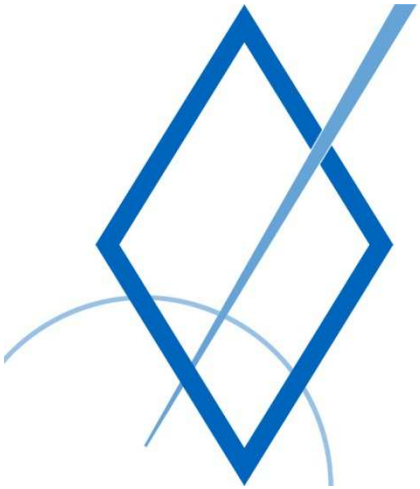


EuSEC

European
Space Elevator Challenge

Model design of the climber for the Space Elevator

-ALPHA-

Team:Aoki Bravo A

Speaker: : S.Tanaka

Department of Precision machinery engineering,
Graduate School of Nihon University

Team introduction

—team “Aoki bravo A”—

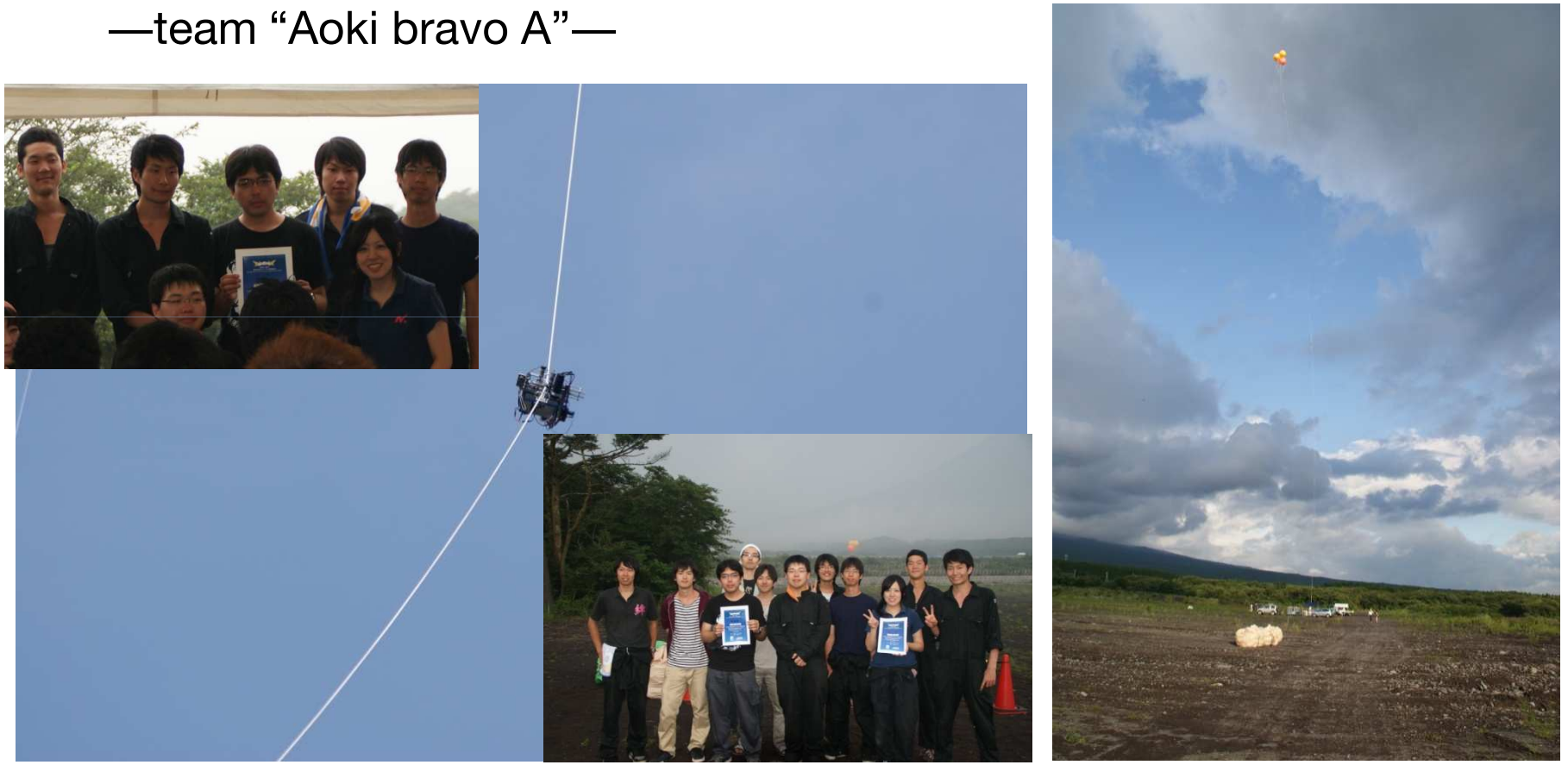


Fig. 1 photos of JSETEC on August 7, 2011

Concept of the Climber

- To have extensibility
  - obtain many kinds of data for development.

  Cameras, Rotary encorder, Aerotonometer,
  Triaxial accelerometer, etc.

- For the competition
  - EuSEC

  Payload：10[kg]
  (including weight of the climer)
  - JSETEC

  Speed：10[m/s]
  (This competition‘s target distance is 600m)

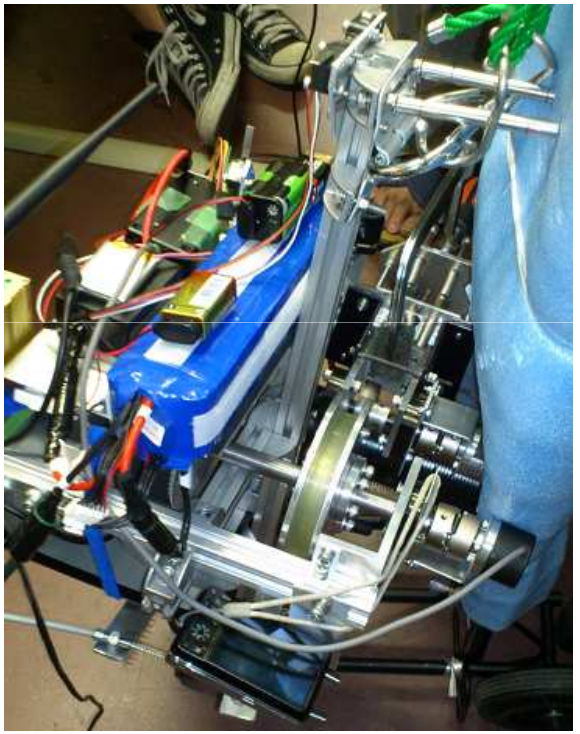


Fig. 2 The climber

Design of the climber

- Pressure originated from the springs

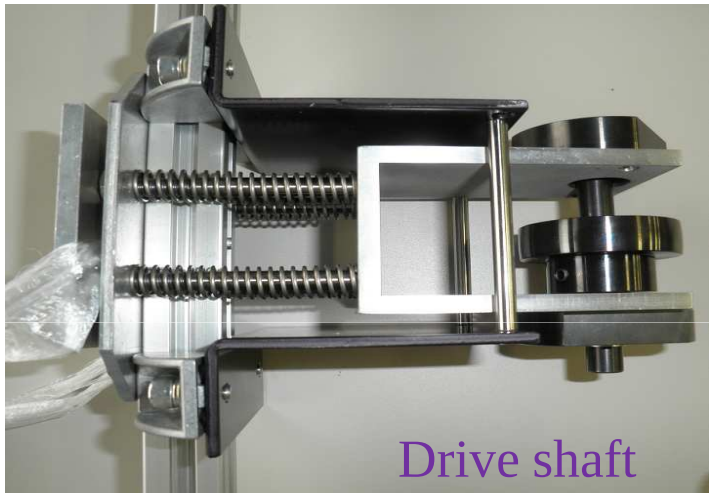


Fig. 3 Tightening with spring

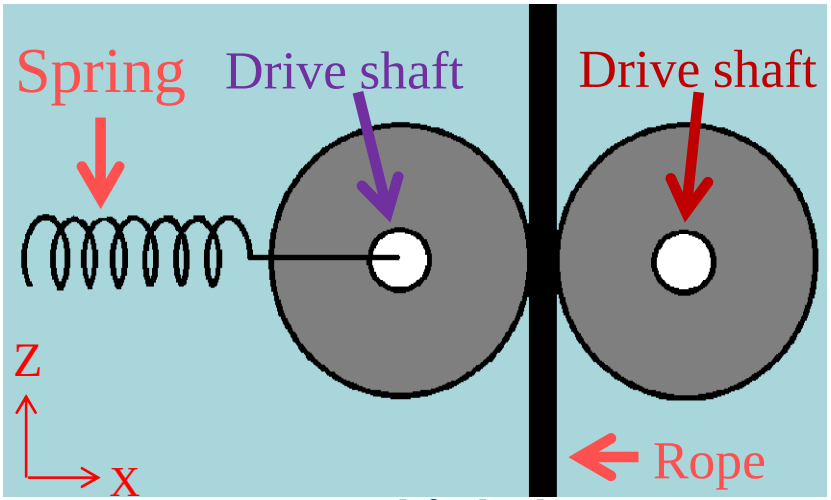


Fig. 4 Simplified schematic

Installation is easy

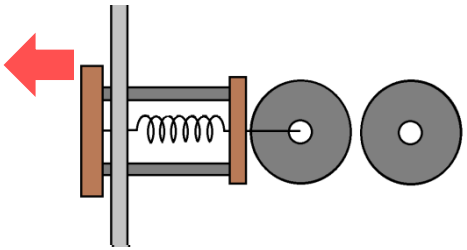


Fig. 5 Installation on rope

Design of the climber

- Constitution of frame
  - Using a frame for extensivility.
- Advantage of this method
  - This method can set up a new part easily

Fig. 6Alpha flame

Customizing easily

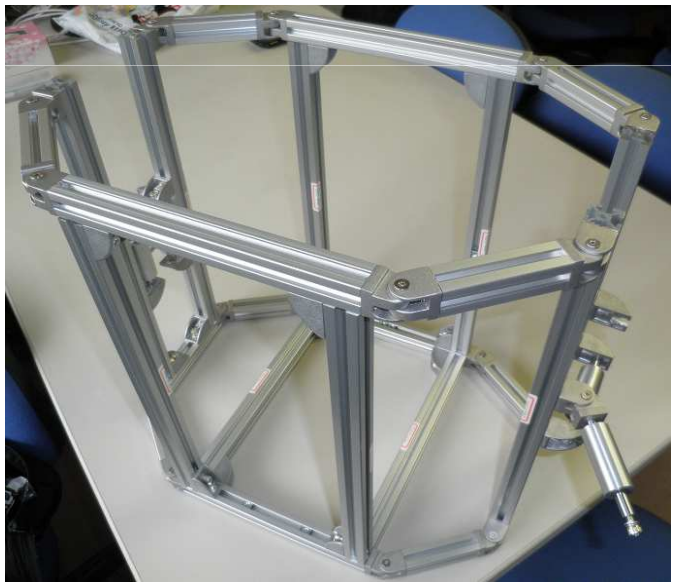


Fig. 7 Climber 1

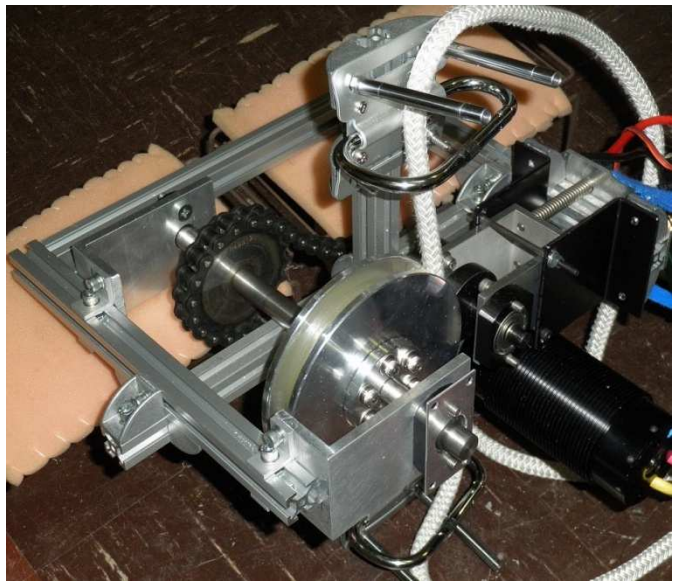


Fig. 8 Climber 2

Design of the climber

- The design of the drive roller

  The drive roller is designed of three parts

  – Advantage of this method

  This method can Change material of the different hardness urethane washer for choosing better friction between the roller and rope.

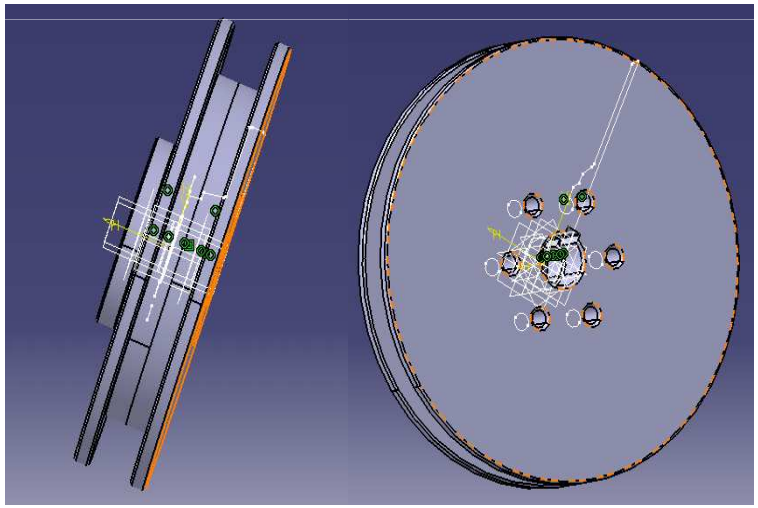


Fig. 9 Roller

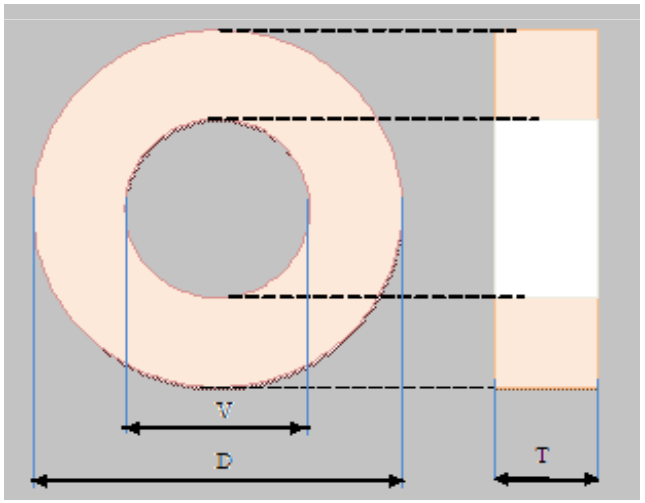


Fig. 10 Washer

Sensors mounted on the climber

• Sensors

- The climber was loaded with many sensors to fulfill the concept.
  - Rotary encoder

  -For checking the slipping between the roller and rope-
  - CCD camera

  -For observing the driven roller and rope-
  - Digital camera

  - For observing the earth side
  - Watt meter
  - Angle sensor
  - Triaxial accerometer
  - Aerotonometer

Fig. 11 sensors

Specifications of the components

- Motor & Gear

NEU MOTORS

Motor : Neu 2230/1Y F

Gear box : Super HD 6.7:1

Kv : 725[rpm/V]

Max Power : 5,000~10,000[W]

Max Rpm : 9,000[rpm]

Fig. 12 Motor & Gear Box

Specifications of the components

- Speed Controller

Castle Creations

PHOENIX ICE HV 160A

Kv : 725[rpm/V]

Max Power : 5,000~10,000[W]

Max Rpm : 9,000[rpm]

Fig. 13 Speed Controller

- Battery

HYPERION

Cells :12S(6S+6S)

Volts :44.4[V]

Capacity :4500[mAh]

Fig. 14 Battery

Specifications of the components

- Power Transmission
  - With timing belt
  - Gear ratio 2:1

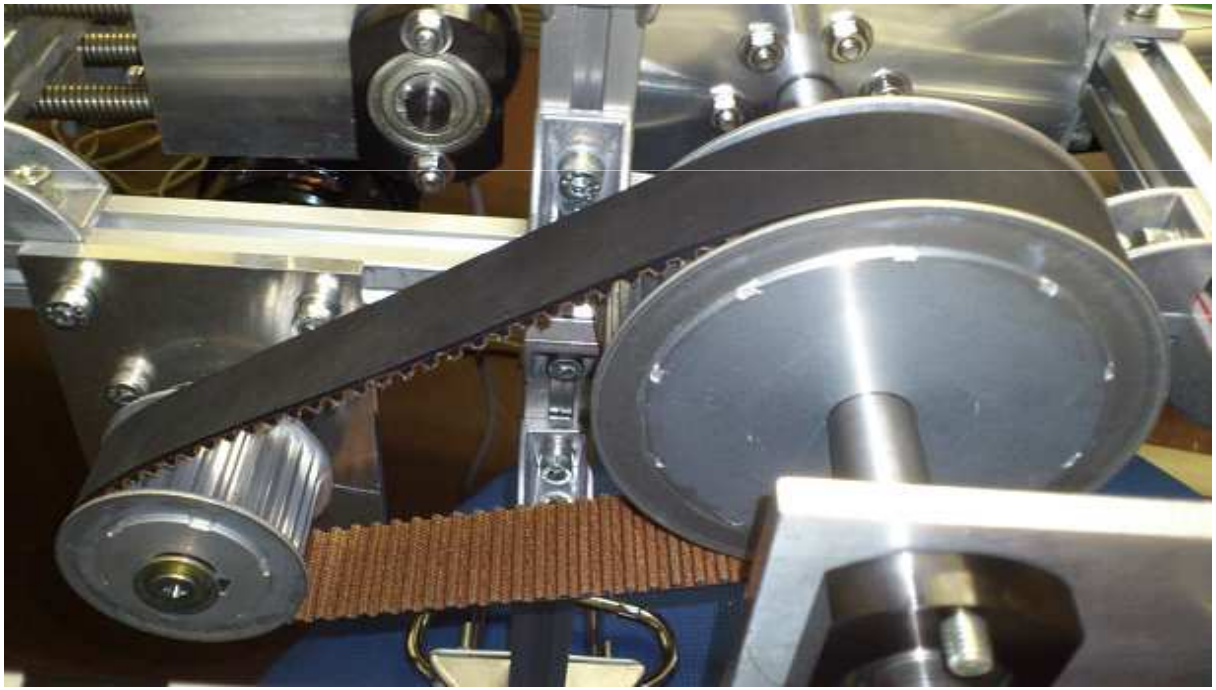


Fig. 15 Accurate region

Safety

- Emergency stop switch

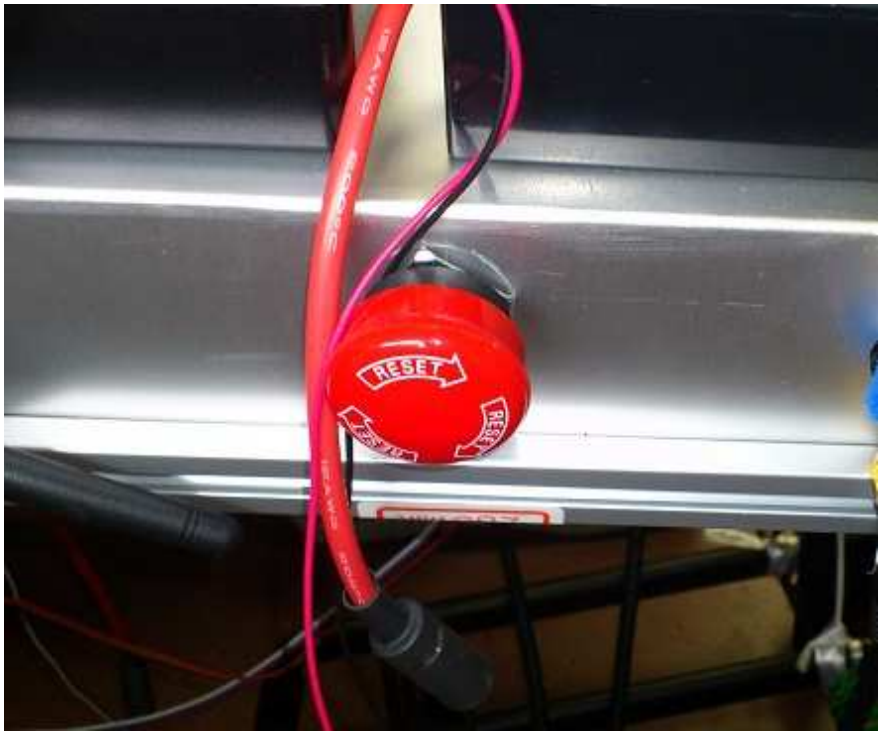


Fig. 16 Emergency stop switch

- Control of safety

- **Control during running**

the brake control set whenever the climber's speed reaches 4m/s

- **If anything urgent happens**

During an autonomous run the signal for the motor brake system can be transmitted wireless by PC

Manufacture

- The climber was designed by 3D-CAD
- The versatile standard parts were used to the basic parts
- The several components were manufactured at college workshop

Fig. 17 College workshop

Fig. 18 NC milling machine

Data of the experiment on JSETEC, 2011

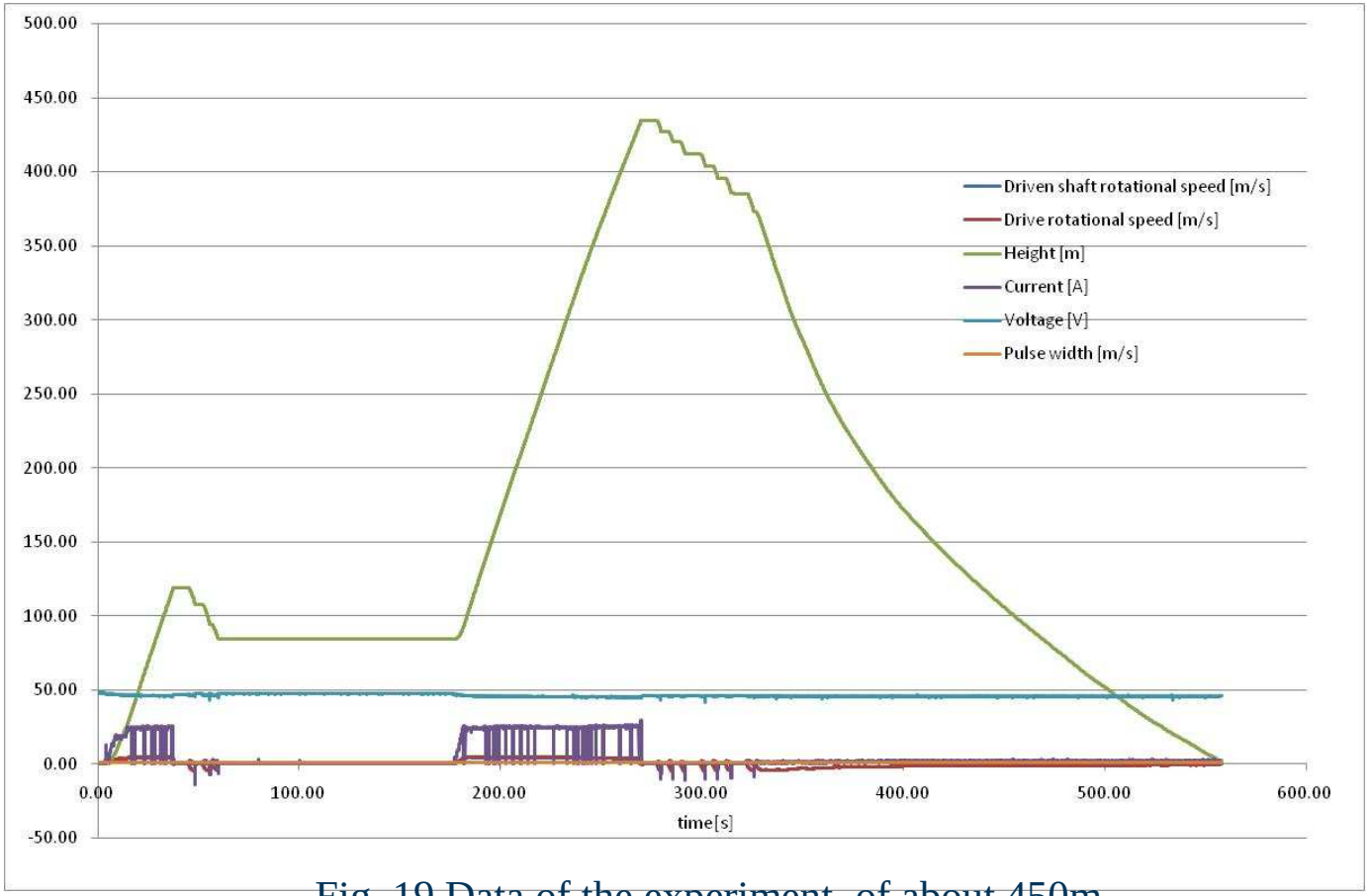


Fig. 19 Data of the experiment of about 450m

Data of running down with safety control

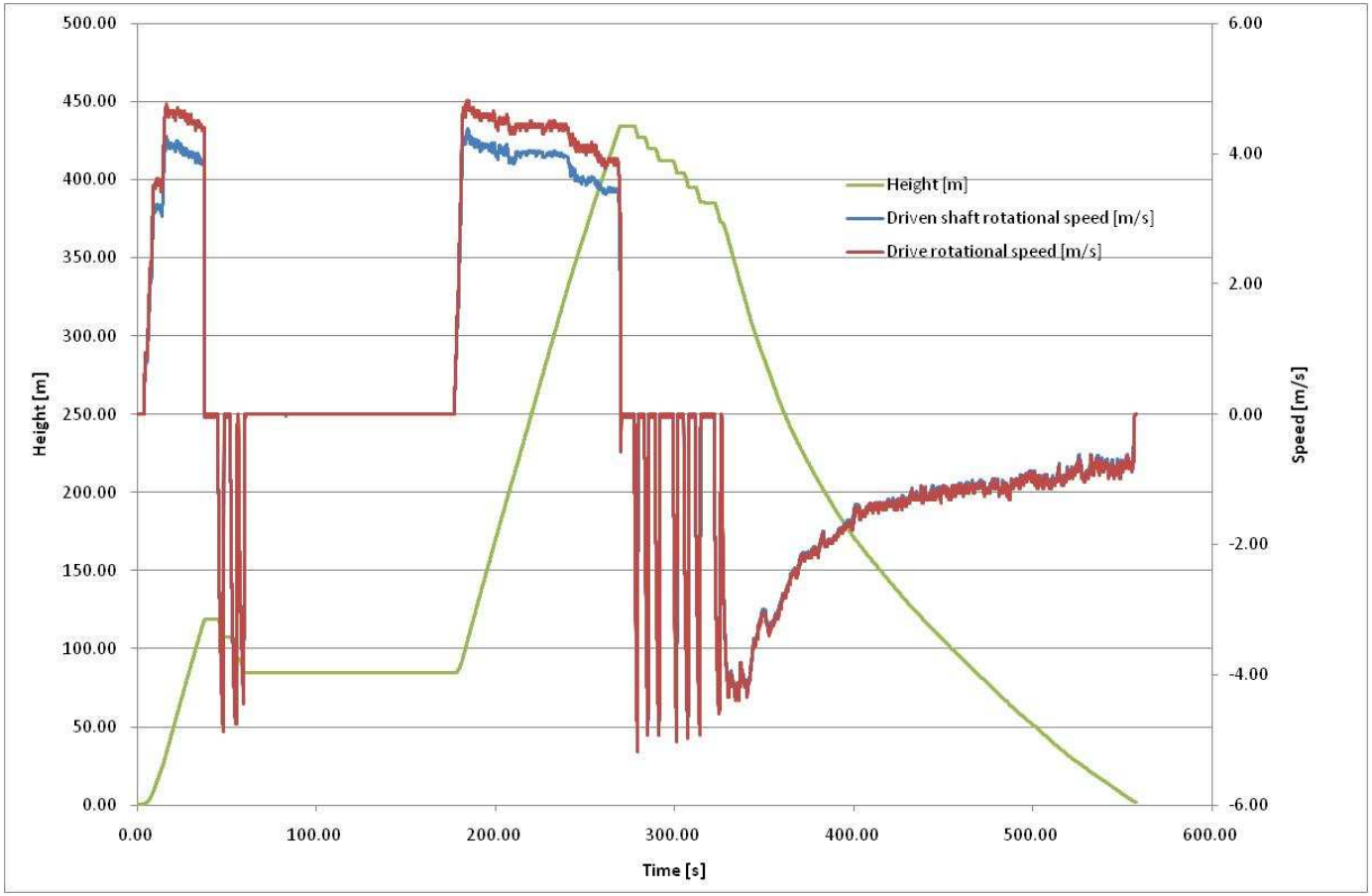


Fig. 20 Data of running down

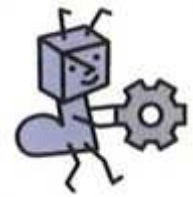
Achievements and Future works

- By changing materials of the urethane tire to hardness 30, 50, 70, 90. it was found the hardness 70 is the best.
- The length of the climber is better to be long for stability.
- When the climber run down, the brake control which set whenever the climber's speed reaches 4m/s is valid.

Future Works

- Add more sensors to the climber
- Duplication of control unit for safety
- Weight saving for mounting more payload

Thank you for your attention.



Contact information

- Postal Address

Aoki laboratory

7-24-1-#728, Narashinodai , Hunabashi-shi Chiba-ken

274-8501,JAPAN

- Team Member

S.Tanaka ： E-mail: cssi10025@g.nihon-u.ac.jp

E.Hara

Y.Takezawa

A.Miyara