Tohoku University

Windnauts

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What is Windnauts?

✈ We make the human powered aircraft for participating in the Birdman rally at Biwa lake.

✈ We compete distance from taking off to landing on the water.

✈ In 2015, 35 members belonged to our team.

Official name	**Human-powered flight club**
Team name	**Windnauts**
Founding	**1993**
Average production cost	**¥250,000**

Our records

year	event	Aircraft name	Record	
2006	30th rally	谺 ~echo~	28,628m	1st /18 team
2008	32th rally	來(sou)	36,000m	1st /13 team (Tourney record)
2009	Record Flight	Rera	20,720m	FAI official record
2011	34th rally	Riih	18,687m	1st /11 team
2012	35th rally	翠(sui)	14,129m	1st /11 team
2015	38th rally	鴻(kou)	35,367m	1st /11 team

✈ We have…

- 5 times victory at Birdman rally.
- Tourney record, 36,000m, at Birdman rally.
- FAI official record.

Design concept

Theme

✈ How to win the Birdman rally in any conditions.

✈Designer …Designing high speed and short span wing.	Removing effect of external wind. Improving steering performance.
✈Pilot …Training priority to high rotational speed.	Making good escape from complex wind conditions.
✈Worker …Planning minutely, then attaining roll-out early.	Being experienced many test flights,(=wind conditions) for pilot,

✈Our result of winning the Birdman rally, distance section.

×Low power then aim the farthest record.

✓**High speed then overcome the day's wind condition.**

機体諸元

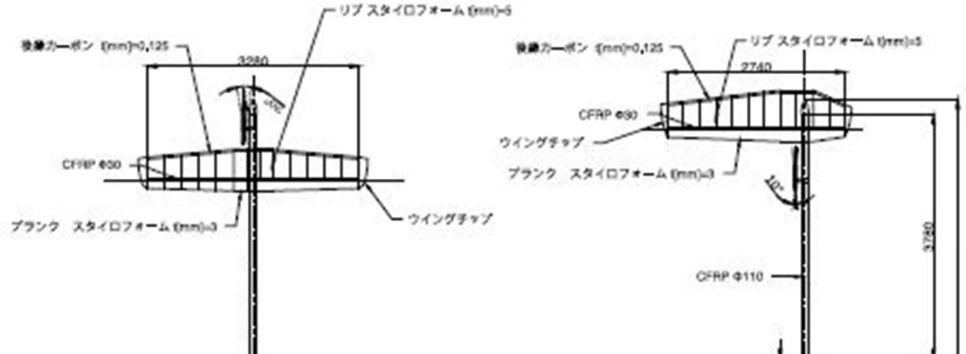
総重量	90[kg]
機体重量	30[kg]
パイロット重量	60[kg]
巡航速度	7.3[m/s]
必要パワー	220[W]
重心位置	0.38[mac]

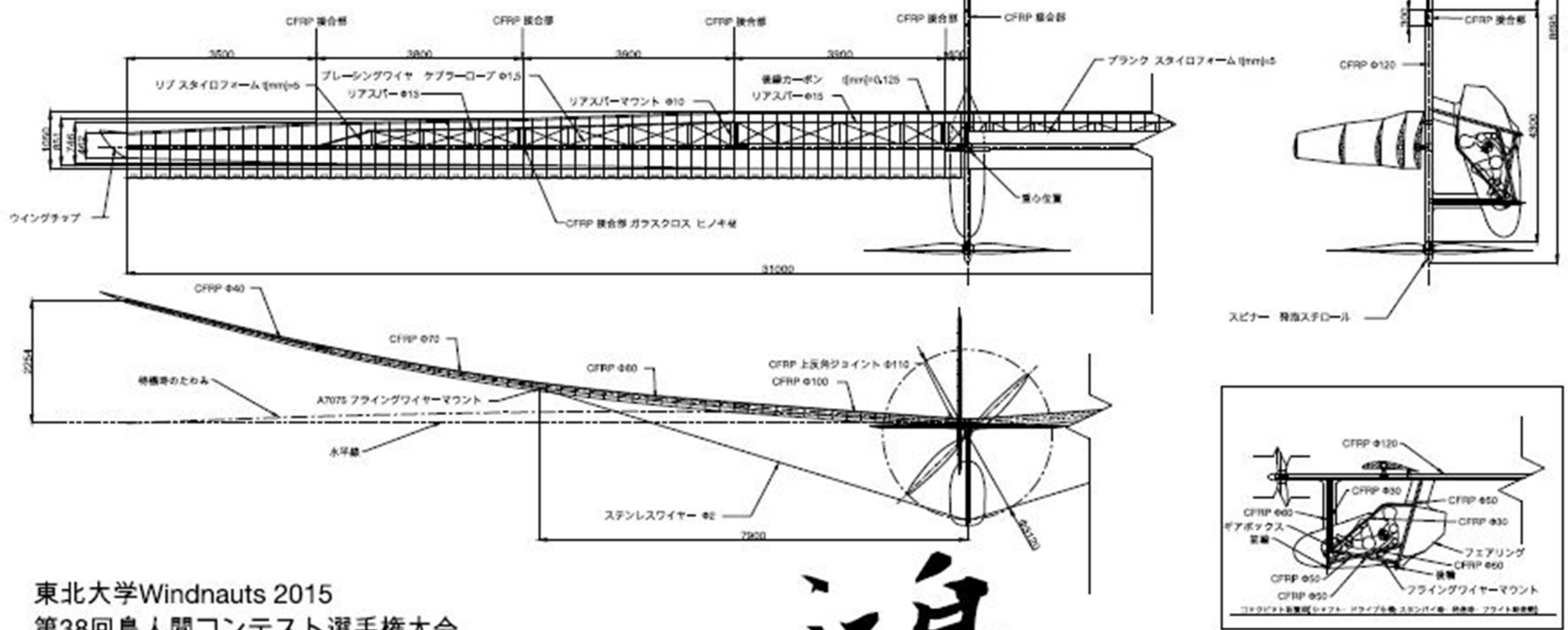
主翼	翼型		DAE21 ・ DAE31
	スパン		31.0[m]
	翼面積		26.73[m²]
	平均空力翼弦		0.84[m]
	アスペクト比		35.95
	桁位置	DAE-21	36.6[%]
		DAE-21,31	36.6 ・ 38.1[%]
		DAE-31	38.1 ・ 42.2[%]
	翼面荷重		3.37[kg/m²]
	捩角	DAE-21	4.4[deg]
		DAE-21,31	4.4・3.7[deg]
		DAE-31	3.0・1.8[deg]
	主翼中央部初期上反角		4.0[deg]

水平尾翼	翼型	NACA-0009
	スパン	3.28[m]
	モーメントアーム	5.0[m]
	翼面積	1.88[m²]
	桁位置	25[%]
	水平尾翼容積	0.417
	舵角	±6[deg]
	アスペクト比	5.71

垂直尾翼	翼型	NACA-0009
	スパン	2.74[m]
	モーメントアーム	6.1[m]
	翼面積	1.86[m²]
	桁位置	25[%]
	垂直尾翼容積	0.137
	舵角	±10[deg]
	アスペクト比	4.03

プロペラ	翼型	Milly ・ Terry (Original)
	回転半径	1.56[m]
	回転数	137[rpm]
	推力	23.2[N]





東北大学Windnauts 2015
第38回鳥人間コンテスト選手権大会
プロペラ機ディスタンス部門出場機体

Cleave the Path, Achieve the Myth.

一鴻一

チーム名	東北大学Windnauts	機体名	鴻
パイロット	松島昂汰	尺度	1:25
設計	井上荀太郎	投影法	三角法

Meaning of Test Flight

✈ Final tuning of aircraft

Assembling

Checking center of gravity

and resolving the other initial failures

Meaning of Test Flight

✈ Flight training of pilot

→ handling tail and flying horizontally,

adjusting thrust power and keeping airspeed

Flow of tuning at Test Flight

1. Practice of the departure and taking off
2. Tuning the center of gravity by observing the appearance of steady flight
3. Control of the posture of aircraft by steering horizontal and vertical tails

Flow of tuning at Test Flight

1. **Practice of the departure and taking off**
2. Tuning the center of gravity by observing the appearance of steady flight
3. Control of the posture of aircraft by steering horizontal and vertical tails

‘15.6.5 Test Flight at Tohoku Univ.

Flow of tuning at Test Flight

1. Practice of the departure and taking off
2. **Tuning the center of gravity by observing the appearance of steady flight**
3. Control of the posture of aircraft by steering horizontal and vertical tails

‘15.6.20 Test Flight at Kakuda

Flow of tuning at Test Flight

1. Practice of the departure and taking off
2. Tuning the center of gravity by observing the appearance of steady flight
3. **Control of the posture of aircraft by steering horizontal and vertical tails**

‘15.7.5 Test Flight at Kakuda

Result of the competition

- Date : July. 26, 2015
- Rank : 1st
- Flight distance : 35,367[m]
- Flight time : 110[min]

Flight route

Rank	Team	Record[m]
1st	Tohoku University	35367.02
2nd	Nihon University	22892.36
3rd	Osaka Institute of Technology	5368.97

The Birdman Rally 2015

Summary

- We created a HPA within a year.
- Completed aircraft was brushed up through the test flight.
- We participated in the birdman rally, and won.

Additional Slides

Specifications

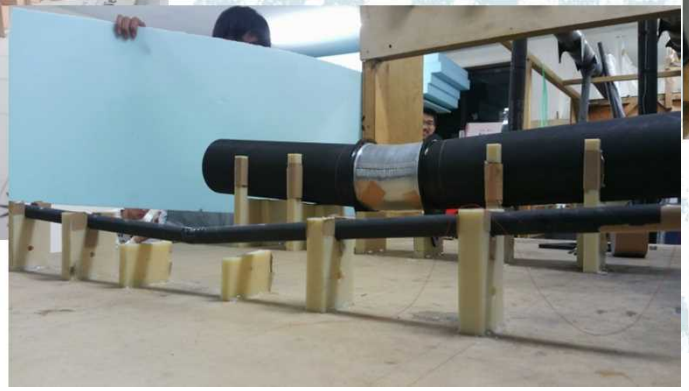
Specification	
Gross weight	90[kg]
Empty weight	30[kg]
Design cruising speed	7.3[m/s]
Need power	220[W]

Propeller	
Airfoil	Milly-Terry(Original)
Rudius	1.56[m]
Rotational speed	137[rpm]
Thrust power	23.0[N]

Main wing		
Airfoil	DAE21 - DAE31	
Span of wing	31.0[m]	
Wing area	26.8[m^2]	
Aspect ratio	35.95	
Angle of attack	DAE-21	4.4[deg]
	DAE-21,31	4.4-3.0[deg]
	DAE-31	3.0-1.8[deg]
Dihedral angle	4.0[deg]	

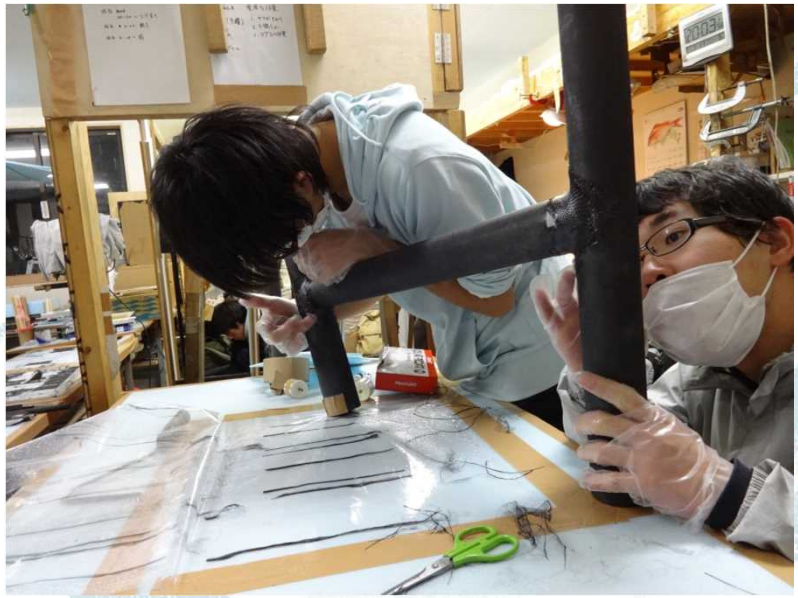
Appearance of each section

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.

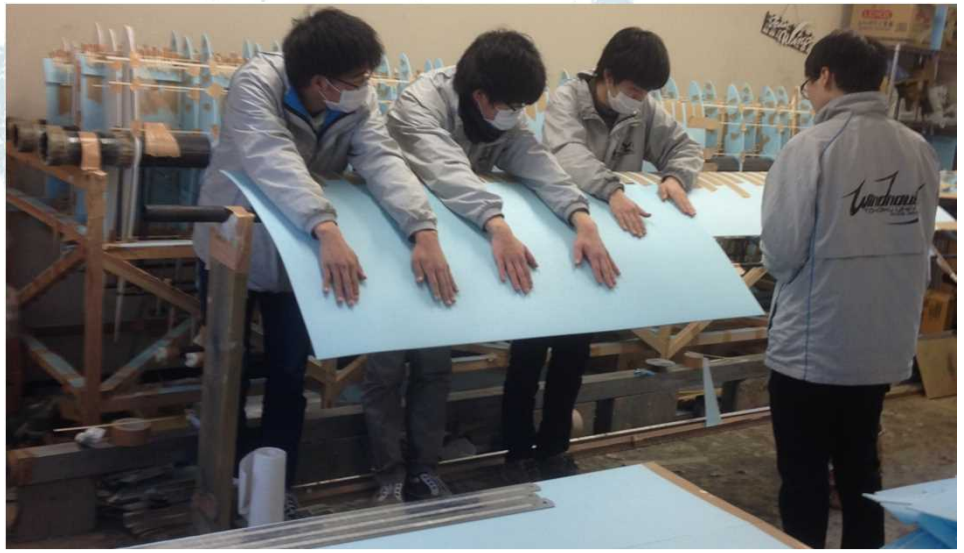
Fillet increase workability

Appearance of each section

Wing

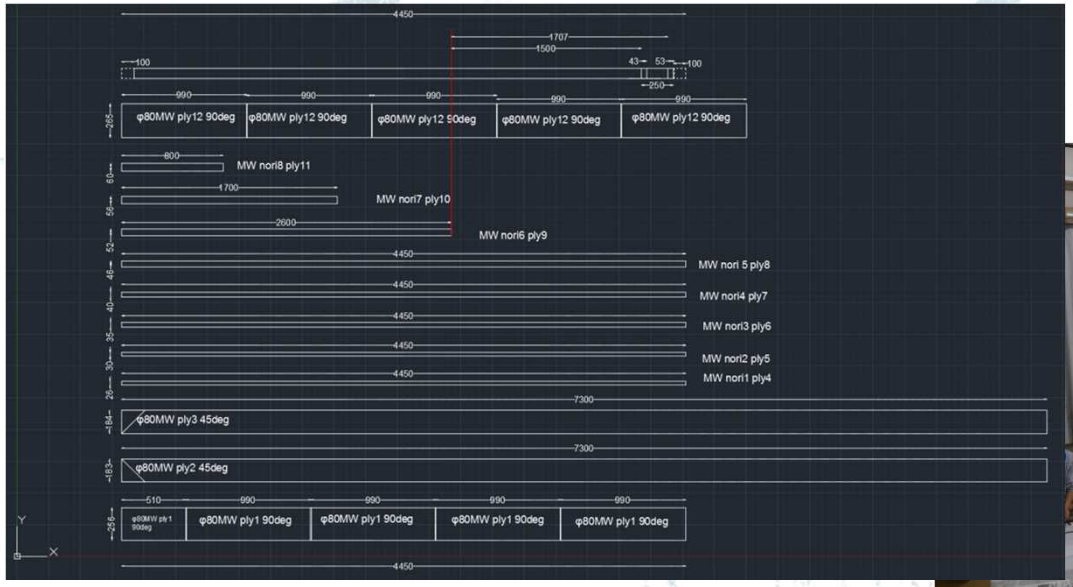
Trailing edge are equal

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.