Singapore Country Report

by
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History and Outline

• Weather Satellite Reception Facilities in Meteorological Service Singapore (MSS)
• Centre for Remote Imaging, Sensing and Processing (CRISP) remote sensing satellite ground station established in 1995
• Centre for Research in Satellite Technology (CREST) established in 2001 (responsible for XSAT satellite)
• Singapore Technologies SatSys (joint venture of ST, NTU and DSO) in May 2011
• Universities programmes – NTU and NUS
• Economic Development Board establish Office for Space Technology and Industry (OSTIn) in August 2012
• Future – TeLEOS-1, CSAT, KR-1...
CRISP Ground Station
Centre for Remote Imaging, Sensing and Processing (CRISP) - started in late 1992

CRISP Ground Station currently operates 4 S/X-band tracking antennas
Ground Station Update

• CRISP currently operating with 4 tracking antennas:
  • 13m S/X antenna installed in 1995
  • 6m X band antenna installed in 2000
  • 8.5m S/X (dual polarisation) antenna installed in 2009
  • 6.1m S/X antenna installed in Jan 2014

• A new 6.1 m S/X (dual polarisation) antenna will be installed in Feb 2015. This antenna will replace the older 6m antenna.

• All antennas will also have TT&C capabilities
Satellite Data CRISP received since 1995:

1. SPOT 1,2,4 (France, Sep 1995)
2. ERS 1,2 (Europe, Mar 1996 till 2011)
3. RADARSAT 1 (Canada, Apr 1997 till 1999)
4. SeaWiFS (USA, Sep 1999)
5. TERRA MODIS (USA, March 2001)
6. IKONOS (USA, August 2001) – 0.82 m resolution
7. AQUA MODIS (USA, July 2002)
8. SPOT 5 (October 2002) – 2.5 m resolution
9. ERS-2 Low Bit Rate (Scatterometer, Gome etc)
10. GeoEye-1 (June 2009) – 0.41m resolution
11. Worldview I & II (Nov 09) – 0.47m resolution
12. XSAT – May 2011
ASEAN-China Remote Sensing Satellite Data Service Platform

a project under China-ASEAN STEP
Forest Fire and Haze Monitoring
Research Groups

• Very High Resolution (1-2m data)
  • DEM generation, mapping, feature extraction
• Hyperspectral (tens to hundreds of Spectral Channels)
  • Toxic red tides monitoring, ocean pollution, coastal erosions studies
  • Water qualities, atmospheric aerosols and land vegetation
• Multiple Beam, Multiple Polarization SAR
  • Natural hazards monitoring, ocean pollution and land cover studies
• Regional Land Cover and Climate Change
Mini/ Micro-Satellite Programs
XSAT

• XSAT is the first Singapore design and build remote sensing satellite.
• Weight 120kg
• Launch in April 2011
• Image resolution 10m, Spectral bands – red, green and infrared

• Completed more than 3 years of operations
  – Currently being used for experiments testing in space to help TeLEOS-1 design
Follow-on to XSAT …

Singapore Technologies (ST) Electronics set up a new joint venture company (with DSO and NTU) called ST Electronics (SatSys) Pte Ltd in May 2011

• To design, develop & produce advanced satellites
• To exploit & commercialise indigenous satellite engineering capabilities

First satellite to be built by this venture is TeLEOS-1
TeLEOS-1

- Launch Date: 2nd Half 2015
- Designed Life: 5 years
- Orbit: Near Equatorial Orbit (10° to 15° Inclination)
- Orbital height: 550km
- Mass: About 400kg

Imaging & Collection Specifications
- Mean Revisit Time: 12 to 16 hours
- Resolution: 1m nominal at nadir
- Swath width: 12km
- Dynamic Range: 10bits per pixel
- Slew Rate: 2.5 deg/sec

Image Reception and Processing System (Ground Station)
- In-house development of CRISP
TeLEOS-1 NEqO Coverage
ST Electronics new Satellite System Centre was officially opened on 19 August 2014

• 6 storey high
• Total floor area – 11,000 sq m
• High bay clean room of 12m height for corrent assembly, integration and test (AIT) of 2 satellites
OSTIn
Office for Space Technology and Industry
Office for Space Technology and Industry

The Office for Space Technology and Industry (OSTIn) was established by the Singapore government in August 2012 with the mandate to serve as the designated office to develop Singapore’s space industry.

OSTIn was established with the following mandate:

- Plan and execute economic strategies to grow Singapore’s space industry in a sustainable manner.
- Forge collaborations within Singapore, as well as between Singapore and the international community on space initiatives.
- Champion the growth of Singapore’s pool of human capital for the space industry.
Office for Space Technology and Industry

OSTIn has provide partial funding for NUS KR-1 satellite and NTU Velox C1 satellite, to be ready for launch in 2015.

OSTIn is also providing R&D project grant funding to local institutions of higher learning in September 2013 and in November 2014.
Universities
Programmes

Nanyang Technology University
National University of Singapore
**NTU CSAT-1**  
(Tropical Environmental Monitoring Microsatellite)

Weight: 100~120 kg

Payload:
1. GPS Occultation (main)
2. Experimental RF Probe
3. Other experimental missions: e.g. Altitude determination with GPS

Planned launched in 2015 with TeLEOS-1
NUS Kent Ridge-1 (KR-1)  
*(Hyperspectral Imaging Microsatellite)*

Collaboration with Berlin Space Technologies  
Weight : ~70 kg

Payload

- (Main) Singapore developed hyperspectral camera  
  - 30~50 bands from Blue to NIR (SWIR being developed)  
  - resolution: ~ 50m  
  - swath width : ~ 50 km

- (Sec) Video camera  
  - resolution: ~15m  
  - swath : 10km

Planned launch in 2015 with TeLEOS-1
2015 Launch (?)
TeLEOS-1 (400 kg)
CSAT-1 (100 kg)
KR-1 (50 kg)
+ a few CubeSats of NTU and NUS
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<th>卫星类型</th>
<th>南大卫星</th>
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<td>VELOX-CI</td>
<td>VELOX-II</td>
<td>TeLEOS-1*</td>
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<td>重量（公斤）</td>
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<td>用途</td>
<td>热带气象研究</td>
<td>测试卫星技术</td>
<td>提供商业卫星图像，监测环境灾害、海上和国土安全及规划城市</td>
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<td>VELOX-PII</td>
<td>VELOX-I</td>
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<td>4.5</td>
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<tr>
<td>用途</td>
<td>拍摄地球表面图像，研究卫星之间的通讯</td>
<td>测试卫星技术</td>
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<td>X-SAT</td>
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<td>用途</td>
<td>拍摄地球地理图片；侦测环境变化，侦测地面泥石流或森林火患等</td>
<td>测量地球土壤、植物、火山以及水体温度的变化</td>
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Global Space & Technology Convention (GSTC) is Asia's Premier Space & Technology Event, providing a platform for latest technology in space engineering and design.

What is GSTC

Organised by Singapore Space Technology Association
11 to 13 February 2015

VENUE

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Thank You