TOHOKU university FROM THE EARTH <u>mon</u>te (Noshiro Hybrid Rocket Project The Parth since2011 Kentaro Uno, Kohei Shimizu

Boeing Higher Education Program Accomplishment report

Objective

1) Launch "hybrid rocket" by operating of our own GSE (GSE : Ground Support Equipment) 2) Recovery of rocket by opening two stage parachutes -First one is small and the second one is large. 3) Examination of measurement instruments -altitude, air pressure, acceleration, etc

Noshiro Space Event

-We participated in an amateur rocket launching event which was held in Noshiro city, Akita prefecture every summer.

-We developed rocket named FTE-04 for this event.

Mechanism of power source of rocket



-Our rocket flies by propulsion by using chemical reaction, oxidation-reduction reaction.

The fuel is solid plastic and the oxidizing agent is N_2O gas. -The rocket which use solid and liquid fuel like this is called "hybrid" rocket" generally.

^LWe use Ground Support Equipment called GSE to divert high-pressure gas. **Measurement Instrument**

-FTE-04 had some sensors.

^Latmospheric pressure, altitude, acceleration, GPS, and gyro rotation degree Parachute

-FTE-04 was equipped with two parachutes.

^LThis two stage parachute system should have played an important role about making smaller the distance between taking off point and landing point.

Result

1) We couldn't use our own GSE. -Our GSE was not completed.

2) The two parachutes didn't open.

-Though command signal to open the two parachute doors were sent actually, but the doors were not open because of mechanical troubles. 3) We could obtain some data successfully using rocket-laptop communicating system.

-We could obtain the data about acceleration, angular velocity, atmospheric pressure, geomagnetic measurement.

GSE operating

-We couldn't use our GSE owing to a defect of a pressure regulator.

- We misunderstood how to use air pressure valve.
- ^LWe borrowed GSE of Kyushu University and launched FTE-04.

Parachute

-We failed to open the two parachutes, the small one and the large one.

- -But, we could observe that the first command to open the door of parachute was sent successfully.
- ^LSo we think that the door didn't open because of some mechanical reasons.

Obtained data

-We could obtain some digital data thanks to a wireless communicating system between the flying rocket and the laptop on the ground.

Laltitude, acceleration, angular velocity, atmospheric pressure, geomagnetic parameters

σ Altitude igula t [msec] -Altitude - Angular vel.





Fig.4 Broken body of the rocket



Next Plan

1) Develop our GSE

2) Conduct experiment of combustion hybrid engine

3) Launch a rocket towards sky above the sea -A rocket reaches higher altitude.

How to solve above problems

-We have to develop our own GSE which works perfectly as soon as possible. -We have to conduct some experiments in order to confirm the performance of our GSE using high pressure gas.

^LWe would like to operate combustion hybrid engine experiment on by own. -We have to improve the parachute opening system.

Method of launch

-We would like to launch rocket with angle towards the sky above the sea ("sea shot"). In this project, we launched a rocket vertically on the ground ("ground shot"). – By this method, we can launch a rocket to higher altitude.

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Fig.6 Launching method "ground shot" and "sea shot"