



# University Hands-On Space Education - Japanese Case -

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## History

- 1990 Necessity of hands-on education recognized by academic societies
- 1992 **Satellite Design Contest**, to provide a venue for university students to work and compete
- 1998 **USSS** (Univ. Space Systems Symp) started under JUSTSAP  
**Joint projects between Japanese and US universities**  
**Proposal of CanSat, CubeSat, Ground Station Network**
- 2001 UNISAT (University Satellite Consortium)
- 2003 **NPO UNISEC** (Univ. Space Eng'ng Consortium)
- 2003~ Launches of CubeSat's  
Cooperation with local Industries
- 2008~ JAXA launches of small satellites

# Satellite Design Contest

Promotion of Student Space Activities  
 Through Small Satellite Design Based on Student Initiative  
 Categories: Design=Piggyback, Idea=No Limitation

- **Initiative of Academic Societies (1992~)**  
 JSME, JSASS, IEICE  
 later Joined by NASDA, ISAS, JSF
- **Providing a Trigger to University Space Activity**  
 A Sep Further from "Theory"  
 Accessible Space
- **Well Received by Society**  
 Increase in Participation  
 Encouragement from General Public & Journalism  
 Expectation toward Piggyback Launches
- **Accumulate Student Expertise**  
 1<sup>st</sup> University Satellite (WEOS by Chiba Inst. Tech)  
 Desires toward Next Step .....

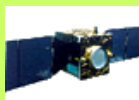
## Student Satellite Designs Satellite Design Contest (1993~)

1993



Whale Observation  
 Chiba Ins. Tech.

1998



Lunar 2001  
 Kyushu U



Jumping Turtle  
 Tohoku U

2002



PETSAT  
 Tokyo U



Microscopic Newtonian Gravity  
 MIT

2003



Infrared Astronomy  
 Tokyo U



Jupiter Probe  
 Tokyo Inst. Tech.



Orbital Elevator  
 Kyushu U

# JUSTSAP/USSS

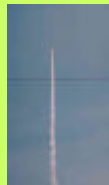
Japan US Science Technology and Space Applications Program  
University Space Systems Symposium

- JUSTSAP:  
Pursuit of Joint Projects (Japan/US),  
Meetings in Hawaii Annually
- USSS:  
Students from 6-10 universities, Japan/US  
Define Joint Small Satellite Projects  
through Discussions among Students
- Well Defined Project Proposals Adopted &  
Implemented  
CanSat, CubeSat, Ground Stations,  
Satellite Concurrent Designs

## USSS in Action



2-Day Discussion in Hawaii



CanSat Lunch in Nevada, US



# UNISEC

University Space Engineering Consortium

NPO Established in 2003, succeeding JSASS  
Sub-Group Activities

Support university satellite and rocket projects  
for technology development, space education  
and international cooperation

- Working Items

- 1) Fund raising and financial support to student projects
- 2) students' usage of agency/companies test facilities
- 3) Acquisition of radio frequencies
- 4) information exchange, workshop among universities
- 5) Promotion of regional and university/industry cooperation

## UNISEC Supported Activities



Workshop



Symposium



CanSat Projects



USSS



CubeSat Projects



Ground Station Network



Hybrid Rocket Projects

Currently 35 universities, more than 300 students, 60 regular members involved







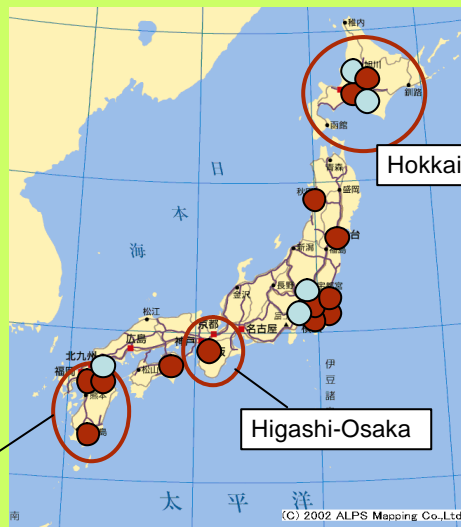
<Example of Activities>

- UT & Titech : CubeSat succeeded
- Nihon Univ. : CubeSat launch in June 2006
- Soka Univ. : CubeSat under development
- Kyushu Univ. : Tether experiment satellite development
- Hokkaido Tech: Remote sensing satellite for agriculture
- Hokkaido Univ., Tokyo MIT: Hybrid rocket experiment
- Tokai Univ. : Hybrid rocket launch in Alaska
- Collaboration with local private sectors begin:  
Hokkaido, Tokyo, Osaka, Kyushu <http://www.unisec.jp>

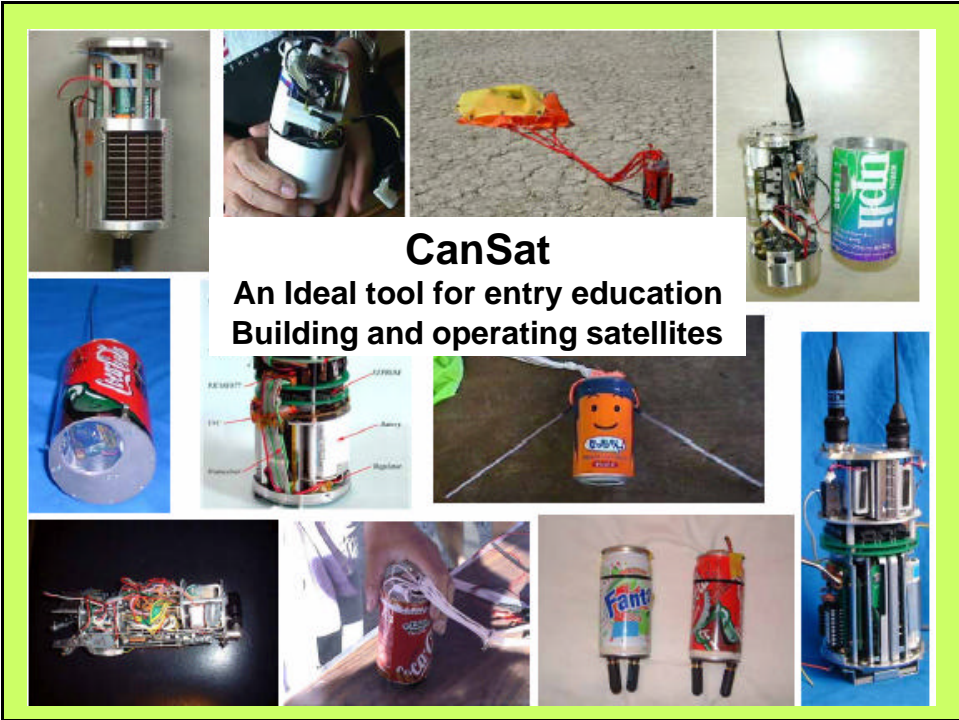


UNISEC Activities  
And associated regional projects

 University Satellite  
 Regional Satellite  
 University Rocket  
 University Rocket



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# CanSat

An Ideal tool for entry education  
Building and operating satellites



# CanSat

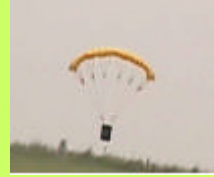
Sub-Orbital Flights

**Competition**  
Call Back Your CANSAT!  
ELISS2002 PROJECT

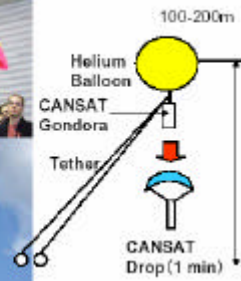




# CanSat Balloon Flights

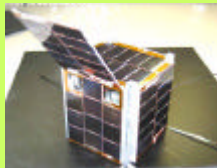


IAC 06, Fukuoka  
International competition



# CubeSat

- Now International Standard -



Cute, Tokyo Ins. Tech



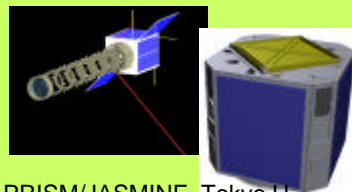
Xi, Tokyo U

followed by  
Nihon U, Soka U,  
Hokkaido Inst. Tech

# And Further-On



QTEX, Kyushu U



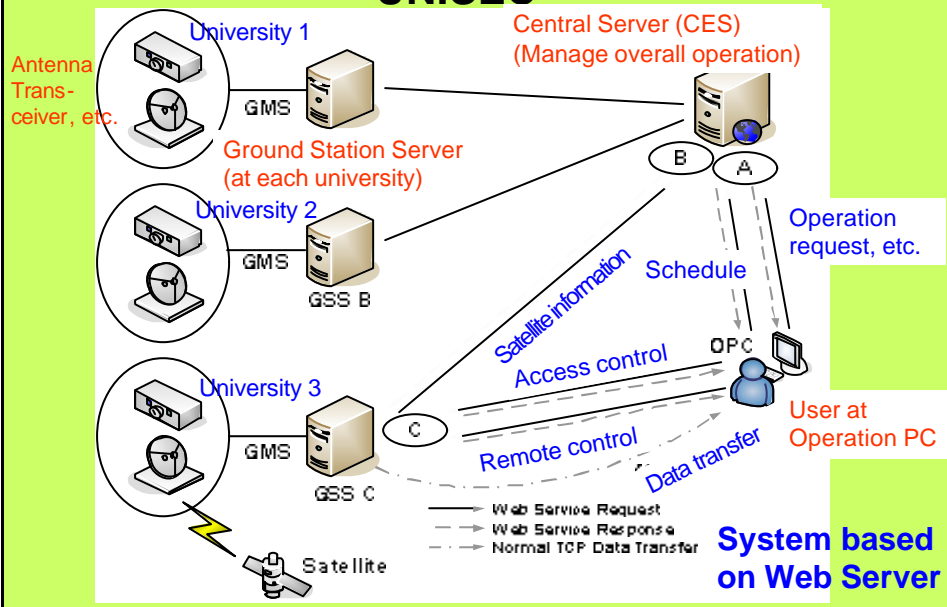
PRISM/JASMINE, Tokyo U

## Ground Station Network

- Connect university ground stations all over the world via Internet, and remotely operate satellites
  - To enhance satellite operation opportunity and time
  - To back-up in case of ground station failures
  - To operate satellite quickly in case of emergent situation of satellite



## GSN System Architecture developed by UNISEC





## GSN Current Status World-Wide

Experiments in collaboration with domestic and international universities have started using GSN software developed by UNISEC



### Experiment History up till now (2003 – 2006)

- Multiple receiving of downlink data (Japanese domestic universities) since 2003
- Uplink from remote stations (Japanese domestic HAM engineers) since 2005
- Uplink/downlink using remote stations (Univ. Tokyo & CALPOLY) April 2006
- Developing GSN software and manual completed May 2006

1<sup>st</sup> International Ground Station Workshop in Univ of Tokyo

July 2006

## UNISEC Rocket Groups

Hybrid rocket propulsion/launch experiment  
Fly-back type rocket upper stage (winged)  
International joint launch in Alaska, etc



Taiki-cho (Hokkaido)  
Launch experiment

## Summary of Hands-On Education in Japan

- **Accumulation of space system expertise** in universities, leading to a less expensive, more effective way of space system integration.
- Student's experiences on **complete cycle of projects**, from conception to operation, including design, fabrication, integration, testing and review.
- Cultivation of **international minds and understanding** through multi-national collaborative works.
- **Meeting social demands** to provide creative youths readily applicable not only to space development but also to any industrial and scientific practices.
- An excellent example of **effective educational process** to bring up challenging youths **within universities capacity** that could be applied to any nation.