



# EXPERIENCE GAINED IN CLTP7

Mohammed Khalil Ibrahim, Ph.D.  
[mkhalil@cu.edu.eg](mailto:mkhalil@cu.edu.eg)  
Cairo University - Egypt



北海道大学 HOKKAIDO UNIVERSITY

研究者総覧



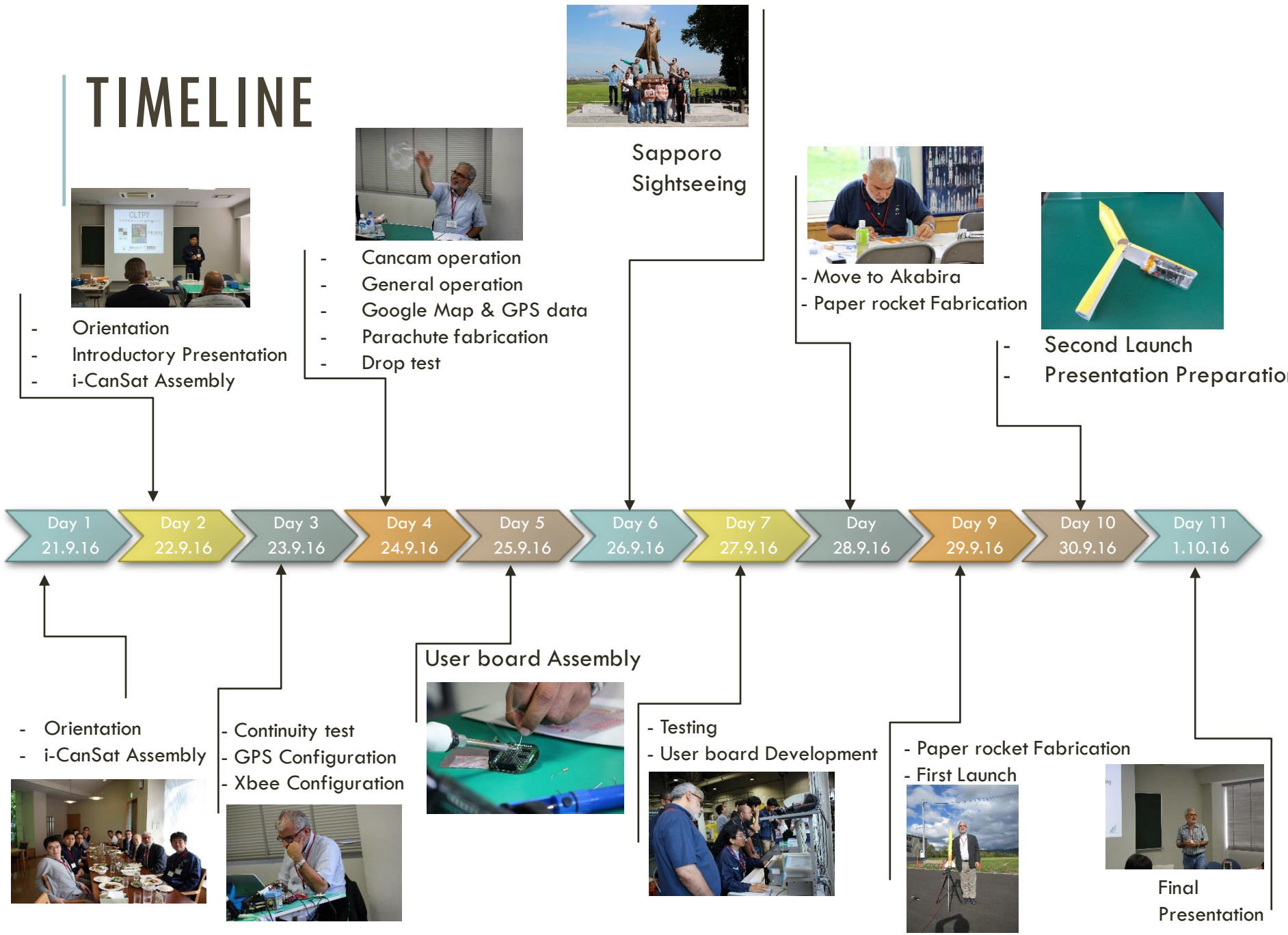
# OUTLINE

- Objectives
- Timeline
- The i-CanSat Assembly
- Recovery System
- Testing (Drop, Mechanical, and Thermal)
- Launching
- Results
- Conclusions
- Further Developments

# OBJECTIVES

- Experience the teaching method used in CLTP7.
- Collect participants' feedback about the i-CanSat manual.
- Propose improvements to i-CanSat-6 kit.

# TIMELINE



- Orientation
- Introductory Presentation
- i-CanSat Assembly



- Cancam operation
- General operation
- Google Map & GPS data
- Parachute fabrication
- Drop test



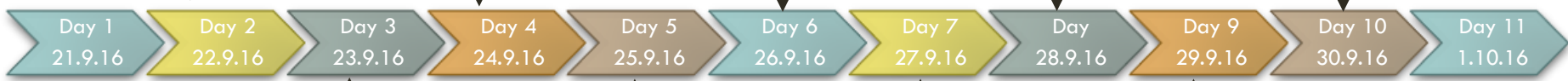
Sapporo Sightseeing



- Move to Akabira
- Paper rocket Fabrication



- Second Launch
- Presentation Preparation



- Orientation
- i-CanSat Assembly



- Continuity test
- GPS Configuration
- Xbee Configuration



User board Assembly



- Testing
- User board Development

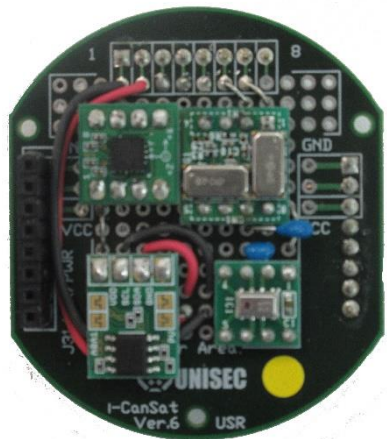


- Paper rocket Fabrication
- First Launch



Final Presentation

# I-CANSAT



USB PCB



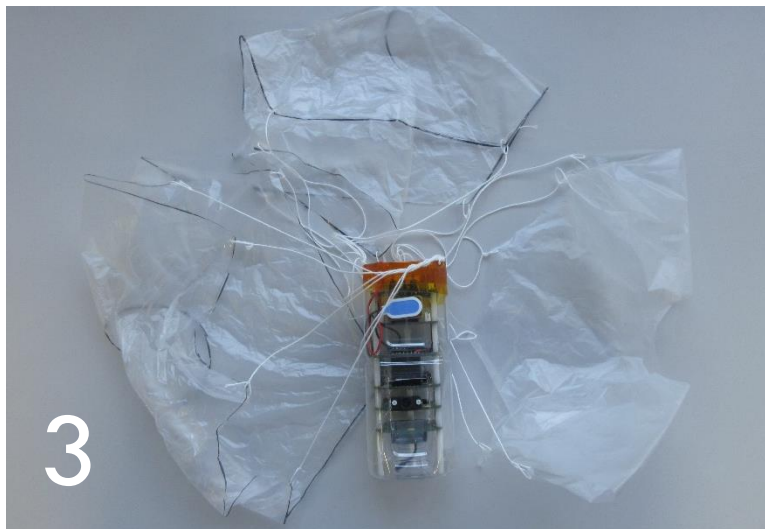
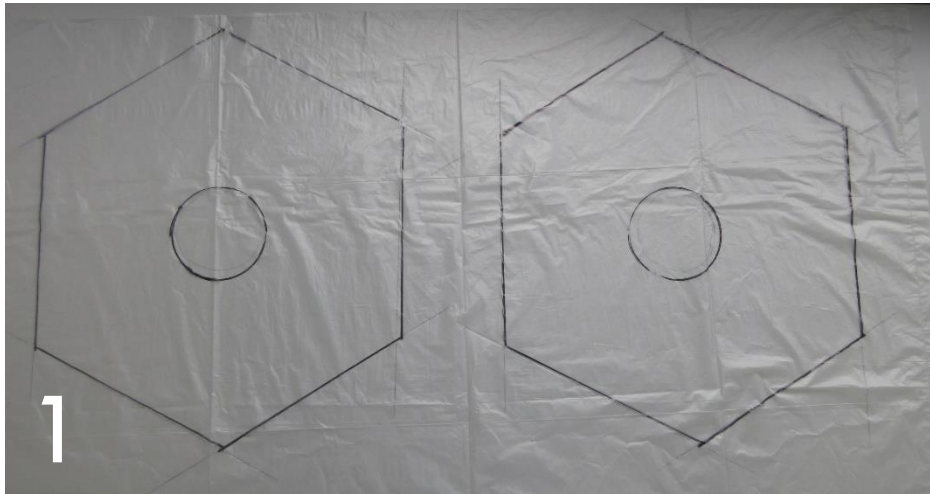
i-CanSat



i-CanSat: Structure & Parachute



# RECOVERY SYSTEM



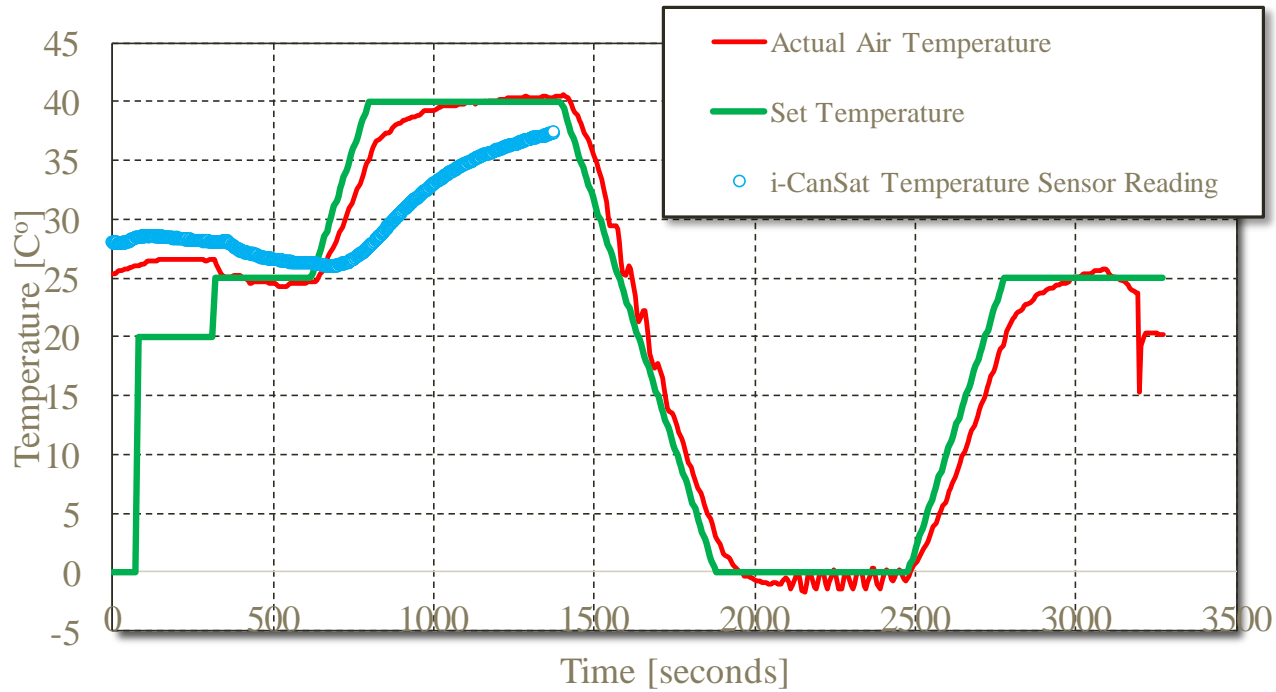
# PARACHUTE TESTING

First test with dummy load: Failed

Second test with dummy load: passed



# TEMPERATURE TESTING





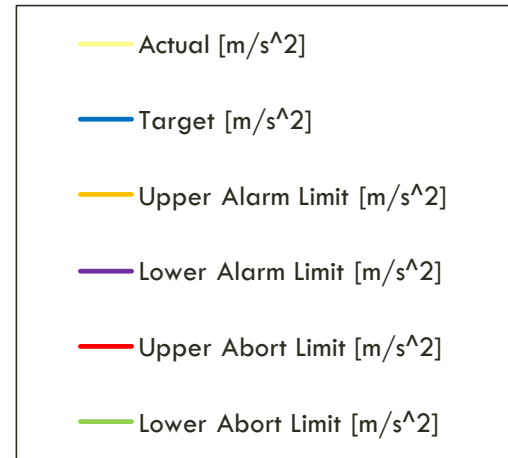
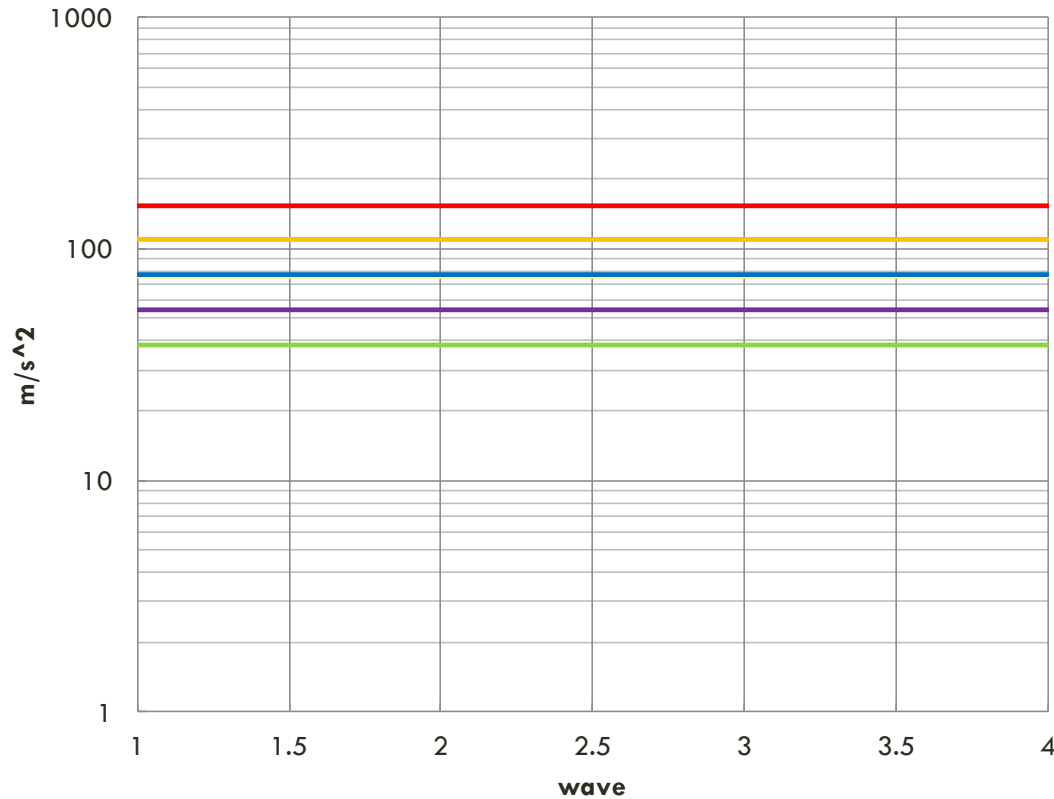
# VIBRATION TESTING

- Sine wave vibration
- Random vibration
- Shock vibration

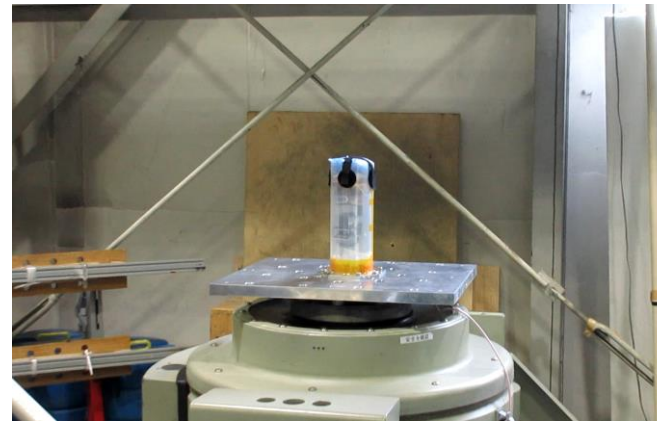


VIBRATION GENERATOR  
EMIC 916-AW/LA

# SINE CHARACTERISTICS

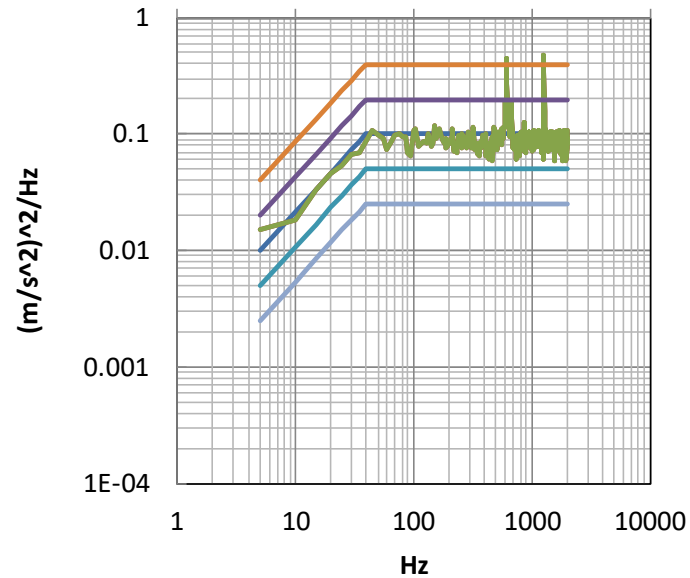
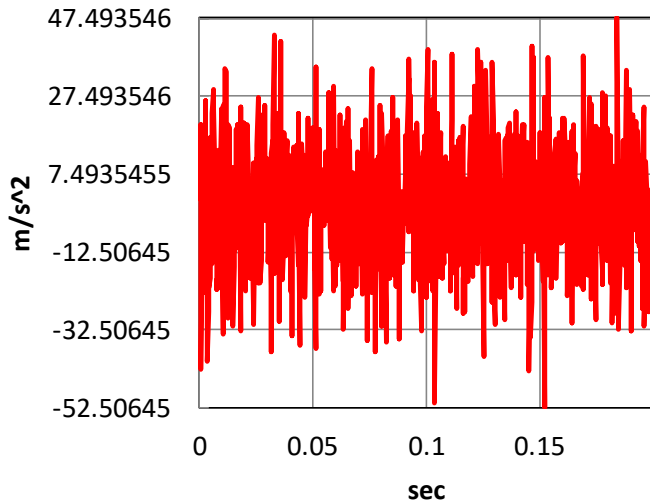


Frequency = 10 Hz



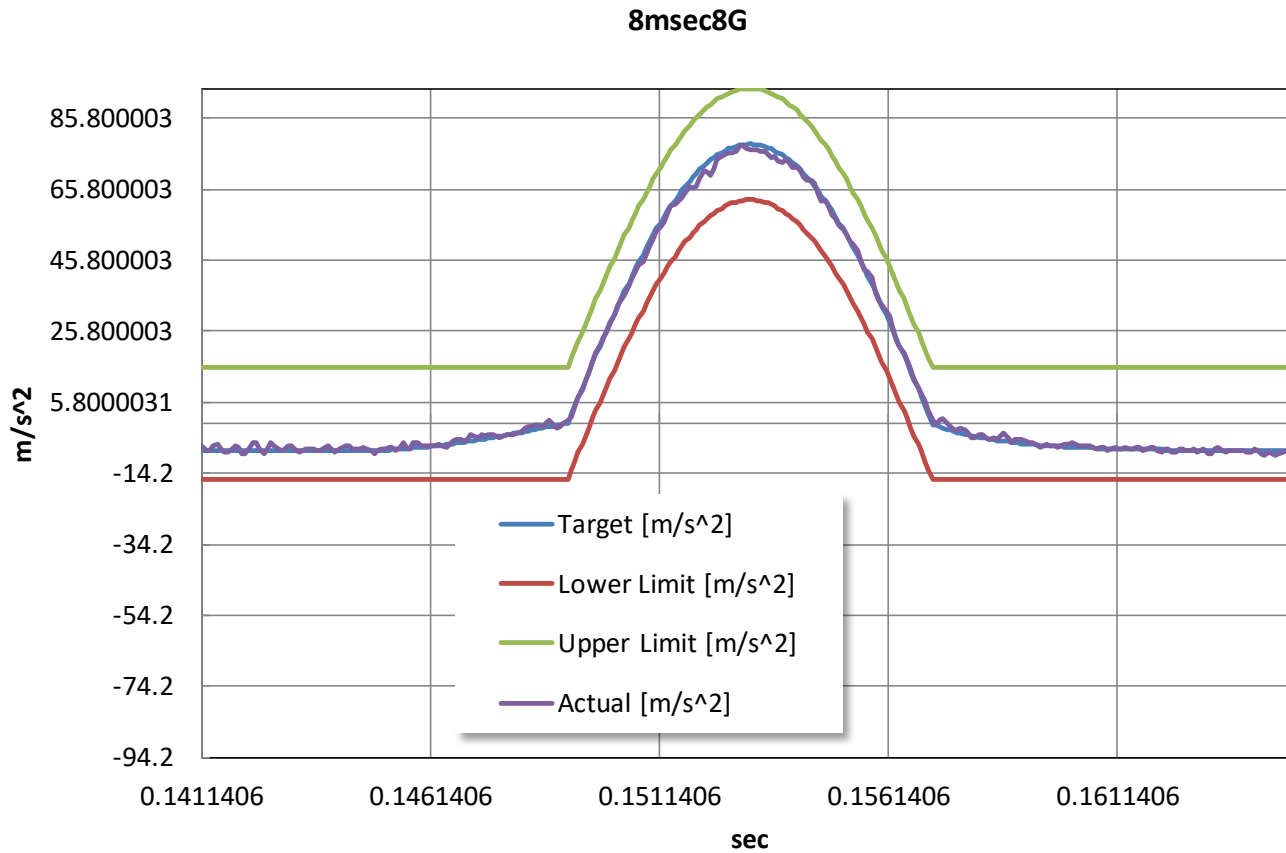
# RANDOM CHARACTERISTICS

Measured acceleration

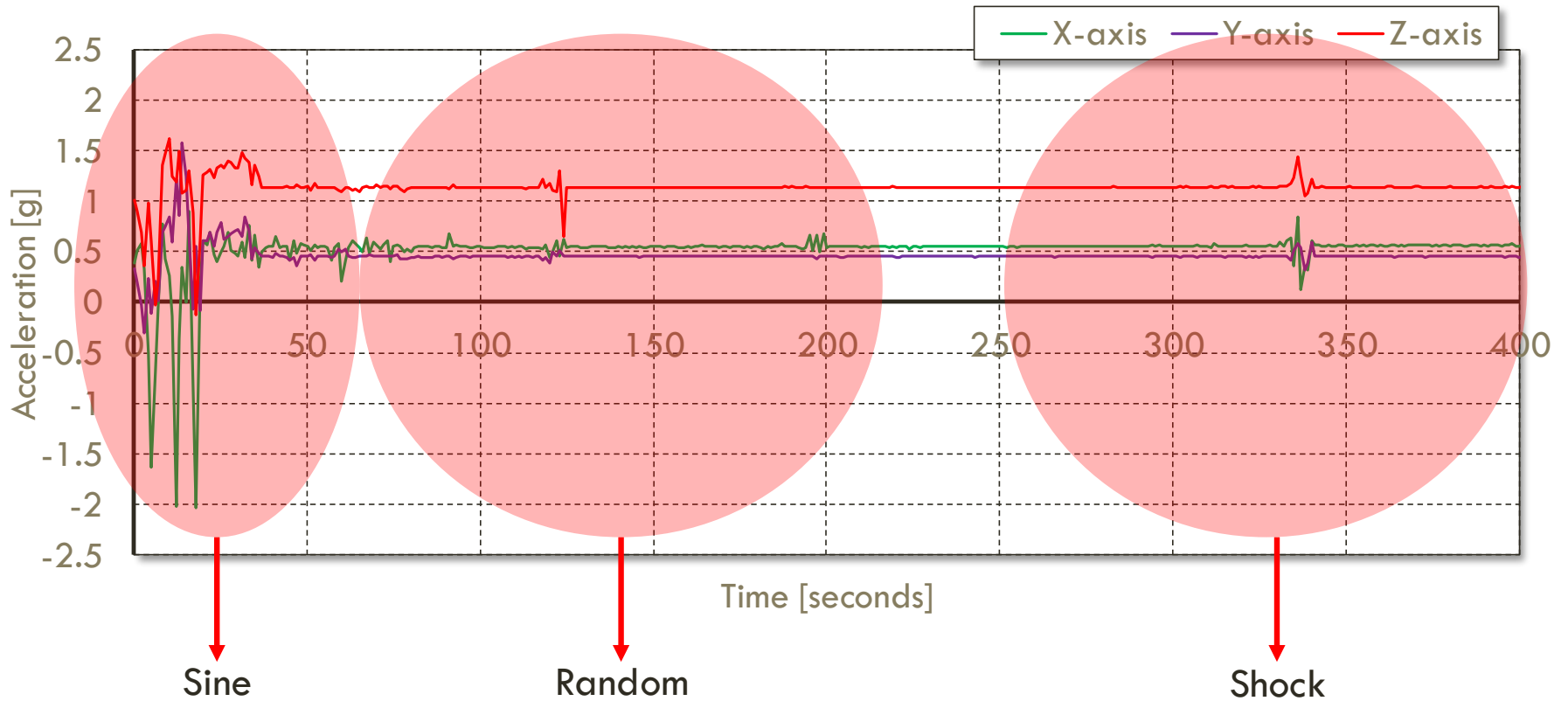


- Target  $[(m/s^2)^2/Hz]$
- Actual  $[(m/s^2)^2/Hz]$
- Reading  $[(m/s^2)^2/Hz]$
- Upper Alarm Limit  $[(m/s^2)^2/Hz]$
- Lower Alarm Limit  $[(m/s^2)^2/Hz]$
- Upper Abort Limit  $[(m/s^2)^2/Hz]$
- Lower Abort Limit  $[(m/s^2)^2/Hz]$

# SHOCK CHARACTERISTICS

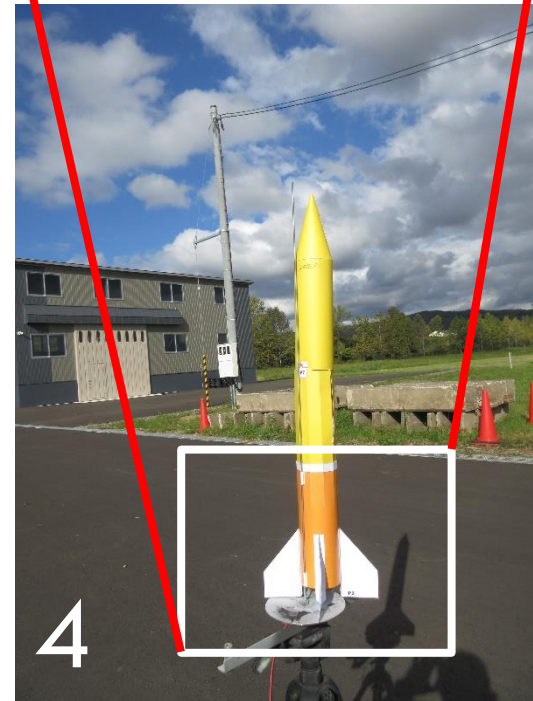
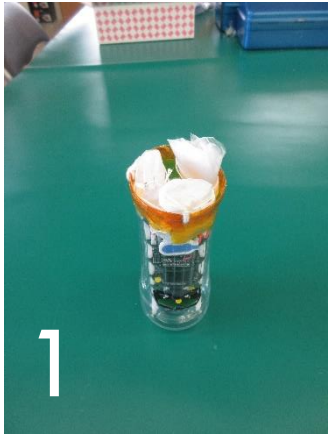


# ACCELEROMETER READINGS





# LAUNCHING

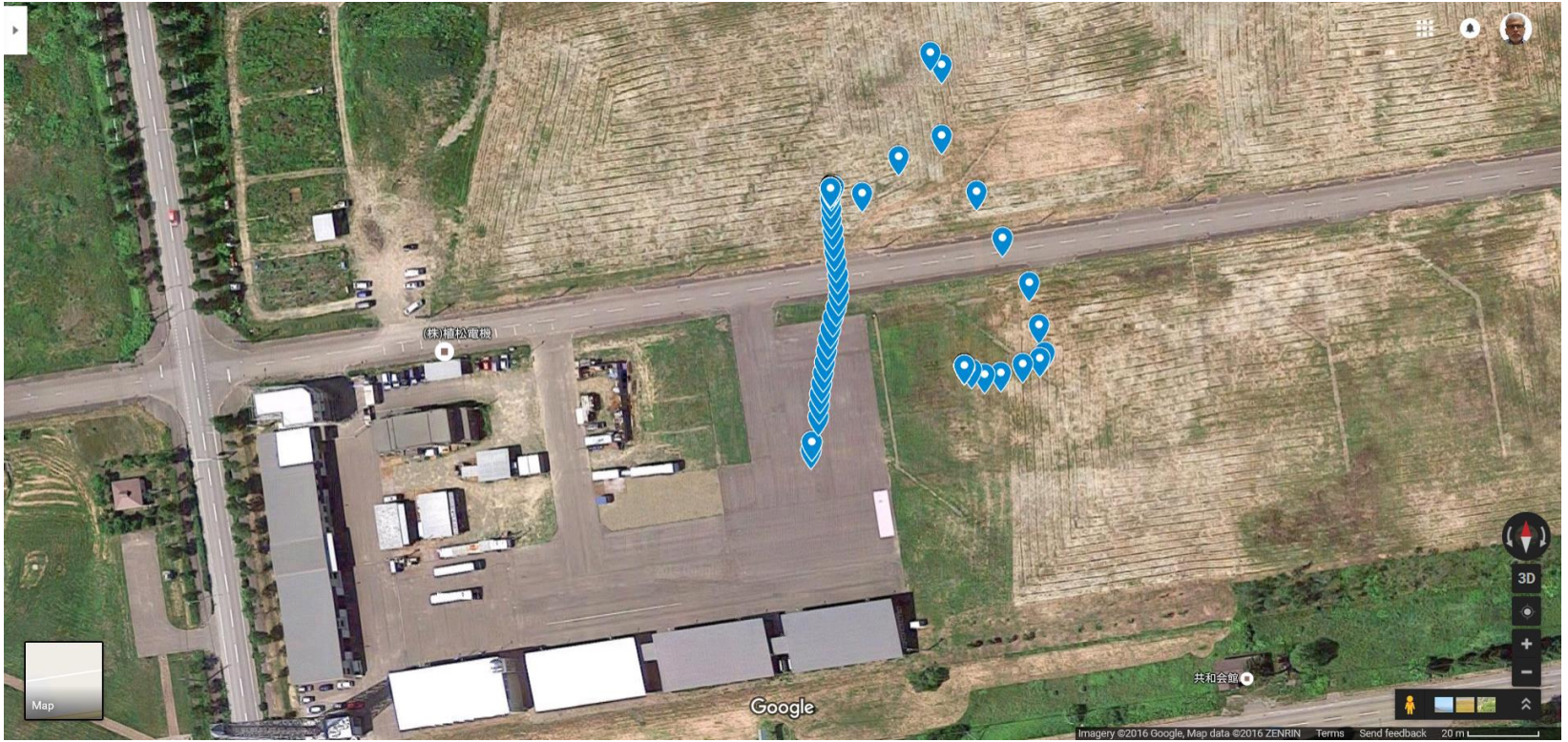


# LAUNCHING





# GPS RESULTS — FIRST LAUNCH (29.09.2016)



# GPS – 3D RESULTS

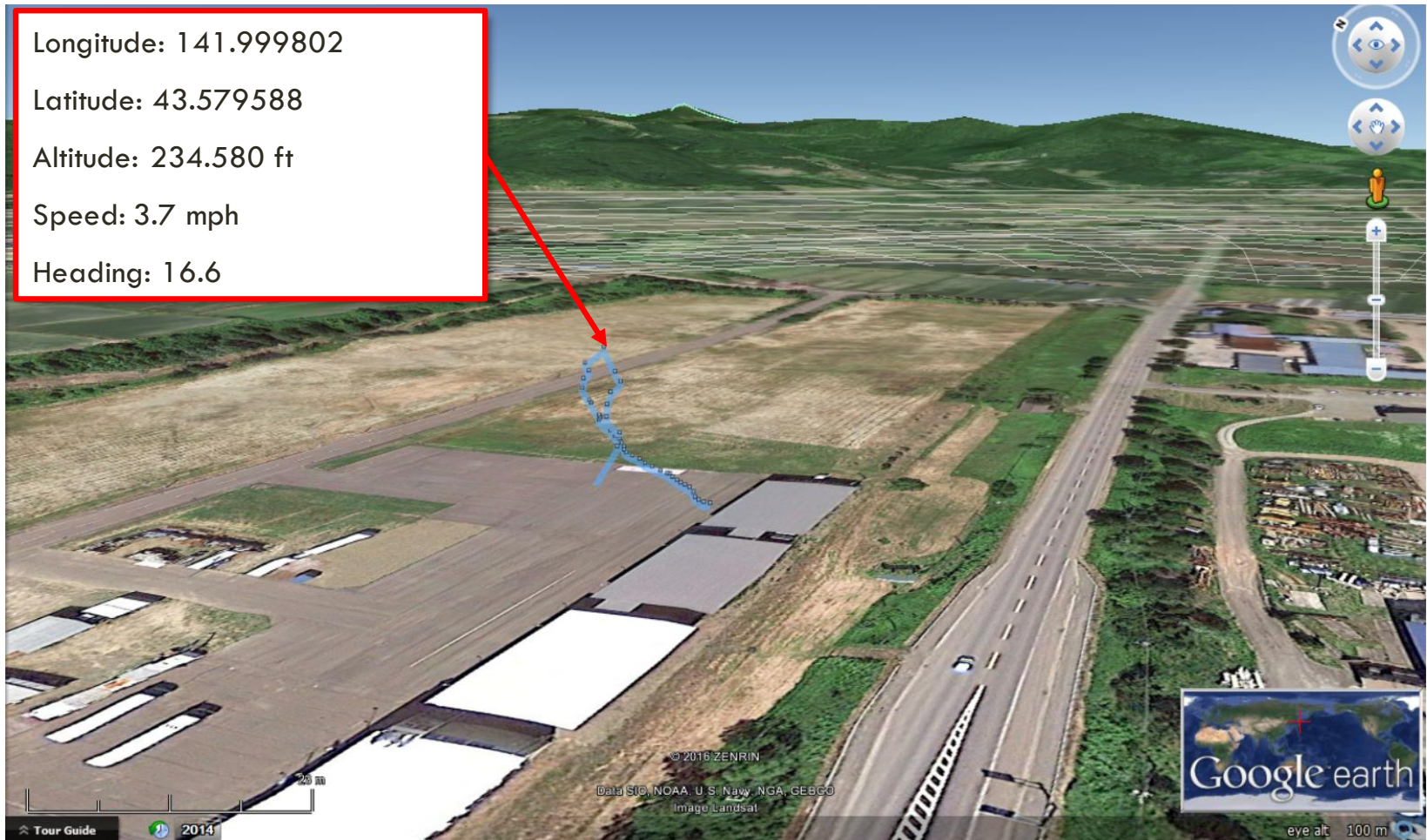
Longitude: 141.999802

Latitude: 43.579588

Altitude: 234.580 ft

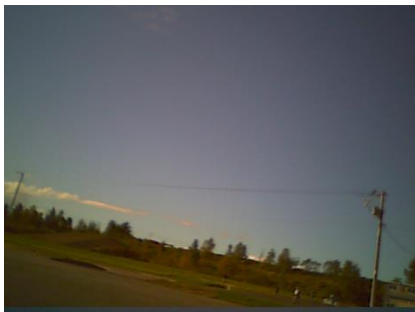
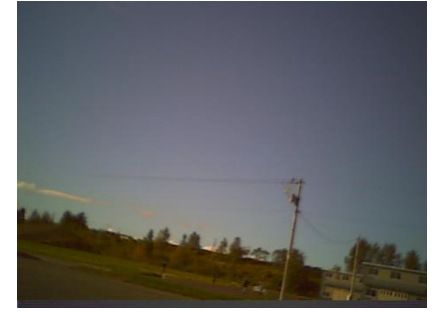
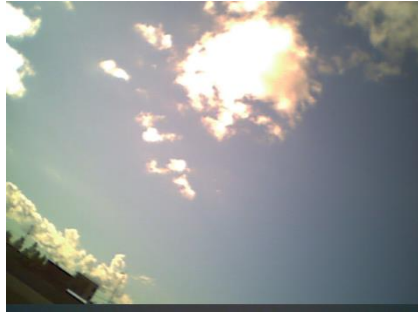
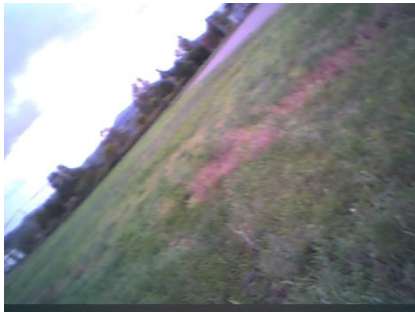
Speed: 3.7 mph

Heading: 16.6



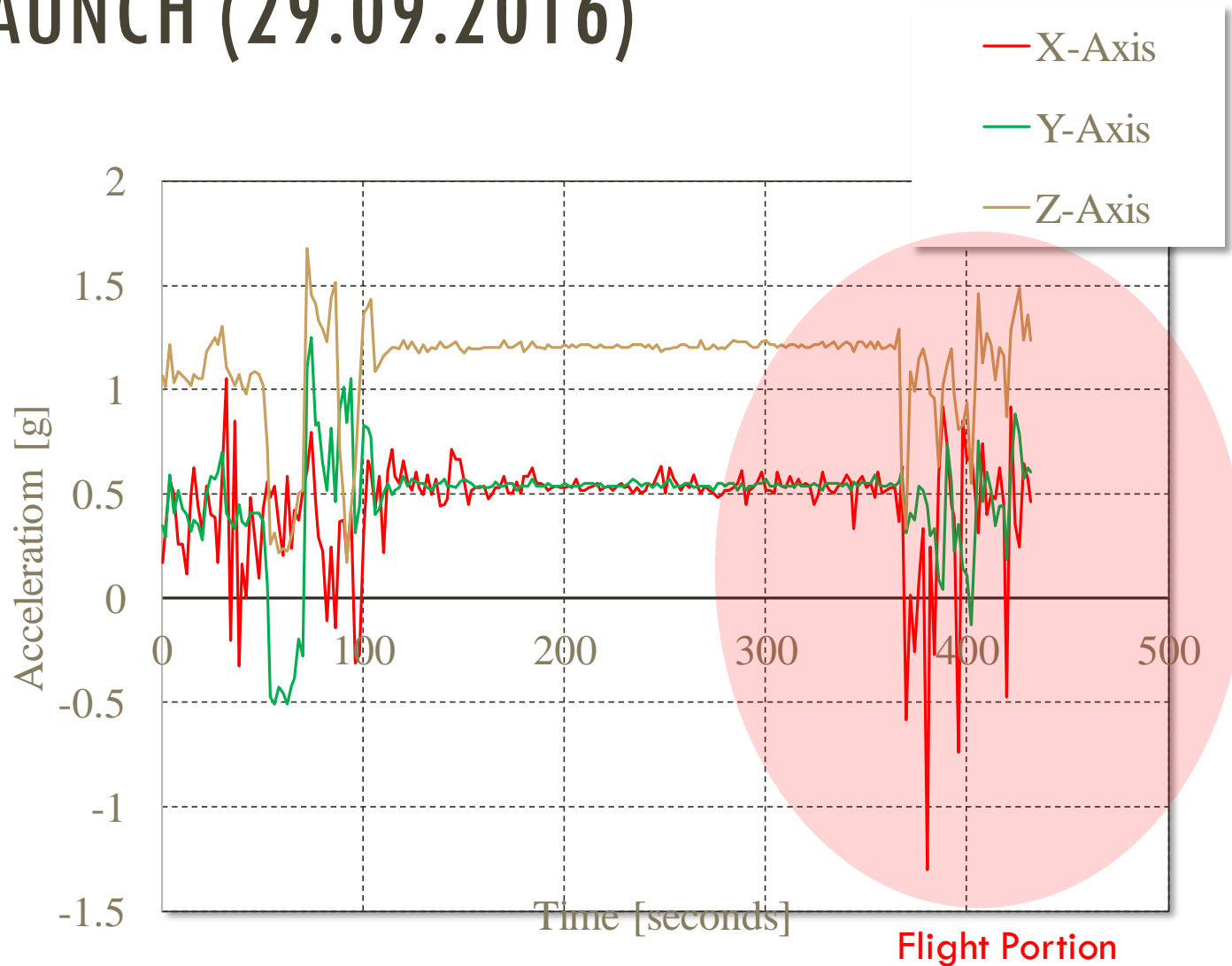


# IMAGES – FIRST LAUNCH (29.09.2016)

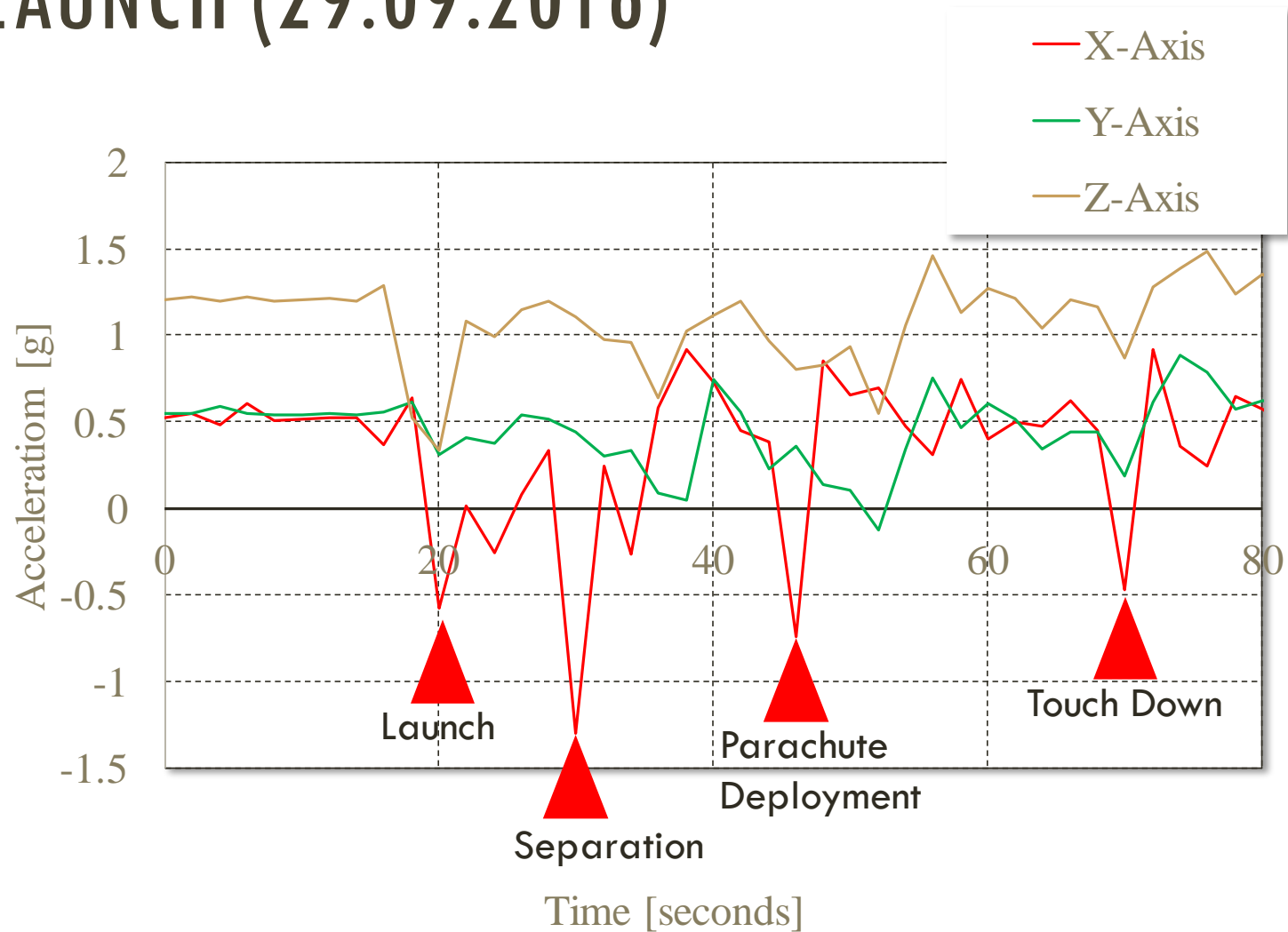




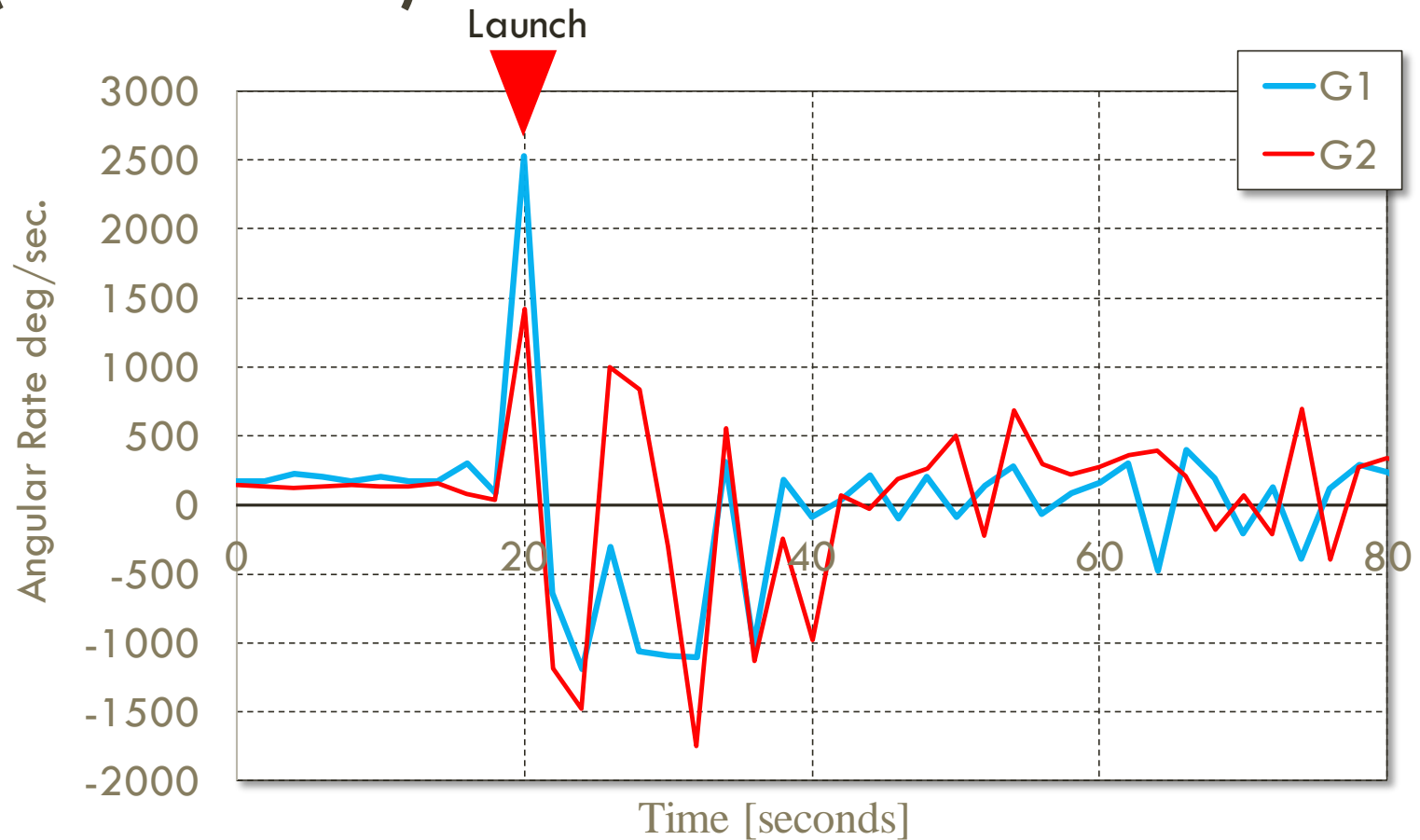
# ACCELEROMETER RESULTS— FIRST LAUNCH (29.09.2016)



# ACCELEROMETER RESULTS— FIRST LAUNCH (29.09.2016)



# GYROSCOPE RESULTS— FIRST LAUNCH (29.09.2016)

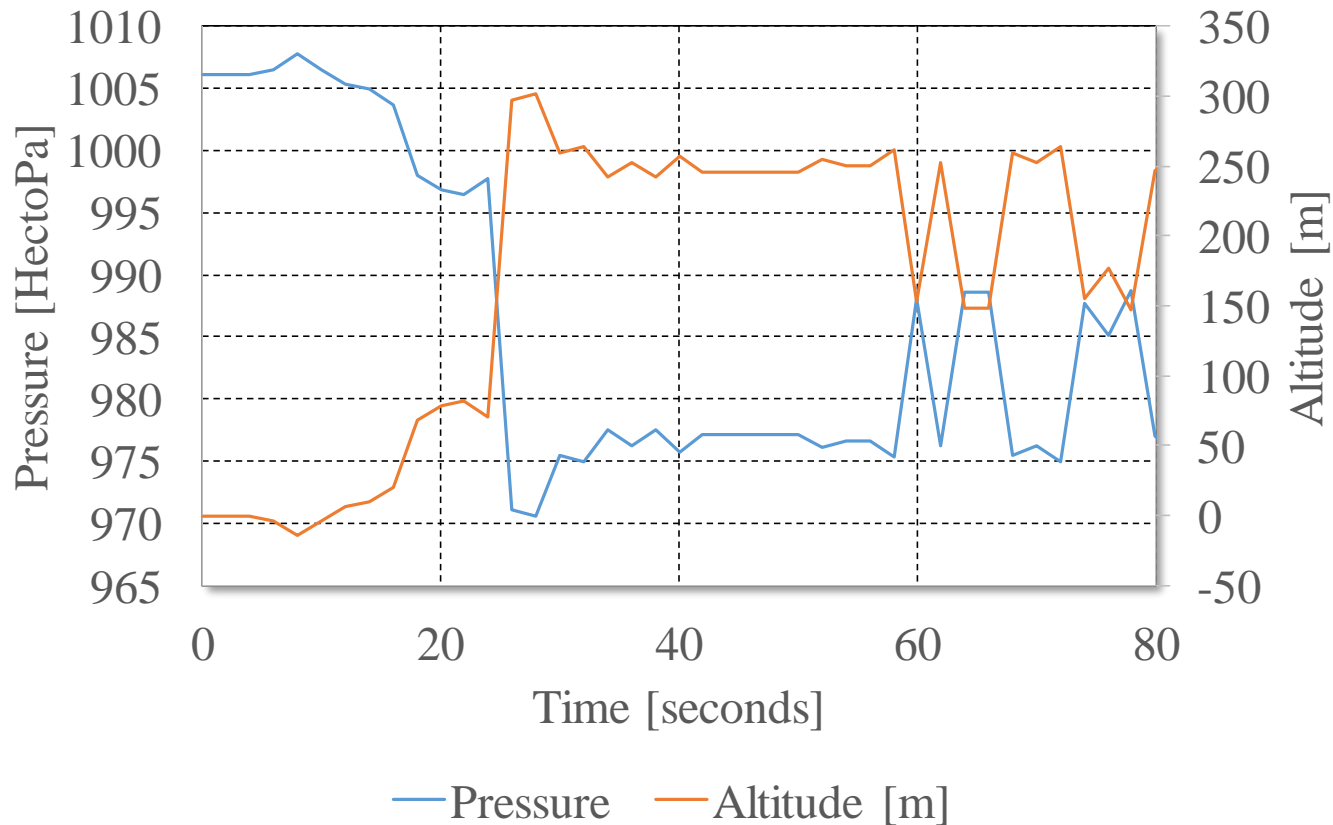


# FIRST LAUNCH: SPINNING



# PRESSURE SENSOR RESULTS— FIRST LAUNCH (29.09.2016)

$$h[m] = 44330 \left[ 1 - \left( \frac{p}{1013.25} \right)^{0.19} \right]$$



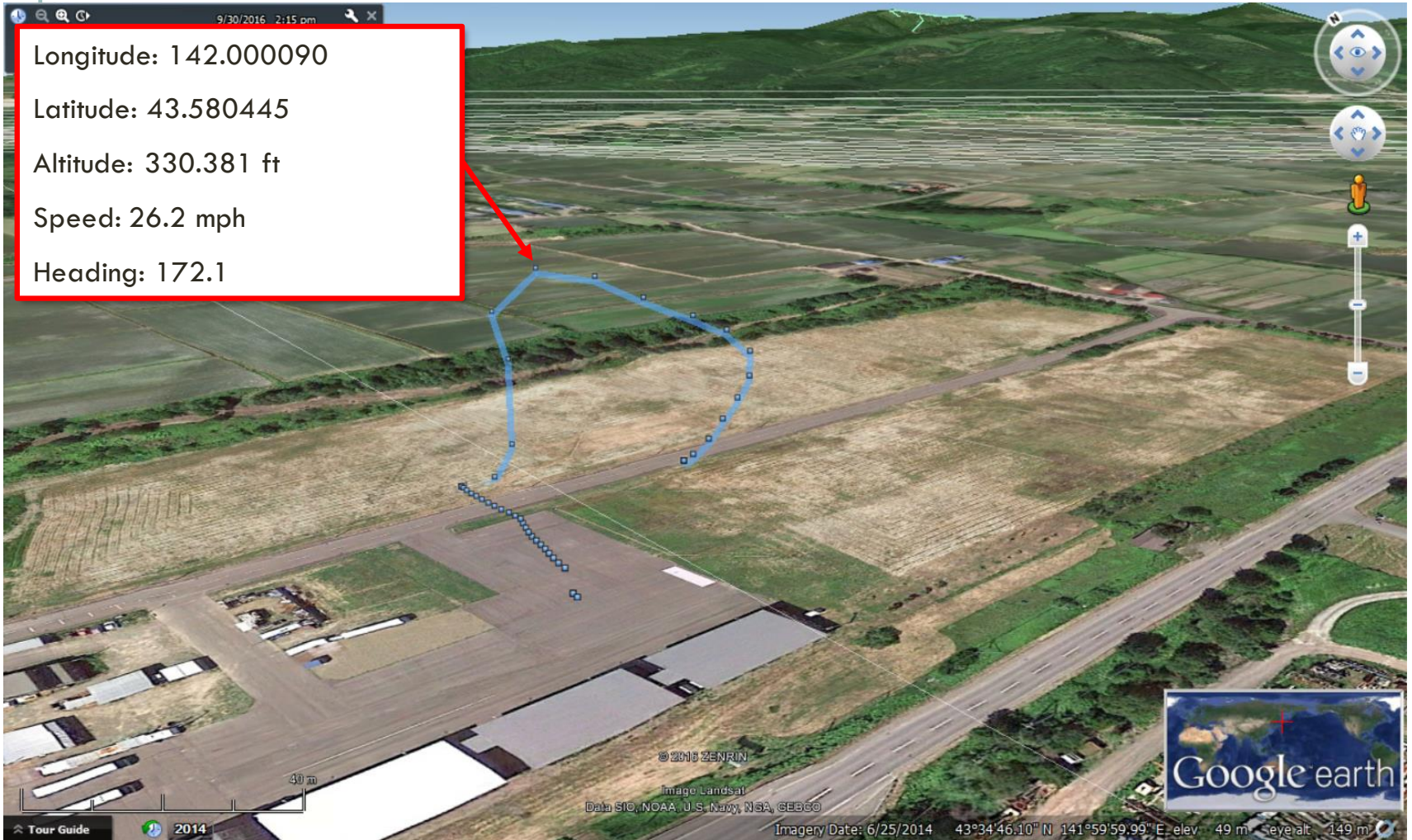


# GPS RESULTS — SECOND LAUNCH (30.09.2016)





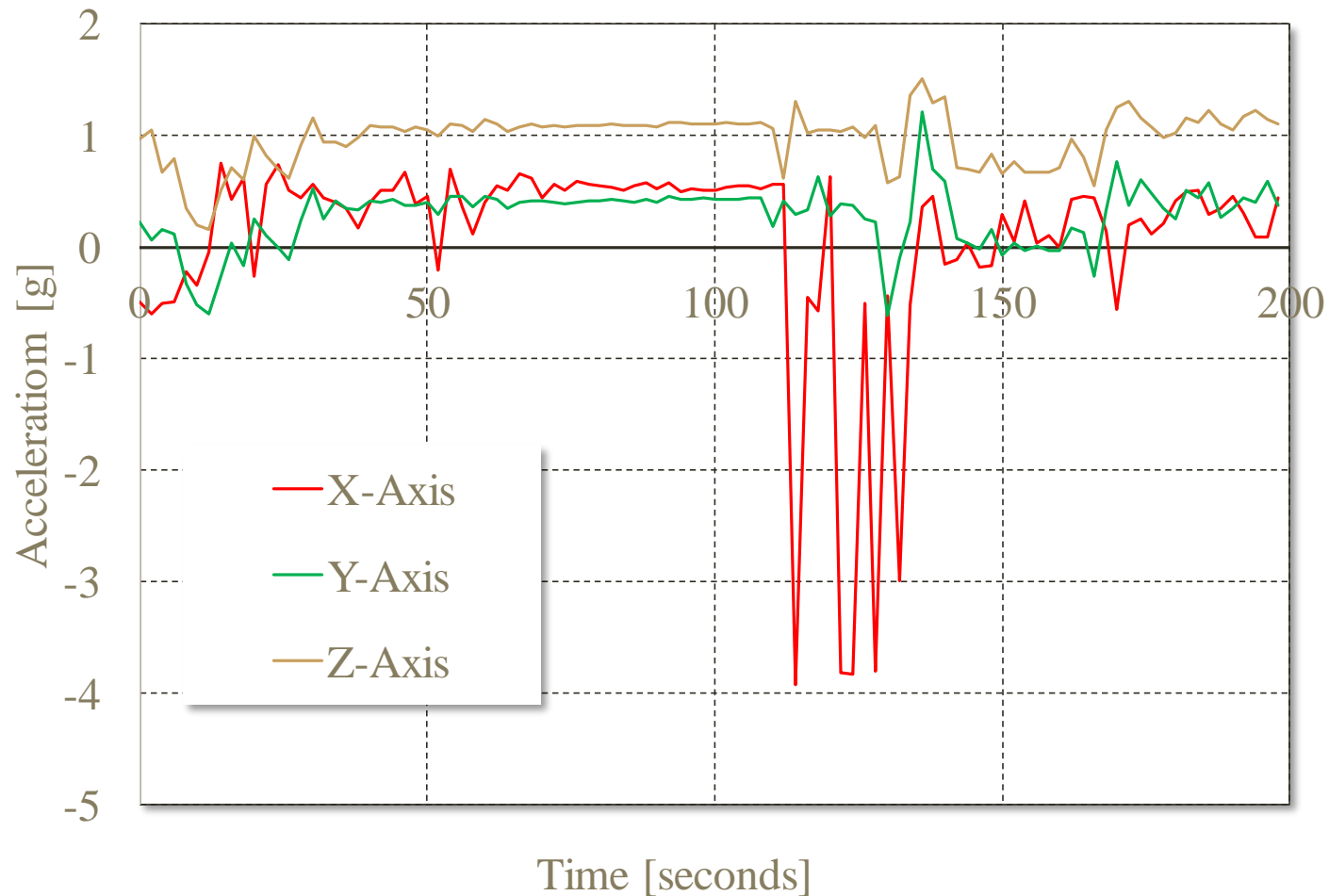
# GPS – 3D RESULTS



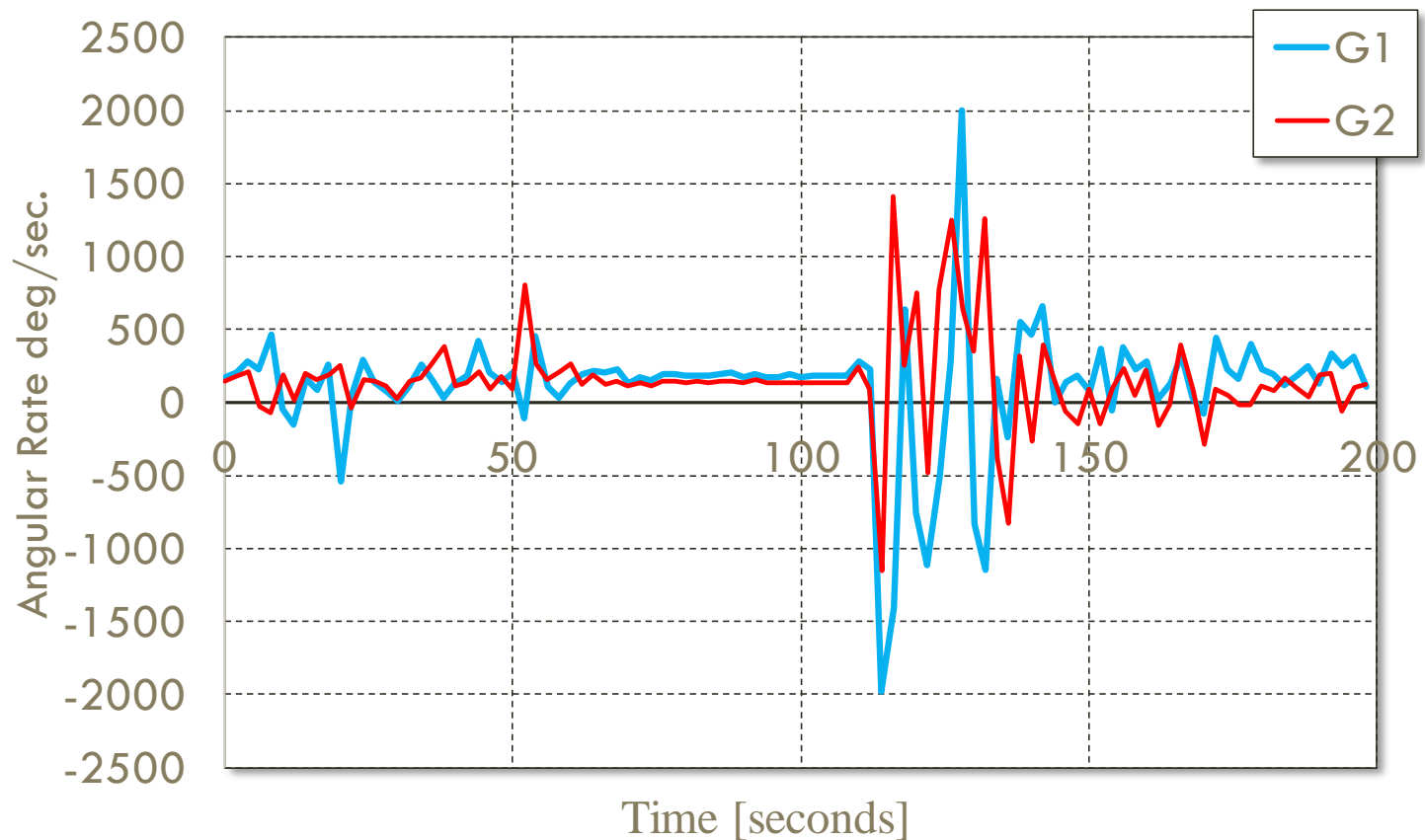
# IMAGES – SECOND LAUNCH (30.09.2016)



# ACCELEROMETER RESULTS— SECOND LAUNCH (30.09.2016)

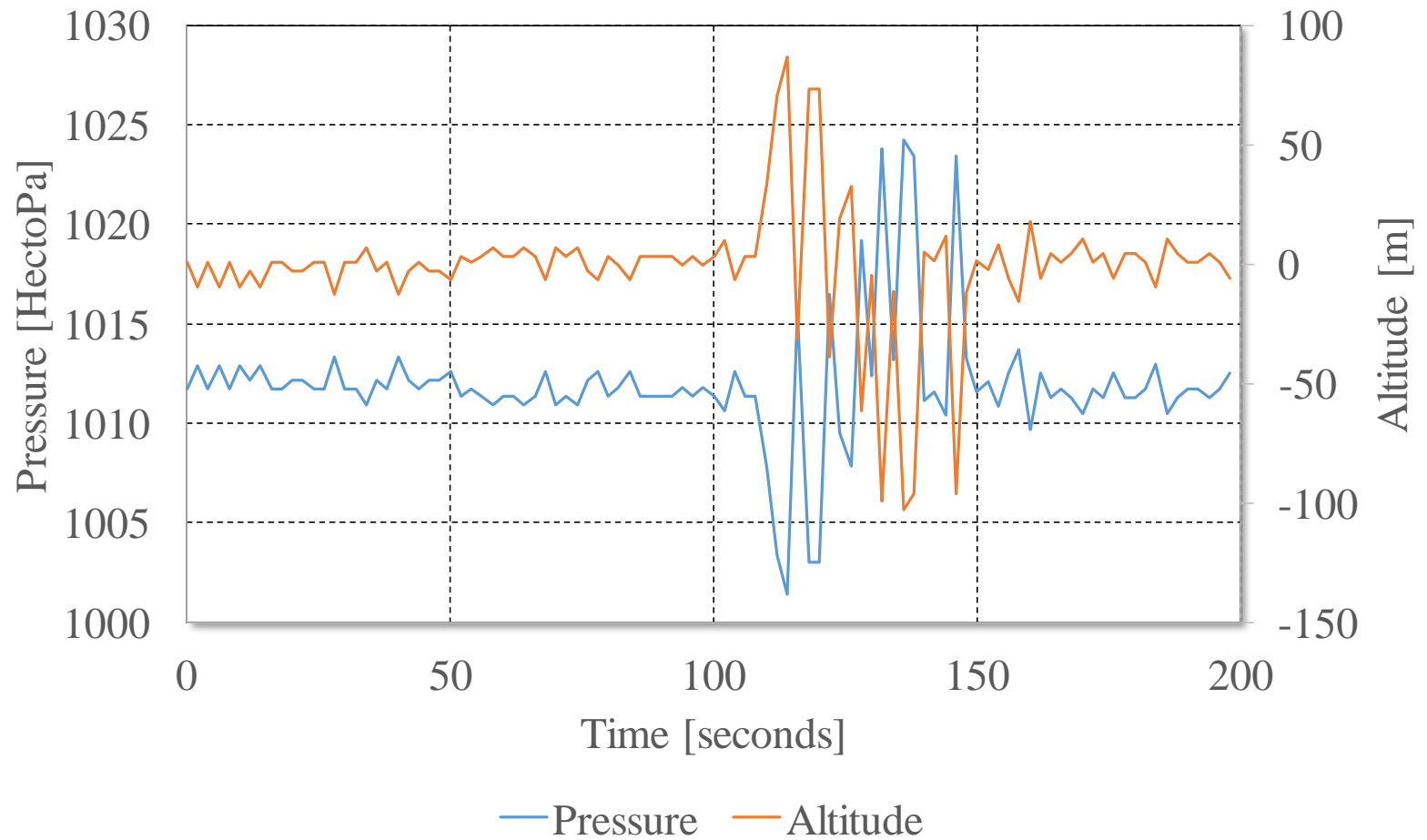


# GYROSCOPE RESULTS— SECOND LAUNCH (30.09.2016)





# PRESSURE SENSOR RESULTS— SECOND LAUNCH (30.09.2016)



# CONCLUSIONS

- i-CanSat Assembly, Integration and Testing (AI&T)
- Launching and Operation: Complete Cycle
- Hands-on Training Project: Low cost and short time
  - Parachute
  - Paper rocket
- Hardware & Firmware development skills
  - Soldering, GPS & XBEE configurations.
  - PIC programming
  - Sampling time.
- Project Based Education
  - Rocket spinning
  - Parachute deployment

# FURTHER DEVELOPMENT

- Manual Revision with improved software content
- External Power Supply
- PIC Limitation (USR board Development)
- Testing: Modal Analysis Experiments
- Sensor Calibration

# ACKNOWLEDGEMENT

- UNSEC
  - Ms. Rei Kawashima
  - Mr. Michio Ozawa
- Hokkaido University
  - Prof. Tsuyoshi Totani
  - Mr. Tomohiro Takanashi
  - Mr. Ryohei Goto
  - Mr. Jyunya Sato
  - Mr. Delburg MITCHAO
- Nihon University
  - Prof. Yasuyuki Miyazaki
- Uematsu Electric Co.,Ltd
- Sakura Rubber Co., Ltd.
  - Mr. Tetsuya Iwasaki
- CLTP participants & alumini

Thank you  
Questions?