



APSCO Student Small Satellite  
亚太-大学小卫星项目

# APSCO SSS Project and Space Education for B&R Cooperations

**Wang Xinheng**

**Beihang University, China**

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# Outline



**Overview of APSCO SSS Project.**

**Space Education and Training Practice**

**APSCO Ground Station Network**

**Cooperation in the Future**

**Summary.**

# Overview of APSCO SSS Project

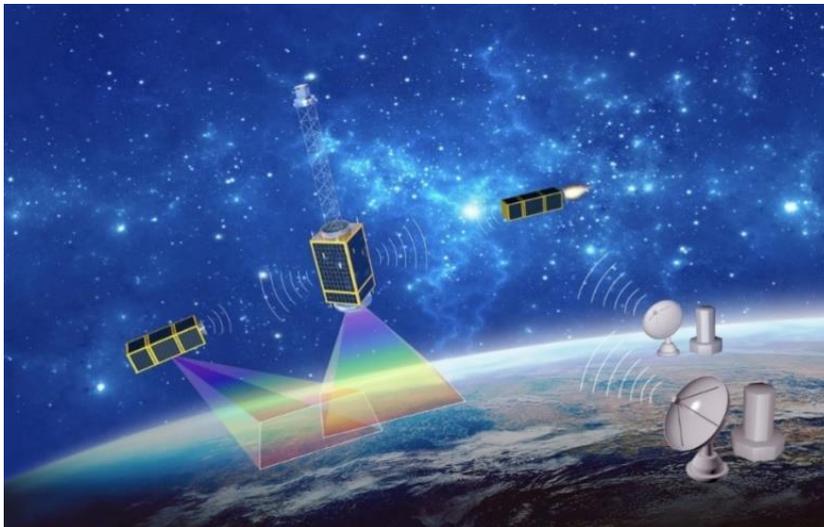
## The Belt and Road (B&R) Countries and Status



# Overview of APSCO SSS Project

## APSCO Small Student Satellite (SSS) Project

- The largest basic activities of APSCO, It was kick-offed in December, 2016.
- Launching service will be provided by CNSA .
- Member States : Bangladesh, China, Mongolia, Iran, Pakistan, Peru, Thailand and Turkey.
- Beihang University was identified as the Leading University.

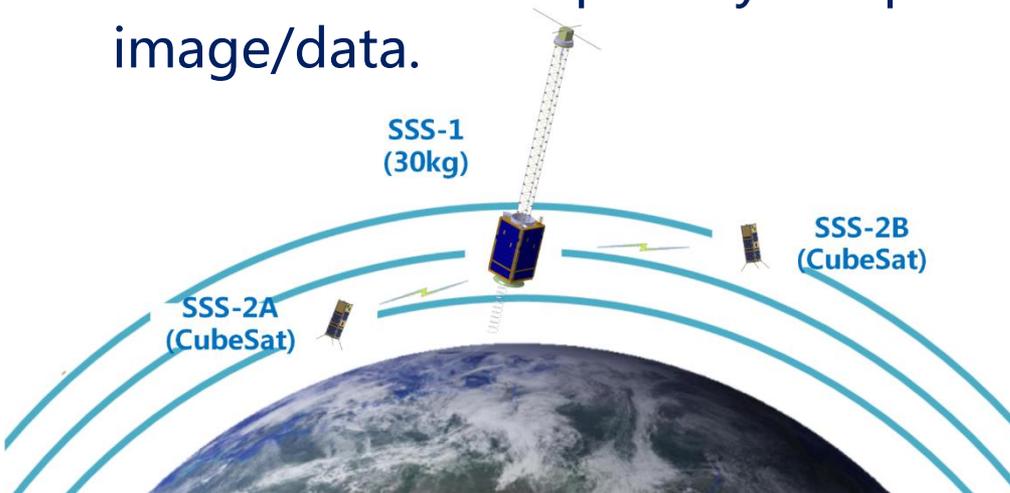


# Overview of APSCO SSS Project

## APSCO Small Student Satellite (SSS) Project

APSCO SSS Project aims to train students and faculties from Member States (MS) for satellite engineering through hands-on practical training until the flight model is made.

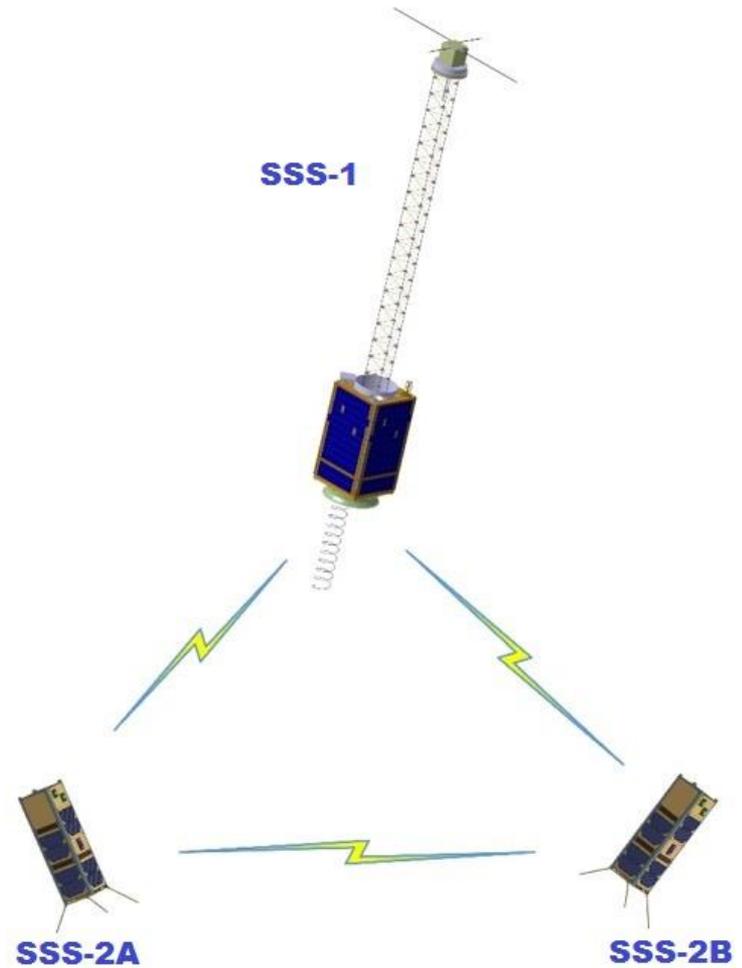
- Develop their own space education system;
- Build their own capability to develop small satellites;
- Build their own payload/subsystem integrated on the satellite(s);
- Build their own capability to operate satellites and/or process image/data.



# Overview of APSCO SSS Project

## Payloads and Technologies

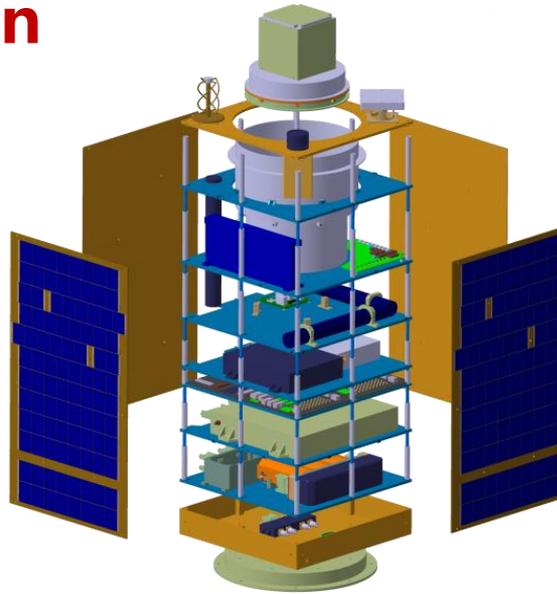
- Remote Sensing/Optical Camera
- Radiation Monitor
- AIS/ADS-B Receiver
- GNSS Receiver
- Deployed Mechanism
- Inter-satellite Communication



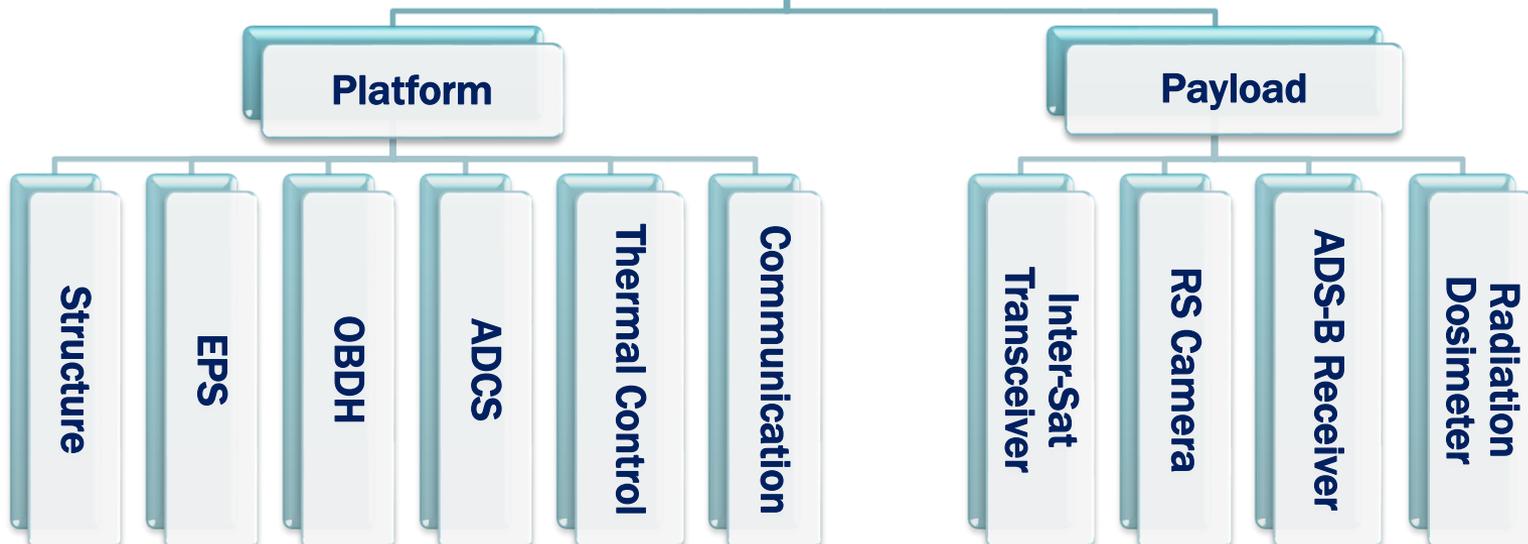
# Overview of APSCO SSS Project

## SSS-1 Configuration

- Main/Sub-sat, Coillable Mast
- GaAs Solar Array +Li-ion Bat
- ARM Processor with CAN Bus
- Passive + Active (MTQ, RW)
- Passive(MLI) + Active(Heater)
- S-band TRX + UHF/VHF TRX

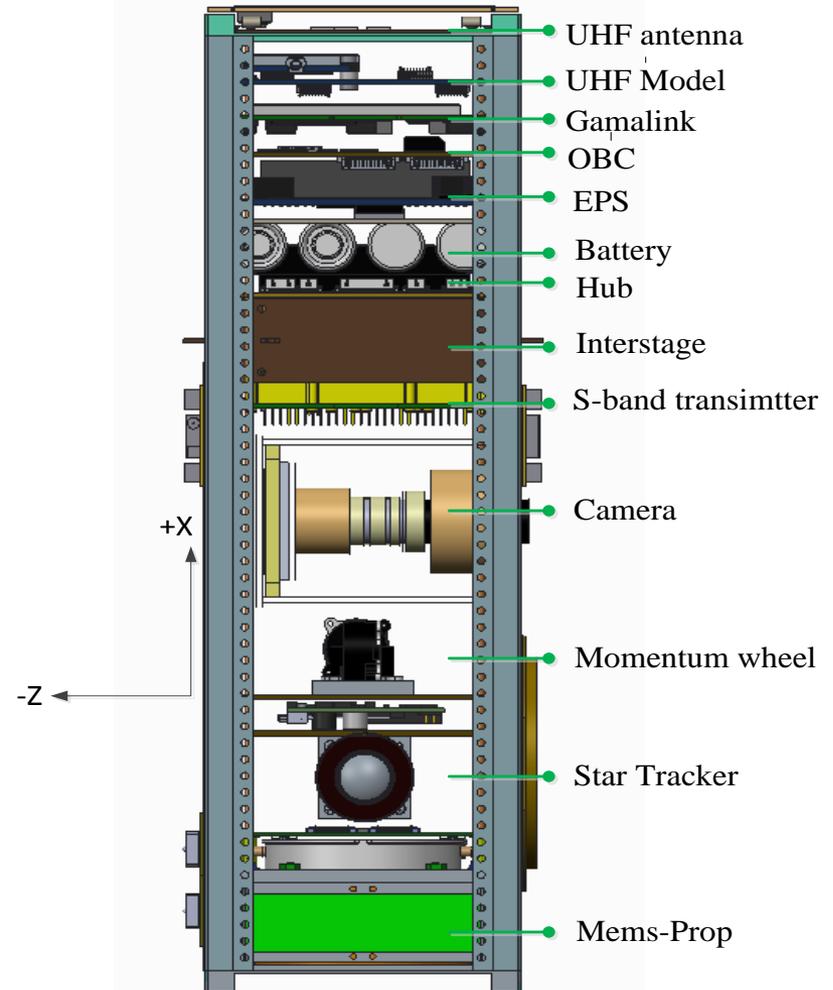
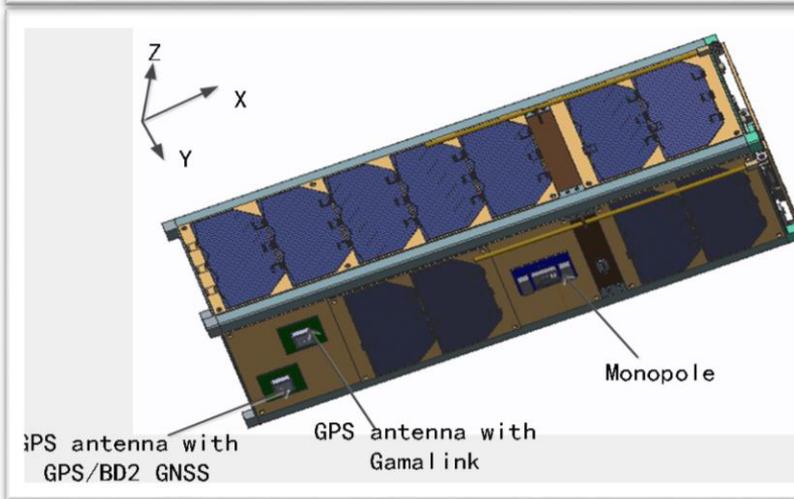
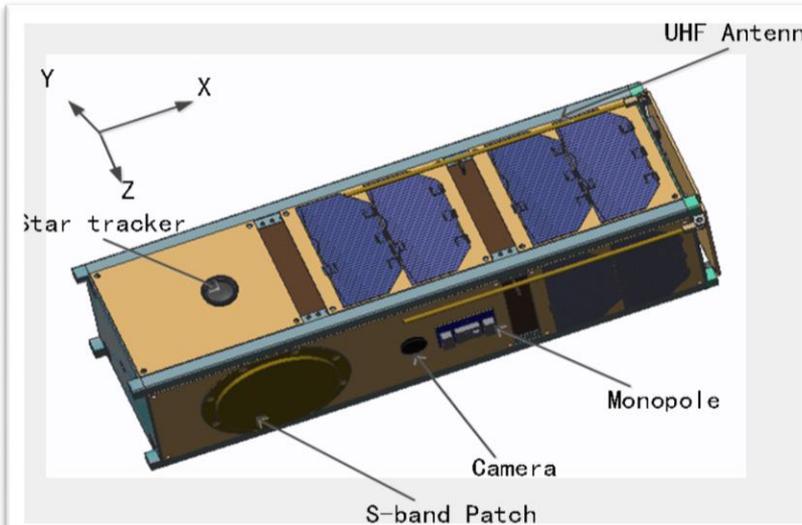


- Inter-Sat Transceiver
- Remote Sensing Camera
- ADS-B Receiver
- Radiation Dosimeter



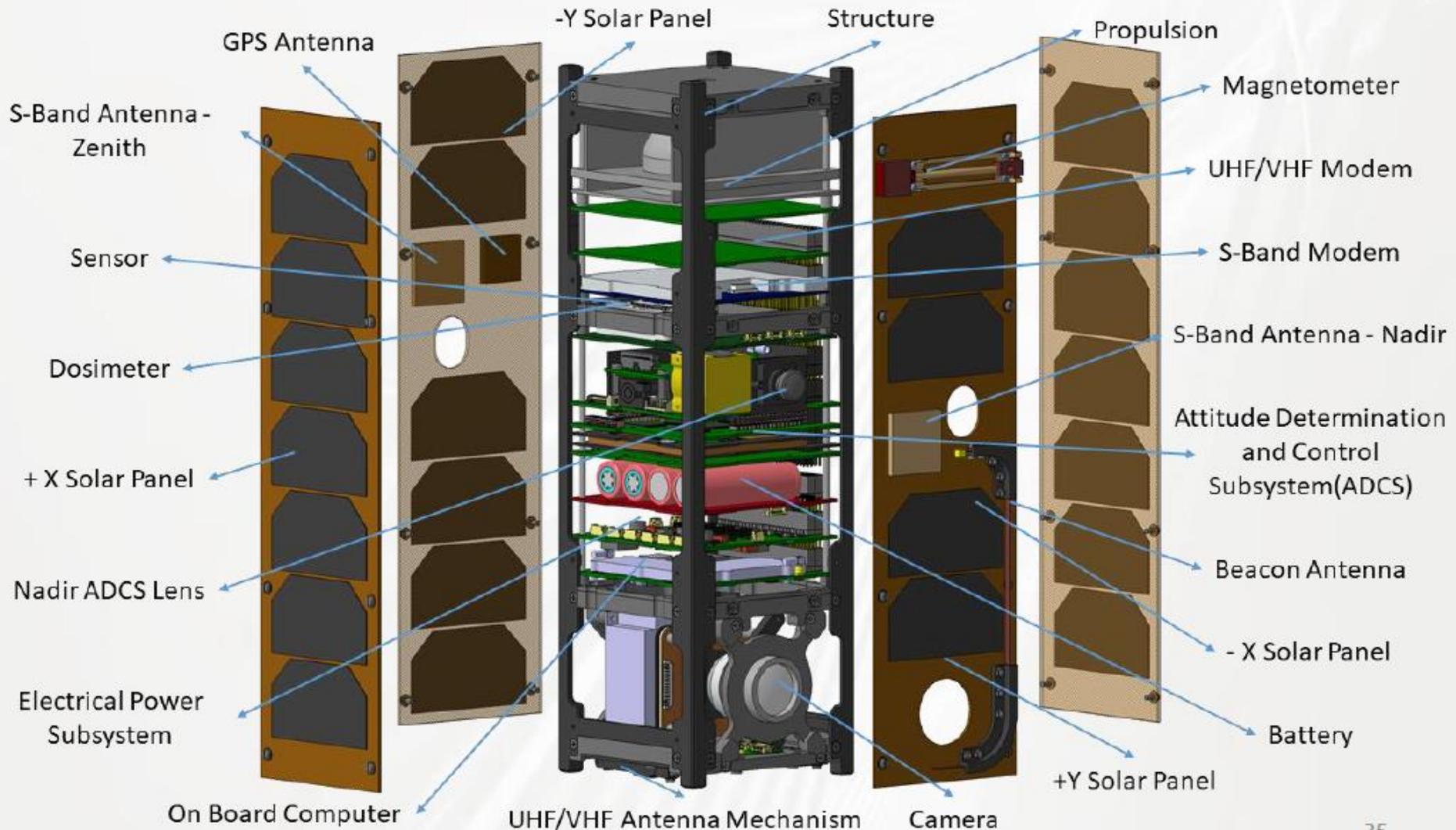
# Overview of APSCO SSS Project

## SSS-2A Configuration



# Overview of APSCO SSS Project

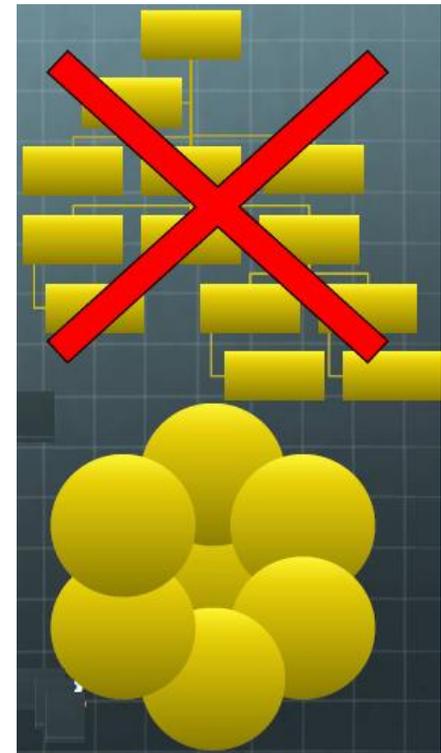
## SSS-2B Configuration



# Overview of APSCO SSS Project

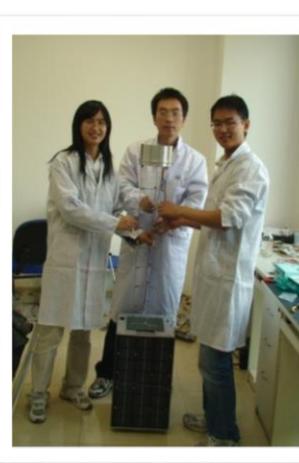
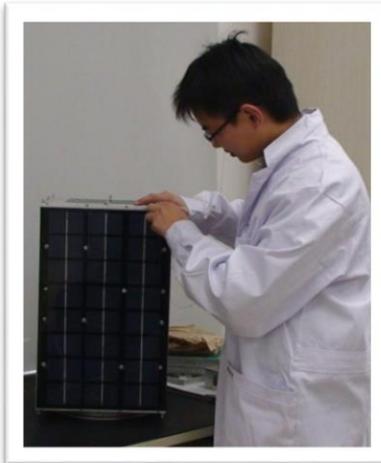
## APSCO R&D Team

- Small core team  
Schedule/Cost/Highly integrated system  
/Minimum management layers
- Multidisciplinary
- Overall system understanding
- Flexible
- Complete Life Cycle Understanding
- Aerospace engineering education



# Overview of APSCO SSS Project

## APSCO SSS Team Members



# Space Education and Training Practice

UN Regional Centre for Space Science and Technology Education in Asia and the Pacific (**RCSSTEAP**), established in the later of 2014.

## 4 Directions of the Center



- **Remote Sensing & Communication**
- **Global Navigation Satellite System**
- **Small Satellite Technology**
- **Space laws**

**Doctoral Program : Space Technology Application (DOCSTA)**



Seminar Room



# Space Education and Training Practice

## → MASTA Program (Long-term Education)

Cultivate student capable on multidisciplinary and system engineering in aerospace engineering research field and application.

- More basic course learning, **2.5 years**;
- Creative theoretical and experimental studies;
- Advanced methods related in spacecraft engineering;



# Space Education and Training Practice

## → MASTA Program Framework

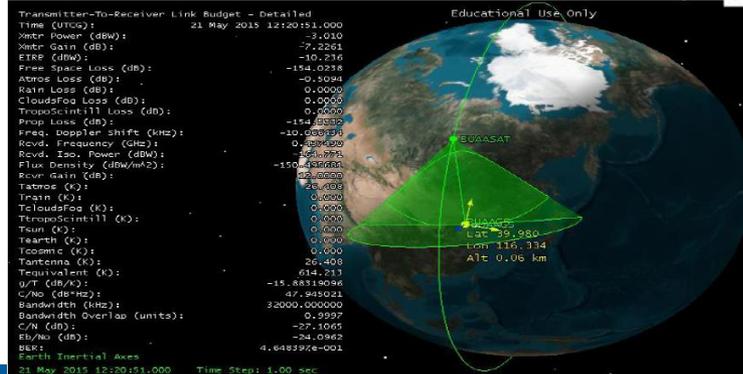
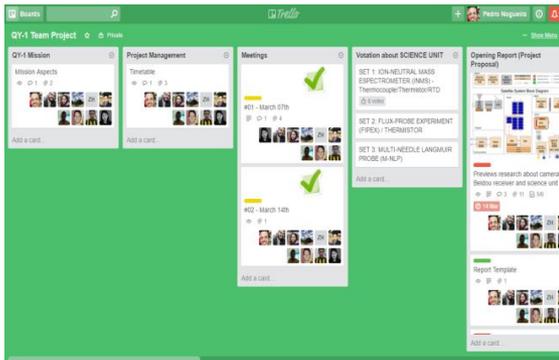
<b>Phase I</b>			
<b>Course Study: 9 months</b>			
	<b>Module I</b>	<b>Module II</b>	<b>Module III</b>
<b>Individual Training Plan</b>	<b>Common Platform Courses</b>	<b>Major courses Academic Lectures Professional visits</b>	<b>Pilot Project</b>

<b>Phase II</b>				
<b>Thesis Research: 12 month (in China or home country)</b>				
<b>Literature Survey and Thesis Proposal</b>	<b>Midterm Assessment</b>	<b>Academic Activities</b>	<b>Thesis Research</b>	<b>Thesis Defense</b>

# Space Education and Training Practice

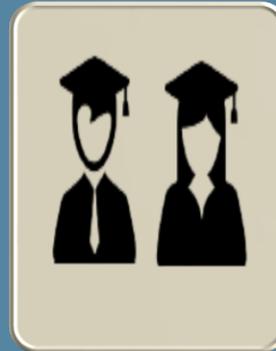
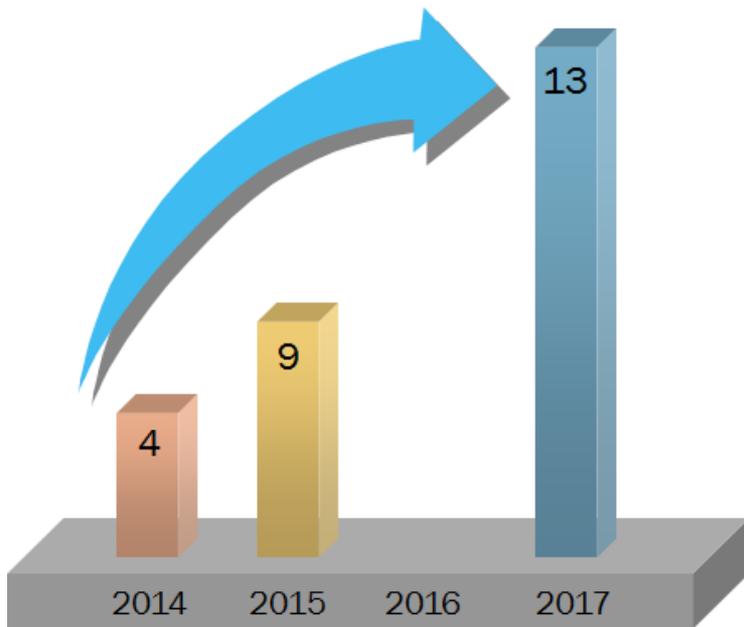
## → MASTA Program :Team Pilot Project

- Training the students to put the knowledge and skills into practice.
- Encouraged to be carried out in Team to provide a chance to complete a task with teammates for developing the teamwork spirits.
- Conduct experiments to verify their ideas with the facilities of BUAA-Sat project.



# Space Education and Training Practice

## → Recruited Foreign Students in MASTA Program



The most special feature is **Practice ! (21 months)**

- Based on the platform of SSS-1;
- Make use of the materials of design/analysis/test for SSS-1 Sat;
- Conduct experiments to verify their ideas SSS-1 project with the facilities of SSS-1 project.



# Space Education and Training Practice

## ✈ Short-Term Training: the Summer Camp



# Space Education and Training Practice

## → the Summer Camp Framework

<b>M1- Course</b> Small-satellite Interdisciplinary Lectures	<b>M4-WORKSHOP</b>  Satellite Technical Workshop	<b>M5-HP</b> Project Hand-on Practice
<b>M2-TP</b> Team Project		
<b>M3-IP</b> Individual Project		



Photo/Mondal Krishna Prosad



# Space Education and Training Practice

## Space Education and Training

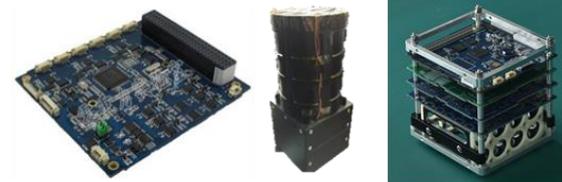


# Space Education and Training Practice

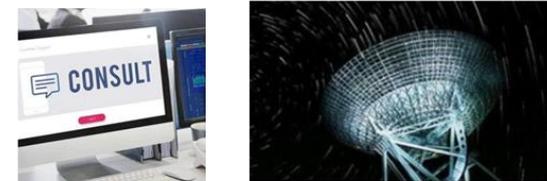
## Spin-off Startups



R&D and sales of NanoSat core modules and components



Technical consultation services



Launch coordination services

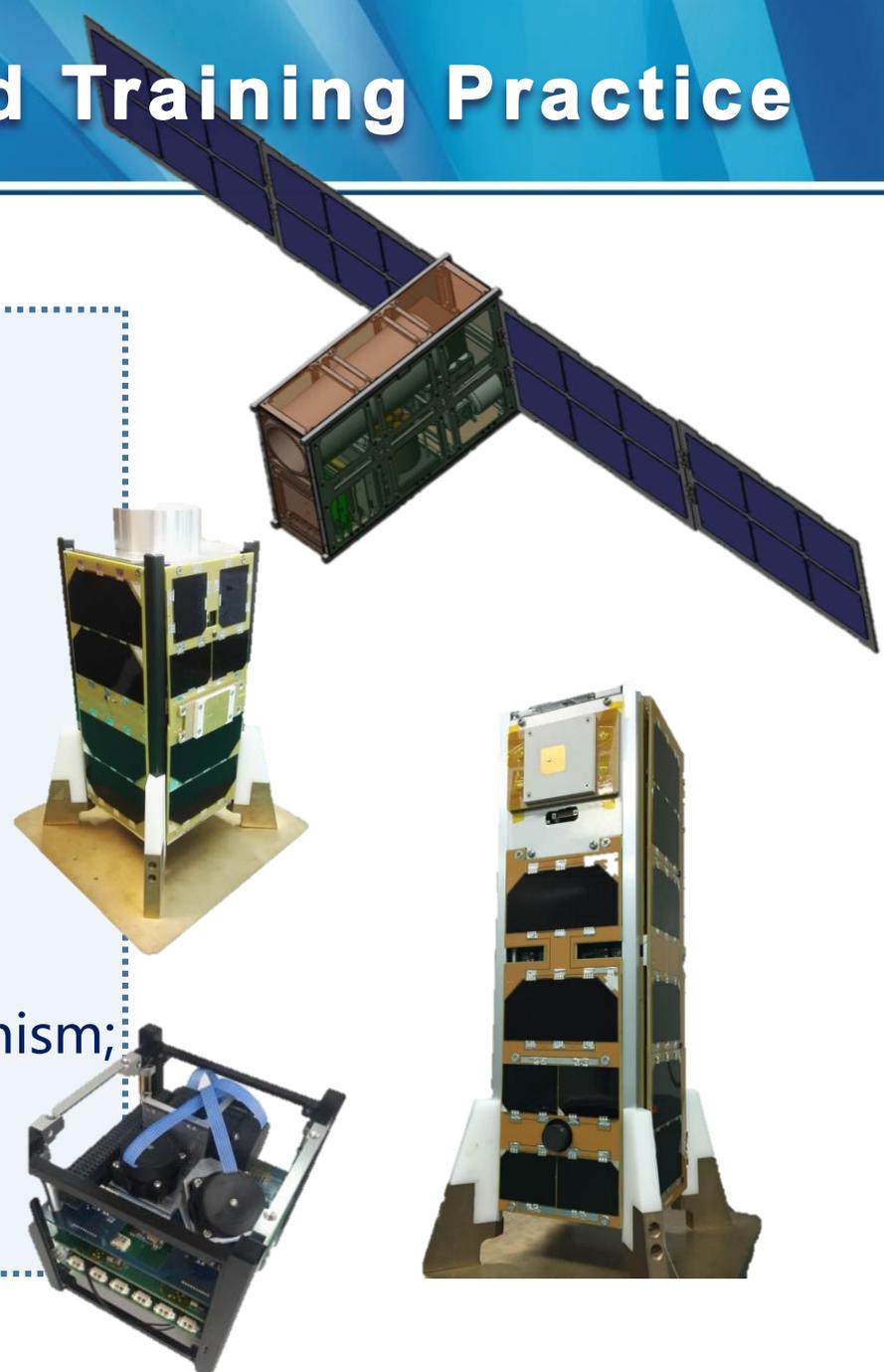


# Space Education and Training Practice

## Spin-off Startups

Integrated solutions to NanoSat:

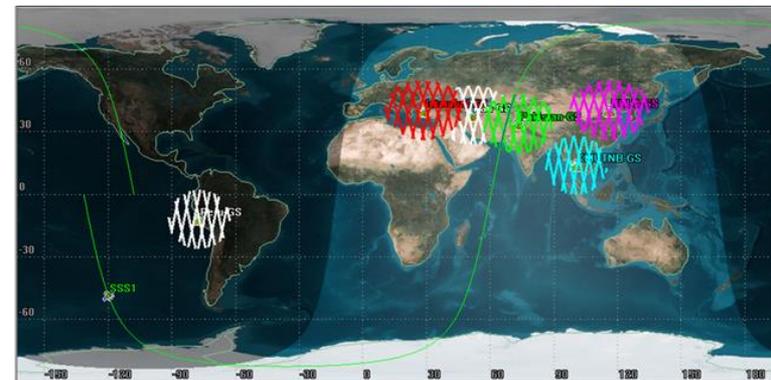
1. Satellite task analysis and design;
2. Task demand analysis;
3. Hardware manufacturing;
4. Software development;
5. Key payload development;
6. Satellite integration and testing;
7. Launch and its separation mechanism;
8. Ground station services;
9. Training and operation support.



# APSCO Ground Station Network

## → Problems

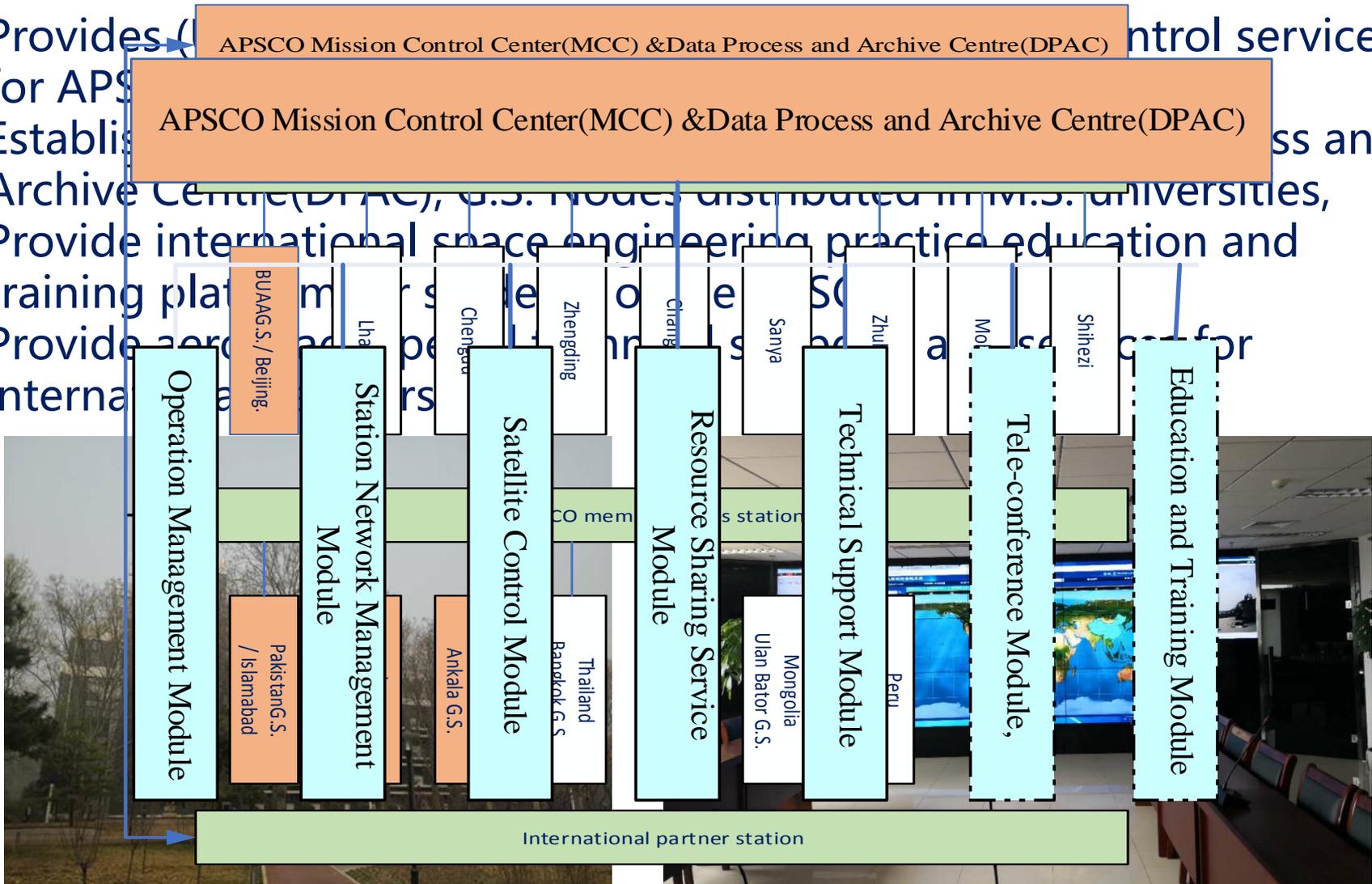
- ❑ M.S. universities have established UV or S-band ground station independantly.
- ❑ Satellite TT&C coverage and communication time is limited.
- ❑ Existing G.S. facilities do not have the operation and application service efficiency



# APSCO Ground Station Network

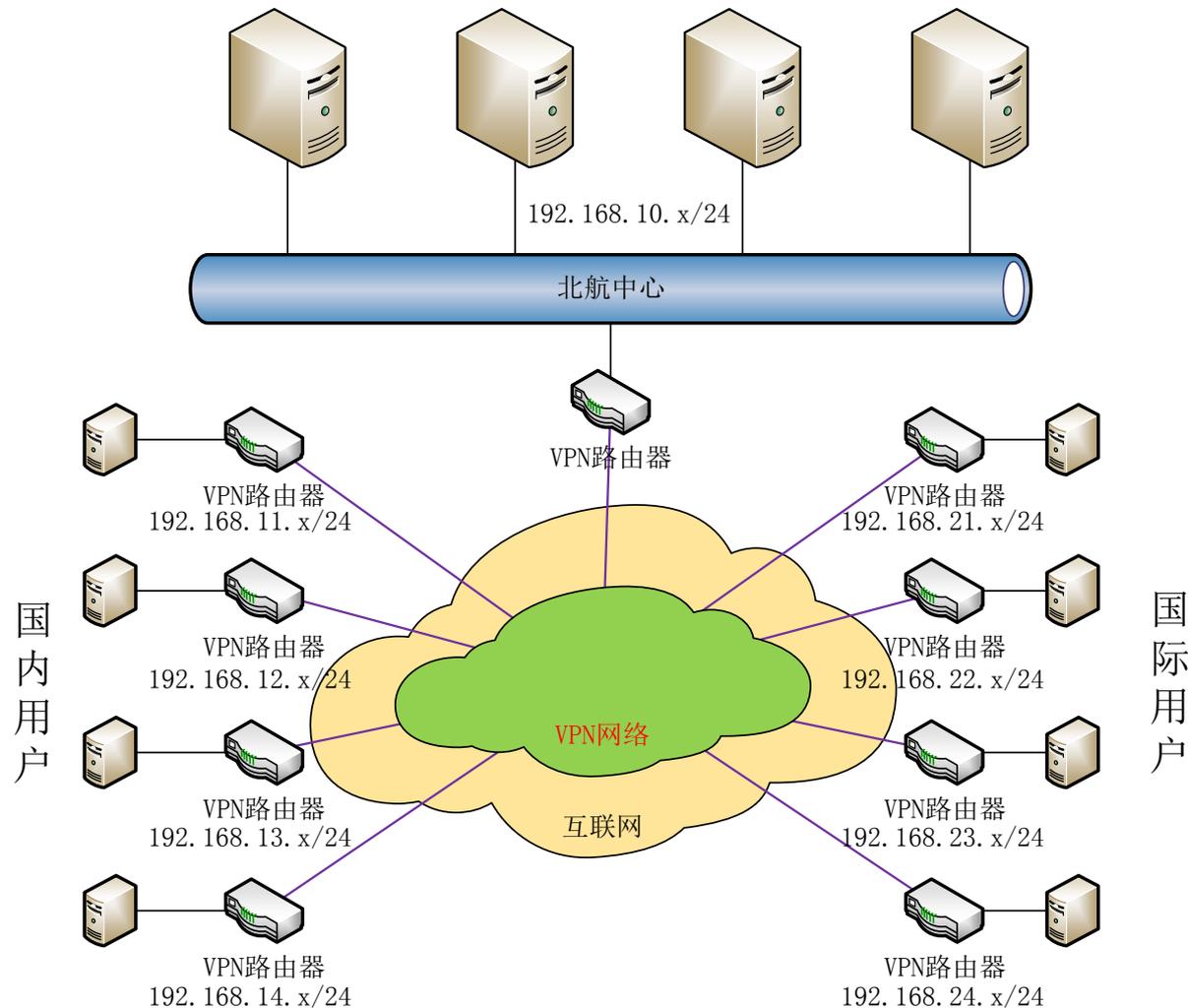
## Ground Station Network

- Provides (APSCO Mission Control Center(MCC) & Data Process and Archive Centre(DPAC)) control services for APSCO
- Establishes (APSCO Mission Control Center(MCC) & Data Process and Archive Centre(DPAC)) process and Archive Centre(DPAC), G.S. nodes distributed in 11 v.s. universities,
- Provide international space engineering practice education and training platform
- Provide zero-charge service for international



# APSCO Ground Station Network

## → G.S Network Architecture



# APSCO Ground Station Network

## ✈ APSCO MCC& DPAC Location



Located in Beihang Campus ( Beijing, N40.153°, E116.268°)

# APSCO Ground Station Network

## → **APSCO MCC& DPAC Function**

- ❑ Scheduling G.S. resource allocation, management plan;
- ❑ Receiving satellite telemetry data and payload data ;
- ❑ To generate the satellite telecommand;
- ❑ Orbit control for spacecraft ;
- ❑ Satellite data display;
- ❑ Provide international space technology engineering practice education and training.
- ❑ Provide teleconference center for M.S.

# APSCO Ground Station Network

## → BUAA UHF/VHF Ground Station

### 1) VHF yagi antenna

Frequency : 143~146MHz

Number of the oscillator : 2×11

Gain : 17.25 dBic

Front to back ratio : 25

Beam width : 38.5°

VSWR : 1.5:1

### 2) UHF yagi antenna

Frequency : 432~438 MHz

Number of the oscillator : 2×21

Gain : 18.85 dBic

Beam width : 21.5°

### 3) Radio technical specifications

The support of the band : UHF/VHF

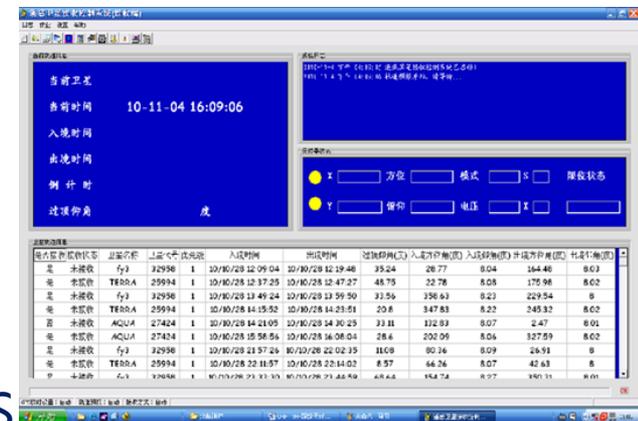
Modulation / demodulation method : FM/SS

VHF Maximum RF power : >=100W

UHF Maximum RF power : >=50W

Bit rates : 1200bps、2400bps、4800bps、9600bps (optioned)

Communication protocol : AX.25



# APSCO Ground Station Network

## ➔ BUAA S-band Ground Station

- Antenna D= 4.2m;
- $G/T > 14.5\text{dBK}$ (elevation= $5^\circ$  , 2.3GHz) ;
- Antenna Gain  $\geq 37.5\text{dBi}$  @2.3GHz
- Transmit Power 40W,
- Antenna Track Accuracy  $< 0.05^\circ$  ;
- Work Mode : , satellite data receive, telecommand uplink;
- Full duplex work, polarization: LHCP,RHCP switched by software.
- Data rate: 10kbps~10Mbps ( SDR )
- Remote operation, autonomous operations

当前卫星 SPOTS  
当前时间 14-08-14 09:12:35  
入轨时间 14-08-14 10:19:16  
出轨时间 14-08-14 10:27:47  
倒计时 01:06:41  
过顶仰角 18.69 度

是否接收	接收状态	卫星名称	卫星代号	轨道号	入轨时间	出轨时间	过顶仰角(度)	入轨方位角(度)	入轨方位角(度)	出轨方位角(度)
是	未接收	SPOTS	27421	2	14/08/14 10:19:16	14/08/14 10:27:47	18.69	45.61	8.23	141.95
是	未接收	1421A	33320	5	14/08/14 11:18:38	14/08/14 11:20:44	79.39	8.83	15.7	197.09
是	未接收	SPOTS	27421	2	14/08/14 11:59:49	14/08/14 12:09:25	47.65	356.56	16.07	234.32
是	未接收	AQUA	27424	1	14/08/14 12:43:08	14/08/14 12:46:09	9.19	78.89	0.06	44.29
是	未接收	ora	28376	1	14/08/14 14:07:10	14/08/14 14:17:18	64.79	156.21	8.39	353.38
否	未接收	AQUA	27424	1	14/08/14 14:16:19	14/08/14 14:26:45	84.54	168.1	8.24	346.42
是	未接收	ora	28376	1	14/08/14 15:48:03	14/08/14 15:52:39	10.79	242.52	8.13	296.29
是	未接收	GRACE	27411	3	14/08/14 11:30:11	14/08/14 11:47:53	14.0	133.1	0.1	101.1



# Cooperation in the Future

## → UN Regional Centre Alliance



# Summary

- SSS project is the largest basic activity in APSCO and on-going basic space technology activity for B&R countries.
- APSCO G.S. Network improved capacity-building and resources sharing in basic space technology for B&R countries, **More G.S nodes are welcomed to join in the worldwide.**
- Strengthen the space technology academic exchanges and the international education cooperation among UN Regional Centre Alliance .



*THANK YOU!*

Welcome to website: [www.apsco-sss.com](http://www.apsco-sss.com)

Email: [xswang@buaa.edu.cn](mailto:xswang@buaa.edu.cn)