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
  1st 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

2002
- Jumping Turtle
- Tohoku U

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
Hybrid Rocket Projects

CubeSat Projects
Ground Station Network
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
CanSat
An Ideal tool for entry education
Building and operating satellites

CanSat
Sub-Orbital Flights
CanSat Balloon Flights

IAC 06, Fukuoka
International competition

CubeSat
- Now International Standard -

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

International collaboration is essential, and it is an excellent educational tool

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

- CalPoly
- Wurzburg Univ.
- Univ. of Hawaii
- Univ. of Tokyo
- Kyushu Univ.
- Hokkaido Institute of Technology

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
- 1st 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.