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 surface.

✈In 2016, 53 members belonged to our team.

Official name	**Human-powered flight club**
Team name	**Windnauts**
Starts	**1993**
Project costs for 2016	**¥3,500,000**

Past Performance of The Team

year	event	Aircraft name	Record	
2006	30th rally	研 ~echo~	28,628m	1st /18 team
2008	32th rally	來(rai)	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.
- 5th victory in last year.

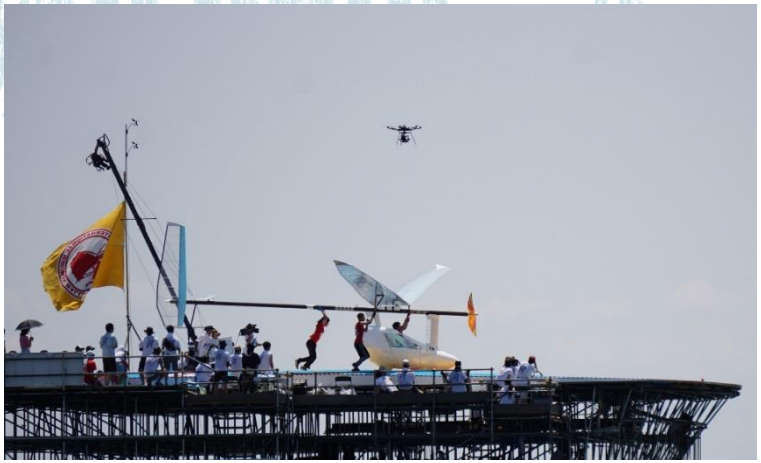
Our target for this year was…

“Back-to-Back Victory”

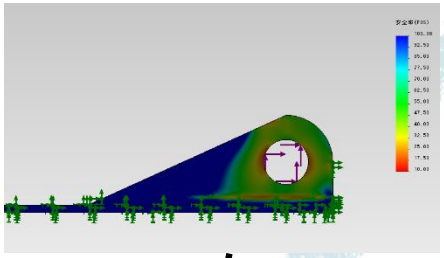
- But, we had some problems to be solved…

  →We had to flew at high-noon as handicap.

  - High temperature. (Around 33℃)
  - Strong and wild wind. (3~4 m/s)



The Process to Competition



Load Test

Test Flight

Competition

Making

Design

Design Concept

Theme

✈ <u>How to win the Birdman rally in bad condition.</u>

✈To overcome “High Temperature” …

Highly efficient air inlet. (NACA ducts)

✈To overcome “Strong and Wild Wind” …

Good steering.(short wing span, high rigidity of tail wing)

This year’s design concept of aircraft

“Low Power and Good Steering”

機体諸元

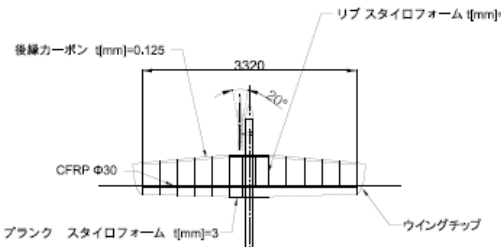
総重量	85[kg]
空虚重量	31[kg]
パイロット重量	54[kg]
巡航速度	7.2[m/s]
必要パワー	210[W]
重心位置	0.39[mac]

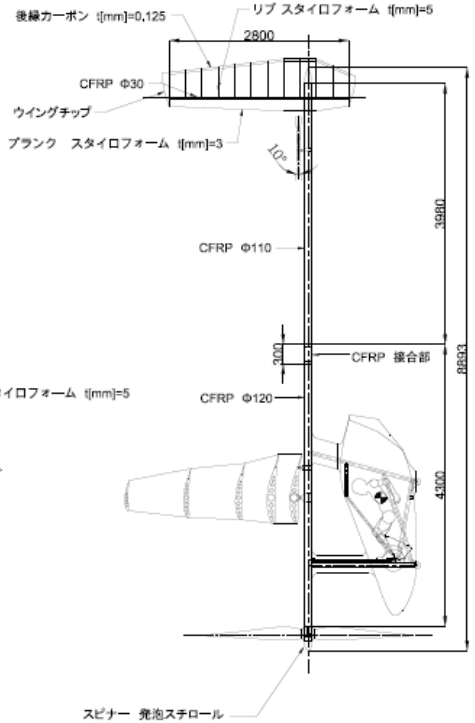
主翼	翼型		DAE21 - DAE31
	スパン		31.6[m]
	翼面積		27.42[m²]
	平均空力翼弦		0.90[m]
	アスペクト比		36.42
	桁位置	DAE-21	36.9[%]
		DAE-21,31	36.9 - 38.5[%]
		DAE-31	38.5 - 42.5[%]
	翼面荷重		3.17[kg/m²]
	迎角	DAE-21	4.1[deg]
		DAE-21,31	4.1 - 3.0[deg]
		DAE-31	3.0 - 1.8[deg]
	主翼中央部初期上半角		4.0[deg]

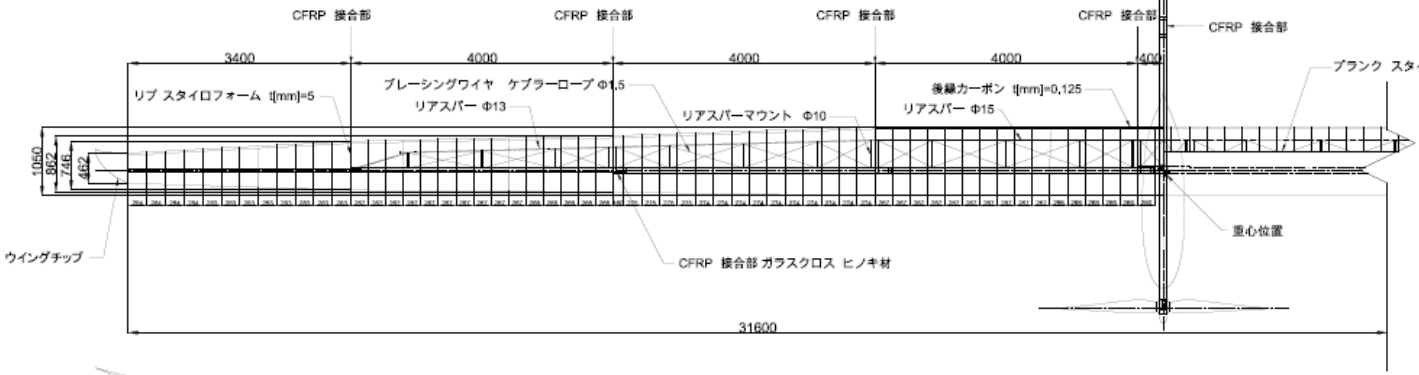
水平尾翼	翼型	NACA-0009
	スパン	3.32[m]
	モーメントアーム	5.3[m]
	翼面積	1.93[m²]
	桁位置	25[%]
	水平尾翼容積	0.415
	操舵角	±5[deg]
	アスペクト比	5.71

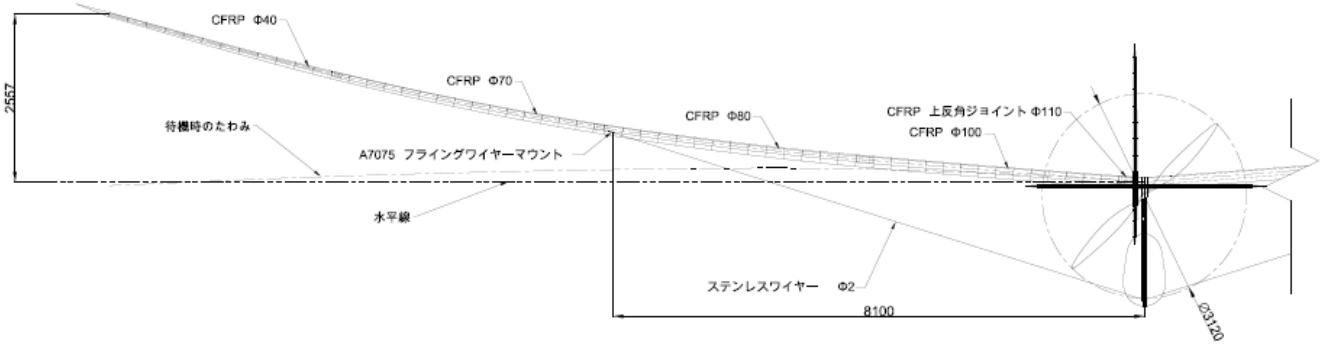
垂直尾翼	翼型	NACA-0009
	スパン	2.80[m]
	モーメントアーム	5.1[m]
	翼面積	1.95[m²]
	桁位置	25[%]
	垂直尾翼容積	0.137
	操舵角	±10[deg]
	アスペクト比	4.03

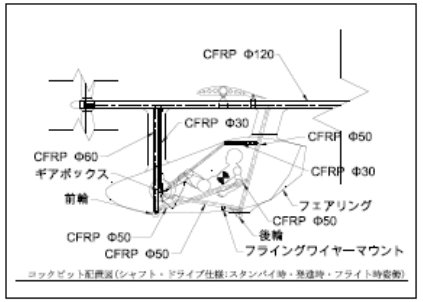
プロペラ	翼型	Milly - Terry (Original)
	回転半径	1.56[m]
	回転数	133[rpm]
	推力	22.2[N]











東北大学Windnauts 2016

第39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

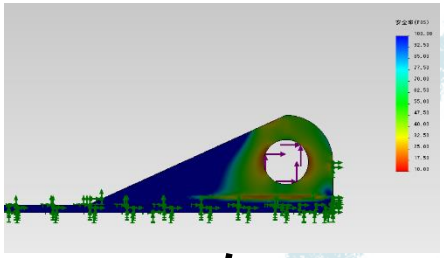
凛

怖めず臆せず

万難を排してただ凛然とあれ

チーム名	東北大学Windnauts	機体名	凛
パイロット	赤石亮将	尺度	1:25
設計	平井遼	投影法	三角法

The Process to Competition



Competition

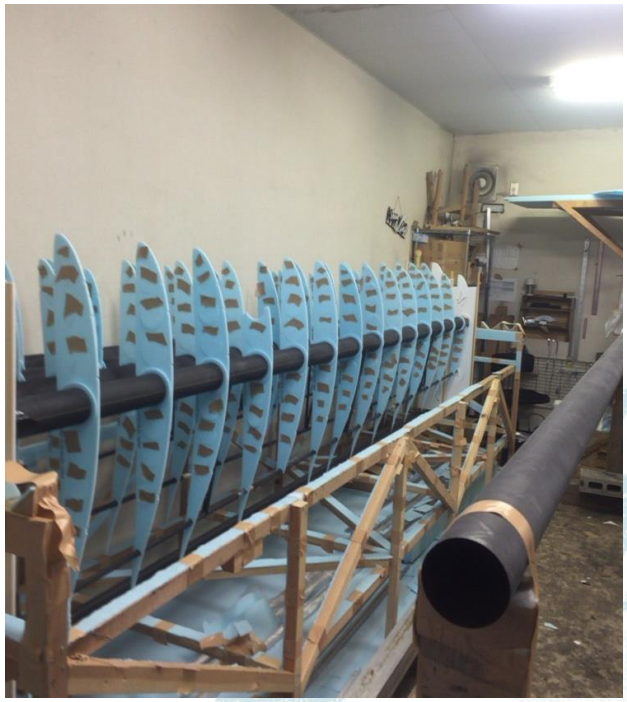
Test Flight

Load Test

Making

Design

Making Scenery



Wing

Frame

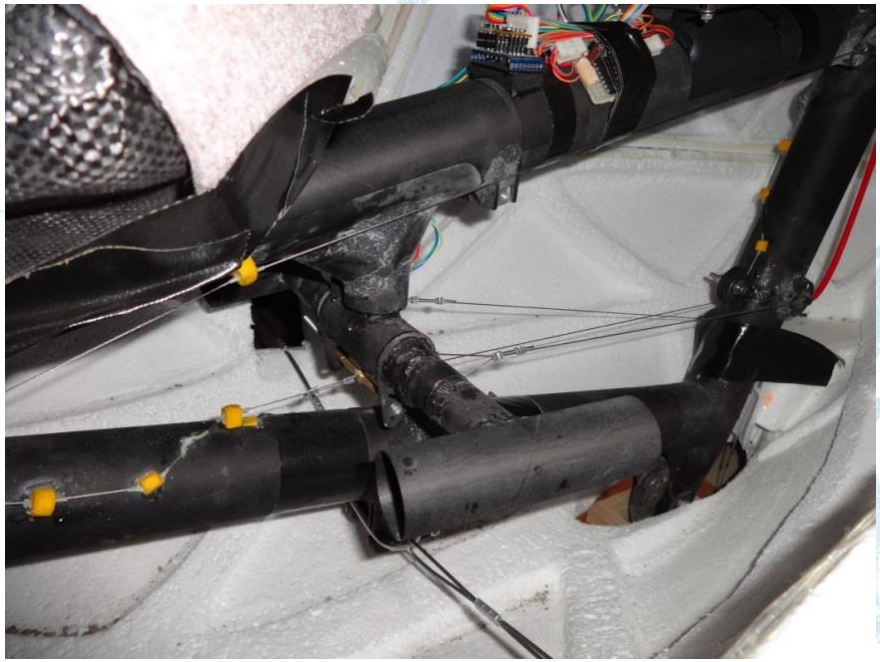
Fairng

Making Scenery

Propeller

Drive

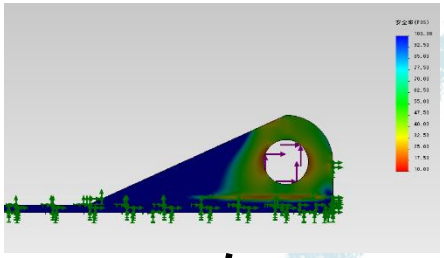
Making Scenery



Steering

Speed･Cadence meter

The Process to Competition



Competition

Test Flight

Load Test

Making

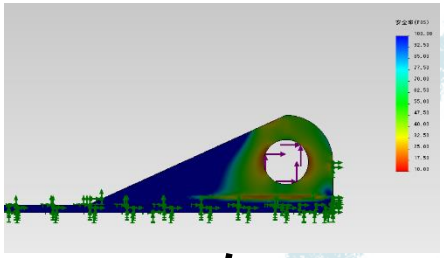
Design

Load Test

- To check strength of wing beam…

  Take a load $1\frac{1}{2}$ times as much weight as steady flight.

The Process to Competition



Competition

Test Flight

Load Test

Making

Design

Test Flight

- The purpose of Test Flight is…
  - Training of the Pilot and the members.
  - Check-up of assembly correctness.
  - Training of airplane handling.

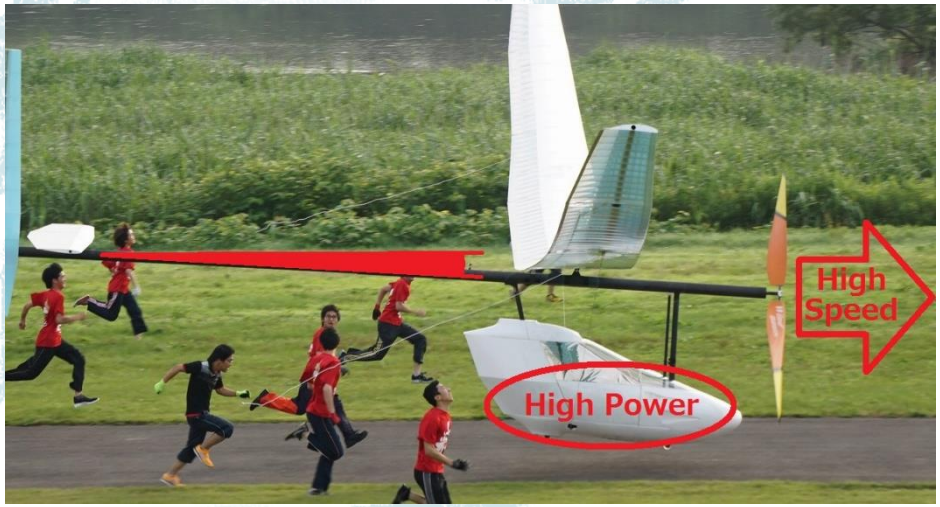
‘16.7.11 Test Flight at Kakuda

Advanced Skill of Operating Aircraft

✈This year, we did Test Flights ahead of schedule.

→We trained proper combination of
tail wing movement and speed of the aircraft.

The Attack Angle is high



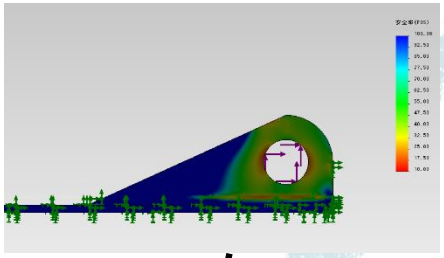
The Attack Angle is low

The technique helped us to adjust to strong wind.

Training of Speed Control

Training of Speed Control

The Process to Competition



Competition

Design

Making

Load Test

Test Flight

Take off

Steady Flight

So Strong Head Wind

Landing on The Water

Result of The Competition

- Date : July. 31, 2016
- Rank : 2nd
- Flight distance : 19,669 [m]
- Flight time : 70[min]

Flying route (Red line is the estimate)

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

Summary and Next Year

- We won the second prize in the competition.
- Next year, we will design a higher speed aircraft to overcome strong wind.
- We consider using Ice Best.

Thank you for your attention


©ytv

Additional Slides

Specifications

機体諸元

総重量	85[kg]
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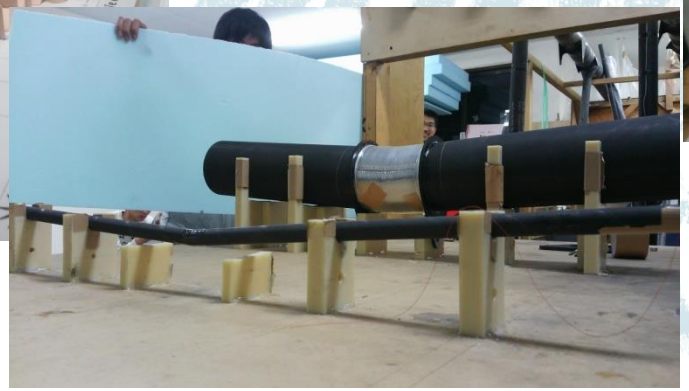
Flow of tuning at Test Flight

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

Appearance of each section

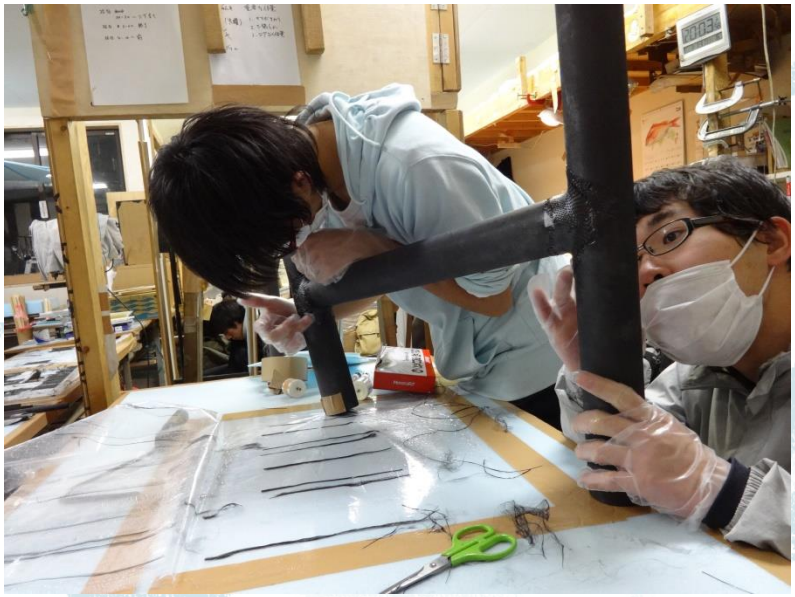
Jig installation

Jig made by ABS resin or balsa



All parts are filed by the hand of workers

Appearance of each section

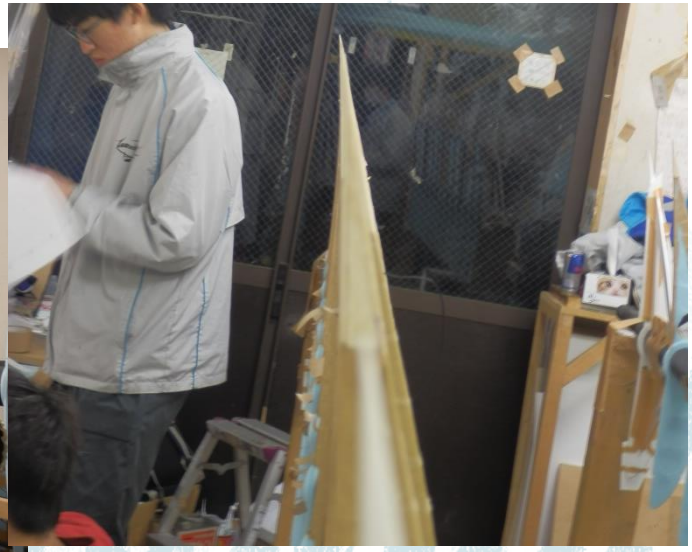


Carbon cloth impregnated with epoxy

And rapping.

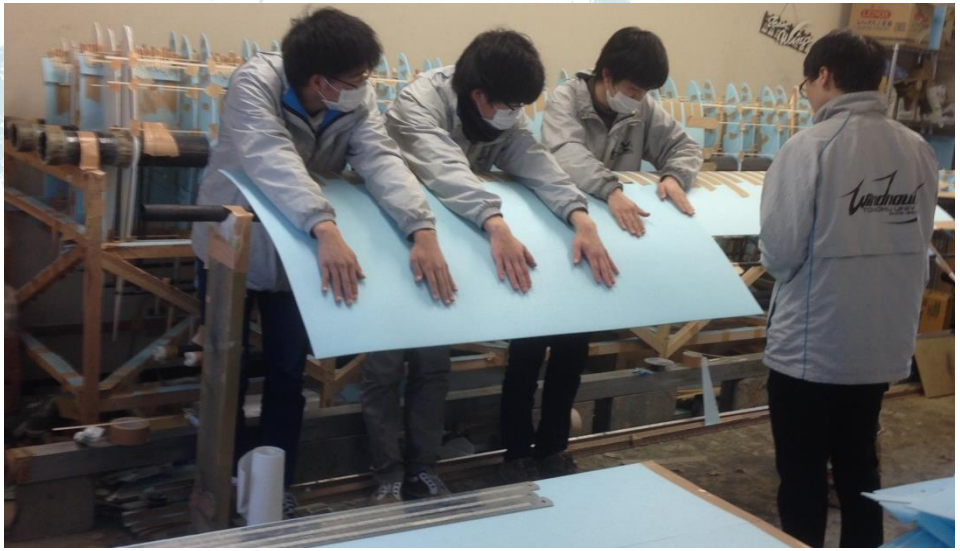
Fillet increase workability

Appearance of each section



Trailing edge are equal

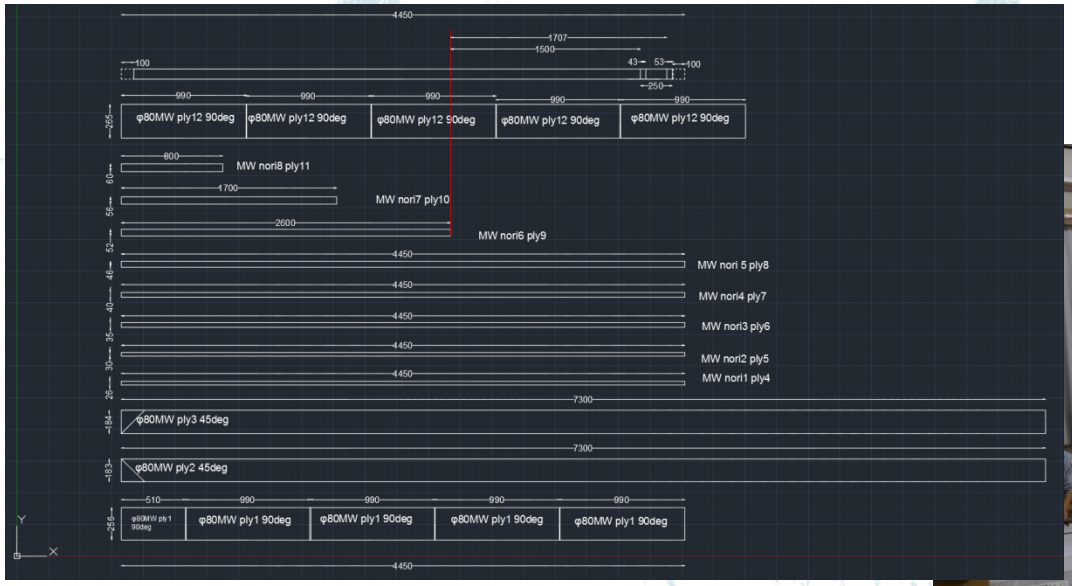
Wing



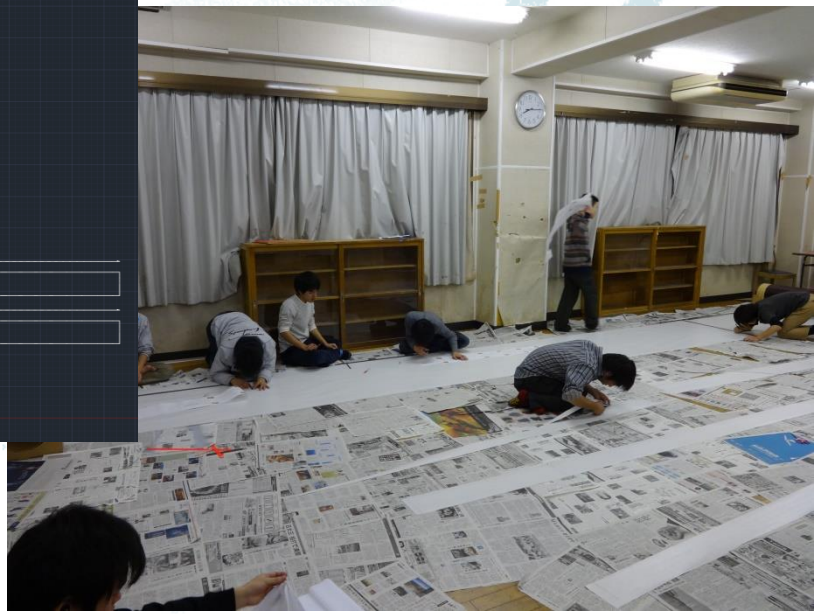
Intersection plank and fix

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.