Tohoku University Formula Team

2016 Student Formula Japan
- Monozukuri Design Competition -

Nov. 24, 2016
Akari SAWASE (Team leader)
Hiro ABE (Technical director)
Outline

- Tohoku University Formula Team
- TF-16
- Result
- Future Plans
What is TUFT: Tohoku University Formula Team?

We develop Electric Racing Cars.

Our purpose is to win the Student Formula Japan.
What is TUFT: Tohoku University Formula Team?

**Whole processes are coordinated by students.**

We don’t just design and manufacture it, but also a public relations and a budgetary control.
What’s student formula?

To challenge design, fabricate, develop and compete with small, formula style, vehicles.

Name of competition: 2016 Student Formula
Date: Sep. 6~10, 2016
Place: Ogasayama Sports Park ECOPA (Shizuoka prefecture)
Activity bases

Tohoku Univ. Aobayama Campus

Tagajo demonstration site of NICHe

Moto Garage WINDS

Tohoku University
2016 Theme

High Power and Light Weight
Our problems

TF-14
Reliable chassis mechanism

TF-15
Reliable Electrical Systems

But too heavy!!

We need lighter weight, higher power!
Power Up: Completively NEW Tractive System

- **Controller**
- **Li-ion battery**
- **Compact layout and light weight casing**
- **Twin DC Motor Unit**
  - Light weight, high power and high efficiency
Power Up: Twin motor unit
Power up: Twin-motor Unit

Simple and Reliable Mechanism
Weight reduction of Chassis: Down Sizing

Less Clearance and Higher working Accuracy
Weight Reduction of Chassis: Frame

Weight reduction of frame

55.1 kg*  
40.1 kg*

Thickness of Steel tubes

Blue: 1.6 mm  Red: 2.3 mm  Green: 1.2 mm
※ Including weight of stays

TF-15  TF-16

-15kg
Weight Reduction of Chassis

TF-15

TF-16

-30kg
Power Weight Ratio

TF-15

TF-16

W/P 18.9kg/kW → 6.3 kg/kW
※with a 68kg driver
## Specification

<table>
<thead>
<tr>
<th>TF-16</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drive system</strong></td>
<td>EV</td>
</tr>
<tr>
<td><strong>Overall Length</strong></td>
<td>2750mm</td>
</tr>
<tr>
<td><strong>Overall Height</strong></td>
<td>1150mm</td>
</tr>
<tr>
<td><strong>Wheel Base</strong></td>
<td>1650mm</td>
</tr>
<tr>
<td><strong>Track Width Front / Rear</strong></td>
<td>1250mm/ 1250mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>321.4kg</td>
</tr>
<tr>
<td><strong>Weight distribution</strong></td>
<td>45:55 (with 68kg driver)</td>
</tr>
<tr>
<td><strong>Motor</strong></td>
<td>LEM200-D135RAGS</td>
</tr>
<tr>
<td><strong>Peak power</strong></td>
<td>60kW</td>
</tr>
<tr>
<td><strong>Peak Torque of Motor</strong></td>
<td>84Nm</td>
</tr>
<tr>
<td><strong>Battery Type</strong></td>
<td>Li-ion</td>
</tr>
<tr>
<td><strong>Max Voltage</strong></td>
<td>131V</td>
</tr>
<tr>
<td><strong>Battery capacity</strong></td>
<td>6kwh/50Ah</td>
</tr>
</tbody>
</table>
Other Challenge

【Key words】
・Renewal of high voltage system
・Independent left & right wheel driving device
・Weight reduction
・Change of driving position
・Improvement of controllability
・Gear ratio change of steering
・Improvement of suspension linearity
・Increasing suspension adjustment mechanism (anti-roll bar, anti-pitch, canber-angle)
・proportioning valve
・Strengthening wiring
・Easy Maintenance
・Printed circuit board
・Sensor
・Independently developed of Li-ion battery
Result of SFJ2016
Movie
We must have got more high scores, if we have not had a trouble in the endurance.

<table>
<thead>
<tr>
<th>Items</th>
<th>Rank of 106 teams (ICV + EV)</th>
<th>Rank of 13 teams (only EV)</th>
<th>Point</th>
<th>from a year earlier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Inspection</td>
<td>Passed</td>
<td>Passed</td>
<td>—</td>
<td>—</td>
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<tr>
<td>静的项目</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cost and Manufacturing</td>
<td>72</td>
<td>5</td>
<td>8.4pt/100pt</td>
<td>+108.4</td>
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<tr>
<td>Design</td>
<td>37</td>
<td>4</td>
<td>68pt/150pt</td>
<td>+3</td>
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<tr>
<td>Presentation</td>
<td>24</td>
<td>3</td>
<td>45pt/75pt</td>
<td>+14.21</td>
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<tr>
<td>动力项目</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration</td>
<td>41 (of 46 teams)</td>
<td>3 (of 3 teams)</td>
<td>3.5pt/75pt</td>
<td>+3.5</td>
</tr>
<tr>
<td>Skid Pad</td>
<td>Do not started (of 44 teams)</td>
<td>Do not started (of 2 teams)</td>
<td>0pt/50pt</td>
<td>0</td>
</tr>
<tr>
<td>Autocross</td>
<td>49 (of 74 teams)</td>
<td>3 (of 3 teams)</td>
<td>53.78pt/150pt</td>
<td>-37.17</td>
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<tr>
<td>Endurance</td>
<td>4th rap retired</td>
<td>—</td>
<td>3pt/300pt</td>
<td>-6</td>
</tr>
<tr>
<td>Efficiency</td>
<td>—</td>
<td>—</td>
<td>0pt/100pt</td>
<td>0</td>
</tr>
<tr>
<td>Overall result</td>
<td>50</td>
<td>3</td>
<td>181.68pt/1000pt</td>
<td>+100.94</td>
</tr>
</tbody>
</table>
Plan for 2016-2017

Machine Concept

Reliable System, Reliable Performance

【Key Words】
• Drivability
• Easier Maintenance
• Reliable power train
• Light weight
• Low center of gravity
Thank you for your attention.
Styling
Styling