
	アスペクト比	35.31
	桁位置 DAE-21	36.7[%]
	DAE-21,31	36.7 - 38.2[%]
	DAE-31	38.2 - 42.5[%]
	翼面荷重	3.30[kg/m²]
	迎角 DAE-21	4.3[deg]
	DAE-21,31	4.3 -3.0[deg]
	DAE-31	3.0 -1.8[deg]
	主翼中央部初期上半角	4.0[deg]

水平尾翼	翼型	NACA-0009
	スパン	3.25[m]
	モーメントアーム	5.3[m]
	翼面積	1.83[m²]
	桁位置	25[%]
	水平尾翼容積	0.415
	操舵角	±5[deg]
	アスペクト比	5.76

垂直尾翼	翼型	NACA-0009
	スパン	2.645[m]
	モーメントアーム	6.1[m]
	翼面積	1.79[m²]
	桁位置	25[%]
	垂直尾翼容積	0.0137
	操舵角	±10[deg]
	アスペクト比	3.91

プロペラ	翼型	Milly - Terry （Original）
	回転半径	1.55[m]
	回転数	135.5[rpm]
	推力	22.8[N]



東北大学Windnauts 2017
第40回鳥人間コンテスト選手権大会

陸奥の飛隼、碧翼を仰ぎ
十里の琵琶を舞い戻らん

プロペラ機ディスタンス部門出場機体

− 隼 −

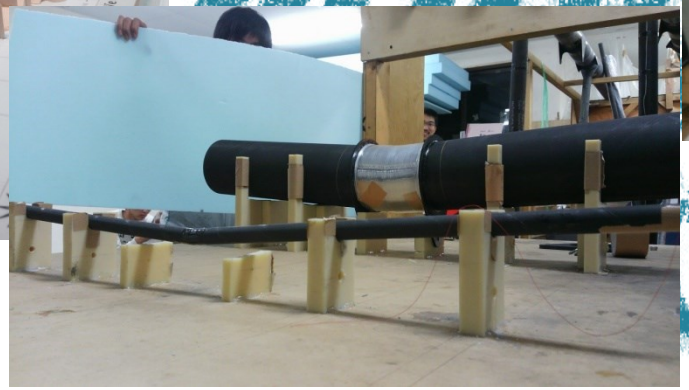
チーム名	東北大学Windnauts	機体名	隼
パイロット	多田隼都	尺度	1:25
設計	花田豊	投影法	三角法

The crash accident

Appearance of each section

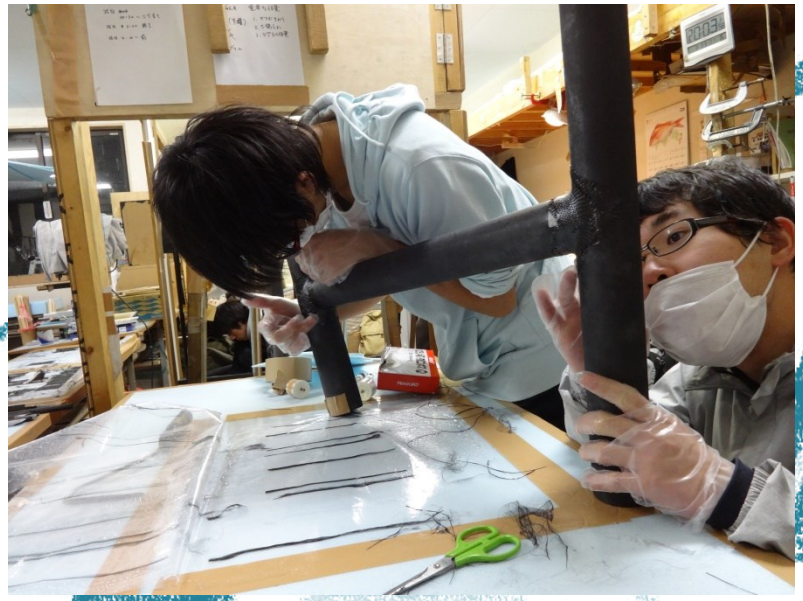
Jig installation

Jig made by ABS resin or balsa



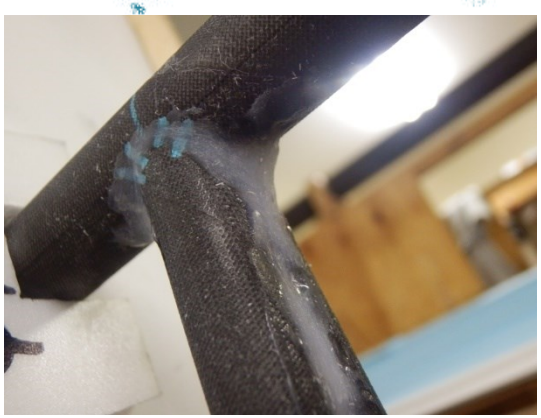
All parts are filed by the hand of workers

Appearance of each section



Carbon cloth impregnated with epoxy

And rapping.

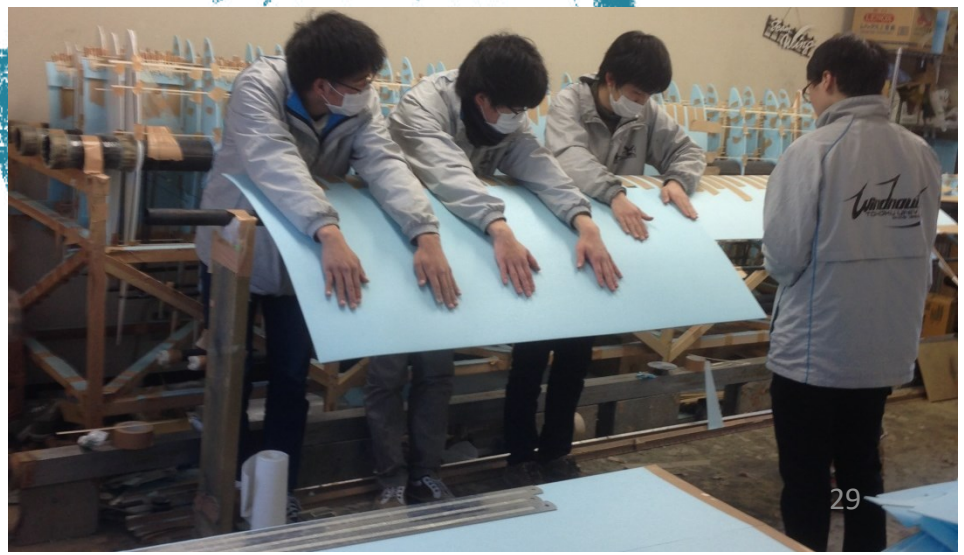


Fillet increase workability

Appearance of each section

Trailing edge are equal

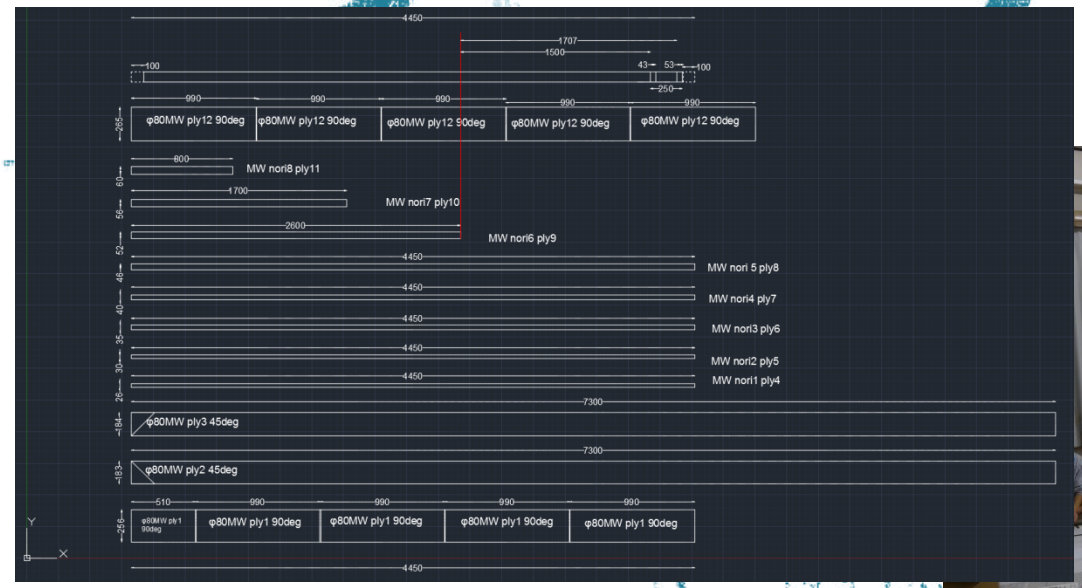
Wing



Intersection plank and fix

Columnar beam made by CFRP

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



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°
Ply3 45°
Ply4 -45°

} Ply5~ base on each design

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

Constitution of Windnauts

✈In 2017, 49 members belonged to our team.

Grade	Number of People
1	17
2	22
3	10

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

・Wing team ・Propeller team ・Cockpit team

・Fairing team ・Avionics team ・Drive team

・Steering team

Our target for this year was…

“Win Back at the Birdman rally”

✈ Last year, we participated the Birdman rally as a Defending Champion.

✈ But, the wind is so strong that we can not have won the competition.

The Record of Last year

Rank	Team	Record[m]
1st	Nihon University	21,415.53
2nd	Tohoku University	19,669.59
3rd	Birdman House Iga	17,854.09

Flying route in2016 (Red line is the estimate)